

Polyalthia yingjiangensis sp. nov (Annonaceae) from the China/Myanmar border

Bine Xue, De-Ping Ye, Yun-Yun Shao and Yun-Hong Tan

B. Xue (<http://orcid.org/0000-0002-4515-4316>) and Y.-Y. Shao, Key Laboratory of Plant Resources Conservation and Sustainable Utilization, South China Botanical Garden, Chinese Academy of Sciences, Guangzhou, P. R. China. BX and YYS also at: Guangdong Provincial Key Laboratory of Applied Botany, South China Botanical Garden, Chinese Academy of Sciences, P. R. China. – D.-P. Ye, Forest Bureau of Pu'er, Pu'er, Yunnan, China. – Y.-H. Tan (tyh@xtbg.org.cn), Southeast Asia Biodiversity Research Inst., Chinese Academy of Sciences, Yezin, Nay Pyi Taw, Myanmar and Center for Integrative Conservation, Xishuangbanna Tropical Botanical Garden, Chinese Academy of Sciences, Menglun, Yunnan, P. R. China.

Polyalthia yingjiangensis sp. nov. is described from the China/Myanmar border. It is distinct in having outer petals that are much shorter than the inner petals and having a very long pedicel. It is most similar to *P. miliusoides* I.M. Turner, but differs in having perianth parts that are glabrous adaxially and pubescent abaxially, thicker and sparsely pubescent pedicels, as well as verrucose and darker monocarps.

The genus *Polyalthia* Blume (Annonaceae) has historically been the source of considerable taxonomic confusion due to extensive polyphyly. However, recent molecular phylogenetic studies have accelerated the segregation of the disparate elements and have thereby largely resolved this taxonomic impediment. The recent disintegration of *Polyalthia* includes the transfer of species to the two new genera *Maasia* Mols, Keßler & Rogstad (Mols et al. 2008) and *Huberantha* Chaowasku (Chaowasku et al. 2012 [as '*Hubera*'], 2015), as well as the transfer of species to *Fenerivia* Diels (Saunders et al. 2011), *Marsypopetalum* Scheffer (Xue et al. 2011), *Monoon* Miquel (Xue et al. 2012), *Goniothalamus* (Blume) Hook. f. & Thomson (Tang et al. 2013), *Meiogyne* Miquel (Xue et al. 2014), and *Wangia* X. Guo & R.M.K. Saunders (Xue et al. 2016). The circumscription of *Polyalthia* s.s. has therefore been redefined (Xue et al. 2012, Xue 2013).

Polyalthia s.s. can be distinguished from other closely related genera by a combination of characters, including an asymmetrical leaf base with petiole attachment superficially below the lamina surface, brochidodromous venation and usually reticulate tertiary veins, non-verrucose and non-clawed inner petals that are not tightly appressed over the reproductive parts, more than three carpels with two to six ovules per carpel and one to five seeds per monocarp, seeds with a shallow longitudinal circumferential groove on the raphe, and spiniform endosperm ruminations (Xue et al. 2012, Turner et al. 2014).

During a field survey in Hongbenghe close to the China/Myanmar border in Yingjiang County, Yunnan Province, we found a species with leaves with a slightly asymmetrical

leaf base, brochidodromous venation and reticulate tertiary veins, and hence referable to *Polyalthia* s.s. Molecular phylogenetic studies (not shown) also confirm its placement in *Polyalthia*. It is most similar to *Polyalthia miliusoides* I.M. Turner in having outer petals that are much shorter than the inner petals and very long pedicels, i.e. characters which are rare in *Polyalthia*, but differs in having perianth parts that are densely hairy abaxially and glabrous adaxially, pedicels that are thicker and sparsely pubescent, as well as verrucose and darker monocarps. We believe that the plant represents a new species and describe it here as *Polyalthia yingjiangensis*.

