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A revision of the Asian *Pinus* subsection *Strobos* (*Pinaceae*)

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APPENDIX I. – Herbarium material

1. Older herbarium material examined

Pinus wangii* subsp. *wangii

C. W. WANG 85830: Yunnan, Shi-Chou, Fa-Tou, Ku-Chu-Chun, alt. 1400 m, on open ridge of limestone hills; tree: height 10 m h., d.b.h. 50 cm, locally; December 1940 (January 1940 on English label) [probably actually 17 Dec 1939]. The field label: Yunnan, *Wang & Liu 85830*, 1939-40. Det. as *P. wangii* Hu & W. C. Cheng by Y. W. Qing, 24.3.1959. **Type.** [KUN]

C. W. WANG 85830: *the same data, but* – Si-chou Hsien, Far-doe, ..., locally occasional but of quite restricted distribution; 17.12.1939. **Isotype.** [PE: two specimens]

C. W. WANG 85830: *the same data, but* – Hsi-chou, Fa-Tou, Ku-chu-tin, ..., locally occasional; 2.1.1940 [?, probably 17 Dec 1939]. **Isotype.** [PE: two specimens]

C. W. WANG 85867: Yunnan, Hsi-chou, Hsin-ti-fang [Sen-di-fang in protologue], alt. 1300 m, rocky ridge; tree 14 m h., occasional; 5.1.1940. The field label: Yunnan, *Wang & Liu 85867*, 1939-40. Paratype. [PE]

C. W. WANG 86308: Yunnan, Mar-li-po, Hwang-gin-yin (Huang-king-ying, Huang-chin-yin), alt. 1100 m, rocky hill; tree 10 m h., 40 cm d.b.h., locally occasional; 21.1.1940. The field label: Yunnan, *Wang & Liu 86308*, 1939-40. Paratype. [KUN: three specimens, PE]

K. M. FENG 12106: Yunnan, Si-chou hsien, Fan-doon (Faa-doou), alt. 1500 m, on top of rocky hill, rare; tree 20 ft. h., 3 ft. d.b.h.; 29.9.1947. [KUN, PE: two specimens]

K. M. FENG 12952: Yunnan, Mar-li-po, Hwang-jin-in, alt. 1600-2000 m, on rock mt., common; tree 30 ft. h.; 6.11.1947. [KUN, PE]

K. M. FENG 13584: Yunnan, Mar-li-po, Tung-ting, alt. 1500-1800 m, in mixed forests on rock mt., common; tree 20 ft. h.; 23.11.1947. [KUN, PE: three specimens]

K. M. FENG 13931: Yunnan, Mar-li-po, Hwang-jin-in, alt. 1300-1600 m, in mixed forests, common; tree 30 ft. h., fruits in young trees; 20.12.1947. [KUN, PE: three specimens]

L. H. LIU 59356: Yunnan, Shi-Chou, Fa-Tou, Pianyan Litouwan, alt. 1470 m; 24.11.1964. [In Chinese; KUN: two specimens]

P. Y. MAO 82-78: Yunnan, Malipo Co., Jinchang, Huoshao Mts., alt. 1500 m; tree 6 m h., trunk 0.3 cm in diam.; 6.9.1982. [SWFC]

Pinus wangii* subsp. *kwangtungensis

S. P. KO 51137: Kwangtung, Loh-Chang; 16.1.1931. Paratype. [PE]

N. K. CHUN 42954: Kwangtung, Lokchong [Loh-Chang in the protologue]; 16.11.1931. Paratype. [PE]

Z. S. CHUNG 10955: Kwangtung, [Loh-Chang in the protologue], Ji-Gong Mts.; 31.8.1935. Paratype. [PE]

Y. LI 2058: Kwangtung, Ruyuan District [in the protologue erroneously referred from Loh-Chang]; 11.10.1936. Paratype. [PE]

Canton 01094: Kwangsi, Long-Sun District, alt. 1330 m; [coll. ?] 1.11.1955. South China Inst. Bot., Canton. [PE]

C. J. QI 1099: Hunan, Mang Shan; coll. Qi Cheng-Jing, August 1956. [In Chinese; PE]

S. Q. CHEN 15370: Kwangsi, Jiu-Wan Mts., 900 m; 28.8.1958. [PE]

S. Q. CHEN 15447: Kwangsi, Jiu-Wan Mts.; 31.8.1958. [PE]

S. Q. CHEN 15502: Kwangsi, Jiu-Wan Mts.; 2.9.1958. [PE]

Z. Z. CHEN 51818: Kwangsi, Ziyuan District, Wupai [region], Liangshui [village], Baishating, forest mountain slope; tree 30 m h., 80 cm d.b.h.; coll. Chen Zhao-Zhou, 6.8.1958. [In Chinese; PE]

B. G. LI 05269: Hunan, Jianghua Co., Helukou Gongshe [region], Chuitou, Dengshan, alt. 1000 m; tree 8 m h., 40 cm d.b.h.; coll. Li Bing-Gui & Wan Shao-Bin, 1.11.1975. [In Chinese; PE]

S. C. LUO 018: Hunan, Xinning Co., Sun Huangshan; coll. Luo Shen-Chun, 23.7.1979. Xinning Forest Inst. [In Chinese; PE]

J. S. YING 0002: Guangxi, Longsheng Co., Hua-Ping Forest Region, alt. 1340 m; tree 18 m h., 40 cm d.b.h.; coll. Ying Jun-Sheng, Sang Cheng-Gong & Li Liang-Qian, 17.10.1979. [In Chinese; PE: two specimens]

WEGER CA95/27: USA, California, Eldorado Co., Placerville, Institute of Forest Genetics, Eddy Arboretum; alt. 840 m; coll. Jan Weger (Prague, Czech Rep.), 24.10.1995; grafted tree 30 years old. Mother plant from Univ. of Washington Arboretum, Seattle, originated from seeds collected in "northern upland of Kwangtung Province, about 1000 m alt.", obtained from China in 1940 [Herbarium of the RILOG, including a unnumbered specimen from Seattle collected in 1972.]

Pinus wangii* subsp. *varifolia

Fragments, presented by Prof. Phan Ke Loc, deposited in the Herbarium of the RILOG:

AVERYANOV & HIEP, AN-4957: Cao Bang Province, Tra Linh district, Quoc Toan municipality, 22°45'34"N, 106°18'46"E, summit of limestone hill, alt. c. 1000 m; coll. L. V. Averyanov & N. T. Hiep, 24.5.1997.

AVERYANOV & PHAN KE LOC, CBL-748: Cao Bang Province, Ha Lang district, Duc Quang municipality, Lung Hoai village, 22°41'23"N, 106°40'14"E, on limestone ridge at alt. c. 1000 m [at maximum of slightly more than 800 m]; coniferous closed forest community with the dominance of *Pseudotsuga brevifolia* W. C. Cheng & L. K. Fu.; coll. L. V. Averyanov & Phan Ke Loc, 28.11.1998.

