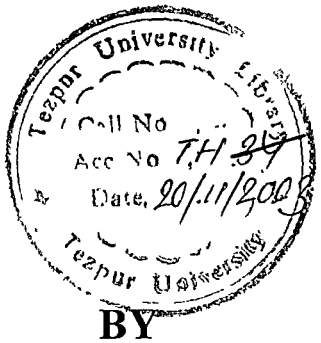
ELEMENTS OF SCIENCE AND TECHNOLOGY IN THE TRADITIONAL LORE OF NORTH-EAST INDIA WITH PARTICULAR REFERENCE TO ASSAM: AN EXPLORATORY STUDY

A THESIS SUBMITTED FOR
THE DEGREE OF DOCTOR OF PHILOSOPHY
OF
TEZPUR UNIVERSITY



BY
DINESH BAISHYA
DEPARTMENT OF ZOOLOGY, B.BOROOAH COLLEGE,
GUWAHATI-781007, ASSAM.

Dedicated
to
My parents, My teachers
and
All the people who introduced me to their Traditional Knowledge and Culture

Dr. Birendarnath Datta,
Formerly
Professor and Adviser,
Department of Traditional Culture and Art Forms,
Tezpur University, Tezpur, Assam.

This is to certify that Sri Dinesh Baishya, M.Sc.(G.U.), Selection Grade Lecturer, Department of Zoology, B. Borooah College, Guwahati- 781007, Assam, has worked under my guidance and supervision for the thesis entitled **" Elements of Science and Technology in the Traditional Lore of North-East India with Particular Reference to Assam : An Exploratory Study"**, *which is being submitted to Tezpur University for the degree of Doctor of Philosophy.*

The thesis is the result of his own investigation into the subject. Sri Dinesh Baishya has fulfilled all the requirements under the Ph.D. regulations of Tezpur University. No part of the Thesis was submitted to any other University for any research degree.

Birendranath Datta
(Birendranath Datta)

Dated Guwahati
The Twentieth Day of June ,2001.

CONTENTS

PREFACE

There has been world wide interest in the study of History of Science and Technology. It is because throughout the course of history, science and technological development have played a great role in hum a n progress. The realisation that the modern scientific and technological paradigm does not offer viable solutions to many vexing problems of today has sparked off a world wide search for 'alternatives'. In this context, India in general and North-East India in particular is uniquely placed in that this land had a vibrant tradition of not just isolated techniques, but a complete integrated structure that evolved independent of the modern system. Further, this tradition continues to be practised widely even today. But this subject has not received much attention in India more particularly in North-East India.

The debate on the relevance of traditional sciences and technologies has added new dimensions to the process of identification of sources of strength of the people and the nation. The path of development based primarily on modern institutions has failed to provide the people even the bare necessities of life. Therefore efforts at identifying traditional

strengths of our society have acquired added significance.

The modern sciences have been taking shape in India purely through the occupation of the empty spaces created by the political and economic onslaught on Indian sciences and technologies. The British through their revenue policy and other measures , first carried out the colossal disorganisation of Indian society . They broke down the traditional fiscal arrangement, thus breaking the lifeline of the society, rendering all the aspects of defenceless. Religion, social organisation, political set-up, sciences, technologies, industries, nothing in the absence of the uniting features could came to the rescue of another. With the formal assumption of power by the British government in India the foundation of the modern state were laid. From that time India was subjected to law and order State in which all the dimensions of public life, education, justice, administration, science and technology were created afresh on an alien pattern.

Policies of independent India relating to agriculture, industry, health, forest, in fact the overall policies of development , are such that they have undone indigenous science in every possible sphere. Crafts men, blacksmiths, metal workers, architects, peasants, weavers, folk healers, all have suffered continuous deterioration over the last fifty years. Tribal have been further deprived of forest resources, women have lost control in a great many productive activities which were earlier organised by them. Thus traditional social organisation has further suffered rupture and the logic of indigenous science and technology become more alien to the educated. However , new phenomenon have been unleashed,

which give an impression of regeneration of indigenous consciousness. Now the conscious people are beginning to realise that people's knowledge system need not always be considered informal just because the rules of the formal system fail to explain innovations in other system.

That is why, a study in science and technology in the history and civilisation of the of people of India is much more than a matter of mere academic exercise. It is linked up with the question of our very survival. It has profound significance for the national requirements, specially in the grim days through which the people of present day India are passing.

Though I am a student of life science, I have developed a keen interest in the study of history, specially the history of civilisation and technological development. I have been inspired to enter in this field by the books on history of science and technology written by two great Indian scholars D.P.Chattopadhaya and B.M.Seal.

I am greatly inspired by Prof. Birendranath Datta, a renowned scholar in the field of Traditional Culture, to enter in this vast area of knowledge. As a student of science I was quite ignorant about the relevance of the study of traditional culture. It is he who taught me with love to walk in this field. I have the most pleasant duty to express my heart felt gratitude to Prof. Birendranath Datta under whose kind supervision I had the privilege to carry out this research work . I shall always remember his loving encouragement and valuable suggestions .

My teacher, Dr. Siv Nath Barman, a professor of Physics is probably the first Assamese scholar to study history and development of science

in India. I was very much inspired by him to study in this line. I am grateful for his inspiration and valuable suggestions.

It is my great pleasure to acknowledge Prof. Anil Sadgopal , Dean and Head of Education, University of Delhi, whom I met very closely as National Convenor of Bharat Jan Vigyan Jatha, for his pleasant teaching in the study of indigenous knowledge and local history. It is he who helped me to avail a UGC fellowship to work as an activist of Bharat Jan Vigyan Jatha, during which time I had the oportunity to visit many places of North-East India and gathered knowledge on the elements of science and technology in the traditional culture of various ethnic groups of people.

In this study I was much helped by the works of many renowned scholars of Assam like Late Dr. S.K Bhuyan, Late K.L.Barua, Late Dr. B.K Barua , Late Dr. M. Neog, Late Dr. L.Gogoi, Dr. P.C. Choudhury, Dr. H.K.Barpujari, Dr. H. Bareh, Dr. S Rajguru, Dr. S.N Barman, Dr. N.C. Sarma, Sri B.C. Handique, Late Dandiram Datta and many others. I take this opportunity to record and express my thanks and gratitude to them.

It is my duty to offer thanks to my friend Dr. Bhubaneswar Saharia, controller of examinations, Tezpur University, who helped me a lot with valuable suggestions in my work.

I express my heartfelt gratitude to the librarians and employees of various libraries who helped me tirelessly during my study.

My grateful thanks are due to the people living in the villages of various part of the North-East India whom I met and who introduced me to the elements of science and technology absorbed in their traditional

culture without hesitation. This work is greatly enriched by their invaluable contribution.

I must thank the authorities of Srimanta Shankardeva Kalakshetra and Assam State Museum, Guwahati, for their kind permission to study in the Museums. I am thankful to Mr. Goutom Sarma for his help in using the computers of the Srimanta Shankaradeva Kalakshetra for computer works. I am also thankful to Sri Prafulla Bhatta, who takes a lot of pain in computerising this work..

Last but not the least, I carve the indulgence to record the name of my wife Srimati Ranu Baishya and my daughter Pahi who helped in the way of inspiring and helping me all the ways.

(Dinesh Baishya)

"Sangeeta"
Ananda Nagar, Chaimail,
Guwahati- 781022, Assam.
The first day June 2001.

Chapter-I

INTRODUCTION

CHAPTER - I

INTRODUCTION

PART- A

THE BACKGROUND :

"Interest in practical uses of science came first through superstition and magic. In science, the successors stand upon the shoulders of the predecessors"

- Bertrand Russel

Science is basically "the search for causes and their effects" and such search has been going on since the beginning of human society. " Science is cummulative, science is the history of science. Every scientific discovery of an importance is absorbed into the body of human scientific knowledge to be used thereafter."(Kosambi, 1976: 103)

D.P. Chattopadhya emphasised the need of the study of history of science and technology in traditional and ancient societies in his famous book *Science and Society in Ancient India.* To quote him " In science, more than any other human institution, it is necessary to search out the past in order to understand the present and to control the future." (Chattopadhya, 1979 : 24)

Some common misconceptions plague the terms 'science' and 'technology'. On a rather superficial level, we tend to think that science and technology are contemporary developments and as such, are sole repositories of the modern age. Again, there is the popularly held view that people of traditional societies

were ignorant about science and technology; and such societies harboured only myths and superstitions in their day-to-day dealings.

It is also commonly misinterpreted that science and technology developed entirely in the West, and are preservers of the Western civilisation; the contribution of the East is nil or negligible in this regard.

However, science and technology do not belong to the modern age alone nor are their development confined to the West. Close observation in the tradition-bound societies, most of them belonging to the East, clearly reveal that much of the collective wisdom and effective knowledge about natural phenomenon and objects, which have been passed down from one generation to another, by word of mouth, is nothing but what is called 'science' in the modern age.

Every society has its own heritage of science and technology stored in its traditional wisdom, although they might appear to be nothing more than mere magic and superstition, far removed from science; they form the basis of the later development in the field of science and technology. Traditional aspects in science and technology is still relevant and useful to the modern society. For example, traditional medicinal systems have proved to be highly scientific and effective in the treatment of ailments even amidst high-tech medical system. Most traditional agricultural practices are eco-friendly and sustainable in comparison to modern agriculture. Modern agricultural scientists are now looking for rediscovery of traditional agricultural knowledge for sustainable development in the field of agriculture. When the modern chemical pest-management system proved futile, the traditional pest management system are on the way to be reinstated once again.

Again, as Claud Levi-Strauss maintains, the mind of the so-called primitive man possessed the capacity for logical thinking in the same measure as modern man, only, the primitive man's capacity manifested itself through myths. As he maintains, there is no qualitative difference between the two minds. According to Levi-Strauss, "Prevalent attempts to explain alleged differences between the so called primitive mind and scientific thought have resorted to qualitative differences between the working processes of the mind in both cases...the kind of logic in mythical thought is as rigorous as that of modern science, and the difference lies not in the quality of the intellectual processes but in the nature of the things to which it applies...what makes a steel axe superior to stone axe is not that the first one is better made than the second. They are equally well made, but steel is quite different from stone... the improvement in scientific thought lies not in an alleged progress in the man's mind, but in the discovery of new areas to which it may apply its unchanged and unchanging powers." (Levi-Strauss,1979:230).

Till quite recent times, few in the developed world cared about the knowledge and wisdom inherent in the traditions of the so-called 'backward' societies. The widespread attitude have been that Western science with its powerful analytical tools has little to learn from traditional knowledge. However, there has been a noticeable change in attitude, scientists are learning to look to the past for traditional knowledge and to perceive that the world is losing an enormous amount of basic research as indigenous people shed their culture and tradition. Today with little notice vast archives of knowledge and expertise are spilling into oblivion, leaving humanity in danger of losing its past and perhaps jeopardising its future as well. Stored in the memories of elders, healers, midwives, farmers, fishermen and hunters, in the estimated fifteen thousand cultures remaining in the earth, is an enormous trove of wisdom. But

the world's tribes are dying out by being absorbed into the so-called modern civilisation. As they vanish, so also their irreplaceable knowledge. Over the ages, indigenous people have developed innumerable technologies and art. Much of this expertise and wisdom has already disappeared, and if neglected most of the remaining could be passed on to the next generation (Linden,1991: 48).

II. SCIENCE AND TECHNOLOGICAL HERITAGE OF INDIA :

The notion that science and technology emanated in Europe was deeply embedded in the minds of educated people all over the world till very recent times. The alchemists of Arab countries, were occasionally mentioned, but there was very little references to India and China in the books of Western science. The Indian National Science Academy and many other organisations have studied and documented the development of science and technology in the ancient and medieval India. A large number of scientists, technologists, mathematicians, astronomists, historians and philosophers have engaged themselves in the studies of the history of science and technology in ancient and medieval India in various parts of the country. Recently, a body of scholars was organised in the name of "Traditional Science and Technology Congress of India". Three congresses had been organised since 1992, where a large number of scientists, technologists and historians presented their findings on traditional science and technology of India. This congress has proved the relevance of traditional science and technology in the present day context and also added new dimensions to the process of identification of strength of the people in the form of traditional science and technology.

It has become quite evident, from these studies, that India has consistently been a scientific country, right from the ancient times. Studies in the various branches of science and technology in the Vedic times, as it appears from the various *Vedas* and *Upanishads*, affirm that India has had a glorious heritage of science and technology.

It is universally acknowledged that much of the mathematical knowledge in the world originated in India and moved from East to West. The high degree of sophistication in the use of mathematical symbols and developments in arithmetic, algebra, trigonometry and astronomy, specially in the work attributed to Aryabhatta, is indeed remarkable and should be a source of inspiration to all the modern Indians (Ramanna,1986:2).

Nagarjuna, Aryabhhata and Varahamihira had indeed developed brilliant thoughts in the domain of philosophy of science as practised in India. A master philosopher, Nagarjuna, was also an international pioneer in chemistry and metallurgy, specially in the art of making zinc metal (*jasada* or *dasta*), which later spread into China and the West. Aryabhhata was possibly influenced by the Greek and Roman astronomy and could well have thought that the Hindus had much to learn from these subjects. Varahmihira wrote that although the foreign scholars were not Hindus, they were as worthy of respect as the ancient sages. He further wrote that since human lives were sustained by agricultural crops, the production of which depended on adequate rainfall, it was imperative that the laws which governed rainfall on the earth should be discovered (Chattopaddhaya, 1979:41).

In the field of minerals and metallurgy, substantial progress was achieved and recorded by the authors of the *Rasa-Sastra*, who emphasised the need for accurate and careful experimentation. Yet, these texts propagated awful theories about the origin of minerals from the excretory products from the body constituents of the gods and goddesses (Biswas,1969:52).

The authors of *Rasa-Sastra* succumbed to the theory of caste stratification. According to them, diamond and other precious gems could be categorised

under the four castes, and should be used only by people belonging to the respective castes. On the one hand, they advised careful scientific experimentation and observation and, on the other hand, their *tantric* cult prohibited free diffusion of knowledge (Biswas,1969:49).

III. ROLE OF WESTERN AND TRADITIONAL SCIENCE AND TECHNOLOGY

1. A Critical Look in to the Western Science :

Science has been observed , by some western scientist themselves, as giving the power to exploit. Kurt Mendelsshon, an Oxford professor , in his book *Science & Western Domination*, asserts that western science is the key to world dominion (Pereira,1990:1).

During 200 years of occupation of India, the British used science to further their commercial and political interests. A botanical garden was set up in 1787 near Calcutta to grow teak for ship-building. An observatory was established in 1790 at Madras to survey the treacherous Coromandel coast. The Geological Survey was set up in 1854 when coal was needed for steam navigation (Kochar,1991:41).

The imposition of a single science necessarily means the destruction of innumerable locally created scientific-systems of knowledge. This mental marginalisation, the counterpart of colonial material conquest, is a more subtle but much more devastating form of domination. We help the process to continue and expand by consenting to being exploited, by being dependent on and promoting Western science and technology. It is irrational to expect that Western science can be used for liberation from the very exploitation that it continuously creates (Pereria,1990:27).

It is often asserted that humankind has an inherent need to understand the universe, to find meaning in it. It is claimed that the truth, that Western

science uncovers about reality is available to all, and hence, "science is the common heritage of mankind".

A majority of the people are not even aware of Western science's theories, while awareness alone does not mean understanding. Can people get pleasure from a science they are not aware of or do not understand ? Few get mental satisfaction from theories that space is curved or that quarks come with queer flavours. Few scientists themselves can understand such theories, but they may not be capable of adding to or even criticising them. "Only a few people can keep up with the rapidly advancing frontier of knowledge", says Stephen Hawking, "and they have to devote their whole time to it and specialise in a small area. The rest of the population has little idea of the advances that are being made..."(Hawking,1988 :178).

The term "common heritage" is itself being used as an excuse for much present day robbery of the genetic resources of two-thirds of the world. Western bio-technologists claim that the thousands of varieties of food crops carefully selected and cultivated, and of plants tested and used for centuries for medicinal purposes, are the common heritage of mankind. This claim leaves them free to use the genes from them for genetic modification of commercialisable crops, with patents making the modifications so private that the original preservers of the gene will be unable to use it themselves.

The patent system itself was a fallout of Western science. Whereas earlier, all inventors freely shared their innovations with their community, the commercialisation of science required the inventor to be "protected" from competition. It is quite common to hear that the publication of scientific papers has been held up to give lawyers time to file their patent applications.

Because Western science and technology does not benefit majority of the people, it has become essential for that science to sell itself to non-scientists. Just like commercial advertisers, scientists loudly proclaim science and technology's benefits, hardly ever mentioning its exploitative costs, assuming that the lay public are gullible enough to appreciate their role as omniscient experts.

Even the West's low technology products cannot reach more than a tiny proportion of humankind because of its use of polluting power sources and scarce resources. If all the world's population were to miraculously reach the same level of consumption that the West has today, critical resource and pollution crisis would occur within a few years.

Soon after Hiroshima was bombed, Bertrand Russell asked in the House of Lords: "Is it possible for a scientific society to continue to exist, or must such a society inevitably bring itself to destruction?" (Schell, 1982: 183).

The power that western science has bestowed has resulted in a spectacularly irrational situation. Politicians and militarists now claim that, in order to ensure a nation's survival, they must have, at an ever-ready state of launch, the nuclear weapons to destroy all life on earth several times over. Scientists of smaller nations, while asserting that mega-science is essential for their nation's defence, may not have this extreme objective in mind, but they certainly aim at the efficient production of mass mortality.

There is built-in self-destruction in much of Western science. Genes are required in order to breed new crop varieties that can withstand the pests created by synthetic pesticides itself. But the wide deployment of such new varieties is destroying the very sources which are essential for producing new

crops. The technology, claimed to produce more food, thus ensures its own elimination which must result in a drastic decline in future food production.

Although Stephen Hawking states that, "The eventual goal of science is to provide a single theory that describes the whole universe", he admits that "it turns out to be very difficult to describe the universe all in one go". So, science breaks the problem up into bits, invents a number of partial theories, each of which predicts a certain limited class of observations, neglecting the effects of other quantities. It may be that this approach is completely wrong. Moreover, Hawking concedes that though in the past "scientific discovery has conveyed a survival advantage, it is not so clear that is still the case; our scientific discoveries may well destroy us all..." (Hawking,1988: 65).

The "survival advantage" that Hawking claims for past discoveries has been put to question with the environmental crises which have arisen because of Western science's inadequate knowledge, plain ignorance and premature interventions in nature, made on this basis.

With the imminent possibility of global climatic change and its potentially disastrous consequences, a few scientists are supporting the precautionary principle. Such action indicates that science can no longer be taken as the sole or even the most important authority in making decisions that visibly affect people. But with science dependent on industry and governments only concerned with economic growth, there is no chance of the principle being widely used. Moreover, the scientists recommend the principle only because the consequences might be irreversible; this cannot be a guiding principle for protecting the environment (Riorden,1992:14).

2. Sustainablity of Traditional Science and Technology :

The main characteristics of traditional technology are: the technology is researched and developed by "ordinary" people, at little cost, perhaps without

theories to support it. The innovators do not require formal recognition for their work. The technology uses local and usually low cost resources, and is of immediate relevance to the people. Others are free to use the technology and improve upon it. Knowledge is disseminated free and it spreads spontaneously by traditional, oral means of communication. The processes of innovation as well as use are supported by traditional culture. Such a system cannot be easily used for domination; innovators do not achieve positions of power or authority because of their innovations, neither can the technology be enclosed by patents. The time when the innovation was made - centuries ago or today - or the continuing use of the technology, is not of importance.

The traditional system encouraged self-reliance, thereby, freeing people from the need to be dependent - and dominated by others. Traditional technology allowed people the freedom to exercise their creativity, to solve their own problems, to have control over their environment. Traditional technologies were mostly based on renewable raw materials, including sources of energy, making them sustainable. Not all these criteria may be applicable to particular technologies, and there may be other criteria that could be applicable, too (Pereira, 1990:42).

3. Traditional Technology - Result of People's Research :

Much of traditional research has been based on the uses of plants for food, manure, pesticides, fodder, medicine, timber and other housing material, oil for cooking and lighting, cosmetics, dyes, tans, fibres, fuel, material for mats, baskets, ornaments, and dozens of other purposes.

Each experiment done by a person-in-the-field is small in itself, but when one considered the vast number of species of plants and the multiple uses to

which each has been put, it can be seen that a tremendous amount of systematic, directed, conscious research and development has been undertaken by millions of normal people over millennia, resulting in a rich fund of knowledge.

Taking medicinal uses alone, if one multiplies the number of species of common plants in India (say, ten thousand), by the number of parts of a plant (the leaves, flowers, fruits, seeds, stem bark, roots, root bark and others) that are used, by the number of common diseases and other health uses for which each of these are tested (say a hundred, ranging from headaches to fertility-control) and by the methods of preparation and dosages possible, one gets a faint idea of the stupendous amount of research that has been accomplished. If one takes into account the possible synergistic combinations of herbs, this again is increased by several orders of magnitude.

While it is well known that a colossal number of traditional technological practices have been developed over the centuries in India and other regions, it is usually believed that the use of most of these has died out because of the onslaught of Western technology and science. However, investigations reveal that not only are these technologies still widely employed among primitive tribes, but also that they are widespread among non-tribal, in rural as well as urban areas. This is extensively used not only in the fields of agriculture and herbal medicine, but is also fairly prevalent in many other areas as well.

There are evidently many scientists working outside, rather than within, institutional laboratories. The former conduct research in their daily life, while carrying on their normal occupations, in their fields and homes, using locally available resources. Such a technology is naturally concerned with the provision of vital necessities, not with the wants of professional scientists. It is what the majority of people in the world still depend on for their survival (Pereira, 1990:52).

4. Contribution of Peoples' Research :

Pharmaceutical companies claim that they spend millions of dollars on developing each drug that they manufacture and that it takes over a decade to research and produce each. Costing at similar rates would value the research carried out traditionally at trillions of dollars. The appropriation of our traditional herbal knowledge must accordingly be saving the pharmaceutical companies' billions of dollars and centuries of time, without compensation for their use of our intellectual property, of course.

The chemicals of less than 1% of all plant species have been studied by Western science, while nearly all plants in India have multiple uses based on their chemicals. The percentage of plant species studied, will no doubt, increase rapidly through Western research as well as by the extinction of unstudied species by habitat destruction. But the requirement of identifying the chemicals prior to using plant materials ensures that the Western system will take a very long time before it finds uses for all plant species, even if Western scientists continue to use our heritage to guide them.

Much of such formal research is also pointless, since it works by isolating and checking single plant chemicals *in vitro* or in clinical tests. These can easily produce false-negative results, since each plant contains numerous chemicals - *neem*, for instance, has more than a hundred identified compounds - each of which acts in several ways. And working with all possible synergistic combinations would take still longer.

It is correctly claimed that many Indian formal scientists merely repeat research that has already been carried out in the West. But it is highly amusing to watch the frantic research that is being done in the West and here, which

merely replicates what has been done here hundreds of years ago. Pharmaceutical companies and pesticide multinationals have established elaborate laboratories merely to study traditional practices. Individual scientists want to be the first to discover what has already been discovered ages ago. The vast accumulation of indigenous knowledge now supplies numerous themes for doctoral dissertations, with such stolen research being considered scientifically proper. A number of papers deal with efforts to verify traditional uses of plants, though only a few cite such uses.

It is becoming increasingly obvious that a centralised research establishment cannot solve the multitude of agricultural problems requiring resolution in minutely differing ecological niches. Centralised research, by its very nature, cannot work in micro-niches; farmers work at the few hundred square metre level, even if agricultural scientists may be vastly different from the conditions in which particular farmers would use the technology (Pereira,1990:49).

For many years scientists at IRRI, believed that, they would be able to develop paddy varieties - arrogantly numbered from IR8 onwards - which they would supply to the whole rice-growing world. They have now made the discovery that, besides being susceptible to pests and having other problems, standard varieties cannot produce well because of local variations in climate, soil and so on. IRRI has given up promoting universal varieties and is now distributing germ-plasm through the various regional rice research centres. But neither can regional centres produce varieties to suit all micro-niches. So we are full circle back to the need for traditional varieties, selected by millions of small farmers. However, there is a new danger lurking on the horizon. The demand by the West for patent rights on new species is an attempt to stop all on-farm research.

Centralised agricultural research is expensive and negligible compared to decentralised, on farm, research by farmers. It takes more than a decade to

check out a new fruit species and costs thousands of rupees to do so in a horticultural establishment. How much would it cost and how many millennia would it take if such research centres had been required to develop all the varieties of mangoes that we already have?

The need for millions of local experimenters is made essential and urgent by the possibilities of global warming and the destruction of the ozone layer. It is impossible to predict the innumerable changes that may occur in millions of micro-niches. A centralised research system would have to collect data from each locality, work out alternatives and feed back the results to the corresponding region, even while the environmental conditions may have changed during institutional scientists' struggles with bureaucracy. On the other hand, local research could provide millions of correct solutions faster and continuously. The problem of transferring technology from laboratories to field users can be avoided simply by transferring the research back to the field.

Moreover, theories have been highly developed in the fields of health, for instance, in India. There may have been theories in other fields which could be lost. Such theories may or may not have been rational in the Western scientific sense; much of traditional technology could have developed from a recognition of patterns in phenomena. Mathematisation is unnecessary and may even be impossible in such cases. This is particularly so when a large number of environmental interactions have to be taken into account.

An important corollary of development by the people is that, the technology is invented and tested in the field, where all natural interactions, known and unknown, are allowed to play their part. It is holistic in practice and thereby avoids the pitfalls of incomplete and incorrect theories. India's vast accumulation

of traditional technology would probably not have developed had people waited for detailed theories to explain all that they discovered. If innovators had restricted their experiments to those based on logic or patterns, it is possible that many experiments would not have been carried out at all and that much knowledge left undiscovered.

As Mahatma Gandhi opined, every man must be his own scientist and every village a science academy. Anyone has the right and should exercise it to be a scientist or technologist, to develop new technologies or to modify old ones. There appears to be no need for a separate class of people who do only or mainly such work. Those who develop traditional practices are mainly - but not necessarily - those, who use the practices themselves. There are few specialist boundaries. The same farmer may develop botanical pesticides, herbal treatments for their bulls, methods of catching fish and many other practices.

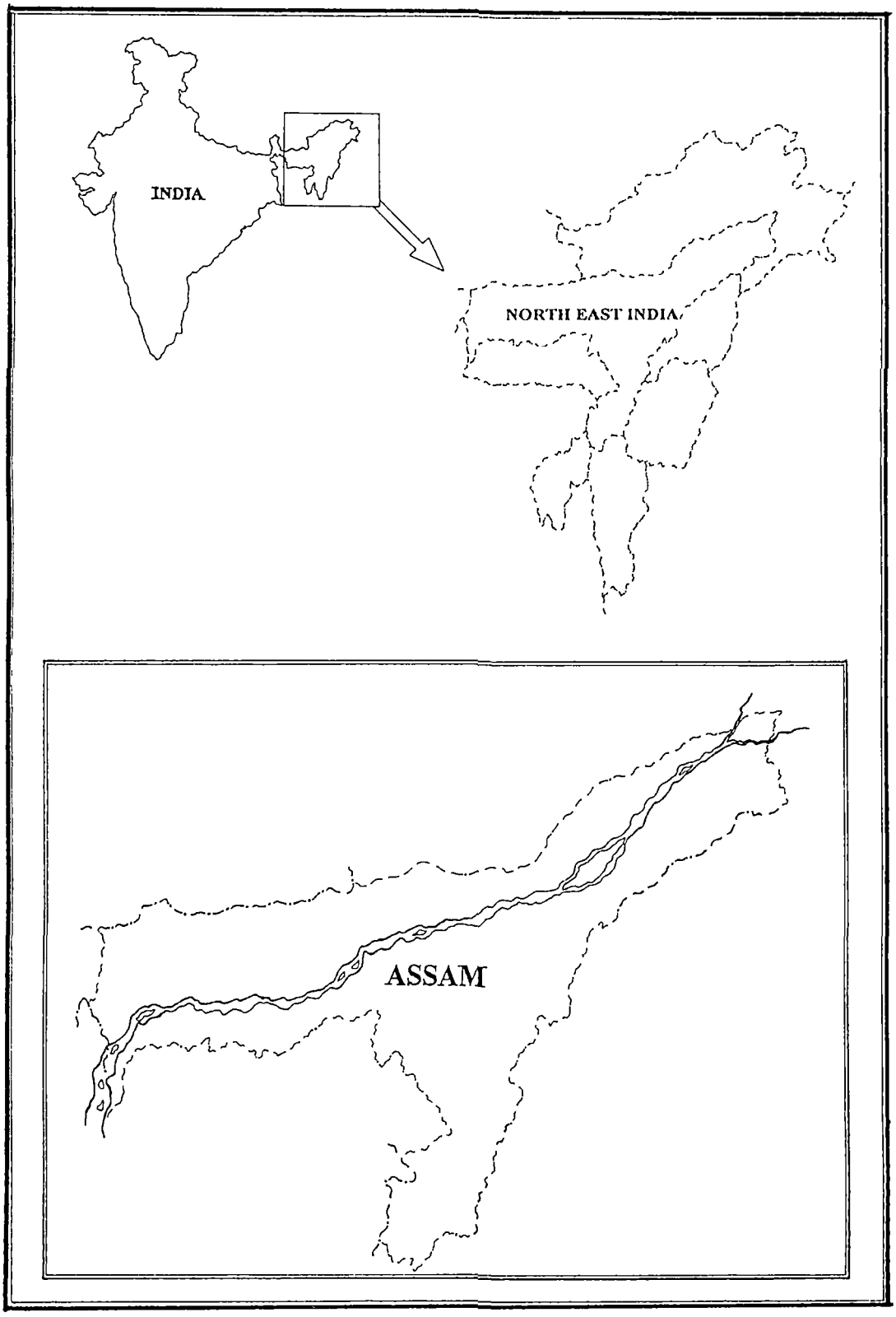
Western science has diminished traditional creativity by removing research and development from the public domain, by privatising and commercialising it. The impression has been created that no one except self-labelled highly qualified scientists do research. Shifting science from the villages to the laboratories - the enclosure of the scientific commons- appears to have been the initial means of controlling knowledge. When experts claim to be the sole repositories of knowledge, the rest of humanity is deemed to be ignorant, and much of the rest of western humanity has internalised this notion. Parallel with this process, goes the transfer of power from people in general to the self-elected elite. These try to devalue the science of those in the field, dismissing it as chance findings and superstition. The tribals, particularly, are called ignorant, even by those who appropriate their knowledge under the disguise of ethno-sciences. Such appropriation, in fact, confirms the validity of traditional science - if such proof is required at all .

5. Traditional Technology - Socio-culturally Appropriate :

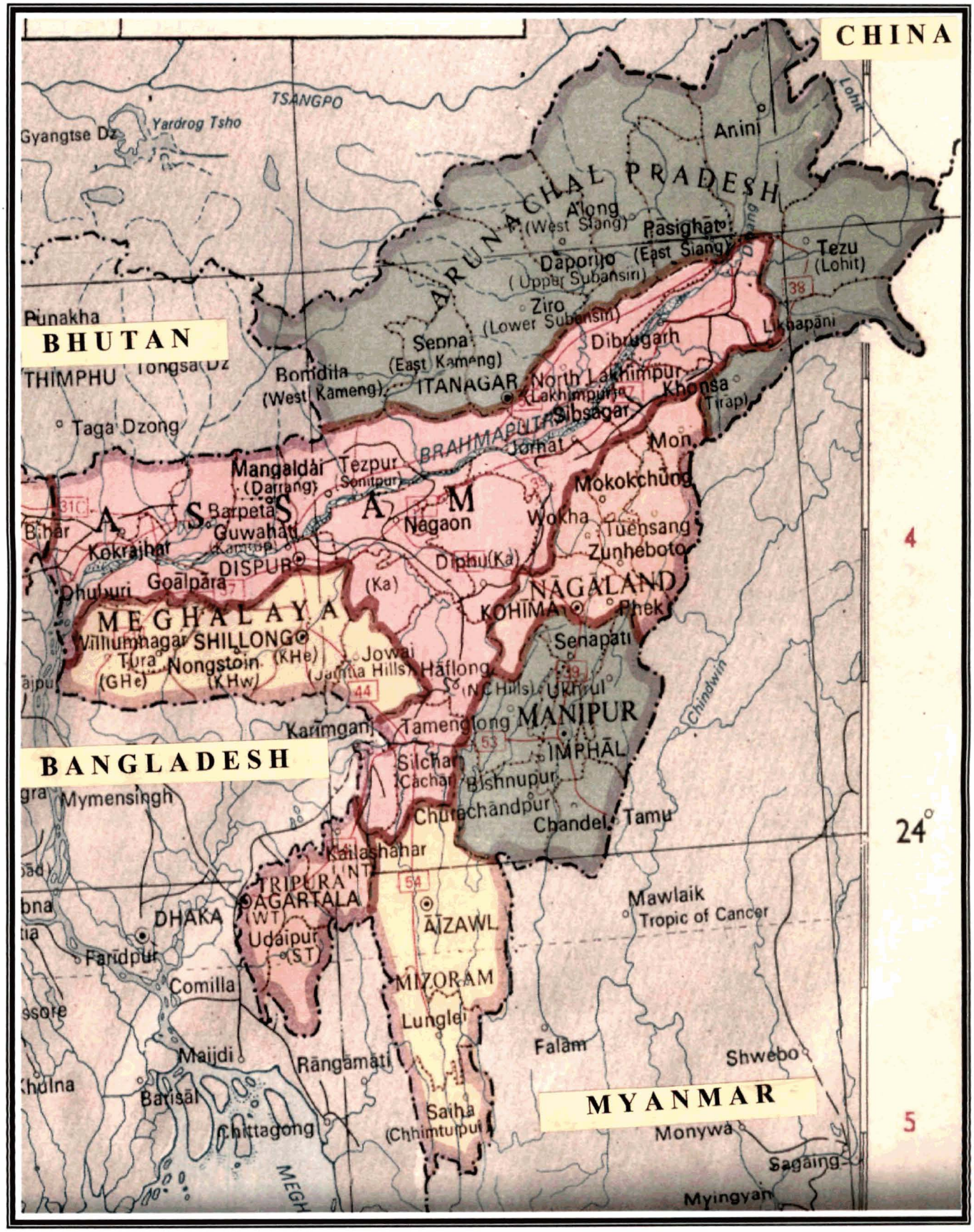
Traditional technologies are of immediate relevance to the people in the region in which they are developed. They are rarely-if at all - invented merely for the sake of the knowledge gained or the technology itself. Farmers may develop a botanical insecticide because a pest has attacked their crops, or artisans may develop a new plant-derived dye for the cloth they weave. Traditional technologies are usually low in cost, since they have to be affordable for village artisans and farmers. The western industrialised system, on the other hand, develops technology mainly for big farmers and industrial capitalists, where the higher the cost, the larger the profits usually made by the manufacturers. Traditional technologies mainly use locally available materials and renewable ones. Metals are used but usually in a form that makes them long-lasting and recyclable. Most of traditional technology is inherently socially appropriate.

Traditional systems have intrinsic social and environmental feedbacks. When people live in a region from which they would not normally emigrate, they are extremely careful to avoid damaging their environment to the point of non-sustainability. When interventions are made in such an environment, any deterioration is usually quickly observed and further intervention of that type avoided. The development of traditional technologies is limited to those which do not pollute the environment, exhaust resources or produce unemployment. It could be that, the failure to develop labour-displacing textile machinery in India was due to precisely such social control. It is only because the Western system promotes the ravaging of remote regions that it can temporarily prolong its un-sustainability (Pereira, 1990:46).

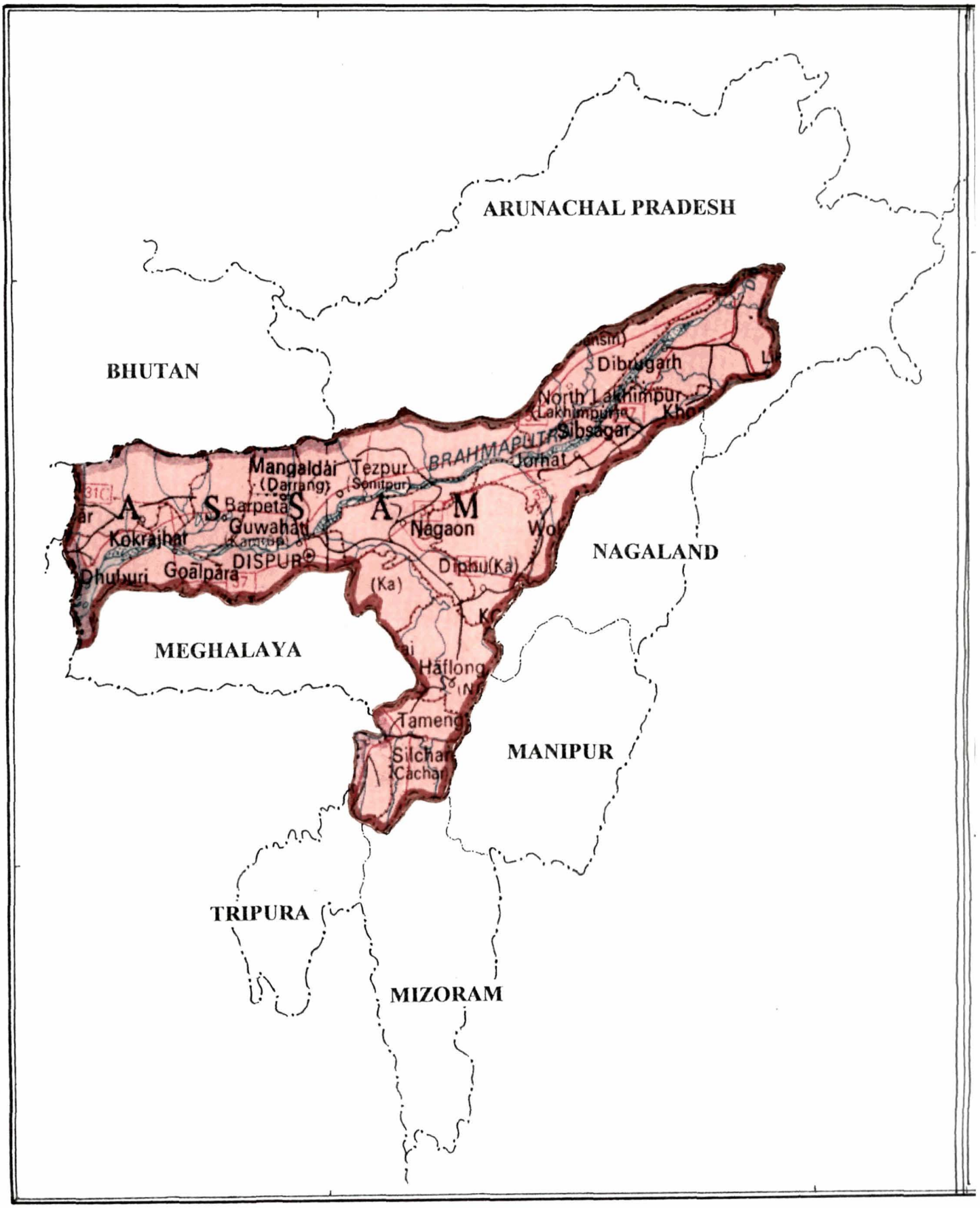
LOCATION MAP OF NORTH-EAST INDIA



NORTH -EAST INDIA



ASSAM


ARUNACHAL PRADESH
BHUTAN
Dibrugarh
North Lakhimpur
(Lakhimpur)
Sibsagar
BRAHMAPUTRA
Jorhat
Mangaldai
(Darrang)
Tezpur
(Sonitpur)
Barpeta
Guwahati
(Kamrup)
Nagaon
Kokrajhar
DISPUR
Dhubri
Goalpara
Diphu(Ka)
(Ka)
NAGALAND
MEGHALAYA
Haflong
Tamenglong
Silchar
Cachar
MANIPUR
TRIPURA
MIZORAM

PART- B

IV. NORTH EAST INDIA : A BRIEF SKETCH

1. The Land and the People :

The seven states of north eastern part of India together is often called the‘ ‘North East India’ or simply the ' North -East'. In ancient and medieval time in this region there were several kingdoms, ruled by several kings of various ethnic groups. Later, in the modern times the British rulers ruled all those kingdoms (except Manipur and Tripura) together as a single state which was known as Assam. Later, after independence of India, Assam was again divided into new states at different times and it lost its identity as a single state of Assam. Though the greater Assam is divided politically into several states, yet it preserves a common cultural and social identity and it is still continuing in the name of the North-East India.

North- East India is situated in one of the greatest routes of migration of mankind. Down the ages she received people of different strains, particularly the Indo-Chinese Mongoloids, pouring into India, who added new elements to the country's population and culture-complex. Across her geographical boundaries there came men, ideas and means of production to mingle together with the aboriginals and shape a new mode of living, a rich culture and science and technology. It is well known that China is the home land of many scientific and technological discoveries. Science and technology of ancient India is also well known for many of its foremost discoveries. As North East India is situated in the cultural ecotone of both ancient Indian and ancient Chinese culture, therefore she has a long history of rich indigenous science and technology.

Geographically the North- East is situated in between latitudes 28 ° 18" and 24 ° north and longitudes 89 ° 46" and 97 ° 4" east, in the extreme north-east frontier of India in the vicinity of China, Tibet and Bhutan on the north, of Burma on the east and the south and of Bangladesh on the west. North- Eastern India has an unique geographical situation. Flanked by hills on both the sides, the mighty Brahamaputra flows from the eastern corner to the western corner. The western side of this region is open to the eastern part of Indian subcontinent. The Region includes the states of Assam , Manipur, Meghalaya, Nagaland, Arunachal Pradesh , Mizoram and Tripura. This part of India is often termed as "seven sisters" of the North East. This part of the country although comprises of seven separate states yet they constitute a homogenous natural region of hills, valleys, plains and other related geographical features. Though the North -East region reflects certain significant ecological and cultural adaptive contrasts between the hills and the plains regions, there are also significant elements of continuity in biological, cultural and social factors between the hills and the plains. Again available ancient, medieval and modern records indicate interdependence and interactions between the hills and the plains of the North- East.

North -East India is linked with the rest of the country by a narrow neck of Indian territory hardly about 60 kms. wide between the foothills of Himalayas in the north and Bangladesh in the south. The total area of this region is 254985 sq. kms. Out of the seven states of this region Arunachal Pradesh covers the largest area- 83,578 sq. kms, followed by Assam - 78,400 sq. km., Manipur, Meghalaya and Mizoram are almost of similar area i.e. 22,356 sq. kms., 22,548 sq. kms. and 21,090 sq. kms. respectively. Nagaland has 16,536 sq. kms. followed by Tripura - 10, 477 sq. kms.

This part of the country experiences a very low density of population in comparison to other parts of the country. Assam has the highest density of population - 254 persons per sq. km. followed by Tripura- 196, Manipur- 64, Meghalaya -60, Nagaland-47, Mizoram -23, and Arunachal Pradesh has the lowest only 8 persons / sq. km.

An anthropologist's paradise, North East India is regarded as the museum of races. Various races from different parts of the world migrated to this region made their settlement and contributed to a unique society and culture of the world. This region is situated on one of the main routes of migration of human races. From the north and the east came the Alpines or non-vedic Aryans, the Austrics, the Tibeto Burmans and Thai Chinese people. From the west came the Negritos, the Dravidas and the Aryans. The Negritos and the Dravidas could not exert their influence here and they were probably driven out by succeeding Mongoloids. Traces of negritos and Dravidas are found only in some places of Assam, specially in the Naga-hills (Chatterjee, 1951: 4). The other inhabitants who have their share in the constitution of the Assamese Society and its culture are the Alpines, the Austrics, the Tibeto-Burmans, the Thai- Chinese and last but not the least, the Aryans. The Austrics, the Kiratas, the Alpines, the Negritos, the Aryans etc. are the earliest inhabitants of the State.

The Khasis of Meghalaya belong to the Monkhmer group of the Austro-Asiatic branch. They were perhaps forced to take shelter in the Khasia and Jyantia hills by the Tibeto-Burman people. It is supposed that Austro-Asiatics are the earliest inhabitants of ancient Assam. The Khasis contributes a lot towards the traditional science and technology of this region particularly in smelting and manufacturing of iron (Rajguru, 1988:40).

After Austro-Asiatics the second group of people who came to this region are the Tibeto-Burmans. Tibeto-Burmans are a branch of the Tibeto-Chinese people. This group of people practically occupy the whole of this region. Tibeto-Burmans are again subdivided into Tibeto-Himalayan, Assam-Burma, and North Assam sub divisions. Bhutias are the Tibeto-Himalayans, Bodo, Naga, Kuki-Chin, Kochin, Burmese, Lolomochu and Lui are the members of Assam-Burma subdivision. The Bodos of Assam are again divisible into the Kachari or the Bodo, Lalung or the Tiwa, Dimacha, Garo, Koch, Rabha, Tripuri, Chutia and Moran. The Naga group of people again subdivided into Naga-Bodo, The west, the middle and east branches of the Naga and the Naga-kuki. The Meiteis of Manipur, the Kukis and the Lushais of Mizoram belong to the Kuki-Chin group. The Singphos of Arunachal Pradesh are the Kachins. The Akas, the Daflas, the Abor, the Mishimis and the Miris of Arunachal Pradesh and Assam respectively are the people of North Assam division of Tibeto-Burmans (Rajguru, 1988:42).

The Ahoms, the Khamtis, the Shans, the Phakials, the Tairungs and the Naras are the people of Thai-Chinese branch (Choudhury, 1959:103).

A section of scholars believe that earlier to Mongoloids, the Alpines, that is the non-vedic Aryans came to this region and established flourishing kingdoms. The existence of Alpines is believed in connection with the priestly class of the Kayasthas mentioned in the Nidhampur grant of Bhaskarvarmana and the priestly class of Kalitas who had been working as priests to the Koches and the Kiratas and whose influence came to be over shadowed by the Aryan Brahmanas in the subsequent times. Some notable writers believe that the Alpines are allied to the Iranians. According to this group King Bhagadatta of ancient Assam or the Kamrupa was from this group of people (Choudhury, 1959:103).

According to most of the Indologists, ancient Assam came into contact with Aryan Indians between the second century B.C. and second century A.D. During the reign of early Hindu kings of Kamrupa. beginning from Bhaskaravarmana there are ample references to Brahamanas, Kayasthas and other professional Hindu people living in Assam, from the different grants issued at different times. In the medieval period also a large number of Brahamanas, Kayasthas and other professional Hindu people came to Assam and made their permanent settlement under patronage of the Kamata, the Koch, the Kachari, the Chutiya and the Ahom kings. The Koch and the Ahom kings showed special favour to Brahamanas and Kayasthas. Historical account of Mohammedans in Assam can be traced back to the beginning of thirteenth century AD.

The units comprising North- East India

1. Assam

In ancient days, Assam was known as Pragjyotisha and later as Kamarupa. It is by these two names that Assam has been referred to both in epigraphs and literature. The modern state of Assam is but a part of the extensive kingdom of Pragjyotisha or Kamarupa of ancient times. The references in the epics indicate that the country stretched as far as the sea and that it was at least, partly a hilly country. According to most of the *Puranas*, the kingdom of Kamarupa extended upto the river Karatoya in the west and included Manipur, Jaintia, Cachar, parts of Mymensing, Sylhet, Rangpur and portions of Nepal and Bhutan. The *Kalika Purana*, stating that Kamarupa lay to the east of the river Karatoya, mentions that it was triangular in shape, 100 *yojanas* in length and 30 *yojanas* in breadth and that it was bounded by the Dikharvasini (modern Dikrai river) in the east. According to the *Yogini Tantra,* Kamarupa was

divided into Ratnapitha, Bhadrapitha, Saumarpitha and Kamapitha . The *Hara Gauri-Sambada* also divides Kamarupa into four *pithas* marked by river boundaries, viz- (I) Ratnapitha between the Karatoya and the Swarnakosha, (ii) Kamapitha between the Swarnakosha and the Kapila, (iii) Swarnapitha between the Pushpika and the Bhairavi and (iv) Saumarpitha between the Bhairavi and the Dikrang rivers. From all these, it becomes clear that the kingdom included the present Brahmaputra valley, Bhutan, Rangpur, Koch-Behar and the adjoining lands.

The origin of the name Assam is uncertain. According to some, it is derived from the world *asama* meaning uneven as distinguished from the *samatala* or the level plains of Bengal. B. K. Kakati suggests that the word *asama* (peerless) may be a later Sanskritisation of an earlier from *acham*. In Tai, *cham* means "to be defeated". With the prefix 'a', Assam would mean "undefeated", "conquerors". If this is its origin, then the name once applied to the people was subsequently applied to the country as well. There is another suggestion according to which, the word *Assam* is derived from a Bodo formation like *ha-chom*, meaning low-land . But there is no denying the fact that, the name *Asam* or *Assam* is connected with the Shan invaders, who entered the Brahmaputra valley in the beginning of the 13th century, for the term nowhere occurs prior to the Ahom occupation. The *Vamsavali* of the Koch kings, the *Yogini Tantra* and the Vaishnava literature apply this term to the Shan conquerors rather than to the country which they occupied. Therefore, there is no doubt that the word is derived from the designation applied to the Ahoms. The tradition of the Ahoms themselves, which finds mention in some Assamese chronicles is that the name *Ahom* is derived from the term *asama* meaning "unequaled" or "peerless", which was first applied to them by some

local tribes in token of their admiration of the way in which, the first Ahom king Sukapha conquered and then conciliated them. This view was supported by Gait, and is accepted by the Assamese scholars at large. But it is doubtful how a Sanskrit derivative can be associated with Mongoloid tribes of Bodo speech. It is, therefore, more probable that the word '*asam*' has a non-Aryan origin.

The Assam Range broadly divides Assam into two valleys - the Brahmaputra valley or Assam valley and the Barak valley. The Brahmaputra is one of the largest rivers of the world. It flows majestically through the heart of the Assam valley. Another river, the Barak (a tributary of Surma) flows through the Barak valley. The Brahmaputra valley is an alluvial plain, of about 720 km. in length, with an average breadth of 0.96 km. The valley spreading flat and wide from east to west in the lower portion, tends to project northward in its upper portion where it tapers off. There are seventeen districts in the Brahmaputra valley -Dhubri, Bongaigaon, Kokrajhar, Goalpara, Kamrup, Nalbari, Barpeta, Darrang, Sonitpur, Nowgong, Marigaon, Jorhat, Golaghat, Sibsagar, Dibrugarh, Lakhimpur and Dhemaji. The Barak valley has three districts namely Cachar, Karimganj and Hailakandi . There are two hill districts in Assam which are inhabited mostly by tribals. These two districts are Karbi Anglong and North Cachar Hills. Both these two districts are autonomous hill districts inhabited by mostly Karbis and Dimasha Kacharis respectively. Assam has an area of 78,400 square kilometre and a population of about 2.5 crore (1991 Census).

2. Arunachal Pradesh

The present Arunachal Pradesh earlier known as the North- Eastern Frontier Agency (NEFA) has undergone several political changes. It is of considerable geo-political importance. On the one hand, the high mountain ranges,

difficult terrains, formidable streams and thick forests made it an isolated region, and on the other, it provides the international boundary for several neighbouring countries like Burma, Nepal and Bhutan. The mountain passes and the river courses, again, provide migration routes while the great mountain ranges and the difficult streams discourage the people to have contact with one another. Lastly, the Brahmaputra river forms a cultural watershed by barring the people of Arunachal Pradesh from having contact with the people of Assam.

The state has an area of 83,743 square kilometres and is bounded by Burma in the East, Tibet in the north east, Assam in the south and Bhutan in the west. The rest of the great Himalayan range forms the northern and north-eastern boundary with Tibet. The altitude of these mountain ranges sometimes vary from as high as 21,000 feet to sometimes as low as 9,000 feet. Towards the Burma border the mountains gradually descend and in the Patkai hills, the average altitude is about 6,000 feet. The extension of foothill strips is constituted by the mountainous belt comprising the spurs radiating southward from the Himalayan crestline. The pattern is a little varied in Western Arunachal Pradesh where regions like Tawang, Bomdila etc. run parallel to the great Himalayan ranges.

The major important rivers of Arunachal Pradesh are the Tirap, the Lohit, the the Siang, the Subansiri and the Kameng. The five districts are all named after the major rivers flowing through the respective districts. The communities of the state can be classified under three broad categories of the Kameng, the Subansiri and the Siang districts. The Kameng district is predominantly inhabited by tribes like the Monpa, Sherdukpen and Aka. The Subansiri district has predominant population of the Nishi (the Daflas), the Apatani, the Tagin and the Hill Miri.

The history of Arunachal Pradesh is shrouded in the mists of traditions and mythology. Observing the ruins in the foothills suggests some contacts between the ancient rulers of Assam and the tribesmen living near the plains. Local traditions regards the area near Sadiya as the ancient Vidarbha and the archaeological relics at Bhismaknagar in Lohit as the capital of King Bhismak, whose daughter Rukmini was carried away on the eve of her marriage by Lord Krishna himself.

In addition, there are several such archaeological sites of ancient times which reflect certain contacts with Hindu culture. In the Lohit division are the ruins of the copper temple—Tamreswari, which at one time, must have attracted many worshippers, and a place of great sanctity in the beautiful lower reaches of the Lohit river, the Brahmakund, where Parashurama was reputed to have opened a passage through the hills with a single blow of his axe, which is visited every year by thousands of pilgrims (Elwin,1960:1).

The old records and archaeological sites and folklore traditions have to be explored to know more about the history of the tribes living in Arunachal Pradesh. It has been established that the Mishmis must have visited the forts and temples of the Lohit and probably helped to build them just as the Daflas must have worked at the Ita and the Akas at Bhalukpung. In general, the Ahom kings adopted a policy of conciliation towards the tribes, supporting it by display of force when it could be effectively employed.

When the British took over the control of Assam from Purander Singh in 1838, they found that the war-like tribes of the frontier had become even more aggressive as a result of the breakdown of the authority of Government, and for the remainder of the century they largely followed the policy of the

Ahom kings. They did whatever they could to make friends with the tribe; they protected the plains people against their raids; they established outposts in the foothills and from time to time imposed blockade and undertook punitive expeditions to the interior.

3. Manipur

Manipur, the land of Jewels, and once described by Lord Irwin as the 'Switzerland of India', is split up into two regions—the Hills and the Plains. Manipur comprises an area of 22,327sq. kms. of which 20,126sq. kms. forms the hill areas. In 1981, the population of the state was 14,20,953. The inhabitants of the hills are about 29 colourful tribes and have their respective dialects, customs, practises and modes of dress. The Meiteis inhabiting the plains are mostly Hindus and speak Manipuri, a highly developed language with a rich and ancient literature of its own.

Manipur is the twentieth state of the Indian Union. The small plain area comprising about 2,230 sq. kms. is surrounded by hills on all its sides. Manipur is bounded on the north by Nagaland, on the south by Mizoram, on the east by Burma and on the west by the Cachar district of Assam.

The communities living on the hills is the least studied. They have been classified on the basis of their linguistic affiliation as well as geographical locations into three linguistic groups—1) Naga-Bodo group of the Manipur north district, 2) Eastern Naga group of the Manipur north and Manipur east district and 3) Kuki-Chin group of the Manipur south district and Tengnopal district.

4. Meghalaya :

Meghalaya, having an area of 22,429 sq. kms. and a population of 13,35,819 has been characterised with the Garo and Khasi hills from which the two matrilineal tribes—the Garo and the Khasi, derive their names.

The two districts of Western Meghalaya are the Garo Hills East and the Garo Hills West. These districts are inhabited by the major tribe: the Garos. The other tribes inhabiting the western Meghalaya are the Hajong, the Rabha, the Koch, the Baro and the Dalu. In addition, the Garo hills provide shelter to the Muslim population, which evidently have migrated from the neighbouring areas of Assam and Bangladesh.

The eastern part of Meghalaya is characterised by the Khasi and the Jayantia Hills which now constitute the two administrative districts of Khasi and Jayantia. These districts are inhabited by the Khasi and the Jayantia tribe which now claim separate ethno-cultural identities. They are unique in being the only Austric speaking group in the north east India and also in terms of possessing a perfect matrilineal organisation. The majority of the Khasis have embraced Christianity. In case of Jayantias, though their Kings were Hinduism followers upto the16th century, yet studies have revealed that at present, majority of the Jayantias have accepted Christianity.

Meghalaya has the unique distinction of having prehistoric sites reminding us of its hoary antiquity. It is an arduous task for the Paleo-anthropologists to link the ancient evidences with the contemporary ethnic group.

5. Mizoram

Mizoram, formerly known as Lushai Hill district of Assam is sandwiched between Burma in the east and south and Bangladesh in the west. On the north are the Cachar district of Assam and Manipur, while on the north-west lies Tripura.

The state with an approximate area of 21,081sq. kms. is of considerable geo-political significance, as it has about 1,014kms. of international boundaries

with Burma and Bangladesh. The steeped and rugged hill ranges run from the north to the south with an average height of about 900 metres. The highest peak is Phawngpuri or Blue mountain with an altitude of 2,065 metres. The two main rivers are the Tlwang (Dhaleshwari) in the north and Kolodyne (Chhintuipui) with their tributaries which become turbulent during the rainy season.

Geologically, keeping at par with the other areas of the north east region, the hills in Mizoram constitute of sand stones and shades. Owing to this geological composition, there are frequent and heavy landslides in the rainy season. The climate is temperate, with pleasant summers and not very cold winters. The summer temperature varies between 20 to 29 degree centigrade and in winter it varies between 11 and 21 degree centigrade. The state receives rain from the Monsoon, the average rainfall being 208cms. in Aizawl, the capital.

The Mizo is a genetic term and it stands for several major tribes and sub-tribes of the area. The major tribes are the Lushai, the Ralte, the Hmar, the Paite and the Pawl. Besides, it is also inhabited by a number of smaller communities, culturally very much akin to the Mizos. Christianity is the dominant religion of the territory while Buddhism stands next to it.

The term 'Mizo' appears to have been derived form the two mizo words—'*Mi*' and '*Zo*'. *Mi* in Mizo means 'man'. There is however, some dispute on the term '*zo*'. According to one view, *zo* means highland and '*Mizo*' means high-lander or people living in high hills. Another view expressed by an author goes to state that '*zo*' may also mean cold region and therefore the word 'Mizo' signifies people of the cold region . People living in the hills could be called Mizo by the people of the hot and humid valleys.

It is found that the Mizos might have formed part of the people who once inhabited the T'ao valley of Kansu province in the north-west of China. Because of many disturbances they moved towards the border of Tibet and Burma, probably around the seventh-century A.D. Then, through Kakaung Valley they came to Chindwin belt. It has been further established that, because of the Shan penetration, they left the Kalbaw valley for the Chin hills and settled on the Than range. In the late 15th century, they again moved to the Len range near Tiau river. Around 1700A.D., owing to the pressure from Pawih, the Mizos crossed the Tiau river and came to the place now called Mizoram. It is said that they built a big village at Selsih around 1740 A.D. The village later on broke up and they started moving further west. They came into confrontation with the British also and that gradually led to the final annexation towards the close of the nineteenth century.

6. Nagaland

Nagaland is the sixteenth state of the Indian Union and was thus designated on the 1st of December, 1963. It is located on the eastern frontier of the country and is bounded by Assam on the west and north, by Arunachal Pradesh in the north and east, by Burma in the east and Manipur in the south. Most of the state is hilly and forested except for the area near Dimapur and a few other small areas near the border of Assam. Major part of the state is covered by three mountain ranges—Patkai, Naga and the Barrail, running north-east to south-west. The Patkai range lies on the east and forms the Burma border. The state has a very rugged topography with wide spurs and ridges. The altitude of the state varies between 198 metres (636 feet) to 3,048 metres (10,000 feet). The highest peak is Saramati (12,598 feet) in the Patkai range in the

Tuensang district, followed by Japvo (9800 feet), near Kohima in the Barrail range. Nagaland covers an area of 16,579sq. km. with a population of 7,74,930 (census1981), and its population density being 47persons per sq. kms. The climate varies from the sub-tropical to temperate. The average winter temperature comes down to as low as 30 degree Fahrenheit. The soil is acidic and rich in organic matter but poor in phosphate and potash content. Different types of trees, plants, herbs abound in Nagaland which are used for timber, fuel as well as for medicinal purposes. Indigenous tea grows all over the state.

The population of the Naga tribes and sub-tribes with their distinctive languages and cultural features are concentrated in the seven districts of Nagaland. The Nagas inhabit one thousand one hundred and twelve villages of the state, which are located at the height of 1,000 to 2,000 metres. The capital town of Nagaland, Kohima, is located at a height of 1,463metres. The state covers an area of 16,579 sq. kms.

The origin of the name 'Naga' has given rise to some considerable speculations. The term includes the various tribes of the present state of Nagaland, the tribes: Nocte, Wancho, Tangsa, etc. of Arunachal Pradesh and their likes in Manipur state and in the Somra tract of Burma.

Dr.W.C. Smith (1925: 67) has mentioned the opinions of different scholars about the origin of the word 'Naga'. For example, according to Peal, the true form of this word is not *Naga* but *Noga* from a root—*nog* or *nok*, meaning 'people'. They are so named in the Buranjis or Chronicles or History of the Kings of Assam.

It is difficult to say exactly when they entered into the present Nagaland, but the ancient Hindu literature mentions the presence of early Indo-Mongoloid

(Kirata) in eastern India speaking various Sino-Tibetan dialects as early as 1000B.C. By that time the Kiratas were known to the Vedic Aryans as cave-dwellers, from whom the Aryans obtained mountain produce like herbs and drugs. The four books of the *Vedas*, supposed to have been compiled in the 10th century B.C. mentions about the Kiratas in the passage of the *Yajurveda*. This shows that the Kiratas are at least as old as that period (Chatterjee, 1950 : 23). The Greek in the first century A.D. had heard of these people with the characteristic flat nose of the Mongol races.

7. Tripura

Tripura lies to the south-west of Assam, and to the east of Bangladesh. The state covers an area of 10,477 sq. kms. It is a curved strip of land, measuring about 183.5kms in length from north-east to west and 112.7kms. from south to north. This land-locked state and its geographical limits touch both national and international boundaries. Four-fifth of its borders are enclosed by the Bangladesh in the north, west, south and the south-east and only in its north-eastern border that Tripura meets the state of Assam and Mizoram. Possessing a climate which is almost akin to that of the other north-eastern states and Bangladesh, it is neither too hot nor too cold. The average maximum temperature is 35 degree centigrade in May and June and the average minimum is 10 degree centigrade in December and January. Tripura is excessively humid accustomed to an annual heavy rainfall of about 400cm.

Geologically, the territory is not very old and seems to have arisen from the sea-bed in the late Tertiary Age, about 40 million years ago. The land surface is mountainous and uneven. The whole terrain abounds in rivulets, brooks, rivers, hills, plains, valleys and lakes. All the rivers traverse Bangladesh before they fall into the Bay of Bengal. There are seven bay ranges and numerous hillocks in Tripura. The topography of the state makes it much prone to soil erosion and frequent floods.

Tripura has been called a 'herbarium' for its abundance in many medicinal herbs. The fauna and flora of Tripura resemble those of its neighbouring states, the terrestrial fauna being comparatively more than the aquatic fauna.

After the decline of the Deva dynasty in the early Medieval period the chief of the Tripura tribes rose into prominence in the hilly region of the state. They gradually extended their hold in the plain lands of the Tripura region and came into collision with the Muslim power, which was firmly established in Bengal at that time, known in history as the Sultanate of Bengal.

The earliest chief of the Tripura tribe, who successfully defended the country against the Muslim power of Bengal as recorded in *Rajmala* was Chhengthung Fa. According to it a large army was sent against Chhengthung Fa from Gour as a retaliatory measure against the Tripura for an incident in which one Hiravant Khan was allegedly plundered of his wealth on his way to Gour to present gifts to the Sultan. The kingdom which they established in this region came to be known as Tripura Kingdom. They assumed the title 'Manikya', dropping the original title 'Fa', and their dynasty came to be known as the Manikya Dynasty. According to the *Rajmala*, again, this family belonged to the Lunar dyansty of the Kshatriya caste as in similar cases, they compiled a new genealogy. Most modern scholars believe that the Tripuris like the Cacharis and other tribes of Eastern India were Mongolian in origin. The late Prof. Suniti Kr. Chatterjee also classified them under the Indo-Mongoloids or the Kiratas and classified them as linguistically belonging to the Bodo group. The Bodo people occupied at one time the greater part of the north and east Bengal and the entire Brahmaputra valley.

The Rajmala refers to an inscription dated A.D. 1458 of King Dharma Manikya. In this inscription Maha Manikya was regarded as the father of Dharma Manikya. According to *Tripura Vamsabli* (Genealogy), Dharma Manikya who ruled from 1431 to 1462. He was a great supporter of art and

learning. The dynasty of Dharma Manikya through their descendants continued undisturbed till the British stationed a political agent in 1871 at Agartala with the special object of protecting British interest on the frontier, which suffered from Lushai raids throughout the state under British influence. This post, however was abolished in 1978 and the Manikyas continued to do developmental work in their territory.

V. SCOPE OF THE STUDY

1. Scope:

The study of aspects of science and technology in traditional wisdom is comparatively a new field of investigation. There are only a few scholars who have undertaken studies in this field. In the international plane, some of the advocates of this field of study are J.D. Burnell, J. Needham, B. Ferrington, George Thompson, J. Borownosky, D.H.Gordon etc. Studies in this direction has also started recently in India. A handful of scholars who have done substantial works in this area are B.M.Seal, D.P.Chattopadhya, B.V.Subbarayappa, O.P.Jaggi, H.C.Bhardwaj, A.Rahman, etc.

Apparently no serious attempt seems to have been made so far to study the elements of science and technology attributed to the traditions of the various ethnic groups of north eastern part of India. However a few scholars sparsely throw light on material culture of some ethnic groups of people of north eastern region, when the cultural history of those people are studied. Some of the important scholars who studied on material culture of this region are S.K.Bhuyan, P.C.Choudhury, H.K.Barpujari, M.Neog, B.K.Barua, S.N Sarma, L.Gogoi, B.C.Handique, Benudhar Sarma, B.K.Kakati, K.L.Barua, S.Rajguru, R.M.Nath, E.A.Gait, W.W.Hunter, J.P.Wade, F.B.Hamilton, B.C.Allen,

E.T.Dalton, F.C.Henniker, W. Robinson, A. Campbell, J.H.Hutton, P.R.T.Gurdon, J.P.Mill, S.N.Mazumdar, Verrier Elwin, B.K.Roy Burman, A.C.Bhagavati, B.N.Datta, D.N.Mazumdar, R. Dasgupta, P.Dutta, Mutua Bahadur, T.C.Das, B.M.Das, and others. The north eastern part of India, though endowed with a rich cultural heritage, still remains an enigma for many. Its traditional knowledge and practices are reserves of diversified elements of science and technology, which have remained practically unexplored in a scientific manner.

2. Methodology:

The probe into elements of science and technology in the tradition and culture of various ethnic groups of North East India obviously requires a multidimensional approach involving a multi-pronged methodology. An attempt has been made in the present work to identify the elements of science and technology in the indigenous culture of this region with particular reference to Assam by scrutinising literary sources, delving into the folklore materials, looking at archaeological evidences and by establishing contacts with folk healers, farmers, traditional technology practitioners and experts and veteran tradition bearers. Extensive field work throughout the entire North Eastern states along with the library study in different libraries of the country has been done to explore the elements. Various museums and traditional institutes have been visited for collection of materials.

3. Source Materials:

Literary Sources :

The literature available on material-culture and tradition of the North-Eastern India throws considerable light on the elements of science and technology in its native traditional wisdom. Published and unpublished literature available can be divided into three distinct periods - ancient , medieval and modern.

Ancient Literature:

Both the early *Vedic* and later *Vedic* literature are important for the study of socio-cultural aspects of this region. The *Aitreya Brahamana* gives indication of Aryan culture to Kamrupa. Kautilya in his *Arthrasastra* makes an important reference to many places of Kamrupa in connection with the economic products of Kamrupa. The *Brihatsamhita* of Varahamihira, ascribed to about the fifth century A. D., refers to both Pragjyotisha and Lauhitya. *Harshacarita* of Banabhatta, attributed to the early part of 7th century A.D., contains much historical material for the period of Bhaskaravarmana. For study of political and cultural history in the seventh century Kamarupa , this book has great value.

The political and cultural history of Kamrupa and Pragjyotisgpura find mentions in the *Puranas.* The *Garuda Purana* mentions Kamarupa and Kamakhya as great centres of pilgrimage. The *Markandeya Purana* mentions Pragjyotisha along with Udayachala, Lauhitya and Kamrupa as countries in the east. Among all the *Puranas,* the most important work is the *Kalika Purana,* which was composed in Assam itself and is a valuable repository for study of political and cultural history of ancient Assam.

Tantrik Buddhist works and Assamese chronicles are also important sources for study of ancient Assamese culture. The *Yogini Tantra* and *Haragouri Samvada* embody valuable data about the tradition and culture of ancient Assam.

Certain foreign accounts are available on the culture and tradition of ancient Assam. In Chinese sources, Kamarupa is chiefly mentioned in the travelogue of Yuan Chwang, in seventh century A.D. Commercial and cultural relations between Kamrupa and China, through Burma and other routes are testified by earlier sources like the evidence of Chang Kien of the 2nd century

B.C.. The accounts of Shung Shu (A.D. 420-79), record the sending of two emissaries from India to China, of which one was sent by Yu Chai in A.D. 428 from the Kapili valley.

Medieval Literature:

The literature of medieval Assam provide ample sources in exploration of elements of science and technology in the tradition and culture of Assam. The literature of this period can be bifurcated into two distinct divisions such as historical literature and the biographical literature.

Ahom Chronicles:

Historiography is a great contribution made by the Ahoms to Assamese culture. The Ahoms who are a offshoot of the great Tai Chinese people, account their origin from A.D. 568. Some of the chronicles of the Ahoms have been in fact, detected to that year. The first Ahom king Sukapha, entered Assam in the A.D.1828. He ordered his attendant scholars to note down whatever novel aspects they come across and whatever had happened to them in this new land (Gait, 1897: 17). This was the beginning of chronicle-writing in Assam and since then the system began to develop in this land. The word *Buranji* is of Ahom origin, the meaning of the word is "store house of useful knowledge for the ignorant". The very meaning of the word itself indicate the high regard the Ahoms accorded their *Buranjis*. For administration of the country, the Ahoms had no written constitution; they conducted the administration by looking into the parallel precedents recorded in their chronicles when they thought it necessary. The Ahoms had the custom of reciting chapters from the chronicles whenever a marriage took place in their families. Every family, of some status, in the state had at least a manuscript copy

of chronicles in their possession. Besides the royal court, the Ahom priests known as *Deodhai*, and the nobles preserved chronicles containing reliable continuous narrative account of the rule of the Ahom kings (Bhuyan,1956:34).

The *Buranjis* written during the days of Ahoms gives us valuable information. Some of the important chronicles of that period are:

1. *Asom Buranji* : A historical account of Assam from the reign of *Gargoniya Raja* (the King of Gargaon) to the reign of Sivasingha. The author and the date of the manuscript is not known. It gives some rare historical details of that time.
2. *Kaliabharat Buranji* : This chronicle was written by one Dutiram Hazarika. It provides an account of Assam in the period from 1679 A.D. to 1858 A.D.
3. *Belimarar Buranji* : This *Buranji* was composed by one Visveswar Baidyadhipa and contains the events of the period during which the Ahom kings Gaurinath Singha and Chandrakanta Singha were on the throne of Assam. During this period, the Ahom power dwindled into a state of collapse as a result of the great civil war known as *Moamoria Vidroh*, and the three successive ghastly invasions made by the Burmese.
4. *Deo Buranji* : There are two volumes of *Deo Buranji*. The author and date of both the volumes are not mentioned . Volume-one of the *Deo Buranji* contains an account of the creation of certain heavenly beings, while the second volume contains an account of Lengdan's sending down Khun Lung and Khun Tai.
5. *Swarganarayan Devar Yuddhar Charitra* : This is another treatise on history which chronicles the events of the Ahom rule in Assam. Author and date of the manuscript is not known. It contains a detailed account of the

battle of the Ahom king with Turvak and describes at length the war with the Muslims in the reign of Chakraddhaj Singha. It also contains copies of the letters that passed between the Ahom kings and the Muslim officials.

6. *Swarganarayan Dev Maharajar Janma Charitra* : This a well written ancient *Buranji* of Assam. Though the author is not mentioned, it was written during Sivasingh's reign extended from 1696 to 1714. It begins with the legendary origin of Ahom and described how they first occupied the '*Nara*' country and how Sukapha quarrelled with his cousin and migrated to Eastern Assam. It also gives a second version of the origin of Ahoms. Apart from many historical events, it also describes the material culture of that period of Assam.
7. *Changrung Phukanar Buranji* : This is the most important chronicle of the Ahoms for study of the Ahom architecture. Changrung Phukan was the chief architect or the chief engineer of the royal Ahom administration. He was the in-charge of all building activities of Ahom royalty. He described all the planning and architectural details of royal buildings, royal graves, temples, pavilions, roads and bridges in this *Buranji*. This is a book of Ahom building technology .

Historical literature in Mediaeval period :

The histories or the *Buranjis*, as they are called in Assamese, are the most valuable contribution to Assamese literature made by the Ahoms, who migrated to Assam in the 13th century A.D. Assam has a good position in historiography in India. G.A. Grierson, in his work *Linguistic survey of India*, remarks: " The Assamese are justly proud of their national literature. In no department have they been more successful than in a branch of study,

in which India, as a rule, is curiously deficient. The ... *Buranjis* are numerous and voluminous." During the rule of Ahoms, of about six hundred years , a large number of chronicles were written, both in Tai and Assamese languages.

The chronicles of medieval Assam is again divisible into the following groups

(Rajguru, 1988:7):-

1. Chronicles of Ahom kings of Assam: These chronicles were composed during the period 1228 A.D. to 1826 A.D. This is the period from the advent of Ahoms to Assam and termination of their rule after British occupation.
2. Chronicles of countries other than Assam: This class of chronicles include the chronicles of Burdwan , Kashmir, Tripura and Mughal India. They are not available now. The chronicle of Tripura written in 1724 A. D. was published by Govt. of Assam in 1938, obtaining a manuscript from British Museum, London.
3. *Kataki Buranji* or chronicles of Diplomatic Embassies: The chronicles of diplomatic embassies provide data about that period.
4. Fragmentary Chronicles : This class of chronicles deals with particular episodes, events, time, and tribes. For example *Kachari Buranji, Chutia Buranji, Jayantia Buranji* etc, are very important monographs. The metrical chronicle of the kings of Darang, the *Darang Rajvangshavali*, provide important information about the Koch kingdom. This important chronicle was composed by Suryakhari Daivagya, under the patronage of king Samudranarayana in 1798.

5. Chronicles of religious monasteries or the *Satra Buranji*: There are many *Buranjis* of many *Satras*. These chronicles provide us valuable information about the material culture of that period.
6. Chronicles written during early part of British rule: Some Assamese historians like Maniram Dewan, Haliram Dhekial Phukan, Radhanath Barbarua, Kashinath Tamuli Phukan, Harakanta Sadaramin, Raibahadur Gunabhiram Barua etc. wrote some important books on Assam history. These chronicles also provide valuable information of that time.

Traditional Lore :

Another source of this inquiry is a large number of manuscripts and later published books on traditional lore. However, there are also innumerable number of oral lore which contributes towards the study of traditional science and technology in North East India. Apart from numerous oral lore, the following are some of the important sources of traditional lore from which elements of science and technology are being explored in this study:- *Mantra puthi*, *Baidyakalpadruma*, *Darabarputhi*, *Dakbhanita*, *Bhabishyat sangrah*, *Adbhut puthi*, *Ratishastra*, *Mangalgoa mantra*, *Bejali puthi*, *Chikitsa samhita*, *Udan are daini mantra*, *Nidan sangrah*, *Adbhut xagar*, *jyotish puthi*, *markuchiar ousadh*, *Ghrabyadhir puthi*, *Bidhi puthi* etc.

4. Disciplines Covered :

The present work is an exploratory study on elements of science and technology in the traditional culture of the North east India. The elements of science and technology explored in the present work from the traditional culture of the various ethnic groups of people of North East India is divisible into ten different disciplines. These disciplines are - traditional taxonomy,

traditional agriculture, traditional human medicines, traditional veterinary medicines, traditional fish and fishery technology, traditional practices of environment management, traditional mathematical and astronomical lore, traditional crafts and industries, traditional metallurgy and traditional architectural lore. These are described in ten different chapters in the present work.

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Chapter-II

TRADITIONAL TAXONOMICAL LORE

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I. INTRODUCTION :

Taxonomy is one of the oldest arena of all sciences. It is the theory and practice of nomenclature and classification of plants and animals. This codification of the natural flora and fauna was since the dawn of civilization. Early civilizations like that of India, China and Egypt practiced a type of taxonomy in accordance with their acquaintance with a fairly good number of plants, particularly those with consumable and medicinal value.

Almost every society had developed their own system of nomenclature and classification of plants and animals. Man has learnt to identify plants and animals since the days of yore, from the day they started the art of hunting, fishing and gathering of fruits from forests. In traditional societies, plants are used for healing various ailments since time immemorial. Man has been analyzing the characteristics of plants and animals over the ages. They tried to nomenclate and classify these plants and animals on the basis of their studies. Traditional people, inhabiting different parts of the world, in divergent environments studied, classified and nomenclated numerous plants and animals. Thus, emanated a branch of knowledge, the development of a traditional form of science which may be designated 'taxonomy'.

Systematic study of flora and fauna originated in various ancient civilisations in Egypt, China and in India. There are evidences of systematic study of

plants and animals in the Indus valley civilisation. *Vrikshayurveda,* a book on study of plants was written in India during the Vedic period (1500 B.C), was probably the first book on taxonomy.

In the history of western science a number of western scientists made serious attempts to classify plants and animals with a view to identify them for use in medicine and other purposes. Since then, in 4th and 3rd century B.C. several Greek and Roman Philosophers tried to classify and identify living organisms. In India Charaka (1st century A. D) and others could identify and name a great number of plants for medicinal purposes. Charaka Samhita was the earliest book on Indian medicine based on plants. Theophratus (370-287 BC) was a noted student of Aristotle who published *Historia Plantarum* where he classified plants based on habits, duration floral parts. The modern period of classification in the western science began with the system of classification proposed by John Ray (1628-1705 A D), Tournefort (1656- 1708 A D) and Carolous Linnaeus (1707- 1778 A D). In modern system of classification about 2 million species have been identified and classified.

The methods of classification used in the earlier days are not valid in the modern science, still those were the starting point, the platform on which the present day methods have emerged. As it has been said that the history of science is a science in itself, therefore study of traditional science and technology has relevance in the study of modern science.

II. CLASSIFICATION OF PLANTS AND ANIMALS IN ANCIENT INDIA :

There was a common Hindu pattern of classification of flora and fauna in ancient India which was prevalent throughout India. As the Hindu system was the base of all branches of knowledge in ancient India, therefore in the classification of animals and plants, the same system ensued. There were many ancient Indian scientists who tried to codify plants and animals in manifold ways.

II. 1. Classification of Plants :

In ancient India, taxonomical studies of plants and animals was done in scientific ways. In the days of *Vedas* and *Upanishadas* there are evidences of the classification of plants. Some of the prominent scientists who strived to create an index of plants and animals in ancient India were Charaka, Shushruta, Prasatapada, Patanjali and Amara,. All of them tried to classify both plants and animals by considering various aspects. Though these classifications have no parity with the modern pattern of classification, yet it proves that in ancient India brilliant taxonomical works had been done. The following are the systems of classification of plants and animals worked out by various ancient Indian taxonomists .

II. 1. 1. Charaka's System :

Charaka, the ancient Indian taxonomist and physician contributed a great deal in the classification of the plant kingdom based on the cited reasons as follows:

(1) *Vanaspatis* : trees bearing fruit without flowers;

(2) *Vanaspatyas* : trees bearing flowers as well as fruits;

(3) *Ausadhis*: herbs that wither after fructification; and

(4) *Virudhas*: other herbs with spreading stems.

The *Virudhas* comprise of two classes:

(i) *Latas* : creepers and

(ii) *Gulmas*: herbs with succulent stems and shrubs.

The *ausadhis* are again sub-divided into-

(i) Annuals or perennials, bearing fruit, and

(ii) Plants that wither away after maturing and without fructification, eg. grasses like *durva (Cynodon dactylon).*

II. 1. 2. Shushruta's System :

Shushruta's division is identical with Charaka. The following are some of the impetus on the basis of which Shushruta classified plants into the following divisions:

The *plaksa* (*Ficus infectoria*) and the *udumvara* (*Ficus glomerata*) are given as instances of trees bearing fruits without flowers (*vanaspatis*). It appears that plants with naked and incomplete flowers were considered as flowerless, as also trees whose flowers, like those of the fig, are placed on the internal walls of common receptacle. Of the *vriksas*, flower and fruit -bearing trees, the mango-tree, the *jambu*- tree (*Eugenia jambolana*), etc. are given as examples.

Similarly the *virudhas* are of two classes:-

(1) creepers with stems spreading on the ground , and

(2) herbs with succulent (cactaceous) stems .

Ausadhis are those that wither away after fructification, e.g. wheat, barely, etc.

Again *ausadhis* are divided into two classes:-

(1) those that wither after bearing fruit, e.g. paddy , linseed, pulses, etc. and

(2) plants that wither after maturity, and bear neither flowers nor fruits, e.g. the mushroom, etc.

II. 1. 3. Prasastapada's System :

Prasastapada, the *Vaisesika* doctor, also played his role in classifying plants as follows:-

(1) *Trinas* - grasses;

(2) *Ausadhis* - herbs that whither after fructification;

(3) *Latas* - spreading and creeping herbs ;

(4) *Avatanas* - arboraceous plants and shrubs;

(5) *Vriksas* - trees bearing flowers and fruits; and

(6) *Vanaspatis* - trees bearing fruits without flowers. (Seal, 1985: 169).

II. 1. 4. Amara's System :

Amara, the lexicographer, in the *vanausadhi varga* and the *vaisya varga* (enumeration of wild plants and of food-grains) gives some interesting particulars.

(1) The trees, the flowering *vrisksas* and the flowerless *vanaspatis* are fruit - bearing, and possess woody stems or trunks .

(2) Arboraceous plants and shrubs bearing flowers as well as fruits.

(3) The *latas* are next noticed, flowering plants with herbaceous stems, some of them creeping on the ground, others succulent, others twining or voluble.

(4) Next come the *ausadhis* (in the narrower sense), herbaceous plants bearing fruit with or without flowers, and dying or withering away after fructification. Some instances of *kandasaka* (tubers, rhizomes, corns) are noticed, e.g. the *palandu* (the onion), the *lasuna* (garlic), etc. But the graminaceae enumerated in the *vaisyavarga* are the common instances of the *ausadhis* - plants that die after fructification. These are cultivated *ausadhis*, but their affinities with next class, the grasses (*trinas*), are also noted.

(5) The *trinas*, grasses, of which the characteristic is the formation of *gulmas* (culms of grasses with annular knots from which leaves spring). It can be noted that in the enumeration of the grasses, the bamboo is considered as a sort of giant grass. Reeds are also included among the grasses.

(6) Finally, the *palmaceae (tambul gotra)* (including the coconut, date, areca nut and other palms) are classed as tree-grasses, probably because, like the grasses, they are endogens, characterized by spikes and parallel veins (Seal, 1985 :169).

partly under the *udvijja* (Vegetable-born) class (Seal, 1985 :182).

II. 2. 2. Charaka's System :

Charaka was the ancient Indian taxonomist who classified animals in a more or less scientific manner. He mentions four primary divisions of animals categorising them on the basis of different kinds of birth :-

(1) *Jarayuja*: born from the uterus, or rather placentalia, viviparous (no aplacental mammals were known),e.g. man, the quadrupeds, etc.

(2) *Andaja*: born of an ovum(egg), comprising of fishes, reptiles, and birds.

(3) *Svedaja*(or *Usmaja*): born of moisture and heat, spontaneously or a-sexually generated, e.g. worms, mosquitoes, etc.

(4) *Udvijja* : born of vegetable organisms.

II. 2. 3. Prasastapada's System :

Prasastapada begins his classification with two great divisions:

(1) *Ayonija* : animals that are asexually generated,of small dimensions ;

(2) *Yonija* : sexually generated, i.e. from the union of a sperm and a germ element . The latter are subdivided into:

(a) *Jarauyuja* - placentalia, viviparous and

(b) *Andaja* - oviparous. Man ,the quadrupeds(dosmesticated and wild),etc,are given as examples of viviparous animals and birds, *sarisripas* (reptiles, etc.) of oviparous animals. Udayana in the *Kiranavali* notes that *jarayu* means the placenta, Udayana adds that the term *sarisripa* includes insects and fishes as well as reptiles (Seal, 1989:177).

II. 2. 4. Patananjali's System :

The asexually generated animals, as we have seen, are also called *ksudrajantus* (small animals). Patanjali in the *Mahabhasya* gives several alternative definitions(or descriptions) of this class of animals. They have been defined as-

(1) animals without bones, or

(2) animals that do not possess any blood of their own, or

(3) animals numbering more than a thousand in a palmful ,i.e. minute in size ; or

(4) animals not easily crushed; or

(5) animals comprehending all animals up to the ichneumon (in the animal series).

II. 2. 5. Shushruta's System:

Shushruta presented four divisions of animals which are as follows :

(1) *Sansvedaja* - born of moisture and heat. This division is mentioned first, as *Dalvana* notes, because moisture and heat are essential factors in the generation of all forms of animals life, including the classes that follow;

(2) *Jarayuja* - viviparous or placental;

(3) A*ndaja* - oviparous; and

(4) *Udvijja* - bursting fourth (from the ground, or perhaps from some previous unmanifest shape, *e.g.* frogs, coccidae , etc.).

The second, third, and fourth classes are mentioned in the order of their importance. Subsequently the order of enumeration is changed to :

(1) *Jarayuja*, (2) *Andaja*, (3) *Svedaja,* (4)*Udvijja.*

Shushruta mentions man, *vyala* (carnivorous quadrupeds), and *pasu* (herbivorous quadrupeds) as examples of the viviparous ; birds, snakes, and *sarisripas* as examples of the oviparous ; *krimis*, *kitas*, and *pipilikas* (worms ,insects, ants, etc) as examples of the moisture- born ; and frogs and the coccidae (the coccinella) as examples of the animals that " burst forth ". The divisions are really cross-divisions, and intended to be such, as the natural divisions of *jiva*

and species are not all exclusively oviparous or exclusively viviparous. For example, among birds (winged animals), bats and *valakas* are viviparous indeed. But some *valakas* are oviparous. Among snakes, the *ahipatakas,* a species of non-venomous colubrines snakes, are viviparous (ovo-viviparous). Among the moisture-born, there are some kinds of ants which also lay eggs or burst forth (from the grown, or perhaps from some previous unmanifest shape).

The oviparous animals are divided by Shushruta into birds, snakes, *sarisripas*, etc. The *sarisripas* include fishes and *makaras* (sea- fish with fierce teeth,) and the "etc." comprehends tortoises and crocodiles. The "moisture-born" are due to the moisture and heat either of the earth or of organisms. Of these, the *krimis* (Worms) arise from the moisture of the faeces in the bowels; from putrefying dead bodies.

The second class, *kitas*, noticed among the moisture-born, include the scorpions, the six- spotted venomous insect *sadvindu*, etc. Of these the scorpions arise from cow-dung, excreta of snakes, rotten wood.

The third class, *pipilikas,* ants and the like insects, are born of moisture and heat, as well as of eggs, and sometimes burst-forth from the ground . The gnats and mosquitoes are also usually placed among the moisture-born. An *anda* (egg) is described as oval (Shushruta's *Kalpasthana*).

II. 2. 6. The Dietary Animals in Charaka and Shushruta.:

Taking note of the different kinds of meat consumed for dietary purposes, Charaka gives a classification of animals (mammals and birds) which has only a practical (therapeutic) significance.

The dietic value of the flesh of any animal was conceived to depend mainly on its habitat and mode of life. Dietary animals (mammals and birds) were accordingly divided into eight classes.

(1) *Prasaha* : Carnivorous as well as non-carnivorous (*Chakrapani*), comprehending land quadrupeds and birds that fall on their food with force.

(2) *Anupa* : Animals that live in marshy or waterlogged lands or graze on river-banks.

(3) *Bhusaya* or *Vilesaya* : Animals that live in under ground holes.

(4) *Varisaya* : Aquatic animals, both fresh water and oceanic.

(5) *Jalachara* : Amphibious animals.

(6) *Jangala* : Animals that live in dry and elevated (hilly) jungle lands, mostly species of deer.

(7) *Viskira* : Birds that scatter their food while picking up; and

(8) *Pratuda* : Birds that pierce or torment their food (worms and fruits) with the beak.

Shushruta gives a practical classification of (vertebrate) animals for dietary purposes Animals that find a place in this diet are first divided into two classes:

(i) *Anupa* - animals that live in marshy or water-logged land(or in water);

(ii) *Jangala* - animals that live in dry (hilly) jungle land. The Jangala are divided into five classes, and the Anupas into eight. The thirteen classes are based on real and natural distinctions of food and habitat; they are for dietary purposes arranged under six conventional (or artificial) classes - (Dalvana's *Sutrasthana,*) . These thirteen classes of dietary animals may be enumerated as follows:-

I. *Jangala* animals- *Janghala, Viskira, Pratuda, Guhasaya, Prasaha, Parnamriga, Vilesaya* and *Gramya*, and

II. *Anupa* animals - *Kulechara, Plava, Kosastha, Padina*, and *Matsya.*

Of these, the *matsyas* (fishes) are divided into two groups- fresh-water (river- water) and sea-water fishes. Among the sea fishes , the *timi* and the *timingala* (whales) find a place, as also the *makara.*

The *kosastha* (living in shells-mollusca)are distinguished from the *matsyas* (fishes). In this class are enumerated *sankhas* (Conchifera), *sankhana* (smaller Conchifera), *sukti* (pearl-mussels), *sambuka* (Helix) with spiral shell , *valluka* (a species of Helix), etc.

The *padinas*, aquatic animals having pedal (or long dorsal) appendages, comprise *kurmas* (oval or oblong-shaped tortoises, turtles), the *kumbhiras* (crocodiles, Emydosauria, Reptilia), *karkatas* (white and black crabs, Crustacea), the *sisumara* (a species of the Delphinidae cetacea), muscular, with a sharp protruding snout, breathing with the blow- hole *out of the water*, probably a dolphin, as the long dorsal fin was taken for a sort of pedal appendage. The *padinas* do not represent any natural division.

Of the *anupa* animals (aquatic or amphibious animals), the *plavas* (*lit.* floating on the water) represent a class of birds exemplified by geese, ducks, cranes, etc.

The *kulecharas* are herbivorous quadrupeds that prevail in the banks of rivers and ponds, and comprise the elephant, the rhinoceros, the *gavaya* (*Bos gavoeus*), the buffalo, various species of deer, etc.

Of the land animals (*jangala*), three of the sub-divisions represent birds, and five, mammals. The land birds are:-

(1) the *Prasaha* (birds) - birds of prey proper (raptores),comprising the vulture, kites, hawks, owls, etc. (Charaka's *Prasaha* is a much wider class);

(2) the *Viskiras* - birds that scatter their food in picking up; and

(3) the *Pratudas* - birds that pierce or torment their food (fruits or worms) with the beak.

The last two classes comprehend between them the *Passeres* , the *Scansores,* the *Rasores* and the *Columbae.*

The remaining five classes of *jangala* animals are mammals, with the exception of several species of *vilesayas,* which are reptiles. The *parnamrigas* (arboreal animals) comprise the apes, sloths, squirrels, as also some of the reptiles and carnivora. Among the *parnamrigas*, the *putighasa* is a kind of tree-cat giving out a pungent odour; the *madgumusika* and the *briksasayika* are arboreal rodents; and the *avakusa* is a species of cow-tailed monkey . The *janghalas* are wild animals, herbivorous quadrupeds that are strong- legged and quick- footed, comprising various species of deer and antelopes.

The *Gramya*s (living in or about villages, domesticated quadrupeds) comprise the horse, the mule, the ass, the camel, the goat, the sheep, etc. They are non-carnivorous, being distinguished from the carnivorous quadrupeds . Some are *ekasapha* (animals whose hoofs are not cloven).

The *guhasayas* are carnivorous quadrupeds living in natural caves or hollows. .They comprise the lion, the tiger, the wolf, the hyena, the bear, the panther, the cat (wild cats), the jackal, the *mrigevaru*, etc. The *vrika* (wolf) is defined as a dog-like animal, small-sized (in comparison with the lion and tiger). The *mrigevaru* is described as a jackal-like animal that kills deer.

Finally come the *vilesayas*, animals that live in holes or burrows, comprising various species of rodents and insectivora, and several species of reptiles (Seal, 1985 :185).

II. 2. 7. Snakes Described by Nagarjuna :

The snakes are specially described by Nagarjuna in the chapters relating to toxicology. Five different genera or families are noted, of which one is non-venomous and four venomous. The four venomous are as follows:

(1) the *Darvikaras*- (*Naja tripudians, Naja bungarus*) are hooded, swift in their movements, diurnal in their habits, and bear on their hoods or their bodies the marks of chariot-wheels, ploughs, umbrellas, rhombs or cross- bands, goads, etc.

(2) The *mandalis* (viper) are thick, slow moving, nocturnal in their habits, and bear circles or rings on the body. Charaka adds that they are without hoods.

(3) *rajimats* also are without hoods, and nocturnal, and bear series of dots or marks, and are often of variegated colours on the upper parts and sides. Twenty-six varieties are named of the first, two of the second, and ten of the third (Majumdar, 1951:365).

II. 2. 8. Umasvati's Classification of Animals :

A more thorough classification of animals is found in the ancient Jaina work, the *Tattvarthadhigama* of Umasvati. Umasvati's classification is a good instance of classification by series, the number of senses possessed by the animal being taken to determine its place in the series.

1. Animals with two senses, viz. touch (as evidenced by contractility of tissue) and taste (as involved in the selection and rejection of food.) this division comprises-

(a) *Apadika* (vermes without lateral appendages).

(b) *Nupuraka* (ring-like, with pendants, vermes with unsegmented lateral appendages, Annelids).

(c) *Gandupada* (knotty- legged, Arthropoda, including Crustacea, Myriapoda, etc.).

(d) Some forms of Mollusca, e.g. *Sankha* (Conchifera, Lamelli-branchiata), *Suktika* (Pearl-mussel, Lamelli-branchiata), and *Sambuka* (Helix).

(e) *Jalaka* , leeches (Annelids).

2. Animals with three senses, namely smell in addition to the primordial senses of touch and taste involved in the contraction of tissues and the appropriation of food. Here also well-developed and active senses alone were perhaps intended; rudimentary or dormant senses were not reckoned. This division comprises-

(a) *Pipilika,* ants , (b) *Rohinika,* red-ants , (c) *Upachika, Kunthu, Tuburaka,* bugs and fleas, (d) *Trapusavija* and *Karpasasthika,* cucumber and cotton-weevils and lice ,(e) *Satapadi* and *Utpataka,* spring-tails , (f) *Trinapatra,* plant-lice, (g) *Kastha-haraka,* termites, white ants .

3. Animals with four well-developed and active senses ,i.e. sight, smell, taste and touch. This division comprises- (a) *Bhramara , Varata,* and *Saranga,* bees, wasps, and hornets (Hymenoptera, Holometabola). (b) *Maksika, Puttika, Dansa,* and *Masaka,* flies, gnats, gad-flies, and mosquitoes , (c) *Vrischika* and *Nandyavarta,* scorpions and spiders (Arachnida, Arthopoda). (d) *Kita,* butter-flies and moths (Lepidoptera, Holometabola), and (e) *Patanga,* grasshoppers and locusts(Orthoptera , Hemimetabola).

4. Animals (Man) with five well- developed and active senses. Omitting man, this divisions comprises - (a) *Matsya,* Fishes, (b) *Uraga,* (c) *Bhujanga,* (d)*Paksi,* birds,and (e) *Chatuspada,* quadrupeds .

Uraga and *bhujanga* in popular use mean reptiles ; but here evidently *bhujanga* is used to mean oviparous limbed animals (limbed reptiles and batrachians) and not creatures whose movements are crooked or in the form of a bent bow; and *uraga* stands for apodal reptiles, including snakes (Ophidae).

It will be seen that the first three divisions fall under the Invertebrata, and the fourth is identical with the vertebrata. This last division (the Vertebrata) is sub- divided on a different basis, viz . the mode of reproduction. There are three sub- divisions :

a. *Andaja,* oviparous (pisces, reptiles and birds), e.g. *sarpa* (snakes, ophidia, reptilia),*godha* (varanidae lizards, reptilia), *krikalasa* (chameleons), *grihagolika* (Common lizards) , *matsya* (pisces), *kurma* (tortoise), *nakra* (crocodile), *sisumara* (dolphin or porpoise) and birds proper with feathered

wings - *lomapaksa paksis*. Porpoises are erroneously put here, being really viviparous like other Cetacea. Frogs are not mentioned in this list. The ommission is strange. Perhaps (as in Shushruta) frogs were believed to be *udvijja* (eruptive or metamorphic) and not *andaja* (oviparous). But Shushruta mentions the frogs after the quadru pedal and centipedal reptilia (kanava, godheraka, galagolika and satapadi).

b. *Jarayuja*, mammals born with placenta, including all mammals other than the Potaja (here Jarayuja is used in a restricted sense): (1) Man, (2) Cow, (3) Buffalo, (4) Goat and Sheep, (5) Horse, (6) Ass, (7) Camel, (8) Deer, (9) Yak (Chamara), (10) Hog, (11) Bos Gavaeus (Gavaya)-Ungulata, (12) Lion, (13) Tiger, (14) Bear, (15) Panther, (16) Dog, (17) Jackal, (18) Cat, (Carnivora), etc.

c. *Potaja*, a class of placental mammals comprising the Deciduata with the exception of man, the apes and the carnivora, e.g. *sallaka* (Porcupine, Rodentia), *hasti* (Elephant, Proboscidea), *svavit* and *lapaka* (Hedgehogs and other creatures that lap up, Insectivora), *sasa* and *sayika* (Hare, Rabbit and Squirrel, Rodentia), *nakula* (Ichneumon, which though carnivorous is supposed to come under the Deciduata), *musik* (Mice, Rodentia) and the *charma-paksa paksis*, so-called birds with leathern wings (Bats, Chiroptera) e.g. *valguli* (Flying fox), *paksivirala* (Flying-Cat, Micro-chiroptera) and *jaluka* (apparently meaning blood-sucking Bats or Vampires, though these are scarcely found in the Old World).

The *Potaja* class thus comprises the following Deciduata : Probosidea, Rodentia, Insectivora and Chiroptera.

The term *Potaja* is intended to signify that these animals are born without the placenta which is thrown off as an afterbirth, whereas such of the *jarayujas* as are not *potaja* are born with the placenta attached to the embryo. But it is not easy to explain why Man, the Apes and the Carnivora should not also be reckoned among the *Potajas*. An explanation is suggested below (Seal, 1985 :192).

III. TRADITIONAL TAXONOMICAL LORE OF ASSAM :

People of North East India are mostly forest dewellers. They live in the forest and work in the forest. Their life style and culture are still dependent on forest resources. Therefore people of this region traditionally has developed their own system of identification and classification of plants and animals. There are many folklores on taxonomical excercises of the people of this region. Each and every society has it's own definite forms of nomenclature of plants and animals.

Assam had not produced any remarkable scientist like Charaka, Shushruta and other ancient Indian scientists. But the great Assamese litterateur and philosopher Sankardeva and his contemporary writers tried to classify plants and animals in different ways. In most of the Vaishnavite literature of medieval Assam, life was classified into four different classes. These are:

1. *Uran*- those which can fly.
2. *Buran*- those which can sink into water.
3. *Gajan*- those which germinate or grow out of the earth.
4. *Bhraman*- those which can walk or move.

Again the plants were classied into the following classes:-

1. *Trina*- grasses.
2. *Taru*- little trees (eg. A medium sized plant is called *Tarua kadam* (*Casia fernasiana*), because its flower resembles the big *Kadam* (*Anthocephalus cadamba*) tree.
3. *Briksha*- trees.
4. *Gulma*- shrubs.
5. *Lata*- creepers.\

In common Assamese literature a parasitic creeper is called *Akashi lata* (creeper of the sky) because it has no roots, it grows in the tree top. Orchids are the epiphytes growing on tree trunks and branches. As these plants grow on the trees above the ground therefore these are called *Kapou phul* (bird flower). Of course, there are some orchids which grow on ground and are also called *Kapou phul.*

III. 1. Classification of Animals in Traditional Assamese Form :

In Traditional Assamese literature Animals are classified more extensively. Though this classification is not biologically up-to-date yet it has a scientific base. The classification is based on morphological and behavioural similarities and dissimilarities. On this basis, the whole animal kingdom is classified into the following classes:

1. *Keeta Patanga*:- Worms and Insects.
2. *Matshya* or *Mach*:- Fishes.
3. *Sareeshreep*: - Reptiles.
4. *Pakshi* or *Charai* :- Birds.
5. *Pasu* (*Stanyapayee*) :- Mammals.

Again the mammals are classified into the following groups:

1. *Bandara* :- Monkeys.
2. *Banmanuh* :- Primates.
3. *Manushya varga* :- Man.
4. *Karpaksha* or *Baduli* :- Chiropteras.
6. *Mangshahari* :- Carnivorous.
7. *Trinabhoji* :- Herbivorous.
8. *Keetabhoji* :- Insectivorous.
9. *Suradhari* :- Tusked mammals, Elephant.
10. *Kshuradhari* :- Hoofed mammals.

III. 2 . Plants and Animals Described in Mediaeval Assamese Literature :

Assam is very rich in flora and fauna . A wide variety of wild plants and flowers inhabit the forests of Assam. The natives of Assam cultivated flowers and grew useful plants in their courtyards as a part of their culture. In fact , there is not a single house where flower gardens or orchards are not seen . Ancient Assamese writers listed large number of flower plants and trees in many occasions. In *Yogini Tantra, Lava Kusar Yuddha* of *Harihara Vipra* and in the *Kirtana,* particularly the *Harmohana* Chapter written by Sankaradeva, *Ramayana* of Madhav Kandali contain codification of many plants and animals. The following are the names of the plants as noticed by Harihara Vipra , Madhava Kandali and Sankardeva in their books :-

III. 2. 1. Flowers :

Ashok (Saraka asoca), *Baagi (Barleria strigosa),Bokul (Mimosops elengi*) ,*Bonduli (Penapetus phoenicia), Bok (Sesbenia grandiflora), Chandan (Santalum album), Champak (Michelia champaka) , Dhastur (Datura sativum), Duwamali, Gulal (Cymbo pogon citratus), Jaai, Juti* (varieties of jasmine), *Kanchan (Bauhunia recimosa) , Kadamba (Anthocephalas cadamba), Karabira (Nerium indicum), Keteki (Pandanus odaratisimus), Kopou* (orchid) , *Kunda (Jasminum multiflora) , Lavanga (Syzygium aromaticum), Mandar (Erythrina stricta), Malati (Agnosma dicotoma), Mali, Madhai (Hiptage benghalensis), Morua (Senseviera roxburghiana), Nageswar (Mesua ferrea), Padma* (lotus), *Palash (Butea monosperma), Parli (Steriospermum chelonoides), Pushpa mal, Tomala (Garcinia xanthochymus), Tulasi (Ocimum sanctum), Xeuti* (wild rose), *Xewali (Nyctanthes arboristis).*

III. 2. 2. Fruits :

1. *Am (Mangifera indica), Durafal , Dasnoiya kal (Musa sanguinea), Ela , Jaiphal, Jam (Eugenia caryophyllifolia), Kamala (Citrus sinensis), Kathal or Kantoki (Artocarpus integrifolia), Khiri, Kunhiyar* (sugarcane), *Madhuphal* (papaya), *Mahari , Matikathal* (pineapple), *Narikal (Cocos nucifera), Ponial (Flacortia catafracta), Sreefal (Aegle marmelos), Tambul* (arecanut) , *Tenga (Citrus sp.)*

III. 2. 3.Animals :

1. *Barah* (wild boar), . *Barun, Bhera* (sheep), *Gor (Rhinoceros unicornis), Gobak* (paddy bird), *Gui (Varanus indicus), Kaccha* (turtle), *Mesha* (buffalo), *Mriga* (deer) ,*Moh (Babulus bubalis), Xoha pohu (Hystrix indica), Xukar (Sus scrofa)* (Neog, 1981: 45).

IV. Taxonomical Lore in the Form of Riddles in Assam:

Since time immemorial people have been toying with nature. Their mode of life largely depended on their habitat which obviously included the plants and animals. Many amongst them tried to develop some kind of way to classify them for their easy reference. But they failed to arrive at a scientific method of classification. They used some kind of symbolic and pictorial descriptions to aid in their classification . They represented them in the form of riddles , which are nothing but traditional art of taxonomy. Riddles, a kind of folk literarure (oral) is developed by traditional people over the generations . There are a large number of riddles in Assamese folk literature which may be considered as traditional form of taxonomy . Some of these are as follows :

1. Isn't it amazing ?
   Who could imagine ?
   When the child is born at home
   Mother is far from the home

   Answer:- Tortoise

2. You cannot call me a flower
Still, I am offered at the altar
A shell on my body but a snail I am not
Clothes on my body but human I'm not
Can you tell who am I ? Answer:- Coconut

3. Two mountains on either side
A black cow in between grazes
Crushed between the mountains, the black cow expires.
Answer:- Lice

4. One single sill
Two roofs on either side
Though unbound, it remains forever bound.
Answer:- Banana leaf

5. I arrived, but you did not come with me
Later you arrived and then left
Again you came and then left
Now that you are not there
Even I have to leave after a while
Who on earth are You ?
Answer:- Teeth

6. Who has hands and legs
Eye, ears and navel
What creature is he
Tell me, oh brother ?
Answer:- Man

7. Both live adjacent to each other
Both twin brothers roam together
Viewing the world
But they cannot see each other
Who are these two, tell me, my brother ?

Answer:- Pair of eyes

8. Whose offspring looks up at the sky
And the mother towards the earth ?

Answer:- Bamboo tree

9. Born is the young one with a tail
Grows up the young one leaving behind the tail.

Answer:- Tadpole

10. It is plucked from the tree
Sold in the market
Customers buy it at a high price
It is cooked and served
What is it that is not consumed but thrown away ?

Answer:- Bay leaf

11. She is tiny in size
Remains hidden during the day
Go visible in the night
Burning lamps in the sky.

Answer:- Firefly
(Sarma, 1989:14- 32)

12. My name comprises of three letters (in Assamese)
Cause damage to households day in and out
Reverse the order and my name remains the same
Tell me what is my name ?

Answer:- Mouse
(*Nigani* in Assamese)

13. Assam is an amazing land
The leaves of which plant eats man.

Answer:- Leaf of *Chorat* plant.
(Sarma, 1989: 7)

14. One man has a hundred daughters
Proper nutrition bred twenty five offspring's
Can you decipher what kind of daughter is she ?

Answer:- Jack fruit see

(Sarma, 1989: 35)

15. Like Lanka's Ravana
It has ten heads not one (Head - Xir)
Not a fish, nor a tortoise
Everyone relishes it
It is served in the months of Ahin-Kati.

Answer:- Ridge gourd.

16. Which tree dies with seeds on it ?
Which animal graves with its nose in its hand ?

Answer:-Banana tree/Elephant.

17. A single-coloured glass
Has two-coloured liquid
And it forms the diet of the rich.

Answer:- Egg (Sarma, 1989:15)

18. I went to cut the plant
With an axe in my hand
The plant lies dead
And the seeds remain scattered.

Answer:- Pumpkin.

19. Its a strange tale of Assam
The leaves of which plant are thick.

Answer:- Onion.

20. One old man asked his wife as to what was wanted from the market, the old woman replied :
"Get golden seeds
And leaves of copper
Get lives made in water
And an elephant's tusk."

Answer:-Ripe betel nut, ripe betel-leaf, live fish & raddish

21. Which fruit's shell is consumed ?

Answer:- Outenga
(Rajguru,1972:150)

22. Red in childhood
Black in youth
Yellow in old age
Always has thorns on its head.

Answer:-Pine apple

23. Thousand legs has he
Red is its colour
Which animal is it
Tell me, O brother.

Answer:- Centipede

24. Which tree is sweeter
Than its ends which are bitter ?

Answer:- Sugarcane

25. Not a tiger but it jumps
Not a dog but it sits
Not a fish but it sinks.

Answer:- Frog
(Sarma, 1989: 4)

26. A thick knot
And a garland on its neck
What is it that stares at the sky
With its hair wide open ?

Answer:- Betel-nut tree
(Rajguru,1972:198)

V. TRADITIONALLY NOMENCLATED CROP PLANTS OF ASSAM :

Assam is a land of rice. Natives of Assam cultivated rice since time immemorial. It is said that Assam is the land where wet rice was first cultivated. The Bodo tribe of Assam probably first of all started wet rice cultivation. Ecologists

opined that the traditional people of ancient Assam developed a large number of rice species. Some of the rice varieties of Assam are still peculiar to rest of the country. Most of these rice are endemic to this region. It is estimated that ancient Assam (present North Eastern India) had several thousands of varieties of rice. But due to the advent of modern agricultural system, particularly due to cultivation of hybrid and high yielding rice, the rich diversity of rice of Assam eroded rapidly. It is now very difficult to find most of the endemic rice varieties, which were once most popularly cultivated in this region. The following are some of the rice varieties developed by Assamese cultivators. These rice varieties were cultivated till the last part of 19th century.

V. 1. Varieties of Rice in Assam :

V.1.1.Sali Variety

1) *Kachari sali 2) Akhi sali 3)Kola sali 4) Baga sali 5) Motaddang sali 6) Lohadang sali 7) Mugi sali 8) Saru sali 9) Ranga sali 10) Paro chakua sali 11) Bagi sali 12) Halodhia sali 13) Bora sali 14) Baga maguri sali 15) Kola magur sali 16) Doka sali 17) Barjul sali 18) Sarujul sali 19) Baga sagar sali 20) Kola sagar sali 21) Khalihaijul sali 22)Naga sali 23) Garo sali 24) Amna sali 25) Neghiri sali 26) Neghiri-tema sali 27) Bar chukuri sali 28) Saru gendhuri-tema sali 29) Bar neghiri sali 30) Saru chukuri sali 31) Kehajul sali 32) Kahura sali 33) Malasor sali 34) Kati-neuli sali 35) Katiram sali 36) Genguni sali 37) Bagitora sali 38) Rupsi sali 39) Chhorai banuwa sali 40) Jahinga sali 41) Kanaimuluk sali 42) Dalkachu sali 43) Gamira sali 44) Katari dubua sali 45) Bar suwagmani sali 46) Saru suwagmani sali 47) Chakhuru-dhani sali 48) Bat-kapahi sali 49) Nekera sali 50) Dhas khas sali 51) Matanga sali*

52) Bar khamti sali 53) Saru khamti sali 54) Khab chena sali55) Ranga-jul sali 56) Mougutia sali 57) Goru sokua sali 58) Ranga-bora sali 59) Mur mohora sali 60) Tangonbora sali 61) Jatabora sali 62) Tilbora sali 63) Kolabora sali 64) Paitabora sali 65) Tenglibora sali 66) Bogabora sali 67) Bor sokua sali 68) Soru sokua sali 69) Tora-mandal sali 70) Malbhog sali 71) Phata-kantha sali 72) Gamiribora sali 73) Miribora sali 74) Pakhoribora sali 75) Khorika-joha sali 76) Gidapuri sali 77) Maniki-madhuri sali 78) Goalpuri-joha sali 79) Kali joha sali 80) Ranga joha sali 81) Bhebeli joha sali 82) Kola joha sali 83) Saru joha sali84) Kan joha sali 85) Mon joha sali 86) Gobind tulasi sali and 87) Lata 88)Khamtilahi, 89)Chengkhow 90) Holpona (Hunter, 1879: 333).

V. 1. 2. Ahu Variety :

1)Baga pharma 2) Ranga pharma 3) Salpana 4) Barpanji-sori 5) Saru-panji-sori 6) Barbang 7) Sarubang 8) Phanpuri 9) Betgutia 10) Guni 11) Bengnagutia 12) Girini 13) Naga 14) Charai-tuni 15) Swarga-phala 16) Nekhiri 17) Bamuri 18) Ahubora 19) Kati-khaska 20) Ahu joha 21) Harmukta 22)Aausor ahu-dhan.

V. 1. 3. Bao Variety : *1)Bati achara bao 2) Kekowa bao 3) Panikekowa bao 4) Pharma bao,5) Negheri bao 6) Sukuri bao 7) Ranga pharma bao 8) Boga pharma bao 9) Dolkochu bao*

V. 2 . OTHER CROPS: Apart from the rice varieties Assamese cultivators cul tivated some non rice crops are as follows:

V. 2. 1. Cereals : *baga gam dhan, ranga gam dhan, baga ranga gam dhan, rani gam dhan, china dhan, barbocha, nal dhan* and *abar dhan,* etc.

V. 2. 2. Pulses : *Mug-maha, mati-maha, kala-maha, lechera-maha, beji-maha, masur maha, barkala-maha, arhar* or *rahar* or *garo maha, urahi* and *kati urahi* etc .

V. 2. 3. Fibres : *Marapat,* a kind of jute, sown in May and cut in October, *reha, bar son barial, saru son barial, bhedeli lata, phonpat* and *sonpat.*

V. 3. Miscellaneous Crops :

V. 3. 1. Sugar Cane Varieties: *bogi kuhiar, mugi kuhiar, teli kuhiar, medela kuhiar, pura kuhiar pakhari kuhiar .*

V. 3. 2. Spice and Oil: *jalakia* (capsicum), *jaluk* (black pepper), *jira* (cumin seeds), *xariah* (mustard seeds), *til* (sesame), *pipali* (long pepper), *ada* (ginger), *naharu* (garlic) *piaz* or *ponoru* (onion), *haladhi* (turmeric), *dhania* (coriander), *elaichi* (cardamom), *tezpat* (bay leaf), *methi* (fenugreek), *afu* (poppy seed), etc.

V. 3. 3. Vegetables : *alu* (potato), *kachu* (colocasia), *mitha alu* (yam), *ximalu alu* (tapioca), *Ol, bilahi* (tomato), *bengena* (brinjal), *bandha kabi* (cabbage), *phul kabi* (cauliflower), *paleng, lai , lafa, jilmil, dhekia* (all green leaf), *lechera, urahi* (beans), *jika* (ridge gourd), *bhendi* (ladies finger), *ranga lau* (pumpkin), *pani lau* (gourd), *kerela* (bitter gourd), etc.

VI. TRADITIONALLY NOMENCLATED PLANTS AND ANIMALS OF ASSAM:

Assam is very rich in its bio-diversity. The biodiversity of the rain forest of Assam is very affluent in comparison to the other parts of Indian sub-continent. Early Assam, presently the North Eastern India is designated as one of the richest hot-spots of the world biodiversity. There are large number of endemic plants and animals in Assam. The people of Assam have developed a very rich knowledge of traditional taxonomy. They have identified, nomenclated and classified large number of plants available in the forest. They have also idenified the utilty of the plants, particularly the medicinal uses and etology of animals. The process of trying to nomenclate plants and animals itself is a science. People have studied anatomy, morphology and behaviour of plants and animals and on the basis of such characterstics thy have nomenclated plants and animals.

This traditional system of giving name is the basis of modern taxonomy. Various ethnic groups of people of this region have nomenclated a large number of plants and animals of this region. Thus one can say that the traditional taxonmical knowledge of the people of this region is very rich.

A glossary of traditionally nomenclated plants and animals along with English equivalent and scientific name has been listed in the Appendix-I at the end of this thesis.

(Glossary of plants and animals in the Appendix I)

VII. TAXONOMOCAL LORE OF TANGAMS OF ARUNACHAL PRADESH

The tangams are probably the least known tribe of India. This very small group of people, living in a remote hill of Arunachal Pradesh, a distant state of India. Surprisingly this very small group of people are sustaining a scientific traditional culture of their own. They have developed a strong sense of science and technology in their tradition.

Tangam is a branch of the Adi tribe of Siang district of Arunachal and they trace their origin from Pedong Nane, the mythical mother of all beings. After a long stay in the beginning at Luku Tirang, they wandered for some time along the Siang, till they arrived at last at their present habitat. It is a very small ethnic group of people of Arunachal Pradesh. They have a very long history of tradition and culture.

The Tangams are expert in collecting aconite from the forest, they also know the method of preparation of aconite. They have identified a large number of medicinal plants for treatment of various diseases. The most important medicinal plant of Arunachal Pradesh, *coptis tita* or *mishimi tita* was first known to the Tangams. This small group of people have identified , nomenclated and

discovered the utility of a large number of plants. Traditionally, the Tangams have been using about a hundred varieties of plants as their source of food and medicine etc. A glossary of names of the plants identified by the Tangams along with their use are described in Appendix -II. (Bhattacharya, 1975: 14).

VIII. TAXONOMICAL EXCERCISES IN TRADITIONAL MEDICINAL SYSTEM OF ASSAM :

In Assam, a system of folk medicine known as *bejali chikitsa* (*bejali* : the profession of physicians) is the result of the people's knowledge acquired from their day-to-day contact with the herbs which has been developed by the community since time immemorial. Though these are continuing through centuries in the form of traditional oral lore, there are manuscript copies, written in Medieval Assam, regarding treatment of disease by this traditional system. Presently many of these manuscripts are published in the form of books (published in recent times) which contain people's knowledge on traditional medicinal system. It is very interesting to note that traditional healers had identified and nomenclated a great variety of diseases. More particularly variety of fevers are identified and classified. On the basis of symptoms they have nomenclated large varieties of fevers. The folk healers of Assam have classified fever or *jawara* according to the origin and symptoms. According to the folk healers of Assam there are eight types of *jwaras* .These are as follows:-

VIII. 1. Different Types of Jawaras :

Bata jwara, Pitta jwara , Kapha jwara, Bata pitta jwara, Bata sleshma jwara, Pitta sleshma jwara, Sanipata jwara, Agantuja jwara (Tahsildar, 1910:77) Besides these, considering the symptoms and duration of the fever, they have again classified the various types of fever. They are as follows :

Purani jwara, Leteka jwara, Nitta jwara, Pal jwara, Um jwara, Teeya jwara, Antar jwara, Caru jwara, Rati-rati-utha jwara, Bisam jwara, Bhute-powa jwara, Sarbabeath jwara, Leng jwara (Broncha pneumonia) , (Tahsildar, 1910:85).