Material and methods

The morphological description of the new species was based on the examination of fresh and dried herbarium specimens. Morphological comparisons with other species in *Polyalthia* were based on careful studies of herbarium specimens at HITBC, YUKU, and KUN, specimen photographs and a literature survey.

Carpels, stamens and pollen of the new species were obtained from air-dried herbarium specimens and then directly attached to metal stubs using adhesive carbon tabs, sputter-coated with gold/palladium, and viewed using a JSM-6360LV scanning electron microscope at 25 kV.

***Polyalthia yingjiangensis* Y. H. Tan & B. Xue sp. nov. (Fig. 1–4)**

Chinese name: ying jiang an luo (盈江暗罗)



Figure 1. Flower and fruit morphology of *Polyalthia yingjiangensis* sp. nov. (A)–(E) branch and inflorescence, showing extra-axillary inflorescence with long pedicel, unequal corolla whorls and leaves with slightly asymmetrical leaf base with petiole superficially below lamina surface, (F) dried fruits (C. L. Dang 9977, YUKU), (G) a single dried monocarp, showing the verrucose surface (86 Exped. 01111, KUN), (H) lateral and top view of one seed, showing the shallow longitudinal circumferential groove (86 Exped. 01111, KUN), (I) transverse and longitudinal section of the seed, showing spiniform endosperm ruminations (86 Exped. 01111, KUN). Photos: (A)–(E) De-Ping Ye, (F)–(I) Bine Xue.

Type: China, Yunnan: Yingjiang, Hongbenghe, 24°27'16"N, 97°32'10"E, 356 m a.s.l., 22 Apr 2016, D. P. Ye 0002 (holotype: IBSC; isotypes: HITBC, KUN).

Etymology

The new species *Polyalthia yingjiangensis* is named after its type locality, Yingjiang county of Yunnan province, China.

Description

A shrub with young twigs pubescent, later become glabrous. Petioles 3–5 mm long, 2.0–2.5 mm in diameter, pubescent, superficially below lamina surface (Fig. 3B–C); leaf laminae 9–15 × 2.5–4.5 cm, length:width ratio 2.2–4.1, narrowly

oblong, oblong or obovate, cuneate to sub-rounded at base, asymmetrical, acuminate at apex, papery, glabrous above, pubescent to sparsely pubescent below; midrib impressed above, pubescent when young, raised and sparsely pubescent below; secondary veins 8–11 on each side of the leaf, parallel, diverging at 45–60° from midrib, anastomosing within margin, raised below; tertiary veins reticulate, faintly prominent abaxially. Flowers extra-axillary, solitary. Pedicels slender, 3.0–5.5 cm long, ca 1 mm in diameter, sparsely pubescent, usually with one minute bract above the middle and another one near the top, pubescent abaxially, glabrous adaxially, 2 × 1 mm (Fig. 1A–E, 3A). Sepals triangular, 2.5–3.0 × 3–4 mm, densely pubescent abaxially, glabrous adaxially