Pinus orthophylla

F. A. McCLURE 719: Hainan, Hung Mo Tung, summit of Hung Mo, above Fan Ta; tree 13 m h., 1 m trunk circ.; 22.8.1929. Det. as *P. morrisonicola* Hayata by E. D. Merrill (Herb. No. 18253); later as *P. fenzeliana* Hand.-Mazz. and finally (23.10.1956) as *P. kwangtungensis* Chun. [PE]

N. K. CHUN 44092: Hainan, Wu-Zhi Shan, 3000 ft. [\cong 900 m]; 21.10.1932. Without determination on the original label; indicated as paratype *P. kwangtungensis* Chun ex Tsiang. [PE]

N. K. CHUN 44197: Hainan, Wu-Zhi Shan, 6000 ft. [\cong 1830 m]; 28.10.1932. Without determination on the original label; indicated as paratype *P. kwangtungensis* Chun ex Tsiang. [PE]

Herb. PE 1954 No. 598: Hainan, Wu-Zhi Shan, the main peak, 1500-1760 m; trees 5-25 m h., trunk diam. 40-100 cm; coll. "Group 1954 of Herb. PE", 8.11.1954. Det. as "*Pinus huanglingensis* Chun" [meant *P. kwangtungensis* Chun ex Tsiang] by S.Q. Chen & C.J. Wang, Mar. 1955. [In Chinese; PE]

P. L. Army 1974 No. 1744: Hainan, Qiong-Zhong Co., Wu-Zhi Shan, Er Fon (the second highest peak); coll. "P.L. Army Coll. Group", 28.12.1974. Det. as *P. kwangtungensis* Chun by K.S. Zhou, Nov. 1976. [In Chinese; PE]

Pinus eremitana

PHAN KE LOC 4482: Vietnam, Ha Son Binh [Province], Mai Chau, Pa Co; trees 20 m h. or more with 50 cm trunk diam. or more, of pure zonal occurrence or mixed with broadleaved woody plants on limestone ridges or steep eastern slopes; coll. Phan Ke Loc & Vu Ngoc Long, 12.11.1981. Det. as *P. kwangtungensis* Tsiang. [HNU: 2 specimens]

NGUYEN HGHIA THIN 982: Vietnam, Ha Son Binh [Province], Mai Chau, Pa Co, alt. 1400 m; trees 20-25 m h. on top of a limestone hill; coll. Nguyen Nghia Thin, 11.4.1982. Det. as *P. kwangtungensis* Tsiang. [HNU: 3 specimens of four individua, all without cones]

N. T. HIEP & L. T. CHAN 400: [Vietnam,] Prov. Hoa Binh, Mai Chau, Pa Co, alt. 900-1500 m; arbre 20-30 m de haut; 24.11.1991. [HN: 4 specimens (one det. as the next spec.)]

N. T. HIEP 400 [?]: [Vietnam,] Prov. Hoa Binh, Mai Chau, Pa Co, alt. 1300 m, ... calcaire; Oct. 1991. Det. as *P. kwangtungensis* Tsiang by P. K. Loc & N. T. Hiep, 3.12.1991. [HN]

Pinus parviflora subsp. *pentaphylla*

T. NAKAI, s. n.: Japan, Hokkaido, Hidaka, Mt Apoi; Apr. 1928. [TI]

J. MURATA & al. 2312: Japan, Honshu, Gumma Pref., Tano-gun, Ueno-mura, Hamadaira – Mt Suwayama, alt. 1300 m; coll. J. Murata, Y. Tateishi & K. Midorikawa, 28.7.1976. [TI]

P. wallichiana subsp. *wallichiana*

BŘEZINA IN96/2: India, Uttar Pradesh, Garhwal Himal, Uttarkashi region, about 5 km E of Gangotri, valley bottom; alt. 3300 m; 30°59'30" N, 78°59'E; coll. Boleslav Březina (Praha, CZ), 26.6.1996; middle old tree. [R. Businský Herb.]

JENÍK & JIČÍNSKÁ, s. n.: India, Jammu, Pir Panjal range, N slopes; alt. c. 2000 m; coll. J. Jeník & D. Jičínská (Praha, CZ), Mar./Apr. 1987. [R. Businský Herb.]

Pinus dalatensis subsp. *dalatensis* var. *dalatensis*

DESCHAMPS [s.n., s.d.]: [Annam,] Yang Sin, alt. 2400 m, 50 km Sud est d'Ban Methuot, pin en mélange avec *Fokienia Hodginsii*; without date. Paratype of *P. dalatensis*, det. by Y. de Ferré in 1960. [P]

V. N. LONG 205: [Vietnam,] Prov. Daklac, Mt Chu Yang Sinh; 6.12.1993. [HN]

Unnumbered material (more specimens) of several trees: Vietnam, Dac Lac and Lam Dong Prov. border, Chu Yang Sinh massif, alt. above 2000 m; coll. N. C. Lam & al., Jan. 1994. Only specimens of typical trees are included. [Institute of Tropical Biology, Ho Chi Minh City]

Pinus dalatensis* subsp. *dalatensis* var. *bidoupensis

E. POILANE 32581: Annam, sud de la pro. du Darlac, massif du Chu Yang Sinh, sol granitique médiocre bien que couvert de vieille forêt, 1800 m alt.; 24.4.1941. Conifère de 10 à 12 m de h., t. de 2 m de circ. Paratype of *P. dalatensis*, det. by Y. de Ferré in 1960; det. as *P. kwangtungensis* Chun ex Tsiang by L. K. Fu & N. Li, 28.9.1995. [P]

Pinus dalatensis* subsp. *procera

A. CHEVALIER 38353: Annam, Thua Luu, Forêt de Duông; coll. Service forestier, 14.5.1918. The oldest determination: “Pin du groupe de *Pinus parviflora*, *Pinus Fenzeliana* ?, mais rameau pubescent, Y. de Ferré”. [P]

V. X. PHUONG 375: [Vietnam,] Gia lai - Kong tum [province], Dak Lay, Ngoc linh; 21.3.1978. Det. as *P. dalatensis* by N. T. Hiep, 24.11.1992. [HN - 3 specimens]

V. X. PHUONG 381: [Vietnam,] Gia lai - Kong tum [province], Dac lay, Ngoc linh; 21.3.1978. Det. as *P. dalatensis* by L. K. Bien, 19.4.1979. [HN]

See: Businský, 1999a.

From *Pinus morrisonicola*, *P. uyematsui* and *P. wallichiana* subsp. *bhutanica* only type specimens were examined from older herbarium material.

2. Herbarium material collected

Herbarium material collected by the author is cited below (excluding the type collections) uniformly according to specimen labels with the following abridgements. Neither are the collection numbers preceded by the name ‘R. Businský’, nor the collection dates by the entry ‘coll. Roman Businský’ in the following list and in figures. Collection numbers marked with an asterisk represent samples evaluated statistically (this applies also to the type samples of both new species shown without an asterisk in the main text). Repeated parts of the collection data referring to localities and dates of the parallel samples are also omitted. The abbreviation ‘t.c.’ in brief descriptions of sampled trees means a trunk circumference at 1.3 m height; ‘diam.’ refers to the crown’s maximum diameter. Abbreviations of the institutional herbaria where the specimens will be deposited are given in brackets.

Pinus wangii* subsp. *wangii

43113*: China, Yunnan, Wenshan Prefecture, Malipo Co., NE ridge of deforested karstic hill approx. 1.3 km SSW of Tiechang; solitary tree on rocky ridge, beginning steep N declivity; alt. 1580 m; 23°21'50"N, 105°02'05"E (GPS); 27.7.1996; tree: 90 cm t.c., 6 m h., 7 m diam., branched from base, old. [B, BM, G, MO, P]

43114*: China, Yunnan, Wenshan Prefecture, Malipo Co. – at E boundary of Xichou Co., karstic hills more than 1 km NW of Tai-ping-chieh, the top of the ‘Northern hill’; rocky top of limestone hill with dense low woods; alt. 1550 m; 23°24'50"N, 104°58'50"E (GPS); 28.7.1996; tree: 105 cm t.c., 9 m h., 11 m diam., branched from base; old. [G, MO]

43115*: *the same coll. data, but* – tree: 80 cm t.c., 8 m h., straight trunk; rather old. [BM, G, K, P]

43116*: *the same coll. data, but* – tree: 80 cm t.c., 7 m h., straight trunk; rather old. [G, K, MO, PR]

43117*: *the same region, but* – E slope of the ‘Southwestern hill’; single tree on steep rocky slope of limestone hill with low woods; alt. 1550 m; 23°24'45"N, 104°58'45"E (GPS); 29.7.1996; tree: 130 cm t.c. & 5 lateral trunks from base, 10 m h., very old. [B, G, MO, P]

43118*: *the same region & date, but* – N slope of the ‘Southern hill’; partly deforested steep rocky slope of limestone hill; alt. 1530 m; 23°24'40"N, 104°58'50"E (GPS); tree: 70 cm t.c., 8.5 m h., straight trunk, middle aged. [G, MO]

43119*: China, Yunnan, Wenshan Prefecture, Malipo Co., the deforested karstic hill approx. 1.5 km N of Tiechang; solitary tree on steep rocky SW slope of limestone hill; alt. 1500 m; 23°23'15"N, 105°02'00"E (GPS); 30.7.1996; tree: 160 cm t.c., 8 m h., 11 m diam., very old. [B, BM, G]

48112: China, Yunnan, Wenshan Prefecture, Malipo Co., karstic hill approx. 3 km ESE of Xiajinchang above the road to Babu (betw. km 29 & 30); single tree on rocky, lowly woody S slope of limestone (the "Middle") hill; alt. 1700 m; 23°10'11"N, 104°49'46"E (GPS); 19.7.1999; tree: 130 cm t.c. at 1 m, 8 m h., 10 & 12 m diam., branch from base, old.

