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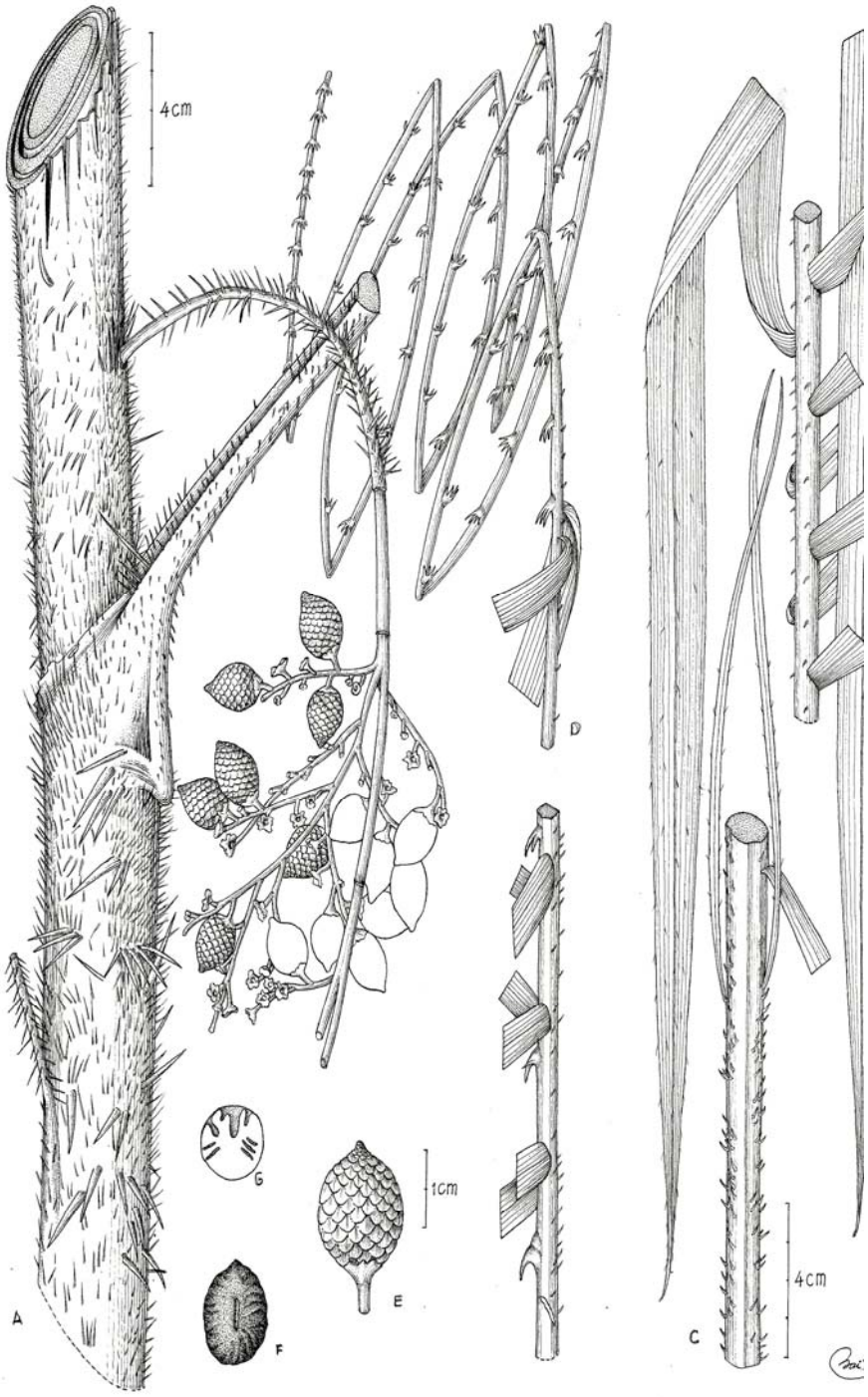

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KEY AND CHECKLIST OF XANTHOPHYLLUM (POLYGALACEAE) OF BORNEO

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ABSTRACT
DE WILDE, W.J.J.O & DUYFJES, B.E.E. 2009. Key and checklist of *Xanthophyllum* (*Polygalaceae*) of Borneo. *Reinwardtia* 13(1): 79–86. — A key to and a check list of the 56 *Xanthophyllum* (*Polygalaceae*) species of Borneo is presented. One species is newly described, *X. albicaulis*. *Xanthophyllum hildebrandii* is sunk in *X. ellipticum*.

Key words: Borneo, check list, new species, *Polygalaceae, Xanthophyllum*

ABSTRAK
DE WILDE, W.J.J.O. & DUYFJES, B.E.E. 2009. Kunci dan daftar *Xanthophyllum* (*Polygalaceae*) dari Borneo. *Reinwardtia* 13(1): 79–86. — Disajikan kunci dan daftar 56 jenis *Xanthophyllum* (*Polygalaceae*) dari Borneo. Dipertelakan satu jenis baru, *X. albicaulis*. *Xanthophyllum hildebrandii* dimasukkan dalam *X. ellipticum.*

Kata kunci : Borneo, daftar jenis, jenis baru, *Polygalaceae, Xanthophyllum*

INTRODUCTION

Since the publication of *Xanthophyllum* Roxb. (*Polygalaceae)* for Flora Malesiana (Van der Meijden, 1988) and for the Tree Flora of Sabah & Sarawak (De Wilde & Duyfjes, 2007) the study of additional material from Borneo, notably that from Kalimantan in the Leiden Herbarium, permitted the description of one more new species: *X. albicaulis* W.J. de Wilde & Duyfjes.

