Tectona grandis L.f.

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VERBENACEAE (VERBENA FAMILY)

No synonyms

Teak, teca, teck

Tectona grandis occupies two areas of native range: the western portion includes most of peninsular India and the eastern portion includes parts of Burma, Laos, and Thailand (Weaver 1993). It has been cultivated since ancient times in Asia and today the species is planted in much of the moist tropics. *Tectona grandis* has naturalized in at least the Philippines, Java (Little and Wadsworth 1964), and Puerto Rico (Francis and Liogier 1991).

Tectona grandis is a large deciduous tree that reaches maximum heights of 30 to 40 m and diameters of 2 m (Chanda Bacha 1977). Although varying considerably by habitat, the trees individually and by stands demonstrate a moderate growth rate. The tree has large, yellow-green leaves, a medium-dense foliage, a medium-to-narrow crown, and a straight trunk covered by tan-to-gray scaly bark. It grows in a wide variety of soils if they are well drained, are not compacted or have a shallow hardpan, and are not seriously depleted of nutrients. *Tectona grandis* tolerates a wide range of climates, but grows best in a warm, moist, tropical climate (1250 to 3000 mm of mean annual precipitation) with a marked dry season of 3 to 6 months (Webb and others 1984). Trees of the species are not harmed by infrequent light frosts (Weaver 1993).

Although *T. grandis* is not divided into subspecies or varieties, a number of different habitat-correlated populations can be distinguished by both morphological characteristics and adaptability (Wellendorf and Lauridsen 1986).

The heartwood of *T. grandis* is golden brown with a distinct grain and has a specific gravity of 0.55. It dries with little degradation and is easily worked with hand or power tools (Longwood 1961). The untreated wood weathers well, resists rot, and is not attacked by dry-wood termites. These superlative properties make it one of the best known and most valuable woods in the world. The wood is used for furniture, flooring, joinery, trim, doors, paneling, carving, musical instruments, turnery, vats, boat masts and decks, railway sleepers, mine props, fuel, and fence posts (Weaver 1993). Trees of the species are also used as ornamental and shade trees.

In Thailand, flowering begins between ages 8 and 10 (Hedegart and others 1975). The small, white, perfect flowers are borne on short pedicels, in large, erect, terminal panicles, about 2 months after the dry season has ended and the leaves have emerged. Flowering generally takes place for 2 months or more between June and September. The fruits ripen 2-1/2 to 3 months later (Chable 1969, Mahapol 1954, Troup 1921). The fruit consists of a subglobose, four-lobed, hard, bony stone about 1.2 cm in diameter, surrounded by a thick, felty, light brown covering, the whole enclosed in an inflated papery involucre. The stone (often called a nut) contains 1 to 3, rarely 4, seeds, and has a central cavity. Researchers in one study found that the number of seeds per stone averaged 1.7 (Schubert 1974). In a survey of the fruits in 23 provenances in India, 51 percent had no seeds, 35 percent had one seed, 12 percent had two seeds, 2 percent had three seeds, and 0.4 percent had four seeds (Gupta and Kumar 1976). In India, good seed crops are produced by plantations less than 20 years old (Troup 1921).

The bladder-like involucres turn from green to brown when the seeds are ripe and gradually fall to the ground during the next dry season. The fruits can be swept or picked up as they fall, clipped from the trees with pruning poles, or shaken from the branches. Fruits can be spread in the sun or in ventilated sheds to dry. The involucre can be removed by mechanical dehusking or by working a cloth bag half-filled with dried fruits against the ground with a foot and then winnowing to separate the fruits from the chaff. *Tectona grandis* fruits in Honduras average 705 per kg with involucres intact and 880 per kg with the involucres removed (Chable 1969). In other parts of the world, the number of clean fruits per kg varies from a low of 880 to a high of 3,070 (Champion and

Brasnett 1958, Parry 1956). The seeds make up about 3 percent of the weight of the cleaned fruits (Dabral 1976). The fruits retain their viability for about 2 years in sacks in dry warehouses (Kushalappa 1977). High seed moisture content or high atmospheric humidity will shorten the storage life considerably. Long periods of storage have not been necessary in most areas because *T. grandis* produces good seed crops almost every year (Mahapol 1954, Troup 1921).

