# Exploration and Collection of Crop Germplasm from Eastern Parts of Arunachal Pradesh

**SK Singh, U Barua*, DK Hore and AK Misra**

*NBPGR Regional Station, Umroi Road, Umiam-793 103, Meghalaya, India*

** Present address : KVK, ICAR Research Complex for NEH Region, Umiam-793 103, Meghalaya, India*

Survey and collection of multi-crop germplasm from Arunachal Pradesh was executed in three different trips, during November to December to collect the indigenous crop germplasm diversity and other economic plants. These exploration trips concerted in East, West and Upper Siang districts of eastern part of Arunachal Pradesh. These explorations were conducted in a way keeping in view of the period of maturity and harvest of collected germplasm. These trips were yielded a total of 553 different crop germplasm collected from 49 different sites with an altitudinal variation between 183 to 1100 m above msl. The crop group wise break-up of collections is cereal (188), pseudocereals (51), grain legumes (78), vegetables (86), oilseeds crop (21), spices (66), tuber crop (22), fruit crops (38) and other crops (03). Local indigenous technical knowledge practiced by the farmers on some crops was also recorded during exploration. Extents of diversity with in the collected accessions have been summarized in this paper.

**Key Words: Northeastern India, Siang district, Variability, Indigenous technical knowledge**



## Introduction

Arunachal Pradesh is located in the contiguity of the eastern Himalayan region, sharing international boundaries with China (North), Myanmar (South) and Bhutan (West). The state is situated in between $26^0$28' and $29^0$30' North latitude and $91^0$30' and $97^0$30' East longitude with an area of 83,743 km$^2$. A number of exploration and collection trips for the collection of crop germplasms have been conducted in this state since the colonial period, which was referred as *Abor* land. It is reported that about 134 plant species are consumed by the people of the state (Maikhuri and Ramakrishnan, 1992). However, many plant species and crop germplasm are still need to be collected, identified and assayed scientifically for potential use in future. Harnessing unknown/ underutilized natural resources and to bring them in agriculture will obviously uplift economic status of the local people. The important tropical semi evergreen tree species of Arunachal Pradeesh are *Terminalia myricarpa, Bombax ceiba, Canarium strictum, Alianthus grandis, Ammora wallichi, Toona ciliata, Juglans regia* etc. The coniferous forest containing *Pinus wallichi*, *Cedrus deodara*, *Abies pindraw*, *Picea* spp., *Quercus* spp. are other important temperate species found in higher altitudes of these areas. The farmers generally practice mixed type of farming system. Majority of crops are grow in spring season, autumn cultivation is very rare. Rice, finger millet and job's tear are grown as mixed crop in uplands (Burkill, 1978). Besides these, maize, foxtail millet, rice bean, soybean, *Perilla,* cucurbits, *Colocasia, Dioscorea,* ginger, etc are other commonly grown crops.

*Author for correspondence: sahayg1@ rediffmail.com*

The literature and demographical information available about the area coupled with its remoteness and less explored conditions has lead to undertake the explorations with the following objectives, *i.e.* inventorization and collection of crop landraces, their diversities, both inter and intraspecific level from three explored area, especially in eastern parts of Arunachal Pradesh.

### Materials and Methods

The collection mission was planned meticulously with an aim to collect as many as the crop diversities of cultivated plants as well as their wild relatives, so that it covers and represent the genotypes of the particular crop within the districts. Three explorations were executed in East, West and Upper Siang districts (Fig. 1). The West and Upper Siang districts share international boundary with China in North. Altitudinal variations (350 – 4,500 m msl) of the area determine the vegetation type of the localities. The study area is characterized by their mountainous, undulating topography. Soils are fairly deep to very deep and well drained, whereas in the valley land and plains of East and west Siang are alluvial deposit favouring luxurious growth of plants. Hence rich soils, moderate temperature and plenty of rainfall (2,000-2,500 mm) are conducive for good agricultural harvest. The three explorations were executed separately in the months of November to December coinciding the period of crop maturity and harvest so that fresh, viable seeds could be collected. Standard practice and procedure of collection of germplasm developed by NBPGR was followed (Pareek *et al.,* 2000). Mostly the local landraces and primitive

