# Comparative Study of Wild Mangoes of Andamans (India) for Nutritional Composition and Rootstock Potential

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Out of reported five species of mango, *M. andamanica, M. griffithi* and *M. comptosperma* are reported from Andaman and Nicobar Islands, India. Detailed explorations and studies were carried out in Andamans for their habitat, botanical description, and nutritional composition of fruits, rootstock studies and grafting success of *M. indica* on these species. Nutritionally, *M. andamanica* and *M. griffithi* were found rich in vitamin C(ascorbic acid) (99.5 mg/100 g and 37.9 mg/100 g, respectively), total sugars (17.80 and 9.09%, respectively), which is comparable with traditional varieties of *M. indica*. Seedlings *M. comptosperma* showed more vigour, success and survival after grafting of *M. indica*. *Ex situ* conservation of these wild species and *M. andamanica* in particular was carried out by collecting of stones and raising of seedlings in bulk for further improvement and exploitation.

**Key Words: Wild Mango, Andaman, Botany, Nutrition, Grafting, Rootstock**

## Introduction

India holds rich genetic diversity of both cultivated and wild relatives of several horticultural crops including mango, which is decidedly the most important fruit for million of people. Perhaps, mango, originated in the Indo-Burma region and before domestication was growing wild in the forests of India, especially in the hilly areas in the northeast. Many indigenous genotypes are lost in recent past due to intervention of man and urbanization. Nevertheless, a great genetic diversity still exists owing to the large geographical area, diverse climatic conditions and allopolyploid nature of its origin.

Andaman and Nicobar archipelago (India) unique to India, have a vast variety and diversity in many tropical indigenous and unexploited fruit tree species (Parkinson, 1932; Rao, 1986 and Singh *et al.*, 1996).

Genus *Mangifera* belongs to the dicotyledonous family Anacardiaceae and almost all commercial cultivars of mango are included in a single species i.e. *M. indica*. Out of 41 recognized *Mangifera* species, valid number stands up to 39 (Mukherjee, 1985). Five species *viz., M. indica, M. khasiana, M. sylvatica, M. comptosperma* and *M. andamanica* were reported from India (Mukherjee *et al.*, 1983; Sreekumar *et al.*, 1996). Out of reported species 3 species *viz., M. andamanica, M. griffithi and M. comptosperma* are reported from the small stretch of Andaman and Nicobar islands.

In recent years, man and its associated anthropic factors have been radically changing the ecosystems, causing continuous loss of forestland. Consequently, many valuable and endemic species become rare and extinct. *M. andamanica* has fallen in the list of endangered species (Mukherjee, 1985).

Except few of the botanical studies no efforts were made to study the wild mangoes of Andaman to evaluate their nutritional value, their exploitation as rootstock multiplication and conservation of these rare and endangered species. These wild species can be a good stock for crop improvement and further utilization for processing and making value added products.

These explorations and detailed study were therefore conducted to gather maximum stones of different species in a region that is menaced by the genetic erosion as a result of the development of the agriculture and industrialization, for their botanical description, habitat, nutritional composition of fruits, rootstock studies and grafting success of these species and mass multiplication and conservation of rare and endangered species.

## Materials and Methods

Series of explorations during different seasons of vegetative growth and fruiting were conducted in several Andaman and Nicobar islands; situated of the Eastern coast of India, in the Bay of Bengal (10° 31′ and 13° 42′ N latitude and 92° 14′ and 90 ° 16′ E longitude) having a typical tropical and humid climate; annual average precipitation of 3086 mm with 82% relative humidity. Vegetative, flowering and fruiting characteristics of different mango species of wild were studied during different seasons. Flowering and fruiting of different species of mango was recorded from December to May during 1996-1998. The ripe fruits were collected and analyzed for different quality parameters (size and weight

of fruit, thickness of peel, weight of stone, TSS, acidity, vitamin C (ascorbic acid) and total sugar). TSS of the fruit was determined using hand refractometer and expressed in Brix. Titratable acidity and ascorbic acid were calculated using methods described by Rangana (1986). Titratable acidity was determined a 10 g aliquot of the homogenates made up to 100 ml. Titratable acidity was expressed in gm citric acid per 100 g fresh weight. Vitamin C was calculated as ascorbic acid mg/100 g fresh weight using 2,6-dichloro indophenol dye.

The healthy and bold stones of these species were raised for rootstock study. Grafting of Neelum variety of *M. indica* by soft wood grafting techniques (Singh and Suryanarayana, 1996) was done on 2 months old rootstock of different wild mangoes of these islands. 25 grafts were made for each species, which were replicated thrice.

