Pinus pseudostrobus Lindl.

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PINACEAE (PINE FAMILY)

P. orizabae Gordon (Martínez 1948, Stead and Styles 1984)

False Weymouth pine, macochyaj, macohtai, pino blanco, pino lacio, pino liso, pino real (Carbajal and McVaugh 1992, Eguiluz-Piedra 1978, Farjon 1984, Perry 1991)

Pinus pseudostrobus is primarily a Mexican pine although its range reaches the high mountains in Guatemala. It is chiefly distributed along the Volcanic Axis Mountains in Central Mexico (Martínez 1948, Perry 1991). *Pinus pseudostrobus* forms pure stands or grows in association with *P. montezumae, P. douglasiana, P. michoacana, P. maximinoi, P. leiophylla, P. ayacahuite, P. patula, P. cembroides* Zucc., *P. rudis*, *P. pringlei*, *Abies religiosa* (Kunth) Schltr. & Cham., *Quercus* sp., *Arbutus* sp., *Juniperus* sp., *Buddleia* sp., and *Dasylirion* sp. (Eguiluz-Piedra 1978, Perry 1991).

Pinus pseudostrobus is one of Mexico's finest pines with its usually straight, branchless trunk. It is a fast-growing tree that reaches 30 to 40 m or more in height and 40 to 80 cm d.b.h. (Perry 1991, Stead and Styles 1984). The species grows at elevations from 1600 to 3250 m, but the best stands are found at 2500 m on deep volcanic soils. This tree can also be found in swallow and calcareous soils. *Pinus pseudostrobus* grows in temperate to temperate-warmer climates, where temperatures may drop to freezing during the coldest winter months. The species is found where temperatures range from -9 to 40 °C and annual rainfall from May to October is 600 to 2000 mm (Eguiluz-Piedra 1978, Martínez 1948, Perry 1991).

No geographic races have been reported, but the species can naturally hybridize with *P. montezumae.* (Perry 1991)

The wood is light, soft, strong, and yellow, with a specific gravity 0.32 to 0.51 and high pulp yields. It is widely used for general construction, hewn timber, decorative items, pulp, and firewood (Eguiluz-Piedra 1978, Perry 1991, Wright and Malan 1991, Wright and Wessels 1992, Zobel 1965).

The species begins reproducing at 6 to 7 years and flowers in February and March (Patiño-Valera 1973). Cones are ovoid or long-ovoid, slightly curved, almost symmetrical, not reflexed, 8 to 12 cm long and 5 to 8 cm wide. Cones are borne singly, or sometimes in groups of two and three, on short peduncles 10 mm long or more. Cones open when mature and soon fall, leaving the peduncles with some basal scales. Cone scales are thin, hard, 30 to 35 mm long, and 15 to 18 mm wide. The apophysis is raised-to-flat, 2 to 8 mm in height, and lightly transversely keeled; the umbo is dorsal, small, occasionally depressed, not prominent, and armed with a small, weak, deciduous prickle (Carbajal and McVaugh 1992, Martínez 1948, Perry 1991, Stead and Styles 1984). Maturation is indicated when the cones change from green to brown in color. The number of sound seeds per cone is 25 to 82 (mean 48). The percentage of sound seeds (per cone) is 20 to 43 percent; empty seeds, 3 to 23 percent (Aldrete and López-Upton 1993). Delgado (1994) found, in eastern México, 12 sound seeds per cone out of 73 potential seeds, seed efficiency of 16 percent, and 95 percent germination in one natural but affected location. Seeds are dark brown, 6 mm long, about 4 mm wide; the seed wings are pale brown, articulate, 20 to 23 mm long, and 6 to 12 mm wide (Carbajal and McVaugh 1992, Martínez 1948).

Cones mature in the second year, and ripe cones begin to appear from December to February, but the best time for collection is from January to mid-February (Aldrete and López-Upton 1993). Cones are collected from the tree using pole-mounted pruners and cutters. Cones are dried by exposing them to the sun for 4 to 6 weeks (Patiño-Valera 1973); however, they must be protected from rainfall during the drying process. Seeds are removed from cones by shaking in a large mechanical tumbler or shaker, or in a small manual shaker for small lots. Seeds are dewinged by rubbing or flailing, cleaned by air screen or floating in water, and should be dried before storage. Care must be used in processing with mechanical dewingers to avoid damaging the seeds. In central Mexico, seeds average 53,705 per kg. In Chiapas, México, seeds aver-