Leng jwara has been again classified into the following types :

Ulia-leng jwara, Kala-leng jwara, Swasa-leng jwara (strong fever depriving power of speech), *Kandhua-leng jwara, Chaudra-leng jwara* (Fever and cough which do not come out easily), *Jioaria-leng jwara* (Fever and consumption), *Pania-leng jwara, Phutani-leng jwara* (Fever and cough with piercing pain), *Batahi-leng jwara* (Fever and gout), *Hupa-leng or shuktishala jwara, Hagonia-leng jwara, Bayoo-leng jwara, Balia-leng jwara* (Fever and cough which make one crazy) ,*Bhutia-leng jwara* (Delirium), *Xarba-leng jwara* (Tahsildar, 1910:106).

IX. TAXONOMY IN THE HORSE AND ELEPHANTLORE OF ASSAM:

A detail study of horse and elephants in Assam has been done in the past. Several old manuscripts on horse lore and a detailed illustrated manuscript on elephant lore has been discovered and later published. It has been seen the manuscript of horse lore namely the *Ghora Nidan,* horses were classified into seventy nine varieties on the basis of the colour of the horses. Ethological descriptions were also provided on the basis of this classification. It has been observed that people in earlier times used these ethological knowledge in idetifying usefulness of the horses at the time of purchasing. *Hasti Vidyarnava* is a great manuscript on elephant lore of Assam. The informations mentioned in this manuscript was the knowledge of Assamese traditional veterenians. It has been seen that elephants has been classified in this manuscript into 16 different varieties. On the basis of their characterstics these were also nomenclated meaning fully. (Ref.: Chapter- Traditional Veterinary and Animal Husbandry lore.)

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Chapter-III

TRADITIONAL AGRICULTURAL LORE

CHAPTER- III

TRADITIONAL AGRICULTURAL LORE

I. INTRODUCTION :

Farmers all over the world have developed their own agrarian systems and this has come about within the framework of local possibilities and limitations of ecology within the social, economic and political structure of their countries. To bring about a major development in the agricultural sector, it is logical, initially, to get an insight into the already existing knowledge and expertise acquired throughout the ages. While it is cliché to say that "India is the land of agriculture", it is indeed true that Indians have paid great attention and achieved great sophistication in this area over the centuries. Many of the age old practices continue to prevail in large parts of India even today. There has hardly been any modern technological advancements that practice dry-land agriculture - what has today come to be known as 'survival agriculture'. Even in those areas , where modern agriculture has replaced traditional agriculture, it is largely in the nature of inputs which show no ingenuity, apart from the already existing traditional agricultural system in that area.

Indian farmers - the real practitioners - are the storehouse of the knowledge of traditional agriculture. They are the living authorities on traditional agriculture and the repositories of our ancient wisdom. The knowledge of traditional agriculture is also impregnated in the folklore - such as folk songs,

rituals, proverbs, riddles and several other traditions by which the art of cultivation is passed on to successive generations. Much of this existing knowledge of traditional agriculture has not been consolidated and documented together. No systematic work has been done in recent times to bring this knowledge to light. A great deal of work needs to be done in this area. This knowledge of traditional agriculture needs to be - not just documented - but also, to be encouraged and helped to take its rightful place in the context of modern knowledge .

Rice originated in India and then spread throughout Asia. In Asia alone, about 96% of the rice crop of the world is produced and consumed. Rice grows in many places where other food crops are difficult to grow. Various varieties of the crop is grown throughout the year in some parts of the country - up to an altitude of 7000 feet above sea level and 10 feet below. Rainfall in rice-growing areas varies between twenty inches and two hundred inches (500 mm to 5,000 mm). Rice crop is extremely variable in the form of thousands as its cultivators are spread in Indian and other rice growing belts of the world. Rice plants also have a very flexible genetic make up and mutational power for adaptation to local environments (Vijoyalakshmi,1993:12).

According to Dr Richharia, the well known rice scientist, four lakh varieties of rice existed in India during the Vedic period. His estimate is that, even today two lakh varieties of rice still exist in India- a truly phenomenal number. This means that, even if a person wants to consume a new rice variety every day of the year, he could go ahead for over five hundred years without reusing a variety ! Every variety has a specific purpose and utility. Dr Richharia has collected and identified twenty thousand types of rice in the Chattisgarh area of Madhya Pradesh alone. Farmers in every part of the country have deep

knowledge of their own varieties of rice, of their environmental and nutritional requirements, properties and peculiarities. This enables them to harvest a crop even under the most unfavourable conditions. Farmers also possess high yielding varieties of their own which are not recognised in agricultural extension programmes (Ramayah, 1993:19)..

The north-eastern part of India is another rice bowl of the country. Large number of traditional varieties of rice has been growing in North Eastern India since a long time. Farmers of this part of India traditionally developed many rare varieties of rice like *joha* (scented rice), *bora* (sticky rice), *boka* (rice which is ready for consumption simply by soaking) etc. Though there is no scientific data on traditional varieties of rice grown in the North -East India, yet agricultural scientists have estimated the availability of more than thousand endemic varieties of rice in this part of the country.

However, this genetic diversity of our traditional varieties has not been taken into account by our modern agricultural programmes. A look into our traditional varieties will open the door to discovering many pest and drought resistant varieties.

There has been a great resurgence of world wide interest in recent times in analysing traditional methods of agriculture which has encompassed diverse areas such as - agronomic methods, soil testing and soil classification, pest control and crop-protection techniques, irrigation, meteorology, forestry, nomenclature and taxonomy - to name a few of these areas. These studies have become extremely important in the light of world wide efforts to seek alternatives to modern agriculture and evolve sustainable strategies for development.

II. AGRICULTURAL PRACTICES IN ANCIENT INDIA :

Agriculture came to be practised when man gave up his nomadic habits and settled in favourable climate and topography. In this gradual process of

evolution from the nomadic to the farming stage, ancient men undoubtedly had to learn many things by trial and error. From the coarse elementary stone implement developed the ploughshare to till the soil. That crops would respond to the use of manure like cow-dung and decomposed plant material perhaps dawned on the ancient farmer only by chance. Animals were initially killed for their flesh and skin, but it was gradually realised that they could be used for farming as well. Thus began the domestication of animals.

Although, it has not been exactly ascertained when the early inhabitants of India took to farming as their chief occupation, the practice of agriculture has been traced back to the Indus Valley Civilisation. Thus, for at least the last 4,500 years, the Indian society has been primarily an agricultural one. The variety of topography and climate of the subcontinent has accorded a great diversity in the crops cultivated in different regions. Moreover, the country possesses vast arable land. Indeed, India's agricultural wealth in terms of variety and production , has significantly influenced the course of her history (Raichoudhury,1986:177).

The ancient Indian discipline of science, the *Vrkshayurveda* is of great relevance in agriculture, horticulture and life sciences. It provides a wealth of knowledge on a variety of areas such as seed treatment, soil testing and preparation, methods for yield increase, land classification, details of cultivation of plants, etc. Various other topics like - the causes of diseases, their identification and treatment, exploration of water and minerals with the help of plants -are also discussed here.

II. 1. Scientific Agricultural Practices in Ancient India:

II. 1. 1. Classification of Soil :

Panini (c. fifth century B.C.) in his *Astadhyayi* speaks of cultivated land (*karsa*) and two kinds of uncultivated land, viz. *usara* (wasteland) and *gochara*

(pasture). Classification of land was also made at this period on the basis of the crops grown and the quantities of seed required for sowing. In this regard, the land where *sali* is grown is termed *salieya*. Similarly, the land which grows *tila* is called *tilya* , that growing *vrihi vraiheya* and so on. He also prescribes the quantity of seeds required to be sown on a given measure of land. By the time of Kautilya (c. 320 B.C.), people appear to have developed an awareness of the agricultural properties of land. According to his *Arthashastra*, land could be *krsta* (cultivated), *akrsta* (uncultivated), *sthala* (high and dry ground), *kedara* (field sown with crops), *mulavapa* (field for growing roots), and so on. He also classifies various regions according to annual rainfall. Patanjali (c. second century B.C.), in his *Mahabhasya* (III.3.119), refers to arable land (*kshetra*) and pasture (*gochara*). Land under the plough is described as *halya* or *sitya* (I. 1.72).

In the post-vedic period land was classified on the basis of the productivity, rainfall or inundation, and terrain of the land. Classification was also made based on the colour of the soil, viz., grey, black, white, red, or yellow; the taste of the soil, viz., sweet, sour, bitter, or pungent and its texture - whether stony or soft. It was known that, the best soil was dark in colour, full of organic matter, and in the near proximity of water. Wet lands were considered suitable for the cultivation of paddy and dry lands for other crops. (Raghavan , 1964: 5).

II. 1. 2. Manure:

Manuring was widely practised in ancient India. Kautilya (*Arthasastra*) mentions the use of bone and cow-dung as manure. He also recommends that seedlings should be manured with fry and the milk of the *snuhi* plant (*Euphorbia antiquorum*). The *Brhat-samhita* (sixth century A. D.) and the *Agni Purana*

(eighth century A. D.) refer to the application of such manure as animal excreta, fish, bone, beef, and various kinds of decoction. The *Brhat-samhita* describes in detail how seeds should be soaked in specially prepared solutions and how they should be treated before they are sown. The *Agni Purana* says that the soil should be manured with powdered barley, sesame, and the offal matter of goats, and soaked in washings of beef for seven nights at a stretch. Sprinkling of water - in which fish was washed - on the seeds ,is also recommended. In those days, the knowledge obtained about manure was obviously the result of practical observations. It is now known that the loss of nitrogen from a dung-heap is minimised if the heap is kept undisturbed. It is significant that Parasara in his *Krsi-parasara* (A.D. 950) also advises that a dung-heap should remain undisturbed up to the month of Magha (January-February), i.e. for ten months of the year. The *Vrksayurveda* (tenth century A.D.) by Surapala, has numerous references to manure and the process of manuring. Milk and extracts of cereals and pulse, apart from animal excreta, are considered efficacious in the nutrition of specific crops and various plants and trees. The *Sukraniti* (c. fourteenth to sixteenth century A.D.) states that, for healthy growth a plant should be nourished by water, meat, and the excreta of goats, sheep, and cows. The *Sukraniti* also speaks of the application of water mixed with barley, sesame, and the excreta of goats and sheep to the roots of plants. If the solution is applied after it is kept for seven days, the *Sukraniti* says, it promotes the growth of flowers and fruits (Raychoudhury, 1986 :180).

II.1. 3. Tillage, Implements:

The plough has been one of the symbols of the material evolution of India. It was known post- that one ploughing gave a fair result in terms of

crops, two ploughings a better one, while the best result was obtained if the land was ploughed five times. The *Arthasastra* (II.24) speaks of preparing the fields by ploughing three times in heavy rain. Deep ploughing is also mentioned. Patanjali in his *Mahabhasya* refers to ploughing being done with the help of oxen (V. 3.35). It appears from the *Mahabhasya* (III. 3.83) that weeds, thorns, and stones were removed by a hoe (*stambaghna*) before the ploughing. The number of ploughs employed for tilling a piece of land depended upon various factors like its fertility and dimension. The maximum number mentioned in the *Mahabhasya* in this respect is five.

The *Amarakosa* (c. A.D. 500) lists a number of agricultural implements and accessories which must have been in use in the post-Vedic period. Among these are *langala* or *hala* (plough), *yoktra* (tie for fastening the yoke to the plough), *prajana* or *todana* (goad), *kotisa* (harrow), *khanitra* (spade of hoe), and *datra* or *lavitra* (sickle). A detailed description of the plough is found in the *Krsiparasara* (110-117). The plough, the text says, comprises the following parts: *yuga* (yoke), *addacalla* (pins of the yoke), *isa* (pole of the plough), *niryola* (a wooden pole at the end of which the plough is fixed), *saula* (an extra piece of wood which firmly fixes the *niryola*), *niryolapasika* (plates), *halasthanu* (a piece of wood fixed to the *niryola* at the end opposite to that of the ploughshare), *apccani* (a goad made of bamboo with an iron top), *abandha* (iron rod which prevents the *niryola* from getting out of its position), *yoktra* (tie), and *phala* (ploughshare). The choice of size and shape of the plough depended on several factors such as the nature of the soil, sub-soil, crop, season, and manure. Thus in the post-Vedic period different forms of ploughs were in operation, some of which are still to be seen in parts of the country. In

addition to enumerating the parts of the plough, the *Krsi-parasara* mentions the following agricultural accessories: *srni* (sickle), *khanitra* (hoe), *musala* (pestle), *surpa* (winnowing basket), *dhanyakrt* (winnowing fan), *calani* (sieve), and *methi* (threshing post) (Raychoudhury, 1986: 181).

II. 1. 4. Irrigation:

Patanjali notes that periodic watering (irrigation) of the fields is necessary for the growth of crops and apparently suggests that canals should be employed for this purpose . The *Narada-smrti* (third century A.D.) mentions two classes of dikes or water courses, namely, *kheya* and *bandhya* . The first, dug into the ground, served the purpose of irrigation, while the object of the second kind was to prevent water from flowing out.

The *Kasyapiya-krsi-ukti* provides much information on the excavation, maintenance and utilisation of reservoirs, canals, and wells. It says that reservoirs should be excavated near a hill or on flat land. They may be fed by a big lake, big river, forest stream, or rivulet. They should be deep, have high embankments, be strongly reinforced for protection against breakage, and be furnished with a causeway, flood-gates, and channels. Additional channels should be dug during the rainy season to carry away the increased flow of water. The reservoirs should be inspected regularly. Canals should be dug to carry water to the fields when a perennial source of water above the field level is available. The canal should terminate in a lake or reservoir, or if that is not possible then in the fields.

II. 1. 5. Protection of Crops from Diseases and Pests:

Crop protection , in the modern sense of the term, had not developed much in the early post-Vedic period because of the lack of knowledge about

the remedial chemicals. Reference to the destruction of paddy crops by mildew attack occurs in the Buddhist text *Cullavagga* (X.1.6), which also speaks of the 'blight' disease of the sugarcane crop. But there is no mention of any remedy. References to the need for protection of crops from damage caused by animals and birds are found in Patanjali's *Mahabhasya*. Misra Cakrapani in his *Visvavallabha* of unknown date, recommends medicines to destroy vermin that cause damage to crops. The medicines referred to are of several kinds such as those emitting offensive smell and those having acrid taste (Raghavan,1964).

II. 1. 6. Soil Testing :

Land is of three kinds, viz., arid, wet (i.e. marsh) and moderate (i.e. neither too dry nor too wet) and is distinguished by six tastes which can be known from the colour of the soil. Grey coloured, pale-white, black, white, red and yellow soils are sweet, sour, salty, bitter, pungent and astringent in taste respectively according to ancient traditions. Land that is littered with ant-hills, pits and stones is saline, contains gravel and has water at great depth. It is poisonous as far as the planting of trees, etc. is concerned.

In a region where trees and plants are blighted with frost and in a place littered with stumps, a garden should not be laid. Land in which the water is near the soil and is soft is best suited for planting trees. It is in such a place that a garden should be laid for welfare in this, as well as the other world. On the land which is stony, or soft or shines like molten gold, trees like *gudhapuspa* (*Mumusopa elengi*), *pumnaga*, *rajadana* and *campaka* grow without much effort (Raghavan,1964:6).

III. TRADITIONAL AGRICULTURAL PRACTICES IN ASSAM :

III. 1. Antiquity :

A very nominal number of manuscripts and other such written proofs are there standing testimony to the prevalence of agricultural practices in the early North East India. Some clues have been picked up from various manuscripts, travelogues, bronze and other inscriptions, with regard to agricultural practices, implements, organisation and coming up of settlements in areas feasible for agricultural purposes.

It is difficult to give the exact time of the beginning of cultivation process in flooded fields (*da panir kheti*) and growing rice in fields criss-crossed by embankments (*ali di saali*) in Assam. However, certain sources leads one to believe that the practice started during the reign of Bhuti Barma, in the 6th Century AD. Sources reveal that the king Bhuti Barma donated land to some Brahmanas. However, the bronze folio which contained the information of the land allotment was spoilt. Due to this, Bhuti Barma's successor, Bhaskara Barman made arrangements to prepare another bronze folio, and the land allotted to the Brahmanas by his predecessor was returned to the original owners or their families. The bronze folio properly documented the names and details of the land allotted. It was made clear to the beneficiaries that the land would be their family's property and may be passed on to the later generations along with other possessions. The most obvious motive of the kings behind this scheme was to incur blessings, goodwill and fame for themselves and their ancestors. However, another not so obvious motive was the introduction of permanent agricultural practise and the beginning of setting up of permanent homes. The gesture of Bhaskar Barmana of re-allotting the land to the families of

the original recipients almost after a gap of a hundred years, following the donation by Bhuti Barman, holds no meaning other than with a motive of permanently settling the subjects and introduction of permanent agriculture system.

Since time immemorial, the staple food of the people residing in the area of Assam has been rice. The rice cultivation in Assam was so significant that once the concept of Permanent Settlement began, the land was measured in terms of the amount of rice yield in the said area.

There is no direct evidence which states that cultivation of the *saali* paddy was as common as it is today. The bronze folios, which documented the details of the allotted land, also do not make any mention of the practice of cultivation of the *saali* crop. However, some land registers mention such lines as '...in the embankments in the paddy fields...', which are consider to be pointers to *saali* cultivation, which was done by building embankments in the fields to manage the irrigation process.

With the beginning of permanent agricultural practices in the area, it is known that use of bulls and hoe were popular in Assam. This fact also stands testimony to the close cultural ties with northern India. The donating of land to the Brahmanas and the consequent transcription on the bronze folio, with all the details of the allotted land were ideas no doubt taken from their counterparts in the kingdoms of the north.

Use of the plough and the bulls for agriculture find mention in age old scriptures like the *Rig-veda*, *Yajur-veda* and the *Satapath-Brahmana*. Although the use of bull and plough in agriculture in Assam was in vogue during the Mahabharata war or even before that, however, it is confirmed that

it was popularised in the 6th century AD, during the reign of King Bhuti Barma or just before that period.

Some authors have suggested that the Bodos were the first to start wet agriculture in this region. The Bodos irrigate their fields from water of hills-streams drained to the agricultural fields. Irrigation came to be regarded as an important aspect of agriculture from that period onwards. Or rather, it can be stated that irrigation became a top priority with the proliferation of agriculture. With this came up the various ideas, leading to building of different types of embankments, canals, and development of other techniques of water harvesting for agriculture.

Cultivation was carried on in the beginning by the crude method of 'jhuming' i.e., by cutting down jungles and trees, setting them on fire, making holes in the land with the help of digging sticks and then sowing seeds. Practised from time immemorial, this is the most extensively used method among most tribes till this day (Rajguru,1988:279). But, with the introduction of hoes and ploughs in agricultural practices, people took to a more complicated process of cultivation. This method of cultivation of land - particularly in the settlements - is proved by the grants. There are also references to irrigation. It is known from the grants that most of the important towns, villages, and arable lands were situated on the banks of rivers. Moreover, the occurrence of expressions like *sajala-sthala*, used in connection with most of the donated lands, and other terms like *jala*, *garta* (pit), *doba* (reservoir of water or small tank) etc., indicate that the arable areas were supplied with water. Even orchards were irrigated by channels. This is proved by the accounts of Yuan Chwang, of the 7th century A. D.(Choudhury,1959:360).

Rice being the staple food in this area, paddy cultivation naturally constituted one of the chief economic pursuits of the people - whether living in the plains

or the hills. Ancient Assamese works refer to summer and winter paddy. The *Yogini Tantra*, for instance, mentions a number of varieties in connection with the worship of different deities. The cultivation of sugar cane is indicated by the fact that among the presents sent by Bhaskaravarman, the king of Pragjyotishpura, to Harshavardhana, included *guda* (molasses) prepared from sugarcane in earthen pots. The Muslim travellers and historians of the Ahom period -Qazim - for instance, writes that the sugarcane of Assam "excels in softness and sweetness and is of three colours, red, black and white". Both records and literature refer to the cultivation of pumpkin. Bana mentions that among the gifts offered by king Bhaskaravarman included pumpkin and gourds containing painting materials. The Bargaon grant refers to arable land with clusters (hills) of gourds: (*labukutiksetra*). The cultivation of various vegetables is mentioned in many works (Choudhury , 1959:342).

The plantation of various fruit trees of different varieties is proved by both records and literature. The inscriptions mention *kantaphala* (jack fruit), *amra* (mango), *jambu* (*Eugenia jambollana*), *sriphala, dumbari, sakhotaka* (walnut) *bagari* (jujube), *lakuca, amalaka* (a kind of bread-fruit tree), *batasa* (gamboze), *coraka* (a kind of wild palm tree), *rudraksa* (bead tree) and many sour fruits, such as *ou* (*Dillenis indica*), *teteli* (tamarind) and others. The abundance of jack fruit and coconut is evidenced by Yuan Chwang who states that in Kamarupa "the jack fruit and coconut were in great esteem though plentiful." (Choudhury,1959:360).We are not sure whether oranges were grown during our period. But Qazim , at a later time , mentions them along with others. He writes that Assam "produces mangoes, plantains, jack fruits, oranges, citrons, limes, pineapples and plums. There are also coconut trees, pepper vines,

areca trees in great plenty". Not only mangoes but also a preparation of mango juice was sent in bamboo tubes by Bhaskara Barmana to Harshavardhana. A particular mention of the different uses of the plantain tree is found in Tavernier. The extensive plantation of *areca* nut and betel vine is supported by a number of literary sources and epigraphs. This is mentioned in the Aphsad inscription of Adityasena, Nowgong Grant (v.5), *Harsacharita, Yogini Tantra, Qazim, Fathiyah-i-Ibriyah* and other sources. The plantation of *haladhi* (turmeric), *ardraka* (ginger), *jiraka* (cumin), *pippaliyaka* (long pepper), *marica* (pepper), *sariah* (mustard) *karpura* and others is evidenced by the *Yogini Tantra.*

Black pepper was an extensively cultivated product of Assam. The production of *tejpat* (bay-leaves) was extensive in Assam. Watt rightly points out that it was mainly grown in Assam and Burma. In fact, articles like *tejpat* and *manjit* have been extensively cultivated in the hills and forests of Assam, mostly by tribes like the Garos, Abars and Mishmis. All these statements indicate that important and essential agricultural products were produced in Assam from early times (Basu, 1898:897).

For the cultivation of paddy, the people were mainly dependent on nature. They received ample water during monsoons . However, there were some traditional artificial irrigation system in Assam as in other parts of India . On the other hand, the Assamese cultivators were not required to undergo hard labour in the cultivation work because of the excessive fertility of the soil and the water received from heavy rainfalls (Barua,1875:246) . Although there were no major irrigation projects, yet it cannot be said that the people were ignorant of the art of irrigating their fields or draining out water from them. Ralph Fitch says that the people could, by constructing dams across the streams inundate the country when necessary , making it impossible for

men and horses to traverse it (Barua, 1933:303). Robinson also admits the existence of the practice of field irrigation to a small extent. It is known from various sources that the people were accustomed to the construction of embankments, called *mathauri*, along the banks of rivers to check the rushing water of the rivers in spate into the fields. The proverbial saying of the Assamese people, known as *dakar-bachan*, reveals the existence of the irrigation system in Assam. Maniram Dewan, the famous freedom fighter from Assam was also a famous horticulturist who states that, the Ahom kings occasionally constructed embankments for the protection of crops from inundation.

Assam had an ancient system of division of lands and land settlement. Records show division of lands into *vastu-bhumi, ksetra, khila* and *goachara-bhumi.* Existence of such division of lands in the medieval period is also evident. About the land occupied by people in the medieval period, Martin says : " Assam proper is higher and of a better soil than Kamrup and contains a few or no hills, nor woods. It is reckoned that formerly ¾ of the whole were in full cultivation and that even now not above 5/16 are waste or unoccupied. This, I presume, is only meant to apply to the islands and the parts that are on the south side of the Brahmaputra. It is said that of all the lands in Assam proper which are occupied, 2 ½ annas belongs to the temples or men esteemed holy (Devottara and Brahmottara), 4 ½ annas are let out for a rent and 9 annas are distributed among *paykes* (*paiks*) or reserved for the king and his officers" (Martin, 1938:669).

Under the Ahom Government, all the lands were divided into divisions, such as *rupit* (fit for cultivation of *sali* and *lahi* paddy), *patit* (fallow land), *bao tali* (fit for cultivation of *bao* paddy), *basti* (land fit for housing purposes), *pharingati* or *tangani* (dry land), *jalah* (low land filled with water) and *pitani*(marshy land) (Martin, 1938:670).

There were also people who neither possessed land for cultivation nor implements for cultivation purposes . Such people were sometimes employed by the land owners for which the former were either given wages in coins or a share of the crop . In the latter case, the system was called '*marakia*', in which the labourers were generally reimbursed by ¼ share of the crop . The employer furnished the seed and the necessary agricultural implements . Landlords sometimes sublet their farms to persons who did not hold any land of their own . Such a tenure was called '*adhi*' (Hunter,1879:371).

III. 2. Traditional Agricultural Implements of Assam:

(1) *Nangal* (Plough) : The wooden plough is the basic implements prevalent in rural Assam. The indigenous Assamese plough is one of the lightest ploughs in India. The wooden plough ('*desi*' plough) is very simple in construction. It consists of an angled wooden body fitted with an iron point called the share (*phal*) for penetrating the soil , a grip or handle (*muthi*) for guiding the plough and a wooden or bamboo beam (*dila-mari*), to attach the plough to the yoke (*juali*). It can be easily repaired and it is inexpensive, because except the share - all other parts are made of wood or bamboo and can be constructed by the farmer himself. It is light in weight and can be drawn by smaller types of bullocks. On the other hand, the improved mouldboard plough is made of iron except the handle and the beam, which are made of wood. Its different parts, such as the body or frame, the share, the mouldboard, the landslide and the frog are all of iron. In heavy mouldboard plough even the beam and the handle are of iron. It is, therefore, much heavier and costlier. It can be drawn only by a pair of strong bullocks.

Indigenous ploughs in Assam are generally of three types : (a) *mukhfolia* plough, (b) *kakofolia* plough and (c) *singfou* plough . *Mukhfolia* plough is the

most common plough used in Assam and is about the same as that used in other parts of India. There is also a heavy type of *mukhfolia* plough, which is used for operations like opening of new lands, uprooting sugarcane stubble, etc. in high land only. The *kakofolia* plough is similar in construction to the *mukhfolia* plough except the share which is fixed in a different way. It is fixed in the plough bottom through a hole running from end to end. The share is inserted from the back. The main advantage of this plough is that when the share wears out it need not be replaced, but only to be pushed forward and adjusted according to the requirements. In the case of *mukhfolia* plough once the share is worn out, it needs to be replaced by a new one. In some places bamboo or wooden shares are also used with the *kakofolia* plough.

The *singfou* plough is quite different from the other two and is an ingenious device. The share of this plough is slightly curved and therefore, it combines to some extent the advantages of both the mouldboard plough and the *mukhfolia* plough. All the parts except the share is made of wood or bamboo which makes it is very light . The share is small and the mouldboard device is also a miniature one. Hence the whole plough is very light and at the same time combines the effect of slightly inverting the soil and furrowing it up like the *mukhfolia* plough. Usually, the first one or two ploughings are given with the *singfou* plough when the soil is not wet and sticky. After that it is followed by *mukhfolia* or *kakofolia* plough.

(2) *Moi* (harrow) : The most common type of drag harrow used is the 'moi' . It is an indigenous type of implement the counterpart of which is the 'patela' used in northern India. But it is much more advantageous than the 'patela'. The 'moi' may also be used as a ladder. It is simple in construction and is used for breaking clods, levelling the land after ploughing and for covering seed after sowing.

(3) *Dolimari* (clod breaker) : Another simple implement for breaking clod is the '*dolimari*'. It is a wooden hammer or mallet with a long bamboo handle.

(4) *Bindha*: There is also an indigenous spike-tooth harrow called the '*bindha*'. Its body is made of wood and the spikes are of bamboo. The beam is also of bamboo and is attached to the yoke drawn by a pair of bullocks. Another spike-tooth harrow similar to the '*bindha*' is the '*jabaka*'. One must use one's hands instead of attaching it to the yoke.

(5) *Kor* or *Kodal* (spade): Besides the harrows, there are a few other inter culturing implements of local origin. These are mainly used for hoeing, weeding and earthing . The '*kor*' is a kind of hoe and is similar to the '*kodali*' used in northern India. It is used for breaking open land, inter cultivation, making ridges and furrows, for making irrigation channels, for making '*bunds*' in paddy fields and for harvesting root crops. The Khasi spade is somewhat different from the ordinary '*kodal*'. The handle is much shorter and the spade is more inclined towards the handle. The shape of the spade is also different, slightly curved inwards with two side ends pointing outwards and the apex being gently curved. It is an all-purpose hand tool used for various operations from the preparation of the land to the harvesting of crops.

(6) *Khonti* : It is an inter- culture hand tool similar to the '*khrupri*', but is slightly different in construction. It is used for weeding, transplanting of seedlings and for general inter- culturing of vegetables.

Harvesting and transporting implements :

(7) *Kachi* (sickle): It is the most common harvesting implement for harvesting paddy, pulses, etc.

(8) *Dao / Da* (chopper): A heavy knife used for cutting trees and for various construction works with bamboo.

(9) *Siprang* (digging hoe): For harvesting root crops the spade is used and sometimes even the '*siprang*'.

(10) *Bharmari, Kandhmari* or *bauka* (Carrying Rod): For carrying loads from the field to the farm house a shoulder rod called '*bharmari*', '*kandhmori*' or '*bauka*' is used. It is a split bamboo, the ends being a little narrower than the mid-portion and specially treated to give proper elasticity to the rod when the load is carried. The loads are balanced on both ends and carried either in baskets or in strings of jute or cane.

(11) *Holonga, Holongamari* or *Hulabari* (Carrying Rod) : Paddy bundles or bundles of pulses or oilseeds are carried on shoulder by means of a bamboo shoulder rod with both ends pointed. This is called '*holonga*' and is a strong thin seasoned whole bamboo. Bullock carts are often used by well-to-do farmers in order to carry un-threshed paddy or other grain crops in bulk from the field to the farmhouse. The bullock cart or the buffalo cart is fitted with iron-rimmed wooden wheels.

Threshing:

Threshing of paddy and other grains is generally done by trampling with a number of bullocks tied in a row and allowing them to trample in a circular manner. This is called *marana*, the bullock in the centre is called *merun*.

(12) *Mukhura* (mask): To prevent the bullocks from eating the paddy a small bamboo basket is tied round their mouth, which is called '*Mukha*'.

(13) *Ukhon* , *Ukhana* or *Ukhuni* : After the paddy is well threshed the straws are separated by means of a whole bamboo rod with slightly curved spike at the end. This is called *Ukhon* , *ukhana* or *Ukhuni*.

(14) *Lahoni* or *Lahoti*: Various irrigation implements include the '*lahoni*' and the '*lahoti*'. These are a form of swinging caskets used to transfer water from one plot to the neighbouring. The '*lahoni*' is made of bamboo mat or

usually of old kerosene oil tins shaped in the form of a boat, cut in the middle. The handle is made of bamboo. The same implement is used for fishing also. This is most commonly used in paddy cultivation where sometimes it is necessary either to fill the plot with water or to remove water from it.

(15) *Leheti* : The *'leheti'* is the actual swinging casket worked by two persons. It is frequently used for dehydrating tanks and ponds for cleaning or fishing. Its capacity is 10 to 13.5 litres (Mahanta,1975:108).

III. 3. Traditional Methods of Cultivation:

Traditional methods of cultivation vary with crops. Broadly speaking, the different traditional methods of cultivation followed in the North East of India may be classified as : 1. Lowland or wet cultivation , 2. Highland cultivation, 3. Shifting cultivation or *jhum* cultivation.

1. Low Land cultivation : For certain crops, a major part of the growing period requires standing water in the field. The most important crop of this type in Assam are the *sali* paddy or the transplanted paddy . Monsoon season is the usual season for the cultivation of these crops. For *sali* paddy the land is prepared by giving at least 5 to 6 ploughings. Ploughing usually starts immediately after the first monsoon shower in April- May.

Sali paddy is usually transplanted to a previously puddle field. Seedlings are raised in separate nurseries prepared on high land in June and transplanted to the puddle field in July- August. Standing water is necessary for *sali* paddy and to hold water, *'bunds'* are raised in the fields. For proper puddling of the field six ploughings are necessary and six ladderings are necessary. Laddering is usually done with the *moi.* It helps in levelling and packing the puddled soil properly so that water may stand well on the field . Transplanted *ahu* is also grown under similar type of wet cultivation.

Asra , a shallow water winter paddy is also grown under wet cultivation. Seeds are broadcasted in the puddled field in March-April and harvested in November - December. Certain *asra* varieties can stand water up to a depth of 1 to 1.75 metres. *Bao* is a long stemmed water paddy. Seeds are broadcasted in March -April, either dry or wet on low land , subject to heavy floods during monsoon. It can grow in 2 to 4 metres of water or even more.

In case of *sali* paddy, weeding is not a problem as it is transplanted in puddled fields and water is always standing during the growing period. But in broadcasting paddy, hand weeding is necessary after germination. Weeding is also done with *bindha* (spike -tooth harrow) when the seedlings are about 15 cm. tall

2. Upland Cultivation : Upland cultivation includes all the crops grown in the State under rain-fed or irrigated conditions or on highlands. *Ahu* paddy, potato, sugarcane, oil seeds, pulses, cotton, tobacco, tea and most of the vegetables fall under this type of cultivation. For the *kharif* crops preparation of the land starts as early as December-January and the sowing usually commences from April-May. In areas with irrigation facilities, sowing may be done in February-March. This is very important for sugarcane cultivation. For broadcast and line sown crops the field is prepared by thorough ploughing for 5 to 6 times, followed by laddering. The soil is thoroughly mingled. When a good tilt is obtained, the seeds are sown as required for the particular crop. For instance, for the cultivation of potato a fine seed bed is necessary. All vegetables , especially the winter ones require a fine preparation of the soil. For sugarcane the common methods are the ridge and furrow methods. The furrows are usually made by hoes and plough.

3. Shifting Cultivation or *Jhuming* : This is the most common type of cultivation practised in the hills. The main feature of the practice of *jhuming* is almost the same everywhere. It consists mainly of clearing a piece of land by cutting and burning the forest and raising one or two crops there. The land is then left out to be covered again by vegetation, cultivation being carried out similarly in a newly opened land. Usually, an interval of 8 to 10 years , is allotted before the same piece of land is brought under cultivation again. This helps the land to regain its productivity. The implements used are a small hoe, a *dao* and an axe for clearing the jungle and preparing the land. A dibbler or a dibbling stick is used for making holes in the soil for putting the seeds. The usual practice is to cut down the jungle and leave it to dry. When fully dry it is set on fire. It is a common belief among the tribal people that more the blaze of fire, the better would be the yield. There is a scientific explanation behind it .If the fire is more intense it would kill the insect pests and destroy their eggs, the weed seeds would be burnt and the ash that would result from the burning of more jungle would form valuable manure. If on the other hand, the jungle is poorly burnt, because of untimely rain, the jungle growth would spring up along with the crops and weeding would become a very strenuous job.

After the fire is out, the remains are utilised in a number of ways. The ashes are left strewn all over the field. The half-burnt or un-burnt logs are cleared to one side and used for fencing. The sticks are used as fuel and the bigger ones are used for contour bunding. The field is then ready for sowing. The seeds are sown by digging holes with the dibbler and putting the seeds therein. In certain areas, a crude preparation of the land with the help of hoes and spades is done prior to the sowing process. Mixed cropping is the most common practice. Maize, millet, cucumbers, pumpkins, chillies and paddy are sown together, the time of sowing being adjusted according to the local

conditions. Brinjal, ginger, turmeric, sesame, potato, yams, arum, tapioca are some other crops used in shifting cultivation. Mixed cultivation meets three major needs of the people - food from paddy and maize, alcoholic drinks from millets and vegetables from other crops. Tobacco and sugarcane are also grown to a limited extent.

III. 4. Agricultural Oral Lore of Assam :

Many agricultural oral lore are prevalent in Assam. Most of the agricultural oral lore in Assam are found in the form of maxims attributed to a most popular bard of this region, known as "*Dak*". "*Dak*" was supposed to be the son of Varaha Mihira, sixth century astronomer. Maxims of *Dak* are vary popular amongst the people of Assam, particularly the agriculturists. The sayings of *Dak* (*Dakar bachan*) deal with necessary knowledge or experience on subjects like agriculture, choice of cattle, meteorology, desirable qualities in women, food and nutrition, health and medicine and astrology.

The maxims of '*Dak*' are particularly scientific. Till date, the modern agriculturists consider these lores as scientific. Some of the important oral lores on agriculture are as follows :

1. *Dak* says, "Listen my dear, don't go for business; practise agriculture without fear".
2. Men who go for agriculture enjoy life in future.
3. What is the meaning of silver & gold? Without rice, we would be hungry, not bold.
4. You may have a diamond hive but you have to starve without rice.
5. Rice is valuable. Without rice there is no sign of life.
6. Keep faith in the plough and the bull. And the one who deviates is a fool.
7. If you are interested in agriculture keep plough and bull with care.

8. Sow mustard seed densely, sow black pulse thinly.
9. Cotton seeds do not sow bare, without cover they grow rare.
10. Fourth day of *Bhadra*, fourth of *Aswin*, sow seeds of black pulse in between. It will grow luxuriously green.
11. Add cow dung to black pepper, red soil to betel vine, clean banana plants monthly, they will grow very fine.
12. Sun in the east shade and in the west any kind of crop yield its best.
13. Select bulls with horn. Field at the corner yields corn.
14. Plant banana plant at knee deep. Harvest fruits size of cubit.
15. Water flows through middle of a field with high yield.
16. If your land is not plain, construct dense embankments. Plant rice at your will, harvest with high yield.
17. Make terrace on the hill. Plant rice at will.
18. Make embankments densely. Earn paddy easily.
19. '*Panikekowa*' lies under water, where you go ignorant farmer, go and borrow enjoy with best I will repay all in one harvest.
20. Buy a land, low at the centre and marry a girl who has a good mother.
21. Keep water in the paddy field during the months of "*Katiard*", "*Ahin*" as the king keeps the queen.
22. Plant three hundred and sixty banana saplings carry fortnightly rice clearings use the bark and leaf with profit trade of 'Lanka', at home you meet.
23. Nurture '*Pura*' banana with kitchen water. Apply ash to grown '*Malbhog*' .Best '*Manohar*' grow with household waste. For '*Athia*' banana cow dung is best.

{ *Pura, Malbhog, Manohar, Athia* : (Varieties of banana) *Pura is* used as vegetable. *Malbhog* is the best quality of banana with high nutrition value. *Manohar* happens to be a very sweet banana with little seeds. *Athia* is a very big sized banana with many seeds.}

24. Banana plantations in ten cubits gap. Prevents water logging around. Provides fruit the year round.
25. Plan and plant banana tree ahead of marriage. Don't worry, feel free, enjoy fruit with progeny.
26. Apply cow dung to betel nut, cover bamboo roots with earth. Cut only the coconut roots if it fails to bear fruits.
27. If water in the field is knee-deep plant paddy at a distance of cubit.
28. If the farmer is counting his days without ploughing land till '*Jetha*' it will be difficult to earn a good harvest.
29. Plant *Ahu* at steps, plant *Sali* at small gaps.
30. One who does not grow paddy sapling in '*Shravana'* he will not gain. One who plant paddy in '*Ahin'* all in vain.
31. Betelnut grows healthy when the distance between the two saplings is seven cubits. At a distance of five cubits it is very knit. At a distance of six cubits produce more fruit indeed.

III. 5. Traditional Lore on Agricultural Meteorology :

Meteorology observations leading to prediction of rainfall, scarcity of water etc. were made by experts of society traditionally from the days of yore. These observations were established in the society and were obeyed by all as valuable sayings of the experts. Till date, when modern scientific

meteorological forecast is available through radio and television, people in the agricultural societies believe only the traditional sayings about weather. It proves that the traditional meteorology is scientific.

Dak , the most popular bard of Assam made a large number of sayings about weather forecast. Some of the important and popular sayings of *Dak* are described below.

1. If there is scanty rain till the end of month of *Ahara* forget your bull and plough and serve in the king's palace.
2. Thunder in the month of *Puha* ,cloud in the sky in the month of *Magha,* plenty of *kendu* fruits in *Chaitra,* hailstorm in the month *Bahaga,* little rain in the month of *Jetha,* forecasts good rain in the other four months.
3. Thunder rain in the month of *Magha* and *Phaguna,* there will be heavy rain and flood throughout.
4. Black cloud in the sky on the seventh day of bright fortnight keep aside *ahu* paddy, prepare yourself for *sali* .
5. Good rain in the bright fortnight of *Magha* , keep aside your business, go to the field with bull and plough with happiness.
6. If there is no rain in the month of *Shravana* sell your plough and hoe and worship god *Madhava.*
7. Frogs trout in the rainy season, rush to the field with bull & plough.
8. Sun in the *Magha,* cold in *Bahaga* indicates scanty rain in the rainy months.
9. Sky is red when sun rises ; it is dark when sun sets and a heavy downpour it indicates.
10. Sun rises but no sun indicates rain very soon.

11. Whirlpool in the sky , be sure of heavy flood.

12. *Tula, Karkata, Magha, Markara* seen in the northern sky indicates very heavy flood in the field paddy still die.

13. Thunder in the south, rain in the east, rainbow appears in the west , rainfall will be all time highest.

14. Soil of '*Phaguna'* is like gold. Soil of '*Chaitra'* is like silver. Soil of '*Bahaga'* is not good. Soil of '*Jeth'* is the worst.

III. 6. Traditional Practice of Land Classification :

The Bodo tribe of Assam are considered to be the first ever agriculturist tribe of early Assam (present North- East India). Some historians opined that the Bodos are the premier agricultural tribe of India. They are regarded as the first cultivators of wet system of rice (*sali kheti)* cultivation in India.

The Bodos first select a land suitable for good cultivation, then only they settle near the land. They determine the quality of land by the following systems of land identification:

1) The Bodos traditionally identified a variety of herb as the indicator of quality of land. This herb is widely known as *ding dinga* in Bodo , and *moorphula* in Assamese. The land where this plant grows abundantly is not suitable for cultivation. Usually, this herb grows in permanently wet and marshy land. Such a land is not good for rice cultivation. They call such a land '*khandiha*' or temporary land.

2) A piece of sandy land which is nearer to a big river with a stiff bank is not considered as good land for cultivation. The explanation is that such land is enormously porous, so nutrients and water drain out through the pores into

the river- making it unsuitable for cultivation. The Bodos call such a land as *Yamgara* (hole of the god of death). They believe that one who cultivates such a land dies out of starvation.

3) The Bodos consider a land as good for cultivation if it has proper irrigation facilities. And so , a piece of land which depends on rainwater for cultivation is naturally not considered as good land. Obviously, a piece of land at the bank of a *dong* or a big drain as good for cultivation.

There is a popular folk song regarding the quality of a good cultivable land -

I had selected a land at the *Agni* direction

I had selected a pair of bull with curved horn

The crops at the bank of a big drain have been eaten by cattle and pigs.

Now, O' my dear wife what shall we eat ?

Now, O' my dear wife what shall we do ? (Narzi,1966:39)

4) The Bodos always select a land , situated at a down level near the homestead for cultivation. They knew that the land at the down level near the homestead always receive the domestic sewage and cattle sewage, which adds to the fertility to the land. There is a traditional system of constructing dwelling houses, at the north side of the agricultural land, by the Bodos of northern bank of Brahmaputra river. This system is scientific because the northern side of the Brahmaputra river is gradually at higher level. The system of having agricultural lands on the southern side and dwelling houses on the north enables a easy flow of domestic waste and sewage to the fields which enhances fertility of the soil (Narzi,1966:44).

III. 7. Selection of Land for Plantation:

Traditional concepts prevail as regards selection of land for plantation which are as follows :

1) As the banks of beautiful reservoirs of water are generally devoid of shade, the gardens should therefore, be laid on the borders of the water-reservoirs . 2) The soil that is full of poisonous matter, stones or ant-hills or is saline, gravelled or has bad underground water, is not favourable for trees. 3) Trees of all kinds thrive in soil that is dark-coloured, near to water, fallow or full of greensward. 4) Land that is of average humidity - neither too dry, nor too wet, is considered to be good. All kinds of trees grow on it well . 5) Bamboo, citron, *jamu,, kadam,* , areca-nut tree, plantain, coconut, etc. are the trees that generally grow on wet-land. 6) *Sajina* (*Moringa olifera*), *bel* (*Aegle marmelos*), *pudina* (*Mimosa pudica*), *karira* (*Capparis aphylla*), *neem* etc. are the trees that grow on dry (arid) land. 7). The rose-apple, *kadamba, dimoru*, *arjuna*, citron, vine, pomegranate and mango are the trees that grow on wet-land.

III. 8. Traditional Practices of Diseases and Pest Management in Assam :

The methods of traditional pest management is a very important body of knowledge in the field of agriculture. Now a days agricultural scientists are researching for exploration of traditional system of pest management as modern system of pest management creates problems of environmental pollution. More over chemical methods of pest management is not sustainable. Following are some of the important methods of traditional pest management. These methods have been explored from the farmers of various places of the state.

1. Worm Infestation : If the leaves and flowers of a plant wither away and become disfigured for no apparent reason, it is an indication of the presence of worms at the root of a tree. After destroying the worms at the root, the tree is smeared with a paste of cow's urine, mustard and sesame oil. The bark of Indian beech (*karanja*), Indian laburnum (*aragwadha*), soap berry, is pounded in cow's urine along with nut grass. Treatment given with this paste helps to destroy worms.

2. Insect Infestation : Farmers of Assam consider that - insects are of two kinds. Those that attack from outside and those that attack from inside. Some of those which affect from outside infest the leaves, the bark, flowers and fruits. There are other insects which live inside the roots and branches. A number of treatments have been suggested for both types:

Treatment for insect attack from inside : If the flowers and shoots fade away and the tree looks pale, it is an indication of worms inside the trees. After removing the worms, the following treatment is given. Cow's urine, sesame should be poured in a vessel and boiled. After it has cooled it should be poured around the trees. After removal of the worms, milk and water are used for irrigation.

The powder of *neem* and Indian beech is dissolved in cow's urine and kept overnight. This paste is used for treating the plants.

Treatment for insect attack from outside : Asafoetida (*hing*) is mixed with sweet flag (*vacha*), pepper, marking nut (*bhellu*), mustard and paste of cow's horn. It is mixed in cow's urine and applied around the trees. This keeps away insects. Fumigation with cow's horn, marking nut, *neem* , sweet flag (*vacha*), aconite and Indian beech (*karanja*), in conjunction with resin of sal tree and white mustard destroys insects of the trees.

3. Treatment for Early Dropping of Fruits : If fruits wither away from trees, horse-gram (*Kullathi*), Indian bean, wheat and sesame are fried in equal proportions and when cooled, applied to the soil.

4. Pest Control :

Prior to the introduction of conventional chemical pesticides, farmers used a wide range of traditional pest control practices. These practices are rapidly disappearing as farmers adopt high yielding insect resistant varieties

and other varieties which necessitate chemical use. Pest control practices can be categorised as botanical, mechanical, agronomical, biological and other methods. In addition, some practices are supplemented with religious ceremonies and rituals.

Our farmers have adopted various innovative techniques from time immemorial for the cultivation of crops. These methods were simple, cost effective, eco-friendly and easily adaptable.

Herbal Methods : Assamese farmers possessed a wide knowledge of the botanical species in their environment and identified a wide range of plants they could use for pest control. Some of these are as follows -

Use of *Pongomia* **:** The leaves of *Pongamia pinnata* (*karaja tenga*) is added to the soil to control different insect pests.

Use of *Calotropis* **:** Green leaves of *Calotropis* are spread on the fields which are infested by larvae. By this treatment, the larvae settles down under the leaves during the night and in the morning it can be collected and destroyed by burning. Fresh leaves are replaced everyday.

5. Weed Control : Farmers divert the harvested rain water of adjoining fields into the weed affected fields. Cut branches of *Calotropis* are kept at the entrance of the rain water channel. This practice minimises weed population to a great extent if repeated for several times during rainy days.

6. *Neem* as Insecticide : Application of two or three kilograms of *neem* oil cake at the base, check root nematodes, white ant infestation and multiplication of bugs. *Neem* is effective against beetles, flies, butterflies and moths, grass hoppers and locusts as well as aphids, fungi, leaf hoppers, leaf miners, mites, nematodes and termites. Almost all the pests that consume *neem* parts are either killed, repelled, develop deformities or have their eggs destroyed.

7. Control of Aphid by Chilli and Garlic : Aphid is a dangerous insect pest of many crops, which may be controlled by using the extract of green chilli and garlic. An extract of green chilli and garlic is mixed with water , sprinkled over the crop which is infected by aphid.

8. Use of Tobacco as a Natural Pesticide:

Nicotine in tobacco is a powerful insecticide. It is already available in the form of tobacco decoction or nicotine sulphate in the market. Nicotine from tobacco when incorporated in the soil, comes in contact with the termites and kills them.

Dried leaves of tobacco are boiled in water (five hundred grams in five to seven litres) till only half the volume is left and used as an insecticide. It is used exclusively on various crops. Sometimes residue of tobacco (stem, small and fallen leaves) left in the field after harvesting is used instead of costlier leaves. Residue of tobacco is collected in bulk from harvested tobacco fields and boiled in water. Filtered suspension is sprayed directly without any water on the crop..

9. Cultural (Mechanical) Practices of Pest Control :

Burning : There is a traditional practice among farmers of burning the remaining stalks and stumps after each cultivation. This destroys all insect pests and rodents and prepares the field for the next crop.

Use of Traps : Farmers in different parts of Assam and North- East India, make extensive use of traps in the fields. These are usually localised versions and improvised according to the needs of the farmers. Traps are used for destroying both pests and rodents.

Light Trap : Light traps are used for control of paddy pests, especially stem borers, in the paddy fields, particularly during flowering and seed bearing time.

There is a cultural practice of entrapping pests in the paddy fields specially during the flowering time. During this time, a popular cultural festival known as *Kati bihu* is observed by the agricultural community in particular, and the people of Assam in general. During this festival the farmers place lighted earthen lamps in the paddy fields at night . Insect pests of rice are attracted by the lamps and are burnt down.

10. Precaution Against Insect Pests :

Agronomical Methods : These methods reduce the occurrence of pests by manipulating the immediate environment. This method lays stress on clean cultivation for reducing the weed population and pest build-up. Ploughing the fields in the summer months improves the soil health and also helps in the destruction of nematode population by exposing the insect cocoons to the birds.

Inter-cropping, mixed cropping and adapting other cropping sequences reduce the incidence of pests especially in rice. Mono-cropping and mono-culture builds up the insect and pest population to more than the economic threshold level.

Field Sanitation : Weeds, grasses and pest-affected plants are periodically removed to control pests such as bugs and scales. To reduce rice pests in cultivated fields, weeding and plastering of rice field 'bunds' is done.

Healthy Seeds and Planting Material : Healthy seeds and planting materials in crops like paddy, sugarcane etc., are always selected by the farmers either by sorting out or by floating method to control pests and ensure good germination.

Resistant Varieties: Use of resistant varieties in the breeding programme is given much importance. Farmers grow certain varieties of crops which are suited to the climatic conditions of the region.

Periodical Drying of Harvested and Stored Produce : To prevent moisture content in the grains and seeds and to avoid storage pests, the farmers periodically dry the grain and seeds.

Seasonal Sowing or Planting : To escape from pest and insect attack the farmers adopt seasonal sowing or planting of different crops .

Crop Rotation : Based on the type of crop, rainfall and availability of water, cropping patterns are adopted by the farmers to indirectly avoid the occurrence of pest and disease. After harvesting a crop of groundnut, growing of rice crop especially in puddled condition eliminates white grub and suppresses the growth of weeds like cyperus. Crop rotation is a well- known practice for weed control.

Mixed Cropping and Inter-cropping : Mixed cropping is practised by farmers especially in dry lands. This encourages the natural enemy population and predators by supplying them with pollen and nectar.

Tillage Operations:

To kill soil pests and to expose certain insect pests soil tillage operation such as ploughing and inter-cultivation are adopted by the farmers so that the pests are picked up by birds. Trimming and plastering of field 'bunds' are also adopted especially to kill the grasshoppers.

Pruning:

This method is adopted extensively in horticultural crops. Stem borers, scales, mealy bugs etc., are eliminated by pruning dead, dried twigs and branches. Rice-stem borer egg masses laid at the leaf tips are eliminated by clipping the tips of the rice seedlings.

11. Biological Methods :

Use of Birds :

In some places, ducks are allowed inside the fields after the harvest of the short term rice crops. These ducks not only eat the snails and small fishes but also feed on insects found on the boundary.

Cows' Urine to Control Aphid :

Urine of cow is sprinkled on many crops to minimise aphid infestation.

Control of Bacterial Leaf Blight in Paddy :

Some farmers practice an interesting method for control of bacterial leaf blight in paddy. A slurry of twenty kilograms of cow dung is made with two hundred litres of water and strained through a gunny bag. The filtrate is diluted with fifty litres of water and allowed to stand. The filtrate water is then decanted, strained and sprayed on healthy plants to check the spread of disease.

Aphid Control by Using Ash :

Ash makes fine scratches on the insect's body. Through these scratches water is lost from the insect's body and the continuous dehydration causes death in injured insect's. Ash is dusted on many crops for aphid control.

IV. TRADITIONAL AGRICULTURE IN MEGHALAYA :

The people of Meghalaya are industrious cultivators. Although they are not using modern methods of cultivation they know many indigenous technologies of soil fertility. Their system of turning the sods, allowing them to dry, then burning them and raking the ashes over the soil, is much in advance of any system of natural manuring to be seen elsewhere in this region.

IV. 1. Traditional Agricultural Implements : The Khasis of Meghalaya use the following agricultural implements - A large hoe (*mokhiw heh*), an axe for felling trees (*u sdie*), a large 'da' for felling trees (*ka* wait *lynngam*), two kinds of bill-hooks (*ka wait prat* and *ka wait khmut*), a sickle (*ka rashi*), a plough in some parts of the Jaintia Hills (*ka lyngkor*), also a harrow (*ka iuh moi*). In dealing with agriculture, the lands of the Khasi and Jaintia Hills may be divided into the following classes :- (a) Forest land, (b) wet paddy land called *Sali* or *pynthor*, (c) high grass land or *ka ri lum* or *ka ri phlang,* (d) homestead land (*ka 'dev kyper*).

IV. 2. Traditional Methods of Cultivation : *Jhumming* or shifting method of cultivation is the most popular and age old practice of cultivation in the hills.

***Jhum*ing :** Forest lands are cleared by the process known as *jhuming*, which involves the trees being felled early in the winter and kept as such till January or February, when it is set on fire. The heaps of logs of wood are placed at intervals of a few feet to prevent as far as possible, the ashes being blown away by the wind. The land is not hoed, nor treated any further, paddy and millet being sown broadcast, and the seeds of root crops, as well as of maize and Job's-tears, being dibbled into the ground by means of small hoes. No manure, beyond the wood ashes above mentioned, is used on this class of land ; there is no irrigation , and no other system of watering .The seeds are sown generally when the first rain falls. **Wet Cultivation :** Wet paddy land (*sali* or *pynthor*) is, as the name implies, the land where the kind of paddy which requires a great deal of water is grown. The bottom of the valleys are divided into little compartments by means of fairly high banks corresponding to the Assamese '*alis*', and the water is let in at will into these compartments

by means of skilfully contrived irrigation channels, sometimes a mile or more in length. The soil is made into a thick paste in the Jaintia Hills by means of the plough, and in the Khasi Hills through the agency of the hoe. Droves of cattle also are driven repeatedly over the paddy-fields until the mud has acquired the right consistency. The seed is then sown broadcast in the wet mud. It is not sown first in a seedling bed and then transplanted. When the plants have grown to a height of about four inches, water is let in again; then comes the weeding, which has to be done several times. When the crop is ready, generally, the ears are cut with a sickle (*ka rashi*) so as to leave almost the entire stalk. These and are then left in different parts of the field. They reap their grain by pulling the ear through the hand. Manure is not used in the paddy-fields. The Khasis, while cultivating high lands, select a clayey soil wherever possible. In the early part of the winter, the sods are turned over with the hoe, and they are exposed to the action of the atmosphere for a period of about two months. When the sods are dry, they are placed in piles, which are generally in rows. In the piles a slow fire is kept up, the piles of sods being gradually reduced to ashes. The ashes so obtained are then carefully raked over the field. Sometimes other types of manure is also applied, but not when paddy is cultivated. The soil is now fit to receive the seed, either high-land paddy, millet, Job's-tears, or other crops, as the case may be. Manure is used plentifully in the homestead lands and consequently, with proper care and attention, good crops are produced.

Orange Orchard : The cultivation of oranges in Meghalaya ranks equally in importance with that of the potato. The orange comes from the warm southern slopes of the hills where it is cultivated on an extensive scale. Although, oranges do best when there is considerable heat, they have been known to do

well in altitudes even as high as 3,000 feet .But , the usual limit of elevation for the growth of oranges is probably about 1,000 to 1,5000 feet. The orange of the Meghalaya Hills has always been famous for its excellence.

Orange Nurseries : The seeds are collected and dried by exposing them to the sun. In spring, the nurseries are prepared, by thoroughly hoeing the ground and pulverising the soil to the best possible extent. The nursery is walled with stones. The seeds are then sown, a thin top layer of earth being applied. The nurseries are regularly watered, and are covered with layers of leaves to ensure, as far as possible, the retention of the necessary moisture. When the plants are 3 or 4 inches in height, they are transplanted to another larger nursery, the soil of which has been previously well prepared for the reception of the young plants.

An orange garden is prepared in the following manner :-

The shrubs, weeds and small trees of an area are cut down, leaving only the big trees for the purpose of shade. The plants from the nurseries are planted about 6feet to 9 feet apart. When they have become young trees, many of the branches of the sheltering trees mentioned above are lopped off, so as to admit the necessary amount of sunlight to the young orange trees. As the orange trees increase in size, the sheltering trees are gradually felled. The orchard requires clearing of jungle once in spring and once in autumn. The Khasis do not use manure for the orange trees, nor do they dig about and expose the roots. The price of orange plants is from 75 to 100 plants per rupee for plants from 1 to 2 ft. in height, and from fifty to seventy-five plants per rupee for plants from 2 to 5 ft. in height. Orange trees bear fruit when from five to eight years old in ordinary soils. In very fertile soils they sometimes bear after four years. A full-grown tree yields annually as many as 1,000 oranges.

Potato : Potato is the most popularly cultivated vegetable crop of Meghalaya. Potatoes are raised on all classes of land, except *sali*, or wet paddy land. When the land has been properly levelled and hoed, drains are dug about the field. A cultivator (generally a female), with a basket of seed potatoes on her back and with a small hoe in her right hand, digs holes and with the left hand drops two seed-potatoes into each hole. The holes are about 6 inches in diameter, 6 inches deep, and from 6 to 9 inches apart from one another. Another woman, with a load of manure in a basket on her back, throws a little manure over the seed in the hole and then covers the hole with earth. After the plants have attained the height of about 6 inches, they are earthen up. When the leaves turn yellow, it is a sign that potatoes are ripe.

The Khasis also possess agricultural sayings and proverbs. The following may be quoted as examples - (1) Plant trees or sow seeds not when the moon is waxing, but when it is on the wane.

(2) A red sky in the west in the evening is the sign of fine weather tomorrow.

V. TRADITIONAL AGRICULTURE IN NAGALAND :

Nagaland is completely a hilly region except for a narrow belt of foothills bordering Assam and some small valleys in between the lower ranges on the western and north-western flank. The Borail range flanks the boundary with Burma and the highest mountain in summit of the state Saramati (3,830 m.), lies on the range in Tuensang district. There are several other hill ranges. Topographically the landscape can be grouped into three divisions :

(i) The foothills with undulating to rolling topography and having warm subtropical climate. (ii)The lower ranges and the mid-slopes with varying degrees of slopes and having sub- montane climate. (iii)High hills and mountain regions above 900 metres altitude.

The hills are dissected by several perennial streams with V-shaped internal valleys in between. There are four major river systems in the state: Dhansiri, Doyang, Dikhou and Tezu.

The climate over the foothills is cool and temperate. The midslopes and lower ranges in the western flank have a moderate sub-montane climate. The summer and winter temperature over the hills vary from 5 degree centigrade to 25 degree centigrade. On the high hills, occurrence of frost over large tracts is observed but snowfall is rare in the inhabited areas.

Due to prolonged rain and high humid conditions, the natural vegetation over the lower range of the western flank is characterised by subtropical evergreen forests. The central hilly regions have broad-leafed temperate evergreen rain forests. The eastern and south eastern plateau has a characteristic coniferous (pine) vegetation.

In Nagaland, agriculture is mainly of the primitive type and labour intensive. Slope and valley land cultivation is most common. There are some areas where beautiful and effective indigenous cultivation (natural farming) techniques are developed. Among these, 'bench terrace cultivation'. '*zabo* system of farming' and 'use of alder in cultivation' are excellent examples. These tribes depend for the cultivation of crops as well as harvesting and storage of food grains on the phases of the moon. also depend on the phases of the moon.

These effective indigenous cultivation techniques which are resource-based and involve local skills have been evolved by the local farmers in different parts of the state. These practices are discussed as below:

V. 1. Bench Terracing:

An excellent bench terraced land cultivation system is widely practised in some parts of the Kohima district of Nagaland and the adjacent areas. These farmers have been cultivating in bench terraces from the days of yore. Bench

terrace cultivation - with availability of irrigation water particularly in Nagaland, using steep slopes (upto 100% and more) presents excellent opportunities and even rocky land areas, where small quantity of soil is available, have been used for developing bench terracing. The top soil is maintained in the terraced bed while construction of terraces is done annually. In almost all cases, disposal of excess water and application of irrigation water is managed by allowing the water to flow from one terrace to another by way of providing openings in the ridge *bund.*

In the terrace fields, agricultural operations start in the month of December and January with the digging of fields with spades. Soil is dug to turn in the residues of the rice plants. Puddling operations start in the month of April. After that farmers start allowing water to enter into the terraces. They are flooded with water by the first week of June. In the same month, seedlings are transplanted from their nurseries into the puddle lands. June 21 is the longest and busiest day, with everyone, young and old, involving themselves in transplanting rice plants. The appearance of the terrace fields continues to change. By the end of September, with grain farming, paddy plants are bunched together. This prevents the plants from being damaged by the wind or by the weight of grains. This also reduces the loss of grains during harvest and makes the harvest easier.

No chemicals are used by the farmers in their terrace fields to control insect pests. There is a belief that application of fertilisers will decrease the quality of the soil.

V. 2. Zabo Farming System :

The Zabo system of farming is an indigenous system practised by the farmers of Chakhesang tribe of Kikruma village located at an altitude of about 1,270 metres near Pfutsere town in Phek district. Zabo has a combination of

forest, agriculture and animal husbandry with well-founded conservation based soil-erosion control, water resources development and water management and protection of the environment. The beauty of this system is that each and every farmer takes care of his land with his ingenuity, skill and the available natural resources. This system of farming is also called *ruza* by local farmers (Chakhesang tribes). Farmers practice this cultivation on flat hills, protected hill top slope, and in the ponds and paddy fields with special seepage control. The cultivation depends fully upon the amount of water collected in the pond and fields. The farmers divert road-side drain water wherever feasible, for use in agriculture. Only one crop of local paddy (Var. *Tabyekemugah*) is grown with irrigation from the storage pond (as supplement) and an yield of about 30 to 40 q/ha (quintal per hectare) is obtained. Chemical fertilisers are not used in this system but use of green manure (like *Albizia lebbeck*) and local tree leaves (mekhonu), application of cowdung and the technique of run-off diversion through open cattle yards are the usual methods of manuring the paddy crops. Farmers also use *Azolla*- that grows naturally- for enhancing the soil fertility, whenever permanent impounding of water resources are available. Most of the farmers practice paddy cum fish culture technique and derive about 50 to 60 kilograms of fish per hectare as additional output.

V. 3. Agriculture with Alder Tree:

In some pockets of Nagaland, farmers use alder trees for agriculture. In this system they primarily grow maize, millet, Job's-tears, potato, wheat and secondarily, chilli, pumpkin, taro, using alder trees.

The process involves planting of alder (*Alnus nepalensis*) seedlings on the slope-land intended for cultivation. The alder grows fast for six to ten

years. At this stage, initially the alder trees are pollarded, the leave and twigs burnt and the ash mixed with the soil to prepare it for raising crops. Subsequently, pollarding is also done once every four or six years. Under the process coppices are cut except five to six on top of the main trunk and crop schedule is followed including maintaining a fallow period of two to four years. The bigger branches stripped of leaves are used for firewood, while the roots of the tree develop nodules (colonies of frankia) responsible for fertilising the soil. The spreading nature of the roots helps in preventing soil erosion on slopes.

The ability of the alder trees to retain fertility of soil has been fully utilised by farmers in the Angami, Chakasang, Chang, Yimchunger and Konyak areas in Nagaland, at varying altitudes between one thousand to two thousand meters. In Khonoma village of Kohima district, people have even restored terracing the alder fields to further reduce soil erosion and to retain soil fertility.

Among these farmers, there is a belief that the moon's phase has tremendous influence on the behaviour of plant growth and development and also the yield of crops . The moon's phase greatly influences the infestation of insect-pests on crops.

In conventional farming, both crop production and livestock feeding are concerned with providing fertilisers and animal feeds brought from outside the farm, instead of making full use of what is found in our farms. The result is that farming has become an expensive affair- with the farmer having to incur large costs of chemical fertilisers, sprays, insecticides, vaccines and medicines. However, where natural conditions are maintained, nature continues to provide an abundant production and healthy crops at no cost.

We can conclude by saying that in traditional or indigenous farming, the measure of success or failure is not based on increased yields or reduced costs, but rather on the health and abundance and interaction of all the living things present in the farm (Singh, 1993: 1.13)

VI. Traditional Agriculture in Arunachal Pradesh :

The people of Arunachal Pradesh have developed an interesting traditional system of sustainable agriculture. In the hills, irrigation to the agricultural field is the main problem. People of Arunachal Pradesh have developed two important traditional irrigation systems in Arunachal Pradesh- the irrigation of rice terraces with the help of bamboo pipes, and the Apatani system of wet rice irrigation. In the former case, water is transported through an intricate system of bamboo pipes to agricultural fields. But this system is now becoming obsolete and is being replaced by iron pipes and channel irrigation

The main form of cultivation in Arunachal Pradesh is shifting cultivation. Settled agriculture is mainly practiced by the Apatanis, who live around Zero in the lower Subansiri district, at an altitude of 1,572 meter. Rainfall in this region is about 1,758 mm and about 75 per cent of it falls between May and September. The monsoon is followed by a dry winter with March and April as the driest months of the year. The agriculture of the Apatanis resembles terrace cultivation with the difference that, the cultivation is done in valleys with a slight slope.

The Apatanis have evolved a very scientific system of field irrigation. The striking features are the partially flooded rice fields, and the intricate design of the contour dams dividing the plots. The valley floor has a gentle gradient and the terraced holdings are laid out along the general slope. The plots are divided by 0.6 m high earthen dams supported by bamboo frames. All holdings have an inlet facing the water-head and an outlet on the opposite side . The inlets for the low-lying plots act as outlets for the higher level plots. A deeper conduit channel connects the inlet point with the outlet point. When a terrace is to be filled with water, the outlet is blocked. By opening and blocking the connecting ducts, any field can be flooded or drained as required.

The Apatanis conduct a very efficient form of agriculture. The crop cultivated in this region is predominantly rice and the land preparation for it begins in February, with the surface application of rice husk from the previous year's harvest. There are two varieties of rice that are grown by the Apatanis - the early maturing variety-which take less time to grow - and the late maturing variety. The early ripening varieties are grown in plots which are further away from the village habitat because of poor water availability in the later stage of the cropping season, and because of the fear of attack by wild animals . The late ripening varieties are grown in plots close to the homesteads and these plots are also well mannered and rich in nutrients.

When irrigation channels pass by the village, human, pig and poultry refuse flows in to them, especially during the monsoon season, with the addition of rain water enhancing the flow. Thus, in a sense, the local drains merge with the irrigation channels. In some cases, the domestic waste water channels flow directly into nearby crop fields. As a result, plots closer to the village are better fertilized than those further away. Cultivation of late varieties of rice together with pisciculture are conducted in plots near the village. The yield in these plots is higher than the plots on the periphery of the village. The Apatanis use the rice husk from the previous year's harvest and the refuse from their homesteads, including pig refuse, as fertilizer. Pigs are an integral part of their livelihood (Agarwal,1997:39).

Land preparation for rice cultivation begins in February. First of all, rice husk is spread on the fields. The quantum of rice husk applied is higher in plots on the periphery than in the plots close to the homestead. The land is then tilled by hand after levelling the ground, and no draught power is used. Rice seedlings are transplanted in April or May from nursery beds raised in

March or April. Weeding is then done regularly, and water flow into the plots controlled by manipulating the bamboo sluice. The early variety of rice is harvested in August - September, and late varieties in October - November (Gruneing,1911:59).

Along with rice, millet seeds are sown along the *bunds* separating the plots. Millets are harvested together with the early varieties of rice. The Apatanis have kitchen gardens in their villages . They also grow bamboo in the valleys.

Apatani agriculture is extremely efficient. Production of rice varies between 3.5-4.1 tones per hectare (t/ha)for early and late varieties, respectively. Fish production is approximately 50 kg per ha (kg/ha) from late variety rice fields. With human labour as the only major input and with very little organic manure, the Apatanis obtain a high energy output. The energy efficiency of the system expressed as an energy output to input ratio, is very high 60-78 for rice. This is the highest energy efficiency reported for a rice agro-eco-system in the region, and is much more than the traditional Indian agro-ecosystems. With 27-35 mega-joules of energy output per labour, per hour, this system has been compared favourably with similar systems in China and the more modern agriculture of industrialised societies in Europe. The cost - benefit ratio is also very high for the Apatani agro-ecosystem .

(More information on sustainable agricultural system in Chapter VII)

VII. TRADITIONAL AGRICULTURAL PRACTICES IN MANIPUR :

Jhuming is the traditional system of agricultural practice in Manipur. According to a recent data about 70,000 families of this state are involved in jhuming practice. It is the way of life of these people. Though there are

criticisms regarding jhum cultivation , a close look in this practice proves that it helps to preserve local races, crop plants and domesticated animal varieties and also conserve valuable germplasm for resistance to pest and diseases. In the traditional type of farming in Manipur, the peasants select a hill area and fell trees in a manner so as to leave those which are larger. Un-consumed stamps are left for collecting rain water down the slope and thus preventing soil erosion. A few trees are left in parallel lines close to the field. Then the slash is dried during the winter and burnt before the onset of monsoon. Care is taken to select the appropriate time for burning, otherwise the crops raised will mostly deteriorate. Without using the plough, machinery or animal, the seeds are sown in drills made with a stick. Mixed cropping is practised for rice, legumes, cucurbits and traditional vegetables and crops throughout the year, thus utilising every inch of land. The field is constantly watched against grazing animals, birds and weeds. After harvesting, the grains are deposited in the granary close to the field. Then the land is left fallow and the tribal shift to another place for similar practice.

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Chapter - IV

TRADITIONAL HUMAN MEDICINAL LORE

CHAPTER-IV

TRADITIONAL HUMAN MEDICINAL LORE

I. INTRODUCTION :

"In ancient India, the only discipline that promises to be fully secular and contains clear potentials of modern understanding of natural science is medicine." This was the remark made by Prof. D.P. Chattopadhya, in his book *Science and Society in Ancient India*, to provide argument for establishment of medicinal lore in ancient India as a positive science. In contrast to other discipline in ancient India, medicine - in spite of its historically inevitable humble beginnings- takes already in the ancient period the momentous step from magico - religious therapeutics to rational therapeutics, i.e. in the terminology of the physicians themselves, from *Daiva-vyapasraya bhesaja* to *Yyukti- vyapasraya bhesaja* (Chattopadhya, 1977 : 4).

II. TRADITIONAL SYSTEM OF INDIAN MEDICINE :

Archaeological remains concerning pre-Aryan medical elements unearthed from different sites of Indus and pre-Indus cultures testify to rudimentary ideas about some medical and surgical practices. Surgical activities are inferred from trephined human skulls and curved knives from two pre-Indus sites, viz. Burzahom in Kashmir and Kalibagan in Rajasthan. Medical practices inclusive of some health and hygienic measures are indicated in excavations at Mohenjo-daro and Harappa. These comprise elaborate sanitary measures, arrangements for bath in specially-built chambers, and medicinal substances consisting of stag-horn, cattle-fish bone and bitumen (Jolly, 1977:33).

The birth of rational medical system, the ayurveda may be traced to the appearances of recessions of earlier medical texts by Charaka and Sushruta. The date of redaction of the *Charaka-samhita* may be assigned to the first century A.D. on the identification of Charaka with one having the same name who happened to be the court physician of Kaniska, Sushruta's original text is believed to have been redacted by one Nagarjuna between the third and fourth centuries A.D. These two *Samhitas* bear testimony to the scientific research, patient investigation and experimentation which preceded them and served as works of reference to students and research workers alike.

Each of these two *Samhitas* deals with, among other subjects, anatomy, physiology, toxicology, psychic therapy, personal hygiene and medical ethics. Some differences are noticed in their presentation and treatment, Charaka, an enormous compendium suffering from repetitions, contains a vast amount of floating tradition of considerable historical value whereas Susruta, while sufficiently emphasizing earlier traditions and knowledge, is a much more compact and systematic work. In the treatment of subjects, the two compendia follow two tradition - Charaka that of *Atreya* and Shushruta that Dhanvantari. The former is divided into eight *sthanas* (books), namely, *Sutra, Nidana, Vimana, Sarira, Indriya, Chikitsa* and *Kalpa*, the sixth *sthana, Uttaratantra*, being a supplementary work containing *Salakya-tantra, Kaumarabhrtya* and *Bhutavidya.* Susruta's division of six *sthanas* has been adopted by *Vagbhata* I and *Vagbhata* II in their respective works (Dasgupta, 1952: 294).

Life and matter, both having their source in prakrti and purusa, are similarly constituted. The five gross elements (*mahanhutas*), viz. *akasa* (space), *vayu* (air), *tejas* (fire), *ap* (water) and *prithvi* (earth), together with their subtle aspects

(*suksmabhutas*) form the common constituents of all objects, animate and inanimate. Charaka, following the *Vedantic* view, declares each of the gross *bhutas* to be a peculiar ultra-chemical compound of five original subtle *bhutas*. Each of the gross *bhutas*, according to Sushruta, is mixed up with other *bhutas*. Every substance is in reality *penta-bhautic* and it is only the relative predominance of a particular *bhuta* or *bhutas* in any substance that determines its class (Dasgupta, 1952: 270).

II. 1 . Principle, Diagnosis and Treatment :

Disease, according to *Ayurveda*, is a condition of the body and mind which results mainly from abnormal states of the fundamental elements (*dhatus*) of the human system. Restoration to normalcy depends on proper understanding of the factors leading to physical and mental growth and decay.

Physical growth depends on the equilibrium of the three *dhatus* of the body comprising *vayu, pitta* and *kapha*. Decay of the body is caused by imbalances in the *dhatus*. These two conditions of equilibrium and imbalance are known as *dhatu-samya* and *dhatu-vaisamya* respectively. When the amount of these *dhatus* are in normal measure (*prakrta-mana*), i.e. *dhatu-samya,* they are *prasada-dhatus* and growth follows. When there is excess or deficiency in their normal measure *(dhatu-vaisamya*), they become *mala-dhatus* and cause decay. To help keep the *dhatus* in balance, there should not be deficiency of any particular kind of substances in the body . Apart from substances inducing imbalances in the proportion of *dhatus*, several other factors are considered responsible for organic decay. These include : (a) excessive (*atiyoga*), inadequate (*ayoga),* and wrongful (*mithyayoga*) content with sense-objects; (b) climatic variations of heat and cold; (c) misuse of intelligence; and (d) three

dosas (deranged humours) (Dasgupta, 1952: 297).

II. 1. 1 . *Vayu, Pitta* and *Kapha* :

The concept of the three humours-*vayu* (gaseous element), *pitta* (fiery element) and *kapha* (liquid element)-forms the basic *ayurvedic* medicine. According to Charaka, these are generated in the body as waste products in the process of assimilation of the various *rasas* or essences contained in food. Of all the waste products, *vayu, pitta* and *kapha* are regarded as being the most important, since they sustain the functions of the body when in proper measure or retard them when in a state of imbalance. In a balanced state they are termed *dhatu* (that which upholds) and in an unbalanced state they are called *prakriti-dosa* (constitutional *dosa* or deranged humours). In appropriate proportions, these *dhatus* contribute to the efficiency of all sense-organs and to the strength, colour and health of the body, thus creating a man's longevity.

Vayu, in its five forms, has the properties of dryness , coldness, lightness, immeasurable latent power and great speed. It maintains a desirable equilibrium among the *dosas* (humours), *dhatus* (physiological elements) and *agni* (heat) present in the body. Hence, *ayurveda* declares that the body can function normally only when *vayu* is in an undisturbed state, *pitta,* in its five types, contributes to the process of *agnikarma* (metabolic combustion). Some of the functions of *agnikarma* are separation of digested food elements as chyle, excreta, urine, etc.; supplying colour matter to blood; and imparting motion to body activities of *kapha* or *slesma,* in its five forms, are strengthening and promoting bodily endurance and contributing to proper and healthy functioning of the body. Disturbance or balance in the normal proportion of the three elements, *vayu, pitta* and *kapha,* is stated to be caused by climatic conditions, the quantity of food consumed, abnormal or normal life-style, incongenial or

congenial environment, and unfavourable or favourable natural phenomena (Ray, 1956: 37).

II. 1. 2. Diagnosis of Diseases :

Diagnosis of diseases involves proper knowledge about the patient's constitution, his strength is ascertained from (a) his normal constitution in health; (b) the abnormality that has set in ; (c) the predominance of the particular element or essence (*sara*) in his constitution; (d) his compactness or lack of it; (e) his proportions such as stature; (f) things agreeable to his constitution; (g) his mental disposition; (h) his power of assimilation, (i) his age; and (j) the season of the year.

II. 1. 3. Treatment of Diseases :

According to Charaka and Sushruta, success in ayurvedic treatment depends on the physician, patient, medicines and attendant. Factors governing the treatment are *purusa* (patient), *vyadhi* (disease), *osadhi* (medicine), *kriya* (processes) and *kala* (seasonal and climatic factors as well as the time and frequency of medication or surgical treatment). In treating a patient, his age, sex, physiological and mental strength and constitution have to be taken into consideration. Surgical treatment is strictly prohibited for the weak, old, infirm, infants and expectant mothers.

Diseases are classified as *agantuja* (extraneous) and *sarira* (constitutional); or, again, as *adhyatmika* (generated inside the organism or the mind), *adhibhautika* (due to adverse external causes) and *adhidaivika* (due to fate, malign influences, or non-observance of rules of health). According to the degree or intensity of a disease is *sadhya* (curable by medical treatment or requiring surgical treatment), *asadhya* (non-curable) or *yapya* (relievable by treatment). Physicians are advised not to take up treatment of non-curable diseases. Signs of curable and non-curable types have been fully enumerated in ayurvedic treatises. Sushruta includes general paralysis, leprosy, piles, fistula,

urinary calculus, abdominal dropsy and other diseases in the latter category.

Sushruta divides all drugs into two categories, viz. *samsodhana* (purificatory) and *samsamana* (pacifying). Apart from these two divisions, Charaka divides drugs into fifty *vargas* (groups) according to their supposed action on the different organs of the body or on particular symptoms of the disease. In addition to these *vargas*, Charaka describes two other classes of medicine : *rasayana* and *vajikarana*.

Ahara consists of substances agreeing with the constituent elements of the patient, which retain their inherent properties even in combination with other substances. Susruta dwells at length on the merits and demerits of different kinds of food and drink with reference to their effects on the human system. *Acara* implies observance of hygienic rules and a code of correct conduct as well as taking of prescribed medical diet. Hygienic rules comprises cleansing the teeth, washing the face, bathing, nail- paring, care of the hair, exercise, massage, etc. correct under regulation of sex life, avoidance of sleep in day-time, correct posture for sitting , etc. Apart from these, a*yurveda* lays down several rules for seasonal observances suitable for keeping the three *dosas* in balance (Ray, 1956: 53).

III. TRADITIONAL MEDICAL LORE OF ASSAM :

III. 1. Antiquity :

Evidence of the study of medicine, concerning human as well as animal, are found both in the early and medieval sources. In early Assam, we find one Nagarjuna whose name is associate with the compilation of a medical work called *Yoga Satake*. According to K.L. Baruah there are still certain specific remedies, in the *Kamarupi ayurvedic pharmacopoeia*, which are associated

with the name of Nagarjuna. It is further believed that Nagarjuna was contemporary of Ratnapala of the 11th century A.D. and belonged to the *Vajra-yana* school. Moreover, Nagarjuna of Assam was a different person from the Nagarjuna of the 2nd century B.C. who is believed to have revived the *Sushruta-Samhita* (Choudhury, 1959: 403). In the '*subhankara-pataka*' grant of king Dharamapala, there is reference to a *vaidya* named Prasthana Kalasa, who composed the grant. Like the present terms *bej* and *oja*, the term *vaidya* stands for a professional class of physicians. The Nowgong grant of the king Balavarman III mentions *Bhisaja*, a class of physicians (Barua, 1933:159).

The proverbial sayings, particularly the *Dakar-bachanas* (aphorisms of *Daka*), furnish evidence to the fact that the study of a*yurveda* was widely prevalent in the country. The influence of Assamese Medical works, known as *Nidana* and other a*yurvedic* works, particularly of *bhava-prakasha* of the 11th century is manifested in the Assamese proverbial sayings. These sayings make us believe that even the common people were aware of what was good for health and what was not. According to Hunter, the professional people called *vaidya* or *kaviraja* "practise medicine according to rules laid down in the Hindu religious books, although they were ignorant about surgery. The medicines used by them take the shape of large pills or boluses, containing many ingredients possessing different and sometimes antagonistic properties." Hunter gives a long list of medicinal herbs in his work . *A statistical account of Assam* (Hunter,1879: 284). The study of *ayurveda* or medicine in the medieval period is proved by the existence of manuscripts also. Gunabhiram Barua points out that though the Sanskrit works on *ayurveda* were not entirely rendered into Assamese, yet parts of them were rendered into it. There are many manuscripts written in both

prose and verse, where names of different diseases along with antidotes are found. The Assamese physicians known as *bej*, which is a debased form of the term *vaidya*, used both medicine and versified incantations or charms for the removal of diseases and other evil spirits from the body of a man (Barua, 1875: 245).

In Assam, the *bejali* (the profession of physicians) is the result of the people's experience acquired from their day-to-day contact with the herbs and knowledge acquired from the *ayurveda*. They apply these medicines prepared from local herbs. The knowledge of these medicines or incantations traditionally has been handed down from father to son, or mother to daughter or from mother-in-law to daughter-in-law and so on (Barua, 1961:169). In treating diseases under the *bejali* system, medicines and *mantras* are equally applied. *Mantras* were mostly applied, as is the practice prevalent even now, to cure bodily pain or pain caused by the bite of venomous insects, reptiles and animals.

There are manuscript copies, written in medieval Assam, regarding treatment of disease by the *ayurvedic* system and by uttering incantations. There is a Sanskrit work written in Assamese called *Vaidya-Saroddhara* by one Jagannatha with 121 folios. This is a voluminous manuscript having detailed discussions on *ayurvedic* treatment with particular reference to *Tridosa*. Therefore, the treatise is believed to have dealt with scientific *ayurveda* . The other manuscript works on *ayurveda* are *Chikitsa-Saṃhita* (in Sanskrit) by Damodara, containing 19 folios and *Vaidyavati* (in Assamese) containing 29 folios. There are works on indigenous medicine and incantation such as *Vyadhi-guchibar-katha* and *Chikista-mantra-tantradi* which deal in the symptoms of different kinds of tumour, carbuncle, boils etc. and prescribe medicinal herbs for these diseases. The works *Jvarar Lakshan* deals in the symptoms of fever as well as prescribes

medicine for it. The two works *Sapar dharam mantra* and *Sapekhowa-mantra* contain incantations mainly for curing snake-bites; the first one contains mantras for curing dog-bite, stomach-ache and sprain etc. and gives medicine for cough and rheumatism etc. There is a copy of manuscript called *Jvarjara mantra aru birajara mantra* preserved in the library of the Kamrup Anusandhan Samiti. The manuscript contains mantras for curing fever and driving away the evil spirit called *bira*. If one were to agree with Dr. P.C. Choudhury, it may be said that in Assam, there was a worked out system of indigenous medicines and it is not difficult for a village physician known as *oja* or *bej* to find out a herb from the neighbouring jungle to cure a particular disease. The tradition is still alive in Assam and the *ayurvedic* treatment known as *asuric* or *bejali* is very popular even now in the villages. It is true that the surgery in the strict sense was not known to the Assamese people, but if they suffer from any boil or carbuncle, they can cure it by applying medicine to it or by removing the pus with the help of a thorn (Barua,1961:169).

The Koch and the Ahom kings patronised the study of *ayurveda* in Assam. Under the Koch kings there were *vaidyas* well-versed in the *ayurvedic* studies. From the *Darrang Rajvamsavali* it is gathered that the physician of the Koch king was not only well versed in *ayurveda*, but also knew the *abhichara-mantras* (*mantras* for doing harm to the others or *mantras* of *marana*, *uchatana* etc.). The cook of the Koch king was also acquainted with *ayurveda*.

Under the Ahom Government, there were separate departments under trained officers and physicians to look after and prescribe indigenous medicine for both men and animals. The head physician, known as Bezbaruah, was in charge of looking after the health of the king in particular and of the ministers and nobles, Darabdhara Baruah had to taste and examine the medicine which was

prepared for the King (Sadaramin, 1930:126).

III.2. TRADITIONAL AROMATIC, COSMETIC AND SEX-MEDICINES OF ASSAM :

Use of cosmetics and aromatics by the people of early Assam has been described in many books. There are descriptions of use of cosmetics and aromatics by ancient Assamese people in *Arthasastra*, *Kalika Purana*, *Yoginitantra*, *Harshacharita* and others. It has been mentioned in *Arthasastra* that aromatics were manufactured in many places of Assam. *Jonga, donga, grameruka, suvarnakundya, parnadeepaka, parlouhityaka antarbatya* etc. were some of the famous Assamese aromatics mentioned in *Arthasastra* (Goswami, 1981:15).

It is known that scented powder was manufactured from different plants in Assam. Scented paste was manufactured from *agaru*, *chandana*, *sarala* and other wood. Liquid extracts of *devadaru*, *chandana*, *agaru*, *padum* and other plants were used as scented cream. Body lotion was also prepared from extracts of *karabira*, *bel*, *til*, *gandhiri*, turmeric, pulses and other vegetable materials (Goswami, 1981:17).

III. 2. 1. Perfumes:

Strong perfumes were manufactured from oil glands of musk deer. It has been mentioned that perfume of musk was extensively used in worshipping of gods and goddesses. Assam was famous for musk in ancient India. Kumar Bhaskar Barmana, the famous king of ancient Kamrupa offered musk made materials to king Harshavardhana. It has been mentioned in *Raj Nirghanta* that the musk of Assam was second in quality to the musk of China. Many historians mentioned that musk of Assam was exported to many countries of the world. People of Assam used musk perfume to repel serpents. They believed that serpents dislike

the smell of musk. French traveller Travernier, wrote in his travelogue that the population of musk deer in the forest of Assam was very high. Travernier brought 7673 bags made of musk skin. The tribal kings of Assam always offered musk oil along with other presentation. The *vaidyas* of ancient Assam used musk oil for preparation of medicines. They used it for preparation of medicine for asthma, rheumatic pain, cough etc.

Agaru **:** Use of *agaru* wood for manufacturing of perfume is a very old process. The *agaru* tree (*Aquilaria agalocha*) was considered as most precious in Assam from ancient times. The bark of *agaru* tree was used for writing. It was popularly known as *sanchipat*.

Agaru tree was very common in the forest of Assam. It is a very big tree of 60-70 feet in height and 10-12 feet in circumference. It has been mentioned in *Mahabharata* that *Bhima* brought *agaru* and *chandan* wood from Kamrupa. Kautilya mentioned about the *agaru* wood of Kamrupa in his *Arthasastra*. The *Banamala* inscription of Tezpur describes about use of *agaru* wood in Assam. King of Pragjyotishpura, Bhaskar Barmana offered *agaru* oil in bamboo nodes along with other presentations. It has been mentioned in *Ain-E-Akbari*, that Arabians knew Kamrupa as a place of *agaru* forest (Goswami,1981:20).

Till today, *agaru* is exported from Assam to different parts of India and abroad, particularly to Arabian countries.

A particular species of insect infest the aged *agaru* tree. The insect secret a special type of resinous material inside the tree. This secretion hardens and produce resinous logs of *agaru* tree. When *agaru* trees are put in water, they sink if they carry the *agaru* resin, because this resin is very heavy. When it is proved that there are *agaru* resin inside a log then it is split carefully and the

resin is collected. Oil is produced from this material with a special method. *Agaru* oil was used as perfume. Now a days, the scented sticks are known as *agarbatties*, this name has been derived from *agar* as the sticks were made with the perfume extracted from *agaru* tree.

Sandal wood : *Chandan* or sandal wood was used in Assam as raw material for manufacturing of perfumes. It is not sure, whether sandal wood tree was available in the forest of Assam or brought from other place, but the people of ancient Assam were using sandal wood for cosmetic purposes from a long time. They used sandal wood paste for beautification of face and other body parts. Sandal wood oil was also used very popularly as a perfume.

Fifteen different varieties of sandal wood has been described in the *Arthasastra*. All these sandal woods are of different colours and scents. Again it has been described that three varieties of sandal wood were found in Kamrupa. These were *jap*, *jongak* and *tourup*. These varieties of sandal wood produced mild scents.

***Sal* wood :** *Sal* (*Shorea robusta*) is a common hard wood of Assam. There are large number of *sal* trees in the forest of Assam. *Sal* tree secrets a special type of resinous material known as *saldhuna*. *Saldhuna* is widely used for production of perfumed smoke in religious functions. When powdered *saldhuna* is sprinkled on fire, it produce scented smoke.

In ancient Assam, people produced a kind of oil from *sal* seeds. Oil produced from *sal* seed was also used as a perfume, as it has a characteristic fragrance. People of Assam used to make bathing soaps from *sal* oil.

III. 2. 2. Tooth Powder :

In the days of yore, people of Assam used branches of some trees as tooth brush. Branches of *sarua* tree, *bhotera* (*Jatropa gossipifolia*), *neem* (*Azadiractus indica*) etc. were commonly used for brushing teeth. mustard oil

mixed with powdered salt was also used for brushing teeth.

A special type of tooth paste was prepared with charcoal of tobacco, chalk and camphor. Ashes of citronella plant was also used as tooth powder. Ashes of groundnut shell mixed with *neem* and black pepper powder was also used as tooth powder.

Dry pieces of betelnut fried sufficiently, powdered finely, and mixed with fine camphor powder is also used as tooth powder. Ashes of betelnut, bamboo charcoal and burnt borax mixed and powdered is used as tooth powder. Khasis and some Assamese people use peel of betel nut as tooth brush. Powered root of *bagari* tree (*Zizyphus jujuba*) and powder of used and dried tea leaves are mixed together and is used as a medicated tooth powder specially for pyorrhoea. Long pepper, black pepper, *silikha (Terminalia chebula)* powder mixed with rock salt and mustard oil is used as a tooth paste (*Kamaratna Tantra* : 23).

III. 2. 3. Face Cream :

It has been known from *Ahom buranjis* that Ahom queens used facial cream for beautification of their face. Rind of orange, white mustard seeds, flower of *pirika sak* a kind of green leaf vegetable, extract of raw turmeric, powder of *agaru* and sandal wood are boiled in *ghee* (oil of cows milk) and made a paste. This paste was used as facial cream (*Kamaratna Tantra*: 23)..

Hair oil : Ahom queens also used a kind of scented hair oil for beautification of hair. This oil was made from a large number of ingredients. The most popular among them were :

1. *Matimah (Phaseolus mug),* extract of *bhim* plantain, extract of *ou* fruit (*Dillenia indica*), paste of *ghrita (Enteda gigas), gunraj, bhimraj (Wadelia calendularia), kehraj (Eclipta alba), mutha (Eiperus botundus), gandh birina*

*(*Lemon grass*), satmul (Asparagus racemosus)*, seeds of *kenwa ban, meethiguti (*Ferugreek*), saguni lata (Tinospora cordifolia), bagh achora ban (Martinia annua), pathali komora, chal kunwari (Aloe vera), kol dil* .A scented oil is obtained when these ingredients are crushed and the extract is boiled in mustard oil. This oil was used as hair oil, which was known as *gondh tel* (*Kamaratna Tantra*: 30*)*.

III. 2. 4. Materials used for Bath and Face wash :

In the days of yore, no soap was used by the people of Assam for bath. But pastes or oil was used as detergents for bathing purpose. Paste made of some materials was applied on the body during bath. The materials from which the bath paste were prepared are – gram powder , rice powder, mustard oil, olive oil, *sal mogora* oil, ground nut oil , *til* oil . A special type of face wash was made with cream of milk, yolk of egg and lemon juice. Fine river silt was also used for washing hand, face and body in a bath.. Silt was rubbed all over the body before a bath.

III. 2. 5. Body Cologne :

To stop body odour due to sweating, the following may be prescribed -

1. Filaments of *nageswar (Mesua ferra),* roots of lemon grass and *sirisha* (rain tree), and the leaf of coconut are grounded to powder, should be rubbed all over the body.
2. Roots of lemon grass, the black aloe and bay leaf, taken in equal proportion should be ground and made into a paste and then rubbed all over the body, to get a sweet scent.
3. Paste of *masoor dal (Lens culinaris*) should be applied all over the body before a bath.
4. Decoction of *lazukilata (Mimosa pudica*) must be applied on the body, specially on the arm pits.
5. Finely made paste of *tezpat (Cinamomum tamala*) can be applied on the

body and arm pits. (*Kamaratna Tantra* : 32).

III. 2. 6. For beautification of female body in general :

1. Linseed, *sorghum* and long pepper is mixed in equal amount and powdered. A paste is prepared out of this mixture with clarified butter, and is applied all over the body to enhance brightness and beauty of the body.
2. Extract of *amlakhi (Embelic myrobalan)* and *jamu* mixed with honey, applied on the body, enhances brightness and beauty of the skin.
3. Tamarind, *boch*, *kur*, long pepper, *joni (Trachyspermum)*, black pepper, ginger, and rock salt taken in equal amounts and ground together. When this powder is taken with honey, the brightness of skin and beauty of body is enhanced.
4. Paste made of *dhaiphul* and *haithaguti*, taken with milk helps in curing extreme thinness of body (*Kamaratna Tantra* : 33)..

III. 2. 7. For a slim waist :

Paste of one *tola* of bark of the root of *madhabilata,* should be taken with curd or milk every morning at least for a month. The waist tied tightly with a cloth, also helps in narrowing the waist.

III. 2. 8. To beautify facial skin :

1. Raw turmeric paste, powder of red sandal wood, buffalo milk, mixed and made to a paste, applied regularly on the face, may beautify the face.
2. *Masoor dal's (Lens culimaris)* paste mixed with honey applied on the face regularly will beautify the face with brightness.
3. Thorns of the silk cotton tree (*simalu*), is ground finely and mixed with milk to make a paste. This paste when applied on the face and all over the

body, beautifies the skin. It also produces a sweet fragrance.

4. White mustard seed and sesame seed (*til*) ground, and made into a paste with milk, is applied on the face for brightening facial skin and is used as a mouth wash to stop bad breath.
5. *Masoor dal* is popularly used as a facial cosmetic. Paste of *masoor dal* and raw turmeric, when mixed with curd and applied on the face, removes black spots and improves brightness of the skin. (*Kamaratna Tantra* : 35).

III. 2. 9. For brightness of eyes :

1. The eyes becomes bright by application of extraction of bark of *leteku (Baccaurea sapida)* tree,
2. Haziness of eyes may be removed by application of the paste made from the roots of white hog weed (*Boerheavia chinensis*) with clarified butter.
3. Paste made with onion, ashes of four *cowri* shells, powder of long pepper and cardamom mixed with scum of milk and cows urine, applied to the eyes enhances the brightness of the eyes. Application of this medicine is also believed to help in curing of cataract.
4. Brightness and curing of cataract may also be attained by application of a paste made from roots of *myrobalan* mixed with cream of milk (*Kamaratna Tantra* : 39).

III. 2. 10. Hair Care:

For healthy hair : Clarified butter, extract of *bhringaraj (Eclipta prostrata)* and its root and mustard oil is mixed in equal amount, and boiled till it is reduced to one third its volume. This should then be kept in a new earthen receptacle, with the mouth closed carefully and then buried underground for a month. Care should be taken so that water does not seep into the receptacle and the mixture does not come in contact with air. Oil prepared in this way helps in

maintaining healthy hair.

For maintaining black colour of hair : A buffalo horn is first filled with black cumin seeds and kept buried after closing the open end tightly. The horn should be extracted after six months and the contents of the horn should be made into a paste and applied on hair. Continuous application of this material for a fortnight helps in blackening of the hair. (*Kamratnatantra* : 28)

For fragrance of hair : When root of lemon grass, *amlakhi (Embelica myrobalan)*, the root of *jamu (Engenia jamubulana)* and lotus leaf are ground together and the hair is anointed with it, the hair gives out a sweet fragrance.

For strong hair roots : Roots and leaves of *jamu* tree are ground and mixed with urine of black cow, the paste is applied to the roots of hairs to get strong roots. Paste of China rose mixed with urine of black cow, applied on the roots of hairs, also ensures stronger hair roots.

For alopacia : Latex of *xiju* plant (*Euphorbia neriifolia*) mixed with warm *Til* oil or coconut oil, applied on the head, helps in growth of hair.

For greying and falling of hair : Application of extract of *khutura sak (Amaranthus spinosus)* on hair cures untimely greying and falling of hair.

To prevent untimely greying of hair : *Amlakhi (Embelica myrobalan)* cut into pieces, dried in sun, boiled in coconut oil for a long time, gives a black coloured oil solution. Regular application of this oil on hair prevents untimely greying and falling of hair and also enhances brightness. Application of *neem* seed oil may also prevent untimely greying of hair (Tahsildar, 1910:82).

To cure acne : Extract of *gutimali (Jasminum sambac)* flower applied on the acne affected face, cure acne. Application of finely ground paste of gram on acne affected face regularly for few days, cure acne (*Kamaratna Tantra* : 56).

III. 2. 11. Medicine for Enhancement of Intelligence and Memory :

1. The roots of *babacha* grass powdered and mixed with clarified butter,

taken internally for seven days, enhances intelligence and memory.

2. Sixteen *tolas* of weight of roots of *babacha* grass being soaked for one day in the liquid extract of *amlakhi* (*Embelic myrobalan*), mixed with clarified butter, and taken internally for seven days may enhance the memory, intellect and eloquence.

3. Intellect enhances sharply when powdered roots of *babacha* grass is taken internally with clarified butter and honey.

4. The roots of white *shallow-wort* (*Sweta akan*), dried in the shade reduced to powder, taken every morning by mixing one *tola* of the powder with milk, enhances memory and intellect.

III. 3. Sex Medicines :

In early Assam there was traditional knowledge and practices of sex medicines. Herbal medicines and *mantras* were used to enhance sexual ability of man and woman. There were some traditional methods of beautifying the breasts of women. There were medicines for treatment of some sexual diseases also. Information on this subject has been collected from the folk healers in the villages, from the *bejaliputhis* (treatises on folk medicine) and *Kamaratna tantra*, a very old book on this subject. Some of the important methods of practice of these medicines has been described here.

III. 3. 1. Development of Breasts :

1. Cardamom, roots of pomegranate tree and white mustard seeds is ground together and roasted in fire after rolling the paste in a plantain leaf. If the breast is plastered with this paste for at least eight days, then the breasts will remain erect like those of young damsels of sixteen.
2. At the time of puberty, if the girl inhales through nasal aperture, the rice washed water, her breast remains erect.
3. If one *tola* of rice is ground with blood and sniffed, the breasts of a girl

remain erect.

4. Roots of *cartos* plant, fat materials of *sol* fish (*Channa striatas*) and extract of green *bel* fruit (*Aegel marmelos*), is mixed as a snuff and sniffed. The paste made of these materials applied to the breast as a plaster for one month, also helps the breasts remain erect (*Kamaratna Tantra* : 44).

III. 3. 2. Sexual Potency :

1. The parasitic creeper *raghumala*, grown on banyan tree ground finely and mixed with milk, taken orally in the first lunar fortnight, helps acquire sexual potency.
2. The juice of the root of the full grown silk cotton tree, taken orally with sugar for seven days, helps in increase in semen production of a man.
3. Handful of powdered *matikalai (Phaseolus radiatus)*, mixed with clarified butter, dried in sun and taken orally for some days, helps in enhancement of sexual potency.

III. 3. 3. To reduce unusual sexual excitement :

Unusual sexual excitement is not a disease as such, but it causes physical and mental disturbances. It may cause laziness, headache, tiredness, mental fatigues etc. Therefore it requires treatment. Unusual sexual excitement may be reduced by taking internally the extract of the seeds of '*tianh*" (long cucumber).

III. 3. 4. To Prevent Rapid Ejaculation :

Rapid ejaculation is a kind of sexual handicap and this may be prevented by drinking a mixture of pollen grains of *keteki* flower and milk, twice a day.

III. 3. 5. To Prevent Looseness of Penis :

Some man suffers from looseness of penis. The penis doesn't erect properly at the time of sexual intimation, for which intercourse becomes impossible. In such condition the oil extracted from the seeds of *lazukilata* applied regularly on the

penis may help in proper erection of the penis at the time of sexual intercourse.

III. 3. 6. To prevent uncontrolled ejaculation :

Uncontrolled ejaculation is a common sexual disease. It also causes physical and mental disturbance. It may be prevented by taking medicine prepared with extract of bark of the roots *amara* tree or bank of the lower stem of the same tree mixed with sugar and diluted in water.

III. 3. 7. To prevent inability in sexual mating:

For physical and other reasons one may be unable to indulge in sexual activities. This may cause mental weakness also. This may be prevented by adding mushroom preparations in the list of daily food (*Kamaratna Tantra* : 87).

III. 3. 8. To prevent extreme dilution of semen :

Few grams of garlic paste mixed with hot milk, taken regularly may help in prevention of dilution of semen (Tahsildar,1910: 76).

III. 3. 9. *Aangmora* (Impotency) :

Aangmora is a sexual disease. Symptoms and causes of this disease are described as follows :

Causes : 1. One may suffer from *aangmora* (impotency) if he has been indulging in sexual mating since an early age. 2. One who masturbate regularly since early age. 3. One who keeps sexual relations with many women.

Symptoms: 1. Discharge of semen along with urine. 2. Discharge of semen with the slightest sexual excitement. 3. Discharge semen even on the sight of a women, touch of a woman or remember any sexual scene. iv. Discharge semen without erection of penis.

Medicines : 1. Ashes of pearl equal to weight of a mustard seed, mixed with one *tola* of *ghee*, one *tola* of palm sugar and just milked milk 5-10 *tolas*, taken

internally, enhances physical strength, prevents dizziness. 2. One *rati* amount of *mamar* (oxidised iron), mixed and boiled with extract of roots of *sonbarial* plant, taken internally, enhances physical strength. 3. Black sesame seeds and *amlakhi* (*Embelic myrobalan*) grind, mixed and taken internally every evening, enhances physical strength and sexual ability. 4. Two *rati* amount of dried latex of silk cotton tree, same amount of dried tender roots of silk cotton tree grind with *elachi, dalchini, jasthi madhu, jaiphal*, taken internally, enhances sexual ability, helps prevent sex linked diseases. It also helps in curing gonorrhoea. 5. *Amlakhi (Embelic myrobalan)*, *silikha (Terminalia chebula), bhomora (Beleric myrobalan)* seeds grinds with *jastimadhu(Glycyrhiza glabra)* and long pepper mixed with *ghee* and honey, taken in the evening enhances sexual and physical strength.

External application : 1. Excreta of pigeon mixed with rook salt applied to the penis, helps in rapid erection during sexual mating. 2. Oil of *barali* fish (*Wallago attu*), oil of pig, oil of river dolphin, mixed in equal amount when applied externally on the penis, enhances sexual ability.

3. Paste of the following materials mixed with butter applied to the penis, helps in rapid erection and cures looseness:- *Barial, kukursuta*, jaggery, *boch, gajpipali, aswagandha, bhataguti* mixed unequal amount, grind and made a paste with butter. *Bhalla* seeds are used only after refining it. (Tahsildar, 1910: 77).

Diet for enhancing sexual ability and curing impotency :

All kinds of rich nutritious food is useful, specially the following- old rice, *rohu (Labep rohita)* fish, *barali* (*Wallago attu*) fish or other big sized fishes, meat of goat specially the testicles of goat, pigeon, wild pigeon, chicken,

house sparrow, *moong* (whole), *masoor dal,* gram, eggs of duck, potato, onion, brinjal, *kachu*, cabbage, *salgom, ghee, sulakshani* roots, roots of milk cotton tree, roots of *ananta*. In addition to keeping up a proper nutrition, the intake of more salt, more chilli, more sour, alcohol, more sexuality, sunburn and sleepless nights should be avoided.

III. 3. 10. *Ratibilas Badi* (Sexuality Tablet) :

One may make tablets with the following materials for enhancing sexuality: *swarna sindur*, camphor, *jaiphal, gandh kalai*, suth, ginger, long pepper, black pepper, roots of *aswaganda*, seeds of *bandar kekowa* mixed in equal amount, made into a paste, and then made into tablets of the size of 2 *ratis* in weight, taken with milk twice in a day for one month enhances sexual ability, cures looseness of penis, cures dilute semen, and enhances reproductive capacity.

III. 3. 11. *Kamsakti batika* (Tonic for Sexuality) :

Tablets of 2 *ratis* weight made with the paste of following materials are called as *Kamsakti batika*. This tablet is used as a tonic for enhancing sexual ability of a man.

The materials are: 1. *Sengmora, gandh kalai,* cardomom, *gajpipali,* camphor, bark of *bel,* seeds of *sonporua* creeper, cumin seeds, bark of *hatisaria,* bark of *biyani sabta, bhui komora, satmul, gokshur, barial,* seeds of *bandar kekowa, jaiphal,* clove, seeds of *bhang* (*Cannabis*), white mustard seed , *joni* seeds. Five *ratis* of each material is mixed, ground, made into a paste with water and made into tablets of 2 *ratis* size. This tablet taken with warm milk for few days enhances sexual ability.

III. 3. 12. Medicines for enhancing male sexuality :

Bark of roots of *palas* tree (*flame of the forest*) made a paste with *ghee*

or honey, taken in the early morning enhances male sexuality, and helps in increase of semen production. Paste of *bhui komora* (2 *tolas*) boiled with *ghee* (8 *tolas*) and milk (one *ser* 0.9 kg) taken at night for 20-25 days enhances sexual ability of man. It is effective even on aged males.

III. 3. 13. *Ratiballabha Modak* (Sex Drug) :

The mixture of the following materials are boiled : Sugar one *ser,* extract of *satmul* two *sers,* decoction of country *bhang* (cannabis), cow's milk - 2 *sers,* goat's milk - 2 *sers, ghee* - 15 *tolas,* powder of country *bhang* (*cannabis*) - 1 *powa,* Powder of the following (one *tola* each), *amlakhi (Embelica myrobalan), mutha (Eiperus botundus),* seeds of *bandar kekowa,* flower of *nahar (Musea ferra),* leaves of *mah* plant, cardamom, *dalchini (Cinnamom), kaljeera (Earth nut),* aniseed, roots of *hatisuria* plant, ginger, black pepper , long pepper, roots of *singari, keheru,* germinating roots of *tal* seeds, *aswagandha, satmul, xilikha, dhania,,*seeds of *kuli kait , jastimadhu,* yoni , *dood khari* , clove , *mosondari, bonyoni, gojpipali.* Boiled mixture of the above materials is mixed with honey (one *powa*), *gandh kalai* and camphor. One or two *moha* amount of this paste taken regularly with milk enhances sexual ability of both male and female. It also cures cough, respiratory trouble, dysentry and some female diseases.

III. 3. 14. *Rativardhak Badi* (Tablets for enhancing sexual strength) :

Tablets are made of one *rati* weight with the paste of the following materials : Roots of *akon* (one *tola*), *jaiphal* (one),opium (one *ana*)This tablet taken with *ghee* enhances sexual strength. If one feels very hot after taking this tablet, he may use rock salt with vegetable preparations to reduce warmth.

II. 3. 15. *Kameswar Modak* (Sex drug) :

It is a drug made with the following ingredients : *Amlakhi (Embelica*

officinalis), silikha (Terminali chebula), long pepper, dry ginger, aniseed, *joni (Trachispermum amni), bonjani, amoilata, mithi (Tenugreek),* black caraway, *bhui komora (Trichosanthes cordata), jasthimadhu,* latex of silk cotton tree, coriander seeds, rock salt , *godha lata, gokshura (Tribulus terrestris),* seeds of *kuli kait, keheru, kakara singia, boch (Acorus calamus), nageswar (Mesua ferra),* roots of *katoangana, hatisuria,* germinated seeds of sesame, *mouri,* cinnamon, bay leaf, cardamom, black pepper , *jaiphal (Myristica fragrans), akalbir,* roots of *agiachit (Plumbago zeylanica), poornanawa (Boerhavia chinensis), kismis, keturi* (wild ginger), roots of silk cotton tree, seeds of *bandar kekowa,* seeds of *bhoira.* One *tola* of each of the above mentioned materials, one *powa* of powdered country *bhang* (cannabis), one *ser* of sugar, mixed together is fried, ground and boiled in *ghee* to make a paste. This paste is known as *kameswar modak.* This *modak* (sex drug) used once daily enhances sexual ability, gives physical strength.

III. 3.16. To increase the size of the male sex organ :

The root of *talamuli* (*Curcerids orchioides*) is grounded and charmed with *Sthulikaran mantra* and the paste is plastered in the male sex organ (penis). It makes the penis stouter. A paste made of long pepper, salt, milk and sugar and applied to the penis, makes it longer.

III. 3.17. Medicines connected with childbirth, abortion, etc. :

1. A twig of castor plant of the size of eight fingers in length inserted in the vagina, causes abortion of a foetus.
2. Roots of *agiachita (Semicorpus anacardium*) and roots of *pachatia (Vites negundo*) is grounded and mixed with honey. One *tola* of this mixture taken

internally by pregnant woman may cause abortion.

III. 3.18. Stoppage of Menstrual Flow :

The menstrual flow may be stopped by taking internally the mixture of boiled *matimah (Phaeseolus radiatus)*, paste of white sandal, and clarified butter. The menstrual flow may be stopped by plastering the vagina with a paste made of grinding husked rice with the outer cover of a bulb of the water lily. The menstrual flow is also checked when paste of white sandal is taken mixed with milk clarified butter and honey.

III. 3.19. Prevention of Miscarriage :

The potters earth, prepared for making wares, when taken internally, mixed with honey, prevents miscarriage. The extracts of a house pigeon when taken with salt and water prevents abortion.

III. 3.20. Medicines for Easy Delivery :

The seed of white *kachamani* rubbed over the abdomen and a paste made of it applied to the vagina, helps in easy delivery(Tahsildar, 1910:111).

III. 3.21*Rajarodha* (Ammenorhoea) :

1. Decoction of *bonkopah ½ rati, tutia ¼ rati*, mixed and made into a paste and administered orally three times a day cures ammenorhoea.
2. Equal amount of *dubariban* and boiled rice made into a paste and administered orally, cures ammenorhoea of girls.

III. 3.22. Abdominal Pain During Menstruation :

1. *Mosobbar tita* one *moha* , seeds of ridgegourd one *moha,* fruits (*Panpipali*) of betelvine one *moha,* mixed, made 12 tablets from the paste, and taken during the menstrual period, relieves pain.
2. A mixture of honey with warm water or extract of *tulsi* leaves with palm

sugar relieves pain.

3. *Mosobbar, hirakoch* and cinnamon one *moha* each and 2 *ratis* of opium, is made into a paste and 12 tablets are prepared out of this measure. This tablet when taken orally during menstrual period, relieves abdominal pain.

III. 3.23. Fever during menstrual period :

Decoction of leaves, bark and roots of *ashoka* tree (one *chatak* each), taken orally during menstrual period cures menstrual fever.

III. 3.24. Profuse bleeding during menstruation :

1. Powdered latex of silk cotton tree taken with palm sugar checks profuse menstrual bleeding.
2. Tablets made with powdered *hirakoch*, ginger and latex of *babla* tree, taken during menstruation stops checks heavy bleeding.
3. 2 *ratis* amount of paste made with *silikha (Terminalia chebula)*, *amlakhi (Chebulic myrobalan)* and *rasanjan* or *rasmanik* (a crystalline metal) taken for seven days during menstruation, takes care of exessive menstrual bleeding.
4. Paste made with *bel* fruit, bamboo-leaves and honey, taken for seven days checks menstrual bleeding.

III. 3.25. Painful Urination (Dysuria):

Medicines :

1. *Arai* rice, *dubari*, and shoots of *kala simalu* (silk cotton tree) are mixed and the extract obtained out of these materials is taken with milk and palm sugar to relieve the pain and discomfort during urination.
2. Extract of raw *athia kol* and old *kuji thekera (Garcinia kaidia)*, taken with

little amount (one *rati*) of opium, brings relief from pain during urination.

III. 3.26. Menorrhagia : (Irregular menstruation, profuse bleeding and related health disorder)

Medicines:

1. A paste made out of roots of *bonsot* and *khutura*, taken with one *rati* of opium cures menorrhagia.
2. Roots of *satmul*, seeds of *tara* plant (10 nos.), shoots of *tara* plant (4 nos.), tubers of waterhycinth, tubers of *dhekia* (fern), ashes of bamboo (4 *ratis*), mixed and made into a paste, taken regularly for a few days helps in cure of menorrhagia.
3. Decoction of roots of red *jaba* flower, seeds of *jilmil* plant and *tokma*, taken with water and palm sugar helps in curing menorrhagia.
4. Decoction of bark of *ashoka* tree, taken with milk regularly, helps in curing menorrhagia.

III. 3.27. *Petpora Darab* (Contraceptives):

1. Extract of red *jaba* flower and *nimbu* (citrus) taken during the days of menstruation provides contraception for a month.
2. Extract of *tabluki lata's* leaves taken thrice daily during menstrual days, acts as a contraceptive for a month.
3. Decoction *of akashi lata, majathi*, red *agiachit* taken with little amount of *hing (Aesfotida)* and *suwaga* (sulphur) prevents conception.
4. Decoction of roots of *bhola* tree taken for three days from the 4th day of menstrual cycle, prevents conception (Tahsildar, 1910: 142).

III. 4. Occult Medicine (*Tantra, Mantra*) : The therapeutic Use of Witchcraft and Magic in Assam :

Assam, particularly with its ancient name Kamarupa, is known throughout

India as the land of magic. The culture of witch-craft and magic has existed in Assam since early times. In this connection, it should be noted that, the names of Kamarupa and Kamrupa-Kamakhya are invariably associated with *mantras* and magic. It is believed that the *tantrik* Buddhists are mainly responsible for the spread and development of the culture of witch-craft and magic (Barua, 1933: 158).

During the medieval period the culture of the black art, that is witch-craft, magic and potioning was carried on to a great extent. In fact, the culture of witch-craft, magic and potioning are still in vogue in Assam, particularly in places like Kamakhya, Mayang, the southern portion of the district of Nowgaon and the Cachar district. It is stated above that the physicians (*bej*) along with their knowledge of medicine, knew *mantras*, *tantras* and the *abhichara*. Sometimes they applied both medicine and mantra. To subdue a male person or to bring a woman under one's control or to put an end to the life of one's enemy, the evil practice, such as potioning, or the application of incantations, or the application of both, are still in vogue in Assam. To do mischief to one's enemy, sometimes, the hair, nail or a piece of cloth used by the person are taken away secretly and after being incantated are buried under the earth. To find out a stolen property or a culprit, the practices of *bati-chalowa*, or *bachhani-chova* are still prevalent. These are performed with the help of incantations. The other evil practices of doing mischief to the health of a man are *hera-dia* and *ban-mara*. There are counter systems of *hera-dia*, and *ban-mara*. *ban-mara* is believed to comprise of injurious incantations only. In the system of *hera-dia* an effigy of the enemy is made and then along with the utterance of incantations, *kharikas* (splints) are thrust into the body of the effigy (Lekharu, 1952:206). It is a well-known fact that some *bejas* domesticate an evil spirit called *bira* with whose

help they can do harm to a man or even kill him in a supernatural way.

III. 4. 1. Therapeutic Aspects of *Mantra* :

Since the days of yore, *mantras* are being used for therapy of diseases. It is difficult to explain the scientific basis of the therapeutic aspects of *mantras*. Though a large number of people till this date have a firm believe on the functionality of *mantras* for treatment of diseases, however there is no proof of its functionality as a mode of therapy.

There are certain reasons which are considered as the cause of disease. One of them is the imbalance of hormonal secretions of glands. Over secretions and under secretions both create disorder in body-mind. Proper secretions depend upon mental state of a person. When a person is not in a happy mood, glands do not work properly. This improper way of working of glands results in diseases. *Mantra* gives happiness to mind and keeps mind silent. In the silent mind glands work without any obstacles or disturbances and that way here, *mantra* works indirectly as therapy In the mantric therapy, there is nothing like a miracle or humbug. It is just a way of cultivation of inner resistance power against diseases and positively strengthening the will power in the case of self-healing (Shah, 1987:124).

III. 4. 2. Various *Mantras* for Therapeutic Uses in Assam :

Since time immemorial, the people of Assam believed in *mantras* and *tantras*. Following are the names of *mantras* for different diseases :

1. *Usah sular mantra* (*mantra* for relieving pain while breathing).
2. *Bisha sungar mantra* (*mantra* for curing hairy caterpillar bite).
3. *Juẏe pora mantra* (*mantra* for healing burn wounds).

4. *Pixas kheda mantra* (*mantra* to repel ghost).
5. *Chakur rogar mantra* (*mantras* to cure eye diseases).
6. *Morar mantra* (*mantras* for curing various syndromes)

The folk healers of Assam identified different syndromes or diseases. The *bejas* try to heal syndromes or diseases with the help of *mantras*. The following are the different syndromes or *moars* - *arya mor, sanipatar mor, dhenutankar mor, bagh mor, dhenuphinduya moar, khunda mor, perperiya mor, uda mor, nipat mor, ukali mor, bati mor, heketi mor* (Hiccough), *xiramuri mor, jinjinia mor* etc.