The 2007 treatment for Sarawak and Sabah recognized 55 species and 3 species, A, B, C, left unnamed, because of inadequate materials. Two keys were presented, one primarily using flower and fruit characters, and one mainly based on vegetative characters. In these keys, already in an early stage, a number of difficult to ascertain characters is used, *e.g.* (1) leaf papillose or non-papillose beneath, (2) number of axillary buds, (3) presence or absence of nodal glands, (4) position of leaf glands, and (5) number of ovules in the ovary.

Reconsidering these keys we have now framed one single new 'easy' key for fertile specimens, either in flower or in fruit, avoiding the above mentioned 'difficult' characters at least in the early couplets of the key.

For full descriptions and synonyms see Van der Meijden (1982, 1988), and De Wilde & Duyfjes (2005, 2007). A considerably part of the species is confined to Borneo, of which many are endemic to the region of Sabah, Sarawak, and Brunei, and only a few to Kalimantan. From Kalimantan 35 species are known, of which 4 are endemic: *X. albicaulis, X. inflatum, X. ionanthum,* and *X. rheophilum*; *X. petiolatum* is endemic to Brunei.

In this paper all Bornean species are enumerated with a brief indication of their occurrence.

For rarely collected species, especially from Brunei and Kalimantan, the specimens are cited.

The character-choice venation 'scalariform' versus 'reticulate' may cause some problems, but, as emphasized and explained by Van der Meijden (1982) it appeared sound and practical in almost all cases.

KEY TO THE SPECIES

Note. Whether the leaves are papillose or not beneath should be examined with a magnification of at least X 25.

1. a. Leaf intercostal venation (in part of the leaf) scalariform (sometimes only visible in places in small-leaved forms of *X. flavescens*, occasionally difficult to ascertain in coriaceous leaves of *X. ferrugineum*, *X. flavescens*, and *X. rhizocarpum*).....…2
   b. Leaf intercostal venation reticulate (venation sometimes ± scalariform in *X. subcoriaceum* and *X. tenue*) ……..……11
2. a. Leaves patently hairy beneath (at least on midrib), hairs 0.3–1 mm long ……..3

b. Leaves (thinly) minutely hairy beneath (hairs 0.2 mm or less), or glabrous ……..4
3. a. Leaves papillose beneath …….48. *X. rufum*
b. Leaves not (or indistinctly) papillose beneath ……..……..55. *X. velutinum*
4. a. Inflorescence branches (including rachis) thickish thickened, densely flowered, with pedicel-scars conspicuously raised and often densely packed..... ……...18. *X. havilandii*
b. Inflorescence branches not thickened, not densely flowered, pedicel-scars not or but a little raised….. ……..……...5
5. a. Plant flowering on the older wood…… ……..…….10. *X. contractum*
b. Plant flowering at or near the apex of the twigs, among the leaves ……..…….6
6. a. Leaves beneath pale, mostly papillose and finely appressed hairy. [Leaves 4–12 cm long.]..... ……..49. *X. schizocarpon*
b. Leaves beneath not papillose, glabrous or hairy… ……...7
7. a. Leaf midrib flattish beneath. Leaves 6–12.5 cm long …….45. *X. resupinatum*
b. Leaf midrib protruding beneath. Leaves small or large ……...8
8. a. Inflorescences unbranched. Fruit 3.5–4 cm diam ……..21. *X. inflatum*
b. Inflorescence mostly branched. Fruit 2 cm diam. or less…….……9
9. a. Flowers drying blackish. Ovary and fruit hairy on 4 ribs in apical half; hairs brown..... …….26. *X. macrophyllum*
b. Flowers drying grey or yellowish. Ovary glabrous, sparsely hairy, or hairs in 2 rows; hairs greyish ……..10
10. a. Pedicel 1–1.5(–4) mm long. Outer sepals sparsely minutely hairy ……. 15. *X. ferrugineum*
b. Pedicel (2–)4–10 mm long. Outer sepals (sparsely or) densely hairy ……..….16. *X. flavescens*
11. a. Plant flowering on the older wood. Leaves coriaceous. — Peat swamp and kerangas forest..... ……..……...42. *X. ramiflorum*
b. Plant flowering at or near the apex of the twigs, among the leaves. Leaves various……12
12. a. Leaves patently hairy beneath, at least on midrib (hairs (0.3–)0.5 mm long or more ……..13
b. Leaves glabrous beneath (hairs 0.2 mm long on midrib excepted) …….20
13. a. Sepals, pedicels, and rachis with hairs c. 1 mm long …….54. *X. trichocladum*
b. Sepals, pedicels, and rachis with hairs 0.5 mm long or less ……....14
14. a. Leaves bullate ……...46. *X. reticulatum*
b. Leaves not bullate …….…....15
15. a. Pedicels 5(–7) mm long or less ……..16
b. Pedicels 7–15 mm long ……..18
16. a. Twigs c. 1 mm diam. Inflorescence 1 cm long or less ……...6. *X. brachystachyum*
b. Twigs 1–3 mm diam. Inflorescence 2 cm long or more ……..……17
17. a. Twigs c. 1 mm diam., hairs pale, minute, 0.5 mm long (or less). Leaf base short-attenuate …… ..2. *X. albicaulis*
b. Twigs (1–)2–3 mm diam., hairs dark brown, c. 1 mm long. Leaf base subcordate or rounded……..……..……41. *X. purpureum*
18. a. Leaf base long-cuneate. Ovules 4 …….. ……22. *X. ionanthum*
b. Leaf base short-cuneate, rounded or subcordate. Ovules 8–12 ……...19
19. a. Leaves more than 10 cm long. Twigs 2–3 mm diam….. ……..….3. *X. beccarianum*
b. Leaves 4–10 cm long. Twigs 1–2 mm diam……..……..36. *X. pedicellatum*
20. a. Axillary buds extravagant in shape or position, clove-like or leaf-like or placed above leaf axils ……..……...21
b. Axillary buds less conspicuous, strictly axil lary, up to 10 mm long, ellipsoid or ovoid-oblong or long-triangular (at base sometimes with corky outgrowths in *X. penibukanense*)..... ……23
21. a. Axillary buds stalked for 1–2 mm, and inserted (1.5–)3–15 mm above the leaf axils..... ……...23. *X. korthalsianum*
b. Axillary buds sessile, inserted in the axils……..22
22. a. Axillary buds 6.5–12 mm long, clove-like shaped …….9. *X. clovis*
b. Axillar buds large and foliaceous, 10–20(–30) mm long ……...……..19. *X. heterophyllum*
23. a. Petiole long, (20 –) 25 – 40 mm long……..….24
b. Petiole shorter, 2–20(–25) mm long…….……..27
24. a. Petiole 2-coloured the distal part paler similar to the midrib of the blade ……..25
b. Petiole uni-coloured ……...26
25. a. Petiole 2–3 mm thick. Leaf blade pale cinnamon beneath, papillose ……..4. *X. bicolor*
b. Petiole, 1–2 mm thick. Leaf blade concolorous, not papillose ……....25. *X. longum*
26. a. Leaf base (broadly) cuneate, leaf not papillose beneath. Petiole transversely wrinkled ……8. *X. ceraceifolium*
b. Leaf base (broadly) rounded; leaf papillose beneath. Petiole not transversely wrinkled. — *Brunei* ……38. *X. petiolatum*
27. a. Leaves (blades) large, on the average more than 12 cm long …….28
b. Leaves small, on the average 10(–12) cm long or less ……47
28. a. Leaves linear, c. 6 times longer than wide ……..24. *X. lineare*
b. Leaves ovate, elliptic or oblong, 4(–5) times longer than wide or less ……29
29. a. Leaves (20–)25–40 cm long …….…….30
b. Leaves 20(–30) cm long or less……..31
30. a. Inflorescence branched. Petiole 10–20 mm long. Leaves not papillose beneath …….. ……1. *X. adenotus* (2 varieties)
b. Inflorescence unbranched. Petiole 10–12(–15) mm long. Leaves papillose beneat …….. ……...39. *X. pseudoadenotus*
31. a. Inflorescence branched ……..32
b. Inflorescence unbranched ……..34
32. a. Axillary buds appressed to the twigs, minutely hairy ……..44. *X. reflexum*
b. Axillary buds not appressed to the twigs, variably

