Physico-chemical Evaluation of ‘Casturi’ Mango

TOMAS AYALA-SILVA*, HAMIDE GUBBUK2, AND CRISTINA URBINA3

1National Germplasm Repository System, Subtropical Horticulture Research Station, 13601 Old Cutler Road, Miami, FL 33158
2Department of Horticulture, Faculty of Agriculture, Akdeniz University, Antalya 07058, Turkey
3Department of Agroecology, School of Environment, Arts and Society, Florida International University, Miami, FL 33199

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Mangifera casturi is one of about 31 species of mango that can be found in Kalimantan, Indonesia. The ‘Casturi’ may have originated in a very small area around Banjarmasin in southern Borneo, Indonesia, where it is called Kalimantan or Kasturi. The species was endemic to the region, but is believed extinct as a wild population. The tree is about 10–30 m tall, which is endemic to a very small area around Banjarmasin in southern Borneo (Indonesia). The ‘Casturi’ mango is believed to be first introduced to Florida by Garry Zill and Richard Campbell in early 2000 as part of a germplasm conservation effort. The study was conducted at the USDA/ARS Subtropical Horticultural Research Station (SHRS), National Germplasm Repository, Miami, FL. The fruits were harvested in June–July 2012. After harvest, color, several physicochemical and morphological characteristics (weight, length, width and thickness, total soluble solids, Brix, pH, and titratable acidity) of fruit, stone, and seed fresh and dry weight were performed at the commercial maturity stage. The fruit has an attractive color (green to purple-black) during maturity, firm flesh, and is relatively free from anthracnose disease 7 d after harvesting. The fruit is ovoid with a smooth, regular surface. Fruit weight ranged from 92.0 to 122.0 g, an average weight of about 105 g. Average fruit length and width were 72.0 and 50.0 mm, respectively. The stone characteristics for weight, length, width, and thickness were 20.78 g, 59.82 mm, 28.55 mm, and 16.77 mm, respectively. The fruit had high Brix (17.8 to 20.6), pH 4.5, and titratable acidity of 1.09% to 1.15%. Further, description in accordance with the mango descriptor book, International Plant Genetic Resources Institute (IPGRI), was presented and will be available at the Genetic Resources Information Network (GRIN) database system.

Origin

Kasturi may have originated in a very small area around Banjarmasin in southern Borneo, Indonesia, where it is called Kalimantan or Kasturi (Mangifera casturi) (Campbell, 2007; Koltermann, 1998). The variety was endemic to the region, but is now extinct as a wild population (World Conservation Monitoring Centre, 1998). The ‘Casturi’ inflorescence has a compound interest with a double unisexual flower shape and often hairy racemes meeting. The length of the flower stalk is ≈28 cm with a very short stalk, namely 2–4 mm. The leaf sheath is an elongated oval with a length of 2–3 mm. Elongated oval petals and fragrant flowers with stamens are equal in length to the crown, with very short staminodia and stamens like protrusions embedded in the base rate. ‘Casturi’ mango trees can reach a height of 25 m with a trunk diameter of ≈40–115 cm (Fig. 1). The bark is grayish white to light brown, sometimes having small cracks or fissures with ≈1 cm of dead bark. Stemmed leaves, elongated lancet-shaped with a pointed end, have 12–15 veins on both sides of the leaf midrib. The young leaves hang limp and are copperish brown in color (Kostermans and Bompard, 1993).

History and Evaluation

The original ‘Casturi’ mango is believed to have been first introduced to South Florida by Garry Zill and Richard J. Campbell in early 2000 as part of the germplasm conservation effort at the Center for Tropical Plant Conservation of Fairchild Tropical Botanical Garden (FTBG) in Coral Gables, FL. Two accessions were
planted at the USDA/ARS Subtropical Research Station around 2001. Mango fruit used in this study were from the two aforementioned accessions from the USDA/SHRS/FTBG collection.

Traits measured in this evaluation included physical measurements of fruit, stone, seed, and leaf. Also included were skin and flesh color, internal breakdown (jelly seed), Brix, citric acid content, pH, and anthracnose tolerance. Fertilization and cultural practices were as recommended for mango production under South Florida production (Crane et al., 2003).

