Carica papaya L. cultivated in greenhouse conditions

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Abstract Papaya is widely cultivated and consumed, both for its agreeable flavour as well as its many pharmacological properties. Papaya (Carica papaya) is a palm-like, soft-stemmed, evergreen tree, that is native to the tropics of the Americas, but which is now cultivated not only in tropical and warm, semi-tropical zones around the world, but also in protected cultivation. Papaya also is the name for the large, juicy, melon-like, edible fruit of this tree, which has black seeds in the center and typically ranges in colour from orange to a yellow hue. A botanical and pomological description of papaya fruits cultivated in greenhouse conditions are given in this paper.

The papaya plant (Carica papaya L.) belongs to the Caricaceae family, includes six genera with at least 35 species [9]; [12]; [5]. It is called ‘pawpaw’ in Australia and also known as ‘mamoo’, ‘watermelon’, ‘lechosa’, ‘tree melon’ in other countries, but it is very different from the North American ‘pawpaw’ (Asimina triloba Dunal), which is a member of the family Annonaceae. Carica papaya it is believed to be native to tropical America, its region of origin being southern Mexico and neighbouring Central America [13]. In the sixteenth century the Spanish explorers took the papaya plant to the South East Asia and to the Caribbean. The factors that are thought that have contributed to the wide geographical contribution of the fruit are the large number of seeds in the fruit and their long viability [6]. Carica papaya L. is typical of a tropical and subtropical regions species which require temperatures between 21 and 33°C, being intolerant to cold weather (less than 15 °C) [7]; [10]; [16]; [18]. Prolonged dry periods reduce crop output [1]. Papaya is grown in nearly all countries of the tropical Americas (Central and South America and the state of Hawaii). It is also cultivated in India, Sri Lanka, various Asian countries, as well as the Antilles and tropical Africa [6]. This manuscript describes a short botanical and pomological description of the papaya, Carica papaya L., growth in the greenhouse; papaya trees were obtain from seeds which were brought from Australia (from different area) and grown/bred under greenhouse conditions at the Hortinvest Greenhouse within Research Center for the Study of Quality Food Products from Bucureşti.

Generic and Local Names

The generic name is from the Latin ‘carica’, meaning ‘edible fig’, that is because of the similarity of the leaves with the fig tree (Ficus carica). Around the world papaya it is called in many different ways: Arabic (fafay, babaya); Bengali (pappaiya, papeya); Burmese (thimhaw); Creole (papayer, papaye); English (bisexual pawpaw, pawpaw tree, melon tree, papaya); Filipino (papaya, lapaya, kapaya); French (papailier, papaye, papayer); German (papaya, melonenbraum); Hindi (papaya, papeeta); Indonesian (gedang, papaya); Javanese (kates); Khmer (hlong, douem lahong); Lao (Sino-Tibetan) (hlong); Luganda (papaali); Malay (papaya, betek, ketalah, kepaya); Sinhala (pepol); Spanish (figuera del monte, fruta bomba, papaya, papaita, lechosa); Swahili (mpapai); Tamil (pappali, pappayi); Thai (ma krai that, malakor,loko); Tigrigna (papayo); Vietnamese (du du) [15].

Botanic Description

Papaya is an evergreen herb-tree, single-stemmed, semi-woody with fast growth (1–3 m during the first year, eventually reaching heights of 6 to 9 m). The stem it is hollowed, herbaceous erect stem 10-30 cm in diameter and it is usually unbranched, which terminates with a cluster of large palmate-lobed leaves with 25-100 cm long petioles and latex vessels in all tissues. Has an extensive rooting system. Vigorous vegetative growth may induce axillary bud break and branching at the lower portions of the plant, which rarely exceeds a few centimeters in length.
Some branching may also occur if apical dominance is lost due to tip cut/damage in tall plants, releasing the lower buds from the dominant effect of the apex. The leaves arranged spirally are glabrous, prominently veined, palmate borne on long, hollow petioles emerging from the stem apex, which may be 30 to 105 cm long and 30 to 60 cm wide, are divided into 5 to 9 main segments, which are further lobed; lobes are deeply and broadly toothed. Both leaves and stems contain large amounts of white, milky latex. Older leaves die and fall as the tree grows (Fig. 1).

