Aromatic pickle mango morphological characterization

Morphological Characterization of a few Farmers'-Identified Unique Aromatic Pickle Mango varieties of the Central Western Ghats

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Abstract

Aromatic pickle mango (locally called *appemidi* and GI tagged) is a special type of pickle mango harvested and semi-domesticated from rivenrine habitats of the Western Ghats. These types are recognized by the local people based on their aroma and taste apart from fruit shape and size. Despite its commercial importance there are very few attempts to formally characterize these types. Twelve farmers' identified varieties collected from a fifteen-year-old mango orchard were characterized adopting standard mango descriptors developed by the IPGRI. In the present study 12 varieties of aromatic pickle mango were characterized and delineated adopting simple forking method to individual unambiguously.

Introduction

India is the regarded as the centre of origin and the primary centre of diversity of mango harboring perhaps the largest gene pool with over 1000 mango cultivars (ref). Apart from eating raw, a wide array of products ranging from jam, jelly, leather, squash, wine, *etc* are prepared using this fruit (ref). Different stages of fruit development are used to prepare these

products. One such unique preparation is pickles of highly aromatic mango types in their tender, un-ripen stage. In the central Western Ghats of Karnataka state, India, these effervescent fruit types are locally termed as " *appemidi* " and extensively collected from the wild habitats even today. Unlike commercial mango, " *appemidi* " fruits are extremely sour and far from sweet taste and hence are not used as edible fresh fruits. For a common man of this region, no meal is complete without the extraordinary effervescent taste of these *' appemidi'* pickles. Because of this deep cultural attachment, people have recognized several hundred pickle-mango types from the wild habitats. These types are recognized by the local people based on their aroma and taste apart from fruit shape, size. Unique types of ' *appemidi'* are identified and cultivated by the progressive farmers. It is distinct from other cultivated fruit varieties with respect to morphological characters such as fruit size, shape, taste, aroma, crown shape, height, and resistance to pest and diseases. The fruits of these wild mango trees are specially suitable for pickling and are in more demand in the market. Very recently, Government of India has also accorded a " geographic indication (GI)" tag to *' appemidi'* types (ref).

Despite its high importance in rural people's livelihoods and food security, and efforts made by few progressive farming communities to introduce into the agro- ecosystems, there are very few attempts to survey and formally characterize aromatic pickle mango. Perhaps for the first time an attempt to develop a set of quantitative descriptors for these traits is made in this study.

Materials and Methods

The study material was collected from a fifteen-year-old mango orchard of a progressive farmer located at *Salkani* village, situated at about 17 km away from the College of Forestry, Sirsi (14 ^{0} 37' N latitude and 74 ^{0} 51'E longitude; 650 m above msl), India. The area falls in the central Western Ghats eco-region, which is one of the hotspots of biological diversity of the world. This farmer has scrupulously maintained dozens of aromatic pickle mango types in his 7 acre orchard obtained through grafting of the original mother trees from natural habitats. The orchard has been raised on a fairly plain land with an uniform spacing of 5 m between rows and between trees. He has been recognized as a custodian farmer of *' appemidi'* recently by the Bioversity International (ref). Twelve farmers' identified varieties considered in the study and their special uses is shown in the Table 1.

The morphological characterization was done adopting standard mango descriptors developed by the IPGRI (IPGRI, 2006). Three ramets per variety were considered for the observations. Only when traits were consistently expressed by all the three ramets, the variety was selected for evaluation. The morphological characterization is carried under four broad category such as A) Tree descriptors, B) Leaf descriptors, C) Flower descriptors, and D) Fruit descriptors as prescribed by the IPGRI (IPGRI, 2006). All the varieties focused in the study are ' grafted' types, had similar trunk circumference and crown diameter facilitating the comparison for other characteristics.

Results and Discussion

A) Tree descriptors

Tree growth habit, foliage density and crown shape were considered under the tree morphological descriptors (Table 2). With respect to tree growth habit, except ' *Haldota'* variety, which showed an ' erect' type, all other varieties were categorized as ' spreading' type. Except *Ananthabhatta* and *Karola* varieties, all others showed ' intermediate' to ' dense' foliage. ' *Malanji'* variety recorded ' pyramidal crown' while others were either ' oblong' or ' semi-circular'. However it is likely that the crown shape might have been altered through the management.