hairy or glabrous ……...33
33. a. Leaves papillose beneath ……..20. ***X. impressum***
b. Leaves not papillose beneath. [Check also ***X. nitidum*** with leaves c. 10 cm long]……
……56. ***X. vitellinum***
34. a. Leaves pale (dull or glaucous) beneath …….35
b. Leaves ± concolourous ……..37
35. a. Ovary and fruit glabrous. Ovules 4……
……..5. ***X. borneense***
b. Ovary and fruit hairy. Ovules 8–16 ……..36
36. a. Petiole transversely wrinkled, gradually passing into the narrowly attenuate leaf base. Lower lateral veins usually reaching to over halfway the leaf ..……...37. ***X. penibukanense***
b. Petiole wrinkled or not, not gradually, but abruptly passing into the leaf base. Leaf base attenuate, rounded or cordate. Lower lateral veins not usually reaching to halfway the leaf.....
……..40. ***X. pulchrum***
37. a. Leaves drying green. Petiole short, to 5 mm long. Leaf base truncate-rounded or cordate. Fruit small …….. ……..52. ***X. tardicrescens***
b. Leaves drying green or (grey)brown. Petiole comparatively longer. Leaf base cuneate. Fruit small (1–3 cm diam.) or larger than 4 cm diam.
……38
38. a. Plant flowering ……...39
b. Plant not flowering but fruiting ……43
39. a. Flowers (especially sepals) not drying black
……40
b. Flowers (especially sepals) drying black……
……..……..41
40. a. Ovules 8–14 ……14. ***X. ellipticum***
b. Ovules 4 ……53. ***X. tenue***
41. a. Carina large, boat-shaped ……...31. ***X. obscurum***
b. Carina small, not boat-shaped ……...42
42. a. Ovary stipitate, stipe 2–3 mm long...……...
……..……13. ***X. ecarinatum***
b. Ovary subsessile ……14. ***X. ellipticum***
43. a. Fruit small, 3 cm diam. or less ……..44
b. Fruit large, 4 cm long (diam.) or more……...46
44. a. Fruit bluish-blackish, pericarp inside reddish
……14. ***X. ellipticum***
b. Fruit greenish or brown, pericarp inside not reddish ……45
45. a. Fruit 2–3 cm diam., with a c. 7 mm thick spongy or solid pericarp. [Flowers not known]…….
……33. ***X. pachycarpon***
b. Fruit c. 1.5 cm diam., pericarp thin.…53. ***X. tenue***
46. a. Fruit ± ellipsoid, coarsely wrinkled on drying ……...13. ***X. ecarinatum***
b. Fruit globose, not wrinkled on drying.....
……31. ***X. obscurum***
47. a. Fruit large, c. 4 cm diam. or more……..48
b. Fruit small, 2 cm diam. or less; or plant flowering
……51
48. a. Leaves light (green-)brown on drying. Fruit pear-shaped, c. 4 cm long, much wrinkled on drying
……7. ***X. brevipes***
b. Leaves dark brown on drying. Fruit usually larger, not wrinkled or but with a few wrinkles …49
49. a. Fruit ± ellipsoid, coarsely wrinkled on drying
……..…13. ***X. ecarinatum***
b. Fruit globose, smooth, not wrinkled ……..50
50. a. Fruiting pedicel thicker, 5–10 mm diam.……
…….……31. ***X. obscurum***
b. Fruiting pedicel narrower, 2–4 mm diam……
……50. ***X. stipitatum***
51. a. Leaves lanceolate-linear, c. 10 times longer than broad. — Rheophytic ...……....47. ***X. rheophilum***
b. Leaves broader ……...52
52. a. Inflorescence or infructescence branch .……53
b. Inflorescence or infructescence hardly branched or unbranched (or very few-flowered) …..……56
53. a. Leaves (usually) pale beneath (papillose or not papillose) ……..17. ***X. griffithii*** (2 varieties)
b. Leaves concolorous (not pale beneath, not papillose) ……...54
54. a. Leaves dull brownish on drying. Intercostal venation coarsely reticulate, areoles 1–5 mm diam…
……56. ***X. vitellinum*** (including ***X. species B*** from Sarawak)
b. Leaves glossy green-yellow or yellow on drying
……55
55. a. Intercostal venation sharply or faintly coarsely reticulate or venation ± scalariform. Ovary glabrous. Go back to ……..10
b. Intercostal venation sharply very finely reticulate, areoles c. 0.5 mm diam. Ovary hairy …….
……30. ***X. nitidum***
56. a. Inflorescence stout, axis 2–3 mm diam., erect. Leaves coriaceous ……57
b. Inflorescence more delicate, axis 1(–2) mm diam., not erect. Leaves coriaceous, subcoriaceous or membranous ……..58
57. a. Finer venation beneath faint and hardly raised.....
……11. ***X. crassum***
b. Finer venation beneath sharp and raised.....
…….....…...43. ***X. rectum***
58. a. Plant not fruiting, but flowering ……59
b. Plant fruiting, fruit small (2 cm diam. or less
……76
59. a. Leaves dark brown on drying. Flowers (especially sepals) blackish on drying [sepals occasionally bright (brown) in ***X. Ellipticum*****.....**
……60
b. Leaves green or pale brown on drying. Flowers bright (not black) on drying ……..64
60. a. Pedicel 2–6 mm long. Flowers solitary or (occasionally) 2 or 3 together. [Carina not boat-shaped] ……..61
b. Pedicel 5–15 mm long. Flowers or pedicel-scars solitary ……...63
61. a. Ovary (sub)sessile ……..62
b. Ovary stipitate, stipe 2–3 mm long …….
……...13. ***X. ecarinatum***
62. a. Leaves ± green on drying. [Fruit black, 1.5–2 cm diam.] .....14. ***X. ellipticum***
b. Leaves (dark) brown on drying. [Fruit brown, 1–1.4 cm diam.] ……...29. ***X. nigrican*****s**
63. a. Carina large, boat-shaped ……31. ***X. obscurum***
b. Carina smaller or absent, not boat-shaped……....
…….....….50. ***X. stipitatum***
64. a. Petiole comparatively short. Leaves green on dry-