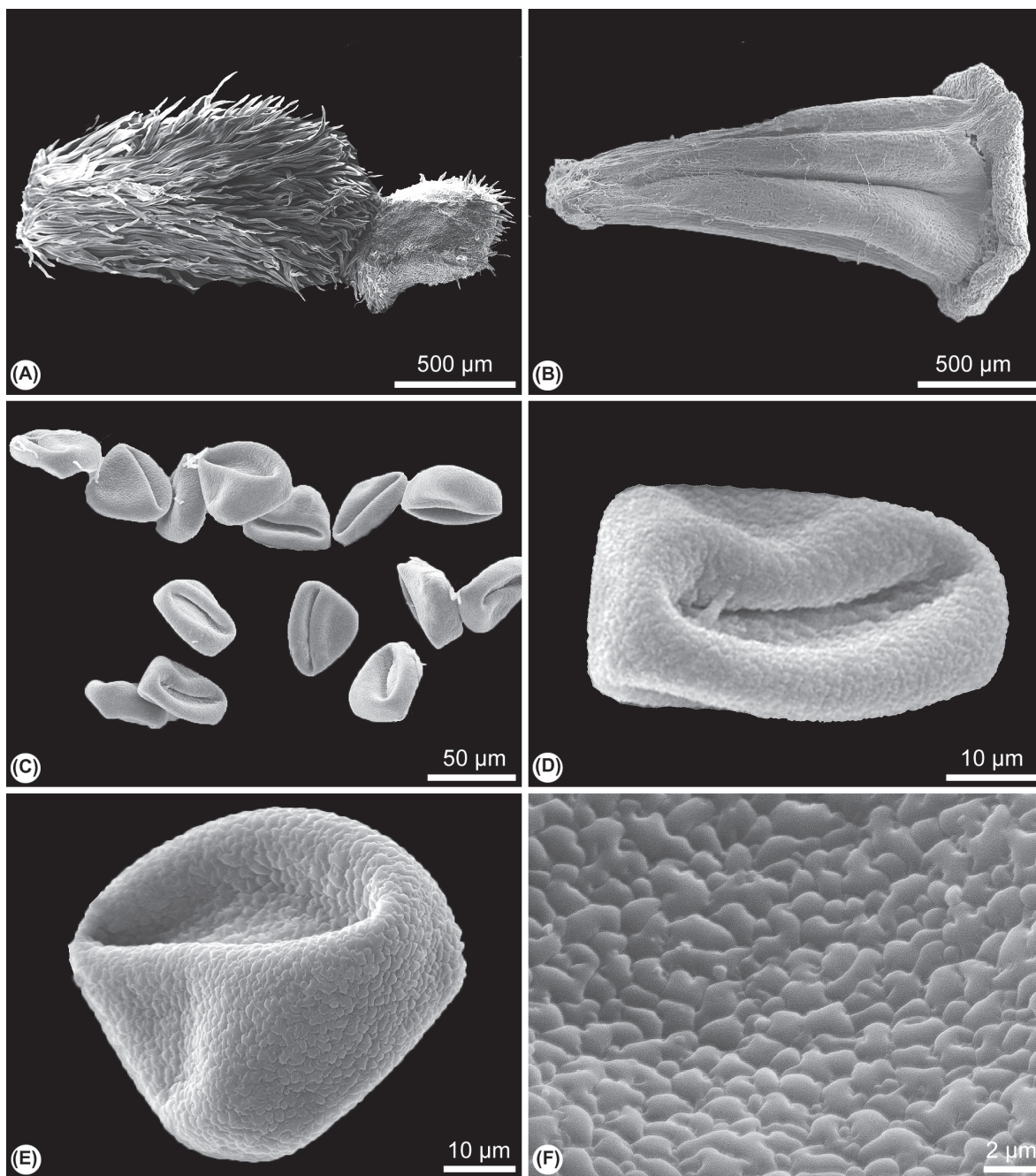


Figure 2. Morphology of carpel, stamen, and pollen of *Polyalthia yingjiangensis* sp. nov. (scanning electron micrographs). (A) carpel, (B) stamen, (C) pollen grains, (D) pollen grain showing two germination zones, (E) lateral view of one pollen grain, one germination zone showing on top, the other one beneath, (F) rugulate-verrucate pollen exine ornamentation.

(Fig. 3F); petals ovate to elliptic, yellow or pink (Fig. 1A–E, 3A), densely pubescent abaxially, glabrous adaxially; outer petals $5\text{--}7 \times 4\text{--}5$ mm (Fig. 3G), inner petals $12\text{--}17 \times 5\text{--}7$ mm (Fig. 3H). Stamens up to 90 per flower, with broad flat-topped connectives, ca 2 mm long (Fig. 2A, 3J). Carpels up to 25 per flower, ca 2 mm long (Fig. 2A, 3J); ovaries ca 1.5 mm long, densely hairy; stigmas clavate, pubescent on top; ovules 1 or 2 per carpel, lateral. Fruiting pedicels 33 to 70 mm long, 1 mm thick (Fig. 3K). Monocarps up to 18 per fruit, globose, ca 10 mm in diameter, glabrous, drying