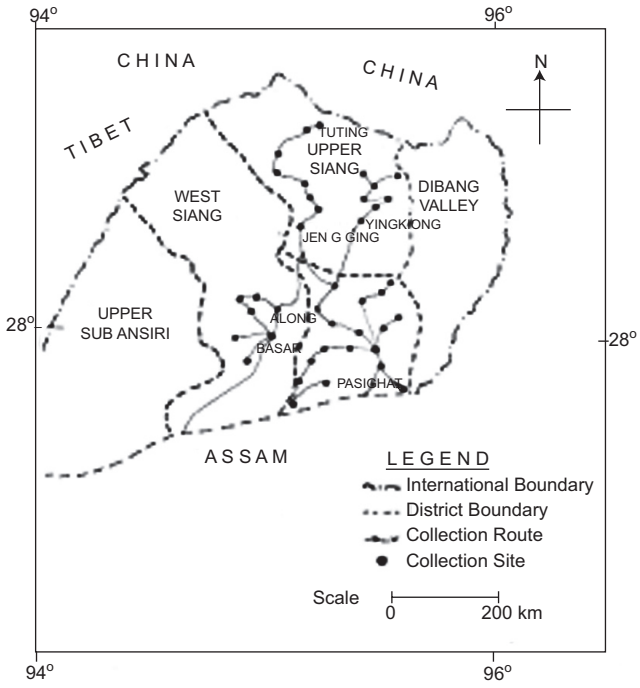


**Fig. 1: Map showing explored areas in East, West and Upper Siang districts of Arunachal Pradesh**

crop cultivars of germplasm were collected during this trip. Selective and bulk method was followed as per the population/quantity of germplasm material available. Sampling was made in fruit form in case of *Citrus* spp., which is recalcitrant in nature. Due attention was paid to collect the materials which are disease free, viable and confirm the standard for medium term storage, as voucher sample. Most of the materials were collected from wild habitat, farm store, and farmer's field. A few samples were collected from village markets, after ensuring the information from the place of cultivation from the retailers. Markets were surveyed, because they represent a large area where villagers from many nearby areas come to sale and purchase of their farm produce which gives broad idea of the type of crop variability represented in the area. The source of collected germplasm is mentioned in Table 1. Passport data on each accession was recorded at the time of collection, following the standard procedure.

Samples of collected plant species were identified with the help of relevant floras (Hooker, 1872-1897; Kanjilal *et al.,* 1934-1940; Burkill, 1978; Arora and Pandey, 1996; Hajra *et al.,* 1996; Chauhan *et al.,* 1996). The vegetatively propagated materials were retained at the NBPGR Regional Station, Umiam, Meghalaya for their multiplication, maintenance and subsequent characterization. The seed materials were sent to the National Gene Bank, NBPGR, New Delhi for medium term storage along with passport data.

## Results and Discussion

Altogether 553 accessions of various crop genotypes were collected, covering 63 botanical species together with their variability. The break-up of collections is cereal (188), pseudocereals (51), grain legumes (78), vegetables (86), oil seed crop (21), spices (66), tuber crop (22), fruit crops (38), and other crops (03). The genotypes were collected either in seed form or as vegetative propagules as per the nature or method of reproduction of the respective crop. Primitive cultivars and landraces are dominant collection and this may be due to the isolation and remoteness of the area (Table 2, Figs. 2 and 3). The collection includes 84 rare genotypes indicating biodiversity richness of the area. The description and discussion of collected germplasm along with ITK is as under:

### *1. Cereal*

A total of 188 collected accessions of cereals belong to 3 different genera (*Oryza, Zea* and *Sorghum*). Most of these collected samples were primitive cultivars occurring occasionally. Ten rare samples of rice landraces were collected from this belt. The diversity of rice and their presence of variations to a great number from the North eastern region of India can be traced way back to 1931 (Roschevioz, 1931) and Assam rice collection, where 6,730 rice races were collected from Northeast India, including Arunachal Pradesh. Sharma (2002) reported 105 rice landraces from this state and precisely 12 and 32 accessions from West and East Siang districts, respectively.