48113: *the same locality & date, but* – group of young trees on rocky shrubby N ridge of limestone (the "Middle") hill; alt. 1720 m; 23°10'19"N, 104°49'45"E (GPS); tree: 30 cm t.c. at 0.5 m, 3 m h., 3.3 m diam., branched from base, young.

48114: *the same locality & date, but* – group of young trees on rocky shrubby NE ridge of limestone (the "Middle") hill, E exposure; alt. 1670 m; 23°10'25"N, 104°49'47"E (GPS); tree: 33 cm t.c., 6 m h., branched from 2 m, young & slender.

48115: *the same locality, site & date, but* – no side exposure; tree: 57 cm t.c., 6 m h., 6.5 m diam., rather young with a umbrella-like crown.

Pinus wangii* subsp. *kwangtungensis

39117*: China, Guangdong – N corner, Lechang Co., right flank of gorge in upper part of valley descending to SW approx. 8 km E of Jiufeng; steep rocky lateral SE ridge with sparse vegetation, S exposure; alt. 1000 m; 25°20'30"N, 113°26'00"E; 6.1.1994; tree: 145 cm t.c., 8 m h., old. [BM, G, MO, P]

39118*: *the same locality, site & date, but* – SE exposure; alt. 1030 m; tree: 80 cm t.c., 6 m h.

39119*: *the same locality, but* – rocky saddle between cliffs of lateral SE ridge; NE exposure; alt. 1050 m; 7.1.1994; tree: 130 cm t.c., 9 m h., old. [K, PR]

39120*: *the same locality & date, but* – steep rocky lateral E ridge together with *P. massoniana* & sparse vegetation; alt. 1090 m; tree: 180 cm t.c., 14 m h., old.

39122*: *the same locality & date, but* – steep rocky S declivity, together with *Pinus massoniana* & sparse vegetation; alt. 1110 m; tree: 75 cm t.c., 9 m h., young.

39123*: *the same locality, site & date, but* – alt. 1100 m; tree: 110 + 70 cm t.c., 9 m h.

39127*: China, Hunan – SE corner at Guangdong border, Rucheng Co., N ridge of boundary mountain 1652 m h.; steep rocky NE declivity, together with *Pinus hwangshanensis*; alt. 1470 m; 25°22'30"N, 113°27'00"E; 9.1.1994; tree: 90 cm t.c., 9 m h., rather old.

39130*: China, Guangdong – N corner, Lechang Co., right flank of gorge in upper part of valley descending to SW approx. 8 km E of Jiufeng; lateral rocky ridge of wooded E slope, NW exposure; alt. 930 m; 25°21'00"N, 113°27'00"E; 11.1.1994; tree: 180 cm t.c., 8 m h., branched from base, very old. [K]

Pinus wangii* subsp. *varifolia

46125*: China, Guangxi – SW part, Tiandeng Co., limestone rocky hill at SE outskirts of Tiandeng town; isolated tree on rocky slope above cliff of NE exposure; alt. 520 m; 23°04'35"N, 107°08'27"E (GPS); 31.8.1998; tree: 250 cm t.c., 17 m h., 18 m diam., very old. [B, BM, G, HN, K, MO, P, PR]

Pinus orthophylla

39104*: China, Hainan island – central part, Wuzhi Shan mountains – NW ridge of the main massif (1867 m), W stony declivity below the ridge; in dense mixed forest at bottom limit of species occurrence, together with *Pinus fenzeliana*; alt. 1050 m; 18°54'40"N, 109°41'20"E; 24.12.1993; tree: 150 cm t.c., 13 m h., young.

39105: *the same region, but* – W below the rock face of SW peak of the main massif; rocky ridge of SW inclination with low mixed forest; alt. 1710 m; 18°54'00"N, 109°41'40"E; 25.12.1993; tree: 135 cm t.c., 10 m h.

39106: *the same region & date, but* – the main peak (1867 m), near the summit on beginning SW declivity; on rocky top of mountain among shrubby vegetation; alt. 1860 m; 18°54'20"N, 109°42'20"E; tree: 55 cm t.c., 4 m h., dwarf.

39107*: *the same locality, site & date, but* – S near the summit on beginning steep SE declivity; alt. 1855 m; tree: 95 cm t.c., 5 m h., dwarf, old.

39108*: *the same region & date, but* – the rock face of SW peak of the main massif; steep rock of NW exposure with sporadic dwarf trees; alt. 1780 m; 18°54'00"N, 109°41'40"E; tree: 110 cm t.c., 5 m h., branch from base, dwarf.

39110*: *the same region, but* – N slopes of the main massif, rocky slope of W ridge on right side of NW forest valley; in dense mixed forest on steep S stony declivity; alt. 1200 m; 18°54'40"N, 109°42'00"E; 27.12.1993; tree: 320 cm t.c., 21 m h., very old. [B, G, MO, P]

39111*: *the same region & date, but* – NW ridge of the main massif, W stony declivity below the ridge; in dense mixed forest at bottom limit of species occurrence, together with *P. fenzeliana*; alt. 1040 m; 18°54'40"N, 109°41'20"E; tree: 120 cm t.c., 17 m h. [BM]

Pinus eremitana

39131*: N – Vietnam, Son La Prov. – E border near Ha Son Binh Prov., karstic hills approx. 1.5-2 km W of Pa Co village NW of Mai Chau, top of the 'Eastern hill'; rocky top ridge of limestone hill with dense low woods; alt. 1480 m; 20°45' N, 104°53' E; 31.1.1994; tree: 200 cm t.c., 8 m h., 15 m diam., old. [B, BM, K, MO, P]

39132*: *the same locality, but* – below top of the 'Eastern hill'; W exposure; 1.2.1994; tree: 280 cm t.c., 13 m h., 16 m diam.; very old. [BM, G, HN, K, P]

39134*: *the same locality & date, but* – NW exposure; tree: 180 cm t.c., 8 m h.; old. [B, BM, G, HN, K, P]

39135*: *the same locality & date, but* – N exposure; tree: 180 cm t.c., 12 m h., 15 m diam.; old. [B, BM, G, K, MO, P, PR]

39136*: *the same locality & date, but* – top ridge of the 'Eastern hill'; tree: 27 cm t.c., 4 m h.; young. [BM]

39137*: *the same locality, but* – ridge of the 'Western hill'; NW exposure; 2.2.1994; tree: 85 cm t.c., 9 m h.; rather old. [BM]

39138*: *the same coll. data, but* – tree: 125 cm t.c., 11 m h. [B, BM, G, HN, K, MO, P, PR]

39139*: *the same locality & date, but* – the top of the 'Western hill'; alt. 1500 m; tree: 150 cm t.c., 7 m h., 9 m diam.; old. [BM]

39140*: *the same coll. data, but* – tree: 180 cm t.c., 9 m h., 14 m diam.; very old. [B, BM, G, HN, K, MO, P]

Pinus parviflora subsp. *parviflora*

32103*: Japan, Kyushu, Kagoshima Pref., Tarumizu, Takakuma mts. – W slope; single tree on rocky rib of SW inclination in dense mixed forest; alt. 860 m; 31°28'30" N, 130°48'30" E; 30.10.1991; tree: 170 cm t.c., c. 16 m h., a few hundred years old.