Quantitative evaluation of skin color changes in fruit samples was done using a portable tristimulus colorimeter and SpectraMatch software (Minolta Chroma Meter CR 400, Osaka, Japan). A white calibration plate was used for calibration (L*= 98.15, a*= 0.13, b*= 1.92).

Juice was extracted out of the ripe mango and samples, approximately 1 mL of juice, were used for brix determination. Brix measurements were obtained using a portable SPER Scientific Digital 30034 refractometer. A Precision advanced scale (Symmetry®) was used to measure weight of fruit, stone, seed, and pulp.

Citric acid and pH measurements were obtained by using a Titrator G20 (Mettler Toledo). Mango pulp was extracted out of ripe mangoes. Three samples of 20 g were collected for each mango and blended with 40 mL of pure water. Then, samples were placed on a compact titrator for evaluation.

Three replicates of 30 fruits each were used for this evaluation. Data were analyzed using GLM mixed procedure (SAS), least squares mean, and standard errors were obtained.

**Description**

Observations are based on performance of grafted trees located at the National Germplasm Repository located at the Subtropical Horticulture Research Station in Miami, FL. The ‘Casturi’ mango tree can be very tall, reaching a height of 15 m (measured from ground level to the top of the tree) and a trunk diameter of ≈40–115 cm measured at 50 cm above ground level. Bark is grayish white to light brown; sometimes there are small cracks or fissures with 1 cm of dead bark. The crown diameter is approximately 12.0 m (measured as the mean diameter using two directions, N–S and E–W) and the crown shape is semi-circular. The ‘Casturi’ mango tree growth habit is spreading with dense foliage (Fig. 1).

The tree has flowered and fruited under tropical and subtropical conditions. The ‘Casturi’ mango leaves have an elliptic leaf blade shape and a semi-drooping attitude in relation to the branches (Fig. 2). The leaf length measured from the base to the tip of the leaf blade ranged from 20.8 to 33.0 cm, with an average length of 28.2 cm. The leaf blade width measured at the widest point ranged from 6.2 to 9.3 cm, with an average width of 7.5 cm. The petiole length measured from the stem to the base of the leaf blade ranged from 3.0 to 7.3 cm, with an average length of 5.2 cm.

Venation in the leaves has a medium angle (45° to 60°) of secondary veins to the midrib and the curvature of secondary veins is absent. Leaf texture is coriaceous; leaf apex and leaf base have an acute shape; an entire leaf margin and leaf pubescence is absent. The young leaves hang limply and are bronze (copperish color). The intensity of anthocyanin pigmentation of juvenile leaf is high measured at juvenile stage and turns dark green when leaves are fully developed. The ‘Casturi’ mango leaves, when fully developed, have a mild fragrance when crushed (Fig. 2).

The flowering duration may range from 25 to 35 d (from first flower opening until end of flowering). The ‘Casturi’ mango tree flowers regularly during season but rarely have a secondary or off-season flowering stage. The inflorescence has a terminal position and its axis growth habit is semi-erect with a pyramidal inflorescence shape, compound with a double unisexual flower shape and often hairy racemes meeting. The length of flower stalk is ≈28 cm with a very short young stalk, namely 2–4 cm. Leaf sheath elongated oval with a length of 2–3 mm with elongated oval petals and fragrant flowers. Stamens are equal in length to the crown, with very short staminodia and stamens like protrusions embedded in the base rate.

‘Casturi’ mango leaves have a fruiting duration of about 30–45 d and maturation dates ranged from mid-May to June. The ‘Casturi’ mango tree has a high fruit bearing intensity.

The fruit shape is ovoid and the shape of the fruit apex is obtuse with a flattened base. The fruit has a vertical stalk insertion and no stalk cavity. The fruit has also a prominent neck and a pointed beak (Fig. 3). The fruit length ranged from 6.6 to 7.7 cm, with an average length of 7.2 cm. The fruit width ranged from 4.7 to 5.6 cm, with an average width of 5.0 cm. The fruit weight ranged from 92.08 to 118.36 g, with an average of 105.71 g (Fig. 3).

