CHAPTER-V

DISCUSSION

The present research work is based on more than three years of field works during November 2007 to December 2010 in different localities of the North Cachar hills (presently Dima Hasao) district of Assam. An extensive collection and documentation of crop germplasms as well as other useful plant resources have been made during the field work.

The following villages and their surrounding localities have been explored, often repeatedly, during the field work:

A total of 422 plant species have been recorded belonging 204 genera and 103 families of different plant groups and of which a total of 174 crop germplasms has been submitted to NBPGR, Umium, Meghalaya and obtained their IC nos. from 560759 to 560844 and 566675 to 569114 from the National Authority (Table-18 & Pie diagram:5; Histogram:6).

Information on their botanical names, families, vernacular names of different ethnic communities, frequency, habit, biological status (Table-19 & Pie diagram:7; Histogram:8 ), parts used, method of use/ preparation, traditional knowledge related to the plants and also about the plant resources sold in the local /makeshift market have been recorded.

Table: 18: No of Families, Generas and Species recorded

<table>
<thead>
<tr>
<th>Sl. no.</th>
<th>Plants</th>
<th>Families</th>
<th>Generas</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Fungi</td>
<td>6</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>2.</td>
<td>Pteridophytes</td>
<td>5</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>3.</td>
<td>Gymnosperms</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4.</td>
<td>Monocot</td>
<td>16</td>
<td>61</td>
<td>110</td>
</tr>
</tbody>
</table>

264
Table: 19: analysis of Biological status of the recorded species:

<table>
<thead>
<tr>
<th>Sl.no.</th>
<th>Plants</th>
<th>Wild</th>
<th>Semi domesticated</th>
<th>Cultivar/Jhum cultivar</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fungi</td>
<td>9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Pteridophytes</td>
<td>6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>Gymnosperms</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>Monocot</td>
<td>44</td>
<td>24</td>
<td>42</td>
</tr>
<tr>
<td>5</td>
<td>Dicot</td>
<td>106</td>
<td>68</td>
<td>122</td>
</tr>
<tr>
<td></td>
<td><strong>Total=166</strong></td>
<td></td>
<td><strong>Total=92</strong></td>
<td><strong>Total=164</strong></td>
</tr>
</tbody>
</table>

The ethnic people of the hill district have an intrinsic relation with plants in their ambient vegetation in their day to day life. They use and consume wild plants in and their habitats for sustenance. The use and management of the local plant resources are associated to their food habit as well as their traditional and cultural practices and rituals.

Present investigation has recorded 92 species of semi-domesticated plants i.e. wild plants found under cultivation both in homesteads as well as in jhum fields. This can be considered as a step towards the traditional plant resources management practice and food security to the people of the area.

Ethnic farmers in their traditional agriculture system select indigenous locally suited along with other parameters such as yield, resistant to disease, etc. With the acculturation of the ethnic societies and various developmental activities, the indigenous crop germplasms and the associated traditional knowledge and practices have been eroding very fast. Due to various socio-political reasons many of the crop landraces could not be characterized, except rice and maize, during the period of present work.

Total numbers of the plants collected and recorded according to the crop type or use wise:

A total of 1102 samples of plants used and/or information on uses have been recorded during the present study among the different ethnic groups of the study area and out of which, 860 have only one use (Pie diagram:9). Rest of the 242 recorded species/samples has more than one uses described under different sub headings. All those
species/samples with more than one uses including the species possessing the IC nos. from National Authority have been cited only once even if these have been described under different sub headings. The total counts of the species/samples also include the number of variations recorded within the same taxa.

The plant resources recorded during the present study have been categorized as below:

A. Edible plant resources:

I. Cereals:

a) Rice genetic resources: A total of 63 germplasm samples have been collected from the study area. Out of which, 39 landraces have been characterized and analyzed. In terms of Frequency of all the 63 collected rice genotypes, 5 accessions are abundant, 21 are frequent, 24 are occasional and 13 are rare.

Out of 63 germplasm, 36 are Jhum/ upland paddy and 27 are wetland cultivar/ lowland paddy.

Again, out of 24 sticky rice samples collected, 18 are upland and 6 are lowland paddy.

A total of 5 samples having aroma includes 2 aromatic only and 3 are sticky as well as aromatic.

In respect of kernel colour, the characterized 39 landraces can be divided into 27 white/yellowish, white/silvery white, 8 red and 4 golden/light brown.

