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ARTICLE

MORPHOLOGICAL ANALYSIS OF *SYZYGIUM PALODENSE* AND *SYZYGIUM DENSIFLORUM* USING QUALITATIVE MARKERS

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Abstract

The traditional method of plant taxonomy based upon comparative external morphological characters is till indispensable to systematic study. Morphological characters of plants have provided the foundation and frame work for taxonomic study and they have been used extensively in the preparation of classification system, diagnostic key etc. Myrtaceae Juss. is an angiosperm dicotyledonous family belongs to the order Myrtales. The family has a wide distribution in tropical and warm-temperate regions of the world and are common in many of the world's biodiversity hotspots. Syzygium Gaertn.,is the largest genus in Myrtaceae with about 1200 species. The evergreen forests of the southern Western Ghats have a large number of Syzygium specieses. The present plant under study, *Syzygium palodense* Shareef, E.S.S. Kumar & Shaju, is a new species of Syzygium described and illustrated from the southern Western Ghats, Kerala, India. This species is unexplored. The flowering twig of *Syzygium palodense* Shareef, E.S.S. Kumar & Shaju was collected from Palode in Thiruvananthapuram district of Kerala of Southern Western Ghats and the flowering twig of *Syzygium densiflorum* Wall. ex Wight & Arn. was collected from Munnar of Southern Western Ghats in April, 2018. Fresh materials were subjected to taxonomic treatment. Both qualitative and quantitative characters were analysed and measurements were taken using a stereo dissection microscope. Morphological study revealed that both the plants showed similarity in majority of the characters under study. But they showed differences in characters like height of the plant, size of the leaf, fruit, seed, flower including all floral whorls, colour of the bark, phyllotaxy, shape of leaf base and presence or absence of bract. The present taxonomic study revealed that both are allied species and showed strong similarity between them.

Keywords: *Syzygium palodense, Syzygium densiflorum*

Introduction

Although in recent years, the synthetic approach has fast developed, yet the traditional method of plant taxonomy based upon comparative external morphological characters is till indispensable to systematic study. Morphological characters of plants have provided the foundation and frame work for taxonomic study and they have been used extensively in the preparation of classification system, diagnostic key etc. The plants all around us have many various forms and structures due to the difference in living conditions, genetic structures, and phylogenetic characteristics. Myrtaceae Juss. is an angiosperm family belongs to the order Myrtales. It is the eighth largest family of angiosperms in terms of number of species (Snow et al., 2003) with plants of economically important as source of edible fruits, essential oils, wood and honey. Myrtaceae is divided into two subfamilies - Myrtoideae and Psiloxyloideae, with 17 tribes and 142 genera (Govaerts et al., 2008). The number of species may vary from about 3,600 to 5950 (Biffin et al., 2006). The number of species reported may be entirely different which clearly express the complexity of taxonomy of Myrtaceae.

Syzygium Gaertn. is the largest genus in Myrtaceae with about 1200 species. Most of them are medium to large trees and are occurring in the tropics, in a diverse range of habitats (Parnell et al. 2007). Syzygium is found in Africa, southern Asia, Malesia, Australia, and Pacific Islands etc. The evergreen forests of the southern Western Ghats have a large number of Syzygium in India. Of the 52 species reported from the Western Ghats, 26 species of Syzygium have been listed under the IUCN Red List category. Overexploitation, habitat degradation, irregular phenological events, lower productivity and lesser seedling establishment in the natural habitat are the real factors for the vanishing of the population of most of the species of Syzygium (Vinod kumar 2003). The present plant under study, *Syzygium palodense* Shareef, E.S.S.Kumar & Shaju, is a new species of Syzygium described and illustrated from the southern Western Ghats, Kerala, India. It is similar to the *S. densiflorum* and *S. rubicundum* (Shareef et al., 2012a).

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Materials and Methods

Systematic collection of the plant materials was done from Western Ghats, during April and May 2018. Flowering twig of *Syzygium palodense* Shareef, E. S. S. Kumar & Shaju were collected from Palode, during April and May, 2018 and *Syzygium densiflorum* Wall. ex Wight & Arn. were collected from Munnar in Southern Western Ghats in May, 2018. Fresh materials were subjected to morphological analysis. All parts, including vegetative organs such as leaf colour, leaf venation, leaf margin, leaf apex, veinlets, etc., and flower characters (calyx, corolla, androecium gynoecium, etc.), fruit, seed etc. of all the species were analysed and measurements were taken. The external features of the materials were studied and the small parts were analysed using a stereo dissection microscope.