ing. Leaf base rounded, truncate or cordate. Flowers in the raceme often 2 or 3 together ……..
……52. *X. tardicrescens*

b. Petiole short or longer. Leaves green or brown on drying. Leaf base rounded or cuneate. Flowers or pedicel-scars in the raceme (almost all) solitary ……65

65. a. Flowers or pedicel-scars numerous, (4 or) 5 or more, when flowers only 4 or 5, than pedicel 6 mm long or less ……66

b. Flowers or pedicel-scars few, 1–5(–6), when flowers 5 or 6 than pedicel 7 mm long or more…
……...73

66. a. Leaves pale beneath (± papillose) …….67

b. Leaves ± concolorous (not papillose)…….68

67. a. Ovary glabrous or ± hairy all over; subsessile ……...5. *X. borneense*

b. Ovary hairy; c. 1.5 mm stipitate……..……
……....12. *X. discolor*

68. a. Ovary ± black on drying. Ovules 8–14. Stamens triadelphous. Leaves often larger (4–20 cm long) ……...69

b. Ovary pale brown on drying. Ovules 4. Stamens ± free. Leaves small (12 cm long or less) ……...70

69. a. Leaves 5–20 cm long, green on drying. — Usually in lowland area ……14. *X. ellipticum*

b. Leaves 4–9 cm long, (green)brown on drying. — Montane Kinabalu area..…….27. *X. montanum*

70. a. Ovary hairy……71

b. Ovary (sub)glabrous ……..72

71. a. Leaves membranous, apex acute-acuminate …….28. *X. neglectum*

b. Leaves coriaceous, apex (sub)obtuse. — Sabah, Bt. Silam ……..*X. species A*

72. a. Ovary stipitate, style persistent after anthesis…..
……...51. *X. subcoriaceum*

b. Ovary sessile, style caduceus..……...53. *X. tenue*

73. a. Leaves papillose beneath, subsessile, petiole 1.5–3 mm long. Ovules 18. Branches of tree drooping. [Flowers 2–5. Ovary glabrous. Fruit 4–5 cm diam., wrinkled, black on drying] ……..
……7. *X. brevipes*

b. Leaves papillose or not papillose beneath, comparatively with longer petiole (2–6 mm long). Ovules 4. Branches of tree patent, not drooping. [Fruit c. 1 cm diam., greenish on drying]……..74

