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Thespesia populnea (L.) Soland. ex Correa, commonly known as portiatree or seaside mahoe in English, emajagüilla or palo de jaqueca in Spanish, and by several other common names, is a small evergreen tree or shrub that grows up to 18 m in height. It has thick, light- to dark-gray fissured bark and a dense crown (fig. 1). Native to the Old World Tropics, portiatree has been introduced and has become naturalized in coastal woodlands throughout the Caribbean and elsewhere in tropical America. It is easily recognized by its showy, bell-shaped flowers; long-petioled, heart-shaped leaves; and tough, fibrous bark. The wood is used to a limited extent in boatbuilding, cabinet-work, and handicrafts.

HABITAT

Native and Introduced Ranges

Portiatree is a pantropical coastal species apparently native to the Old World Tropics from the east coast of Africa to Polynesia between latitudes 30° N. and 23° S. In the New World Tropics, it has been introduced and naturalized in Bermuda, southern Florida, throughout the West Indies from the Bahamas and Cuba to Trinidad and Tobago, both coasts of southern Mexico, Central America, and northern Peru and Brazil in South America.

Climate

Where it has been introduced in the New World Tropics, portiatree grows in the tropical very dry, tropical dry, and subtropical moist forest life zones (17). Within this range, mean annual rainfall varies from approximately 500 to 1600 mm with a dry season lasting up to 8 months (41). On dry and very dry sites, portiatrees survive by tapping fresh or brackish subsurface water reserves. Mean monthly temperatures during the warmest months average about 28°C throughout the range. During the coolest months, mean temperatures range from 18°C in the north to 26°C in the south (16, 36). In southern Florida, portiatree is subject to rare frosts (31).

Soils and Topography

Throughout its native and introduced ranges, portiatree grows in littoral forests on well-drained sandy, gravelly, and rocky soils derived from coral limestone and volcanic par-

ent materials (6, 12, 19, 45, 46, 49). It is extremely salt tolerant and, hence, a good species for planting on saline soils.

In India, Bangladesh, Myanmar, Sri Lanka, and peninsular Malaysia, portiatree grows best on porous, well-drained sands along the coast, although it is also found on rocky seacoasts and in mangrove forests that are occasionally inundated by exceptional or equinoctial tides (30, 42). In Kenya, portiatree occurs naturally on saline sands behind mangrove forests and along riverbanks near the coast (7).

Associated Forest Cover

In Puerto Rico, portiatree grows in coastal thickets and secondary forests in association with *Bucida buceras* L., *Calophyllum brasiliense* Jacq., *Casuarina equisetifolia* J.R. & G. Forst., *Coccoloba uvifera* (L.) L., *Cocos nucifera* L., *Delonix regia* (Bojer ex. Hook.) Raf., *Pithecellobium dulce* (Roxb.) Benth., *Tabebuia heterophylla* (DC.) Britton, and *Terminalia catappa* L. (author, personal observation). It is also found near the landward edges of mangrove forests with *Conocarpus erectus* L. and *Laguncularia racemosa* (L.) Gaertn. f. and on sandy or pebbly beaches in association with *Clerodendrum aculeatum* (L.) Schlecht., *Conocarpus erectus*, *Hippomane mancinella* L., and *Randia aculeata* L. (47).

In Barbados, it is found in coastal woodlands in association with *Ceiba pentandra* (L.) Gaertn., *Coccoloba uvifera*, *Cordia obliqua* Willd., *C. sebestena* L., *Ficus citrifolia* P. Miller, *H. mancinella*, *Leucaena leucocephala* (Lam.) de Wit, *Tabebuia heterophylla*, and *Terminalia catappa* (13). It grows in littoral woodlands in the Leeward Islands as a codominant with *Coccoloba uvifera* (37).



Figure 1.—A portiatree, *Thespesia populnea* (L.) Soland. ex Correa, growing along the coast in Puerto Rico.

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In the Andaman Islands (India), portiatree grows in littoral forests with *Calophyllum inophyllum* L., *Erythrina variegata* L., *Heritiera littoralis* Ait., *Hibiscus tiliaceus* L., *Intsia bijuga* (Colebr.) O. Kuntze, *Manilkara littoralis* (Kurz) Dubard, *Pandanus tectorius* Park., *Pongamia pinnata* (L.) Merr., and *T. catappa* (30, 39). In West Bengal (India), it grows in coastal forests in a codominant position with *E. variegata*, *H. tiliaceus*, *Tamarix troupia* Hole, *Trewia nudiflora* Linn., and *Vitex* spp. (30).