Results and Discussion

Syzygium palodense

S. palodense is reported only from Palode, in the Thiruvananthapuram district in Kerala at ca. 100 m elevation. It is growing as a riparian element along the banks of a stream. Flowering and fruiting occurs from March to July. Small to large evergreen trees, ca. 18 m high; bark pale brown, smooth, blaze bluish pink; twigs quadrangular, slightly winged, brownish when dry. Leaves opposite, subopposite or alternate, coriaceous, folded, punctate beneath, elliptic to elliptic-oblong, 5.5–9.5 × 2.4–5.4 cm, base obliquely cuneate, apex caudate–acuminate; margin slightly revolute, midrib channeled above, elevated beneath; lateral nerves 24–35, close, parallel, obscure above and distinct beneath; intra-marginal nerve one tiered, ca. 2 mm from the margin. Young leaves crimson red turning green at maturity. Petiole 2–5 mm long, thick and robust, black on drying. Inflorescence terminal or subterminal, ca. 9 cm long; peduncle and branches 4-angled, slightly winged. Bracteoles 2, deltoid, ca. 0.7 mm long, rounded at apex, caducous. Flowers calyptrate, sessile, creamy-white; calyx campanulate, punctate, outer yellowish green, inner creamy-white, ca. 3.5 × 4 mm; lobes 4, persistent, deltoid to sub orbicular, margin split up during anthesis. Petals 4, free, creamy-white, 2.5 × 3 mm, orbicular to sub orbicular, calyptrate. Stamens many, filaments ca. 5 mm long, pointed. Ovary 2-celled, ovules many; style ca. 5.5 mm, long, pointed. Fruit subglobose to obovoid, ca. 2.2 × 1.8 cm, fleshy, dark purple when ripe; seed 1, subglobose, ca. 1.6 × 1.3 cm (Table 1) (Fig. 1).

The main associated species of *S. palodense* are *Artocarpus hirsutus* Lamarck, *Holigarna arnottiana* Hooker, *Hopea parviflora* Beddome, *Olea dioica* Roxburgh, *Vateria indica* Linnaeus, *Xanthophyllum arnottianum* Wight, *Terminalia paniculata* Roth etc. Flowering and fruiting occurs from March to July. Bruised leaves smell like tender mangoes. Ripe fruits are sweet and eaten by the local people. The seeds showed a maximum more than 80% of germination but the survival rate is low.

