

Pinus chiapensis (Martínez) Andresen

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PINACEAE (PINE FAMILY)

P. strobus var. *chiapensis* Martínez (Andresen 1964)

Cuctoj, ocote, palo-pique, pinabete, pinabeto, pino blanco, tonatzin
(Donahue and others 1991, Eguiluz-Piedra 1978, Perry 1991)

Pinus chiapensis has a natural distribution ranging primarily from southwestern Mexico into northern Guatemala; from 15 to 20° N latitude, and 91 to 101° W longitude. In Mexico it is most abundant in the States of Oaxaca and Chiapas; isolated occurrences are also found in Puebla, Guerrero, and Veracruz. In Guatemala, *P. chiapensis* grows in the Departments of El Quiché and Huehuetenango (Donahue and others 1991, Martínez 1948, Perry 1991). *Pinus chiapensis* is considered a rare and endangered species. It now generally consists of small remnant populations of 5 to 20 ha throughout most of its range, with little or no natural regeneration (Donahue 1985). *Pinus chiapensis* forms pure stands or may grow in mixed species stands in association with *P. maximinoi* H. E. Moore, *P. oocarpa* Schiede ex Schltld., *P. pseudostrobus* Lindl., *P. michoacana* Martínez and *P. pringlei* Shaw at low to mid-elevation sites and with *P. ayacahuite*, *P. patula* var. *longipedunculata*, *P. pseudostrobus*, *P. tecunumanii* (Schw.) Eguiluz & J.P. Perry, *P. teocote* Schiede ex Schltld. & Cham. and *Abies guatemalensis* Rehder at the higher elevations. Associated hardwoods include *Liquidambar styraciflua* L., *Ulmus mexicana* (Liebm.) Planch., *Carpinus caroliniana* Walter, *Fagus mexicana* Martínez, *Cyathaea mexicana* Schltld. & Cham., and also species of the genera *Quercus*, *Ostrya*, *Platanus*, *Cedrela*, *Populus*, *Podocarpus*, *Clethra*, and *Fraxinus* (Donahue and others 1991, Farjon and Styles 1997, Rzedowski and Vela 1966, Zamora-Serrano and Velasco-Fiscal 1978).

Pinus chiapensis is a fast-growing tree that generally reaches 30 to 40 m in height and 80 to 100 cm d.b.h. (Donahue and others 1991, Martínez 1948, Perry 1991). The species is found at elevations from 150 to 2300 m, most abundantly at 1200 to 1800 m. The tree, typically restricted to the lower slopes and foothills of mountains, is also found frequently in isolated canyons (Donahue and others 1991). *Pinus chiapensis*

grows primarily in well-drained sandy loams, sandy clay loams, and clay loams, with pH values of 4.5 to 5.5. These topsoils are generally more than 1 m deep and have good fertility. The species grows in areas where the climate is subtropical to temperate-warmer and usually with high humidity. These areas receive an annual rainfall of 1300 to 2300 mm, occurring primarily from May to October (Dvorak and Donahue 1992, Eguiluz-Piedra 1978). Mean annual temperatures are 20 to 22 °C, maximum temperatures are 40 to 42 °C, and minimum temperatures are 4 to 6 °C (Donahue and others 1991). This species has not been reported to occur naturally in frost zones.

The wood of *P. chiapensis* is soft and light, the sapwood creamy white, and the heartwood slightly darker (Perry 1991), with a specific gravity from 0.34 to 0.38 (Centro Técnico de Evaluación Forestal 1972, Yáñez-Márquez and Caballero-Deloya 1982). It is used for sawn lumber, furniture, doors, window frames, and interior woodwork (Donahue and others 1991, Eguiluz-Piedra 1978).