B) Leaf descriptors

The aromatic pickle mango varieties considered in the study did not differ with respect to leaf blade shape and showed ' oblong' leaf shape (Table 3). Leaf apex shape was generally ' acute' except in ' *Kalkai'* , ' *Kadigai'* and ' *Gadihalli Kuchagai'* varieties. The leaf base shape showed only two variants *viz* . ' acute' and ' obtuse'. Similarly leaf margin was either ' wavy' type or ' entire' type. The colour of the matured leaves ranged from ' pale green' to ' dark green' colour. The most distinctive trait used by the farmers to identify ' *Nandagar'* variety was the slight reddish tinge on the leaf petiole.

The range of leaf blade length varied from 16. 98 to 25. 03 (Table 4). This is perhaps much smaller than the fruit varieties. ' *Kadigai'* variety showed the largest leaf blade length (25. 03 cm), while a minimum was observed in ' *Malangi'* (16. 98 cm). Characteristically *Dannalli* and *Kadigai* varieties had a very good shininess of leaves; while strong leaf fragrance was observed in ' *Anantabhatta* ' and ' *Mudgar kosagai'* varieties. With respect to fragrance, ' *Ananthabhata'* variety showed the strongest aroma in the leaf.

C) Flower descriptors

Among the floral traits, variety ' *Purappe mane'* recorded the slight ' pinkish' shade which was the distinctive.

D) Fruit descriptors

For the purpose of pickling, farmers harvest aromatic fruit types of different varieties at different stages. ' Whole fruit pickle varieties' are harvested at very immature stage while the ' sliced pickle' varieties are harvested at mature but unripen stage (Table 1). It is at these stages distinctive traits are observed by the farmers to recognize the varieties. Hence it is important to evaluate them at appropriate stages to determine the best characters for pickling. For this reason, morphological characterization of the aromatic pickle mango varieties has been done at two different stages of fruit development. For all the whole pickle mango varieties (Sl. No. 1- 8 ; Table 5), tender stage was considered while for the ' sliced pickle mango' types (Sl. No. 9 – 12; Table 5) fully developed but immature stage was considered. All ' sliced pickle mango' types were 'roundish' with 'round' fruit apex and ' smooth surface texture'. Variety *' Haldota'* showed ' Serpentoid' fruit shape which is most preferred by the farmers. With respect to fruit beak type ' pointed' and ' perceptible' types were predominant, and ' prominent type' of fruit beak was observed in only two varieties *Haldota* and *Anantabhatta* . Among all the varieties it was observed that there were an equal proportion of ' waxy' and ' non-waxy' fruits. There were no specific associations among the fruit characteristics.

As shown in the Table 6, all ' whole-fruit pickle' varieties (sl. no. 1- 8) showed smaller diameter (ranging from 2. 87 to 4. 29 cm) and fruit length (ranging from 4. 84 to 7. 62 cm); while the ' sliced-pickle' varieties (sl. no. 9-12) recorded larger diameter (ranging from 5. 07 to 8. 22 cm) and larger length (ranging from 6. 30 to 10. 4). All ' whole-fruit pickle varieties' did not show any stalk cavity.

For the general characterization of the aromatic pickle mango varieties, the observations are also recorded after fully ripenening of fruits of all the varieties (Table 7). Varieties used for ' sliced pickles' generally possessed larger mass and mild aroma than those used as ' whole-fruit pickle'. Matured fruit colour of all the ' sliced pickles' varieties was ' yellow'. In general the ' whole fruit pickle' varieties showed greenish yellow colour.

The application of morphological markers is the simplest of the methods of evaluating genetic diversity that could be repeatedly done (Lyngdoh et al., 2007). Since the published descriptor lists are readily available for the morphological markers, it can be carried out *in situ* , is relatively low-cost and easy to perform. Morphological characterization is the first step that should be done before more profound biochemical or molecular studies are carried out (Hoogendijk and Williams, 2001). Historically mango genotypes have been characterized using morphological markers (Singh, 1969). The strength of the descriptors lays in its ability to delineate genotypes without redundancy. It is shown in the present study that of 12 varieties of aromatic pickle mango could be delineated adopting a set of fruit traits (Fig. 1). The simple forking method adopted to individual varieties was designed in a way that traits where unambiguous categories could be made were considered

first and subjective traits were considered towards the end. Such a pattern of varietal identification has not been reported for any of tree species even though morphological characterization have been done in case of *Populus spp.* (Mohanty and Khurana, 2003) and *Santalum album* (Bagchi and Veerendra, 1985). Leaf descriptors were earlies adopted to describe inter-provenancial (Rawat et al., 1998) or to describe inter-clonal variation (Gunaga and Surendra, 2002) in teak. Gunaga and Surendra (2002) stressed the importance of morphological characterization as a cheaper tool for quick identification of clones based on their observation of eight leaf characters.

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