7. *Chakur sular mantra* (*mantra* for relieving pain in the eyes).
8. *Chakur kutar mantra* (*mantra* for dark circles around the eyes).
9. *Sapar mantra* (*mantras* for snake bites).
10. *Sapar pani jara mantra* (*mantra* to be chanted with water for snake bites).
11. *Sapar sil jara mantra* (*mantra* using a special type of stone for snake bites).
12. *Gangothir mantra* (*mantras* for healing painful glands).
13. *Galkatikar mantra* (*mantras* to cure diseases of the throat).
14. *Narenga mantra* (*mantras* for healing abscess in the back bone).
15. *Jwarar mantra* (*mantras* to cure fever).
16. *Sarbadhak mantra* (*mantras* for all type of diseases).
17. *Bhekulia jara mantra* (*mantra* to cure asthma).
18. *Mukh banga mantra* (*mantras* for healing a disease due to evil eyes).
19. *Ubhata mantra* (*mantras* to send back other *mantras*)
20. *Piyah sirar mantra* (*mantras* for curing pain in the mammary gland

of a child bearing woman).

21. *Tej rakha mantra* (*mantras* to stop bleeding).
22. *Chelai khowa mantra* (*mantras* to cure a centipede's bites).
23. *Petar bihar mantra* (*mantras* to heal stomach pain).
24. *Ritu bandha mukali kara mantra* (*mantras* to cure dysmenorrhoea).
25. *Balia kukure khowa mantra* (*mantras* to cure dog bites).
26. *Sarbabyadhi bighatak mantra* (*mantras* to cure all types of diseases).
27. *Mohini mantra* (*mantras* to keep under hypnotic spell).
28. *Xuprasab mantra* (*mantras* for safe delivery) (Goswami, 1986; 1-35).

III. 5. Assamese Folk Healers' System of Diagnosis and Treatment :

Since the days of yore, the people of Assam has been practising a traditional method of diagnosis and treatment of diseases. This system of practice is called *bejali chikitsa*. The folk doctors are called *bej*. The *bejali chikitsa* of Assam may be considered as a mixture of Indian *ayurvedic* system and local traditional systems. The *bejs* or the folk doctors sometimes uses Indian *ayurvedic* systems and sometimes local tribal medicines along with *mantras* etc. to cure diseases. Since time immemorial, people of various ethnic groups has identified large number of medicinal herbs to cure diseases. This branch of knowledge has been absorbed in the traditional culture of these tribes. A particular class of people (folk healers) have kept up the practice of this system of folk medicine and treatment, generation after generation. Each ethnic society has its own folk healers and are called by different names. The system of practice vary from one society to another. Altogether it is a very rich body of knowledge of traditional medicinal system, where hundreds and thousands of medicinal herbs are identified.

III. 5. 1. *Narigyan* (Knowledge of Examination of Pulse Rate) :

The Assamese folk healers determine the condition of a human body by

examining the pulse rate. Pulse rate is examined by pressing on the vein at the wrist at the joint of thumb finger's bone. Usually the pulse rate is slow in the morning and fast in the evening.

Pulse rate is not to be examined just after rubbing of oil on the body, after a bath, at sleep, just after a meal or during a meal, when one feels thirst, one in hunger and after a walk in the sun (Tahsildar, 1910,25).

III.5. 2. Detection of *Bat, Pitta* and *Kapha* by Pulse Rate :

If the patient is suffering from disorder of *vayu* (wind) then the vein, strikes either very slowly or very fast and irregularly. If the patient is suffering from disorder of *pitta* (bile) then the vein strikes very fast and fickle. If the patient is suffering from disorder of *kapha* (phlegm), then the vein strikes very slow (Tahsildar, 1910,27) .

III. 5. 3. Diagnosis of Fever With Pulse Rate :

In general, higher pulse rate indicates fever. If it is rheumatic fever then the vein looks thin and soft, and pulse rate is slow. In case of *pitta* (bile) fever, the vein enlarge and strikes fast. In case of *sleshma* (phlegm) fever, the vein becomes very thin and the pulse rate is very slow. In case of diarrhoea pulse rate is slow and it is very difficult to trace.

III. 5. 4. Diagnosis by Examination of Urine, Tongue and Eyes :

The *baidyas* or folk doctors try to diagnose dieseases by examining urine, tongue and eyes of patients.

Urine : If the patient suffers from disorder of *vayu* (wind), urine becomes pale. If he suffers from disorder of *pitta* (bile), then urine become reddish or bluish coloured. If the patient suffers from disorder of *kapha* (phlegm), the urine become white and frothy. In case the patient suffers from disorder of

blood the urine become blood-red coloured.

Tongue : Patient with disorder of *pitta* (bile) shows yellow coloured tongue. When the patient suffers from *bata* (wind), the tongue becomes red coloured and develop pointed abscess. In case of disorder of *kapha* (phlegm), the tongue becomes white and stiff.

Eyes : Smoke coloured eyes indicates disorders of *vayu* (wind). Yellow coloured eyes indicates disorder of *pitta* (bile). White coloured and blurred eyes indicates disorder of *kapha* (phlegm) (Tahsildar,1910,35) .

III. 5. 5. *Anupan* (Ingredient):

The materials which are taken along with the medicine is called *anupan.* The *anupans* (materials) traditionally used with the medicines of different diseases are enlisted below.

Kaf jwar (fever due to disorder of phlegm): Extract of ginger, extract of *tulsi* (basil) leaves, extract of betelvine leaf and honey.

Pitta jwar (fever due to disorder of bile) : Decoction of leaves of *latipurula, jet kopra, amoi lata* and bark of *neem* tree along with honey.

Bat jwar (fever due to rheumatism): Decoction of dried jute leaves, *chirata teeta,* with honey and clarified butter.

Purani jwar (Chronic fever): Extract of *sewali* leaves, *bel* leaves, *tulsi,* long pepper, black pepper with honey.

Body pain and heavyness of the body : Extract of ginger leaves, wood apple and honey .

Xindurar (Gonorrhoea) **:** Extract of *triphala* (*amlakhi, xilikha* and *bhomora*), raw turmeric, *chal kunwani* and honey.

Chronic Gonorrhoea : Powder of *dimaru* seeds, dry turmeric powder and honey.

Sannipat (Typhoid) : Extract of ginger, leaves of betelvine, *gandh kalai* and honey.

Dhwaj bhanga (Male impotency) : Extract of betelvine leaves, powder of silk cotton seeds, honey, surface layer of boiled milk, palm sugar and butter.

Nervous disability : Butter and sugar.

Palpitation in the chest : Rice washed water and honey.

Insomonia : Decoction of *triphala* (*amlakhi, bhomora* and *xilikha*) and honey.

Burning in the palm and sole : Rice washed water and honey.

Headache : Sugar and butter.

Cough : Powder of long pepper and honey.

Cough with congested phlegm : Powder of *jaiphal*, extract of ginger and honey.

Piles : 10 years old jaggery.

Child's cold, fever and cough : Extract of *tulsi* leaves, leaves of betelvine and honey.

Vomiting : Extract of pomegranate fruit, leaves of datepalm, palm sugar or cane sugar.

Dysentery : Rice washed water, extract of the tuber of *kenwa bon.*

Piles : Paste of germinated sesame seed (*til*), pollens of *nahar* flower, butter, palm sugar, and extract of leaves of marrygold flower.

Fever and dysentery : Extract of leaves of wood apple (*bel*) with honey.

Bleeding Piles : Pollens of *nahar* flower and butter.

Infestation of round worm or other worms : Extract of tender leaves of pine-apple and honey.

Hoarseness of voice : Powder of *yastimadhu* and black pepper with honey.

Diabetes : Extract of roots of banana plant, powder of black *jamu* and honey.

Heart trouble : Powder of bark of *arjuna* tree, honey, butter, powder of large cardamom and palm sugar.

Acidity : Extract of *amalakhi* fruit and honey. (Tahsildar, 1910:79) .

III. 5. 6. Doses of *Anupan* (Ingredient) :

Doses of *anupan* depends upon the severity of illness. When a dose of *anupan* for an illness is 5 *tolas* of decoction then the equal dose of extract will be one *tola* and powder will be of one *tola* in weight. Usually powder ingredient is taken after mixing with honey.

III. 5. 7. Traditional Method of Refining of Poisons to Be Used for Medicinal Purpose:

Refining of poison : Some poison materials are often used as ingredients of medicine, these materials are used in medicine only after refining. Some of the important poison materials, are refined traditionaly using the following methods :

Opium : Soaked in extract of ginger and sun dried at least 21 times.

Datura seed : Partially grinded *datura* seeds soaked in cow's urine and dried.

Konibih : Seeds of *konibih* contains a leaf which is deadly poisonous. This leaf is to be removed carefully. After removing the leaf, seed is to be boiled in fine cow's milk.

Gul gul latex : To be boiled in cow's milk.

III. 5. 8. Traditional method of refining of metals for medicinal use :

Gold, silver, copper, brass, tin, iron, mica etc. are used for preparation of medicine. No metals can be used in preparation of medicine until it is refined.

There are different traditional methods of refining of metals.

Gold : Fine leaves of gold are made and burnt. Burnt gold leaves are boiled at least seven times in each of the following materials - mustard oil, curd water, cow's urine, lemon juice, decoction of *kutthi* (a pulse). After boiling in the above materials the gold leaves are cut into pieces and made into a solid ball with mercury. This gold mercury ball is then put into a closed bottle along with sulphur, the tube is put into fire and the gold is burnt in presence of sulphur. This process is done again and again for fourteen times. The ultimate result, the ashes of gold is used as ingredient in medicine.

Silver : Silver is refined in the same process as gold. Silver leaves are burnt in fire and treated with a mixture of mustard oil, curd water, cow's urine, lemon juice and extract of *kulthi* (pulse), for three times. Silver, treated thus, is again treated with two parts of sulphur and one part of mercury and burnt inside a bottle. This treatment and burning continues for fourteen times. Finally silver is obtained in the form of ash and is used as ingredient of medicine.

Copper ash : Copper may be refined by boiling thin copper leaves in cow's urine. Equal amount of refined copper leaves are treated with mercury, citrus juice and sulphur. After this treatment, copper leaves are burnt inside a bottle in fire to obtain copper ash with lemon juice and then put inside a tuber of alocacia, wrapped with a thin layer of mud, dried in sun and burnt inside metallic tube. Copper ash does obtained is edible.

Bell metal : Bell metal is an alloy of copper and tin. Thin leaves of bell metal is first burnt in fire. Hot bell metal leaves are treated with mustard oil, curd water, lemon juice, cow's urine and decoction of *kulthimah* (a pulse), three times each separately. After this treatment bell metal leaves are burnt inside a bottle.

Refining of iron : Thin leaves of iron burnt and treated with oil, curd water, lemon juice, cow's urine and decoction of *kulthimah* three times, each sepa-

rately. Each time iron is to be made hot.

After this, again the iron leaves are to be boiled in a mixture of milk, lemon juice, cow's urine and decoction of *triphala (amlakhi, bhomora* and *xilikha*). Iron leaves thus treated are again mixed with cow's urine and burnt inside a bottle.

After several times of burning, iron leaves will turn into ashes and may be used as ingredients of medicine.

Mercury*(Para)* : To refine mercury it is rinsed with extract of betelvine leaves and garlic.

Preparation of '*Makarddhaj'* **:** '*Makarddhaj'* is a kind of life saving drug used in critical condition of patient suffering from any diseases. Traditionally "makaraddhaj" was prepared with the following method : Some amount of sulphur is boiled in a frying pan till it form liquid. Equal amount of mercury is added to the liquid sulphur in the pan. Gradually, in a stepwise manner, more sulphur is added to it. Amount of sulphur should be around six times of the amount of mercury. Mercury powder thus obtained is known as "makaraddhaj" (Tahsildar, 1910:57) ..

III. 6. Classification Fever and Its'Treatment :

Jwara (Fever) : Traditionally the *bejas* or folk healers of Assam have classified fever or *jawara* according to the origin and symptoms. There are eight types of *jwaras* identified by the folk healers. These are as follows : *Bata jwara, pitta jwara, kapha jwara, bata pitta jwara, bata sleshma jwara, pitta sleshma jwara, sanipata jwara, agantuja jwara.*

Besides these, considering the duration of the fever, the folk healers of Assam have identified the following *jwaras* : *Purani jwara, leteka jwara, nitta jwara, , pal jwara, um jwara, teeya jwara, antar jwara, , caru jwara, rati-rati-utha jwara,*

bhisam jwara, bhute-pua jwara, sarbabeath jwara, leng jwara (Broncha pneumonia),

Leng jwara has been again classified into the following types : *Ulia-leng jwara, kala-leng jwara, swasa-leng jwara* (strong fever depriving power of speaking), *kandhua-leng jwara, Chaudra-leng jwara* (Fever and cough which does not come out easily), *Jioaria-leng jwara* (Fever and consumption), *pania-leng jwara, phutani-leng jwara* (Fever and cough with piercing pain), *batahi-leng jwara* (Fever and gout), *hupa-leng or shuktishala jwara hagonia-leng jwara, bayoo-leng jwara, balia-leng jwara* (Fever and cough which makes one crazy), *bhutia-leng jwara* (Delirium), *xarba-leng jwara* (Tahsildar,1910:44)

III. 3. 2. Symptoms of various *jwaras* :

1. *Baata jwara* :– The symptoms of this fever are – fall and rise in body temperature, shivering, dryness of the lips, mouth and throat, sleepiness, bodyache, flatulence, constipation, yawning, buzzing in the ears, bitterness in the mouth, joint pain, vomitting, dry cough, heaviness of the body, blabbering, thirst, eyes and urine turns red, over sensitised teeth and inability to tolerate cold.

2. *Pitta jwara* :– The symptoms of *pitta jwara* are — very high body temperature, loose motion, sweating, blabbering, bitterness in the mouth, thirst, burning sensation, vomitting, yellow colouration of urine and eyes , pain in the lips, throat and eyes , joint pain.

3. *Kapha jwara*:— The symptoms of this type of fever are – not very high temperature, the body feeling very heavy and lazy, drowsiness and cold, loss of apetite, sweetness in the mouth, indigestion and heavy feel in the stomach , cough and running nose, urine, and eyes turns white.

4.*Batta pitta jwara* :– The symptoms are – extereme thirst, swoons or

faints, halucination , burning sensations in all parts of the body, headache, loss of hunger, dryness in the mouth and throat, joint pain, yawning, vomitting.

5. *Batta sleshma jwara* :– The symptoms are – the temperature of the body remains medium, drowsiness, the body feels heavy, headache, coughs, running nose and the feels cold.

6. *Pitta sleshma jwara* :– The symptoms are – the patient feels cold and hot at the same time, the mouth feels bitter and sticky, sleeplessness, loss of hunger and cough.

7. *Shanipatta jwara* :– The symptoms are – the patient feels hot and cold at the same time, joint pains, headaches, the eyes turns watery and colours of the eyes reddens, pain in the ear, sleepiness, blabbers, fast breathing, cough, loss of hunger, halucination, tounge feels dry and rough, blood and phlegm vomitting, restlessness and chest pain, the patient suffers from very less sweating and less urine expulsion (Tahsildar,1910:48).

III. 3. 3. Medication and cure for the above *jwaras* :

1. Purgatives or *julaps*

a. *Abhaya bori – xilikha, jaluk, pipali, suwaga*, these are grounded to paste and made into small balls or '*bori*' and taken with hot or cold water. This preparation functions as a purgative or laxative.

b. *Kaurmoni* leaves, wood apple (*bel*) leaves and *sewali* leaves, the extract of which acts as a very good laxative.

1. To cure of any type of fever – *amlakhi, xilikha, bhairaguti, neem* leaves, common salt, rock salt, *joni*, black cumin, *jahkhar*, equal amount of these are grounded to a paste and made into small

III. 7. Traditional First Aids :

III. 7. 1. Cuts, Wounds, Sore, Ulcer :

To stop bleeding of a cut wound. The extract of *dubari bon* should be applied immediately . Dusts of alum should be applied. Application of extract of tobacco leaf helps in checking the blood flow. Extract of the leaves of merrigold (*narzi phool*) must be applied on the wound.

III. 7. 2. Healing of Wound :

The application of the following heals a wound : The paste of leaves of *bon kopah* (wild cotton) The extract of the leaves of *bonsot*. The paste of black pepper and raw turmeric (for a cut wound).

III. 7. 3. Healing of Wound due to piercing of a spine or nail :

Two or three drops of boiled mustard oil must be applied on the wound. The wound must be burned with boiling mustard oil with the help of a spine or a *betel* leaf.The paste of onion must be applied to a wound made by a fish spine. It also reduces the pain caused by *singhi* fish bite.

III. 7. 4. Healing of an Infectioned Wound (*Gorol laga*) :

A paste, made out of the tender leaves of castor plant, leaves of pomegranate, *kutharcuda, danu dewka* should be applied to an infected wound.

III. 7. 5. Medicine for sprain :

Application of a warm mixture of lime, raw turmeric and salt, daily 2-3 times to relieve the pain of sprain. Paste of roasted onion and raw tamarind is applied to the affected area to get relief from pain.

III. 7. 6. Disarticulation of joint :

Dry turmeric-2 *tolas*, lime-1 *moha* and chilli-1 *moha* are grounded and heated which is applied 4-5 times on the dislodged joint to relieve pain. *Nisadal* water is mixed to the above mixture and used as plaster for broken or fractured bone.

III. 7. 8. For Burnt Wounds :

Equal amount of coconut oil and water are mixed and applied to the affected

area. Terpentine oil is also very good for burn wounds. Jaggery used soon after any burn wound helps get rid of pain. Cowdung can also be applied over a burn. *Xagar phena* is made into a paste and applied on the affected area. Paste of *pitkachu* or round potatoe can also be used over a burn wound.

III. 7. 9. For deep burn wounds :

Mixture of *til* oil (sesame) and *jadhau* ash is applied over a deep burn wound to relieve pain. Coconut oil or mustard oil is applied over a deep burn wound and *atta* or *maida* flour is dusted of over the affected area. Honey is applied over a burn wound and powdered *jadhau* is dusted over it.

III. 7. 10. For neutralisation of poison :

The extract of *bagari* leaves in an amount of 250 ml. taken, will help digest poison inside the stomach. 1 *ser* of *kakat* leaves mashed with half *ser* of water, when applied all over the body and also given to drink, helps digest the poison in the stomach. 1 *tola* faecal matter of man is mixed with 1 *tola* of water and this is given to drink to digest any type of poisoning (Tahsildar, 1910:111-145).

III. 8. Folk Medicines of Assam for Treatment of Various Common Diseases :

1. *Abhok, Bad hajam* (Dyspepsia) :

Xukan ada (dried ginger) powder-2 gms., taken twice daily with warm water relieves from *abhok*. *Ada* (ginger)-5 gms., to be taken with salt or *gur* (jaggery) twice daily before meal. *Xilikha* powder-3 gms., to be taken twice a day before meal with salt or *gur* (jaggery). *Nemur ras* (lemon juice)-7 to 14 ml., to be taken three times a day after meal. (Tahsildar, 1910: 9).

2. *Ajirna* (Indigestion) :

Xukan ada (dried ginger) is to be taken several times a day with boiled water. Powdered rind of the fruit *harataki* (*Chebulic myrobalan*) - 1 to 3 gms., is to be taken with equal quantity of *xarkara* (raw sugar), two times a day

before meal. Powdered *xukan ada* (dried ginger) - 1 to 3 gms., is to be taken with *gur* (jaggery) three times day. A paste is prepared out of equal parts of fruit rind of *haritaki* (*Chebulic myrobalan*), *xarkara* (raw sugar) and *angur* (grape fruit). 3 to 6 gms. of this paste is to be taken with honey two times a day before meal.

3. *Shoush Kholosa Nohowa* (Constipation) :

14 to 28 ml. of *era gutir tel* (castor oil), to be taken with the same amount of decoction of *xukan ada* (dried ginger), once a day in the morning. A mixture of a powder is first made out of equal parts of :- wood of *devadaru* (deodar), rhizome of *vaca* (sweet flag), root of *kustha* (kooth), fruit of *satapuspa* (fennel), *bhaja hing*(fried asafoetida) and *xaindhava* (rock salt). 3 to 6 gms. of this powder is taken and ground in 12 to 25 ml. of *kanji nemu* juice. This is to be taken with warm water two times a day before meal (Tahsildar, 1910: 31).

4. *Pet-chala* (Diarrhoea) :

A powder is prepared out of *bhaja jira* (fried cumin) or root of *mutha* or fruit of *pippali* (long pepper) or *xukan ada*(dried ginger). 5 gms. of this powder is mixed with 1 litre of *ghoal* (butter milk) and divided into four draughts. Each draught is to be considered as one dose and each must be taken at an interval of six hours. 1 to 3 gms. of *xukan ada*(dried ginger) - powder taken with equal part of *xarkara* (raw sugar), two times a day is useful for relieving the symptoms of *pet-chala*. Equal parts *kurchi* seed, *dalacini* (cinnamon bark), root of *khas*, seed of *jamun* and fruit pulp of *bel* is taken and made into a powder. 3 to 6 gms. of this powder is to be taken with *ghoal* (butter milk) three times a day.

5. *Tez-grahani* or *Tez -hagani* (Dysentery) :

3 to 6 gms. of powder of fruit pulp of *bel*, is to be taken with equal quantity

of *gur* (jaggery) three times a day. 3 to 6 gms. of banyan shoot paste, is to be taken with 100 to 250 ml. of *chaul dhowa pani* (rice washing) - three times a day. 3 to 6 gms. of powder of the roots of *ankota*, is to be taken with 100 to 250 ml. of *chaul dhowa pani* (rice washing) - three times a day. 1 to 3 gms. powder of dried fruit pulp of *bel* or stem of *cavya* or root of *citraka* (leadwort) or fruit of *jira* (cumin) or rhizome of *sati* (zedoary) is to be taken with 100 to 250 ml. of *ghoal* (butter milk) or water, two or three times a day. 6 gms. powder of bark of the trees - *ama* (mango), *arjuna* or *bagari* (jujube) or *jamu* is to be mixed with 6 gms. of honey and taken three times a day with 100 to 250 ml. of goat's milk. Equal parts of the leaves of *jamu*, *amalaki* (*Embelic-myrobalan*) and *amra* (mango) is taken and its *svarsa* (fresh juice) is extracted. 28 ml. of the juice is to be taken three times a day after adding to it 14 mgs. honey and 100 ml. goat's milk (Tahsildar, 1910: 35).

6. *Sula Olowa , Kechumuri* (Prolapsus anus) :

Application of *til tel*, light fomentation, and the anus may be restored to its normal position with the help of cotton. *Mitha tel* is applied, the area fomented and cotton is used to press up pro-lapse to its actual position.

7. *Grahani* or *Petkamorani* (Dysentery) :

1. 3gms. of fruit pulp of *bel* fruit , is to be taken with *gur* (jaggery) three times a day.

2. 3 gms of seeds of *isabgool* (plantago), is to be taken with water three times a day.

3. 5 gms.-15gms. of *ximalu atha* (silk cotton tree resin), is to be taken with 1 gm. powder each of bark of *dalim* (pomegranate) and fruit of *jira* (cumin), twice or thrice a day before or after meal with water.

4. 3gms. of fruit pulp of *bel* fruit and 2gms. of *kala til* (black sesame) seeds, is to be ground together with cream or curd and taken twice or thrice a day.

5. Fruit pulp of *bel* fruit, 1 year old *gur* (jaggery), *til taila* (gingelly oil),

lodhra and fruit of *jaluk* (black pepper) is taken in in equal parts, mixed together and taken in a dose of 3 to 6 gms., twice a day (Tahsildar, 1910: 40).

8. *Antra Briddhi* (Hernia) :

1. *Til tel* (sesame oil) must be applied and hot fomentation must be given.

2. *Era gutir tel* (castor oil) must be applied on the abdomen and hot fomentation must be given.

9. *Mrigi* (Epilepsy) :

Cold water must be sprinkled on the patient and he/she must be removed to an airy place. Any one of the following preparation may also be used locally. 5 to 10 drops of juice of bulb of *piaz* (onion), to be instilled in the nose as *nasya*. 5 to 10 drops of juice of root of *nirgundi* (fine leaves chaste tree), to be instilled in the nose in the form of snuff. The following preparations are useful for preventing the attacks of *Mrigi* : 1. Fresh juice of the whole plant of *brahmi* (Indian panny wort) is to be taken in 14 to 28 ml. dose, with 4 to 6 gm. honey twice a day. 2. Powdered root of *xatavari* (wild Asparagus) is to be taken in 12 gm. dose, with 100 to 250 ml. milk twice a day. 3. Powdered rhizome of *vaca* (sweet flag), is to be taken in 1 gm. dose, with 4 to 6 gm honey twice a day.

10. *Amlapitta* (Hyperacidity) :

1. 100 to 500 ml. of water obtained from the green fruit of *narikal* (coconut), is to be taken twice a day.

2. Powdered fruit rind of *amalakhi* (*Embelic myrobalan*), (- 3 to 6 gm.), to be taken with 100 to 250 ml. milk twice a day.

3. A powdered mixture of the fruit rind of *haritaki* (*Chebulic myrobalan)* and whole plant of *bhringaraja* is taken in equal quantity. 3 to 6 gm. of this powder is to be taken with 12 gm. of *gur* (jaggery) and warm water twice a day.

4. Dried rhizome of *haladhi* (turmeric), leaf of *patola* and fruit rind of *amalaki* (*Embelic myrobalan*) is taken in equal parts and made into a powder. 3 to 6 gm. of

this powder is to be taken with the fresh juice of *ada* (ginger) and 30 drops of papaya latex twice a day (Khanikar, 1987:17).

11. *Aruchi* (Anorexia) :

1. *Lavana* (common slat) and *ada* (ginger) is to be taken twice a day before meal.

2. A *nimbu* (lemon) is cut into two halves, sprinkled with 1gm. powdered *jaluk* (black pepper) and *lavana* (common salt) and its juice to be sucked frequently.

3. Fruits of *pippali* (long pepper), *cavya*, *yavani* (Ptychotis) and *teteli* (tamarind) are taken in equal parts, powdered and placed on the tongue.

4. Barks of *dalacini* (cinnamon), *daruharidra* (barbery) and fruit of *yavani* (*Ptychotis*) is taken in equal parts and ground into powder. This powder is to be placed on the tongue .

5. A decoction is prepared from the seeds of *yava* (barley). 14 to 28 ml. of this decoction is to be taken with 1g. powdered fruit of *pippali* (long pepper) and 4 to 6 gm. honey, twice a day (Tahsildar, 1910:52) .

13. *Kechumuriya, Padonola* or *Arsa* (Haemorrhoid, Piles) :

Medicines for *Suskarsa* :

1. An amount of 1gm. powdered root of *citraka* (lead-wort), to be taken with 100 ml. *ghoal* (butter milk) twice a day.

2. Equal amounts of fruit of *yavani* (*Ptycotis*) and *krisna lavana,* weighing 1gm. each, to be taken with *ghoal* (butter milk) twice a day.

3. Fruit rind of *haritaki* (*Chebulic myrobalan*) kept overnight in *gomutra* (cow's urine) is to be taken in 6 to 12 gm. dose, with *gur* (jaggery), twice a day.

Medicines for *Tezpara arsha* :

1. 14 ml. of fresh juice obtained from the fruit of *dalim* (pomegranate), is to be taken with 5 to 10 gm. *xarkara* (raw sugar) twice a day.

2. Powdered fruit rind of *haritaki* (*Chebulic myrobalan*) in the measure of 1 to 3 gm. is to be taken with 50 ml. warm water twice a day.

3. Pericarp of *dalim* (pomegranate) - 12 gm., to be taken with equal part of *sarkara* (raw sugar) twice a day (Tahsildar, 1910: 49) .

14. *Mutra pathari* (Stone in bladder) :

1. Powdered seed of *kulattha* (*Dolichos* bean) - 40 to 80 gm., to be taken twice a day.

2. Powdered fruit of *goksura* (small caltrops) - 4 gm., to be taken with sufficient honey to make a paste followed by 250 ml. cow's milk or sheep's milk twice a day.

3. Flowers of *narikal* (coconut) - 12 gm., bruised in water, to be taken with 0.5 gm. *yavaksara* twice a day.

4. Decoction prepared from the fruit rind of *amalakhi* (*Embellic myrobalan*) - 14 to 28 ml., to be taken with 25 gm. *gur* (jaggery) twice a day (Khanikar, 1987:25).

15. *Asthila* (Enlarged prostate) :

1. A dose of 14 to 28 ml. of a decoction made out of the fruit *goksura* (small caltrops), is to be taken with 14 g. honey and 25 g. *xarkara* (raw sugar), twice a day.

2. Fresh juice obtained from the fruit pulp of *pani lau* (a kind of pumpkin gourd) is to be taken in 56 ml. dose, with 0.5 gm. *yavaksara* and 25 gm. *xarkara* (raw sugar) twice a day.

3. A paste prepared from 2 gm. wood of *boga chandana* (white sandal) in 2 ml. water, is to be taken with 56 ml. *chaul dhowa pani* (rice washing) and 25 gm. *xarkara* (raw sugar), twice a day.

4. An amount of 25gm.seeds of *teeonh* (cucumber), bruished in 25 ml.

Kanji with 4 gm. *xaindhava* (rock-salt) is to be divided in two doses. One dose is to be taken in the morning and one in the evening (Khanikar, 1987:13).

16. *Peta Phula* (Tympanites) :

1) 1 g. of *xaindhava lavana* (rock salt) and 5 gm. of *ada* (ginger), to be taken twice a day.

2) 14 to 28 ml. of decoction of *triphala* - to be taken twice a day.

3) A powder is made out of *xukan ada* (dried ginger) - 2 parts, *kala nimakh* (a salt) - 1 part and *sankha bhasma* - 1 part. 3 to 6 gm. of this mixture is to be taken with 50 ml. warm water twice a day (Tahsildar, 1910: 73) .

18. *Jora bat* or *Sandhi bat* (Rheumatism) :

1. Powder of *xukan ada* (dried Ginger) - 2 gm., to be taken with 50 ml. warm water twice a day.

2. Decoction of equal part of *ada* (ginger) and stem of *guduci*-14 to 28 ml., is to be taken with 6 gm. powder of fruit rind of *haritaki* (*Chebulic myrobalan*) twice a day (Tahsildar, 1910: 83) .

19. *Paksthalir Gha* (Peptic Ulcer/Gastric Ulcer) :

1. Fluid obtained from the green fruit of *narikal* (coconut) - 100 to 500 ml., is to be taken three times a day.

2. Fresh juice obtained from the root of *xatavari* (wild asparagus) - 14 to 28 ml., is to be taken twice a day.

3. Powdered fruit rind of *amalakhi* (*Embelic myrobalan*) - 3 to 6 gm., is to be taken with 100 ml. milk, twice a day.

4. Powdered root of *xatavari* (wild asparagus) - 3 to 6 gm., is to be taken with 100 ml. milk twice a day (Khanikar, 1987:16) .

20. *Kanar Sul* (Ear ache) :

1. Fresh *gomutra* (cow's urine)-2 to 4 drops, to be instilled in the affected ear twice a day.

2. Fresh juice of *ada* (ginger), to be warmed and instilled 2 to 4 drops in the ear twice a day.

3. Juice obtained from the seed of *sigru* (horse-radish), to be warmed and instilled 2 to 4 drops, in the ear twice a day. 4. Fresh juice of rhizome of *mula* (radish), to be warmed and instilled 2 to 4 drops, in the ear twice a day (Tahsildar, 1910: 80) .

21. *Kan Paka* (Septic in the Ear) :

1. *Xariahar tel* (mustard oil)-200ml. and juice of fresh root of *haladhi* (turmeric)-50 ml is mixed and boiled ; after cooling 2 to 4 drops of this mixture is to be instilled in the affected ear twice in day. 2. Juice of barks of banyan tree, *dimaru* (fig) and prepare an oil with *ghrita* , 2 to 4 drops, to be instilled in the affected ear twice a day (Tahsildar, 1910: 90) .

22. *Kanar Puj* (Otorrhoea) :

1. Purified powder of *xamudraphena* (*Ossepia*)-120 to 250 mg., to be used locally twice a day.

2. Purified *xuaga* (borax)-120 to 250 mg., to be used locally twice a day.

3. Powder of purified *phitkiri* (alum)-120 mg. dissolved in women's milk, to be instilled in the ear twice a day.

4. Powder of equal part of *suddha la* (purified lac) and *sal dhuna* (Oleo-resin of *Sala*)-60 to 120 mg. to be used locally, twice a day.

5. The fresh juice of leaf of *jati* (jasmine)-4 parts and honey-1 part is taken. 2 to 4 drops of this mixture is to be instilled in the ear, twice a day .

23. *Kuhuma-Sara* (Jaundice) :

1. Juice obtained from the fresh stem of *guduci*-14 ml. is to be taken with 14 g. honey twice a day.

2. Juice of fresh bark of *daruharidra* (berberry)-14 ml., is to taken with 14 gm. honey twice a day.

3. Juice obtained from the fresh leaf of *neem*-12 to 24 ml., is to be taken with 6 to 12 gm. honey twice a day.

4. Powdered stem of *daruharidra* (barberry)-1 to 3 gm., is to be taken with honey twice a day.

5. Juice of *nemu* (lemon)-12 to 24 ml., is to be taken twice a day.

24 *Sukan Kanh* (Dry Cough) :

1. *Long* (clove), fried in *ghee* is to be kept in mouth for sucking. It is useful for relieving the cough.

2. 14 ml. of juice of fresh leaf of *vasa* is to be taken with *sarkara* (raw sugar) and *ghee* in equal parts, twice a day.

3. 60 mg. powdered fruit of *pipali* (long pepper) and 120 mg. of *saindhava* (rock-salt) is to be taken with hot water twice a day.

4. Powder of equal part of fruit and root of *pippali* (long pepper) and *xukan ada* (dried ginger)-3 to 6 mg., is to be taken with 4 to 6 mg. honey twice a day (Khanikar , 1987 :56).

25. *Purana Kanh* (Chronic Cough) :

1. Juice of fresh leaf *kala tulasi* (black Basil)-7 to 14 ml., is to be taken with 4 to 6 gm. honey twice a day.

2. Powdered wood of *aguru* 1 gm., is to be taken with 4 to 6 mg. honey twice a day.

3. Powdered fruit of *jaluk* (black pepper)-1 gm.m, is to be taken with 5 to 10 gm. *ghee* and 4 to 6 gm. honey, twice a day.

4.1 part fruit rind of *amalakhi* (*Embelic myrobalan*) is boiled in 4 parts

milk and ground together. 12 to 24 ml. of the ground drug is to be taken with 12 to 24 gm. of *ghee* twice a day.

26. *Mat Bhanga* (Hoarseness of voice):

1. The root of *yastimadhu* (*Glycyrrhiza*) to be sucked from time to time.

2. Powder of *xukan ada* (dried ginger)-1 to 3 gm., is to be taken with 4 to 6 gm. honey, twice a day.

3. Powdered old fruit of *teteli* (tamarind)-1 gm., is to be taken with 4 to 6 gm. honey, twice a day.

4. About 14 to 28 gm. honey must be taken, followed by a draught of 50 ml. warm water.

27. *Krimi* (Worm infestation) :

1. Juice obtained from the fresh leaf of *mahaneem* -14 ml., is to be taken with 7 to 14 gm. honey twice a day.

2. Juice of seed of *palasa* (flame of the forest) 2-10 ml., is to be taken with *ghoal* (butter milk) twice a day.

3. Paste of unripe *tamol* (areca nut)-1 to 3 gm., is to be taken with 7 to 14 ml. juice of *jambura* (medicinal lemon) twice a day.

4. Powdered seed of *sigru* (horse radish)-1 to 2 gm., is to be taken with water twice a day.

28. *Kustha Roga* (Leprosy) :

1. Juice of fresh stem of *guduci*- 14 to 28 ml. is to be taken twice a day.

2. Powdered fruit of *pippali* (long pepper)-1 to 3 gm., is to be taken with *gomutra* (cow's urine), twice a day.

3. Decoction of bark of *khadira* (*khair*) is to be taken in 14 to 28 ml. dose, twice a day.

4. The wood of *khadira* (*khair*) must be used for preparing food, drinks and water for bath.

5. *Gomutra siddha,* fruit rind of *haritaki (chebulic myrobalan*)-3 to 6 gm. is to be taken twice a day..

29. *Galaganda* (Goitre) :

1. Juice of fresh leaf of *nirgundi*-14 to 28 ml., is to be taken thrice a day. 2. Powdered root of *sveta aparajita* (wing leaved Clitoria)-1 to 3 gm., is to be taken with 3 to 6 gm. *ghee*, thrice a day. 3. *Nasya* (nasal drops) prepared by contusing root of *nirgundi* in 12 to 24 ml. water, is to be used twice a day. 4. Decoction prepared from the bark of *kancanara* (white mountain ebony)-14 to 28 ml. is to be taken thrice a day.

30. *Khahu* (Scabies) :

1. A paste prepared from the decoction of root of *karavi* flower plant (Oleander) in mustard oil is to be applied on the affected part. 2. *Lepa* of equal part of powder of *xindura* and fruit of *jaluk* (black pepper), prepared in buffalo butter milk, is to be applied on the affected part. 3. *Lepa* prepared from the juice of leaves of *akana* and rhizome of *haladhi* (turmeric)-12 to 24 gm., in mustard oil-14 to 28 ml., is to be applied on the affected part (Tahsildar,1910:132).

31. *Becu* (Dry and Weeping Eczema) :

1. The stem of *snuhi* (milk-hedge) is taken without its thorns, and into it is packed 50 gm. paste of mustard seed. It is then covered with clay and cooked over a fire. After self cooling, it is mixed with mustard oil and applied as *lepa* (plaster) on the affected part. 2. A *lepa* (plaster) is prepared by fermenting the seeds of *cakramarda* (*Foetid cassia*), *til* (sesame), mustard, root of *kustha* (koot) and fruit of *pipali* (long pepper) in water obtained from curd, till the liberation of an obnoxious smell. It is to be applied on the affected part. (Tahsildar,1910:121).

32. *Sal mainaa* (Acne) :

1. A *lepa* of *priyala* (*Cuddapah almond*) is prepared in cow's milk and applied on the acne.

2. *Lepa* of thorn of *ximolu* (silk cotton tree) prepared in cow's milk, is to be applied on the acne.

3. *Lepa* of *jatiphala* (nutmeg), prepared in water, is to be applied on the acne.

4. *Lepa* of purified *xuaga* (borax)-6 gm., prepared in jasmine oil-12 gm., is to be applied on the face and retained overnight.

33. *Khar* (Ringworm) :

1. A mixture is made out of powdered rhizome of *haladhi* (turmeric)-1 gm., in 100 ml. cow's urine and taken three times a day.

2. *Lepa* prepared from the seed of *cakramarda* (*Foetid cassia*) in the juice of *mula* (radish) is to be applied on *khar.*

3. *Lepa* prepared from the bark of *sigru* (horse-radish) in the juice of *mula* (radish) is to be applied on *khar.*

34. *Nakhmuri* (Onychia) :

1. *Neemar gutir tel* (neem oil) is to be applied on the affected part.

2. *Lepa* of root of *aparajita* (clitoria)-12 gm., and *suddha xuaga* (borax)-12 gm., in water is to be applied on the affected part.

3. *Lepa* of fruit rind of *haritaki (Chebulic myrobalan)* in juice of fresh rhizome of *haladhi* (turmeric), prepared in an iron vessel is to be applied on the affected part.

4. *Lepa* of equal part of *hing* (asafoetida), bark of *khair* (catechu) and leaf of *neem* to be applied on the affected part (Tahsildar, 1910:139).

35. *Porani* (Burning sensation) :

1. In severe case of *porani,* patient may be covered with a wet sheet and a spray of cold water may be given to the head. For other patients, a bath may be

given with cold water which is medicated by adding the powder of rhizome of valerian, woods of wild cherry and sandal; and root of khas.

2. Fluid obtained from the fruit of *narikal* (coconut), is to be taken frequently.

3. Juice of fresh root of juice wild asparagus-50 ml., oil of fruit of *misiry* (fennel)-5 ml. and *xarkara* (raw sugar)-100 gm., mixed with 500 ml. water is to be taken in 14 to 56 ml. dose, three times in a day

37. *Chaku nama* (Conjunctivitis) :

1. 12 to 24 gm of *ghee* is taken with meal or with 5 gm. *xarkara* (raw sugar) thrice a day.

2. 100 ml. milk prepared in the decoction of *triphala* is taken, twice a day.

3. *Ghee*-12 to 24 gm., prepared in the decoction of *triphala*, is to be taken twice a day.

4. 100 to 250 ml. of cow's milk is boiled with 12 to 24 gm. root of *satavari* (wild asparagus) and 7 ml. juice of *ada* (ginger)- is to be taken, thrice a day.

38. *Chakur Khajuwati* (itching in eye) :

1. 1 to 2 gm. powdered seed of *dangar elachi* (larger cardamom), is to be taken with 5 to 10 gm. *xarkara* (raw sugar), thrice a day.

2. The eyes are fomented with the decoction of bark of *khaira (khair)* and seeds of *rahar* (pigeon pea) and *sigru* (horse radish), after they have been washed with tepid warm water.

3. The eyes are fomented with the decoction of rhizome of *haladhi* (turmeric) and roots *daruharidra* (barberry) and *yastimadhu (Glycyrrhiza)* mixed with honey.

4. An *Anjana* of seed of *cakramarda* (*foetid cassia*) is applied on the eyes at bed time.

39. *Acinai, Ajina* (Stye or style) :

1. A *lepa* (plaster) of seed of *era* (castor), *sphatika* (alum) and *xuaga* (borax) is to be applied.

2. The eyes are fomented with cotton, dipped in warm water, and properly squeezed.

3. Leaf of *bagari* (jujube) must be rubbed on the affected part.

4. After the hands are washed, two fingers of one hand are rubbed on the palm of the other and when hot, the abscess is fomented with the fingers (Tahsildar, 1910:144-49).

40. *Drishti Durbalata* (Weak eye sight) :

1.7 to 14 ml. juice of *bakula* is to be taken with honey.

2. 7 to 14 ml.juice of *dhania* (coriander), is to be taken with 5 to 10 gm. honey.

3. Decoction of fruit *mesasrngi* (Indian screw tree)-14 to 28 ml., to be taken with 5 to 10 gm. *ghee* twice a day.

4. Decoction of *triphala*-14 to 28 ml. to be taken with 5 to 10 gm. *ghee* and warm water thrice a day.

41. *Chani para* (Cataract) :

1. *Triphala churna*-6 to 12 gm., to be taken with 12 to 24 gm. *ghee* thrice a day.

2. *Ghee* with rhizome of *haladhi* (turmeric) and root of *usira (khas)*-12 to 24 gm., to be taken twice a day.

3. A powder is made out of equal parts of *triphala* and root of *yastimadhu (Glycyrrhiza)*. 3 to 6 gm. of this powder is to be taken with honey or *ghee* thrice a day.

4. *Ghee* with equal part of decoction of leaf of *patala*, juice of *nemu* (lemon) and stem of *guduci* is to be taken in 12 to 25 gm. dose, thrice a day.

5. *Ghee* with 12 to 24 gm decoction of root-bark of *bonsoth.* and 14 to 28 ml decoction of *dasamula* - is to be taken, thrice a day (Tahsildar, 1910:265).

42. *Madhumeha* (Diabetes Mellitus) :

1. Juice of leaf of *bel*-14 to 28 ml., to be taken with 5 to 10 mg. honey three times a day.

2. Juice of stem of *guduci*-14 to 28 ml., to be taken with 5 to 10 gm. honey thrice a day.

3. Powdered flowers of *palasa* 12 gm., to be taken with 5 to 10 gm. *xarkara* (raw sugar) thrice a day.

4. Powder of *satvari*-25 gm. to be taken with 250 ml. cow's milk thrice a day.

5. Cow's milk 500 ml., to be taken with equal quantity of water, twice a day. It is useful for *shukra meha* (Tahsildar, 1910:245).

44. *Rakta hinata* (Anaemia) :

Juice of *kuhiar* (sugarcane)-100 to 250 ml., to be taken three times a day. Powdered fruit rind of *haritaki* or *xukan ada* (dried ginger)-1 to 3 gm., to be taken with *gur* (jaggery) twice a day.

45. *Padonola, Naligha* (Fistula) :

1. *Kala tila* (black sesame)-12 to 24 gm. to be taken with 100 to 250 ml. milk, thrice a day.

2. Decoction of wood of *khair* to be taken as many times as possible, for quenching thirst. 14 to 28 ml. decoction, prepared out of equal part of fruit rinds of *haritaki* (*Chebulic myrobalan*), *vibhitaka* (*Belerie myrobalan*) , and *amalakhi* (*Embelic myrobalan*) and *suddha laa* (purified lac)- to be taken thrice a day. 12 gm *triphala*, 60 gm. *xuddha guggulu* and 10 gm. *ghee* is taken and made into pills of 1 gm. weight each; one pill is to be taken twice a day with warm water (Tahsildar, 1910:193)..

46. *Basanta* (Smallpox) :

1. Leaf juice of *tulasi* (sacred basil)-7 to 14 ml., to be taken with 5 to 10 gm. honey thrice a day.

2. Leaf juice of *tita-kerela* (bitter gourd)-7 to 14 ml., to be taken with powdered rhizome of *haladhi* (turmeric)-1 gm., thrice a day.

3. Paste of *rudraksa* seed diluted in water to be taken in 1 to 2 gm. dose, twice or thrice a day.

4. Powdered leaf of *haladhi* (turmeric)-3 to 6 gm., to be taken with 100 to 250 ml. cold water thrice a day.

5. Powdered leaf of *teteli* (tamarind)-3 to 6 gm., to be taken with 100 to 250 ml. cold water thrice a day.

47. *Murcha* (Syncope) :

1. *Triphala churna*-1 to 3 gm., to be taken with equal quantity of *gur* (jaggery) and *ada* (fresh ginger) thrice a day.

2. Paste of root and stem of *padum* (lotus), fruit of *pippali*, fruit rind of *haritaki* (*Chebulic myrobalan*) prepared in water, to be taken in 12 to 24 gm. dose, with honey thrice a day.

3. *Ksirapaka* prepared from the powder of equal part of roots of *satavari* (wild asparagus) and *angurar ras* (raisin or grape fruit)-100 to 200 ml., to be taken with *xarkara* (raw sugar) thrice a day (Tahsildar, 1910:211).

49. *Pechab Kamkoi howa* (Dysurea) :

1. Fruit juice of *kantakari* (yellow berried nightshade)-14 to 28 ml., to be taken with 4 to 6 gm. honey thrice a day. 2. Powder of equal part of fruit rind of *amalakhi (Embelic myrobalan)* and *gur* (jaggery) is first prepared. 6 gm. of this preparation is to be taken thrice a day. 3. Hot milk-150 ml., to be taken with 5 to 10 gm. *xarkara* thrice a day. 4. Decoction of fruit *goksuru*-14 ml to 28 ml., to be taken thrice a day. 5. Equal part of *xarkara* (raw sugar) and *yavaksara* to be taken in 2 gm. dose with 50 ml. water thrice a day. 6. Powdered fruit of

goksura (smaller caltrops)-3 to 6 gm., to be taken with 1 gm. *yavaksara* and 50 ml. water thrice a day.

50. *Pechab Bandha* (Retention of urine) :

1. Powdered rhizome of *rudrajata* (spikenard)-1 to 3 gm., to be taken with *ghoal* (butter milk) twice a day.

2. Decoction of fruit of *goksuru*-14 to 28 ml., to be taken thrice a day.

3. *Chunar pani* (lime water)-14 to 28 ml., to be taken with freshly milked milk-250 ml., twice a day.

4. Decoction of equal part of roots of *nala* (nodding reed), *kahua*, *kusa* (sacred grass) and *kuhiar* (sugarcane root)- 14 to 28 ml., to be taken when cold with 5 to 10 gm. *xarkara* (raw sugar), thrice a day (Tahsildar,1910:244)..

51. *Luti aai* (Measles) :

1. Fruit juice of *tita-kerela* (bitter gourd)-5 to 10 ml., to be taken with 4 to 6 gm. honey thrice a day.

2. Sponge of seed of *methi* (fenugreek) boiled in water, is useful in cutting short the eruptive state.

3. Decoction of leaf of *maricha* (a variety of amarnath)-5 to 15 ml., to be taken with 1 gm. powder of equal part of fruit of *patala* (a small variety of cucumber-snake gourd), rhizome of *haladhi* (turmeric) and of *amalaki* (embelic myrobalan), twice a day.

4. Decoction of equal part of *khair, triphala,* leaf of *neem*, whole plant of *patala* (a variety of small cucumber-snake gourd), stem of *guduci* and leaf of *vahaka* 5 to 15 ml. -to be taken twice a day (Tahsildar,1910:231).

52. *Paksaghata* (Paralysis) :

Decoction of equal part of seeds of *mati maha* (black phaseolus bean) and

kapi-kacchu (cowage) and roots of *era* (castor) 14 to 28 ml., to be taken with 2 gm. of fried *hing* (asafoetida) and 1 gm. *xaindhava* (rock-salt), twice a day.

53. *Sika lara* (Spondalities) :

1. The neck must be massaged with *ghee* wrapped with leaf of *akana* and then it is fomented with warm milk. 2. An emulsion is made by mixing an egg of hen with *xaindhava* (rock-salt) and *ghee*. This emulsion is to be used for massage of the affected parts..

54. *Pora Ratna Mala* (Erysipelas and eruptions) :

14 to 28 ml. of decoction, prepared out of equal part of leaf of *patala* (a variety of small cucumber-snake gourd), bark of *neem*, wood of *rakta chandana* (red sandal), roots of *mutha*, rhizome of *katuri*, whole plants of *patala* and *garudi* and stem of *guduci* to be taken twice a day.

55. *Vis phoha* (Abscess) :

1. 14 to 28 ml. of decoction, made of equal part of whole plant of *chirata*, rhizome of *vaca* (sweet flag), leaf of *vasa* (*vasaka*), *haritaki* (*Chebulic myrobalan*) and *amalaki* (*Embelic myrobalan*), bark of *kutaja* (*kurchi*), leaves of *patala* (a variety of small cucumber-snake gourd) and *neem*- to be taken with 5 to 10 gm. honey, twice a day.

2. Decoction of equal part of *guduci*, leaf of *patala* (a variety of small cucumber-snake gourd), whole plants of *chirata* and *khair* and root of *motha*-14 to 28 ml., to be taken thrice a day.

56. *Mur Kamorani* (Headache) :

Powder of *xarpagandha* (*Rawalfia serpentina*) to taken in 180 mg. to 500 mg. Dose, with 4 to 6 gm. honey thrice a day.

57. *Surya Kapali* (Chronic sinusitis) :

12 to 24 gm. of *ghee* to be taken with 250 ml. milk, thrice a day. A *nasya* of *ghee*-1 gm., *xaindhava* (rock-salt)-0.5 gm. and *dasamula* -28 ml is prepared. 2 to 4 drops of this mixture is to be instilled in the nose. A *nasya* of *kesara*-(saffron)-1/116th part, with *ghee*-2 parts is first prepared and 2 to 4 drops of this preparation is instilled in the nose.

59. *Kesuli Utha, Chaka Utha* (urticaria) :

1. Powdered leaf of *neem*-1 to 3 gm., is to be taken with 4 to 6 gm. honey, twice a day.

2. *Purana gur* (old jaggery)- 6 to 12 gm. to be taken with juice of *ada* (ginger)-7 to 14 ml. twice a day.

3. Powdered fruit rind of *amalakhi* (*Embelic myrobalan*)-1 to 3 gm., to be taken with 5 to 10 gm. *ghee*, twice a day.

4. Decoction of *triphala* -14 to 28 ml., to be taken with 4 to 6 gm. honey, twice a day.

60. *Petar Vih* (Colic) :

1. Juice of lemon-7 to 14 ml., to be taken with *yavaksara*-1 gm., twice a day.

2. Powder of equal part of *xaindhava* (rock-salt), *kala nimakh*, *hing* (asafoetida), fried in *ghee* to be taken in 12 gm. dose with warm water, twice a day.

3. Decoction of *dasamula* -14 to 28 ml., to be taken with *xaindhava* (rock-salt)-1 gm., *yavaksara*-1 gm. twice a day.

4. Decoction of bark of *sigru* (horse radish)-14 to 28 ml., to be taken with fried *hing* (*Asafoetida*)-1 gm. and *yavaksara*- 1 gm, twice a day (Tahsildar, 1910:132).

61. *Pittasmari Janita vih* (Biliary colic) :

1. Leaf juice of *patala* (a variety of small cucumber-snake gourd)-7 to 14 ml., to be taken twice a day with juice of *kuhiar* (sugar cane).

2. Leaf juice of *neem*-7 to 14 ml., to be taken twice a day.

3. Powder of *xaindhava* (rock-salt)- 2 gm., *xankha bhasma* (conch)-1 gm., *hing* (asafoetida)-1 gm. to be taken with warm water, twice a day.

4. Powder of equal part of *hing* (asafoetida) fried in *ghee, xukan ada* (dried Ginger)-1 to 3 gm., to be taken with warm water, twice a day (Tahsildar,1910:128).

62. *Godha rog* (Elephantiasis) :

1. Powdered rhizome of *haladhi* (turmeric)-3 to 6 gm., to be taken with *gur* (jaggery)-6 gm. and *garur mut*-7 to 14 ml., twice a day.

2. Powdered fruit rind of *haritaki (Chebulic myrobalan)* fried in *era tel* (castor oil) to be taken in 3 to 6 gm. dose with warm water or 50 ml. milk, twice a day.

63. *Hapani* (bronchial asthma) :

1. Juice of whole plant of *kantakari* (yellow berried night shade)- 7 to 14 ml, twice a day.

2. Mustard oil- 12 gm., in *gur* (jaggery)-12 gm. , to be taken twice a day.

3. Powdered *xukan ada* (dried ginger)-4 to 6 gm., to be taken thrice a day.

4. Powder of whole plant of *kantakari*-1 to 3 gm., mixed with 4 to 6 gm. honey, to be licked 2 to 3 times a day.

5. Decoction of equal part of root of *vahaka,* rhizome of *haladhi* (turmeric), stem of *guduci*, fruit of *kantakari* (yellow berried night shade)-14 to 28 ml., to be taken with 1 gm. of powdered *jaluk* (black pepper) twice a day.

64. *Sveta Pradara* (Leucorrhoea) :

1. Powder of equal part of flower of *mahua, triphala*, root of *mutha* -1 to 3 gm., to be taken with alum-120 to 180 mg. and honey-4 to 6 gm., twice a day.

2. Decoction of equal part of stem of *daruharidra* (barberry), leaf of *vahaka,* root of *mutha,* whole plant of *chirata*, fruit pulp of *bel*-14 to 28 ml., to be taken with 4 to 6 gm. honey, twice a day.

65. *Rakta Pradara* (Menorrhagia) :

1. Juice of fruit of *amalakhi* (*Embelic myrobalan*)-14 to 28 ml. to be taken with 5 to 10 gm. *xarkara* (raw sugar), twice a day.

2. Leaf juice of *guduci*-14 to 28 ml., to be taken with 5 to 10 gm. *xarkara* (raw sugar), twice a day.

3. Juice of *dimaru* fruit 14 to 28 ml., to be taken with 4 to 6 gm. honey, twice a day.

4. Juice of leaf of *vahaka*-14 to 28 ml., to be taken with 5 to 10 gm. *xarkara* (raw sugar), twice a day.

5. Decoction of green *kal* (plantain)-50 to 100 gm., to be taken with 5 to 10 gm. *gur* (jaggery) twice a day (Tahsildar,1910:132).

69. *Prasuti-jwara* (Puerperal Fever) :

1. Decoction of equal part of root of *rasna* (Indian groundsel), wood of *sarala* (pine), root *yastimadhu* (*Glycyrrhiza*)-14 to 28 ml., to be taken twice a day.

2. Decoction of tuber of giant potato-14 to 28 ml. to be taken with 1 gm. *xaindhava* (rock-salt), twice a day.

3. Decoction of equal part of roots ofyellow berried night shade, *era* (castor) and *rasna* (Indian groundsel) and woods of *sarala* (pine) and *devadaru* (deodar)-14 to 28 ml., to be taken twice a day.

70. *Piyah phoha* (Abscess of the Breast) :

1. A *lepa* (plaster) made of rhizome of *haladhi* (turmeric) and leaf of d*hatura* (*datura*) in water, is to be applied on the abscess. 2. A *lepa* (plaster) made out of the root of *indravaruni* (*Colcynth*) in water, is to be applied on the abscess. 3. A *lepa* (plaster) of root of *bandhyakarkotaki* prepared in water, is to be applied on the abscess.

71. *Kahi Phula* (Leucoderma) :

1. Powdered seed of *bakuci* (pimple flea bane)-500 mg. to 1 gm., to be

taken with 4 to 6 gm. honey, twice a day.

2. *Neemar aag (Neem* shoot)-6 to 12 gm., to be taken with 50 ml. water, twice a day.

3. Juice of *dimaru* fruit -5 to 10 ml., to be taken with 6 to 12 gm. *gur* (jaggery), once a day.

4. Root of *baga jayanti* flower bruised in cow's milk-100 to 250 ml., to be taken once a day and also to be applied externally.

5. 3 to 6 gm. of powder of whole plant of *bhringaraja* is fried in *til tel* (sesame oil) in an iron saucepan, collected in iron pot is to be taken orally twice a day.

73. *Hikati* (Hiccough) :

1. Juice of root of *kal* (plantain)-7 to 14 ml., to be taken with 5 to 10 gm. *xarkara* (raw sugar), twice a day.

2. Powdered seed of *elachi* (lesser cardomom)-120 to 250 mg., to be taken with 4 to 6 gm. honey, twice a day. Powder of root of yellow pumpkin-1 to 3 gm., to be taken with 4 to 6 gm. honey, taken many times a day

III. 9. Use of Bamboo as Medicine:

People of various backgrounds, belonging to different races, tribes and communities, residing in the North-East, are acquainted with at least one reciepe, with bamboo as an ingredient. Different parts of the bamboo plant are used for preparing different types of dishes. The variety of bamboo used or the mode of preparation may be different with different people, but bamboo is used in almost all the house-holds of the North-East for culinary purpose, in one form or the other.

Bamboo is also used for medicinal purposes. There are many traditional medicines which prescribe different bamboo parts, in different forms for curative measures. Below are some common examples.

(i) **Fresh cuts :** Greenish portion of the bamboo stem is ground and made

into paste for application over fresh cut area. It usually acts as antiseptic and results in the wound healing quickly.

(2) **Early diabetes or nights watering of children :** Water collected inside the bamboo stem, when taken relieves the above diseases considerably.

(3) **Tooth ache :** Tooth ache is relieved when fomentation is applied over it by heating young bamboo twigs.

(4) **Loose teeth :** The sticky juice which comes out from burning of dried bamboo is to be applied on the root of the tooth to make it firmer.

(5) **Hypertension :** White part of new bamboo leaf taken on a empty stomach early in the morning helps to control hypertension.

(6) **Chicken pox, small pox and ulcers :** Dried young bamboo shoots when grounded and taken with cooked cat fish (*'magur'*) helps in early healing of chicken pox, small pox and ulcers.

(7) **Dandruff :** The ashes of clump sheath of bamboo is effective for removing dandruff.

(8) **Headache and sinusitis :** Dried bamboo burnt and the inhaling of the smoke of the bamboo relieves headache and sinusitis.

(9) **Giddiness and chronic pain :** Curd prepared with young bamboo shoots taken with black pepper relieves giddiness and chronic pain.

(10) **Body pain :** Sleeping on a bed made of whole bamboo relieves body pain.

Bamboo leaves are used for increasing milk content of cow and for treatment of many other diseases of animals.

Traditional Bamboo Recipes for Curing Diseases :

1. Mushroom and bamboo shoot : For, freshening skin.
2. Spring Bamboo : For beautifying and freshening skin, and increasing vitality.
3. Spinach cake, bamboo shoot : For curing gastric ulcer ; getting stronger.

4. Stewed pork leg, bamboo shoot : To get strong, regulates blood cycle. Good for weak kidney.

5. Spicy roasted cuttle-fish, bamboo shoot : For nourishing weak liver and strengthening stomach.

6. Stir-fried fresh clams, bamboo shoot : For strengthening liver.

7. Stir-fried chicken dices, bamboo shoot : To resist germs and good for people having tuber culosis.

8. Beef and, bamboo shoot : For anaemia in pregnancy, and for making hair darker .

9. Stir-fried salty pickles, bamboo shoot : For strengthening stomach and increase the appetite.

10. Agaric pork, bamboo shoots : For strengthening stomach and bowels and easier bowel habits, also for beauty care.

(N.B. - Scientific and English versions of the vernecular names of plants mentioned here, may be found in theAppendix-I)

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Chapter - V

TRADITIONAL ANIMAL HUSBANDRY AND VETERINARY LORE

CHAPTER-V

TRADITIONAL ANIMAL HUSBANDRY AND VETERINARY LORE

I. ANIMAL HUSBANDRY IN ANCIENT INDIA :

The raising of animals is as old as civilisation itself, for our common domestic animals were domesticated even before the dawn of documented history. Paleolithic man hunted animals for food and raiment; his successor, the Neolithic man, tamed and confined them. It was in the Neolithic or new Stone Age that men first practised agriculture, which included the raising of domestic animals (Anderson,1955:3).

Animal husbandry was the occupation, either sole or part, of majority of the people. Every villager usually kept a few animals for draught purposes and to meet the supply of his own household.

A detailed information about rearing and care of the cow in ancient India is given in many books written by various authors of ancient India. A detail account of animal husbandry in ancient India is described in the *Brhat Parasara Samhita* written by Parasara. *Krishi Parasara* is another book witten by Parasara which contain many information about agriculture and animal husbandry. Kautilyas *Arthrashastra* is another very important book which contains many useful information on animal husbandry. The *Vishnu Dharmatma Mahapurana* by

Puskara also contain many valuable information about veterinary and animal husbandry in ancient India. The following are some of the important information about traditional animal husbandry and veterinary lore in ancient India.

Parasara in *Krishi-Parasara* says that by keeping the cow-shed clean and beautiful, the cattle not only remain happy but also become healthy. He recommends some useful suggestions for keeping the cow-shed neat and clean. The animals of a cultivator, whose cow-shed is strongly built and is clean and free from dung, thrive even without very nourishing food. What can nourishing feed do to (strengthen) the animals when every day they come out of the shed with their bodies besmeared all over with dung and urine ? Tending of cattle was regarded as a sacred duty by the people in ancient India. *Krishi-Parasara* contains elaborate rules of looking after the cattle (Raghavan, 1964 :127).

In Kautilya's *Arthasastra* are recorded, the duties of the superintendent of cattle and the manner in which he should deal with them .

The superintendent of cattle shall have under his control - herds maintained for wages, herds surrendered for a fixed amount of dairy produce, disabled and abandoned herds, herds maintained for a share in dairy produce, classes of herds, strayed cattle, cattle that are irrevocably lost, and the total produce of milk and ghee (Bose.1945:88)

I. 1. Medical Care and Treatment of Animals in Ancient India :

In ancient India, people had adequate knowledge of the diseases of farm animals and the methods of curing them. Though in the light of the modern advances made in the field of veterinary science, the techniques adopted for the diagnosis of the disease of an ailing animal and its treatment in the olden days may appear to be crude, yet these are scientific and result oriented. There are

many treatises on ancient Indian veterinary practices. Out of those the following are some of the important books to be mentioned.

In the *Vishnu Dharmatma Mahapurana* written by Puskara there are description of care and medical treatment of cattle. Some of the important prescriptions for traetment of cattle mentioned in the said book are quoted here for example :

In dysentery of cattle, the two species of turmeric and *pathya* should be administered and in constipation turmeric mixed with *ghee* should be given. In all leprous diseases and diseases of the horns as well as in cough and asthma, ginger and *darvi* should be administered. For the undoing of fractures, *priyangu*, mixed with salt, is useful. In wind disorders cattle should be administered oil in which *sata-puspa* has been cooked, for it is a specific remedy for such troubles. Pea soup mixed with honey is to be given in disorders of the phlegm. In all bilious disorders, the specific remedy is cow's *ghee* in which liquorice has been cooked and it should be administered when such troubles arise. The ointment prepared from *sesamum*, *ambhakaruha* (lotuses), yellow orpiment and *ghee* is excellent for applying on the open wounds of the cattle.Ailing calves should be made to drink *pathya* stirred in butter-milk or turmeric dissolved in milk, for alleviating their suffering.

Oil-cake is considered to be an elixir for the cattle. Wet grass and cold-water for drinking should be eschewed from the cattle-shed. At night, lamps should be lit in the cattle-shed. As a prophylatic measure, salt should be regularly given to cattle, after every fortnight, for it prevents constipation, colic and want of appetite. It is also beneficial to sheep and goats.

In *Asva-Vaidyaka* Jadudutta gives the following account of the medical treatment of horses: If a horse suffering from excess of blood in the nose feeds on young grass along with oil, etc., he is soon affected with disorders of phlegm

and meets with his end. If an anaemic and dried up horse feeds on young grass, he becomes affected with acute disorders of wind and soon meets his death. These are said to be the symptoms arising from the disorders of blood.

When a horse is affected with the de-arrangement of bile and vitiation of blood then he gets itching sensation all over his body and scratches it continuously. He longs to go under the shade and particularly to a pool, and is eager to drink and take food. Having thus come to know, that the horse is suffering from disorders of blood and bile, one should have his blood let from a vein and then give him jaggery mixed with black and long pepper and ginger. With that he becomes purged of morbid affection and free from disease. If flow of tears and paleness round the eyes is observed in a horse suffering from disorders of bile and blood, death is sure to claim him soon. These are the symptoms of disorders of bile and blood.

When a horse is affected with disorders of phlegm and blood, he always keeps his muzzle lowered, coughs repeatedly, refuses food and does not rouse to activity (i.e. remains sluggish). He who does not respond to the whip nor to the nudge of the heel, nor to the saddle and he who swivels profusely at the nose and loves to keep warm should also be given jaggery mixed with dry ginger after blood-letting. In this way his whole blood will be purified (Raghavan, 1964 : 145).

II. TRADITIONAL VETERINARY AND ANIMAL HUSBANDARY LORE OF ASSAM :

II. 1. Cattle Lore :

There are many traditional animal husbandry and veterinary lore in the oral literature of Assam. These wisdoms are the result of research of the people since time immemorial. *Dak*, the most popular bard of Assam described many maxims particularly on animal husbandry. Sayings of *Dak* are still followed with great honour, by the people in the villages, because these practices are

highly useful. Not only the medicinal prescriptions, but there are traditional lore for behavioural study of cattle and other domestic animals. Traditional beliefs maintain that cattle are not subject to diseases and malnutrition if they are housed in proper cowsheds. Therefore the Assamese people always clean the cowshed with utmost care. A householder whose cowshed is clean is respected by all. A cowshed keeping with dirt is regarded as crime. There is an elaborate annual ritual of bath for cattle with oil and paste of raw turmeric and black pulse applied an their body during the Bohag bihu festival , which is a cultural practice of keeping diseases at bay. There are many such cultural practices in the villages of Assam to for taking care of domestic animals particularly cattle. Following are some of the important traditional cattle lore of Assam.

II. 1. 1. Characteristics of a Good Bull or a Cow :

While choosing a bull or a cow of a good breed, traditionally, farmers took certain characteristics into consideration. This practice have been carried on since time immemorial and is still observed today in the villages of Assam, while buying or selling a bull. There are many popular sayings on the process of selecting good bulls and cows by *Dak*, which are still honoured by the farmers. Some important popular lore are described below.:

1. Buy a bull which is young and beautiful. Possessing two, four or six young teeth marks a good bull.
2. Buy a bull without fear whose tongue and ears are like deer.
3. Keep a watch on the bull you intend to buy ; The bull of an alcoholic, a washer-man and an oil-merchant should be avoided.
4. Choose a bull with four or six teeth.

5. Fortunate is the finder of a bull with six new teeth.
6. Buy a bull from the same village without fear, Instantly buy a land which is near.
7. Buy a cow whose mouth is smaller And pelvic region larger.
8. Do not buy a cow which is abortive in character, Whose hoofs are shaped and sized in an unnatural manner, And whose head is large whatsoever.
9. Immediately buy a bull whose tail is furry like hairy caterpillars, And whose hump is of black colour.
10. Buy a dappled bull. And subject it for training full.
11. The decision is very right To buy a bull brilliantly white.
12. One will be hailed If he buys a bull with a long tail.
13. Ploughing with a pair of bull of unequal size. Amounts to leading a famine stricken life.
14. Buy a long-tailed bull. Test in harrow, whether it cripples.
15. Ploughing with a pair of bull with broken horn
    Is equal to walking in a field of thorn.
16. Ploughing with a pair of reddish bull is fair,
    Plough with a blackish pair with care.
17. Do not plough with a pair of lame bull.
    Also one who ploughs with calves is a fool.

(Sarma, 1987: 4-90)

II. 2. TRADITIONAL CATTLE HUSBANDRY AND MEDICINE :

Since the days of yore, the natives of Assam possessed knowledge about traditional means of curing and treating the various ailments afflicting cattle. Some of the traditional cures for the same have been described below :-

II. 2. 1. Diseases and Treatment :

1. *Basanta* or *Aai* (Variola or small pox) :

Symptoms : Along with coughing , there is profuse watering through the nose and the mouth. The eyes, nasal cavity and the buccal cavity appears red and form sores, loss of appetite, the cattle develops an urge to keep sleeping or sitting, passes stool with mucous and blood which is odorous, has problems in breathing and pox appears on the neck, mammary glands and in the back.

Prevention : Cowshed is to be cleaned regularly. The infected cattle is to be removed from the cow-shed.

Medicine:

1. In cases of constipation and abdominal distension, salt may be given as a purgative.

2. In case of blood coming out with stool, the following ingredients should be powdered and fed with alcohol (country wine), *korpoor* (camphor) - 3 *moha* (10 grams), seeds of *datura* (*Datura starmonium*) - 6 ana (5 grams), *jakhar* (a kind of powdered alkali) - 3 *moha* (10grams), *chirata tita* - 3 *moha* (10 grams). The medicine prepared with all these ingredients is to be given three times after every 12 hours and should be discontinued, once bowel movements become regular (Tahsildar, 1992:112).

2. *Cherowa Rog* (Diarrhoea) :

1. Bamboo leaves to be fed to the cattle. 2. *Cheera* with *athia kol* (a kind of big sized banana). iii. In acute cases, paste made of opium and betel leaves with *cheera* and *athia kol.*

3. *Chabaka* (Foot and mouth diseases) :

Symptoms : Fever, sore in mouth and in the joint of hoofs. The sore in mouth hampers their food consumption and the sore in the hoofs creates retardation in walking. Sores are also seen to appear in the mammary glands.

Medicine : i. Sores should be washed with alum and hot water. ii. A mixture of camphor, turpentine and linseed oil must be applied on the sores. iii. A liquid mixture of *jakhar,* powder of c*hirata*, salt and jaggery should be applied externally. iv. If maggots appear in the sores of the hoof, the cattle must be kept in knee-deep mud for a few hours. After removing the cattle from the mud the sore must be washed properly and an extract of garlic must be applied externally (Tahsildar,1992:114).

4. *Jibha bet* (Gingivities : Sore in the tongue and in the buccal cavity) :

Medicine : Burnt ashes of *chital* (*Notopterus chitala*) or *puthi* (*Puntius* sp) fish in the sore must be applied on the sores. In large sores, latex of *bhatta guti* (seed of a kind of tree) with ashes of fish and cotton pack must be applied and the mouth must be bound tightly with a string.

5. *Pet Ukhaha* (Tympanitis) :

1. A mixture of raw turmeric paste with jaggery must be fed.2. The extracts of the leaves of *raghu* tree must be given orally. 3. 2 *mohas* (6 grams) of black salt is to be given orally. 6. *Pet Kamorani* 6. 6. 6. **6. *Grahani* (Dysentery) :**

Symptoms : Restlessness, sleeping and standing suddenly, loss of appetite, irregular bowel movement or stoppage of bowel movement.

Medicine : 1. The extract of the roots of *dhepa tita* plant (2 tola / 25 grams) to be administered orally.

2. An extract of the leaf of *raghu* plant mixed with jaggery must be given orally.

7. *Tezemuta* (Babesiosis):

Symptoms : Weakness, weight loss, stooping while walking, flatulence, blood in the urine, bad smell while urinating and which ultimately proves fatal due to respiratory problems.

Medicine : 1. Extracts of the roots *satamool* (*Assparagus racemosus*) to be given orally. ii. The suffering cattle must be fed with a liquid mixture of the following :- Salt (2 *chatak* / 120 grams), *masabbar* (1 ½ *mohas* / 5 grams), dried ginger powder (2 ½ *tolas* /36 grams), jaggery (2 *chatak*/120 grams) and warm water (1 seer / ·9 litre) (Tahsildar,1992:116).

8. *Bhokla* or *Bhekulia* or *Galbera* or *Galphika* (Heamorrhagic septicaemia):

Symptoms : Burning fever, respiratory problems, profuse salivation, hardening and enlargement of respiratory pipe (trachea), swelling of tongue and dysentery.

Medicine : 1. The paste of the following : *jabrang* (*Crocus salivus*), roots of *tezmui* (*Xanthoxylon hamiltonian*), plantain ash alkali, tobacco, *maricha* vegetable leaves must be administered orally. 2. Paste of the following pack in a leaf of *dimoru* tree (*Ficus carica*) is prepared and given orally – *gathion, laitaru* (a spice), *ol kachu* (*Arum campanulatum*), salt and pepper. 3. Paste of the following to be given orally – *gunraj, laitaru, berahudu*, pepper, *jabrang,* black ginger, burnt ash of toad, *bhang* (cannabis) and salt. 4. The burnt ash of *kala kachu* (black colocacia) and stem of *lata* vegetable is to be applied on the tongue (Tahsildar,1992:116).

9. *Benga Rog* (Three days' fever) :

Symptom : The earlobes hanging down, reduction in body temperature, trembling of the body, arteries of the ear and tongue turning black, loss of appetite and aversion from rumination.

Medicine : 1. *Dimoru* leaf (*Ficus caria*) should be rubbed on the tongue and also given for consumption. 2. A black vein is selected in the tongue and pierced to release some blood and then mustard seed paste is to be applied to the wound. 3. A mixture of raw turmeric and jaggery (1:2 proportion) is to be administered orally.

10. *Jima Bhekulia* :

Symptoms : Suffering from loss of appetite, the cattle lies down continuously.

Medicine : 1. *Purai* (*Basella alba*) leaf, stem of decayed plantain, and (*kala khar*) black ash alkali is boiled together and the paste is rubbed on the body of the animal on the first day. On the second day, a mixture of water and mustard cake is to be rubbed on the animal. On the third day, clay soil is rubbed on the animal and then the animal is washed clean at mid day 2. Burnt cucumber is boiled with black pulse and offered orally with salt (Khanikar, 1989 :45).

11. *Dhoka Bhokla* :

Symptoms : Enlargement of the stomach , respiratory problems and restlessness.

Medicine : 1. Dry ginger powder is mixed with pepper powder in alcohol and water and given orally.

2. Salt, dried ginger powder, sulphur powder and jaggery is mixed with warm water and offered orally after cooling.

12. *Ahom Phohoran* (Lymphangities):

Symptom : Painful abscess with pus.

Medicine : The flesh of white monitor and black pulse is boiled with black plantain ash -alkali in water and given orally for 2 to 3 days.

13. *Letekuwa* (Flowing tears from the eyes) :

1. The juices of extract from the following ingredients are applied in the eyes - Leaves of *manimuni (Hydrocotyle asiatica), pectkachuwa*, leaves of *chana kachu (Arum indicum*), tobacco and chilli.

2. The juice extract from the bark of *kothera (Eruatamina coronaria*) is applied in the eyes.

14. *Bish or Baat Bedona* (Rheumatism):

Symptom : Swelling in the joints of legs.

Medicine : A heated flat rod is to be rubbed on the knee and the animal is to be kept at rest.

15. *Bagal Nama* (Swelling on the shoulder):

Medicine :The extract of snail and paste of the leaf of *mithiguti* is applied on the affected part.

16. *KandhKhar, Chutkhar* (Hump sore):

Medicine : 21 big tobacco leaves are taken and soaked in half a litre of water. In addition to that one *ana* (.75 grams) of opium and half litre urine of goats is taken. Then the beak of a crow is burned and a powder is made out of it. Tobacco is boiled in water, opium and urine of a goat till it is reduced to ¼ litre. The powder of burnt beak is mixed with this preparation and it is applied on the sore regularly, till it heals (Tahsildar,1992:119).

17. *Konamuri Bhalukiya* (Laminities) :

Symptoms : Nails get elongated abnormally with retardation in walking.

Medicine : The mixture of the following materials is administered orally :- Bones of *kanowa* (Hawk), salt, *agyachit* plant (*Plumago zevlenica*), *aroakchand, sarpajibo*, pieces of earthen pot, *bontulsi, bhutmuta* (*Gyanandropsis gyandra*), bark of *dudhkhari* (*Holarrhsena antidysenterica*). A paste of all these materials are to be made and packed in a leaf of *kunsara* plant. Meanwhile, the animal should not be allowed to graze outside and made to consume only hay mixed with salt. Consumption of cold water should be completely avoided.

18. *Bih Bhalukiya* (Laminitis) :

Symptoms : Pain, elongated nail, inability to walk and eat.

Medicine : The following preparation is to be administered orally :– flesh of bear, *kata* (*Solanum xanthocarpum), tita bhekuri* (*Solanum indicum*), *sengmora (Laria spinara*), *bez kachu* (*Colocasia*), *baranokhowa kachu, bengali bhang* (coriander), *jira* (cumin), *charali, kaljira* (*Nigellw saliva*), *jatamangshi, muramangshi* and duck's egg or hens egg (Khanikar, 1989: 54).

19. *Ghenalaga* (Calcium deficiency):

Symptoms : Loose teeth, dark tinge in the teeth, and inability to consume grass.

Medicine : The paste made with the mixture of the following ingredients is to be applied to the teeth and the to the gums must be applied, powder of earthen pot, powder of black pulse, powder of earth from the traditional ovens and powder of the burnt banana peels.

20. *Bih Khowa* (Food Poisoning):

Symptoms : In cases of food poisoning, the animal starts trembling, feels pain in the abdomen and hits at the abdomen with his legs. Foam emanates from the mouth and blood accompanies stool and urine.

Medicine : In cases of confirmed poisoning an oral mixture of the following ingredients should be provided orally to the animal :– Linseed oil (2 *chatak* / 120 grams), *gandhak* (sulphur) powder (1 *chatak* / 60 grams), rice starch (1/2 litre).

21. *Naijoka* (Sucking of blood from the genital aperture by leeches) :

Medicine : A mixture made of the following ingredients is to be applied and administered orally:- burnt ash of plantain, leaf of *ranga alu* (*Ipomoea batatas*) and leaf of *bulakshani* (*Polygonum* Sp).

22. *Makhi Koni Diya* or *Pok laga* (Formation of Maggots) :

Medicine : Application of the following ingredients on the sores where maggot formation takes place helps in getting rid of the maggots:- 1. Mixture of tobacco leaf and limestone. 2. Extract or latex of *Colocacia.* 3. Extract or boiled water of the leaves of *mahaneem* (*Azadiracta indica).*

23. *Maur* or *Jahani* (Cattle plague or Rinderpest) :

Symptoms : A highly infectious disease . Drowsiness in the animal, hampering its movement and eating habits. There is swelling in the skin, the hair loses its brightness, there is reddening of the eyes and buccal cavity. Sores form in the mouth and there is profuse watering from the eyes and mouth. The animal also suffers from loose motion accompanied by bad odour.

Medicine : 1. An oral treatment of the mixture of the following ingredients in cases of loose motion is prescribed:- linseed oil, castor oil, mustard oil,

joipal or *jamal* oil (5:2 & 1 *chatak*). 2. The mixture of the following must be administered orally :- alcohol (125 ml), ginger powder (10 grams), chilli powder (10 grams), with boiled rice and water.

24. *Piah Xira* (Mastitis) :

Symptoms : Fever with burning sensation in the mammary glands, refuses to consume grass and ruminate and there is hardening of the teats. Stops milking and the colour of the milk becomes dense yellow or red emitting a foul odour (Tahsildar, 1992:119).

Medicine : 1. A mild purgative may be a cure in the early stages of this ailment. Purgative: Black salt.- 400 gms, dry ginger powder - 5 gms., sulphur powder-5 gms, *lali* (fermented jaggery) - 5 gms.- a mixture of all these ingredients with 250 ml of hot water should be given orally after cooling.

2. A mixture is prepared out of the following materials and offered after every four hours-alcohol-125ml, chilli powder-750-gms.,rice wash water-750 gms. 3. The following ingredients are mixed thoroughly and given orally: Opium or canal'spowder-125 gms, *hing* (Asafoetida) 125 gms,dried ginger powder- 125 gms. alcohol-125 gms,boiled rice water -500 gms.

25. *Kanh* (cough) :

Symptoms : An initial dry cough followed by wet cough. profuse watering from the nose and the mouth.

Medicine : 1. A mixture of equal amount of mustard oil and turpentine oil may be applied in the neck region. 2. The animal may be made to inhale the vapours of turpentine oil along with water vapour.

26. *Dhoka Dingaria* (Impaction of the stomach):

Symptoms : The animal stops ruminating, losses appetite, develops flatulency in the stomach, hard stool and keeps making noises with its teeth.

Medicines : A dose of a purgative may be useful.The purgative dose may be followed by another medicine. Purgative : A mixture of the following should be given orally with water. Black salt- ½ seer (450 grams), dried ginger powder.-1 *tola* (12 grams), sulphur powder- 5 *tolas* (60 grams) and 1*ali* fermented liquid jaggery -.(250 grams).

The purgative may be followed by the following doses :-A mixture of the following should be given orally with rice boiled water - *nishaelal* (1 kg), ginger powder (1 kg), powder of *kulicha* (450 grams).

27. *Ajeerna* or *Bodhajmee* (Dyspepsia) :

Symptoms : Refuses to walk and eat, stops rumination, hard stool, odour from the mouth, rapid respiration, keeps making noise with its teeth and the animal becomes very weak.

Remedy : 1. Linseed oil may be fed with boiled rice water. 2. Purgative : Mixture of the following may fed with boiled rice water - *jakhar*, sulphur-powder, *ajowan* seed and powder of the *kuchita* seed. (Tahsildar,1992: 126)

II. 3. HORSELORE OF ASSAM :

People of Assam always displayed compassion and concern towards animals. The royalty in various time in the past established separate departments to look after domestic animals. Trained officers and physicians were commissioned to look after the well being of the animals and prescribe indigenous medicine for sick and weak animals.

Ralph Fitch, an English traveller, who visited the Koch capital during the reign of Naranarayana, writes that they have hospitals for sheep, goats, dogs, cats and birds and for all creatures. When they become old and lame, they were looked after until they die. Therefore, the veterinary science was well developed in the country and it was an important department of medicine (Barua,1933:302).

Though horse is not an endemic animal of Assam, yet Bhutan was known for its horses since the days of yore. Kings of Assam, probably procured horses from Bhutan. The western part of Assam, particularly Mangaldai and Kamrup was the main centre of horse trade in the past. Therefore, in these places there were traditional veterinarians for looking after the horses and as such a scientific raditional veterinary lore has been developed.

There were many manuscripts of horse lore in different parts of Kamrup and Mangaldai, which were named as *Ghora Nidan, Ghorar Puthi etc.* Horse lore, described in a copy of such manuscript namely *Ghara Nidan* has been published during British rule in Assam. This manuscript written in old Assamese script contained many useful information on horse lore. Unfortunately, the *puthi* bears no name of the author. The method, style and treatment of the subject are so peculiar that it can be recognized at a glance that it is not a translation from other Sanskrit treatise. Unlike any other medical treatise in Sanskrit, which is commonly met with in other parts of India, this treatise has no mention either of spice or herbs which are rare in Assam (Bhattacharya, 1930 :11)

The literary style of the book suggests that it may be a piece of work, compiled sometime during the administration of Ahoms as the horse was an important factor in the civil and military functions at that time, and the Ahom royalty had a special officer namely *Ghora Barua* to look after the horses (Bhattacharya, 1932 : 111).

II. 3. 1. Traditional Assamese Horse Lore as Described in *Ghora Nidan* :

The manuscript of *Ghora Nidan* contains the description of -kinds and characteristics of the horses, description of colours and what they denote, characters of the horse, vices and their cure, instructions to the rider, description of diseases, and their symptoms and treatment.

II. 3. 1. 1. Traditional Ethology of Horse :

In earlier times the people of Assam had done a detail scientific ethological study of horses. This may be proved by the observations mentioned in the *Ghora Nidan.* Following are some of the remarkable information provided by the traditional veterinarians of Assam in the manuscript of *GhoraNidan.*

1. To judge the traits of a good pony : Walk round the pony, if it open its eyes but does not erect its ears it is a bad pony.

2. To test a pony for lameness : Take out the animal to a long walk till it perspires, then hold it firm on level ground for about one *danda* (24 minutes), it will limp on that side on which one testicle is concentrated. If a leg is moved slowly a little above the ground, it is defective.

3. To examine the strength of the loins : If it breaths quick and hard while walking or will not move even on being beaten, and sweat comes out in the ear after a short walk, it is void of strength. If one can not strength down a slope it has also no strength. If one cannot walk at all, or the footprints of the hind feet do not reach up to those of the fore it has no strength in the loins.

II. 3. 2. Colours of horse :

It is very interesting to note that , altogether 79 different varieties of horses on the basis colours has been described in *Ghora Nidan.* Depending on the colour of horses the disposition of the horses is also determined. According to colour, the horses were classified in to different behavioural varieties. T h e following colour of the horses were described in *Ghora Nidan* : *Sukila* (white) or *jat sukila, ranga* (bay) or *jat ranga, jat kalia* (pure black), *ghora kalia, bhomara kalia* (bee-like black), *mati kalia* (earth-like black), *chokoa kalia* (Sparrow-like black), *rangrai kalia, bengena kalia* (Brinjal-like black), *kaba*

kalia, pakhara (dappled), *baula pakhara, bog pakhara* (Egret-like dappled), b*amuna pakhara, keku pakhara, kukur pakhara* (Dog-like dappled), r*upohi pakhara* (Beautiful dappled), p*hulam pakhara* (Flowery dappled), b*agh pakhara* (Tiger-like dappled), c*habua pakhara* (Spotted-dappled), *chilimi,* d*aha chilimi* , c*hilmi sukila,* m*atia chilimi,* b*hobora chilimi, chai chilimi, lekao chilimi* , c*hokoa chilimi, hoha chilimi, phulam chilimi, nora or lotha chilimi, dogodha chilimi, daha chilimi, chabua chilimi, dhepa chilimi, talau, chali talau* or c*hari talau, rangi talau, kali talau, talau pakhara, darya* (Chestnut), *tam darya, xon darya, bagh darya, dagadha darya, xet darya, doha darya, tel darya, darya pakhara, khirang, khirang rangbhar, khirang bhadara, deocharai, bhadara, bhadara chaltuni, kalia bhadara, tuling, tuling pakhara, abilakh or ablaksha or ablakh or abrach,sukla ablakh, chal ablakh , kolia ablakh, abrach tuling, ablakh pakhara, kumit,* c*hakoa kumit,* k*umit ranga,* k*umit kalia,* n*ara kumit,* chandara or c*handra,* c*handara kalia, tamu or tam,* t*am chandara,* h*udumuwa,* k*rishna aahania, tukam, tukam telia, tiphara,* r*anga tiphara,* t*ilak chandan, dangkachi,* r*anga dang kachi,* k*ala dang kachi* (Bhattacharya, 1932: 11-18).

In *Ghora Nidan* it has been described that colour of a horse indicates its behaviour. There are elaborate descriptions how the colour indicates the nature of a horse. It is advised to select horses for different purposes on the basis of its colour (Bhattacharya , 1932 : 14-20).

. II. 3. 3. Morphological Ethology :

There are also indication of the disposition of horses on the basis of shape, size and other morphological characters of its body parts. These are as follow :

1. Muzzle : A muddy coloured and short muzzle is not a good character of a horse.

The excess growth indicates craftiness and a shorter growth indicates dullness.

15. Mane : Short mane is bad in all cases. Black and dense mane is bad, short or thick or patchy mane is bad. Short and standing mane is always bad. If the line of the crest of a pony is bad, the animal is inferior. A pony with matted hair is bad for all purposes.

16. Whorl : A mark like pair of whorls at the crown of the head is good. A pair between the eyes indicates weakness. Three whorls below the wither is good. A pony with a whorl near the eye keeps shaking its head. A whorl on the buttock is bad. A whorl below the neck is considered to be good.

17. Hairy protuberance *(Loam ghatika)* : Hairy protuberance (*loam ghatika*) in the ears and cheeks are bad, it is believed to ruin the rider . If it is on the body it is good, but if it begins from the right it is bad.

18. Teeth : A temporary, or a milk tooth has a line mark, while a permanent does not. A milk tooth has a depression which is not found in a permanent one and also a black spot at its top (Bhattacharya , 1932 : 25).

II. 3. 4. Symptoms and Medicines of Diseases :

Description of symptoms of varieties of diseases of horses are prescription of medicines are found in many sources of traditional lore . The following are the description of symptons and prescriptions for diseases of horse found in the manuscript of *Ghora Nidan.*

1. ***Amurtak Byadhi*** **(Loss of Appetite) :**

Symptoms : The animal loses appetite, and continually lies down .

Medicines: 1.One *seer* (0.8 kg) of poppy seeds,must be administered orallly in three equal doses in a day. 2.Powdered long pepper and black pepper must be given internally,in equal quantities,by mixing in milk. 3. Rice is boiled in cow's *ghee*, arum and long pepper in equal parts and the same is applied in the urethra, when cold.

2. *Akhoiya Byadhii* **(Eruption in the genital region) :**

Symptoms : Eruptions like parched paddy at the end of the genital organ.

Medicines : The juice of both the small and big varieties of *manimuni* (*Centella asiatica*),is squeezed out, and the same is boiled in mustard oil and applied externally with a feather of the pigeon.

3. *Arik- hai- Khorowa* **(Lameness):**

Symptoms : Limping along with stooping.

Medicines : The affected part is bandaged with the paste of 7 ripe leaves of *chorat* plant (*Tragia involucrate*), 7 leaves of b*och* plant (*Acorus calamus*), *harghrrevcha*, and *naljora.*

4. *Awan* **(Rhinitis) :**

Symptoms : Swelling like a polypus in the palate for which the animal cannot eat.

Remedy : The swellings are punctured and rubbed with common salt.

5. *Karnamul* **(Otitis)** :

Symptoms : Swelling at the foot of the ear causing sores.

Medicine : First the affected area is to be foment with *temena* leaves and castor leaves heated over fire, followed by bandaging with the same.

6. *Kachowa Byadhi* **(Abscess) :**

Symptoms : Hard swelling on the breast or abdomen.

Medicines : 1.The juice of *jatarmala* plant is squeezed out and given internally with common salt, and fomented later with the refuse of a water body bank. 2. Apply externally a paste made of the following things is to be applied externally on the affected parts. They are :- barks of *chong plant, jatormola* plant, *baghnala* plant (*Martniya annua*), roof of papaya, lime soot and juice squeezed out of the plantain sheet (Bhattacharya , 1932:35).

7. ***Kanh* (Cough) :**

1.A powdered mixture is first prepared and administered internally – roots of castor plant, roots of *tita phul* (*Phlogacanthus thyrsiflorus*), roots of *akon* (*Calotropis gigantea*), roots of *ketwil* (*Cureuma zedoaria*), seeds of *toni* (*Trachyspermum ammi*), seeds of coriander (*Coriandrun sativum*), *hing (Qerula assafoetide*), *kaljeera* (*Nigella sativa*) and rock salt. 2. 7 leaves of *aakon* rolled in a green plantain leaf and roasted within blazing charcoal is given orally with salt. 3. A *bon-nohoru* (*Urginea indica*) is roasted and kept outside the house for one night. This is given to the horse the next day.

8. ***Kurkuria Byadhi* (Abnormal peristalsis) :**

Symptoms : Rumbling and rolling sounds emanating from the stomach, inability to eat and drink, the animal keeps the head lifted and remain standing.

Medicines : A mixture is made in the form of a paste, taking the following ingredients and administered internally:– *xaru-manimuni* (*Hydrocotyle rotundifolia*), *jaboiseri* (*Drimania cordata*), *bhot dubari, jabrang* (*Crocus sativus*), garlic, 5 slices of ginger, 5 varieties of salt. A drink of hot water should be given thereafter.

9. ***Kriyanala* :**

Medicines : A paste made of :- roots of young *khutara* (*Amaranthus spinosus*), roots of very young (2 leaved) castor plant, roots of *mathokthoka,* bark of *tezmui (Xanthoxylon hamiltonian*) and ginger is to be appied on the affected area.

10. ***Khura Ophora* (Decay of hoofs) :**

Symptoms : Hoofs often break away as they get brittle by a long journey, or from stumbling on rough ground.

Medicines : A fire is first lit on the ground and when the flames smolders, the ashes and remains of fuel is removed and the horse is made to stand on the hot earth untill the place becomes cold. This process is to be continued for three days. In addition, the hoofs must be massaged daily with *mahua* leaves.

11. ***Khurar Pok*** **(Maggot in hoofs):**

Symptoms : Sore and maggots in the hoof.

Medicines : The pus from the sore is first removed,cleaned and washed with tepid water. Then it is dried with a piece of clean, dry cloth. A paste made out of the top of the apices of bamboo sprouts and salt is then applied, which kills the maggots or makes them fall off the affected area.

12. ***Khorowa*** **(Limping or lameness) :**

Medicines : Some buffalo dung is boiled with salt, turmeric and water, then the hot paste is applied over the affected part, keeping the horse in the sun for about two hours.

13. ***Gagala Byadhi*** **(Urethrities) :**

Symptoms : Flat circular eruptions on the body, swelling of the uretha and the genital organ, with yellow and watery discharge from the latter in drops.

Medicines : A paste made of the following ingredients is to be applied externally and internally as well : Sheaths of *sonakachu* , plantain tree, stems of pumpkin creeper, bunches of straw with the help of which young silk worms are spread upon the tree, and the juice squeezed out of the sheath of plantain tree (Bhattacharya , 1932:35-39).

14. ***Garbha Byadhi*** **(Stomach ailments) :**

Symptoms: All sorts of bowel complaints.

Medicines : i.3 fowl eggs with 5 *tolas* of *magu mah* (*Phaseolus mung*) consisting of one dose is to be given internally. ii. A powder is first prepared out of :- seeds of 1 *jagannath-teeta* ½ *powa*, salt 1 *tola*, turmeric 2 *tolas*, *laiguti* ½ *powa*. This powder must be mixed with some paddy or pulses on which the horse feeds.

15. ***Gorbha Nasta Nohowa*** **(Prevention of abortion) :**

Medicines : A fly or bird found dead, and hanging in a cobweb is wrapped within a ripe plantain leaf and the mare is made to swallow it.

16. ***Garbha Hara*** **(bowel diseases and rumbling) :**

Symptoms : Bubbling sound of water in the stomach.

Medicines : i. A nest of *kotidanga pipra* (a kind of red ant), found on bamboo plants, is crushed with the hands, keeping it immersed in water. Some salt and the juice squeezed out of some *siju* leaves is added to that, and the mixture is given internally. ii. The following ingredients are mixed up in a mortar and given internally:- roots of *boch* (*Acorus culamus*), *barahak*, chilli, *nilkhantha*, *moran ada* (black ginger), salt and liquid *toda* made from ashes of plantain trees.

17. ***Gat Gha*** **(Sores or Scabies in the Body):**

Medicines : The affected area is rubbed or dusted with the ashes of the leaves of the *phurad* plant.

18. ***Gochaka*** **(Gingibities) :**

Symptoms : Formation of pill like balls under the skin, beneath the tongue.

Medicines : The affected parts are burnt with hot iron or fomented with fried salt.

19. ***Goboruwa Hagoni* (Diarrhoea) :**

Symptoms : Diarrhoea with loose stools, resembling cow dung.

Medicines :The juice of the following is taken out, mixed well and given internally after heating it over the fire in a bamboo pipe: Roots of *tianh jali phool*, *borahura, sonakachi phool*, and bark of *kathnanda* (*Ervatamia coronaria*) and *arjun* tree (*Arjuna terminalaria*).

20. ***Grahoni* (Dysentery):**

Internal administration of the following cures dysentery: 1. *Bahaka* (*Adhatoda vasika*), *nilkhantha*, seed of *bhesori*, (*Solanum indicum*), *singari* (*Trapa bispinosa*) and *moihali*, mixed up in a mortar and made into a paste. 2. Dry wood apple, *mutha, shatmul* (*Asparagus racemorus*) and roots of *malatiphool* (*Aganosma caryophyllata*), mixed up in a mortar, and made into a paste. 3. Powders of rind of pomegranate, *trifala* (*Embelica officinalis*, *Terminalia chefule*) and *trikatu* , mixed in equal quantities, and old *gur* added to it (Bhattacharya , 1932 : 39-41).

21. ***Ghora Ghurani Byadhi* :**

Symptoms : Frequently touches the shoulder & fore legs with its muzzle and moves in a circular motion.

Medicines : Some roasted sprouts of *malbhog* plantain tree is fed to the horse, and some of the paste made out of the same is applied to the crown of the head.

22. ***Ghora Tangan* (Lameness) :**

Symptoms : Lameness of one foot.

Medicines : The paste made of the following is given internally : 3 apices of *rattan* or cane (after the sheaths are removed), roots of *tezmuyi* (*Xanthoxylon lamiltonian*) and *doam chorat* (*Laportea cirnulata*), chilli and salt.

23. ***Ghora Salakha*** **(Anthrax) :**

Symptoms : Unsteadiness, panting and salivation.

Medicines : The paste of *Naga* spear tree is taken out ,where in *muga* silk is reared rubbing against some stone, and the same is administered internally.

24. ***Chaku Kona*** **(Blindness) :**

Medicines : The following is powdered, mixed up, and some of it is fed to the horse and some dusted into the affected eyes:- 1.Rock salt, *ganthion, chengeri tenga* (*Oxalis corniculata*) and nutmeg. 2. First, *laigotli* (seeds of *Brasica rugosa*), *chulemora mokora* (a kind of spider that dies on a touch) and chilli are separately charred over a fire. Then, these are crushed into a fine powder and putting the mixture into a tube, it is blown into the eyes.

25. ***Chakuraj*** **(Tremors) :**

Symptoms : Aversion from food and drink along with trembling of the body as if in terror of something.

Medicines : The afflicted horse is fed with nine leaves of *Naga pan* and nine long peppers, every alternate morning, followed by a hot drink.

26. ***Chaluka*** **:**

Symptoms : Aversion from food and drink and profuse running of the nose.

Medicines : The following is wrapped in a green plantain leaf, placed on a fire for some time then the contents are taken out and fed to the horse, adding a little salt to it: Leaves of *moa alu* (*Dioscorea aculeata*) and twigs of *nechkuri* (*Morus indica*), *moihoali* and *bhang* (Cannabis). 2. 7 *ramkolas* (a variety of banana), 7 *amalkhis* (*Emblica officinalis*), roots of *banjara* (wild citrus) and salt is together made into a paste and given internally.

27. ***Chikon Howa*** **or** ***Ga-howa*** **(Tonic for growth and strength) :**

1.One pot of *aajani* is buried in the ground in the stable, in such a manner that, 4 *anguls* (fingers) of the mouth of the pot remain above the ground, and the urine passed by the horse falls into the pot. The pot is kept in that position for a fortnight, then a handful of *ajani* from that pot is given to the horse every morning. 2.The animal is fed with -one *powa* (230 ml) of mustard oil one seer (.93 kg) of big size brinjal and some pulses. 3. A medicine is prepared with some ingredients mentioned below. The ingredients are threshed on a stone and boiled with some paddy adding some salt and fed to the horse in three doses in a day. These are:– *bachanitita*, apices of the cane burnt and leaned, roots of *tezmui* (*Xanthoxylon hamiltonian*), roots of *nangal bhanga*, roots of *gorokhchoi*, roots of *borulu* (a kind of long grass), *bhui komora* (*Ipomoea eniculata*), *goonraj naharu* (garlic), *bon noharu* (wild garlic), *piaj* (onion), *hogjani* (*Carum copticum*), *kaljira* (*Nigella sativa*), *dhania* (corriander), *ghoraoni* (*Pimpimella involurate*), *guamuri* (aniseed) and *jabrang* (*Crocus sativus*).

28. ***Cheroni*** **(Diarrhoea):**

Medicines : 7 leaves of jack tree is given with some cow's ghee and the stomach is fomented with the same. *Koliabora* rice, along with old molasses may also be given.

29. ***Johorbat*** **(Black quarter) :**

Symptoms : Perspiration, shivering, inability to eat, dry and slimy mouth, red eyes, cough, thirst, heavy breathing, rumbling of the stomach etc. Without prompt treatment, the animal may die within days.

Medicines : 1.The mixture of following materials must be administered orally:-pepper 100 gms, ginger 450 gms, mixed with powdered rice. 2. Pills of

one *tola* weight are made from a paste of the following materials and given orally every evening :– *kaljira* (450 gms), powdered *mogumah* (450 gms), borax (burnt 25 gms), opium (25 gms), seasame oil (350 ml), *lakshi* (12 gms), *bilakshi* (12 gms), *kuchila* (36 gms). 3. Roots of *keturi* (*Cureuma zedoaria*), bark of *jotormala*, soft inner parts of old pumpkin and molasses mixed and made into a paste is to be given internally. 4. The following is burnt into redness, and water is poured using these as a sieve, into a cup of bell metal and then the water is given for drinking. *Jati ghila* (*Entada scandens*), *makori ghila* (smaller variety), *shreephal, raghunarni kota*, rind of *athia kol* (a big variety of banana), flowery top of the peacock's tail and rind of a coconut. (Bhattacharya, 1932: 41-51).

30. ***Anda Joharbat*** **:**

Symptoms : Unsteadiness, constant neighing and shivering.

Medicines : A paste is made out of the following and given internally :- Roots of *deo-tora* (*Andropogon serratus*), sprouts of *bota* (reeds), *nal* (Aquatic reed-*Phragmites karka*) and *tara* (*Alpina allughas*), the core and white inner part of *makorighilla* and the rind of *xonaput.*

31. ***Ubhatibhonh Johorbat*** **:**

Symptoms : Swelling of the belly, grinding of teeth, foams oozing out from the mouth.

Medicine : The following is powdered, mixed and given orally -: old, used thatch, stones of mango seeds, jute leaves, leaves of *mahaneem*, leaves of *pachatiya* (*Vitex negundi*) and *moinaguri* rice.

32. ***Khora Johorbat*** **(Lameness of one foot) :**

Medicines : The paste of following is administered orally :- *bihlungi* (*Eupatorium ayapana*), *agara* (*Tribulus terestnis*), *bhot jhaluk* (a variety of pepper), roots of jack tree and *chengmora* (*Laria spinara*) and ashes of plantain.

33. ***Chowrangi Johorbat*** **(Stiffness) :**

Symptoms : Stiffness of all four legs and inability to stand.

Medicines : Rub well on the legs, the following, powdered and mixed - gun powder, bark or *ttezmuya*, *moran ada*, *bhot bengana* and the ashes of stem of *bahak*.

34. ***Jama Johorbat*** **:**

Medicines : The paste of following is given orally:- *poutita*, *chando tita*, *bhado tita*, *tharmul* and nine varieties of spices.

35. ***Dalima Johorbat:***

Symptoms : Stamping, perspiration, sweating, and yawning.

Medicines : A paste made out of the leaves of pomegranate, *jetuka* and *phutuka* (*Melastoma malabathricum*), turmeric and *kajal gouri* is to be given orally.

36. ***Xira Johorbat*** **:**

Symptoms : Stiffness of feet, occasional wagging of the tail, unwillingness to move, quick breathing and panting.

Medicines :The paste of following is given orally :- Ripe betel leaf, ginger, *bhedailata* (*Hadyotis scandens*) and knots of *dom deuka* (*Impatiens balsamina*).

37. ***Pania Johorbat*** **(weakness and salivation) :**

Symptoms : The animal continually lies down and there is marked watery discharge from the mouth.

Medicines :The paste of *xaru* (small) and *bor* (big) *manimuni* (*Centella asiatica*), *jabeiseri* (*Drymaria cordata*), *narasingha* (*Murraya koenigi*), *bhedailata*, roots of *agara*, salt and chilli is to be given orally.

38. ***Hihinia Johorbat*** **(Breathing Difficulties) :**

Symptoms : Shivering, drowsiness, drooping head and breathing difficulty.

Medicines :The barks of *harishankar, nilkantha, arkchand, tezmuya* and chilli is to be given orally.

39. ***Jakshma*** **(Tuberculosis) :**

Symptoms : Swelling and bleeding from different parts of the body.

Medicines : The diseases can then be kept at bay by plastering the affected parts with a thick layer of *gur* (jaggery) and then burning it by placing a piece of red hot iron over the place.

40. ***Jalimora*** **or** ***Konamora*** **:**

Symptoms : Drowsiness with ears and head dropped down.

Medicines :A paste made out of 100 leaves of *nag pan* and 225 grams of black pepper is to be administered orally.

41. ***Jalowa*** **(Tumour) :**

Symptoms : Tumour formation at the base of the knee.

Medicines : An incision is to be made over the affected parts and some gunpowder is rubbed onto it.The affected parts are plastered and bandaged with the paste of *dhatura* leaves, ghee and aesafoetida.

42. ***Jikira*** **:**

Symptoms : Passing pus with the urine.

Medicines : The paste of the following is to be given orally and also rubbed on the body – Five seeds *jika (Luffa acutangula)*, 5 seeds of *hathikorota (Momordica chorontia)* and 5 seeds of *dhatura.*

43. ***Pora Jikiri:***

Symptoms : Pain and burning sensation in the urethra, while passing urine.

Medicines : The paste of the following is to be given orally – roots of *satmul (*of *Asparagus wacemosus*), flower of water lily, lime juice, juice of pure sugarcane and ripe *athia kol* (a type of banana) with milk.

44. ***Jora Byadhi*** **(Fever) :**

Medicines :The horse must be kept inside a walled stable and a fire is lit up around it. When it perspires it should be wiped dry. A mixture of one seer (.9kg) of jaggery, 225 gms of *bhang* (canabis) and one radish is to be administered orally.

46. ***Totola Byadhi*** **(Bottle Jaw) :**

Symptoms : Salivation, heavy perspiration in the head region, swelling of the throat and pharynx.

Medicines :The paste made from the folowing is to be administered orally :- bark of *tezmuya,* tuber of wild arum, *moiha ali*, *jabarang* and salt. This is to be followed by a hot drink.

47. ***Taluk Byadhi*** **(Salivation) :**

Symptoms : Salivation and cessation of chewing grass (ruminating).

Medicines : Bark of *koroi* tree, bark of *songla* tree, one leaf of fan palm, chilli, brinjal and common salt, all is to be grinded, mixed and given orally (Bhattacharya , 1932:51-61).

48. ***Padanala*** **(Genital Haemorrhage) :**

Symptoms : Bleeding from the penis.

Medicines : The paste made of the following things is to be applied externally with oil :– rind of *athia kol*, spike of jackseeds and seed vessel of the lotus.

49. ***Panileng*** **(Asthma like disease) :**

Symptoms : Watery discharge from the mouth and nose.

Medicines : A paste made out of the following is to be given internally :- root of *tezmuya,* root or *nangalbhanga* and *punirgathi.*

50. ***Pithir Gha* (Back sore) :**

Medicines : Ghee is first applied on the sores and then it is dusted with the ashes of earth worms.

52. ***Poak Mara* and *Gha Sukuwa* (Healing of sore on the body and destruction of Maggots):**

Medicines :The sore is dusted with *mashur mah* powder (*Lens culinaris*).

53. ***Phandonia Byadhi:***

Symptoms : Swelling of the scrotum.

Medicines : A paste made of the twigs of the following plants is to be applied externally :- *raghumala (Loranthus longiflorus*), ashes of the nest of red wasps, saltpeter and secretion of snail (snail water).

54. ***Bar Rog* (Abscess) :**

Symptoms : Sores like fig in the body.

Medicines : *Sukan khar* (alkali powder) -1 *tola, hingul*-1 *tola, khair (catechu)*-1 *tola,* borax -1 powder is taken and mixed with ginger juice. Small pills, the size of black pepper, are prepared with this paste and one pill is given orally every morning and evening for a few days.

55. ***Bat - Chowrongi* (Foot ache) :**

Symptoms : Lameness of all the four feet.

Medicines :Same as *Tangana byadhi.*

56. ***Jinjinia Bat :***

Symptoms : Swelling of the pasterns and dragging of the feet for a few steps while walking.

Medicines : 1. A paste is prepared out of the following ingredients and

given orally :- stems of *jaluk* (*Piper ourantiacum*) stem and leaf of lemon grass, *harghunucha* and roots of *gooti mali (Jasminum sumtar)*. 2. The affected joints are bandaged with a paste made of the following - Cotton seeds, core of rotten plantain plant and chaff of paddy. 3. Split *matimah* (black pulse) with all the spices and ashes of plantain is cooked and fed to the suffering horse.

57. ***Jutee Bat*** **(Morning lameness) :**

Symptoms : Lameness which increases in morning.

Medicines :A paste made of :- roots of *nangal bhanga* and *iharmul*, apices of cane, roots of *tezmuya*, chilli and salt is to be given internally.

58. ***Bhori Bat*** **(Rheumatism of foot) :**

Medicines : First the juice of ginger, leaf of *dhatura*, leaf of *aakon* and leaf of *pachatiya* is to be squeezed out separately. Half a *powa* of each type is taken and mixed with one *tola* powder of unripe dry mango fruit. This preparation is to be rubbed on the affected part and in addition, some amount is to be fed with some paddy or pulses.

59. ***Bishali*** **(Emaciation) :**

Symptoms : Gradual thinning down of the body accompanied with aversion to food and drink.

Medicines :The juice of *bhedailata (Hadiotis scandens)* with all spices, is to be given internally.

60. ***Byadhi*** **(Boils) :**

Medicines : A paste made from the following is to be given internally :- *sond pariya, khajur* (date palm), pea, roots of *bonmula (Aglaia roxburghiang)*.

61. ***Bhokola*** **or** ***Bhekola*** **(Laringitis) :**

Medicines : A paste of the following is prepared and administered internally :-

1. Leaf of *jalukoti* (*Piper aurantiacum*), *moran ada* (a vanity of ginger), thorns of *simolu* (silk cotton tree) and *mondar* (three of each in number), *jabrang*, chilli and *khohua thekuli* (toad), which is burnt and powdered.2. Twigs of *ghumoru, tejmaya, chona* chilli and ashes of plantain tree.

62. ***Kakooiya Bhokola :***

Medicines : A paste made the following is to be given orally : 1. Bark of *tezmuya, jabrang*, onion and garlic. 2. Ashes of rind of ripe *athia kol*, bunch of coconut, spike of the jack fruit, sheath of *bhaluka* bamboo and *khohua bhekuli* (toad).

63. ***Kooya Bhekola*** **(Foetid smell) :**

Symptom : Emission of an offensive smell during rumination.

Medicines : 1. The following ingredients are boiled in mustard oil until they are churned and the oil is applied with a bunch of *dubari* grass in the mouth and some amount of this oil is also administered internally. Bark of *arjuna* tree, dead and dry barks of *ou* tree, *chinajok* (leech), bone of *kanua* (hawk), dead spider and black pepper (7 in number). 2. 7 nests of *gagini* (mantis) and 8 black pepper are given internally.

64. ***Goria Bhokola*** **:**

General symptoms : Foaming from the mouth and constant grinding of the teeth.

Medicines : A paste made of onion, garlic, *nilkantha* (bitter creeper), and *harishankar* is put in the stomach of a *goroi* (*Channa punctatus*) fish. This fish is roasted, the bones removed and fed to the horse , with some salt.

65. ***Jima Bhokola:***

General Symptoms : Drowsiness and aversion to food and drink.

Medicines : A paste made of the bark of *harishankar,* ripe betel leaves and knots of *domdeuka* (*Inpotiens balsamina*), is to be given internally.

66. ***Thoriha* or *Ha Bhokola* :**

General symptoms : Inability to open the mouth or to eat.

Medicines : The following type of pastes, prepared with the given combinations are to be given internally:- 1. Root of *agaru* (*Agolocha*), *moj* (*Albizzia lucida*), leaves of tobacco and salt petre. 2. Barks of *jalukati* (*Pepper auranticum*), *tezmuya (Xanthoxylon hamiltonian), nangalbhanga, gunraj* and onion. 3. The body is rubbed with the ashes of dry cow dung, stem of *puroi* and dust of *ghum* (wood bored).

67. ***Dingiria Bhokola:***

Symptoms : Swelling of the stomach and inability to eat and drink.

Medicines : Internal administration of ;- *moran ada, am ada, kajal gouri* and turmeric is prescribed.

68. ***Dhoka Bhokola :***

General Symptoms : Swelling of the stomach and inability to eat and drink.

Medicine: The paste of *nangal bhanga, tejmaya, bonjora chengamora,* gurney, garlic and onion is to be given orally.

69. ***Dud Bhokola* :**

General Symptoms : Heat from the mouth of young ones and inability to suck milk.

Medicine : A paste prepared out of soft twigs of *ghimaru* and ashes of the stone of hog plum and hair of man is to be administered internally.

70. ***Poronia Bhokola* :**

General Symptoms : Dryness of the tongue with eruption and burning sensation at the tip of the tongue.

Medicine : Six *tolas* of ghee (milk fat) is washed with water (100 times), mixed with some vermillion powder made of dry core of bottlegourd and its flower and is given internally.

71. ***Xukhuna Bhokola*** **:**

General Symptoms : Cough and wasting of body continously.

Medicine : A leaf of *kanni*, *bon nohoru*, twigs of *jengtiyah* and *aharua champa* is wrapped in some green leaves, roasted, mixed with some salt and given internally.

72. ***Hihiniya Bhokola*** **(Asthma) :**

Medicine : 1. First, a paste prepared out of - *tezmaya*, *bonjora*, *silikha*, bark and seeds of *hogplum*, *chando bhado* and 5 tolas of salt-petre, is fed to the horse. Following this, a cold massage is given to the suffering horse with the paste of - the bark and root of *odal* and pomegranate. 2. A paste prepared out of - *laiguti*, jute seeds, chilli and the apices of the tube of black arum is given internally. iii. The following are to be collected separately and given internally with some salt :– Bark of *tezmaya*, chilli, *jabrang*, *laiguti*, jute seed, dry brinjal used for pelting the cattle in *bihu*, *chenga mora*, green jack fruit, *sula corriander* seed, *kaljeera* (black luminin), onion and garlic.

73. ***Marishra*** **(skin disease) :**

General Symptoms : Boils and pimples with itching and falling of hair.

Medicine : Half a seer of poppy seeds is to put in an earthen pot. The mouth of the pot is to be shut tightly and placed on a fire until the seed gets charred. The charred seeds are powdered and the affected parts are dusted with this powder. This is followed by covering the area with mud. The mud is then washed off when it dries, and this procedure is continued for at least three days. (Bhattacharya, 1932:79).

74. ***Mamroshi* or *Mamorohi* (Eruption of skin) :**

General Symptoms : Itching, fall of hair, eruption of skin like-dust on rubbing.

Medicine : 1. The body of the horse is washed after rubbing it with mixed-ashes of *ghoralejia*, ashes of *patidaiya* (a kind of cane like plant) and fresh mustard cake. 2. The affected parts are dusted with the mixed ashes of *kehraj*, *hansraj, bhimraj* and *batraj* after rubbing the body with mustard cake and finally cleaned. 3. The whole body is rubbed with mustard cake, washed and then rubbed with the ashes of *athia kol* (a variety of large sized banana), mixed with home castor oil. 4. The following ingredients are administered internally after having boiled them together in water:- stem of long pepper, *gorokhachoi*, *moran ada*, garlic, onion, *jabrang*, split *matimah* (½ seer), a handful of long pepper, a handful of black pepper and a handful of salt.

77. ***Mou bichaniya* :**

General Symptoms : Swelling of scrotum.

Medicines : *Matipuruha*, spike of the jack-fruit, and honeycomb, burnt and powdered, is mixed with gun powder and a paste is prepared with water. The scrotum of the animal is then rubbed with the paste and washed.

78. ***Rakta Xar* :**

Symptoms : Bleeding from the anus.

Medicine : Roasted twigs of *moihaal* and leaves of old *bhang* (cannabis) is to be given internally with salt.

79. ***Ros bhor Byadhi* :**

Symptoms : Swelling in patches in the body.

Medicine : The horse is fed with a paste made out of the sprouts of *bhaluka* bamboo and sprouts of *nal*, with salt.

80. ***Roh phuta* (Pimples):**

Symptoms : Scattered pimples all over the body.

Medicines : 1. The body is rubbed with ;- one *tola* of lime and one *tola* of

mustard oil boiled together. 2. *Siaatrup ½ powa,* black pepper 1 *powa* and salt ½ seer is boiled in mustard oil and the same is fed to the horse with pulses. 3. Internal administration of a mixture of :- rice powder -one *powa*, turmeric -½ *powa, soots* - ½ *powa* and *gur* (jaggery) - ½ *powa* is prescribed in this condition.

81. ***Rajpira*** **:**

Symptoms : Eruption of pimples in circular patches over the body.

Medicines : The paste of the following is to be applied externally :- Bark and leaf of *bon av, bon puroi, kukursuta* and *soru barial* and twig of *bon kopahee.*

82. ***Sinduria Rajpira :***

Symptoms : Eruption in patches of red pimples all over the body from head to hoof.

Medicines : 1.A paste, prepared out of - *panipotoni, kothoreea*, flower of *domdeuka*, soft twigs of *jabeseri*, salt petre and vermillion is to be applied externally. 2. A paste made of old *silikha*, old *amlakhi*, stone of mango and bark of *chagol tita* is to be applied externally.

83. ***Solila Rog*** **:**

Symptoms : Itching and falling of hairs from legs.

Medicine : A mixture of juice squeezed out of *jetuka*, sugarcane, turmeric and mustard oil is applied externally on the legs.

85. ***Silpot Byadhi*** **:**

Symptoms : Swelling at the base of the penis.

Medicines : A paste of *silikha,* stone of mango fruit, red sandal wood, white sandal wood, *nagaru, tejmaya*, red mushroom and bay leaf is applied as a plaster over the affected parts.

86. ***Sarba rog nash*** **(Tonic for good health and cure of all diseases) :**

The following medicines should be administered internally:- 1.One pot of milk (about four *seers*), one pot of jaggery (about 4 *seers*), and one pot of powdered *bhang* (cannabis), all boiled together is administered in equal doses for 21 days. 2. One *barali* fish (*Wallago attu*) boiled and cleaned of all the

bones and mixed with one *powa* of mustard oil, is to be given daily. 3. *Nagapan* (9 leaves) and chilli powder (2 *tolas*), to be administered daily for a month. 4. One fowl cooked or boiled with some paddy and pulses with all the spices, to be given daily, for 21 days. 5. Seed of *makot* (1/2 *powa*), chilli (1/2 *powa*), salt (5 *tolas*) and *lonka* (2 *tolas*) is to be made into a paste and given internally each day. 6. The following is put in an earthen pot, the mouth tightly shut and kept buried in a heap of paddy for eight days. Then, it is taken out and eight *tolas* of its content is to be given daily to the horse :- Long pepper (4 *tolas*), *chitta* (4 *tolas*), corriander seed (4 *tolas*), *tani* (4 *tolas*), *banjoni* (4*tolas*), turmeric (4 *tolas*), *gokhur kanta* (4 *tolas*), jaggery (4 *tolas*), sugar (2 *tolas*), asafoetida (2 *tolas),* Bhutan salt (4 *tolas*), *ujonia* salt (4 *tolas*), common salt (4 *tolas*) (Bhattacharya,,1932: 75-90).