Success of grafting and growth studies was carried out in the nursery at Central Agricultural Research Institute, Port Blair, India. The stones of these species and that of *M. andamanica* in particular were collected graded and raised in bulk for *in situ* conservation of rare and extinct species.

## Results and Discussion

### *Taxonomical Distribution/Botanical Description*

These wild species of mango i.e. *M. andamanica, M. griffithi and M. comptosperma* were studied for their morpho-taxonomical distribution (Table 1).

**I. *M. andamanica:*** Rare and endemic, was collected from Chidyatapu and Choudhari (South Andaman), 30-40 m high of upright growth. Flowers were 1/4$^{th}$ inch in diameter. Fruit was very small yellow orange in colour.

**II. *M. griffithi:*** First time reported wild from Mount Harriet of South Andaman. Tree was small 6-8 m high, having a characteristic thin leaf stalk (±3 mm) and prominent secondary veins, along lower surface with characteristic small fruits. Flowers were small 1/4$^{th}$ inch in diameter, white in colour.

**III. *M. comptosperma*:** It is not found common, usually found in middle Andaman; long island: South Andaman (Rutland). Tree was large 50-100 m high with greyish bark, leaves 5-10 inch long. Flowers 1/4$^{th}$ inch in diameter, white in colour. Fruits were compact in shape.

### *Fruit Characteristics/ Nutritional Composition*

These species were found in flowering and fruiting during January to April. The fruits of *M. andamanica* and *M. griffithi* were small and oblong in shape while that of *M. comptosperma* were comparatively larger and compressed in shape. Single fruit weight varied from 15.5g (*M. griffithi*) to 50.5 g (*M. comptosperma*). Maximum length (7.0 cm) of fruit was found in *M. comptosperma* and minimum (3.7 cm) in *M. andamanica*. Minimum weight of stone (23.6 g) was recorded in *M. andamanica*. Minimum weight of peel (19.35%) and maximum pulp percentage (52.25%) was recorded in *M. griffithi*, which was followed by *M. andamanica* (10.0%). Minimum thickness of fruit peel (0.15 cm) was recorded in *M. griffithi* and *M. andamanica* (0.18 cm). Maximum total soluble solids were recorded in fruits of *M. griffithi* (18.4°B) and *M. andamanica* (10.0°B) in *M. andamanica*. Minimum acidity was found in *M. griffithi* (3.0%) and *M. andamanica* (3.8%). Vitamin C content of the fruits was maximum in *M. andamanica* (99.5 mg/100 g) followed by *M. griffithi* (37.9 mg/100g). Total sugars were found maximum (17.80 and 9.09%) in *M. griffithi* and *M. andamanica,* respectively. Overall

**Table 1. Habit and habitat, vegetative growth and flowering of wild mangoes of Andaman and Nicobar Islands (India)**

| Species | Distribution | Tree characteristics | Flowering/Fruiting |
|---|---|---|---|
| *M. andamanica* | Endemic and rare: distributed in Andaman forests, Chidyatapu, Chouldhari (South Andaman) | The trees are of upright growth (30-40 m). Leaves 3-5 inch long obovate to broadly ablanceolate or eliptic | Flowers 1/4$^{th}$ inch in diameter, fruit very small, yellow orange in colour. Flowering and fruiting in Feb-April. Fruit yellowish orange |
| *M. griffithi* | South Andaman Island (Mount Harriet) | The trees are small (6-8 m high) with greyish brown bark and a dense canopy of green elliptic or obovate leaves. Allied to *M. longinifera* Griff by having a thin leaf stalk (±3 mm) and prominent secondary veins, along the lower surface with characteristic small fruits | Flowers small <1/4$^{th}$ inch in diameter, light yellow in colour. flowering and fruiting in Feb-April. Fruits are yellow with crimson tinge. |
| *M. camptosperma* | Not common, usually found in middle Andaman; long island: South Andaman, Rutland | The trees are large (50-100 m high) with greyish bark cut streaked dark reddish brown with little milky juice. Leaves 5-10 inch long, lanceolate, shortly acuminate in 16-24 pairs | Flowers 1/4$^{th}$ inch in diameter, white in colour in ample terminal panicle. Flowering and fruiting Feb.-April. Fruits are yellowish green. |

physical compositions of fruits indicate that *M. andamanica* and *M. griffithi* are having nutritional composition comparable with table varieties of *M. indica* (Table 2).