**Table1. Sources of collected germplasm from Arunachal Pradesh**

| Source | Number of accessions | % Collected accessions |
|---|---|---|
| Farm store | 437 | 79.1 |
| Market (local weekly market) | 16 | 2.9 |
| Farmer's field | 83 | 14.9 |
| Homestead garden | 2 | 0.4 |
| Wild habitat | 10 | 1.8 |
| Institutional experimental field | 5 | 0.9 |
| Total | 553 | 100.0 |

**Table 2. Status and frequency of germplasm collected from Arunahal Pradesh**

| Crop group | Crop | Status of collections | | | | Total | Frequency of collected accessions | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Type of material | Primitive cultivar | Landraces | Genetic stock | | Abundant | Occasional | Frequent | Rare | |
| Cereal | *Oryza sativa* | Seeds | 135 | 7 | 0 | 142 | 5 | 70 | 57 | 10 | 142 |
| | *Zea mays* | Seeds | 38 | 4 | 0 | 42 | 0 | 18 | 17 | 7 | 42 |
| | *Sorghum* sp. | Seeds | 4 | 0 | 0 | 4 | 0 | 1 | 2 | 1 | 4 |
| Pseudocereal | *Amaranthus* sp. | Seeds | 2 | 0 | 0 | 2 | 0 | 1 | 0 | 1 | 2 |
| | *Elusine coracana* | Seeds | 26 | 6 | 0 | 32 | 0 | 13 | 18 | 1 | 32 |
| | *Setaria italica* | Seeds | 3 | 1 | 0 | 4 | 0 | 2 | 0 | 2 | 4 |
| | *Coix lacryma-jobi* | Seeds | 10 | 3 | 0 | 13 | 5 | 2 | 6 | 0 | 13 |
| Grain legumes | *Phaseolus vulgaris* | Seeds | 6 | 0 | 0 | 6 | 0 | 5 | 1 | 0 | 6 |
| | *Vigna unguiculata* | Seeds | 33 | 1 | 0 | 34 | 0 | 12 | 21 | 1 | 34 |
| | *Cajanus cajan* | Seeds | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 |
| | *Vigna umbellata* | Seeds | 17 | 0 | 0 | 17 | 0 | 12 | 3 | 2 | 17 |
| | *Dolichos lablab* | Seeds | 5 | 0 | 0 | 5 | 0 | 4 | 1 | 0 | 5 |
| | *Glycine max* | Seeds | 9 | 2 | 0 | 11 | 0 | 4 | 2 | 5 | 11 |
| | *Vigna mungo* | Seeds | 4 | 0 | 0 | 4 | 0 | 2 | 0 | 2 | 4 |
| Vegetables | *Benincasa hispida* | Fruits | 6 | 0 | 0 | 6 | 1 | 3 | 1 | 1 | 6 |
| | *Momordica charantia* | Seeds | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 2 | 2 |
| | *Lagenaria siceraria* | Seeds | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 |
| | *Solanum melongena* | Fruits | 10 | 2 | 0 | 12 | 0 | 8 | 2 | 2 | 12 |
| | *Cucumis sativus* | Seeds | 17 | 0 | 0 | 17 | 0 | 9 | 4 | 4 | 17 |
| | *Lycopersicon pimpinelifolium* | Seeds | 2 | 0 | 0 | 2 | 0 | 1 | 0 | 1 | 2 |
| | *Raphanus sativus* | Seeds | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 |
| | *Cucurbita moschata* | Fruits | 17 | 0 | 0 | 17 | 0 | 9 | 2 | 6 | 17 |
| | *Luffa acutangula* | Seeds | 2 | 0 | 0 | 2 | 0 | 1 | 0 | 1 | 2 |
| | *Trichosanthes anguina* | Seeds | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 |
| | *Abelmoschus esculentus* | Seeds | 6 | 0 | 0 | 6 | 0 | 4 | 0 | 2 | 6 |
| | *Solanum gillo* | Fruits | 8 | 1 | 0 | 9 | 0 | 6 | 3 | 0 | 9 |
| | *Solanum indicum* | Fruits | 2 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 2 |
| | *Solanum spirale* | Fruits | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 |
| | *Solanum* spp. | Seeds | 3 | 0 | 0 | 3 | 0 | 0 | 2 | 1 | 3 |
| | *Luffa cylindrica* | Seeds | 2 | 1 | 0 | 3 | 0 | 0 | 1 | 2 | 3 |
| | *Lycopersicon esculentum* | Seeds | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 |
| Oilseeds | *Brassica* sp. | Seeds | 14 | 0 | 0 | 14 | 0 | 6 | 4 | 4 | 14 |
| | *Guizotia abysinica* | Seeds | 2 | 0 | 0 | 2 | 0 | 1 | 0 | 1 | 2 |