brown, rounded at apex, their surface verrucose when dried (Fig. 1F–G). Stipes 15–17 mm long, 1 mm thick. Seed 1 (rarely 2) per monocarp, discoid, ca $9 \times 7 \times 7$ mm, with a shallow longitudinal circumferential groove (Fig. 1H, 3L); endosperm ruminations spiniform (Fig. 1I). Pollen grains solitary, triangular, ca $50 \mu\text{m}$ long, disulculate, rugulate-verrucate (Fig. 2C–F).

Phenology

Flowering in April–May; fruiting in August–November.

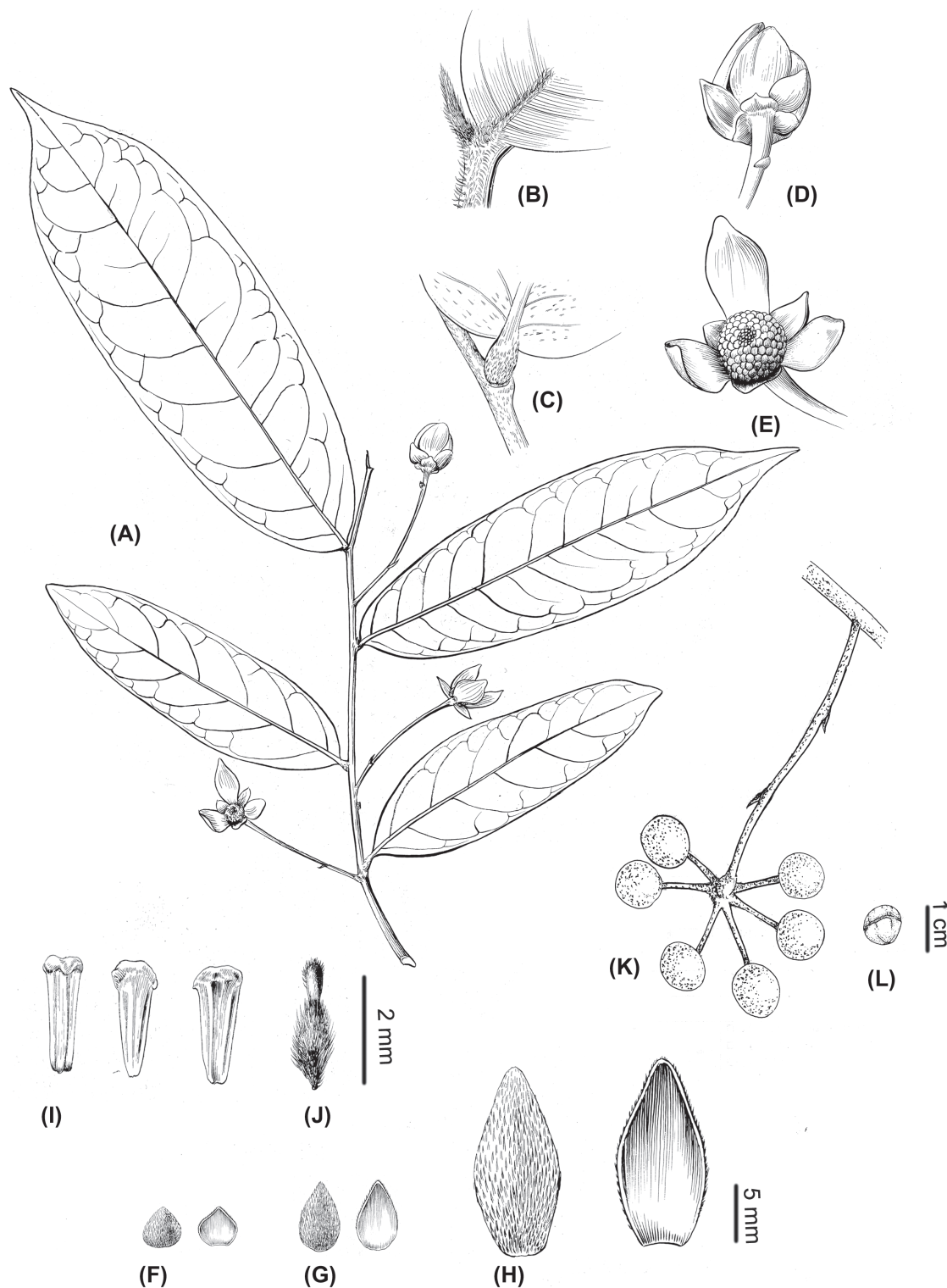


Figure 3. *Polyalthia yingjiangensis* sp. nov. (A) fruiting branch, (B) close-up of adaxial surface of leaf base, showing the slightly asymmetrical leaf base, (C) close-up of abaxial surface of leaf, showing the petiole below lamina surface, (D) flower bud, (E) flower, top view, (F) sepal (abaxial and adaxial view), (G) outer petal (abaxial and adaxial view), (H) inner petal (abaxial and adaxial view), (I) stamens, (J) carpel, (K) fruit, (L) seed. (A)–(J) drawn by Ding-han Cui, (K)–(L) drawn by Ning Wang.

Distribution and habitat

Known from three localities in Yingjiang County, Yunnan province, close to the China–Myanmar border: Hongbenghe, Nabang, and Tongbiguan. Growing in forests at low elevations, from 350 m to ca 900 m a.s.l.

IUCN conservation status

Polyalthia yingjiangensis is classified as ‘Endangered’ (En B 2a, IUCN 2012), and is only represented in herbaria by four collections from three localities in Yingjiang county where forests are severely fragmented. In our preliminary field