74. a. Raceme with 1–3 flowers. [Leaves papillose beneath, bright brown on drying. Ovary (fruit) hairy] ….....34. *X. parvifolium*

b. Raceme with 3–6 flowers ……..75

75. a. Leaves green on drying, papillose beneath. Ovary hairy ……35. *X. pauciflorum*

b. Leaves (bright) brown or green-brown on drying, not papillose beneath. Ovary glabrous (check also *X. subcoriaceum*) ……32. *X. ovatifolium*

76. a. Fruit black on drying, endocarp purplish. Axis of infructescence c. 1 mm diam …….
……..…14. *X. ellipticum*

b. Fruit green or brown on drying, when black, then axis of infructescence stouter, c. 2 mm diam.....
……77

77. a. Leaves dark brown on drying, concolorous, or sometimes grey bluish, papillose beneath. [Fruit c. 1.3 cm diam.] ……...29. *X. nigricans*

b. Leaves green, green brown or bright brown on drying ……78

78. a. Petiole comparatively short, 3.5–5 mm long. Leaf blade oblong, 7–16 cm long, base rounded, truncate or cordate. [Mature fruit not known] …….
……...52. *X. tardicrescens*

b. Petiole comparatively longer, 3.5–10 mm long. Leaf blade various of length and shape, base rounded or cuneate ……79

79. a. Leaves pale beneath (and papillose). [Ovules 4 or 8. Fruit 1–1.8 cm diam.] ……80

b. Leaves ± concolorous (concolorous, but papillose in *X. pauciflorum*) ……..81

80. a. Fruit glabrous or (sparsely) hairy. Ovary subsessile. Ovules 4 ……....5. *X. borneense*

b. Fruit (sparsely) hairy. Ovary c. 1.5 mm stipitate. Ovules 4 or 8 ……..…12. *X. discolor*

81. a. Leaves oblong. Fruit c. 1 cm diam. Ovules 8–12. — Mt. Kinabalu area; 900–1600 m…..…..…..…..
……27. *X. montanum*

b. Leaves ovate, elliptic, or oblong. Fruit 1–1.8 cm diam. Ovules 4. — Lowland or montane, including Mt. Kinabalu ……82

82. a. Leaves on the average c. 6 cm long or less. Inflorescence with 1–5 flowers. — Three species: 32**.** *X. ovatifolium* [leaves not papillose beneath, dull brownish-greenish above, ovary glabrous, fruit not known]; *34. X. parvifolium* [leaves papillose beneath, shiny and yellowish or greenish-brown above, ovary appressed hairy, fruit 1–1.2 cm diam., sparsely appressed short-hairy]; 35. *X. pauciflorum* [leaves papillose beneath, (dull) green above, ovary roughly hairy, fruit 1–1.7 cm diam., glabrescent]. For flowering material of these species see above, with leads ……74 & 75

b. Leaves on the average more than 6 cm long. [Inflorescence with (4 or) 5 or more flowers].....
……...83

83. a. Ovary (densely) hairy. Fruit (sparsely) hairy, dull ……84

b. Ovary (sub)glabrous. Fruit glabrous, dull or glossy ……87

84. a. Leaves membranous or coriaceous, apex acute-acuminate ……..85

b. Leaves coriaceous, apex (sub)obtuse. — Sabah, Bt. Silam ……..*X. species A*

85. a. Axis of infructescence less than 1 mm diam. Fruit c. 1 cm diam., greenish ……..28. *X. neglectum*

b. Axis of infructescence 1–2 mm diam. Fruit 1.5–2 cm diam ……86

86. a. Fruit black, not wrinkled on drying. — Sabah ……...*X. species C*

b. Fruit light brown, wrinkled on drying……
……5. *X. borneense* (p.p.)

87. a. Fruit smooth, glossy. Style-base often subpersistent on growing ovary ……..51. *X. subcoriaceum*

b. Fruit ± wrinkled. Style early caduceus……..
……53. *X. tenue*

ENUMERATION OF *XANTHOPHYLLUM* SPECIES OF BORNEO

With each taxon the following is presented: References to pages in Van der Meijden in Flora Malesiana I, 10: 455–539 (1988) [indicated as FM], De Wilde & Duyfjes in Gard. Bull. Singapore 57: 47–61 (2005). [GBS], and De Wilde & Duyfjes in Tree Flora of Sabah and Sarawak 6: 219–295 (2007) [TFSS]. Only relevant synonyms are given.

1. XANTHOPHYLLUM ADENOTUS Miq. — FM: 515; TFSS: 235, f. 1.

Key to the varieties

A. Leaf base cordate or narrowly cordate, margin usually curved upwards……... ……...var. *adenotus* — TFSS: 236. — Sumatra, Borneo (Sabah, Sarawak, Brunei, and Kalimantan).

B. Leaf base (rounded or) cuneate, margin flat……. ……var. *arsatii* (C.E.C.Fisch.) W.J. de Wilde & Duyfjes — GBS: 47; TFSS: 236. — Endemic to Borneo: Sabah, Sarawak, Brunei, and Kalimantan.