| | *Perilla frutescens* | Seeds | 2 | 0 | 0 | 2 | 0 | 0 | 1 | 1 | 2 |
| | *Sesamum indicum* | Seeds | 3 | 0 | 0 | 3 | 0 | 0 | 3 | 0 | 3 |
| Spices | *Capsicum annum* | Fruits | 37 | 4 | 0 | 41 | 4 | 13 | 21 | 3 | 41 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Allium schoenoprasum* | Bulbs | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 |
| | *Coriandrum sativum* | Seeds | 4 | 0 | 0 | 4 | 0 | 4 | 0 | 0 | 4 |
| | *Curcuma caesia* | Rhizomes | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 |
| | *Zingiber officinale* | Rhizomes | 14 | 0 | 0 | 14 | 0 | 5 | 9 | 0 | 14 |
| | *Illicium grifithii* | Seeds | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 |
| | *Allium cepa* | Bulbs | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 |
| | *Curcuma longa* | Rhizomes | 3 | 0 | 0 | 3 | 0 | 2 | 1 | 0 | 3 |
| Tubers | *Colocasia esculenta* | Rhizomes | 16 | 0 | 0 | 16 | 0 | 13 | 2 | 1 | 16 |
| | *Dioscorea* sp. | Rhizomes | 6 | 0 | 0 | 6 | 1 | 3 | 0 | 2 | 6 |
| Fruits | *Musa* sp. | Suckers | 2 | 0 | 0 | 2 | 1 | 1 | 0 | 0 | 2 |
| | *Citrus jambhiri* | Fruits | 7 | 0 | 1 | 8 | 1 | 6 | 0 | 1 | 8 |
| | *Citrus latipes* | Fruits | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 |
| | *Citrus reticulata* | Fruits | 3 | 0 | 0 | 3 | 3 | 0 | 0 | 0 | 3 |
| | *Citrus* spp. | Fruits | 10 | 0 | 0 | 10 | 0 | 3 | 3 | 4 | 10 |
| | *Garcinia* sp. | Fruits | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 |
| | *Artocarpus heterophyllus* | Fruits | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 |
| | *Kinnow* | Fruits | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 |
| | *Cucumis melo* | Seeds | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 |
| | *Carica papaya* | Fruits | 4 | 0 | 0 | 4 | 0 | 4 | 0 | 0 | 4 |
| | *Citrus grandis* | Fruits | 2 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 2 |
| | *Poncirus trifoliata* | Fruits | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 |
| | *Juglans regia* | Seeds | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 |
| | *Citrullus lanatus* | Seeds | 1 | 1 | 0 | 2 | 0 | 0 | 1 | 1 | 2 |
| Miscellaneous | *Canarium strictum* | Seeds | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 |
| | *Gossypium arboreum* | Seeds | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 |



Wide variations were observed in characters like panicle type, presence or absence and size of awn, glume and kernel characteristics in the collected samples. Red and black kernelled rice was also observed. Tribal people usually prefer glutinous types of rice for food as well as to prepare the local beer (*Apong*). They have a preference of local rice landraces known as *Taker, Amsi, Amkel Ketsing* and *Umkel* for beer preparation. These variants were found to be growing in Karko (849 m), Nari (200 m), Linka (250 m) and Mariyang (1,100 m). Some farmers also grow lowland rice in terraces with 30-60 cm water depth under controlled water management. The farmers informed that there was very less incidence of crop failure due to pest or disease attack, which may be attributed to their mixed cropping system of cultivation. Similar observations were also reported in some of the earlier reports (Hore, 1999a).