II. 4. ELEPHANT LORE OF ASSAM :

Elephant capturing, a very old practice in Assam, was not merely a past time but was intended for enhancing the prosperity and strength of the rulers and their kingdom as well as for ivory crafts industry, a fine art of Assam displaying excellent craftsmanship, which had evolved from the ancient times (Choudhury, 1959: 350).

Chinese pilgrim, Yuan Chwang, mentioned in his travelogue about the elephant-keeping by the early rulers of Assam. Indian literary evidences, including the Epics, the *Arthasastra* from Kautilya and the *Raghvangsa* of Kalidasa makes mention of large number of elephants kept by the early rulers of Assam. The Muslim historian, Shihabuddin Talish, who accompanied Mir Jhumla in his invasion of Assam during the middle of the seventh century A.D., makes mention of the large number of elephants, abounding in the hilly regions and forests of Assam. He praised the cleverness of the riders and the elephant capturers.(Rajguru, 1988: 378)

As the early rulers and the Ahom kings of Assam kept large number of elephants for defence purpose, a traditional science for taking care of these animals developed. The traditional knowledge of taking care of elephants was documented in the form of a manuscript during the reign of Swargadeo Siva Simha under the direct care of the king Shiva Sinha and his wife Ambika Devi. This manuscript is known as *Hastividyarnava* (Choudhury, 1976: 12).

Hastividyarnava is a valuable manuscript on elephant lore, which contains a large number of coloured illustrative paintings. It is not only an invaluable treatise on elephants, containing a mass of information on the various categories of elephants, their modes of training and care of their ailments and treatment, it also contained the modes of constructing their stables and making their ropes.

The original manuscript of *Hastividyarnava* contained 193 folios. The manuscript deals with the types of elephants and treatments of their ailments. It was as known from the colophon, composed in *Saka* 1656 (A.D. 1734), under the orders of the Ahom king Shiva Sinha and his queen Ambika Devi.

The text makes mention of the composition of an earlier work on the subject by the Sambhunatha. It is not unlikely that Sambhunatha was from the ancient land of Kamrupa. *Hastividyarnava* was written by some Barkath, about whose life nothing is definitely known. Some scholars believed that this treatise was originally compiled in Tai Ahom language, maybe without picture of the elephants. The treatise was recomposed by Sukumar Borkath under the orders of Ahom king Shiva Sinha and his queen Ambika Devi, with materials drawn from *Gajendra Chintamoni.*

The most important part of the treatise is its paintings done by Dilwar and Desai whose identity is not definitely known, though it is presumed that they

were Muslim painters, either invited by Shiva Sinha for the purpose or already settled in this land. The materials used for paintings included- besides black ink, prepared from *xilikha* (*Terminallia citrata*), bull's urine, indigo, yellow ochre, vermilion (*hengul*), green and lamp black (Choudhury, 1976: 22).

II. 4. 1. Ethological Classification and Taming of Elephant:

It is mentioned in *Hastividyarnava* that Vyasa classified elephants into eight varieties. The classification of elephants in *Hastividyarnava* is as per Vyasa's classification. However there is mention of 14 varieties of elephants in this treatise. Probably these classes are made by the elephant catchers and tamers of Assam . The following are the salient features and procedure of taming of various classes of elephants as mentioned in the *Hastividyarnava*.

1. ***Supratika*** **:** Both the tusks are strong and of the same size and painted red, the fore legs are equal in size and bulky, the tail long and straight, complexion dusk fine and spotted, red eyes, and whitish nail. It is believed that this type of elephants love to be surrounded by a large number of female elephants and that it can be owned only by the most fortunate. It is a difficult task to tame this elephant.

2. ***Airavata*** **:** The height is seven cubits, skin colour -white, all four legs are of equal size, the head is bulky and raised upward, ears are spotted and nails are strong, wheatish in tinge but a bit of it is painted red, eyes are reddish, the neck, which is slightly hunched remain drenched with large quantity of rutted water. This type of elephant moves about gracefully and is usually surrounded by a large number of females. The training of this elephant was also not easy.

3. ***Pundarika*** **:** The two tusks are of equal size and painted red, complexion of the body is white like camphor, the four legs are also equal in size, the tail is long and straight, the height being seven cubits, head is somewhat plump and raised upwards, ears are strong and spotted, the trunk is long and tapering towards the end, nails are a bit white, neck is plump and strong, the back is a bit

hunched, neither too short nor to long, neck region remains drenched with large quantity of rutting water. This elephant also loves to be surrounded by large number of females. It, too, cannot be trained easily and is done so with the help of *mantras*.

4. ***Vamana*** **:** It measures only five cubit in height, the tusks are equal in size and painted red, the body is narrower towards the end, it is speedy in motion, the head remains raised, nails are spotted, the tail is long and strong and it is capable of hard labour. It can be tamed with proper instruction.

5. ***Kumuda*** **:** It measures six cubits in height, dark in complexion, possesses long tusks, and blackish nails. Being very strong it does not care for anybody and can be tamed only with furious threats.

6. ***Anjana*** **:** These type of elephants possess fine black coloured, bulky bodies, long tusks which are equal in size, painted red towards the end and the tails is a bit darker in colour. When such elephants are procured, the king's wealth is believed to increased. They can be trained by feeding them with the best kind of fodder.

7. ***Puspadanta*** **:** These elephants which measure six cubits in height, moves with great speed and possess strong tusks which are equal in size, short and whitish in colour and with white eyes with a slight reddish tinge and spotted trunks and nails. They can be tamed by threatening with spears.

8. ***Sarvabhauma*** **:** The tusks are equal in size and slightly reddish. All the four legs are equal in size, the tails are bulky, and the complexion of the body is a fine dark. They measure seven cubits in height, with their heads raised, spotted ears, long trunks, tapering towards the end and fleshy necks which remain drenched with a large quantity of rutting water. They too love to be surrounded by females and cannot be easily tamed.

II. 4. 2. Other Varieties of Elephants : Apart from the above classification, the male elephants are again classified on the basis of the characters they possess,

as follows:

1. *Satabanchi* : They are with blue complexion, big sized heads, copper coloured ears, spotted neck, big eyes and long tails, touching the palms. The flanks of the legs are small, broad and the nails are long. If the calves of such nature is caught in the forest, their treatment is as follows-A medicinal preparation of buffalo ghee, *yastimadhu*, juice of *aathia* variety of plantain and lemon is to be fed, so as to correct their wild nature. They are to be fed with *laijabori*, leaves of sesame, opium, a kind of water lily, bull's urine, mixed in equal quantity with *bara* variety of rice. This make the calf healthy and cures it from all diseases. Thereafter, it is considered for training.

2. *Pramada* : They possess big tusks, small trunks, raised heads, narrow necks, small ears and reddish coloured eyes and with a hunched back. Body complexion is of grass colour.The captured calves are to be fed with rice, black turmeric and *moran ada* (a kind of ginger). They are to be bathed thrice a day and the body is to be rubbed with mustard oil everyday.

3. *Nagendra* : They have narrow heads, long tusks, bulging eyes, narrow trunk, short tail and bulky body, with blue complexion. It is very difficult to train up the young elephants of this kind. Before training, they are to be fed with a particular medicinal preparation for atleast 16 days. The medicinal preparation to be fed to this elephant are - *Moran ada* (a variety of ginger), roots of *amara*, *bel*(wood apple), *amlakhi,* sugarcane, cucumber, *atangi*, *yamlakhuti* and *tara* plant. These medicinal plants are to be grinded and their juices are to be mixed with honey and rice. After this medicinal preperation, the wild nature of the elephant is brought under control.

4. *Meghnada* :The body complexion of this breed of elephant is red, with a long trunk, big head and ears, eyes with white stripes, spotted tusks, long body,

At birth- 1 cubit (c)12 fingers (f),	Full grown - 7 c - 2 f ;	**2 nd year** - 2 c -2 f,
3rd year- 6 c - 2 f ,	**4th year**- 7c-2f,	**5th year**- 2 c- 14 f,
6th year-2c-18f,	**7th year**-2c-19f,	**8th year**-3c-2f,
9th year-3c-6f,	**10th year** -3c-10f,	**11th year**-3c-14f,
12th year-3c-18f,	**13th year**-3c-22f,	**15th year**-4c-2f,
18th year-4c-10f,	**20th year**-4c-22f,	**23rd year**-5c -1f,
25th year-5c-14f,	**26th year**-5c-22f,	**27th year**-6c-2f,
28th year-6c-6f,	**29th year**-6c-10f,	**30th year**-6c-14f,
31st year-6c-18f,	**32nd year**-6c-22f,	**33rd year**-7c-2f .

big legs, broad palm and the roots (hoof) of the nails are depressed. The calves of these elephants if captured, are not to be led out for walking, but to be kept separately in a stable. It is not to be fed with hard grass and is to be bathed in the stable itself. It should be brought out of the stable only after 15 days or a month has elapsed. It is to be noted that this variety is not to be allowed to walk alone with bigger elephants, instead it is to be made to walk along with smaller female elephants. It is to be fed with *sandhyava* everyday and during mid-day it is to be fed with fermented rice, mixed with salt, along with plantain leaves.

5. *Namchuk* : The *Namchuk* variety of elephants has a clear, fine complexion, depressed head black ears, long eyes, smaller tusks, long legs and a short tail. The medicinal preparation it is to be fed with, consists of ghee, honey, *varuni*, *athia* plantain (a type with bigger sized fruits) and sugar mixed with boiled paddy. Tender grass mixed with the ingredients is also to be fed. It is to be bathed thrice a day. This variety of elephant cannot be tamed easily. It attacks people and even kills them. To get rid of the violent nature of this elephant, a medicine is used, which consists of *dimaru*, burnt up sugarcane, lemon and starch mixed with *manibhadra*.

6. *Daichai*: This variety of elephant has a spade shaped head, red coloured trunk, red tusks, striped neck, and a flat and long body. It should be fed with red water of boiled paddy. During war time, it should not be fed with chillies. It is to be fed with the reddish water in which winter paddy is boiled everyday.

7. *Kunjarata* : The elephant of this variety is characterised by a pointed head, long and graceful trunk, a comparatively smaller body, legs strongly built and a short tail. The wild calf of this variety of elephant when caught from jungles are to be treated with a medicinal preparation made of *yamlakhuti,* roots

of *patidi* and *amlakhi*. After feeding the preparation, it looses its wild nature. For this purpose, this animal may be fed with boiled *ahu* paddy or rice mixed with milk.

8. *Bhadra* :The complexion of this elephant is honey coloured. The back-bone of the elephant is bent like a bow -the flanks being like those of a boar. It measures 7 cubits in height, 9 cubits in length and 10 cubits in girth. Colour of the rutting water is yellow.

9. *Uttama* : This elephant is considered to be of the best variety. The colour of its lip, palate and the face is like cooper. Eyes are like that of a sparrow, and the tusks are broad. The shape of the body is bent like that of a bow, and the back is broad. Ears, naval cheekbone, forehead and trunk are also broad. It has stripes on the tails. The rutting water that flows through its trunk spreads odour.

10. *Mriga* : This variety of elephant is characterised by short lower lips, tail, genital organ, nails, neck, trunk and ear. The eyes are big. It measures 6 cubits in height, 7 cubits in length and 8 cubits in girth. The colour of the rutting water is black.

11. *Manda* : It has shrunken skin like bangles over the portion of the heart and the buttocks, big belly, thick skin, big neck, the joints of the front legs being like those of the necks of the peacocks, big in size and yellowish in colour, who gazes like lion, measures 6 cubits in height, 8 cubits in length and 9 cubits in girth. The colour of the rutting water of this elephant is like that of the feather of a green pigeon.

12. *Misra* : This type of elephant is with combined features of elephants called *Bhadra, Manda* and *Mriga*. It has irregular height, length and girth.

13. *Khanaka* : It has a big head, a long trunk and tusks, the colour of the eyes being like that of turmeric, the colour of the ears copper like, the back

portion depressed, the colour of the body golden, with long tail, big legs, broad palm, big eyes, and they are capable of great speed and get angered very quickly. Such an elephant is hard to procure. If a baby elephant of this nature be caught, it should be fed with tender grass and milk boiled with *sali* paddy and mixed with *malbhog* plantain. Thereafter, it should be given to drink cold water. If a young elephant of this type be caught, it should be fed with tender sprouts of reeds and *jaha*-rice boiled in equal quantity of milk and water, mixed with *madhuvaruni*, when the mixture becomes cool. It should not be brought out from the stable even after a few days of capturing has elapsed. When it is a little tamed, it should be led out in the midst of other elephants and its hairs should be *sharon*, on knowing its nature it should be trained up in various ways.

14. ***Nampit*** : It has uneven back with a hunch, a smooth tail, well built legs, with the nails depressed, the palms spotted and black in colour, the trunk tapering, the tusks long, the body striped with a colour of conch shell. Such a variety of elephant is available everywhere.

If an wild one of this elephant is caught, it should be led out in company of other elephants both in front and back side for its protection. The medicinal preparation that is to be given, consists of *chengeri*, *nilkantha*, hemp and the juice of sugarcane mixed with *jaha* rice. After feeding the elephant with this medicine, its wild nature is brought under control. If a baby elephant of this variety is caught, it is to be fed with a preparation of *malbhog* rice boiled in milk mixed with *marirai* plantain, thereafter, it should be given to drink water of *kuji thekera*, mixed with salt. The rider should not leave the company of such an elephant. He should rub mustard oil on its body everyday and the elephant should be bathed in hot water for 4 days. Then it should be fed with *xoleng* (a sour taste green vegetable), *dadhi kachu* (a kind of *colocacia*) and *rangana*. In doing so, its wild nature is reduced.

II. 4. 3. Measurement of elephants according to age :

Healthy calf of a normal elephant attains the following height at different ages : The elephants attain their middle age in the 30th year, measuring between 5-7 cubits in height. The tusks of an elephant are to be pruned at the intervals of 5 years and nails be cut on becoming long. The place where the elephants sleep is to be strewn over with the ashes of dried cow dung. The elephants are said to grow handsome if they are besmeared in *Magha* and *Falguna* and with *ghee* in the months of *Jetha* and *Ahara*. If their tusks get loosened, they are to be fed with the pounded rice of *sali* paddy for best results (Choudhury, 1976: 198) .

II. 4. 4. Medicine for treatment of various diseases of elephants :

1. Fever : If the elephant suffers from fever they should be fed with the juice of *hati tengechi,* boiled and mixed with lemon juice.

2. Eye-Diseases : An elephant, suffering from eye-disease, due to exposure in the sun and dust entering the eyes, is to be treated by applying daily little amount of juice of lemon and turmeric. An elephant, suffering from eye-disease like eyes becoming reddish coloured and tears rolling down, should be treated by applying honey and *thekera* soaked water mixed with salt on the eyes. An elephant, suffering from the diseases of eye-sight due to which it cannot move about, should be treated by applying on the eyes, the juice of tender mangoes in the morning. An elephant, suffering from the disease causing falling eye lashes, due to which it cannot open its eyes, should be treated by applying red sandal wood paste, mixed with the juice of *chajina* (drum stick)on the eyes.

Other medicinal preparation for disease of eyes consists of the juice of *marvarati tenga, koadal, tolotha*, tender leaves of *kani* rice (a kind of paddy) and black *tulsi* leaves along with honey, mixed with goat's milk.

3. ***Petar rog*** (Gastritis) :An elephant that moves in the sun, takes hot water and eats earth, suffers from gastritis, caused by indigestion and should be treated with *bhumyangha*, hemp, lemon, *gathian*, *jaipatri*, *doapaga* and *yavaksara.* Another preparation to be fed with consists of *saguri* creeper, *gunaraja,* turmeric and since, mixed with liquor. This preparation is efficacious also for gout.

4. ***Bih*** (Gout) :The medicinal preparation for the gout of an elephant, as prescribed by Ramananda Vairagi, consists of the following ingredients:- pounded wheat, and a head of serpent (cobra), along with the blood from its body and skin, is boiled in a pot. When the ingredients become cool in the morning, the preparation is to be fed in the proportion of two *tolas* to a big elephant. The disease (gout) gets cured, if an elephant is fed with - *moran* ginger and roots of *chorat* plant, mixed with lemon-juice. It gets cured also by the application of the preparation of black turmeric, black cow's dung, roots of *xiju* plant on the pelvic region.

5 . ***Grahani*** (Diarrhoea) **:** The elephants, suffering from diarrhoea due to eating of earth, may be cured if they are fed with paste made of the roots of *babaca,* roots of *koabhautri*, roots of *amara* and *kanji,* barks of mango tree and black pepper . The animals may be cured of diarrhoea, if they are fed with the following preparations:- *Son bariyal, mosandari*, *kukur-suta*, two kinds of *manimuni* –(big and small), hemp, *dhatura*, cotton seeds, ginger and salt;

6. ***Krimi*** **(** worms **) :** The worms are killed, if the elephants are fed with - (1) seeds of *palasa* tree and black turmeric, both pounded and mixed with *ghee*, (2) *gorakhachan*, *dhuna*, *maja*, powder of leaves of *bihalangi*, roots of black pepper, *ulu* and *tejmui,* latex of *xiju* plant, salt, black pepper and burnt up snails. The animals are relieved of the worms, if they are fed for 21 days with

chirata, puni, acu wood, seeds of *palasa, neem, yani, parolalat,i mutha, bach,* black pepper, long pepper, and ginger, all pounded and mixed with *ghee* or *kanji* (lemon). The worms get killed if they are fed with black turmeric, roots of *bhetai-tita, dighlati, tita-jara* and roots of *ulu* and the seeds of *kaya* grass, all pounded and the paste mixed with the juice of *moa*-potato .

7. ***Abhok*** (loss of appetite) **:** An elephant regains the loss of appetite, if it is fed with (1)- *yavaksara, ahara-vindhi*, barks of *karanja* (a kind of sour fruit), seeds of *biranga, achari-champa,* dried *mula, keturi, acu*-wood, *dhuna, mutha, bach, amalakhi*, powder of roots of *teteli*, *kecheru* and *pipali* (long pepper), all grinded, mixed with juice of *soleng* and *kanji* ; (2)- black pepper, *pipali*, ginger, garlic, onion, coriander, sulpha, *yani, mutha, cita, yavaksara* and salt, all mixed up in equal preparation, adding oil to the preparation, for seven days. (3)- the bitter leaves of *mara,* garlic, onion, mixed with rice water, all pounded along with white and black *cumin* and ginger; (4)- white pulses, boiled in water with rice, mixed with black pepper, long pepper and dried ginger.

8. ***Pet ukhaha*** (Flatulence) **:** An elephant enjoys relief from flatulence, if it is fed with the bark each of *sonaru* and *neem*, along with the bile of python, tortoise, a frog and the roots each of *bhat-dimaru*, *ghukuscumoi*, *chatiyana* plant, *gunaraj* and of *suryakanti*, all dried and grinded, mixed with *ahu* rice and grass.

9. Constipation : An elephant passes its excreta, if it be fed with the roots each of *bagh-anchora* and *ghukuscumoi*, grinded and mixed with the juice of a *jamira* and of pomegranate, *moran*-ginger and black pepper, mixed with grass.

10. Choleric Diarrhoea : An elephant suffering from choleric diarrhoea is cured of the disease, -if it is fed with tender *bel* fruit (wood apple), the bark

of *lodhra* and *amalakhi*, powdered and mixed with sugar ; if fed with dry marrow of *bel, bariyal*, pomegranate, *jamu, lodhra*, coriander, *mutha, akana, sunthi, kurala* and *amalakhi,* all powdered and mixed with the juice of *amalakhi*, the contents being boiled, or simply fed with the said juice .

11. Jaundice : An elephant suffering from jaundice is to be treated with the medicines prepared with the following - Turmeric of both kinds (*haladhi* and *daru haridra*), mixed with cow's urine, castor oil being added to it with rock salt. If an elephant is fed with this medicine jaundice is cured.

The other medicine is prepared with *xilihika, amalakhi, bhomora*, ginger, long pepper, black pepper, rock salt mixed in equal proportion and fed with honey.

12. Heart Disease : An elephant suffering from heart disease, constipation and stomach pain may be cured if fed with medicines prepared with 1. *dhuna, sunthi*, long pepper, black pepper, *agiacita, akona, dandi mula* and juice of *somlata* mixed with little wine., 2. bark of *arjuna* tree, *jamu* and mango.

13. Diseases of Sex organs : An elephants suffering from sex diseases may be fed with the medicines prepared with the following ingredients, continuously for 21 days :- rinds of pomegranate fruit, turmeric, *achukath*, date palm , coconut, *bhang*, long pepper, *yani*, dried ginger, seeds of *gamari*, roots of *chirata*, coriander seeds, *neem , tita bhekuri, xilikha, amalakhi, bhomoraa* and *barial*..

14. Medicines for Rutting, Itches and Other Skin Diseases : An elephant suffering from frequent rutting , itches on the skin and other skin diseases are treated with medicines prepared with the following ingredients :- roots of castor oil, *kusa, kanhua*, reeds, *satamula*, sugarcane, gourd, *dimaru,*

amalakhi, cucumber, *manimuni* and *achukath* ; grinded and mixed together in equal amounts and fed to the elephant.

15. Flowing of Pus from Vital Parts of the Body : Sometimes pus comes out from some vital parts of the elephant body . In such disease medicines prepared with the following ingredients may be fed to the diseased elephant :- 1. Rock salt and common salt grinded together and fed with lemon juice. 2. Juice of ginger , long pepper, grapes, sugar, milk, gravy of goat's meat, all mixed in equal proportion and made into paste.

16. Blood Vomiting and Passing of Blood with Urine : Elephant suffering from the above disease may be fed with medicines prepared with the following ingredients : Juice of ginger , long pepper, grapes, sugar, milk, gravy of goat's meat, all mixed in equal proportion and made into paste.

17. Profuse Rutting and Restlessness : Elephant with profuse rutting and restlessness may be fed with the medicines prepared with the following ingre dients continuously for seven days in the morning : 1. Bark of *keturi*, gourd, cucumber, *silikha, amalakhi, bhomora, thekera, simalu, satamula, guduchi*, tender leaves of *bhomora, pani khutara* ; all pounded mixed together and boiled . ii. Rutted elephants can be cooled down when fed with the medicines prepared with the following ingredients :- Turmeric, *oil, bariyal*, rock salt, sugarcane, *mutha, achari champa*, white pulses mixed with hemp , pounded and made into a paste with *ghee*.

18. Medicines for Cooling the Temperament of a Newly Caught Elephant : Newly caught elephants are highly irritable and extremely energetic . For taming of such animals some medicines are to be used . The medicines prepared with the following ingredients may be fed : Bark of *amara*,

mango, *jamu* tree, orchid, *chengmora*, *sonaru* , *puni* and *kalmau* made into a paste. This medicinal paste is mixed with starch, or molasses, boiled and later mixed with salt and fried in oil before being fed.

19. Medicines for swelling : The swelling in an elephant is cured by applying -dung or urine of a black cow, *ghee*, salt and oil on its affected parts. The disease caused by gout gets cured, if the affected parts of an elephant are treated by applying thereon *jetuka*, *dura-lata*, earth from seven white ant-hills, lemon from seven house-holds, turmeric powder, *triphala*, salt, molasses, *gandha-kachu*, *dom-deuka*, black *dhutara*, black turmeric, *latarun* and dried jute-leaves, all boiled; the disease gets removed, if the affected parts are treated by applying three or four varieties of *taro*, *bar-kachu, bej-kachu, dadhi-kachu* and *gandha-kachu*, *had-ghukuca*, *latarun*, *dem-deuka*, salt, molasses and dried jute-leaves, all pounded. An elephant, suffering from gout in its legs causing swelling during the months of *Pausa* and *Magha,* is relieved of the disease if earth from three white ant-hills mixed with *kanji* be heated and applied on them. . The swelling of the vital organs of an elephant is cured by *kanji* from the orchards of seven house-holds, mixed with the leaves each of *tita-jara, soleng* and lemon, all fried and powdered, and applied thereon.

20. Stomach-pain : An elephant suffering from stomach pain is relieved of the pain, if it be fed in the morning with the preparation of :- *biranga*, hemp, *hing* (asafoetida), turmeric and black turmeric. Another way is to feed the animal with the pounded bits of *biranga*, *indrayava*, barley, *sandhyava* (rock-salt), turmeric and black turmeric. An elephant suffering from pain in the head gets relieved of it, if a preparation, consisting of *biranga, xilikha, amalakhi, bhomora* (*Belleric myrobalan*), black pepper, *pimpali* (long pepper), dry ginger, *kan-jakhara* and *sandhyaka*, be applied thereon and the ingredients, mixed with honey and water, is to be administered orally to the animal.

21. Neck- diseases : An elephant, suffering from the said disease, may be cured by applying a preparation of *dasamula*, juice of *kalattha* along with *kaka-mamsi*, all boiled and then mixed with oil and *pimpali*, on its neck. If it is fed with a preparation of *vilva* (wood apple), *sonaru, gamari, madara, salani, pithani, tita bhekuri* (*Solanum indicum*), *tita-kanhi, kantakari* (*Solanum jacquini*), *gokssura-kata,* black tender vegetables, all being boiled with water, measuring four times the contents and then mixed with sesame-oil and black pepper and if the animal is fed with the juice of the ingredients consisting of *sali*-rice, white pulses and roots of lily and if the pounded leaves of tenders *bel* tree be applied on the neck, the elephant gets relief. An elephant, suffering from mumps, may be treated by feeding it with a preparation of *gorakhehoi, tejmui, nilkhantha, arak-chand, sharati, lata-guti* and black turmeric.

22. Diseases of Eye : An elephant, suffering from Eye disease, gets cured, if a preparation of the roots of a big variety of *koa-bhaturi* (*Momordica monodelpha*), be pounded, mixed with water and the sprinkled on its eyes. An elephant, suffering from cataract, is cured of the disease, if a preparation of the powder from the barks of *vahaka*, roots of *ghila* tree, mixed with the fat of a barren boar, be applied on the eyes. An elephant suffering from wounds in its eyes is cured of the disease, if a preparation consisting of the juice of black *tulasi* (*Ocimum sanctum*), *charingi-tenga* and of the branches of the *thekera, sandhyva* salt, *jaiphal* (nutmeg), *long* (clove), *bhuni-madara* and *taro* juice, all mixed up, is applied on the eyes.

23. Sores and Wounds : An elephant, suffering from the said diseases, including the sores of the vital organs, gets cured and the wounds heal up, if it is bathed with the water in which the barks of *vilva, sonaru, paroli* and of *madara*

are boiled and is fed with only pure and tender fodder. The sores and wounds in an elephant get cured or healed up, if :- a preparation of the barks of *vilva, sonaru, gamari, paroli, bhat-ghila, madara,* pomegranate and of *dhutura,* be pounded and ten seers of the same be boiled in a seer of water and then three seers of boiled oil being added to it. This preparation is again mixed with the powder of *triphala, bowal*, pomegranate, *vilva, chita* and of *makari-ghila, dhuna, sunthi, griha-dhuma akana* (swallow-wort) and *latarun*, in the quantity each of nine *tolas*, boiled in the said oil along with twenty *tolas* of pounded fried rice, keeping the entire contents at six seers in quantity, be applied thereon. The wounds in the nails and sores of an elephant get healed up, if a preparation consisting of three *tolas* of powder, each of *panca-mula, bhat-ghila, madara, chita,* pomegranate and *bowal* mixed with ten *tolas* of *khoir* (catechu), four *tolas* each of *suhaga* (borax) and sulphur, two *tolas* each of *tutiya* (copper-sulphate), *yamaha* and *biyali-chup*, one tola of *dhuna*, one and a half quarter *seer* of oil and ten *seers* of water, all boiled and the contents kept at a stage of liquid molasses, be applied thereon. Even the septic wounds get healed up, if a medicinal preparation consisting of ten *tolas* each of *khoir* (catechu) and *dhuna*, six *tolas* each of *chaga-laduri, vilva* and of *bowal,* nine *tolas* of *triphala*, six *tolas* each of *medelua* seeds, *bagh-nala*, six pairs of *areca-nuts*, six *tolas* of *leteku* powder, half a *seer* of oil and nine *seers* of water, all boiled up, kept at a stage of liquid molasses, be applied thereon. All kinds of sores including *padum-nala* (an eating sore) get cured, if a preparation consisting of *bhala, kendu, ol, chol, chita, kani* (cotton seed), *akana, latarun, neem, vahaka, vilva* and *sonaru*, all pounded and boiled , be applied thereon.

24. Boils , Itches and Ring-worms : All these diseases get cured, if an elephant is fed with a preparation consisting of turmeric, *acu*-wood, *triphala,*

bach, akana-vindhi, mutha, trikatu (three pungent drugs), *corat, majathi, biranga,* red *punarnava* and *devadaru,* all pounded in equal quantities, mixed with milk and *ghee* , in the proportion of one *bodi* at a time. An elephant becomes normal, if it is fed with gourd, cucumber, *punarnava, akana-vindhi*, the roots each of *amara, amalakhi, chal-kunwari, mati-kunwari,* a big variety of plantain, fermented rice and *sali* paddy , mixed with milk and *dahi-kachu.*
The animal is relieved of the said disease, if it is fed with *akana-vindhi*, juice of ripe sugarcane, fermented rice and milk, all being mixed up, in equal proportion. An elephant, suffering from blood dysentery and choleric diarrhoea is relieved of the disease, if it is fed in the morning with *akana-vindhi*, roots of *cheng-mara*, dry hemp, forest *babari* and two seers of poppy, all grinded , put in a big pot, in the small proportion of one spoonful .

25. Stomach-diseases : Diseases of all nature of the stomach in an elephant get cured, if it is fed with a preparation of *parada* (mercury), *hadchok, varuna su-san bolahaka, jambu,* black cumin, *duvari, dhaniya* and *mithi,*

26. Carbuncle : The disease gets cured, if an elephant is fed with the pounded bits of red *chita*, hemp, turmeric, *amalakhi, kuji-thekera*, leaves of *akana* and the roots of *tejmui*, along with liquor ; and with the pounded bits of white cumin, *guna*-raja, *yavaksara*, leaves of *varuna, pimpali* and *cecuria*, mixed with liquor, and also with the leaves of *bhumali, maruya* flower, *lavanga-betu, kuji-thekera, thariachoi* and *bhat-ghila*, all pounded together.

27. Hook-worms : The worms get destroyed, if an elephant is fed with the pounded bits of *mechandari*, leaves of black pepper, *ol* and *madhu-varuni* . The ailment also gets cured, if the animal is fed daily with sour curd, juice each of *lata-paniyali* and *hati-tengechi*, boiled with barley (*yava*-rice), along with lemon juice.

28. Colitis : An elephant, suffering from this disease, with complains of flatulence in the stomach, making sound , resulting in indigestion caused by its habit of eating earth or for making it walk in the sun and drinking hot water, is to be treated by feeding it with a preparation of lemon, *gathiyan*, *jaipatri*, *doa-paga* and *yavaksara*, all mixed up. This preparation also removes the pain elsewhere in the entire body of the animal .

29. Round Worms : An elephant is to be fed with ten *tolas* each of black cumin, *bari-dung*, *ajani,* twenty *tolas* of black pepper, six *tolas* of *pimpali,* ten *tolas* of the roots of *pimpali*, white cumin -five *tolas, bit*-salt -four *tolas*, *sandyava* -two *tolas*, *hingul* -two *tolas*, spiced leaves -four *tolas*, *mutha* -six *tolas* and salt -twenty-five *tolas* , all mixed up and divided into five proportions, along with grass and straw, dipped in rice-beer, in the evening for five days. The rice beer is to be served in the proportion of the three-quarters of a *seer* in the first evening, increasing it to one and a quarter *seer* and then to one and a half a seer for the next two days. It is to be fed with fifty *tolas* each of black pepper and garlic and twenty five *tolas* of turmeric, divided into five equal proportions, along with grass, for five days in the morning (Choudhury, 1976: 24-74).

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Chapter - VI

FISH LORE AND TRADITIONAL FISHERY TECHNOLOGY

CHAPTER-VI

FISH LORE AND TRADITIONAL FISHERY TECHNOLOGY.

I. INTRODUCTION:

The entire North -Eastern part of India is rich in wetland biodiversity and aqua fauna. This part of India receives the highest amount of rainfall in the world and comprises of important rain forests. This region is impregnated with large number of rivers, tributaries, ponds, hill-streams, beels, lakes and other water bodies. These water bodies harbour a rich fish diversity. A large number of endemic fish species have been found in this region. Nearly all the people of this region consume fish; as the fish is the only easily available and most popular animal food for the people of this region. Fish and fishing has consolidated an important place in the traditional culture and beliefs of the people of this region. It plays a vital role in moulding the minds of the people towards a rich tradition of conservation of rich fish diversity. Over the ages a large number of fishing gears and devices are developed by the various ethnic groups of people of this region, which are unique in construction and modes of operation. Fishermen of this region has traditionally gathered some amazing knowledge in fish behaviour and biological indicators in fishery. This body of knowledge has immense importance in the study of fish and fishery management.

II. FISH LORE OF NORTH EASTERN INDIA :

II. 1. Traditional Culture of Eating Fish - Hidden Rule of Fish Conservation : Fish is an essential article of food of the people of North Eastern India. Consequently, fish plays a significant role in the cultural life of the people of

the area and naturally many beliefs and ceremonies are associated with fish, fish eating and catching of fishes. This belief system on the other hand act as a strong tradition of conservation of fish.

In Assam fish is not only eaten by Brahmanas but also by the devout Vaishnavas. Reviewing the customs prevalent in different parts of ancient Assam, *Yogini Tantra*, a Sanskrit text written sometime in the 16th century A. D. enjoins fish and flesh eating to all classes of the people of the province (Kakati,1948:48). The use of some particular varieties of fish is, however, forbidden. A high class Assamese Hindu in earlier times did not take the species of fishes like *Mirika* (*Cirrhinus mrigala*), *Singhi* (*Heteropneustes fossilis*), *Neria* (*Eutropichthyes neria*), and *Garua* (*Bagarius bagarius).* Of course, nowadays many high class Hindus also eat these fishes. The Wanchus of Arunachal Pradesh also do not eat these fishes. They call these fish as *Yami.* They do not eat them because according to a legendary folk story of the Wanchu's this fish was originally a girl (Elwin,1958:317).

The Sema Nagas avoid two kinds of fishes. Of these one is *Akhaki* , avoided by the young men, because of a legend which ascribes its origin to a part of the anatomy of a man which he accidentally knocked off with a stone after a successful love affair. The other variety is *Azho* which is tabooed as it is believed that one taking it will suffer great pain at the time of death (Hutton,1921:94). Among the Memi group of the Angami Nagas, the Mohvus (Stone puller) and others of high social status refrain from eating a small fish called *Kureu* (Hutton,1968:339).

Some people of high social order particularly the princes of the royal family in Manipur do not take *Ngaril* (snake like fish) because they believe

that their original ancestor Pakhangba sometimes takes the form of a snake . Among the Khasis also, some clans do not eat certain kinds of fish as they claim to have some ancient relation with those particular fishes. According to one belief there was a family feud between two clans . The one that was stronger, cruelly treated the other and dismissed them in great shame, out of the village. Thus they went and took their abode by the side of a river. There they saw an unusually big fish swimming in the shoal. The man with their sticks jumped into the water and surrounded it . They used their sticks freely. At last the fish was caught and each one of them cudgelled it to powder to satisfy their spirit of revenge on it as they could not retaliate against their younger opponent. It is known to them up to this day as ' the fish of vengeance', and they consider it taboo to eat the particular fish. The Khasis like Manipuris believe that their serpent god *U-Thlen* sometimes changes itself into a form of living fish inside the home in the presence of outsiders to shame the owners for neglecting to propitiate him with the sacrifice of human blood at least once a year.(Barua, 1958:55).

Among the Dimasas of North Cachar hills, in case of barrenness the couple perform a religious function called *Mulilinga* . In this worship , fish of catfish family, eel (*Nadang*), mud fish (*Namma*), *Barali* or *Wallago* (*Nayeh*) etc. are offered in the *puja*. This gives the belief that such *puja* brings fruits to the couple. The couple therefore do not take these fish. If children are born thereafter they can take this fish but not their parents (Barua, 1958:55).

II. 2. Traditional Believes in Fishing Helps Conservation of Fish :

There are many believes in various societies of North Eastern India in regards to fishing. These believes indirectly helped the people to conserve fish community. Traditional people do not fish indiscriminately at the time of breeding, which is most important for conservation of fish.

The non-tribal and tribal Assamese both observe certain rituals before fishing on certain occasions. On an auspicious day, in the month of Chaitra and on the day before Magh Bihu (harvesting festival of Assamese people), an entire village including men, women and children, go out ceremoniously for fishing in the nearby rivers and ponds. Before commencement of the actual operation, a *puja* is performed on the bank and offerings are made to the river with prayers for good luck. Then *Mantras* or charms are also used to obtain a good catch . In Assamese there are large number of *mantras* to charm and capture fishes (Barua, 1958:55).

According to Lotha Naga custom sexual intercourse is forbidden on the night before the fishing is to take place, nor is anything to be killed in the morning before going down to the water. The presence of woman is absolutely forbidden when fishing is going on (Mills,1922:71). During the time of village sacrifice a Lakher priest is allowed neither to eat fish nor to go and catch fish (Parry,1932:370).

II. 2. 1. Fish in Marriage :

Fish is one of the must items used in the marriage ceremonies of many communities of North Eastern India. The Khasis of Meghalaya use fish as an essential item in the marriage ceremony. Three pieces of dried fishes are taken and placed in the floor and the presiding priest pours libations on them thrice calling upon god, the spirits of ancestors and the community respectively to witness the marriage. After this the fish is tied to the roof or rafter of the house and are not lowered until the birth of a child to the couple. Fish is also indispensable in betrothal among the Mishings. One hundred and twenty varieties of fish either raw or dried must be supplied to the bridegroom at the time of *Arcu-Acum* (betrothal) without which the betrothal becomes a meaningless proposition. The presence of a lesser number of fishes is regarded as a sign of

disrespect to the bride's party. Again at the time of final marriage ceremony sixty dry fishes of the same size must be brought by the groom's party and the bride and the groom must be fed together on the same plate with dry fish and specially cooked rice.

The Karbis also offer pieces of dry fish to the deceased ancestor at the time of marriage. In marriage of Manipuris particularly at the stage of *sampradan* ceremony , two *ngmaoo* (murrel) fish, one representing the bridegroom and the other bride, are released in the water. The procedure of releasing fish is that these two fishes are brought by the bridegroom's party to the house of the bride where the marriage is held and kept in the *sramahika* , a room in the house specially reserved for the god *sramahi*. When the time for releasing the fish approach one night or two women from the bridegroom's party come and take one of the two fish which is lies in the right hand side of the two and two or three women take the remaining fish. They release this two fish simultaneously. The parties predict the luck of the new couple from the movements of these two fishes. It has been observed that certain Assamese community also release a *magur* (*Clarius batrachus*) fish in the water in the name of the married couple. There is a folk song in Assamese in this occasion sung in the particular time of marriage ceremony:

"Put a pair of live Magur fish in a bowl in front of the bride

Release this pair of fish in the river to gift the son a long life" (Barua,1958:56)

The presentation of fish by a man to his betrothal is the formal sign of the completion of an Ao marriage. This is done in the following manner. The young man goes to an old man of his clan and uses the formula: " I am going to fish today . Come to my house in the evening." He then goes and catches some

fishes and comes back to his father's house in the evening to find the old man waiting for him. He hands over the fish to the old man to carry, and walks behind him to the girls parent's house. The fish is left and he and the old man are given a drink, but nothing is said about the marriage. In the morning he goes again to the girl's parent's house and is given a meal. If the girl's parents eat the fish brought the day before, it means that they agree to the marriage (Mills,1926:271)

.II. 2. 2 . Fish in the Birth & Death Ceremonies:

It is common custom amongst the Assamese to send presents of fish to relatives and friends on the birth of a child. In *pumsavana* ceremony a pair of *magur* (*Clarius batrachus*) fish is worshipped and released in a pool after the ceremony. In the feast of the name-giving ceremony (*namakarana*) guests and relatives are given meal with fishes. In the first rice offering to a child ceremony (*annaprasanna)* which is generally performed in the sixth to nine months of age of the new born, cooked fish is presented but not allowed to eat by the child. Usually the guests are offered a feast with fish preparations.

The Khasis use fish with rice bear, ground rice and turmeric in attending the ceremony of the birth of a child. In the naming ceremony of a Khasi child, the members of the family would partake amongst themselves handful of powered rice with bits of dried fishes and ginger(Gurdon,1914:147).

The Lotha Nagas also offer fishes to a new born within a month of the birth, ceremonially.

Fish has a great relation with the death ceremony of many societies in the North- Eastern India. During the 'unpristine' days which follow the death member of a family an Assamese does not partake any meal with fish or meat. But immediately after the *sraddha* ceremony a feast is arranged which is known as

gyatiali bhoj (feast of the close relatives of the family), where the relatives specially the agnates take meal with the family of the departed in which fish is an essential article. This feast is also known as *matsyasparsa* (fish touching feast). In this feast the departed soul is offered a meal with fish preparation.

The Bodos and the Garos also hold sacramental feast on the morning after the cremation of a man or woman. The widow, widower, or a near relation of the deceased, goes to the place of cremation with a cooking pot, some rice, fresh water prawns and an egg. These are cooked, if possible, on the embers of the funeral fire, and when the food is ready, the mourner breaks the vessel containing it and raises a loud lament (Playfair,1909:110).

II. 2. 3. Fish in Agriculture :

Fish is closely associated with many agricultural rites and rituals performed by the various ethnic groups of North -Eastern India.

In the Manipuri month of *Thawan* (August -September) just after cultivation , there is a feast known as *Thawan Chakchanaba* in which eating of fish is compulsory. In the month of *Wakching* (December -January) there is another feast just after harvest called *Wakching Chakchanaba* in which also fish eating is compulsory. Among a section of Nagas living in Manipur fishing is prohibited during the cultivation time ,i.e. from sowing to harvesting (Hudson, 1911:88).

The place which abounds in fishes, are believed by the Mishings, to be the seat of the mother of the barn. The Mishings, therefore prefer to dwell in those places. Fish play an important part in the ceremonial rites of the Rengmas during the agricultural season. After the first shower in the village and after the sowing of seeds they partake a feast where fish is a compulsory item. During the ceremony of reaping the first reaper take a meal with only fish and ginger and rice (Mills,1937:66).

Success in fishing is considered as a sign of increasing harvest by the Lotha Nagas. According to Lakher custom during harvest time fish may not be taken because a great deal of rice must be eaten with fish, and if fish and rice are eaten during the harvest, the crop will be reduced in the same way as the stored rice is reduced when fish is eaten. It is a prohibition both of Lakhers and Lushais to roast a fish in a field house at any time between the sowing of the paddy and the harvest. The belief is that when fish is roasted, it is parched up, and that if this is done in a field-house, the paddy will dry up in the same way (Parry, 1932:59). *na' karek* (dry fish cut into shreds) is invariably necessary in Garo *galmaka* ceremony of *jhum* burning. On the next morning of burning the newly opened *jhum*, the head of the family of each home is to perform *galmaka* ceremony in the field. In performance of *galmaka* with due rites *na'karek* (dry fish) is cooked in honour of *rokime*, god of food grains and made an offering to him with some chicken curry. For *na'karek* is considered to be a favourite dish of *rokime*.

II. 2. 4. Fish in Other Ceremonies :

The fish is used in many other ceremonies of various people of North-Eastern India. The Khasis use it in the ceremony of dedication of a new house. When the owners move into a new house, they observe a ritual known as *Kynjoh khoskain* where the use fly-infested fish . Five pieces of dried fish are taken and placed on the floor. Then a libation is poured upon them for the deity of the house and then three pieces are tied to the roof, the guests are then invited to catch the pieces hanging on the roof by the mouth. The man who gets the fish by the mouth becomes the hero of this merry-making feast-and it is performed to invoke blessings on the family and the Mother Earth on which the foundation stands. It was believed that at one time the earth was under water. The dried fish is used to indicate that no fish should live there any more, and that the foundation should always remain dry (Barua, 1958:61).

II. 2. 5. Fish as Medicine:

Fishes are traditionally used as medicine for curing many common diseases. Certain type of fishes are prohibited during certain ailments. Traditional healers use some fishes as ingredients for preparing medicines.

Assamese people use *Patimutra* (*Glossogobius guiris*) fish to cure passing urine while asleep. Some other people prepare medicine for some female diseases with *Darikana* (*Daniconius* sp.) fish. Bones and scales of certain types of fishes are preserved and hung up in the houses, both by the Assamese and some tribal people as magic charm. Fishes also have magical uses as love potions. The Lotha medicine woman prepares love potions with roots of some herbs, which has to be ground up and given to the shy loved one with cooked fish . If an infant has a sore on its tongue a certain small, very slippery fish is brought up by the Aos from a stream, alive, and rubbed on the tongue. In case of barrenness and aborting diseases, the Aos make offerings of dried fish to *tiya* (fate) of the patients for recovery. (Mills, 1926:168). For thorns that cannot otherwise be extracted from an injury, the brain of a certain fish is applied by the Angami Nagas. The Lushais believe that soup of fish (boiled with water) cures diarrhoea and mild dysentery. The Manipuris eat the entrails of *rohu* fish to improve eye sight. When a person is seriously ill a *Maibo* (Manipuri physician) releases a ngamoo, (murrel) in water with the pray that the murrel is given in substitution of the life of the man, which is called *Usin Sinba*. The *Mitaya Puran* of the Manipuris says that ngamoo was created first amongst the fishes by the *Guru Sidava* (the Creator) and given the power to save the life of the human beings when their lives would be in danger. A kind of fish called *Nahram* in Dimasa- Kachari language, which is usually found in the hill streams of North Cachar Hills, contains stones on its forehead. It is commonly believed by the Dimasa people

that if this kind of fish is eaten, then one may get disease like gall-bladder stone. The stone of this fish if taken with some medicinal herbs is believed to cure gall-bladder. The Dimasas also use the bile of *Bagh* fish for stomach trouble.

III. FISHERMEN COMMUNITY IN ASSAM :

In the tribal societies of North Eastern India there is no definite fishermen caste as such. Among the tribal every body know the technique of fishing . From a child to an old man every body goes for fishing. Fishing is like a kind of sports or merry making. Fishing is also observed as a festival in many occasions. Community fishing is itself a festival for many tribal societies.

In Assam, among the non-tribals there is a definite community whose main occupation is fishing. They are known as *Kaivarttas*. Though *Kaivarttas* are professional fishermen but later some of them left fishing and took to the agricultural pursuit for their livelihood .

There is a class of people called *Nadial* whose population is comparatively larger in upper Assam. They are called *Nadials* because of the fact that they lived on the banks of the rivers in general for the purpose of fishing (Rajguru, 1988: 127).

IV. TRADITIONAL FISHING GEARS AND METHODS :

Fishing is a primary form of production like agriculture. Fishing is one of the oldest professions of mankind . History of fishing is probably older than hunting, because fishing is easier than hunting. Till today from time immemorial people catch fishes in water with bare hands. Catching of fish with bare hand or with very simple implements is a common practice in traditional societies. Even women and children are expert in catching fishes.

Traditional people studied the behaviour of different fishes and also developed various types of fishing implements to catch them. Different types of fishing implements are used to catch fishes in different environmental conditions . North

Eastern India has a very rich fish fauna in its varied environment. Almost all the people of this region of India are fishivorous. Fish is a popular food in this part of India.

Therefore fishing is a very popular and important part of the life of the people of North Eastern India. In tribal society all of them catch fish for food, whereas in non-tribal society there are professional fishermen community . However, many of the non tribal communities also catch fish themselves.

IV. 1. Fishing Methods & Implements :

The technique of fishing includes fishing methods without gear as well as with fishing gears. There are various ways of catching fishes in different aquatic environment which are called fishing methods. The implements developed for capturing fishes are known as fishing gears. A fishing method may be applied by means of various gears, on the other hand, a single gear may be used for various fishing methods. Often the gear alone is not sufficient for a successful fishing operation, some auxiliary implements are also used for it.

Eighty five different types of fishing gears have been identified in this exploratory study. All these gears have been classified into 10 different classes. This classification has been made on the basic operational methodology of the gears and not according to materials by which they are made. It is very difficult to classify the gears on the basis of materials used for construction of a single gear. Therefore, the classification has been made on the basis of the methods employed in the use of the gears.

IV. 1. 1. Fishing Without Gear :

In olden times, prior to the invention of fishing gears, man used their hands to catch fishes and other aquatic animals for food along the banks of the rivers, lakes and other water bodies. Even after the invention of various fishing

gears, this primitive method of catching fish is still prevalent in traditional societies. The following are some of the methods of fishing without gear.

1. Hand Picking : Catching fish by hand in the shallow flooded water and river banks is the simplest method of fishing since ancient time. But it would be wrong to assume that this type of fishing methods were employed only by primitive men. Hand and foot picking of fishes and aquatic animals is also popular in the present society, particularly among the tribals. This method of catching fishes is common throughout the whole of North Eastern India. Hand picking method of fishing is common in the time of flood and in winter in the shallow *beels* and other fresh water fisheries. However these fisheries are decaying as the rivers are restrained between embankments and settled for intensive cultivation.
Usually hand picking method of fishing is done only in the shallow waters where one can walk or in the areas which have dried up after the floods. The flooded areas adjoining rivers tributaries and *beels* which regularly overflow after heavy rainfall, offer a rich catch. To ensure their greater usefulness, many little artificial pools are constructed in which fishes are let out during rainfall. The water may be bailed out with the help of simple devices. Hand picking is not always performed by bare hands. Some auxiliary implements are used which cannot be termed as fishing gears. These may be ordinary knives, rakes, shovels and other bamboo and wooden implements.

2. Grasping by Diving : The gathering activity of the fishermen, who works without gear and without a boat is not restricted to the shallow water. But by adopting the practice of diving he has been able to penetrate into deep waters to gather, which he cannot catch from the bank.

There are a considerable number of fishing methods in use by which the diver fishermen drive fish from the bottom to the surface. Diving fishermen investigate artificial fish shelters and stationary nets. Some of the divers are also trained for repairing of nets under water which are operated for long time without taking any rest.

3. Fishing with the help of Animals : Early men trained animals to help them in different purposes. One of those purposes was fishing. In different parts of the world people use some birds and mammals for catching fishes. Some of the hill tribes of North East India trains birds to catch fishes for them. In lower Assam, some tribes trains otters to catch fishes under water and collect them for its master.

4. Trapping with sprigs (*Khati diya*) : In the fresh water bodies like ponds, small tanks and ditches, fishes hide in shelters of sprigs and aquatic plants. Traditional fishermen developed a fishing method on the basis of this behaviour of the fish. In Assamese it is known as *Khati diya* (Bush fishing). The simplest form of this bush fishing technique is employed in fishing in small pits or ditches around cultivated lands and villages. During rainy season when these tanks or ditches are full of water, leafy branches are thrown in it. As the water level goes down after the end of the rainy season fishes seek shelter in these pits. Often unused boats are kept submerged where fishes find their shelter. The boats are then drawn ashore and the fishes are caught. Sometimes along a shallow stream, fishes are misguided into shelter into these artificially made mud embankments - in particular sections of shallow water alongside the stream . A small mouth of this artificial ditch is kept open to the main channel. The space within these embankments is filled with branches of trees. In intervals these fishes taking shelter, are caught with various devices.

5. Use of toxic plants for fishing : Toxic plants are used for stupefaction of fishes, traditionally ,by many tribes of North Eastern India. Fishing by plant poisoning, is usually done in small and stagnant water bodies. In hill streams, barriers are installed in the downstream at different intervals. Fish poisoning

with ichthyo-toxic plants provides one of the most interesting chapters in the story of native fisheries. Different types of poisonous plants are identified by traditional fishermen for poisoning of fishes. This poison effects sensory and motor nerves and muscles of fishes. Fishes suffer from suffocation and nervous disability. It is to be noted that these poisons do not effect the human body, and people can consume without any side effects. There are large number of ichthyo-toxic plants used for poisoning of fishes by the people of North Eastern India. The following are some of the important plants used for poisoning of fishes in North Eastern India. *Xaru Bih.* (*Derris* sp.), 2. *Bar Bih* (*Randia* sp)., 3. *Mach mara Bih* (*Phyllanthus* sp.),4.*Zanthoxylum hamiltonianium* (Leaves are used), 5. *Sapindus attenuatus* (Bark is used), 6.*Engelhardtia spicata* (Leaves are used) , 7.*Clausena excaveten* (It's root is used).

IV. 1. 2. Fishing with Gears

1. Impelling Gear : Fishing gears which are used to impel a fish is categorized as impelling gear. Impelling is a very primitive fishing method, practised in North Eastern part of India. Impelling gears may be classified into three different types. These are as follows:

1.1. Spokes and Points : This type of impelling gear bears a handle made of bamboo, with one or more metallic points. The gear is hurled at the fish which entangles or pierces the fishes. According to numbers and patterns of points these gears are named as follows.

1.1.1.*Suli or Eknala* (single Point) : This gear bears only one metallic point on a short bamboo handle and is not detachable. Small fishes of streams or paddy fields are pierced at sight. Surface feeder and medium sized fishes such as *Kakila mach* (*Xenentodon cancila), Pani mutara* (*Glossogobino guiris*), *Goroi* ,(*Channa punctatus*) are mainly hurled by this gear.

1.1.2 *Sarika Pocha or Konch* (multiple point) : This type of gear posses many metallic points in odd numbers over a long bamboo handle. The shaft in fixed with the handle and is non-detachable. Fishes of small streams, usually live fishes, when ascending from the water or crawling over the ground in search of breeding place in *beels*, fields or ditches are pierced at sight. Medium sized upstream ascenders and crawlers such as *Kawai mach* (*Anabus testudinius*), *Magur Mach* (*Clarius batrachus*), *Sol mach* (*Channa striatus*), *Barali mach* (*Wallago attu*) etc are mainly hurled with this gear.

1.1. 3. *Jonwar* (multiple points) : Usually it bears three points, occasionally five or seven points. Gears with three points are called *Teen patiya.* Points may be made of metal or bamboo and encysted with metallic foils. The shaft is fixed with the handle and is non-detachable. Fishes hurled by this gear is larger than the fishes hurled by *Sarika pocha.*

1.2. Spear : This type of gear consist of one to several barbed prong or prongs attached to a long wooden or bamboo handle or to several bamboo splits. Prongs are detachable but fixed to strong lines with the handle. The fishermen hurls it on the stream from the boat. As soon as the fish is pierced, the prongs get detached but the fish cannot escape as the prongs are attached to the handle by a long or short line. There are different types of spears:

1.2.1. *Jathi or Jobong* (simple spear) : It consists of several split bamboo spears (usually 10-16 in numbers) with shafts between 135 to 180 cm in length. The split bamboo spears bear barbed metallic heads at one end and the other end is tied with a long bamboo handle. The shaft is non-detachable. These gears are mostly operated during showering nights of the rainy season.

1. 2. 2. *Theta or Phasa* (Trident Spears) : This gear consists of a long bamboo handle at the border and it bears three or four metallic rods with barbed pointed heads. The rods are tightly tied to the handle with wires. Sometimes the heads are not barbed .

1.2.3. ***Eknala or Ekpatiya*** **(Harpoon) :** This gear consists of a long bamboo handle. The broader end of the handle bears the shaft to which a large, long and strong metallic rod is attached -which has a broadly barbed head on both sides. The base of the metallic rod is tied with a string on one end and the other end is tied with the handle. Since the gear is heavy it requires considerable strength to hit the target fish. The gear is generally operated by a man standing on the prow of the boat or from the bank. When the fish is pierced, the barbed metal is detached from the handle and the fish carries it to some distance. After some time the fish is pulled slowly with the string. Usually this process used to catch only the big fishes .

1. 2. 4. ***Palongia kocha or Pach patiya*** **(Pentadent harpoon) :** This gear is also consists of a long bamboo which bears five or more split bamboo sticks tied together on a shaft at the broader end of the handle. The bamboo stick bears metallic barbed prongs. These prongs are detachable from the bamboo sticks and are associated with a string connection from the base of the barbed points to the main handle. The method of operation of this gear is same as *Eknala*. It is operated generally in rivers and other large water bodies and hurled on large fishes.

1. 2. 5. ***Jora kata or Jora boa*** **(Impelling of fish with light) :** Another primitive but even presently used method used to catch fishes, is by the use of a source of light and an impelling gear. Usually the source of light is called *Jora* - a sort of beacon light made with a bamboo stick lighted in one end. During rainy seasons, especially in showering nights, hoards of men go out in nights with the *Jora* into knee- deep waters. The fishes are attracted to the light and instantly the fishermen pierce the fishes with the impelling gear they hold on the other hand . This is a common fishing scene through out the North East India.

1. 3. Bow and Arrow : Fishing with bow and arrow is one of the most primitive method . Probably this type of fishing was a game in early days among the tribals. Surprisingly this type of fishing gear is still prevalent among some of the hill tribes of North Eastern India. There are different types of Bow and Arrow gears available in North Eastern part of India. These are as follows.

1. 3. 1. ***Kar Dhanu or Ei-Jambook*** **(Bow with simple arrow) :** This type of gear is still popular in the hill tribes of Arunachal Pradesh and specially among the Mishings of Assam. This gear consists of a bamboo bow with two threads connecting the both ends of the bow. The two threads are inter connected at its middle by a weaving mass of string structure . The arrow is placed at this interwoven structure , when it is used. The fishermen wait at the bank of a hill stream, where water is crystal clear. Fishes are pierced at sight with the help of the arrow. The fishermen immediately plunge into the water and catch the pierced fish.

1. 3. 2. ***Jambook*** **(Bow with string connected arrow) :** This is another type of bow and arrow gear almost similar to the previous one, used by tribal fisherman. The only difference is that the arrow base is connected with the bow by a long thread. The arrow shoots the fish and the pierced fish is collected by the thread connected to the arrow base.

1. 3. 3. ***Jobong*** **(Multiple point arrow and bow) :** This is another type of fishing bow and arrow where the arrow bears multiple points. It has been found to be used by the Hill Miris of Arunachal Pradesh and Mishings of Assam. Usually medium- sized surface feeder fishes are pierced at sight during the day time.

1. 3. 4. ***Chutiya Dhanu*** **(Chutiya's crossbow) :** This gear appears like a gun with a bow. It consists of gun stem which bears a trigger at its basal position. From the point of the position of the trigger, there is a groove for the

accommodation of the arrow. Before operation, the bow string is pulled and placed in front of the trigger while the arrow is placed in the groove touching the trigger. A slight variation of this gear is found, where the arrow is connected by a long string with the bow. In case of the former gear when the arrow pierces the fish, the fishermen jump into the water and collects the fish. In the case of the latter gear, the fisherman just pull the string after piercing at the fish. This gear has been found to be used by the *Chutiyas* of Assam. It has been reported that some hill tribes of Nagaland and Arunachal Pradesh also use this gear for fishing.

2. Hooks and Lines :

Fishing with hooks and lines is most primitive but still very popular throughout North Eastern India. Various types of line gears are found in this region. Line gears may be classified according to absence or presence of floats, types of baits, shapes and sizes of hooks and materials of the bait.

2.1. Lines without hook : In line fishing, an attractive bait is fastened to a line of adequate length. Line fishing without a hook is very primitive but popularly used by traditional fishermen of this region. The following are the different methods of line fishing without a hook.

2.1.1.*Bami Barasi* (Bobbing) : *Bami Barasi* is used for fishing *Bami* or Eels. In this gear, the bait is presented in such a way that when the fish is entangled, it hangs to the bait by its teeth and cannot spit it out. The bait is made by earth-worms being threaded length-wise on a twine. The twine is rough and made up of hemp. The eel bob is ravelled up into a bunch weighted with a weight usually of a metal and fastened to 10-15 metres of strong line. It is lowered in the water, till it rests at the bottom, with the help of a angling rod or twig. The line is

slowly moved up and down to attract fishes. If an eel bites, it entangles in the rough threads of the bob. The fishermen may catch the fish by pulling the line quickly.

2. 1.2. *Makara Jalar Barasi* (Spider web bait) : Some people traditionally use spider web as a bait. Fishes when engulf the bait made of spider web, get fastened to it by their teeth.

2. 1. 3. *Chital mara Barasi* (Notopterus fishing line gear) : This is a peculiar and a popular line gear used for fishing of *Chital* (*Notopterus notopterus*). It consists of a cotton thread string, an eri cocoon and a bamboo handle. The eri cocoon is used as a bait, after filling it with rice powder. A float is tied to the line at a calculated distance. As soon as the gear is put in water it sinks, the fish engulf the cocoon bait. Its teeth being entangled to it, though the fish tries to escape it fails. The fisherman observe a pull in the float and catch the fish by a sharp pull on the line. The target fish group of this gear is the feather back. This type of gear has been found in the Goalpara district of Assam.

2.1.4.*Nolpunga* (gorge) : It is a very old type of fishing gear. It is commonly called *Nolpunga*. The gear consists of a floating part, a long node of an aquatic reed (*Phragmites Karka*). Some times a smaller variety of bamboo called *tarai* is also used as a float. The length of the float is usually not more than 30 cm. In all cases the floats are usually dried in the sun, to make it light. The hollow node of the bamboo or the *Not* should be air light, so that no water can shier in it . The other part of the gear is a short line made of silk cotton or nylon thread and a spring hook tied at the end of the line. The length of the line may vary between 30 to 60 cm. The hook consist of a small bent bamboo slit pointed at both the end and bound together. It is either covered with a bait or the

bait is fastened between the tied up sides of the spring gorge. As soon as the bait is swallowed by a fish, the spring bamboo slit spread out into the throat and the fish cannot escape. The bait usually used is a bit of an earthworm. This gear is usually operated in marshy water bodies, paddy fields or beels. The fishermen leaves the gears operated in the evening and collect the trapped fishes early in the morning. Target fishes are *Kawai* (*Anabus testudinius*), *Singhi* (*Heteropneustes fossilis*), *Goroi* (*Channa Punctatus*), *Sol* (*Channa striatus*) etc.

Specially designed iron hooks have been widely used traditionally since long. The hook and line gear essentially consist of a long or short line made of synthetic or cotton fibre, a hook, a float and a strong thin pole. The hook has a head or eye, shank, besides crook and the point. The head of the hook is used for fastening the line. There are different types of hooks depending upon size and shape. Different types of hooks are used to catch different type of fishes.

2. 2. 1. Hook and line without floats :

This type of hook and line gear bears no float, rather there is always a weight at the base of the hook, to help the hook in sinking down in the water. The following are the different hook and line gears without a float.

2.2.1.1. *Dol barasi* (Hand line) : This hook and line gear consists of a hook and a very long line (50-60 meters). The hook bears a weight at its base. In this gear the bait is made of putrefied flesh of fishes. After putrefaction of fishes like *Chela bacila* , *Puntius sp* or *Wallago attu* the skull and vertebral column remains and the putrefied flesh is folded and tied to the hook. After putting the bait the hook is thrown into water. As soon as the hook is settled down in the bed of the water body, the fisherman pulls it slowly. A group of smaller fishes try to eat the flesh tied to the hook- and the fisherman can feel

the pull. At this points, a large fish , usually a cat fish, comes to catch the smaller fishes that gathers arround the bait. At the sight of the large fish the smaller fishes flee and the large fish engulfs the bait itself. The fisherman can guess the action of the big fish and he allows the fish to engulf it to pull it up slowly, after a while. Usually fishes like *Wallago attu*, *Mystus aur* , *Mystus sheenghala*, *Bagarius* etc are caught with this gear.

2. 2. 1. 2. *Lafa* (Frog baited hook) : This gear consists of a 3 to 3.5 meters long bamboo, 5 to 6 meters long line and a medium sized hook. The bait used in this line and hook gear is a living frog or a living fish. Usually a *Khaslisa* or *singara* fish is used as a bait instead of a frog. The bait is tightly tied to the bait so that it cannot escape at any case . As soon as the baited hook and line gear is put into the water, the bait tries to escape moving here and there. Usually a carnivorous fish comes lured by the sight of the frog or the fish and gets entangled in the hook. Eventually the fisherman catch the fish.

2. 2. 1. 3. *Bami barasi* (Eel catching hook) : This gear consists of a single long lined hook with a short handle. The hook bears a ball like metallic weight at its base. After the hook is thrown into the water it reaches to the bottom and the ball like metallic weight rolls on the bottom of the water body in the current. The movement only stops when it reaches the hole of eels. As soon as a baited hook reaches the mouth of the hole of the eel, the fish is eventually entangled in the baited hook and then a slight pull is observed by the fishermen. He then slowly pulls the whole line and catches the fish. This gear is operated usually during the winter season.

2. 2. 1. 4. *Kuchia Barasi* (Kuchia hook) : This is one of the most primitive and simplest form of fishing gear. It is consist of a 30 to50 cms long thin bamboo stick to which the hook of the line is attached and the other end of the

line is kept in the fisherman's hand. The hook is baited with earthworm. The baited hook is then pushed inside the hole of a *Kuchia* (*Amphipnous Kuchia*) fish, which are found in the paddy fields and banks of the small canals. The hook is kept for a while inside the hole. If there is a fish inside the hole, it will engulf the bait and get entangled. The fisherman can feel the pull in the line and slowly pull it to catch the fish.

2. 2. 1. 5. *Bar barasi* (Long line) : This hook and line gear consists of a very long line and is operated in very deep waters. Usually eight to fifteen branch lines are attached to the main line. These branch lines are short (50-90 cm in length). Usually all the hooks of the branch lines are put together and is baited with a big flour ball. Some times each hook is separately baited with a grass-hopper or an earthworm. The target species of this line gear are big sized *Lobes rohita, Catla catla, Tor tor, Tor puthitora, Wallago attu* etc.

2. 2. 1. 6. *Daun barasi* (Set line) : This hook and line gear consists of a long main line to which large number of short lines are attached. Each short line bears a hook. The main line is very long (50-100 metres) whereas short lines are 90-150 cms in length. Hooks are of bigger sized and usually baits are live fishes. Baits may differ depending upon the target catch. *Kuchia* is used as a bait for *Garua* or *Baghari* (*Bagarius bagarius)*. If the target fish is *Ari (Mystus aor)* then the bait is a minor carp. Cockroaches and flesh of snails is also used . The line is stretched at mid-river with a float and the hooked line is allowed to settle in the bottom with a stone while the other end of the line is firmly tied to a pole at the bank of the river. This line gear is usually operated at night and sometimes also during the day time . Catches are checked at certain intervals of time. Principal species sought by this gear are *Bagarius bagarius, Mystus aor, Pangasius pangasius, Wallago attu* etc.

2. 2. 1. 7. *Jial barasi* (Hanged line) : It is a very simple rod and line gear where the bait is live fish. It consists of a long bamboo rod with a very short line. The bamboo rod is planted tight, to the bottom of a shallow water body, slightly inclined. The line is adjusted so as just to reach the water, allowing the live fish bait to swim. As the live bait will try to escape then some predatory fish may engulf the bait . The fish will be entangled with the hook and will be caught by the fisherman. Usually a large number of such gears are operated in a water body and one or more fishermen constantly supervise the gears. These gears are generally operated in the beels in rainy season or throughout the year. The principal fish species caught by this gear are *Channa Sp., Wallago attu, Notopterus chitla* etc.

2. 2. 2. Hook and Lines with a Float : This is the most commonly used rod and line gear with a float on the line. The float is attached to the line at a requisite distance from the hook. The distance of the float from the hook depends upon the depth of the water and behaviour of the target fish. The following are the hook and line gears with a float.

2. 2. 2. 1. *Sip barasi* (Rod & line) : The Sip barasi is most popularly used gear in North East India. Usually the rod is made of a special variety of bamboo which is very thin in size- the length being between 2 to 4 meters. One end of the cotton or nylon line is tied to the distal end of the rod. The hook is tied to the end of the line. The float is attached to the line near the hook. The hook is baited with a bit of an earthworm ,the flesh of a snail (Pila), the larva of a sting fly or a grasshopper. The float is made up of cork, peacock feather, reeds or water hyacinth. When the fish engulfs the bait with the hook the float indicates a pull. In a deeper pull the fisherman forcefully pull the line with the rod and catch the entangled fish.

3. Trapping gear :

Trapping gears are kinds of traps consisting of bamboo, cane or other materials where fishes enter into it and cannot escape. Some trapping gears often don't have a valve. On the basis of presence or absence of valves trapping gears are classified as follows .

3.1.Valved trapping gears :

Valved trapping gears are usually made of bamboo and cane materials. These are of different sizes and shapes. The gears bear valves at the place of entrance of the fishes.

3.1.1. *Emukhia chepa* (single valved trap) : This trapping gear is made up of fine bamboo slits knitted with cane or jute strings. It is oval in shape, spacious in the middle, tapering both ends. The length of *Emukhia chepa* varies from 50 cm to 150 cm and the diameter at the middle is from 12 cm to 50 cm. One end of the gear is permanently closed, other end is open, but closed with a mass of layer at the time of operation. It has a valved mouth at the middle. It is placed in the streams or paddy fields, the valved mouth facing the water current. Fishes enter into the gear with the water current through the valved mouth and cannot escape. It is usually operated in the rainy season.

3.1.2. *Dumukhia Chepa* (Double valved trap) : It is almost similar to the *Emukhia chepa*, the only difference is that it bears two opposite valves. The merit of two valves is that the fishes moving both up & down streams enter the trap.

3.1.3. *Emukhia Dingara* (Single valved rectangular trap): This is a rectangular fishing trap made of bamboo slits and cane strings. There are different sizes of this trap. The valved mouth extends throughout the length of the

trap. There is a small opening for collecting the entrapped fishes. It is usually operated in the rainy season.

3.1.4. *Dumukhia Dingara* (Double valved rectangular trap): This gear is almost similar to the *Emukhia Dingara*, except it has two opposite valved mouth, allowing entrance of the fishes from both up and down streams.

3.1.5. *Darki* (Rectangular triple valved trap): It is made up of bamboo slits , tied with cane strings. It is a slightly arched rectangular trap. The upper side of the trap is completely open which also serve as a passage for collection of entrapped fishes. Its mouth is single valved with a single opening . It is operated in rainy season. The method of operation is like *Darki.*

3.1.6. *Baladha* : *Baladha* is another rectangular trapping gear made of cane string and bamboo slits. A very simple valve is located at one end of the trap. This trap is operated at shallow water where there is no current . A bait is placed inside the trap in another small cage. Being attracted by the bait fishes enter into the gear and are entrapped. Usually a baked grasshopper or fish is used as a bait.

3.1.7. *Khonwar ban* (Pound trap) : This is a large pound type trap usually operated in shallow water. In fact, it cannot be called a gear, rather it may be called an arrangement for catching fishes with nets. A large pound is made with knitted bamboo slit walls. The pound occupy about 100 to 150 sq. metres area. The walls of the pound are such that fishes easily enter inside the pound but find no way to escape. Entrapped fishes are collected with small nets afterwards.

3.1.8. *Jap Ban* : This is another pound trap, operated in running water. The trap consists of two long walls which gradually gets closer to each other to make a tapering end. At the tapering end there is a bottom wall. Fishes come

along with water current and enter the gear. The only way of escape it finds is a hole at the bank of the water body, to which the wall leads the fishes. Fishes fall in the hole and is collected by the fishermen.

3.2.Un-valved trapping gears :

There are some very simple trapping gears which does not posses a valve. These are very primitive type of trapping gear used for catching fishes in the paddy fields, streams or in flood waters. Though this gear has no valve , the fishes once inside the gear cannot come back.

3.2.1. ***Pari*** **:** Tendrils are cut into pieces of 70 to 90 cm and made into an elongated trapping gear like *Khoka* or *Sorha.* Here, when the fishes enter inside the trap, they are entangled in the spines. This trap is usually operated in the strong current. Sometimes a scorched grasshopper is placed inside the trap to attract the fishes.

3.2.2. ***Bami Khuchura Sorha*** **(Eel trap) :** This elongated trap is made up of a piece of bamboo. At a distance of about 20 to 25 cm from the basal node, the bamboo piece is slit into fine bamboo slits. These slits are knitted thickly with thin strings. The water body is combed for the eel holes and the inverted trap is placed vertically on the mouth of the hole. Then a long stick is used to disturb the fishes inside the hole. They then come out only to get trapped into the *Sorha* placed in the mouth of the hole. They cannot escape out from this trap. This gear is operated only in the rainy season.

3.2.3. ***Hoorguma or Hookma*** **:** This is a bigger type of valveless trap made with cane and bamboo. It is constructed in the same plan as '*Sorha*'. It is bigger and wider in comparison to '*Sorha'*. Its mouth is very wide and the belly position of the gear is spacious. The diameter of the mouth is not less than 90-120

cm. Usually it is operated in the river banks and beds. The trap when operated is enrolled with small branches of trees or with twigs. This provides an artificial shelter for the fishes. Fishes being attracted by this enter the trap. The gear is kept in the water for one, two or many days depending on the availability of fishes. At a calculated interval of time the gear is pulled out of water and the fishes are caught.

3.2.4. *Dalanga* (Triangular large trap) : This is the largest bamboo made fishing trap without valve. It is triangular in shape, with a very wide mouth (200-250 cm). The shape of this gear is like that of *Jakoi* the most popular fishing gear of North East India usually used by women, but very large in size. It does not operated instantly by a fisherman, but kept into water for two or three days , allowing fishes to hide inside it. Usually branches of trees and twigs are placed inside the gear with a view to make it a house for the fishes. After stipulated time the gear is pulled out from the water to the bank and the entrapped fishes are caught.

4. Entangling Gear :

Drift gill nets are the only entangling gear prevalent in this region. In these nets, the fish is entangled at its operculum by the mesh of the net when trying to swim through the net. The mesh of the nets varies in size in accordance with the size of the fishes. Usually these are made by of nylon or cotton threads. The surface line of the net contains floats at certain intervals while the bottom line of the net bears weights which helps the net in keeping it stretched properly in the water current. Locally these are called *'Langi jal'* or *'phasi jal'* There are several types of *'Langi'* or *'phasi jal'* depending upon the mesh size, as well as, on the size of the fish species to be caught.

4.1.*" Langi" or "Phasi" Jal* : It is to be noted that the making of *langi* and *phasi jal* involves the same net making methodology. Only the method of

operation is different depending upon the nature of water where the nets are operated. It is seen that *langi jal* is usually made up of small meshes to captures smaller fish groups in shallow waters. However *phasi jal* is used to capture large fishs and hence are made of bigger sized-meshes. *Phasi jal* is used in comparatively deeper water.

4.1.1. *Langi jal* : There are large nos of *langi jal* used by the fishermen. However the naming of this type of *jal* does not follow any definite rule. In other words it has a vague terminology. The *jals* are usually named after the types of fishes sought to be caught such as *Kawai langi* (used to capture perches), *Goroi langi* (for murels), *Bar langi* (for Indian major carps), *Puthi langi*. Though the size of nets and meshes vary from each other, yet they all bear similar method of operation of fish catching. There are only two primary varieties of the *Langi jal*.

4.1.1.1. *Kawai langi* (Perch gill net) : This type of gear is usually used by villagers in shallow water of beels where the water current is slow and the beel bears aquatic parts. Usually *langi jals* are used in places where other gears are not possible to operate. The duration of operation of the net depends upon the availability of fishes. Usually two fishermen use a boat in deeper water or at one time only one man without a boat can operate in the shallow water. Mesh size : 1.5 - 2.5 cms, Net breadth : 60 - 90 cms, Net length : 600 - 900 cms. This type of fish catching is usually practiced in the rainy season for both domestic and commercial purposes. Mostly caught species are *N. nandus*, *A. testudinius*, etc.

4.1.1.2. *Puthi langi* (Puntius gill net) : This gear is usually operated in the flooded water of paddy fields and shallow water of beels. Method of operation is some as that of *Kawailangi*. Mesh size : 1.1 cms - 2.1cms, Net breadth: 60 cms - 90 cms, Net length : 6 meters - 9 meters.

4.1.2.*Phasi Jal* : *Phasi jal* is a type of a larger entangling net. Usually these type of nets are used in rivers and deep waters of beels or lakes. The usually sought species are bigger fishes, often bigger sized *B. bagaruis* are also caught. It is obvious that mesh size of this gear is larger than the former types of entangling nets. Two types of *Phasi jals* are prevalent in this region.

4.1.2.1. *Ghan phasi* (Bag bearing entangling net) : This gear is practiced in deep beels and rivers to catch smaller and medium sized fishes. This gear bears floats of reeds in the surface line, and at the bottom line a weight of steel or terracota balls. The net bears a bag where the fishes that are not entangled are entrapped. The net is set in the water with the help of two boats and two men in each. The net is stretched up to its fullest extent and trawled from one side to other. At that time one or two boats with two or more men in each boat come towards the net slashing the water. At this, the fishes become frightened and rush towards the net. The rushing fishes get entangled in the meshes of the net and are caught.

4.1.2.2. *Rewal phasi* (entangling net with bigger mesh size) : This gear is also operated only in big and deep beels and rivers to catch bigger sized fishes. The gear bears floats of bamboo or rubber tube at the surface line and weight of big terracota balls at the bottom line. This net is without a bag unlike the previous one i.e. *Ghan phasi*. The net is set in the water with the help of two boats. The method of operation of this net is also same as the *Ghan phasi*. Mesh size. 5. cms to 8 cms, Net length 20 mts to 80 mts, Net breath 2 mts to 4 mts. Principally sought species are: *Notopteus Chitla, Labeo Rohita, Catla catla, Cirrhinus mrigala, Mystus aor, Bagarius bagarius*. etc.

5. Encircling Gears :

Fishing gears which are operated by encircling the fishes to be caught are classified as encircling gears. There are several varieties of encircling gears.

5.1. Seine nets : In seining usually one end of the net is shot from a fixed point. At a certain area it is surrounded and the other end of the gear retied to the starting point and the gear is hauled. The starting point can be on the bank of a river, lake or pond. In certain circumstances both the end of the nets, touching both the banks of a river, move from one point to other and is hauled for a long distance. But at the time of hauling one end become fixed while the other surrounds and comes to the fixed end. It is then hauled to the bank. The net has a pocket at the middle to collect the fishes. The seine is mostly worked on the river.

5.1.1. *Ber Jal* (Bank haul seine) : *Berjal* is the popularly used haul seine of this region. Commercial fishermen use this net in each and every each season, where landing prospects are very high. The size of the mesh varies, depending upon the fish population of the catch area from 0.7 cm to 4.5 cm. The length and breadth of the net varies from 500 to 200 metres and 2.0 to 4.6 meters respectively. The surface line of the net bears elongated floats of bamboo or rubber tubes and the bottom line bears weights of clay balls , zinc or iron. One end of the net is kept fixed at a point of the bank of the river, while the other end is hauled often by a number of men or by a boat. Then the whole net is stretched up to its fullest extent. With the floats at short intervals, the surface line of the net remains on the surface of the water while the bottom line with the weight reaches the bottom of the water. Then the stretched end of the net returns back to the starting point enclosing the maximum possible area of the water and is ultimately hauled to the bank. Usually 10 to 20 persons haul the seine nets, operated throughout the year. Sought species are: *Wallago attu*, *Labeo rohito*, *Notopterus notopterus*, *Catla catla*, *Labeo gonius*, *Cirrhinus mrigala*, *Mystus aor*, *Tor puthitora*, *Tor tor*, *B bagarius* etc.

5.1.2. *Tangani jal* (Double stick haul net) : This is comparatively a smaller type of haul seine. The net is 6 to 10 metres in length and .90 to 1.20 metres in breadth. On the two ends there are two short bamboo handles bound to the nets. Two men take the handle and after stretching the net come from one side of the beel or lake to the other side where they ultimately close the net. At the time of operation when the two fishermen haul the net from one side to other then at the opposite side two other fishermen disturb the water and come to wind the net. At the time of closing the two other fishermen also help them . This is operated throughout the year for both commercial and domestic purposes. Principally sought species are: *Wallaga attu, Labeo rohita, Catla catla, Channa marulius, channa striatus, Notopterus notopterus, Notopterus chitala.* etc.

5.1.3. *Bor jal* (Floating haul seine) : *Bor jal* is the largest haul seine prevalent in this region. It also possesses some special devices and peculiar methods of operation. The length of the net is 200 metres to 500 metres and often more. The breadth of the net depends upon the depth of the water and it consists of two distinct parts. One part remains under water while the other portion rests above water during operation. The surface line of the net bears floats of bamboo or rubber tubes, while the bottom line bears the weight. The upper part of the net bears a special bamboo arrangement which floats in the water and is dragged with the net. This bamboo arrangement bears some vertical bamboo poles which form a wall like arrangement. Another net is attached to this vertical bamboo arrangement. This is done with a view to prevent the escaping of impugned fishes. With all such arrangements the net is stretched at one point and covers the breadth of almost the whole river. After setting the net in the water it is hauled by a number of fishermen along the two banks of the river. In this way the net is

hauled to a great distance. Usually the hauling is done towards a blind end of the river or towards an artificial barrier of the river. Sometimes this hauling continues for several days. When the net approaches towards the close end, the fishes in the inner water are caught by some other gears. At the time of closing the net it is dragged to the bank and the fishes are caught.

5.2. Surrounding net :

The task of surrounding nets is to encircle a detected fish school, which is sometimes scooped out with some other gears. The surrounding nets are used to close a water body. The net itself closes at the bottom and after removing the water plants, etc. the fishes are caught by hauling the closed net to the bank or to a boat.

5.2.1. *Moi jal* (Surrounding net) : This net is generally used in the beels and shallow swamps where water hyacinth and other aquatic vegetation are most prevalent. Mesh sizes varies from 1 cm to 1.5 cm. The length of the net varies from 7 metres to 20 metres. Usually the net is used to fish in marshy waters where water hyacinth or other aquatic vegetation is very rich. A suitable water area is encircled along with the aquatic vegetation with the net. The bottom of the net bears weight that helps the net to touch the water bed and it is pulled slowly to close the net. Subsequently the vegetation from the surface is removed from the encircled zone and the fishes are captured. Principally sought species are: *Channa punctatus* , *Channa gachua, Channa marulius, Channa striatus, Anabas testudinius, Clarius batrallus, Heteropneustes fossilis* etc.

5.2.2. *Katal mara* (Bush fishing) : Many fishes prefer living in shady, hiding haunts. So they select certain spots like caves in the bottom, clefts, reefs of deep vegetations etc. They have a positive thigmotaxis. They possibly feel

that they have an appropriate hiding place when their body touches something. Fishermen take advantage of this natural behaviour by building artificial fish shelters and adopt some special methods of capturing a profitable quantity of fishes. The most popularly used and highly lucrative of these methods is the "*Katal mara*". Between August and November when the water subsides slightly, bushes and branches of trees are piled in suitable spots in big beels. Various kinds of fishes but chiefly carps and chital (*Notopterus sp.*), resort to shelter of the piled up bushes called 'Katal'. As the flood subsides, the rapid growth of water weeds forms a dense felting over the branches where small fishes and crustacians swarm in multitudes. To catch the fishes that take shelter among the bushes needs the co-operation of a considerable number of fishermen. This method of fishing requires long time preparation. This is usually done in between January and March depending upon the depth of water. When the flood subsides sufficiently reducing the depth of water in and around the bushes it is then considered the appropriate season to begin fishing. By this time the maximum number of fishes have concealed into the shelter. The first operation is to fish the surrounding water with cast nets. This frightens the remaining fishes into the bushes or *Katals*, which are then surrounded by a special form of wall nets tied end to end. The length of this enclosing wall of netting depends on the height and the area of the *Katal*. For large ones as many as 15 to 20 sections of nets are joined together, each about 10 metres long with a height of 5 metres . The net is held upright by the head rope being tied to a circle of poles driven securely into the bed of the beel and projecting several feet above the surface of the water. The pieces of netting are made specially deep to permit the lower edge, heavily weighed with elongated earthen sinkers, to rest in folds on the bottom and the upper edge to be carried aloft several feet above the water, to

prevent the alarmed fishes from escaping by leaping the barrier. After the pieces are laced together, with an exception of an opening in the netting at one point, the fishermen enter inside with a boat, and after closing the opening behind them, set to work to clear away the mass of branches. The bottom has been made thoroughly clean with the help of bamboo poles .The fishermen dive to the bottom and draw the sinkers attached to the foot-rope on one side of the enclosure as far as possible towards the other side. The same course is followed with the sinkers on the other side, so that the bottom of the coral is covered with two layers of net. Divers now lace these overlapping layers together, and then the men in the attendant boats draw up the centre of the net, driving the fishes to the side of the net, when they are emptied into the boats, or the whole net may be detached from the poles and hauled ashore to be emptied later on. The principally sought species are *Labeo rohita, Labeo gonius, Catla catla, Cirrhinus mrigala, Channa striatus, Channa marulius, Mystus sheenghala, Notopterus chitala, Notopterus notopterus,* etc.

6. Trawling gear :

Trawling gears are operated by combing the entire water body so as to capture the fishes inside the bag of the net.. The operation is done with the help of trawling vessels such as ordinary canoes or big boats, their use varying keeping up with the method of operation and size of the nets. These gears are usually of commercial importance.

6.1. *Shangla jal* (clap net) : *Shangla* is a purse type of net with hinged mouth which can be shut instantly when desired. As such it may be termed as clap net. It has a roughly rectangular bag- whose mouth is widely gaping and is attached to two long and flexible bamboos. One flexible bamboo represents the

head rope and the other the foot rope of ordinary nets. These two edges hinge together at each angle of the mouth and passes upwards through a ring at the middle of the upper lip. The net when ready is lowered a few feet into the water attached to the boat and arranged in such a way as to close the mouth of the net when the boat, is rowed downstream, and a fish is trapped in the process.

These ropes are attached to the upper lip of the net one on each side of the vertical bamboo which is held on the hands of a fisherman sitting at the fore of the boat. A second man steers the boat forward. Meanwhile the mouth of the net is kept open by the first man pressing downwards upon the vertical bamboo. The fishes which are intent on breeding and hastens upstream, by chance, enters the wide open mouth of the purse. At this, the trained touch of the fisherman senses this and instantly hauls on the bamboo. Then he shuts the mouth of the trap. The net is then hauled aboard, the captured fish taken out, and the net hung again in the open position over the boats.

This net may run over 4.5 meters wide with a length of bag of over 2.4 meters and the meshes are of about 5 cms from knot to knot. All over the Brahmaputra and its tributaries where usually the *shangla* is used the closing rope may run to a depth of 3 to 10 meters. This net is usually used only by the professional fishermen. The main sought species is the *Hilsa ilisha* (Indian shad). Occasionally other fishes such as Indian major carps, *Notopterus chitala*, *Mystus spp* are also netted.

6.2. *Basuri jal* (Fries fishing net) : This net is used for catching fries of fishes. The meshes of the net is very small, meant to catch. small fishes. As the net is very long it is trawled by the help of two boats, usually in flood water of rivers and beels, where schools of small fishes normally frequent. The length of the net is not more than 15 meters. The net is stretched in between the two

ends of the boat. It is used by the traditional fishermen of lower income group. Principal species sought are the *Daniconius* sp.., *Puntius* sp., *Barilius* sp. etc.

6.3. *Feshi jal* (Otter trawl) : This is another type of trawling gear almost like that of the *barjal*. It varies from 60 to 150 meters in length and 4.5 to 9.0 m. in breadth with floats at considerable intervals. The bottom line is tied with suitable weight. When operated the net is stretched with the help of two boats at suitable sites possibly from one side of the river or the beel, to the other side, as far as practicable with each boat. After stretching completely the two boats diverge from the stretching point. Ultimately both the boats meet at a point and trawl towards the net. In the meantime, the fishermen on board, disturb the water by beating it with the help of long bamboos while making noises and continuous waves in the water. As a result fishes rush from all sides towards the net. Simultaneously the hauling of the net continues till it is completed and closed. Captured fishes are collected in the boat. It is used by fish traders and professional fishermen. Principal sought species are Indian Major Carps, *Notopterus* sp., *Mystus* sp. etc.

6.4. *Shirki jal* (Clap net) : This is the same type of net with the *shangla jal*. But this net is with a rectangular bag in the mouth and is bounded with long flexible bamboos. In *shangla jal* the ropes which are attached to the flexible bamboos in the mouth of the net and which are known as head rope and foot rope are represented by two bamboos in *shirki jal*. Other points of construction and operation is quite similar with that of *shangla jal.* It is used by the professional fishermen for catching *Hilsa ilisha* during the migration of *hilsa* to the *Brahmaputra* river and its tributaries from its estuarine region.

7. Scooping Gear :

In the scooping type of gears, the fishes are actually filtered out from the water. These gears usually consists of a totally or partially framed mouth which

is kept open in the water and then scooped out when fishes enter the bag. The mobile varieties of scooping gears are dragged in the water and lifted. These gears may be divided into two groups - nets and pots.

7.1.Scooping Net : Here the main gear is made out of netting material while the mouth, plunging and the dragging frame is constructed with bamboo sticks.

7.1.1. *Ghoka jal* (Triangular scoop net) : It is a small triangular scooping net. The mouth is framed with two bamboos at the two sides. Two bamboos from the sides meet behind at an acute angle. The fishermen catch the bamboos from its sides and drag it through the water. When fishes enters the net, it is scooped out from the water and the fishes are collected in the bag that is attached behind it. The area of the mouth of the net varies from 1.5 sq. meter to 2 sq. meters. The *Ghoka jal* is used by villagers in the beels mostly at the time of community fishing. There is no particularly sought species and all types of fishes are caught by this net which can be operated throughout the year.

7.1.2. *Dheki jal* (Large triangular scoop net) : This is a fixed type of scooping net and is triangular in shape. The net is fastened on two bamboo poles which make an acute angle below, while the other end is supported by a rope. The net possesses a big bag behind. The entire gear is kept hanging on a rigid frame constructed of stout bamboos. The area of the mouth varies from 5.5 sq. m. to 12.5 sq. m. The net is fitted to the bamboo frame in such a way that it can be lifted up by the operator himself by giving extra pressure on the triangular corner of the net. Usually this net is operated near the bank of the river where the water is shallow. Sometimes a bamboo fencing is also provided from the bank to the net to prevent the easy escape of the fishes. The *Dheki jal* is used by professional fishermen. No particular species is sought by this gear and it can be operated throughout the year.

7.1.3. *Parangi jal* (Quadrangular scoop net) : It is a rectangular net having an area of 1.5 to 1.8 sq. m. at the mouth. Each of the four corners of the net is fastened to the four ends of two flexible bamboos tied together crosswise at the middle. Another bamboo pole and a rope is tied at its distal end to the centre of the frame which serves as the handle for plunging and lifting the net in and out of water. The net thus hangs like a sac. The fishes enter the net area and are caught when the net is lifted and are collected into a bag attached to the net. Sometimes rice barn is used as fish food to attract the fishes towards the net. The *Parangi jal* is generally used by villagers in shallow waters throughout the year. The *jal* is mainly used to catch small fishes.

7.1.4. *Akasi jal* (Bagless scoop net) : This net is almost similar to that of the *Parangi jal*. The difference is that it does not bear a bag. Usually the meshes are of bigger size, the knot to knot length being not less that 4 cm. The area of the *jal* is also less, about 4 square meters, and the *jal*, as a whole, is lighter and smaller than the *parangi jal* thereby making it easier to carry it from place to place. The *Akasi jal* is used by the villagers, often by professional fishermen and the tribal women folk of Assam. No particular species is sought by this gear and it can be use throughout the year.

7.1.5. *Firki jal* (Hilsa scooping net) : It is also a triangular scooping net, the basic points of construction being similar to that of the *Ghoka jal*. But the *Firki jal* is larger than that of the *Ghoka jal* and is generally operated from a boat. The triangular mouth of the net has an area of about 3.5 sq. meters. Two sides of the mouth is attached to two long bamboos which meet themselves at and angle. The opposite side of the net that is adjacent to the angle is without a supporting bamboo. The net is operated from the fore of a boat by filtering the water through the meshes. When a fish enters the net, the net is lifted, and the

fish is caught. The *firki jal* is used by the fishermen of lower Assam and Barak valley. This net is operated throughout the year and is used for capturing *Hilsa* fishes.

7.2. Scooping Pots : The scooping pots are made up of bamboo slits tied with cane strings which are bag like gears with a wide mouth and a handle. The operator holds at the handle and lifts it up after plunging it in water. The fishes gather at the blind corner of the pot and are collected in the collecting pot. Interestingly, only two kinds of scooping pots are prevalent in this region and both are popularly used by the women folk.

7.2.1. *Jakoi* (Prism shaped scooping pot) : It is a prism shaped scooping pot made up of cane and bamboo slits tied with cane string. The broad surface of the triangular equipment is open and used as the mouth. It has a handle at the top which is not shorter than 45 cm. A jute string is tied to the two corners of the base angles of the implement for manipulating and lifting purpose of the gear. The *Jakoi* is usually operated throughout the year in swampy areas of shallow waters with dense vegetation of aquatic plants like water- hyacinth etc. The sought species are mostly the small fishes like *Pustins, khalisa* etc. and live fishes like *Clarius batrachus*, *Anabas testudinius*, *Channa punctatus, Channa gachua, Channa striatus, Heteropneustes fosoiles* etc.

7.2.2. *Henga* (Boat shaped scooping pot) : *Henga* is a boat shaped scooping pot in which at one end there is a handle and the other end is blunt like the fore of a boat. The operator catches the handle and plunges it in the water at the bank of the beels and heels. Fishes that go inside the pot are caught by lifting the pot. The *Henga*, operated mostly by the village women, throughout the year, is generally used to catch small and live fishes.

8. Falling Gear :

The principle of falling gear is to cover the fish with a cover pot or a cane shaped net with stiff opening. As the gear sinks the fishes are entrapped and are

caught under water by hand in case of pots. In case of nets the fishes are entrapped in some special bags of the net where fishes are caught after hauling the net to the land.

8.1. Falling Nets : Falling nets are light, circular and somewhat bell-shaped with a stiff opening. There are two kinds of falling nets prevalent in this region- one is completely made of netting materials, while in the other, the net portion is supported by a bamboo frame. The principle of operation in both the types is the same

8.1.2 *Ashara jal* (Cast net) : The *Ashara jal* is the most common and widely used fishing net of Assam. It is very popular because it is handy and easily portable to any place. This bell shaped net vary in size depending upon the mesh size. In all types the net bears small weights, usually of terracota or iron, at the peripheral edge. At the edges the net is folded at certain intervals to make pockets. A long small rope is tied to the centre of the net which is its blind end. This rope acts as the hauling string of the net and also help in throwing it into water. The net is cast into water in a calculated way so that it spreads out properly. As soon as the net falls on the water, it sinks immediately to the bottom due to the weight in the peripheral line, and thus it covers the fishes upon which the net falls and encloses them. After sometime when the net settles down, the fisherman pulls it steadily towards the bank of the river or beel or to the boat from where it was thrown with the help of the hauling string. Fishes inside the net are either entangled in the meshes or entrapped in the pockets. There is a strict correlation in the size of the mesh, size of the pocket and the thickness of the thread which is maintained while constructing the net. The size of the net depends upon the size of the meshes, while the size of the pockets depend upon the size of the net. Two type of cast-nets are available in

this region. They differ in the size of the meshes, pockets and the net as a whole and are known as *Jhaki jal* and *Rek jal*. This type of *ashara jal* is operated thought out the year by the villagers and fishermen. Except very big fishes, all kinds of fishes are caught by this net.

8.1.3. *Chak jal* (Cover net) : This gear is made up of mixed type of materials such as net, bamboo slits and cane string. This may be regarded as the intermediate form of gear between barricades and nets. This gear consists of a long bamboo handle is split into 4 or 5 slits at one end. These slits are kept open and a bamboo ring is fitted to their distal ends, which forms the mouth of the net. The mouth has an area of not less than 900 sq. cm. The net portion of the gear is like the cast-net. The blind end of the net bears a string while the peripheral edge of the net is tied closely with the bamboo ring. The string connected with the net remains tied to the bamboo handle during operations. This net is operated in the shallow waters of beels and swamps by plunging the net into the water. Fishes thus covered with the net are then caught with hand by the fisherman. The *Chak jal* is operated throughout the year at shallow waters mostly by the villagers. All types of fishes are caught by this net, mostly the live fishes *like Channa gachua, Channa striatus, Channa punctatus, Heteropneuster fossilis, Anabas testudinius, Clarius batrachus* etc.

8.2. Falling pots or Cover pots : Falling pots are another most widely used form of plunged buskets. Conical shaped pots are modified in shape and given the shape of a bell according to the need. Sometimes these cones are high and elegant and at others depressed and squat. The shape can be controlled by varying the relative diameter of the hoops to which are attached downwardly radiating bamboo splints from the narrow upper opening. These are three in number and can be classified as below

8.2.1. *Thorka* : The *thorka* is particularly simple in construction. A long, fairly thick bamboo is taken and split into a large number of long, narrow strips to width, in a few inches at one end, which is kept to serve as a handle. Then the rod like strips are spread till a long narrow conical form is assured. In this position they are secured upon narrow internal hoops of progressively larger diameter from the undivided butt to the wide mouth which is securely distended by a stronger hoop. It is operated throughout the year by the villagers. It is used to catch fishes living in the mud, like *Channa gachua, Clarius batrachus, H.fossilis* etc. It is a simple plunge cone and without an opening at the apex to admit the hand. So it has to be lifted up with a scoop like motion to lift out any fish caught.

8.2.2. *Jhuluki* (Medium cover pot) : It is a popular fishing gear among the villagers. It looks like an interned drinking glass, made of very fine bamboo slits split many times by bifurcation and knitted with cane string into a cone shaped gear. The bottom of the gear is 60-90 cms. in diameter while the upper structure or the mouth opening is 10 to 15 cms. in diameter. The height of the gear is pressed against the muddy bottom of the water. When a fish or fishes are entrapped in it the fishermen receives a sound and catches the fish by putting his hand inside the gear through the opening at the top. It is operated in the shallow water of beels and flooded water. Usually the types of fishes caught are available in the swampy areas of beels and other shallow waters.

8. 2. 3. *Polo* (Big cover pot) : It is the most common and popular plunge basket of this region. It varies from 60 to 90 cms. in height. The lower opening when conveniently operated has a diameter of about 45 to 60 cms, whereas the upper opening is just sufficient to permit the hand and arm to enter comfortably - 8 to 12 cms. The form is made of split bamboo supported internally by a

number of bamboo hoops. The length of the bamboos used in construction, about 90 cms. in length, are first split into three or four narrow splints in width, a few cms. from the end. The undivided extremities are bound around the mouth hoop very firmly with a closely set series of loops and knots, while the split length being pulled asunder slightly, are kept apart at the proper distance by being tied with jute fibre or cane string to the series of bamboo hoops which are placed within a regular intervals, each succeeding one increasing in diameter towards the bottom. The lower end of the bamboo splints project the hoop in order to enable the basket to be pressed down into the mud and grip end prevent any imprisoned fish from escaping by burrowing under the edge of the trap. The *Polo* is used only in quite shallow water not exceeding 60 cms. in depth. The fisherman wades into the water, generally of some partially dried beel or fork continually dropping the trap into water and pressing down the wide mouth into the muddy bottom with his left hand, while with the right passed in through the narrow upper opening. He gropes around the mud for any fish that the trap may have covered.

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Chapter - VII

TRADITIONAL KNOWLEDGE AND PRACTICES OF ENVIRONMENT MANAGEMENT

CHAPTER-VII

TRADITIONAL KNOWLEDGE AND PRACTICES OF ENVIRONMENT MANAGEMENT

I. INTRODUCTION :

Over the ages, indigenous people have developed innumerable technologies and art forms. They have devised ways to farm deserts without irrigation and produce abundance from the rain forest without destroying the delicate balance that maintains the ecosystem, they have explored the medicinal properties of plants, and they have acquired an understanding of the basic ecology of the flora and fauna. Much of this expertise and wisdom has already disappeared, and if neglected, most of the remaining could be extinct in the near future.

Until quite recently, very few in the developed world cared much about this cultural holocaust. The prevailing attitude has been that the so called Western Science, with its powerful analytical tools, has little to learn from tribal knowledge. The developed world's disastrous mismanagement of the environment has somewhat humbled this arrogance. However, some scientists are beginning to recognize that the world is losing an enormous amount of basic research, with indigenous people drifting away from their culture and traditions. Scientists may some day be struggling to reconstruct this body of wisdom to secure the developed world's future.

Human impact on nature has reached such a high proportion that the world is today witnessing an extra ordinary rate of species loss. In 1988, the International

Union for Conservation of Nature and Natural Resources (IUCN) listed 4,589 threatened animals. By the year 2050 at least 60,000 plant species will become extinct or threatened. According to a report of biologists the current rate of extinction is at least 25,000 times greater than the intensity of extinction that took place during evolutionary times. The rate of extinction of mammals alone has risen from one species every five years in the 17th century to one in every two years in the 20th century.

There are many records in the form of written or unwritten traditional lore that, traditional societies have a very good concept of ecosystem management. Indigenous people have a logic of life, which is very different from that of modern man. It is because of this logic that indigenous people are where they have been for ages and not because of their backwardness or primitiveness. These people decided not to run for so called development. Once one runs for development one does not know when to stop and also does not know why one is running, it is hard to define what is development.

Sacred groves, sacred ponds, sacred patches of grass lands, sacred animals, and others are examples of traditions of conservation backed by religious sanctions. The preservation of biological resources by such traditions is of immense significance. Certain species of plants and animals have been preserved on account of sacred qualities attributed to them. The most common examples of such trees are those of *Ficus religiosa*, neem, mango, wood apple, etc.

Plants and animals worshipped as totems symbolize the kinship ties of humans and nature. These totems, sacred to specific clans, are accorded full protection. This practice is mainly prevalent among the tribal populations and specially among those who undertake hunting and gathering in some form or

the other. The practice of certain taboos with regard to resource extraction could be interpreted as conservation practices cast in religious idioms, as most of them allowed for regeneration and perpetuation of species.

In addition to the belief systems which condition the relations between humans and biodiversity, the social, political and economic relations between the humans themselves influence or control the use of resources. Thus, the indigenous community and wider institutional structures form the second context of resource use. These include structures for the management of common property resources, customary tenure rights, customary laws and rules, regarding resources, localized economics and so on. Traditional community based management of common property resources typically imposed restrictions on the indiscriminate use of resources and ensures some form of distribution of benefits and livelihood opportunities . The self managed village commons (water bodies, forests, pastures etc.) were often equitably managed.

The diverse types of forests in India are perhaps the richest assemblage of biodiversity. The dependence of traditional communities on this forests resource is enormous. Being of such critical socio-economic importance, these communities tended to exercise self restraints in the use of forest resources , thus conserving both the constituent biodiversity of forests as well as diverse forest type as a whole. Beside these communities are also vast repositories of forest related biodiversity knowledge.

II. ENVIRONMENT MANAGEMENT IN THE RELIGIOUS AND CULTURAL HERITAGE OF INDIA :

An in-depth and unbiased investigation of the religious and cultural heritage of Indian society reveals that they have, over centuries, provided a knowledge

of nature and rules of natural resource utilization that has enabled ancient civilizations to survive materially. The fundamental constituents of the material world are defined in these systems in a manner which respects the integrity of nature and the stability of essential ecological processes. India's religious and cultural traditions are rich and diverse which includes a rich resource of beliefs about nature and rules for the sustainable utilization of material resources.

Plantation of trees in the public places , such as road-sides, temple gardens etc. is an ancient tradition of India. The abundant age-old trees found throughout the holy shrines in India reveals an age old eco-friendly Indian tradition.. Trees such as mango, neem or banyan have always been planted along the roads to give shelter and shade, their leaves acting as natural air-conditioners. These huge trees have, for generations, proved to be comforting shady haunts for weary travelers.

Planting trees and digging wells have traditionally been the two great acts of charity by which any one could earn merit and universal appreciation. This tradition of valuing trees was passed on in to Indian culture and led to a subtle ecological relationship between human communities and the forest community of trees, plants and animals.

Concern for the welfare of the natural world has been an important element throughout the history of Buddhism. The recognition that human beings are essentially dependent upon and interconnected with their environment has given rise to an instinctive respect for nature. Although Buddhists believe human beings have a unique opportunity to gain enlightenment, which other creatures do not, they have never believed humanity is superior to the rest of the natural world (Batchelor, 1992 :14).

Buddhism advocates a gentle, non-aggressive attitude towards nature. According to Buddhist philosophy, a householder should accumulate wealth, as a bee collects nectar from a flower. The bee harms neither the fragrance nor the beauty of the flower, but gathers nectar to turn it in to sweet honey. Similarly, a human being is expected to make legitimate use of nature so that he can rise above nature and realize his innate spiritual potential (De Silva, 1991:18).

Among Buddhists, large, old trees are particularly revered . The attitude, which is a legacy of pre-Buddhist animism, does not violate the belief system of Buddhism. The trees are called *Vanaspati* in Pali, meaning 'lords of the forests'. The deference to trees is further strengthened by the fact that huge trees such as the ironwood , the *sala (Shorea robusta)* and the fig tree are acknowledged as *bodhi* trees, trees under which Buddha attained enlightenment. It is well known that the fig species *(Ficus religiosa)* is held as an object of great veneration in the Buddhist world as the tree under which Buddha attained enlightenment (De Silva, 1991:23).

The great ancient Indian king Ashoka had passed the famous abstinence for protection of many wildlife. In his famous abstinence ordinance the following animals are declared inviolable - *Suka* (Parrot), *Salika* (Myna), *Cakravaka* (Ruddy goose), *Hamsa* (wild goose), *Nandimukha* (a kind of bird), *Gelata* or*Jetuka* (bat) *Ambakapilika* (queen ants), *Dali* (terrapin), *Anathika maccha* (jelly fish), *Vedaveyaka, Gamgapuputaka* , *Samkujamaccha* (skate-fish), *Kaphata sayaka* (porcupine), *Pamnasasa* (squirrel), *Simaqla Samdaka* (wild bull), *Akapinda* (iguana), *Palasata* (rhino), *Seta kapota* (white dove), *Gama kapota* (domestic dove), he adds the significant clause "which is neither useful nor edible". That the spirit of the edict is not less economic than altruistic is

further proved by the forest law- "forests must not be burnt either uselessly or in order to destroy living animals" (Raichoudhury, 1964:129).

The preservation of the four-footed, feathered and finny races is sought with assiduous care in other rules of the economist. For this specific purpose the *Abhayaranya* (sanctuary) is set apart and none are allowed to entrap, kill or molest deer, birds and beasts protected thereunder (Bose,1945:68).

III. TRADITIONAL ENVIRONMENT MANAGEMENT IN NORTH-EASTERN INDIA :

North Eastern part of India is one of the rich area of biodiversity. It is an established fact that the areas which are rich in cultural diversity are also rich in biodiversity. North Eastern part of India is also a region rich in cultural diversity . People of North Eastern India preserved the nature and natural resources of this part of the country as a part of their traditional culture. But, as the indigenous peoples of this region has been threatened for a long time, as development encroaches on their lands and traditions, the Bio-diversity of this part of India is also greatly threatened. Therefore an effort for preservation of traditional culture for the sake of conservation of nature and natural resources is the need of the hour. For a better understanding of the significance of traditional practices for conservation and management of environment in the present day context a study in this line is of utmost importance. Various ethnic groups of people of North-Eastern India has practiced a large number of traditional systems of environment management. Some of these practices are described below.

IV. 1. Traditional Rain Water Harvesting :

Collective action is the most important aspect of traditional people's management of environment in North Eastern India. Dugout-cum-embankment type of water harvesting structures were used for storing rain or runoff water traditionally

by most of the tribes and communities of this region. Initially, the main purpose of water harvesting was to meet drinking water requirement of humans and animals during scarcity. With the development of the agricultural system, the utility of such water storage's began to be extended to irrigation. People of North Eastern India retain and harvest water in several ways.

Several hundred years ago, tribes in Meghalaya developed procedures of harvesting water from hill streams from bamboo pipes for irrigating betel vines and other plantations on steep slopes. With a net work of bamboo pipes of different diameters, lengths and shapes, 18 to 20 liters of water were diverted per minute from the main channel to flow at the rate of 20 to 80 drops per minute at irrigation points. The beauty of the system lies in the use of local materials and resources, and the perfection in water distribution without leakage. Streams are also diverted for irrigation with the help of channels or pipes.

Traditional water harvesting units were managed and maintained by rules and procedures commonly agreed upon by the villagers. Such rules and regulations are still prevalent in villages of north eastern India, particularly in the hills. Problems relating to water management are not the result of any single individual's activity, rather the cumulative effect of the actions of many individuals. Traditional systems, if studied and evaluated in totality and not just for their technology, can provide some answers to the current problems in our environment (Singh, 1997:2).

III. 1. 1. Rain Water Harvesting in Assam :

Assam has a long tradition of rain water harvesting by different methods. The Bodo tribe of Assam is one of the premier ethnic groups of people to start wet cultivation of rice in the earlier Assam. The cultivators of Assam, particularly in the areas of Bodo inhabitants usually never face a drought condition in

their rice fields, as there are age old man made canal systems, which canalized rain and spring water from the distant hill springs or lakes . In Assam this age old man made canal system is called *dong*. The *dong*s are though not very wide but very long, distributing its branches and sub branches throughout an extensive paddy field. It is estimated that a single *dong* may be capable of irrigating one thousand to five thousand hectares of land in the dry season.(Imperial Gazetteers of India, Provincial series, Eastern Bengal and Assam, 1909). It is worthy to be mentioned that such a large and scientific irrigation canal system was the creation of the wisdom of the people. The villagers collectively made such a large irrigation system. Again, it is interesting to note that, there was standing rules for management and equal distribution of water to all the villagers at the time of need .

At the time when the water is necessary for drenching of a field, the farmers make a temporary mud *bundh* over the canal. After the *bundh* is made properly, the water in the upper part flood the whole of the canal above the *bundh*. At this stage, the longitudinal embankment of the canal has cut in places so that the water can enter the field. After complete inundation of the field to the desired level , the *bundh* is demolished.

III. 1. 2 . *"Pukhuri"*(Tank) : The Marvels of Water Conservation in Assam :

Construction of tank for conservation of water is the most ancient and glorified technology of water management in Assam. Tanks are small reservoirs built by constructing dams and is the oldest method of water conservation by storage of runoff water. There are large number of tanks in Assam most of which were constructed in early times. The rulers of ancient Assam were much conscious about the construction of water tanks for public service. There were special royal officers to look after the construction of water tanks, specially in the days of Ahoms (Basu , 1970 :112).

Construction of pond or tank either for domestic use or for public use is a worthy tradition of Assam. There is a strong belief that one can earn much God's grace, if he can construct water tanks or ponds for the public. Due to this traditional belief in the Assamese society, the rulers of Assam had an aim of constructing as many tanks as he could. The Ahom kings of Assam constructed a large number of large sized water tanks. Construction of tanks was a point of consideration about the greatness of the king. Most tanks were constructed for religious purposes, but these tanks served economic and agricultural needs. Tanks were constructed when a deity was being installed or on the demise of a loved one. There are many instances in folk tradition when women and men sacrificed their lives as well as those of their children in the belief that their sacrifice will bring water.

IV. 1. 2 . 1. List of the large tanks (*Pukhuri*) constructed during the rules of various Ahom kings:

Dihingia King ,Chuhung Muhung(1497-1539)

1. *Karotowa Pukhuri* 2. *Athabari Pukhuri*

Gargayan King , Chuklen Mung(1539-1552)

3. *Gargaon Pukhuri,* 4. *Padum Pukhuri*

Khora king ,Chukhampha(1552-1603)

5. *Nahar Pukhuri,* 6. *Jethi Pukhuri,* 7. *Mechlou Pukhuri,*

8. *Sondar Pukhuri*

King Pratap Singha, Chuchenpha (1603-1648)

9. *Mechagarh Pukhuri,* 10. *Rupahi Pukhuri,* 11. *Teliadonga Pukhuri,*

12.*Phulcheng Pukhuri* 13. *Taokak Pukhuri,* 14. *Dergaon Pukhuri*

King Jayaddhaj Singha , Chutamla (1648-1663

15.*Rahdhala Pukhuri,*16. *Athaisagar Pukhuri,*17. *Tenga Pukhuri,*

18. *Baduli Pukhuri,* 19. *Neo Gohain Pukhuri,* 20. *Lakhimi Pukhuri*

King Chakraddhaj Singha,Chupung Mung (1663-1670)

21.*Burha Gohain Pukhuri,*

King Gadadhar Singha, Chupatpha (1681-1696)

22.*Bhogdai Pukhuri,* 23. *Rahdai Pukhuri,* 24. *Bauli Pukhuri,*

25. *Mitha Pukhuri,* 26. *Borkala's Pukhuri,* 27. *Joha Pukhuri,*

28.*Thaora Pukhuri,* 29. *Sukan Pukhuri*(Betbari), 30. *Aghoni Pukhuri,* 31. *Panibeel Pukhuri,* 32. *Achubulia Pukhuri,* 33. *Demow Pukhuri,* 34. *Sukan Pukhuri*

King Rudra Singha, Chuthrangpha (1696-1714)

35.*Jaisagar Pukhuri,* 36. *Borkola Pukhuri,* 36. *Sontola Pukhuri,*

37.*Borpatra Pukhuri,* 38. *Rongpur Pukhuri,* 39. *Chaara Pukhuri,*

King Siva Singha, Chutanpha (1714-1744)

40.*Dhai Pukhuri,* 41. *Sibasagar Pukhuri,* 42. *Gourisagar Pukhuri,*

43.*Rajmao Pukhuri,* 44. *Lakhimi Pukhuri* (Kalugaon)

King Rajeswar Singha, Churampha (1751-1769)

45. *Silpukhuri* (Guwahati)

King Lakshmi Singha, Chunyaopha (1769-1780)

46.*Bogidol's Pukhuri,* 47. *Rudra Sagar Pukhuri,* 48. *Gouri Ballabh Pukhuri,* 49. *Ligiri Pukhuri*

King Gourinath Singha, Chuhitpongpha (1780-1795)

50. *Aideu Pukhuri,* 51. *Kunwari Pukhuri,*52. *Borborua Pukhuri*King Kamaleswar Singha, Chuklingpha (1795-1811)

53. *Cheuni Pukhuri,*

King Chandrakanta Singha, Chudingpha (1811-1821)

54. *Bishnusagar Pukhuri,* 55. *Bangal Pukhuri,* 56. *Burhagohain Pukhuri*

Some other large tanks constructed during the Ahom rules, the time of construction of which could not ascertained are:

57. *Nitai Pukhuri,* 58. *Dhitai Pukhuri,* 59. *Sadhowa Pukhuri,* 60. *Petudhowa Pukhuri,* 61. *Kordhowa Pukhuri,* 62. *Lengibar Pukhuri,* 63. *Sonari Pukhuri,* 64. *Bamun Pukhuri,* 65.*Senduri Pukhuri,* 66. *Gabharu Pukhuri,* 67. *Khemdoi Pukhuri,* 68. *Solal's Pukhuri,* 69. *Numali Pukhuri,* 70. *Senchowa Pukhuri,* 71. *Bejar Pukhuri,* 72. *Sukan Pukhuri,* 73. *Phulpanichiga Pukhuri,* 74.*Rangachila Pukhuri,* 75. *Monkhamor Pukhuri,*76. *Lepetkata Pukhuri,*77. *Bejdoloi Pukhuri,* (Gogoi,1994:198).

III. 1. 2 . 2. Traditional Methods of Selection Site for Construction of a Tank :

There are some traditional know-how to select a suitable place where under ground water sources will easily be available. It is stated in the chronicles of Ahoms, that the selection of site for a proposed tank depends on an expert known as *maticheleka* or the soil tester, who undertook a scientific experiment for locating a perennial spring for keeping the water level of the tank constant

Before construction of a tank, the site is selected by an experienced water table locator. Rituals are performed on this occasion. The Ahom kings calculate the exact auspicious time for a good start of construction of a pond, with the help of the royal astrologer. The construction work of a pond was considered to be very auspicious and religious. (There are many interesting folk tales about the construction of ponds by the king. One such interesting story is that

of a particular king, who, after completing the construction of a tank found that there was not a single drop of water in the tank. Then, the king performed worship of the Water God. At night, the king dreamt that the Water God demanded the sacrifice of the queen, and unless the queen is sacrificed in the name of the Water God the tank will remain dry. In such a condition, the king sacrificed his dearest queen to satisfy the Water God and to provide water to his subjects. There is a very popular ballad on this folk story in Assamese- a good example of how a king looked after the needs of his subjects looking beyond his personal emotions.)

III. 1. 2 . 3. Traditional Technique of Construction of Tanks:

The Ahoms have adopted a scientific technique of construction of pond. The Ahom rulers had appointed a royal officer to look after the construction works of tanks etc. He was known as *Chang-Rung-Phukan* (Chief engineer). He also maintained accounts of all the construction works. This account is known as *Chang-Rung Phukanar Buranji* (History of Chang-Rung-Phukan:Chief engineer).

The tanks constructed by the Ahom rulers were very large sized. Some of these tanks are called "*sagar*"(sea). According to Chang-Rung- Phukan's history, the sizes of the very big tanks, built by them are as follows:

1. Jaisagar Pukhuri : Total square area : 240 bighas 6 kathas and 10 lochas.
2. Gourisagar Pukhuri : Total square area : 221 bighas 3 kathas and 8 lochas.
3. Sibsagar Pukhuri : Total area : 194 Puras.
4. Meshagarh Pukhuri : Total area : 27 puras
5. Rajmao Pukhuri : Total area : 19 puras
6. Rohdai Pukhuri : Total area : 18 puras

The work of digging of the tanks was started in the morning, because morning time is generally said to be auspicious. Usually, the area selected for construction of the tank was first cleared by digging the surface earth to a few feet's depths. Then, the embankment is constructed in the proposed area with the dug out soil from inside of the tank. Digging of the whole tank area is continued till the arteries of under ground springs started oozing. After percolation of sufficient amount of water, digging work of the whole tank is stopped. Then, a particular place is selected for construction of a well. The purpose of construction of the well is to be sure of a good source of under ground water and to prevent drying of the tank at any time. The well is dug out to a considerable depth despite a heavy flow of water. A very long piece of hard wood is erected on the well, which is known as "*nag*". The tanks which bear such a *nag* is known as *nag pota pukhuri*. Almost all the big tanks constructed under Ahom royalty contain a *Nag*. It is said that the *nag* is a symbol of the Serpent God. A *nag* is also used for marking the water level of the pond.

It is very interesting to note that, the Ahom tank builders used a kind of chemical to get the clarity of water. It is said that this chemical is nothing but mercury. The Ahoms called it *rah*. There are many ancient tanks which are known as *rah dhala pukhuri* i.e. the tank where the *rah* or the mercury is poured. It is not known from where the Ahoms procured such a huge amount of mercury . Of-course there are many instances of using mercury in heavy amount for other purposes. The Ahom gold washers used mercury for solidifying of gold particles collected from the river sand.

