

Custodian Farmers and the Mango Legacy of India

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Abstract

Mango (*Mangifera indica* L.) one of the most important commercially grown fruit crop of India. India has the richest collection of mango cultivars with mango being grown in all the states of the country. Different varieties have unique taste, flavour, texture and size. In recent times molecular genomics technologies are being used to assist our understanding of mango genetics and the diversity of the mango gene-pool. It is of prime importance that these varieties be conserved for further mango improvement or mango genetics study. Custodian farmers have been maintaining, promoting and adapting a wide range of indigenous fruit tree varieties on their farms. These custodian farmers protect, nurture and propagate the rich mango legacy of India. One of the strategies of conserving diversity, on-farm, is identification of custodian farmers and extending support to them.

Keywords: Mango varieties, custodian farmers, genetic diversity, mango legacy

1. Introduction

“Custodian farmers” are ordinary farming community members, who have knowledge and access to diverse seeds and resources and help conserve biodiversity in their region. Despite the availability of preferred commercial fruit varieties, farmers around the world have been maintaining, promoting and adapting a wide range of indigenous fruit tree varieties on their farms and homesteads¹. Such male and female farmers, ‘who actively maintain, adapt and promote agricultural biodiversity and related knowledge over time and space at farms and community level and are locally recognised for these efforts’, have been defined as custodian

farmers². These custodian farmers protect, nurture and propagate the rich mango legacy of India.

Mango (*Mangifera indica* L.) belonging to Family Anacardiaceae is one of the most important commercially grown fruit crop of India. India is the leading producer of mangoes accounting for more than 50 % of mango production worldwide³. Other major mango producing countries include China, Thailand, Mexico, Pakistan, Philippines, Indonesia, Brazil, Nigeria and Egypt. Mango is the national fruit of Pakistan, India and Philippines. The mango tree on which mango is the national tree of Bangladesh.

Mangos have been cultivated in India for more than 4000 years, mainly for the tasteful and nutritious fruit⁴. It is referred to in Sanskrit literature as Amra. This fruit occupied an important place in horticulture during the rule of the Moghul emperors in India. It is said that Akbar the Great (1556-1605) planted an orchard of 100,000 mango trees in India. The species spread to other parts of Asia, and by the beginning of the 16th century mango trees were gradually being distributed around the world.

1. Rich intra-specific diversity of mango

Mango has rich intra-specific diversity and there are about 1600 cultivars in the world. India has the richest collection of mango cultivars with mango being grown in all the states of the country. Different varieties have unique taste, flavour, texture and size. Ataulfo, Haden, Keitt, Kent, Edward, Palmer, Manila, Kesar are some of the famous mango varieties worldwide. Different mango cultivars are suited to different agro- climatic zones. For example, Alphonso is very successful in Maharashtra and Goa areas; Dusehari in Lucknow (Uttar Pradesh) and Suvamarekha in Andhra Pradesh. However in India, the mango gene pool has not been explored fully with regard to extent of variability, identification, collection and conservation of mango germplasm⁵ which are pre requisites for crop improvement.

The common Mango tree (*Mangifera indica*) is the most well known species within the *Mangifera* genus. These trees are native to subtropical and tropical south-east Asia. Most species of *Mangifera* trees are found in the Malay Peninsula, Borneo, and Sumatra. Common mango (*Mangifera indica* L.) originated as allopolyploid and its native home was suggested as Eastern India, Assam to Burma or possibly further in the Malay region. Based on detailed study of the history, phyto-geographical distribution of allied species, fossil records, evidence of numerous wild and cultivated varieties in India, S. K. Mukherjee^{6, 7} considered origin of genus *Mangifera* probably in Burma, Siam, Indo-china and the Malay peninsula, but the birth of common mango in Assam-Burma region and not in Malay.

While geneticists and plant breeders are particularly interested with diversity at the molecular level, farmers are more concerned with visible morphological and agronomic variation, which helps them to identify cultivars that are productive and do well in their location specific environment narrow adaptation as they are unfamiliar with the characteristics of the many different cultivars of mango that are now grown and available across the country.