The fruit skin is non-waxy and has a smooth skin surface texture. The ground color of the skin is dark green when immature and during maturity the skin color change to purple-black (Fig.
4, left and right). The skin is very thick and has a high density of yellowish lenticular dots. The flesh of the fruit is bright orange in color and has a very juicy texture. The flesh flavor is rich and sweet with a 17.63 Brix (Table 1) with a strong aroma.

The pulp texture of the ripe fruit is quite firm and has high fiber content (Fig. 5). The fiber length in the pulp is long, ranging from 1.5 to 2.0 cm. Color description of ripe and unripe fruits is given in Table 2.

The stone (endocarp) is woody and hard with a length ranging from 4.9 to 6.5 cm, with an average length of 6.0 cm. The stone width ranged from 2.2 to 3.0 cm, with an average width of 2.8 cm. The stone thickness ranged from 1.4 to 2.2 cm, with an average thickness of 1.7 cm. The stone weight ranged from 11.10 to 33.48 g, with an average weight of 20.86 g. The veins on the stone are level with the surface and follow a forked pattern. There is a high quantity of fiber on the stone and the length of the stone fiber is medium and ranged from 1.0 to 1.5 cm. Adherence of fiber to the stone is strong and its texture is coarse. The stone of the fruit also has high fiber content but with a low adherence of fiber to the fruit skin.

The space occupied by seed inside the stone is about 76% to 100%. The seed length ranged from 4.1 to 5.6 cm, with an average length of 4.7 cm (Fig. 6). The seed width ranged from 1.4 to 3.0 cm, with an average width of 2.3 cm. The seed thickness ranged from 1.1 to 1.8 cm, with an average thickness of 1.3 cm. The seed weight ranged from 9.13 to 19.74 g, with an average weight of 10.98 g. The seed has a reniform shape and it is polyembryonic (Fig. 6).

Leaves, flowers, and fruit show very little or no confirmation of anthracnose disease. However, mild symptoms of powdery mildew have been observed on the leaves. Ripe fruit at room temperature remains firm and edible for long periods of time. There seems to be slight symptoms of jelly seed but this may be due to the pulp color. Fruit pH was 4.34 with citric acid content of 1.15% (Table 1).

### Discussion

This mango has been popular and held in high regard across Indonesia, Myanmar, and Thailand. Traditionally the fruits are grown from seeds and consumed locally (Campbell, 2007; KPR–Gardeners Club Slovakia, 2009). However, most recently trees are often cultivated on a small scale by local people in their backyard gardens or on small farms (Kosterman and Bompard, 1993). Unlike the fast growing tropical fruit trees, the Kalimantan mango is not planted in large plantations in Indonesia due to its slow growing process (KPR–Gardeners Club Slovakia, 2009).
Kalimantan mango plantations could only be found in the Mataraman area in the Banjar district. The people of Mataraman tried to plant a small-scale cultivation in 1980 and the first harvest was in 2005. Although the fruit is locally found abundantly, it still does not satisfy the demand. To get to the fruit is not very easy as the Kasturi trees grow very tall and one has to climb very high to harvest it. The fruit falling to the ground are of much lower quality but the fruits could be eaten fresh or processed as jams, juice, or paste. The fruit is rarely on sale in the markets, as farmers consume these themselves (KPR–Gardeners Club Slovakia, 2009). These products are, however, quite hard to find as the fresh fruit is always in high demand and one of the favorite fruits of the Banjar people (Bompard, 1988; Kostermans, 1986). The fruits are also quite expensive, but to the Banjar people it is worth their money because of the wonderful taste.

On the island of Borneo in Indonesia there are 34 mango species (Mangifera), including Kasturi, occurring naturally on the island (Kostermans, 1986). Many of these species are seriously in danger of extinction due to the rainforests’ deforestation and land grabbing activities such as business and housing expansion (World Conservation Monitoring Centre, 1998).

**Summary**

There is considerable potential for the use of ‘Casturi’ as a “backyard” orchard tree, ornamental, interstock for other wild mango species, and also in breeding with Mangifera indica (Campbell, 2007). But most important is the conservation of the species ex situ. Further selection and evaluation of superior germplasm along with research into the postharvest handling, processing, and marketing of this valuable fruit are necessary.

**Literature Cited**