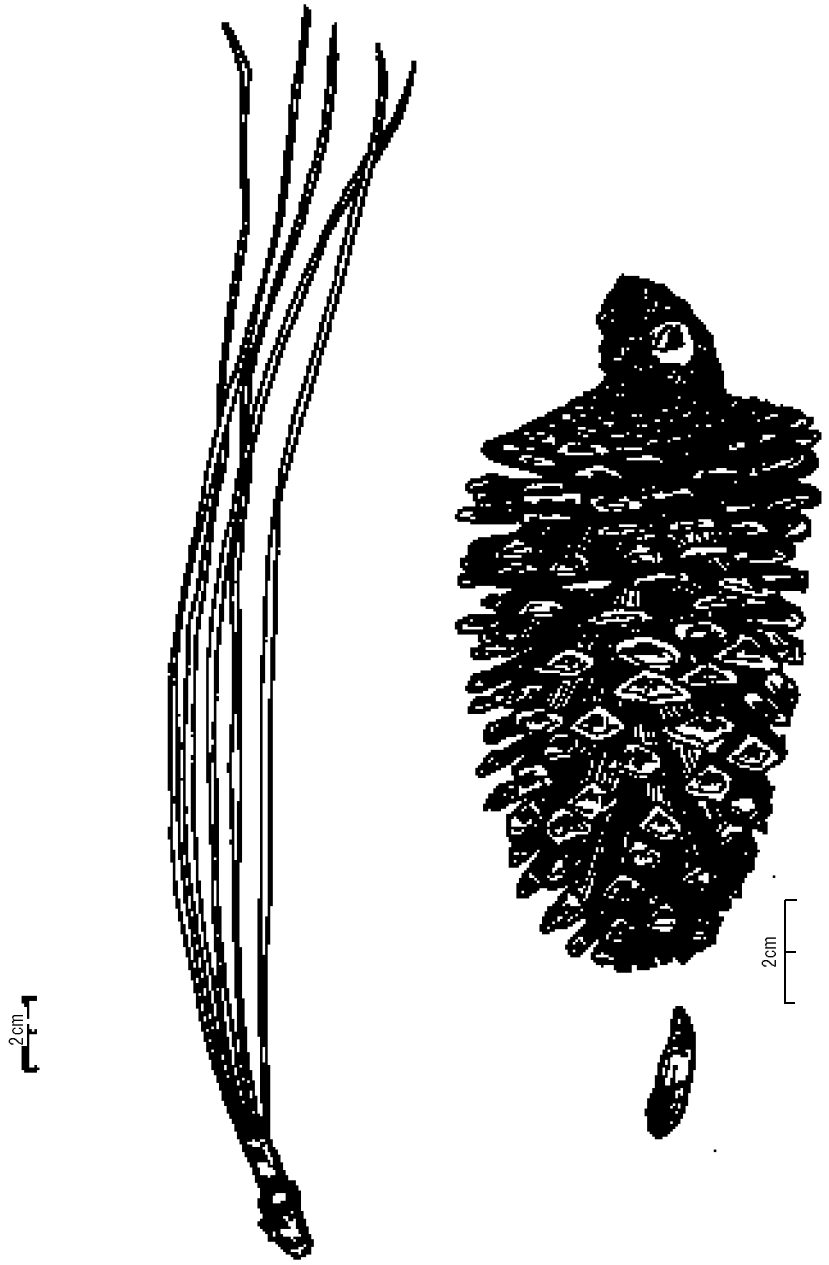
age 44,500 per kg (Patiño-Valera 1973, Zamora-Serrano and others 1993). Seeds must be stored in dry, cool (4 °C), and air-tight conditions.

Seeds are pretreated by soaking overnight in water before sowing. Seeds should be sown at a depth of 1 cm, in seedbeds at densities from 12,000 to 15,000 per m^2 or 400 g (Zamora-Serrano and others 1993). The sowing medium must be sterile and light, providing aeration and moisture. The uncleaned-seed percent germination is 65 (Patiño-Valera 1973); the sound-seed percent germination is from 70 to 95 depending on provenance (Aldrete and López-Upton 1993). The best temperature for germination is 25 °C, which results in 50 percent germination in 8 days and 90 percent germination in 12 days. However, alternating temperatures between 20° and 30 °C will provide acceptable results (Belcher 1985). Seedlings are susceptible to damping off. Thus, substrata must be sterile or watering with a fungicide may be needed. The ectomycorrhizal fungi *Pisolithus tinctorius* (Pers.) Coker et Couch improves seedling field performance in both fertile and adverse sites (Valdés 1986).

ADDITIONAL INFORMATION

Pinus pseudostrobus wood production is 12 to 30 m^3 per ha per yr (Pancel 1993). There are 5,827 closed cones per m^3 (Patiño-Valera 1973). The interval between large cone crops is from 3 to 5 years (Zamora-Serrano and others 1993).

Leptoglossus occidentalis Heidemann and *Conophthorus ponderosae* Hopkins are the most important insect pests of conelets, cones, and seeds. *Tetyra bipunctata* (Herrich-Schaeffer) produces empty seeds. *Cecidomyia bisetosa* Gagné causes cone death. Larvae of *Cydia montezuma* Miller and *Megastigmus albifrons* Wik feed on seeds (Cibrián-Tovar and others 1995). Seeds and saplings are severely affected by the fungus *Shaeropsis sapinea* (Fr.) Dyko & Sutton (Rees and Webber 1988).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