2. Identification of the custodian farmers: Some examples

3.

Society For Conservation of Mango Diversity (SCMD) identified farmers, which over time and space are maintaining, enhancing and creating genetic diversity and ensuring their availability to and from farmers. Custodian farmers of these communities are conservers who actively maintaining mango diversity.

Malihabad, one of the three tehsils (smallest political unit) of Lucknow, has several claims to fame but it is the mango varieties that have put the town on the world map, as when the Malihabadi Dashehari variety was granted Geographical Indication registration in 2009. Malihabad, one of the three tehsils (smallest political unit) of Lucknow, has several claims to fame but it is the mango varieties that have put the town on the world map, as when the Malihabadi Dashehari variety was granted Geographical Indication registration in 2009.

4. The custodian farmers: Some examples

Source: Custodians of Tropical Fruit Tree Genetic Resources in India

A. Mr Chhote Lal Kashyap

Mr Chhote Lal Kashyap is a farmer of Gopramau village, in Lucknow District, Uttar Pradesh State and belongs to the middle-income group. About five decades back, Mr Chhote Lal, owner of approximately 2 hectare land, became fascinated with the mango farmers of the area and made efforts to plant an orchard on his own land, which was not suitable for cultivation of arable crops. He made efforts to plant commercial varieties and failed to grow grafted saplings due to the poor sandy soils, undulating landscape and lack of irrigation facilities. Now Mr Chhote Lal maintains about 135 different seedling types and three grafted varieties in his orchard, most of which originated from seed (bijju). Bijju Deshi Dashehari, Deshi Chausa, Tukmi Heera, Sunehra, Badamba, Gola, Dil Pasand are some of the seedling types that he has named on the basis of their resemblance to known parent cultivars or because of the similarity of particular shapes or colours of the fruit. The conservation of diversity adds to his esteem in the community. He exchanges fruit with others and earns his livelihood by selling fruit in the market.

B. Ms. Kamala Devi

She is a 55-year-old farmer, maintaining a mango orchard of 2.25 ha as her major source of livelihood. She is primarily a mango grower who maintains 38 varieties of indigenous mangoes, including 35 indigenous and seedling types. Average age of the trees in her orchard is 25. The mango diversity maintained consists of mainly non-commercial types.

A. Mr. Mahadeen

He is a 65-year-old farmer, maintaining a mango orchard as his major source of livelihood. (0.4 ha). He is primarily a mango grower who maintains 38 varieties of mangoes, including

35 indigenous and seedling types. Average age of the trees in his orchard is 30. The mango diversity maintained consists of mainly non-commercial types. Tukmi Chausa, Desi Gola, Lamboi, Tuhuru, Surkhi.

C. Mr. Nawab Hasan

Mr. Nawab Hasan maintains 51 different traditional farmers' varieties in his orchard, most of which are selections collected from elsewhere. Varieties like Surkhi, Sundari, Pauda Gaj, Deshi Bombaiya, Machhli, Pan, Matka Gola, Chandni, Bhura, Nauraj, Surkha Matiyara, Nazir Pasand, Baudi, Kamal Pasand and several others may not be available in other orchards of Malihabad. A few of them are the only living trees of their varieties on earth.

One of the strategies of conserving diversity, on-farm, is identification of custodians and extending support to them as these farmers have maintained the diversity without any formal support. The results of a recent study⁸ in 2015 (Table 1) indicated that it is not only the economic factors (market value) which motivated the farmers to conserve mango diversity but also personal, social and cultural/religious factors.

Table I. Mango varieties conserved by the custodian farmers and the different motivating factors⁸.