![Figure 1. Papaya trees details: leaf, buds, stem and branches](image)

**Plant type**

There are three types of plants based on flowers type and fruits shape: female, male and hermaphrodite. **Female plants** always produce female flowers. If no male or hermaphrodite plants are nearby to provide pollen, female plants usually fail to set fruit. Unpollinated female plants occasionally set parthenocarpic fruits, lacking seeds like for example in our case, we found in the greenhouse in the V₁₄ genotype (Fig. 2).

![Figure 2. Papaya parthenocarpic fruit](image)
Male plants are distinguished by their long flower stalks bearing many flowers. Usually they do not produce fruit, but on rare occasions there is female expression in the flowers, and they may set fruits.

Hermaphrodite plants have male flowers, hermaphrodite flowers, or both, depending on environmental conditions and the time of year. Hot, dry weather may cause suppression of the ovary and the production of female-sterile (male) flowers. This accounts for occasional seasonal failure of hermaphrodite plants to set fruit. Hermaphrodite plants tend to produce self-pollinated seeds, which result in relatively uniform progenies.

Flower type
Papaya flowers are small, cream white coloured, funnel-shaped, solitary or clustered are formed in the leaf axil. Flowers can reach 2.5 to 3.6 cm long and they are slightly fragrant (Fig. 3). The type of inflorescence depends upon sex of the tree and the type of the flower present, which are primarily of three types: staminate (male), pistillate (female) and hermaphrodite (both female and male organs). The stigmatic surfaces are pale green and the stamens are bright yellow.

Flower type is determined by the presence or absence of functional stamens (male parts) and stigma and ovary (female parts). Female flowers are relatively large and rounded at the base. They have large functional pistil, ovoid-shaped ovary but lack stamens (Fig. 4).

Male flowers are thin and tubular. They have perfect structure (they contain both male and female organs), but the small, vestigial ovary is non-functional. Male flowers on hermaphrodite plants are borne on short peduncles (Fig. 5).
Hermaphrodite flowers are intermediate between female and male flowers in size and shape. They are less bulbous than female flowers, but not as thin as male flowers. They have perfect structure with functional stigma and stamens and usually are self-pollinating (Fig. 6).

**Fruits**

Papaya fruits are berries that show high diversity in size and shape. The fruits are large with fleshy orange pulp and thin yellowish-orange skin when ripe. Fruits from hermaphroditic plants tend to be elongated and vary from cylindrical to pear shaped, while fruits of female plants tend to be round (Fig. 7).
Seeds
Well-pollinated papaya fruits have numerous small seeds, black coloured, round shape (Fig. 8). The seeds are coated by a mucilaginous mass derived from the pluri stratified epidermis of the external integument. The embryo at physiological maturity is enclosed in a gelatinous, fleshy sarcotesta.
Papaya is cultivated for its edible fruits as a fresh fruit and for use of drinks, jams, candies and dried fruit. Ripe fruits are usually eaten fresh and green fruits are also used as a cooked vegetable. Papaya also has several industrial uses. Biochemically, its leaves and fruits produce several proteins and alkaloids with important medical and industrial application. The latex of green fruits contain a proteolytic enzyme, papain. Papain belongs to the papain superfamily and is of critical importance in many vital biological processes in all living organisms [11]. The digestive enzyme papain, isolated from papaya, is used as an ingredient in brewing, meat tenderizing, pharmaceuticals and cosmetic industries [8]. Evolutionary, papain may be associated with protection from frugivorous predators and herbivores [3].

Nutrition
The edible portion of the ripe pawpaw fruit contains both macro and micro minerals and these Na, K Ca, Mg, P, Fe, Cu, Zn, and Mn [14]. Carica papaya is a source of carotenoids, vitamin C, thiamine, riboflavin, niacin, vitamin B-6 and vitamin K [4]; [2]; [17].

References