Cut tests of fruit from 56 collections across the range of *T. grandis* revealed a potential mean viability of 71 percent with a range of 40 to 96 percent (Danish/Food and Agriculture Organization Forest Tree Seed Centre 1973). Germination of fruits in nursery beds in various parts of the world has varied from 0 to 96 percent in periods varying from 10 days to 3 months. Seeds extracted from fruits and treated with fungicide gave a germination of 54 percent in 12 days (Dabral 1976). But because seed extraction is difficult, and untreated *T. grandis* seeds have protracted, often low and unpredictable germination, some fruit pregermination treatment is usually applied to the fruit. A number of pretreatments have been effective:

• Soaking the fruits in water for several days or alternately wetting and drying have proven effective (Schubert 1974, Troup 1921). In one test, clean fruits pretreated by five cycles of alternately soaking in water for 24 hours and drying in the sun for 48 hours, were sowed. Germination began 18 days after sowing, increased for 15 days, and gradually decreased. The germination rate 68 days after sowing was 61 percent. Weathering of the epicarp and mesocarp helped germination (Schubert 1974).

• Innoculating seeds with *Scytalidium* sp., a cellulolytic fungus isolated from teak litter, and keeping them moist for 21 days resulted in 96-percent germination compared to 20-percent for uninoculated controls (Dadwal and Jamaluddin 1988).

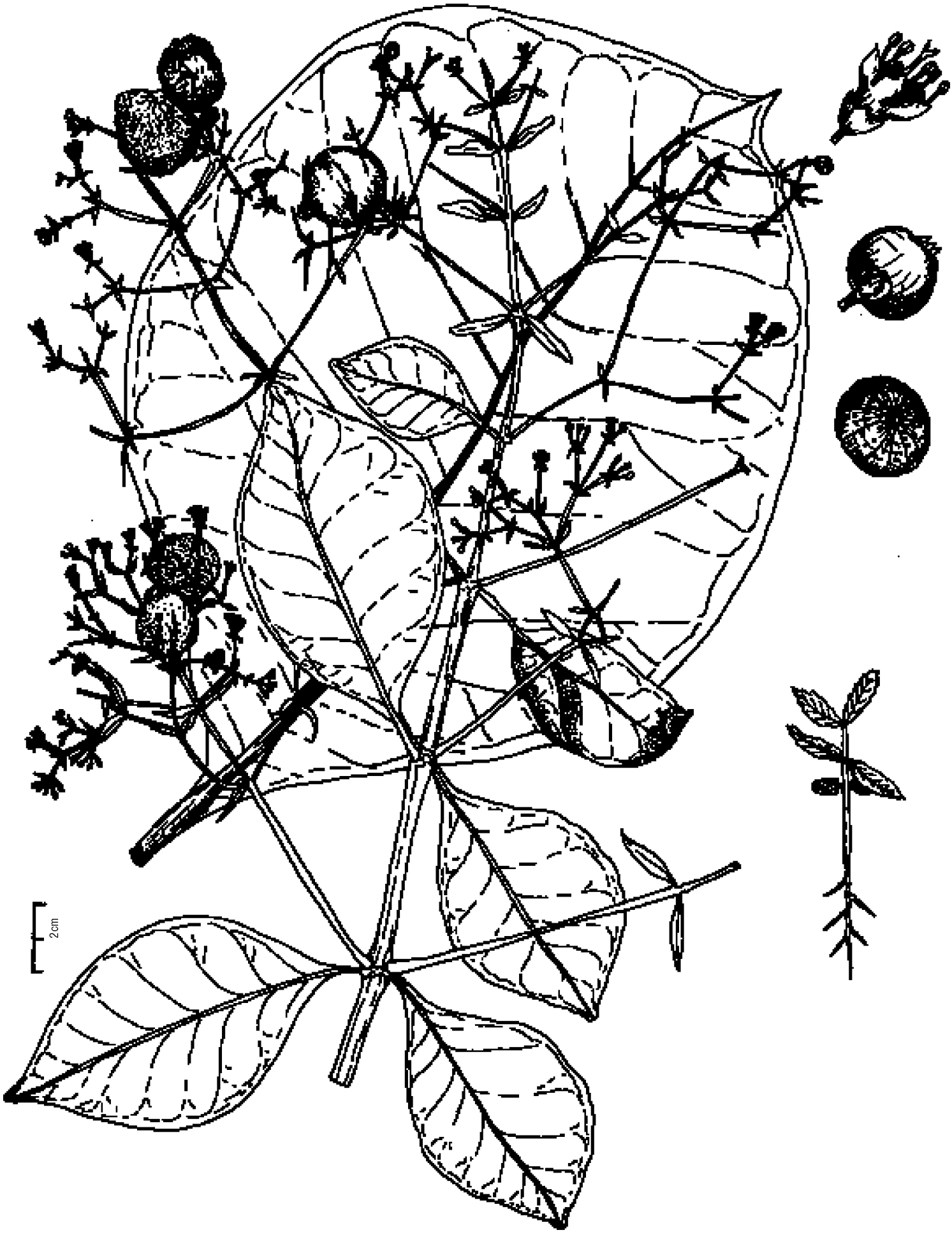
• Treating with indoleacetic acid and gibberellic acid, alone and in combination at various concentrations, increased germination 5 to 12 percent over controls (21-percent germination) (Uanikrishnan and Rajeeve 1990).