It has been mentioned by some ethnologists that the *rah* or the mercury was prepared in the olden days from the leaves of *bel* (*Aegel marmoles*) tree.

How far this statement is correct is not known. This confusion has made it a subject of research. It is said that the Ahoms have used mercury or *rah* for preserving the dead bodies of the Ahom kings for burial in the *maidams*.

Whether the Ahoms used mercury, that was manufactured from wood apple, for clearing turbid water of tanks is true or false, is not known, but there are references of using wood apple's extract for clearing turbid water of tanks in ancient India.

The ancient Indian scientist Chakrapani described in his book *Viswa-Vallava* about the technique of purification of turbid water in the wells and the tanks. Along with other plants, use of *sriphala* (wood apple) for purification of turbid and pungent smell of water is prescribed. It is mentioned in the Ch-II, sloka-38 of the said book that the juice of *Terminalia chebula* and the powder of *Terminalia citrina*, *kustha*, cardamom, and the fruit of *sriphala* (wood apple), if thrown in the turbid water, will turn the water clear and sweet (Ray,1948:12)

III. 1. 2. Traditional Water Harvesting System in Arunachal Pradesh :

People of Arunachal Pradesh has developed various ways for harvesting of water in the hills and valleys. They not only strategically harvest rain water but also use techniques for conservation of moisture and nutrients.

There are two important traditional irrigation systems in Arunachal Pradesh- the irrigation of rice terraces with the help of bamboo pipes, and the Apatani system of wet rice irrigation. In the former case, water is transported through an intricate system of bamboo pipes to agricultural fields. But this system is now becoming obsolete and is being replaced by iron pipes and channel irrigation .

The Apatanis have evolved a very scientific system of field irrigation. The striking features are the partially flooded rice fields, and the intricate design of

the contour dams dividing the plots. The valley floor has a gentle gradient and the terraced holdings are laid out along the general slope. The plots are divided by 0.6 m high earthen dams supported by bamboo frames. All holdings have an inlet facing the water-head and an outlet on the opposite side . The inlets for the low-lying plots act as outlets for the higher level plots. A deeper conduit channel connects the inlet point with the outlet point. When a terrace is to be filled with water, the outlet is blocked. By opening and blocking the the connecting ducts, any field can be flooded or drained as required (Malley, 1907:66).

III. 3. .Meghalaya :

Bamboo Drip Irrigation :

In Meghalaya, an ingenious system of tapping of stream and spring water by using bamboo pipes to irrigate plantations is widely prevalent and so perfected that about 18-20 liters of water entering the bamboo pipe system per minute gets transported over several hundred meters and finally gets reduced to 20-80 drops per minute at the site of the plant. The 200-year-old system is used by the tribal farmers of Khasi and Jaintia hills.

The bamboo drip irrigation system is normally used to irrigate the betel leaf or black pepper crops planted in areca nut orchards or in mixed orchards. Bamboo pipes are used to divert perennial springs on the hilltops to the lower reaches by gravity. The channel sections, made of bamboo, divert and convey water to the plot site where it is distributed without leakage into benches, again made and laid out with different forms of bamboo pipes. The flow of water into the lateral pipes is also controlled by manipulating the intake pipe positions. Reduced channel sections and diversion units are used at the last stage of water application. The last channel section enables the water to be dropped near the roots of the plant.

Bamboo's of varying diameters are used for laying the channels. About a third of the outer casing in length and inter-nodes of bamboo pieces have to be removed while fabricating the system. Later, the bamboo channel is smoothened by using a *dao*, a type of local axes which is a round chisel fitted with a long handle. Other components are small pipes and channels of varying sizes used for diversion and distribution of water from the main channel. About four to five stages of distribution are involved from the point of the water diversion to the application point.

The water for betel leaf plants is diverted from streams by temporary diversions into very intricate bamboo canal systems. Betel leaf is planted in March before the monsoon. It is only during winter that irrigation water is required, and the bamboo pipe system is used. Hence, these bamboo systems are made ready before the onset of the winter, and during the monsoon no water is diverted into them.

Maintenance of the pipes and supports is done by the farmers themselves. A cooperative has been formed, and each farmer provides his skill and labor to maintain the system. Repair work is undertaken as and when required. Distribution of water is carried out by diverting water from one field to another at fixed timings. To divert the water, a short bamboo with a hole at the bottom is placed across the main lines. This blocks the main water pipe and diverts the water.

IV. ENVIRONMENT MANAGEMENT IN ORAL LORE :

From early times, conservation of surface water by constructing very big ponds in the field has been a tradition in Assam , as well as in some other parts of the North Eastern states. During the days of Ahom kings there was a very good tradition of constructing big water tanks which are often regarded as *Sagar* or sea. These water tanks never dried-up and were used as a reliable source of

water in severe drought. The ponds were used simultaneously for field irrigation, for drinking water purpose and also as fisheries. There is a very popular proverb regarding the conservation of water in Assamese.

"As you regard your own religion

Keep water like a queen constructing a pond."

In autumn and early winter the water in the rice fields starts drying up. But this is peak time for the flowering and maturing of rice. During this time if the rice field dries up it hampers the production of rice. Therefore, there is a tradition of keeping water in the rice field during the flowering time of rice in the autumn. In this regard there is a very good proverb in Assamese.

"Conserve water in *Kati* and *Aswin*.

As the king keeps the queen."

Cultivation in the hilly slopes is a problem for want of waters, because the water flows down immediately to the plains. Rice is the manifold crop of the Assamese people. Moreover, wet cultivation is the most popular practice of the people. The *"sali"* variety of rice is the only one variety popularly used by the people. Cultivation of this variety needs a considerable amount of water in the field. But in the hilly areas cultivators of this region developed a system of constructing embankments densely to conserve rain water in hill slopes. There is an old proverb regarding this.

"Construct dense embankments on the hill

Then only plant rice in the field."

Good crop usually come from lands whose middle portion is low lying. The reason why it is made fertile is the accumulation of water in the center and flowing down of the fertile top soil from the higher ridges around. This is mentioned in a proverb.

"Buy a land whose middle is low,

Marry a girl whose mother is good, you know."

V. ENVIRONMENT MANAGEMENT IN TRADITIONAL CULTURE :

V. 1. Plant cult:

Plants play a very important role in the traditional culture of Assamese society. The traditional culture of Assam is based on the available resources of nature. A large number of plant species are indispensable in the performance of various traditional cultural functions.

The '*Bor gach*', banyan tree *(Ficus bengalensis)* is worshipped by the Assamese people for numerous reasons. A sacred spot is installed below the '*Bor gach*' or the banyan tree for the deity which is known as '*Bura gosain*'. The sacred spot is therefore known as '*Bura gosainr than*' and the people worship the tree as a symbol of the '*Bura gosain*'.

In traditional Assamese society, during the ninth month of the first pregnancy of a woman, a symbolic marriage is performed which is known as *puhan biya*. In the evening, a day before this symbolic marriage, a bud of the banyan tree is worshipped. Later, this bud is crushed and the woman is asked to smell it. The significance of this ritual is the belief that the essence of the banyan bud protects the embryo. In some parts of Assam, marriage ceremonies between banyan trees are also performed.

Srimanta Shankardeva had mentioned in the *Keertana* that the sin of cutting of a banyan tree is equivalent to that of the killing of a *Brahmana*. There is also a belief that a worshipper of the banyan tree would earn God's grace and protection. And a person who treats a banyan tree with holy respect can enjoy the benefit of an '*Ashwamedha Yagna*'.

Another species of *Ficus* genus, the *Ficus religiosa*, commonly known as the *Aahat Gach* is also regarded as sacred by the Assamese people. Usually the

old and huge *Ahat Gach* (peepal tree) at the middle of the village square is regarded as the abode of the evil spirits. And in order to stay away from the evil influence of the spirit, this tree is worshipped.

Sheetala, the deity of small pox is also worshipped by the Assamese people under the big *Ficus* tree. It is a belief that the *Ficus* tree is the abode of this deity. Goddess *Kali* and lord *Shiva* are also worshipped beneath big *Ficus* trees.

There is a tradition of according honour to the cowherds by the villagers. The ritual is known as '*Garakhia Sewa*" i.e. honouring the cowherds. Rituals are arranged in honour of the cowherds beneath the large *Ficus* trees. The belief is that at the time of storm and the heat of the sun, only the big *Ficus* trees provide shelter to the cowherds. Therefore, the villagers accord honour to both the cowherds and the *Ficus* tree for the safety of the cowherds.

Women of the villages set up religious institutions beneath the big trees of the villages which are regarded as sacred.

Mango tree is also regarded as a sacred tree. Branches and leaves of this tree are used in various religious ceremonies. Cutting of Mango trees is considered a sacrilege. Even sleeping in a bed made of wood from a mango tree is prohibited. These trees are planted at social places like streets, *namghars* and temples. In almost every Assamese house hold there are a number of mango trees in the courtyards. It is commonly believed that the great lord *Mahadeva* and Goddess *Parvati* reside on the *bel* tree (*Aegel marmelos*). Therefore, this tree is held in high esteem and honoured by everyone. Cutting of this tree is also tabooed.

Kadam or *Kadamba* tree(*Anthocephalous indicus*) is also honored as a religious tree. It is believed that Sri Krishna played the flute sitting on the branch of *kadama* tree. Therefore, people worship *kadama* tree and plant this tree at religious places.

Again, there is a belief that when *Kali naga* released its venom in the *kalia* lake, then all the plants and animals of that lake breathed their last but the *kadam* tree survived. The tree's survival is attributed to another legend associated with *Garura,* the heavenly bird, when bringing the '*Amrita*' *i.e.* the eternal drink, resting for a while on the branch of a *kadam* tree.

Silikha tree (*Terminalia chebule*) is also regarded as sacred. The great Assamese saint philosopher Srimanta Sankardeva wrote most of his books under the s*ilikha* tree. The *silikha* fruit is used in many religious ceremonies and the tree is also honoured greatly.

The *Neem (Azadiractus indica)* tree is an integral part of the worship of the goddess *Kali.* To get rid of evil spirits, the tantriks use the *neem* leaves while reciting the *mantras*. Planting of the *neem* tree in the house yards and the temples is a religious tradition in Assam. The devotees of goddess *Kali* always keep a branch of *neem* leaves with them.

The *barun* tree (*Crataeva religiosa*) is also worshipped in Assam. People, in order to protect themselves from evil spirits keep branches of the *barun* tree in the houses. Its branches, cane climbers or *Bet* are hanged around a house where a pregnant woman or a new born baby resides. Branches of *bagari* plant is also kept for the same purpose in a house.

Bihlangani is used while *mantras* are recited to drive out evil spirits and to relieve body pain. *Narasingha* (*Murraya keeningi*) is also used while reciting *mantras* to drive out evil spirits from an affected person or to get relief from body ache and ailments of the stomach.

Tulsi (*Ocimum sanctum*) is the most sacred plant in India. In Assam almost every household has a *tulsi* plant in the courtyard. The *tulsi* plant is worshipped in the evening by lighting an earthen lamp. Assamese widows apply the soil from the base of the *tulsi* plant on her forehead after taking bath in the morning.

The Assamese believe that the *tulsi* leaves soaked in water is sacred. They sprinkle *tulsi* water on filthy places to make it holy or germ free. *Tulsi* leaf is a must in every sacred and religious occasion. Moreover, the Assamese people use the extract of *tulsi* leaves as medicine particularly for cold, cough and stomach ailments. They believe that snake and evil spirits do not venture near places wherever there is a *tulsi* plant.

Another popular belief goes that evil spirits usually live in the *kendu* tree (*Diespyrus cordifolia*) and *xarua* tree (a kind of tree, branches of which are used as a tooth brush). Therefore, people worship this tree.

Siju (Euphobia nerifolia) is the most revered plant of the Bodos. In the courtyard of every Bodo, there is a s*iju* plant, and it is worshipped in the morning and in the evening. *Siju* is specially worshipped during the "Bathon Puja". It is believed that the s*iju* plant is the fierce life of the earth erected by god. In *Manasha puja* and *Maroi Puja* (a religious function of worshipping the snake goddess), the *siju plant* is use s*iju plant* is also regarded as a shield against evil spirits and hence it is grown in the courtyard of a house specially where there are pregnant women and new born babies. *Siju* plant is not planted in the fences keeping up to the superstitious belief that doing so heralds ominous storms.

Sariah (Mustard) is the most essentially used plant in Assam. Its leaf is a common vegetable and its seed is commonly used in various recipes. Mustard oil, commonly known us *Khati tel* or *mitha tel* is the only medium for cooking used by the Assamese people. The mustard seed is also used for various purposes. A packet of the mustard seed is kept in the house or with a person in order to keep evil sprits at bay. Mustard seeds with *mantras* recited are kept with bridegrooms and brides to stay away from many evil inferences.

Ada (ginger) and *haladhi* (turmeric) are also traditionally used for various purposes in the Assamese society. It is used in religions ceremonies. It is customary for the Assamese people to use turmeric powder on any vegetable preparation. Mantras recited on ginger is used for various purposes and specially for curing diseases. Turmeric extract is also used to remedy different diseases and also as a cosmetic. On the day of marriage the bride and the bridegroom are cleansed with a paste of turmeric along with other traditional ingredients like *mah* (*Phaeselous sp.*).

In traditional Assamese society, a great place of honour is accorded to the betel leaf and areca nut. It is a must to serve the guest to this fruit and leaf as a mark of respect. It is a popular belief that areca nut and the betel leaf are taken from same tree on which the betel vine had climbed, and if it is offered to a girl by the boy after incanting some '*mantras*', then the girl would surely come under his sway.

A betel vine is greatly honoured and is considered a sacred plant A woman having her monthly periods is prohibited from plucking betel leaf from the betel vine. These plants are commonly found in almost every household. Passing of urine and stool in and around the areca nut trees and betel vines is strictly prohibited.

On the day of '*uruka*' (the day before *Magh Bihu*), people tie hay or dried banana leaves on the areca nut and coconut trees and other fruits. This ritual is performed early in the morning and is believed to enhance the fertility of the trees in order to produce more fruits. Trees are also chided by saying that if they do not produce more fruit, they would be cut down.

Marriage ceremony between the trees is also reformed in Assamese culture. Marriage ceremonies are usually performed among the banyan (*Ficus*)

and other such sacred trees. This ritual of the marriage ceremony is akin to that of human beings. Some young girls are also married to trees in order to make her immune from the harmful influence of the evil spirits (Sarma, 1995: 145).

VI. 2. Water Cult :

Water, the source and mainspring of life is worshipped as a divine incarnation in the various cultures and traditions of the world. The origin and development of water cult has been associated with deep and symbiotic bond that exists between life and water. Myths of various traditional societies assert the significance of water in sustaining life. The cult of water worshipping is intricately connected with the tradition and culture of the various ethnic groups of the north-eastern part of India.

The *Deuris* and the *Dimasa Kacharis* of Assam traditionally believe that earth has an aqueous origin, i.e. initially there was nothing but water on this earth. Another indigenous native tribe of Assam, the Tiwas (Lalungs) associate their origin to the water emerging out of the mouth of *Mahadev*. The Bodos believed that prior to the origin of life on earth, there was water all around. They believed that from a small amount of sticking material in the barbells of a pair of *Magur* fish (*Clarius batrachus*), the earth was formed. Hindus substantiate this belief that the creation of the earth owes its origin to water. This belief is also prevalent among the Christians, Muslims and other sects.

Ancient sages of India venerated water by chanting '*Slokas*' or devotional prayers, glorifying the various attributes of water, Water was also regarded as 'Mother'

"O, water you are the source of happiness,
Provide us food and herald the rainfall
O, water you are our mother,
You provide us with the joyful sap of life"

Vedas recall the water as the panacea and the source of peace and joy. Water is the matter of origin of life. Water is the source of life of all flora and fauna. Traditional societies venerated water as a divinely ordained source of life. This sanctification of water is scientifically relevant as an indigenous practice to preserve the purity of water. This is why, in order to ward off evil spirits, a dip in the water is recommended. In Assamese society, a practice of sprinkling water mixed with cow-dung is prevalent. This practice supposedly sanctifies the area.

In Hindu religion '*Varuna*', the God of water occupies a significant position. The natives of Assam venerate water as '*Jal konwari*' (water princess), and '*Jal devata* (water god).

In the ancient days, the kings dug ponds and water tanks for the welfare of their subjects. In order to obtain water in these ponds and tanks, various animals and sometimes even human beings were sacrificed. There are also instances of kings dedicating their beautiful queens in the sacrificial altars. There prevails a popular ballad about a king who dedicated his beautiful wife in order to appease the water god . Ballads and tales of this order are prevalent in many other traditional Indian societies also.

These beliefs assert the significance of the preciousness of water in those days. Traditional Assamese belief holds that the incantation of *mantras* by the bank of a river regularly, venerates the river and it shields them from all harm and natural calamities.

It is believed that if any person incurs the wrath of the water god, he or she succumbs to ill health. In a bid to appease the water god traditionally prayers are offered with white flowers, white pigeons and eggs by some tribes of Assam. When the females have their periods, it is considered inappropriate to cross the

rivers or pollute it by passing stool or urine- which is also not hygienic and may lead to various ailments. A pregnant woman is also forbidden to cross a river as it is believed that the foetus may die or be diseased or deformed. Throwing dirty clothes and wastes of small children in the water is also said to incur the wrath of the water god. Hence, people refrain from indulging in such prohibited activities. Whenever a new boat is launched in the river and whenever an attempt to cross the river in a boat is initiated, the water god is worshipped.

In cases of prolonged and unusual droughts, the water God is appeased by the native people by following an interesting ritual, a pair of frogs are bound in nuptial union and this is supposed to relieve the earth of the drought (Sarma, 1989:202).

VI. 3. Fish Cult :

Fish plays a significant role in the cultural life of the people of north eastern India and naturally many beliefs and ceremonies are associated with fishes.

Though fish is a staple food for the people of this region, but the use of some particular varieties of fish is, however, forbidden. A high class Assamese Hindu in ancient time did not take the species of fishes like *Mirika* (*Cirrhinus mrigala*), *Singhi* (*Heteropneustes fossilis*), *Neria*(*Eutropichthyes neria*), and *Garua* (*Bagarius bagarius).* Of course, nowadays many high class Hindus also eat these fishes. The Wanchus of Arunachal Pradesh also do not eat these fishes. They call these fish as *Yami.* They do not eat them because according to a legendary folk story of the Wanchu's this fish was originally a girl (Elwin, 1958 :317).

The Sema Nagas avoid two kinds of fishes. Of these one is *Akhaki* , avoided by the young men, because of a legend which ascribes its origin to a part of the anatomy of a man which he accidentally knocked off with a stone after a successful love affair. The other variety is *Azho* which is tabooed as it is

believed that one taking it will suffer great pain at the time of death (Hutton,1921:94). Among the Memi group of the Angami Nagas, the Mohvus (Stone puller) and others of high social status refrain from eating a small fish called *Kureu* (Hutton,1969:339).

Some people of high social order particularly the princes of the royal family in Manipur do not take *Ngaril* (snake like fish) because they believe that their original ancestor Pakhangba sometimes takes the form of a snake (Hadson, 1908:58). Among the Khasis also, some clans do not eat certain kinds of fish as they claim to have some ancient relation with those particular fishes. According to one belief there was a family feud between two clans. The one that was stronger cruelly treated the other and dismissed them, in great shame, out of the village. Thus they went and took their abode by the side of a river. There they saw an unusually big fish swimming in the shoal. The man with their sticks jumped into the water and surrounded it. They used their sticks freely. At last the fish was caught and each one of them cudgeled it to powder to satisfy their spirit of revenge on it as they could not retaliate against their younger opponent. It is known to them up to this day as ' the fish of vengeance', and they consider it taboo to eat the particular fish.

The Khasis like Manipuris believe that their serpent god *U-Thlen* sometimes changes itself into a form of living fish inside the home in the presence of outsiders to shame the owners for neglecting to propitiate him with the sacrifice of human blood at least once a year.(Barua, 1959:54).

Among the Dimasas of North Cachar hills, in case of barrenness the couple perform a religious function called *Mulilinga* . In this worship , fish of catfish family, eel (*Nadang*), mud fish (*Namma*), *Barali* or *Wallago* (*Nayeh*) etc. are offered in the *puja*. This gives the belief that such *puja* brings fruits to the couple. The couple therefore do not take these fish. If children are born thereafter they can take this fish but not their parents (Barua, 1959:56).

Fish is one of the must items used in the marriage ceremonies of many communities of North Eastern India. The Khasis of Meghalaya use fish as an essential item in the marriage ceremony. Three pieces of dried fishes are taken and placed in the floor and the presiding priest pours libations on them thrice calling upon god, the spirits of ancestors and the community respectively to witness the marriage. After this the fish is tied to the roof or rafter of the house and are not lowered until the birth of a child to the couple. Fish is indispensable in betrothal among the Mishings. One hundred and twenty varieties of fish either raw or dried must be supplied to the bridegroom at the time of *Arcu-Acum* (betrothal) without which the betrothal becomes a meaningless proposition. The present of a lesser number of fishes is regarded as a sign of disrespect to the bride's party. Again at the time of final marriage ceremony sixty dry fishes of the same size must be brought by the groom's party and the bride and the groom must be fed together on the same plate with dry fish and specially cooked rice.

The Karbis also offer pieces of dry fish to the deceased ancestor at the time of marriage. In marriage of Manipuris particularly at the stage of *sampradan* ceremony , two *Ngmaoo* (Murrel) fish, one representing the bridegroom and the other bride, are released in the water. The procedure of releasing fish is that these two fishes are brought by the bridegroom's party to the house of the bride where the marriage is held and kept in the *sramahika*, a room in the house specially reserved for the god *sramahi*. When the time for releasing the fish approach at night one or two women from the bridegroom's party come and take one of the two fish which lies in the right hand side of the two and two or three women take the remaining fish. They release this two fish

simultaneously. The parties predict the luck of the new couple from the movements of these two fishes. It has been observed that certain Assamese community also release a *Magur* (*Clarius batrachus*) fish in the water in the name of the married couple. (Barua,1959:58).

Among a section of Nagas living in Manipur, fishing is prohibited during the cultivation time, i.e. from sowing to harvesting (Hadson, 1911:58).

Many species of fishes are used as sources of medicine. These fishes are honoured and people do not catch these fishes for food. Some of the Assamese people use *Patimutura* (*Glossogobius guiris*) fish to cure the diseased condition of passing urine while asleep. Some other people prepare medicine for some female diseases with *Darikana* (*Daniconius* sp.) fish. Bones and scales of certain types of fishes are preserved and hung up in the houses, both by the Assamese and some tribal people as magic charm. Fishes also have magical uses as love potions. The Lotha medicine woman prepares love potions with roots of some herbs, which has to be ground up and given to the shy loved one with cooked fish . If an infant has a sore on its tongue a certain small, very slippery fish is brought up by the Aos from a stream, alive, and rubbed on the tongue. In case of child-less-ness and aborting diseases, the Aos make offerings of dried fish to *tiya* (fate) of the patients for recovery (Mills, 1926:271). For thorns that cannot otherwise be extracted from an injury, the brain of a certain fish is applied by the Angami Nagas. The Lushais believe that soup of fish (boiled with water) cures diarrhoea and mild dysentery. The Manipuris eat the entrails of *Rohu* fish to improve eye sight. When a person is seriously ill a *Maibo* (Manipuri physician) releases a *ngamoo*, (murrel), in water with the pray that the murrel is given in substitution of the life of the man, which is called *Usin Sinba*. The *Mitaya Puran* of the Manipuris says that *ngamoo* was

created first amongst the fishes by the *Guru Sidava* (the Creator) and given the power to save the life of the human beings when their lives would be in danger. A kind of fish called *Nahram* in Dimasa- Kachari language, which is usually found in the hill streams of North Cachar Hills, contains stones on its forehead. It is commonly believed by the Dimasa people that, if this kind of fish is eaten, then one may get disease like gall-bladder stone. The stone of this fish if taken with some medicinal herbs is believed to cure gall-bladder. The Dimasas also use the bile of *Bagh* fish for stomach trouble.

Many people believed that there are fish ghosts in the water bodies. These fish ghosts do not like catching of fish excessively. Therefore, people do not go to catch fishes to those water bodies frequently, because they believe that a frequent fisherman may be attacked by a fish ghost easily. This belief can be attributed to a traditional method of conservation of fish.

Many beliefs and superstitions are associated with fish catching. Fishes are considered to be the favorite of ghosts; and tanks, pools, stream-lets which are generally believed to be haunted by ghosts. Assamese call these fisher ghosts *bak*. These ghosts are believed to subsist on raw fish. According to the Miris this kind of ghosts can be caught only by fishing-net. We have already referred to the abstinence of fish on certain ceremonies, and also its use in ceremonial break of fast. In the month of *Mersa-Hiyangei* (about October-November) Manipuri Vaisnavas abstain from taking fish. On or about 16th or 17th Hiyangei they break the fasting of fish. The ceremony is called *Mersa Ngatangba*.

The Miris consider *Machundari*, an unusually big fish, as lord of fishes. They believe that a man's days are numbered if he comes across this fish. There is an eel-like fish which the Sema called *azho*, and which is believed to cause, if eaten, great difficulty in dying, for when cut up, the sections of this fish display muscular movements for some time. It is believed that if women going to be

married to distant villages are given a bit of the flesh of this fish, they will survive even under great physical extremes till their parents come over . In keeping up with this belief such women are usually fed with this fish, unknown to themselves (Hutton, 1921:94). When occupied with the work of dying, the Lhota women refrain from taking dried fish (Mills, 1922:72).

VI. 4. Serpent Cult:

From the early times in Assam, a folk goddess believed to preside over serpents has been widely worshipped among all classes of people. She, the serpent goddess, is known as *Manasha* or *Vishahari*. *Manasha Puja* (worship of serpent goddess) is performed by many people of Assam either individually or commonly in the society. There are many serpent cult literature in Assam. Oral tradition of serpent legend produced a rich literature in the form of narrative poetry known as *Manasha Kavya*.

The most popular legend of serpent cult is that of 'Beula Lakhinder' the legendary wife and husband, the daughter-in-law and son of the famous merchant Chand Sadagar. It is said that Chand Sadagar had his merchandise estate in the Chaigaon area of present south west Kamrup District.

Many poets composed verses with the legend of Beula-Lakhinder. These verses are very popular till today. People recite and sing these verses in many art forms viz. *Ojapali, Nam Lokageet* etc.. Apart from Beula-Lakhinder, there are however, many other legends on serpent cult in Assam.

Apart from the serpent goddess there are varieties of serpent beliefs in Assam and the north eastern part of India. The word "*Sap*" meaning snake, is used to name any species of snake, poisonous and non-poisonous. Any word synonymous with snake is carefully avoided after dusk, specially by the women folk. They prefer to use symbolic words for serpents such as creeper (*lata*), rope (*jari*), worm (*pok, poka*) etc. Some times when a snake is noticed one utters the name of *Astik Muni* (a sage of ancient India) as a sign of respect to the serpent.

The people of Assam considers one as lucky to see two serpents coiled together in the act of mating. It is believed to be a valuable acquisition, if one can touch or cover the mating snakes with a piece of cloth or a *gamocha*. The holder of this cloth may get miraculous luck.

Again, it is believed that if a snake protects some body during sleep from sunshine by spreading its hood over his head very good luck will be bestowed on the man concerned. He will enjoy his life like a king. It is said that the great Assamese saint Sankar Deva was protected by a snake during his sleep. Therefore, the Vaishnavas never kill a snake.

Like other traditional societies, the Assamese also believe that serpents are associated with removal of barrenness. There are certain places in the villages which are considered sacred to the serpent goddess *Manasha*. Barren women hang pieces of rags with small pieces of stone tied at one of the ends in the branch of a tree adjoining such places in the hope of getting children. It is keeping up to the belief that serpents can bestow male issues, that women constantly giving forth female issues, resort to such practices. As in other parts of India , a middle class Assamese family also nourishes hopes for a male child.

Serpent in dreams always assures birth of a male child in the family. If any women is known to be pregnant at the time when a serpent is dreamt of, it is believed that a male child will be born to her. Though women in general refrain from animal slaughter they take particular care not to kill nor even hurt any serpent.

Universal respect is paid to a class of non-venomous serpents known as *Griha Lakshmi* or *Bari Rakshak*, in Assam. A class of harmless serpents which generally make the straw roofs of the houses as their abode and live on the lizards, worms and insects attracted by the burning house-lamps during night are called *Bari Raksha* snake.

The word *bari* means relating to a dwelling place. These snakes are considered to be the guardians of the dwelling houses. They are absolutely harmless and very timid in nature. They hide themselves behind the cross bars supporting the straw roof whenever they find anybody approaching and come out of their hiding places mostly during nights. Nobody tries to kill these snakes. The serpents are also considered to be the guardians of hidden treasures and are not killed.

One of the family customs of a section of people is that before they set hand to any affair relating to marriage of their children they must worship the serpent goddess. The pregnant women of some parts of Assam are forbidden to see dead snakes and sometimes live snakes also. Snake charmers are generally not invited to a house where there is any pregnant women.

It is believed that the serpent is extremely revengeful. If any injury is done to it even inadvertently and if it escapes, it will take revenge upon the assailant . For this reason no body injures a snake.

A serpent in the agricultural field or in a water body is considered to be the goddess of agriculture and water respectively. It is believed that presence of such a serpent may enhance the production in the field and protects the water and the fishes of the water body (Sarma,1989:205).

Many tribes of north eastern India believed that their forefathers reincarnate as a snake to protect the later generation and live around them, therefore these people consider almost all snakes as their forefathers and abstain from killing snakes.

Some Manipuri tribes believed that the snakes are their forefather -the *Pakhamba.* They also believed that the *Pakhangba*, live below the throne of a king in the form of a snake to protect the king. The king will rule nicely till the presence of the snake(Barua, 1961:56).

The Khasis of Meghalaya also worship a snake goddess. The name of the Khasi snake goddess is *U thlein.*

Most of the Naga tribes believes that it is dangerous to kill a snake when his wife is pregnant. If one kills a snake during the time of his wife's pregnancy then she will give birth to a deformed child.

VI. 5. Tiger Cult:

Apart from the sense of fear associated with the anger of a man-eater, the tiger finds for itself an integral place of honour in the traditions of the various tribes of north eastern India. Tiger is a totem of many of the tribes of this region. The Semas believe that the tiger is their fore father and the same mother had borne man and tiger. The Rengma Nagas too subscribe to this belief. Accordingly they also consider intake of the flesh of a tiger to be as much of a crime as intake of one's own flesh. Neither do they ever kill a tiger consciously nor do they abstain from the long process of purification they have to undergo if they happen to do so unconsciously (Barua, 1961:58).

The Mushaharis are a clan of the Bodos who traced their origin to the tiger and they never indulge in killing of a tiger. If they happen to hear about the death or killing of a tiger they resort a day long of fasting, discarding their utensils and washing their clothes, a process very similar to that of a Shraddha ceremony (Narzi,1985:135).

Famous for its magical powers and witchcraft, the Mayang area of Nagaon district has many magicians who observed the rituals of the death of a dear one following the death of a tiger.

In Assam people worship the tiger. The goddess of tiger is known as *Bagheswari* and North Guwahati has a famous temple devoted to the tiger

goddess. There are other temples of tiger goddess in Bongaigaon and Nalbari districts. These temples are known as "*Bagheswari* temple". In some of the villages of Darrang district, people worship Tiger god in the seventh day of the month of *Bahag*. In undivided Goalpara district, people of Gouripur, Dhubri, Golokganj, Baxirhat, Agomoni, Chatrachal, etc. worship Tiger god. The tiger god of this area is known as "*Sonarai Dewata*". They believe that they can save their cattle by worshipping the Tiger god.

Most of the people of Assam customarily offer the concentrated first milk after the birth of a calf to a bunch of *Birina* (a kind of tall grass) grass to ward of attacks of a tiger to the new born (Sarma, 1989:229).

Consideration of tiger as a god proves the respect of the people of this region to this animal. Killing of tiger was considered as a crime and thus the tiger, beauty of the forest was saved in ancient time.

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Chapter - VII

TRADITIONAL KNOWLEDGE AND PRACTICES OF ENVIRONMENT MANAGEMENT

CHAPTER-VIII

TRADITIONAL MATHEMETICAL AND ASTRONOMICAL LORE

I. MATHEMATICAL HERITAGE OF INDIA :

The history of the development of mathematics in India is as old as the civilisation of its people. It is universally acknowledged that much of mathematical knowledge in the world originated in India. The high degree of sophistication in the use of mathematical symbols and developments in arithmetic, algebra and trigonometry are indeed remarkable. More than four thousand years ago, the inhabitants of the basin of the river Indus created a highly developed culture no way inferior to that of such centres of ancient civilization as Mesopotamia and ancient Egypt, and in some respects, even superior to it (Bag, 1985:120).

In the valley of the Indus, numbers were designated by stroke-like notches. Some horizontal and vertical lines have been preserved in the latest number systems of *Kharosti* and *Brahmi* . In carrying out arithmetical operations, a special counting device had been used. In Lothal, a square brick board had been found, each side of which was divided into five rectangles. This was most likely a board for some kind of game. But it could also have served as a counting device for carrying out very simple arithmetical operations, for which purpose the stones or beans found during excavations may have been used. (Bag,1985:130).

The brilliant tradition of Indian mathematics was continued during the Vedic period. The vast sacred literature contains enough materials to help form a good

idea of the mathematical ability of the Vedic Hindus. These materials are mostly scattered and diffused in the *Samhitas* and *Brahmanas*. Two *Vedangas*, the *Kalpasutras* and *Jyotisa* directly concern a large body of mathematical knowledge without which neither the construction of various kinds of sacrificial alters nor the reckoning of time for calendrical purposes would have been possible. This debt to mathematics or the science of calculation was freely acknowledged and the study of mathematics was always given a place of pride in the various branches of learning.

An important source of Vedic mathematics are sections called *Sulba-sutras* which can be translated as "a collection of rules concerning measurements with the help of a chord of various figures". The most valuable four of them are : the *Baudhayana-Sulba-sutra*, the *Manava-Sulba-sutras*, the *Apastamba-Sulba-sutra* and the *Katyayana-Sulba-sutra* (Rangachari,1981:52)

The Vedic Hindus adopted 10 as the basis of numeration and developed a great interest in thinking out and naming large numbers. The four fundamental arithmetical operations (addition, subtraction, multiplication and division) were common-placed operations of Vedic mathematics. Acquaintance with fractions is clearly indicated in the Vedic texts. The *Rigveda* gives names of a number of simple fractions such as *ardha* (1/2) and *tripada* (3/4), and the *Maitrayani Samhita* mentions *pada* (1/4), *sapha* (1/8), *kustha* (1/12), *kala* (1/16).

The next peak period in Indian mathematics started from the first few centuries AD This period is characterised by the range, depth and quality of mathematical investigations which admirably suited the natural talents of this area of culture. In the previous periods, the problems of architecture and some others stimulated the development of mathematics but beginning from the first few

centuries AD, the greatest inspiration for mathematics came doubtless from considerations of problems concerning the reckoning of time. As elsewhere, here in India too, a substantial part of mathematics developed as a sequel to astronomical advancement and it is no accident that a sizeable part of post-Vedic mathematics has been found only in association with the *Siddhantas*, a class of astronomical works. Problems of accurate positioning of the heavenly bodies, description of their motions in longitudes, calculations and explanations of true positions from the mean, and several others, called for refinements in algebraic solutions of indeterminate problems, many arithmetical operations such as handling of large fractions, root extraction and led to the emergence of entirely new mathematical techniques of analyses and the methods of plane and spherical trigonometry.

One of the most important achievements not only of Indian mathematics but also of all Indian culture of this time, was the creation of decimal place-value system, using nine digits and zero. An extensive literature exists on the Indian method of expressing numbers, particularly on the decimal place-value model, and on the question of its transmission to South and West Asia and to Europe leading to its international adoption. Mathematicians and orientalists generally agree that the system with zero originated in India and then travelled to other parts of the world. But Indian mathematicians discovered not only the modern system of reckoning, but also created all modern arithmetic based on the decimal place-value system with zero. It is very remarkable that the first arithmetical rules which have been preserved up to our time are the rules of extraction of square and cubic roots which appeared in the "*Aryabhattya*" written by the eminent Indian mathematician and astronomer Aryabhatta (476 A.D.).

In the history of mathematics, Aryabhatta occupies a special position not only by his appearance as the head of the Hindu mathematical renaissance but by the pattern and the tone set by him in mathematical investigations to be emulated by the generations of mathematicians to follow (Sengupta,1929:172). Aryabhata was the founder of a mathematical-astronomical school. His commentators included, among others, Bhaskara-I, Nilakantha Somasutvan, Paramesvara, Somesvara and Suryadeva. The first three, while following in the footsteps of their great master, also made important contributions of their own. Bhaskara I (c. A.D. 600) is well known for his *Mahabhaskariya*, a shorter tract *Laghubhaskariya* and a commentary *Bhasya* on the *Aryabhattya*. Bhaskara I primarily developed *Aryabhatta's* principles of astronomy. In mathematics his main contribution lies in the field of indeterminate equations of the first degree. (Rizvi,1984:25).

Brahmagupta (A.D. 598) was one of the eminent mathematician of ancient India. Although a critic of *Aryabhatya*, he follows the latter in introducing two chapters on mathematics in his great astronomical treatise *Brahma-Sphuta-siddhanta.* Mahavira (A.D. 850) was a great Jaina mathematician. In keeping with Jaina tradition, he studied mathematics for its own sake and not in association with astronomy. His *Ganita-sara-samgraha* does not, therefore, form part of any astronomical treatise, but treats of mathematical problems in a more simple and direct manner (Datta,1929:115).

Aryabhatta II (A.D. 950) was well known as the author of *Mahasiddhanta,* an astronomical compendium. Aryabhata II, discusses the favourite Hindu topic of indeterminate equations in a section called *Kuttakadhyaya* in the 18th chapter of his book (Sengupta,1929:179). Bhaskara II (12th Cent. A.D.) represents

the culminating point in mathematical and astronomical investigations in ancient and medieval India. In originality and innovations, he probably ranks with Aryabhatta I and Brahmagupta. As a lucid expositor of abstruse mathematical and astronomical rules, he was probably unrivalled among his class in ancient and medieval India (Daji,1865:392).

The centuries following the time of Bhaskara II belonged to the original authors as well to the commentators. Mathematicians Narayana Pandita (1350 A.D.) composed two works, one on arithmetic the *Ganita-kaumudi* and the other on algebra, *Bija-ganitavatamsa*. During the 15th and following centuries South India developed active centres for astronomical-mathematical studies. These schools produced works such as *Karana-paddhati*, *Ganita-yukti-bhasa* and *Sadratnamala* which among others, discussed for the first time trigonometrical sine, cosine, tan and *pi* series and gave the rules for them.. The mutual process of Hindu scholars assimilating Arabic and Persian learning and Muhammadan scholars digesting, reproducing and translating Hindu scientific works has started in the medieval period. Mahendra Suri of the 14th century A.D. endeavoured to incorporate Persian knowledge in his *Yantaraja*. In the 16th century, Faizi prepared a Persian version of the *Lilavati* and , in the 17th century, translated into Persian, Bhaskara's *Bija-ganita* (Daji,1865:399). Such cross-fertilization of scientific learning between the exponents of Hindu scholarship on the one hand and those of Arabic and Persian scholarship on the other reached its highest point in the astronomical efforts of Sawaji Jai Sing (1686-1743). He developed an interest in astronomy and mathematics and studied the Hindu, the Arabic and the European systems of astronomy. He set up in Jaipur, Delhi, Ujjain, Banaras and Mathura, astronomical observatories where a large number of his giant instruments were constructed in masonry. The results of the observations formed part of his astronomical table *Zij Muhammad Shahi*, prepared both in Persian and Sanskrit (Abdi,1982:2).

In conclusion, special mention needs to be made of one of the greatest mathematicians of the 20th century, Srinivasa Ramanujan (1887-1920). Ramanujan made outstanding contributions to the history of numbers, partitions, the theory of elliptic, and modular functions.

II. TRADITIONAL MATHEMATICAL LORE OF ASSAM.

II. 1. History of Arithmetical Studies :

Studies in basic mathematics is continuing since ancient times in Assam. It was an important subject of study in the *toals* and *chatuspathis* . The man who was the pioneer in the studies of mathematics in Assam is Bakul Kayastha. He was the court intellectual of the royal court of King Naranarayana. It has been mentioned in the *Darang Rajvangshavali* that, King Naranarayana requested him to translate some parts of the famous mathematical book of Bhaskaracharya II, namely the *Siddhanta Siromani*. Accordingly, Bakul Kayastha translated the *Lilavati* part of *Siddhanta Siromani* to Assamese. Probably this was the first Assamese book in Mathematics. But this book has not been found anywhere. The first original Assamese book on mathematics written by Bakul Kayastha is *Kitabat Manjari* . It was a book containing preliminary knowledge about bookkeeping of royal materials, primary calculations and about weights and measures. Bakul Kayastha mentions the names of four ancient Assamese mathematicians, namely Narayana Das, Umapati Siddha, Hridayananda Kayastha and Durga Das. Probably they were the pioneers in the study of mathematics in ancient Assam.

Again the *Lilavati* part of Bhaskaracharya was translated to Assamese by Kaviratna Dwija . He entitled the book as *Lilavati.* which contains topics on addition-subtraction, multiplication and division, algebrical equations, origin

of square roots and squaring, cubing etc. Another important traditional Assamese mathematical chronicle is the "*Ankar Arya*" written by one Kashinatha. Another Assamese mathematician Churamani Dwija wrote in his book on mathematics the *Churamani* that - Bakul Kayastha was his teacher (Guru). (Sarma, 1995:25)

Pandit Hemchandra Goswami, in his book *The Descriptive Catalogue of Assamese Manuscripts*, mentioned about four books on mathematics and one on astronomy. These books are *Ankar Arya* by Kashinath, *Jyotish Churamani* by Churamani, *Kitabat Manjari* by Bakul Kayastha , *Lilavati Katha* by Kaviratna Dwija and *Bhaswati* by Kaviratna Dwija (on Astronomy).

Contents and description of the books as described by Pandit Hemchandra Goswami are as follows:

Ankar Arya: This was a book on Arithmetic written by Kashinath , whose date is not known. The book was written on oblong strips of *sanchi* bark and contains 37 folios. The language of the book was Assamese prose but there were also few Sanskrit *Slokas* here and there. The book was free from any serious orthographical mistakes. It does not appear to be a complete copy .The book begins with eight compartments which teaches the four simple rules and then goes on to teach functional sums by giving numerous examples. Different mathematical tables have been given in the book. It also teaches the measurements of lands and concludes with the squares and square roots. This book provides the Assamese equivalents of mathematical terms.

Jyotish Churamani : Jyotish Churamani was another Assamese book on-Arithmetic and Land Surveying. This book was written by one Churamani, mainly for his students. It mentions Bakul Kayastha , the famous Arithmetician , who wrote his book on Arithmatic in *Saka* 1356. Therefore, it must be of a later

date. It was again mentioned in this book that there were some students of the writer in the *saka* ending in 82. Therefore this book may be written in the year of *saka* 13 82 or 14 82. The book was written on locally made paper and its size was 10.5 x 4. 5 inches. -There were 32 folios in all but few were missing. Every folio contains 11 lines in a page. The language was Assamese verse and there were 347 stanzas altogether. The book first teaches the notion and numeration and the four rules simple and mixed. It gives a large number of examples to work out besides their answers . It then lays down to rule how to survey and calculate the areas of land of different shapes giving appropriate examples to work out.

Kitabat Manjari: It was a poetical treatise on arithmetic , land surveying and book keeping. The author of the book Bakul Kayastha was the greatest Arithmetician of his time, he flourished in 1434 AD. This book was written in Saka 1356 or 1434 AD. In the reign of Ahom king Swarga Narayana Deva. The book was written on *sanchi* bark, the size was 9.5 X 2.5 inches. There were 77 folios with 5 to 8 lines. The book was written in Assamese verses. The book first describes how accounts are to be kept under different heads and how the stores belonging to the Royal household are to be classified and entered into a stock book, etc. It then teaches the Arithmetic in three parts: (1) *Athkatha* (2) *Dasamsa* and (3) *Bidya Uthi. Athkatha* deals with the four rules with whole numbers and *Dasamsa* deals with fractional numbers and *Bidyauthi* deals with miscellaneous examples. According to this book the multiplication is to be taught first from it the addition is deduced as a corollary and then division is taught and the subtraction is deduced from these processes. This book not only deals with arithmetic, but also teaches how lands are to be measured and their areas calculated and also how the land rolls are to be prepared. Towards the end

it contains numerous examples from several authors such as Narayan Das, Umapati Siddha, Hridayananda Kayastha and Durga Das.

Lilavati Katha : It was an arithmetical treatise in Assamese language based on Sanskrit Mathematical works of Lilavati, the famous lady mathematician of ancient India. The author of the book was Kaviratna Dwija. Nothing is known about Kaviratna Dwija. 'Kaviratna' has been assumed to be his title. The manuscript of the book was in country- made paper. There were fifty folios in the book, each folio contains 8 lines on each of its sides. The size of the folio was 13 x 4 inches. The book was divided into two parts, the first part is the Assamese translation and the second part is the Sanskrit translation by Lilavati.

The book teaches Arithmetic divided into nine different sections , viz multiplication, division, subtraction, addition , cubes, cube roots, square, square roots and *Sankalan.* It also teaches how multiplication can be done in 5 different ways and how division can be worked out in long and short processes. Then, it gives the rules of calculating the areas of lands of different forms and magnitudes. At the end it gives a large number of worked out examples.

Again, according to Dandiram Datta there were altogether 27 books on traditional mathematics written by the Assamese mathematicians. These are:

1. *Kaitabat Manjuri* - (1862 Saka, 156 pages.), 2. *Ankarputhi* (42 pages),
3. *Gananarputhi* (44), 4. *Mati Pialar Katha* - (1150 saka, 48 pages),
5. *Pera Kakat* (1857 saka, 48 pages), 6. *Suramani Ankasastra (* 66 pages),
7. *Jyotish Suramani* (1755 saka, 32 pages), 8. *Ankar Puthi (* 80 pages),
9. *Bihu Panjika Ganana* (24 pages), . 10. *Jyotish Anka* (1496 saka, 24 pages),
11. *Chausast Sura* (30 pages), 12. *Jyotisha (* 68 pages),
13. *Jyotish Anka (Prasna Ganana)* (52 pages), 14. *Raj Martanda* (1734 saka, 180 pages),

15. *Grihar Bheti Nirnay* - (1320/1835 saka, 12 pages), 16. *Churamani Anka Puthi* (1795/1280 saka, 102 pages),

17. *Mitir Patani Anka* (*Bahal Kagaj*) (2 pages), 18. *Jyotish Churamani* (24 pages),

19. *Kshetra Bujanir Arya (Bahal Kagaj)*(2 pages), 20. *Ankar Kagaj* (2 pages)

21. *Lilawati Anka (* 64 pages), 22. *Anka Ganit Jyotish*

23. *Surya Sidhanta* (120), 24. *Ank Puthi (* 46 page),

25. *Asta Bargi Das (* 24 pages), 26. *Ankar Arya (*78 pages),

27. *Jyotish Churamani* (64), 28. *Lilawati Anka* (100 pages).

The writers who scribes these books of *Kaitheli Anka* were Subhankar Das, Bakul Kayastha, Kavi-Ratna, Sreedhar, Kavi Chudamani (Datta, 1964 : 23)

II. 2. Assamese Folk Arithmetic (*Kaitheli Anka*) :

During the reign of the Kamata, the Koch and the Ahom kings the services of the Kayasthas, a caste , were mostly requisitioned from other parts of India in connection with the census works and clerical jobs. The Kayasthas do not plough land for cultivation, but earn their livelihood by using their pen. The knowledge of the Kayasthas contributed a lots towards the intellectual development of the Assamese people. There was a branch of knowledge which was supposed to be learnt specifically by the Kayasthas. This branch of knowledge was known as *Kaitheli Vidya.* In fact, the Kayasthas were the account keepers in the Merchant houses and Royalties .

The Kayasthas of Assam had developed a kind of mathematics, in course of time, which is known as *Kaitheli Anka.* The *Kaitheli Anka* is the traditional form of Assamese mathematics. In medieval Assam, mathematics was taught by Kayastha teachers only, therefore this set of mathematics is known as *Kaitheli*

Anka. The *Kaitheli Anka*s were originally in the form of oral mathematics. The folk mathematicians described various forms of mathematical calculations in the form of poems or riddles. Later, these mathematical elements were collected and written in book-form. Books of these mathematics were taught in the traditional educational institutions or the *Toals* of Assam. Till today, there are some mathematical elements in the form of oral lore in villages. Most of the Assamese riddles contain elements of folk mathematics.Dandiram Datta, a folklorist mathematician of Assam collected elements of oral folk mathematics and published it in book-form. He has two books to his credit namely *Kaitheli Anka* and *Kautuk.* (Datta,1964:32)

The Assamese people had their own system of census, book-keeping, counting crops in granaries, measurement of construction of houses, measurement of flours, bamboo and canes, taxation, income and expenditure of royal treasury, earth work, weighing of bell-metal, copper, of export and import goods, and astrological research etc. The knowledge of this type of mathematics has been handed down from generation to generation and was written in modern Assamese *Puthis* (books) as well. Many Assamese families have presented books containing such mathematics till now. A study of these books reveals that there was a sound tradition of arithmetical studies in Assam in those days.

II. 2. 1. The codes used for numbers :

In the Kaitheli system of arithmetic numbers were represented by codes. Instead of using numbers directly names of some universally representable things were used. These were as follow :

One- *Chandra, Sachi, Nishapati,*	Two *Netra, Bhuja, Kara, Pakha* ,
Three - *Ram, Bahni, Guna,*	Four *Veda, Yuga* ,
Five - *Ban, Sara, Indriya* ,	Six - *Rasa, Dhatu* ,
Seven - *Samudra, Muni, Aswa, Sara* ,	Eight - *Basu, Naga, Sarpa, Mangala* ,

Nine - *Graha* ,

Ten - *Disha, Lokapala* ,

Eleven -*Rudra* ,

Twelve - *Aditya,*

Thirteen - *Biswa,*

Fourteen - *Bhuban, Manu* ,

Zero - *Akas, Gagan.*

These types of attribution, given to the numbers are found on copper-plates, inscriptions and canons. Even to-day the scholars of astronomy use these numbers and prepare the Assamese Calendar. *Surya Siddhanta, Bhaswati Darpan, Smriti-Sagar, Brahma Siddhanta, Samayamrit, Jyotish Ratnamala, Graha Arya, Prasna-Karati* and such other works are reportedly consulted in Assam even in those days.

Till the arrival of the English in India, Assamese students were taught the *Kaitheli Anka* in Assamese language. In the kaitheli system of arithmetical education along with basic mathematics bookkeeping and accountancy etc were also taught. These methods were known as - *athkatha, dasanka, piyal, panchak, jamakharash, jamabandi, talab, hichab, jarip* etc. Various sorts of algebrical sums were also taught and these are written in verse.

II. 2. 2. Schools of Traditional Arithmatic Education in Assam :

In different places of Assam, there were schools for the teaching of traditional arithmatic or the *Kaitheli Vidya.* In addition to 'Shiromoni Bhuyans', there were teachers amongst the different castes who specially practised the teaching of arithmetic and alphabets (*Ka-phala', A-phala'*). This was prevalent mainly among the Chalihas, Baruahs, Dowerahs, Kakatis, Barajania Mahantas, Barua Mazumdars etc belonging to Upper Assam. The *Kayasthas* or the *Kakatis* held discussions on the provincial languages also. The Kayastha children specially practised keeping land-accounts. This was also called *Majimdari* education. The people who are *Kayasthas* by caste, chiefly depended on this occupation

of keeping records (Kakati). This was called '*Kaitheli vidya*' because of the fact that they were studied and exercised by the *Kayasthas*.

Adjustment of education of all the *Kaitheli* schools of the Bhuyan kingdom were vested upon one famous scholar, Pandit Raghabananda by name. During the reign of Ahom King, Chakradhwaj Singha, Chanda Ram Barkayastha who read in the *Luaguri Kaitheli* School sent his son to be tutored by Shri Sankardeva. The latter gave education to his son by the Pandit Chakrapani Mazumdar and Vidyananda in the School of Baruagara during the time of Chilarai.

Vidyananda wrote : "Sankardeva's youngest son named Hari is a great Pandit whose knowledge is as deep as an ocean (Datta, 1964 : 10)

In a description of the schools during the period of the Ahom kings, the author, of '*Ahomar Din*', Dr. S. K. Bhuyan gives a vivid description of the state of education during those times. *Deodhai* and *Bailung Pandits* educated the children in accordance with the methods of the Ahoms making *changs* - a type of traditional bench made of bamboo, which were very few in number. One such school was established during the reign of queen Phuleswari but which almost ran into a dilapidated condition by the time of Swargadeo Rajeswar Singha. There were also schools inside and outside the town, but, as for students, only about twenty attended each school. Only the Brahmins were privileged enough to receive the ray of education. Swargadeo Buddhinarayan is said to have made Sanskrit schools throughout the length and breadth of the country. Apart from this, some Kayastha Mazumdars practised the surveying of lands and working out of sums. (Bhuyan, 1962:60)

II. 2. 3. *Kaitheli* Concept of Numbers :

Jyotish Churamani a traditional mathematician of Mediaeval Assam described numbers in the form of a poem as follow ;

With the blessings of mother Saraswati

Let me describe the numbers.

Firstly one, to lastly ten

Ten into ten gives a hundred.

A zero with one forms a ten,

Another zero with ten gives a hundred.

A zero to hundred forms a thousand

A million is formed by a zero to a thousand

A zero to million forms a lakh

A lakh with a zero gives a *Nijut* (ten lakh)

A zero to a *Nijut* forms a crore

He also described more bigger numbers as follow : *Arbood, Nirbood, Kharba, Mahakharba, Padma, Mahapadma, Sankha, Mahasankha, Brinda, Mahabrinda, Dhuli, Mahadhuli, Akshouhini, Mahaakshouhini, Brahma, Padakini* and *Mahapadakini.*

II. 2. 4. *Kaitheli Piyalar Arya* (*Kaitheli* Arithmetic of Census):

The following are the rules cited in verse to calculate an area:-

1. The length is to be multiplied with the breadth,

The last two digits are omitted, to find the area.

Twenty lechas form one *Katha*

Four *katha* is one *Doan*

Twenty *Doans* gives a *Poan*

Again, six Doans form one Katha

Twenty *Doans* forms a *Bishi*

Sixteen *Bishis* forms a *Kotha.*

2. The number giving length and breadth is multiplied.

The last two digits are omitted. The resultant is one *Lecha*

Again to find out an area:-

Five *lecha* is one *Katha.*

Four *Katha* is one *Doan.*

Four *Doan* is one *Pura.*

II. 2. 5. Use of Riddles and Jests in Teaching of *Kaitheli Anka* :

There are many examples of traditional Assamese arithmetic, found in the form of oral lore. These are very popular amongst the masses because these are composed in the form of riddles and jests. The following are some of the examples :

1. In a farm of brinjal
   There are one lac rows.
   In each row, a million (*Ajut*) branches
   In each branch there are
   Six *baris* of brinjal.
   Tell me *kayastha*
   How many brinjals?

   Ans :- 12000,000,000,0 brinjals

2. In a silk cotton tree
   There are nine branches.
   Nine birds in each branch,
   Nine birds have nine nests
   Each nest has nine eggs
   Each egg hatches one bird.
   Tell me *Kayastha* how many birds ?

   Ans :- 59149 (new born birds)

3. If nine wives can use one *rati* of *sindur.*

How many wives can use nine maunds of *sindur* ?

Ans :- 24883200 wives.

4. Cost of an elephant is four rupees

Cost of a horse is eight annas

Cost of a sheep is four annas

Buy twenty animals in twenty rupees.

Ans :-	Elephant -	3 nos.	@ Rs. 4	= Rs	12.
	Horse-	15nos.	@ Eight anas	= Rs	7^{1}_{2}.
	Sheep -	2 nos.	@ Four anas	= Rs.	½

Thus, the total number = 20 animals can be bought in Rs. 20

5. A merchant said-

If divided by sixteen, remains three

If divided by fifteen, remains two

If divided by fourteen, remains one

What is the number?

Ans. :- (14815816) = 3360(3360-13) = 3347.

6. The following is a wonderful example of how, in a jesting way, a daughter- in-law, late at preparing dinner, keeps her hurrying father-in- law engaged while she gets it ready :-

Count the stars in the sky

Sky moon, sky moon, sky moon,

Four into fourteen is equal to earth

Take thirty two to multiply

Tell me how many stars in the sky?

Sky = 1 Moon = 0

Ans. 45252525 1232320 stars.

7. One *anna*, two *annas* and three *annas* defaulters together
Did not pay revenue to the king for12 years together
Rupees one thousand and ninety in total
How much to be paid by each individual ?

Ans:- One *anna* defaulter will pay Rs. 181- 10 *anna* 8 p
Two *annas* defaulter will pay Rs. 393- 1 ,, 4 ,,
Three *annas* defaulter will pay Rs 545 -0 ,, 0 ,,
Total Rs 1090

8. There was a very large flock of birds
The birds found one hundred cowries in the king's treasury
The birds grinded the cowries and ate them up
The king caught a bird and asked how they ate the cowries
The bird answered that they had broken down the cowries to the size of a "til"
O' Kayastha ! tell me how many birds were there ?

Ans: 10240000 birds.

10. Three hundred and sixty rats infested the paddy field of a farmer
The farmer started killing the rats,
The rats requested the farmer not to kill them
Instead, each of them will pay 60 '*puras*' of rice to the farmer.
How much rice the farmer will get ?

Ans 7200 *maunds* of rice.

11. Distribute 20 bananas amongst male, female and children, twenty in total

Each male will get two bananas

Each female will get one and half

Each child will get only a half.

Ans 13 children will get 6 and half bananas

6 male will get 12 bananas

1 female will get 1 and half banana

Total 20 persons 20 bananas

12. There were two flocks of birds

A bird from one flock said to the other

Come only one from you

Then we will be double of you

The other flock invites two from the former, to equal each other.

What were the number of the birds in the flocks, and total ?

Ans : .5 in one and 7 in other, Total 12 birds.

13. A big tree contains nine lakh leaves

Nine hundred leaves drop each day

How many days will it take for all the leaves to drop from the tree?

Ans : 10000 days.

14. Buy each elephant at the rate of Rupees Five,

Buy each horse at the rate of half a Rupee (one *Adhali*),

Buy each goat at the rate of a quarter Rupee (one *Siki*)

Buy twenty animals at twenty Rupees

What are the number of elephants, horses and goats ?

Ans:	No of Elephants	3	for Rupees 15
	No of Horses	3	for Rupees 1 and 1/2
	No of Goats	14	for Rupees 3 and 1/2

Thus a total of 20 animals can be bought for rupees 20 only.

III. ASTRONOMY IN ANCIENT INDIA :

The Indian sub-continent which exhibits a fairly advanced civilisation and which is at least five millennium old, possessed, as part of that civilisation, a robust scientific heritage, as attested by some statements in the *Vedas* and by the artefacts as is evidenced by the proto-historic Indus Valley discoveries. This heritage included astronomy and mathematics as well, the former being required during Vedic times for fixing correct times for rituals and sacrifices, and the latter for designing fire altars for offering oblations. During the Vedic age, *Naksatra-vidya* (Astronomy) and *Ravi-vidya* (Mathematics) were being studied as part of the curriculum of general studies called *Apara-vidya.* (cf. *Chandogyopanisad.* 7.1.4). The *Yajurveda* refers to the professionalists of both the disciplines, as the *Naksatradarsa* (astronomer) and the *Ganaka* (Mathematician). (YV. Vaj. 30.10; 30.20).

III. 1. The Vedic Astronomy :

The beginning of astronomy are definitely earlier than those of the sister discipline of mathematics, though, in due course, it was mathematics that enabled astronomy to stabilise itself and develop fast. The Indus Valley discoveries offer little that is definitive, for instance the depiction on seal No. 2430, of seven human figures being taken as the seven stars of the constellation *Kritika,* and

the ritual depicted in the seal to indicate the beginning of the year, is analogous to the practice during Vedic times. However, the vast Vedic literature provides a fair appraisal of the astronomical acumen of the times. Then again, the recording of celestial observations found in certain Vedic passages enable us to compute back, within margins, the date of the composition of the relevant hymns.

References in the Vedic literature indicate that, at that age the lunar year was followed, the year being delineated by six seasons. The cosmic hymn in the *Rigveda* (1.164) of *Dirghatamas* speaks of a year of 12 lunar days, starting with the autumn star *Kritika*, which, on calculation, gives the date c. 2350 B.C. The *Atharvaveda* carries a full list of the 27 *naksatras* and the *Naksatrakalpa*, an *Atharva-parisista* specifies their longitudinal positions in the sky. A fair knowledge of calendrical science is implied in the instructions given for the conduct of the sacrifice *gavamayana*, based on the daily progress of the Sun. The twelve lunar months are specified, as also the intercalary month. Minute divisions of time have been specified in the *Taittiriya Aranyaka* . Five planets are identified, two of them by their names. The eclipse of the Sun has been described in the *Rigveda* 5.40.4-9 as the occultation of the Sun by *Svarbhanu* (*Rahu*). Of particular interest is the extolling of *Naksatra-vidya* (science of stars) in the *Taittitiya Brahmana* (3.10.0) and the mention of a hierarchy of scholars who cultivated the science.

III. 2. Jaina Astronomy :

The Jaina canonical literature treats of a variety of subjects including mathematics and astronomy. Among them the texts that deal with astronomy are : *Sthananga* and *Bhagavati Sutras*, among the *Angas*, *Suryaprajnapti*, *Candraprajnapti* and *Jambudvipaprajnapti* among the *Upangas*, and

Tandulaveyaliya among the Prakirnakas. Extensive excerpts of these texts by scholiasts like Malayagiri (c. A.D. 1100-1200) and Santicandra help in understanding the Jaina concepts and practices, which offer significant contrasts with their Hindu counterparts. Among post-canonical Jain texts, mention may be made of ch. VII of *Trilokaprajnapti* of Yativrsabha (between A.D. 473 and 609), *Jyotisakarandaka* by Padaliptacarya and the *Karananuyoga* or the *Ganitanuyoga*, being a compilation of astronomical and mathematical matter scattered in different texts.

III. 3. *Vedanga-Jyotisa* (c. 1150 B.C.):

Vedanga-Jyotisa is the earliest full-fledged Indian astronomical text available. It is currently found in two slightly varying versions, ascribed to *Lagadha*. Internal evidence indicates that the date of the work might be around 1150 B.C., but the current reactions are much later. It is not as if the *Vedanga-Jyotisa* is a compendium of all Vedic astronomy. Rather, it is a manual which provides the data and instructions needed by a Vedic priest with practical knowledge, for computing correct times for rituals and sacrifices and for ascertaining proximate astronomical phenomena. However, cryptic expressions, obscure technical terms and, above all, the practical knowledge taken for granted, often stand in the way of understanding this text easily.

III. 4. Astronomical *Siddhantas* :

As the Vedic age evolved into the Classic age in the few centuries before and after the beginning of the Christian era, the advent of the unorthodox trends of thought through Buddhism and Jainism and direct contracts with Greece and Rome, led to a resurgence in the Indian sub-continent in all walks of life, including arts, literature and science. In the realm of astronomy, it ushered in the Siddhantic period. The Vedic *Naksatra* system was replaced by the twelve signs

of the zodiac. The planets were also included in the system and sophisticated modes of the determination of the periods of planetary revolutions and the relative sizes of the Sun, the Moon and the Earth came into vogue. The mean longitudes were calculated from the number of days elapsed from the beginning of long periods of time called the *kalpa* and the *yuga*, the current *Kaliyuga* being taken to have commenced on 17/18 Feb. 3102 B.C. The length of the year and the day-lengths were determined accurately. Planetary positions were computed by using the epicyclic and eccentric circles. The computation of eclipses were done with greater accuracy by applying the corrections due to parallax. Computations were characterised by arithmetical, geometrical and algebraic practices, and certain aspects of plane and spherical trigonometry were also utilised.

The basic methodologies of classical astronomy, the objectives aimed to be achieved through them were : (i) accurate determination of the longitudes of the Sun, the Moon and the planets and also of the ascending and descending nodes of the Moon, for any specific moment; ii) the corrections to these computations due to the passage of time; (iii) lunar and solar eclipses; (iv) problems relating to the shadow; (v) the phases of the Moon; (vi) helical rising and setting of the heavenly bodies; (vii) occultation of stars and planets; and (viii) astronomical instruments.

III. 5. The *Siddhantas* :

Of the eighteen traditional *siddhantas*, only five, *viz.*, those of *Pitamaha* (*Brahma*), *Vasistha*, *Paulisa*, *Romaka* and *Surya* are available as condensed by *Varahamihira* (6th cent.) in his *Pancasiddhantika*. Later, sophisticated *siddhantas* have superseded and thrown the earlier ones into disuse. Some of these later *siddhantas* were so distinctive that they established independent

schools, each having several scholiasts and giving rise to secondary *Siddhantas*, *Karanas* and *Kosthokas* based on them. Among these mention might be made of the *Aryabhattya* and the *Aryabhata-siddhanta* (the latter known as *Ardharatrikapaksa*) both by Aryabhata (b.A.D.476), the *Brahmasphuasiddhanta* by Brahmagupta (b598), later *Suryasiddhanta* (before A.D. 900), and the most comprehensive and popular of all, the *Siddhantasiromani* of Bhaskara II (b. 1114). Important texts like the *Mahabhaskariya* and the *Laghubhaskariya* of Bhaskara I (7th cent. A.D.), *Sisyadhivrddhidatantra* of Lalla (8.9 cent.), *Vatesvarasiddhanta* of Vatesvara (10th cent. A.D.) and *Tantrasangraha* and *Siddhantadarpana* of Nilkantha Somayaji (b. 1444) reinforce and take forward the Siddhanta of Aryabhata. The Siddhantasekhara of Sripati belongs to the school of Brahmagupta. To the Suryasiddhanta school belong the *Siddhántatattvaviveka* of Kamalakara and the *Siddhantasarvabhauma* of Munisvara. And, several texts take the *Siddhantasiromani* as their base (Sengupta, 1929: 173).

IV. TRADITIONAL ASTRONOMICAL STUDIES IN ASSAM :

Almost all ancient civilised societies tried to study the celestial bodies. People who studied the celestial bodies also tried to establish a relation of these celestial bodies with the activities of earthly elements. Thus, the traditional astronomy always takes a form of Astrology. It was very difficult to establish traditional Astronomy apart form Astrology. People of Assam made significant progress in the study of stars and planets. These studies were definitely the studies of Astronomy as well as Astrology in the traditional ways. There are enough evidences of Astronomical and Astrological studies in Ancient and Medieval Assam.(Barman, 1995:14)

The Navagraha temple of Guwahati and the remains of Surya Pahar or Sun

Hill of Goalpara are the evidences of astrological and astronomical studies in Assam. The ancient name of Guwahati the capital city of ancient Assam itself was Pragjyotishpura meaning: 'Eastern city of Astrological studies'. Pragjyotishpura was the capital of Kamrupa the most ancient Kingdom of Assam. The people who studied stars and planets in ancient Assam were also expert in foretelling therefore, they were called *Daivagyas* , *Suryavipras or Ganakas.* The meaning of the word *Daivagya* is one who knows heavenly facts or who has knowledge to understand God. The meaning of the word *Suryavipra* is the priest who has knowledge about the sun and the stars. The meaning of the word *Ganaka* is the man who can study celestial bodies to calculate time.

Astrologers or astronomers of ancient Assam also wrote manuscripts on Astrology or Astronomy. Of all such manuscripts, the most important one is the *Kamrupiya Nivandhaniya Khandasadhya.* It was known from the epigraphs that the rulers of ancient Assam maintained astrologers. There were astrologers in Royal Courts. *Kamrupiya Nivandhaniya Khandasadhya* was written in Sanskrit and is regarded as the first manuscript on Astrology and Astronomy in ancient Assam. Historians opined that, this book was written in the seventh century A.D.

From the *Darang Rajvangshavali* it is learnt that the Koch King Naranarayana advised Sridhara Kandali to render the *Kamrupiya Nivandhaniya Khandasadhya* into Assamese verse. Sridhara was the Royal astrologer in the court of the Koch King, Viawasingha. Sridhara wrote one manuscript on Astrology in Assamese . The name of the manuscript was *Rasi Jora Grantha.* Probably this was the first original Assamese manuscript on Astrology (*Darang Rajvangshavali*)

In the days of Narnarayana, the famous king of Koch Kingdom, the son of

Viswasingha , the Royal astrologers prepared many manuscripts on Astrology and Astronomy in both Sanskrit and Assamese languages. In sixteenth century Pitambara Siddhanta Vagish, the teacher (Guru) of Naranarayana and his brother Chilaraya wrote two manuscripts in Sanskrit language on Astrology and Astronomy. These two manuscripts were known as *Grahana Kaumudi* and *Siddhanta Kaumudi* . Other contemporary manuscripts on Astrology and Astronomy in Sanskrit languages were *Jyotimuktavali* written by Bangshivadan Sarma and *Samayamrita* by Mathura Das Vidyalankara, *Adbhut Sar* by Madhava Sarma and *Samvitsar Ganana* by Krishna Dev Mishra. Mathura Das Vidyalankar was the most prominent astrologer of that time. Krishna Dev Mishra in his book *Samvitsar Ganana*, gave credits to Mathura Das Vidyalankar for studies in *Jyotisha* (Barman, 1995 : 15).

'Kamrupa Anusandhan Samiti', a cultural history research Association of Guwahati, preserved two manuscripts on Astrology. These two manuscripts are namely *Jyotisha* and *Samvitsara Ganana.* The manuscript *Jyotisha* contains 30 folios and the *Samvitsara Ganana* contains 16 folios. *Samvitsara Ganana* is a treatise on the method of forecasting of facts to come in the year. The manuscript also describe the method of calculation to find out the important events in each year. The yearly Hindu almanac gives an account of the coming events of the year to which the almanac relates. This manuscript contains a detailed account of such calculations. This tradition of preparation of annual almanac is still preserved by the traditional astronomers of Kamrup. The present system is same as the old system with some distinct arithmetical and astronomical calculations.(Goswami,1930:25).

The great Assamese historian Surya Kumar Bhuyan mentioned in one of

his published paper that an European came to Assam with Mirjumla , when he (Mirjumla) attacked Assam. The name of this European was M. de la Leubierre. He took away with him to Europe, a manuscript on Astronomy written in Assamese. On the basis of this manuscript an European astronomist - Zeovani Dominico Cassini established a theory on Astronomy (Bhuyan 1933 : 452).

It is a great evidence of high level research on Astronomy in AncientAssam. Early Assamese traditional astronomers wrote many manuscripts on Astronomy both in Sanskrit and Assamese languages. The following are the available manuscripts in Sanskrit:- *Jyotisha Tattwa (* Raghunandan Bhattacharya.), *Jyotimuktavali* (Vaishnava Dwija.)' *Graha Nirnaya (*Ganga Acharya), *Jatachandrika* (Jagadiswar), *Graha Vija Gyana (*Annonymous).

There were also many manuscript on Astronomy written in Assamese language by early Assamese traditional astronomers. The following are the available manuscripts in Assamese:- *Jyotisha Ganana , Jyotisha Parichaya, Jyotisha Arya, Jyotisha Sastra, Graha Jan Ganana.* etc. The names of the writers of these manuscripts are not known. These manuscripts are preserved in the History and Antiquarian Dept of Govt of Assam.

IV. 1. Astronomical Studies in the Days of the Ahoms :

The Ahom Kings maintained astrologers in the Royal Court in the capital at Rangpur and in the court of Barphukan at Guwahati. The chronicles of the Ahom period recorded that Astrologers from other parts of India came to Assam and settled here. It is evidenced from the records that not only in the Ahom Kingdom but in the Kingdoms of Chutiyas and Koches also, astrologers came from different parts of India and settled in Assam. During the Ahom rule, *Daivagyas* from Kanyakubja came and settled permanently in Assam. In Kamrupa,

astrologers were known as *Ganaka*. It is mentioned in *Katha Guru Carita* that, there was a village in Kamrupa which was known as 'Ganakakuchi' . This place was inhabited by astrologers only . Ganakakuchi still exists in the present Nalbari District of Assam.(Barua,1933 : 421)

Suryakhari Daivagya, a well known astrologer in the Koch Kingdom mentioned the duties of *Daivagyas* in the book *Darang Rajvangshavali.* It is said:-" A *Daivagya* knows the movements of stars , planets and can read past, present and future as well. In the court of King Naranarayana, one Sridhara, who was in-charge of the Astrology, was a most steady and erudite scholar and always thought for the well being of the King. He ascertained the dates for the performance of all ceremonial and religious functions of the royal family after proper calculations. He frankly expressed to the king whatever good or evil he found in his calculations about the king and worshipped the planets for the good of the king ."(*Darang Rajvangshavali*)

In the Ahom court the 'Mazumdar Barua' , who was generally a *Daivagya* by caste, was a very responsible officer and worked just as the personal assistant to the king. There were a number of astrologers , who were known as *Doloi* appointed by the Ahom king in the Royal Court. There were three principal grades of *Dolois* in the Royal court of Ahoms. These were the - *Bor Doloi* (astrologer of first category), *Maju-Doloi* (astrologer of second category) and the *Saru-Doloi* (astrologer of third category). A set of *Dolois* were permanently appointed to advice the 'Borphukan' of Guwahati. They obviously lived in Guwahati. There were another set of *Dolois* at Gargaon . Each of the sets of *Dolois* were required to attend the court at their respective places. When ever there was a famine, a drought, an epidemic or any other disaster in the country,

the *Dolois* had to calculate the positions and the effects of stars and planets. The *Daivagyas* had to perform *Homa*, and worship the particular planet due to whose wrath the drought or the famine or the calamity took place. When a king or a noble would fall ill the *Dolois* were required to find out, by making calculations, at which planet's wrath the King or the Noble had fallen ill. The *Daivagyas* were also entrusted with the duty of pacifying the planet by performing *Homa* even on a regular basis. When war broke out in the country, the *Bor-Doloi* had to go with the General to the war front where his duty was to ascertain the time and direction of the movement to the field of action and the accurate time of the first shot of the cannon to the battle field.(Bhuyan, 1930 :43)

At the time of launching a war against the enemies, an expert astrologer was appointed to take his seat in a very secluded place by the side of the battle field where he engaged himself in finding out the proper time, by calculation, for commencing the attack. A small gun known as *Khen Hiloi* was also placed with a man by the side of the astrologer, at his disposal. As soon as the astrologer indicated the best moment, the man in charge of the *Khen Hiloi* instantly fired it and then the soldiers taking positions in the battle field could begin their actions against their enemies in the field.

The astrologers got promotion on the basis of efficiency. A *Saru-Doloi* may be promoted to the position of *Maju-Doloi* and a *Maju-Doloi* may also be promoted to the position of *Bor-Doloi* on the basis of their efficiency.(Bhuyan,1962 : 47)

At the patronage of the Koch and the Ahom Kings, astrology or traditional astronomy was deeply and extensively studied in Assam and many original works were performed.

IV. 2. Institution of Traditional Astronomical Studies in Assam :

There were many institutions for Astronomical studies in ancient Assam . In fact, the whole of the ancient Assam was known as the place for astronomical studies by its ancient name Pragjyotishpura. Most of the temples, particularly *Siva* temples, were the centres of astronomical studies. The temple of Navagraha was the most famous institution of Astronomical studies in the Ancient and Medieval Assam. The Surya Pahar or the Sun hill of Goalpara was also a place of Astronomical studies in ancient times. It is said that the hill contains one lakh *Siva Lingas* scattered all over the place. There were also images of Sun God in this hill. This proves that this was a place for studies of stars and planets. In many other places astronomical studies were performed in Assam.

Navagraha, The Temple of Planets :

High on the western crest of Chitrachal Hill, overlooking the mighty Brahmaputra on one side and the city of Guwahati on the other, surrounded all around by tall trees, stands the Navagraha temple, the most famous ancient institution of astronomical studies in Assam. The Navagraha temple is built on a supposedly ancient astrological site.

The temple is dedicated to nine planets which are represented by nine stone *Sivalingams* . Inside the temple, which is designed in the form of an octagon on the base are seated the nine planets (*Grahas*). These nine planets do not exactly co-relate to the nine planets that circle the Sun (*Ravi*), but only five of them which are- *Budha* (Mercury), *Sukra* (Venus), *Mangal* (Mars), *Brihaspati* (Jupiter) and *Sani* (Saturn). The other so called planets include the Sun (*Ravi*) and the Moon (*Chandra*) and the Astrological conjectural bodies called *Rahu* (North Node) and *Ketu* (South Node) . Each of the planets (*Grahas*) is represented by the *Linga* , seated on a *Yonipitha* which is placed at the centre of a nonagon ditch, about six inches deep into the floor. These nine celestial bodies

are personified and assigned with positive and negative energies, which are believed to rule the ups and downs of human life.

The present *Navagraha* temple is of a relatively modern construction which have been rebuilt after it was devastated in 1897 AD. From a stone inscription on the eastern wall of the present *Navagraha* temple, it appears that the earlier temple was built by the dictate of Ahom King, Rajeswar Singha in the *Saka* era, 1674 (1752 AD). It is believed that the temple is of much older origin, being at least 1000 years old.. The *Sivalingams* inside the inner sanctum, representing the individual planets are dated to the pre-mediaeval period of 4th to 10th century of the Christian era.(*Kalikapurana*).

The origin of the *Navagraha* temple , the only one of its kind in Northern India is shrouded in mystery, as absolutely nothing is known about its background. Sparing a brief report in *Kalika Purana* and a fleeting reference in the *Markandya Purana* no aspect of the temple is mentioned in any of other ancient texts of the region and neither is there any comprehensive religious myths associated with it. One folk tradition says that the original temple of *Navagraha* is as old as the *Kamakhya* temple i.e. 4th to 6th century and existed since the time of Bhaskara Varmana who also reigned in the early part of 6th century. Others claimed that this area was a major centre of astrology and was visited down the ages by many prominent exponents of this mystic science, including the great Varahamihira. But these legends are not validated by historic texts.

The stone inscription in the temple placed by the Ahom builders , refers to the temple not as *Navagraha* but as the *Navaratna* temple and adds that the temple is built in the Chitrachala hill, upon a peak called *Navagraha.* It does not mention about any earlier temple being located in the spot as in the case of

other reconstructed sites.

The *Kalika Purana* which had been compiled at around the 9th century, refers to Assam as an ancient seat of astrology. It also mentioned that the Navagrahas are worshipped on the Chitrachal Hill.

A few historians are convinced that the temple had been an early solar observatory. The basis of their argument is that, the nine *Sivalingams* inside the inner sanctum are arranged in a circular manner with one in the centre representing the sun. Such patterns are also used in many presumptive ancient solar observatories and calendars, around the world, starting from the stone hinge to the rock circles in North America. Moreover, the location of *Navagraha* temple also provides maximum amount of direct sunlight during the day which is essential for astronomical works.

IV. 3. Significance of representation of *Grahas* by *Lingas* in Traditional Astronomy :

It commonly questioned, why the *Grahas* are represented by *lingas*. The Saivite cult was already prevalent in ancient Kamrupa, and presumably it had made room for the solar cult to flourish. This was possibly preferred to be done not at the cost of the already predominant Saivite cult, but through a fusion of saivite and solar cults. Identically, it may be noted that the Brahminical *Pujas* or performances, such as *Sradhas* usually begin with a brief worship of *Siva* and invariably concluded with *Suryagraha*. This procedure might have facilitated this fusion of this *Siva* and Solar cults, and an almost equal importance of both the cults. The representation of the *Grahas* , the planetary members of the solar family, by the *linga*, symbol of *Siva*, stands as a testimony to this fusion . The *linga* was presumably used as a symbol of the Sun God, the lord of *Grahas* himself. But the symbol of the lord was later

extended to the planets, the *Grahas*. The distinction between the lord and the planets was maintained by placing the former in the centre being surrounded by the eight other planets. That is how the *Grahas*, whose worship was decidedly the outcome of a legacy of the solar cult happened to be represented by a symbol identical with that of *Siva* (Chutia, 1975: 99).

The philosophical idea behind representation of the planets by the *lingas* possibly may be as follows :-

Siva is the supreme deity (*Parama Maheswara*) and the *Grahas* are only the different agents of the supreme deity. They are so to say , the deputies of the supreme lord and operate only under the authority of the crown and this aspect was meant to be made apparent by superimposing the *linga* form on the *Grahas*.

Secondly, *Siva* is the supreme self or the supreme reality. The *Grahas* , are only the different aspects of the same supreme reality and as such, the *Grahas*, when they are worshipped, are in no way better than symbolical representation of that supreme object of devotion. That is why, the individual identities of the different *Grahas* are enveloped commonly by the *linga* form, the regular and direct symbol of *Siva,* the supreme reality.

Thirdly, it may be noted that the *Grahas* are worshipped for obtaining *mangala*, the goodness, as we find in the expression, *Satyam Sivam Sundaram* (*Kalikapurana*).

It may be noted here that the Brahminical worship of all the deities is preceded by a brief worship of *Siva.* This proves the *mangala* aspect of *Siva.* This common factor of *mangala* also seems to justify the motif of representing the *Grahas* with the *linga* symbol. This also displays the misgivings about

Siva's lordship over the *Grahas,* the main object of worship in the so called *Navagraha* temple (Chutia, 1975: 106).

IV. 4. Astronomical Significance of *Sivalingam* and *Sivaratri* :

Astronomists tried to describe the significance of *Sivaratri* astronomically. They opined that there occurs a *Sivaratri* every month about two days before *Amavasya.* The moon rises at the time of sunset on full moon day i.e. *Poornima.* Thereafter, it rises about fifty minutes later every night and at the end in the day of *Sivaratri,* it rises about an hour before sunrise. We first see the crescent moon coming above the horizon which is later followed by the rising sun. Thus, the rising sun of that day looks like Shiva with crescent moon on its head. This spectacular scene can be seen only in the morning following a *Sivaratri.* The word *Sivaratri* is thus eminently appropriate to this night. The *Chandradarshan* (viewing of moon) after *Sivaratri* is the last appearance of the moon in the month which is a counterpart of its first appearance on *Shukla Dwittiya* (second day of early lunar fortnight) . Most probably in ancient times, the priests or the astronomers used to observe both phenomena for determining the moment of *Amavasya.* (Abhayankar 1988: 12). This is the astronomical significance of the monthly *Sivaratri.*

Having understood the astronomical significance of monthly Sivaratri it is easy to understand the significance of *Mahasivaratri* . The *Mahasivaratri* is the longest *Sivaratri* of the year. Hence it should occur close to the longest night of the winter solstice. At present, the *Mahasivaratri* occurs on February 26 ± 15 days. But in the epoch when the *Mahasivaratri* festival was introduced, it must have occurred near December 22 ± 15 days. The difference of 66 days gives for this period an epoch of 2600 BC ± 1100 years which agrees with the

age of Indus Valley Civilization of Mohenjodaro and Harappa. It is well known that Shiva was the most prominent deity of those times (Abhayankar 1988: 13).

IV. 5. Sites of Astronomical Studies and *Sivalingam* in Assam:

It has been found that there are plenty of *Sivalangams* in the places which are thought to be sites of astronomical or astrological studies. Therefore, the places or the temples where there are *Sivalingams* must have a connection with astronomical studies. There are many places in India with *Sivalingams* and are recognised as ancient sites of astronomical studies. It is very significant that most of these places are located at the top of high hills. Many of these places become *Siva* temples or *Graha* temples.

In Assam the most famous site of astrological studies, the Navagraha temple is located at the top of the Chitrachal hill. The Chitrachal hill contains large number of *Sivalangams*. Even the Navagraha temple which is dedicated to nine planets are represented by nine *Sivalangams.*

The Sri Surya hill of Goalpara is also regarded as an ancient site of Astrological studies . Significantly this site also possesses large number of *Sivalingams* . It is said that the Sri Surya hill of Goalpara bears one lakh *Sivalingams.*

It may be assumed that during *Sivaratris* and *Mahasivaratris*, the ancient astronomers or the priests studied the positions of the sun, the moon and other planets sitting in front of *Sivalingams*. They must have also worshipped *Sivalingams* before the start of the astronomical studies.

IV. 6. The Solar Cult and Planetary Studies in Assam :

Sun worship in Assam has a great antiquity. It is said that, the Alpine Iranian or even the Magical culture in Pragjyotisha were largely responsible for the solar cult and planetary worship in Ancient Assam or Pragjyotisha. It is mentioned in the *Sankhyayana Grhyasamgraha* that a student of astronomy should visit

Pragjyotisha before sunrise. *Markandya Purana* and *Brihatsanghita* mentioned about the astrological studies in Pragjyotisha. The evidence proves that Pragjyotisha-Kamrupa attained celebrity in sun worship from early times. The *Kalika Purana* referring to the solar cult in Pragjyotisha, records that the Sri Surya hill in Goalpara was the perpetual abode of the sun. It is again described that the people of Pragjyotisha were formerly worshippers of the sun, (Choudhury,1959). The *Adicharita* (Sankardeva) gives a description of solar cult during *Vaishnava* period (Choudhury,1959 :381).

The prevalence of solar cult is proved by the existing remains dedicated to the sun , and many icons of the deity, found in Dah-Parvatiya, Gahpur, Tezpur, Pandu, Sadiya, Sukreswar, Suryapahar and other places of Assam. (Choudhury,1959 : 382).

V. TRADITIONALWEIGHTS AND MEASURES

V.1. TRADITIONALWEIGHTS AND MEASURES IN INDIA :

India is probably one of the first countries of the world to develop the scientific method of weights and measures. The ancient scientists of India developed highly sophisticated instruments to measure things. They also measured time and space apart from other materials. Ancient Indian chemists used a very sophisticated system to measure materials of very small quantity.

V. 1. 1 Measurements of Time and Space in Ancient India :

30 *Kshanas* = 1 day, 2 *Ghatikas* = 1*Kshana,* 30 *Kalas* =1 *Ghatika,* 30 *30 Kasthas* = 1 *Kalas,* 18 *Nimeshas* = *Kastha,* 0 *Tatparas* = 1*Nimesha,* 00 *Trutis* = 1 *Tatpara.*

This makes a *Truti* of time equal to 1/33, 750 of a second, which is nearly

the measure of *Paramanu* of time, as given in *Vishnu Purana* (Bhaskara's *Siddhanta Siromoni,*)

The above measures were in use among the astronomers in Ancient India. But the physicians computed according to the following table, given both in Udayana's *Kiranavali* and Sridhara's *Nayakandali* :

30 *Muhuratas* =	1 day (24 hours),	30 *Kalas* =	1 *Muhurata,*
30 *Kasthas* =	1 *Kala,*	18 *Nimeshas* =	1 *Kastha,*
2 *Lavas* =	1 *Nimesha,*	2 *Kshanas* =	*Lava.*

This makes a *kshana* of *Nyaya Vaiseshika* equal to 2/45 of a second. The *Naya* assumes that the unit of physical change (or the time occupied by any single antecedent step in a casual series before the succeeding steps is ushered in) is equal to a *kshana* (2/45 of a second). The astronomers were familiar with far smaller measures of time.

Note : A similar system of measuring time was there in Assam as these units of time is also mentioned in the Assamese *Bhagavata.*

V.1. 2. Measures of Weight and Capacity :

The '*Amarakosha*' mentions measures of three kinds - weight, length and capacity.

The '*Krishnala*' (*gunja, raktika,* black and red berry of the shrub *Abrus precatorius*) was employed as a natural measure of weight. 80 *krishnala* berries on the average weigh 105 grains Troy, and this must be taken as the basis of our computation, though in current practice 80 *krishnala* are taken to be equivalent to 210 grains.

The conventional measures were , however;- one gold *masha* was the weight

of 5 *krishnalas* of gold, 1 *suvarna* or *tola* weighed as much as 16 *mashas*, and one *pala* as much as 4 *suvarnas* or *tolas*. A *pala* of gold, therefore, weighs 320 *krishnalas* (Manu, Chp. VIII).

A *masha* of gold, therefore, would weigh 6 $^{8}/_{16}$ grains, a tola, 105 grains(in current practice it weighs about 180 grains); and a *pala* 420 grains Troy.

1 silver *masha* =	2 *krishnalas,*	1 *dharana* =	16 silver *mashas,*
1 *pala* =	10 *dharanas,*	1 ikrishanala =	1296 *traserenus.*

A *traserenus*, as a measure of weight, therefore is the equivalent of 7/6912 of a grain Troy, or double this according to current measures.

V.1. 3. Measures of capacity :

Here the standard was furnished by the *kudava*, a vessel described as three *angulis* long, 3 *angulis* broad, and 1 ½ *anguli* deep,- with a cubical capacity of 13 ½ cubical *angulis*.

4 *kudavas* =	1 *prastha,*	4 *prasthas* =	1 *adhaka,*
4 *adhakas* =	1 *drona,*	4 *dronas* =	1 *khari or bhara.*

24 *angulis* make one *hastha,* cubit, which may be taken to be 18 or 19 inches. A *Kudava* would contain about 4 *palas* of distilled water at 30° C (Roy, 1956 : 284).

V. 2. TRADITIONAL WEIGHTS AND MEASURES IN ASSAM.

In early Assam the value of articles were measured in terms of commodities and the business transactions were carried on by the barter system. As shown by early literature, animals like cattle, animal skins, garments, rice, etc. were used for barter. In ancient Assam, barter was the only medium of exchange, which is still continuing amongst the tribes, particularly in the hills. To-day also, in this modern age, some of the hill tribes of the North Eastern India are

still using articles like animal heads, mithuns (a kind of valuable and sacred cow like semi-wild animal of Arunachal Pradesh and Nagaland), daos, arrows, spearheads, gongs, bells etc. in barter system(Choudhury, 1959).

Amongst the tribes of Arunachal Pradesh and Nagaland, Mithun is still used to determine the value of their property. Hill tribes exchange their products with products of the people of the plains.

In ancient Assam, people, particularly of hills, had a vague idea of weights and measures. The size of a thing is described by gesture and action or by comparison. If a man has anything for sale , say a basket of corn , a bundle of cotton, or a few fishes, he will tell a buyer that he wants so many things in exchange. If the buyer asked him how much cotton or corn he have, he will reply " so many men's load".

In speaking of a length of a journey , he only states the number of nights he would be required to sleep on the road before reaching his destination. To express a short distance the standard of measurement is by the number of '*pans*' (betel-nut) a man chew in the course of the journey. The hunter tribes of hills usually express the measurement of a short distance by arrow shots. He will say the place is so many arrow shots. Some times distance is indicated by distance travelled by sound, for example "distance of a cry's reach". People of ancient Assam either tribal or non tribal usually expressed a distance of a place by days such as "one day's journey", "three days journey" etc. (Hunter,1879).

V. 2. 1. Measure of distance, length or area :

Under the rule of Ahom kings the distance from one place to another is found measured , as per the chronicles, by the standard of a long pole known as "*Tar*" in Assamese. Such descriptions are found specially in the chronicles written

by *Chang Rung Phukan*, the chief architect or engineer of the Ahom royalty. The distance from Guwahati to Rangpur was expressed in the following way: " from Rangpur to the the steps (bathing steps) of the river Sonari is 7500 *beo*; from there to Gajpur 7500 *beo*; from Gajpur to Dergaon 6400 *beo* etc. (Rajguru,1988). For the measurement of distance or to find out the area of a plot , a pole, usually made of bamboo, known as *Tar, Nol* or *Beo*, was used. The standard length of the pole is 7 *hat* (cubit), one *beget* (half cubit) and four *anguls* (fingers). The length of the pole used in different places was not uniform. But the variation is negligible. According to Hemchandra Barua, the noted lexicographer, it is 8 cubits or 13 feet in length. In case of a plot measuring 20 poles in length and 20 poles in breadth , the area will be measured as one *pura* or 4 *bighas* in total (Barua, 1941 : 421).

V. 2. 2. Measurement of Time :

In ancient Assam, time was calculated by observing natural phenomena. Usually the appearance of sun in the morning sky and the and setting of sun in the evening sky was considered as standard time of morning and evening. Morning time was called as *"dhal phat diya samay"* meaning, the early dawn, while the evening time was called *"beli patat baha samay"* meaning, the time of just setting of the sun. The time of the day throughout was determined by observing the shadows of the trees or the houses or the position of the sun in the sky. Sometimes the morning was called as the "C*harai Puwa"* (birds cry morning). The time during the night was calculated by observing the position of the moon in the night sky.

After the popularisation of astrological calculations, an accurate standard of measurement of time came into use among the literate mass. According to this standard, a whole day or twenty four hours was divided into 8 *praharas*.

Each *prahara* constituted of 3 hours according to the present day. The lowermost unit of time is a *pal* or a moment. Above the *pal* there are other units such as *danda* , *bipal* and *din* (day). Again 60 *bipal* is equal to one *pal* , 60 pal to one *danda,* and 60 *danda* to one *divas* or *din* (day). A *divas* or *din* is a full day of twenty four hours, from sunrise to sunset. An English hour is equivalent to two and half *danda* . Seven *divas* or days make a week or a *saptah,* 15 days a *paksha,* two *pakshas* or 30 days a month , twelve calendar months a year *batshar* . (Hunter, 1879). People of ancient Assam had a good sense of the lunar movements. Almost all the people had an idea about the time according to the movements of the moon. The increasing fortnight of the moon's age or from new moon to full moon, is termed as white fortnight or *sukla paksha,* and the decreasing fortnight or from full moon to the next new moon, the black fortnight or *krishna paksha* (Hunter, 1879 :62).

V. 2. 3. Measurement of Weights:

In the ancient Assam there was no unit system to measure weight . Things were simply exchanged as per volume of some definite baskets. Till the later part of medieval period, people used a kind of basket to exchange things in weight, which is called *doan.* A *doan* is a bamboo basket of definite size. Later, however units of measurement of weights were employed.

V. 2. 3. 1. Units of Weights and Measures in Assam:

The units of measurement prevalent during the last part of the Ahom period continued to be in use also during the British period - till the introduction of the modern decimal system. Probably, the system was , to an extent influenced by the visiting Mughal invaders. We cannot however deny the influence of northern India, brought along with them and also by the Kayasthas and Brahmins brought by the Koch and Ahom kings to adorn their courts.

VI. 3. 1. 1. Units of weights:

Usually grains and other weigh-able materials was measured as follows:

5 *sikki* = 1 *kaccha,* 4 *kaccha* = 1 *chatak,* 4 *chatak* = 1 *powa,*
4 *powa* = 1 *seer,* 5 *seer* = 1 *pachuri,* 8 *pachuri* = 1 *maund,*
40 *seers* = 1 *maund.*

Liquid was also measured in the same units except the *pachuri* and *kaccha,* as these two units are not considered in measurement of liquid.

VI. 3. 1. 2. Units of Measurement of cloths:

The following are the units of measurement of cloths :

3 *jab* = 1 *anguli,* 3 *anguli* = 1 *gira,* 8 *gira* = 1 *hath* (cubit),
2 *hath* = 1 *gaz* (yard).

VI. 3. 1. 3. Units of measurement of land :

The following were the units of measurement of land:

System No I:-

3 *jab* = 1 *anguli,* 4 *anguli* = 1 *muthi,* 3 *muthi* = 1 *beget,*
2 *beget* = 1 *hath* (cubit) 5 *hath* = 1 *chatak,* 16 *chatak* =1 *katha* ,
20 *kath* = 1 *bigha.*

System No II:

14 *hath* = 1 *tar,* 1 *tar* X1 *tar* = 1 *lecha,* 20 *lecha* = 1 *katha,*
5 *katha* = 1 *bigha,* 4 *bigha* = 1 *pura.*

V. 2. 4. Measurement of distance:

3 *jab* = 1 *anguli,* 4 *anguli* = 1 *muthi,* 3 *muthi*= 1 *beget,*
2 *begets* = 1 *hath,* 2 *hath* = 1 *gaz,* 4 *hath* = 1 *dhanu,*
100 *dhanu*= 1 *tal,* 2 *tal* = 1 *kos,* 4 *kos* = 1 *yojan.*

V. 2. 5. Currency :

In ancient Assam, cowries was used as a kind of currency, a standard medium of exchange. The earliest reference to the use of cowries is found in the *Harshacharita* where, Bana states that Bhaskara sent to Harsha 'heaps of black and white cowries' as presents. The use of cowries is further proved by the Tezpur rock inscription of Harjara. The earliest reference to a silver coin probably from Kamrupa is noticed in the *Arthrasastra* which mentions it under the name of *Gaulikam*. A definite reference to gold coin is found in Simlipur grant of twelfth century A. D., which refers to a *tulapurusa* gift from the Kamrupa king Jayapala and states that the Brahamana Prahasa did not accept the offer of 900 gold coins (Choudhury, 1959).

Till the medieval age, the currency system of cowries continued to be in use, in the Brahmaputra valley. The base was related to a unit of silver *ingot* (or dust), each having a fixed weight. This system was occasionally supplemented by coins , which could be exchanged with cowries. For example a copper coin of Harjaravarman having the weight of 80 rati or 144 grains could have fetched 80 cowries(Sircar,1975).

Cowries remained in use, in the medieval period of Assam, extensively as a medium of exchange. The Nilachal inscription of Madhava of c. 15th century A. D., states that, each areca nut tree fetched 40 cowries annually. This system of medium of exchange continued till the early Ahom reign, amongst the common people. Of course there are references in literary texts to the use of coins by a few early Ahom kings. Sukapha (1228-68), the first Ahom king of Assam is noted to have offered gold and silver coins to his family deities. According to Ahom chronicles , Ahom King Sudangpha (A.D. 1397 to1407) minted coins at the time of his coronation. (Sarma, 1981: 81).

V.3. WEIGHTS AND MEASURES AND MEDIUM OF EXCHANGE IN NAGALAND :

The Nagas had but a vague idea of weights and measures. Most of the Naga tribes expressed the size of a thing by gesture. Till recent times, barter system continued in the Naga villages. They express the amount of materials in weight by the standard load of a man and the length of a journey or distance to a place by the number of nights one would be require to spend on the road before reaching the destination.

Though the barter system is the principal method of exchange or trade, yet a currency of a sort existed in conch shell and iron. One conch shell , in length equal to the breadth of eight fingers , is said to have been worth a cow. Small iron hoes brought from Manipur were also used as a currency . Iron was used as a currency by the 'Ao's in the form called " *Chabili*", a piece of thin iron roughly key shaped and about eight inches long by three inches broad. These " *chabili*" however , were tokens, having no use except as money. One "*chabili*" was reckoned the equivalent to a day's labour. Large number of these "*chabili*" are still to be found in the house of the rich 'Ao' man. Among the 'Yechumi' and other trans-frontier tribes there was a form of currency, consisting of a string of beads alternated with bits of bamboo. One string having a token value of about 4 annas of Indian money. The 'Chang' used flat metal gongs, each being worth two rupees or more. The 'Angamis' used *daos* as a medium of exchange. Salt was the most precious material in those days and was also used as a medium of exchange.

V. 4. WEIGHTS AND MEASURES AND MEDIUM OF EXCHANGE IN KHASI AND JAYANTIA HILLS :

Like other hill tribes of ancient Assam, Khasis also had a primitive method of measuring and weighing materials. The standard of measuring distance is by the number of "*pans*" (betel nut) a man would chew in the course of the journey.

In some parts of Khasi and Jayantia hills, land is measured by a stick called *Ka-dieng-mong* , varying in length from 6 to 7 cubits.

Liquids are measured in gourds and bamboo tubes of different measures.

Rice, potato, beans or other grains were measured in baskets (Bareh,1964:165).

V. 5. 1. The Khasi Calender :

Khasis have a peculiar, traditional method of calculating time. Unlike other people , the Khasi week is consists of eight days. The names of the week-days are not derived from the names of planets or stars, as is the case with others. Khasis has a tradition of giving name of the days of the week, by the name of markets. The reason of the eight day week is because the markets are usually held every eight day.

Khasis adopt the lunar month, *u bynai*, twelve of which go to the year *ka snem*. They have no system of reckoning cycles, as is the custom with some of the Shan tribes (Gurdon,1907 : 62).

Khasi Months :

U kylla-lyngkot , corresponding to January, this month in the Khasi hill is the coldest of the year. The Khasis turn *kylla,* the fire brand *lyngkot,* in order to keep themselves warm in this month, hence its name *kylla lyngkot.*

U Rymphang, or the windy month, corresponding with February.

U Lyber, around March, when the hills are again clothed with verdure, and the grass sprouts up(*lyber*), hence the name of the month, *U Lyber.*

U Iaiong, in and around April. This name may be a corruption of *u biyani-iong,* the black moon or the changeable weather month.

U Jymmang , corresponding to May. This is the month when the plant called

the *ut'ieu jymmang,* or snake plant blooms, hence the name.

U Jyllieu, corresponding to June is the deep water month, the word *Jyllieu* meaning deep.

U naitung, the evil smelling month, when the vegetation rots owing to excessive moisture. This corresponds with July.

U nailer -The month when the weather is supposed to become clear, *synlar,* and when the plant called *ja'nailer* blooms. This month corresponds to the August.

U nailur, corresponding to September is the month for weeding the ground.

U ri saw - The month when the autumn tints first appear, literally when the country, *ri,* becomes red, *saw*. This is October.

U nai wieng is the month when cultivators fry the produce of their fields in *wieng* or earthen pots. This month corresponds to November.

U noh prah, - The month when the *prah* or baskets for carrying the crops are put away (*buh noh*). It is also called the month of the fall of the leaf and it corresponds to the month of December.

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Chapter - IX

MISCELLANEOUS TRADITIONAL CRAFTS AND INDUSTRIES

CHAPTER- IX

MISCELLANEOUS TRADITIONAL CRAFTS AND INDUSTRIES

I. INTRODUCTION :

India has been throughout the ages acknowledged as the stronghold of diversified and rich tradition of material culture. Through out the ages the people of India have developed many traditional crafts and industries. The North Eastern part of India has always deserved special mention in this aspect. The people of this region have developed many traditional crafts and industries, most of which have evolvd through the ages, and have survived the ravages of time. Most of the crafts were indigenously developed.

The crafts and industries of Assam has found place in many well known and important books of history. The great epic *Mahabharata* makes mention of a painter of repute of this region, 'Chitralekha' and the ivory industry of Kamrupa, the present Assam. The *Ramayana* praises the prosperous boat industry of Assam, the then Kamrupa. Other books like *Harshacharita*, *Arthasashtra*, *Atharvaveda* also makes clear mention about the traditional arts, crafts and industries of this region. Mughal chronicles like the *Fatiyah-i-Ibriah* or *Tarikh-e-Asham* of Shihabuddin Talish, stand testimony to the fact that arts and crafts of this area was internationally renowned. Local history literature like the history book of Chang Rung Phukan, the *Assam chronicles*, etc. gives details of the crafts and industries of the North East. In addition local, national and international museums display items of the antiquity, which speak for itself of the prosperous traditional crafts and industries of the North-East India.

Paper making, is one of the oldest technologies that developed in this area. It is believed that, the close geographical and perhaps socio-cultural and political proximity with China, which was the first country to develop the craft of paper making, was instrumental in the maturing of this industry in this area. Along with paper making developed, the technique of writing. North East India is known for producing special and indigenously developed types of paper, writing ink, painting material and innovative processes to preserve manuscripts and paintings. The idea of laminating paper or book covers by using red shellac is also regarded as an indigenously developed technology of this region.

It is interesting to take into account that, since the days of yore, edible salt was manufactured from fresh water brine springs of some areas in the present Assam and Nagaland. In olden days, due to inconvenience of transferring salt from the coastal region, this type of salt, derived from fresh water was commonly used. Surprisingly, this technology is still prevalent and this salt is used by many of the local people, who consider that this salt has some miraculous medicinal properties.

A large number of lime-mines are found to occur in this part of the country. The lime produced from the mines of the present Khasi and Garo hills (Meghalaya), is considered to be superior in quality. Edible lime was produced by burning the shells of locally available snails. Tons of lime, manufactured by burning shells of snail was used as a cementing ingredient in many construction works of the Ahom Kingdom.

People of the North East have developed an age old traditional technology of dyeing fabrics with natural dyes. Assam is famous for producing silk fabrics, with which developed the technology of dyeing silk fabrics by using herbal dyes.

Natives of this region have identified large number of plants which are used for dyeing purpose. A large variety of wood yielding trees grow in the forests of North East India. Wood is the main raw material for construction and many arts and crafts. Wood was also used for making modes of conveyance like boats, carts and palanquins etc. Along with wood, bamboo was also used very frequently for various construction purposes. The large variety of bamboo and cane species in the forests of the North East has made it possible to have a wide range of the use of bamboo, in addition to construction purpose. Cane and bamboo were used for making toys, musical instruments, baskets, fishing gears, containers, paper, furniture, curtains, etc. The ivory industry was also an well established industry and the region was famous for ivory products like sword hilts, ornaments, icons, dices, containers, combs, boxes and most interestingly, mats of ivory.

It is very interesting to note that the people of Arunachal Pradesh particularly the Monpas have developed a technology for using energy of water current to run a traditionally made machine for threshing and husking . The machine is entirely made with cane, bamboo and wood. This technology is indigenously developed by the village people who does not have any communication with the out side world.

II. PAPER MAKING, PAINTING AND WRITING TECHNOLOGY :

The *Harshacharita* has direct references to the popularity of paintings in 7th century in Assam as gifts from Bhaskarvarmana to Harshavardhana of Kanauj, which included accessories to paintings. The gifts included carved boxes of panels for painting with brushes and gourds, and gold painted cages. Other objects were, the fine tinted manuscripts, volumes of fine writing with leaves

made from aloe bark, and of the hue of ripe pink cucumber. It was in this aspect of manuscript painting that Assam excelled in the Ahom period (Choudhury, 1959: 391).

II. 1. Techniques of Paper Making and Manuscript Painting :

II. 1. 1. Agar Tree Bark (*Sanchipat*) as a Source of Making Paper :

The most common carrier of manuscripts in Assam was made from the bark of the Agar tree (*Acquillaria agalocha*) and is known as *sanchipat*. Its use was almost universal, specially for most important manuscripts and those ordered by the royalty and nobility.

The preparation of bark carrier entailed a laborious process of curing, seasoning and polishing of raw slices before it could be made to retain the ink. A tree is selected of about 15 to 16 years' growth and 30 to 35 inches in girth, measuring about 4 feet from the ground. From such a tree, the bark is removed in strips from 6 to 8 feet long and from 3 to 27 inches in breadth. These strips are rolled up separately with their inner or white part of the bark outwards and the outer or green part inside and are dried in sun for several days. These are then rubbed with hand on a board or some other hard substances so as to facilitate the removal of the outer or the scaley portion of the bark. After this, these are exposed to dew for one night. Next morning the outer layer of the bark (*Nikari)* is carefully removed and the bark proper is cut into pieces of a convenient size, approximating 9 to 27 inches long and 3 to 18 inches broad. These are put into cold water for about an hour, and the alkali is extracted after which the surface is scraped smooth with a knife. These are then rubbed with a piece of burnt brick. A paste prepared from '*matimah*' (*Phaseolus radiatus*) is next rubbed in, and the bark is dyed yellow by means of yellow arsenic (*Haital or Harital*). This is followed again by sun drying, after which the strips are rubbed to get a surface as smooth as polished marble. The process is now complete and the

strip is ready for use . The labour involved in preparing the bark and in inscribing the writing is considerable (Gait, 1926 : 129).

The surface of the folio was prepared for painting and writing as well, by priming it with different materials and then rubbing smooth when dry. The paste most commonly used from this was made from *matimah* (*Phaseolus-radiatus*), but duck's egg were also used, though not very often. The universal custom of applying *harital* or yellow arsenic was not only for colouring the folios but for protecting these from the attack of insects and micro-organisms. The finished manuscripts were then exposed to the fumes of *gandhaka* (sulphur), which also acted as an insecticide. A special officer was attached to the Ahom court, called the '*Gandhia Barua*', who supervised over the archives and the preservation and conservation of not only manuscripts but also documents, letters, maps and plans for architectural undertakings.

Apart from *sanchipat* folios, as a carrier of writing and painting , there were other types of carriers which may be considered as the primitive form of papers in ancient Assam (Neog ,1959: 15).

II. 1. 2. Making Paper out of Felted Cotton :

Another material on which writing and paintings were done was *tulapat*, which had ginned cotton as its ingredient. *Tulapat* as the name implies, is a sheet made from cotton by felting it. Its leaves were made by pressing cotton. The earliest reference of the use of this type of paper for writing and painting is the prose biography, *Katha Guru Charita*, written in the year 1469 A.D (Neog ,1959: 20).

The oldest painted manuscript on *tulapat* are the *Phung Chin* (1437 A.D.) and the *Suktanta Keyompong*, both in Tai Ahom language and script. The Book X of *Bhagavata Purana* from Bali Satra, Nagaon, was written and painted on

the same. The *Lanka Kanda* of *Ramayana* is also one of the finest specimen of writing and painting on *tulapat*. The process of making *tulapat* is indigenous to Assam, and possibly was a contribution of the various Tai and Shan peoples who entered Assam, beginning with the Ahoms in 13th century .(Gogoi, 1960 :119).

The process of making *tulapat* as described by 'Chaikhang-let Gohain', an Ahom scholar of Namphakial village is as follows: *Tulapat* is essentially a paper made from wood pulp. Three kinds of trees were usually selected for making *tulapat*. White *tulapat* was made from *maihai* tree. The dark brown variety of *tulapat* was made from *yaman* tree. There was also a red variety of *tulapat*, but the tree from which this was made is not known. The *yaman* tree has been identified with the *hsa* tree of the Shan people, and the *nuni* of the Assamese or the paper-mulberry (*Bronsanettia papyrifera*). The barks of the above mentioned trees were cut into convenient sizes and then beaten thoroughly. These were then boiled till they disintegrated and formed a fine pulp and became clear of the impurities. The pulp was next poured over water and kept in rectangular ditches of required sizes where it floated on the water surface and was left to cool. When cold, the film of pulp lying on the surface of the water gave a sheet of strong and tough paper. Usually, a *tulapat* folio was made by stitching two single sheets together, or by folding a longer sheet into two and then stitching them. This was done to give strength to the folios. Important centres of making *tulapat* were located at Namphakial, Munglong and Narayanpur in the district of Lakshimpur in Assam. The people who made it were mostly Ahoms. The Monpa Buddhists of Kameng district of Arunachal Pradesh, also made paper in a similar way from the bark of the paper-tree locally known as '*sukso*'. (Gogoi, 1960 :120).

II. 1. 3. Bamboo Strips and Palm Leaves:

The other unusual carrier used by the scribes and painters of early Assam is the *banhpat* or strips of cleaned and smooth bamboo. Leaves of the *nahar* tree (*Mesua ferra*), and a kind of leaf known as *alpal* were also used for the same purpose. The bamboo strip folios as well as palm leaves were used as a carrier for writing and painting mainly by the Buddhists of upper Assam and Arunachal Pradesh who belong to the Ahom, Khampti, Taiphake, or Phakial, Nara, Aitonia, Turung and Khamjodia tribes. (Gogoi, 1960 :120).

II. 1. 4. Muga Fabric as a Carrier :

Manuscripts and scrolls on Muga and other silk were also common in Assam. Sometimes, folios made from Muga cloth and stitched along the top to form a pad. These were also finely illustrated. The Purani Samaguri Satra of Sibasagar district has the important *Padaputhi* manuscript done on Muga silk cloth.

II. 1. 6. Technique of Lacquering :

Lamination of paintings and folios were done with the help of lac. A piece of finished painting was selected for lacquering. A quantity of good shellac is boiled in water to make it soft and clean. Blobs of the clean red shellac are then dropped on several places of the surface and allowed to cool down. Then a piece of red hot iron is held above each blob of shellac. This melts the blob and makes it sticky. Next, with a blade of *keteki* leaf, the sticky blob is spread on the surface as extensively as possible, so that the resulting film become thin to allow the painting to be visible under it. Then a second blob is tried until the whole surface is coated with a transparent golden yellow film of shellac of uniform thickness. All excess shellac is scrapped off the surface (Neog, 1965: 303).

II. 2. Preparation of Ink :

The process of preparation of ink in Assam were varied and interesting. The most common ink was the black ink, though ink of various colour, golden

ink or '*sonar-pani*', white ink and invisible ink etc. were also used. White ink had been used to write on green folios of *tulapat*. The ink that was used in old Assamese manuscripts was made of peculiar ingredients, the formula for which was commonly known to the painters and writers. It can be noted that, the preparation of ink with the traditional method was a practice among the students of Assam, even till the middle part of 20th century, particularly in the villages. The chief characteristic of Assamese ink is its tenacity of adherence to glossy and slippery surfaces. Its durability has been proved by the old manuscripts, of whose, folios have crumbled away through the destructive influence of insects and the wholedestructive agency of mildew and dump, but the ink has endured .

The main ingredient of ink is *xilikha* fruit (*Terminalia chebula*). A few fruits of this variety are kept steeped in water in an earthen basin for a few days. The basin is then exposed to dew for few nights. The water which turns black by this time percolates through the first bowl and drops into the non-porous basin as very fine and deep black ink. Some add iron and iron sulphate and others add to it, the blood of a particular variety of fish known as *kuchia (Amphipnous kuchia*). Cows' urine was also added to the *xilikha* extract. This process of manufacturing of this ink is indigenous to Assam.(Choudhury,1959:505).

Different inks used in early Assam were : 1. *Kajal mahi* (lamp black), 2. *Narikal mahi* : *Narikal mahi* was made from soot collected on the inner side of a coconut shell by placing it above the flame of an oil lamp. This system is similar to the process of preparing ink by the Shans, though the Shans used an earthen vessel instead of a coconut shell for collecting soot. 3. *Tel mahi* :This kind of ink was probably prepared with oil instead of water. This was not a common variety of ink, though Assamese manuscript writers used this ink. The

detailed process of preparation of *tel mahi* is not available. 4. *Kare mahi* (The *Kare mahi* was made from rice roasted black. The rice is roasted to black, powdered finely and mixed with water. It is then filtered and used as ink. 5. *Sanchi mahi* : This was another type of ink used by the ancient Assamese manuscript writers. The details of the method of preparation of this ink is not known. However, it may be prepared with black or extract of *sanchi* wood, as its name indicates . 6. Other Inks :

The Buddhists of Lakhimpur and Sibsagar used a kind of ink made from gold dust. Valuable manuscripts in Tai scripts were written with this ink. The *Asom Buranji* states that *alta* or the *ranga-la* or red lac were also used as ink.

II. 2. 1. Colours and Paints :

The *Katha Guru Charıta*, the biography of Sri Sankardeva, has description of use of colours. The *hengul* and *haital* was used as colour in paintings and writings. Sankardeva used these colours for painting of the scenes of *Cihna Yatra* and manuscript cases. He was also supplied with lime and twelve varieties of colours in powdered state, for priming the *pirali* (plinth) of *Chandan Chora* by king Naranarayana. The following colours were commonly used in Assamese miniatures : Indigo for blue colour (*Nila*), Yellow arsenic for yellow colour (*.Haital*), Vermillion (*Hengu l*), Lamp-black or black (*Kajal mahi*).

Gold paint was put to use on rare occasions. Usually, gold paint was used for painting and writing important manuscripts and royal letter papers. The Buddhists of Assam used gold paint to illustrate the *Therabada* manuscripts, the oldest specimen of which, *Phung chin* is dated 1473 A.D. To the Buddhists who are mainly of Tai origin, extraction of gold as well as gold paint is known as *Kham*, while the Assamese called the art of gold painting or gilding as '*Sonar-pani-chorowa*'. The gold in dust form facilitated and quickened the process of preparing the *kham*. A piece of paper was smeared with *yang* or the

vegetable gum obtained from *yang pow* or *bhotera* plant. On it was placed, a quantity of gold dust in an even and smooth layer. As a result, the dust clung to the paper. Then it was left to dry and cut into convenient sizes. The reverse process was followed to apply *kham* to a selected surface. The surface was smeared with right quantity of glue made from buffalo hide and the gold leaf was applied to it. The gold, now stuck to the gummed surface and the paper was left blank.

The palette of Tai artists was limited to blue, red, black and gold only. They used a thick layering for their colours, which gave their manuscript a lacquered look, the *Suktanta Keympong* manuscript, contemporary of *Phung Chin* manuscript is a good example of use of thick layers. It was made from buffalo hide and in this way is related to the *vajralepa* mentioned in *Vishnuddharmottaram*. A quantity of the hide was burnt and the ash reduced to fine powder. To this, necessary blue or red colours, extracted from different kinds of berries, are included. Sometimes this thick layering style, was also used to apply *kham* instead of using the *yang* gum. The hide paste when further diluted, served as ink. Sometimes fish bile is also added to it to make it flawless (Neog, 1965: 303).

II. 2. 2. Brushes, Pencils and Styles:

The earliest reference to brushes and gourds for keeping paints are found in *Harshacharita*. The pen used was a goose quill or reed. Pens were also made of bamboo shoots and known as *jeng*. The native Assamese name for a pen *kap* was possibly derived from the fern known as *kap-dhekia*, which also served as a pen.

Pencils were also in use in ancient Assam. Pencils were made from a kind of earth known as *hemsila*. The *hemsila* was probably imported from Bhutan.

As its name implies it might have had a golden or yellow colour. Terra-cotta pencils were also made for writing as well as for initial sketching of the outlines of paintings. Thin bamboo tubes were filled with finely kneaded earth. This is then baked till the earth hardened and was thoroughly burnt. The tubes were then split open and the pencils were ready for use. (Handique, 1959:37).

III. SALT MAKING :

An age old traditional technology of salt manufacturing was prevalent in early Assam, with salt being one of the most precious commodities in this part of India. In ancient days there was no supply of salt to the North Eastern part of India from the coastal regions due to lack of communication and inaccessibility owing to dense forest, hill ranges and rivers. The natives of this region produced this essential commodity with great difficulty. They discovered brine springs in the hills and also the process of manufacturing salt from this brine. There were numerous brine springs in the hills of North- Eastern region. Some of these brine springs are still flowing, from where the natives are producing salt till today. The different tribes of this hilly region have their own indigenous practices of salt manufacturing .

The Nagas possessed know-how of this traditional practice of salt manufacturing from brine springs. There were large number of brine springs in different parts of Naga hills. From these brine springs the Nagas prepared salt and continue to do so even today. This kind of salt is said to be pure and possess medicinal values. Today the price of one kg of this salt is Rs. 150. Though the present day price of common salt is around 5 or 6 rupees, many people of Nagaland still consume this precious salt, considering its medicinal values. While consuming their traditional alcoholic drinks, they lick this salt frequently.

Apart from the Nagas, some other ethnic groups of the North Eastern region of India traditionally manufactured salt from brine springs. The Jayantias

from Jayantia hills, the Garos from Garo hills (Meghalaya), the Karbis from Karbi hills of Assam, Khamtis, Abors, Daflas and Mishimis from the Eastern hills (Arunachal Pradesh), Kacharis and Koches from Assam and Bhutiyas from Bhutan also traditionally manufactured salt and sold them to their neighbours through the barter system (Choudhury,1959:341).