45152*: Japan, Shikoku, Ehime Prefecture, Ishizuchi-san (1982 m) mt. region, the ridge E near Joju Temple approx. 3 km NNE of the elev. point 1982 m; single tree on steep SE declivity top of NE ridge, together with *Chamaecyparis obtusa*, *Abies homolepis*, *Tsuga sieboldii* & *Quercus mongolica*; alt. 1370 m; 33°47'16" N, 133°08'03" E (GPS, Tokyo); 22.9.1997; tree: 190 cm t.c., 16 m h., old.

45153*: Japan, Shikoku, Ehime Prefecture, Mt Ishizuchi-san (1982 m) – NE ridge approx. 1.5 km NNE of the elev. point 1982 m; single tree on N ridge, together with *Tsuga sieboldii*, *Abies homolepis*, *Chamaecyparis obtusa*, *Fagus crenata*, *Acer australe* & *Betula* sp.; alt. 1360 m; 33°46'38" N, 133°07'26" E (GPS, Tokyo); 23.9.1997; tree: 215 cm t.c., 19 m h., old.

45154*: *the same locality & date, but* – approx. 1.1 km NNE of the elev. point 1982 m; group of low trees on rock of NW exposure, together with *Chamaecyparis obtusa* & *Enkianthus* sp.; alt. 1580 m; 33°46'24" N, 133°07'24" E (GPS, Tokyo); tree: 125 cm t.c., 8 m h., old.

45155*: *the same locality & date, but* – approx. 0.9 km NE of the elev. point 1982 m; group of trees on rocky rib of N exposure, together with *Chamaecyparis obtusa*, *Abies homolepis* & *Enkianthus* sp.; alt. 1650 m; 33°46'19" N, 133°07'18" E (GPS, Tokyo); tree: 165 cm t.c., 11 m h., very old.

45156*: *the same region, but* – Mt Ishizuchi-san (1982 m) – summit crest between the elev. points 1974 & 1982 m; narrow rocky crest, NE exposure; alt. 1960 m; 33°45'56" N, 133°06'59" E (GPS, Tokyo); 24.9.1997; tree: 140 cm t.c., 4 m h., 6 m diam., short & old.

45157*: *the same locality, site & date, but* – no side exposure, together with *Abies veitchii* var. *shikokiana*, *Betula* sp. & *Sorbus commixta*; alt. 1955 m; 33°45'55" N, 133°07'00" E (GPS, Tokyo); tree: 55 cm t.c. at 1 m, 4 m h., short.

45158: *the same locality, site & date, but* – summit crest about 100 m SE of the elev. point 1982 m; together with *Abies veitchii* var. *shikokiana* & *Enkianthus perulatus*; alt. 1980 m; 33°45'49" N, 133°07'07" E (GPS, Tokyo); dwarf tree branch from the base, 4 m diam.

45159*: *the same region & date, but* – Mt Ishizuchi-san (1982 m) – E ridge approx. 1.2 km E of the elev. point 1982 m; sparse trees on grassy S declivity of ridge, together with *Abies homolepis* in low *Sasa* undergrowth; alt. 1650 m; 33°45'44" N, 133°07'49" E (GPS, Tokyo); tree: 180+100 cm t.c., 7.5 m h., 11 m diam.

45160*: *the same locality & date, but* – approx. 1.5 km E of the elev. point 1982 m; group of trees on grassy S declivity of ridge, together with *Abies homolepis* & *Fagus crenata* in low *Sasa* undergrowth; alt. 1600 m; 33°45'41" N, 133°08'03" E (GPS, Tokyo); tree: 80 cm t.c., 5.5 m h., rather old, branch from the base.

45161*: Japan, Shikoku, Kochi Prefecture, Shikoku mountains, Mt Bingamori (1896 m) – S ridge, on beginning SE lateral ridge of the elev. point 1710 m at E side of road bend; steep rocky E declivity, together with *Abies homolepis*, *Fagus crenata* & *Tsuga sieboldii* (sporadic); alt. 1570 m; 33°46'42" N, 133°11'45" E (GPS, Tokyo); 25.9.1997; tree: 160 cm t.c., 11 m h., old.

45162*: Japan, Shikoku, Kochi Prefecture, Shikoku mts., Bingamori (1896 m) mt. region, Mt Takanosu-yama (about 7 km E of the elev. point 1896 m), at mountain road in glen on S slope; steep rocky SW declivity, together with *Abies homolepis*, *Quercus* sp., *Fagus crenata* & *Tsuga sieboldii*; alt. 1350 m; 33°46'57" N, 133°16'40" E (GPS, Tokyo); 26.9.1997; tree: 120 cm t.c., 14 m h., old.

Pinus parviflora* subsp. *pentaphylla

45101*: Japan, Hokkaido, Hidaka mountains, Mt Tokachi-dake (1457 m) – bottom of S ridge; narrow rocky ridge of SSW exposure, together with *Abies sachalinensis*; alt. 580 m; 42°16'07" N, 143°05'05" E (GPS, Tokyo); 3.8.1997; tree: 150 cm t.c., 12.5 m h., old.

45102*: *the same coll. data, but* – tree: 95 cm t.c., 12 m h., middle aged.

45103*: *the same coll. data, but* – tree: 95 cm t.c., 11 m h., middle aged.

45104*: *the same locality, site & date, but* – beginning SE declivity; alt. 600 m; 42°16 09 N, 143°05 06 E (GPS, Tokyo); tree: 125 cm t.c., 17 m h., old.

45105*: Japan, Hokkaido, Hidaka mountains, valley SW of Mt Rakko-dake (1472 m), rocky elevation at bottom of NE ridge approx. 2.8 km SW of elev. point 1472 m; together with *Abies sachalinensis*; alt. 500 m; 42°15 10 N, 143°05 25 E (GPS, Tokyo); 6.8.1997; tree: 225 cm t.c. at 0.5 m (2 trunks from 1 m), 13 m h., very old.

45106*: *the same coll. data, but* – tree: 130 cm t.c., 16 m h., old.

45107*: *the same coll. data, but* – tree: 170 cm t.c., 20 m h., old.

45112: Japan, Hokkaido, Hidaka mountains, massif Tokachi-dake (1457 m) – bottom of SW ridge approx. 5 km SW of elev. point 1457 m; rocky SE rib, beginning E declivity, together with *Abies sachalinensis*; alt. 370 m; 42°15 00 N, 143°03 10 E (GPS, Tokyo); 9.8.1997; tree: 95 cm t.c., 15 m h., middle aged.

45113*: *the same locality & date, but* – rocky S rib; alt. 390 m; tree: 135 cm t.c., 14 m h., old.

45114*: *the same locality & site, but* – 11.8.1997; tree: 110 cm t.c., 13.5 m h., middle aged.

45115: *the same coll. data, but* – tree: 90 cm t.c., 13.5 m h., middle aged.

45116: *the same locality, but* – headland of SW ridge approx. 6 km SW of elev. point 1457 m; narrow rib of S inclination, together with *Abies sachalinensis*; alt. 340-360 m; 42°14 45 N, 143°01 55 E (GPS, Tokyo); 14.8.1997; mixture specimen from rather young trees with 70-90 cm t.c. & 12-17 m h.

45117*: *the same region, but* – SW of Mt Tokachi-dake (1457 m) in bottom of valley with road No. 236 at Miyama bridge, on E side of main brook on gentle W slope at confluence with left lateral brook; alt. 230 m; 42°14 53 N, 143°01 07 E (GPS, Tokyo); 15.8.1997; tree: 55 cm t.c., 12 m h., young.

45128*: Japan, Honshu, Nagano Prefecture, Hida mountains, Kamikochi region, in valley between Tokusawa hut & Yokoo hut at bottom of W ridge of Mt Nagakabe-yama; foot of steep rocky SSW declivity, together with *Pinus koraiensis*, *Tsuga diversifolia*, *Thuja standishii*, *Picea jezoensis* var. *hondoensis* & *Abies homolepis* (sporadic); alt. 1630 m; 36°16 37 N, 137°41 50 E (GPS, Tokyo); 31.8.1997; tree: 245 cm t.c., 27.5 m h., old.