• Soaking fruits from 11 Indian provenances in a nutrient solution resulted in a higher seedling yield (34 percent) than control (18 percent), water soaking (30 percent), or scarification (28 percent). Gupta and Pattanath (1975) felt that nutrient deficiencies in some of the sources resulted in lower germination or early seedling failure.

• Storing seeds for several months improves germination. Some seed lots that were stored for several months germinated better than fresh seeds (Champion and Brasnett 1958, Mahapol 1954, Troup 1921), probably because they needed a period of afterripening (Schubert 1974).

Size of fruit and region of origin also affect germination rates. Because large fruits tend to have a greater number of seeds than smaller fruits, they yield a significantly higher number of seedlings per fruit. Banik (1977) recommends that fruits smaller than 14 mm in diameter be culled. Seeds from dry regions are frequently more difficult to germinate (Troup 1921). Germination is epigeal (Troup 1921).

Tectona grandis fruits are usually broadcast in nursery beds and covered with 1.2 to 2.5 cm of sand, soil, or sawdust (Schubert 1974, White and Cameron [n.d.]). A temperature of 30 °C during germination appears to be optimal for the seeds (Dabral 1976). A seedling yield of about 25 percent can be expected from good seed (White and Cameron [n.d.]). The beds should be kept moist. Once the seedlings have become established, watering should gradually be reduced. Stump plants (seedlings with the tops removed) or potted plants grown in plastic nursery bags are usually used in field plantings. Direct seeding is also practiced but requires prepared seed spots. Early growth is slow and mortality is often high (Weaver 1993). The stump plants are grown in the nursery until they reach 1.2 to 2.5 cm in diameter at the root collar; the top is cut back to about 2.5 cm, and the tap root cut back to 18 or 20 cm in length (Schubert 1974, White and Cameron [n.d.]). Ideally, plants of suitable size can be grown in 6 to 9 months. In Thailand (Kushalappa 1977) and India (Gupta and Pattanath 1975), some nurseries undercut the beds and remove seedlings large enough for stump plants after 1 year, allowing the remaining seedlings to grow an additional year after which the whole bed is harvested. Sowing of the nursery beds should be timed to ensure the proper size for planting at the start of the rainy season. Another approach involves harvesting in the dry season, storing the dormant stumps in beds of dry sand for 3 months, and planting at the start of the wet season (Kushalappa 1977). After outplanting, seedlings must be weeded for 1 to 2 years until they are well above weeds, grasses, and vines.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