A REASSESSMENT OF PINUS SUBGEN. PINUS IN CHINA

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A recent study of Pinus subgen. Pinus for the Flora of China project recognized 10 native species with four new combinations, all at subspecies rank, and determined one new homonym, and six new synonyms. A neotype is designated for P. kesiya. Doubtful or little-known species are listed.

Keywords. New combinations, new synonyms, Pinus subsect. sylvestres, taxonomy.

INTRODUCTION

As the largest genus of the gymnosperms, Pinus is one of the most important genera of trees in both natural and man-made vegetation in China. An earlier taxonomic account for the Chinese pines was written by Cheng (1930), who recognized nine species. This was followed by Wu’s (1956) revision of 19 species. Further work was published in the Chinese version of the gymnosperm volume of the Flora Reipublicae Popularis Sinicae (Cheng & Fu, 1978) in which 24 native and 15 introduced species were treated. There has been no comprehensive treatment for the genus since then.

The concept of species is a problem still unresolved in biology. There are two main classes of species definition: taxonomic and biological (Davis & Heywood, 1963). One of the main differences between them is whether or not to use the criterion of reproductive isolation. In the case of Pinus, as pointed out by Stebbins (1950) and many others, the barriers of incompatibility and hybrid sterility are weakly developed, and most closely related species are separated largely by ecological and seasonal isolation. It is very difficult to define ‘biological’ species in the genus and this is not the goal of the present paper. However, species delimitation of Chinese pines using morphological-geographical methods has not been resolved. This is perhaps not surprising, especially in the subgenus Pinus, or the hard pines, with which this paper is concerned: all the species of this subgenus in China belong to the same subsection, Sylvestres (for infrageneric division, see Little & Critchfield, 1969) and therefore are closely related, except P. roxburghii in Tibet (sect. Sula, subsect. Canarienses). An attempt was made to reclassify the hard pines in China by consistently employing the same criteria for a given taxonomic rank. In addition, the rank of subspecies (rather than variety) has been used where patterns of geographical variation are apparent from the examination of numerous available specimens. For a discussion of infraspecific categories, see Hamilton & Reichard (1992).

As a result of the present study, 10 native species are recognized in subgen. Pinus

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in the *Flora of China*. Additionally, *P. taeda* of N America and *P. thunbergiana* of Japan, which are naturalized in China, are also included. Descriptions, distribution and ecology of species, subspecies or varieties will be available in the English and updated version of the *Flora*. For practical reasons, new taxa published after June 1994 are not included for discussion.

*Key to species of Pinus subgen. Pinus in China*

1a. Seed-wing not detachable, falling together with seed body; apophyses strongly projected, claw-like; seed cones large, 9–15 × 4–7cm

1. *P. roxburghii*

1b. Seed-wing detachable, easily separating from seed; apophyses thickened or flat, but never claw-like; seed cones moderate-sized or small, usually less than 9cm long

2. *P. thunbergiana*

2a. Leaves in fascicles of 3 (sometimes mixed with fascicles of 2); scale leaf bases persistent on first- and second-year shoots

3. *P. yunnanensis*

2b. Leaves in fascicles of 2; scale leaf bases usually deciduous on first- and second-year shoots

6. *P. kesiya*

3a. Seed cones conspicuously armed; resin canals 2, medial; leaves long and thick, 12–25cm × 1–1.5mm (introduced N American species)

12. *P. taeda*

3b. Seed cones unarmed or weakly armed; resin canals 2–6, marginal or medial; leaves either long and thin or short and rigid (native, SW China)

4. *P. densata*

4a. Leaves in fascicles of 2 (with some of 3), short and rigid, 8–14cm × 1–1.5mm; apophyses strongly prominent, usually 4–6mm thick

8. *P. densata*

4b. Leaves usually in fascicles of 3, long and soft, 10–22(–27)cm × 0.5–1mm; apophyses thickened, usually 2–3mm thick

5. *P. yunnanensis*

5a. Leaves relatively thick, 0.7–1mm diam.; branches more or less drooping, first-year shoots uninodeal, relatively stout, shiny reddish brown

9. *P. yunnanensis*

5b. Leaves slender, 0.5–0.8mm diam.; branches horizontally spreading, first-year shoots bi- or multinodal, slender, shiny yellowish brown or pale brown

10. *P. kesiya*

6a. Winter buds whitish; leaves rigid, not twisted or nearly so, 7–12cm × 1–1.3mm; resin canals 6–11, medial (introduced Japanese species)

4. *P. thunbergiana*

6b. Winter buds reddish brown to dull brown; leaves rigid or soft, more or less twisted; resin canals medial or marginal (native)