In peninsular Malaysia, portiatree grows on the upland fringes of mangrove forests in association with *Acanthus* spp., *Brownlowia riedelii*, *Brugeira gymnorhiza* Lam., *Carapa moluccensis* Lam., *C. obovata* Bl., *Cerbera* spp., *Cycas rumphii* Miq., *Daemonorops leptopus* (Griff.) Mart., *Derris uliginosa* Benth., *Heritiera littoralis*, *Hibiscus tiliaceus*, *Intsia retusa* Kuntze, *Lumnitzera coccinea* Wight and Arn., *Nipa fruticans* Thunb., *Podocarpus polystachyus* R. Br., and *Sonneratia acida* L.f. (42). In coastal forests in Kenya, it is most commonly associated with *H. tiliaceus* and *Sophora* spp. (7).

In American Samoa, portiatree grows in littoral forests with *Barringtonia asiatica* (L.) Kurz, *Calophyllum inophyllum*, *Cocos nucifera*, *E. variegata*, *Hernandia nymphaeifolia* (Presl.) Kub., *Hibiscus tiliaceus*, *Pandanus tectorius*, and *Pisonia grandis* R. Br. (6). On the island of Makatea in the Tuamotu Archipelago (Polynesia), it grows in littoral forests with *Calophyllum inophyllum*, *Cordia subcordata* Lam., *Morinda citrifolia* L., *Pandanus* spp., *Tamarindus indica* L., *Terminalia catappa*, and *T. littoralis* Seemann. (46). In the Marquesas Islands, portiatree forms nearly pure stands on dry coastal slopes (14). On seacliffs and coastal forests on the island of Niue, portiatree is associated with *Aleurites moluccana* Willd., *B. asiatica*, *Calophyllum inophyllum*, *Capparis sandwichiana* DC., *Clerodendrum inerme* Gaertn., *Cordia subcordata*, *Guettarda speciosa* Linn., *Hernandia ovigera* Linn., *Leucaena* spp., *Ochrosia parviflora* Hemsl., and *T. catappa* (48).

LIFE HISTORY

Reproduction and Early Growth

Flowering and Fruiting.—In India, Southeast Asia, and the Pacific, flowering and fruiting occur throughout the year (3, 27, 30). In the West Indies, flowering occurs primarily from April through January (1, 24).

The large, bell-shaped flowers, approximately 5 cm long and broad with overlapping petals, are borne on stout stalks 1.5 to 5.0 cm in length at the leaf bases (fig. 2). Flowers are composed of: a cup-shaped green calyx; five broad, rounded, oblique petals that are pale yellow with a purplish base when first produced and later turning to pink or purple; numerous stamens on a column 2.5 cm long; and a pistil having a five-celled ovary with a slender style and five broader stigmas (21).

The fruits are rounded but flattened five-celled capsules 2.5 to 4.0 cm in diameter and approximately 2 cm in length with a disklike persistent calyx at the base. Fruits are black when ripe (30). In the West Indies, the fruits ripen from May to January (1, 21) and remain attached to the tree for a period of time. A sample of oven-dried fruits collected in

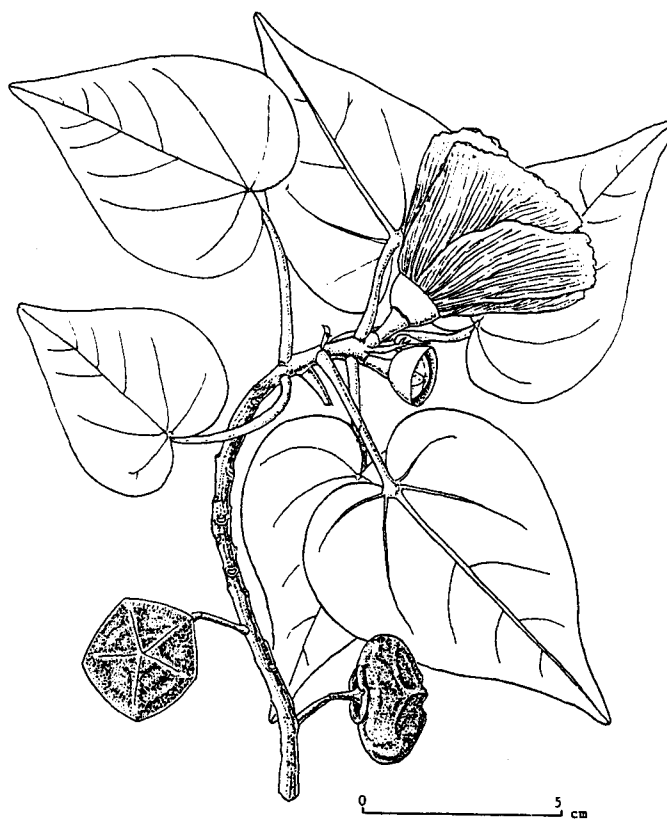


Figure 2.—Foliage and fruit of portiatree, *Thespesia populnea* (L.) Soland. ex Correa (21).