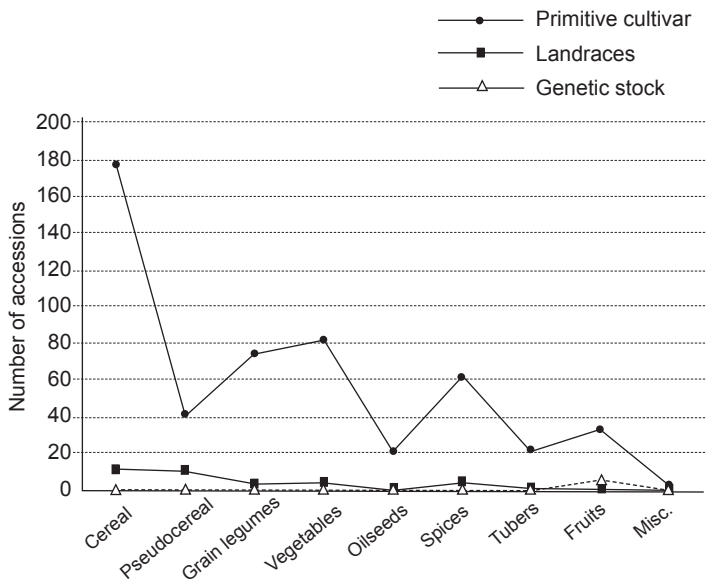


**Fig. 2: Status of collected crop germplasm of Arunachal Pradesh**

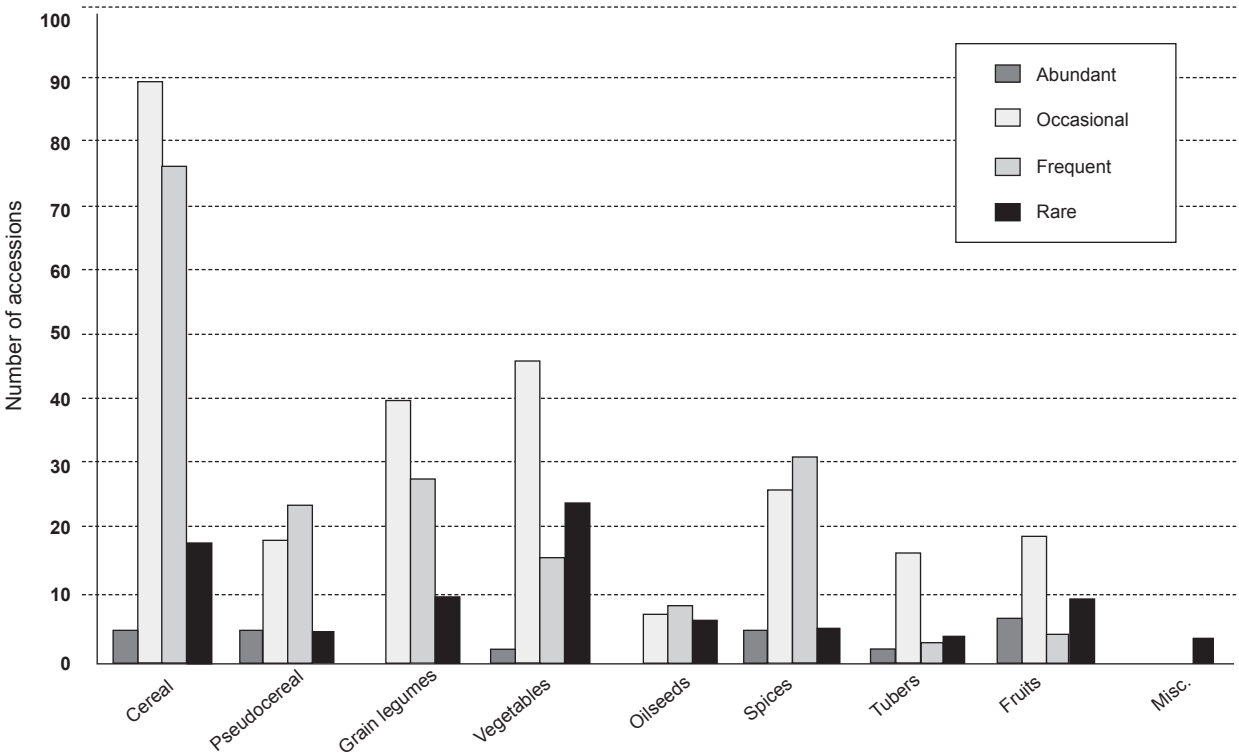


**Fig. 3: Frequency of collected crop germplsm of Arunachal Pradesh**



Ricebug (*Leptocorisa oratorius*) is one of the major pest of rice in these areas, which generally appears in the field during flowering. Farmers fix several wooden/bamboo sticks randomly at certain interval in the rice field (both in lowland and upland condition). Dead frog/crabs are placed on it for 5-6 days. The idea behind this is to attract the bugs to this rotten, foul smell emitting frog/crab deviating from crop. Meanwhile, the milk stage of rice grain is over and thus evades the pest attack. Farmers also apply other traditional method for control of pest and disease, such as application of ash from wood, rice husk, straw, cowdung slurry, cattle urine etc. Leaf and seed extracts of *Xanthoxylum* and *Nicotiana* are also used for the control of pest and disease attack.

Maize is another important crop for these areas, which is generally sown in April - May and the crop gets ready within 120-150 days. Variability was found with regard to cob especially in size, length, kernel size, row arrangement pattern, etc. Kernel colour was found to be varying to a great extent and it may be due to highly heterozygous nature of this crop and farmers are not aware to maintain the purity of the genotype by keeping isolation distance. This is in conformant of earlier report by Sharma (2002).

Villagers prefer to smoke the seeds by keeping them in the ceiling of kitchen for safe storing of seeds. Smoke makes the seeds dry and keeps free from insect and disease attack. But such system does not followed for bulk quantity of seeds. Singh and Bag (2002) reported such practices adopted specially by Adi tribe of the state.

### *2. Pseudocereal*

Among the 51 collected pseudocereals samples, finger millet and job's tear had the largest share. The availability and occurance of these crops are frequent. Farmers use to grow primitive cultivars of these two crops. The main preference lies with these crops are for their brewing quality, which forms local beer (*Apong*). The finger millet accessions were found to vary in number of fingers, which ranges between 5 to10. The prominent types were *Tami* (10 fingers), *Taker* (8 fingers), *Kompo* (6 fingers) and *Marua* (5 fingers). Burkill (1978) also reported the preferences of local tribes for using finger millet and job's tear in local beer (*Apong*) preparation.