7. *P. thunbergiana*

7a. Leaves long, slender, mostly (12–)15–25cm × 0.6–0.8mm; umbos unarmed

8. *P. thunbergiana*

7b. Leaves short, thick, mostly (3–)7–12cm × 1–2mm; umbos armed or mucronate

9. *P. thunbergiana*
8a. Seed cones sessile or nearly so, narrowly ovoid before opening; apophyses flat, 1–2 mm thick; resin canals 4–8, marginal 5. P. massoniana
8b. Seed cones with conspicuous peduncles, cylindrical before opening; apophyses prominent, 3–4 mm thick; resin canals 2, medial 11. P. merkusii
9a. Leaves 3–9 (–12) cm long; winter buds more or less resinous; young cones usually pendulous; apophyses prominent 2. P. sylvestris
9b. Leaves (5–)8–14 cm long; winter buds non-resinous; young cones usually erect or pendulous; apophyses fat or thickened 10
10a. Apophyses strongly prominent, 3–5 (–8) mm thick; resin canals 5–9, marginal 7. P. tabuliformis
10b. Apophyses relatively flat, 2 mm thick; resin canals medial or marginal 11
11a. Bark reddish brown to orange on lower portion of trunk; shoots pale yellow or reddish yellow; resin canals 4–6, marginal 3. P. densiflora
11b. Bark greyish brown to dull grey; first year shoots pale brown to brown; resin canals 3–4 (–8), medial or with some marginal 6. P. luchuensis

1. Pinus roxburghii Sarg., Silva 11: 9 (1897). Type: not designated.

Previously this species was recorded only in the monsoon belt of the Himalayas from Bhutan to Pakistan (Critchfield & Little, 1966; Farjon, 1984). It was found distributed in Gyirong in south Xizang (Tibet) and was classified as a rare species in China (Fu & Jin, 1992).

2. Pinus sylvestris L., Sp. PI. 2: 1000 (1753). Lectotype: illustration of ‘Pinus sylvestris’ in Dalechamps, Hist. General. Pl.: 45. ic.1586 (chosen by Farjon & Jarvis in Jarvis et al., 1993).
Syn.: Pinus sylvestris var. mongolica Litv. in Sched. Herb. Fl. Ross. 5: 160 (1905). Type: ‘Mandshuria occidentalis (Mongolia), In arenosis pr. stat. viar ferreae Charchonte’, D. Litvinov s.n. (holo. LE, n.v.).
Misident.: Pinus sylvestris var. fastigiata auct.: Q.F. An & X.X. Zhang in Bull. Bot. Res. Harbin 6(2): 147 (1986), non Carrière (1856).

Additional specimens examined. CHINA. Liaoning: Lushun, Yuo-Chang Zhu 837 (KUN). Heilongjiang: Manpi, Yuo-Chang Zhu 56 (KUN); Mijiang, Xiao Xingkaihu, Guang-Zheng Wang 777 (KUN). Inner Mongolia: Haila’er, Z. Wang 524 (KUN).

Pinus sylvestris (Scots pine) is the most widely distributed pine species; it grows throughout northern Eurasia, from Scotland and Spain in the west, to NE China (Critchfield & Little, 1966). The morphology of the Scots pine is very variable; more than 150 variants have been described. There have been different opinions on the taxonomic status of its populations in NE China. Until recently, Cheng & Fu (1978) treated these as var. mongolica while Kitagawa (1979) accepted only var. sylvestris. Some botanists (Chang & Li, 1982; An & Zhang, 1986) recognized both var. mongolica and var. sylvestris in China. By matching herbarium material throughout the
distribution range, it seems that the variation of this species in NE China also follows a clinal pattern, as it does in Europe and the Far East. To make the Flora compatible with other modern floras, such as Flora Europaea (Tutin, Burges, Chater et al., 1993) and the Russian checklist (Czerepanov, 1995), var. mongolica is not recognized here. Further study is needed to clarify the affinity of the Chinese populations of this species.

3. Pinus densiflora Siebold & Zucc., Fl. Jap. 2: 22 (1842). Type: Lectotype: ‘in Japonia’, P.F. von Siebold comm. 1842 ex herb. Zuccarini No. 438 (M; selected by Farjon, 1993).

Syn.: Pinus densiflora f. sylvestriformis Taken. in J. Jap. Forest. Soc. 24: 120 (1942); Pinus sylvestris var. sylvestriformis (Taken.) Cheng & C.D. Chu in Fl. Reipubl. Pop. Sin. 7: 246 (1978); Pinus densiflora var. sylvestriformis (Taken.) Q.L. Wang, Chang-bai Shan zhi-wu min-lu [Checklist of plants in Changbai Mt.] 49 (1982) & in Fl. Liaoningica I: 152 (1988). Type: not designated.

Additional specimens examined. CHINA. Heilongjiang: Xinkaihu, Guang-Zheng Wang 4076 (KUN). Liaoning: Fengcheng, Yuo-Chang Zhu 264 (KUN); Xiongyue, Y.L. Chou 2641 (KUN). Jiangshu: Lianyungang, Yuntai Shan, S.L. Liou & K. Yao 8510 (MO). Shandong (Shantung): S.T. Dunn 1394 (K); Lao Shan, C.Y. Chiao 3852 (K); Kunlunshan, Shandong Exped. 0432 (KUN); Weihaiwei, Peishan, F.Y. Hwang 453 (K); Taishan, Shandong Univ. 127 (KUN).