There were about 20 wells of brine in the localities of Barhat, Nagahat and Joypur in the Nagaland -Assam boarder area. These wells were alternately used by the Nagas and the Assamese and the produce was equally shared between them. Of all the brine springs, those of Borhat and Sadiya were the most famous . In order to gain access to the brine wells in the Naga hills, one had to cross twenty four hills from Barhat. In these hills there were more than twenty two brine wells. The biggest brine spring in this region was the Taring-Jan spring near Namchang. The brine of 'Taring Jan' was greatly concentrated. It has been stated that half *powa* (almost 125 grams) salt was produced after evaporating one *seer* (almost one liter) of brine. This was the highest concentration of brine in whole of the North-Eastern region. Another famous area where salt was manufactured was Mahanghat near Sadiya. There was a very large brine well, which was famous as Mahang brine well. Huge amount of salt was produced from this brine well. There was a very large salt market near the well which was famous as Mahanghat (Hunter,1879:39).

The brine wells of Mahang were a part of the Naga kingdom. But in 1536 AD, The Ahom king Chuhung Mung defeated the Nagas and occupied this brine well. Subsequently, Ahom kings harvested these wells and produced huge amounts of salt , which were exported to different places. Ahom kings appointed a superintending officer to look after the salt manufacturing business at Mahanghat and he was designated as '*Mahanghat Barua*'. It has been reported that in the year 1809, the brine wells of Mahanghat produced salt worth Rs.40,000 (Hamilton,1940:48).

III. 1. The Process of Salt Making :

The process of salt manufacturing is very simple. The brine is evaporated till the crystallization of salt. The process starts only in the winter season and in dry days. Ahom kings appointed a definite set of workers designated as '*lonpuria paik*'. They constructed temporary sheds near the brine wells and collected huge amount of fuel, wood and bamboo stem containers before they started the evaporation of brine. The process commences in November and continue till the month of March and April. Due to its location in a valley the wells are subjected to inundation during the rains .

The process of manufacture is carried out by filling the bamboo stem containers with the well water and then placed over a flue to which a fire is lighted. The brine in the bamboo is thus evaporated and the dry salt remains behind. The bamboo stalks are stripped off their outer covering and only a thin scale of inner wood is retained, which is kept damp by the percolation of the brine, which is not affected by heat until the salt is nearly dry. Once dried, it is removed. One joint can be used over the fire three or four times. Half *ser* to three-fourth *ser* of salt can be procured from 100 to 350 bamboo joints of brine (Handique, 1959:28).

Regarding manufacturing of salts by the Nagas, particularly by the Angami Nagas, J.H.Hutton described : " Salt though now a days very seldom, if ever made in Angami villages deserves mention in a list of manufacturers, as it must have been 'Viswema' and other villages possessing brine wells before the pacification of Angami hills, and still form an important commodity of commerce. Naga salt, as opposed to salt bought in Kohima bazaar, is now a days purchased from the Kacha Naga, Sangtam or Tangkhul country. It is said to possess medicinal

properties unlike ordinary salt and is used as a thirst raiser, a cake being nibbled at intervals of draughts of rice beer. The method employed in preparing it by Kacha Nagas, Tangkhuls, Sangtams and others probably differs little from that formerly employed by the Angamis. Where there is no natural well, a hole is dug and a hollowed tree trunk is sunk into it, near the salt spring, in such a manner that the end of the trunk projects. A receptacle in a string is let down to haul up the brine. This receptacle is emptied into other vessels for evaporation. In some cases, the latter is flat earthen or iron dish lined with a leaf which adheres to the block when the moisture has been evaporated . The block with the leaf adhering is taken from the dish, and the edge bound with another leaf tied on by bamboo thongs, then the whole is ready for trade. In other cases, the brine is poured straight into a small round earthen ware pot in which it hardens, then the whole pot with its contents are sold. Evaporation takes place either over an ordinary fire, the pot being placed on the three hearth stones, or over a regular oven which has holes in the top to receive the evaporation dishes. Ovens of this sort are built on clay and sticks. Wood ashes from the fire are sometimes sprinkled into the boiling brine, apparently to prevent over boiling during evaporation and to increase the bulk of the salt product. These ashes of course, become a part of the final salt block. Though expensive it is generally preferred by Angamis to purified salt for every purpose. Tangkhul Nagas about to make salt must remain chaste on the preceding night and refrain from speaking to anyone the next morning until the salt wells are reached and fires for evaporation" (Hutton, 1968: 71)

Note : Till date, the Naga people are engaged in manufacturing salt from the brine springs. I had visited the Peletkai village of the Paren subdivison of Kohima district in the month of April 1998. The denizens of Peletkai collect brine from the springs and evaporate it in the traditional way in order to make

salt. Now a days, instead of bamboo stalks, they use very large sized iron pans for evaporation. The ready salt is then packed in leaves or in bottles to be sold in the market. Nagas consider this salt to posses medicinal values and buy it inspite of its very high cost of Rs. 150.00 per Kg. I myself, have witnessed people buying this salt from the salt manufacturers at such a high price. I have even tasted this salt which has a pungent, bitter taste. I think it is an alkaline salt.

IV. PRODUCTION OF LIME :

Natives of Assam have an age old tradition of using lime for various purposes. Inhabitants of this region have a very old habit of chewing betel-nut and betel leaf with lime.

Lime was also used to make cement for building construction in the days of Ahom. It is believed by the people of this region that the chewing of lime with betel-nut is good for health, as it possesses medicinal values.

The people of Assam collected lime from the lime mines, found in the hills of this region. Certain section of the people also prepared a special kind of lime from the shells of some molluscs, particularly the river mussels(*chun xamuk*). Lime was abundantly found in the hills of Assam, particularly in the Khasi, Jayantia, Garo, Naga and other hills.

The onset of autumn and winter leads the manufacturers to the hills in search of lime-stone. They construct temporary houses near the source of lime. The place where lime is manufactured is known as *Chun-sali* or lime shed. The professional manufacturers of lime stay engaged with this business for months together. Instances of *Chun-salis* are still present in various parts of Assam today. There is one Chun-sali village near the Guwahati city, and one Chunpora village near Sibsagar town. The presence of Chun-sali near Guwahati at the

bank of river Brahmaputra and a Chunpora near Sibasagar at the bank of river Dikhou, indicates that these places were famous for manufacturing of river mussels' shell lime.

Lime was an essential material for the preparation of cement. Manufacturing of lime was considered as an essential and important service in the days of Ahoms. An officer was appointed to look after the manufacturing of lime.

The History of *Chang-Rung Phukan* reveals that a huge amount of lime was used in the construction of the king Siva Singha's *maidam* (burial structure). A total of 8040 of shell lime, 15340 *dhols* of stone lime and 100 *kalahas* (pitcher pot) liquid lime (*chaka chun*) was used in the construction of the *maidam* of king Siva Singha. In the construction of the *maidam* of king Gadadhar Singha 2600 *dhols* of lime stone, 156220 *dhols* of shell lime and 7137 pots of liquid lime was used.

IV. 1. Production of Lime in Khasi and Jayantia Hills :

Khasis and Jyantias of early Assam (present Meghalaya) were experts in producing lime from limestone deposits in the hills. Large deposits of lime-stone exists towards the southern slopes of the hill stretching from Lakadong to Nongstoin, as well as towards the Tuber and Sumer areas in the central Jayantia uplands. Working in limestone has had a long standing, being corroborated by the fact that areca nuts and betel vines are taken together with lime , and the legend of the dragon's death, whose remains were changed to lime deposits in the country (Bareh, 1986 : 461).

As early as 1774, Lindsay had stated that lime obtained from Khasi hills was the best in the market and were demanded even in Calcutta since the previous period. Lindsay also took a lease of the limestone quarries from Khasi Syiem. In 1818, limestone quarries at Laur were leased to Mr. R .English Co. by U.

Lar, Rajah of Langrin. By the close of the close of the last century, about 35 limestone quarries existed, the most important being those worked at Cherra, Langrin, Nongstoin, and Mawlong. A cement factory was established at Chatak (presently in Bangladesh) with the lime procured from Khasi Hills (Bareh, 1986 : 463).

At present, in the modern Meghalaya a very big cement industry has been established with the lime procured from Meghalaya itself, which is popularly known as 'Cherra Cement'.

IV. 2. Production of Lime in Garo Hills:

Limestones of good quality has been discovered in great abundance in the valleys of Someshwari and Bhogai rivers of Garo Hills. A good quantity of lime is also found in the Tura and Damalgiri region. Limestone found in Tura and Damalgiri is of inferior quality to that of Someshwari and Bhogai valley. Limestone of Tura and Damalgiri contains 79% lime and the rest is clay. In comparison, limestone of the lime quarries of Someshwari and Bhogai are of a very high quality.

Since ancient times, Garos collected lime from these quarries and sold it to the people of other parts of Assam. Garos do not use lime prepared from molluscan shell (Hunter, 1889 : 236).

V. TRADITIONAL DYES AND PIGMENTS :

In India, the use of natural dyes for dyeing, painting and printing goes back into the prehistoric periods . The excavation of Harappan culture at Mahenjodaro revealed a cloth which carries evidence of red dye. The excavated potteries of Harappan culture also reveals the use of dyes . The decorations of the palaces and temples of medieval India, loudly testify to the mastery of the Indian craftsman in the use of natural dyes. The exquisitely

coloured silk and muslin fabrics of India had acquired fame throughout the world during the sixteenth and seventeenth centuries.

Just how important were the natural dyes in the economic and cultural life of Indian people during the 17th to 19th century is illustrated by the uprising of Indigo planters of Champaran in Bihar. This rebellion also represents a water-shed in the history of natural dyes in India.

The survey of the available literature revealed that there were as many as 500 plant species which have been identified as useful sources of dyes. Unfortunately, most available publications refer to less than 200 species only. Being a tropical country, India is rich in equatorial and temperate flora . There are large number of fruit and crop plants which are used as dyes . Some of the important fruit and crop plants used as dyes are pomegranate, mango, onion, safflower etc. The use of secretions of three insects namely Cochi. neal, Kermes and Lacca (Lac) as dyes, are commonly referred to in this context

V. 1. Traditional Dyes in North Eastern India :

The people of North-Eastern region of India are experts in dyeing silk and cotton fibres. Even presently, in the days of influx of synthetic dyes ,most of the tribes of the North East India are continuing the use of traditional natural dyes from plants for dyeing of both silk and cotton fibres and cloth . They use leaves, fruits, barks or whole of the plant for producing dyes.

V. 1. 1. Traditional Dyeing Technology in Assam :

From time immemorial, Assam has witnessed the manufacture of silk and cotton clothes. These clothes are dyed, and intricate designs with coloured threads are embroidered on them. Kautilya's *Arthrasastra* mentions this kind of colourful embroidery prevalent in ancient Kamrupa. Adequate knowledge

about the dyeing methods of ancient Kamrup were lacking. It was only after the advent of Ahoms, that the written records of this method were to be found. The local tribal have been using natural dyes to colour their fabrics. Till date, the Bodos, Karbis, Tiwas, Mishings and other native tribes of Assam are using traditional dyes for dyeing clothes and threads (Barua,1957: 134).

It has been mentioned in *Satsari Asom Buranji* that when the Morans and Barahis of upper Assam came to pay taxes to Swargadeu Sukapha, they were elaborately attired in colourfully dyed clothes. The Ahom royalty and the officials used brightly coloured turbans. The dye was made out of a of bright yellow coloured flower known as *kuhum* (safflower). Therefore, the turban was known as '*kuhum buliya pag*'. This age- old practice was prevalent till the early parts of 20th century in Assam. In the days of the Ahom rule, a class of people cultivated this type of flower for its valuable use as a dye (Choudhury, 1959:368).

The dyers comprised a different class altogether in early Assam, known as '*rangali-dhoba*'. In early Assam, the dyed threads were known as *anchu suta*. The name *anchu* is derived from a type of tree which was originally extensively used as a source of dye .

Srimanta Sankar Deva, while in Barpeta, had employed its local weavers to weave a piece of cloth which was of a mammoth length. Colourful illustrations of the life of Sri Krishna was embroidered on it and this piece of cloth was known as '*Brindavani vastra*' . This has been preserved in the Royal British Museum in London. The threads used on it were variously coloured and dyed by the local weavers, using traditional means (Rajguru, 1988: 307).

The most popular colours used in Assam were red, light red ,brick red, earthen red, blue , green , yellow, golden and bright yellow. Most of the tribal dyers of North Eastern India usually added country-made alcohol on the dyes

as a medium. But non tribal dyers of Brahamaputra valley did not follow this practice of adding alcohol. They use alkaline , acidic , and alcoholic dye.

Alkaline dye was usually used on cotton clothes. Mulberry silk (*pat*) and *Muga*, were dyed with acidic dyes. Bird's feathers and fur of various animals, bamboo and cane made materials were dyed with alcoholic dyes. Lime was also used as an ingredient in the dyeing process. Certain chemicals and minerals were also traditionally used in the dyeing process by the people of Assam . *tutia* (copper sulphate), *hirakhush* (ferrous sulphate), and *fitkiri* (alum) were some of the very important chemicals and minerals traditionally used in dyeing.

In order to create fast dyes certain mordants were used. Some of the commonly used mordants are *Bhomrati* plants, the leaves of *Barun* tree and the shell of *Bel* fruit (Chaliha, 1998: 67) .

V. 3. 2. Plants Used as Sources of Dyes in Assam:

1. *Majathi* (*Rubia cordifolia*), 2. *Kusum* flower (*Carthemus tinctorius*), 3. *Achu* wood (*Morinda ngustifolia*), 4. Seeds of *jarath* tree (*Bixa orellina*), 5. Barks of *letuku* tree (*Bucauria sapida*), 6. Turmeric (*Curcuma longa*) , 7. *Ranch* leaf , 8. *Madar* (*Erethrina indica*), 9. *Lochan* seed or *gangai* (*Molatus philipiniensis*), 10. *Sewali* flower (*Nycanthes arborirstis*).

V. 3. 2. 1. Plants Used as Mordant in Red Dye:

1. *Bhomrati* (*Symplocos spicata*), 2. Bark of *khaira* tree (*Acacia catechu*), 3. Flower of white *pama* tree (*Chuprasia tabularis*), 4. Flower of *nahar* tree (*Musea ferrea*), 5. Leaves of *bharali* tree, 6. *Bor thekera* (*Garcinia pedenculata*)

V. 3. 2. 2. Plants Used for Yellow Dye:

1.Turmeric (*Curcuma longa*), 2. Bark of *kardai* tree(*Avarhoa carambola*), 3. *Kusum* flower (*Carthamus tinctorius*), 4. Roots of *puli-kait,* 5. Bark of *tapor* tree (*Garcinia xanthochymus*), 6. *Kathal* wood (*Atrocarpus intigrifolia*),

7. Flower of *palas* tree or flame of the forest (*Butea frondosa*)

V. 3. 2. 3. Plants Used as Mordant in Yellow Dye:

1. Leaves of *bhomrati* tree (*Sympolocus spicata*), 2. Tamarind (*Temarindus indica*) 3. Peel of the seed of *barun* tree (*Crateva religiosa*), 4. Flower of *tita-champa* (*Michelia champaka*) 5. Flower of *bogi-pama* tree (*Churprasia tabularis*), 6. Shell of *bel* fruit (*Aegel marmelos*)

V. 3. 2. 4. Plants Used for Orange or Brick Red Dye:

1. Bark of *tapor* tree (*Garcinia xanthochymus*) , 2. Wood of *achu* tree (*Morinda angustifolia*) 3. Seeds of *jarath* tree (*Bixa orellana*), 4. Shells of *barun* seeds (*Crateva religiosa*) 5. Flower of *nahar* tree (*Musea ferra*), 6. *Majathi* tree (*Rubia cordifolia*) 7. *Sewali* flower (*Nycanthes arbortristis*).

V. 3. 2. 5. Plants Used for Green Dye :

1. Leaf of *rom* tree (*Strobilanthes flacidifoliys*), 2. Bark of *leteku* tree *(Buccaurea sapida*), 3. Turmeric, 5. Leaves of *urahi-mah* (*Phoseolus lunatus*), 6. Shell of *barun* seeds (*Crateva religiosa*)

V. 3. 2. 6. Plants Used as Mordant of Green Dye :

1. Bark of *kordoi* tree (*Averhoa carambola*), 2. Fruits of *bor-thekera*(*Garcinia Pentaculata*), 3. Leaf of *bhomrati* tree (*Sympolocus spicata*) .

V. 3. 2. 7. Plants Used in Blue Dye :

1. Leaf of *rom* tree (*Strobilanthes flacidifoliys*), 2. Fruit of *kordoi* (*Averhoa carambola*), 3. Shell of *barun* seeds (*Crateva religiosa*)

IV. 3. 2. 7. Plants Used in Black Dye:

1. Leaf of *rom* tree (*Strobilanthes flacidifoliys*), 2. *Silikha* fruit (*Terminalia chubela*), 3. Bark of *jamu* tree (*Eugenia jambulena*), 4. Bark of *madhuriam* (*Psidium guajava*), 5. Rind of Lemon fruit, 6. Seeds of *bhola* tree, 7.Tender

leaves and bark of *dalim* (*Pomegranate*) fruit.

V. 3. 2. 8. Plants Used as Mordant of Black Dye:

1. Burnt ashes of banana tree, 2. Leaf of *bhomrati* plant, 3. *Raghumala* (*Pothos scandens*)

V. 3. 2. 9. Plants Used in Brown Dye :

1.Bark of *amara* tree (*Amara rohituka*), 2. Seeds of *bhomora* tree (*Terminelia belerica*) 3. *Kendu* fruits (*Dryospiros embryopterus*), 4. Bark of *khaira* tree (*Acacia catechu*), 5. Leaf of *dagal* tree., 6. Bark of Rain tree (*Albezzia lebeck*), 7. Bark of *jamu* tree (*Eugenia jambolan*)

V. 3. 2. 10. Plants Used as Mordant of Brown Dye:

1. Leaf of *bhomrati*., 2. Seeds of *barun*

V. 4. Dyeing Process :

There are different methods for dyeing of different colours prevalent in Assam. These are as follows:

V. 4. 1. Red Colour:

Jarath (*Bixa orellena*) plant is mainly used for red dye in Assam. Weavers or dyers collect seeds of *jarath* and preserve it for future use. The seeds of *jarath* usually get matured in the month of *Chaitra*. At the time of dyeing, the shells of the seeds are boiled to get a coloured decoction. The thread or fabric is then put in the coloured decoction for a long time. After the thread or the fabric is fully coloured, it is again soaked or boiled for fastness of the colour in a mordant. *Thekera* (*Garcinia pedanculata*) is used as mordant for silk threads and cloths, while *bhomrati* and banana ash is used for cotton clothes.

V. 4. 2. Yellow Colour :

1. Roots of *pulikait* crushed and boiled with leaves of *bhomrati* and cow's urine gives yellow dye. 2. Decoction of *tapor* (*Garcinia Xanthochymus*) boiled with leaves of *bhomrati*, mustard oil and bark of *leteku (Buccaurea sapida*) is boiled together with threads or clothes for a long time to get a fast yellow dye.

V. 4. 3. Blue Colour :

Tender branches and leaves of *rom* tree (*Strobillanthes flaccidifolius*) were allowed to ferment in an earthen pot for a few days. This liquid is filtered and boiled with leaves of *bhomrati* to get a fast blue dye.

V. 4. 4. Black Colour :

Blue dye obtained from *rom* tree is boiled with banana ash to get a fast black dye.

V. 5. Traditional Dyes Used by Tribes of North East India :

Most of the tribes of North Eastern India dye clothes using traditional means till date. The Khasis, Garos, Karbis and many other tribes of Assam and Meghalaya are still using traditional dyes to colour their clothes. They use different types of dyes for dying of both silk and cotton fabrics. Traditionally dyed coloured clothes of these tribes are spectacularly brilliant and fast. Some of the sources of common traditional dyes and dying methods of some of the tribals of Assam and Meghalaya are as follows:

V. 5.1. Dyes of Eri Silk :

V. 5. 1. 1. Red colour on Eri silk :

Eri silk is obtained from a kind of silk worm known as Eri silk worm (*Philosomia riccini*). The silk is secreted by the worm from its silk gland. The silk contains a kind of gum known as sericin, which causes difficulty during

dying. Therefore, traditional dyers processed the silk to remove this material. The silk is boiled with traditional soap or soda to remove this gum material. The boiling treatment is continued for 30 minutes. It is then squeezed and washed thoroughly with cold water and finally dried . Only after completion of this process, the Eri silk is ready for dying.

To get a red colour, the Eri silk is dyed with the extract of lac and leaves of a tree, which is locally known as *lynki* .The lac is crushed to powder with the help of a wooden mortar and an iron pestle. When it is completely crushed, some boiling water is poured over the mortar and the material is mixed properly. Then, the mother liquor is taken and poured into an earthen pot through a bamboo basket, which act as a traditional filter. This is done because the solution should not contain any grains of lac. After this, the leaves of the *lynki* tree are cut into pieces. The yarn to be dyed is folded in layers and the small pieces of leaves are placed in between the layers and boiled in an earthen pot with the lac solution . While boiling, care should be taken, that the yarns are not in the dye bath till all the water is evaporated. Some times, dying is repeated for two or three times to get a desired shade. The dying time ranges from 3 to 4 hours at a boiling temperature. After the yarn is properly dyed, it is removed from the earthen pot and dried in shade.

V. 5. 1. 2. Yellow Colour in Eri Silk :

To obtain an yellow colour, the Eri silk is dyed with the tuber of turmeric and the bark of a plant ,which is locally known as *dieng rnong* . Before putting the yarn in the dying bath, the bark of the *dieng-rnong* tree and the tuber of turmeric are crushed separately with the help of a mortar. A little amount of water is added to it and the material is filtered through a bamboo basket. A required amount of this solution is taken in the earthen pot. The traditional

dyers know the amount required for a proper colour. The yarn is then put in the solution and boiled . The dyers also know the requisite time for boiling. Usually the boiling duration is three or four hours, till the solution is almost exhausted.

V. 5. 2. Dyeing of Cotton Yarn :

V. 5. 2. 1. Dying of Cotton Yarn With Red Colour :

Cotton yarns are vegetable fibres. Cotton yarns also contain many impurities like pectins, nitrogen containing compounds, fats, waxes, inorganic matters etc. It also contain acquired impurities like dust, dirt, oil-stains, iron-stains etc. To remove all these impurities, cotton yarns are washed with hot water and soap or washing soda. After a proper wash and drying the cotton yarns are ready for dying. Dyeing process of cotton yarn for obtaining red colour is similar to the Eri silk. The raw materials are also the same, i.e. the lac and the *lynki* leaves .

V. 5. 2. Plants Used as Dye by Khasis :

1. *Dieng rnong* (*Albizzia procerae*) : This is a tall handsome sub-deciduous tree attaining over 80 ft in height. The colour of the bark is brown. The skin of the roots are yellow in colour. The root is specially used for dyeing red colour on cotton yarns.

2. *Slapyng dong* (*Nelumbium speciogum*) :This is a large aquatic plant with milky opaque creeping leaves. It grows wild in Khasi hills. The leaves provide blue colour on cotton yarns.

3. *Soh latarngei - nahar* in Assamese - (*Mesua ferra*) : It is a very big and popularly known tree of both Assam and Meghalaya. It grows up to 200 ft in height. The Khasis use the roots and seeds of this plant as dye. It gives red colour on cotton yarns.

4. *Musti* : It is a perennial shrub. It is about one foot tall. It is a wild shrub and bears small beautiful flowers. Some professional dyers cultivate this plant for dye. The leaves of this plant yield blue colour on Eri silk.

5. *Sohkhu* (*Acacia concina*) : This is a common perennial wild tree. It grows widely in the forest of Meghalaya, Assam., Nagaland and Arunachal Pradesh. The leaves and bark of this plant is used to dye yellow colour on silk.

V. 5. 4. Dyes used by the Apatanis, Nishings and the Adis of Arunachal Pradesh :

The art of spinning, weaving and dyeing is an important part in the life of the tribals of Arunachal Pradesh. It is the monopoly of the women folk of the state. Every mother, through her cradle song, inspires her daughter to be an adept in this art. The colour, design and pattern of a home made garment signify the age old wisdom of a particular tribe. The tribal weavers are simultaneously good dyers also. The have identified different plants for dying of cotton and silk clothes or fibres in different colours. The following are some of the important natural dyes used by the Apatanis, Nishings and Adis of Arunachal Pradesh.

1. *Sankhii* in Apatani (*Symlocos paniculata*): Its leaves are boiled with the cotton yarn in water in an earthen pot imparting yellow colour.

2. *Taming* in Apatani , *Tamin* in Nishing and *Gallo* in Adi (*Rubia cardifolia*) : It is a creeper. Small pieces of its stems are boiled with the cotton yarn, in water in an earthen pot, to yield red colour. Leaf of another plant which is known as *bukhu* is added to the solution while boiling, and the colour becomes brilliant red.

3. *Mubu* (Apatani): It is a tree, whose crushed leaves are boiled with the cotton yarn, in water in an earthen pot, to get a black colour.

4. *Silop* (Adi) : The bark of this tree when boiled with cotton yarn gives chocolate colour.

5. *Sinking moling* (Adi): The roots and barks of this plant when boiled with cotton gives brilliant yellow colour.

6. *Engot* (Adi) : The leaves of this plant when boiled with cotton gives green colour.

7. *Nimar* (Adi) : The fruits of this tree when boiled with cotton gives green colour.

VI. WOOD WORKS :

Wood was the most popular medium for architectural constructions as well as for other creative endeavours in Assam. The easy availability of a variety of tropical and alpine varieties of timber from the sprawling forests in the plains and mountains of Assam, Nagaland and Arunachal was responsible for the wide use of wood. Being subjected to frequent earthquakes it was felt that building with wood was more safe in Assam than with vulnerable materials like masonry and stone. Yet, as in the previous epochs, so also in the Ahom period, ponderous temples and other examples of civil architecture were built in stone and bricks.. Wood were also used to fashion a variety of boats for civil, military and mercantile purposes. Modes of conveyances like carts, *dolas* or litters and sedan chairs of various grades and designs were also made with wood. Apart from the *Buranjis* of the period, Mughal and foreign chronicles also testify to the high standard reached by workers in wood in Assam.

VI. 1. Use of Wood for Making Boats :

In a riverine tract like Assam with the Brahmaputra flowing as the main artery of communication and joined by a network of tributaries in the plains, boats were the most common and quickest mode of conveyance. Boat building was both a royal as well as private enterprise. Places like Pandu, Guwahati,

Kaliabor, Biswanath, Dikhon-Mukh, Rangur, Garhgaon and Sadiya were centres of boat building, being established on the banks of important rivers like the Brahmaputra and the Dikhou. There were likewise some important river ports and harbours at Lata Sil in Gauhati, Sakbari in Rangpur, Garhgaon and others. These harbours of riverine navy were known as *Nao Sali*. These were always kept abundant with navy boats, ready for action. During Mir Jumla's invasion of Garhgaon, the Assamese burnt 12000 boats at *Barnaosali*, as a matter of scorched-earth policy against the Mughal army. Again in the 19th century, Capt. Wales on occupying Assam acquired 20,000 boats from the Ahoms (Handique,1959: 62).

The various boats had names and were meant for special purposes like cargo boats, pleasure boats, passenger boats, fishing boats, scout boats and navy boats. Gun-boats were generally known as '*Hiloi chara nao*'. Boats of the rich people and the ceremonial barges of the royalty and of the temples and Vaisnava Satras were beautifully painted and their prows were fashioned as '*Makaras*' and other mythical animals. Boats with animal headed prows were the '*Magarlaga nao*'. Such a boat is illustrated in the (1790 A.D.) *Sahapari Upakhyan* manuscript from Rangmahal in north Guwahati. The '*Mar-nao*' was an ingenious shape designed for maximum loading capacity. For this, two boats were joined lengthwise with a broad platform on them. These sometimes had a shed on the top for the passengers, while the rest of the platform was reserved for goods and animals. These were mainly piled between ferry points or *parghat*. The design of the *Mar-naos*, made them safe in addition to giving maximum utility. Other boats were '*Barnao*', '*Chara-nao*', '*Pansoi*', '*Kapikol*', '*Hayakali*', '*Sihu*', '*Jap-nao*' and '*Chilapati*'. Specially designed boats were used for the annual regattas or *Nao-khels* patronised by the court and by the Satras and temples (Handique,1959: 63).

VI. 1. 1. Technology of Boat Making in Assam :

The carpenters of Assam were employed to built boats. In ancient Assam boats were made in two distinct methods. In one method it was carved out of a single piece of log and the other was constructed by fixing planks of durable wood together. The boats made of a single piece of log were of various sizes and were known as *Bachari-nao*, *Gutiya-nao* and *Chellengi-nao*. The two ends of such boats were large enough to accommodate boatsmen on it. The boats were so constructed so that they were well-balanced on the waters. The planks used to make boats were well-chiselled and flat iron nails were struck on it. The gaps in between the planks were cemented with an adhesive made of resin, lac and bee-wax. The boat was then laid in the sun to dry. After being kept in the sun for a few days, it was examined if the holes enlarged in that process. After the boat dried up, a special type of adhesive known as Ahom *atha* was used to paint the whole boat. This particular adhesive was originally prepared by the hill tribes of Arunachal, specially, the Apatanis. After the adhesive dried up, an auspicious day was fixed to launch the boat in the river. This adhesive was expensive and so an alternative adhesive was used for covering the gaps. This was made of lime made from the shell of the snails and dried jaggery. These two ingredients were boiled together and the paste thus obtained was used as an adhesive. Finally, it is painted with a pint made of decoction of *kendu* fruit. This decoction is black in colour and water resistant.

Nowgong was a centre of boat building, for which *sonaru*, *ajhar*, *titasopa*, and *gondh xarai* wood were used. These boats were in the shape of dug-out canoes which were floated down the Kapili, the Jamuna and Barpani rivers to Chaparmukh. Merchants intending to buy boats thus flocked at Chaparmukh from Goalpara and Guwahati (Allen, 1906: 139).

VI. 1. 2. Various Types of Boats Used in Assam :

1. *Chara nao* : This boat is sufficiently spacious and made of timber planks. The two ends of this boat are high and large. These boats were mainly used for water sports and travelling (Barua, 1933 :52).

2 *Hiloi chara nao* (Gun carrying boat) : This boat was used in battles. The two ends of the boats were high and sufficiently large to accommodate guns and cannons. Gun carrying boat was invented by the Chutiyas. When the Ahoms defeated the Chutiyas they brought away the gun carrying boats along with guns and cannons.

3. *Mogor chara nao* : Swargadeo Rudrasingha converted gun carrying boats into this boat. This boat was used for boat-races. The ends of the boat were decorated with sculptures of crocodiles. Ahom kings mainly used this boat for recreational boating.

4. *Gach nao* : This was a very big sized boat, used in battles. It was very strong and it's movement was very slow. This type of boat was used by Mughals when fighting with Ahoms. They could not carry these type of boats when they fled after defeat, due to its slow movement.

5. *Aag lagi nao* : The ends of this boat were elevated and curved inside in style. This boat was used for carrying officials and respected people. It was often used for sports purpose.

6. *Bhari nao* : A very big sized spacious boat used in battles, Navy fighters used this boat.

7. *Mar Nao* : These were very big sized boat used for carrying goods. Sometimes two such boats were joined together, covered and used as a single boat.

8. *Bacharu nao* : These were medium sized boats used for both civil and military transportation.

9. *Kocha nao* : These were big sized boat, made of timber planks, which were moveable in shallow water also.

10. *Gerap nao* : These comprised of very big sized military boats, and were used in battles.

11. *Domali nao* : This boat is carved from a single log, used by fisherman for fishing purpose.

12. *Gota nao* : This was a small sized boat carved out from a single log, and could be used by a single boatman.

13. *Petala nao* : Very big sized spacious boats, they were used by merchants for carrying goods.

14. *Bajara nao* : Very big sized boat constructed with timber planks, this type of boats were covered with roofs. The boat looks like a house with decorative walls, doors and windows. This boat was nicely painted, decorated and adorned with flags and tails of yak, which were imported from Bhutan for decoration. This type of boats was used by the *Barabhuyans, Goalpariya* Zaminders and the heads of the *Vaishnava Satras.*

15. *Chulup nao :* It was a boat used in battles, very fast in speed. This boat was originally designed by Mughals.

16. *Garami nao* : This was a huge boat used in battles.

17. *Bajra nao* : A huge boat made of planks, this contains a beautiful wood house and on its top is decorated by flags, plumes etc., and is beautifully coloured and designed. It was extensively used by *Barobhuyans,* chiefs of Satras, merchants etc.

18. *Mahagiri nao* : Specially designed small and a beautiful boat, it was used by aristocrats. It later came to be known as Molonggirit by people.

19. *Lapati nao* : This was a big boat used for trade and carrying battle articles.

20. *Holong nao* : This was a large trade boat made of planks.

21. *Sal nao :* It is a long and strong boat, carved out of large *sal* (*Shorea robusta*)trees.

22. *Selengi nao* : It was made from single tree having very little weight and high speed. It was used for fishing, riding, in household works.

23. *Gutiya nao* : It was a small boat used by a single person carved from a small log.

24. *Bor nao* : *Bor-nao* was a huge boat used by merchants for carrying different commodities.

25. *Panchai nao* : This was a luxurious house boat used for pleasant rides by the rich.

26. *Khel nao :* A kind of racing boat, long and serpent shaped, it had the capacity to carry large number of players. It is still used by the boat racers of Barpeta.

27. *Par nao* : A medium sized boat without cover, it was used to carry people from one bank to other.

28. *Dinga nao* : This was a large boat with covers, used by merchants to travel distant places.

29. *Bhaoliya* : Smaller than '*Bajra nao*' with wooden roof, it was spacious and comfortable. It was used by the then *Zaminders* (landlords) of Goalpara.

30. *Gayana nao* : A large passengers boat carrying man to distant places, it had roof on top and had sufficient place to sit and sleep. It was mostly used in Goalpara district.

31. *Mar nao* : Goods, livestock like buffaloes, cows etc. were transported by it to different places. Sometimes, two similar sized boats were tied.

VI. 2. Use of Wood for Making *Dolas* (Palanquins) :

Wood was used in early Assam for manufacturing of great variety of *dolas* (palanquins), specified for use by the aristocrats and bureaucrats of Assam. *There*

were various kinds planquins in use. These are ;*kekora dola, dhekarlaga dola, parhi dola, dhekar laga changi, carhi changi, khatola* etc. The *kekora dola* and *parhi dola* are almost similar in shape, with the only difference that the pole over the *kekora dola* is rounded. The hoods of these *dolas* have upturned ends and curved inwards. In the holes of the hood are inserted the pointed sticks on the pole. The hood is covered with red or white cloth, embroidered with gold thread. Little hangings shaped like banana-flowers (*kaldilia*) made from red, green and yellow threads were hung from the pole of the *dola*. A tassel made of 12 coloured silk threads was also attached for the passenger to hold on to. The seat is of cotton filled culshion spread with an embroidered '*talsa*'. The centre of the pole of a *kekora dola* is greatly curved while that of the *parhi dola* is slightly so. But that of the *charia* or *athubhanga dola* is completely straight. The *dolas* of the above two types are also fixed with a couple of mirrors .

VI. 3. Wooden Domsetic Furniture and Crafts:

Assam is famous for artistic wooden crafts. Beautiful wood carvings were done on various articles.Beautiful carvings had done on brackets (*chati*), poles and pillars, doors and windows and on the wooden portions of the *bat-chara* (gatehouse) or the gate of the important institutions. In the Assamese domestic architecture gate-houses were an important member of the entire house plan. The Kirtan-ghar of the Barpeta Satra has some of the finest wood carvings existing to this day.

In furniture making, the Assamese followed a unique technique. They carved out smaller pieces of furniture, chests, boxes, manuscripts boxes, lamp stands and similar other accessories of daily life , from blocks of wood. These too were brightly painted. Large variety of wooden furniture and articles are commonly used by the Assamese people. Some of these are as follow :

Bar pira (a flat wooden plank with little raised support), *Tamuli pira* (a variety of the above), *Dukharia pira* (a variety of the above), *Salpira* (a raised seat),. Boxes and chests:*Pera* (a chest), *Barpera* (large size chest), *Chorpera* (a variety of chest), *Batanipera* (small handy boxes) etc. S*imhasanas* or thrones made of wood were used by the kings. In the *Satras* also, *simhasanas* were kept to hold the *Bhagavata*-Book X used for veneration instead of an icon (Gogoi,1976: 89-91).

VII. IVORY WORKS :

The antiquity of the Assamese ivory industry can be accorded to the days of the Mahabharata. The *Harsacharita* of Banabhatta also records the splendid presents sent by Bhaskaravarman, the king of Assam to Harsa of Kanauj. The last item refers to round ear-rings made of the long tusks of elephants . During the long history of the Ahoms, ivory objects were exported from Assam and were also sent to neighbouring lands and presented to rulers by the Ahom monarchs. King Jayadhwaj Singha's (1954-63 A.D.) gifts to the Mughal Emperor included mats, combs and back-scratchers made of ivory. Kamaleswar Singha (1795-1811 A.D.) of the same dynasty also sent to the king of Bhutan, boxes, bed steads and other objects made of ivory . During the last phase of Ahom rule ivory objects worth Rs. 6500/-were annually exported from Assam at the check post of Hadira-chowki (Handique,1959: 59) .

Apart from hilts and handles of weapons and legs of furniture, ivory was used for making various kinds of boxes, containers, cylinders (*chunga*) for keeping letters and scrolls, back-scratchers, fans, combs and pins for the coiffure, shuttles and combs for the loom, pieces of ornaments, icons, dices and men for chess and other board-games. Small stools or *Piras*, *Sarais* or dish-on-stand, mats and even manuscript folios were made from ivory.

VII. 2. Technique of Treating Ivory :

Ivory tusks are straightened in the following manner. A thick coating of clay is applied to the tusks and then they are slowly heated. Thus they get soft and are pliable and hence are easily straightened. After that the tusks are left to cool and the clay coating removed. From these tusks, thin strips are extracted, for making ivory mats or *dharis*. These thin strips are similar to the cane strips with which normal mats are woven. The technique of weaving ivory mats is the same as that of cane mats (Handique,1959: 59). For making other objects, the tusks are cut into required shapes and sizes after being straightened in the above manner. During the Ahom rule, ivory carving was an important industry and was practised by a group of *khanikars*. Buffalo horn was also worked upon to produce combs, horns (*pepa*), hilts and handles for knives and toys and men for games. Workers in other forest product, like hides and skins, feathers and bones were also grouped under '*khels*' with their respective '*Baruas*'. Among these were the *Pakhi-maria-Barua* (Superintendent of feathers), *Hati-Barua* (Superintendent incharge of elephants) and *Nomalar-Barua* (Superintendent incharge of furs), (Handique,1959:61).

VIII. BAMBOO AND CANE WORKS :

Bamboo has a hundred and one requirements in the daily life of an Assamese villager. It provides material for building houses, fences, bridges and making baskets, traps for fishing and hunting. It also serves as containers and cooking utensils in addition to being a delicacy.

Bamboo abundantly grows in Assam, both cultivated and widely grown. It is the principal, and in most instances, the only material of which the houses are built. Furniture, implements of agriculture and in fact every article used by the

people in this region is entirely, or in part made from this valuable plant and not infrequently introduced as an article of food. In fact, the Assamese culture, in a sense, is a bamboo culture in which bamboo played a predominant part in almost all aspects of social and individual life.

VIII. 2. Some Common Variety of Bamboo In Assam :

1. *Jati* (*Bambusa tulda*): It is green in colour, thin but strong and consists of compact fibres. Internodes are 12 inches to 18 inches, with the circumference ranging from 6 inches to 8 inches, and a length of 30 feet to 40 feet. It has a serviceable length of 20 feet to 25 feet. Fibres are very tensile, fine and strong. It can be easily sliced out for making fine baskets. Compressive strength is fairly high, for which reasons it can resist vertical hammering for driving into earth etc. without much damage to fibres for all purpose including posts and palisades.

2. *Makal* (*Bambusa pallida*): It is a variety of *Jati*, with a slightly blackish colour, with longer internodes measuring 12 inches to 20 inches , generally very straight, fibres being hard, thick and compact but not very pliable. Compressive strength is also less. It is used for all purposes except for posts. Hammering for driving in, breaks up the fibres quickly.

3. *Kako* (*Dendra calamus hamiltonii*): It is same as *Makal* in appearance and other characteristics. However, internodes are 10 inches to 16 inches, with a circumference of 12 inches to 10 inches and serviceable length 30 feet to 40 feet . Fibres are loose and weak. A slight hammering on top to drive it vertically, smashes the fibres and splits the bamboo. It rots easily, prone to attack of insects, and is thus used only for general purpose of temporary nature.

4. *Bhaluka* (*Bambusa tulda*): A very sturdy and robust bamboo, it is thick and stiff, with short internodes, thick nodes , thick skin, and a narrow lumen. Its girth is 12 inches to 18 inches, and internodes 6 inches to 15 inches. Tensile strength is very great, and thus used mostly for building bridges and other works where strength is required.

5. *Muli* (*Melocana bambusosides*) : This type is very common in Southern part of Assam, with big girth and length. It has a thin skin. The fibres are thin but very strong and hard. It is suitable for making bamboo mats. The girth is 6 inches to 12 inches , interodes 12 inches to 24 inches and serviceable length is 16 inches to 20 inches.

6 . *Delu* **:** An evergreen shrubby bamboo, it grows in hills. It is actually a variety of *Muli*, but skin is thinner. Fibres are comparatively loose and weak. It is mainly used for mats and baskets. The whole bamboo , when dried is used for roof frames and other frames. Internodes are comparatively longer measuring about 1 ½ feet and girth about 1 inch to 4 ½ inches. The serviceable length is 20 to 30 ft.

7. *Bijuli* (*Bambusa tulda*): Thin, evergreen, and of short length, this shrubby bamboo, grains are very thick and occur in a very large cluster. Girth measures1 inch to 3 inches, and internodes 12 inches to 20 inches. Length varies from 16 feet to 24 feet. Fibres are fairly stiff and thick. It is usually used for making frames.

8. *Mirtinga* (*Bambusa tulda*): It is a variety of 'Bijuli' , grown mainly in Cachar. It is thick skinned with very little hollow inside. It is usually used for making sticks, angling rods, and umbrella handles.

9. *Kata* or *Kotowah* (*Bambusa arundinaceae*): It is a variety of thorny *Bholuka* that grows wild mostly in slopes or bottom of hills. Its girth is 1 ½ inch to 3 inches , internodes 9 inches to 18 inches, and length 12 to 15 ft. It is used for tent poles and posts.

VIII. 3. Various Uses of Bamboo :

Bamboo House : Bamboo is used as the primary material for construction of houses in rural areas both in hills and plains of Assam and its sister states in North-East India. In hill areas, the tribals construct houses where the bamboo posts are arranged on a square grid and strengthened, also by bamboo posts.

Roof frames are made of whole bamboo and walls, doors, windows, floor and ceilings are made of split bamboo and bamboo mats. Roofs are made with bamboo singles, bamboo leaves or other roofing materials. A large number of structure using bamboo material are built in the plains of Assam. These structures may be granaries, houses, shops, workshops, warehouses etc. These houses are light weight constructions, able to withstand severe earthquakes, and at the same time they are wind resistant.

Bamboo Fencing : Several types of fence constructions, using bamboo as a primary material are in evidence in North East India. These vary from region to region, reflecting local understanding of the material, the state of art in terms of technology available and techniques known and the economy of constructions. The functional requirements also determines the variation of constructions. Fences are used around the field or compound and may have open rigid structure of whole and split bamboo, their height and spacing being sufficient to prevent entry of animals. Fences around the house reflect the need for privacy, as these are generally of close weave and extend slightly above human heights to create the necessary visual barrier. Some of the fences exhibit an element of decoration.

A kind of thin evergreen, short length, shrubby bamboo, known as *Bijuli*, grows very thickly in large clusters and are used as hedges in a house compound. A rhizome wall on all sides can be developed by trimming. Width can be regulated, allowing the growth to advance only alonbg the length. This variety of bamboo grows very thickly and it is impenetrable by animals.

Bamboo Gates : Several types of decorative, simple sliding and hinged gates are seen all over Assam. Even the road check posts use whole bamboo as barriers.

Bamboo Bridges : Bamboo bridges are quite common in rural areas of Assam. These are constructed over shallow and stagnant or mild current channels. Such bridges are usually constructed for use over rivers in cold weather and hence called cold weather bridges. All bamboo structure bridges have posts of bamboo, cross beams, streets and fencing, floor of whole bamboo, cross *gurhs* of whole or half bamboo, two layers of even bamboo on floor, wheel guards of half bamboo and railings. Width of floor for such bridges are normally 12 ft. and 10. 6 inches clearance for traffic. The allowable load for these bridges is 5 M.T. In interior rural areas, single beam bamboo bridges are quite common. This has a single whole bamboo supported horizontally over a series of crossed braces sunk into the ground. One side of the crossed members extend above the walk rail to support a hand rail at about waist level. It is significant that only one hand rail is used because people crossing the bridge usually carry loads and need sufficient space, while one hand is free to grip the hand rail. Some of these single beam bridges are fairly long with two or more whole clumps over lapped and joined to span the ditch. Wider walk ways across the drain or ditch are used in front of houses in Assam.

Bullock Carts : Bullock carts made of bamboo are used in Assam. Bamboo is used in the bed, yoke. Yoke shaft and superstructure of the craft is made of bamboo, while the wheel and the axis blocks are made of wood. The main chassis is made either by bamboo or wood. These carts are seen in two variations, with or without a hood made of bamboo splits and mats.

Bamboo in Looms : The loin loom used in the North Eastern region is made almost entirely from bamboo. It consist of several whole bamboo elements both holding and separating the warp threads. Several types of shuttles are made

from bamboo. Country handlooms of Assam are mainly made with bamboo frames and parts. Other bamboo accessories used are hand winger and assortment of baskets for storing yarn etc.

Fishing Gadgets : Rural people of Assam use a variety of fish traps either in flowing water or stagnant pools. The form and structure of fishing traps differ from place to place, tribe to tribe, who use them and the purpose for which it is used. Apart from the traps, there are baskets to store their catch while fishing. Bamboo fishing rods are quite common. The fishing traps like *poloi* is now achieving popularity in interior decoration as lamp shades and other traps like *jhakoi*, conical fish traps, also bear the skill and innovative ideas of craftsmen.

Smoking pipes : Smoking pipes made from bamboo are used by several hill tribes of Assam. These pipes are normally made in two parts, the bowl in which tobacco is burnt and the stem attached to the bowl for drawing smoke.

Kitchen Equipments : Winnowing trays: Winnowing trays and fans are used to sift grain from chaff. The products found in North Eastern region have their own distinct characters and differ in size. They are made basically by woven bamboo strips in desired shapes and have a strengthened rim with thick bamboo strips. The commonly used are *dalas* and *kulas*.

Saloni: These are sieves used to dry out or wash vegetables. It is made of open weave bamboo strips with a bamboo rim.

Khorahi : This is a form of *saloni* which comprises a semi-spherical dome sieve, used for washing grains and vegetables.

Sekoni (Strainers) : Most rural people in Assam use bamboo strainers for washing and to strain tea or milk.

(*Don, Katha*)Measuring Basket : In rural areas bamboo baskets of different dimensions are made which is used to measure paddy, betelnut etc.

Bamboo Containers : Bamboo containers are made by cutting in between nodes in rural areas for storage of salt, spices etc. Bamboo containers are used for measuring and strain liquids like milk, curds etc. Bamboo containers are available in different shapes and sizes by using whole bamboo clumps or by flattening a bamboo clump into a sheet.

Bamboo Furniture : In rural areas, a household is furnished with various bamboo furniture, which include beds made of whole bamboo, whole flooring is done by split bamboo and finely woven bamboo mats, bamboo benches and divans, bamboo *dharis*, teapots and *murrahs*, bamboo shelves, rakes, baby cots, portable partitions, high stools which can be used as bar stool, table lamps, hand fans etc. In rural areas it is a common sight to see money saving containers made of whole bamboo, cut from node to node which also serve to enhance the saving habit in small children.

Bamboo Mats : In addition to flattened bamboo mats, a wide range of bamboo mats are made of bamboo splits. Several of these are used in house construction while others are used as floor mats and for sleeping or as surfaces for drying grains. These mats are also used for making large bins for storing grains. These mats are now-a-days made into bamboo boards of different thickness by using urea-formaldehyde hot presses. The bamboo boards can be used as partition, ceiling or any other substitute of plywood or hardboards. These bamboo boards can be shaped into moulded trays, baskets etc.

Bamboo Toys : Wheeled push along toy : A wheeled push - along toy is used by local rural boys for active play. Young children running down the lane push these

wheeled toys made from bamboo. The handle is a length of a small diameter of whole bamboo, split longitudinally at one end. The split ends is spread apart with the help of small pieces of bamboo. The wheel is shaped from a node of a large bamboo with a hole in the centre to permit free movement as wheel.

(a) Bamboo Pop Gun : A length of small diameter of bamboo is used as the barrel and a thick split is anchored at one end of this, while the other end is bent to rest in the slot in the middle of the tube. When the split is pulled back in the slot and released, it can propel a pellet inside the tube.

Bamboo Musical Instrument : Flute is a commonly used musical instrument made out of bamboo. Besides this, other musical instruments like bamboo beater, *do-tara* etc. are used in the Bihu festival of Assam. *Gogona* is another musical instrument shaped from a thick bamboo outer split so that one end forms the handle while the other end can be struck by fingers when the instrument is held against the mouth.

Bamboo Headgears : The North Eastern region has either heavy rainfall in monsoon or scorching heat in summer. The rural folks working in the field need protection and they have developed various types of headgears for their protection. Most of these are made by sandwiching a layer of dry leaves between two layers of bamboo net-like structures. These are usually made in an open hexagonal weave which creates a strong surface and the dried leaves provide the water-proofing.

Japi of Assam, is a rain hat which has a wide circular horizontal brim around a small cone. Generally, the cone has a base of 200 mm and height of 100 mm and the diameter of the shade is 525 mm. The edge of the shade is turned down to form a vertical rim 50 mm wide. This type is generally used for working in the fields. The decorated version of *Japi*, known as *phulam-japi*, is made on a larger scale as well as on a miniature scale. These are decorated with coloured

cloth, silver paper, coloured aluminium foils, shining glass beads and hung on walls or presented to welcome an honoured guest. In the district of Cachar, simple form of *japi* is known as *chetta*, and in tribal areas they use something shaped like a peak cap. It is formed in two layers, each made from strips of bamboo woven in open hexagonal weave.

IX. SALT-PETRE AND GUNPOWDER MANUFACTURING :

A book called '*Ancient Monuments of Kashmir*', by R.Kak refers to the introduction of fire-arms in Kashmir in1466. The same also mentions a Persian treatise on fire-works by a ruler of Kashmir, Zain-ul-Abidin(1421—1472) .In a publication on: '*The History of Fire-works in India*' (between 1400—1900), there is mention about the formulae for manufacture of specific fire-works from a Sanskrit work called the Kautukachintamani by Gajapati Prataparudradeva . He has noted down the following materials used in the manufacture of fire-works, as found in the Sanskrit verses - Sulphur(*gandhaka*), salt-petre (*yavakshara*), charcoal (*angara*), steel and iron-powder (*tikshna loha churna* and *loha churna*), copper-carbonate (*jangala*),yellow orpiment (*talakam* or *harital*), ochre (*gairika*), wood of *khadire* tree (*khadiram daru*), hollow bamboo piece(nalaka), wick(bartika), five-salts(pancha kshara), lodestone (*akhupashan*), pulp of castor seeds (*aranda majja*), mercury (*sutam*), rice-paste (*annapista*), tin or lead (*naga*), charcoal from the *arka* wood (*arkangara*), cow's urine (*goumutra*), cinnabar (vermillon).

It may be assumed as suggested by Gode that some of the recipes for fire-works in India might have been brought from China and then modified by the substitution of Indian ingredients for the Chinese materials. For, fire-works, fire-arms and military pyrotechniques were developed in China much earlier than in any other country. The Chinese had real fire-arms in the 13th century

A.D., and they achieved considerable skill in manufacturing fire-works. Preparation of explosive powder, containing sulphur, charcoal, salt-petre, paper, oil, etc., for military purpose, was known to them as early as 1000A.D. A description of fire-works and guns also occurs in another Sanskrit work, called *Akasabhairava Kalpa*, found in the form of a manuscript in the Tanjore Manuscript Library. This treatise, according to Gode, obviously belongs to a period later than 1400A.D.

From the description given of fire-works in India by Verthema and Barbosa in their *Travels* (1502—1518A.D.), he concludes that fire-works were manufactured in India on a large scale at a time near about 1500A.D. for use during marriage ceremonies and other festive occasions.

IX. 2. Salt-Petre :

Sauvarshala stands for saltpetre in *Rasarnava* and *Sukraniti*. It occurs extensively in Bengal and upper India as an efflorescence on the soil. Salt-petre has been in use in India from a very early time as the basis of rocket and other fire-works. In the *Dasakumaracharita* by Dandi (circa 6thcenturyA.D.) mention is made of *yogavartika* (magic wick) and *yoga churna*(magic powder), of which salt-petre was probably the basis. The earliest account of the manufacture of salt-petre on a commercial scale in India, that has come to our notice, occurs in a work entitled, *The Travels of John Albert de Mandelso from Persia into the East Indies*, London,1669. It describes the process as follows:

"Most of the salt-petre, which is sold in Guzuratta, comes from Ajmer, 60 leagues from Agra and they get it out of land that hath lain long fallow. The blackest and fattest ground yields most of it, though other lands afford some, and it is made thus: They make certain trenches, which they fill with saltpetrous earth, and let into them small rivulets, as much as will serve for its soaking,

which may be the more effectually done, they make use of their feet , treading it till it becomes a brooth (broth) . When the water has drawn out all the salt-petre which was in the earth, they take the clearest part of it, and dispose it into another trench, where it grows thick, and they boil it like salt, continually scumming it, and then they put into earthen pots, wherein the remainder of dregs goes to the bottom; and when the water begins to thickens, they take it out of these pots, to set it adrying in the sun, where it grows hard, and is reduced into that form wherein it is brought into Europe."

Acharya Prafulla Chandra Rai is of the opinion that gun-powder manufacturing was first started in India in the 16th Century AD (Rai, 1956:225). However, it is known that during Babbar's regime gunpowder was used in the battle-field, around 1483-1530AD. On the other hand, it is documented that the Chinese made ample use of gunpowder in the 10th CenturyAD itself (Davis, 1947:522).

IX. 3. Manufacture of Salt Petre and Gun Powder in Assam :

There are no evidences as such about the Ahoms carrying in fire-arms with them during their influx into the territory of Kamrupa. But, the Tai's are known to have used '*Hiloi*'(guns) since long time(Gogoi, 1994:219). Towards the end of the 14th Century, the Ahoms won a battle against the Chutiyas. It is learnt that, the Ahoms managed to capture and thus procure a '*mitha xoleng bortop*' from the defeated party. This indicates that the Chutiyas must have known about the technique of manufacturing gun-powder as they had fire-arms in their possession. Whether the Chutiyas mastered this technique on their own or learnt it from the Tai people remains a confusion. However, there is no doubt that development of gun-powder and fire-arms manufacturing technique developed contemporarily with the Chinese. Some authors are of opinion that this

happened because the people of this area always had some sort of interactions on cultural or economical fronts with the Chinese. Infact, the doubt is whether the Chinese learnt the technique from the people of Kamrupa or was it the other way round.

In the travelogue by J.B. traverner, there is an excerpt which goes as—"It is believed that it is the same people who in ancient time first discovered gun and gun-powder, which passed from Assam to Pegu and from Pegu to China. This is the reason why the discovery is generally ascribed to the Chinese"(Handique,1959:23).

Muslim invaders have praised the high quality fire-arms available with the Assamese army. Fateha-i-briate states that—".....the match lock and cannons were well cast. The gun-powder was of various kinds." The fact that the Muslim invaders carried away guns and gun-powder from Assam stands testimony that they did not posses these advanced war implements. ".....when Mir Jumla attacked Garhgaon, they carried away 675 guns (*hilois*),....343 *Jumurs*, 1200 *Ramsangi*, 6570 *hat-nolia*, 370 *maund* salt-petre, 1960 barrels of gun-powder, each stuffed with 2—2½ *maunds* of gun-powder (Handique,1969:33).

The Assamese also developed the art of making cannons and cannon-balls by themselves. The subjects collected salt-petre from the cow-shed, wrapped them in leaves of *tokou* and gave them to the *Khargharia* (Officer-in-charge of ammunition) of Ahom Kings. Those who could not give the prescribed share of salt-petre had to pay a tax instead. The *khargharia* prepared the gun-powder from the salt-petre collected from the people (Handique,1969:33).

A source claims that the Kacharis developed the art of gun-powder and fire-arms manufacturing indigenously. It also says: " When Rudra Singha invaded

Maibong, they came across 700 hilois, 200 maunds sulphur, armours etc. in the Kachari kingdom".

Thus, taking into account the claims of various writers one may conclude, contrary to the popularly-held belief that the art of gun-powder production developed in Assam almost simultaneously with the Chinese.

X. SERICULTURE AND WEAVING INDUSTRY :

The art of sericulture and the rearing of different kinds of silk worms for the manufacture of a variety of silk cloths were known to the people of the North- East India since the days of *Ramayana* and *Arthasastra. Ramayana* mentions the name of Magadha, Anga, Pundra and the 'country of the cocoon rearers'. This 'country of cocoon rearers' is believed to be none other than Kamarupa, lying to the east of Pundra, by the historians of the early period. In the *Arthasastra*, Suvarnakundya is referred to as one of the places which produced various silk garments, such as *ksauma*, *dukula* and *patrorna.* Historians are of the opinion that this Suvarnakundya is no other than modern Xonkudhia, in the present district of Nalbari. From the evidence of the *Arthasastra, Harsacharita* and other classical writers, it is inferred that in the art of rearing silk worms and the weaving of the best kind of silk cloths, the weavers of ancient Assam had earned a reputation that was at par with the Chinese. Later, writers like Quazim, observed that Assam produced the finest silk cloths in comparison to those of China. According to Travernier, the silk of Assam was produced on trees and the end product was very radiant. Hunter makes an exhaustive survey of the silk industry of Assam. According to him, "During the supremacy of the Ahom dynasty, the industry was greatly encouraged and grants of lands were conferred upon the *Jogis* or weaving caste who were also exempted from the

personal labour exacted by the State from all other classes. This caste produced silk from mulberry silk worms and the produce was for the exclusive use of the royal family. The climate is eminently adapted to the vigorous growth of mulberry and other silk-producing trees and plants. The Ahom King Shuteupha (A.D. 1268-1281), in order to increase the production of silks, such as mulberry silk, *mejankari* and *muga* appointed one thousand *paiks* from the Chutia and the Kachari community to rear silk moths. Under the patronage of the Koch kings also, the silk industry made a considerable progress in the Koch kingdom. From all these facts we can come to the conclusion that the silk industry has been prevalent in Assam since the days of the *Ramayana* and the silk fabrics that were produced in Assam received great favour in India and other parts of the world (Choudhury, 1959).

The exact date of introduction of the silkworm into India cannot now be ascertained. Many clues picked out of history indicates that Assam was one of the first places in which the practice of rearing silkworms and using their thread became popular. The silk worm rearing has survived the ravages of time and the downfall of kingdoms, one after the other. Perhaps it was because this was one area which ensured good profits and was always responsible for making a difference in the economy of the people and the state as a whole In spite of the attractions of imported silk and cotton, the temptation to abandon sericulture in favour of more lucrative occupations, and the high price, silk still remains the raw material for the national dress of the Assamese, and forms the common costume of the women of the Assam Valley (Allen, 1899).

X. 2. Tradition of Silk Rearing and Production :

X. 2. 1. Silk Worms of Assam :

It has been reported that, there are no less than seventeen varieties of silkworm indigenous to Assam, but three only are used to any appreciable extent.

These are :- the eri worm (*Attacus ricini*),- the muga *(Anthera assama),* and the *pat,* of which there are two kinds: the *bor polu* (*Bombyx textor),* and the *Xoru polu (Bombyx mori).*

X. 2. 2. The Eri Silk Worm and Silk :

Of the three silk worms prevalent in Assam, the *eri* worm yields the cheapest form of silk. The *eri* worm (*Attacus ricini*) derives both its scientific and its vulgar name from its attachment to the castor-oil plant (*Ricinus communis*), called *eri* in Assamese. It also feeds on the *kesuru* (*Heteropanax fragrans*), and several other trees, like the *gulancha* (*Jatropha curcas*), the *gamari* (*Gemelina arborea*), and even, it is said, the common *bogori* tree (*Zizyphus jujuba*), on which the worm can thrive in its later stages, if other food is not procurable in sufficient quantity. The *eri* worm is of multivoltine nature and is reared indoors entirely.

Usually, the rearing of the silk worms are done in the household, where castor-oil plant (*eri*) grows abundantly in the backyard of the house, in little patch of unoccupied land around the rearer's house. The tending of the worms, which is a round the year affair, depends principally upon the women of the family. As many as eight broods can be obtained in twelve months, but the number actually reared never exceeds five or six, and depends a good deal upon the quantity of food which chance has provided for the worms. This is because no care is taken to ensure a supply by planting extra trees. It is the autumn, winter and spring broods, which spin their cocoons in November, February and May, respectively, are chiefly destined for use. Of the three broods mentioned, the spring cocoons are the most numerous, and yield the most silk.

Cocoons preserved for breeding are placed in a round basket, woven out of bamboo, with a narrow mouth, and are hung up in the house out of the way of rats

and insects. After about 15 days in the hot season, and 20 to 30 days in the colder months, the moths emerge, and are allowed to move about in the basket for four-to-twenty hours. The females, distinguished by their larger body and broader and flatter abdomen, are then tied to pieces of reed or *ulu* grass by a ligature passing under the shoulder-joint of a pair of wings on one side of the body only, leaving the pair of wings on the other side free. Ten females moths are tied to one piece of reed, two feet long. The males, though left at liberty, do not attempt to fly away, but remain with the females to which they have attached themselves until the latter lay eggs, after which the males depart. It is usual to have unequal numbers of male and female moths. If in case, the number of female moths exceed the number of male moths, many of the females will be left unmated. The reeds containing the unmated female moths are left exposed in the evening, on the cave of the house. These attracts some stray male moths moving about in the vicinity of the house. A female moth lays about 200 eggs in three days, and the life of the moth lasts a day or two longer.

X. 2. 2. 1. Trditional Methods of FightingDiseases and Enemies :

Large numbers of the worms are lost by disease, of which neither the nature nor the remedy is known, but which probably has its origin in unhygienic conditions. No care is taken to remove the excreta, nor are the dead worms regularly rejected. The native account of the disease is simply that the worm ceases to eat and withers away. Some good effects are said occasionally to follow from sprinkling water in which *tulsi* leaves have been steeped over the worms among which this disease has made its appearance. The Iehneamon fly is a deadly enemy. Its bite, which leaves a black mark, usually proves fatal to the worm at the next moulting; and if the wound has been inflicted after the

last moulting, the worm spins a smaller cocoon and dies before it is completed, leaving the eggs of the fly to hatch inside the cocoon. Rats are the other serious enemy of the silkworms, sometimes sweeping off an entire brood in a single night. The cultivator is careful to abstain from praising his crop of worms, lest of these calamities should overtake them.

X. 2. 2. 4. Mode of Spinning:

In arranging the cocoons for use, the first step is to destroy the life in the chrysalis. For this purpose exposure to the sun during one or two days is usually sufficient, and this is the method preferred by the cultivators, as enabling them to keep the cocoons longer, and avoiding the dis-colouration which is caused by fire-drying. In the process of heat drying using fire, bamboo trays, upon which are placed the cocoons are placed atop, under which fire is lit.

Cocoons intended for immediate use are boiled for two or three hours in an alkaline solution of the ashes of the plantain stem in water, which serves the double purpose of killing the chrysalis and softening the cocoons. Usually, however, the cultivator stores his cocoons until he has a stock sufficiently large to make it worth his while to begin to begin spin. He then boils them in the solution described above; or the ashes used may also be those of grass, rice-straw, or the stems and leaves of the castor-oil tree, or of various other plants. In this way, cocoons several years old, if they have been kept uninjured, can be softened and rendered capable of spinning. After this process, the cocoons are opened, and the chrysalis is extracted; they are next washed white, slightly kneaded in the hand, dried in the sun, and are them ready for use. At the time of spinning, the empty cocoons are placed in an earthen bowl containing water, in which a little cow-dung is sometimes mixed. Each cocoon is taken up separately, and the silk

is drawn off in a coarse thread, nearly as thick as twine. Thickness of the extracted silk thread is roughly preserved by rubbing the thread between the finger and thumb, and in this way also new cocoons are joined in.

Care has to be taken to guard against over-boiling which reduces the cocoons to a soft sticky mass, from which no thread can be obtained, and to avoid any difficulties of this nature the cocoons are sometimes removed when parboiled, tied up into bundles in plantain or arum leaves and exposed to the sun. It is not absolutely necessary to spin off the thread immediately after boiling, but the cocoons, if kept for too long, yield a different shade of silk. The thread when spun is made into little balls, called *chapari*, which are dried in the sun, and then twisted on an instrument called the *jatar*, as the spun silk is too fine to be easily worked. Occasionally, one thread of silk is twisted with one of cotton, and a cheaper article is thus produced, but the real *dohatia* cloth is composed of two silk filaments twisted together. Silk is woven and twisted on the same instruments and in the same way as cotton with the trifling exception that the *reed* used for the weaving of *eri* silk should be rougher and stronger than that employed for cotton

(Samman, 1897).

X. 2. 3. The *Muga* Worm and Silk :

The scientific name of the *muga* silkworm (*Antherea asaama*) denotes its peculiar connection with Assam, and in fact it is found in no other part of India except Dehradun, where it occurs sparingly. Its Assamese name is said to be derived from the amber colour of the silk, and is frequently used to denote silk in general, so that *eri muga* means *eri* silk, *kutkuri muga, tusser* silk, and so on; the genuine *muga* being distinguished by the title of *sompalia muga*, or

silk yielded by the worm that feeds on the *xom*-leaf. It is a multivoltine worm, and is commonly said to be semi-domesticated, because it is reared upon trees in the open air; but in fact it is as much domesticated as any other species, being hatched indoors, and its cocoon spun indoors, while during its life on the tree it is entirely dependent on the cultivator for protection from its numerous enemies. The *xom* tree (*Machilus odoratissima*) furnishes its favourite food; but in Lower Assam it is extensively bred on the *xoalu* (*Tetranthera monopetala*). The leaves of certain other forest trees - the *dighlati* (*Tetranthera glauca*), the *palichanda* (*cinn. obtusifolium*), and the *barmoti* (*Symplocos grandiflora*) - can be eaten by the worm in its mature stages if the supply of its staple food begins to fail; but *xom* and the *xoalu* are the only trees upon which the worm yielding the ordinary *muga* silk (as distinguished from *champa* and *mezankuri*, which will be mentioned hereafter) can be permanently reared. The *xom*-fed worm is considered to yield the more delicate silk

X. 2. 3. 1. Number of Broods in a Year:

Five successive broods are distinguished by vernacular names roughly denoting the months in which the worms breed and spin their cocoons. These are the *katia* brood, in October-November; *jarua* - in the winter months of December-February; the *jethua* in the spring; the *aharua* in June-July; and the *bhadia* in August-September. But it is only in a few parts of the Assam Valley that this regular succession of broods is maintained. The *aharua* and *bhadia* broods are reared chiefly in the district of Kamrup, whence cocoons are exported for the *katia* brood in Upper Assam. In the districts of Darrang and Sibsagar , the only broods for use are the *katia*, *jarua*, and *jethua*; while in Lakhimpur only the *jarua* and *jethua* are generally in vogue. The worm is said to degenerate if bred

all the year round in Upper Assam; and another reason for the discontinuance of breeding in summer is the flooding of the *xom* forests by the incessant rains, thus leading to inability to take proper care of the worms, which in turn brings about heavy losses. Hence, the breeders of Upper Assam generally go down to Kamrup or Nagaon to buy cocoons at the beginning of the cold season. Occasionally, a *bhudia* brood of inferior quality is reared in Sibsagar on a high-lying patch of *xom* land. Even in Jorhat, the centre of the cultivation of the *muga* silkworm, it is estimated that one-fourth of the breeding cocoons are imported from Kamrup(Allen, 1899).

X. 2. 3. 2. Treatment of Cocoons for Breeding:

The cocoons intended for breeding are placed in woven bamboo trays and hung up safely within the house. The period of the chrysalis lasts about a fortnight in the warm months, and three weeks or a few days longer in the cold season, when the room in which the cocoons are kept has to be warmed by a fire and they are sometimes suspended near the hearth.

If the cocoons are kept in a covered basket, the moths are allowed to move about inside it till the day following their emergence; but where open trays are employed, the female moths, recognisable at once by their bulkier body, are immediately tied by a thread passing round the thorax behind the wings to single pieces of straw, which are hooked on a line stretched across the room; or several moths may be fastened in this way to a bunch of straws 18 inches long by one in diameter. Straws black with smoke, are usually selected, from a notion that the colour helps to reconcile the moth to captivity. The male moths are left free, and some of them make their escape into the open air, but the majority remain attached to the females. Any deficiency in the number of males is supplied by

placing the females outside the house in the evening, when unattached males will discover and consort with them. A song chanted by the cultivator is supposed to attract the males on such occasions. Each female produces about 250 eggs in three days, and the life of the moth lasts one or two days longer, but eggs laid after the firt three days are rejected, as they are likely to give birth to feeble worms (Allen, 1899).

X. 2. 3. 3. Growth of the Worms:

The pieces of straw, with the eggs deposited on them, are carefully taken down and placed in a basket covered with a piece of cloth. In winter, the temperature of the room in which the eggs are kept is maintained by lighting a fire, or the eggs may be kept in a place warmed by the sun, but not directly exposed to its rays, the heat of which would prove destructive. They ought to be kept in the dark to the best possible extent. The period of hatching lasts from seven to ten days, according to the time of the year. In the summer months, it is not necessary to keep the eggs indoors at all, and they can be placed on the tree at once, with due precautions, however, against sun, rain, and dew; and even in the winter a small proportion of the eggs may be placed out un - hatched, together with the young worms. The usual practice is however getting the eggs to hatch indoors. On being hatched, the worm is about a quarter of an inch long; it appears composed of alternate black and yellow rings. As it increases in size, the black coloured portion become distinguishable as six black moles, in regular lines, on each of the twelve rings which form its body. The colours gradually alter as it progresses, that of the body becoming lighter, the moles sky blue, then red with a bright gold-coloured ring round each. The worm passes through four moultings, known respectively as *chaiura*, *daikata*, *tinikata*, and *maiki chalkata*. The full-grown

worm, when extended in the act of progression, measures about 5 inches long, and is nearly as thick as the forefinger. Its colour is green, the ventral part being of a darker shade, while the back is light green, with a curious opaline or transparent tinge. Excluding the head and tail, the body is composed of the rings, each having four hairy red moles, with bright gold bases, symmetrically disposed round its edge; a brown and yellow stripe extends midway down each side from the tail to end within the two rings of the head on either side, and below it the breathing holes are marked by a series of seven black points; the head and claws are light brown, the holders dark green, with black prickles, the tail part widening above into green circles enclosing a large black spot. Two sizes of the full-grown worm are distinguished. The *borbhogia* is 5 inches long, the *xorubhogia* somewhat shorter; and a similar difference is observed in the size of the cocoons. It is not necessary that the worms should complete their growth on a single tree. If the leaves be exhausted, they descend the trunk till they are stopped by a coil of straw rope, or by a band of plantain leaves, which serves to arrest them till they can be gathered and transferred to another tree. This may be done either by simply placing them on the trunk and leaving them to crawl up (and if so treated, it is said they will refuse to ascend a tree which has already been stripped off its leaves), or by means of a triangular tray, which is pushed up at the lend of a long bamboo, and hooked on to one of the upper branches. The latter is also the method employed in putting the young worms on the tree for the first time. Young trees are preferred to begin with, and generally trees from three to twelve years old are considered the best. Old trees are avoided, as they harbour ants, and the moss on their branches impedes the movements of the worm. The worms feed about eight o'clock in the morning till near noon, and again from three till sunset. During the intervening hours they descend the

trunk to bask in the sun, and at night they take shelter under the leaves. A dropping sound like that of light-hail is heard under the tree at feeding time, and is caused by the pea-like excrement (*lad*) of the worms, which is constantly falling to the ground.

X. 2. 3. 4. The Spinning of the Cocoons :

The period from hatching to maturity varies from 26 days in summer to 40 days in winter. The moultings are completed about a week or ten days before the end of this term. There is no difficulty in discerning when the worm is ready to begin its cocoon, because it invariably descends the tree to the edge of the plantain-leaf band and once there becomes motionless, grasping the bark with its holders only, while the fore part of the body is raised and thrown slightly back. Another sign is said to be a peculiar sound yielded by the body when slightly tapped. Worms which show these symptoms are removed at nightfall, or if left over night, they begin to make their preparations for spinning in a roll of grass tied round the tree for that purpose. Being carried to the house, the worms are there placed on a bundle of branches with the dry leaves attached, or in a basket with a bundle of leaves suspended over it, into which the worms crawl. About four to seven days are spent in spinning the cocoon.

To extract the silk, the cocoons are boiled for an hour or a little longer in an alkaline solution composed of the ashes of rice straw, plantain leaves and wood, to which is sometimes added a few green leaves of the Jew's mallow (*Edibilis corchirus*), or of a plant called the *kukursuta*. After boiling, the cocoons are placed in a vessel filled with water, mixed with a small portion of the solution, in which the cocoons were boiled. Near the vessel a small piece of bamboo is erected on two uprights. One of the reelers then takes a filament

each from ten or twelve cocoons, and passes the collection over the bamboo bar to the other operator, who rubs the filaments together to form one thread which she guides to the *bhauri*, a piece of stick kept continuously revolving in front of the bamboo twig. The filaments are thus reeled off in one thread. The silk immediately surrounding the chrysalis and the floss that is picked off from the cocoon cannot be reeled, but is spun and is then woven into an inferior form of cloth called *jotar*.

After the thread has been reeled, it is kept in the shade for three or four days, and then wound off into skeins on an instrument resembling a small hen-coop, called a *sereki*; the skeins are sized by the application of a mixture of powdered rice and water, and are then ready for the loom; but as the reeled thread is fine, it is occasionally twisted in order to increase its strength.

X. 2. 3. 5. Muga Silk Cloth :

Muga cloth is much lighter and handsomer than *eri*, and is largely worn by women, and as a holiday dress by men. The colour is a brownish yellow, which after washing assumes a fine gloss. Sibsagar, and more especially Jorhat, are well known centres for the production of *muga* cloth, but comparatively little comes into the market, and purchasers are, as a rule, compelled to order whatever they require.

It has been stated that the breeders of Upper Assam annually import cocoons for breeding purposes from Kamrup, and that all attempts to perpetuate the race in Lakhimpur and Sibsagar are said to have failed. This, however, is not quite correct, but it is true that the worm, if reared continuously in Upper Assam, is liable to degenerate, as the *xom* tree, upon which it is fed in Sibsagar and Lakhimpur, renders it more delicate and susceptible to diseases. In Nowgong and Kamrup districts, the worms are principally fed upon the *xowalo* tree, and the breed does not degenerate. In Upper Assam few people raise the hot weather

(*aharua* and *bhodia*) broods, and the supply of cocoons for the *jharua* brood is, therefore, insufficient and has to be supplemented by importation from lower down the valley.

X. 2. 3. 6. *Chapa* and *Mezankari* Silk :

The leaves of the *xom* tree is the staple food of the *muga* worm, but it is occasionally reared on the *chapa* (*Magnolia-griffethu*) and the *mezankari* (*Tetranthera polyantha*), and spins a very fine white cocoon. During the reign of the Assam Rajas, *chapa* silk was in great request amongst the upper classes, and was produced in considerable quantities, but after the deposition of Purandar Singha the industry was abandoned. But some entrepreneurs of Jorhat endeavoured to revive the industry, and induced certain villagers in the Holongapar mauza of the Jorhat subdivision to rear worms on the *chapa* tree, but in spite of the high price obtained for the silk, there has been no development of the industry, and this *mauza* is now the only place in Assam where specimens of the *chapa* thread are procurable. Only those worms that hatch on the first day from eggs laid on the first day by the *muga* moth are used for rearing on the *chapa* tree. The temperature of the leaf is considered to be enough hot so as to be fatal to any but the strongest insects, which is itself an eliminating test which only the best and strongest can endure. The villagers estimate that this ensures a better quality of their trade. The cloth when woven from this thread is washed twice in a solution of plantain leaf and exposed to the dew at night, it is then washed in clear water, and said to be as white as *pat*, but thicker, stronger and glossier.

The cultivation of *mezankuri* silk has now almost entirely fallen into disuse. The *muga* worm, when fed on the leaves of the *mezankuri* tree, yields a strong white thread with a fine gloss. The rearing of the worm is, however, a

troublesome and expensive process. The *mezankuri* tree springs up in abandoned clearances in jungle, and as it only affords a suitable food to the worms in the earlier stages of its growth, the cultivator has to keep on clearing jungle year after year, in order to obtain supplies for his brood, which, owing to its close proximity to the jungle, is much exposed to the attacks of birds and insects.

X. 2. 4. *Pat* silk :

There are two distinct species of *Pat* silk worm in Assam- the univoltine, (*Bombyx tector*) called *bor polu*, or large worm, and the multivoltine, *xaru polu*, or small worm. Both kinds are reared indoors, on the leaves of the mulberry (*Morus indica*), called *nuni* in Upper and *meshkuri* in Lower Assam.

X. 2. 4. 1. The larger *Pat* Worm *(Bombyx Textor)* :

The peculiarity of the *bor polu*, or large *pat* silk worm, is that the period of hatching lasts ten months. To this circumstance it owes its name of *lehemia*, or slow. During this time the eggs are kept in a piece of cloth deposited in a wicker-basket (*japa*), which is carefully placed out of the reach of rats and insects. The cultivators look for the appearance of the young worms about the time of the festival of the first day of *Magh*, that is, towards the middle of January when the mulberry is putting forth green shoots.

X. 2. 4. 2. Process of Breeding :

The worms are fed at first on young mulberry leaves cut into pieces and shred over them. They change their skin four times. After the second moulting, they are able to feed on entire leaves. A hundred worms in this stage will consume about one seer of leaves in a day. The tending of the worms usually devolves upon the women and infirm members of the family. The life of the worm lasts thirty to forty days, of which ten or twelve days elapse between the final moulting and maturity. The mature worms are removed to a basket divided

into compartments, each occupied by two or three worms. Here the cocoons are spun.

The cocoon formation is completed in about six days. Those selected for breeding are placed on a sieve. The moths emerge in about a fortnight (the time is also stated as ten to twenty days, according to the prevalent temperature), and remain in pairs on the sieve for three days, when the females are taken away and placed on a cloth suspended in some quite corner, where they deposit their eggs and die a day or two later (Stack, 1884:13-21).

X. 2. 4. 3. Method of Reeling:

The cocoons intended for use are placed in the sun, to destroy the life of the chrysalis. This having been effected, a score of cocoons are thrown into a pot of boiling water, and stirred with a splinter of bamboo; the fibres attach themselves to the bamboo, and a thread is thus carried to the reel and reeled off. Sometimes the bamboo fails to pick up the filaments, and a twig of the *makudi* creeper with the leaves on, has to be employed.

Like the *mezankari* variety of *muga*, the pat silk is rather an article of luxury than of ordinary trade. If a piece is wanted, it usually has to be made on order. Nothing like a market for pat thread or cloth can be said to have existed. The breeding of the worms is restricted by custom to the Jogi caste, who used to supply the requirements of the Ahom kings and their court, and the industry is hardly known out of the district of Sibsagar, the ancient seat of Ahom rule. The Jogis still make a profound mystery, of the business, refusing to let a stranger see the worms, and answering enquiries in a manner calculated to mislead. They say, for instance, that the worm takes nine months to spin its cocoon. There can be little doubt that the production of *pat* silk has greatly declined since the annexation of Assam, nor is there any prospect of its revival.

Pat cloth is finer and whiter than either *eri* or *muga*, and is proportionately more expensive. The appearance of the cloth is much improved by washing, as it then takes on a bright sheen in place of the dull uninteresting hue of a piece of newly woven cloth. Most respectable families in Upper Assam possesses pat silk cloths, which are worn at marriages and other festivities, but specimens cannot easily be obtained except on order. In the time of the Ahom kings, the wearing of *pat* cloths was confined to the royal family and the nobility, but these distinctions of rank are now disappearing. The following proverb shows the estimation in which pat cloth was held :

"Ruined and broken down, he is still a Bhuyan's son.
It is still a scarf of *Pat* silk, tattered and torn."

X. 3. Traditional Assamese Textiles :

Textile weaving was one art which regaled Assam in the ancient times. Apart from cotton textiles and a small quantity of woollens, Assam produced three kinds of silks, viz., *muga, pat* and *endi* or *eri*. Assamese textiles were in great demand in the adjoining countries of Tibet, Bhutan, Sikkim, Burma and Bengal. The sophisticated Mughals also prized Assamese silk textiles which were either sent as gifts to the Mughal court or were exported for sale . Assamese textiles were known for the fine quality, brightness of colour and durability. On the other hand, cotton goods were known for the bright colours, durability and the bold loom-embroidery designs, the motifs of which, though taken from nature and were given abstract and geometrical shapes. Though in general, Assamese cotton textiles resembled Shan and Indonesian products yet. Another special feature about Assamese textile weaving was that it was not confined to any particular community or artisan group. Textile weaving was a woman's work and

was produced in every home. To orthodox Hindus, no stigma was attached to weaving and rearing of silk worms by members of other castes. The Brahmins did not rear silk-worm though their women too practised weaving. Writing in the early 19th century, before Assam was annexed by the British, Hamilton has given an accurate account of the state of weaving in Assam. This industry was directly patronised by the state, so much so that queens established weaving schools in the palace , to teach the art to the daughters of the nobles. Widows and other female members of the household of executed prisoners were also employed by the state for spinning and weaving as a means of subsistence. The neo-Vaisnava movement of Sri Sankaradeva was an equally potent force in the development in the art of weaving, specially of figured cloth. Though textile weaving dwindled like all other arts with the fall of the Ahom rule, it never became extinct as many other branches of Assamese art. It is still a living art and as much in demand as it had been in the medieval period.

X. 3. 1. Historical Perspective:

The distinctive Assamese textiles has also been documented in the *Harsacharita* of Banabhatta (7th ct. A.D.). The gifts sent by King Bhaskaravarman of Assam to Harsha of Kanauj included a variety of fine textiles. The most important variety of textile was in the shape of the white silk parasol known as the *Abhoga* which was also a gift from Assam. It, however, was the family heirloom of the king of Assam or Kamarupa. An important gift item typical of ancient Kamarupa textile industry were the linen cloths (*Kshauma*) that were bright like the rays of the autumn moon, and that were capable of undergoing washing treatment (*Sauchakshama*). The exact nature of these fabrics has not been made clear by previous commentators, although Bana has indicated sufficient hints

for the purpose. There seems be references of a special kind of scarf that were rolled up (*Kundalikrita*), not folded in the ordinary way, and hence required to be specially packed in round or cylindrical baskets of wicker-work (*vetra-karanda*) tastefully coloured on the outside. Bana referred to them as *bhangura uttariya* in a list of textiles specially being made on the occasion of Rajyasri's marriage, which were so called because of the series of gathering folds along their length, this precluded folding and necessitated a different kind of packing.

In the beginning of Ahom rule also, the kings were taking interest in the progress of the textile art. King Suteopha (1268-1364 A.D.) engaged a thousand Chutias and Kacharis to rear worms for silks like *pat, muga* and *mezankari.* The Ahom introduced into Assam silks like *muga* and *pat.* During the early years of the Koch rule, textile industry had received state patronage in western Assam and Baranagar and was a great centre. But the Ahoms of eastern Assam were extremely proud of their own textiles. When King Naranarayana of the Koches sent the Ahom king Sukhampha or Khoraraja presents including fine pieces of flowered silk saris of Barnagar. The Borgohain replying on behalf of the Ahom king told the Koch envoys to take back the saris, for in Assam such dresses were used by the prostitutes only. But there were other items of textiles among the gifts like *gomcheng* silk, *chit* or *chintz* and *ghagari* and other dress materials (Dasgupta, 1967: 576).

X. 3. 2. *Vrindavani Vastra* : the Marvel of Assamese Textiles :

During the lifetime of Sri Sankaradeva, tapestry weaving developed under his direct supervision. At the request of the Koch King's brother Chilarai, Sri Sankaradeva took up the project of tapestry weaving for which he engaged the weavers of Tantikuchi or Barpeta. Their leader was one Gopal, a master weaver.

The tapestry was 120 cubits long and 60 cubits broad and it took about a year to finish the weaving. Since the scroll depicted *Krisna Lila* scenes, it was known as the *Vrindavani Vastra*. The designs were woven with a large variety of coloured threads like red, white, black, yellow, green, etc. Of the colours some were evidently mixed colours or '*misravarna*' like *kach-nila*, *gaura-syama* etc. The above colours are still popular in Assamese loom embroidery work. The scenes depicted included those from Krishna's birth in the prison of Kansa, to the vanquishing of Kansa, by Krishna. Each scene had its caption below it in beautifully embroidered alphabets. The tapestry was presented to Chilarai, the brother of the Koch king with due ceremony only a little before the expiry of Sri Sankara Deva. During his stay at Patbausi, the saint, used to go to inspect the progress of the tapestry being woven at the '*karkhana*' of Kenduguri, every day at Tanti Kuchi (Barpeta). The master weaver Gopal, later on became a disciple of Sri Sankara Deva through Madhava Deva and was given the name-Mathuradas. Eventually, the *Vrindavani Vastra* was lost, though the last place of resort for the *Vastra* was the Madhupur Satra, in Cooch Behar.

Sankardeva, as early as in the 16th century, initiated the use of figured silk cloth as alter covers of which the *Vrindavani Vastra* is one of those classic examples. Though this unique piece of art today finds for itself a place in London's " Victoria and Albert Museum", the wonderful visual evidence and iconography pulls back its linkage to the obviously Vaisnavite (Pertaining to the worship of Vishnu) and to the Assamese Vaishnavite ritual. The quality of silk, the stylization of the drawing , and the blocks of curious angular in-woven script, as yet not securely identified or translated, all point to an origin somewhere in North East India.

X. 3. 3. Heritage of Weaving :

Assam has the great heritage of weaving from ancient time. During the Ahom rule, weaving industry was officially patronised by the Ahom kings. Momai Tamuli, who was the Barbarua in the reign of king Pratap Singha, made a rule that every woman in Assam was to spin two or three bundles of yarn for weaving, every night. Each morning the *Gaonburha* or the village headman was to inspect the progress of the previous night at every household. This boosted the overall production of textiles in the kingdom. Women who failed to produce the specified quantity of yarn were severely punished, even physically. Pratap Singha also settled many weavers at Sualkuchi from many places on the south bank of the Brahmaputra. Even today, Sualkuchi- on the opposite bank of Guwahati is the greatest centre for weaving. Every household had to send the king about 250 grams of silk yarn per year.

Next we hear about Assamese textiles from the *Tarikh-e-Asham* or *Fatiyah-I-Ibriah* (1662 A. D.). It is mentioned in these scriptures that the people were very skilful in weaving embroidered silk.

Though the Assamese were proud of their national culture including that of costumes yet, during the days of King Rudra Singha (1969-1714A.D.) many changes were brought about. At first when he wished to introduce the Mughal style court dress consisting of *Pag* (turban), *Jama* (frock-coats) and *Izar* (*pajamas* or pantaloons) and *Poijar* (shoes), the nobles resisted his attempts. On one occasion, the grandees returned their presents consisting of the new suits of dress expressing their disapproval of wearing foreign dresses. Rudra Singha had established two posts of the *Khaund* and the *Vairagi* who were to travel all over India and inform the king of new ideas prevalent in the main land.

The *Vairagi* was to roam around India in the guise of a mendicant and collect all sorts of information for the king. Thus, in the teeth of great opposition, King Rudra Singha was successful in introducing new court dresses for males and females. The new dress for the courtiers consisted of the *Churia* (*dhoti*), *Chola* (shirt), *Paguri* (turban), *Jama* (frock-coat), *Buku chola* (tunic) and other dress items of various cloths like *Tobta* (*tafta or tafetta*), *Jijira* and *Karchipi* (*karchobi*). *Fachau* , as the Ahom style turban used by the true Ahoms and also Baswal and Tangali as cummer-bands. For women, the court dress was specified as the *Riha* and the *Mekhela*. The *Tripura Buranji*, an Assamese chronicle of the days of Rudra Singha, however gives in great detail the textiles that were produced in Assam in that period. Those were sent as gifts to the king of Tripura for diplomatic enterprises.

X. 3. 4. Different Kinds of Silk Cloths Produced in Assam : Spinners produced different varieties of cloth in ancient Assam. The following are some of the varieties of clothes produced in ancient Assam:

(1) ***Barkapor*** (literally a large cloth) - A sheet worn as a wrap in cold weather, the largest size being 21 feet by 5 feet. It is a always worn double, and has a fringe at each end, consisting of the unworn parts of the warp, half an inch to one inch long, which is twisted by hand after the cloth has been completed. The cloth is made either entirely of eri or of a mixture of *eri* and *muga*, called "*endi*", the latter forming the warp. The Borkapor is hardly ever died, but the fringe has, as a rule, an ornamentation of coloured thread. *Dohatia eri* thread is sometimes used mixed with *muga* for this cloth. In the Goalpara district this cloth is called a *gilap*, and when worn in the shape of single sheet a *pachra* or *chaddar*. In Mangaldoi, cloths called *bachal* are made for home use. In the district of Cachar, the Kacharis weaved for their own use, sheets of *eri* silk of inferior quality called *rilaps*.

(2) *Chola Kani* (*Chola* = a coat and *kani* = cloth, i.e., cloth for coat) - *Eri* cloth used for coats and waistcoats (*borkoo chola*) made either of *eri* alone or a mixture of *eri* and *muga,* the latter forming the warp.

(3) *Patar Chelang*, called also *sal kapor* in Kamrup - There are different varieties of this cloth. It is generally made of foreign *pat* silk, and is principally worn by men. Size 12 feet by 5 feet to 9 feet. Quantity of thread required for the latter size is about ½ a seer.

(a) ***Uka Patar-Chelang*** is plain, having at the ends a few thick lines of *muga* or white cotton thread.

(b) ***Gunakata Patar-Chelang*** is plain in the body but has a border of gold twist at the ends.

(c) ***Mugaphulia Patar-Chelang***, a plain cloth with borders of *muga* silk.

(d) ***Garidia Patar-Chelang*** has stripes of cotton, *muga* or pat silk, running length-wise only, or both lengthways and crossways, with or without ornamental borders. The price varies with the nature of the ornamentation.

(e) ***Mugabania-Chelang*** - This is a mixed fabric of *muga* and cotton, the latter forming the woof. It is usually plain, having only a few thick lines of *muga* or white or coloured cotton yarn.

4. *Mugahonia Kapor* - This is also mixed fabric of *muga* and cotton, and is worn double. It is used by men, and has no ornamentation beyond a red or brown line at the ends.

5. *Gamocha* (literally *ga* = body, and *mocha* - to wipe): - Made of pat *muga* or *eri* silk, either plain or with borders of white or coloured cotton yarn. It is sometimes ornamented with stars of plain and coloured cotton yarn, and with stripes of silk or cotton. The longer ones, 12 feet by 16 feet, are worn as a turban by ordinary villagers. The smaller ones, 6 feet by 1 foot, are used for

tamal gamacha, i.e., as napkins to hold betel-nut. It is also called a *hanchuti* or *mokcha* in Barpeta.

1. *Churia* :

Borchuria - It is of a size 15 feet by 4 feet to 21 feet by 5 feet. The un-woven portion of the threads of the warp are cut close to the cloth at each end, and there is, therefore, no fringe. At a distance of from 2 to 3 inches from the extreme end, there is a plain stripe, 1/3 or ¼ of an inch broad, of pat silk or white or coloured cotton yarn woven into the cloth. At an equal distance from the stripe, or 4 to 6 inches from the extreme end, there is another larger stripe of similar colour, about 1 to 1 ¼ inch deep.

The *borchuria* is made of :*Muga* thread alone. A *mugachuria*, 15 feet by 4 feet, will require about 10 *chittacks* of thread. *Muga* and cotton yarn mixed, the latter forming the weft. *Muga* and pat mixed, the latter forming the weft. Untwisted reeled indigenous or foreign pat alone. A cloth, 21 feet by 5 feet, will require one seer of thread. Twisted indigenous or foreign *pat* alone. Twisted indigenous and foreign *pat* mixed.

Saru churia, is called *pancha kathia* when 5 yards long ; *charikathia* when only 4 yards in length. Another name is *tion-churia*, literally a bathing cloth, made of *eri* or *muga* thread, generally plain with white or coloured stripes at each end, similar to, but narrower than, those of the *borchuria*, or sometimes with only a white or coloured line at each end. The *mugachuria* for ordinary use is generally woven *hukankaria*, i.e., the thread is not damped during the process of weaving. Another variety is made with *muga* and cotton yarn mixed, the latter forming the woof.

Dhutichuria - A special kind of *haruchuria* worn at meal times only by devout Hindus. These cloths are made of pat thread, and are invariably coloured.

6. *Mekhela* or **Petticoat :**

An *Eri Mekhela* is made of *eri* thread alone, and is usually plain. A piece of cloth, 3 yards long and 1 yard broad, is sufficient to make a *mekhela* for a grown-up woman, and requires 6 to 7 *chittacks* of thread.

Titakaria Muga Mekhela - During weaving ,the spools are soaked with cold water, and the cloth woven is also kept wet with water till it is wound round the cloth beam. With the result that it becomes stiffer and thicker than if treated in the ordinary way. The quantity of thread required for a *titakaria mekhela* is 6 *chittacks.*

Sukankaria Mekhela - The cloth is made from entirely dry thread. It is thinner and softer than the preceding two varieties. Quantity of thread required 4 *chittacks.*

Eri* and *Muga Mekhelas - Worn by women are always plain, but those intended for little girls have occasionally a border of coloured cotton yarn at the bottom, and a few small flowers on the body of the garment.

Mugabania Mekhela - Made by weaving pat and *muga* thread together, the latter forming the warp. About 4 *chittacks* of *muga* and 4 *chittacks* of pat thread are required.

Patar Mekhela* or *Sudhpatar Mekhela - Made of either indigenous or foreign *pat* silk alone, or indigenous and foreign *pat* mixed. In the latter case, the foreign thread is generally used for the warp. The *pat* thread, when too fine, is sometimes doubled *"dohutia"* (but not twisted), and used for the woof. In weaving a *pat mekhela*, the spool and cloth are generally kept wet. The *pat mekhela* is made of untwisted thread, and the quantity of thread required is about half a seer

Patat Phulbacha* or *Bonkara Mekhela - This is a somewhat rare and costly article, and is only prepared and used by the women of the upper classes. The

thread used is not twisted, and is either indigenous or foreign *pat* silk of superior quality, or sometimes both.

Dhardia Mekhela - This is most rare and expensive garment, and is perhaps the finest example of the art of weaving as known amongst the Assamese. It is similar to the *patat phulbacha mekhela*, with this difference that in the latter the decorations are not continuous, whereas in the case of the *dhardia mekhela* continuous diamonds woven in gold twist treated from the ornamented border at the bottom over the greater portion of the body of the garment.

7. *Riha* - A cloth worn by women on the upper part of the body. One end is tucked in at the waist, the other thrown over the head. Size for adult women :- length 13 ½ feet to 12 feet, breadth 13/4 feet to 21/2 feet. The quantity of thread required is generally 3 to 4 *chittacks*. *Rihas* are made of *eri, muga, muga* and white cotton mixed, *pat* and *muga* mixed, and indegenous or foreign *pat* alone or mixed. They are also made of *muga polowa suta, muga pokowa* and reeled *muga* mixed, the latter forming the woof, *pat pokowa suta*, *pat pokowa* and reeled *pat* mixed, *pokowa muga* and untwisted *pat* mixed, the latter forming the woof.

Uka-Riha has an ornamental border of coloured cotton or gold twist at the ends, the body of the cloth being plain. ***Paridia riha*** has the edges made of coloured silk. It is generally made of *muga* or *pat* silk. ***Garidia riha***, generally made of *muga* or pat silk; has stripes of silk or white cotton running length wise only, or both lengthways and crosswise, with or without edges of coloured silk. ***Bonkara riha***, made of *pat* silk. The borders at the ends are made of gold twist. A portion of the cloth, generally a yard at each end, i.e., the portion which hangs loose in front of the wearer, is also decorated with flowers woven in the cloth

with gold and silver thread. ***Daridia riha***, made of *pat* silk. The borders are similar to those of the *bankara riha*, but like the *daridia mekhela*, a portion, generally a yard from one end, is entirely covered with diamonds of gold twist. This portion of the garment hangs in front of the wearer when worn. ***Karsipi-Riha or Karsipi-Boakari-Riha*** - (1) A plain *riha* with border of gold or coloured thread, having about a yard at one end embroidered with gold foil. (2)The cloth is home-made *pat* or European-made satin and the borders are made by tacking at the ends an artistically embroidered piece with gay tassels formed by bunches of gold or silver foil. The whole cloth is embroidered in various patterns with gold or silver foil, or both.

8. ***Eria*** **or** ***Khola Mugar Kapor***, is a very coarse but warm cloth, made of the spun thread of waste *muga* cocoons. It is of different sizes, and worn single or double, and is plain, with the exception of white stripes or lines at the ends. Coats are also made of this cloth.

9. ***Aar-Kapor***, a large screen used by travellers, made of *eri* or *eria barakapar*, the cloth is generally coloured.

X. 5. Spinning and Weaving :

Spinning and weaving was universally practised in Assam. In *Fathiyah-Ibriyat* it is said : "The people were very skillful in weaving embroidered cloth". Every evening a woman had to spin at least five *Sutalahi*, i.e. five conical balls of threads. Francis Hamilton says : "The native women of all castes, from the queens downwards, weave the four kinds of silk that are produced in the country, and with which three-fourths of the people are clothed. Considerable quantities of the two coarser kinds are exported. There may be one loom for every two women; and in well-to-do families there are eight or ten, which are wrought by slave girls. The raw materials is seldom purchased; each family spins and weaves the silk which it rears, and petty dealers go round and purchase for ready money

whatever can be spared for exports or for the use of the few persons who rear none of their own". There were many looms in the royal *harem* which were wrought by the female attendants. From the biographical records it is learnt that the mother of Bhavanipuria Gopal Ata, who was a dexterous weaver, was entrusted with the charge of superintending the twelve score of looms that were in the royal *harem* during the reign of the Ahom king Shuhungmung, alias Dihingia Raja. Even, some of the Ahom queens were personally in charge of training the young girls as well as looking after the activities of the looms which were in the palace. King Siva Singha's consort Sarvesvari, alias Anadari, was such a queen. The Government appointed some persons to supply raw materials for the looms of the prominent queens of the Ahom kings. Further, there were higher officers appointed by the State to supervise the activities of these people. The Raidangia Phukan and the Raidangia Barua were under the Raidangia queen to manage her estate as well as to see the activities of the *paiks* who were in charge of supplying yearns and other raw materials for the looms of the queen. In the same way, under the Parbatia queen, there were the officers known as Parbatia Phukan and Parbatia Barua for such works. In his monograph on cotton fabrics of Assam, H, F. Samman writes : "The Ahom Rajas kept skilful weavers to supply the royal wardrobe with cloths and it is related how in the reign of Purandar Singha, one Madhuram Tanti, excelled all other weavers of the day and was for his services to the royal family, granted land rent free by the king."

X. 6. Cotton Weaving :

Cotton weaving is comparatively less in volume compared to the silks. Cotton, however, is popular in Lower Assam. The Kacharis, Garos and Mishings also produce fine cotton cloth. These tribal cloths are known for their durability, heaviness, bright colours and exquisite loom embroidery. Though normally Assam silks are not dyed, the cotton goods are gaily coloured. Even caste Hindu women in

Lower Assam wear coloured cotton *Mekhelas,* the most popular being green, red, yellow and vermilion. Cotton is grown in the hills and are dyed with the vegetable dyes from the hills.

Main articles of cotton are the *Gamochas* or napkins which are used for bathing as for using as an ordinary turban, *chellengs* or women's *chadar* to be used over the *Mekhela,* or the *Sarong* and other dress materials for common use. Darrang produces the *Barkapor* or the *Chadar Khania* and the *Paridia Kapor* or fine shawls with borders. Goalpara specialises in the *Patani* or the *Sarong* which is tied at the breast and thus leaves the shoulders bare, *Pachara* or smaller shawls and the *Gilap* or *Barkapor.* The *Patani* in other areas is known as the *Methani* and has the appearance of an off-the-shoulder-evening-dress of modern western women. Kachari women of Goalpara also use a similar dress of a striped material known as the '*Dokhona*', which is sometimes accompanied by a *Chadar* for the breasts and shoulders.

X. 6. 1. The Loom :

In Assam, women used the throw-shuttle loom in the plains and the throw-shuttle loin loom in the hills. The looms in the plains were fitted with an arrow bench for the weaver or *xipini* (the female artist) and the pit loom was not used. Articles produced on the loin-loom were narrower and long strips were stitched length wise to form a whole piece of cloth.

X. 6. 2. Throw Shuttle Loom (*Tat*) :

The loom consists of four, stout posts which are driven into the ground so as to make a rectangle about 5.10 x 2.6 and are joined together at the top by cross beams. These are composed of warp and cloth beams, heddles and reed etc. A hand-shuttle is moved through the shed (the opening of the warp threads) by a slight and quick wrist movement of the hand from one side of the cloth and caught by the other hand on the opposite side of the cloth. As soon as the

shuttle is out of the shed, the weft thread is beaten to the fold of the cloth with the reed fitted in the sley, hung for to and for motion. The warp beam is placed at a bit higher level than the cloth beam to avoid reed marks and thereby to effect good cover of the cloth. The different parts of the loom are made of wood and bamboo and the old looms were ornamented by carving the different sections into animal or floral shapes and were lavishly painted. In the loom, an arrangement is made with the help of two solid wooden bars fixed horizontally on both sides of it to keep the warp. There is also an arrangement whereby a whole group of warps can be lifted, so that the weft can be made to pass through the open spaces between the lifted warps and the dormant ones. As soon as the lifted warps are released, the space closes up as they fall back and the weft falls automatically into the weaving process.

X. 6. 3. Throw Shuttle Loin Loom :

This type is very common in the hill areas of the country. The warp of manageable length and breadth usually of about 6 yards x 18 inches is prepared in a circular form and woven with bamboo-tube shuttle. One end of the circular warp (6 - 3 yards) is fastened to the wall of a house and the other end is attached to the waist of the weaver, mostly female, with a cotton or leather belt. No reed is used for heating up the weft. In the warp various colour schemes are adopted. Moreover extra figuring, lappet, swivel and various figures of animals and natural views are very decoratively produced by hand. Extra weft figuring is known as *Ba'tola* in Assamese and is popular among the tribals and non-tribals alike.

X. 8. Embroidery:

It has been the practice of the women to embroider their various pieces of garments and cloths, such as *Khania, Cheleng, Riha* etc. For their embroidery work they use coloured threads, *Muga*, gold or silver threads. The piece of cloth which is used to cover *Singhasana* (at the altar of god of the chapel) and

generally known as *Gosai-kapor*, is profusely embroidered with the designs of flowers and trees; sometimes, verses from the much revered *Namghosa* and *Kirtana* are also woven there. Even the incarnatory figures of god and the activities of Lord Krishna in Vrinabana, as recorded in the literary and biographical works, are woven into designs of the cloths (Bhuyan, 1956:63). According to Hamilton, the mosquito curtains were also decorated with embroidery works (Barua, 1930:87). The best silk scarf, *Riha* and *Mekhela* of the best silks were embroidered with gold or silver threads and the varieties were known as *Karchipi-ka* or *Gunar Bankara Kapor.*

At the time of the Ahom king Shuhungmung, among the captured Mohammedans, there were many Mohammedan artists who were established in the *Khelsa* (guild) of *Gunakara* and *Chola-sia*. These artists could make gold and silver threads strings. During the reign of king Jayadhvaja Singha, Mohammedan experts in gold and silver embroidery work were brought from Delhi and were established in Assam. From these experts, large number of Assamese people learnt this industry (Bhuyan, 1932:60). But unfortunately, the industry is now lost in Assam; there are still villages by the name of *Guna-gathia*, only to remind us that their ancestors were expert manufacturers of gold and silver threads and could do embroidery work in fine cloth during the Ahom rule. About the extinction of this industry in Assam , L. H. Samman, in his monograph, writes:

"In former days the gold and silver wire (*guna)* used for embroidery was made within the province by a class of workmen called *guna-getia*; the process of manufacture was a trade secret, and no information concerning it has been procured. This is all the more regrettable as the class of *Guna-gathia* is rap-

idly becoming extinct and such men, as still retain the name, depend no longer on their professional occupations for a livelihood, but have taken to agriculture or other more profitable employment and are fast losing, or have lost already, entirely their knowledge of the art for which they were once so famous."(Bhuyan,1960:90-91).

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Chapter - X

TRADITIONAL METALLURGY AND METALWARES

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I. INTRODUCTION :

India is the first country to develop a sound material culture by using various metals for manufacturing of different materials. The most ancient culture of the world the Pre-Harappan culture dated back 3300 BC proved a strong metallurgical tradition of Indian people. People of India have developed various traditional metallurgical technologies. Some of these technologies are proved to be the first of its kind in the world history of metallurgy.

II. IRON SMELTING IN INDIA :

India's most notable achievements in metal technology has been in the field of iron and steel. The archaeological evidences indicate that finding of iron at about 1000 B.C., *wootz* which is a corrupt form of the Kannada word *ukku* was the first crucible steel made in the world and was famous all over the middle east. This was the raw material from which Damascus sword was forged. The steel was imported from South India by the Arabian sailors who did not disclose the origin of the material (Subbarayappa, 1988:194).

Iron making was in general practiced all over India other than the Indo Gangetic plains. Recently, the Archeological Survey of India has unearthed a site at Bonahalli, about 60 km from Bangalore, where iron furnaces of the Catalan type have been found. It is dated to be about 250-300 BC. The findings are under investigation.

Until about two or three decades ago indigenous people of different states of India like Assam (undivided), Orissa , Madhya Pradesh, Bihar etc were engaged in making iron in traditional ways. The construction of the furnaces and the smelting process with all the rituals and ceremonies were meticulously followed and this could have been an index of the age old practice.

The iron furnace is a pear shaped cylindrical shaft built of tempered clay with two openings at the bottom. One of the opening is for blowing in air for combustion and the other for draining out the iron and slag. Generally, the furnaces were in sizes of 3-4 feet in height, 15-20 feet in width at the bottom and 8-10 feet at the top, the wall thickness being 3-6 inches. The shape and size of the furnaces, however were modified to suit the local raw materials.

The charge or "burden" consisted of soft iron ore and charcoal which were dropped in to the furnace in alternate layers after the initial fire had been lit The smelting operation took about 5-6 hours and thereafter a semi-molten mass of iron was pulled out and beaten on anvils, to remove all the slag. India, and particularly South India has a major contribution in the field of metal technology, specially in making of crucible steel. The iron smiths of the ancient days had realised the importance of carbon for hardening iron. The induction of carbon in iron was brought about by heating small pieces of iron along with hydrocarbons (wood) in close clay crucibles. The crucibles were arranged to form a flat arch inside a circular furnace. The furnace was heated for several hours, so that the iron could absorb carbon from the gases evolved and converted into high carbon steel. The steel ingots were dipped in

water and subsequently forged into different shapes and repeatedly treated with heat to produce the desired hardness and ductility. The result is a dual phase steel with properties some what like a composite of rubber and glass, after suitable forging and heat treatment (Rao, 1988:187).

II. 1. Traditional Iron Smelting in Assam :

The natives of Assam, specially the hill tribes traditionally smelted iron ores and manufactured iron implements for many purposes. No scientific study on iron culture of Assam has been conducted so far. Therefore, it is difficult to date the period when the people of this area started smelting iron ores and manufacturing iron implements. According to Robinson, Khasis were manufacturing iron since the last 2000 years in traditional methods. There are many references on iron culture of the people of Assam in the writing of many historians. Well -known historians like Plinny, Ammianus Marcellinus and Oldham remarked on the iron culture of the Assamese people. According to Plinny, the iron of Serica (Assam) was considered to be the best. The articles of merchandise mentioned by Ammenius Marcellinus, from Serica (Assam) consisted of skin, iron, aloe, musk and horns of the rhinoceros. The classical sources, therefore point to the working on iron from ancient times. It is believed that the people of this area learnt the art of smelting iron from the people staying in the hills of this region. The Khasis in particular, produced it in considerable quantities. As opined by Oldham, Khasi iron was excellent for all purposes as the Swedish one, and huge quantities were exported to other parts of the state either in lumps or in the shape of hoe (Choudhury, 1959:354).

Various sources reveal that, iron deposits were found in different parts of North- East India, particularly in the hilly regions such as the Khasi hills, Garo hills, Naga hills, Manipur and in the hills of present Assam. The iron

deposit at Joypur in the present Dibrugarh district, Barhat in Sibsagar district and those of Naga hills, and at Bacha Dayang in the present Dayang valley in the Mikir hills were very prominent during the Ahom period .

II. 1. 1. Iron Works in the Days of Ahoms :

The sources of iron deposits in Assam was first discovered by the first Ahom king Sukapha. In the course of his war with the Morans , Chutiyas, and Barahis, he drank water from various rivers and discovered that the water of Dikhou river was heavier than the other rivers. In order to discover the cause of the heaviness of the water, he ascended upwards along the bank of Dikhou. He established his capital at Charaideu hill as he found it appealing. He ascended again to another hill where he discovered deposition of iron ore. Sukapha initiated the smelting of iron ores and manufactured iron implements. The hill was called Tiru hill . In Tai language the meaning of *tiru* is the place where iron was smelted ('ti'= smelting of iron, 'ru'= caves). There was a small hill stream flowing through this area and this stream was also called Tiru. This stream ultimately drains into the Dikhou river.

Ahom king Sukapha established villages of iron-smelters including iron smelting workshops in this area. Remains of some iron-smelting furnaces can still be seen here. A big pond also found there, was probably dug by some Ahom monarch as a source of water in the process of smelting of iron. Till date, small pieces of iron are found lying scattered in the jungles of Tiru hill . Till the 19th century, villagers of this locality wandered in this hills in search of pieces of iron for producing agricultural implements. Due to the presence of many iron smelting furnaces and workshops this place was known as Tiru loha khat (*loha khat* -the place where iron is manufactured) (Handique,1959:28).

The workers employed in the Tiru loha khat as iron-smelters were known as Tiruwal. Some historians opine that the tiruwals or the iron-smelters belonged to the Bodo tribes of Assam. There were three big villages of iron manufacturers or tiruwals, namely Lohakhat, Pachikhat and Perakhat . The tiruwals enjoyed a tax free life except when the worked for some time in the workshop. They were provided with land for settlement and cultivation by the Ahom kings.

Royal officers were commissioned to look after the iron workshops and the workers. Bora and Saikia officers were in charge of iron workers villages. Tiruwal Rajkhowa was the overall administrative in-charge of the entire iron workshop region. The officer who maintained the accounts was designated as Tirukakati. The *paiks* or the workers who were employed in the iron workshop had to deposit a certain amount of iron to the king, and they utilized the remaining for their own uses or sold to others in the barter system. The socio-economic conditions of the iron workers was good . They earned a lot for their economic development, though they had to toil hard and incessantly. There is a popular saying about the iron workers among the common Assamese people as follows :

" The *tiruwal* earns a lot
In the vice of gluttony he indulges not,
Slogging tirelessly is a life time affair,

A tied cattle skin on the waist as his attire" (Buragohain,1855:35). Benudhar Sarma, the famous Assamese historian, vividly described the traditional means employed in iron smelting in India . According to him, - the Naga foot hills were abodes of large amount of iron deposits from Joypur to Bacha Dayang

in Sibsagar district. Better quality iron ores were described at a place about 15 miles away from Rongpur (the capital of Ahoms), at the bank of Jhanji river in the Tirugaon, Hatigarh and Kacharihat on the Tiru hills. With the onset of the autumn season, and with the occurrence of dew drops or in the winter season, the *losalias* or the iron workers construct smelting workshops near the ore excavation site. Usually five workers work in a workshop and out of them one is in-charge of the workshop; an expert in this technology is known as *Ojha* .The other four workers are known as *Pali*. These five workers work for the whole day and produce at least five pieces of iron .

During the days of Purnananda Buragohain, the Ahom king, there existed about 30 to 40 iron workshops or *losals* in the Tirugaon and Hatigarh villages .The workers brought iron ore from distant places and produced iron in the workshops. The rain water washes the iron ores in the distant hills which comes down with the flowing water of the Dayang river. The iron mixed silt is deposited in the bank of the river at different places and this silt hardens in the winter season. Iron smelters and particularly the *ojha* identifies the hard silts mixed with iron-ore. Then the *palis* start the excavation and collection of the iron ores up to a depth of 10 to 16 cubits .Usually, two *palis* dig into the well , one raises the ores to the surface and another carries it to the workshop. Thus, a group of five workers usually collect one thousand mounds of ores in ten days. They collect the ores in a pit. The size of the pit is ten cubits in length, seven cubits in breadth and three to four cubits in depth. Then some amount of this ore-mixed mud is taken into a pit full of water. The mud is grated in water to find out the real ores. This ore is then smelted in an iron smelter.

II. 1. 2. Technology of Iron Smelting in Assam :

Smelt House : The workers construct a smelting house which has two roofs, joined in the middle. The two roofs touch the ground by the lower end forming

an angular top. The house is 16 to 17 cubits in height, the length is 20 cubits and the breadth is10 cubits. The house has three separate rooms and the furnace is constructed in the middle room.

Furnace: An open hearth furnace was used for the smelting of iron-ores in Assam. It consisted of a bowl shaped pit in the ground, lined with clay which baked to a hard and a fairly smooth surface. In the small sized hearths, the iron ores was reduced directly and charcoal was used as fuel. Draught was provided by rude bellows, or by arranging the hearths at the top of a gully and taking advantage of the prevailing winds. The furnace was called *hadora* .

Blast Arrangement: The blast was introduced by a single hose which consisted of a hollow bamboo set with clay. The air was forced in by means of a pair of goat skin bellows bullock hides. The bellows were worked by hand by a person squatting on the ground. The bellows were called *bhatti.*

Fuel: Usually reeds are used as fuel. In absence of reeds, other hard woods were also used as fuel. The significance of using reeds as fuel is that , it is easily combustible and generate more heat at a time.

Process of smelting: In the days of Ahom , a team of two or three groups of *paiks* (workers) of *tiruwal khel* constructed workshops for smelting of iron. Four persons constituted a group of *paiks*. The head of the *tiruwals* was known as *doloi.* As mentioned earlier, the head of the smelters' group was known as *ojha* and his assistants were known as *palis.*

The *ojha* examined or investigated a particular plot of land, for traces of iron and then directed the *palis* to construct a smelting workshop in this area. The *palis* constructed a temporary and spacious house and dug a large but shallow pit on the floor. The pit was subjected to a thin mud plastering and was used for smelting of iron . This was known as *hadora.*

The pit was usually dug on a cliff or in an inclined piece of land. The bellows made of goat skin were attached on the upper part of *hadora.* At the bottom, an earthen pipe with an open-end is attached to drain out unwanted waste. The ores are layered and placed on the pit and then reeds are added and a fire lit on the pit. Simultaneously, air is pumped in through the bellows to raise the temperature. Then, the ore starts smelting. After prolonged smelting, the iron settles at the bottom and the wastes are cleared through the earthen pipe. These wastes were known as *lojara* or iron-waste .

After it is cooled , the iron accumulated at the bottom is picked up by the smelter and then hammered to segregate the unwanted materials. Thus, pig-iron was manufactured.

Manufacturing of Steel: Steel was manufactured from the pig-iron by the application of a special procedure. The iron smelter of ancient Assam were aware of the process of manufacture of steel by carbonisation of iron. The charcoal created out of the woods of *koroi* and *nahar* trees was powdered and introduced to the smelting process of iron to manufacture steel.

The accumulated iron wastes in huge amounts were transformed into a field of iron- wastes which was known as Lojara chapori by the native people. Traces of such Lojara chapori remains are still found in some parts of Golaghat District.

Blacksmiths and Iron Workshops : In the days of yore, in order to manufacture weapons, farming implements, and house hold items, blacksmiths with their iron workshops were present in Assam. Prior to the advent of the Ahoms , the tradition of iron manufacturing was witnessed in ancient Kamrup. This process developed into a large scale industry. The Ahom king Swargadeo

Chuhung Mung or Dihingia Raja was the pioneer of iron manufacturing industry. He established hamlets of blacksmiths and iron smelters. The iron smelters and the blacksmiths were two separate groups of workers in ancient Assam.

Process of Iron-casting : The smelted iron was casted into various shapes and forms by adopting various methods in ancient Assam. The format which gave shape and size to the objects was earthen . Some of the cast manufacture of ancient Assam are cannons, guns, axles of cart-wheels and various domestic goods.

II. 1. 3. Iron Made Weapons and Implements of Assam :

1 . Cannons(*toaps*) and Guns (*hilois*): The Ahoms were great warriors they made different types of guns and cannons. Usually the cannons were known as *toaps* and the guns as *hiloi.* According to size, shape and function the cannons and guns were nomenclated variously. The following are some of the popular guns and cannons used by Ahoms.

I. Cannons (*toaps*): There were different types of cannons or *toaps*. The large cannons were known as *Bor toap*. The *Bor toaps* were again of 5 different types: 1.*Biyagom bor toap*(very large cannon), 2.*Hatimura* or *Hatimuriya bor toap*.(elephant head cannon), 3.*Tubuki bor toap* (turkish Cannon), 4. *Mitha soleng bor toap* 5.*Bagh muriya bor toap* (tiger head cannon)

II. Guns (*hilois*) : The Ahoms used 11 different types of guns for different purposes. These are:-1.*Gathia hiloi,* 2.*Pahlangi hiloi,* 3.*Ramchangi hiloi,* 4.*Hat hiloi* (hand gun), 5.*Pathar kalai hiloi* 6.*Kamayan hiloi,* 7.*Jumur hiloi,* 8.*Kechai hiloi,* 9.*Toa hiloi,* 10. *Khoka hiloi,* 11.*Bocha dari hiloi.*

2. Bullets : Different types of bullets of different guns and cannons were made of iron . There were special workshops and iron-smiths to produce bullets.

