Pomelo—*Citrus maxima*—the indigenous mega-citrus of South-East Asia

The pomelo, the largest of the citrus fruits, is indigenous in South-East Asia and uniquely identified with local food and culture.

By Casey Ng

The pomelo is native to South-East Asia, where it exists in a large number of cultivated varieties. The fruit, like all citrus fruits, is filled with juicy sacs (vesicles), shaped like tear drops. In Thailand, the juicy sacs of the pomelo are key ingredients of a traditional salad dish *yam som oh*. In Malaysia, the pomelo is featured in a festive dish of raw fish salad known as *yee sang*. People also bathe in water infused with pomelo leaves to wash off bad luck. The velvety-textured white flowers, which emit a jasmine-like fragrance, are gathered by Vietnamese and Balinese as prayer offerings. In contrast the Chinese in Malaysia use the fruits as prayer offerings. Flowers are plentiful on trees throughout the year and they have been used in Indo-China to make perfumes. In many Asian homes, the aromatic rinds are placed in kitchens and bathrooms as deodorizers.

Origins and varieties

In Malaysia, a variety known as the Bali pomelo or *Limau Bali* was introduced in 1884 when Sir Hugh Low brought in seedlings from the Dutch East Indies (Indonesia). The seedlings were distributed and planted in Penang and Perak. Over time, the name *Limau Bali* became the general name in Malaysia for all pomelos and cannot now be used to designate any particular variety.

Hugh Low made significant contributions to Malaysia's agriculture sector when he became the fourth Resident (British Advisor to the Sultan) of Perak. He introduced rubber by growing the first plants, in Kuala Kangsar in Perak. Hugh Low is also credited for pioneering coffee, pepper, tea and sugarcane, with support from Henry Nicholas Ridley.

The pomelo variety that Hugh Low brought to Perak was probably the origin of the pomelo grown in Tambun, Perak, that has made Tambun famous for pomelo horticulture. Plants of this lineage are characterized by rounded fruit with a flat base, low acidity, whitish juice sacs and thick rind. There are several forms in cultivation in which the juicy sacs differ in taste (sweet to sour) and colour (white, yellowish or pink). These pomelos are now known by names such as Tambun White and Tambun Pink.

There are two other groups of pomelos planted today in Malaysia. The 'Chinese group' includes the Shatian variety and is typically pyriform

(pear-shaped), with yellowish or pinkish juice-sacs and thick rind. These are currently planted in Malacca, Johor and Negeri Sembilan.

The third group is the 'Thailand group' with smaller and rounder fruits, grown in Kedah and Kelantan.

In October 1998, MARDI launched a new variety called Melomas. The fruit is rounded, juicy sweet, fragrant, with fine hairy thin rind and slightly pinkish juice sacs. Melomas has natural resistance to the soil-borne pathogen *Phytopthora parasitica*, which affects many fruit crops including pineapple, banana and papaya. Pomelo trees have a productive lifespan of roughly 20 years and Melomas is increasingly sought after in replanting projects around the country.

The pear-shaped Shatian variety

Pinkish sweet vesicles of Melomas variety

Growing challenges

The pomelo is propagated by air-layering, which is better known in Malaysia as 'marcotting'. Propagation by seeds is not favoured because seedlings are not true copies of the mother plant—they are not 'true to type'. Also, seedlings need a longer period to mature before they begin to flower. In citrus, there is the additional problem that seedlings bear larger thorns than the branchlets of mature trees. Plants obtained by marcotting branchlets of mature trees effectively bypass the thorny juvenile phase.

Trees can produce fruits the whole year round and it takes roughly five months for fruits to be fully developed from flower buds. However, growers prefer to prime the trees for harvesting a few weeks before the Lunar New Year and Mid-Autumn Festivals, which are celebrated in many South-East and East Asian countries, when pomelos are prized as gifts and can be sold at peak prices.

Trees are spaced 30–40 feet apart and they go through 5 years of juvenile stage before starting to bear flowers. Trees produce the most fruits at the age of 10 and the harvest will start to decrease as the trees pass 20 years old. At maturity, each tree is capable of producing 200–300 fruits annually.

Branches laden with heavy pomelos are propped with poles. If this is not done, the branches will break. To encourage flower and fruit profusion, trees are planted 30–40 feet apart to allow plenty

of space for the branches to spread out. Purchased at RM5 per bag, 8–10 bags of chicken manure are placed around each tree for fertilizing.

Pomelo trees will sometimes defoliate due to weather conditions. Both too-wet and too-dry conditions will affect the trees. Periodical pruning of 10–20% of foliage is carried out by growers to remove weak branches after harvesting, and to improve sunlight penetration and air circulation in the crowns. The branches exposed to more sunlight will produce more flowers. The tree trunks are commonly whitewashed with slaked lime. The developing fruits are wrapped with plastics and newspapers as protection from sunburn and fruit flies.