Morphological study (Wang, 1988) and molecular analysis (Szmidt & Wang, 1993) indicate that var. sylvestriformis is closer to P. densiflora than to P. sylvestris.

4. Pinus thunbergiana Franco in Anais Inst. Super. Agron. 16: 130 (1949). Basionym: Pinus thunbergii Parl. in A.DC., Prodr. 16(2): 388 (1868) non Lamb., Descr. Pinus 2: v (1824). Type: not designated.

Additional specimens examined. CHINA. Inner Mongolia (?): Wang Yeh Fu, R.C. Ching 33 (E). Jiangsu: Yi-xing, W.Z. Fang 8059 (MO); Nanking, collector unknown s.n. (herb. no. 993) (E).

Pinus thunbergiana is naturally distributed in the coastal areas of Japan and southern Korea. It was introduced into China in the early 1900s and is now widely cultivated in Liaoning, Shandong and Zhejiang provinces as a reafforestation tree. It is also planted in Dalian, Hanzhou, Lushan, Nanjing, Wuhan, Shanghai and other major coastal cities as an ornamental tree.

In the literature, Pinus thunbergii Parl. was commonly used, but it is a later homonym of P. thunbergii Lamb.

5. Pinus massoniana Lamb., Descr. Gen. Pinus 1: 17 (1803). Type: [S Africa, Cape of Good Hope] a specimen ‘brought by Mrt Francis Masson from the Cape of Good Hope, where it was raised from seeds which had been sent from China’ (whereabouts unknown). Lectotype: Lambert, Descr. Pinus 1: t.12 (1803) (selected by Farjon, 1993).
Syn.: *Pinus crassicorticea* Y.C. Zhong & K.X. Huang in Guihaia 10: 287 (1990), *syn. nov.* Type: Guangxi, Leyu Xian, Yachang, alt. 910m, Huang Kai-xiang 63420 (IBK).

Additional specimens examined. CHINA. Fujian: *H.H. Chung* 2956 (E, K); *W.R. Charles* 740 (E, K). Guangdong: Guangzhou, *W.M. Chun* 5490 (K); *Dalziel* s.n. (E); *Freeman* 2404 (K); *A.D. Hancock* 76 (K); *Levine* 3368 (E), s.n. (Canton Christian College No. 428) (MO); Lantau Island, *F.A. McChure* 13091, 13092, 13109 (MO), 13194 (K); *F.W. Xing* et al. 190 (E); *Luyuan*, *C. Wang* 44089 (MO); *Meihsien*, *J.L. Gressitt* 1207 (E, MO); *Waiyuen (Huiyang)*, *W.T. Tsang* 16618 (MO), 20021 (K, MO), 26096 (E); *Yangjiang*, *C. Wang* 41817 (IBSC, MO). Guangxi: *P.P. Wan* & *K.S. Chow* 79157 (E). Guizhou: Jiangkou (Kiangkow), *Y. Tsiang* 5438 (E), 7511 (K); Guiding (Pingfa), *J. Cavalerie* 1695 (K). Hubei: Yichang (Ichang), *A. Henry* 1212, 3275 (K); *H.C. Chow* 74 (E); *C. Sihestri* 3979 (E); *E.H. Wilson* 293, 793 (K), 1378 (E, K), 1469 (E, K), 1473 (E), 1474 (K), 1480 (E, K), 1481 (E, K), 1482 (K), 1802 (E), 2503 (E, K, MO); 1980 Sino-American Expedition 1729 (E). Hong Kong: *Bodinier* 1421 (E); *Champion* 173, 174 (K); *Rev. Pere Faurie* 15844 (K); *Hind* 1841 (K); *R.V. Hoffman* s.n. (MO); *Page* 10333 (E); *G.R. Shaw* s.n. (MO); *Urgukart* 1861 (K); *E.H. Wilson* 1483 (E); *C. Wright* All (K). Hunan: Handel-Mazzetti 11582 (E). Jiangsu: Nanjing, *Chen* & *Teng* 4037 (K, E); Purple Mt., *A.N. Steward* 1906 (K), 1973 (E); *d'Argy* s.n. (E) (syntype of *Pinus argyi* Lemée & Lév.); *d'Argy* s.n. (bis) (E) (syntype of *P. argyi* Lemée & Lév.); *d'Argy* s.n. (E) (type of *P. argyi* var. longevaginans Lév.); Yixing (I-hing), *W.Z. Fang* 8062 (MO). Jiangxi: *H.C. Cheo* 490 (E, K). Sichuan: Chengkou, *R.P. Farges* s.n. (K No. 4688); *E.H. Wilson* 1468, 1476 (E, K); *Ba Xian* (Pahsien), *W.P. Fang* 47 (E, K), 3398, 6042 (E), *W.K. Hu* 7748 (E); Hubei-Sichuan boundary, Metasequoia area, *W.C. Cheng* & *C.T. Hua* 439, 655, 852, 1167, 1178 (all K); *Yongchuan*, *D.H. Du* 153 (MO, PE). Taiwan: *W.R. Price* 341, 714 (K); *C.C. Wang* 963 (E, K), W.B. (Brown?) s.n. (E); Chibun Shan, *F.N. Meyer* 1458 (K).