2. **Xanthophyllum albicaulis** W. J. de Wilde & Duyfjes, *spec. nov.*

Xanthophyllo beccariano et *X. purpureo* similis, foliis ellipticis glabris praeter costam abaxialiter pilis minus quam 0.5 mm longis, laminae basi cuneate-attenuata differt. — Typus: *Elsener 221* (holo L), West Kalimantan.

Small tree. *Bark* grey-white, smooth. *Twigs* whitish, smooth, 1(–2) mm diam., densely minutely pale hairy, hairs c. 0.2 mm long, glabrescent. *Axillary buds* solitary, 1–2 mm long, short-hairy. *Leaves* discolorous, chartaceous, glabrous, except midrib; *petiole* 4–5 mm long, hairy, glabrescent, transversely wrinkled on drying; *blade* flat, green above, pale, papillose beneath, (narrowly) elliptic, 4.5–8 by 2–4 cm, base broadly cuneate, short-attenuate, apex acute-acuminate with narrowly rounded apex; midrib flat, abaxially densely hairy, hairs erect, pale brown c. 0.3 mm long; lateral veins 4–6, pinnate, indistinctly interarching; intercostals venation finely reticulate; glands inconspicuous, few or absent, c. 0.1 mm diameter. *Inflorescences* ± longer than the leaves, 4–6 cm long, unbranched, densely short-hairy, 6–12-flowered, flowers sometimes in pairs; bracts minute, caduceus. *Flowers*: pedicel 3–4 mm long, minutely hairy; outer and inner sepals about equal in length, 3–3.5 mm long, minutely hairy outside, glabrous inside; petals glabrous, creamy with pale lilac tinge, 11–12 mm long; stamens 8, filaments free, c. 12 mm long, glabrous, but very finely hairy at broadened base, anthers narrow, c. 1.5 mm long, glabrous; ovary ovoid, c. 3 mm long, 2 mm wide, c. 2 mm stipitate, densely patently brown-hairy, hairs 0.3–0.5 mm long, style 8 mm long, glabrous, stigma minute, ovules 8. *Fruit* not known.

Distribution. Only known from the type: West Kalimantan, Sanggau, in scrub in rubber-forest, altitude not recorded, flowering in February.

Collector's notes. Twigs grey-white, sepals brown-purplish toward the tips, and the petals cream-coloured, pale violet tinged.

3. XANTHOPHYLLUM BECCARIANUM Chodat — FM: 522; TFSS: 236. — Endemic to Borneo: Sabah, Sarawak, Brunei, Kalimantan.
4. XANTHOPHYLLUM BICOLOR W. J. de Wilde & Duyfjes — GBS: 48; TFSS: 238. — Endemic to Borneo: Sabah, Brunei.
5. XANTHOPHYLLUM BORNEENSE Miq. — FM: 508; TFSS: 239. — Endemic to Borneo: Sabah, Sarawak, and SE Kalimantan.

The distinction against *X. discolor* is not clear. Our notion that *X. borneense* comprises material with a glabrous as well as with a hairy ovary needs further confirmation as the materials for study are restricted. In Kalimantan the species is only known from the type, *Korthals s.n.*

6. XANTHOPHYLLUM BRACHYSTACHYUM W.J. de Wilde & Duyfjes — GBS: 49; TFSS: 241. —Endemic to Borneo: Sabah and Sarawak.
7. XANTHOPHYLLUM BREVIPES Meijden — FM: 536; TFSS: 241, f. 2, plate 7A. — Endemic to Borneo: Sarawak and Brunei.
8. XANTHOPHYLLUM CERACEIFOLIUM Meijden —FM: 517; TFSS: 242, f. 3, pl. 7B. — Endemic to Borneo: Sarawak; known only from few collections from the Semengoh Forest Reserve.
9. XANTHOPHYLLUM CLOVIS Meijden — FM: 517; TFSS: 244, f. 4. — Endemic to Borneo: Sabah, Sarawak, Brunei, and E Kalimantan.
10. XANTHOPHYLLUM CONTRACTUM Meijden —FM: 532; TFSS: 246. — Endemic to Borneo: Sarawak known from the type from Upper Rejang River, Belaga District (*Clemens 21664*), and from another collection from Ulu Katibas, Song District (*S 64876*). In Brunei, represented by one collection (*Hotta 13348*) from Temburong District.
11. XANTHOPHYLLUM CRASSUM W. J. de Wilde & Duyfjes — GBS: 50, f. 1; TFSS: 226. — Endemic to Borneo: Sabah, Bt. Tawai, where

known only from the type: *Sugau SAN 134307*.

12. XANTHOPHYLLUM DISCOLOR Chodat subsp. DISCOLOR — FM: 520; TFSS: 246, pl. 7C. — Peninsular Malaysia (Johor), Singapore, and Borneo (Sabah, Sarawak, and Kalimantan). Subsp. *micranthum* Meijden throughout The Philippines.
13. XANTHOPHYLLUM ECARINATUM Chodat — FM: 539; TFSS: 247. pl. 7D. — Endemic to Borneo: Sabah, Sarawak, Brunei, and Kalimantan.
14. XANTHOPHYLLUM ELLIPTICUM Korth. ex Miq. — FM: 530; TFSS: 248, f. 5. — Synonym: *X. hildebrandii* Meijden — FM: 532 — S Thailand, Sumatra, Peninsular Malaysia, Singapore, Borneo (Sabah, Sarawak, Brunei, and Kalimantan).
15. XANTHOPHYLLUM FERRUGINEUM Meijden — FM: 503; TFSS: 250. — Endemic to Borneo: Sabah, Sarawak, Brunei, and Kalimantan.
16. XANTHOPHYLLUM FLAVESCENS Roxb. — FM: 500; TFSS: 251, f. 6. — Synonym: *X. affine* Miq. — FM: 503. — Continental SE Asia (E India, Bangladesh, Myanmar, Thailand, Laos, Cambodia, Vietnam) and W Malesia: Sumatra, Peninsular Malaysia, Java, Borneo (the most common species; Sabah, Sarawak, Brunei, and Kalimantan) and The Philip pines. A widespread and very variable taxon.
17. XANTHOPHYLLUM GRIFFITHII A.W. Benn. — FM: 513; TFSS: 254. — SE Asia and Malesia. A widespread species.