The husk colors of the 39 characterized rice genotypes include 35 mottled reddish-brown/ reddish brown/ light brown/ brown/ dark brown/ shaded brown; 2 red and one each of mottled purple and black.

b) Maize genetic resources: A total of 46 collections were characterized and analyzed. Out of these, 9 races and 1 sub-race have been identified from the area.

c) Other cereal crops: A total of 6 other cereal crops have been recorded from the study area.

II. Wild edible ferns: A total of 4 edible wild ferns eaten cooked as vegetable were recorded.

III. Wild edible mushrooms: A total of 9 wild edible Mushrooms were recorded.

IV. Fermented food and drinks: Plants used as raw material for preparation of fermented food include only 5 plants; plants used for non alcoholic are 4 and 17 for alcoholic drinks.
V. Fruits and seeds: A total of 25 wild fruits; 28 cultivated fruits; 13 *Citrus* fruits; 9 bananas (both wild and cultivated); 29 Cucurbits (both wild and cultivated); and 12 brinjals and tomatoes (both wild and cultivated) have been recorded.

VI. Legume and pulses: A total of 25 samples, including some wild, have been recorded.

VII. Marketed edible plants: A total of 254 have been recorded from Haflong weekly market.

VIII. Spices and condiments: A total of 33 plants used as Spice and another 23 types of Chilies have been recorded.

IX. Tuber crops:
   a) Yam genetic resources: 17 edible and 1 non edible (*Dioscorea hispida* Dennst.) Yams have been recorded from the study area.
   b) Taro genetic resources: A total of 25 types edible and 5 ornamental, including medicinally used Taros has been recorded.
   c) Other tuber crops: 9 tuber crops other than the ones mentioned above have been recorded.

X. Vegetables: A total of 77 plants recorded that includes both eaten cooked and raw.

B. Masticatories and fumigatives: 8 plants used for the purpose have been recorded.

C. Oil yielding plants: A total of 13 of plants have been recorded.

D. Medicinal plants: No. of plants used for the purpose by three different communities are *Hrangkhols* 36 plants; *Hmars* 35 plants and *Zeme Nagas* 17 plants have been documented.

E. Bamboo and canes: A total of 32 species of Bamboo and 8 species of canes have been recorded.

F. Plant resources for material uses:
   I. Soap, detergent and alkali preparation: A total of 11 plants recorded to be used for the purpose.
   II. Dye yielding plants: A total of 19 plants have been recorded.
   III. Fiber yielding plants: A total of 17 plants recorded to be used for the purpose.
   IV. Ichthyotoxic plants: A total of 12 plants recorded to be used for the purpose.
   V. *Eri* silk worm rearing plants: A total of 9 plants recorded as feed plants of the worm.
   VI. Pesticidal plants: A total of 14 plants recorded for their use as pesticide.
VII. Miscellaneous plant resources: 32 plants used for construction of huts and other structures and 17 for various other uses have been recorded.

G. Sacred groves and sacred plants of the Dimasas: A total of 13 plant used in worshipping; 23 plants based naming of the villages and 34 plants for naming Clans by the Dimasas have been recorded.

H. Plant resources and agriculture management:
A total of 13 species having multifarious uses have been identified and recorded to be used in agricultural practices and watershed management of hill agricultural practices.

From the present study, a clear picture can be drawn on the traditional plant resources and their management in the district. The changing environment and socioeconomic scenario during the last few decades have brought many changes in the use of plant resources by the ethnic people of the district. Under such circumstances not only the plant resource of the area have been showing a depleting trend but also the related Traditional Knowledge base for sustainable utilization of these resource, which may not ensure the security of utilization of these resources by the ethnic groups of the district in near future. Also the diverse genetic resources will be lost before these are exploited for the benefit of mankind.

Variability recorded in selected crops:

Number of variation recorded for different crops is mention here in parenthesis following the respective botanical names. Rice landraces (Oryza sativa-58), Maize (Zea mays-46), Fox tail millet (Setaria italica-3), Sorghum (Sorghum bicolor-2) and Coix (Coix lacryma-jobi-2).

Number recorded on fruits in respect of size, colour, taste, etc. are as follows: Baccaurea ramiflora (2), Prunus persica (3), Citrus reticulata (3), Benincasa hispida (14), Cucurbita moschata (13), Cucumis melo (3), C. sativus (4), Lagenaria siceraria (8), Luffa cylindrica (2), Sechium edule (5), Solanum gilo (11) and S. melongena (13)

Number of variations of pods recorded on legumes and pulses are: Psophocarpus tetragonolobus (2), Dolichos lablab (10) and seed colour variation in Vigna unguiculata (9).