*Pinus crassicorticea* was based on two specimens from northern Guangxi, the western boundary of *P. massoniana*, with slightly thicker needles (0.7–0.8mm diam. in the former vs. 0.6–0.8mm in the latter) and thicker bark (up to 10cm). It was described that in *P. crassicorticea* the first-year shoots bear with two or three nodes. However, this can sometimes be found in the southern part of the range of *P. massoniana* in Guangdong, especially in dry areas (Cheng & Fu, 1978). It was also stated that there was an internal resin canal in the needles of *P. crassicorticea*. This is a somewhat variable character. However, a re-examination of the type showed that the resin canals are all marginal.

6a. *Pinus luchuensis* H. Mayr subsp. *hwangshanensis* (Hsia) D.Z. Li, *comb. et stat. nov.* Basionym: *Pinus hwangshanensis* Hsia in Chin. J. Bot. 1: 17 (1936). *Pinus luchuensis* var. *hwangshanensis* (Hsia) C.L. Wu in Acta Phytotax. Sin. 5(3): 158 (1956). Type: Anhui, Huangshan, alt. 2000m, *M. Chen* 1252 (holo. PE).

Syn.: *Pinus hwangshanensis* Hsia ex Tsoong in Contr. Inst. Bot. Natl. Acad. Peiping 4(2-3): 156 (1936), nom. illeg. Type: Anhui, Huangshan, Xihaimen, alt. 1700m, *Liou & Tsoong* (PE, not found), *homonym nov.*
Pinus taiwanensis Hayata var. damingshanensis Cheng & L.K. Fu in Acta Phyto tax. Sin. 13(4): 85 (1975), syn. nov. Type: Guangxi, Wuming, Damingshan, alt. 1100–1300m, Damingshan Exped. 74297 (PE, not found).

Additional specimens examined. CHINA. Anhui: Huangshan, R.C. Ching 3009 (E, K), 3028 (E), 3038 (K). Fujian: C. Ho 2255 (KUN); Guizhou: Fanjingshan, collector unknown 909 (KUN); Hunan: Xinning, Lin-Han Liu 15297 (KUN); Jiangxi: Anfu, Wugongshan, Jun-San Yue 3579 (KUN); Lushan, L. Charter 219 (E); A.N. Steward 2723 (MO); E.H. Wilson 1745, 1747 (E); Yue-Guo Xiong 6680 (KUN); Shangyou, Min-Xiang Ni 08308 (KUN); Zhejiang: R.C. Ching 1545, 1607, 3299 (E, K), Tiantaishan, S. Chen 471 (E, K), 1244 (K); Feng Yang Shan, H. Y. Zou 279 (MO).

6b. Pinus luchuensis H. Mayr subsp. taiwanensis (Hayata) D.Z. Li, comb. et stat. nov. Basionym: Pinus taiwanensis Hayata in J. Coll. Sci. Imp. Univ. Tokyo 30: 307 (1911). Syntypes: Taiwan, Central Range, T. Kawakami & U. Mori 2097 (TI); Randaizan, B. Hayata & U. Mori 7142 (TI).

Additional specimens examined. CHINA. Taiwan: Arisan, E.H. Wilson 9788 (K); Chiayi Hsien, T.I. Chuang & M.T. Kao 4048 (MO); C.C. Chuang 2950 (MO); Hsingchu Hsien, C.L. Huang 64 (MO); Mt. Hohuan, C.N. Page 10103 (E); Hwalien Hsien, C.C. Chuang & M.T. Kao 4382 (MO); Nantou, Yushan, Tamura, Shimizu & M.T. Kao 22083 (E); Nantou, M.H. Chen 34 (MO); E.H. Wilson 9810, 9911, 11167 (K); Pinan, E.H. Wilson 11135 (K); Taichung, H. Koyama 24045 (E), T. Shimizu & C.C. Chung 20205 (E).

Pinus luchuensis, P. taiwanensis and P. hwangshanensis were described from the Ryukyu Islands, Taiwan and mainland China respectively. There has been no consensus on their inter-relations for a considerable time. Wu (1956) accepted P. hwangshanensis as a variety of P. luchuensis, and P. taiwanensis as a synonym of the latter. However, Cheng et al. (1975) and Cheng & Fu (1978) treated P. hwangshanensis as a synonym of P. taiwanensis, and populations of P. hwangshanensis in Guangxi with both marginal and medial resin canals were recognized as a new variety of P. taiwanensis, var. damingshanensis. Among non-Chinese authors, Critchfield & Little (1966) accepted all three species, while Farjon (1984) did not mention P. hwangshanensis. Silba (1984) at first recognized only one species, P. luchuensis, but later (Silba, 1986) treated the other two taxa as varieties of the latter (even though his combination, P. luchuensis var. taiwanensis was not validated). It is true that the three taxa are similar to one another because of their seed cones, medial resin canals and relatively thicker needles. There are differences, though not very conspicuous, which make them distinct (Table 1). It is therefore better to treat them as one species with three subspecies.

