

CONSERVATION OF *MUSA* GENETIC DIVERSITY BY ETHNIC GROUPS

Indian people, irrespective of their geographic locations, consider bananas very close to their culture owing to their versatility and use by humans and animals. Conservation of useful and unique types is given more emphasis, while wild types, especially *Musa nagensium*, *Musa itinerans* and *Musa balbisiana*, exhibit persistent perpetuation in nature in some areas of the northeastern states (Figures 20 to 27).



Figure 20. Conservation of wild *Musa* species around the family pond

By nature, *Bhimkol*, the most cultivated or domesticated wild type is hardy and perpetuates by its copious suckering habit. Every Assamese rural household has an area of not less than one acre with a house built in the centre, with a pond and garden. *Bhimkol* is grown along the boundaries to demarcate one's ownership. *Bhimkol* is planted and also maintained around the family pond to provide ducks and fishes a fine microclimate. Invariably *Bhimkol* gets perpetuated as a live hedge plant and folks maintain the best types discarding weak and poor-yielding offspring.

Musa itinerans, one of the truly wild species, exhibits large scale localized distribution in

the West Siang district of Arunachal Pradesh around Hapoli, Potin and Sessa areas. Being stoloniferous in nature, they spread to a larger distance and occasionally become a nuisance in fields prepared for cultivation. In such cases, though they are cut and burnt, the local Adi tribes make sure that few clumps are left on the far side of the field or plant a few stoloniferous suckers in their backyard for their survival and maintenance.

Musa rosaceae (Syn. *Musa ornata*), one of the Rhodochlamys members is found in the plains of Lakhimpur in Assam, Subansiri, East Siang, Dirang districts of Arunachal Pradesh. It is distributed in clusters in wet humus mixed alluvial soils along the river courses. It is also abundant in central Mizoram. Nitshi and Adi tribes of Arunachal Pradesh and Mizo tribes of Mizoram harvest flowers for vegetable purpose and the rhizomes for cattle feed or for preparing medicine from its ash. While doing so, the complete destruction of a clump is avoided. Children are also taught to leave a couple of clumps for multiplication while collecting the flowers and rhizomes.



Figure 21. Conservation in a backyard garden

In villages, Gami near Daporijo (Arunachal Pradesh), where a unique hybrid of *Musa velutina* has been noticed, the Adi tribes are aware of its uniqueness and have multiplied the clumps along the water course in the outskirts of their villages. Surprisingly, even children, while collecting mature fruits for eating, spit the seeds and automatically cover the seed with soil with their foot. Spitting and seed covering are an integral part of eating wild banana fruits. This is a very unique way of conservation and perpetuation of wild *Musa* germplasm. Similar conservation practices have been adopted for *Musa aurantiaca* and *Musa sanguinea*, but in the case of *Musa velutina*, the situation is very different. It grows as a weed in Arunachal Pradesh (Bhalukpong area of West Kameng district and Namsai forests of Lohit district) and villagers use the flower buds for vegetables. Whenever a large number of clumps of *Musa velutina* is removed as a weed, a few are planted along the bunds, backyard boundaries and on roadsides, by the women in the family. Whenever a tribe relocates from one place to another, the women become responsible for collecting a few suckers of each of the wild and cultivated species of bananas and establish them in their newly occupied land.



Figure 22. Conservation around sacred trees of the village

Ensete glaucum is well distributed on the Mizo hills of Mizoram and sparsely in Diphu

hills of Assam. Being essentially non-suckering, seeds form the only way of propagation. Most households have a plant or two, in their backyard. As the plant grows, sheaths are ripped off and used as a vegetable. At least one plant, is left without being used and taken good care of by the female members of the family to make sure that it produces seeds and plants for the next year. Planting material is shared or sold only when the family is assured of sufficient material for its use.