Pinus chiapensis flowers during March and April (Farjon and Styles 1997, Zamora-Serrano and others 1993). The cones are subcylindrical, tapering toward the apex, mostly straight, often resinous, and 10 to 15 cm long. Their color remains green right up to the time of opening (seed dispersal). They are borne singly or in groups of two and three, on oblique, slender peduncles 25 to 50 mm long, which fall with the cone (Hernández-González 1986, Martínez 1948, Perry 1991). The cone scales are thin, flexible, 31 mm long, and 15 to 34 mm wide (Hernández-González 1986). The cone scale apophysis is prolonged, with the apex often slightly curved inward. The umbo is terminal, without a prickle (Martínez 1948, Perry 1991). Cones of *P. chiapensis* may begin to ripen in July through October, depending on the geographic location. Maturation is indicated when they change from green to brown in

color. They may open 1 to 2 weeks after turning brown and are soon deciduous; the seeds are shed immediately. In natural stands in Chiapas, Mexico, 160 kg of cones yield approximately 1 kg of sound seeds (Zamora-Serrano and Velasco-Fiscal 1977). As an exotic planted in trials in Colombia, cones averaged from 0.2 to 3.5 sound seeds (Wright and others 1996). Seeds of *P. chiapensis* are dark brown, occasionally mottled, 4 to 8 mm long, and 3 to 7 mm wide. The seed wings are adnate, strongly attached to the seed, and 20 to 26 mm long (Hernández-González 1986, Martínez 1948, Perry 1991).

Careful planning is required for successful seed collection because the period between cone maturation and seed dispersal is short. Cones are collected in most stands from mid-August to mid-September, using pole-mounted pruners and cutters. Cones are dried by exposing them to the sun for 1 to 2 weeks; 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 and cleaned by air screen or floating in water, and should be dried before storage. Special care must be used in processing to avoid damage to the seeds because seed coats are thin. Seeds average 52,000 per kg in Guatemala and 80,000 per kg in Chiapas, Mexico (Perry 1991, Zamora-Serrano and Velasco-Fiscal 1977).

Seeds should be stored in dry conditions at temperatures near 4°C. Donahue and others (1991) note that drying seed to an 8- to 10-percent moisture content enables viability in long-term storage. Seed germination ranges from 17 percent to 85 percent (Carrillo and others 1980, Donahue and others 1991, Zamora-Serrano and others 1993), and viability of seed stored for more than 2 years has shown reduced germination (Lambeth and others 1990, Wright and others 1996).

Germination rates improve with a cold-stratification period of 40 days at 2 °C before sowing (Moreno 1985). If extended pretreatments are not possible, seeds should be soaked overnight in water before sowing. If germination is 85 percent, seeds are sowed in seedbeds at densities of 300 g per

m²; if percentage of germination is less, seeds should be sowed at 400 g per m². Alternating temperatures between 22 and 30 °C will provide acceptable germination results (Zamora-Serrano and others 1993). Seeds should be sowed at a depth of 1 cm, in a light and sterile medium that provides good aeration and moisture.

Seedlings of *P. chiapensis* are susceptible to damping off disease. Thus, substrata must be sterile or watering with a fungicide may be needed. As an exotic in Colombia, the species has been found to require 10 to 12 months in the nursery to attain adequate transplant size (Wright and others 1996). In Mexico, nursery stock should be grown between 1000 and 2000 m elevation because the species cannot tolerate frost (Donahue and others 1991).

ADDITIONAL INFORMATION

Pinus chiapensis wood production at 8 years of age in exotic test plots ranged from 12 to 25 m³ per ha per year (Dvorak and others 1996a). In natural stands, average traqueid length was 2.82 mm, and wood specific gravity from 0.34 to 0.38 (Centro Técnico de Evaluación Forestal 1972, Yáñez-Márquez and Caballero-Deloya 1982). In exotic plantations at 10 years of age, the specific gravity varied from 0.34 to 0.35 (Dvorak and Brouard 1987).

Cones and peduncles from the western extreme of the species distribution in Guerrero have been reported to be longer than in more southerly populations, tending more toward a morphological similarity with *Pinus monticola* Douglas ex D. Don (Rzedowski and Vela 1966). Cone crops can be consistently large, commonly producing up to several kilograms of seed per tree (Donahue and others 1991, Zamora-Serrano and others 1993).

Principal seed insect pests include the moth *Dioryctria erythropasa* and several seed chalcids of the genus *Megastigmus*. Early spring insecticide applications have been shown to control *D. erythropasa*. *Apolychrosis candidus* Pogue, also a moth, can be an important cone pest (Cibrián-Tovar and others 1995).

