

Taxodiaceae C Deciduous cypress family

Cryptomeria japonica (L. f.) D. Don

sugi or cryptomeria

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Synonyms. *C. fortunei* Hooibrenk, *C. mairei* (Leveille) Nakai, *C. kawaii* Hayata, *Cupressus japonica* L. f., *Cupressus mairei* Leveille.

Other common names. Japanese cryptomeria, Japanese-cedar, goddess-of-mercy-fir, peacock-pine.

Growth habit, occurrence, and use. *Cryptomeria* is a monotypic genus native of Japan and China (Streets 1956). Sugi *Cryptomeria japonica* [L. f.] D. Don has been cultivated there since about 1300 A.D. for timber, shelterbelts, and environmental forestry. It was introduced to Hawaii for the same purposes about 1870 by Japanese immigrants (Carlson and Bryan 1959). An evergreen tree, it reaches heights of 36 to 46 m (Carlson and Bryan 1959; Dallimore and Jackson 1967; Troup 1921). Its wood is soft and fragrant; the red heartwood is strong and durable (Dallimore and Jackson 1967). It is used for boxes, poles, and general construction (Tsutsumi and others 1982). This species is also used for Christmas trees (Carlson and Bryan 1959; Dallimore and Jackson 1967).

Flowering and fruiting. Sugi is a monoecious species, with the male and female strobili located on different parts of the same branch. The female strobili are formed in fall and are fertilized when pollen is shed the following spring (Dallimore and Jackson 1967). Seed weight and percentage filled seed are higher and seedling growth rate is greater when flowers are wind-pollinated (outcrossed) rather than selfed (Tabachi and Furukoshi 1983). In the native range in Japan, female cones begin to open between late January and mid-February and flower for 54 to 57 days. The male strobili begin to open about 25 days after the female strobili (Hashizume 1973). The solitary cones are globular and measure 13 to 19 mm in diameter. In Hawaii, cones ripen from July to September.

Seeds are shed during the same periods (Walters 1974). The seeds are dark brown and triangular, measuring 4 to 6 mm long and about 3 mm wide (Dallimore and Jackson 1967) (figures 1 and 2). Trees generally begin to produce seed when 15 to 20 years old (Carlson and Bryan 1959). A 3-year-old orchard of rooted cuttings in Japan that was sprayed with gibberellic acid produced 1,082 kg/ha (967 lb/ac) seeds 11 months later; 46% of the seeds were sound and 45% germinated (Ito and Katsuta 1986).

Collection, cleaning, and storage. When the cones turn from grayish brown to reddish brown, they are ripe and should be picked. Cones should be immediately spread to finish ripening. As the cones dry, seeds fall into trays; agitation aids in seed extraction. Seeds can be separated from chaff by winnowing. The number of seeds per seed weight ranges from 700,000 to 1,200,000/kg

(320,000 to 550,000/lb) (Walters 1974; Ohmasa 1956). The optimal moisture content for storage is 10% (Shi 1985). After drying, the seeds should be stored in sealed polyethylene bags at 2 to 5 °C (Walters 1974). A drying agent placed in the bag aids storage (Ohmasa 1956).

Germination. Sugi seed germination is considered poor to very poor (Parry 1956). In Japan, the standard of sowing is 30 g/m^2 (.1 oz/ft²) based on 30% germination (Ohmasa 1956). Sugi seeds should be soaked in cold water (0 °C) for about half a day, then put moist into plastic bags, and stored at 1 °C for 60 to 90 days before sowing (Walters 1974). Bags should be left open for adequate aeration. A mild fungicide can be added (Ohmasa 1956). Constant day/night temperature, whether high or low, adversely affects germination (RFC 1973). Germination is better in seeds kept in the light than seeds kept in the dark (Chettri and others 1987). Official test prescriptions for sugi call for germination on top of moist blotters at alternating temperatures of 20 and 30 °C for 28 days; no pretreatment is necessary (ISTA 1993).

Nursery and field practice. Sugi seeds are sown in Hawaii from November to March. Sowing is by the broadcast method or by using a planter that has been adjusted to the proper seed size. The planter places seeds in rows about 15 to 20 cm (6 to 7 in) apart. Seeds are covered with 3 to 6 mm (1 to 2 in) of soil (Ohmasa 1956; Walters 1974). No mulch is used in Hawaii (Walters 1974), but a single layer of straw is used in Japan (Ohmasa 1956). The seedbeds are given about 75% shade for about 2 months (Walters 1974). Seedling density in the beds is about 220 to 330 seedlings/m² (20 to 30/ft²). Frost damage to seedlings in early winter can be avoided by shading or shortening the daily period of exposure to solar radiation (Horiuchi and Sakai 1978). Seedlings are outplanted as 1+0 stock in Hawaii (Walters 1974). Sugi can be started from cuttings (Carlson 1959). In an experiment in which the trees were measured after more than 26 years, there was no significant difference in any measure of growth between trees started from seed and those started from cuttings (Yang and Wang 1984).

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Figure 1 *Cryptomeria japonica*, sugi: seed, $\times 4$.

Figure 2 *Cryptomeria japonica*, sugi: longitudinal section through a seed, $\times 16$.