Figure 23. Conservation around the village school complex

In Western Ghats, a clone of *Musa balbisiana* called *Elavazhai* is the only type with wide distribution. Ela means leaf, Vazhai means banana. This clone is the main source of everyday dining plates for each family. Each rural house is located in an area of 0.5-1.0 acres which harbours most of the plants required for daily needs. Bananas are an integral part of backyard gardens. Many families have family graves in a corner of their backyard considered sacred. Suckers of types like *Elavazhai* are usually planted in such vicinities where surroundings are kept clean. Ten to twenty clumps of *Elavazhai* are maintained in each household by the elderly women. Fertilization and irrigation, etc. are taken care of by them. A few suckers are carried along while visiting relatives, as a gift, together with banana fruits, flowers, betel leaves and sweets.

Among all the natural habitats, the situation of wild bananas in Andaman and Nicobar Islands was grave. Wild bananas have a restricted distribution and few people are aware of their existence. Only a few households had *Musa balbisiana* in their backyards, mostly the Bihari and Bengali communities migrated from the mainland. Exchange of suckers was witnessed in the same communities when better yields and soft seeded fruits are desired. *Musa acuminata* was seen occurring naturally along the watercourses. No human intervention for its conservation was noticed.



Figure 24. Wild *Musa acuminata* along watercourse

Forests of western Ghats of Kerala and Karnataka rarely harbour *Musa acuminata* in the Anaimalai hills of Kerala, KMTR forest ranges, Pechiparai areas, Shevroy hills of Yercaud, Nilgiris and Kodai hills of Tamil Nadu. In the Attappady valley of Agasthiar hills (Kerala state), Irulas and Mudugar tribes are the custodians of *Musa acuminata* subspecies *burmannica* and *En sete superbum* (Uma, *et al.*, 2002). Though not grown in their backyards, these tribes keep a watchful eye against destruction from wild elephants and wild boars in the forests where clumps are growing naturally. In such cases, a few suckers may be shifted to a safer place for their perpetuation.



Figure 25. *Musa velutina* hybrid conserved by the locals

In some regions, the local ethnic groups have a fair knowledge of wild banana varieties and their uses. Hence, over years, their cultivation and maintenance have become part of every village household. The eldest women folk are generally involved with kitchen gardens including bananas and become the custodian of genetic material. They decide whether the number of clumps available in their gardens is sufficient to produce fruits or sufficient to get burnt ash, etc. throughout the year for the family in regular succession. If not, new planting is undertaken.

[Editor's note: It is not clear if the author is referring to more than domesticated clones of *Musa balbisiana*.]



Figure 26. *Ensete glaucum* conserved and pampered as a garden

For new planting, healthy-looking suckers from the existing clump or from neighbouring villages are used. Exchange of healthy and robust plant suckers among relatives during their visits is a common

feature and thus perpetuation of elite clones is maintained among the tribes.



Figure 27. Assam women providing ethnobotanical information on *Musa*

ETHNOBOTANICAL KNOWLEDGE OF *MUSA* SPECIES



Figure 28. Cut pseudostem of *Ensete glaucum* for sap collection



Figure 29. Sap of *Ensete glaucum* collected for its medicinal properties

In forested areas, where people are still food gatherers, a knowledge of biodiversity is inextricably interwoven into the social culture and is the main source of providing livelihood. Humans living in a natural environment comprising land, water, plants, animals, etc. have confronted problems for their existence and found solutions managing the elements of nature. This knowledge consists of much useful information, which is passed on from generation to generation. People exclusively depend on the local resources and on indigenous knowledge for their existence in a fragile ecosystem.



Figure 30. Yet to open flower buds of wild bananas sold in the market as vegetable



Figure 31. Packed leaves of *Musa balbisiana* sold as dining plates

Musa species have been an inseparable element to the people who live in forests away from the modern world. The tribes and ethnic groups exploit them for their basic necessities like food, fodder, fibre, shelter and medicine, etc. (Figures 28 to 33). It is wise to acknowledge the importance of farmers' indigenous knowledge. This will form the basis for the future management of genetic resources if sustainable agriculture is to be achieved and farmers' livelihoods ensured (Almekinders, *et al.*, 2000). Interaction with farmers and tribes has depicted a wide spectrum of ethnobotanical uses of *Musa*, but some beliefs are difficult to validate (Annex 2).