Key to the varieties

A. Twigs at apex slender, c. 1 mm diameter or less, glabrous; branches of inflorescences finely hairy, glabrescent. Leaves (indistinctly) papillose or smooth beneath……..…….. ...var. *angustifolium* Ng — TFSS: 255. — Peninsular Malaysia and Borneo (Sabah, Sarawak and Brunei).
B. Twigs towards apex 1–2 mm diameter, hairy; branches of inflorescences hairy. Leaves distinctly papillose beneath……...var. *papillosum* W.J. de Wilde & Duyfjes — GBS: 52; TFSS: 255. — Endemic to Borneo: Sarawak, E Kalimantan.

Xanthophyllum griffithii subsp. *erectum* Meijden occurs in Peninsular Malaysia.

18. XANTHOPHYLLUM HAVILANDII Chodat —TFSS: 255. — Synonym: *X. hosei* Ridl. — FM: 502.— Endemic to Borneo: Sarawak and Brunei.
19. XANTHOPHYLLUM HETEROPHYLLUM Meijden — FM: 519; TFSS: 257, f. 7, pl. 8A. — Endemic to Borneo: Sabah, Sarawak, and Brunei.
20. XANTHOPHYLLUM IMPRESSUM Meijden — FM: 513; TFSS: 259. — Borneo (Sabah and E. Kalimantan) and The Philippines.
21. XANTHOPHYLLUM INFLATUM W. J. de Wilde & Duyfjes — GBS: 53. — Endemic to Borneo: Central Kalimantan, Barito River, known only from the type: *Ambriansyah AA 2772*.
22. XANTHOPHYLLUM IONANTHUM W.J. de Wilde & Duyfjes — GBS: 54. — Endemic to Borneo: West Kalimantan, known from only a few collections: *Susanto & Peters 1177* (type), *Suzuki K9720, K10071*.
23. XANTHOPHYLLUM KORTHALSIANUM Miq. — FM: 520; TFSS: 259. — A rare species, known from a few collections from C Sumatra and Borneo (Sarawak and SE Kalimantan). In Sarawak recorded from Bt. Raya, Kapit District (*S 24806*). Also occurring in SE Kalimantan (*Korthals s.n.*).
24. XANTHOPHYLLUM LINEARE (Meijden) W.J. de Wilde & Duyfjes — GBS: 55; TFSS: 260. — Synonym: *X. adenotus* Miq. var *lineare* Meijden — FM: 516. — Endemic to Borneo: Sabah, where known only from Bt. Silam, Lahad Datu District.
25. XANTHOPHYLLUM LONGUM W.J. de Wilde & Duyfjes — GBS: 55, f. 2; TFSS: 261. — Endemic to Borneo: Sabah, where it is known from the Kinabatangan and Tawau Districts.
26. XANTHOPHYLLUM MACROPHYLLUM Baker — FM: 507; TFSS: 261. — Endemic to Borneo: Sabah, Sarawak, Brunei, and W Kalimantan.
27. XANTHOPHYLLUM MONTANUM Meijden — FM: 532; TFSS: 262. — Sumatra (doubtful) and Borneo (Sabah). In Sabah confined to Mt. Kinabalu, Ranau District.
28. XANTHOPHYLLUM NEGLECTUM Meijden — FM: 509; TFSS: 263. — Endemic to Borneo: Sabah, Sarawak, Kalimantan.
29. XANTHOPHYLLUM NIGRICANS Meijden — FM: 508; TFSS: 264. — Endemic to Borneo: Sabah and Sarawak.
30. XANTHOPHYLLUM NITIDUM W.J. de Wilde & Duyfjes — GBS: 56; TFSS: 265. — Endemic to Borneo: Sabah and Kalimantan.
31. XANTHOPHYLLUM OBSCURUM A.W. Benn. — FM: 536; TFSS: 265. — S Thailand, Sumatra, Peninsular Malaysia, Singapore, Borneo (Sabah, Sarawak, Brunei, and Kalimantan).
32. XANTHOPHYLLUM OVATIFOLIUM Chodat — FM: 508; TFSS: 266. — Sumatra (doubtful) and Borneo (Sabah, Sarawak). In Sabah known

from one collection *Meyer & Leopold SAN 133095*; in Sarawak uncommon and known from the Kuching and Lundu Districts.