45129*: *the same locality & date, but* – steep rocky S declivity, together with *Pinus koraiensis*, *Tsuga diversifolia*, *Thuja standishii* & *Picea jezoensis* var. *hondoensis*; alt. 1660 m; 36°16 38 N, 137°41 50 E (GPS, Tokyo); tree: 205 cm t.c., 24 m h., old.

45130: *the same locality & date, but* – steep S declivity under rocky rib, together with *Pinus koraiensis*, *Tsuga diversifolia* & *Thuja standishii*; alt. 1660-1720 m; 36°16 40 N, 137°41 52 E; coll. Ludmila Businská; mixture specimen from old trees with 140-180 cm t.c.

45131*: *the same region, but* – in valley at confluence about 2 km N of Yokoo hut at bottom of SW ridge of Mt Naka-yama; steep SW declivity of S rocky rib, together with *Tsuga diversifolia*, *Thuja standishii* & *Pinus koraiensis*; alt. 1750 m; 36°18 43 N, 137°42 05 E (GPS, Tokyo); 1.9.1997; tree: 185 cm t.c., 19 m h., old.

45137*: Japan, Honshu, Nagano Prefecture, Hida mountains, Takase dam lake – above E shore near tunnel orifice about 1 km S of dam; rocky rib of W inclination, together with *Tsuga diversifolia*, *Pinus koraiensis* & *Acer* sp.; alt. 1320 m; 36°27 42 N, 137°41 22 E (GPS, Tokyo); 12.9.1997; tree: 120 cm t.c., 16.5 m h., rather old with dense conic crown.

45138*: *the same region & date, but* – Eboshi-dake (2628 m) mt. area, Tateone ridge W above Takase dam; steep rocky N rib, together with *Tsuga diversifolia*, *Betula* sp., *Pinus koraiensis* & *Picea jezoensis* var. *hondoensis*; alt. 1970 m; 36°28 20 N, 137°40 17 E (GPS, Tokyo); tree: 210 cm t.c., 16 m h., very old.

45140: Japan, Honshu, Toyama Prefecture, Hida mountains, Kurobe dam lake region, Mt Funakubo-dake (2459 m) – lateral rib descending to N from E ridge; narrow rocky rib of NW inclination, together with *Tsuga diversifolia*, *Thuja standishii*, *Abies mariesii* & *Pinus*

koraiensis; alt. 1950-2050 m; 36°30'57"-31°05' N, 137°41'13"-20' E; 14.9.1997; mixture specimen from trees with 100-240 cm t.c. & 10-18 m h.

45141*: *the same locality, site & date, but* – without assoc. of *Thuja standishii*; alt. 2030 m; 36°30'59" N, 137°41'19" E (GPS, Tokyo); tree: 205 cm t.c., 17 m h., very old.

45142: *the same region, but* – Mt Funakubo-dake (2459 m) – foot of steep N-NE slopes; together with *Pinus koraiensis*, *Tsuga diversifolia*, *Larix kaempferi* & *Thuja standishii*; alt. 1750-1820 m; 36°31'13"-21' N, 137°40'35"-55' E; 15.9.1997; mixture specimen from four trees.

45143: *the same region, but* – Kurobe dam lake – on NE rib above W shore approx. 4.2 km SSW of dam, N near Dairanokoya hut; together with *Tsuga diversifolia* & *Thuja standishii*; alt. 1460 m; 36°31'45" N, 137°38'35" E; 16.9.1997; tree: 290 cm t.c., 19 m h., very old.

45144: *the same locality & date, but* – N rocky declivity of rib; alt. 1450 m; 36°31'45" N, 137°38'30" E; mixture specimen from trees with 200-250 cm t.c.

45145*: *the same region & date, but* – on E rib above W lake shore 2 km SSW of dam; rocky rib, together with *Thuja standishii*, *Tsuga diversifolia* & *Pinus koraiensis* (sporadic); alt. 1520 m; 36°32'47" N, 137°39'26" E (GPS, Tokyo); tree: 165 cm t.c., 20 m h., old.

Pinus morrisonicola

32128: Taiwan, Taichung Co., Kukuan, S slope of Tachia river valley, the headland above river bend between Dragon Valley and NE part of Kukuan village; a steep rocky slope of S inclination above the river; alt. 730 m; 24°12'30" N, 121°00' E; 20.11.1991; tree: 250 cm t.c., old.

32129: *the same locality, but* – rocky connecting ridge of the headland ...; W exposure; alt. 800 m; 24°12'45" N, 121°00' E; 21.11.1991; tree: 330 cm t.c., about 30 m h., old. [G, K, MO, P]

32130: *the same locality & site as 32128, but* – alt. 750 m; 22.11.1991; tree: 200 cm t.c.

32134: *the same locality, site & date, but* – alt. 800 m; tree: 135 cm t.c., 19 m h. [K, P]

Pinus uyematsui

32160: Taiwan, Kaohsiung Co., lower part of N lateral ridge of Kuan Shan massif (3666 m) above Southern Cross-Island Highway; in dense predominantly broadleaved forest on steep W slope; alt. 2220 m; 23°17' N, 120°54'20" E; 13.12.1991; tree: 370 cm t.c., 34 m h.; old. [B, G, K, MO, P, PR, TAI]

32168: Taiwan, Taitung Co.-NW corner, among bends of Southern Cross-Island Highway on S headland of the peak about 3600 m high; in dense mixed forest of N exposure; alt. 2100 m; 23°14'30" N, 120°58'40" E; 16.12.1991; tree: 330 cm t.c., 33 m h.; old. [B, G, K, P, TAI]

32169: *the same coll. data, but* – tree: 280 cm t.c., 28 m h.; old. [G, K, MO, P]

Pinus ×hayatana

32161: Taiwan, Kaohsiung Co., lower part of N lateral ridge of Kuan Shan massif (3666 m) near below Southern Cross-Island Highway about 1 km of Tienchih; in mixed forest on steep slope of NW inclination; alt. 2210 m; 23°17' N, 120°54'40" E; 13.12.1991; tree: 360 cm t.c., 23 m h.; old. [B, P]

32162: *the same locality, but* – on stony ridge of N inclination; 14.12.1991; tree: 280 cm t.c., 20 m h.; old. [G, K, MO, TAI]

Pinus dalatensis subsp. *dalatensis* var. *dalatensis*

24108: Vietnam, Lam Dong Prov., Dalat, Trai Mat (Ap Da Phuoc) village sit. 7 km E of Dalat centre, around brook in a steep rocky valley descending to S approx. 1 km S of the road from

Dalat to Don Duong; alt. 1470 m; 11°56 00 N, 108°30 05 E (the type locality); 20.11.1986; tree: 155 cm t. c., 23 m h. (trunk 15 m h.).

Pinus dalatensis* subsp. *dalatensis* var. *bidoupensis

39151: Vietnam, Lam Dong and Thuan Hai Prov. border NE of Dalat, Bi Doup (2287 m) mt. region, W slopes of massif 2010 m sit. 6 km SE of Bi Doup, 1,1 km W of elev. point 1978 m; dense mixed forest of W inclination, together with *Pinus krempfii* & *Fokienia hodginsii*; alt. 1860 m; 12°02 20 N, 108°41 50 E; 15.2.1994; tree: 440 cm t. c., 30 m h., 22 m diam., very old; first-year shoots pubescent.

39152: *the same locality, but* – 1,2 km W of elev. point 1978 m; alt. 1850 m; tree: 270 cm t. c., 24 m h., 16 m diam., old.

39158: *the same region, but* – about 1 km WNW of elev. point 1978 m; dense mixed forest on a flat ridge, together with *Pinus krempfii*, *Fokienia hodginsii* & *Dacrycarpus imbricatus*; alt. 1880-1895 m; 12°02 30 N, 108°41 50-55 E; 16.-17.2.1994; mixture of cones from 11 trees from group of c. 30 trees with (60)150-300(450) cm t. c. & 20-30 m h.

39159: *the same locality, but* – alt. 1895 m; 12°02 30 N, 108°41 55 E; 17.2.1994; tree: 240 cm circ., 23.5 m h., 17 m diam., old.