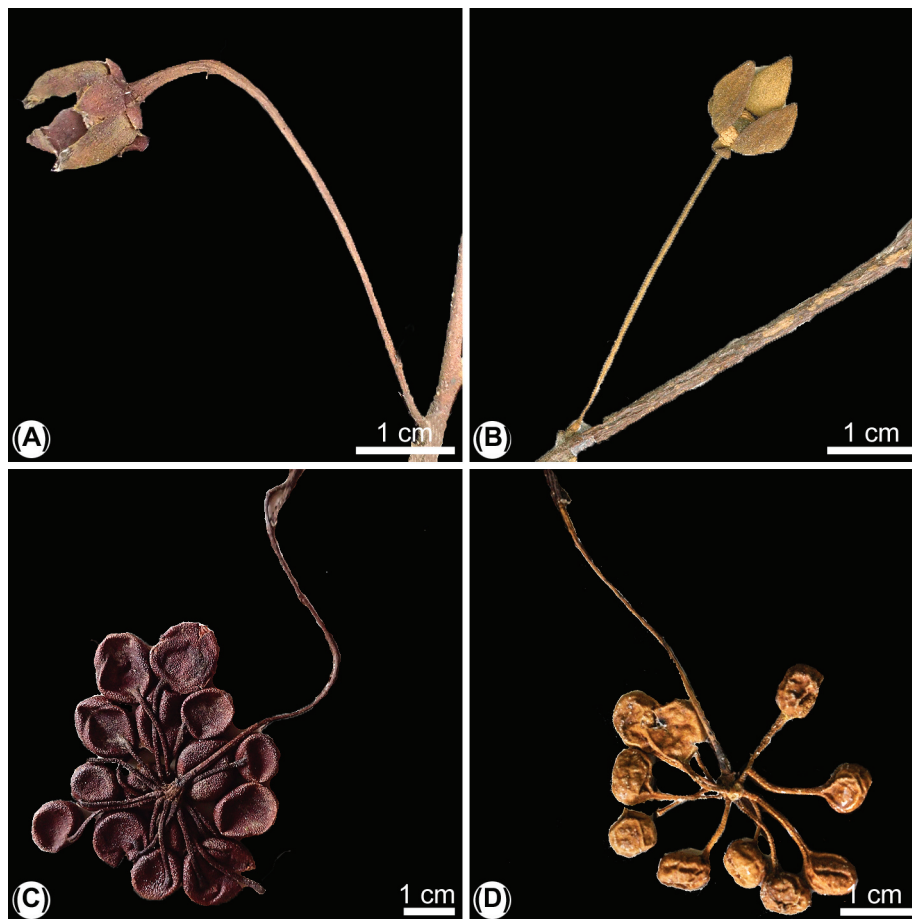


Figure 4. Morphological comparison of the flower and fruit between *Polyalthia yingjiangensis* sp. nov. and *P. miliusoides*. (A) flower of *P. yingjiangensis* (D. P. Ye 0002, IBSC), (B) flower of *P. miliusoides* (L. Madani San 9259, K), (C) fruits of *P. yingjiangensis* (C. L. Dang 9977, YUKU), (D) fruits of *P. miliusoides* (D. Kirkup 221, K).

survey in Yingjiang county we found only around 10 individuals in a plot of about 1 ha in Hongbenghe. It is endangered due to the increasing deforestation of those regions.

Similar species

Polyalthia usually have sub-equal petal whorls, although smaller outer petals are also recorded in *P. evecta* (Finet and Gagnepin 1906), *P. malabarica* (Bedd.) I.M. Turner (Turner 2015), *P. miliusoides* (Turner 2008, Turner et al. 2014), *P. minima* Ast (Bân 2000), *P. rufescens* Hook f. & Thomson (Hooker and Thomson 1872, Turner 2015), and *P. suberosa* (Roxb.) Thwaites (Hooker and Thomson 1872, Sinclair 1955). Nevertheless, *P. yingjiangensis* is readily distinguished from the above-mentioned species except *P. miliusoides* by possessing very long pedicels. *Polyalthia yingjiangensis* is most similar to *P. miliusoides*, a species known from Sabah and Brunei (Turner 2008, Turner et al. 2014). Both species possess very long pedicels and have outer petals that are much smaller than the inner petals. The two species differ, however, in the indumentum of the perianth, thickness and indumentum of the pedicels, and the morphology of the dried