PINACEAE

The pine family is one of the most characteristic families of the holarctic realm of which family a few genera reach the margins of the tropics in highlands, but only *Pinus* extends into tropical lowlands including Malesia.

1. PINUS

LINN. Gen. Pl. ed. 1 (1737) 731; Sp. Pl. (1753) 1000; LAMBERT, Pinus (1803); PARL. in DC. Prod. 16, 2 (1868) 378; ENGELMANN, Trans. St.Louis Acad. Sc. 4 (1880) 161; MASTERS, J. Linn. Soc. 35 (1904) 560; SHAW, Publ. Arn. Arb. 5 (1914) 24, t. 1–39; PILGER in E. & P. Nat. Pfl. Fam. ed. 2, 13 (1926) 331, t. 177, 178; GAUSSEN, Gymn. Act. & Foss. fasc. 6 (1960) 11, t. 324–369, pl. 24–29; MIROV, Genus Pinus (1967); SILBA, Phytologia Mem. 8 (1986) 129. — **Fig. 91–93.**

Evergreen monoecious trees or rarely shrubs. Bark smooth or rough, particularly on older trees, peeling in flakes often of very irregular shape. *Leaves* linear or lanceolate, often with minute serrations, spirally placed, soon replaced by scales in the axils of which appear reduced shoots in the form of bundles enclosed around their base by a sheath of scale leaves, adult leaves in the bundles linear, pungent, needle-like, the cross section of each leaf forming a sector of the circle formed by the entire bundle. *Pollen cones* numerous, axillary, cylindrical, subtended by a cluster of overlapping scales similar to the foliage bud, microsporophylls scale-like with two inverted pollen sacs. *Seed cones* terminal