### *3. Grain legumes*

A total of 75 diverse germplasm of seven grain legumes were collected. The local tribes grow various grain legumes like French bean, cowpea, rice bean, soybean etc. These are generally sown as mixed crop and left unattended,

until they are ready for harvest. Diversity was prominent particularly in soybean, cowpea, sembean, pigeon pea and rice bean. The variability in soybean was observed for growth habit, plant height, number of pods per plant, grain size and colour. Cowpea is generally grown for vegetable and their pod length varied from 8-25 cm. Soybean and rice bean is generally utilized as pulse crop. Variation in the number of seeds per pod and seed shape was found in the collected accessions.

### *4. Vegetables*

A total of 86 accessions, covering 18 types of vegetables were collected. Among the solanaceous crops, a wild relative of tomato, *Lycopersicon pimpinelifolium* was collected. The fruits were rounded, barely 1 cm in diameter with innumerable tiny seeds. *Solanum spirale,* locally known as *Bangkho* in East Siang district, was also collected. The fruits are bitter in taste and used in folk medicines by the tribes. The variations were observed in *Solanum melongena*, involving the morphological characters like fruit size, shape and colour; plant characters such as thorny, thorn less, stem colour, carpel character and fruit taste. The people of these areas also grow *Solanum gillo* in their homestead area and use as medicine for various stomach ailments. Among cucurbits, the variability in terms of their fruit size, fruits skin colour and luster were found in bitter gourd (*Momordica charantia*). Oblong, round and oval shaped fruits of pumpkins (*Cucurbita moschata*) were collected with golden yellow to purple coloured skin. One accession of ash gourd (*Benincasa hispida*) locally known as *Joha lau*, was collected from West Siang district and it was found to possess distinctive pleasant aroma.