Puerto Rico averaged 3.30 g per fruit (author, personal observation). Each fruit contains several brown, hairy seeds about 1 cm long and 0.6 cm broad. A sample of 50 fruits collected in Puerto Rico contained between 1 and 11 seeds per fruit, or a mean of 5.72 ± 0.45 seeds per fruit (author, personal observation).

Seed Production and Dissemination.—Portiatree seeds are ovoid in shape and approximately 1 cm long. Reported weights for fresh seeds range from 3,500 to 6,700 seeds per kilogram (11, 30, 41). In another collection of seeds from Puerto Rico, the average seed weight for a sample of 200 seeds was 0.186 ± 0.002 g, or approximately 5,400 seeds per kilogram (author, personal observation). The seeds are probably dispersed by wind and water while still within the indehiscent pods.

Seedling Development.—Germination in portiatree is epigeal. Seeds may be sown without pretreatment at or near the surface in light-textured, well-drained soils. Germination in fresh seeds is between 65 and 79 percent (11, 32; author, personal observation) and takes place from 8 days to 9 weeks after sowing (11; author, personal observation). Seedlings develop a long, wiry taproot with numerous unbranched fine lateral roots (32; author, personal observation). Seedlings reach plantable size, approximately 15 cm in height, about 3 months after sowing (author, personal observation). Plantations can be established using potted seedlings or rooted cuttings. Natural regeneration is good in the vicinity of mature trees (author, personal observation).

Vegetative Reproduction.—Portiatree is easily propagated vegetatively using branch or shoot cuttings up to 2 m in length and 10 cm in diameter, although smaller diameter cuttings are generally preferred (30).

Sapiing and Pole Stage to Maturity

Growth and Yield.—Throughout most of its range, portiatree grows to a maximum height of between 10 and 18 m with diameters at breast height (d.b.h.'s) of between 30 and 60 cm (7, 24, 27, 44). The largest portiatree found in Puerto Rico measured 11.6 m in height and 57.6 cm in d.b.h.¹

In small-scale plantation trials conducted on the Hawaiian island of Oahu at two low-elevation sites with clay soils, survival and growth rates in 5- to 6-year-old stands showed a substantial difference between sites receiving 500 mm and 700 mm of annual rainfall (43). On the drier site, survival and mean annual height growth increment were 13 percent and 0.36 m/yr, respectively, as compared to 93 percent survival and a growth rate of 0.60 m/yr on the slightly moister site.

Rooting Habit.—On coastal sands, portiatree develops a deep, stout taproot and numerous small, wiry lateral roots with a rather high density of fine, feeder roots (author, personal observation). Older trees do not develop buttresses.

Reaction to Competition.—Portiatree is a light-demanding species. Although seedlings will become established and develop well under light or moderate shade, their growth tends to be poorer under shaded conditions.

Damaging Agents.—Several diseases caused by bacteria and fungi have been reported in portiatree within its native range. In India, these diseases include heartrot caused by a fungus, *Fomes pachyphloeus* (35), and leaf spot caused by *Phomopsis thespesiae* (23) and *Xanthomonas campestris* pv. *thespesiae* (29). In the Mariana Islands, *Phellinus noxius* has been reported to cause root and butt rot (15). In Hawaii, portiatree is susceptible to a fungal leaf spot caused by *Lophodermium* sp. (40).

In Puerto Rico and the Virgin Islands, portiatree is the host of several insect species, none of which are known to cause serious damage (25). These include the coleopteran *Hypothenemus ferrugineus* (Hopkins), the hemipterans *Dysdercus andreae* (L.) and *D. sanguinarius neglectus* Doesburg, the homopterans *Saissetia nigra* (Nietner) and *Pinnaspis strachani* (Cooley), and the lepidopterans *Ereunetis miniscula* Walsingham and *Pectinophora gossypiella* (Saunders). With the exception of *S. nigra* and *Pinnaspis strachani*, these insects feed on the fruits and seeds.