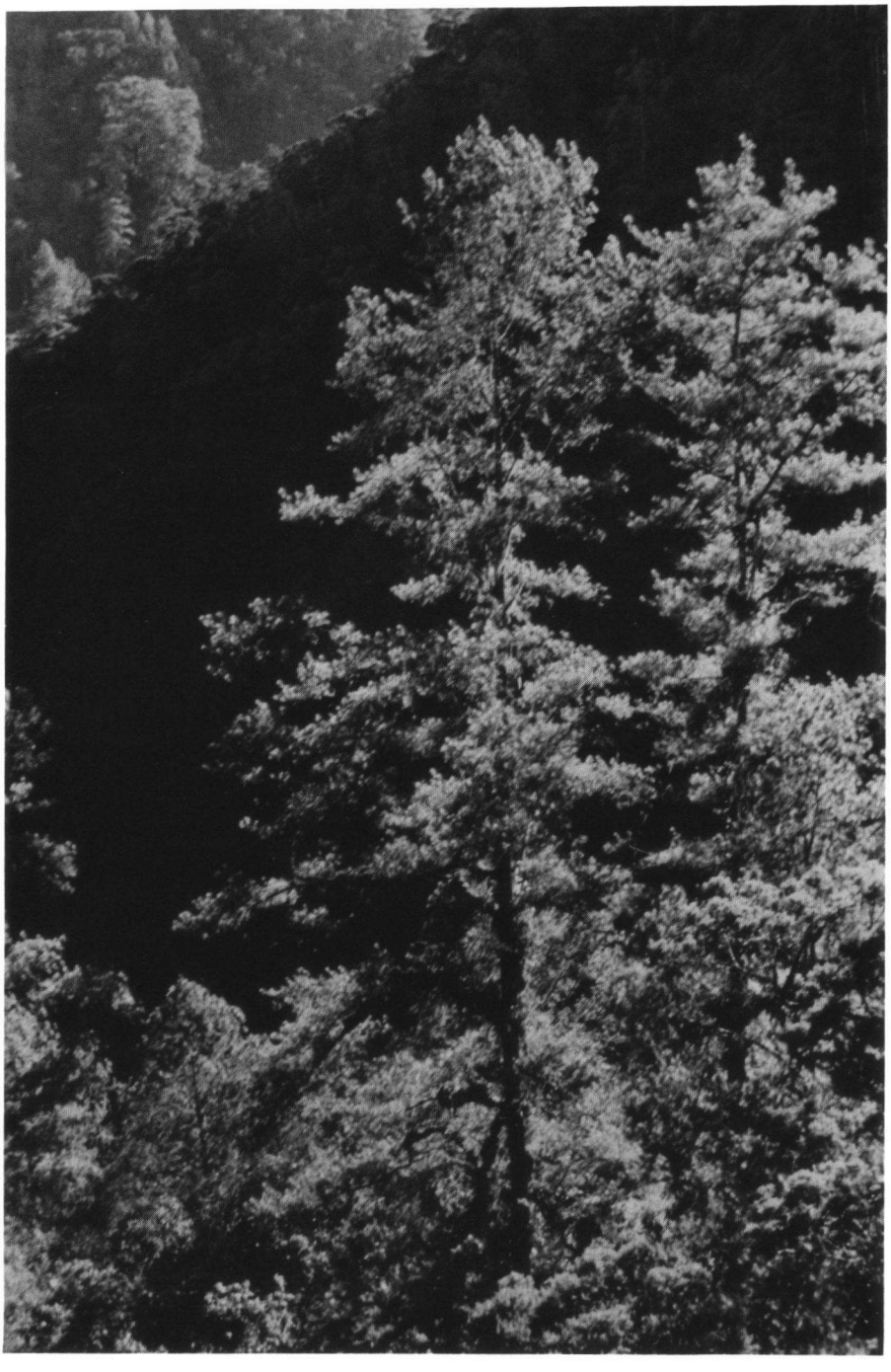

Fig. 91. *Pinus merkusii* JUNGH. & DE VRIESE in primary forest habitat on slope of Mt Bandahara, Leuser Nature Park, Sumatra, 2000 m alt. (Photogr. W.J.J.O. DE WILDE, 1972).

on short scaly shoots, more or less cylindrical, consisting of numerous fertile scales which become woody, ripening in the second or third year, the apiculate bract fused with the scale, two inverted ovules on each scale. *Seed* egg-shaped, with a firm outer shell, usually with an expanded wing which is attached to the broad base of the seed.

Distr. Over one hundred species across the middle and higher latitudes of the northern hemisphere and southward into Central America, Cuba, and Hispaniola as well as into *Malesia*, where two important pines of southeastern Asia (belonging to *subg. Diploxylon*) extend their range. Absent from the Indian subcontinent, but occurring throughout the Himalayan range.

Fig. 92. *Pinus merkusii* JUNGH. & DE VRIESE in fire-prone grassland, blang area along the Gajo-road, Sumatra (Photogr. J.C. VAN DER MEER MOHR, 1925).

Ecol. A wide range of forest and savanna habitats most characteristically following disturbance and thus even as large trees surrounded by rain-forest in some cases. Frequently occurring as a fire climax woodland or scattered in fire-prone grasslands. Pollination and seed dispersal by wind or in many cases the seed are gathered by birds or rodents or even collected for human food.

Note. Pines are leading sources of lumber and pulpwood and some species such as the two described here yield large amounts of pitch and are tapped to make turpentine. Use as ornamentals is widespread and pines are favourite subjects of afforestation. The widespread use of pines in tropical tree plantations derives from the detailed information available for their silviculture and not because they are of particularly good quality wood. The fact is that much tropical pine wood production is of very poor quality and it is to be hoped that knowledge of the production of better quality woods will increase in the future.

Fig. 93. *Pinus merkusii* JUNGH. & DE VRIESE. a. Twig with seed cone; b. twig with pollen cones; c. growing shoot; d. pair of needles; e. tips of needles, enlarged; f, g. pollen cones (from DE VRIESE, Pl. Nov. Ind. Bat. Or., 1845, 5, t. 2).

KEY TO THE SPECIES

1. Leaves two per bundle. Mature seed cone ovate ..... **1. P. merkusii**
1. Leaves three per bundle. Mature seed cone globular ..... **2. P. kesiya**