### *5. Oilseeds*

At lower elevation (<300 m) oilseed Brassicae grows to a limited scale, though utilization of leafy brassicae is much more in practice. Sesame cultivation is not much popular in the area. However, indigenous *Perilla* was seen to cultivate as mixed crop with *Coix,* either in homestead area or in *jhoom* field. *Guizotia abysinica* was also grown in some pockets. A total 21 accessions of these four oilseeds were collected.

### *6. Spices*

Variability in terms of fruit shape, size and level of pungency were observed in collected 41 accessions types of chilli. An accession of *Allium schoenoprasu* (chives) was collected from Karko village in Upper Siang district. The local tribe (*Adi*) of the area called it *Talap.* It has a characteristic bulb of 4-5 cloves remaining attached loosely from the base only. Besides these, the villagers also collect *Curcuma caesia* (black zedoary) and *Illicium griffithii* (a medicinal plant) from the forests, which they use as condiments and also for various medicinal purposes.

### *7. Tuber crops*

The entire northeast belt of India is one of the centers of origin for *Colocasia* and *Dioscorea* (Plucknett, 1976). Six accessions of primitive type of *Dioscorea* were collected and variability was observed in rhizome shape and flesh colour (*viz.,* brown, white). Conical, round and oblong shaped tubers were seen in 16 *Colocasia* accessions.

### *8. Fruit crops*

Chakravarty (1951) established that northeastern region may be the center of origin of cultivated banana and other taxonomic groups of the genus *Musa.* In all three districts, abundant populations of wild banana were observed, while most of them belong to *Musa balbisiaina* group. It is characterized by 6-8 m tall pseudostem with 1.5-2 m long drooping peduncles. During the exploration one accession each of *M. velutina* and *M. ornata* was collected. These accessions are having erect inflorescence with yellow and reddish coloured bracts, respectively.

Species of *Citrus, i.e., C. jambhiri, C. reticulata* and *C. grandis* were collected from farmers fields, while, *C. latipes,* Kinnow and *Poncirus trifoliata* were collected from Basar (West Siang). *C. reticulata* is characterized by upright trees, lanceolate leaves with narrowly winged petiole. Fruits globose, sweet and loose skinned. The trees of *C. grandis* are almost thornless with spreading habit. Lower surface of leaves are pubescent with characteristic broad wings in petiole. Fruits have thick spongy rind with bold seeds. Trees of *C. jambhiri* are medium spreading habit. It is widely used as rootstock and imparts resistance to tristeza and drought. *C. latipes* is also used as rootstock as it is resistant to greening disease and cold tolerant, but the fruits are not suitable for commercial use. *Poncirus trifoliata* is chiefly used for rootstock against frost resistance and tolerance to root knot nematode. Kinnow is a commercial hybrid and mainly introduced for large scale cultivation in these areas. The fruiting season of *C. jambhiri, C. reticulata, C. grandis* and *C. latipes* is in between September–December, April- May, October- February and December-January, respectively. Hore (1999b) reported the occurrence of wild population of *C. jambhiri* around Shimmong, Pugging, Ramshing and Gossang villages of Yingkiong area of Upper Siang

districts. Although, the plants of *C. jambhiri, Poncirus trifoliata* and *C. grandis* are being tried as rootstock for *C. reticulata* (Khasi mandarin), a local type found in this region, but the *Citrus* plantations of this area experiences substantial infestation of trunk borer, leaf miner, die back, lichens and mosses. These maladies finally made a major problem in these areas in *Citrus* production.