In some cotton-producing countries throughout its range, the planting of portiatree is strongly discouraged as it is known to be an alternative host for several economically damaging cotton pests (2, 3). These include: the cotton weevil, *Anthonomus grandis grandis* Boheman (Coleoptera: Curculionidae) (22, 28); the red cotton bug, *Dysdercus cing-*

ulatus Fab. (Hemiptera: Pyrrhocoridae) (2, 33); the Indian dusky cotton bug, *Oxycarenus laetus* Kirby (Heteroptera: Lygaeidae) (38); and the cosmopterigid *Pyroderces simplex* Walsingham (Lepidoptera: Momphidae) (26).

SPECIAL USES

Portiatree sapwood is pale brown, sometimes streaked with red, and easily distinguished from the heartwood, which is dark reddish brown to chocolate and often variegated or striped (31, 34). The wood is moderately fine textured, has a rather low luster, is odorless, and is firm and strong with straight to variable grain. It is moderately heavy, with a specific gravity of 0.55 to 0.89 g/cm³ air-dried (5, 34). Degrade during drying is small due to the low shrinkage of the wood (34). Whether green or dry, the wood is easy to work by hand or machine and is considered one of the best and most easily worked woods for handicrafts in Hawaii (34). The wood seasons well, can be finished to a high polish, and is highly durable (31, 34). It is reputed to be quite resistant to decay and dry-wood termites (34).

Although portiatree timber is of little value in the Caribbean region because of its small size, it is suitable for furniture and cabinetwork and is used for these purposes in tropical Asia and the Pacific (12, 31, 34). In India, the wood is also used for agricultural implements, in the manufacturing of wheels, boats, and toys, and for accessories used in the weaving industry (30). In many parts of the Pacific, it is considered a sacred tree and is frequently planted near temples (3).

In India and elsewhere in tropical Asia, many parts of the portiatree are used in traditional medicine (30). The fruits, leaves, and roots are applied externally in the treatment of scabies, eczema, psoriasis, and other skin diseases (4). The leaf juice and the acrid, yellow juice of the fruit are used as a dressing to treat skin diseases, remove warts, and kill lice (3, 8, 42). The pulp of the fresh fruit and a decoction of the leaves are used in some regions to treat headaches (42). Root extracts are used as a tonic, and an extract of the astringent bark is taken internally as an alterative in the treatment of dysentery, hemorrhoids, and skin diseases (4, 8). The juice extracted from the stem is used in some parts of India for the treatment of herpes (8). In Malaysia, medicinal products derived from the heartwood are used to treat pleurisy and cholera (42).

In the West Indies, the leaves and roots are reportedly used to control high blood pressure. An infusion of the bark and the oil obtained from the seed capsules is used externally to treat scabies. The leaves are used as an emollient, and a decoction of the roots and seeds is used to treat skin diseases (20).

The viscous oil extracted from the seeds can be burned in lamps (9). The orange-yellow juice extracted from the wood by soaking in water is used for dyeing wool in south and Southeast Asia (3, 9). The bark is rich in tannins and is used for tanning leather in many parts of the world (30). The inner bark of the branches and young stems contains a tough fiber useful for making cordage and bags, although it is inferior to the more commonly used bark of *Hibiscus tiliaceus* (3, 9, 31, 34). The bark is also used for caulking boats in tropical Asia and the Pacific (3, 9). The leaves are a

¹ Puerto Rican champion tree register. On file with: International Institute of Tropical Forestry, U.S. Department of Agriculture, Forest Service, Río Piedras, PR 00928-2500.

good fodder for livestock and are used as green manure in rice cultivation in India (30). In Malaysia and India, the young leaves and buds are sometimes eaten, raw or boiled, as a vegetable (3, 33).

GENETICS

The genus *Thespesia* includes about 15 species of trees and shrubs distributed throughout the Tropics (44). *Thespesia populneoides* (Roxb.) Kosteletsky, a species native to continental and island coasts in the Indian Ocean and introduced to West Africa, Brazil, and Guayana, has, until recently, been considered to be conspecific with *T. populnea* (10). It is distinguished from *T. populnea* by its dehiscent fruits, long pedicels, a broad sinus at the leaf base, and coppery or bronzed leaves. A botanical synonym of *T. populnea* is *Hibiscus populneus* Linn. (30). *Thespesia populnea* is a diploid species with 26 chromosomes (18).

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