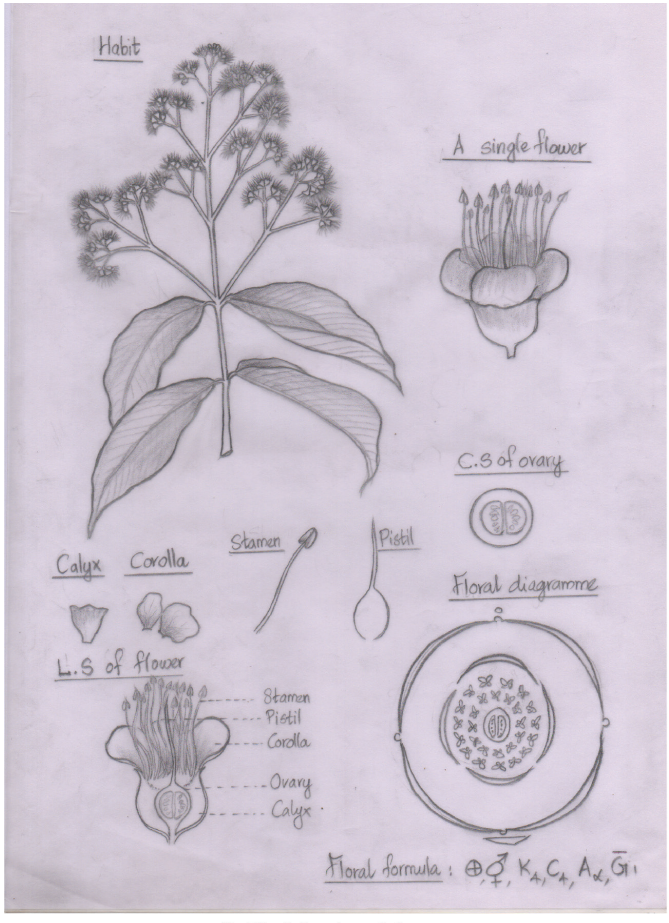
Syzygium densiflorum

S. densiflorum is a native tree which grows in the riparian or marshy area of evergreen forest at higher elevations between 1,500–2,300 m. It was reported from Maharashtra, Karnataka, and Kerala. In Malayalam, it is known by the local names such as Ayuri, Karayambuvu, Njaval, Vellanjaval, Ayura, etc. The flowering and fruiting period of the species recorded from February-May. Large trees, above 15 m height, bark surface blackish-grey, rough; branchlets terete or subterete. Leaves simple, opposite-decussate, extipulate; petiole 3–20 mm long, slender, canaliculate, glabrous, aromatic; lamina 3.5–9×1.8–3.7 cm, elliptic-lanceolate, base acute or attenuate, apex acuminate to caudate, margin entire, glabrous, coriaceous, olive-green when dry; finely dotted on both sides, main nerves and secondary nerves numerous, parallel tertiary nerves obscure to admedially ramified. Inflorescence dense terminal trichotomous cymose, Flowers bisexual. Pedicel stout and short. Flowers white, 10–12 mm long, sessile; calyx tube 5mm, turbinate; lobes 4; no thick disc; petals free, deciduous; stamens many, free, bent inwards at the middle in bud; ovary inferior, bilocular, ovules numerous; style single; stigma simple. Fruits berry, oblong to ovoid, dark purple, fleshy, single-seeded (Table 1) (Fig. 2).

S. densiflorum is reported from Maharashtra, Karnataka, Kerala (Thiruvananthapuram, Eravikulam, Pathanamthitta, Kottayam, Idukki, Palakkad, Kozhikode, Kasargod) and Tamil Nadu (Palni Hills, Aanamalai and Nilgiri Hills (Vinodkumar 2003). The local tribes of the Nilgiris have been using the leaves of S. densiflorum for the treatment of diabetes mellitus from ancient times. Clinical investigators working in India have also confirmed the effectiveness of S. densiflorum against diabetes mellitus. Trace elements from this plant make a good daily supplement for people suffering from bone and anaemic disorders (Subramanian et al. 2012). The oil extracted from the leaves possesses a higher anti-oxidant capacity (Saranya et al. 2013). S. densiflorum is closely associated with other shola arboreals like *Eleocarpus recurvatus, E. variabilis, Rhododendron arboreum, Rhodomyrtus tomentosa, Litsea coriacea* and several *Eucalyptus species*. Flowering is not observed as a regular event in most of the individuals of *S. densiflorum*. A very few mature individuals only flowered once in two years and the period of flowering was also unpredictable. Majority of fruits and flowers fall off before maturity. The fruits are edible and also the food source for many birds, insects, etc. The shelf life of seeds has been observed to be a maximum of one year, but it is best to be sowed within 4–6 m months. The seeds showed a maximum 60% of germination and the least percentage (13%) of seedlings alone emerged as viable seedlings. According to the previous literature and recent field survey, *S. densiflorum* is distributed in selected forest areas of the southern Western Ghats. Due to the lack of updated information, the species being included under vulnerable category by IUCN, and authenticated survey