	Study Areas and Mango Varieties conserved			
Motivating factors	Chittoor	Malihabad	Pusa	Sirsi
	Mango Varieties	Mango Varieties	Mango Varieties	Mango Varieties
Economic	Kalepadu, Imam-Pasand	Dashehari, Gulab Khas, Husnara, Fakira, Mohan-Bhog, Rangeen Gola, Jard-Amin	Calcuttia Malda, Bathua Safeda Malda Lal Malda, Sukul Sipia	Varate Guduga, Malanji, Nandagara, Adderi jeerig
Personal	Kudadut, Royal Special	Surkhi, Sundari,	Calcuttia Malda Safeda Malda	Genesina kuli

		Pauda Gaj, Deshi Bombaiya, Machhli, Pan,	Lal Malda Sukul	
Social	Royal Special, Atimadhuram	Surkhi, Amin, Taimuriya, Fakira, Mohan Bhog, Rangeen Gola, Jard-Amin	Bathua, Belwa, Sipia, Hajipur Mithui, Sukul	Manadur Katte

5. Some indigenous mango varieties of West Bengal

Murshidabad and Malda districts of West Bengal are famous for their traditional mango varieties. More than 200 mango varieties were recorded during the time of the royals of Murshidabad and Malda districts. After independence with rapid industrialization this germplasm is under threat⁷. The mango diversity of the districts of Murshidabad and Malda, once famous for top class mango, are now facing tremendous genetic erosion of the mango germplasm. The traditional mango varieties which are in general are low yielding are being replaced by new high yielding hybrids.

Characterization of diversity is a necessary requirement for the improvement, use and conservation of plant genetic resources^{9, 10}. Despite the pressure of the modern agriculture, which favours uniformity and profit, at least a small percentage of farmers are still actively engaged in maintaining locally important varieties. There is a growing demand for mango from Murshidabad and Malda districts.

6. Role of the custodian farmers in mango germplasm conservation

These 'Custodian farmers' apart from playing a critical role in conserving the rare varieties, act as local guides to disseminate the good practices and also as providers of scions of local varieties and traditional knowledge associated with tropical fruit tree (TFT). It is of paramount importance to survey and identify these local sites and document and characterize the still extant mango diversity.

A preliminary survey by the author and co-workers resulted in documenting some rare varieties (Table II) from Malda and Murshidabad¹¹.

Table II. Indigenous mango varieties of the Murshidabad and Malda districts,

Sl. No.	Mango variety	Locality	Status
1	ARAJANMA	MALDA	RARE
2	BHARATI	MALDA	MODERATE
3	BIMLI	AJIMGAUNGE, MURSHIDABAD	RARE
4	BRINDABANI	SAHAPUR, MALDA	RARE
5	DUDHKUMAR	MALDA	RARE
6	JILEPIKERA	RAIPUR, MALDA	MODERATE
7	GOLACHOKA	MALDA	AVAILABLE
8	GOPALBHOG	CHACHOL, MALDA	AVAILABLE
9	GUTI KHIRSAPATI	MALDA	AVAILABLE
10	KOPAI	NASIPUR, MURSHIDABAD	MODERATE
11	LAKSHMANBHOG	SAHAPUR, MALDA	AVAILABLE
12	MADHUCHUSKI	MURSHIDABAD	MODERATE
13	MADHUGULGULI	MURSHIDABAD	RARE
14	MISRIKANTA	LALBAG, MURSHIDABAD	MODERATE

15	MOLAMJAM	MURSHIDABAD	AVAILABLE
16	RAKHALBHOG	MALDA	AVAILABLE
17	SHADULLA	MURSHIDABAD	AVAILABLE
18	SINDURIA	MALDA	MODERATE
19	SURIKHAS	ARAPUR, MALDA	RARE
20	VABANI	MURSHIDABAD	MODERATE

Table III. Some mango varieties of Murshidabad and Malda districts¹¹.

Sl No.	Mango Variety name	Locality & District	Picture of mango variety
1	Arajanma,	Malda	
2	Bharati	Malda	
3	Gopalbhog	Chanchol, Malda	

4	Misrikanta,	Lalbag, Murshidabad	
5	Rakhalbhog	Malda	
6	Sinduria	Guthi, Malda	
7	Suri Khas,	Arapur Kotwali, Malda	

7. Genetic improvement of Mango

Development of better cultivars by traditional method using morphological traits, although highly heritable, is slow because of long juvenility and being expensive¹². India has a good potential for export of mango and it needs to strive hard to improve its export by improving upon the quality of mango exports and also by improving the yield levels¹³.

