Citrus maxima

Merr.

Rutaceae

LOCAL NAMES
Burmese (shouk-ton-oh,kywegaw); Dutch (pompelmoes); English (shaddock,pummelo,pumelo,chinese grapefruit,pompelmous); French (pamplemousse); German (pampelmus,pompelmus); Indonesian (jeruk besar,jeruk bali); Khmer (krôoch thlông); Lao (Sino-Tibetan) (kiéngz s'aangz); Malay (bali lemon,pomelo); Thai (som-o,ma-o); Vietnamese (bu'o'i)

BOTANIC DESCRIPTION
Citrus maxima is a tree 5-15 m tall, with a somewhat crooked trunk 10-30 cm thick; branches low, irregular and spreading. Spines up to 5 cm long. Young branchlets angular, often densely soft, short, hairy, and usually with spines

Leaves, compound, appearing simple, having one leaflet, alternate, glandular, dotted, ovate to elliptical, 5-20 cm long, 2-12 cm wide and leathery. Petiole broadly winged to occasionally nearly wingless, up to 7 cm wide.

Flowers fragrant, borne singly or in clusters of 2-10 in the leaf axils, or sometimes 10-15 in terminal racemes 10-30 cm long; rachis and calyx hairy; the 4-5 petals, yellowish-white, 1.5-3.5 cm long, somewhat hairy on the outside and dotted with yellow-green glands. Stamens 20–25, white, prominent, in bundles of 4-5, anthers orange.

Fruit ranges from nearly round to oblate or pear-shaped; 10-30 cm wide; the peel, clinging or more or less easily removed, may be greenish-yellow or pale-yellow, minutely hairy, dotted with tiny green glands; 1.25-2 cm thick, the albedo soft, white or pink; pulp varies from greenish-yellow or pale-yellow to pink or red; is divided into 11-18 segments, very juicy to fairly dry; the segments are easily skinned and the sacs may adhere to each other or be loosely joined; the flavor varies from mildly sweet and bland to sub-acid or rather acid, sometimes with a faint touch of bitterness.

Seeds few, large, yellowish-white and white inside; though some fruits may be quite seedy.

This citrus fruit (the largest), is known in the western world mainly as the principal ancestor of the grapefruit. The seeds produce fruit somewhat smaller than the current grapefruit, more like an orange, usually with up to 5 cm long spines if propagated by seed, and spineless if vegetatively propagated.

BIOLOGY
Pummelos may flower 2-4 times a year. In the prime-growing region in southern Thailand, fruiting is heaviest in May-October and scant in January-March and November-December. In Nepal, pummelo trees starts fruiting from September-February. In Florida, the fruits ripen from November to February and there may be a small crop in the spring.

Pummelo is largely self-incompatible, and unlike other Citrus species, does not produce nucellar seedlings. Cross pollination and fertilization occur between pummelo and other species of the genus, giving it a greater range of genetic variability relative to other Citrus species. In most cases, the quality and quantity of production of pummelo is very low in farmers' fields due to inferior trees grown from seeds.

Fruit and leaves at Pulehu, Maui, Hawaii. (Forest & Kim Starr (USGS))

Fruit at Pulehu, Maui, Hawaii. (Forest & Kim Starr (USGS))

ECOLOGY
The pummelo is tropical or near-tropical and flourishes naturally at low altitudes close to the sea. On the salty mud flats, farmers dig ditches and create elevated beds of soil for planting the trees. The salt content of the water varies throughout the year but may be as high as 2.11 % at times. In Malaysia, the tree grows well on the tailings of tin mines.

BIOPHYSICAL LIMITS
Altitude: 0-400 m
Mean annual temperature: 25–30ºC
Mean annual rainfall: 1,500–1,800 mm
Soil type: From its coastal habitat, it prefers the rich silt and sand overlying the organically enriched clay loam of the flood plain and highly tolerant to brackish water pushed inland by high tides. Although it tolerates a wide range of soils from coarse sand to heavy clay, pummelo prefers deep, medium-textured fertile soils free from salt. In southern Florida and the Bahamas, the trees grow and fruit modestly on oolitic limestone.

DOCUMENTED SPECIES DISTRIBUTION

Native: Bangladesh, Cambodia, Chile, India, Indonesia, Japan, Laos, Malaysia, Philippines, Thailand, Vietnam

Exotic:

The map above shows countries where the species has been planted. It does neither suggest that the species can be planted in every ecological zone within that country, nor that the species can not be planted in other countries than those depicted. Since some tree species are invasive, you need to follow biosafety procedures that apply to your planting site.

PRODUCTS
Food: The fruits are a rich source of vitamin C (more than Mandarin), B1, B2 and B12, protein and calcium. The juicy pulp is either eaten raw, in fruit salads or a juice may be extracted from it. The skinned segments can be broken apart and used in salads and desserts or made into preserves. The extracted juice is an excellent beverage and a food flavoring additive. Meanwhile the rind has pectin used in making jelly and candy.