3. Sword: It was possibly the common weapon of offence and defence in the days of Ahom in Assam. Large and small swords were equipped with sharp

strong pointed blade with mid rib or medial ridge and sometimes also had a tang. There were different names of the swords, such as :

1. *Hengdan*, (royal swords), 2.*Tarowal*, (warrior's swords), 3. *Sonia hengdan* (royal swords ornamented with gold), 4.*Rupar hengdan* (royal sword ornamented with silver), 5.*Chandrahans* (long bent sword) , 6.*Dumukhia tarowal* (double edged sword) and 7. *Dakhar* (Very large sword).

4. Dagger (*Churi*) : There were two very popular *churis* namely:- *Muthia hengdan* and *Khanjar.*

5. Chopper (*Daa* or *Dao*) : *Daa* or *dao* is still the most popular and widely used weapon of Assam. *Dao* is a very common house-hold weapon or implement. There are different shapes and sizes of *dao*, depending upon their use. The following are the most popular varieties of *dao* of Assam:-

1. *Nakoi daa*, 2.*Mit daa*, 3.*Kopi daa*, 4.*Mechi daa*, 5.*Khari daa*, 6.*Khangara daa*, and 7. *Bali kata daa* (Sacrificial *daa*).

6 .Axes (*Kuthar*) : In ancient Assam axes were used as both weapon and household implement. In household purpose axe was mainly used for cutting of trees and was known as *Gach kata kuthar.* The axe which was used as weapon in battles was known as *Parasu kuthar.*

7. Knife (*Katari*) : *Katari* or knife is a handy household weapon or implement. In every Assamese house there will be many knives of different sizes and shapes, used for different purposes. There are six different varieties of knives usually used in Assam. These are:- 1.*Naliya katari* , 2.*Hatani katari*, 3.*Dabua katari*, 4.*Dhuti katari*, 5.*Lor nalar katari* and 6.*Machua katari.*

8. Spear (*Jathi*) : *Jathi* was the most common war weapon in ancient Assam. It was mostly used by the royal guards and armies. There were different types of spears according to shapes and sizes. These are as follows:-

1.*Barsha* (leaf shaped spear), 2. *Xel* (barbed spear), 3. *Xul* (simple rod spear), 4.*Trishul* (Trident spear), 5. *Khapar* (multiple barbed spear),etc.

9. Arrow heads(*Kar* or *teer*) : In ancient Assam, large number of iron-smiths were busy in manufacturing of arrow heads. During Ahom and pre Ahom periods, arrow was the main weapon of war. A huge amount of arrow heads were manufactured for both offence and defence purposes. Arrow was also the main weapon of hunting. Every tribal families had large number of different types of arrowheads in their house. Till today, tribals of North eastern India are using bow and arrows for hunting purposes. There were different varieties of arrow heads in ancient Assam. These are as follows:-

1. *Singi muri kar* (arrow-heads made with poisons of *Singhi* fish, *H. fossilis*), 2. *Topa kar*, 3. *Obhota kolar kar* (boomerang), 4. *Bagh dhanur kar* (tiger hunting arrow head), 5. *Karfai dhanu kar.*

10. Iron rod fencing(*xingari*) : The Ahom forts were invariably protected by gorges and iron rod fencing . These fences were called *xingari.*

11. Fishing implements: Large number of fishing implements were made of iron. The important iron made fishing implements are as follow:-

1. *Pocha* (pentadent fishing rod) , 2. *Koch*(single fishing rod), 3. *Obhota kol* (fishing harpoon), 4. *Barasi* (fishing hooks), 5. *Jalar guli* (iron weights of fishing net), etc.

12. Household implements : The following are the important household implements made of iron :

1. *Daa* or *dao* (chopper), 2. *Kuthar* (axes), 3. *Kor* (spades), 4. *Phal* (plough), 5. *Chiprang* (pick axe), 6. *Joboka* (hoe) , 7. *Kanchi* (sickles), 8.*Gul* (pounder head), 9.*Akuhi* (anchor), 10. *Sikali* (iron chain) etc.

13. Materials Used for Horses and Elephants :

1. *Khura* (Horse shoe), 2. *Hatir tongi* or *Haoda* (Elephant seat), 3. *Bagh jari* or *Lekam*(Reins),

4. *Langching*(Elephant pincher), 5.*Hati bandha sikali*(elephant chain),

6. Rekabi(Saddle), etc

14. Palanquin (*Dola*) : Different types of *dola*s were in use for different purposes and by different backgrounds of people, though it was mainly used for transportation purpose by the elites of the societies, more so by the ladies.

15. Armour and other military equipment :

1.*Jakhar* (iron armour of army), 2.*Takaya* or *Ran tupi*(war helmet), 3. *Jamuki* (iron stick used for firing of cannons), etc.

16. Lamp stands : Different types of lamp stands were made of iron, such as : *Sahashra banti* (hundred lamp stand), *Baduli chaki* (hanging lamp stand), etc.

17. Carpenters' tools : 1.*Karat* (saw), 2.*Haturi* (hammer), 3.*Batali* (chisel), 4.*Chanch* (adz), 5.*Hatora* (fork), etc.

18. Tools of Blacksmiths : 1. *Niyari* (anvil), 2.*Chepena* (tong), 3.*Haturi* (hammer), etc.

19. Cosmetic tools : 1.*Khur* (blade), 2. *Kenchi*(scissors), 3. *Narani* (nail cutter), 4. *Kan kharika* (ear pocker), 5. *Lor dapon* (iron looking glass) , etc.

II. 1. 4. Iron Crafts of Assam :

Traditional blacksmiths of ancient Assam manufacture swords, axes and sharp cutting equipment's from good quality steel, and other swords and knives were made of raw iron and coated with steel at the edge. A furrow is made and a blade of steel is inserted inside it and then it is further heated and beaten.

II. 1. 4. 1. Swords Gilded with Gold (*Xon Khatowa Tarowal*) :

The swords of Ahom warriors were known as *hengdan* and was beautifully gilded with gold and silver. This process was traditionally known as *malama*. Domestic knives etc. were similarly glided with brass. Gliding on both side is a different process. Knives which are known as *dab katari* was gilded with brass at both the sides. When both the sides were gilded, a protective mud coating was applied on one side to resist the heat when other side was being glided. A sharp razor was applied to sharpen the implements after gliding. The sheath and the handles of the *hengdans* were engraved with gold and precious gems and stones. Such engraved *hengdan* was called *Bakharami hengdan* .

An alloy of mixed metals such as lead, zinc etc. were also used for gliding of swords and other sharp weapons apart from gold, silver and brass gliding.

II. 1. 4. 2. Welding (*pan juloi*) :

To make a joint of two iron pieces, usually the two iron pieces were melted on fire and hammered . To get a more rigid joint, the welding was done with some brass powder. Usually the brass powder was mixed with sulphur (*xuaga*) and melted. This melting material was known as *pan juloi* .

II. 1. 4. 3. Welders (*dhekar garha kamar*) :

Usually all the blacksmiths did not perform the welding of iron. There were special group of black-smiths to do the welding works. The welding smiths were called as *dhekar garha kamar*. In ancient Assam welding works were done mostly in making of palanquins (*dola*). The parts which join the upper and lower parts of a palanquin is called as *dhekar*. As the welders usually made these *dhekars* in ancient Assam, therefore the welders were called as *Dhekar garha kamar*.

II. 1. 4. 4. Implements and Other Materials Used in Iron Workshops :

1. Bellows (*Bhati* or *Hatina*): Usually the bellows were made with an undissected whole goat's skin. The bellow was attached with two pieces of bamboo at the posterior end for blowing of air.

2. Charcoal (*Angar*): Charcoal to be used in iron workshops was specially made from hard wood. In ancient Assam, people were unaware about the use of coal, though coal was abundant in Assam.

3.Anvil (*Niyari*): Anvil is a block of iron used by smiths for placing the metal when hammering. The four different types of anvils used by smiths of ancient Assam were as follows: 1. Large anvil (*Bor Niyari*): This is very big in size , used for hammering of big pieces of steel or brass sheet. 2 Medium sized anvil (*Belmuri*): The base of this anvil is pointed and fixed on a piece of wood, so that the anvil set inside the earth ,when hammered. 3. Both end pointed medium sized anvil (*Dheka*) 4. Small sized anvil (*Chatuli*)

4. Hammer (*Haturi*) : Three different types of hammer were used in the iron workshops. These were: 1.*Bor haturi*, 2. *Topala goch*, and 3.*Mathani*. The *borhaturi* is very big in size and ridged. The *topala goch* is medium in size. The *mathani* is small in size and used for engraving and gliding only.

5. Dies or Cutters (*Cheni*) : Dies or cutters are used to cut a piece of metal.

6. Tongs (*Sarah*): Six different types of tongs are used in iron work-shops. These were:

i) *Pat sarah* : The anterior end of this tong is flat. ii) *Akora sarah*: The anterior end of this tong is bent. iii. *Cheni dhara sarah*: This tong is used to catch the die or the cutter. iv. *Gall sarah* : Anterior end of this tong is

bending towards posterior end. v. *Beji sarah*(needle tong): It is a very small sized tong used for catching very small things. vi. Pon sarah :A small type of tong like that of a forceps.

7. Bena or Thiha : A cutter used for engraving and gliding.

8. Bagi : A cutter with bent anterior end, used for gliding

9. Naora : A large pot to keep water.

10. Pachrangi : A brush made of pig's fur.

11. Saan sil (Touch stone) : A kind of stone used for sharpening of metal equipments.

II. 1. 5. Socio-economy of Iron Culture in Assam :

The great Assamese historian Benudhar Sarma described about the socio-economy of iron culture in ancient Assam in his book 'Maniram Dewan'. The illustration in 'Maniram Dewan' about the number of persons who worked to produce a mound of iron in the Bacha-Dayang region is as follows:

Type of work.	No. of workers	No. of Days	Total no.of working days
To find out the source of iron ores	6	5	30
Excavation of iron clay	6	15	90
Separation of iron ore	6	11	66
Making charcoal	6	30	180
Smelting	5	20	100
		Total	466

The above table shows that a total 466 work days are required to produce one *mound* of iron in ancient Assam. Iron was a precious metal in those days and therefore, to produce a *mound* of iron by spending 466 work days, was quite justified. The iron produced in Jaypur and Bacha-Dayang region of upper Assam was used for manufacturing of sharp knives, shovels, axes , swords, guns and cannons etc.

Iron was also manufactured by the Garos of lower Assam. They sold iron in Palasbari and Gohainhat area of lower Assam. People from upper Assam brought this iron in exchange of rice , mustard seed and *kuji thekera* (*Garcinia xanthochymus*), a sour fruit. This iron was mainly used to manufacture nails, hooks, plough heads, and other agriculture and household implements.

II. 1. 6. Iron Workers' Guilds in Assam :

In 1422, Ahom king Chuhung Mung vanquished the Chutia king and procured a large number of metal made materials along with metal workers. These workers settled in some villages of the Ahom kingdom and engaged them to produce metal made materials particularly of iron. They mainly manufactured axes, choppers , knives, swords, arrow heads, guns and cannons.

These groups of people were designated as '*kamar khel*' or iron workers' clan. There were royal officers to look after the iron workers and were designated as *Saikia* and *Hazarika.*

Estimates reveal that, during the days of Ahom king Chuhung Mung or Dihingia Raja, there were over three thousand iron workers in Assam. The days of the Ahom kings witnessed the definite number and types of cannons were produced in definite number of workshops and by definite number of iron workers. This production schedule was documented by Benudhar Sarma in his book 'Maniram Dewan'. as follows :

No of workshops	Types of guns and canons	No. of guns and canons produced in one month
1	Small hand guns	4
1	*Ramsangi* guns	2
1	*Gathia Jumur*	1
1	*Mitha soleng* canon	1
2	*Baghmura* canon	1
4	*Tubuki* canon	1
20	*Hatimuria* canon	1
50	*Bortoap*(biggest canon)	1

(Handique, 1959: 34)

The *Mitha soleng* type of cannon was designed by the Chutiyas and the other cannons were subsequently developed by the Ahoms. The largest cannon of Assam was manufactured by the Bahikhowa Phukan of Guwahati, who gifted it to *Swargadeo* (lord) Rajeswar Singha. The size of this cannon was 12 cubits in length and 4 cubits in circumference at the base. One thousand and eighty *ojhas* and innumerable number of *palis* (workers) were employed to manufacture this cannon. The iron for this cannon was smelted with charcoal of reeds only. When operated , this cannon produced a deafening sound which even causes permanent damage to ears. Therefore the cannon operators operated it by hiding inside an underground pit dug near the cannon.

The first guns and cannons were produced in 1427 by the Ahom king Chuhung Mung. This resulted in a mass manufacture of guns and cannons till the early part of the 17th century during the reign of king Rudra Singha. Ahom kings possessed a large number of guns and cannons and gun powders.

These were stored in ammunition stores , which were known as '*kharghar*'(gunpowder store house). According to Sihabuddin Talish, the Ahom armies shot 500 cannons simultaneously. According to records, Mirjhumla retreated to his country carrying with him about 675 guns, 343 cannons, 1200 *Ramsangi*, 6570 hand guns, 370 *maunds* of gun powder and 1828 numbers of *Dhals*. SihabuddinTalish further recorded that most of the Assamese guns and cannons were ornamented with precious stones and metals(Handique, 1959:35).

II. 2. Traditional Iron Smelting in the Khasi Hills :

The abundance of iron ore in the Khasi hills, developed a rich iron culture among the Khasis of ancient Assam (presently Meghalaya). The Khasis traditionally developed a sound technology of iron smelting and works. In the days of yore, there was flourishing iron industries in the Khasi hills. The Khasis had also a flourishing trade of iron and implements made of iron. It has been said that the Khasis moved west from their first settlements in the Jayantia hills in search of location of iron ores. It is not certain how old this industry and its trade could have been, but it may be reasonable to say that the Khasis have had an expert knowledge of excavation and smelting of iron and production of iron implements of sorts for centuries. What is also not certain is whether the science was developed in the hills itself, or whether it came from the plains to the south. It is likely that the science of excavation, smelting and manufacture of iron came through Sylhet from where so many influences made their impact on Khasi life and culture (Syiemlieh,1978:243). Regarding the iron culture of the Khasis, Major P.R.T. Gurdon the British Deputy Commissioner of Eastern Bengal and Assam Commission and Superintendent of Ethnography in Assam, described as follows:

"The iron industry in former days was an important one, and there is abundant evidence that the workings were in a considerable scale, eg. at Nongkrem and Laitlyngkot, in shape of large graphite boulders which have fallen to the ground from the sides of the hills owing to the softer rocks which filled the interstices between the boulders having been worked out by the iron workers, their process to dig out the softer ferruginous rock, and then extract the iron ore from it by means of washing. The softer rock have been removed , the heavier portions fell by their own weight, and rolled down to the bottom of the slopes, the result being the great number of boulders to be seen near the sights of this workings.

Colonel Lister, writing in 1853, estimated that twenty thousand *maunds* of iron were exported from the hills in shape of hoes to the Assam valley, and in lumps of pig iron to Surma valley, where it was used by the boat builders for clamps. Now a days, the smelting of iron is carried on in very few places. There are still smelting houses at Nongkrem and Nongsprung, but these are practically the only places left where smelting of iron ore goes on.

Dr. Oldham, writing in 1863 says, "The quality of Khasi iron is excellent for all such purposes as Swedish iron is now used for. The impurity of the blooms (or masses of the metal in a molten state), however as they are sent to market, is a great objection to its use, and the waste consequent there on renders it expensive." (Gurdon, 1975:58)

The principal sites for the mining operations were Mylleim, Nongdem, Laitlyngkot and the regions around Cherrapunji . The open mines appear to have been excavated in similar manner. A small stream is allowed to rush down a slope. Excavator stands on the slope, poke the soil from between the boulders with long poles having iron spikes .The loosened soil tumbles down the stream and iron ore is made to settle at the base of a dam made of sticks

while the force of water allows lighter grains of soil to be carried off. The ore is then removed to the washing trough where it is washed and then dried. Washing of the ore may be repeated four times .

Of the many accounts of the smelting of iron in the Khasi Hills, that by William Craycroft, officiating Agent to the Governor General, North East Frontier, may be quoted at length for its very detailed explanation.

"There are large grass huts at least 25 feet high, the thatch of which reaches down to the ground on all sides. The interior, of an oval form, 15 by 30 feet, in the two diameters, is divided into three compartments; the central one being the smelting room. Two large bellows, with the nozzles pointed downwards, are set upon one side of the apartment , on the upper part of which a man stands with one foot on each, his back supported by two planks. He holds a stick in his left hand , which is suspended from the roof, and has two strings attached to it, connected with two bellows , these are worked quickly by a wriggling motion of the loins and the strength of the leg. The nozzles of the bellows unite in a tube which leads underground, from a sort of wind chest, to the hearth about four feet in front of them. Over the hearth is a chimney of pipe-clay braced with iron hoops, two feet in diameter at the bottom and about six feet in high .The mouth at bottom is on the side away from the bellows, and the chimney inclined from them to direct the heated air from the smelter towards an opening in the roof. At the right side of the bellows and even with the top of the chimney, is a trough containing damp charcoal and iron sand: at every motion of his body the operator with a long spoon tumbles a piece of this charcoal with the iron sand adhering to it down the funnel of the furnace and when a mass of melted or rather softened iron

while the force of water allows lighter grains of soil to be carried off. The ore is then removed to the washing trough where it is washed and then dried. Washing of the ore may be repeated four times .

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is formed on the hearth , it is taken out with tongs and beaten with a heavy wooden wallet on a large stone by way of anvil." (Yule,1842:853)

The ore was often not smelted in the villages adjoining the mines. It was sold in baskets containing three *mounds* of ore , and carried often for many miles to the villages where the smelting furnaces were situated. In most cases the pig iron in the shape of circular lumps and balls was again brought to market and carried to other villages where it was manufactured into tools and other articles. Much of the iron was sent to the markets in plain areas particularly to Bholaganj, Chattak, Lakhat, Jaintiapur, Jaflong , Pharalbazar, Maodon, Sonapur, Nolagul, Pandua, and Lengjut in Sylhet. The iron that remained in the hills was wrought into spades, shovels, knives, *daos*, arrow heads , swords and spears. Joseph Hooker , the botanist who travelled through the Khasi Hills in 1850 wrote in his "note" that from the summit of Kyllang rock "the tingling sound of hammers from the distant forges on all sides was singularly musical and pleasing; they feel on the ear like "bells upon the wind" each ring being exquisitely melodious, and chiming harmoniously with the others" (Hooker, 1974: 292).

The manufacture of artefacts in the hills was done in workshops differing entirely from the huts in which the first smelting were done . They were generally open sheds of an oblong shape, with the hearth and bellows at one end. The hammers used by the smiths were long in the head, being from 12 to 17 inches, only one faced with the handle inserted near to the end of the head. "This handle is frequently not much longer than the head of the hammer itself. This peculiarity in the form of the hammer leads to a mark difference in the mode of using them as compared with what an English

mechanic would adopt. A Khasi smith never swings his hammer, however heavy, but simply lifts it vertically, and the force of the blow depends on the weight and impetus of the hammer itself, as it falls, rather than on the muscular power of the person who wields it." Few of the hammers exceeded 6 pounds in weight. The anvils were rounded blocks of hard granite. The wedges were good and serviceable. The sharpening of spades , the main manufacture , was by rapidly driving the implement into most sharp sand, the sharp cutting edges of the small quartz grain in the sand acting as a grindstone giving a clean and smooth surface to the spade (Oldham,1858: 293).

Much of iron sold in Sylhet was used for the manufacture of double hook like nails to fasten planks for boats. The boat building industry of Sylhet was old and lucrative. Even as early as when the Mughal rule extended to this region, Sylhet built large boats for the Mughal fleet stationed at Dacca (Walter,1948:553). Smaller square rugged boats and *barkis* were also constructed, the latter used by the lime merchants to transport lime stones from the hills to depots in the plains. Bengali blacksmiths of Sylhet preferred Khasi iron to English iron because of its malleability.

Though European traders in Sylhet were aware of the iron trade, none invested any capital or sought to make technological improvements in the existing process. They were more concerned with trade in limestone , and later after its discovery in 1814, that of coal. Some others traded in salt. When it became possible for European to travel through the hills some among them gave their attention to this trade. The Khasi iron industry continues to cling on to a precarious position . Little or no mining is done today. Black-smiths continue to fashion implements in the shapes and sizes that their predecessors first wrought, and it is this that has ensured a continuation of this craft for tradition dies both for the producer and discriminating purchasers (Walter, 1948 : 563).

II. 2. 1.Tools and Implements used by the Khasi Iron-Smelters :

The following are the important tools and instruments used during the process of iron smelting and manufacturing by the Khasis:-

1. *Narsuh* :- A long iron bar with a wooden handle used in the stirring up charcoal the furnace.

2.*U-Sdie* :- A rough axe for splitting iron blocks.

3. *Ka Jingthap* :- Iron bat for beating the red mass of iron.

4. *Ka Nap* :- Iron pincers (a pair).

5. *Jingking* :- Iron chisels for widening the cut made by *U-sdie*.

6. Ka Phah:- Trough in which dry bracken is smeared with mixture of water and ore.

Tools for Forging :

1. *Tyrnem*:- A hammer ., 2. *Ka khur*:- Rake for arranging charcoals of fire., 3. *Nar Kti* :- A rod of iron with a wooden handle., 4. *Narbsap*:- Similar to the above., 5. *Ka Nap*:-Pincers., 6. *Khuoh*:-Hook poker., 7. *Nar Shit*:- Rod of thin iron., 8. *Ryn ing*:- Anvil.

III. GOLD WASHING AND GOLD WORKS :

III. 1. Antiquity of Gold in India :

In India the antiquity of gold goes to Harappan period (Marshall 1931:675). Gold ornaments , in ancient India are known from Lothal and Rajdoi Harappan and late Harappan, respectively, *Tekalakota* (Neolithic), and Megalithic burials of South India. Gold foil beads and small gold objects are reported from Early Historic period from Nevasa, Nasik, Vaisali, Nagarjunikunda etc. In Deccan , gold was used for making ornaments at least by 2000 B.C.(Rao,1965: 79). Regular use of gold is evidenced from Kushana period, though evidence of gold mining goes back to Neolithic times (Alchin, 1962: 65).

On the very onset in India, gold nuggets were collected from the surface of the mine area and the gold was mined by open cast method .There were alluvial deposits of gold in many rivers of India . In case of alluvial deposits , the sand and gravel are agitated with water in pans , the rocky matter is floated off and the particles of gold are collected at the bottom, alternately the alluvial sand were passed through agitating cradles or sluices, provided with obstruction to retain gold. In this process lighter sand washed away and gold particles retained.

III. 2. Gold Washing in Assam :

Arthashastra contains the earliest reference of the abundance of gold in Suvarna kundya in Kamrupa. On the basis of the practice of gold washing from the rivers of Assam, N.N. Dasgupta appropriately remarks that '*Suvarnyakunda*' was one of the tracts of Assam on the bank of some river which produced plenty of gold. Megasthenes and Strabo, both refer to the clan called 'Derdai', who obtained gold from under the earth. "Among the Derdai"writes Megasthenes " a great nation of Indians living towards the east and among the mountains there is a high table land of about 3000 staid in circumference. Underneath this are mines of gold which was worked by ants." This probably refers to the abundance of gold in some of the mountains of Assam. Schoff remarked that gold was brought to India through Tripura from the rivers of Assam and North Burma (Choudhury, 1959: 370).

The abundance of gold in Assam is also evidenced by records . The Tezpur grants state that the river Lohitya carried down gold dust from gold bearing boulders of the Kailasa mountain. Records depict king Jayapala as offering as many as 900 gold coins to a *Brahmana*. The Tezpur grant of *Vanamala* further records the rebuilding of fallen golden temple of Lord Siva in Harupeswar by the same king. It is possible that the reference in

Arthasastra to a variety of gold called '*hataka*', extracted from the mines of the same name, has bearing on this, and that such a mine may have existed in the mountains lying to the north of modern Tezpur, or at the foot hills of the Himalayas. According to historians , during the invasion of Bakhtiyar, a huge image of gold enshrined in a temple was discovered which weighed one thousand mounds According to Riyaz-Uz-Salatin. This was the temple where the invader sought refuge when he was perused by Kamrupian army (Choudhury, 1959: 370).

Extracting gold by washing sands of various rivers had been in practice from early times in Assam. Gold was found mixed with the river sands of many rivers of Assam namely the Brahmaputra, Dihing, Siri, Bharali, Suwansiri, Dikrong, Disoi, Jorglu, Dibong, Jhanji, Dhansiri etc. (Handique, 1959;25).

Extensive washing of gold was practised by during the Ahom period . Tavernier documents that the practice yielded a substantial quantity of gold and were exported from Assam overland to China. *Fitiyah -i-Ibriyah*, for instance, records that thousands of people were employed by the Ahom rulers for washing of gold in the rivers .The *Alamgiri Namah* mentions that in Assam , twenty thousand workers were employed on a regular basis as gold washers in the rivers .Their efforts paid returns in the form of one tola of gold annually to the royal treasury. Ahom king Kamaleswar Singha sold a massive quantity of gold at Hadirahat amounting to Rs. 18750. King Jayadhwaja Singh imported a few jewellers from Delhi to embroider clothes with gold. Goldsmithing was an age old practice of the Assamese natives. A large amount of materials made of gold was discovered in Sibsagar district. The materials are gold utensils, gold coins, gold embroidered clothes, gold idols, gold turbans, gold crowns and gold umbrellas etc. The *Sikhara* (top) of the Siva temple (*doul*) of Sibsagar was very huge measuring 7 and 1/2 cubits.

It was made of copper and coated with gold. Three persons can hide inside this Sikhara. The earthquake of 1887 demolished it beyond repair (Handique, 1959:35.

III. 2. 1. Technology of Gold Washing and Manufacturing :

Turbulent river water current causes erosion and deposits slits on the bank of the opposite side . This silt deposition is called '*chat*'. The *sonowals* (gold washers) examines the sand of *chats* to discover sand flakes (mica flakes) in the silts. *Chats* possessing larger number of sand flakes have the possibility of presence of more gold particles . The *Gaon burha* or the head of the *sonowal* village examines the *chats* and selects the suitable site . Then, the member of the '*khel*' (gold washers' group) arrive with implements to wash gold .

Four *Sonowal paiks* or gold washers form a group . In a group there is a fifth member , who acts as the leader of the group and is known as '*ojha*'. The *ojha* or the leader guides the group for all activities. The four workers are known as '*palis*'. A group of five workers (consisting of one *ojha* and four *palis*) washed the gold mixed sand in a specially made big sieve known as '*Durani*'.

One out of the four *palis* washes sand . Other two gather sands with the help of a collecting implement which is known as '*leheti*' and the fourth digs the sand. Prior to the group's starting , washing and digging of sand in a chat, they examine the availability of mica flakes. They insert a bamboo made pointed rod inside the sand and feel the hardness at depth. In case of discovery of hardness at depth, they provide a sample with the help of a curved bamboo. The sample sand is analysed and the availability of gold dust in the sand is ascertained. If gold dust is discovered they build a temporary shed in the site.

At the very onset, they construct an embankment over a small stream beside the *chat* or the sand islet. The *bundh* is made of mud if the stream is small or shallow. And in case of a large and deep stream, the *bundh* is build with bamboo, wood or other materials. Following the obstruction of the stream by the *bundh*, water flows over the sand islet, resulting in washing of the superficial sand. With the complete washing away of the superficial layer of sand, the sand washer demolishes the *bundh* allowing the natural flow of the stream. Then the collection of gold-mixed sand is resumed in a bamboo basket known as '*kuki*'. This process is carried out by a collecting implement known as '*leheti*' which is made of bamboo wicker. It is one and half cubits in length and one cubit in breadth. A bamboo handle of the length of four cubits is tied horizontally to the *leheti*. Two long strong ropes are attached to the *leheti* at the middle, so that the implement may be pulled by two pullers while one man will push the *leheti* into the sand. Thus sands are collected with the *leheti* and gathered in a *kuki*.

The *durani*, a kind of a sieving implement, made of wood, is the main implement used for washing the gold-mixed sand. The *durani* is oval shaped, like that of a valved fishing trap or '*shepa*'. Its dimensions include three cubits in length, one cubit in breadth and half cubit in height. Above the *durani*, another sieve made of bamboo known as '*ban*' is placed. The sand collected is poured on the bamboo sieve or the ban. It is then washed with the water coming from the hole at the bottom of an earthen pot (*kalah*). The sand is spread over the *ban* by a gold washer with his hand and the washed sand settles on the *durani*. The twigs, gravels and other materials are removed from the *ban* when the *durani* is filled with sand and it is kept slightly inclined to drain out the superficial sand and other materials through the hole at the pointed side of the *Durani*. The sand mixed with the gold particles settled at the bottom of the *durani*. Finally the gold particle-mixed

sand is spread over a special type of leaf known as '*Koupat*'. Again, the sand is washed by sprinkling water over it . The gold particles thus adhere to the leaf (*koupat*) and is then collected by hand.

An amount of 40 to 50 *kukis* (basket) of sand is washed at a stretch. This amount of sand washing is considered as one '*xia*'. The usual amount of gold collected after washing one *xia* or 40 to 50 *kukis* of sand is about one to two '*ratis*'. One *rati* is equivalent to 0.12 grams. Per day a group of five gold washer-men may collect a maximum of one '*moha*' amount of gold. One *moha* is equivalent to almost three grams. The gold collected is melted with a liquid commonly referred to as '*Rah*'. This liquid has been speculated to be mercury. After wards this molten material is poured in water to obtain a lump of gold . This gold containing some amount of rah is removed in order to obtain pure gold .The gold lump is then placed inside a snail's shell. This shell with gold is burnt in the fire of *nahara* tree (*Mesua fera*) wood. After the complete burning of the shell, a pure gold lump is obtained . The purity of the gold is examined by submerging it in water . In case the gold lump sinks immediately, then it is pure and if it sinks slowly or float in water then it is proved that the gold is adulterated.

Certain gold washers, particularly the *sonowals* of Raidangia Phukan climbed up the mountains, to collect *koupat* leaves submerged by the hill stream water . They burn the leaves and obtain gold from it .The gold washers of Sidang river collect algae and other aquatic plants submerged by the hill streams or river water to obtain gold by burning them.

The months of *Magha*, *Phaguna* and *Chaita* are the three favourable months for collection of gold by the gold washers of Assam. Some gold

washers start washing of gold as early as in the months of *Ahina* and *Kati*. Dark moon and full moon nights, the eleventh day of the lunar fortnight and the end of the month are considered inauspicious for their practice. The most suitable area for gold harvesting are the mountain rivers. The rivers with turbulent water currents are more favourable sites for gold harvesting. Gold collected from the less turbulent rivers like the river Brahmaputra is not of good quality.

The important rivers from which good amount of gold was harvested in the ancient Assam are :

1.Luit, 2.Dihing, 3.Tenga Pani, 4.Parua, 5.Dihing, 6. Dhal, 7.Digaru, 8 Dibang, 9.Chidang, 10.Dibaru, 11.Deeju, 12. Kakoi, 13 Sowansiri, 14.Kodom, 15.Somdiri, 16. Boroi. 17. Dikrong, 18. Khoroi, 19 Dosora, 20.Borgang, 21. Poma, 22.Bhoroli, 23. Bordikhari, 24. Kolijuri, 25Dokajuri, 26. Gorua, 27. Manah, 28 Burhiganga,29.Dhonsiri, 30.Dishoi, 31. Joglu, etc.

Huge number of gold washers worked in these rivers for collecting gold which is their main livelihood. During the days of king Jayadhaja Singha there were twenty five thousand professional gold washers (*sonowals*) in the Ahom kingdom. According to this history, the Chutias and the Kacharis were the traditional experts in gold washing and they washed gold in the rivers from the month of *Kati* to *Bahag*. They finish their work of gold washing in the month of *Jetha*. Each gold washers deposits two and half *tolas* of gold to the royal treasury and enjoyed tax free land for cultivation.

Evidences of presence of traditional gold in the Chutiya kingdom under the patronage of Chutiya kings were also found. Despite the lack of historical accounts of gold washing technology in the Chutiya kingdom, there were traditions of gold working. A large number of gold made materials such as

gold elephants, gold cats, gold thrones, gold pots and gold ornaments were discovered in the Chutiya Royal house holds.

Prior to the advent of Ahoms, the Chutiyas were the civilized and technologically advanced ethnic group of people in ancient Assam. In fact the Chutiyas were among the pioneers in developing the technology of gold washing in Assam. Considering enormous knowledge and the skills of the Chutiyas, the Ahom kings established Chutiya gold washers as professionals (Chaliha, 1998 : 135).

III. 2. 2. Taxation System on Gold Workers :

In the Ahom kingdom , the Ahom kings developed a methodical system of collection of tax from the gold washers. In each *khel* or village of gold washers , there was one supervising officer designated as *Bora* or *Saikia* according to the number of *paiks* they supervised. Each *paik* had to offer one *tola* of gold to their respective officers. Different qualities of gold elicited different amount of taxes. The gold washers who procured best quality of gold, had to deposit three *ratis* amount of gold to the royal officer. For medium quality of gold the gold washers or *paiks* had to deposit four *ratis*, and for low quality gold, six *ratis*. For every twenty *tolas* of gold , the *paiks* had to deposit one *tola* of gold to the officer like *Bora* , *Phukan* and *Tekela Bora*. further they had to offer one *moha* of gold to the accounts officer (*Bhandar kakati*). Apart from this when the *paiks* deposited gold to the Royal bank they had to offer taxes separately to the officers like *Chang kakati, Bhandari , Kukura chowa Barua, Ligira* and *Pachani*. Each of them collectively collect five *mohas* of gold from every *paiks*.

IV. SILVER METALLURGY :

IV. 1. Silver Metallurgy in Ancient India:

The earliest evidence to the use of silver in India comes from Indus valley civilisation. In Vedic literature there are many mentions about silver

along with gold, which evidenced that Aryans were acquainted with silver along with gold. The Aryans called silver as *Rajata* (Bareh, 1986: 461).

Arthasastra reveals regular use of silver including their mining, smelting and minting of coins. It also describes the features of good ,bad, pure and impure silver and gold(Hunter, 1889 :236).

Silver is not reported to occur in India as a primary mineral. Sources of silver may be attributed to either of the following secondary sources 1. Silver associated with gold. 2. Silver associated with Galena (argentiferous).

Silver is also obtained from lead ores from various localities in India. The association of lead as impurity indicates that silver was probably extracted from argentiferous galena, in India, right from Harappan period up to the present time.

IV. 2. 2. Silver Washing in Assam :

The chronicles and the copper plates of ancient Assam contain information about the use of silver in Assam. On the occasion of the coronation of Maharaja Harjarbarma ,had his bath with water brought on a silver water pot. This information finds mention in the copper plates of King Harjarbarma in 9th century. In the same century , Maharaja Banamal Barma's copper plate provides information about various silver-made gifts he used to offer. In the days of Ahoms, various household goods and ornaments were carved out of silver. The Ahom kings used silver dishes (*rupar kanhi*), bowls (*rupar bati*), silver pots to offer betel-nut (*rupar bota*), ornamented silver pots for storing and drinking alcohol (*bhogjora*). The less privileged sections of the society also made silver ornaments to be worn on their hands, neck, nose and other parts of the body.

IV. 2. 2. 1. Collection of Silver from Rivers of Assam :

In ancient Assam, all the tributaries of the river Brahmaputra contained traces of silver. Out of these the rivers of Golaghat district namely Dhansiri,

Dayang and Daigrang were famous for silver washing. Dishai river in the Jorhat district was also well known for silver washing .The professional silver washers were designated as *Rupuwals* or *Thengals*. Most of the *rupuwals* and *thengals* were resided at the bank of the rivers. Some of the *thengals* and *rupowals* are still living in the villages at the bank of the rivers , though they do not wash silver to day (Handique,1959: 56).

The process of silver washing is the same as gold washing. Five or six *thengals* consisted a group and went to the rivers for silver washing. The leader of the group was called '*doloi*' and the others as '*pali*'. The *doloi* determines the site for silver washing in the silt field at the bank of the river . The implements used in the process of washing of silver are almost same as washing of gold. These are:- *Durani's* made of wood, wooden bowls, *leheti* (a device for drawing water) , etc. Two of the *palis* dig out the silt and the other two collect and gather these at a place. And rest of them wash it on the *durani*. After being sieved and washed a number of times, the silver particles are collected . *Rah*, the mercury is poured on these silver particles which accumulates together . After boiling of this solution the mercury is evaporated leaving a solid piece of silver in the pot (Chaliha,1998 :56).

Native tribes like Mishimis, Singphous, Khamtis and Nishis of ancient Assam, presently the Arunachal Pradesh, also were traditional collectors of silver from the rivers. These tribes used to sell lumps of silver in the markets of plains in Assam.

It has been evidenced from different historical sources that in ancient Assam , the Marangial kacharis, a tribe from the western Assam, were engaged by the royal officers of Ahom kings to procure '*rup mati*' or the silver

mixed soil from the Garo hills and the Khasi hills. About 5000 people were carrying this silver ores. These people carried about 1000 *mounds* of this ore to the Ahom kingdom. In the eastern part of ancient Assam, the Chutiyas and the Kacharis from Sadiya, Saikhowa, and Joypur brought silver ores from Burma, for manufacturing of silver, under royal supervision. One thousand people were carrying the ore from Burma regularly. They carried 300 *mounds* of *rup mati* annually. Huge amount of silver was used for production of '*mohar*' (seals) (Handique, 1959: 14).

IV. 2. 2. 2. Silver Works :

Elaborate silver ornaments were carried on in the days of the Ahoms. There were several groups of silver-smiths in the Ahom kingdom. One group manufactured silver coins for the royal treasury and were known as '*rupmara kamar*'. Another group used to manufacture silver ornaments and other silver wares for the general public. They also manufactured silver ornaments for the aristocrats. They were called '*rajahuwa kamar*'(public smiths). Another group manufactured silver wares for the royalty and were designated as '*rajabhagia kamar*'(royal smiths). The *rajabhagia kamars* or the royal smiths were again classified into different sub-groups according to the works attributed to them. They were:

1. Gabharu-Melia : Silver-smiths who manufacture silver ornaments for the royal damsels.

2. Kunwari-Bhagia : Those who made silver ornaments for the queens.

3.*Mahi-melia* : The silver-smiths, who made silver ornaments for the royal mothers.

There was another class of silver-smiths in the Ahom kingdom. They particularly made silver wares for temples and other religious institutions. They were called '*Dewalia*' or '*Dewalbhagia*' (Chaliha , 1998:39).

The royal silver-smiths of the Ahoms made some unique silver wares such as :- 1. *Rupar xarai* (decorated covered vase of silver.) , 2. *Rupar xofura* (Ornamented silver boxes to store precious items) 3.*Bhogjara* (Specially designed decorated pots for storing and distributing royal wine.) The Ahom silver-smiths expertise in silver filigree works also (Chaliha,, 1998:39)

V. Enamelling on Gold (*Minakara*):

The process of enamelling on gold as described by the British Director of land records of Assam was: " Enamelling of gold is done mainly at Jorhat. The artificers are *sunars*, and possess a fair amount of skill. As , however ,they worked almost entirely for the native trade, the articles produced lacked the finish. There are many *sunars* in Jorhat, who worked in nothing but gold. The enamel (*mina*) is usually of three kinds, a dark blue, dark green, and white, but red and yellow are also sometimes used. It is bought in blocks exactly like glass slags."(Darrah, 1896: 47).

V. 1. Tools Used in Gold and Silver Smithy :

The tools used in the manufacture are small hammers, files, pincers, and anvils. The tools peculiar to the enamelling process are the following:

1. *Sala* : A small instrument like knitting needle, flattened at one end, used for putting the enamel into the interstices of the ornament to be operated on.

2 . *Ghor* : A half cylinder of baked clay about 3 or 4 inches long, close at one end and perforated with holes. The ornament is heated under this in the fire to fix the enamel.

3. *San*: A file made in the following way:- A stone called *jaran* , like heavy sand stone in appearance, is obtained from the neighbourhood of

Guwahati. It is usually brought to Jorhat by *telis* or oil merchants and sold at 4 annas to 8 annas a *seer*. This is pounded to powder, and then a piece of lack is heated and pressed into the powder, some of which adheres. The lac is heated again and takes up more powder , and so on till the whole has become a close compound of lac and *jaran* powder. The mass so formed is pressed on the end of a piece of bamboo , and made roughly into a square column. This forms a very fine file for smoothing the surface of the gold.

The finished ornaments usually shows narrow threads of gold arranged in fanciful pattern in the body of the enamel. These are formed of wire and are laid on before the enamel. When the wires have all been put on and the pattern in which it is to appear through the enamel is formed upon the ornament, in the process of completion, some powdered enamel of the desired colour is mixed with water in a shell of snail and the coarse paste so formed is applied by means of the *xala* to the space between the gold wares. These having been filled up , the ornament is fixed by a hole, purposely left in it, to the top of a nail, standing up out of a flat piece of iron (*halpatta*) like those used for binding boxes. The *ghar* is then placed in the *aphuri* (furnace) in a clear space which was made for it in the charcoal, and the ornament carefully put inside. The whole is then covered up with red charcoal and the *bhati* (bellows) is applied. Soon the *ghor* and its contents are red hot, the enamel melts and forms a solid mass in the places it had just previously occupied in a state of paste. When cool, the ornament is boiled in a solution of lime juice and water. It is then carefully examined to see if there are any spaces undone. If there are, more enamel is added, and the heating and boiling is gone over again. The process of applying and melting the enamel

is known as *bharandia* . When it is finally perceived that no enamel is wanting , the workman takes up the khan , and files the ornament until the surface of the enamel corresponds exactly with the upper edge of the gold wires. The latter then looks as if they had been inlayed. While being filed the article is kept wet. It is then boiled again, and when cool, brushed with a small bundle of hog's bristle, called *pachrangi*. This is repeated three times, until the object presents a perfectly smooth surface. The ornament is once again put in the *ghor* in the middle of the fire, this time bellow is not applied, but a hand fan is used. The last process employed puts a reddish colour on the gold. Into a small earthen vessel a little water is poured, and the sides of the vessel is rubbed with sulphur. Next small quantities of salt, sulphate of copper and the leaves of tree called *thekera tenga*, are put into water and the solution is boiled. Then a string is tied to the almost finished article, and it is dipped into the boiling liquid and kept for a minute or two. When taken out the ornament is rubbed with cloth, and the enamelling process is complete (Henniker, 1905:9).

V. 2. Gold and Silver Ornaments of Assam :

The following are the articles in which enamel forms the main decorative feature:-

1 .*Gejera* : This is a boat shaped shell of gold, suspended from a necklace of coral and gold beads(*poal mani*). Only one side of the *gejera* is enamelled, the back being engraved gold. The inside is filled with lac.

2 *Thuria* : These are a pair of ear ornaments for women, in the shape of small cylinders about one and half inches long. One extremity of each expanded into a kind of flower , often ornamented with stones the sides of the cylinder are only enamelled.

3. *Keru* : It is similar to the *thuria* but smaller to it.

4. *Biri* : A cask shaped locket, attached usually to a necklace. Often a row of these forms a semicircle. One side is enamelled , the other either plain or set with false rubies. they are worn both by men and women.

5. *Dugdugi* : A heart shaped pendant of a necklace, very graceful in form, and usually beautifully decorated with an elaborate gold wire pattern set in the enamel only one side is enamelled , the other side being usually set with stones.

V. 2.1 Gold-smithy in Jorhat :

The gold-smiths of Jorhat are either *britial* or *sonar* by caste . The brush used by the sonar of Jorhat for polishing gold ornaments are made of hog's bristles. they can draw out fine wire of gold by means of an iron plate perforated with holes of various degree of fineness through which the wire is successively passed. This filigree work is known as '*rewa*'. Filigree work is usually done by successive welding of one minute globule of gold on to the preceding one. For this the blow pipe is used and a kind of joining material, which is an alloy of copper and gold, called '*pain*'. Borax or *xuwaga* is applied to flux the gold and the two edges soon fuse and unite under the oxygen flame. Precious stones are not usually mounted in filigree work, but many ornaments consists of links and pendants of which some are filigree and others set stones. The stones are apparently rubies (*dalima bakhar*) and emeralds (*panna*). In addition to enamel works the following Assamese ornaments were made by the gold-smiths of Jorhat.

1. Earrings (*Thuria* or *Kanful*) : Though the enamelled earrings are usually called *Thuria*. Yet some times non enamelled ones are also called *thuria*. It is not a ring but a short gold cylinder, diameter half inch to 5/8

inches, about 2 inches long, narrowed in the middle. It is not solid gold , the interior is filled with a composition of sand or lac. This is pushed through a hole in the lobe of the ear. At the end visible in front of the wearer is a rosette or star with12 points large and small alternately, each set with a stone called *dalima* (ruby).

2. Necklace (*Har*) : There are many patterns of *har*. Each of these have their own popular name.

(i) *Gaja mati har* (elephant pearl necklace)

(ii) *Poal mani har* (strings of gold and corals)

(iii)*Chipat mani* (bead necklace)

(iv)*Galpata*(flat necklace with15 segments)

3. Bracelet (*Kharu*) : There are three different types of popular bracelets.

(i) *Bakharami kharu* (Bracelet set with rubies) : It is made of two halves, uniting with two pins, one pin being the hinge the other fastening. Embossed gold with rows of rubies, vertical and horizontal. The bracelet is about 3 inches long.

(ii) *Bala* (heavy bangles)

(iii) *Gam kharu* (larger bangles worn by man)

(iv) *Patia kharu* (solid bracelet)

4.Rings (*Angathi*) : There are different types of rings , each ring named separately.

(I) *Chamchaw* (signet ring)

(ii) *Sen* (a bird set wirh stone in the ring).

(iii) *Pohari* (a square piece of gold)

(iv) *Tarjani* (a rosette with stone) (Chaliha, 1998 : 127)

V. 2. 2. Gold-smithy in Kamrup :

Gold and silver ornaments manufactured by the smiths of Kamrup districts had a reputation. There were large number of professional gold and silver smiths in the Barpeta area of Kamrup District. The gold-smiths of Barpeta were called *sonari* or *bania*. The jewellers of Barpeta do not enamel, and do not, as a rule, produce work in which stones are set. a few only of their ornaments have stones. The finest of their work is filigree, which distinguishes the Barpeta wares. Some of the important gold ornaments of Barpeta are as follow.:

(i) *Janakar hakeli* (worn at the top of the ear)

(ii) *Hijeri* or *Jijeri* (links used to unite parts of ornaments)

(iii) *Kanar sona* (an ear pendant)

(iv) *Nak phul* (nose ornament)

(v) *Jon madli* (crescent shaped pendent of necklace)

(vi) *Mal kharu* (thick circular ornament of leg)

(vi) *Topa mani* (pendent worn at the throat)

VI. Gold Works in Manipur :

Manipur was a another famous producer of gold and silver wares. The *sonari* class of Manipur have four different castes. They are *Kangbum*, *Taurangbum*, *Kaisam*, and *Konsum*. Almost all the jewellery in Manipur was made of gold. Enameling was unknown to the Manipuri jewellers. Silver made Pan boxes of Manipur was famous . There were only few silver wares There were silver cups and ornamenting *hookas* in Manipur. Manipuri jewellers also produced Brass ornaments in the pattern of gold work. Precious stones were not allowed to set in gold necklaces, except for the ladies of the

Maharaja's palace. Gold necklaces and bracelets were only worn on public festivals. Women were not allowed to wear gold ornaments on ordinary occasions (Henniker, 1905:10)

The instruments used in the manufacture of gold ornaments were simple and coarse. It is wonderful that with such clumsy tools the Manipuris were able to turn out such delicate gold works.

VI. 1. Manipuri Gold Ornaments :

The following are the important gold ornaments produced by the Manipuri native gold-smiths.

1.Necklaces : There are 10 different varieties of necklaces in Manipur. These are namely-*Kiyang likphang, Likphang tairen mapansaba, Sanapung ngangoi, Sanapung haiyai thangbi, Sanarik pumdarik, Khang sarik, Marei, Bokul parengsabi, Liksoi chengumthinbi, and Sanarik heikru sabi.*

2. Bracelets : There are 6 different varieties of Manipuri bracelets. These are as follows: *Sani kuji mayek, Fora soba mayek, Samjuk ngmba mayek, Sen saba mayek, Lairen tangkhai mayek,* and *Rahu saba mayek.*

3.Rings : There are only three different varieties of rings are popular in Manipur. These are: *Khudap parei, Khudop mamai thambal saba,* and *Khudop uttari saba.*

4. Earrings : Three different varieties of gold earrings are popular in Manipur. These are:- *Gokhur saba haidakphu, Sana nayil*, and *Kumdar nayil.*

5.Other articles made of gold: Apart from gold ornaments there are many other articles in Manipur made of gold. These are:- i) Anklets of three different varieties, ii) Pan case (k*wagok khunu saba*), iii) Spittoon (*kaosel*),

iv) Towel rack (k*hudeisel*), v) Gold dish (p*ukham*), vi) Gold cup (t*engot*), vii) Smoking pipe (*sana ching chup*) and viii) Smoking *hookah* (three varieties)

VI. 1. Gold smithy in Khasi and Jayantia Hills :

The Khasis and Jayantias of Khasi and Jayantia Hills of ancient Assam, (present Meghalaya) were fond of jewellery. The women are specially partial to gold and coral bead necklaces. The beads are round and large and usually un-ornamented with filigree works. The gold bead is not solid but a hollow sphere filled with lac . These necklaces are usually worn by men and women specially on gala occasion.

The Khasi ornaments and other articles of gold and silver are of a pattern peculiar to themselves, and quite different from anything else in the province. The Siems (local chiefs) wear gorgeous necklaces of large gold and coral beads. Both Khasi and Jayantia women wear gold and silver ornaments frequently on special occasions of festivals. In the Nongkrem dance (the great Khasi festival), the performers wear elaborate silver coronets with a peak at the back and a tassel at the end of a long rope hanging behind (all of silver). There is also a special kind of silver belt (Bareh, 1986: 460)

In both Khasi and Jaintia hills there are only a few Khasi and Jaintia goldsmiths. Most of the goldsmiths of these two hill areas were from outside particularly from Sylhet. There are Khasi goldsmiths to be found in Mawkhar, Cherrapunji, Mawlai and other villages. The filigree work of gold was done by Khasis of Maokhar and U Konjro villages. The Khasi filigree work is delicate and intricate and shows considerable technical skill (Gurdon, 1975:24

Both men and women wear gold earrings, produced by goldsmiths of Sylhet. Women wear different patterns of earrings depending on their locality. An ornament which is also peculiar to the Khasis is the *Rupa-tylli*, or silver-

collar. This is a broad flat silver-collar which is allowed to hang down over the neck in front, and which is secured by fastening behind. Silver chains are worn by man as well as woman. The man wear them round the waist like a belt, and the woman hang round their necks. Gold or silver bracelets are worn by woman. The Lyngam males wear bead necklaces. The beads are sometimes gathered from local hill streams or purchased from outside. These necklace is much prized and is called '*pieng blei*' or God's necklace. The Khasis also wear many brass earrings . The Lyngams wear silver armlets above the elbow and on the wrist. It is only a man who has given a great feast who can wear silver armlets above the elbow. These armlets are taken off as a sign of mourning but never on ordinary occasion (Bareh, 1986: 460).

The following are the gold and silver ornaments common amongst the Khasis and Jayantias.:-

1.*U Kunopar ksir* (a necklace of solid gold), 2.*U Mynjli* (a necklace of gold beads and corals), 3.*U Kynjri ksiar* (a gold chain worn round the neck), 4.*U Paila suhpieng ksiar* (a string of gold beads), 5.*Ki Siar Niangbirnai* (ear pendants), 6.*Ki khaila Ksiar* (earrings), 7.*Syngkha Shreng Sohphan ksiar (*a bracelet), 8. *Shati ksiar* (a ring), 9.*U kynjri rupa* (a silver necklace of four or more strings), 10.*Rupa tylli* (a silver collar) (Bareh, 1986: 460).

VII. BELL-METAL, BRASS AND COPPER WORKS :

VII. 1. Antiquity of Bell-metal , Brass and Copper works in Assam:

The art of working in metal particularly bell-metal, brass and copper was practised from early times in Assam. The ancient kings of Kamrupa used copper plates to describe their royal orders and rules. Bhaskara Varma ,the great king of ancient Kamrupa used copper coins. In medieval Assam there were temples made of copper viz. 'Tamreswari Mandir' of Sadia, 'Somedev Mandir'

of Rangpur (Sibsagar) and a small temple at Kamakhya (Chaliha, 1998 : 41). Bell-metal work was done extensively in ancient Kamrupa during the rules of Bhaskara Varma. He presented bell-metal made articles to Harsha Vardhana. Bell-metal utensils made in ancient Kamrupa was mentioned in Yougini Tantra. The Buddist of ancient Kamrupa used to make brass idols. The technique of making brass idols in ancient was imported from Tibet .Apart from brass idols musical instruments and utensils were also made of brass (Chaliha, 1998 : 45).

VII. 2. Bell- Metal Works :

Assamese artisans knew the method of making bell metal by alloying copper and tin. The use of bell-metal by in the early period is proved by extant sculpture, utensils and ornaments. Since the early period, the Assamese artisans, particularly those of Sarthebari of modern Kamrup District, are known for their artistic bell-metal works (Choudhury, 1959:372). References to bell-metal utensils and ornaments are found in the *Kalika-Purana* (39/17-23). In the *Darrang Rajvamsvali* there is a reference to offering utensils made of various metals, such as gold, silver, copper and bell-metal to the temple of Kamakhya by the Koch king Naranarayana (Lekharu, 1952:56). The *Katha-Guru-Charit* supports the existence of the working on bell-metal in the kingdom of Kochbehar (Choudhury, 1959:372).

During the region of the Ahom king Shuhungmung, the Naras had to pay some amount of bell-metal and amber, and a few long knives called *Nara-daa*, as annual tribute to the Ahom king (Bhuyan,1945:23). The Assamese artisans knew the art of making utensils by using both the process of casting and beating. They made the cannons, used by the Assamese soldiers, by mixing bell-metal, brass or copper with other metals. Shots for the cannons were also

made by the same process (Handique, 1959: 17). Sculptures and ornaments were also made of bell-metal during this time. Chilarai, the brother of the Koch king Naranarayana, once offered a pair of chappals made of bell-metal to Sankerdeva while the latter paid a visit to the Kochbehar state (Handique, 1959:18). From the accounts left by the foreign writers it is learnt that at different times utensils made of bell-metal of bell-metal were exported to different countries like China, Tibet and to the neighbouring State of Bengal (Handique, 1959:19). The existence of a copper mine is probably indicated by the Bargaon grant which mentions '*Kamalakara*'. The working on the metal is proved by the existing remains of the copper temple at Sadiya, and the copper plates of the rulers (Choudhury, 1959:372).

VII. 3. Brass Work :

The traditional brass-smiths of Assam knew the process of making brass by alloying copper and zinc. In ancient Assam the brass workers produced brass idols by pouring melted brass on earthen cast. Some household implements were manufactured by beating brass on anvil. The Kachharis and other

Dapon, a kind of looking glass, either made of brass only or an alloy of brass, silver and other metals, were used extensively in Assam. Besides, many other utensils, such as *Sarai*, *Bata*, (raised tray), *Tou*, (Cooking pot), *Charia* (washing bowl) *Lota* (water vessel), *Kalah* (water vessel of big size), *Heta* (a ladle), dishes etc., were made of brass which are still used by the Assamese people. The bell-metal workers, known as *Kahar*, were equally efficient in brass works also (Handique,1959:20). But, during the region of Shuhungmung, the brass-work was adopted as a profession by the Moham-medan captives of the war (GohainBarua, 1938:40).

VII. 4. Copper Works:

Early reference of copper in Assam is found in the Bargaon grant of the king Ratnapala, where an indication of existence of copper mine is found.

From the inscription it is learnt that the king had certain copper mines in his kingdom, the inscription says: " He delights in making his copper mines lucrative"(Bhattacharya, 1931:106).

The working on copper is further proved by the existing remains of the copper temple , known as 'Tamreswari Mandir', near Sadia (Barua, 1933:187). Copper plate grants were issued by the kings of mediaeval period. *Yogini Tanta* mentions utensils made of copper . In the religious functions, utensils, made of copper, are generally preferred.

During the reign of the Ahom kings, bell metals were made by mixing copper and white tin called Rang in Assamese. From the *Katha Guru Charita* it is gathered that copper was found in Assam and the trade of this metal made article was carried between Assam and Kochbehar. However, copper was not found in plenty in Assam. Substantial amount of copper was imported to Assam from China and from the land of Abors and Singphows (Handique, 1959: 17).

Copper was mainly used in making utensils, particularly religious ones and ornaments. During the reign of king Rudra Singha, utensils made of copper were exported to other countries like China and Tibet (Handique,1959: 17).

VII. Technology of Brass and Bell Metal Works in Assam :

In Assam most metal ware are made both from brass (*pital*) and bell-metal (*kanh*). While the former is beaten from thin sheets of brass the latter is cast in moulds. The sheet metal is worked by the *Marias* (the beaters) who are a Muslim community, but who have eschewed their orthodox customs like circumcision and the '*Namaz*' and freely take wine (Dasgupta ,1982:156).

The brass sheets are cut and beaten to shape over the anvil known as *Belmuri Chutuli* . Other implements of work are the hammers, pincers, chisels of various sizes. Goat skin bellows attached to a hole in the floor of

the workers' hut complete the simple furnace. "When it is desired to join two sheets of brass together, nicks are cut in one edge, into which the other edge is filled and the two are then beaten flat. A rough paste is made of '*pan*', a substance which consists of three parts of sheet brass and one part of solder and borax is then smeared over the point. The metal is heated, the pan melts and the union is complete" (Allen,1941:158).

VII. 4. Brass, Bell-metal and Copper Wares of Assam :

The brass and bell-metal ware industry of Assam was flourishing under Ahom rule. The shape and style of the wares were different from the standard Indian shapes and had parallels in the neighbouring countries of Tibet, Burma, Siam and even in distant Indonesia. The main difference was that each plate or bowl had little stand at the bottom, ranging from about a couple of inches to about a foot in height. Thus these new vessels had the look of chalices and goblets rather than bowls and dishes. These shapes were introduced by the Tais and such vessels had a general prefix '*Ban*' before the actual name of the vessel, e.g. *Ban-bati* (Bowl with stand), *Ban-thal* (dish with stand), etc. The earliest example of the dish-on-stand in India is the wheel turned terracotta piece from Harappa (Wheeler,1960:77). Here as in Assam the plate has raised brims and the stand has a wide bottom. The flower vase shaped tumbler from the same hoard also has a parallel in the Ahom tumbler though the latter have a more slender stand. The general Assamese term Ban has an equivalent in Thai as pan or bowl. A large sized pan is known as *tok* (pronounced as *tou*) in Thai which too has an Assamese equivalent in *tou*,- a large brass basin for washing rice and other edibles before cooking. Some of the dishes-on-stand had hemispherical lids with a long tapering handle. These were known as *sarai* or a receptacle. The shape of a *sarai* is exactly like a miniature stupa. The

number of discs in the stand range from 3 or 5 or 7 according to the size of the vessel. The shapes of the *sarai* clearly shows that it is derived from the stupa-shaped metal reliquaries of the Buddhist period of Indian culture.

Other important shapes in metal were are the *bati* or *ban-bati*, i.e., smaller bowls for curries, the *jara* and the *bhog-jara*, i.e., ewers and jugs and the *gacha* and the *chaki*, i.e. lamp stands and lamps respectively.

The *ban-bati* is of Ahom derivation as the name suggests. These resemble in shape the 'Tibetan butter lamps lit in the monasteries . Here too the lotus flower and the trumpet-like base is present. But the *ban-bati* has more the look of a chalice with its hemispherical bowl standing upon a simple cylindrical stand with a disc-like base. The only decorations are the concentric circles incised on the disc of the base. The brim outside is also decorated with a couple of incised lines running around. What Tucci says about the symbolism of the shapes of the Tibetan butter lamps, tea-cup and censers also apply to these vessels from Assam. He says, "the shape is that of a chalice, either hemispherical or slightly flared out as though to symbolise a blossoming flower resting upon a high stand which incorporates the symbolism the *gumpa* (Dasgupta ,1982:155).

The *bhogjaras* and *jaras* are of cast metal, mainly of bronze, gold and silver with stout bodies which are deeply incised. In this respect the Assamese wares are more like the Tibetan tea pots and water vessels of Arunachal region known as the *khoding*. Like the Tibetan wares the Assamese wares also have bulging bodies and stout necks. The *bhogjaras* have intricate spouts ending in '*makara*' and animal heads. They have the same beauty as the Tibetan tea pots have in their handles. The length of the spout is sometimes like the scaly bodies of serpents and other aquatic animals. Lamp stands or *gashes* are all

cast in bronze and usually have a single deeply chiselled figure carrying the actual lamp. These figures are placed on elaborate and bold lotus pedestals. Rampant Ahom lions, elephants and *Garuras* are the usual figures carrying the lamp. The central figure, the lamp-base and the base of the figure were separately carved in the cireperdue technique and then soldered together. The lamp was either built in the stand with one or multiple mouths or a shallow depression served to hold the separate *chaki* or lamp. Assamese brass and bell metal goods were in great demand in the adjoining areas of Bengal till the 19th century (Hamilton,1940:60). Similar *Garuda* and Lion lamps are seen in the Assam State Museum, Gauhati, Bharat Kala Bhawan, Banaras and in the personal collection of the Maharaja of Banaras (Dasgupta ,1982:156).

VII. 4. 1. Brass Wares :

1. ***Berhia*** : It is a tripod consisting of a ring about a foot in diameter, supported on three hollow legs, the interior of which is filled in with pieces of broken brass which produces a jingling sound. The tripod stands about 14 inches high and is used for supporting flat dishes out of which the upper class Assamese eat their meal.

2. ***Chaki*** : A lamp and sometimes a lamp and a stand combined. In a combined one the top is a cup-shaped hollow for serving as a lamp which holds the oil and the wick.

3. ***Chariya*** : It is a wash-hand basin and is also used as a common bowl for keeping sundry things. It is also made of bell metal. It is known as *dabar*.

4. ***Don*** : It is a measure holding five seers of rice or other grains.

5. ***Gagari*** : It is a decanter-shaped vessel with an ornamental mouth shaped like an open eight petalled lotus. It is used by women for carrying and storing water.

6. *Ghati* : It is a common pot for holding liquids as is similar to the *lota* of north India.

7. *Gacha* : It is a lamp stand sometimes with a built-in lamp bowl on the top.

8. *Kalah* : These like the *gagari* are for holding water but are provided with rims for keeping upright. The top is either plain or flower shaped. These are made also of bell metal and copper, the latter being used for keeping water for religious purposes.

9. *Karia* : A milking pot.

10. *Kharahi* : It is a sieve for rinsing rice and is also known as *Jhajari* or *jejhera.*

11. *Khundana* : It is a handy pestle and mortar, shaped like a thimble and is used by old folks for pounding *pan* and *tamol* or betel nut.

12. *Lota* : A small vessel for holding water and also for drinking. It is also known *khujai* in Manipur, also made in bell metal.

13. *Sarai* : It is a round tray with a stand used for offering food and edibles as religious offering and is also made of copper.

14. *Heta* : It is a large spoon with a handle, thin towards the bowls and thick towards the opposite extremity and is used for distributing rice and curry

15. *Tema* : It is a small round box for keeping betel-nut. It is also made of bell-metal. Those for royal use were of gold set with jewels.

16. *Temi* : Made both in brass and bell-metal, it is smaller in size than the *tema* and is used for keeping lime to be eaten with pan .

17. *Thali* : A large boiling or cooking vessel.

18. Tou : It is a basin-shaped vessel for boiling rice, cooking large quantity of food and also used for keeping water and other things. Its affinity with a vessel of the same name from Thailand has already been mentioned.

VII. 4. 2. Bell Metal Wares:

19. ***Ban bati*** **:** It is a cup joined to a circular rim at the bottom for holding curry.

20. ***Ban thal*** **:** A concave shaped round dish joined to a circular rim at the bottom for holding rice.

21. ***Bar kanh*** **:** A large gong of bell-metal or *kanh* and hence the name.

22. ***Bati*** **:** Made both in bell-metal and copper, it is a round bottomed cup for holding curry.

23. ***Bata*** **:** It is a flat circular basin with raised edge and is generally ornamented. The upper basin is joined to a circular rim at the bottom and is used for betel-nut.

24. ***Dog-dogi*** **:** It is similar to a *lota.*

25. ***Kanhi*** **:** It is circular *thaal* with a raised rim and is used for keeping rice. the name is derived from *kanh* or bell-metal of which the objects are made.

26. ***Maipong*** **:** This vessel is similar to the *ban-thal* but has a cover in addition.

27. ***Pandhoa*** **:** It is a flat basin with an ornamental raised rim and is also used for keeping rice.

28. ***Pikdani*** **:** It is spittoon but as the name suggests it might have been introduced from Northern India.

29. ***Tal*** **:** These are brass cymbals used in religious orchestra of Assam and are known as *kartal.* The *tal* is also known as the *bhor-tal* or *bhot-tal,* i.e., Tibetan or Bhutanese cymbals. These vary in sizes from about six inches to eighteen inches in diameter and give a deep sonorous note when struck together. Exactly similar cymbals are used in Tibetan Lamaistic worship and

hence the name, both the Tibetans and the Bhutanese being designated by the generic name *bhot* in Assam. These people still have contacts with Assam due to their annual visits to the temple of Hayagriva Madhava in Kamrup district. Over and above, the annual winter fairs held on the Bhutan frontiers or *Duars* of Assam are also places of economic as well as of cultural exchanges between the two countries (Dasgupta ,1982:158).

VII. 4. 3. Copper Wares :

30. *Gagari* : A decanter shaped vessel to carry water.

31. *Kalah* : Large decanter shaped vessel to carry and store water.

32. *Bhogjara* : A beautifully decorated decanter shaped vessel with a spout usually used by royals and nobles.

33. *Chaki* : A lamp used for religious purpose

34. *Tema* : A small container to store betel-nuts.

35. *Sarai* : A round tray with stand

36. *Tarzu* : A small balance .

37. *Mangal ghot* : A small pot used for religious purpose.

VII. 4. 4. Centres of Production :

During the Ahom period this industry was mainly concentrated near the capital and also in the present Kamrup District. But other centres also flourished. The centres in Assam continued to flourish as before and were recorded district-wise during the early British rule as follow:

Centres in Sibsagar : Namdang, Dopdar, Salmara, Titabar, Kakajan mauza and Chariali in Jorhat subdivision . Kacharihat in Golaghat sub-division. The *Moria* craftsmen of Sibsagar and Jorhat also migrated to Mangaldai and Silghat respectively (Allen,1906:162).

Centres in Lakhimpur : The centres are inhabited by *Morias* only .There are Japaragaon, Tekelasising, Japihajia, Ghorbund and Jarwa. The usual articles are *hata* (vessels for boiling rice) and *daos* or native choppers . The workers are engaged in the industry only when they are of agricultural activities(Allen,1906:162).

Centres in Darrang : "The number of braziers is, however, very small and of workers in bell-metal smaller still." The chief centres are Chutia, Becheria, Modopi, Bihaguri, Mangaldai and Patharughat (Allen, 1906: 162).

Centres in Nowgong : Here centres are many though the products are not as remarkable as those of Kamrup and Sibsagar. The centres are Kuwaritol, Raha, Jagial, Samaguri, Morigaon in Sarbhagia mauza, Suargaon in Khatoalgaon mauza and Kahargaon in the Raha tehsil (Allen, 1960:162).

Centres in Kamrup : Kamrup excels in its metal-wares. The brass industry is concentrated in Hajo and Gauhati while that of bell-metal at Sartheibari. Iron wares and implements like plough shares, *daos*, knives and sickles are also produced at different places. Shantipur, a suburb of Gauhati and situated just at the foot of the Kamakhya hill, has a settlement of bell metal workers (Allen,1906:163).

VII. 4. 5. The Metal Workers :

The manufacture of brass utensils, on the other hand, enjoys the distinction of being the only industry of the sort which is appropriated by a particular caste. It is the traditional occupation of the *Morias*, who have a very peculiar history. The Assam *Buranjis* (historical narratives) state that they are the descendants of prisoners captured by the Ahoms during Turbak's unsuccessful invasion of their territory about 1506 A.D. These prisoners, it is said, were

at first employed as grass-cutters for the State elephants, but proved so useless that they were soon employed instead as cultivators, but at this work also they proved utterly useless. They were then left to their own devices, with the result that they adopted brass working as a means of earning a living and on this occupation they are still exclusively employed. Cases in which *Morias* have taken to agriculture are very rare.

Owing to their isolation, the *Morias* gradually fell away from the observances enjoined by their religion and a few years ago it was stated regarding them that they ate pork and drank spirits and had given up the practice of circumcision. Of late, however, the Mullahs have been at work among them and they are now rapidly assimilating their practices and habits of life to those of ordinary Musalmans (Dasgupta ,1982:157).

The origin of their name is not certain; it may be a corruption of *mariya* (beating), a name applied with reference to their use of the hammer for making their wares or it may be a jingling corruption of *Goria*, a term assumed by the ordinary Musalmans of this province as an assertion of their claim to have come originally from Gaur.

The necessity for living near their market has led the *Morias* to migrate a good deal and within the last few years one colony has left Sibsagar and settled in Mangaldai and another has gone from Jorhat to Silghat in the Nowgong district. They are a very industrious people working often till a late hour of the night and unlike other artisans in this province (with the single exception of *Hiras*), they are aided in their work by their women (Dasgupta,1982:158).

VII. 4. 6. Raw materials:

In the days of the Ahom kings, it is said that bell metal was made locally, but that is no longer the case; and even when it was done, the product is said

to be inferior to that obtainable from Bengal. The raw material is now either imported from Bengal, or obtained by the purchase of broken or unserviceable articles made of this alloy. Bell metal utensils are manufactured by casting in moulds. They are generally made to order and are not usually manufactured in large quantities for sale to possible customers. The chief centres of manufacture are Sarthebari in the Barpeta and Titabar in the Jorhat Districts. As has already been stated, the local supply is not sufficient to meet local requirements and import from Bengal are considerable.

The *Morias*, on the other hand, never resort to casting, but make their utensils from thin sheets of brass, which they hammer out and piece together so as to obtain the desired shape. These sheets, which are imported from Europe, are purchased by them from Marwari merchants, who often sell them on credit, on the understanding that the manufactured utensils will be sold to them at a somewhat reduced rate. The tools used by them and the way in which they are applied are as follows :-

VII . 4. 7. Tools:

1. *Belmuri* (large anvil) - This is a block of iron, shaped like a short , thick, flat-topped tent-peg. The diameter of the top is about one-third the whole length. The pointed extremely is driven through a hole in a small board and into the ground below. The board keeps the anvil from being driven too far into the ground by the hammering it receives during work.

2. *Chatuli* (small anvil) - This is a bar of iron, shaped exactly like a tent-peg, with a somewhat flat head. The pointed end is driven into the ground and the article to be manufactured beaten into shape on the top.

3. *Dheka* (double anvil)- This is shaped like the head of a hammer, except that it is thinner, longer and has one end pointed. The part which in a

hammer is prolonged over the wood of the handle consists in the *dheka* of a point, which is driven into the ground or a piece of wood when the implement is being used.

4. *Sarugaru* (hammer)- It is medium-sized, with one straight and round, one curved and chisel-shaped extremity. The handle passes through a hole in the head.

5. *Patmara* (hammer) - Shaped like a pick-axe, but with chisel-shaped ends.

6. *Barhaturi* (large hammer)- Shaped like a *sarugaru*, but very much larger and heavier. The flat extremity is hexagonal in shape. It is only employed in heavy work.

7. *Galmara* (hammer) - the head is very long and thin, but the general shape is the same as the *harugara*. It is used for hammering the interior of utensils into which ordinary hammer cannot go.

8. *Mathani* (small hammer)- A small thick-set hammer, with one end shorter than the other.

9. *Sarah* (pincers)- there are two kinds, one like an ordinary pair of English blacksmith's pincers and one like of sugar-tongs.

10. *Kati* (scissors) - Roughly made and with blunt points, but strong enough to cut sheet brass.

11. *Bhati* (bellows) - These are made of goat's skin, with the hair outside. They are funnel-shaped and the point of the funnel is connected by means of a small bamboo pipe with a narrow underground channel communicating with the bottom of the furnace. The upper part terminates in a wide mouth, formed by two slips of bamboo about a foot long. A loop of string attached to the centre of each connects the two slips of bamboo. The operator

works the bellows with his left hand, adjusting the fire with a rod held in his right. The loop passes over his hand, and as he raises it with the slops of bamboo apart, air fills the bellows; the hand is then closed, thereby bringing the two slips together and pressed down and forces the air into the furnace.

12. ***Aphuri*** **(furnace)** - This is simply a hollow in the floor of the hut.

13. ***Bagi*** **(chisels)** - These are small instruments with the extremities slightly bent and used for cutting rings and other ornamental devices on the finished brass utensils.

14. ***Mahi*** **(crucible)** - A small gourd-shaped vessel of baked clay, about 4 inches in diameter. When in use, the mouth is covered by a little cake of clay called *maula.*

15. ***Pajal*** **(mould)** - This is a piece of baked clay, exactly like a brick, with hollows of various shapes on the surface.

16. ***Naora*** **(a wooden trough containing water)-** It usually stands close to the *aphuri.*

17. ***Kunda sal*** - This is a species of lathe, consisting of a rod of wood inserted at one end into one of the posts of the house, and at the other into a peg (*barisila*) driven into the ground. Articles which are ornamented by rings cut into the brass, are fixed on the rod with lac and turned.

VII. 4. 8. ***Pan*** **or welding:**

Pan is the material used in joining the sheet brass where a junction is necessary. It is made by melting together three parts of sheet brass and one part of solder (*setu*). The result is a brittle compound, which is broken up into fragments on the anvil, inside the *nagara.* The pan will not flatten out when struck by a hammer; it breaks up. In melting the pan, the crucible is more than once taken out of the fire and rolled in a heap of rice husks (*tuh*). This is said

to remove all danger of the clay breaking. Goat's fat is put into the mould before the melted pan is poured into it. When it becomes necessary to join the two edges of a sheet of brass, nicks are cut in one edge and the other edge fitted into these and the two beaten flat. Then a rough paste is made of some broken-up pan and borax (*xuaga*), which is smeared over the joining. The junction is then heated; the pan melts and the union is cemented (Chaliha, 1998:32).

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Chapter - XI

TRADITIONAL ARCHITECTURE

CHAPTER XI

TRADITIONAL ARCHITECTURE

I. INTRODUCTION :

The achievement of Indian people in the field of architecture began in the proto-historic times, from the third millennium B.C. or even earlier. The ancient Indian civilisation like Iran, Iraq, Mesopotamia, Egypt showed skill in construction of buildings and granaries. Remains of Indus valley civilisation (4^{th}-3^{rd} - millennium B. C.) unreath at Mohenjo-daro testify to the well developed architectural skill of ancient Indians.

Literary and epigraphic records testify to abundant architectural activity in ancient and mediaeval Assam ; but only a few survives along with vast masses of shapeless ruins thrown over many an ancient site in the territory. The causes of this utter denudation of ancient monuments are not far to seek. Assam is a land of heavy rainfall and violent earthquakes. Excessive rainfall, besides weakening the structure, leads to quick growth of vegetation ; and earthquakes often dislodges the foundation. In this situation a structural monument, unless properly and carefully maintained, is liable to collapse and disintegrate . In early times, except for occasional use of bricks, stone was a common building material ; but the varieties of stone, available in Assam, lack the cohesive strength of their counterparts elsewhere.

The Varmana dynasty of ancient Assam were the great builders. They built many masonry structures at that time with superior architectural tech-

niques, as descriptions are found in many ancient manuscripts. The Salastambha dynasty was next to the Varmanas who built many important religious and secular architectural monuments in ancient Assam. Many copper plates and rock inscriptions testify about their architectural activities. Yuan Chwang refers to hundreds of temples during the 7th century A.D. The erection of temples as early as 5th - 6th century A. D. is proved by the remains of Dah Parvatiya.

In the western part of Assam the Koch kings built many important temples. According to a rock inscription the Kamakhya temple on the Nilachala hill at Guwahati was built by Sukladhwaja, the brother and general of king Naranarayana in the year 1565 A. D. Sukladhwajasa's son Raghu Rai constructed the Hayagriva Madhava temple at Hajo.

After the Koch Kings Ahoms were the great builders of Assam.. Ahoms in the early period built massive wooden structures . Shihabuddin Talish describes magnificent wooden palaces and elegant wooden mansions of Ahom times. Later the Ahom kings built magnificent stone and brick religious and secular structures, some of which are still existing with pride.

II . TRADITIONAL ARCHITECTURAL TECHNOLOGY OF ASSAM :

From most of the masonry architectural remains of Assam the technology of cutting and building of stones may be assumed. The stones were usually prepared at the site of the quarry. After initial blocks of the stones have been removed from the living rock, it was sectioned by making a groove along the desired division and then sinking holes into this groove at intervals. Wooden wedges were then pounded into these holes. On being wetted , the wood expanded thus breaking the stone along the line of the groove. The blocks were faced first with a large iron chisel and then with a small one. Fragments of

carvings found at some quarries suggests that the sculpturing of the stones was also usually done at the quarry site, although sometimes this was done after the stone had been set in its place on the temple itself. All of this entailed accurate measurements. Transportation of stones from quarries to construction site were mostly done by on barges along rivers and streams or pulled by elephants over wooden rollers. These were lifted into place by means of rope pulleys on scaffolding. Ramps of timbers or sand were built on which to haul up exceptionally large stone slabs.

II. 1. Quarrying of Stones :

Hills of Assam specially those of northern side of the valley , contain many kinds of valuable stones of different colours and qualities. These stones were used for construction of temples and royal houses. During the days of the Ahom kings, the works in stone under went a large scale development. Large number of embankments, forts, temples, maidams, sil sakos (stone bridges) were being built. There was a special class of labourers working in stone, who were known as *silakutia paik.* People in those days use to carry different types stones from the hills to the valleys loaded in boats pulled by elephants. The different types of stones usually collected for construction were as follows- *boka sil, bali sil, kakhati pathar,* white, blue, black stones, *zoroth sil, lathia sil, sotia sil* etc. The stones for the famous *Siv dol* of Sivsagar, was collected from Naginimara. Huge pieces of stones were pierced with iron spikes. Then gun powder was introduced into the hole in the stone along with cotton fibres soaked in mustard oil. This was then sparked with fire and exploded into finer pieces. Then the pieces were slashed into slabs with the help of *chach* (saw)(Handique, 1959 :39).

II. 2. Brick Making :

Brick making was quite known to the people of Assam particularly in the Ahom period. Brick making was a highly developed industry under the patronage of Ahom kings. From the evidence of the relics, it is believed that this industry was known to the people of Kachari Kingdom. The bricks were made by different processes and the Assamese people could make strong and beautiful bricks of different shapes and sizes with various designs on them (Handique, 1959:44). From the chronicle of the Chang Rung Phukan, it is understood that in the construction work of the temples and tombs of the kings , bricks were used in large quantities. Bricks were used in construction of palaces and other buildings too. It is said that burnt bricks were coloured and made more strong and permanent by dipping these into blood of the leeches. Joktali a place near Sibsagar was famous for leeches used for this purpose.

Palaces and court buildings of Ahoms were constructed mainly with bricks . These structures have their own characteristics and designs. These buildings were constructed with high technical knowledge as these are still surviving after several devastating earth quakes. Talatalghar the under ground cellar palace at Rongpur, Karengghar the four storeyed royal palace at Gargaon, Rangghar the two storeyed pavilion at the parade ground of Rangpur are some of the brick built buildings of Ahoms are still existing in good condition.

II. 3. Manufacturing of Cement or *Karhal* :

Use of cement in Assam for construction of building is not very old. It is stated that cement was prepared in the days of Ahoms for construction of masonry buildings. In Assamese language Cement is called *karhal* . Cement was manufactured by using different ingredients. These materials were jaggery, snail

lime , stone lime, black gram (*Phaesalus aurens*), *xon* (a kind of plant fibre), fishes, oil, resin of sal tree (*Shorea robusta*). From the historical pages Chang-Rung Phukan, we come to know that these materials were used for manufacturing cement, for construction of the lower part of the *maidam* of king Gadadhar Singha, in the given proportions-Jaggery -5681 *kalahas*, black gram- 696 *dhols*, xon - 635 *dhols*, stone lime-2600 *dhols*, snail lime- 14700 *dhols*, chaka chun- 7138 *kalahas*, *barali fishes* (*Wallago attu*)-186 *dang*, oil -24 *dang*, dhuna(Resin)- 240 *ser* (Handique, 1959: 38).

II. 4. *Chang - Rung- Phukan*, the Chief Architect and Head of Royal Public Works Department of Ahoms :

The Ahom kings had maintained a special officer to look after the royal public works department. The officer was designated as Chang Rung Phukan. The meaning of this tai word Chang Rung is "the expert in house building " (*Chang* = expert and *Rung* = House). He was designated as Phukan, an officer of the royal court. A chronicle preserved in the *gandhia bharal* (manuscript store) of the Ahom royalty is famous for the architectural details of the buildings constructed during that period. The manuscript contains detailed description of the construction plane of many of the buildings and accounts of the materials used for construction of those. It contains detailed description of construction of the city of Rongpur. Description of manufacturing of traditional cement or *karhal* is also incorporated in this chronicle. A peculiar type of measurement of length, weight and volume was used in the manuscript. Words used for the units of weight and volume were *ser, dhol, kalah, dang, pura, pheria* etc. Words like *angul, muthi, bein, beget, hat*, etc were used for units of length. Words used for unit of quantities in number were *kaon, pon, ganda, taka* etc.

Names of the different houses or rooms were also described as - *barghar, batghar, barmarang, changmai xaal, gadhowa ghar, matighar, kujighar couchali ghar* etc. Different parts of the houses were described as- *ber* (wall), *chaal* (roof), *tup* (top), *duwar* (door), *jakhala* (elevator), *mishang, mudh* (top joint), *pharua* (bamboo rods), *chaupang, talar tala* (ground floor), *oparar tala* (top floor), *majar tala* (first floor) etc. Peculiar names of materials used for construction of houses were described as - *ruwa, kami, halikami, harah kami, barni kami, chocha kami, tangani, hengal, phung banh, chahati, korabadha, kaibadha* etc.

The chronicle also contains detailed description of construction of maidam, the burial tomb of Ahoms. Description of the materials used , labours employed and methods of construction of several burial tombs of royal personalities are also described nicely. Description of the construction of maidam the king Rudra Singha in the chronicle of Chang Rung Phukan is sufficient to know about the book keeping of the royal architect. - " The king died on the 13th day of 1636 saka. Construction of the maidam was started on the 10th day of Ahin on the Friday. Stone slabs were laid on Sunday the 10th day of Ahin. The area (*payar*) of the inner *doul* - 11 *hats* at the length , 9 *hats* at the breadth and 12 *hats* at the height. Thickness of the walls were 8 *hats* . The floor was twenty seven hats at the length and 25 hats at the breadth. At the out side the *doul* is 21 hats at height. The materials used for construction of the maidam were - 4620 pieces of (*phala xil*) cut stone slabs, 200015 pieces of (*lathia xil*) long stone slabs from Tiru. Cut stone slabs 3000 pieces and 10000 pieces of long stone slabs, good bricks 569340 pieces and broken bricks 18290 dhols for the jaligat. *karal gat* (cement pit) 84 for the jaligat. On the floor one layer slabs contain

162649 pieces of stone slabs and for three layers of bricks 587347 pieces of good bricks. In the chouchali house total number of materials used are- bricks - 612000 pieces, cut stone slabs- 3000, lathia xil -811627 and cement 5 pits. For the entire construction of the king Rudra singha's maidam the total ingredients used for preparation of cement were jagerry 4548 *kalahas*, black gram 7921 *dhols*, xon 7922 *dhols*, snail lime 200 *kalahas*, stone lime 4740 *dhols* etc for total 158 cement pits."

The chronicle contains descriptions of different maidams, palaces and other secular and religious buildings, canals, bridges built by various Ahom kings.

III. ARCHITECTUTRAL ORAL LORE OF ASSAM :

Before building a house, people consulted building experts, astrologers and the older folk of the locality about the selection of the site, facing the house in the right direction and breaking ground at the proper and auspicious moment. The aphorisms of Dak, the great bard of Assam, were also followed carefully. For example, an aphorism of Dak lays the following conditions for choosing the site of a house. "It should face the east and should have its back to the west. To the east should be planted cane and to the west a bamboo grove. To the north should be the areca nut palms and the cultivable lands to the south.'(Sarma,1995:325). These sayings were based on actual experience of the climatic and geographical peculiarities of the region. A similar saying ascribed to *Khona* is also prevalent in rural Bengal. It says, "There should be pond with ducks in the east and bamboo groves in the west, while the north should be covered and protected and the south should be laid open". In both the cases, the east is left half closed, to catch the rays of the rising sun, while the west is chattered by the bamboo groves to protect the house from the scorching rays of

the afternoon sun in a tropical setting. The south was left open to receive the cool breeze of the sea.

There are many oral lore in Assamese language on traditional architecture. These lore were scientific and useful in construction of houses. Till today, people in rural areas, obey the principle of housing, available in these lore. Some of the most popular oral lore are as follows:

1. South fronted house is the king
   East fronted next to it
   West fronted is bad
   North fronted is worst.
2. Bricks are transformed to earth in 360 years
   Broken clay pot just cries
   Charcoal just open its eyes
   And say it is only a day, a year.
3. In a east westerly house keep your faith
   Do not be afraid of untimely death.
4. The granary in the east and cow-pen in the west
   Kitchen in the north and farm land in the south.
5. A house with a tamarind tree in the east
   And a *bel* (wood apple) tree in the west
   Not to gossip in such a house is the best.
6. A house with ducks in the east, bamboo in the west
   Betel-nut orchard in the north and open south is the best.
7. Many houses, many children
   Dak says, great burden.

the afternoon sun in a tropical setting. The south was left open to receive the cool breeze of the sea.

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7. Many houses, many children
   Dak says, great burden.

8. Tamarind tree in the front yard
Ou tree in the back yard
One who plants calls for days that are bad.

9. Granary in the east and cow-pen in the west
Dak says he is of the architect best.

10. Never build a very big house
Instead of a big one, build ten like mouse.

11. Paddy field in the south, orchard in the north,
Build fences in the boundary in rows,
"*Bhaluka*" bamboo in two corners
Betel-nut in the centre, a wise man grows

(Rajguru,1978: 15-132)

IV. TRADITIONAL DOMESTIC ARCHITECTURE :

In domestic architecture of North East there was a general plan, though individual variations were often seen. In a land lashed for half the year by torrential rain, every thought was given to this phenomenon of nature in house building. Thus in many ways house plans corresponded rather to those of China and Japan than to those of the rest of India. Tribal of this region mostly built houses raised on platforms. But non-tribal always shun such houses, even though geographical reasons demanded their use. Even then, everybody raised the plinths as much as possible in proportion to the house. This was done to protect from clogged rain water and dampness. The plinth was often reinforced with bamboo mats and frames. Usually the rural houses were plain and planned with utilitarian motives.

IV. 1. Traditional Assamese Non-Tribal House:

The commonest materials after earth were wood, bamboo, *ikara* (reeds) and straw for roofing. In the plains too, where the land was low, people raised *bharal ghars* or grain-stores and those on the principle of the *chang-ghars* of the tribals. In the hills tribals built their *chang-ghar* on very tall poles so that wild animals would pass under them and leave the houses alone. Wood was easily available and hence people built mostly in wood (Gogoi, 1957:48).

In the premises of the house the different units of houses were raised . These are namely *chara ghar* or *alahi ghar, bar ghar (* the main room.), *xaru ghar* (the lesser room.), *maral ghar* (the store room.), *sowani ghar* (the bed room.), *bulani ghar* (the living room or the lounge), *randhani ghar* (kitchen.), *pak ghar* (kitchen), *dhekisal* (the husking shed), *tantsal* (the loom-shed), *gohali ghar* (the cow-pen), *bharal Ghar* (the grain store), *bat-chara* (the gate house), *nam-ghar*(the private chapel) .

The *chara ghar* or *alahi ghar* is the guest room. It had two sloping roofs and was at right angles with the rest of the houses. It was connected with the rest of the house by means of a corridor known as the *naora* or the *dighali bat*. A separate door opened to the outer courtyard. Different types of rooms in a common Assamese house are :

All the rooms had two doors, one at the front and one at the back. Normally there were no windows or only one or two little windows. But due attention was paid to ventilation. Open passages were left between the roofs and the top of the side walls. But in some houses a bamboo lattice was fixed up in this space known as the *dhapalika* or *sial tati*. Usually all the *ghars* were divided by partitions to increase the number of rooms. But the *chara-ghar* was not so divided

and was reserved for receiving guests and accommodating them. In winter members of the family gathered in the evening around the fireplace there. The kitchen was on the last row and was a little detached from the rest of the house for reasons of cleanliness. Nobody was allowed to enter the kitchen without taking a bath and changing his dress, for the same reason. The cow-pen was further back but it normally had no side walls.

IV. 1. 1. General Plan of a Traditional House:

Plinth :

In the process of building, the first step was raising the plinth after enclosing the plinth area with bamboo matting about two feet high. This enclosure was filled with earth, which was usually brought from some good field. Before filling the plinth area was dug over and searched for skeletal or other remains of men or beasts, as these were regarded as inauspicious. The section of the plinth which was outside the actual matting walls was the *pirali* or *kathi*.

Posts :

The next stage was planting the central post. It was called *ghai khuta*, *bar khuta*, or the *mula khuta*, all meaning the chief pole. In Assam and cooch bihar people tied a piece of red cloth around the top of the *bar-khuta* for auspicious reasons. Other poles were known as *mudhar khuta*, *kumar khuta*, *panir khuta* or *parir khuta*.

Sometimes the bottom ends of the poles were burnt a little to check the attacks of insects, and before planting sand was put into the holes instead of earth for the same purpose. When the holes went too deep for the hands to reach then bamboo contraptions with one split end were inserted to catch the loose earth in order to remove it. These were called *thorka* or *khonkauri*.

For fixing the central pole of the roof and the triangular sections of the gable, various types of slot were made on the respective poles. These were of three types, *aal*, *kan*, and *kukur*. The gable triangle was the *chati*. The simpler type was the *bharahua chati,* while the elaborate type, with a king-post and two queen-post, as in Chinese architecture, was the *phul chati* or the *saru-chati*. There were thus *chatis* in a building - one in the middle and two at the ends. The two long poles running length wise along the bottoms of the *chatis* were known as *panipotar marali*. The *maralis* are either 3 to 5 in number. To prevent sagging of the roof bamboo of the breadth of the roof were laid across joining the central and side *maralis*. These were the *jati banh*. The wooden *chatis* were often decorated with carvings of lotuses etc.

Roofs :

The roofs were usually sloping with only two slanting members. This type is known as the *duchalia*. The lattice-like framework of the roof was covered with various kinds of thatch. Thicker varieties of bamboo like the *bhaluka* and *jati* were split to make the *kami*, *ruwa* or *jethi*, the strips of the frame. The thinner bamboos like *bijali* or *mutukia* were used whole for this purpose. To prevent the *kamis* from decomposition due to rains and insects, these are immersed in water for a few days for seasoning. The horizontal strips were known as *kamis* while the vertical ones, which were split and interlaced with the *kamis* were the *ruwas* or *jethis*.

Roofs were of two kinds depending on the technique of binding the frame, *hendali chal* or *sitali chal*. Various kinds of vines and vegetable fibres were used for binding the different members of the roof as well as other members of the structure. The commonest were scrapings from bamboos, called the *tamal*

or *tangal*, cane and creepers. The knots were also varied, *mata,*, *rupahi, tapa, thop*, *randhani*, and *hatisangora.* The roof was fixed in two separate places, which were never joined first and then raised up to the framework.

For thatching, straw of the u*lu*, *saran and barota* was used. Old *buruli* straw was also used for a lower stratum on which the new straw was laid, tightly bound between the *kamis* and then tied with *tamals* of two different kinds, *nalia* and *patia* or *pathis*. Other materials for thatching were leaves of the *takau* and *jengu.* While laying the bundles of straw, they were first arranged at the *panipota* and then gradually laid towards the top or *mudhach.* These were summed by tying and this was known as *madaliwa.* The protecting straw from the *panipota* was the *aola* and these were to be trimmed only on an auspicious day. When complete the house was sprinkled with a little water.

Roofs were also of other types: *dui chalia, tini chalia or chauchalia*, and *tup-dia* or domical. The general process of roofing is the same. The shed which was sometimes attached to the *mudha* was called the *chali.* When a house had a low *mudha* such a house was called the *chandapara* type. The plinth and the floor area were trampled hard by tying cattle there for some days. This was also considered auspicious.

Naora :

Naoras were inserted to protect the space between two rooms from rain water. These were made from the carved trunk of the *Chowa* tree, cut in half length wise. The *dhapalika* fixed at the *tup* was known as the *chhoi.* The *dhapalika* when used for the *namghar* was called the *dhekeri chali.*

Store house :

The *bharal* was made in a little different manner. It was built on a raised platform for keeping paddy, on posts called *dhum* or *thum,* and made of trunks of trees or stone. On these were laid length wise planks of wood or *dham.* This

was called the *gadhoi* or the *dadhari*. On it was fixed a bamboo matting wall or *choudhala*. The upright sticks were known as *litikai*. The two ends of the *choudhola* were joined by means of a splintered bamboo called *pota*. The inner walls of the *bharal* and those of the *mer* and the *duli* or the paddy silo were all plastered with cow dung only.

Goat shed :

Goats were kept on a raised platform or *chang* of bamboo for resting. Sometimes a separate shed was constructed with a *chang* for goats, or a *chang* was made in a section of the *gohali* itself. Pigeons were kept in the *tangi-ghar* which was a small box-like structure on the top of a long pole. Otherwise old broken earthen pitchers were hung from the roof with the mouth parallel to the ground, for the birds to enter. Ordinarily, a bamboo was hung horizontally from the roof to serve as a roost for pigeons, which were often domesticated. Ducks, chicken and pigs were kept in round shelters covered on the top and having a small semi-circular entrance. These *garals* were of woven bamboo matting fixed to poles in the ground.

Partitions :

Partitions were either of bamboo matting fixed to frames and poles or were made from *ikara* (reeds) and bamboo splinters and scrapings. The bottom of the partition was protected from direct contact with the clay floor by inserting it into a long bamboo pole split length wise and cleaned inside. This bamboo pole was the *barta* or the *garila*. It was raised on a low bamboo leg *kukur,* cut in a special way. At the corners where the two walls meet, the *pola* bond, already described, was used. It, as well as the walls, were plastered with cow dung and clay. To this mixture, rice-husk and crushed oil seed cakes were also

added. Coloured earth or earth of ant hills was sometimes added in the plaster to colour the walls. In some places earth from crab holes was also used for the same purpose.

Doors and Windows :

Doors and windows were usually of wood and are made by the village *barhoi* or carpenter. But simpler and cheaper houses used bamboo and leaves for the same purpose. Such doors and window panes were made from leaves of bamboo or *Takou* trees. Doors were of different types, namely- the *dang-dia* (where two wooden hinges support a long bamboo or *dang* as an obstruction), *salakha lagowa* (an arrangement made with bamboo and a bamboo nail to be used as a bolt). Doors with the *dang* or bamboo bolt for closing at night to be closed from within. The door step was fixed with a bamboo pole *gar ali* or *duar-dali* serving as the threshold. A bamboo lattice was attached at the top of the door in the manner of the Pan - light of Western architecture. The door was made to revolve on a bamboo hinge or *ghur-ghuri*. Inside a room, bamboo mezzanine floors or *atal* were sometimes fixed for keeping things not in constant use. The floor was usually stretched from one *choli* to another.

House building was always a co-operative venture in Assam. People helped each other in every job including procuring raw materials like wood, bamboo and straw from the forests in the month of *Phagun* . The house was not only a place to live in, but also an institution in itself, in a society where the joint family system prevailed. Each family depended on the other for the construction, maintenance and repair of their houses.

IV. 1. 2. Architecture of the *Rajahua Nam Ghar* (Community Prayer Hall) :

Every village or community has its prayer hall or *Namghar*. In the Satras, however, the *Namghar* is called the *Kirtan ghar*. Some people also call it *Gossain Ghar*. The adult population divides itself into groups and they work

voluntarily for the construction of the *Namghar*. Design and planning of the *namghar* is special. The general plan of the Assamese *namghar* is as follow :

The *Namghar* complex consists of three or four rooms and structures. They usually consist of the *batchara, chon-ghar* and the *manikuta*. The *batchara* is simple and has only a *duchalia* form.

The *Namghar* faces the east. At the western end of the building is the *tup* or the tope or dome. The *tup* is formed by means of curved *kamis* which are wrapped with jute or cane. Where the *tup* begins, a round piece of wood with a handle is inserted into the poles of the *mudhach*. The door towards the *tup*, being the main door, is called the *mukh-duar*. The jambs and the lintel are carved with various designs and this kind of carving is called *meharaji*. Doors with carvings of lions are known as *simha-duar* and those with floral scrolls are the *phul-tetelikata-duar*. Open faced lotus flowers were also common motifs.

A *Namghar* consists of three, five or seven chambers. In the last room, leaving the area under the *tup* is kept the *daba* or the drum, either at the northern or the southern end. The *daba* is kept on a platform with three legs. The doors are fitted with bolts for closing from within and are fitted with *kalasa* (pitcher) shaped handles on the outer side. The doors on both sides of the length of the building are called the *petduar*. The wood of the *chati* is carved with lotus designs. The date of construction is cut into the *bar chati* or the main *chati* which is held by the *lai-khuta* or the main pole. An *aatal* is made, joining the *chatis* on which are kept the *chons* and the *mukhas*, the masks and other accessories for the *bhaonas* or dramatic performances, based on the epics and the *Puranas*.

In a *Namghar,* the first chamber from the east is reserved for the *Asana* or the *Simhasana* containing the sacred book. Of the next pair of poles, the one to the north is the *lai khuta.* To the south, near the *Asana,* the *Brahmanas* and women sit to the north of the room. The other devotees sit to the westwards of the *Lai-Khuta.*. In this arrangement, people who are directly connected with the *Namghar* , like the *Udasinas* and the *Bhakats* , get the front rows. But people of lower classes and tribal occupy the back rows. Although, *ekasarana-nama-dharma* denounces caste distinction it persists even in the religious life of Assamese Vaisnavism.

In the chamber containing the *asana* are placed wooden sculptures of *Garuda, Hanuman* and *Larua-Gopal* or *Gopala* holding a ball of butter. To the left of *Asana* is kept the *gacha* or the main lamp either of wood or of metal such as iron or brass. The elaborate ones have many branches and some even contain a hundred lamps. Such *gachas* are known as the *Saikiya gacha.* To the south of the *Asana* is kept the *thaga* or the *thagi,* the wooden stand for keeping the *Bhagavata* while the prayer goes on. In a *Namghar* with no *Manikuta,* arrangements for the *prasada* etc. the utensils and ritual objects are kept in the first chamber. In the section to the west of the *laikhuta* sits the main reciter or the *nam-lagowa,* and to his right sits the group of repeaters. During a *bhaona,* the *gayan-bayan,* or the choral and orchestral group sit in the section ahead of the one under the *tup.* The centre is left free for the actors or the *Bhaorias* to act. The *Manikuta* is to the east of the *Namghar* across the main structure. The *Manikuta* has a *duchalia* roof. This chamber is like the *Garbha griha* in a Hindu temple. In this chamber is an *Asana, Gacha, Thaga, Tal* or brass cymbals for use at special services for the members of the inner circle,

such as the *Udasinas* and others. Women are not allowed in this sanctum sanctorum. In more elaborate structures there is a special chamber for depositing the *padasila* and the *kharam* or wooden sandals. A separate *choan ghar* or greenroom is attached sometimes in greater and richer *satras* and their *Namghars*. (Dasgupta,1982:47-49)

IV. 2 . TRADITIONAL HOUSES OF DIFFERENT TRIBES :

IV. 2 . 1. Traditional House of the Meiteis of Manipur :

Tribes of Manipur build beautiful houses for different purposes. Manipuri architecture is variedly designed, colourful and expensive. One of the most remarkable art in the Manipuri architecture is wood and bamboo carvings. In order to build a house with carving, the tribals needed a lot of men and materials. If a person in the village accumulated a lot of paddy, the community forced him to build a house. In construction of a carved house the person exhausted all his wealth and had to live a miserable life.

III. 2 . 1. 1. Rituals Related to Construction of a House:

Before constructing a carved house, the tribals performed many rituals with feasts. In Mao, the tribals perform at least four important rituals in the months of *Chothonekhro* (January) and *Chosolopra* (February). Some times they also perform these rituals earlier. After the rituals, and feasts, the Mao tribes construct three types of houses namely *Onymosochi, Ochiyaho kosomychi* and *Uripi koyhiinmchi.* When the house owner had to construct the *Onymoschi*, he had to spend five days without consuming rice, only on drinks and meat. While the man who intended to construct a *Ochiyo kosomychi* type of house , had to spend one solid month only on wine and meat.

In Tungam area, only two types of houses are built namely *keeche* and *kolamthrok*, during the month of *Asiilompra* (January). The houses in the Purul area are *puki* and *ngaiki.* At Oinam, people build three different types of houses

namely *posingka, reeka* and *pongka.* Again the houses build by the Tangkhuls are *khunchon, kharuk* and *sheikhui.* The elders of Nungbi tribe build three types of houses, such as: *phen saam, phen salaka asari maksa* and *sambat takakasa.*

The Kabuis also build as many as seven types of houses. These are namely *pumchan kai, lakpui kai, sianlongpui kai, hoi kai, thingpu kai, uche kai*, and *khong kai.* These houses are build for different purposes and with different types of materials. *pumchan kai* or *talangkai* is a special type of house of the Kabuis. There are some social bindings for building a *talangkai* house. Until and unless these social demands are fulfilled one cannot build a *talangkai* house. At Lakhumbai, if a Kabui is able to kill tigers, only then can he build this type of house. In some other places, only he can build a *talangkai* house , who has killed a tiger, ten mithuns and a hornbill. There is a belief that one who can live in a *talangkai* house, his soul will go to heaven. All the girls and youths of the village come to see the building of the house. The owner feeds the youth and girls with food and wine and the guests also help in erecting the pillars of the house. There should be a minimum of 35 pillars in this house (Bahadur, 1996 :24).

III. 2 . 1. 2. Construction of a House :

In Senapati, Tamenglong and Ukhrul districts tribals do not construct a mud foundation or a raised platform for a house. They use piling method for construction of a house. The pillars of the pile system are made of varieties of wood and bamboo. The walls are made of plaited bamboo. They have a veranda of various sizes. Often a veranda in itself is of the size of 4 metres in length and 3 metres in breadth.

Roofs of most of the houses are made of thatch. Roof skeleton is made of bamboo sticks or rods and are tied with bamboo strips or creepers. Pattern

of the roof is like an inverted "V". The rear portion of the roof have a low inclined angle. Most of the gable ends reach an approximation of the floor.

In some places the pillars and walls are also made of wood. The wall planks are made of one solid timber hewed with axe, hence these are very thick. Breadth of plank may vary from 45 cm to one metre. Planks are tied to the wall with strong creepers or vines.

Normally a house is divided into three rooms. Sometimes the rooms are not partitioned. Doors are usually situated in the front wall occupying a larger portion of the front wall. They prefer a south facing front door. Door facing the south is larger than the door facing the north. Traditionally a house facing the south is considered best.

The *tangkhul* houses are normally ten metres in length and six metres in breadth. There are also houses of 21 metres in length. In the Senapati district, houses are usually 9 to 12 metres in length and 5 to 6 metres in breadth.

After construction of the house, in order to add beauty and grace to the house and as a sign of identification of the tribe a crossed wooden plank is erected in the top. This is called *chirong.* The *chirong* is decorated with variety of carvings and painted. Houses are decorated with skulls of animals and birds they killed . Usually these decorative pieces are kept in the veranda of the house (Bahadur, 1996: 30).

III. 2 . 1. 3. Dormitory:

A common house or dormitory is common in most of tribal societies of North Eastern India. These dormitories have different names. Usually dormitories are constructed by the society for proper social training and education of the youths. There may be separate dormitories for girls and boys. The tribals

of Manipur give different names to these dormitories. The Kabuis call it *khangchang* or *khangchu*, the tangkhuls *yellong* or *yaranlong*, the Marams *rangki*, the Maos *khrechiyeku* or *ekhrochi*, the Thangals *khalang* etc. (Bahadur, 1996 : 34).

IV. 2 . 2. Traditional House of the Angami Nagas of Nagaland :

There are many clans and sub-clans of Nagas. They built varieties of traditional houses. But most of them built in a common architectural plane. The typical Naga house is built in one storey on the ground, the bare earth roughly levelled forming the flooring. A typical Naga house varies in length from 30 to as much as 60 feet and width from 20 to 40 feet. The front gable which is often furnished in case of man of wealth with heavy beams carved with the heads of mithun or man. Other symbols of riches or valour, rises from 15 to 30 feet in height, while the back gable is usually lower, being only about 10 to 15 feet high. On each side the roofs almost touch the ground, doubtless to secure the roof from the stormy winds. The house is constructed by setting up eight posts , four on each side, with four higher corresponding posts, to bear the roof tree, down the centre of the house. These posts are notched at the top, the arms of the notch being equal length, and a hole bored below the notch to take the cane lashings which secure the roof tree, and the beams for the two sides, which are laid over the top of them and securely tied with cane thongs passing through the hole. The post both upright and horizontal are merely trees roughly trimmed. On this framework, an open trellis is made of split bamboo crossing one another at right angles and similarly tied with cane thongs. On this trellis, the roof is constructed. The roof is of four degrees. The first degree is of plain thatching grass, any one is at liberty to roof his house thus. The second degree has the front gable edged by two barge boards running up from the eaves to the

point of the gable. For these and for the further marks of social distinction the builder of the house must duly qualify. In the roof of the third degree these barge boards are continued into two great massive horns of wood known as *kika,* " house horns", usually board with a round hole in their palmated ends. The object of these holes is to be to reduce the resistance offered by the horns to the wind and so lessen the likelihood of their being destroyed.

The sides and back walls of the house are generally of bamboo matting from the ground, though they are occasionally built up of dry masonry to the height of three feet or so. The front wall is made of great boards of wood to the making of one of which the whole thickness of a tree must go, while the partition is made of smaller planks. Those in front are often carved with the heads of men. mithun and pigs etc., usually represented by more or less conventional designs. These planks are dug into the ground at the foot and kept in place by cross pieces formed of two smaller beams, one on one side and one on the other, tied at intervals with cane thongs, and resting on the side beams connecting the corner posts.

The building of a new house is attended by certain ceremonies. When a site has been selected, the man who is going to build goes and places two flat stones on the site, that night he dreams, and if the dreams have been favourable, the next day, which must be working day, he goes in the evening with his wife, taking fire, fuel, a fowl and other food, and builds a fire place with three stones and makes a fire. The couple sit for a few minutes and take their food and return and dream again that night. If they do not dream of copulation, excretion, or any other ill-omened thing , the site is definitely adopted.

The interior of the house is divided into three compartments. The front room comprising half of the length of the house, contains the paddy, which is stored in great baskets of from five to eight feet high ranged along one or both

of the side walls. The second compartment is separated from the first by a plank wall in which there is an unclosed, opening by way of doorway. It contains the hearth, composed of three stones embedded in the hearth so as to form a stand for a cooking pot set over the fire which burns between them. On two of the inner sides of this fire place are rough planks raised about two feet from the ground and laid level so as to form beds. Behind this compartment there is usually a third of three or four feet only in depth, but extending the whole width of the house. Here is kept the liquor vat, a hollowed section of a tree with three legs. The door in front of the house is made of solid wood and is fastened on the outside by a couple of large sticks or bamboo crossed through a fibre or hide along that passes through the middle of the door and is supported against the wall on either side by the weight of the door itself- sometimes a wooden socket of a piece with the door is provided to take a cross bar. When inside, bars are fastened to the wall on each side.

Apart from carving on the front beams there is little ornamentation about the average house. Rich men however sometimes adorn the fronts of their houses with painted representations of men and women, of shields ,of mithun, hornbill feathers and geometrical designs usually in the form of concentric circles. Inside the porch and the front room are the skulls of animals killed by the householders in the chase or slaughtered by him on festal occasions. In some houses particularly those used as morungs, huge reproductions in white pith and coloured wood of ordinary Naga bead necklaces are to be seen (Hutton,1969:49).

IV. 2 . 3. Traditional House of the Khasis of Meghalaya :

The traditional houses of the Khasis are substantially thatched cottages with plank or stone walls, and raised on a plinth some two to three feet from

the ground. The only window is a small opening on one side of the house, which admits but a dim light into the smoke -begrimed interior. The beams are so low that it is impossible for a person of ordinary stature to stand erect within. The fire is always burning on an earthen or stone hearth in the centre. The firewood is placed to dry on a swinging frame above the hearth. In the porch are stacked fuel and odds and ends. The pigs and calves are generally kept in little houses just outside the main building. The Khasi houses are oval shaped, and is divided into three rooms, a porch a centre room, and a retiring room (Gurdon,1975:30).

IV. 2 . 2. 4. Traditional House of the Daflas of Arunachal Pradesh:

The traditional Dafla house is a long hall erected on poles. The width of the house is usually 18 to 20 feet, but the length varies depending upon the number of hearths. It is not unusual for a house having more than ten families to run to a length of more than 50 yards. The walls are made of twilled mats, and the floor of flattened bamboo. The thatches used are either dried plantain or cane leaves and millet or paddy straw, or the thatching grasses commonly growing wild in abandoned clearings. At the rear end of the house, above the ground is the *tumko*, a spacious platform of wooden beams, usually half open and half covered with thatch.. On this will be found a small structure of split bamboo and kra leaves representing Yobu Wiyu, the god of the chase, and one or two sharpening stones. A notched ladder placed slantingly connects it with the ground below. The other end the house is the *batung*, a small porch with one or two mortars and pestles for the pounding of grain. This is not much above the ground and serves as the main entrance and exit for all. The doors opening on the back platform and the front porch are either sliding shutters of matted bamboo or crude wooden planks.

A little away from the house lie the granaries. The distance is planned on purpose as it saves them in case a fire breaks out. The pigsty is often sited near the porch and is reached by two logs connecting it to the latter. Around the house, at convenient places, may be found the *yugings* or ceremonial structures of past sacrifices, often lavishly decorated with bamboo shavings, and rings of bamboo strips as well as the structure where the dead lie buried.

Within the house the fireplaces run in a row, along the centre and parallel to the *nyodang*, each being something like a square of two and a half feet, with the traditional three stones to support the cooking pots. Over these hang two, and occasionally three, wooden trays one above the other for drying firewood, grain and meat. Above the trays is the ceiling on which are kept the unused baskets, a few large gourds and the fermenting millets tied in leaves. The loft is reached by notched ladders which, when not in used, are left lying in a corner.

The main wall of the house called *nyodang* is prominent from the domestic point of view. The members of the household sleep on this side of the house and, occasionally, enclosures are made to keep the various household articles. The opposite wall, *koda*, has one or two racks for keeping the articles such as bamboo tubes, gourds and earthen pots. In many houses may be found a few large rough conical baskets hanging on the *koda*. These are used for brewing beer on various occasions such as marriages. Hearth to hearth partition is not universal, though over wide areas privacy is achieved by partitions, with doors closed with mats at night. There are a few openings in the *koda* wall but rarely any in the *nyodang*. As a result, the house always remains dark and is filled with smoke fumes struggling to escape through the thatch.

The Dafla themselves construct their houses. There are no professional house builders. Every young man of a village acquires this skill by participating

in the actual constructions. Some of the elderly men, however, are more skilled than the others. Their technical guidance and suggestions, therefore, are invariably taken. If such a man is not available in a village, he may be called from another and requested to supervise the work.

A Dafla house lasts for over three years. The house materials are wooden beams and posts, cane or banana leaves or other thatching materials. These are collected well in advance. Usually the collection takes two to three months. The long and thick posts are cut and straightened. The banana and cane leaves are dried. These materials are available in nearby jungles, but the cane and bamboo are sometimes brought from distant places to the site of the building (Shukla, 1965: 10-13).

IV. 2 . 2. 5. Traditional House of the Tiwas of Assam :

The pattern of the house of the Tiwas of Assam is almost similar to that of the Boro Kacharis. They construct their houses on plinths. Thatch is used for roofing. Walls are made of reeds and bamboo. Generally bamboo posts are used in their houses but the well-to-do sections use wooden posts. The plinth of the cooking house (*barghar*) is raised about two feet above the ground in order to distinguish it from other apartments or cottages. *Choraghar*, an out-house is constructed a few yards away from the main house where the guests are entertained and the unmarried boys sleep at night. Now-a-days in most of the Tiwa villages the *choraghar* is replaced by a portico or an additional house near the main house. In between *choraghar* and *barghar* there is a *majghar* which is used for sleeping purposes. The *majghar* has two or three rooms The *barghar* also has two rooms,- one meant for the household deity and the other for cooking purposes. Generally, the room towards west is used for the household

deity. It may be mentioned that the main post of the *barghar* (*thunakhuta)* is planted after completion of the construction of the house. This post does not touch the beam. Except gamari wood no other variety can be used for *thunakhuta.* If such wood is not available, bamboo may be used. Except Gharbura, Zela and Hari kuwari nobody should go near the *thunakhuta.* People belonging to the Mikir (Karbi), Kachari and Koch only are allowed to enter the *barghar.*

The granary is constructed towards the east. Those who do not posses granaries, a corner of the living room or *choraghar* is used for the purpose. There may be a cowshed near the granary. The hill Tiwas prefer to store their paddies in *kerehi* ,(a big container made of barks of trees). Certain taboos are observed in connection with the granary. One must not enter the granary in the month of *Magh* (January /February).

There is a courtyard in front of the Tiwa house. It is encircled by houses with a passage on the eastern or southern direction. In small families the court-yard is in front of the house. It is used for drying paddies, thrasing and such other activities.

There is no provision for windows in a traditional Tiwa house. There are wooden or bamboo doors in each apartment. A verandah is constructed attached to the *choraghar* or *majghar* which is used for sitting purpose. The hearth inside the house is considered sacred and entrance to this place is restricted.

Houses are constructed facing east or south. Richer persons fence their compounds with bamboo fencing. House building materials are collected from the neighbouring forests. Many families in each village possess bamboo grooves.

It may be mentioned that whether it is construction of a house or harvest-ing the paddies, the Tiwas co-operate with one another. Thus if a villager wants

to construct a house, he formally invites the youths of Samadhi to construct a house. The youths of Samadhi completes the construction in a day or two. In lieu of their services, the owner of the house has to entertain the youths with "Zu".

Every clan has its *barghar* (place of community worship) for the clan or *bansha* members. It is a hall constructed in the campus of a respectable clan member. The rules and procedure of the clan *barghar* is same as those prescribed for family *barghars*. In the *barghar* their there is no room for the altar. Besides the *barghar*, there is the Than which, however, is not a family or *Bansha* affair. The Than is constructed in an out of the way place, and there is no daily worship in all the Thans. A Than may be for the entire community e.g. Mahadeosal or Deosal (Sharma Thakur, 1985:29-31).

IV. 2 . 2. 6. Traditional House of the Garos of Meghalaya :

The Garos build beautiful houses. It is said that traditional Garo houses are earthquake resistant. They build their house on horizontal wooden beams upon which the posts are raised. The houses in average are about 80 feet in length. More than half of the house is open from end to end forming one long apartment for general use in which are the earthen hearths for cooking. On the right side are enclosures, little chambers screened off in which the married members of the family and females sleeps.

The house of the Garo chief is a large gloomy mansion about 260 feet in length and 40 feet in breath, raised on piles varying in height according to the inequalities of the ground, and supported by substantial posts of timbers rudely curved with grotesque figures and placed with the broad ends uppermost as more convenient to support the beams. There is an open balcony at one end of the house and a portion of the opposite end is reserved unfloored for stalling

date back to the 8th-9th century A. D. It is also said that the remains of Bamuni hill contain as many as seven shrines .

Some of the important specimen of Bamuni hill remains are - pavements, circular sculptured door step, cross shaped bracket and a huge ornamented lintel, door jambs with temple patterns and floral designs and Panels containing human figures.

VI. 3. Tezpur :

The modern town of Tezpur contains some of the most ancient and best remains of temples and buildings. It is stated by historians and archaeologists that the shrines and buildings of Tezpur remains were either incomplete or demolished. These remains are estimated to date back to the 10th - 12th century. The important specimens of Tezpur remains are divided into three sets of buildings These are- shafts of pillars and a huge lintel, door sill and the lintel which is huge in size determine the huge size of the door frame and a number of carved stones or pieces of pillars.

VI. 4. Singri :

There are exclusive ruins of temples at Singri in Darrang district. These ruins belong to Buddhist, Siva and Durga shrines of the 9th century A.D., as reported by archaeologists. Specimens from this area include carved stones, door frames, pillars, lotus carved stones blocks and other slabs. The remains belongs to a Siva temple of about the 11th - 12th century A.D.

VI. 5. Guwahati and Hajo :

The modern city of Guwahati and many of its neighbouring places still contain various architectural remains. The antiquity of the shrine at Kamakhya is well known. The present Kamakhya temple is not the original one. The original

shrine has been destroyed. The remains of the original shrine is found lying scattered. The remains belong to different periods of history beginning with 7th and 8th century A.D. The remains of the original temple was of very large size. The ancient remains of the original Kamakhya temple consists of - Carved blocks of stone, panels with beautiful carvings. Temple ruins and sculptured specimens lie scattered in many places in and around Guwahati like Umananda, Aswakranta, Urvasi, Manikarneswara, Sukreswara, Navagraha and other places.

Lying at a distance of about 20 kms from Guwahati, the Madan Kamdev hill contains ruins of shrines of Madana and Rati, seated in a position of embrace, the god and goddesses of sex.

The shrine of Hajo, dedicated to various Hindu and Buddhist deities, has great importance in the history of religion and art. An early reference to a Buddhist shrine there was made by Dalton, who noticed that the present temple of Hayagriva was built with old materials and upon an old Buddhist site. The temple ruins at Hajo, like that of Kedarnatha, contain beautifully executed sculptures.

VI. 6. Goalpara :

The undivided district of Goalpara contains scattered remains of temples and buildings. The place called Jogighopa still contains some relics recalling the influence of Tantrik Buddhism. These appear to be contemporary with the specimens from Kamakhya of 9th - 10th century. In Mornoi there are remains of brick built structures, sun temple and Siva lingas. It is said that the hill which is known as Surya Pahar contains one lakh Siva lingas. In the southern bank of Brahmaputra just opposite to Jogighopa, there are ruins of an old Buddhist shrine.

VI. 7. Nowgong :

The present district of Nowgong contains enormous ruins of temples and buildings, which may be placed between A.D. 600 and 1200. The remains in

the area show that the shrines were dedicated to different deities and some of the specimens indicate strong non-Aryan influence. Some of the important places having architectural remains in Nowgong are Akasi Ganga, Gosaijuri, Gachtal, Sitajakhala and Mahadeosal , Changchauki, Kawaimari and Yugijan. These places contain architectural remains like- pillars, door lintels, perforated windows, sills, jambs, pedestals with cravings of human figures and floral designs

VI. 8. Sivasagar :

The Sivasagar town contains many temple remains, brick built edifices and others. There are many temples dedicated to various gods, dated 9th to 12th century A. D.