Number of variations of fruits in Chilies includes Capsicum annum (14) and C. frutescens (14) and seed colour in Sesamum indicum (2).

The numbers of variations in tuber crop resources are- Dioscorea alata (7), D.bulbifera (3), D.pentaphylla (2), Colocasia esculenta (15), Ipomea batatas (2) and
Manihot esculenta (4). The variabilities recorded in certain crops are represented in the Histogram:10.

It is interesting to note that the age old traditional agricultural practices by the ethnic groups might have played a significant role in manipulating their crops leading to different landraces of crops. The traditional selection process of the crops for desired qualities is one of the most important criteria for conservation of germplasm and crop variations. Sometimes traditionally valued landraces of crops are due to their socio-ethical values and may not be otherwise important in terms of productivity.

Manipulation of agricultural practices to suit the local environment and other factors such as land quality, water availability, soil fertility management, location specificity, etc. may also alter the crop qualities leading to the formation of different landraces of a particular crop. The manipulation of agricultural practices may be one of the root causes for such variation.

The more variability within a crop implies more food security to the people and also has wide option for selection of better germplasm of a particular crop.

**Significant findings:**

Some of the specific significant uses and plant resources recorded during the present study are given below. However, due to the paucity of works on similar line most of the plant resources recorded could not evaluated to work out the significant findings.

The three landraces viz., Lokhamu (IC no. 560759), Mezamew (scented rice, IC no.560760) and Uithao (sticky rice, IC no.560761) with fine white kernel, high yielding and disease resistant quality of upland rice recorded to be cultivated by Kuki people from the study area are considered to be significant.

As far as their use are concerned, the upland rice cultivars having sticky grains Biring (IC No. 560771) is preferred for local beer preparation (Biron-Judima) and Maiju-walao (IC No.560796), Maiju-walao-gidiba (IC No.560797) and Maiju-hadi (IC No.560798) having sticky grains with aroma are preferred for preparation packed food items for carrying to the agricultural fields are significant for the Dimasas.

The sticky lowland rice cultivar viz., Changman (IC No. 560818) is used specifically for preparation of Kangpok (local stuffed rice) only by the Hmar people.
(Plumbaginaceae), *Solanum verbascifolium* (Solanaceae) and *Zingiber zerumbet* (Zingiberaceae) are significant as their uses for specific ailments are not known widely.

Uses of tender shoots of *Bauhinia vahlii* (Caesalpinaceae), *Dioscorea bulbifera* (Dioscoreaceae), *Sesamum indicum* (Pedaliaceae), *Sida rhombifolia* (Malvaceae) as substitute of soap/detergent and tuber paste of *Ipomea batatas* (Convolvulaceae) for rejuvenating human skin are considered to be significant findings for their specific uses.

Recording of *Hodgsonia macrocarpa* (Cucurbitaceae) and *Pronephrium lakhimpurensis* (Thelypteridaceae) as dye yielding plants and also the use of leaves of *Persea lanceolata* (Lauraceae) as feed plant for rearing of *Eri* silkworm are found to be not known earlier.

The ichthyotoxic plants like *Croton caudatus* (Euphorbiaceae), *Spondias pinnata* (Anacardiaceae), *Travesia palmata* (Araliaceae), *Zanthoxyllum armatum* (Rutaceae) and *Randia spinosa* (Rubiaceae) are not widely known for such uses.

The powdered roots of *Milletia pachycarpa* (Fabaceae) and smeared leaves of *Plumbago zeylenica* (Plumbaginaceae) used to repel skin parasites of domestic animals are found to be reported for the first in the present work.

The use of *Argyrea argintina* (Convolvulaceae), *Butea minor* (Fabaceae) and also *Sterospermum chelonoides* (Bignoniaceae) recorded to be used in basketry and for minor construction are not known earlier.

Again the production method of gunpowder explosive from *Trema orientalis* (Ulmaceae) has been recorded for the first.

Enumeration of the *Sacred groves* of the district and confirming the identity of the plant based names of the villages and *Clans* of the *Dimasas* are accomplished for the first time during the present study.

The 13 multifarious uses of tree Species (Table: 17) recorded from the *Jhum* fields of the present study are considered to be important as far as the hill agricultural practices of northeast India is concerned.