1. Pinus merkusii JUNGH. & DE VRIESE in De Vriese, Pl. Nov. Ind. Bat. Or. (1845) 5, t. 2; Bot. Zeit. 4 (1846) 13; ENDL. Syn. Conif. (1847) 176; CARR. Traité Gén. Conif. (1855) 380; GORDON, Pinetum ed. 1 (1858) 169; MIQ. Fl. Ind. Bat. 2 (1859) 1069; HENKEL & HOCHSTETTER, Synop. Nadelhölz. (1865) 43; DE BOER, Conif. Archip. Ind. (1866) 5; PARL. in DC. Prod. 16, 2 (1868) 389; VIDAL, Sin. Atlas (1883) 43, t. 98, f. B; Rev. Pl. Vasc. Filip. (1886) 296; MERR. For. Bur. Bull. Philip. 1 (1903) 15; FOXW. Philip. J. Sc. 6 (1911) Bot. 169; SHAW, Publ. Arn. Arb. 5 (1914) 23, t. 198–200; DALLIMORE & JACKSON, Handb. Conif. (1923) 415; GAUSSEN, Gymn. Act. & Foss. fasc. 6 (1960) 146, t. 344, 2 & 3; CRITCHF. & LITTLE, U.S. Dept. Ag. Misc. Publ. 991 (1966) 15, map 39; MIROV, Genus Pinus (1967) 284, f. 3-51-52, t. 3-68-69, 553; COOLING, Fast Growing Timber Trees Low. Tropics 4 (1968) 126; STEEN. Fl. Males. Bull. *n.* 25 (1971) 1948; PHENGKLAI, Thai For. Bull. 7 (1973) 1, f. 1; SILBA, Phytologia Mem. 8 (1986) 149. — *P. sylvestris auct. non* L.: LOUR. Fl. Coch. 2 (1790) 579. — *P. sumatrana* JUNGH. Bot. Zeit. 4 (1846) 698. — *P. finlaysoniana* BLUME, Rumphia 3 (1849) 210. — *P. latteri* MASON, J. Asiat. Soc. 1 (1849) 74. — *P. merkusii var. tonkinensis* CHEV. Rev. Bot. Appl. Ag. Trop. 24 (1944) 7. — *P. merkusiana* COOLING & GAUSSEN, Trav. Lab. For. Toulouse (1970) 1. — **Fig. 91–93.**

Large tree 40–50 m tall, occasionally to 70 m. Pyramidal with heavy horizontal branches and thick fissured bark in most areas but in some regions trees have more slender, somewhat ascending branches and much thinner, smoothish bark resembling that in the upper crown of thick-barked populations. These two types hold true in artificial plantings. The reddish bark of young trees changes to dark brown weathering to gray on older trees. *Foliage buds* long and narrow with awl-shaped scales. *Needles* in pairs, 16–19 cm by 1 mm, abruptly pointed, stomata on all faces, falling in the second year. Basal sheath 12–18 mm long, reddish. *Pollen cones* 18–25 by 5 mm. *Seed cone* cylindrical before opening, 5–11 by 3 cm and twice as thick after opening, generally falling soon after shedding seeds. *Apophysis* broadly tetragonal in shape with a smooth, almost depressed umbo. *Seed* 7.5 by 4.5 mm, with a deciduous wing 25 by 8 mm.

Distr. In *Malesia* common throughout the mountains of Atjeh in Sumatra and scattered further south in Tapanuli with an isolated outlier near Mt Kerintji at *c.* 2° south of the equator and the only natural occurrence of pine south of the equator. The same or a closely related pine is scattered throughout SE. Asia from E. Burma to the South China Sea and two small areas in the Philippines, one on Mindoro and the other near the west coast of Luzon in Zambales Prov. Fig. 94.

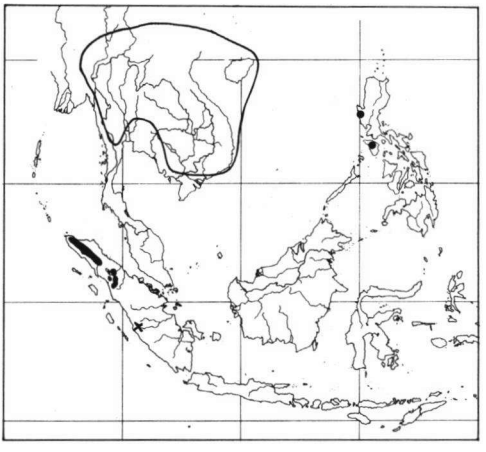

Fig. 94. Range of *Pinus merkusii* JUNGH. & DE VRIESE.

Ecol. From low elevations to 2000 m, generally on poor quality acid podzolic soils over sandstone or fresh volcanic ash, sometimes on deeply leached acid basalt, rarely successfully competing on richer forest soils. Most stands show a clear relationship to fire or other disturbance and the pine can be seen to be expanding in recently disturbed areas. In Sumatra the habitat experiences heavy year-round precipitation, but the pine areas themselves definitely favour the drier sites. The Tapanuli populations, which have thin bark, are more sensitive to fire and do not descend below 1000 m. Elsewhere, including the Philippine islands, this pine grows in strongly seasonal environments.