VI. 9. Dimapur :

The ancient Kachari capital Dimapur contains temples, buildings, ramparts and tanks.

VII. CITIES AND CITY PLANNING IN ASSAM :

VII . 1. Early Period :

From references to a number of fortified cities in Assam it appears that defensive measures were thought to be primary when founding and building a city. The *Kalika Purana* is seen to have valuable information about some important cities of ancient Assam. It describes also six types of forts, namely, *jala-durga* (water fort), *bhumi-durga* (earthen fort), *vriksha-durga* (fort encircled by closely knit thorny trees), *aranya-durga* (fort surrounded by dense forest), *bala-durga* (fort manned by properly equipped army) and *sailaja durga* or *giri-durga* (mountain or hill fort). *Sailaja durga* may also mean a fort with walls of stone.

We have come to know about a few cities of ancient Assam from literature. The first and foremost was Pragjyotishapura, the capital city of Naraka and

before him the seat of Ghataka, the lord of the Kiratas. It was situated in the middle of Kamarupa (*madhyagam kamarupasya*) - was well protected by a *giri-durga* of *sarvatobhadra* design that was unassailable even by the gods.

Pragjyotishapura was apparently the most ancient city in Assam and references to it are also found in the *Mahabharata*. The *Harivamsa* also describes at length Krishna's exploits in Pragjyotishapura. The *Bhagavata Purana* describes the inaccessibility of Pragjyotishapura. Ancient Pragjyotishapura has been identified, on good grounds, with the site of Narakasurgaon, with the Narakasur hills as its most conspicuous landscape. It is situated near the southern part of the modern city of Guwahati.

The *Kalika Purana* also mentions several other cities of ancient Assam : Alaka, Chandravati said to be full of beautiful white buildings and places, Bhogavati, Varasana and Sonitapura, the city of Bana. The last has been identified with modern Tezpur.

In the *Yogini Tantra* we have a graphic description of a sacred *tirtha*, called Apunarbhava, with its shrine of *Hayagriva-janardana*. Apunarbhava has been convincingly identified with modern Hajo wherein is situated the temple of Hayagriva-Madhava. From the description it appears that the layout of a sacred *tirtha* did not differ much from that of a city meant as an administrative head quarter or as a centre of trade and commerce. The sacred city of Apunarbhava is said to be adorned by blue, red and white buildings (*prasadas*), with streamers of many colours flying from their tops.

The Bargaon inscription of Ratnapala, the second ruler of Brahmapala's line, informs about another fortress city, named Durjaya or Sri Durjaya evidently because of the impregnable nature of its defences.

The above information, gleaned from literature and inscriptions, furnish us with a glimpse only of a few of the great fortress cities of Assam.. Even allowing for exaggerations, usual in such references, it appears that the cities were placed in strategic locations, usually on river banks for easy means of communication (Barpujari,1990: 424-429).

VII. 2. Mediaeval Period (Ahom):

The earliest reference to a capital city during Ahom rule is to Charaideo in Sibsagar District. Sukapha, the founder of Ahom Kingdom founded the first Ahom capital at Charaideo in 1174 (1252 A D) Saka, (Gogoi,1990:78). The meaning of the word Charaideo in *Tai* language is " sparkling city on a hillock" (*Che*= City, *Rai* = Sparkling, *Dai* = Hill). It was also the capital of Barahis (Bodo), the rulers of Assam before the Ahoms.

Charaideo, about 10 to 12sq . miles in area, was very close to the Naga hills. Two minor towns, Rangkham and Chungkham, meaning in Ahom the "city of golden paddy" and the "city of golden gardens" respectively, were situated between Charaideo and the Naga hills. Rungpur and Govindapur were two other towns in the same chain of habitations.

The capital was later shifted to Gargaon, near modern Sibsagar, after the accession to the throne of the patricide Suklungmung in 1539 A.D. The new capital was surrounded by a huge rampart at the wishes of the queen of Suklungmung, who was known as Chaoching by the Ahoms and as Nangtyap Kham in her native Nara principality beyond the Patkai hills. The ramparts or Garh gave the name to the new city. The city was on the bank of the Dikhou,on a site known as Semena-bari or the "garden of Semena". Semena was only a common citizen. While making the circular ramparts, the king clashedwith Semena,

on whose garden part of the rampart was to be built. Since he would not give up his land, the king had to wait until his death before completing the ramparts.

Gargaon remained the de facto capital and cultural centre for about four centuries. Even after the capital was shifted to Rangpur and then again to Jorhat it aroused national pride and drew admiration, both from foreign visitors and enemies. The best description of Gargaon at its height of glory is found in the Mughal work in Persian, Fatiyah-I-Ibriyah of Tarikh-c-Asham (according of Assam), by Sihabuddin Talish, the historian who accompanied Mir Jumla on his campaigns in the east.

According to the account of Talish : "The city of Garhgaon has four gates of stone set in mud, from each of which to the Rajas palace, for a distance of three Kos, an extremely strong, high and wide embankment (*aal*) has been constructed, for the passage of men. Around the city, in place of a wall, there is an encompassing bamboo plantation running continuously, two Kos or more in width. But in the city the habitations are not regularly laid out. The houses of the inhabitants have been built in a scattered fashion within the bamboo groves, close to the *aal*, and every man's orchard and plough-land are situated in front of his house, one end of the field touching the *aal* and the other the house. Near the Raja's palace, on both banks of the Dikhou river, the houses were numerous and there was a narrow bazar-road. The only traders who sit in the bazar are betel-leaf sellers. It is not their practice to buy and sell articles of food in the market-place. The inhabitants store in their houses one year's supply of food of all kinds and are under no necessity to buy or sell any article." (Dasgupta, 1982:39).

The eastern section of the rampart was Rajgarh, the royal rampart; the western, Banhgarh, the bamboo rampart; the southern, Lahdoigarh and the northern,

Pathaligarh, the wide rampart. The actual palace was surrounded by an earthen rampart encompassing an area of one sq. mile. The capital itself was 12 miles long and 10 miles wide.

In short the city of Garhgaon appeared to us to be circular, wide and an aggregation of villages. Round the Raja's house an embankment has been made and strong bamboos have been planted on it close together to serve as a wall. Round it a moat has been dug, deeper than a man's height in most places and always full of water. The enclosure is one Kos and fourteen chains in circumference. Inside it, high and spacious thatched houses have been built. Outside the palace enclosure and around it were the houses of the nobles, including that of the Bar Phukan. These houses were large and built of wood; with spacious gardens and sweet tanks. But the beautiful city was ransacked by the Mughal army under Mir Jumla. Temporarily, the capital was shifted to Bakata. The city, being the capital, was successively destroyed by the Moamarias and the Burmese. The Moamarias destroyed important buildings by fire like the Baechara and the *Dolakakharia Chara*. (Dasgupta,1982:40)

Gradually, masonry buildings were built at Gargaon, the chief among them being the Kareng (palace) built in 1752 A.D. The stone gates were added to it by Pramatta Simha, as also the *Silsakos* (masonry bridges) over the Daraka river and the Garakhia Dol (temple of Langkuri or Siva of the Ahoms).

With the rise of the house of Tung-Khung, the capital was shifted to Rangpur, near the present Sibsagar. The new capital was basically different, most of its buildings being in masonry and stone. The era of wooden architecture was gone. This was symbolic of the gradual Indianisation and Hinduisation of the Ahom royal family.

In 1698 A.D. Rudra Singh founded the city of Rangpur. Since masonry buildings were a novelty in Assam he engaged an architect from Koch Bihar, Ghanashyam, who was later converted to Islam. Ghanashyam has been described in the *buranjis* as being or a foreigner. But we are unable to say with certainty whether he was really a Bengali by birth, or from some other part of India, since Bengal applied to all non-Assamese people, including Europeans. Ghanashyam built masonry buildings both at Rangpur and at Charaideo.

The city of Rangpur was bounded breadth-wise by the rivers Dikhau and Nawhang, and length-wise by the *singha-duar* and the *machhkhowa garh.* Within the city walls was the royal city, encircled by a masonry embankment, 18 cubits high. Outside it were the houses of the nobles. The area of the royal city was 423 *puras*. 3 *bigha*, 2 *kothas* and 8 *lochas*. Three gates led to the royal city; the *barduar* (the Big Gate) in the south, the *paniduar* (the Water Gate) in the East and the *na'duar* (the New Gate) in the west. The outer embankment was known as the *baj garh* and it contained the Palace as well as the *bhitar garh* (inner embankment) and other buildings. The *bhitar garh* also had three gates, of which the *darika duar* in the south was the main entrance. The other two gates were known as the *chaudang duar* and were in the charge of chaudangs. Of these, one was the *kalugayan duar* (*ligiri duar* or *mati gharar duar*) and the other was the *kamalabaria duar* (*gossaingharia duar* or the chapel gate). Between the *baj garh* and the *bhitar garh* was the *bar-chara* (main hall). At the head of the *bar-chara* was the *bat-chara* (Gate-House). The *kaluganyan duar* was used by the wives and daughters of high officials for going to the Princess's school (*kuanri tol)*. The abbots used the *gossaingharia duar* for going to the king to offer him the *prasad* or sacrament from the

temples. The barchara was used for the bar mel or general assembly, like the *diwan*-I-am of the Mughals. The *bar-chara* was 120 cubits long and 40 cubits wide along the dais. The Ahom counterpart of the Diwan-I-khas was the bhitaria mel. It was held in the Baghar.

The chief buildings of the capital were the *Talatal ghar* palace (1765), the Kharghar arsenal (1704), the Isanisvara devalaya (1773), the Ranganath dol (1704), the Haragauri dol , the Phakua dol (1704), the Ranghar(Sports Pavilion of Rudra Singh). The masonry Ranghar (1746), Rajeswar Singha's smaller Ranghar, the Natigosain dol, etc. many bridges spanned the ditches and rivers around the capital. Of these the Namdang silsako (1703) was the biggest. The royal roads were the Dubariani ali (Northern), the Paniduariya ali and the Khari Katiya ali. Other detached buildings were the Barpalsa dal and the Bagidal. The temple complexes and tanks at Jaysagar and Gaurisagar were also satellite settlements to the capital city of Rangpur (Dasgupta,1982: 43)

VI. I. 2. 1. Guwahati :

Guwahati was another important city of the Ahom, though in the initial stages it changed hands between the Mughals and the Ahoms. Although Guwahati ceased to be the national capital during the Ahom period, it still was the biggest town in Lower Assam. It was also the gateway to Assam, in the true sense of the term, though the actual frontier was about 100 miles to the west.

Guwahati, being a place of pilgrimage - it had the famous Kamakhya temple and a number of other temples and was primarily a city of temples. It was also a trading post. A detailed account of its condition in the late 18th century is found in the writings of Capt. Welsh. "at that time Gauahati was an extensive and populous town. It was situated on both banks of the Brahmaputra and extended to

the neighbouring hills. Along a portion of the river bank there was a rampart, on which were mounted hundred and thirteen guns of different calibre, including three of European manufacture. The only other fortification of any kind was a large oblong enclosure, a hundred yards from the river, surrounded by a brick wall six feet in height, with a narrow wet ditch inside and outside, and containing a thatched building, so large that the whole of the detachment found accommodation in it." (Dasgupta, 1982: 47)

VII. 5. Dimapur :

Dimapur was the most important of the tribal capitals, the others being Maibong and Khaspur for the Kacharis, and Jayantapur, for the Syntengs. By the first quarter of the 16th century Dimapur was at the peak of her glory and beauty. But the town collapsed and was abandoned by the rulers after their crushing defeats at the hands of the Ahoms in 1536.

The ruins of Dimapur, which are still in existence, show that, at that period the Kacharis had attained a state of civilization considerably advanced compared to that of the Ahoms. Dimapur, on the other hand, was surrounded on three sides by a brick wall of an aggregate length of nearly two miles, while the fourth or southern side was bounded by the Dhansiri river. But Gait also mentions local sources, according to which there was also a wall on the southern side of the city. On the eastern side was a solid brick gateway with a pointed arch, its stones pierced to receive the hinges of heavy double doors. It was flanked by octagonal turrets of solid brick, the intervening distance to the central archway being relieved by false windows of ornamental moulded brick-work.

The excellence of the mortar is shown by the fact that, although the building has evidently been shaken on various occasions by earthquakes, it is still in

a ground state of preservation. Inside the enclosure are some ruins of a temple or perhaps a market-place, the most notable feature of which is a double row of carved pillars of sandstone, averaging about 12 feet in height and 5 feet in circumference.

Some of these huge pillars are curiously shaped cylinders, with a narrow neck topped by a smooth bulbous top. There are some stylised stone pillars in the Dimapur group which are flat and imitate plant shapes similar to the cactus. There are also some curious V-shaped pillars which are apparently memorial stones. The nearest point at which the sandstone for these pillars could have been quarried is at least ten miles distant. It seems probable that rough blocks of sandstone were brought, set up and then carved on site; otherwise, they would definitely have been damaged during transportation and erection.

After the sacking from Dimapur, the Kachari kings established themselves at Maibong, a place on the bank of the Mahur river, surrounded by a wall, inside which the remains of several temples are still visible. The most interesting monument at Maibong, an unfinished rock-hewn temple, was excavated in the *Saka* year 1633 (1721 A.D.) during the reign of Harish Chandra Narayan The rock cut inscription at the above temple, dedicated to goddess Ranachandi, gives the precise date as the 5th of *Margasira Saka* 1643 (1721 A.D.). The temple is perched on a huge boulder out of which the structure has been hewn. It measures 21 x 11. But the temple was evidently not completed, since it had not been hollowed out when work was stopped..

VII. 6. Khaspur :

The last seat of Kachari government was Khaspur, which has about seven important buildings, all built before 1754 A.D. An inscription at Khaspur, dated

1771 A.D., refers to the building of a palace there by King Harichandra Narayan. It was a brick-city. Though the buildings were not very large they had delicacy of form and line. Terracotta decorations enhanced the beauty of these buildings. The chief among the structures are the Snan Mandir, on the bank of the Madhura river, the main Ranachandi temple, the Singh Darwaza and the Baradwari.

VII. 7. Jayantapur of Jayantias :

The Jaintia capital, on the western slopes of the Khasi-Jaintia hills, was called Jayantapur, or Nizpat Jayantapur. Apart from the palace, the grand temple of Jainteswari, the patron deity, was the important building which gave its name to the capital. The temple housed the icon of the goddess brought by Jasa Manik(1605-25) from Koch Bihar.

Another King "Lakshmi Narayan (1669-97 A.D.), built a palace at Jaintiapur. There is an inscription on the gateway in which its erection by Lakshmi Narayan is set forth. It bears an indistinct date which has been read as 1632 Sak, equivalent to 1710 A.D. But since Ram Singh was ruling in 1707, there must be some mistake. The correct reading is perhaps 1602 Saka or 1680 A.D.

VII. 8. Ahom Necropolis at Charaideo :

No account of the cities and towns of the Ahoms would be complete without mentioning the necropolis at Charaideo, which contains hundreds of graves of royal personages, princes, nobles and other dignitaries. Though the graves, or the *maidams*, were built at other places like Jorhat, Guwahati and Goalpara, according to the exigencies of the times, yet Charaideo occupies a position easily comparable to the cities of the dead in ancient Egypt and Shang China, though on a smaller scale. The graves contained funeral chambers filled with articles for the use of the dead person, including his slaves and attendants. These

Maidams were became rich stores of gold and jewellery. As a result, the eyes of the invaders fell on the sacred graves many of which they ruthlessly desecrated and plundered - mostly by the Mughals and the Burmese.

The Ahom royal circles, before their conversion to Hinduism, buried their dead. Afterwards, they burnt the dead and then raised a Maidam over the ashes. Maidams of the latter type were raised over the remains of kings Rajeswar Singha, Lakshmi Singha and Purandar Singha. The ashes were either taken to Charaideo, the ancestral cemetery, or were entombed at the place of cremation itself.

The area between Bibubar and Mathurapur, in the Charaideo region, has hundreds of *maidams* built in regular rows and groups. The *maidams* of the nobility are to be found at Kenduguri, Bakata, Sekerrapar, Khatpathar, and Charing. Like other public and royal building, the *maidams* were also under the supervision of the Changrung phukan (chief architect) , his Maidamia Phukan (supervising engineer of graves) and the Maidamia paiks (workers of grave)(Handique, 1959: 59).

VII. 8. 1. Construction Plan of Maidams :

The Maidams or burial mounds of the Ahoms , outwardly appear hemispherical in shape and their sizes vary from modest mound to a hillock of twenty metres or so in height, depending upon the power, status and resources of the person buried. Inside a burial mound generally exists a vault wherein the mortal remains of the dead is kept. A larger mound indicates a more commodious vault underneath. Mention is made in chronicles that a huge quantity of valuables and attendants living or dead were also buried with the royalty and dignitaries and a bigger and a spacious vault is usually indicative of the existence of larger quantities of riches and attendants inside the vault (Bhuyan,1962: 165).

The Ahom kings used to be buried along with their treasures , customary articles-cloths, ornaments, weapons and the paraphernalia of a bed chamber in specious underground vaults (maidams). Even some of their queens , numerous attendants, slaves and elephants were buried alive. Godadhar's tomb was the highest in structure and strongest in built. His corpse was said to be buried with thirty attendants. The practice of burying alive was banned by Rudra Singha. Customs however die hard; four people were buried with corpse of Rajeswar Singha and about a dozen with that of Pramatta Singha (Barpujari, 1990:243).

Sihab-ud-din Talish refers that the vaults were made of stout wooden poles and beams and it was from the time of king Rudra Singha (1696-1714) that stone and bricks were used. The most authentic and exhaustive records of the *Maidams* are contained in the chronicle *Chang-rung Phukanar buranji.* It reveals that a masonry *maidam* consists of three major features:-

1. A massive underground vault with a domical super structure crowned with a small pavilion known as *chow-chali* (meaning four roofed cottage).

2. The hemispherical earthen mound covering the entire masonry work excluding the *chow-chali* , often pitched with one or more layers of brick flat on its surface.

3. An octagonal boundary wall around the base of mound having an arched gateway on its west.

The bottom-most part of the maidam is known as Garbha griha or Garbha. The construction of the masonry Garbh griha was preceded by covering it entirely with earth except the small funerary temple. Thus in course of time tropical, vegetation covered the Maidam entirely and it looked like a natural mound topped by a small temple (Dasgupta, 1982: 44).

VIII. ROADS AND BRIDGES :

The medieval chronicles mention building of ramparts, fortifications, barricades , roads and bridges. The earthen ramparts with a flat top and slopped sides are common. To stop erosion by seasonal water and also to save the earth work from burrowing animals, the ramparts were often reinforced at its core with a brick wall. This method is seen both in case of the Ahoms and as well as Kacharis. Block stones and bricks were extensively used in erection of ramparts. The old Kachari capital of Maibong contains several massive ramparts of bricks. Capital and residential establishments enclosed by high and huge ramparts are noticed in places like Bhaitabari (Goalpara district), Sahe Rajar garh (Darrang), Pratapgarh (Sonitpur), Rangpur and Gargaon (Sivsagar), Pratimanagar (Dibrugarh) and Maibong (N.C.Hills).

VIII. 1. Bridges (*Sako*) :

Tradition of building bridges (Dalang or Sako) over channels and rivers is considerably old. In the pre-Ahom period a magnificent bridge was built over a channel of river Barnadi and " is situated about 8 miles north west of North Guwahati" on a high road . This bridge was 140 feet long and was possibly used by the first invading Turkish army in 1205-1206 A.D. It was made by the later Kamrupa kings but destroyed in the earthquake of 1897 (Hanney, 1851:8).

In the first half of Ahom period, bridges over the rivers were made of wood and bamboo. Later Ahom kings constructed stone bridges. The earliest extant of stone bridge (Sil-sako) of Ahom period is one at Gargaon , over the Darika river . It was built in the early part of 17th century during the reign of Pratap Singha. This bridge joined two segments of Dhodar ali cut by Darika river. Some stone bridges (Sil-sako) made in Ahom times are still in good condition.

Of these stone bridges the Namdang stone bridge is famous. It was constructed over the Namdang river in 1703, by Rudra Singha. The bridge was made by tunnelling through a massive stone. Surface transports are still plying over this bridge. The Namdang bridge measures two hundred and two feet in length , twenty one and a half feet in breadth and five and half feet in height. According to history of Chang-rung Phukan building of this bridge was started on 10th day of Pausa and was completed on Phalguna of the same year (Gogoi,1957:28). Ahom chronicles mentioned 10 stone bridges or Silsakos . Some of these bridges were constructed on the rivers namely Dijai, Darika, Dimou, Rahdai , Nafuk and Hanhchara. Apart from Namdang, out of these bridges only Darika and Dijai bridges are running in good condition, others are in ruins. These stone bridges were made of stone slabs nailed with stone nails on stone beams and pillars (Handique, 1959:16).

VII. 2 . Roads (*Ali*):

Ahom rulers had established strong public works department, which was responsible for construction of roads, embankments, ramparts, tanks, temples, buildings and bridges. There were special officers to look after particular works. Constructions of roads, temples, tanks etc. were considered as works of piety by the Ahom kings. Therefore, almost all the Ahom kings, executed public works of one type or other. The following are the roads constructed by different Ahom kings in different times:

King Sudangpha (1439- 1488) - Rajmao ali.

King Sukleng mung (1539-1552) - Gargaonr ali, Naga ali(from Bar ali to Naga hills), Kahikuchir mathauri (embankment of Kahikuchi), Nimana garh, Changinimukhar mathauri.

King Sukhampha (1552-1603) - Nahar ali, Pengera ali, Debera parar garh.

King Pratap Singha (1603- 1641) - Bah gar, Mera garh, Chotala garh, Ladoi garh. Raj garh,Kotaha garh, Numali garh, Rangali garh, Chamdhara garh, Dafala garh, Chaiyangar garh, Naga garh, Mahangar garh, Chinatoli garh, Solal garh, Bar ali, Chatai aliParbatar ali, Mekurikhowa ali, Shukati ali, Chaiyangar ali, Haripara ali, Jabakar ali,Bakatar ali, Katarikhamar garh, Hati garh, Lakhau garh.

King Surampha or Bhaga Raja (1641-1644) - Sologuri ali.

King Sutangpha Nariya Raja (1644-1648) - Mishimi garh, Engera garh, Sariah Buragohain ali.

King Sutamla Jayaddhaj Singha (1648-1663) - 41. Machkhowa garh, Bhomoraguri ali, Cheuni ali.

King Chupung mung ,Chakraddhaj Singha (1663-1669) - Tidanga Janjimukh ali, Guwahati nagarar garh, Itakhulir garh.

King Chutanpha ,Udayaditta (1669-1673) - Guwahatir bam garh, Guwahatir pani garh., Bairagi ali, Momaikata garh.

King Sudaipha , Parvatiya Raja(1677-1679) - Chintamoni garh, Kirai ali.

King Chulikpha, Lara Raja (1679-1681) - Dauki ali, Solaphukanar ali.

King Supatpha, Gadadhar Singha - Dhodar ali, Ramani ali, Barbarua ali, Halau phukanar ali, Khara garh, Rahdai ali, Akara ali.

King Sukhrang pha ,Rudra Singha (1696-1714) - Devi garh, Dubarani ali, Metekar ali, Kharikatiya ali, Darika ali, Tejir garh, Barpatra gohain ali.

King Sutanpha, Siva Singha (1714-1744) - Dhai ali,.

King Surampha, Rajeswar Singha (1751-1769) - Bahikhowa phukanar ali, Luthuri

kathkatiya baruar ali, Deka baruar ali.

King suhitpha, Gourinath Singha (1780-1795) - Bibudhi garh, Aidew ali.

Kingha Kamaleswar Singha (1795-1811) - Mahbandha ali, Kamarbandha ali, Susendebandha ali.

Other roads built by other kings are as follows - Phulung garh, Borphukan ali (Nazira), Mahmora ali, Molou gohain ali, Sa niya ali, Gomotha ali, Tarimuwa ali, Namati ali, Laokhowa ali, Shaiangar ali, Maria ali, Nalou gohain ali (Gogoi, 1994:87-89).

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Chapter - XII

SUMMARY AND CONCLUSION

CHAPTER-XII

SUMMARY AND CONCLUSION

SUMMARY :

In recent decades much interest has been aroused in the history of science and technology in the great non-European civilisations, specially in China and India. During the past thirty years historians of science in western countries have tented to reject the sociological theories of the origin of modern science which had a considerable innings earlier in this century. It has been seen that in the recent times Scientists and historians of science and technology are trying to unfold scientifically the forgotten chapter of the history of the intellectual development of the Indian people, namely the cultivation of experimental sciences. It is taken for granted that the ancient Indians, the Hindus, were a dreamy mystical people given to metaphysical speculation and spiritual contemplation. But the fact that the ancient Indian people , the Hindus, had very large hand in cultivation of the experimental sciences is hardly known in these days. It has been observed that apart from the vedic Hindus, people living in different distant corners of India have also contributed largely towards science and technology in traditional ways. North- Eastern India being the neighbouring part of China , the country which greatly contributed towards world of science and technology, has a considerable contribution towards traditional form of science and technology. A large amount of traditional science and technology has been explored from the traditional culture of various ethnic societies of North - East India.

It is already mentioned that there are misconceptions among most of the people about the terms 'science' and 'technology'. On a rather superficial level, this set of people tend to think that science and technology is the development of the modern age. Again, there is the popularly held view that people of traditional societies were ignorant about science and technology. It is also commonly misinterpreted that science and technology developed entirely in the West, the contribution of the East is nil or negligible in this regard. The present study is a humble beginning to fight against such misconceptions in the society.

The present study will be able to reveal, that traditional societies have always been a stronghold of scientific temperament. They have experimented, observed, made conclusions by trial and error and evolved their very own science and technology- which , with the passage of time, has blended with the traditional culture. Thus, every society has its own heritage of science and technology stored in its traditional wisdom. Traditional knowledge in science and technology is still relevant and useful to the modern society.

With the findings of this exploratory work , we will be able to say that the modern scientific methods, developed in the West, may seem very productive in the very first go. But, this, in the long run, has been proven to be non-sustainable. Against this, traditional technologies are found to be eco-friendly and sustainable.

Till quite recent times the widespread attitude have been that Western science with its powerful analytical tools has little to learn from traditional knowledge. However, scientists are now learning to look to the past for traditional knowledge and to perceive that the world is losing an enormous amount of basic research as indigenous people shed their culture and tradition. Findings

of the present work will establish the fact that there are lots of things to learn from the traditional societies.

It is already mentioned that the search for science and technology in traditional wisdom is a comparatively a new field of investigation. There are only a few scholars who have undertaken studies in this field. Apparently no serious attempt seems to have been made so far to study the elements of science and technology attributed to the traditions of the various ethnic groups of the north eastern part of India. The probe into elements of science and technology in the tradition and culture of various ethnic groups of North East India obviously involved a multidimensional approach with a multi-pronged methodology. An attempt has been made in the present work to identify the elements of science and technology in the indigenous culture of this region with particular reference to Assam by rigorously scrutinising literary sources, delving into the folklore materials, looking at archaeological evidences and by establishing contacts with folk healers, farmers, traditional technology practitioners and experts and veteran tradition bearers. I am sure that this a very small beginning of a very large work. I hope future scholars from science and humanities will give proper attention on this subject and will explore a large elements of science and technology from the traditional culture of the people of this region.

Taxonomy is one of the oldest arena of all sciences. Man has learnt to identify plants and animals, since the day they started the activities of hunting, fishing and gathering in search of food. Man has been analysing the characteristics of plants and animals over the ages and there has been a continuous attempt on the part of the various ethnic group, to give each of the myriad plants and animals, a name- and bring them under an organised classification.

Almost every society had developed their own system of nomenclature and classification of plants and animals.

In ancient India , there was a distinct group of scientists who worked on taxonomy long before the advent of Western taxonomy. They studied the anatomy and morphology along with the behaviour of plants and animals and tried to classify those. It has been observed that those system of classification was very much nearer to the modern taxonomy.

The oral and written literature of North East India, particularly of Assam , reflects similar studies in the field of Taxonomy. There are large number of riddles which probably are the result of taxonomical exercises of the traditional people. In the effort of taxonomical exercise, whenever something appeared enigmatic, the traditional Assamese taxonomist - in an attempt to compromise - created riddles- which in their turn, not only facilitated the classification of plants and animals, but also, added invaluable gems to the already existent literature .

Farmers all over the world have developed their own agrarian systems and this has come about within the framework of local possibilities and limitations of ecology within the social, economic and political structure .

There has been a great resurgence of world wide interest in recent times in analysing traditional methods of agriculture which has encompassed diverse areas, such as - agronomic methods, soil testing and soil classification, pest control and crop-protection techniques, irrigation, meteorology, agro-forestry etc. The knowledge of traditional agriculture is propagated by the traditional farmers and stored in the folklore and culture. This knowledge of traditional agriculture needs to be not just documented but also to be encouraged and helped to take its rightful place in the context of modern knowledge

Farmers of the north-eastern part of India traditionally developed many rare varieties of crop plants. Though there is no scientific data on traditional varieties of crop plants grown in the North East India, yet agricultural scientists have estimated the availability of more than one thousand endemic varieties of rice in this part of the country. A look into those traditional varieties will open the door to discovering many pest and drought resistant varieties.

Meteorological observations leading towards prediction of rainfall, scarcity of water etc. made by the farmers from the days of yore are found to be useful at this time of modern meteorological studies.

Plant diseases caused by various organisms are managed traditionally by the traditional methods of pest management. As the modern system of pest management is not eco-friendly and sustainable, therefore this knowledge is of immense importance in the present time.

"In ancient India, the only discipline that promises to be fully secular and contains clear potentials of modern understanding of natural science is medicine." This was the remark made by Prof. D.P. Chattopadhyay, in his book *Science and Society in Ancient India*, to provide argument for establishment of medicinal lore in ancient India as a positive science.

A distinct form of traditional medicinal system was prevalent in Assam since the days of yore. A rich body of traditional medical lore has been found in the oral and written form of literature of Assam. The traditional Assamese system of medical practice is called *bejali chikitsa* or *gharua chikitsa*. *Bejas*, the Assamese physicians applied medicines prepared from local herbs. This system is still living feebly in the traditional societies, which is proved to be a great repository of medical knowledge

In the past, the Koch and Ahom royalties of Assam had maintained separate medical department under trained officers and physicians to look after and prescribe indigenous medicine for both men and domestic animals. There are many treatise on traditional medicine of Assam. It has been found that the Assamese people traditionally used varieties of cosmetics and sex medicines for beauty care and treatment of sex diseases.

In ancient India, people had adequate knowledge of the diseases of farm animals and the methods of curing them. The Indigenous people of North-Eastern India particularly of Assam had also developed methods of curing and treating the various ailments afflicting animals. There are valuable traditional lore on diagnosis and treatment of animal diseases. Descriptions of symptoms of diseases of cattle, horses and elephants and prescription of medicines for those are found in many sources of traditional veterinary lore.

The early rulers of Assam particularly the Koch and Ahom kings kept large number of horses and elephants for defence purpose. Consequently a traditional science for taking care of horses and elephants has been developed by the people of this region. In the Darrang district of Assam manuscripts on traditional horse lore entitled *Ghora Nidan* has been found. Again under the direct care of the king Shiva Simha and his wife Ambika Devi a manuscript on traditional elephant husbandry was written, which is known as *Hastividyarnava*. It is an invaluable treatise on elephant lore containing information on classification and nomenclature of elephants, their modes of training, ailments and their treatment.

Fish is an essential article of food of the people of North Eastern India. Consequently, fish and fishing plays a significant role in the cultural life of the

people. It plays a vital role in moulding the minds of the people towards a rich tradition of conservation of rich fish diversity. Over the ages a large number of unique fishery technologies are developed by the people of this region. Fishermen of this region has traditionally gathered some amazing knowledge in fish behaviour. This body of knowledge has immense importance in the study of fish and fishery management. People of North-East India are traditionally using around eighty seven varieties of fishing implements. These fishing gears are unique in design and in their methods of operation. It has been observed that the people of this region has a through knowledge in the behaviour of the available fish species. On the basis of this knowledge they have developed various fishing gears suitable for fishing of those species. It is worth mentioning that most of the fishing gears are so designed that it prevents over exploitation and helps in conservation of fish population.

Over the ages, indigenous people have developed innumerable traditional technologies for sustainable development. They have devised ways to produce abundance from the forest without destroying the delicate balance that maintains the ecosystem.

Investigation of the religious and cultural heritage of Indian society reveals that they have, over centuries, provided a knowledge of nature and rules of natural resource utilisation. Sacred groves, sacred ponds, sacred patches of grass lands, sacred animals, and others are examples of traditions of conservation backed by religious sanctions. The preservation of biological resources by such traditions is of immense significance.

North eastern part of India has a long standing tradition of rain water harvesting by different methods. Construction *dongs* (traditional canal system)

and tanks for conservation and utilisation of water is glorified technology of water management in Assam.

People of other states of the North-East - Arunachal Pradesh, Nagaland, Meghalaya, etc. have developed various ways for conservation of nature and harvesting of water in the hills and valleys. They not only strategically harvest rain water but also use techniques for conservation of moisture and nutrients.

The history of the development of mathematics in India is as old as the civilisation of its people. Vast sacred literature of Hindus contains enough materials of the brilliant mathematical tradition of ancient India. Arithmetic was an important subject of study in the traditional schools of Assam. The man who was the pioneer in the studies of mathematics in Assam is Bakul Kayastha. He was the court intellectual of the royal court of King Naranarayana. The first original Assamese book on mathematics written by Bakul Kayastha is *Kitabat Manjari* . The Kayasthas of Assam had developed a kind of mathematics, in course of time, which is known as *Kaitheli Anka.* The *Kaitheli Anka* is the traditional form of mathematics in Assam. There are many examples of traditional form of arithmetical exercises in the oral lore of Assam. These are composed in the form of riddles and jests.

There are enough evidences of astronomical studies in early Assam. Traditional astronomists of Assam made significant progress in the study of stars and planets. India has been acknowledged as the stronghold of diversified and rich tradition of material culture. North Eastern part of India has always deserved special mention in this aspect. The people of this region have developed many traditional crafts and industries.

North East India is known for producing special and indigenously developed types of paper, writing ink, painting material and innovative methods to

preserve manuscripts and paintings. The idea of laminating paper or book covers is also regarded as an indigenously developed technology of this region.

Since the days of yore, edible salt was manufactured from fresh water brine springs of some areas of North East India. Surprisingly, this technology is still continuing and this salt is used by many of the local people, who consider that this salt has some miraculous medicinal properties.

Many of the natives of North East India have been using lime while chewing betel-nut and leaves, since ages. In Assam edible lime was produced by burning the shells of locally available snails. People of Khasi and Garo hills produced lime from mines from olden times. Various ethnic groups have developed traditional technology of dyeing fabrics with natural dyes. Natives of this region have identified large number of plants which are used for dyeing purpose.

Traditional culture of entire North East India is regarded as bamboo culture. Bamboo is the main material of all types traditional arts and crafts. Wood and bamboo is the main raw material for construction of houses and for making modes of conveyance like boats, carts and palanquins etc.

The ivory industry was an well established industry of this region . North East specially Assam was famous for ivory products.

India is the first country to develop a sound material culture by using various metals for manufacturing of different materials. People of India had developed various traditional metallurgical technologies. Some of these technologies have been proved to be the first of its kind in the world history of metallurgy.

The natives of North East India traditionally smelted iron ores and manufactured iron implements. The abundance of iron ore in the Khasi hills, developed

a rich iron culture among the Khasis. They have developed a sound technology of iron smelting and works.

Gold was found mixed with the river sands of many rivers of Assam The sonowals (gold washers) and the rupowals (silver washers) examines the sand of *chats* to discover gold and silver flakes in the silts. They have developed a traditional technology for collection of gold and silver flakes from the rivers and at the same time metallurgy of the same.

Manufacturing of gold and silver wares is an ancient profession of the people of Assam. Use of ornaments in ancient Assam goes back to a very remote period. There were also traditional industries on brass, bell metal , copper and other metals in Assam.

Literary and epigraphic records testify to abundant architectural activity in Assam in the past. In Assam the Kachari, Koch and the Ahom rulers built many secular and religious architectural structures .

The traditional Assamese houses are mainly constructed with wood and bamboo. Each type of house are used for different purposes and built in different architectural designs. There are many oral lore on traditional architecture of Assam. These lore were scientific and useful in construction of houses. Till today, people in rural areas obey the principle of housing, available in these lore. According to old literature that there were many fortified cities in Assam. Maidam or the burial mounds of the Ahoms had very high standard architectural structures. There was a chief architect in the days of Ahoms who was known as Chang Rung Phukan.. Ahom rulers had established strong public works department, which was responsible for construction of roads, embankments, ramparts, tanks, temples, buildings and bridges.

In the first half of Ahom period, bridges over the rivers were made of wood and bamboo. Later the Ahom kings constructed many stone bridges. Of these stone bridges the Namdang stone bridge constructed over the Namdang river in 1703, by Rudra Singha was made by tunnelling through a massive stone. Surface transports are still plying over this bridge.

Karhal or Cement was prepared in the days of Ahoms for construction of masonry buildings. This was manufactured by using different ingredients like jaggery, snail lime , stone lime, black gram xon (a kind of plant fibre) , fish oil, resin of sal tree etc.

Various tribes of North eastern India used to build different types of traditional houses. These houses are environment friendly. There are some examples of earth quake resistant houses built by people of north east region.

CONCLUSION:

Traditional technologies are usually spread by the practical demonstration and by oral communication. A particular technology may diffuse to a few neighbours or across the whole region. An innovation may have been developed for the particular ecological conditions where it originated, or by an artisan in a widespread industry. On the other hand, innovations which do not work may not spread at all or quickly fall into disuse if disseminated. Those who are interested in using a particular practice can get full details of raw materials, equipment and processes from the innovator of the device. The technologies are not covered by anything corresponding to patent or intellectual property rights which could possibly limit their dissemination.

Against this, an institutional innovation normally requires publication in one of a limited number of reputed - preferably foreign journals, before it can

be disseminated. And very often, the technology does not reach those who need to use it. Further, barriers to its free use are introduced by patenting the technology. Moreover, most published papers do not give full details of how the practice is to be actually used, neither are the authors available for consultation - without charge. However, in some fields such as agriculture and animal husbandry, the extension services provided by many research institutions do disseminate research results without or before publication. But wherever technology has been commercialised, aggressive salesmanship is required for its profitable dissemination.

Because of the fast erosion of traditional knowledge, it is essential to record as much as possible, before it dies out .Even more important, is the need to inform others that people at the grassroots level are carrying out research today and that they can do it too. The collected data, therefore, requires dissemination, through journals which reaches farmers and artisans The formalisation of traditional knowledge does appear to lead to institutionalisation, for instance, the 'Ayurvedic' system and the folk medicine. Members of such institutions, though accepted as part of the traditional system, either charge for their services or expect to be recompensed in some way .

The Supporting Culture :

A particular culture can be considered as a whole system of knowledge, of a way of understanding the complexity of the natural world so that rules can be laid down which lead to the preservation of that society. Such a culture effectively serves to maintain a production system that serves all its members while not endangering the environment. Culture determines what type of knowledge which is transmitted from one generation to the other, which innovations are to be encouraged, to whom and how the accumulated and new knowledge has to be spread and imposes restrictions on its use.

Sustainability is the moot point in our traditional technology which did not produce unemployment, did not overuse natural resources or pollute the environment. There was no value seen in the possession of an increasing quantity of material products or in a lifestyle that stressed comfort even at the cost of the environment and justice.

The folk knowledge are well known but the support given to innovation is not so visible. Tribal are normally looked down upon and ridiculed by the non-tribal communities. The latter particularly go out of their way to laugh at any tribal who attempts to improve his/her farming or try out any other traditional innovation. Tribal, therefore, are often sceptical and rarely disclose to outsiders of the experiments they undertake, with the result that outsiders think that they lack initiative and imagination as well as scientific curiosity. It is only when they gain confidence that they impart their knowledge to the non-tribal who genuinely desire to learn from them. It then becomes evident that the community support and appreciation for experimentation for what they do grows strong enough to counter the negative forces which the aliens normally projects.

The traditional values which such cultures promote, need to be compared with the values of the Westernised system. If the latter turns out to be different and, perhaps, contradictory, then the traditional systems could disappear unless the values are promoted, while the Westernised values are deprecated. The latter may itself be responsible for the destruction of much of the traditional systems over the last few centuries.

Preservation of the Traditional System:

There has been a recent increase in awareness, debates and action on the collection of information and preservation of traditional technologies, on the

revival of those that have fallen into disuse and on the present day relevance of traditional technologies compared to those of the West.

The continuing persistence of traditional technology and its revival now is a outcome of the Westernised system being unable to resolve the problems individual farmers or artisans face, since its so-called solutions are too expensive, damage the environment, produce unemployment and have other obvious defects. Further, the people are realising that the alien Westernised system is not interested in reaching them except for further exploitation, and that it is in fact dropping them out of the industrial employment system, particularly after the liberalisation process was begun. These are the people who need technologies that will allow them to survive with dignity and this is where traditional system has an important role to play.

The educational, health and other Westernised sub-systems demean traditional systems. It is very noticeable that members of tribal communities who have been through the formal educational system do not know the uses of forest and most other plants, and often cannot even recognise common species. It does not seem possible that the formal education system can replace the traditional transfer of knowledge from parents to children as well as between siblings, which is based on continuous observation and practice in the field.

The forest and other natural resources are also essential for the preservation of traditional technology. Knowledge can be lost when the base for its practice degenerates, for instance, when deforestation destroys the plants from which medicines and other products are obtained its leads to disuse of traditional knowledge.

The need of the hour is a mass support to these traditional practitioners by using their products in preference to those produced by unsustainable means. Their existence will be vital to our survival when the non-sustainable Western system reaches its unavoidable limits.

Today vast archives of knowledge and expertise are spilling into oblivion, leaving humanity in danger of losing its past and perhaps jeopardising its future as well. Stored in the memories of elders, healers, midwives, farmers, fishermen and hunters, in the cultures of the indigenous people, is an enormous trove of wisdom. But the indigenous people are dying out by being absorbed into the so-called modern civilisation. With the loss of traditional culture we are also loosing the irreplaceable knowledge stored in it.

It is observed as an inference of the present work that - over the ages indigenous people of north eastern India has developed many traditional technologies. The main characteristics of this set of technology are : it is researched and developed by the common people, it uses indigenous and usually low cost resources, it is of immediate relevance to the people. After s detail study of the traditional technologies of North- East India the realisation should come that - these are not merely sets of techniques handed down from generation to generation. These are the elements of traditional research and development that are socio-culturally relevant and sustainable.

The north-eastern part of India, though endowed with a rich cultural heritage, still remains an enigma for many. This study should help in establishing that the traditional knowledge and practices of the people of this region are reserves of diversified elements of science and technology.

It is expected that the present study will make some contribution to the world wide efforts to pursue alternatives in the traditional knowledge to evolve strategies for sustainable development.

☆☆☆

APPENDICES

APPENDIX-I
GLOSSARY OF PLANTS AND ANIMALS

PLANTS :

Name in Assamese	Botanical Name
1. *Agyachit*	*Plumbago zeylenica*
2. *Amita*	*Carica papaya*
3. *Aparajita*	*Clitoria terretia*
4. *Ashok*	*Saraca indica*
5. *Agara*	*Xanthium strumarium*
6. *Amal lata*	*Vitis trifolia*
7. *Arahar*	*Cajanus cajan*
8. *Amara*	*Spondius mengifera*
9. *Ananta mul*	*Hemidesmus indicus*
10. *Arjun*	*Terminalia arjuna*
11. *Axi* or *Baji ou*	*Dillenea pentagyna*
12. *Agaru* or *Sachi*	*Aquillaria agallocha*
13. *Ada*	*Zinziber officinale*
14. *Akan*	*Calotropes gigantea*
15. *Amlakhi*	*Embelica officinalis*
16. *Aam*	*Mangifera indica*
17. *Aatlas*	*Anona squomosa*
18. *Afu*	*Papaver somniferum*
19. *Akashi lata*	*Cuscuta reflexa*
20. *Akash bel*	*Carrytha filiformes*
21. *Aahat goch*	*Ficees religiosa*
22. *Aathia kol*	*Musa sapientum*
23. *Aajar*	*Lagerstroemia speciosa*
24. *Aahom bagari*	*Pruhus communis*

25.	*Aachu kath*	*Borberis asiatica*
26.	*Aamari*	*Amoora wallichi*
27.	*Aahai*	*Vitex peduncularis*
28.	*Angoor*	*Nitis vivifera*
29.	*Baghnakhi*	*Martiniaanuya*
30.	*Bilahi bengena*	*Lycopersicum*
31.	*Baghnalaw*	*Martynia annua*
32.	*Borpuli*	*Pistia stratiotes*
33.	*Bihlasgemi*	*Polygoncumspp*
34.	*Bokful*	*Sesbania grandiffora*
35.	*Borial*	*Sida cordifolia*
36.	*Bon agara*	*Mrena lobata*
37.	*Bonchum*	*Phoebe goalparensis*
38.	*Bogi poma*	*Chikrassia tabularis*
39.	*Bajranali*	*Zanthoxylum budrunga*
40.	*Bogori*	*Zizyphus mauritiana*
41.	*Bauh*	*Acorus calamus*
42.	*Bahka*	*Adhatoda bosica*
43.	*Bel*	*Aegle marmelos*
44.	*Banh*	*Bambusa tulda*
45.	*Bon naranga*	*Biophytum sensitivum*
46.	*Benguti*	*Chrusopogon aciculatus*
47.	*But mah*	*Cicer arietenum*
48.	*Belipaka*	*Coccinia indica*
49.	*Bangi*	*Cucumis melo*
50.	*Bajkoron*	*Euphorbia antiquorum*
51.	*Bargoch*	*Ficus bengalensis*
52.	*Beli phol*	*Helianthys annurs*
53.	*Bandor kekeroa*	*Mucuna pruriens*
54.	*Bar thekera*	*Garchinia pedunculata*
55.	*Baga kanchan*	*Bauhinia racemosa*

56.	*Bahak tita*	*Adhatoda vasica*
57.	*Bakul*	*Mimusops elengi*
58.	*Bach*	*Acorcus calamus*
59.	*Brahmi*	*Hydrocotyle asiatica*
60.	*Bishalyakarani*	*Eupatorium ayapana*
61.	*Barun gach*	*Crataeva religiosa*
62.	*Bhui amalakhi*	*Phyllanthas fartanus*
63.	*Bhui komora*	*Trichosanthes cordata roxb*
64.	*Bhekuri*	*Solanum indicum*
65.	*Bhedailata*	*Hadyotis scandens*
66.	*Bhendi*	*Hibiseas asculentus*
67.	*Bhang*	*Cannabis sativa*
68.	*Bhetphul*	*Nymphaea nauchali*
69.	*Bhuj-patra*	*Betula sp.*
70.	*Bottle brush*	*Callistemon viminalis*
71.	*Ban am*	*Mangifera sylvetica*
72.	*Ban pachala*	*Picrasma javanica*
73.	*Ban lichu*	*Nephelium longana*
74.	*Bahat*	*Artocarpus lakoocha*
75.	*Bandar dima*	*Dysoxylum binectariferum*
76.	*Bhola*	*Morus laevigata*
77.	*Bhelu*	*Tetremeles nudiflora*
78.	*Bet*	*Calamus Rotang*
79.	*Chal kuonri*	*Aloe vera*
80.	*Chatiyana*	*Alstromia scholaris*
81.	*Chom*	*Michelus bombycina*
82.	*Chandan*	*Santalum album*
83.	*Chakala tenga*	*Citrus sp.*
84.	*Champa phool*	*Michelia champaka*
85.	*Chida*	*Lagersthomia parviflora*
86.	*Chitronala*	*Cymbopogon winterianus*

87.	*Cham*	*Atrocarpus chaplasa*
88.	*Chengmora*	*Laria spinara*
89.	*Chirata*	*Swertia chirata*
90.	*Chajina*	*Moringna concanensis*
91.	*Chorat*	*Laportea crenulata/Tragia envolucrata*
92.	*Churan*	*Amorphopholus campanulatus*
93.	*Chengaitenga*	*Oxalis repens*
94.	*Chegeem*	*Teetona grandis*
95.	*Chomidh*	*Prosopis spicigera*
96.	*Chuka sak*	*Rumex vericarinus*
97.	*Chama kachu*	*Tryphonium trilobatum*
98.	*Dalim*	*Punica granatum*
99.	*Dudh khari*	*Tlolarrhena antidysenterica*
100.	*Dam deuka*	*Impatiens balsamina*
101.	*Dron*	*Leucas linifolia*
102.	*Dal chini*	*Cinnamomum zeylanicum*
103.	*Debdaru*	*Polyathia longifolia*
104.	*Dhunudli*	*Trichosanthes anguina*
105.	*Dhan*	*Oryya sativa*
106.	*Dhania*	*Coriantrum sativum*
107.	*Dhatura*	*Datura sativum*
108.	*Dimouru*	*Ficus carica*
109.	*Dhuna*	*Mimosa rusicanlis*
110.	*Erigoch/Eragoch*	*Riccinus communis*
111.	*Gadhuli gopal*	*Mirabilis jalapa*
112.	*Gamari*	*Gmelina arborea*
113.	*Garakhia tamol*	*Circuligo orchiodes*
114.	*Garakhia karoi*	*Hibiscus abelmus*
115.	*Gakhirati bon*	*Euphorbia hitra*
116.	*Gajor*	*Dancus carota*

117.	*Gom dhan*	*Zea manys*
118.	*Gulanch*	*Plumaria aculifolia*
119.	*Gandh birina*	*Andropogon sconanthus*
120.	*Goch alu*	*Diascorea bulbifera*
121.	*Gumuni*	*Sensevieria rexburghiana*
122.	*Guwamuri*	*Foeniculum vulgari*
123.	*Gorjon*	*Dipetrocorpus turbinatus*
124.	*Gandhsaroi*	*Cinnamomum ucinodaphne*
125.	*Gohora*	*Pnemna bengalensis*
126.	*Gandhipoma*	*Dysoxylon hamiltonii*
127.	*Ghantakarna*	*Crotaberia sericea*
128.	*Ghila*	*Ertada gigas*
129.	*Ghehu*	*Triticum aestivum*
130.	*Ghora neem*	*Molia azedarach*
132.	*Halim sak*	*Lapidium sativum*
133.	*Hing*	*Ferula assafoetida*
134.	*Haladhi*	*Curcuma longa*
135.	*Helencha sak*	*Enhydra fluctuans*
136.	*Harjosa*	*Cissus quadranguberis*
137.	*Hasnahana*	*Cestrum nocturnum*
138.	*Hanggsa lata*	*Aristolochia gigas*
139.	*Hogla*	*Typha elephasntina*
140.	*Hanhthargia*	*Portuleca oleracea*
141.	*Hati lata*	*Pothos scandens*
142.	*Hasticornalata*	*Smilax zeylanica*
143.	*Harjora*	*Cissus quedrangularis*
144.	*Hallong*	*Dipterocarpus macrocarpus*
145.	*Iswarmul*	*Aristolochia indica*
146.	*Jaiphal*	*Myristica fragrans*
147.	*Jari*	*Ficus benjamina*

148.	*Jalakia*	*Capsicum frutesans*
149.	*Jetuka*	*Lawsonia inermis*
150.	*Japapetari*	*Abutilon indicum*
151.	*Jhau*	*Cagurrina equisetifoilia*
152.	*Jeura*	*Duranta plumieri*
153.	*Joba*	*Hibiscus rosa-simensis*
154.	*Jati phul*	*Jasminum sambar*
155.	*Jatilau*	*Lagenaria siceraria*
156.	*Jika*	*Luffa ocutangula*
157.	*Junuka*	*Passiflora foetida*
158.	*Jaluk*	*Piper nigtum*
159.	*Jayanti*	*Sesfonia serbon*
160.	*Jadhan*	*Sorghun vulgare*
161.	*Joniguti*	*Trachyspermum*
162.	*Jeera*	*Lannca grandis*
163.	*Jutuli*	*Altingia exceisa*
164.	*Jatipoma*	*Cedrela toona*
165.	*Jinari*	*Podocarpus nerifolia*
166.	*Jia poma*	*Lannea grandis*
167.	*Jacaranda*	*Jacaranda ovalifolia*
168.	*Jhaoban*	*Texas baccata*
169.	*Kochu*	*Collocasia esculenta*
170.	*Kalajamun*	*Eugenia jenbolana*
171.	*Kathal*	*Arto-carpus heterophyllus*
172.	*Kalmou sak*	*Ipomer aquatica*
173.	*Kapah*	*Gossypium herbaceum*
174.	*Karpur*	*Cynamoumum comphora*
175.	*Karja tenga*	*Citrus decumens*
176.	*Kadam*	*Anthocephallus cadomba*
177.	*Kal*	*Musa sanguinea*
178.	*Kanak dhatura*	*Dalura fastusa*

179.	*Karabi*	*Nerium odorum*
180.	*Kardai*	*Averrhoe carambola*
181.	*Kala-jeera*	*Nigella saliva*
182.	*Kani bih*	*Croton tigbium*
183.	*Kala xariah*	*Brarica juncea*
184.	*Kuji thekera*	*Garcinia kydia*
185.	*Kala khutura*	*Amaronthus spinosa*
186.	*Katahi bengena*	*Solanum xanthocarpum*
187.	*Kaji nemu*	*Citrus auronlifolia*
188.	*Kath alu*	*Dioscorea alata*
189.	*Kal megh*	*Andrographis paniculata*
190.	*Kath bel*	*Feronia elephantum*
191.	*Kanchan*	*Bahunia variegata*
192.	*Kanhiban/Kanhua*	*Saceherum spontienium*
193.	*Komora*	*Benny kacha cherifera*
194.	*Kowa bhaturi*	*Solenia heterophylla*
195.	*Keteki*	*Pandanus odaratisimus*
196.	*Keturi*	*Cureuma zedoaria*
197.	*Kendu*	*Diespyrus cordifolia*
198.	*Kuhila*	*Strychnos nuxvomica*
199.	*Kukura joba*	*Calosia eristata*
200.	*Kunhiar*	*Sacernarum officinarum*
201.	*Kenhraj*	*Eclipta prostrata*
202.	*Kona ximolu*	*Commelina bengalensis*
203.	*Kutkora*	*Meyna laxiflora*
204.	*Dudhkari*	*Holarrhana antidyseterica*
205.	*Koroch*	*Pongamia pinnala*
206.	*Kopal phula*	*Cardiospermum haloicatcabum*
207.	*Kalpa teeta*	*Andrographis paniculata*
208.	*Kuxbon*	*Eragrostis cynosweides*
209.	*Kuhum Kata*	*Argemona indicus*

210.	*Kothali champa*	*Attabotrys odoratisius*
211.	*Kukur xula*	*Blumia lacera*
212.	*Kusum phool*	*Carthamus linclorius*
213.	*Komola tenga*	*Citrus reticulata*
214.	*Kathanda*	*Ervatamia coronaria*
215.	*Kola mah*	*Hathyrus sativus*
216.	*Kamini phool*	*Murraya paniculata*
217.	*Krishna chura*	*Poinciana pulcherina*
218.	*Kunjalata*	*Quamoclit pinnata*
219.	*Kelkura*	*Heteroparax fragrams*
220.	*Kuhir*	*Terminalia tomentosa*
221.	*Kotahi jamu*	*Eugenia cayophyllifolia*
222.	*Kuki*	*Araucaria kuki*
223.	*Koroi*	*Albizzia procera*
224.	*Khair*	*Acacia catachu*
225.	*Kharpat*	*Casia qalata*
226.	*Khagari*	*Saccherum sare*
227.	*Khutura sak*	*Amararthus spinosus*
228.	*Khejuri*	*Phoenix daclyifera*
229.	*Kharikajai*	*Jesminum sambac*
230.	*Khokan*	*Duabanga sonneratioides*
231.	*Kharika sopa*	*Nyssa sessiliflora*
232.	*Kharmuja*	*Citrullus lanatus*
233.	*Khair*	*Acacia catechu*
234.	*Kharmuj*	*Citrullus lanatus*
235.	*Latumani*	*Abrus precatorius*
236.	*Leteku*	*Baccaurea sapida*
237.	*Lal pat*	*Euphorbia pulcherrima*
238.	*Lakhna*	*Withania somnifera*
239.	*Lajuki lata*	*Mimosa pudica*
240.	*Laijabari*	*Drymaria cordata*

241.	*Lali*	*Dysixykum procerum*
242.	*Mankachu*	*Alocasia indica*
243.	*Madhu solong*	*Poloygonum microphalum*
244.	*Mati kathal*	*Ananas comogus*
245.	*Maha neem*	*Azadirachta indica*
246.	*Medeluba*	*Cassia sophera*
247.	*Manimuni*	*Centella asiatica*
248.	*Mather*	*Erythrina variegata*
249.	*Mecheka tenga*	*Hibiscus sobdarifla*
250.	*Madhai lata*	*Hiptage loengalensis*
251.	*Mitha alu*	*Ipomoca batatas*
252.	*Machur mah*	*Lens culinaris*
253.	*Magu mah*	*Phaseolus aurens*
254.	*Mati mah*	*Phaseolus mungo*
255.	*Matar*	*Pisum sativum*
256.	*Madhuri aam*	*Psidium guayava*
257.	*Madhuri lata*	*Quisqualis indica*
258.	*Mula*	*Raphanus sativus*
259.	*Matak Jara*	*Zea mays*
260.	*Matha*	*Eiperus botundas*
261.	*Malati phul*	*Aganosma dichotoma*
262.	*Marua phul*	*Organum*
263.	*Mati kaduri*	*Alternanothera sessilis*
264.	*Malbhog sak*	*Portulaca oleracea*
265.	*Moj*	*Albizzia lucida*
266.	*Monisal*	*Sapindus mukorosi*
267.	*Moroi*	*Cassia nodosa*
268.	*Morolia*	*Macaranga denticulata*
269.	*Maiphak*	*Evodia meliaefo*
270.	*Mckahi*	*Phoebe paniculata*

271.	*Magnolia*	*Magnolia grandiflora*
272.	*Mezankori*	*Litsaoea citra*
273.	*Mekai*	*Shorea assamica*
274.	*Naharu*	*Allium sativum*
275.	*Nemu tenga*	*Citrus awrantifolia*
276.	*Nishari*	*Ewryale ferox*
277.	*Nuni*	*Motrus alba*
278.	*Lechera mah*	*Vigna linensis*
279.	*Nargi phul*	*Tegetes patula*
280.	*Nayan tara*	*Vinca rosea*
281.	*Narsingh*	*Murraya koenigi*
282.	*Naga tenga*	*Myrica farguharione*
283.	*Nefafu*	*Clerodendron colebrookianum*
284.	*Nahar*	*Mesua corominda linn*
285.	*Nachpati*	*Pyrus communis*
286.	*Odal*	*Sterculia villosa*
287.	*Outenga*	*Dillenis indica*
288.	*Oulata*	*Dillemia sarmantosa*
289.	*Olkochu*	*Amorphophallus campanulatus*
290.	*Piaz/Ponoru*	*Allium cefea*
291.	*Pachtia*	*Vitex negundi*
292.	*Paleng sak*	*Spinacia obracer*
293.	*Puroi sak*	*Basella alba*
294.	*Punnannaba*	*Boerheavia chinensis aschers*
295.	*Pati dai*	*Maranta diclotoma*
296.	*Paniyal*	*Flacoatyia katafraeta*
297.	*Phutuka*	*Melastoma malabathricum*
298.	*Putar*	*Basella lubra*
299.	*Pannora*	*Boerhavia diffusa*
300.	*Pate gaja*	*Bryophyllum pinnatum*
301.	*Palash*	*Butea monosperma*

302.	*Padina*	*Memtha viridis*
303.	*Padum*	*Nelumbo mucifera*
304.	*Pan*	*Piper betle*
305.	*Pan chopa*	*Michelia kingii*
306.	*Paroli*	*Stereospermum chelonoides*
307.	*Parul*	*Lagerstromia indica*
308.	*Pippali*	*Piper longum*
309.	*Pichola*	*Meliosma simplisifolia*
310.	*Ping*	*Cybometra polyandra*
311.	*Pokmou*	*Solanum nigrum*
312.	*Parash*	*Thespesion populnea*
313.	*Poplar*	*Populus ciliata*
314.	*Pati-hoonda*	*Cinnamomum obtusifolia*
315.	*Patal*	*Trichosanthes dioica*
316.	*Rajani gandha*	*Polyanthus tuberosa*
317.	*Rahar mah*	*Cajanus cajan*
318.	*Rubber tenga*	*Citrus grandis*
319.	*Ranga lau*	*Cucurbita moschata*
320.	*Radhachura*	*Deloxix regia*
321.	*Rangan*	*Ixora coccinea*
322.	*Ranga doka*	*Leonurus sibiricus*
323.	*Raghu mala*	*Lorenthus longiftolcus*
324.	*Ranga jabaphul*	*Hibiscus rosa sinensis*
325.	*Ranga chandan*	*Pterocarpus malabari cum*
326.	*Ranga simulu*	*Salmalia malabari cum*
327.	*Ranga verena*	*Jatroper gossypifolia*
328.	*Shal kunwari*	*Aloe vera*
329.	*Shal mogra*	*Jaraktogenos kurzil*
330.	*Sham kurhai*	*Albizzia odoralissina*
331.	*Seleng*	*Sapium baccatum*
332.	*Shewali phul*	*Nyctanthes arbox tristis*

333.	*Sirish goch*	*Pithecobobium saman*
334.	*Shal*	*Shorea robusta*
335.	*Sisu*	*Dalbergia sissoo*
336.	*Shan*	*Crotabaria junncea*
337.	*Simalu*	*Bombax cliba*
338.	*Satmul*	*Asparagus racemogus.*
339.	*Singri*	*Trapa natans*
340.	*Sagar mena*	*Opuntia dilenii*
341.	*Sonaru*	*Cassia fistuta*
342.	*Siju*	*Euphorbia nerifolia*
343.	*Sarihan*	*Brassica campestuis*
344.	*Sthal padma*	*Hibiscus mutabilis*
345.	*Silikha*	*Terminalia chebule*
346.	*Suklati*	*Sambucus jaivanica*
347.	*Sagunilata*	*Tinospora cordifolia*
348.	*Simulu alu*	*Manihat utilissina*
349.	*Saral goch*	*Pinus roxburghit*
350.	*Sumathira tenga*	*Cytrus reticuleta*
351.	*Sonarbial*	*Sida cordifolia*
352.	*Sarpagandha*	*Rahwolfia serpentina*
353.	*Suryakanti*	*Hibiscus phoenicus*
354.	*Siju*	*Eupheric*
355.	*Sonporua lata*	*Melina asiatica*
356.	*Teora goch*	*Duranta plumieri*
357.	*Tianh*	*Cucumis sativum*
358.	*Tarua kadam*	*Acacia nilofica*
359.	*Tishi*	*Zimum uritatissum*
360.	*Tita kerala*	*Momordica charantia*
361.	*Tenga mara*	*Hibiscus sabdariffa*
362.	*Tengechi*	*Oxalis cornicalta*
363.	*Taal*	*Borassus flebedlifar*

364.	*Till*	*Seasamum*
365.	*Teteli*	*Tamarindus indica*
366.	*Tita phul*	*Phlogacanthus thyrsiflorus*
367.	*Tej patlq*	*Cinnamomum tamala*
368.	*Tejmui*	*Zanthoxylon hamiltonian cum*
369.	*Thekera*	*Rumex uesicarius*
370.	*Tokow*	*Livistonia jendinsiana*
371.	*Tung*	*Aleurites fundi*
372.	*Thutmala or ruhimola*	*Garuga pinnata*
373.	*Ubahisoth*	*Achryanthas aspera*
374.	*Ulatchandal*	*Gloriosa superba*
375.	*Urahi*	*Dolichog lablab*
376.	*Uriam*	*Bischofia javanica*

(Gogoi, 1990: 3- 61)

ANIMALS

Mammals :

	Assamese Names	**English Names**	**Zoological Names**
		Mammals	
1.	*Asamia Bandar*	Assamese macaque	*Macaca assamenis*
2.	*Baduli*	Bat	*Chiroptera*
3.	*Banaria Mah*	Wild buffalo	*Babulus bubalis*
4.,	*Banaria ghahari*	Wild bear	*Sus scrofa*
5.	*Bandar*	Rhesus Monkey	*Macaca mulatta*
6.	*Bon mekuri*	Jungle cat	*Felis chaus*
7.	*Chika*	Shrew	*Suncus murinus*
8.	*Cheraw/deo chagali*	Serow	*Capricornis sumatraensis*
9.	*Chuti nejia bandar*	Stump tailed macaque	*Macaca speciosa*
10.	*Dadhi Bandar*	Phayre's Leaf monkey	*Presbytes phayrei*
11.	*Deo chagali*	Goat Antelope	*Capricornes sumatrensis*

12.	*Deosor*	Flying squirrels	*Petaurista magnificus*
13.	*Dhekia patia bagh*	Royal Bengal tiger	*Panthera tigris*
14.	*Dangar kerketura*	Giant squirrels	*Rufa bicolor*
15.	*Dal harin*	Swamp-deer	*Cervus duvouceli*
16.	*Dal kharia*	Hispid hare	*Caprolagus hispidus*
17.	*Kerketuwa*	Squirrels	*Dremomys lokriah*
18.	*Gahari nejia bandar*	Pig tailed macaque	*Macaca nemestrina*
19.	*Gerela*	Hog-badger	*Arctonys collaris*
20.	*Gnarh*	Rhinoceros	*Rhinoceros unicornis*
21.	*Godha phutuki bagh*	Clouded leopard	*Neofelis nebulosa*
22.	*Goch bhaluk*	Black bear	*Selenarctos thibetanus*
23.	*Goral*	*Goral*	*Nemorhadus goral*
24.	*Haga gendera*	Large Indian Civet	*Viverra zibetha*
25.	*Hapa*	Jungle Cat	*Felis chaus*
26.	*Haati*	Elephant	*Elephas maximus*
27.	*Hanuman*	Capped Langur	*Presbytes pileatus*
28.	*Halou bandar*	Hoolock/Gibbon	*Hylobates*
29.	*Jahamat*	Small civet	*Vivericula indica*
30.	*Jinner*	Common Palm Civet	*Paradoxurus hermaphroditus*
31.	*Ketela Pahu*	Chinese porcupine	*Hystrix brachyura*
32.	*Kerketura*	Squirrels	*Dremomys lokriah*
33.	*Kemtai pahu*	Pangolin	*Manis crassicaudata*
34.	*Khatia pahu*	Hog deer	*Axis porcinus*
35.	*Khenk xiyal*	Fox	*Vulpes bengalensis*
36.	*Lata phutuki,*	*Lata makuri*Leopard cat	*Felis bengalensis*
37.	*Lajuki bandar*	Slow loris	*Nycticebus coucang*
38.	*Malay bhaluk*	Malayan-sun-bear	*Helarctos malayanus*
39.	*Malua Bandar*	Rhesus Monkey	*Macaca mulata*
40.	*Mati bhaluk*	Sloth bear	*Melursus ursinus*
41.	*Metcheka*	Small civet	*Viverrimula indica*

42.	*Methun*	Bison	*Bos gaurus*
43.	*Nahor phutuki bagh*	Panther or leopard	*Panthera pardus*
44.	*Nal ghahari/ Takuri Bora*	Pigmy hog	*Porcula salvania*
45.	*Nigani*	House mouse	*Mus musculus*
46.	*Neul*	Mongoose	*Herpestes edwardii*
47.	*Phutuki harin*	Spotted deer/*cheetal*	*Axis axis*
48.	*Ramsor*	Malayan Giant Squirrel	*Ratufa bicolor*
49.	*Rang kukur*	Wild dog	*Cuon alpinus*
50.	*Shihu*	River dolphin	*Platanista gangetica*
51.	*Sonowali hanuman*	Golden langur	*Presbytis geei*
52.	*Sonowali mekuri*	Golden cat	*Felis temmincki*
53.	*Sugari pahu/ Xagra*	Barking deer/Muntjak	*Muntiacus muntjak*
54.	*Tari khowa jahamal*	Palm civet/Toddy cat	*Paradoxurus hermaphroditus*
55.	*Takuri Boar*	Pigmy Hog	*Sus sulvanius*
56.	*Tupia hanuman*	Capped langur	*Presbytis pileatus*
57.	*Udd*	Common Otter	*Lutra lutra*
58.	*Utnura*	Mole	*Talpa micrura*
59.	*Xaha Pahu*	Rufos tailed hare	*Lepus nigrecollis*
60.	*Xihu*	Gangetic Dolphin	*Platanista gangetica*
61.	*Xiyal*	Jackal	*Canis aureus*

Birds :

1.	*Ajan charai*	Grey heron	*Ardea cinerea*
2.	*Ankura thutiai* or *bali khuchra*	Curlew	*Numenius arquata*
3.	*Ba-salika*	Bank Myna	*Aeridotheres ging inanus*
4.	*Balimahi, Khanjan,Tiposi*	Wagtail	*Motacilla cinerea*
5.	*Baga chilony*	White kite	*Elanus caeruleus*
6.	*Baga-dingia Bartokola*	White-necked stork	*Dissura episcopus*
7.	*Bali ghoran*	Lapwing	*Lobipluvia malabarica*

8.	*Bali khuchra*	Sand-piper	*Tringa glareola*
9.	*Bata charai, chukur*	Quail	*Francolinus*
10.	*Batahi*	Swift	*Micropus affinis*
11.	*Bhadar kali*	Scarlet minivet	*Pericrocotus speciosus*
12.	*Bhardwaj*	Sky-lark	*Alauda gulgula*
13.	*Bhatou*	Parakeet	*Psittcula eupatria begalensis*
14.	*Bhimraj*	Racket-tailed drongo	*Dicrurus paradiseus*
15.	*Bulbuli*	Vented bulbul	*Molapastes cafer*
16.	*Chatak/Teltupi*	Swallows	*Hirundo smithi, Hirundo rustica*
17.	*Chakoi chakora*	Ruddy sheldrake	*Casarea feryginea*
18.	*Chereka charai*	Common snipe	*Capella gallinago*
19.	*Chilony*	Brahminy kite	*Haliastur indus*
20.	*Chekcheki*	Wren wrabler	*Prinia inornata*
21.	*Chutia salika*	Jungle Myna	*Aethiospar fuscus*
22.	*Dahikatara*	Magpie robin	*Copsychus saularis*
23.	*Daikola*	*Large cormorant*	*Phalacrocorax carbo*
24.	*Darik*	Patridge	*Francolinus*
25.	*Dhanesh/Pakoidhoran*	Hornbill	*Tockus birastris*
26.	*Deo-darik*	Pea-cock Pheasant	*Phasianidae*
27.	*Dinkana*	Night jar	*Caprimulgus asiaticus*
28.	*Dhapalika*	Jungle babbler	*Turdoides somervillei*
29.	*Dal mara*	Bronze-winged jacana	*Metopedius indicus*
30.	*Dauk*	*Waterhen*	*Amaurornisphoenicurus*
31.	*Deorajhanh*	Grey lag goose	*Anser anser*
32.	*Dhera/bhela*	Pelicans	*Pelecanus philippensis*
33.	*Dhigal neji hanh*	Pintail duck	*Anas acuta*
34.	*Dhritaraj*	Bar-headed goose	*Anser indicus*

35.	*Dhora kauri*	Jungle crows	*Corvusmacror hynchus*
36.	*Fanikatara*	Hoopoe	*Upupa epops*
37.	*Fenchu*	Drongo/King crow	*Dicrurusmacrocercus*
38.	*Ghar salika*	House Myna	*Acirdotheres tristis*
39.	*Ghar chirika*	House sparrow	*Passer domesticus*
40.	*Gal-manika bhatou*	Rose-ringed parakeet	*Psittacus*
41.	*Galpora bhatou*	Blossom-headed parakeet	*Psittacula cyanocephala*
42.	*Go-bag /go-bagali*	Cattle egret	*Bubulcus ibis*
43.	*Ganga-chilony*	River-tern	*Sturna aurantia*
44.	*Ghilla hanh*	Cotton teal	*Nettapus coroma ndeliamus*
45.	*Hargila*	Adjutant stork	*Leptoptilos dubius*
46.	*Haitha*	Green pigeon	*Crocopus phoenic opteros*
47.	*Hetuluka*	Barbet/copper-smith	*Xantholae ma haemacephala*
48.	*Hoodoo*	Horned owl	*Bubo bubo*
49.	*Ita guria charai*	Chestnut bittern	*Ixobrychus cinnamomeas*
50.	*Jalmayur/ dal mara*	Pheasant-tailed jacana	*Hydrophasianus chirurgus*
51.	*Kala khanti/chekcheki*	Tree pie	*Dendrocitta vagabunda*
52.	*Kajala barania machroka*	Pied king fisher	*Ceryle rudis*
53.	*Kana muchuri*	Pond heron	*Ardeola grayii*
54.	*Kaucha*	Roller	*Coracias bengalensis*
55.	*Katkhola/ kathroka*	Wood peckers	*Drybotes mahrattensis*
56.	*Kath salika*	Grey-headed myna	*Sturnia malabarica*
57.	*Kankurica*	Pied Myna	*Sturnus contra*
58.	*Kapou charai*	*Dove*	*Columbidae*

59.	*Kam charai*	Purple moorhen	*Porphyrio poliocephalus*
60.	*Karchan*	Sarus crane	*Antigone antigone*
61.	*Keteki*	Cuckoo	*Cuculus hierococcyx varius*
62.	*Korak charai*	Night heron	*Nycticoraxnycticorax*
63.	*Kut, Kora*	Coot	*Fulica atra*
64	*Kutuluka charai*	Shrike	*Lanius excubitor*
65.	*Kuli*	Koel	*Eudynamisscolopacceus*
66.	*Kurua*	Fishing eagle	*Haltaetus leucoryphus*
67.	*Lakhi Fencha*	Barn owl	*Tyto alba*
68.	*Mah bag, pani bag*	Little egret	*Egretta garzetta*
69.	*Maniyari*	Darter/snake bird	*Anhinga melanogaster*
70.	*Machroka*	Kingfisher	*Alcedo atthis*
71.	*Mara charai*	Peacock	*Pavo cristatus*
72.	*Myna*	Hill Myna	*Gracula religiosa*
73.	*Moupiya*	*Purple* sunbird	*Cinnyris asiaticus*
74.	*Mou-khora*	Bee eater	*Merops crientalis*
75.	*Moukhap*	Serpent eagle	*Haematornus cheela*
76.	*Nila charai*	Blue rock thrush	*Monticola solitaria*
77.	*Pani kauri*	Little cormorant	*Phalacrocorax niger*
78.	*Pati kauri*	Crows	*Corvus spiendens*
79.	*Patsia*	Tailor bird	*Orthotomussutoriuspatia*
80.	*Raja sagun*	King vulture	*Sarcogyps calvus*
81.	*Ranga muri*	Pochard	*Aythya rufa*
82.	*Sakhiayti/Patmadoi*	Golden oriole	*Oriolus oriolus*
83.	*Sagun*	Vulture	*Pseudogyps bengalensis*
84.	*Sharali hanh*	Whisling teal	*Dendrocygna javanica*
85.	*Shen*	Pariah kite	*Milvus migrans*
86.	*Shyama/Magpie*	Magpie	*Kittacincl malabarica*
87.	*Subhra deohanh*	White-wingedwoodduck	*Caurina scutulata*

88.	*Telia sareng*	Black-necked stork	*Xenorhynchus asiaticus*
89.	*Tiyan bhatou*	Lorikeet	*Coryllis vernalis*
90.	*Tokora charai*	Weaver bird	*Ploceus philippinus*
91.	*Thutia hanh*	Merganser	*Uroloncha striata,*
92.	*Tuni*	Munia	*Urolancha punctulata*
93.	*Ulumara*	Bengal florican	*upodotis bengalensis*
94.	*Chekcheki*	Wren wrabler	*Prinia inornata*
95.	*Xaru dhaplika*	Common babbler	*Argya caudata*
96.	*Xhamuk bhanga*	Open-billed stork	*Anastomus oseitans*

Reptiles :

1.	*Gharial*	*Gharial*	*Gavialis gangeticus*
2.	*Guin*	Monitor lizard	*Varanus indicus*
3.	*Jethi*	Wall lizard	*Lacerta viridis*
4.	*Koklonga/tejpia*	Chameleon	*Chameleon chameleon*
5.	*Magar*	Marsh crocodile	*Crocodilus pelustris*
6.	*Naipia*	Common lizard	*Lacerta vivipara*
7.	*Pani guin*	Water lizard	*Varanidae*
8.	*Tekto guin, kenko sap*	Gecko	*Gecko verticillatus*

Snakes :

1.	*Ajagar*	Python	*Python molurus*
2.	*Chakaripheti*	Cobra	*Naja naja naja*
3.	*Dhora*	Water snake	*Checkered keelback*
4.	*Goam*	Common krait	*Bungarus caieruleus*
5.	*Kanxala*	Brozeback tree snake	*Dendrelaphis tristis*
6.	*Mati sap*		Worm snake *Typhlina bramina*
7.	*Machura goam*	Russells viper	*Vipera russellii*
8.	*Pheti*	Monocled cobra	*Naza naza kwouthia*
9.	*Rajapheti*	King cobra	*Naja hana*
10.	*Shanka*	Banded krait	*Bungarus fasciatus*

Fish :

1.	*Aari*	*Mystus aur*	26.	*Ganga top*	*Tetradon cutcutia*
2.	*Barali*	*Wallaga attu*	27.	*Ilih, Ilisha, Ilsha*	*Hilsa ilisha*
3.	*Bahu, Bhakua*	*Catla catla*	28.	*Kandhuli*	*Notopterus notopterus*
4.	*Bami*	*Mastacembelus armatus*			
5.	*Banhpati*	*Chela baceila*	29.	*Khalihana*	*Trichogaster fasciatus*
6.	*Bata*	*Labeo bata*	30.	*Koch*	*Silundia gangetica*
7.	*Bheo*	*Rita buchanani*	31.	*Kolia jora/mali*	*Labeo calbasu*
8.	*Bheseli*	*Trichogaster chuna*	32.	*Kokila*	*Xenentodon cancila*
9.	*Bhangon*	*Labeo boga*	33.	*Kuchia*	*Amphipuous cuchia*
10.	*Bocha*	*Eutropiichthyes vacha*	34.	*Kurhi*	*Labeo gonius*
11.	*Boka gharia*	*Neolissochilus hexagonolepis*	35.	*Koroti*	*Gadusia chapra*
			36.	*Korang*	*Baralius spp.*
12.	*Bareala*	*Aspidoparia morar*	37.	*Kajoli*	*Ailia coila*
13.	*Chenga*	*Channa gachua*	38.	*Lalowa singara*	*Mystus vittatus*
14.	*Chengeli*	*Channa stewartii*	39.	*Laobora pithia*	*Tor tor*
15.	*Cheni-puthi*	*Puntius sarana*	40.	*Lacim*	*Cirrhinus reba*
16.	*Chital, kharida*	*Notopterus chitala*	41.	*Laupatia*	*Chela laubuca*
17.	*Chonda*	*Ambassis ranga / Equnla odentula*	42.	*Magur*	*Clarius batrachus*
			43.	*Mocha singra*	*Mystus cavacius*
18.	*Chelekona*	*Salmostoma bacaila*	44.	*Mirika*	*Cirrhinias mrignla*
19.	*Dorikona*	*Rasbora daniconius*	45.	*Moa*	*Amblypharyn godon mola*
20.	*Eleng*	*Rasbora elenga*			
21.	*Gagol*	*Mystus gagora*	46.	*Naro*	*Labio angra*
22.	*Garua*	*Bagarius bagarius*	47.	*Neria*	*Pseudentropins garua/Clupisoma garua*
23.	*Gedgedi, Bhedbhedi, Khaloibhang*	*Nandus nandus*			
24.	*Goroi*	*Channa punctatus*	48.	*Nadal bami*	*Anguilla bengale nsis bengalensis*
25.	*Gethu*	*Botia dario*			

APPENDIX-II

Plants Traditionally Identified by the Tangam Tribe of Arunachal Pradesh.

Sl no.	Local Name (Tangam/Adi)	Brief Description	Utilisation
1.	*Techi padok*	Shrub, leaf like betel leaf, deep green in colour.	Taken boiled
2.	*Tekang*	Small fern, grows in shady places, the edge of the leaf coiled in loop	Taken boiled
3.	*Batak*	Small berry-like fruits of creeper with prickly hair on the body.	Berries crushed to make an appetizer
4.	*Tosin*	Citrus	Taken raw
5.	*Simkom*	Citrus	Taken as raw fruit
6.	*Machang*	Small shrub, grows as weed in the cultivation field.	Taken boiled
7.	*Emik*	Shrub, grows to a height of 15 to 20 inches	Fruits taken raw
8.	*Tereng*	Shrub resembles cardamom	Fruits taken raw
9.	*Gumba bara*	Same as above	Same as above

10.	*Loba bara*	Plant like cardamom, fleshy stem	Only stem taken after removing the skin. Tastes sour.
11.	*Amkin jajum*	Shrub. Small berry- like fruits of creamy colour, beverage made from leaves, tastes like tea.	Fruits taken raw
12.	*Kodok*	Wild banana	Taken boiled , the inner pith of the skin.
13.	*Doniyut*	Shrub. Broad and long leaves dark green colour.	Leaves taken boiled.
14.	*Ano*	Fruit tree.Fruit like small berry,red in colour.	Fruits taken raw. From the stem fibre is extracted for yarn.
15.	*Begon*	Shrub.Cymose inflorescence, creamy colour-fruits small	Fruit taken as pickle-tastes bitter.
16.	*Ledu bekung*	Shrub leaf, resembling tezpat	Soft shoot taken raw and leaf boiled.
17.	*Doyik*	Small shrub, long leaf.	Leaf taken boiled.
18.	*Ene poikung*	Tree shrub, small leaf.	Leaves taken boiled.
19.	*Siso baren*	Trailer, leaves red in colour	Leaves taken boiled.
20.	*Peji peang*	Small shrub-(touch me not) bristles on the leaves cause irritation and swelling	Leaves taken boiled.
21.	*Lisin*	Wild arum (*kochu*)	Leaves, stem and the arum taken boiled.

22.	*Acho peniyo*	Trailer on the ground,small and red in colour.	Fruits only taken raw.
23.	*Kobo Mege*	Tree shrub, black berry.	Berries taken raw.
24.	*Kumi Kukit*	Tree shrub,green fruits.	Fruits only taken raw.
25.	*Piyamin*	Tree shrub,full of prickles and thorny.	Fruits only taken raw.
26.	*Dappek*	Red berries tree,long and fleshy fruits.	Fruits only taken raw.
27.	*Keke piyaming*	Trailer on the ground,red berries, stems and leaves full of thorns and prickles.	Fruits only taken raw.
28.	*Hongin Ganne*	Arum (*kochu*),grows in marshy land.	Leaf and stem taken boiled.
29.	*Cheden*	Fleshy weed grows in rice fields, seeds dispersible,floats in the air.	Entire plant taken boiled.
30.	*Bunka pibung*	Trailer on the ground with red berries.	Stem taken boiled-berries eaten raw.
31.	*Geyao*	Tree leaf resembles cinnamon,fruits small and green.	Fruits eaten raw. From the seeds oil is extracted and used for cooking and external application.
32.	*Mano paput*	Small shrub, leaf white,fruit are yellow in colour.	Leaf taken boiled

33.	*Tape*	Big tree, leaf broad and long, fruits fleshy and red.	Fruits taken raw.
34.	*Bebi*	Shrub cardamom, small fruits at the base.	Fruit only taken raw.
35.	*Aying kopi*	Big wild brinjal plant, fruits small and green.	Fruits only taken when ripe, tastes bitter.
36.	*Dunda tapok*	Bushy tree shrub grows to a height of 7 to 8 ft. Thorns on fleshy stem (Cymose inflorescence)	Fruits only taken raw.
37.	*Gonge*	Fleshy leaves, trails on the ground. Fleshy fruits, small in size.	Whole plant taken Boiled, fruits taken raw.
38.	*Korodong*	Herb-reaches height of 2 ft., fleshy leaf.	Leaf only taken boiled.
39.	*Dapiya*	Herb, height 3 ft. , leaf fleshy.	Leaves only taken boiled.
40.	*Berak*	Tree shrub; fruits black in colour and small in size	Fruits only eaten raw.
41.	*Teku*	Tree shrub, fruits fleshy and red in colour.	Fruits only eaten raw.
42.	*Ihat*	Climber; fruits at the base as well.	Fruits taken roasted.
43.	*Taba*	Fern-reaches height of 2 ft. on the stem	Base stem ground into powder and made to a paste and used at the time of scarcity of food.

44.	*Sobo labuk*	Herb,small leaves	Leaves taken boiled
45.	*Pibung*	Herb,fleshy leaf and stem	Stem taken as raw food after removing skin sour taste.
46.	*Leron*	Mushroom, pale yellow in colour, small in size; found in decayed	Taken boiled. wood and branches.
47.	*Kejaluta*	Small herb with small leaves.	Taken boiled.
48.	*Okung*	Small herb,leaves and skin fleshy	Leaf taken boiled.
49.	*Nokkon*	Herb,leaves like betel leaves,climber	Leaf taken boiled,used as a drink for stomach-ache ache after extracting juice.
50.	*Techun*	Shrub,leaves long and broad as of turmeric.	Medicine for stomach ache, fruits taken raw.
51.	*Pettu*	Wild mustard.	Taken boiled.
52.	*Papu suchik*	Shrub,height 7 ft., broad leaves, stem hard.	Leaf taken boiled.
53.	*Doko*	Herb,fleshy stem and leaves long,taste bitter.	Leaf taken boiled.
54.	*Dongin*	Tree, height 15 to 20 ft., leaf reddish, prickles on body.	Leaf taken boiled Juice of the leaves used as poison in fishing.

55.	*Popo kero*	Fern	Taken boiled.
56.	*Ayidomin*	Herb,leaves hairy,ht. 1 to 2 ft.	Leaves taken boiled.
57.	*Nipomeru*	Shrub,leaves long and fleshy , flowers up-right on the crown leaf red in colour.	Flowers taken boiled. for cold and cough smoked and inhaled
58.	*Teyimanji*	Tree,height 50 to 60 ft.	Leaves when fleshy and tender taken as vegetable.
59.	*Abu*	Shrub,height 10 to 12 ft., leaf broad and long .	Leaf when tender taken as vegetable.
60.	*Jajun*	Shrub,height 8 to 10 ft. Creamy colour, small fruits.	Fruits taken raw, leaves crushed and dried and used for making drinks.
61.	*Pane beding*	Herb,leaves like big mustard leaves, broad, fleshy and soft.	Leaf taken boiled.
62.	*Ene pokung*	Climber, leaves small and full of prickles.	Leaf taken boiled.
63.	*Dopong*	Trailer on the ground,leaf small and fleshy.	Taken boiled.
64.	*Sidung pongkung*	Shrub,growth upto 8 to 9 ft. long leaf.	Taken boiled.
65.	*Tasat*	Wild palm,growth upto 10 to 12 ft.	Fleshy stem,ground made into paste and roasted in fire and taken as cakes.
66.	*Leret*	Fern	Taken boiled.

67.	*Tamuk*	Wild palm,growth upto 15 to 20 ft.	Soft, white stem, inside of bark taken. The white powdery covering used as fruit.
68.	*Rodok*	Herb,leaf fleshy and soft	leaf taken boiled.
69.	*Tara radung*	cane,trailer on the ground or elsewhere.	Tender portion of the shoot taken as vegetable either raw boiled,bitter taste.
70.	*Obe berung*	Herb,height 3 to 4 ft.	Leaf dark green. af taken boiled.
71.	Tetan	Climber leaf trifoliate,fruit fleshy and of cream colour	Only fruits taken ither raw or boiled
72.	*Tachi*	Wild palm,height 10 to 13 ft.	Taken after crushing the soft stem, made into powder and then ade into bread and roasted in fire.
73.	*Ngeiyong*	Climber,wild yam,tuber long and deep into ground	Tubers taken boiled.
74.	*Upan*	Mushroom,white, small, grows on decayed stem	Taken boiled.
75.	*Teden*	Tree,height 50-60 ft. Fruits small.	Fleshy portion of the fruits taken raw.

76.	*Kobi*	Tree,height 15 to 20 ft.	Leaf taken when tender and soft .
77.	*Tedan*	Shrub, fleshy white berries.	Fruits taken raw.
78.	*Korang*	Shrub, fleshy white berries.	Fruits taken raw.
79.	Terep	Small fern,stem small narrow and tender.	Taken boiled.
80.	*Ononiyorung*	Mushroom,soft and gummy,small and black in colour , grows on decayed stems.	Taken boiled.
81.	*Juron*	Tree height 50-60 ft., leaves long, fruit medium sized, fleshy ,cream coloured.	Fruits peeled and taken raw.
82.	*Siri*	Tall tree,reaches height 100 to 150 ft., leaves light green in . colour	Leaves crushed and dried and used for beverage.
83.	*Jigum*	Climber, leaf light green, soft,fruits small.	Fruits when ripe taken raw; otherwise boiled.
84.	*Likian*	Climber, fruits small,whitish when unripe gradually become red and black.	Ripe fruits only taken
85.	*Hongo*	Tree—height 50 to 60 ft.,fruits sour and fleshy.	Taken when ripe

(Bhattacharya,1975:31)

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ILLUSTRATIONS AND PHOTOGRAPHS

Chapter-II , V & IX

Traditional Taxonomy/ Animal Husbandry Lore/ Writing and Painting

Drawing of Various Kinds of Elephnats (*Hastividyanarnva*): *Khamaka, Nampit, Satavanshi, Pramoda, Namchek, Daichai, Kunjarata* .

Illustrations of Characterstics of Tuskers in *Hastividyarnava*

Pages of *Hastividyarnava* : Example of Traditional Assamese Writing and Painting.

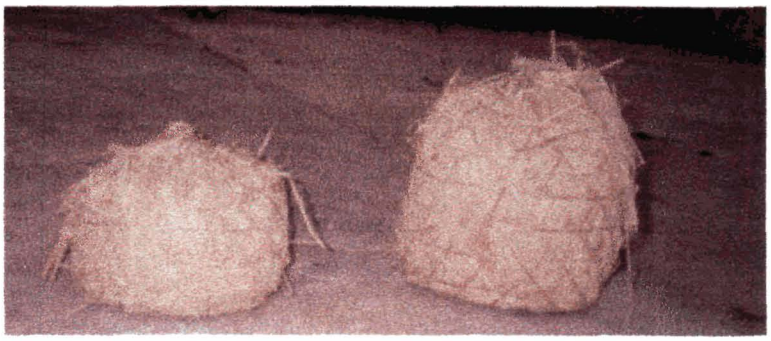
Chapter III

TRADITIONAL AGRICULTURAL IMPLEMENTS

A Cultivator with a *Nangal* (Plough)

Two Cultivators throwing Water with *Sishoni*

A Cultivator with a *Moi* (Harrow)

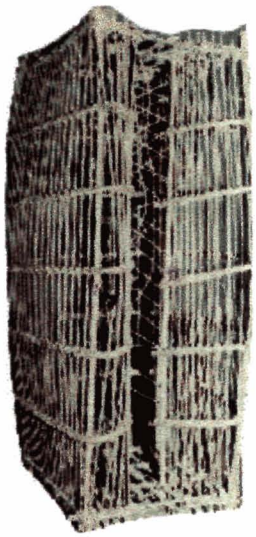


TOM or *TOPA* (Traditional Seed Storage)

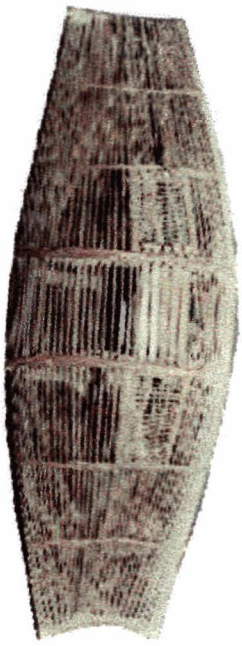
Chapters-VI

TRADITIONAL FISHING GEARS (FISHING TRAPS)

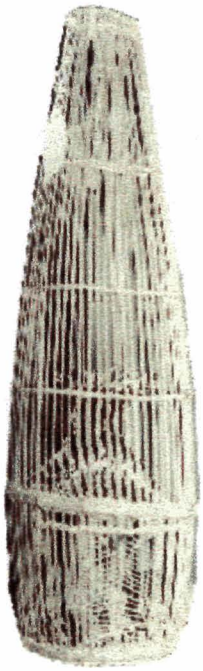
Polo



Emukhia dingara

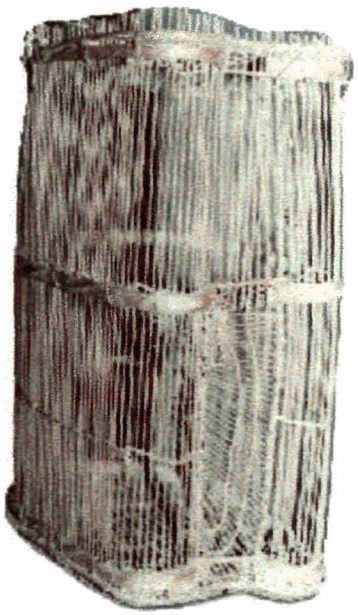


Dumukhia Chepa



Emukhia Chepa

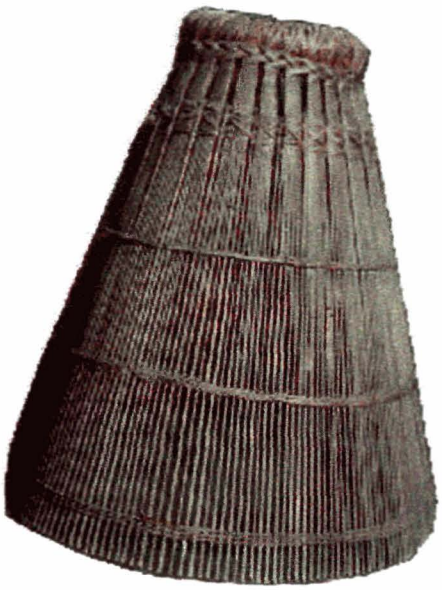
Chapter- VI
TRADITIONAL FISHING GEARS (FISHING TRAPS)



Emukhia Dingara

Jakoi

Emukhia Chepa



Jhuluki

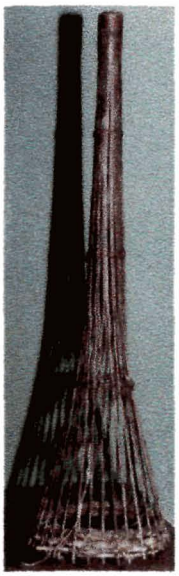
Chapter- VI

TRADITIONAL FISHING GEARS AND ACCESSORIES

Pari

Chak Jal

Khaloi



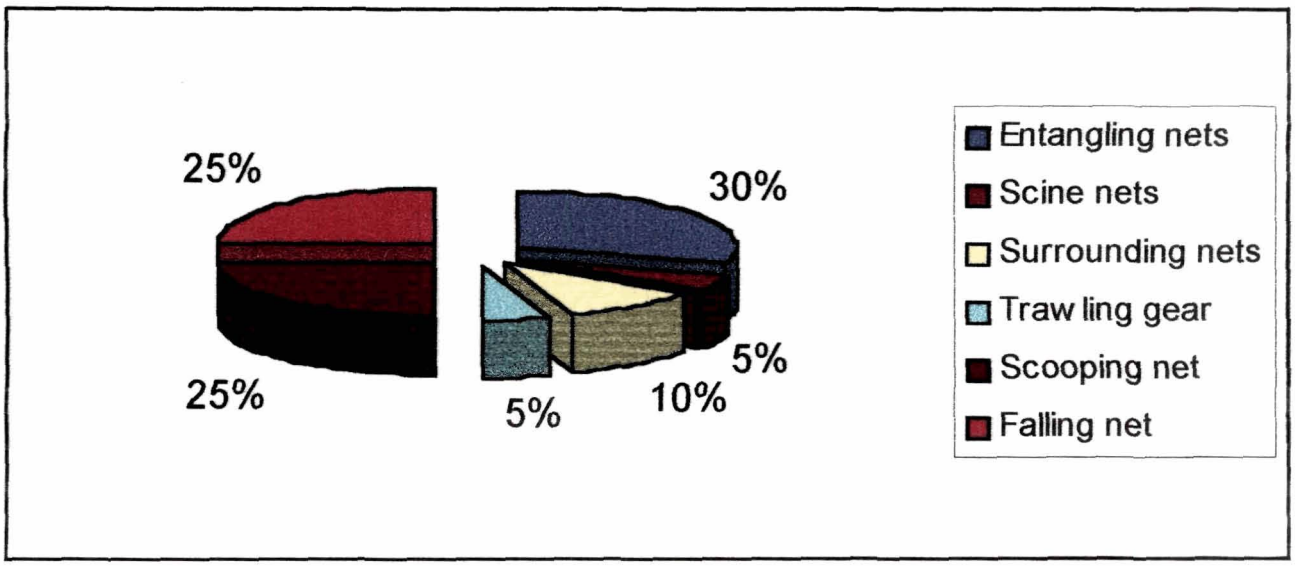
Chorha

Chapter- VI

TRADITIONAL FISHING GEARS AND ACCESSORIES

1. The percentage use of different types of nets in fishing is shown by pie diagram below.

		In%	In degree
(1)	Entangling nets	30%	108°
(2)	Seine nets	5%	18°
(3)	Surrounding nets	10%	36°
(4)	Trawling gear	5%	18°
(5)	Scooping net	25%	90°
(6)	Falling net	25%	90°

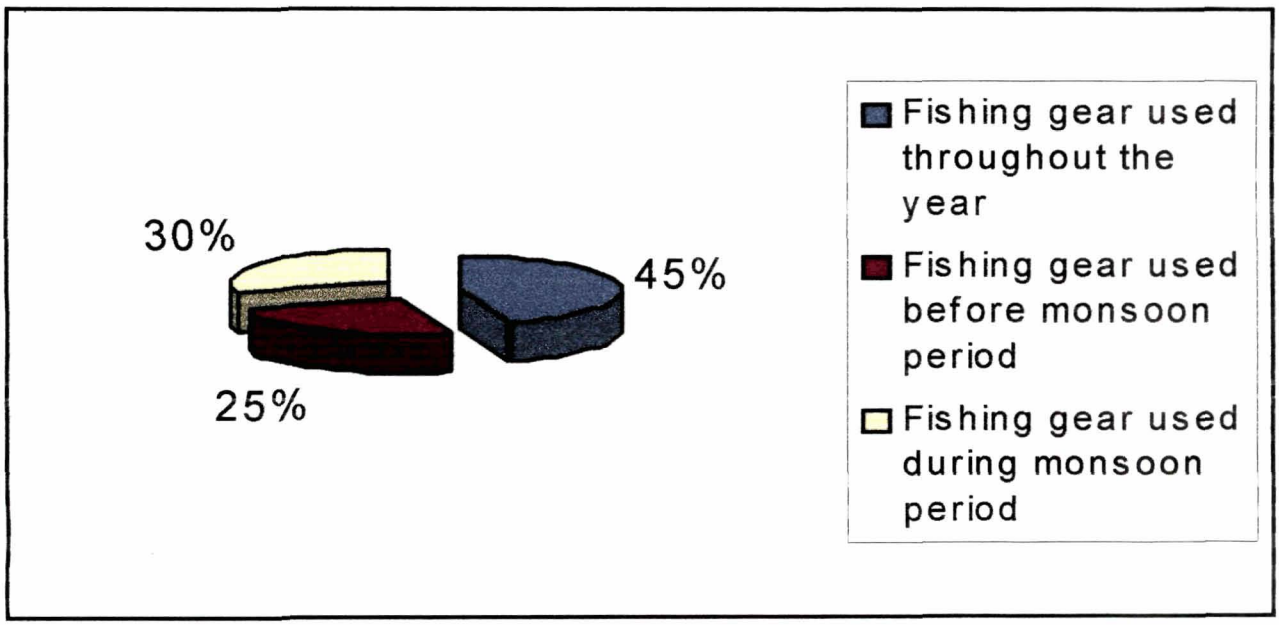


Chapter- VI

TRADITIONAL FISHING GEARS AND ACCESSORIES

2. The percentage use of the fishing gear throughout the year, before monsoon and during monsoon period is shown by pie diagram below.

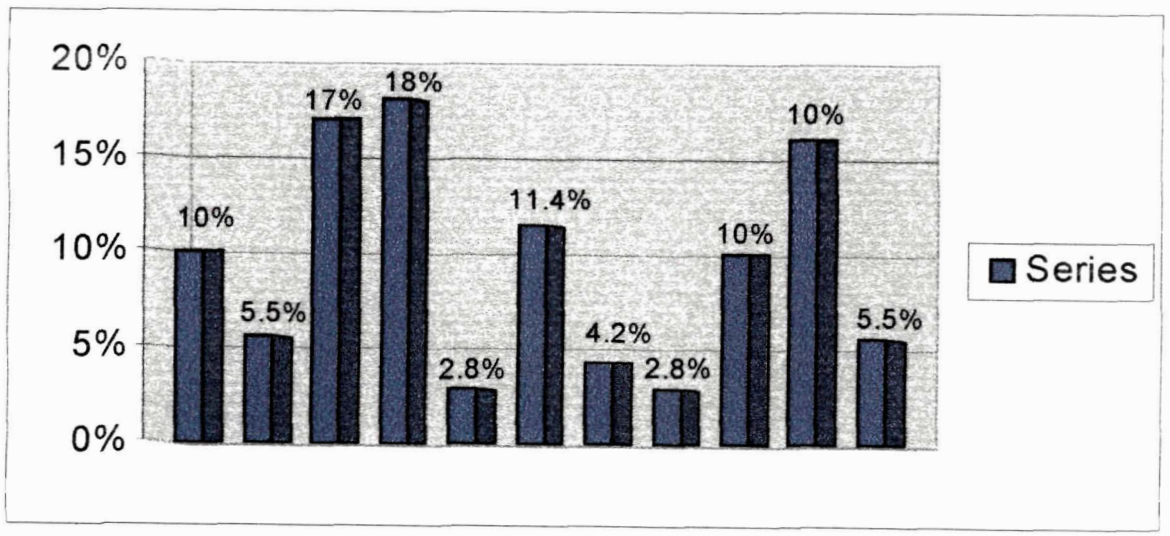
		In%	In degree
(1)	Fishing gear used throughout the year	45%	162°
(2)	Fishing gear used before monsoon period	25%	90°
(3)	Fishing gear used during monsoon period	30%	108°



Chapter- VI

TRADITIONAL FISHING GEARS AND ACCESSORIES

3. Graph showing number of gears present in each type of gear.



10% → Inpelling gear

5.5% → Bow & arrow

17% → Hook & line gear

18% → Trapping gear

2.8% → Miscallaneous gear

5.5% → Trawling gear

11.4% → Entangling gear

4.2% → Seine nets

2.8% → Surrounding nets

10% → Scooping gear

10% → Falling gear

Chapter - VII

Traditional Environment Management

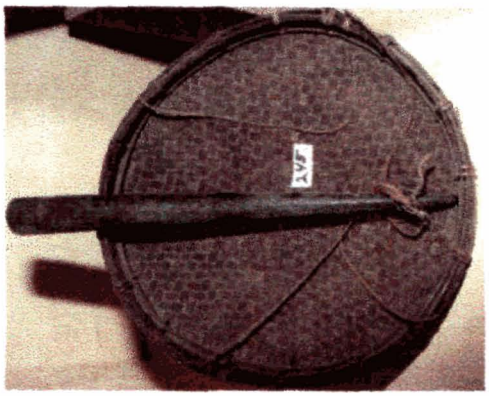
Traditional Bamboo Drip Irrigation in the Hills of Meghalaya.

Traditional Bamboo Drip Irrigation : Joints of Bamboo Pipes

Terracing System for Wet Cultivation in the Hills of Arunachal Pradesh.

Chapter VIII

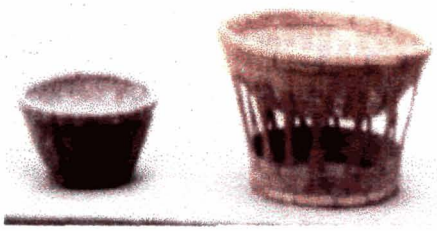
TRADITIONAL MEASURING IMPLEMENTS AND SITE OF ASTRONOMICAL STUDIES



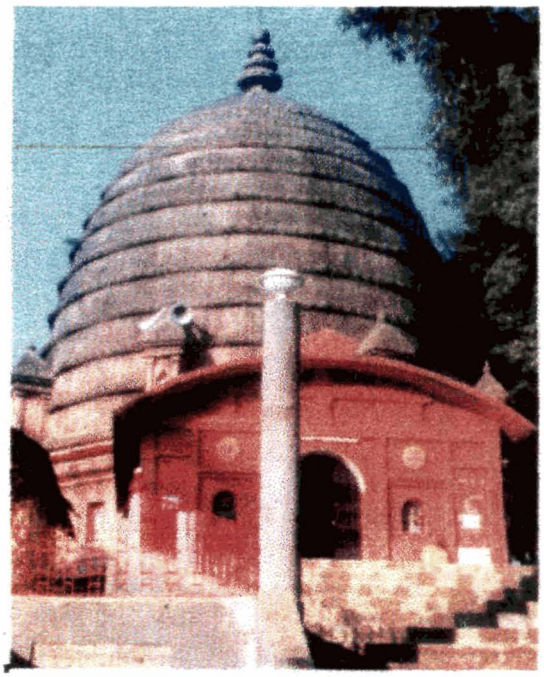
TULACHANI :Traditional AssameseBalnce

PURA: A Measuring Basket

DON and *KATHA*:Traditional Measuring Baskets



Traditional Measuring Baskets



NAVAGRAHA TEMPLE : A Site of Traditional Astronoical Studies at Guwahati.

Chapter- iX

Traditional Assamese Textile

PHULAM GAMOCHA
(Flower Designed Towel)

MUGAR RIHA (A cloth worn by women on the upper part of the body made of Muga Silk)

PATAR RIHA (*Riha* of Pat Silk)

A TRIBAL SHAWL.

Chapter IX

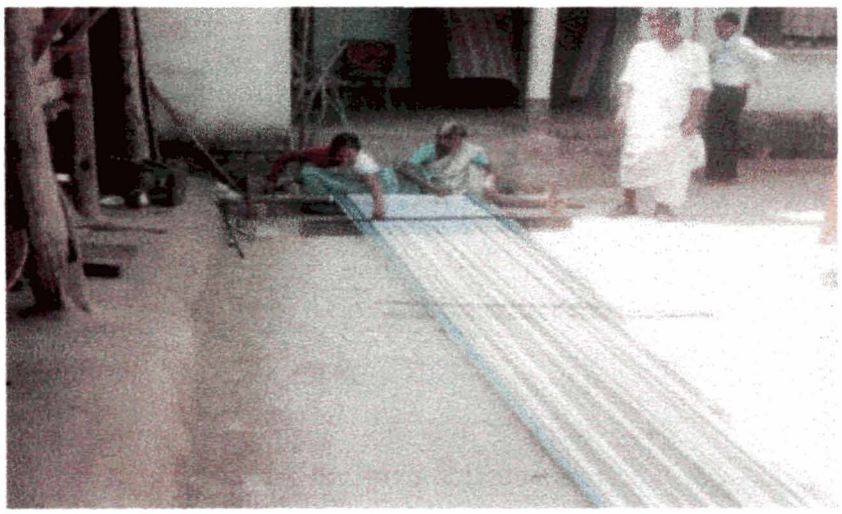
MARVEL OF TRADITIONAL ASSAMESE TEXTILE

Design on Silk Lampast : Claimed to be fragments of the Legendry *Vrindavani Vastra* (17th Century?) Photo: Sankardeva Kalakshetra

Chapter IX

HANDLOOM, WEAVING

TRADITIONAL NAGA LOIN LOOM



PREPARING YARN FOR AN ASSAMESE SHUTTLE LOOM (*Tat Bati*)

Chapter- IX

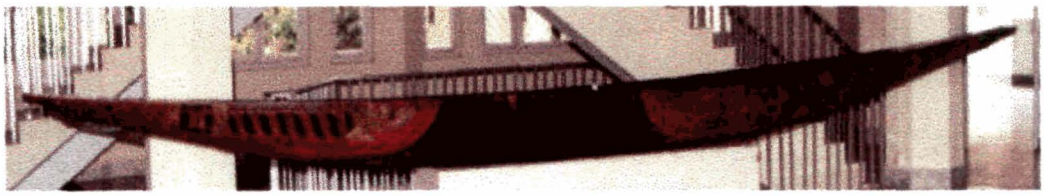
Traditional Assamese Wood Works

WOODEN *GURU ASANA* (Painted with traditional Colour)

WOODEN UTILITY BOXES

Chapter- IX

Traditional Assamese Wood Works



A DECORATED RACING BOAT

BOR PIRA (A DECORATED WOODEN SEAT)

A WOODEN *SARAI*

Chapter IX

TRADITIONAL BAMBOO BASKETS

JAPA: BAMBOO CASKETS

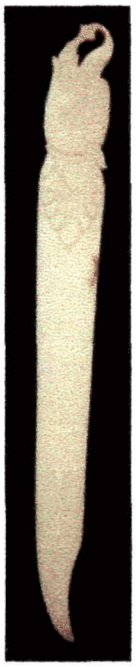
DECORATED CONTAINER MADE OF BAMBOO

BAHU KHALAPIA JAPA:
MULTI CHAMBERED
BAMBOO CASKETS

Chapter IX
TRADITIONAL IVORY OBJECTS OF ASSAM

A Knife Handle made of Ivory

An Ivory Comb(*Kakoi*)

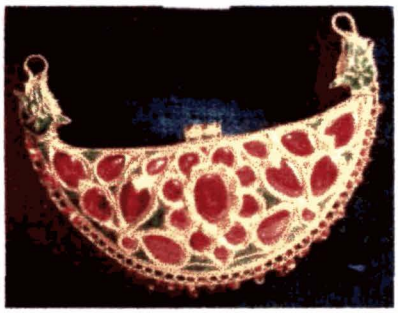


An Ivory Knife

An Ivory Necklace

Chapter- X

Traditional Assamese Gold Ornaments



JONBIRI

BENA

DHOLMADULI

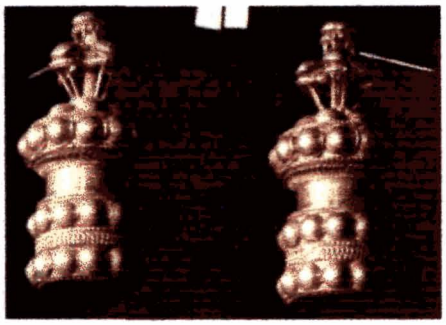
DHOLBIRI

DUGDUGI

THURIA / SARU PHULI

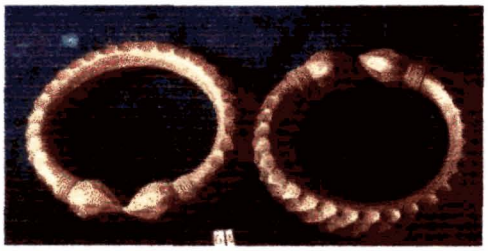
Chapter- X

Traditional Assamese Gold Ornaments



KAN PHULI

MUTHI KHARU



BHARIR KHARU

GALPATA

SATSARI

Chapter- X

Traditional Assamese Brass and Bell Metal Objects

KALAH (Pitcher)

GAGARI, KALAH

BATA

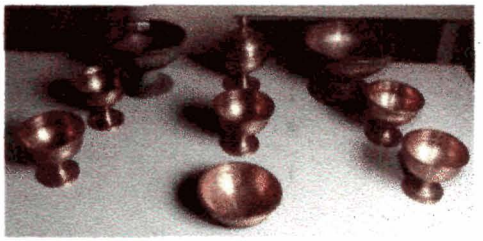
JALIKATA SARAI

DUNARI

BATA

Chapter- X

Traditional Assamese Brass and Bell Metal Objects



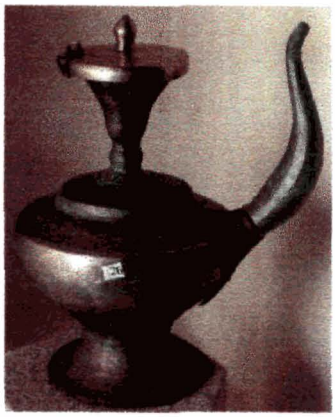
Various types of *Banbati* (Stand bowl)

BARCHARIA (A Large Wash Basin)

MAIHANG (A Noble's Dish)

BAN KAHI (A Stand Dish)

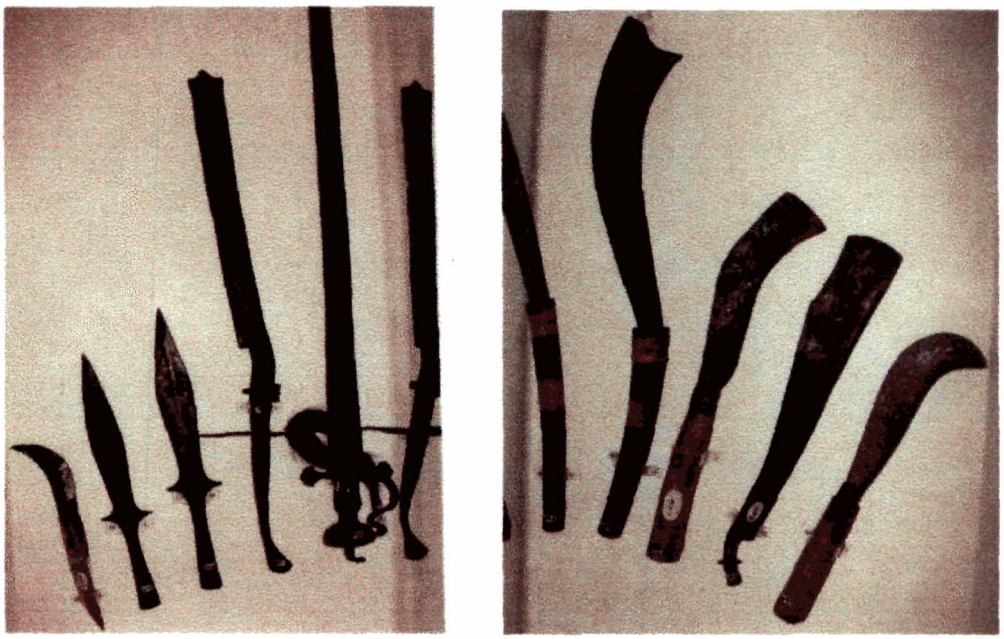
BATI (Bowl)



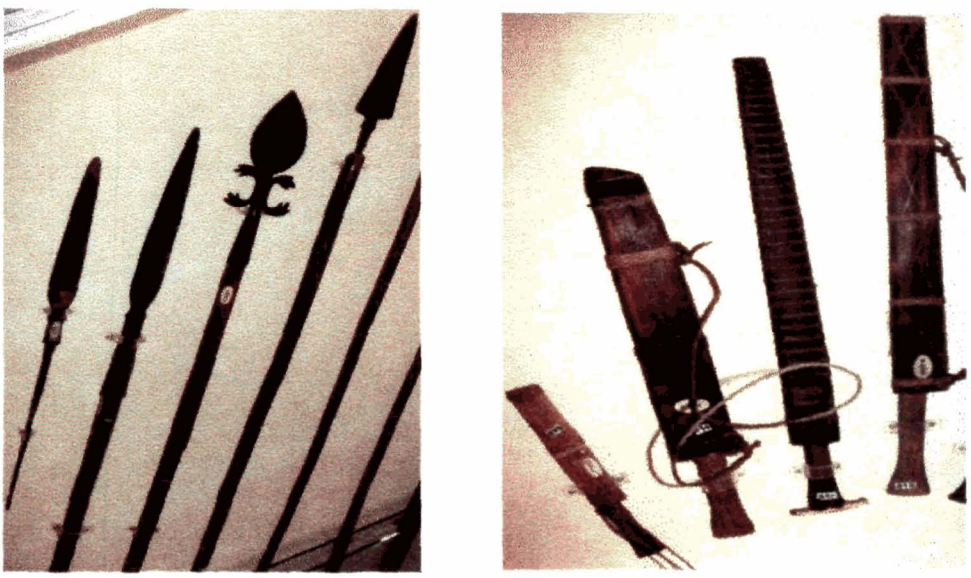
BHOGJARA (Decorated Decanter)

CHAPTER- X

Traditional Assamese Iron Weapons



Various Types of Knives (*Katari*), Dagger (*Churi*) and Choppers (*Dao*)



Various Types of Spears (Jathi) and Other War Weapons

Chapter XI

TRADITIONAL ARCHITECTURE OF ASSAM

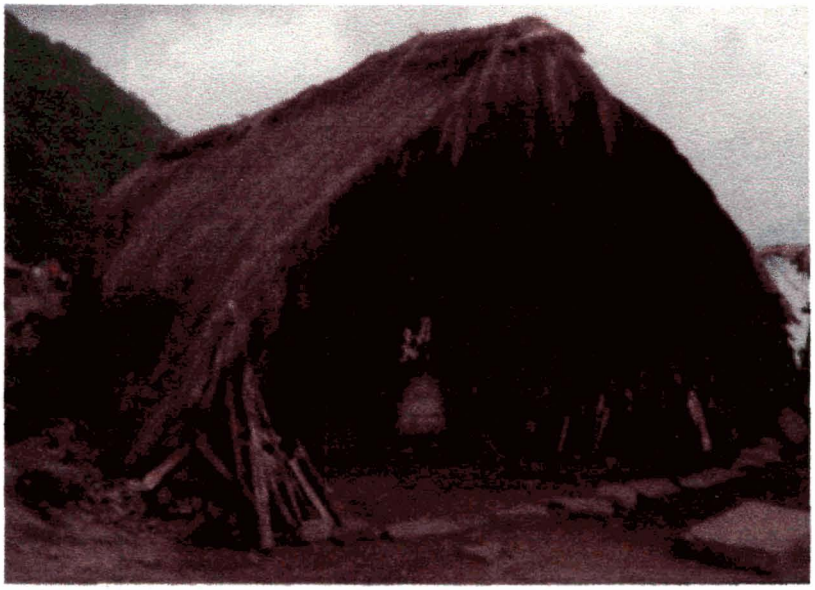
KIRTAN GHAR (PRAYER HALL)OF BARPETA SATRA

TALATAL GHAR (Multi Storied Fort of Ahom Kings at Sivasagar.)

KARENG GHAR (Royal Palace of Ahom Kings at Gargaon, Sivasagar)

Chapter XI

TRADITIONAL ARCHITECTURE



A TRADITIONAL NAGA HOUSE

BHARAL GHAR (A Traditional Assamese Granary with Agri-Implements)