There is an ambiguity in citing the authorship of Pinus hwangshanensis. Tsoong’s paper is available in most western institutions, so that the compiler of Index Kewensis attributed the name to Tsoong. In fact, Hsia is the author of this name and she did publish a separate paper with exactly the same description but a different type citation. Both Tsoong and Hsia’s papers appeared in 1936, but Hsia’s was in the first issue of the Chinese Journal of Botany and presumed earlier than Tsoong’s. Farjon (1993) reached the same conclusion but he ignored there was a specimen cited.
TABLE 1. Comparison of the subspecies of Pinus luchuensis.

|                          | subsp. luchuensis | subsp. taiwanensis | subsp. hwangshanensis |
|--------------------------|-------------------|--------------------|-----------------------|
| Length of needles        | 12–16cm           | 8–11(–15)cm        | 5–10cm                |
| No. of resin canals      | 2–3               | 6–7                | 3(–8)                 |
| Maximum height           | 20m               | 35m                | 25m                   |
| Distribution             | Ryukyu Is.        | Taiwan Is.         | Mainland China        |
| Altitude                 | 0–850m            | 750–2500m          | 600–2000m             |

The only character to separate Pinus taiwanensis var. damingshanensis was leaves with both marginal and medial resin canals, but this character is not very reliable.

7. Pinus tabuliformis Carrière, Traité Conif. ed. 2: 510 (1867). Type: not designated.

7a. var. tabuliformis
Syn.: Pinus mukdensis Nakai in Bot. Mag. Tokyo 33: 195 (1919); P. tabuliformis var. mukdensis (Nakai) Uyeki in J. Chosen Nat. Hist. Soc. 3: 35 (1925), syn. nov. Type: Manchuria, Mukden (Liaoning, Shenyang), H. Ueki 2350 (TI).

Additional specimens examined. CHINA. Gansu: J.F. Rock 12538 (E, K). Hebei: (Chihli prov.) M.S. Clemens 6046, 6046a (E); Chende, L. Charter 195 (E); P.S. Green 2172 (K). Manchuria (Liaoning): E.H. Wilson 8815 (K). Ninghsia: Front of Ala Mt., Y.Y. Pai 183 (K). Peking (Beijing): Bretchenid 706 (K); Limpricht s.n. (K); J.C. Liu 314 (K). Shanxi: Taihangshan, Yao 2901 (Type of P. taihangshanensis, PE); Chin-sü, H. Smith 7592 (E); Wu Chai Hsien, J. Hers 2045 (K). Shanxi (Shanxi), Sa Hua Shan, F.N. Meyer 1828 (K).

P. mukdensis was said to differ from P. tabuliformis in having dark grey bark and greyish brown or dark grey twigs. However, such characters are also found in various populations of P. tabuliformis.

7b. var. henryi (Mast.) C.T. Kuan, Fl. Sichuanica 2: 113 (1983).
Basionym: Pinus henryi Mast., J. Linn. Soc., Bot. 26: 550 (1902); Pinus massoniana Lamb. var. henryi (Mast.) C.L. Wu in Acta Phytotax. Sin. 5(3): 153 (1956). Lectotype: Hubei (Hupeh), Fang Xian, A. Henry 6909 (K, selected here; excl. 42, Fang Shan, 15 iv 1876, Pinus Prov. Shui King, N, China, Comm. Mr. John Ross 10/77).
Syn.: Pinus massoniana Lamb. var. wulingensis C.J. Qi & Q.Z. Lin in Bull. Bot. Res. Harbin 8(3): 143 (1988), syn. nov. Type: Hunan, Cili Xian, Suoxiuyu, Peng Chun-Liang 120357 (CSFC).

Additional specimens examined. CHINA. Hubei: Western Hubei (Hupeh), E.H. Wilson 1447 (K), 1485, 1486, 1487, 1488, 1489, 1490, 1494, 1495, 1497, 1498 (all at E & K); Shennongjia, 1980 Sino-American Expedition 1466 (E, KUN, MO); Xingshan, Ying Liu 614 (KUN).
Sichuan: Fengjie, M.Y. Fang 24204 (KUN).

The status of Pinus henryi has been uncertain as it is an endemic taxon distributed
in a remote area (Daba Shan) in central China. Wu (1956) suggested that its relationship was with *P. massoniana*. However, the needles are shorter and thicker in *P. henryi* than in *P. massoniana*. Furthermore, the apophyses of the seed scales are more prominent, and the bark is deeply furrowed into irregular squares in *P. henryi*. These characters suggest that this taxon is more closely related to *P. tabuliformis* than to *P. massoniana*. According to Kuan (1983), *P. henryi* and *P. tabuliformis* have naturally overlapping ranges in the Daba Shan area in Sichuan province. It is therefore more appropriate to treat it as a variety of the former.