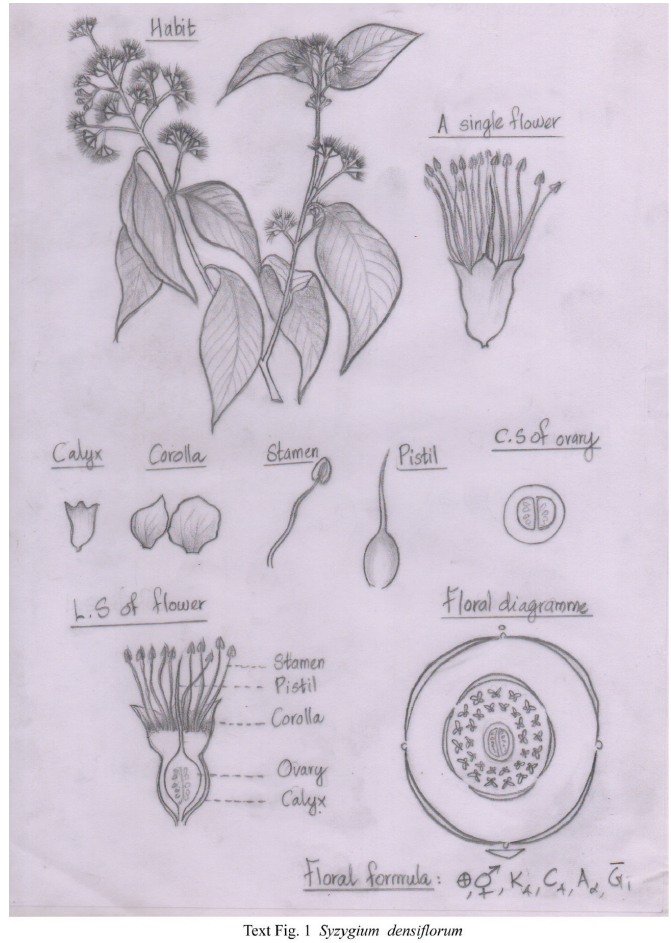
Table 1. Morphological characters of S. palodense and *S. densiflorum*.

Characters	*S.palodens*	*S.densiflorum*
Habit	Trees	Trees
Bark	Rouhg, greyish, tetragonous [blackish]	Smooth, pale brown, tetragonous
Bark blaze	Reddish	Blackish grey
Branchlet	Opposite	Opposite
Leaves	Simple, strictly opposite, exstipulate, evergreen. Smell like tender mangoes, small petioles.	Simple, opposite or sub opposite, alternate, exstipulate, smell like tender mangoes, long petioles
Young leaves	Crimson	Crimson
Leaf lamina	Incurved, coreaceous	Incurved, coreaceous
Leaf base	Cuneate base	Rounded
Leaf apex	Caudate, acuminate	Acuminate
Leaf margin	Entire margin[inter marginal nerve]	Entire margin[inter marginal nerve]
Venation	Reticulate	Reticulate
Midrib	Prominent at below	Prominent at below
Lateral nerves	More than 25 pair, close uniconstate showing submarginal veins, obscure, prominent beneath	More than 25 pair, close
Leaf surface	Glabarous	Glabarous in young[soft in old]
Petiole	Short, pulvinus present	Long, slender
Inflorescence	Panicled cyme, quadrangular, terminal or sub terminal.	Panicled cyme, quadrangular, terminal or sub terminal.
Flower	Sessile, ebractiate, ebracteolate, bisexual, actinomorphic, complete, dichlamydeous, epigynous, creamy-white, showy.	Sessile, bisexual, complete, actinomorphic, bractiate, bracteolate, lanceolate bract, white, epigynous
Bract	Absent	Present
Calyx	Four sepals, cupulate (receptacle formed), valvate, gamosepalous, companulate, persistent.	Four sepals, two type sepals (delicate and triangular), gamosepalous, cupulate, valvate, persisitent
Corolla	4 petals, imbricate, gamopetalous, white, showy, veins present, calyptra occur	4 petals, imbricate, gamopetalous, white, showy, veins and dots present, calyptra occur
Androecium	Indefinite number of stamens, free, arranged at the edge of the receptacle in whorls, dorsifixed stamens are in different length.	Indefinite number of stamens, free, arranged at the edge of the receptacle in whorls, dorsifixed stamens are in different length.
Gynoecium	Epigynous, inferior ovary, stigma simple, pistil is longer than stamens, bilocular ovary, axile placentation.	Epigynous, inferior ovary, stigma simple, pistil is shorter than stamens, bilocular ovary, axile placentation.
Fruit	Berry, large, sub globose, oboid, purple.	Berry, oblong, small purple.



Text Fig. 3 *Syzygium palodense*

Figure 1 - *S. palodense*



Text Fig. 1 *Syzygium densiflorum*

Figure 2 - *S. densiflorum*

reports have to be communicated to IUCN to include under the endangered category (Ramasubbu et al., 2016).

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