39161: *the same locality, but* – 1.2 km WNW of elev. point 1978 m; alt. 1880 m; 12°02 30 N, 108°41 47 E; tree: 470 cm t. c., c. 25 m h., 27 m diam., very old.

Pinus dalatensis* subsp. *procera

44101: Vietnam, Gia Lai - Kon Tum Prov. (N corner), Ngoc Linh (2598 m) mt. region, Dak Glei (Dak Pek), Mt Ngok Niay (2259 m) - NW ridge; in mixed forest on a narrow ridge of N inclination; alt. 2060 m; 15°02 24 N, 107°49 45 E (GPS); 23.1.1997; tree: 150 cm t.c., 20 m h., middle aged.

44102: *the same locality, but* – in mixed forest on a steep NE declivity below the ridge; alt. 2050 m; 15°02 25 N, 107°49 45 E (GPS); coll. Ludmila Businská, 23.1.1997; mixture of cones from 3 old trees.

44103: *the same region, but* – Mt Ngok Niay - N near the summit; among shrubby vegetation on a top ridge in beginning E declivity; alt. 2250 m; 15°02 30 N, 107°50 05 E (GPS); 25.1.1997; tree: 30 cm t.c., 6 m h., young, already fertile.

44104: *the same region, but* – Mt Ngok Niay - main N top ridge; in low shrubby forest on a mountain ridge; alt. 2240 m; 15°02 32 N, 107°50 07 E (GPS); 25.1.1997; tree: 480 cm t.c., 11 m h., 30 m diam., very old.

44105: *the same locality, but* – 15°02 33 N, 107°50 08 E (GPS); coll. Ludmila Businská, 25.1.1997; mixture of cones from 5 old trees.

44106: *the same locality, but* – tree: 100 cm t.c., 9.5 m h., middle aged.

44107: *the same region, but* – Mt Ngok Niay - S ridge; in low shrubby forest at flat saddle on a mountain ridge; alt. 2160 m; 15°02 20 N, 107°49 54 E (GPS); 25.1.1997; tree: 740 cm t.c., 18 m h., 28 m diam., very old.

44108: *the same locality, but* – group of 4 young trees among bamboo & shrubby (formerly burnt) vegetation on a ridge; alt. 2160 m; 15°02 18 N, 107°49 54 E (GPS); 26.1.1997; tree: 45+40 cm t.c., 7 m h., young.

44109: *the same locality, but* – tree: 87+45 cm t.c., 10 m h., young, already fertile.

44110: *the same region, but* – Mt Ngok Niay - NW ridge; in mixed forest on a narrow mountain ridge; alt. 2120 m; 15°02 23 N, 107°49'50"E (GPS); 26.1.1997; tree: 450 cm t.c., 22 m h., trunk hollow, very old.

44111: *the same locality, but* – in mixed forest on a narrow ridge of NNW inclination; alt. 2070 m; 15°02'24"N, 107°49'46"E (GPS); 26.1.1997; tree: 340 cm t.c., 28 m h., old.

- 44112:** *the same locality, but* – coll. Ludmila Businská; tree: 350 cm t.c., 22 m h., trunk hollow, very old.
- 44113:** *the same locality, but* – in mixed forest on a mountain ridge; alt. 2020 m; 15°02'30"N, 107°49'40"E; 26.1.1997; mixture of cones from 3 old trees with 300-350 cm t.c., c. 30 m h.
- 44115:** *the same locality, but* – in mixed forest on a ridge of N-S bearings; alt. 1920 m; 15°02'45"N, 107°49'30"E (GPS); 27.1.1997; mixture of cones from 5 old trees with 300-400 cm t.c., c. 25 m h.
- 44116a:** *the same region, but* – Mt Ngok Niay - W slopes of NW ridge; in mixed forest on elevation of a lateral W ridge; alt. 1720 m; 15°02'50"N, 107°48'55"E (GPS); 28.1.1997; tree: c. 400 cm t.c., c. 25 m h., trunk hollow, very old.
- 44116b:** *the same locality, but* – below elevation of a lateral W ridge, S to W exposure; mixture of cones from 3 old trees with 300-450 cm t.c., 25-30 m h.
- 44117:** *the same locality, but* – SW exposure; coll. Ludmila Businská; tree: 350 cm t.c., 28 m h., very old.
- 44118:** *the same locality, but* – 15°02'48"N, 107°49'00"E (GPS); 28.1.1997; tree: 300 cm t.c., 29 m h., old; first-year shoots wholly glabrous.
- 44119:** *the same locality, but* – on elevation of a lateral W ridge; alt. 1730 m; 15°02'50"N, 107°49'03"E (GPS); 29.1.1997; tree: 390 cm t.c., 27 m h., very old.

Pinus wallichiana* subsp. *wallichiana

- 41101:** Pakistan, Northern Areas (Gilgit), Nanga Parbat (8126 m) mt. region – SE side, Rupal valley, N declivity under left lateral moraine of Bazhin Glacier; last upper population of the species in the valley; an old overgrown stony mound of N exposure; alt. 3400 m; 35°12'N, 74°40'E; 16.10.1994; tree: 220 cm t.c., 17 m h., middle aged.
- 41102:** *the same region, but* – Rupal valley, old lateral moraine above right bank of the river opposite to upper settlement of Rupal village; woody riverside N declivity, together with *Abies pindrow*; alt. 3200 m; 35°12'30"N, 74°41'E; 18.10.1994; tree: 170 cm t.c., 20 m h., middle aged.
- 41103:** *the same region, but* – Tarshing valley, lower N slopes S opposite to Tarshing village; a steep (40°) stony & rocky N declivity, together with *Picea smithiana* & above with *Abies pindrow*; alt. 3000-3200 m; 35°13'N, 74°44'E; 19.10.1994; mixture specimen from middle aged & old trees 15-30 m h.
- 41104:** *the same region, but* – E side, middle Astor valley, right side of the valley appr. 23.5 km E of the elev. point 8126 m; a steep W rocky slope above river; alt. 2500-2530 m; 35°13'35"N, 74°51'E; 21.10.1994; mixture specimen from trees with maximum 240 cm t.c. & 30 m h.
- 41119:** *the same region, but* – N side, upper Raikot valley, left side of the valley SW above pastures called Fairy Meadows; low trees max. about 20 m h. in mountain mixed forest together with *Betula jacquemontiana*; alt. 3430 m, near upper limit of occurrence; 35°22'30"N, 74°35'E; 29.10.1994; tree: 110 cm t.c., 16 m h., middle aged (leaves almost straight, 7-12 cm long & 0.95-1.2 mm wide when fresh).
- 41120:** *the same locality & date, but* – mountain mixed forest together with *Betula jacquemontiana* & sporadic *Picea smithiana*; alt. 3330 m; tree: 300 cm t.c., 32 m h., old.
- 41121:** *the same locality & date, but* – mountain coniferous forest together with *Picea smithiana*; alt. 3300 m; mixture specimen from old trees.
- 41122:** *the same region & date, but* – left side of the valley above Raikot Glacier S of pastures called Fairy Meadows; pine forest on old lateral glacial moraine; alt. 3430 m; 35°21'N, 74°35'E; tree: 19 cm t.c., 200 m h., rather old {leaves straight, (5-)6-9(-10) cm long & 0.96-1.25 mm wide when fresh}.

41124: *the same region, but* – middle Raikot valley, left near small gorge of the river about 3 km S of Thatto village, under the path to upper valley; NE rocky declivity at the valley bottom; alt. 2730 m; 35°24'30"N, 74°36'E; 31.10.1994; tree: 190 cm t.c., 22 m h., middle aged.

41128: Pakistan, Punjab, Islamabad region, Murree Hills, above the road from Murree to Barian approx. 2.5 km N of Kuldana Chowk crossroads; woody NW slope of 30°; alt. 2000 m; 33°56'N, 73°24'E; 5.11.1994; tree: 260 cm t.c., 28 m h., old {leaves pendulous, (12-)15-21(-22) cm long & 0.75-0.97 mm wide when fresh}.