*P. massoniana* var. *wulingensis* was described from Wuling Shan of the Daba Shan area. It differs from *P. massoniana* by having shorter needles (5–7 cm long) and smaller seed cones (3–3.5 × 2–3 cm), and from *P. taiwanensis* by its leaves with marginal resin canals. However, the original authors failed to compare it with *P. henryi*, with which it is conspecific.

8. *Pinus densata* Mast. in J. Linn. Soc., Bot. 37: 416 (1906). Type: ‘China occid., in silvis prope vallem Ya Lung ad. alt. 9000–11000 ped.’, *E.H. Wilson* 3015 (holo. BM).

Additional specimens examined. CHINA. Sichuan: *W.C. Cheng* 805 (E), 1255, 1256 (K), 1775 (E, K), 1839 (E, K), 1840 (K), 2072 (E); *W.P. Fang* 3736 (E, K); *Handel-Mazzetti* 2290 (E); *C.R. Lancaster* L950, L1024 (K); *E.H. Wilson* 905 (E), 1397 (E), 1398 (E), 1493 (type of *P. wilsonii*) (A, E), 1465 (E, K), 1466 (E), 1467 (E), 1475 (E, K), 1478 (E), 1495 (E), 2500 (E, K), 2502 (E, K), 2504 (E, K), 3015 (K), 3016 (K) (type of *P. prominens*), 1055 (K), 4073 (E). Yunnan: NW *Yunnan*, *G. Forrest* 20115 (E); *T.T. Yu* 10725 (E); *Chungtien-Likiang-Dali Expedition* 481, 758 (E). Xizang (Tibet): SE Tibet, *Ludlow, Sheriff & Taylor* 1344 (MO), 4469 (E); *Pome, Ludlow, Sheriff & Taylor* 12028 (E).

Morphological study and molecular analysis suggested this is a hybrid of *P. yunnanensis* and *P. tabuliformis* (Wu, 1956; Wang & Szmidt, 1990). However, *P. densata* is still best treated as a species (for nomenclature see Note 1 of Art. H.3.4. of the ICBN).

9. *Pinus yunnanensis* Franch., J. Bot. (Morot) 13: 253 (1899). Type: Yunnan, Ta pinte, *Delavay* 569 (holo. P, iso. K).

Syn.: *Pinus insularis* Endlicher var. *yunnanensis* (Franch.) Silba, Phytologia Mem. 7: 52 (1984).

*Pinus yunnanensis* var. *tenuifolia* Cheng & Law in Cheng et al. in Acta Phytotax. Sin. 13(4): 85 (1975), syn. nov.; *Pinus insularis* Endl. var. *tenuifolia* (Cheng & Law) Silba in Phytologia 68: 51 (1990). Type: Guizhou, Ceheng Xian, *Z.Y. Cao* 1038 (holo. PE).

Additional specimens examined. CHINA. Guizhou: *E. Bodinier* 938a (E); *Y. Tsiang* 7300 (E); Hezhang, *Ping-Hua Yu* 1324 (KUN); Xingyi, *Guizhou Exped.* 6110 (KUN). Sichuan: Western Sichuan, *E.H. Wilson* 1376 (E, K), 1393 (K), 1394 (E, K), 1395 (E, K), 1396 (E, K), 1399, 1464, 1471, 1472 (all E); *W.C. Cheng* 1726 (E), 1727 (K), 2986 (E); Kangding, *Z.J. Zhao* 113358, 113369 (E, K). Yunnan: NW *Yunnan*, *Ducloux* 813 (K); *G. Forrest* 7757, 9382, 17365, 19377, 20129, 23543, 23615 (all E); *Hand.-Mazz.* 8734 (K); *E.E. Maire* 2451 (E, K),
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F. Kingdon Ward 216 (E); T.T. Yu 788, 8009, 19518, 22911 (E); T.T. Yu 8406, 20139 (KUN); Dali, T.N. Liou 20612 (KUN); 1981 Sino-British Expedition 1043, 1176 (E, K), 1984 Sino-American Expedition 1078 (E), L. Charter 191, 192, 206 (E); Jingdong, M.K. Li 338 (KUN); Kunming, P.S. Green 2187 (K); K.D. Rushforth 312 (E), H.K. Teng 496 (KUN); Lijiang, T.T. Yu 8075 (KUN). Xizang (Tibet): Yigong valley, Bailey s.n. (E); Zayu, Xizang-Qinghai Exped. 73-218 (KUN).

The delimitation of *P. yunnanensis* (Yunnan pine) is sometimes questionable because of its close relationships with *P. kesiya* and *P. insularis* (Wu, 1956; Silba, 1984). However, *P. yunnanensis* may be distinguished in having thicker leaves, more or less drooping branches, and unNodes and shiny reddish brown first-year shoots. The chemical constituents are also different (Mirov, 1967; Farjon, 1984).

Yunnan pine is basically restricted to the Yunnan plateau at elevations of 600–3000m. Two varieties were included in *Flora Reipublicae Popularis Sinicae*, var. *tenuifolia* in south-eastern Yunnan, western Guangxi and Guizhou, with thinner, longer and accordingly pendulous needles, and var. *pygmaea*, a shrub 0.4–2m tall with several trunks, distributed usually at higher elevations.