Vern. Sumatra: *dammar batu, dammar bunga, hejam, hujam, ujam, ujem*, Atjeh, *higi*, Kerintji, *kaju tussam, tussam*, Battok, Tapanuli; Philippines: *tapulao*, Sambal, Luzon, *agoo, aguu, salit*, Philip. islands.

Note. The similar pines of the southeastern Asian mainland and the Philippines differ in certain ways from those of Sumatra. The mainland pines, which grow in areas with a distinct dry season much stronger than any seasonality in Sumatra, have a distinct grass stage for the seedling, a character not seen

at all in Sumatra. The needles are 19–24(–27) cm long, the seed cones have a more typical taper of most pines, not the unusual cylindrical Sumatran shape, and their umbos tend to be distinctly raised on an apophysis distinctly wider than high. Seeds are nearly twice as heavy. Sumatran pines have a multinodal leader (several nodes in each year's growth) while the mainland form is uninodal. The new species, *P. merkusiana*, proposed for the mainland population, was described without a type specimen, but the earlier name, *P. latteri*, is already available. The varietal name *tonkinensis* is also available. Like Sumatra, mainland areas have an 'upland' thin-barked form to which the varietal name applies should further nomenclatural divisions be needed.

2. Pinus kesiya ROYLE *ex* GORDON in Loudon, Gard. Mag. 16 (1840) 8; HARRISON in Dallimore & Jackson, Handb. Conif. ed. 4 (1966) 436; STYLES & BURLEY, Comm. For. Rev. 51 (1972) 241; BURLEY, Proc. IUFRO Breeding Symp. Gainesville (1972) 38; PHENGKLAI, Thai For. Bull. 7 (1973) 3; QUIMBO, Canopy 4 (9) (1978) 9, 14; PADOLINA, Canopy 4 (10) (1978) 5; STYLES, Canopy (Aug. 1979) 5; in Armitage & Burley, Trop. For. Pap. 9 (1980) 199. — *P. taeda auct. non* L.: BLANCO, Fl. Filip. (1837) 767; MERR. Bur. Govt. Lab. Publ. Philip. 27 (1905) 82. — *P. insularis* ENDL. Syn. Conif. (1847) 157; PRESL, Epim. Bot. (1851) 37; PARL. in DC. Prod. 16, 2 (1868) 390; VIDAL, Sin. Atlas (1883) 43, t. 98, f. C; Rev. Pl. Vasc. Filip. 1 (1903) 15; Philip. J. Sc. 5 (1910) Bot. 325; WHITF. For. Bur. Bull. 10 (2) (1911) 26, t. 2, 3; FOXW. Philip. J. Sc. 6 (1911) Bot. 170; SHAW, Genus Pinus (1914) 60, t. 23, f. 208–210; WU, Acta Phytotax. Sinica 5 (1956) 145; RAIZADA & SAHNI, Ind. For. Rec. 5 (1960) 114, t. 5, f. 3; BACK. & BAKH. *f.* Fl. Java 1 (1963) 91; CRITCHF. & LITTLE, U.S. Dept. Ag. Misc. Publ. 991 (1966) 14, map 38; MIROV, Genus Pinus (1967) 297; ROJO, Sylvatrop 3 (1978) 31; DE LAUB. Kalikasan 7 (1978) 148; ROJO, Canopy (March 1979) 10; SILBA, Phytologia Mem. 8 (1986) 145. — *P. khasyana* GRIFF. Notul. Pl. Asiat. 4 (1854) 18, t. 367, 368, with ref. to descr.: 2 (1848) 58. — *P. kasya* PARL. in DC. Prod. 16, 2 (1868) 390; BRANDIS, For. Fl. NW & Central India (1874) 508; KURZ, Fl. Burma 2 (1877) 499; GAMBLE, Man. Ind. Timber (1881) 397. — *P. khasia* ENGELMANN, Trans. St. Louis Acad. Sc. 4 (1880) 179. — *P. khasya* HOOK. *f.* Fl. Br. India 5 (1888) 652; GAMBLE, Man. Ind. Timber 2 (1902) 708; MERR. For. Bur. Philip. 1 (1903) 15; BRANDIS, Indian Trees (1906) 690; DALLIMORE & JACKSON, Handb. Conif. (1923) 400; BUIC NGOC-SANH, Adansonia 2 (1962) 337; GAUSSEN, Gymn. Act. & Foss. fasc. 6 (1960) 154, f. 345, 5, 7, *incl. var. insularis* (ENDL.) GAUSSEN, *l.c.* f. 345, 6; NGUYEN KHA, Ann. Sci. For. 23 (1966) 261; MIROV, Genus Pinus (1967) 295.