41129: Pakistan, North-West Frontier Province, Hazara, Abbottabad region, Ayubia National Park, woody NE rib in top of the valley NE of Ayubia; in mixed forest on limestone rib descending to NE, together with *Abies pindrow* & *Quercus*; alt. 2100-2200 m; 34°02'N, 73°25'E; 6.11.1994; mixture specimen from middle aged trees w. 200-250 cm t.c., 25-40 m h.

Pinus wallichiana* subsp. *bhutanica

33108: China, Xizang (Tibet), Nyingtri Prefect. & Co., lower Lang Ho valley about 1 km of the confluence with Yigong Zangbo river, slopes above road on left side of the valley; in mixed forest on a steep slope of SW exposure; alt. 2100 m; 30°01'30"N, 95°00'E; 18.7.1992; tree: 20 m h., rather young.

33109: *the same locality, site & date, but* – alt. 2180 m; tree: 140 cm t.c., 28 m h.

33111: *the same region, but* – lower Lang Ho valley about 5 km of the confluence with Yigong Zangbo river, slopes above road on left side of the valley; in mixed forest on a steep rocky slope of S exposure; alt. 2200 m; 30°01'N, 94°58'E; 19.7.1992; tree: 100 cm t.c., 21 m h.

33114: *the same region, but* – lower Lang Ho valley between Dongjug and the confluence with Yigong Zangbo river, at km 4115 of road (No. 318) on bottom of the valley on left riverside; alt. 2370 m; 30°00'30"N, 94°54'E; 20.7.1992; tree: 120 cm t.c., 19 m h. [G]

57109: India, Arunachal Pradesh, West Kameng district, Tawang region, in valley c. 1 km WNW of Tawang Monastery; isolated tree on rock above SW steep woody rocky precipice; among broadleaved trees; alt. 2780 m; 27°35'30"N, 91°50'51"E (GPS); 21.5.2004; tree: 230 cm t.c., 26 m h., old.

57110: *the same region, but* – rocky slope c. 0.7 km NW opposite to Tawang Monastery; steep rocky S slope with shrubs & sparse trees; together with *Tsuga dumosa* & *Quercus*; alt. 2890 m; 27°35'32"N, 91°51'10"E (GPS); 23.5.2004; tree: 210 cm t.c., 23 m h., old; leaves to 24 cm, cones to 22 cm long.

57111: *the same region, but* – rocky rib c. 0.7 km WNW of Tawang Monastery; upper part of steep rocky S-SE slope; together with *Tsuga dumosa*; alt. 2750 m; 27°35'23"N, 91°51'04"E (GPS); 24.5.2004; mixture collection from middle aged or rather old trees with 140-210 cm t.c.

57112: *the same locality, but* – upper part of steep rocky S slope; alt. 2750 m; 27°35'23"N, 91°51'03"E (GPS); 25.5.2004; tree: 140 cm t.c., 19 m h., middle aged. [G, P]

57113: *the same region, but* – SW slope c. 1 km WNW of Tawang Monastery; steep rocky slope (60°) with mixed wood; alt. 2770 m; 27°35'25"N, 91°50'53"E (GPS); 26.5.2004; tree: 210 cm t.c., 19 m h., middle aged, two trunks from 4 m.

57116: India, Arunachal Pradesh, West Kameng district, Dirang region, N slopes of main valley 2 km SE of Dirang; partly felled wood on NE slope with sparse older pines and ' ' (GPS); 3.6.2004; tree: 230 cm t.c., 21 m h., rather old.

57118: *the same region, but* – left side of Shangti valley 3.5 km NE of Dirang, above Namthung village; partly felled wood on steep rocky W slope (45°) with sparse trees of *Pinus wallichiana* subsp. *bhutanica*, *P. roxburghii* & *Quercus*; alt. 1640 m; 27°22'30"N, 92°16'17"E (GPS); 5.6.2004; mixture collection from middle aged trees with 130-200 cm t.c.

- 57119:** *the same region, but* – left side of Shangti valley 3 km E of Dirang, S near Namthung village; foot of steep rocky W slope c. 10 m above river, mixed wood with major proportion of oaks; alt. 1560 m; 27°22'03"N, 92°16'13"E (GPS); 5.6.2004; tree: 335 cm t.c., 29 m h., old.
- 57120a:** *the same region, but* – E slopes of right side of Shangti valley 3 km NE of Dirang; partly felled wood on steep stony E slope (40°) with pines of various age and young oaks; alt. 1720-1730 m; 27°22'26"N, 92°15'56"E (GPS); Roman Businský, 6.6.2004; four middle aged trees with 150-240 cm t.c.
- 57120b:** *the same locality, site & date, but* – alt. 1720 m; tree: 510 cm t.c., 34 m h., very old.
- 57121:** *the same region, but* – left side of main valley 4 km NW of Dirang; felled mixed wood on stony SW slope with only young trees; alt. 1770 m; 27°23'20"N, 92°13'03"E (GPS); 10.6.2004; young tree: 130 cm t.c., 12 m h., c. 25 years.
- 57124:** *the same region, but* – SE slope of hill 1.5 km NW of Dirang above road towards Tawang; probably wild scattered trees (this taxon commonly occurs wild in neighbourhood) together with young oaks among planted growth of c. 30-year-old trees of *P. kesiya* & *P. roxburghii*, ESE declivity of c. 40°; alt. 1710 m; 27°22'14"N, 92°14'11.5"E (GPS); 17.6.2004; young tree: 125 cm t.c., 14 m h., c. 30 years.
- 57126:** India, Arunachal Pradesh, West Kameng district, Bomdila region, left side of lateral valley 3 km S of Rupa; rocky NE rib on E slope with partly felled mixed wood; alt. 1700 m; 27°11'03"N, 92°23'54"E (GPS); 21.6.2004; tree: 150 cm t.c., 16 m h., c. 60 years; cones to 30 cm long.
- 57127:** *the same region, but* – W above river confluence S below Bomdila, 1.5 km NE of Rupa; solitary tree on partly deforested rocky NE rib of c. 35° inclination; alt. 1560 m; 27°12'46"N, 92°24'50"E (GPS); 22.6.2004; tree: 235 cm t.c., 28 m h., old. [P]
- 57128:** *the same region, but* – Rupa, foot of W slope at SE margin of the village; scattered young trees on deforested lower slopes of valley; alt. 1500 m; c. 27°12'N, 92°24'15"E; 22.6.2004; young tree with c. 100 cm t.c.; leaves up to 40 cm long! [G]

R. Businsky

A revision of the Asian *Pinus* subsection *Strobus* (*Pinaceae*)

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APPENDIX II. – Statistical and biometrical data

Table A. Statistical data for the seven taxa based on the six quantitative characters evaluated: a – average, mean; d – standard deviation; e – standard error of mean; g – range of all values (min. to max. average value of individuals); m – median; n – number of measurements (of trees evaluated); v – coefficient of variation [%].