### *Rootstock and Grafting*

Maximum germination of stones was found in *M. griffithi* (76%) and *M. andamanica* (70%). Two months after sowing of the stones, the rootstock seedlings of maximum height (40.0 cm) were found in *M. comptosperma*. The seedlings of the *M.comptosperma* were found to be vigorous and stout. After grafting (soft wood) of *M. indica* scion, on these seedlings, maximum survival of 72% was found in *M. comptosperma, w*hile survival (8.0%) was least in *M. andamanica* and *M. griffithi*. After 60 days of grafting, none of the grafts survived on *M. andamanica* and *M. griffithi* whereas 50% of grafts survived in *M. comptosperma*. Number of leaves after 30 days of grafts were recorded in *M. comptosperma* (7.0%). In this rootstock it took least days for first sprouting of foliage i.e. 15 days while in others it took 18 days each. Performance of seedlings of these species for rootstock and grafting revealed that *M. comptosperma* showed more success and survival. Failure of *M. andamanica* and *M. griffithi* may be due to less vigorous growth of their seedlings and their stem, which was not found suitable for grafting. As for as nutritional aspect is concerned, *M. andamanica* (TSS 10.0°B and Vitamin C 99.5 mg/ 100 g) and *M. griffithi* (TSS 18.4°B and Vitamin C 37.5 mg/100 g) were found good in nutritional value (Table 2). These species need proper and sustainable exploitation for using in post harvest industry, which in turn will improve the socio economic aspect of local tribal community and local farmers living in interiors.

For *ex situ* conservation of these species, 1000 stones of each species were collected and raised seedlings were conserved in arboretum of the Central Agricultural Research Institute, Port Blair, Andaman and Nicobar Islands (India) for further detailed investigation.

**Table 2. Fruit physico-chemical characteristics of wild mango species**

| Species | Weight of fruit (g) | Length of fruit (cm) | Breadth of fruit (cm) | Weight of stone (gm) | Length of stone (cm) | Breadth of stone (cm) | Weight of peel (gm) | Weight of pulp (gm) | Thickness of peel (cm) | TSS (°B) | Acidity (%) | Vit. C (Ascorbic acid mg/ 100 g) | Total sugar (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *M. andamanica* | 20.0 | 3.7 | 2.9 | 4.32 (23.6%) | 3.8 | 1.8 | 8.82 (48.2%) | 5.5 (28.09) | 0.18 | 10.0 | 3.8 | 99.5 | 9.09 |
| *M.griffithi* | 15.5 | 4.0 | 2.10 | 3.98 (25.6%) | 3.7 | 1.8 | 3.00 (19.35%) | 8.1 (52.25) | 0.15 | 18.4 | 3.0 | 37.9 | 17.80 |
| *M. comptosperma* | 50.5 | 7.0 | 3.0 | 28.05 (55.54%) | 5.8 | 2.1 | 12.0 (23.8%) | 10.68 (22.0) | 0.22 | 6.0 | 6.0 | 22.0 | 4.80 |

Mean of 10 fruits/treatment

**Table 3. Grafting of *M. indica* Var. Neelum on wild mango species**

***Table 3.1. Stone germination and vegetative growth of seedlings of wild mango species***

| Species | Stone germination % | Vegetative growth of rootstock seedlings (2 months after sowing of stones) | | | Colour of Bark |
|---|---|---|---|---|---|
| | | Height (cm) | No. of leaves | Diameter (cm) | |
| *M. andamanica* | 70.0 | 22.0 | 5 | 0.40 | Greenish Brown |
| *M. griffithi* | 76.0 | 24.0 | 6 | 0.35 | Brownish Grey |
| *M. comptosperma* | 30.0 | 40.0 | 7 | 0.75 | Dark Brown |

Mean of 10 fruits/treatment

***Table 3.2. Growth performance of mango grafts on rootstock of wild mango species***

| Species | Survival (%) | | Days taken for | No. of leaves | |
|---|---|---|---|---|---|
| | After 30 days | After 60 days | first foliage | After 30 days | After 60 days |
| *M. andamanica* | 8 | 0 | 18 | 2 | 0 |
| *M. griffithi* | 8 | 0 | 18 | 2 | 0 |
| *M. comptosperma* | 72 | 50 | 15 | 3 | 7 |

Mean of 10 fruits/treatment

## Conclusion

The wild mango species lying scattered in wild and semi wild conditions in Andaman and Nicobar Islands (India) are found quite rich in nutritional composition and have great potential to be used as rootstock for grafting of different cultivars of *M. indica*. Nutritionally *M. andamanica* and *M. griffithi* are found rich in vitamin C and sugars and can be exploited for making value added products. Whereas, *M. comptosperma* was found to perform better as rootstock for grafting success of *M. indica*.

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