Tree to 35–45 m, the crown expanding on older trees. Bark reddish brown, thick and deeply reticulately fissured, breaking off in small thick irregular plates and thus sometimes becoming smoother and plate-like. Branchlets smooth, bright brown. Buds oblong cylindric and non-resinous with brown lanceolate scales free at the tips. *Needles* in threes, rarely pairs, 12–24 cm by 0.5 mm, acuminate, stomata on most surfaces, falling after two years. Basal sheath 5–18 mm long, greyish brown. *Pollen cones* 18–30 by 5 mm. *Seed cone* ovoid to conical before opening, 4.5–10 by 3–5 cm, very persistent. *Apophysis* wider than long, pyramidal, the umbo with a small expanded and usually deciduous mucro. *Seed* 5–8 by 3 mm with a deciduous wing 20 by 8 mm.

Distr. Across SE. Asia to E. India (Khasia) and a short way into China; in *Malesia*: Philippines (common in the northern part of Luzon). Fig. 95.

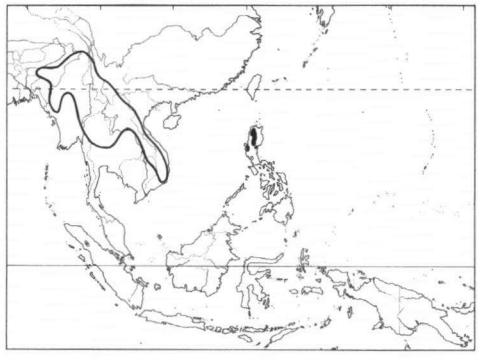

Fig. 95. Range of *Pinus kesiya* ROYLE *ex* GORDON.

Ecol. Most often in open pure stands following fire, but also mixed with oaks and Ericaceous species at intermediate elevations from 300 to 2700 m, often on steep slopes. Generally in the same area as *P. merkusii*, but usually at higher elevations. A few specimens in the Philippines have been considered hybrids between these two species, but actual hybridization has not been verified.

Vern. *Al-al, parua, saleng*; *boo boo, bot bol, bulbul*, If., *tapulao*, Zambales.

Note. *Pinus timorensis* (an earlier name) was thought by some to be equal to *P. kesiya* (*P. insularis*) although the description is inadequate to confirm this. There are no native pines in Timor; perhaps this was a cultivated tree.

Doubtful or Excluded

Callitris sp. mentioned from New Guinea by H.J.LAM, Nat. Tijd. Ned. Ind. 89 (1929) 304, 354; Sargentia 5 (1945) 143, 168, is according to VAN STEENIS, Acta Bot. Neerl. 2 (1953) 299 = *Gymnostoma sp.* (*Casuarinaceae*).

Podocarpus elata R.BR. — ENGLER, Bot. Jahrb. 7 (1886) 445, mentioned a specimen from Timor (Kupang Bay) to belong to this Australian species. PILGER did not mention this specimen in his monograph and WASSCHER did not see it either (*cf.* Blumea 4, 1941, 471).

Podocarpus palembanica MIQ. Fl. Ind. Bat. Suppl. (1860) 252, 289. According to DE BOER (Conif. Arch. Ind., 1866, 4) it is not a conifer because of its non-coniferous wood. KOSTERMANS (Reinwardtia 2, 1953, 362) observed its stipules and nerves and identified it as a juvenile specimen of *Ganua sp.*, later referred tentatively to a distinct species by VAN DEN ASSEM (Blumea 7, 1954, 482): *Ganua palembanica* (MIQ.) VAN DEN ASSEM & KOSTERM. (*Sapotaceae*).

Thuja javanica BURM. *f.* Fl. Ind. (1768) 202, t. 64, f. 3. — *Podocarpus javanicus* (BURM. *f.*) MERR. Philip. J. Sc. 19 (1921) 338, *pro nomen*. BURMAN's description and figure are based on a specimen of Java. In L there is a specimen in herb. VAN ROYEN, with a label *'Thuya javanica è Java. Monoic.'* which seems to be in BURMAN's handwriting and which can provisionally be accepted as the type specimen. According to HALLIER *f.* (Meded. Rijksherb. *n.* 37, 1918, 92) it belongs to *Juniperus chinensis*, a conifer already cultivated in Java in early days.