10. *Pinus kesiya* Royle ex Gordon in Loudon, Gard. Mag. 16: 8 (1840). Type: not designated. Neotype: India, Khasia, Regio Temp., alt. 2–6000ft, (‘In Nepalia? in Khasya alt. 2–6000 ped. in regione temperata et tropica’), *J.D. Hooker & T. Thomson* s.n. (K, selected here; isoneo. E).

Syn.: *Pinus kasya* Royle ex Parl. in A.DC, Prodr. 16(2): 390 (1868). Type: India, Khasia, Regio Temp., alt. 2–6000ft, (‘In Nepalia? in Khasya alt. 2–6000 ped. in regione temperata et tropica’), *J.D. Hooker & T. Thomson* s.n. (lecto. K, chosen here; isoelecto. E).

*Pinus khasya* Royle ex Hook.f., Fl. Brit. Ind. 5: 652 (1888). Type: India, Khasia, Regio Temp., alt. 2–6000ft, (‘In Nepalia? in Khasya alt. 2–6000 ped. in regione temperata et tropica’), *J.D. Hooker & T. Thomson* s.n. (lecto. K, chosen here; isoelecto. E).

*Pinus langbianensis* A. Chev. in Rev. Int. Bot. Appl. Agric. Trop. 24: 25 (1944); *Pinus kesiya* A. Chev. var. *langbianensis* (A. Chev.) Gaussen ex Cheng & L.K. Fu, Fl. Reip. Pop. Sin. 7: 259. 1978, *syn. nov.* Type: Annam, Langbian, Chevalier 30024 (holo. P).

Additional specimens examined. CHINA. Yunnan: Baoshan, Sheng-Tang Li 80-315 (KUN); Jingdong, collector unknown L01438 (KUN); Jinghong (between Keng Hung and Muang Hing), *J.F. Lock* 2694 (E); Lincang, *Jing-San Xin* 527 (KUN); Mengla, *H.T. Tsai* 8380 (KUN); Mojiang, *Simao, H.T. Tsai* 80090 (KUN); Pegu, *H.K. Teng* 496 (KUN); Yanyang, *J.F. Maxwell* 89-141 (MO).

BURMA. Haka Chin, F.G. Dickason 7393 (E); Kampelet, Mt. Victoria, *R.E. Cooper* 5973 (E), *F. Kingdon Ward* 3076 (E); Mandaylay, Maymyo, *Main* 6277 (E), *E. Toenander* 3045 (E); Mindat Sakan, Hilawng Ridge, *U Mg Gale* 2(2) 9146 (E); N. Shan State, Lashio, *G.C.B. Stirling* 26647 (E); Pegu, *S. Kurz* 1003 (E).

INDIA. E Bengal: *Griffith* 4995 (K, MO).

THAILAND. Chieng-Mai, *C.C. Hossens* 318 (E, MO), *J.F. Maxwell* 89-141 (MO).
The nomenclature and taxonomy of the Khasia pine have a confused history. Firstly, *P. kesiya* Royle ex Gordon was sometimes regarded as a *nomen seminudum* (Wu, 1956). However, Gordon’s protologue presented a sufficient diagnosis: ‘the cones resemble those of *P. insignis*, but they are not near so large, much flatter, and the scale not so prominent’. Therefore, most authorities (Critchfield & Little, 1966; Styles & Burley, 1972; Laubenfels, 1988; Farjon, 1993) accept its validity.

Secondly, the Chinese populations, commonly called Simao pine in China, were named *P. kesiya* var. *langbianensis* (Cheng & Fu, 1978), typified by a specimen from central Vietnam. It was stated that the Simao pine and var. *langbianensis* differ from var. *kesiya* by having thinner bark, fissuring into irregular scaly plates. Field observations indicate that the bark of Simao pine may be as thick as 3cm. Further, examination of the type material of var. *langbianensis* and material from the Khasia mountains shows var. *langbianensis* should be part of the distribution of the Khasia pine.

Finally, with regard to its relationship with *P. insularis* Endl., the latter was usually merged with *P. kesiya* (e.g. Styles & Burley, 1972; Laubenfels, 1988), or for those who treated *P. kesiya* Gordon as a *nomen nudum*, *P. insularis* was used (Merrill, 1941; Wu, 1956; Silba, 1984). All herbarium specimens examined show that morphologically they are very similar in bearing longer and thinner needles in groups of three, fasciculate, multi-nodal first-year shoots and seed scales with prominent apophysesa. It is therefore concluded that they are best considered conspecific. However, chemical differences may separate them (Farjon, 1984). In view of their geographical distribution, it seems more reasonable to accept two subspecies, subsp. *insularis*1 from the Philippines and subsp. *kesiya* from China (southern Yunnan, south-eastern Tibet), Bangladesh, Bhutan, Burma, Cambodia, north-eastern India (Khasia), Laos, Nepal and Vietnam.