FARMERS' PRODUCTION PRACTICES ON THE ECOSYSTEM



Figure 32. Mature flower buds of wild bananas sold as vegetable

Wild bananas occur in the humid and evergreen forests of northeastern India, western Ghats, eastern Ghats, and Andaman and Nicobar Islands. A wide array of tribes cohabiting the forests with wild bananas has diverse ethnic and sociocultural backgrounds. They have a way of farming and modes of agricultural production different from the garden and wetland production in the plains. Irrespective of the tribe, people are generally referred to as **Jhumiyas**, based on their agricultural practices. They follow Jhum cultivation, also known as Slash and Burn cultivation (Figures 34 and 35).



Figure 33. Inner core of the pseudostem of wild bananas sold for salad

JHUM CULTIVATION

Jhum is a special kind of agricultural practice among the indigenous people of the northeastern states, Andaman and Nicobar Islands and western Ghats. This method is also known as '**Slash and Burn**' cultivation. Jhuming involves clearing a forest area by cutting and burning of trees and then taking up cultivation. The livelihood and culture of the tribal people in forested areas depend on Jhum cultivation to a great extent. Choice of land for Jhum cultivation depends on certain criteria that include slope, water source in the vicinity and fertility of the soil, etc. 'Moinosh' soil that is both sandy and rocky is preferred by the cultivators. Abundance of earthworms in soil is seen as an essential prerequisite for Jhum cultivation. Land is processed or prepared from January to March by clearing off the trees and bushes for Jhum cultivation. Sowing or planting is taken up in the whole month of March and crops are ready for harvesting by August and the land is left fallow after. Usually, the land is left

fallow for 10-15 years to let it regain its fertility.



Figure 34. Forest clearing – Jhum cultivation

IMPLICATIONS OF JHUM CULTIVATION

Jhumming still remains the main cropping system among the tribal people. It is a way of life that encompasses their social and cultural values and goes beyond the narrow mores of economic values. The entire process of Jhum cultivation and harvesting is based on the concepts of common land ownership, exchange and sharing. The system was practiced by the hill tribes for centuries and was in harmony with their ecology (Hasan, 2003).



Figure 35. Forest burning – Jhum cultivation

Several interactions held with the local people in exploration sites revealed that irrespective of geographical location, type of tribe and their socio-economic status, all had a common opinion that centuries ago, hill farming models were sustainable but only lacked a steady cash flow. Each family had enough fertile land demarcated for year round cultivation of cereals and pulses, etc. This was supported by a larger common area, village forest or community forest. However, with the present situation, hill tribes are no longer able to sustain themselves for the whole year. Some of the reasons attributed to the decline are:

- a. Earlier, under Jhum cultivation, the land was left fallow for 15-20 years, which allowed the forest to regenerate and the soil to stabilize. Due to increases in population and shrinking area under forest cover, however, people are forced to cultivate the same land more frequently. The frequency of leaving the land fallow has been reduced from 15 years to three to five years during which the forests have become permanent settlements and have turned into wasteland in no time.
- b. Due to large numbers and frequent grazing of animals owned by the tribes, regeneration of forest seedlings is severely hampered and young shoots are trampled. Barren lands have made the soil more vulnerable to erosion.
- c. Uncontrolled grazing, along with forest fires and encroachments have also contributed to faster depletion of fertile soil cover.
- d. The forests are also being cleared due to exclusive dependence on tribes for the supply of fuel wood (Figure 36).
- e. Development, in terms of construction of roads, dams and bridges in the forest zone, has brought in accelerated depletion of the natural biosphere (Figure 37).