Fodder: Pulp, molasses and residues from juice extraction are used as cattle feed.

Apiculture: Trees are valued honey plants

Fuel: It is a potential source of firewood

Timber: The wood is heavy, hard, tough, fine-grained and suitable for making tool handles.

Essential oil: Both fruits and leaves produce essential oils which serve as ingredients in scenting toiletry products while the flowers which are highly aromatic are made into perfumes in North Vietnam.

Medicine: Medicinally, decoctions of the leaves, flowers, fruits and seeds have properties, which can treat coughs, fevers and gastric disorders In the Philippines and Southeast Asia. Fruit has alkanizing effect on blood, is a purgative, antibacterial and cleansing agent. The leaves are used for medicinal infusions. Decoctions of leaves, flowers and rind are given for their sedative effects in cases of epilepsy, chorea and convulsive coughing. The hot leaf decoction is administered on swellings and ulcers and fruit juice as febrifuge. The seeds are used against coughs, dyspepsia and lumbago while gum exudes remedies for cough in Brazil. The rind has pectin used in ointments/paste for burns.

Other products: Pummelo peels, like that of other citrus fruits, contains skin irritants, mainly limonene and terpene, also citral, aldehydes, geraniol, cadinene and linalool, which may cause dermatitis in individuals having excessive contact with the oil of the outer peel. Harvesters, workers in processing factories may develop chronic conditions on the fingers and hands.

Fruit growers in China and Southeast Asia put out chicken entrails to encourage the weaver ant to construct its long, hanging nests on citrus trees because it controls the tree borers (Pentatomidae) and other pests. The eggs (pupae) are commonly eaten.

SERVICES
Erosion control: Pummelo is sometimes interplant with Erythrina fusca to help retain the soil with its extensive, fibrous root system, and enrich the soil with its falling leaves

Reclamation: Pummelo growers in southeastern Asia sometimes reclaim swampy land, dig the ditches and canals for drainage, and build the raised beds where pummelo is planted

Ornamental: The species has the potential of being grown as an amenity tree in home gardens

Intercropping: In Nepal, farmers in their homestead gardens have grown pummelo for domestic consumption and religious purposes for centuries intercropped with rice, coconut and betel nut palms

Other services: Pummelo are used as temple fruits and an auspicious gift to give at various religious and cultural festivals and is very popular to Chinese communities

TREE MANAGEMENT
Pummelo growers (in Thailand and elsewhere in southeastern Asia) dig the ditches and canals for drainage and transportation routes, resulting in raised beds. In the 3-5 years before the beds are ready for the pummelo trees, quick crops such as bananas, sugarcane and peanuts are grown on them. Coconut and betel nut palms are planted for shade for the young citrus trees but are removed at the end of 3-5 years, or sometimes not until the pummelos are 10-15 years old. Rice may be grown in the ditches.
The trees are spaced at 3-4.5 m apart. Some growers interplant the colurrinar tree (Erythrina fusca), to shade the mature pummelos, to help retain the soil with its extensive, fibrous root system and enrich the soil with its falling leaves. Weeds are removed by hoeing. Night soil is the standard fertilizer in the Orient and is used on pummelos but, more commonly, paddy ash (the ash of burned rice hulls) is placed in piles under each tree to gradually seep down to the roots. The air-layered trees have a low, spreading habit and must eventually be pruned.

GERMPLASM MANAGEMENT
In Thailand, fruits are generally picked when just beginning to turn yellow, heaped in large piles for sale. If not disposed of immediately, they are stored in dry, ventilated sheds shaded by trees. The fruits keep for long periods and ship well because of the thick peel. Paper-wrapped fruits in ventilated crates can keep in good condition for 6-8 month.
The seed storage behaviour is intermediate. The seeds can be stored for 80 days at 5º C and 56-58% relative humidity.

PESTS AND DISEASES
Among the leading insect pests of pummelo are a leaf miner, Phyllocnistis citrella; a beetle which attacks the leaves; a stinging red ant (Pheidologeton sp.) that damages roots, twigs, leaves and trunk, sometimes girdling and killing the tree. Scale insects (Chrysomphalus aonidum and C. aurantii, Coccus hesperidum, Lepidosaphes gloverii, Parlatoria brasiliensis and P. zizyphus, Pseudaonidia trilobitiformis, and Saissetia sp.) are prevalent but are partly controlled by natural enemies –a black ant (Dolochonderus sp.) and a parasitic fungus, Aschersonia aleyrodis.

In Indonesia, the fruits of one cultivar, 'Bali Merah', which has a thin rind, are so heavily attacked by the citrus rind borer and other insects that they are commonly wrapped in old banana leaves, paper or cloth when young.

Mistletoe (Loranthus sp.) is a great pest on pummelo trees in Asia.

FURTHER READNG

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SUGGESTED CITATION

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