### *9. Other crops*

The tribes grow opium in some pockets of these areas for consumption and other medicinal purposes. Tree cotton (*Gossypium arboreum*) is another crop, which is used by the villagers for household purposes. The seeds of *Canarium strictum* were collected and the dried gums/resin of these trees is used by the villagers as mosquito repellent. One accession each of these three species was collected during the exploration trip.

## Conclusion

The explored areas of Arunachal Pradesh have vast potentiality of crop germplasm as these areas are in contiguity with Chinese center of origin. Looking to the cultivation practices of rice, maize and other crop the identification of cold tolerant and disease, pest resistant types cannot be denied. There is every possibility to occur more genotypes of *japonica* race of rice in this belt. The occurrence of banana and *Citrus* in various altitudes may also enrich our gene pool with biotic and abiotic stress resistant types. Local landraces of various crop germplasm of these areas are vanishing slowly as gradually these are being replaced by high yielding varieties. The changing socio-economic condition of the tribes, different development activities as well as climatic changes is leading to alterations in cropping pattern. The use of local landraces must be enhanced by educating the villagers at grassroot levels, about its benefits, which they have been practicing since ages without fail. There is a further scope to study the area more intensively in respect of the collection of plantation and forestry related plant species.



## Acknowledgement

The authors are thankful to the Mission Leader and Principle Investigator of National Agricultural Technological Project on "Sustainable Management of Plant Bio-diversity" for providing the financial support.

## References

Arora RK and A Pandey (1996) *Wild Edible Plants of India: Diversity, Conservation and Use*. National Bureau of Plant Genetic Resources, New Delhi.

Burkill IH (1978) *The Botany of the Abor Expedition.* Bishen Singh and Mahendra Pal Singh, DehraDun.

Chakravarty AK (1951) Origin of cultivated banana of South-east Asia. *Indian J. Genet.* **11:** 34-46.

Chauhan AS, KP Singh, DK Singh and PK Hajra (1996) *A Contribution of the Flora of Namdapha, Arunachal Pradesh.* Botanical Survey of India, Calcutta.

Hajra PK, DM Verma and GS Giri (1996) *Material for the Flora of Arunachal Pradesh. Vol. I.* Botanical Survey of India, Calcutta.

Hooker JD (1872-1897) *Flora of British India*. Vol. I-VII. International Book Distributor, DehraDun.

Hore DK (1999a) Rice germplasm diversity in Arunachal Pradesh. *Indian J. Plant Genetic Resour.* **12:** 302-306.

Hore DK (1999b) Fruit germplasm diversity and its development in North East India. *Proc. Nat. Conf. Sc. and Tech.* pp 101-106.

Kanjilal UN, A Das, PC Kanjilal and RN De (1934-1940) *Flora of Assam.* Vol 1-5, Shillong. COMPLETE

Maikhuri RK and PS Ramakrishnan (1992) Ethnobiology of some tribal societies of Arunachal Pradesh in North East India. *J. Econ. Taxo. Bot.* **10**: 61-77.

Pareek SK, IS Bisht, KC Bhatt, A Kumar, MN Koppar, PN Gupta SK Mithal and R Singh (2000) *Manual on Exploration and Collection of Plant Genetic Resources and Related Indigenous Knowledge.* NBPGR, New Delhi, p 58.

Plucknett DL (1976) *Evolution of Crop Plants*. Longman, London.

Roschevioz RJ (1931) A contribution to the knowledge of rice. *Bull. App. Bot. Genet. Plant Breeding* **27:** 3-133.

Sharma BD (2002) Crop genetic resources of Arunachal Pradesh. In: KA Singh (ed.) *Resource Management Perspective of Arunachal Agriculture.* ICAR Research Complex for NEH Region, Arunachal Pradesh Center, Basar. pp 1-8.

Singh KA and TK Bag (2002) Some relevant farming practices for Arunachal Pradesh. In*:* RC Sundriyal, T Singh, GN Sinha (Eds.) *Arunachal Pradesh: Environmental Planning and Sustainable Development – Opportunities and Challenges.* Bishen Singh Mahendra Pal Singh, DehraDun, pp 133-160.