<i>Pinus wangii</i> subsp.:			<i>Pinus</i>	<i>Pinus parviflora</i> subsp.:		<i>Pinus</i>
<i>wangii</i>	<i>kwangtungensis</i>	<i>varifolia</i>	<i>eremitana</i>	<i>parviflora</i>	<i>pentaphylla</i>	<i>orthophylla</i>
LEAF LENGTH (mm)						
a = 44.90 n = 210 (7) d = 13.715 e = 0.9464 v = 30.54	a = 43.63 n = 190 (6) d = 8.737 e = 0.6338 v = 20.03	a = 41.86 n = 80 (1) d = 7.493 e = 0.8377 v = 17.90	a = 36.94 n = 320 (10) d = 7.680 e = 0.4293 v = 20.79	a = 36.26 n = 300 (10) d = 7.209 e = 0.4162 v = 19.88	a = 41.64 n = 390 (13) d = 7.035 e = 0.3562 v = 16.89	a = 69.49 n = 170 (4) d = 10.739 e = 0.8236 v = 15.45
LEAF WIDTH (mm)						
a = 1.233 n = 210 (7) d = 0.156 e = 0.0108 v = 12.63	a = 1.314 n = 190 (6) d = 0.149 e = 0.0108 v = 11.33	a = 1.227 n = 60 (1) d = 0.166 e = 0.0214 v = 13.50	a = 0.984 n = 310 (10) d = 0.096 e = 0.0054 v = 9.74	a = 1.070 n = 300 (10) d = 0.147 e = 0.0085 v = 13.74	a = 0.982 n = 390 (13) d = 0.127 e = 0.0064 v = 12.90	a = 1.080 n = 200 (5) d = 0.097 e = 0.0069 v = 8.97
LEAF CURVATURE (angle degree)						
a = 93.03 n = 175 (7) d = 32.883 e = 2.4857 v = 35.35	a = 74.53 n = 200 (8) d = 28.265 e = 1.9986 v = 37.93	a = 84.08 n = 60 (1) d = 33.730 e = 4.3545 v = 40.11	a = 37.28 n = 325 (10) d = 19.089 e = 1.0589 v = 51.21	a = 34.67 n = 305 (10) d = 18.72 e = 1.0718 v = 53.99	a = 42.27 n = 400 (13) d = 19.462 e = 0.9731 v = 46.04	a = 25.14 n = 180 (5) d = 19.530 e = 1.4557 v = 77.69
SEED WING LENGTH (mm)						
a = 13.49 n = 126 (6) d = 2.065 e = 0.1840 v = 15.31	a = 11.30 n = 136 (7) d = 2.173 e = 0.1863 v = 19.23	a = 5.69 n = 20 (1) d = 1.755 e = 0.3924 v = 30.84	a = 8.07 n = 188 (8) d = 3.019 e = 0.2202 v = 37.42	a = 4.96 n = 257 (11) d = 1.467 e = 0.0915 v = 29.55	a = 12.15 n = 252 (13) d = 2.035 e = 0.1282 v = 16.75	a = 14.03 n = 89 (4) d = 1.643 e = 0.1741 v = 11.71
SEED CORPUS % OF SEED LENGTH						
m = 42.0 n = 126 (6) g = 21.3 (39.2-49.6)	m = 47.95 n = 132 (7) g = 23.3 (38.9-51.7)	m = 62.15 n = 20 (1) g = 22.6	m = 55.35 n = 188 (8) g = 32.5 (41.1-61.6)	m = 67.5 n = 257 (11) g = 32.6 (50.9-83.5)	m = 43.45 n = 252 (13) g = 21.1 (32.7-53.8)	m = 36.4 n = 85 (4) g = 20.6 (29.5-39.9)
CONE SCALE LENGTH / WIDTH RATIO						
m = 1.36 n = 140 (6) g = 0.880 (1.20-1.50)	m = 1.205 n = 180 (8) g = 0.790 (0.97-1.41)	m = 1.19 n = 20 (1) g = 0.270	m = 1.09 n = 194 (10) g = 0.810 (0.99-1.30)	m = 0.98 n = 182 (11) g = 0.48 (0.77-1.25)	m = 1.14 n = 330 (16) g = 0.740 (0.84-1.58)	m = 1.50 n = 162 (6) g = 1.050 (1.31-1.74)

Table B. Summary of values of the main quantitative characters of the Asian species of *Pinus* subsect. *Strobi* (* range of individual average values only).

Character:	<i>P. eremitana</i>	<i>P. wangii</i> s. lat.	<i>P. parviflora</i> s. lat.	<i>P. morrisonicola</i>
leaf length [mm]	(20-)30-45(-65)	(15-)30-60(-80)	(20-)25-55(-60)	(40-)55-75(-95)
leaf width [mm]	(0.72-)0.85-1.15(-1.28)	(0.85-)0.95-1.5(-1.75)	(0.7-)0.75-1.3(-1.45)	(0.75-)0.85-1.05(-1.2)
cone length [cm]	(4-)5-7(-9)	(3-)4-10(-11)	(4-)5-10(-12)	7.5-13
cone scale l/w ratio*	0.99-1.30	0.97-1.5	(0.88-)0.95-1.31	1.12-1.28
seed corpus length [mm]	6.7-12.7	7.8-12.8	(6.7-)8-12.5	7.7-12.8
wing length [mm]	3.5-16.2	4-18	2-19	6.5-18
seed corpus %* of seed length	41-62	39-65	36-75	38-48
Character:	<i>P. orthophylla</i>	<i>P. uyematsui</i>	<i>P. dalatensis</i>	<i>P. wallichiana</i> s. lat.
leaf length [mm]	(40-)55-80(-90)	(40-)60-85(-100)	(30-)50-110(-140)	(60-)100-240(-280)
leaf width [mm]	(0.83-)0.95-1.25(-1.35)	(0.7-)0.8-1.0(-1.15)	(0.5-)0.65-1.1(-1.25)	(0.7-)0.8-1.2(-1.3)
cone length [cm]	(4-)6-10(-12)	8-18	(5.5-)9-20(-23)	(11-)15-25(-30)
cone scale l/w ratio*	1.31-1.74	1.76-2.02	(1.41-)1.5-2.0(-2.06)	(1.22-)1.35-1.85(-2.1)
seed corpus length [mm]	5.7-8.7(-10)	6.8-8.4	6.7-10.5	(6.2-)7-9.5
wing length [mm]	11.2-19.2	15-30	(11.5-)14-27(-29)	(14-)20-30(-35)
seed corpus %* of seed length	29-46	24-29	23-36	21-33

Biometrical values of the type specimens of *Pinus orthophylla* (R. Businsky' 39116):

av. = average

- **leaves:** length of leaves (40-)55-80(-89) mm, width of leaves (0.88-)1.0-1.1(-1.2) mm, number of teeth per middle centimetre of length 10-26, number of stomatal lines on ventral sides (4)5-7(8);
- **cones** [values from 42 cones]: length of cones 6.5-9 cm, number of cone scales 40-65, length/width of the largest scales (two longest and two widest ones per cone) 28-32 / 17-19 mm, average length/width ratio of the largest scales 1.63;
- **seeds** [ranges and average values from 50 seeds]: overall seed length 17.6-26.4 / av. 22.0 mm, percentage of seed corpus length of total seed length 26.2-34.6 / av. 29.5 %, length of seed corpus 5.7-7.5 / av. 6.5 mm, width of seed corpus 2.6-3.3 / av. 2.8 mm, length/width ratio of seed corpus 1.87-2.63 / av. 2.28, length of the thickening of wing base 2.7-4.0 / av. 3.3 mm, percentage of the length of the thickening compared with the seed corpus length 46.2-55.3 / av. 50.8 %, length of wings (including the thickening) 11.9-19.2 / av. 15.8 mm, width of wings 4.5-6.9 / av. 5.7 mm, length/width ratio of wings 1.92-3.84 / av. 2.85.

Biometrical values of the type specimens of *Pinus eremitana* (R. Businsky' 39133):

- **leaves:** length of leaves (20-)30-40(-45) mm, width of leaves (0.78-)0.85-1.02(-1.13) mm, number of teeth per middle centimetre of length 10-23, number of stomatal lines on ventral sides (4-)5-6(-8);
- **cones** [values from 32 cones]: length of cones 5-6.5 cm, number of cone scales 40-55, length/width of the largest scales (two longest and two widest ones per cone) 22-25 / 21-24 mm, average length/width ratio of the largest scales 1.11;

– **seeds** [ranges and average values from 25 seeds]: overall seed length 16.6-24.3 / av. 19.2 mm, percentage of seed corpus length of total seed length 50.2-65.1 / av. 55.6 %, length of seed corpus 9.2-12.6 / av. 10.6 mm, width of seed corpus 4.3-5.4 / av. 4.8 mm, length/width ratio of seed corpus 1.94-2.58 / av. 2.20, length of the thickening of wing base 1.3-1.9 / av. 1.7 mm, percentage of the length of the thickening compared with the seed corpus length 10.3-20.5 / av. 15.9 %, length of wings (including the thickening) 6.3-12.0 / av. 8.5 mm, width of wings 6.5-7.4 / av. 6.9 mm, length/width ratio of wings 0.91-1.66 / av. 1.23.