The present account is not only base data but also the only database on the phytoresources of N.C.Hills district of Assam and further investigation covering different aspects on these resources is expected to help in proper planning, monitoring, sustainable management and conservation of these plant wealth of the district in particular and of the entire northeastern region in general. The utilization and self sustained plant resource management practices by the ethnic people of the hill district are expected to open up new developmental vistas.
The 5 Maize races identified from present study area viz., Tirap Nag-Sahypung, Arun Tepi, Asht Samsung, Tista Mendi and Mikir Merakku are the new report of occurrence in the district.

The variation of edible tubers of Dioscorea alata (7 nos.) and corms of Colocasia esculenta (15nos.) that includes both cultivated and wild are important famine food and fodder used by the ethnic groups of the area.

The fruits of Cyclanthera pedata (Cucurbitaceae) recorded to be cultivated only by the Pnars in the Jatinga village and occurrence of Momordica mixta (Cucurbitaceae), a rare species recorded only from the Borail range of Jatinga village are significant. The former is used as vegetable and while the later both as vegetable and as a cure to jaundice.

The use of tender fruits and shoots of Bauhinia acuminata (Caesalpiniaceae) as vegetable by the Hmar people and tender shoots of the climbing fern Stenochlaena palustris (Stenochlaenaceae) of Retzol area and all the ethnic groups throughout the district respectively. The popularity of tender shoots of Clerodendron serratum (Verbenaceae), Micromelum pubescens (Rutaceae) and Vitis pedungcularis (Ampelidaceae) and inflorescence of Giardinia heterophylla (Urticaceae) as vegetable among all the ethnic groups of the district are significant.

Growing of Mucana monosperma (Fabaceae) for tender edible pod as vegetable; Blumea lacera (Asteraceae) as vegetable and Stemona tuberosa (Stemonaceae) for tuber; former one by the Zeme Nagas and the later two by the Hmars respectively in the district is notable. Again the Elaegnus latifolia for sour fruits and one type of Dioscorea pentaphylla grown for tuber by the Dimasas are also recorded.

The use of leaves of Lippia geminata (Verbenaceae) and tender shoots of Polygonum persum (Polygonaceae) as spice and use of both fresh and dried petals of Taphrosia candida (Fabaceae) for preparation of a delicacy with the rice flour called Hon by the Dimasas may be considered significant.

Fruits of Toddalia asiatica (Rutaceae), eaten raw as chutney and selling in the local markets only by the Zeme Nagas, is significant as the other ethnic groups of northeast India adopted to use of the fruits in similar ways open up the scope for commercialization of products of the species.

The medicinal uses recorded for Bridelia retusa (Euphorbiaceae), Careya arborea (Lecithyaceae), Drymeria cordata (Caryophyllaceae), Gynocardia odorata (Flacourtiaceae), Lindernia japonica (Scrophulariaceae), Plumbago zeylenica
It is noteworthy that because of their traditional food habit and life style there is a high demand for the local edible plants even among the urban dwellers of different ethnic groups of the study area even today. Some of the wild vegetables and fruits are becoming rare either due to over exploitation or habitat destruction. Multi-tier plant garden can be an effective measure not only for conservation and sustainable management of these wild vegetables and fruits but also for income generation and food security of the ethnic groups.

Commercialization of some of the ethnic products can be a successful venture for economic upliftment and social justice of the ethnic groups. However, further relevant studies in this regard have to be undertaken as a follow up work.

The primary players in the collection and marketing of non wood forest products and cultivated plants are mainly women. So, any community-based programme must address the gender issue; otherwise, such an attempt will not yield the desired results.

Most of the traditional agricultural and resources management practices such as management of land, soil fertility, and watershed are location specific; therefore any resource management or developmental scheme in the district must consider these aspects also.

The traditional plant resources utilization and management practices of the different ethnic communities recorded during present study in the district have been found to be sustainable as these are based on Traditional Knowledge that have been subjected to the experimentation through generations.
Pie diagram: Total no. of Families, Generas and Species recorded in present study.

Histogram: No. of Families, Generas and Species recorded in each plant group.
Pie diagram: Biological status analysis of the recorded species.

Histogram: Biological status analysis of the different plant groups recorded.
Pie diagram:9: Total no. of plants recorded in the present study from N.C.Hills district.

Histogram:10: Variation recorded within the species in some crops.