monocarps. The abaxial surfaces of the perianth of *P. yingjiangensis* are densely hairy and the adaxial surfaces are glabrous, whereas both surfaces of the perianth of *P. miliusoides* are sparsely pubescent (Turner 2008, Turner et al. 2014; Fig. 4A–B).

The pedicel of *P. yingjiangensis* is sparsely pubescent and ca 1 mm in diameter when dry, whereas that of *P. miliusoides* is glabrous and ca 0.5 mm in diameter when dry (Turner 2008, Turner et al. 2014; Fig. 4A–B). The dried monocarps of *P. yingjiangensis* are dark brown and verrucose on the surface, whereas those of *P. miliusoides* are pale brown or yellow with a smooth surface (Turner 2008, Turner et al. 2014; Fig. 4C–D). *Polyalthia miliusoides* further differs from *P. yingjiangensis* in having minutely undulate leaf margin when dried (Turner 2008, Turner et al. 2014).

Additional specimens examined (paratypes)

China, Yunnan: Yingjiang, 14 Aug 1980, C. L. Dang 9977 (YUKU); 20 Nov 1986, 86 Exped. 01111 (KUN); 27 Apr 1992, G. D. Tao 45486 (HITBC).

Acknowledgements – We are grateful to the curators of YUKU, HITBC, KUN for permission to access their collections, Jinghua Wang and Ende Liu for permission to take one seed from the pocket of the specimen for seed morphology study, Dr Ian Turner for providing specimen photos of *Polyalthia miliusoides* and constructive discussion, Mrs Xiaoying Hu for her technical assistance with the SEM at South China Botanical Garden, Dr Richard Saunders for improving the manuscript and Dr Lars Chatrou for comments on the manuscript.