Figure 36. Forest being cleared inhabited with wild bananas in Andaman and Nicobar islands

The tribal home gardens or backyard gardens are the well accepted 'Micro Diversity Areas' and have been the treasure spots for preserving and utilizing a great diversity of crop species like *Musa*, citrus, cereals, pulses, and even cultivation techniques. The women have been the custodians of these gardens giving variety to the daily menu, enriching the diet and often providing supplementary income. *Ensete glaucum*, with various names such as Chang Pawl and Sai Su, is used for fibre and vegetable. Other named varieties with uncertain status that are used for fibre extraction by poor tribal families over generations are Lairawk, Chang Their, Bantaw and Chang Wandawt.

With the present scenario in Jhum cultivation practices, tribes are quite aware of the fact that there is a fast erosion of valuable plant species. Village doctors spend long hours, searching with great difficulty for *Musa* or other medicinal herbs in the forest to prepare native medicines.



Figure 37. Developmental activities like roads and bridges enable destructive human incursion

Many other species like *Musa sikkimensis* and *Musa nepalensis*, etc. were described to be widely distributed in northeast Indian forests (Simmonds, 1962), but now have a very localized distribution, or are gone altogether.

The most important example of the extinction of wild *Musa* is that of *Musa acuminata* spp. *Burmannicoides*. There is a single clone remaining, taken from the Indian Botanic Garden in Calcutta, named Calcutta-4. As the name suggests, it traces its origin in northeast India/Myanmar. It has been the only gene source conferring resistance to dreaded black Sigatoka leaf spot disease caused by *Mycosphaerella fijiensis*. None of the recent explorations conducted by various Indian organizations could locate this species in its natural habitat and there is every chance that it has been completely wiped out by human incursions. This wild species is available only as a single accession, Calcutta-4, at the International Transit Centre (ITC), Belgium, which supplied it to banana breeding programmes. This has been an eye-opening tragedy witnessed by *Musa* scientists in the last four to five decades.

This awareness of genetic erosion has slowly crept into the minds of farmers and local

tribes (Figures 38 to 43) and therefore a steady thrust on conservation of genetic resources is being emphasized. Government, environmentalists, farmers' organizations and local tribes have given momentum to this movement. *Musa* is one among the several prized crop species having importance in terms of conservation.

Owing to its multifaceted uses (Figures 44 to 46) as food, fodder, fibre, shelter and medicine for existence of tribes against forest hardships, a number of projects aimed at rebuilding and conserving natural resources, including *Musa* species, are being operated in the context of their vulnerability to genetic erosion.

For example, 'Hahn Chhantu' is a non-governmental organization operating in Mizoram State involved indirectly with the conservation of *Musa* germplasm. 'Hahn Chhantu' meaning the rescuer of ethnicity or community was established in 1994. This was started with an aim to achieve self support or self-sufficiency for local tribes from locally available natural resources. The organization

is encouraging the tribes in the cultivation of wild *Musa* species.

The Changel group of bananas, otherwise the wild species, are usually used for fibre extraction purposes and the use of commercial varieties for fibre extraction is seldom seen. Local tribes, the Mizos, Lushais, Lakhers, etc. are educated in the use of wild bananas for fibre extraction, which is a sustainable source of income to the poor families. Local tribes collect the whole plant of wild varieties at the time of shooting. A local technology has been developed by the NGO for extraction of fibre from banana pseudostems. The tribal folks are given training for 15-20 days to extract banana fibre to make banana fibre crafts. The organization supports the tribes to extract fibre in their households or in community areas of villages. Orphans and destitutes are employed by the organization for making handicrafts using fibre bought from local tribes. Slowly, the organization is extending its activity to jails, remand homes and dead-diction centres and helps them to earn money and conserve the wild species.

ETHNIC GROUPS OF NORTHEAST INDIAN STATES



Figure 38. Discussion with Naga tribes



Figure 39. Akka tribe of West Kemeng



Figure 40. Adi tribe of Siang



Figure 41. Apathani tribe of Subansiri



Figure 42. Nitshi tribe of Kemeng district



Figure 43. Monpa of Tavang district