In 2007, trees of the Melomas variety produced an unusual profusion of flowers. The flowers were somewhat deformed and fruit setting did not occur. In December 2011, MARDI's investigation team concluded that high rainfall coinciding with the flowering season was the root cause of the problem. Apparently, if there is a prolonged presence of water droplets on flowers, there is a high chance of anthracnose infection. A solution was eventually found by covering flowers with transparent plastic covers to keep them dry.

There are more than 74 species of insects recorded as pomelo pests. These include the citrus leaf-miner, citrus thrips and mealybug. Rust mites feed on the outer skin of fruit and destroy the rind cells leaving a rust-brown appearance. This does not affect the quality of juice sacs but unsightly fruits have no market value. Since the pomelo is most often used as presents, the appearance of the fruit is absolutely important. The slightest blemish is enough to make a fruit unsaleable. Hence there is a lot of fruit wastage in the industry because there is no canning or juicing industry to make use of the blemished fruits.

Chicken manure in plastic bags, slit and placed below the trees—for slow-release of nutrients

Deformed flowers

The citrus root weevil, aphids, mealybugs and the red scale attach themselves to leaves, branches, trunks, roots and other parts and feed on the plant sap. The aphids and mealy bugs exude a sweet liquid that ants feed on, and the exudate also encourages the growth of sooty mould fungus. The sooty mould is unsightly and cuts off the light needed by leaves for photosynthesis. The ants protect and spread the mealy bugs.

Pomelo in flower

Of late, the HLB disease, also known as the greening disease has started to make its presence felt in many citrus-planting regions around Malaysia. The disease was first reported in 1943 in China and its name HLB is derived from its Chinese name *huánglóngbìng* (黃龍病) literally meaning "yellow dragon disease".

HLB is caused by a species of bacteria spread by a tiny insect, the Asian citrus psyllid *Diaphorina citri*. The insect is infected by feeding on diseased plants and it then passes the bacteria on to other plants. Yellow mottling of leaves is one of the HLB early symptoms but it is often misdiagnosed as nutritional deficiency. HLB causes heavy premature fruit drop and results in the death of citrus tree 3–5 years after infection. Early detection is often difficult because the disease has more than one year's incubation period. HLB first became widespread in 1987 in

The red scale insect—a pest on leaves and fruits

Kuala Terla, Cameron Highlands, and appeared in 2001 in Samarahan, Sarawak. By 2005, West and East Malaysia were both affected by HLB. As there is no cure, the current best practice is prompt elimination of infected plants to eliminate the bacteria.

Pomelo orchard

On the bright side, 109 species of natural enemies of insect pests of citrus plantations have been recorded. Biological control of pests can be encouraged by growing 'companion plants' within pomelo plantations to provide a better environment for pest-control organisms. Companion plants are grown in some oil palm estates to facilitate biological control of the bag worms that infest oil palms (see Peter Ooi's article on biological control in this journal Vol 1, No 2).

Future Prospects

Sabah is currently the largest pomelo producer (Table 1) with Perak at second place and Johor closing in at third place. It is interesting to note that Sabah's financial return per hectare is more than double compared to Perak and Johor. The big differences between states would merit a special study.

There are wholesalers based in Johor Bahru who buy fruits from the growers in Perak and Johore and store them in cold rooms. These are then resold to wholesalers in Singapore who export to East Asian countries in time for peak consumption during festivals. It is a good thing that pomelo quality is maintained by storage in cold rooms.

The pomelo is a minor fruit crop in Malaysia. Family-run orchards are the starting points of the pomelo supply chain in Malaysia. Pomelo is one of the few fruits that can be grown economically on a small plot of land that a smallholder can call his own. As one young grower interviewed sums it up nicely, "Income from pomelo has been sustaining our family for generations. My grandfather and father have been growing pomelo in this land. It is in my blood, and I can't imagine a life without the trees".

Pomelo production based on data from Department of Agriculture's Fruit Crops Statistic Report 2013, ranked by production

Rank and State	Area (ha)	Production (mt)	Value (RM)	Efficiency RM per ha	Efficiency Mt per ha
1. Sabah	239.0	5,518.6	16,555,800.0	69,271.13	23.1
2. Perak	205.4	2,351.6	7,054,917.00	34,347.21	34.3
3. Johore	206.7	2,080.5	6,241,500.00	30,195.94	30.2
4. Sarawak	279.5	1,074.4	3,223,200.00	11,532.02	3.8
5. Melaka	33.4	337.1	1,011,288.00	30,278.08	10.1
6. Kedah	76.0	163.2	489,485.00	6,440.59	2.1
7. Pahang	29.8	91.3	273,896.00	9,191.14	3.1
8. Kelantan	12.6	73.5	220,421.00	17,493.73	5.8
9. Labuan	6.5	8.5	25,500.00	3,923.08	1.3
10. Negeri Sembilan	1.3	7.5	22,365.00	17,203.85	5.8
11. Selangor	0.6	4.7	14,100.00	23,500.00	7.8
12. Penang	2.0	3.4	10,080.00	5,040.00	1.7
13. Perlis	-	-	-	-	-
14. Terengganu	-	-	-	-	-
Malaysia	**1,092.8**	**11,714.3**	**35,142,552.00**		

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