Funding – This research was supported by a grant from National Natural Science Foundation of China (grant no. 31400199) awarded to Bine Xue and by the Foundation of Southeast Asia Biodiversity Research Inst., Chinese Academy of Sciences (Y4ZK111B01).

References

- Bân, N. T. 2000. Annonaceae. – In: Bân, N. T. et al. (eds), *Flora of Vietnam*. Vol. 1. Science and Technics Publishing House, Hanoi, pp. 5–341, in Vietnamese.
- Chaowasku, T. et al. 2015. *Huberanthia*, a replacement name for *Hubera* (Annonaceae: Malmeoideae: Miliuseae). – *Kew Bull.* 70: 23.
- Chaowasku, T. et al. 2012. Characterization of *Hubera* (Annonaceae), a new genus segregated from *Polyalthia* and allied to *Milusa*. – *Phytotaxa* 69: 33–56.
- Finet, A. and Gagnepin, F. 1906. Contributions à la flore de l'Asie orientale. – *Bull. Soc. Bot. Fr. Mém.* 4: 91.
- Hooker, J. D. and Thomson, T. 1872. Annonaceae. – In: Hooker, J. D. (ed.), *The flora of British India*. Vol. 1. Reeve, pp. 45–94.
- IUCN 2012. IUCN red list categories and criteria: ver. 3.1, 2nd ed. – IUCN Species Survival Commission.
- Mols, J. B. et al. 2008. Reassignment of six *Polyalthia* species to the new genus *Maasia* (Annonaceae): molecular and morphological congruence. – *Syst. Bot.* 33: 490–494.
- Saunders, R. M. K. et al. 2011. Phylogenetic affinities of *Polyalthia* species (Annonaceae) with columellar-sulcate pollen: enlarging the Madagascan endemic genus *Fenerivia*. – *Taxon* 60: 1407–1416.
- Sinclair, J. 1955. A revision of the Malayan Annonaceae. – *Gard. Bull. Singap.* 14: 149–516.
- Tang, C. C. et al. 2013. A new species of *Goniothalamus* (Annonaceae) from Palawan, and a new nomenclatural combination in the genus from Fiji. – *PhytoKeys* 32: 27–35.
- Turner, I. M. 2008. New species and new records for *Polyalthia* (Annonaceae) in Borneo. – *Folia Malaysiana* 9: 77–98.
- Turner, I. M. et al. 2014. Annonaceae. – In: Soepadmo, E. et al. (eds), *Tree flora of Sabah and Sarawak*. Sabah Forestry Dept, Forest Research Inst. Malaysia and Sarawak Forestry Dept, Kepong, Malaysia, pp. 141–164.
- Turner, I. M. 2015. A conspectus of Indo-Burmese Annonaceae. – *Nord. J. Bot.* 33: 257–299.
- Xue, B. 2013. Molecular phylogenetics of *Polyalthia* (Annonaceae): identifying clades and morphological synapomorphies in a large polyphyletic genus. – PhD thesis, Univ. of Hong Kong, Hong Kong.
- Xue, B. et al. 2011. Further fragmentation of the polyphyletic genus *Polyalthia* (Annonaceae): molecular phylogenetic support for a broader delimitation of *Marsypopetalum*. – *Syst. Biodivers.* 9: 17–26.
- Xue, B. et al. 2012. Pruning the polyphyletic genus *Polyalthia* (Annonaceae) and resurrecting the genus *Monoon*. – *Taxon* 61: 1021–1039.
- Xue, B. et al. 2014. Molecular phylogenetic support for the taxonomic merger of *Fitzalania* and *Meiogyne* (Annonaceae): new nomenclatural combinations under the conserved name *Meiogyne*. – *Syst. Bot.* 39: 396–404.
- Xue, B. et al. 2016. The identity of *Polyalthia florulenta* (Annonaceae): a second species of *Wangia* in China. – *Phytotaxa* 283: 163–171.