It is most likely that no herbarium specimen was preserved when Gordon published *P. kesiya*. It was ‘raised from seeds presented to the Society by Dr. Royle, F. H. S.’. Therefore, a neotype is designated here, which is the same as that designated as lectotype for *P. kasya* Royle ex Parl. and *P. khasya* Royal ex J.D. Hooker, and the latter are made into two nomenclatural synonyms, to further the current usage of *P. kesiya*.

11. *Pinus merkusii* Jungh. & de Vriese subsp. *latteri* (Mason) D.Z. Li, comb. et stat. nov.

Basionym: *Pinus latteri* Mason in J. Asiat. Soc. Bengal 18(1): 74 (1849). Type: [Burma] ‘In provincia Amherst: in convalli fluvii Thoungyeen’, Latter (whereabouts unknown).

Syn.: *Pinus merkusiana* Cooling & Gaussen, Trav. Lab. Forest. Toulouse Tom. I, Vol. 8: 5 (1970), nom. inval. (Art. 37.1).

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1 *P. kesiya* subsp. *insularis* (Endl.) D.Z. Li, comb. et stat. nov.

Basionym: *Pinus insularis* Endl., Syn. Con. 157 (1847). Type: Philippines, Luzon, *Cumming* 956 (holo. K, iso. MO).
Pinus merkusii var. latteri (Mason) Silba in Phytologia 68: 53 (1990).
Pinus tonkinensis A. Chev. in Rev. Int. Bot. Appl. Agric. Trop. 24: 29 (1944).
Syntypes: [Vietnam] Tonkin, Province de Laokay, Ta-phing, 1600m, d'alt. Chevalier 29 493 (P); Nord Annam: Province de Nghé-An (Vinh), réserve forestière de Hoan-Mai, Fleury in Herb. Chevalier 30202 (P).

Additional specimens examined. BURMA. Magala Reserve, J.H. Lace 4720 (E); Tenasserim, Tavoy District, J. Keenan, U Tun Aung & R.H. Rule 1490, 1563 (E).
CHINA. Hainan: enroute to Wong Chuk, Tung Ngai 9805 (MO).
THAILAND. North Thailand, T. Sorensen, K. Larsen & B. Hansen 1729 (E).

According to Laubenfels (1988), the similar pines of mainland SE Asia and the Philippines differ from those of Sumatra noticeably by having a ‘grass stage’ for the seedling (after it emerges, the seedling grows for a season in height, then it grows without increasing in height in the second and third years). The needles of the mainland pines are 19–25cm long, and the seeds are nearly twice as heavy as those of the Sumatran ones. *P. merkusiana* Cooling & Gaussen was proposed to accommodate them, which, however, is a name published after 1958, without a designated type and thus not validly published (ICBN Art. 37.1). An earlier name, *P. latteri*, is already available. ‘Grass stage’, as a developmental feature, may not be a good character to separate species; this may partly explain why Laubenfels still treated *P. latteri* and *P. merkusiana* as synonyms of *P. merkusii*. However, in view of other morphological differences, such as longer needles and larger cones and seeds, as well as geographical distribution, *P. latteri* is here treated as a subspecies of *P. merkusii*.

12. *P. taeda* L., Sp. Pl. 2: 1000 (1753).
Lectotype: USA, J. Clayton 496 (BM; designated by Farjon & Jarvis in Jarvis et al. 1993).

Introduced to China 100 years ago. Cultivated as a reafforestation tree in Anhui, Fujian, Jiangsu, Jiangxi, Taiwan and Zhejiang.

**DOUBTFUL NAMES**

The following names are doubtful as there was not sufficient material available during this study.

1. *Pinus densiflora* Siebold & Zucc. var. *ussuriensis* Liou & Z. Wang in Liou, Illust. Fl. Lign. Pl. NE China 548 (1955). Type: [Heilongjiang, Xingkaihu] ‘China Boreali-Orientalis, lacus Chanka, in arenosis’, collector unknown (IFP, n.v.). (? = *P. sylvestris*)

2. *Pinus ikedai* Yamamoto in Contr. Fl. Hainanensis 1: 20, t.1 (1943) (adopted from Chun, Fl. Hainan 1: 211, 1964). **Name not in Index Kewensis.** (? = *P. murerki* subsp. *latteri*)

3. *Pinus massoniana* Lamb. var. *hainanensis* Cheng & L.K. Fu in Cheng et al. in Acta Phytotax. Sin. 13(4): 85 (1975). Type: Hainan, Bawang Ling, Yajia Daling, C. Wang 3117 (PE, not found). (? = *P. massoniana*)
4. *Pinus massoniana* Lamb. var. *shaxianensis* D.X. Zhou in Bull. Bot. Res. Harbin 11(3): 41 (1991). Type: Fujian, Sha Xian, *D.X. Zhou* 9016 (PE, not found). (=? = *P. massoniana*)

5. *Pinus takahasii* Nakai in Bull. Forest. Soc. Korea 167: 32 (1939), p.p., quoad typicam. Type: [Heilongjiang] Sinkaihou (Xingkaihu), *Takahas* s.n. (TI, n.v.). (=? = *P. sylvestris*)

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