33. XANTHOPHYLLUM PACHYCARPON W.J. de Wilde & Duyfjes — GBS: 58; TFSS: 267. — Endemic to Borneo: Sabah, Sarawak, and W Kalimantan.
34. XANTHOPHYLLUM PARVIFOLIUM Meijden — FM: 510; TFSS: 268, f. 8. — Endemic to Borneo: Sarawak and Brunei.
35. XANTHOPHYLLUM PAUCIFLORUM Meijden — FM: 509; TFSS: 268. — Endemic to Borneo: Sarawak and Brunei.
36. XANTHOPHYLLUM PEDICELLATUM Meijden — FM: 522; TFSS: 270. — Endemic to Borneo: Sabah and Sarawak.
37. XANTHOPHYLLUM PENIBUKANENSE Heine — FM: 521; TFSS: 271, f. 9. — Endemic to Borneo: Sabah, Sarawak, Brunei, and E Kalimantan.
38. XANTHOPHYLLUM PETIOLATUM Meijden — FM: 517. — Endemic to Borneo: Brunei, Andalau Forest Reserve, where only known from the type, *Wood SAN 17480*.
39. XANTHOPHYLLUM PSEUDOADENOTUS Meijden — FM: 521, *p.p.* (*excl. syn.*); TFSS: 272. — Endemic to Borneo: Sarawak and Kalimantan.
40. XANTHOPHYLLUM PULCHRUM King — FM: 521; TFSS: 274. — Peninsular Malaysia and Borneo (Sabah, Sarawak, Brunei, and Kalimantan).
41. XANTHOPHYLLUM PURPUREUM Ridl. — FM: 522; TFSS: 275, f. 10. — Endemic to Borneo: Sabah, Sarawak, Brunei, and Kalimantan.
42. XANTHOPHYLLUM RAMIFLORUM Meijden — FM: 530; TFSS: 276, f. 11. — Endemic to Borneo: Sarawak, Brunei, and Kalimantan.
43. XANTHOPHYLLUM RECTUM W.J. de Wilde & Duyfjes — GBS: 59; TFSS: 278. — Endemic to Borneo, where it is known from Sarawak: Bako National Park and Sampadi Forest Reserve in the Kuching District.
44. XANTHOPHYLLUM REFLEXUM Meijden — FM: 519; TFSS: 278. — Endemic to Borneo, where it is known from Sarawak: Semengoh Forest Reserve.
45. XANTHOPHYLLUM RESUPINATUM Meijden — FM: 504; TFSS: 280. — Endemic to Borneo: Sabah, Sarawak, Brunei, and N & E Kalimantan.
46. XANTHOPHYLLUM RETICULATUM Chodat — FM: 523; TFSS: 281. — Endemic to Borneo: Sabah and Brunei.
47. XANTHOPHYLLUM RHEOPHILUM W.J. de Wilde & Duyfjes — GBS: 60. — Endemic to Borneo: Central Kalimantan, Barito Ulu, known only from the type: *Ridsdale PBU 97*.
48. XANTHOPHYLLUM RUFUM A.W. Benn. — FM: 505; TFSS: 282. — Sumatra, Peninsular Malaysia, Borneo (Sabah, Sarawak, Brunei, and Kalimantan).
49. XANTHOPHYLLUM SCHIZOCARPON Chodat — FM: 504; TFSS: 285. — Endemic to Borneo: Sabah, Sarawak, and Kalimantan.
50. XANTHOPHYLLUM STIPITATUM A.W. Benn. — FM: 533; TFSS: 285, f. 13. — Sumatra, Peninsular Malaysia, Borneo (Sabah, Sarawak, Brunei, and Kalimantan).
51. XANTHOPHYLLUM SUBCORIACEUM (Chodat) Meijden — FM: 509; TFSS: 287. — Endemic to Borneo: Sabah, Sarawak, Brunei, and Kalimantan.
52. XANTHOPHYLLUM TARDICRESCENS Meijden — FM: 510; TFSS: 289: — Endemic to Borneo: Sarawak and doubtful in Brunei.
53. XANTHOPHYLLUM TENUE Chodat — FM: 508; TFSS: 290, f. 14, pl. 8B. — Endemic to Borneo: Sabah, Sarawak, and Kalimantan.
54. XANTHOPHYLLUM TRICHOCLADUM Chodat — FM: 523; TFSS: 290, f. 15. — Endemic to Borneo: Sabah, Sarawak, and Kalimantan.
55. XANTHOPHYLLUM VELUTINUM Chodat — FM: 505; TFSS: 291. — Endemic to Borneo: Sabah, Sarawak, Brunei, and Kalimantan.
56. XANTHOPHYLLUM VITELLINUM (Blume) D. Dietr. — FM: 514; TFSS: 292. — Thailand, Sumatra, Peninsular Malaysia, Java, Borneo (Sabah, Sarawak, and Kalimantan), and The Philippines.

INSUFFICIENTLY KNOWN SPECIES

Xanthophyllum species A**.** — TFSS: 294. — Borneo: Sabah (Lahad Datu District, G. Silam (*SAN 98132*, *SAN 98164*, *SAN 98176*, *SAN 100814*, *SAN 100981*); Kinabatangan District, Imbak (*SAN 138170*); Keningau District, Nabawan Forest Reserve (*SAN 139139*), doubtful in The Philippines).

Xanthophyllum species B. — TFSS: 295. **—** Borneo: Sarawak, Kapit District, Bt. Raya (*S 23996*); Sri Aman District, Sg. Engkari (*S 69725*).

Xanthophyllum species C. — TFSS: 295. — Borneo: Sabah (Labuk Sugut District, Bt. Meliau (*SAN 39311*), Sg. Meliau (*SAN 99667*), Sg. Tinumbukan (*SAN 90482*); Sandakan District, Bt. Malawati (*SAN 46638*), Bt. Takunan (*SAN 92417*).

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