Breeding mangoes is a long term activity complicated by a heterozygous genome, polyembryony, juvenility, low fruit set and retention rates, long evaluation periods, and out-crossing behavior. These factors make genetic improvement through conventional parental selection and breeding slow and unpredictable. Adoption of molecular markers and genomics-based breeding strategies will likely improve predictability and breeding efficiency.

Mango, which is a tropical fruits genetic resource, is being used in breeding programs and correlated research. Some of the most significant advances in mango research and development that have the capacity to improve the industry and consumer acceptance of mangoes are occurring in the discipline of breeding and genetic improvement. It will be these new genetics that drive world trade in mango in the future due to their superior adaption to production conditions, improved consumer appeal and legal proprietary protection through plant variety rights and associated patents and trademarks.

Molecular genomics technologies are being used to assist our understanding of mango genetics and the diversity of the world mango gene-pool. In recent years many studies using molecular marker to discover the diversity and phylogenetic relationships between mango varieties and related *Mangifera* species have been undertaken. The genetic relationships and origins of individual mangoes and groups of varieties is providing a good understanding of how mangoes have spread around the tropical and subtropical regions of the world.

8. Conclusion

It is of prime importance that these varieties be conserved for further mango improvement or mango genetics study. Unless the mango germplasm is conserved it will be futile to study about the genetic diversity of extinct mango varieties. These mango varieties must be conserved preferably by *in situ* conservation strategy or by on-farm conservation method. If these methods cannot be implemented then *ex situ* conservation methods may be used. After efforts have been on the conservation area then genetic diversity study will be meaningful.

Morphological characterization is the first step that should be done before advanced biochemical or molecular studies are carried out. For the management of mango genetic diversity increasing knowledge on the extent and distribution of mango diversity in the target species is a pre-requisite. Determining current mango germplasm conservation efforts (location, collection, conservation and use) is of paramount importance. Sustainable on-farm and *in situ* conservation is possible only when farmers, communities and national institutions perceive benefits in terms of genetic, economic, social and ecological aspects.

Further, for continuation of mango diversity conservation on a sustainable basis, farmers need to be made aware of the value of their rich diversity by linking them to R&D sector for characterization and evaluation of the elite types, grafting of superior types in their farm and

by distribution of plants⁸. One of the strategies of conserving diversity, on-farm, is identification of custodian farmers and extending support to them. So saving these varieties is important lest we lose them. If any mango variety is lost, its unique genetic constitution is lost forever for posterity.

References:

1. Bhag Mal *et al.* *Indian J. Plant Genet. Res.* **24**, 1-22 (2010).
2. B. Sthapit *et al.* *Proceedings of Workshop on Custodian Farmers of Agricultural Biodiversity*, 11-12 February, 2013, New Delhi, India. (2013).
3. G. M. Naidu and G.R. Naidu. *Acta Hort.* (ISHS) **820**, 79-96 (2009).
4. I.S.E. Bally *et al.* *In Breeding Plantation Tree Crops: Tropical species*. 51-82 (2009).
5. K. V. Ravishankar *et al.* *Acta Hort.* (ISHS) **992**, 269-276 (2013).
6. S. K. Mukherjee. *Indian J. Genet. Pl. Breed.* **11**, 49-56. (1951).
7. S. K. Mukherjee. *Econ. Bot.*, **7**, 130-162. (1953).
8. T. M. Gajanana *et al.* *Indian J. Plant Genet. Resour.* **28**, 1-6 (2015).
9. S. Archak *et al.* *Genome*, **46**, 362-369 (2003).
10. H. Krishna and S. K Singh. *Biotechnology Advances*, **25**, 223-243. (2007).
11. M. De *et al.* *J. Environ. & Sociobiol.* : **11**, 187-198, (2014).
12. S. K. Singh *et al.* *Indian J. Plant Genet. Resour.* **28**, 123-131, (2015).
13. D. K. Kusuma, and H Basavaraja. *Karnataka J. Agric. Sci.*, **27**, 36-39. (2014).