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# New combinations in *Decalobanthus* (Convolvulaceae)

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**Summary.** The recent revisionary work of "Merremieae" has resulted in the segregation of the c. 100 species of the pantropical genus *Merremia* into six genera. Thus, the formerly monotypic genus *Decalobanthus* was expanded, aggregating 13 species of *Merremia s.l.* The genus delimitation is coherent, with strong molecular phylogenetic and morphological support. *Decalobanthus*, hence, consists of woody climbers with broadly cordate leaves, large yellow or white flowers, four-valved chartaceous capsules, and is mostly distributed in Asia and the Pacific. Four species have remained classified in *Merremia s.l.*, although molecular and morphological evidence unequivocally suggests their placement in *Decalobanthus*. In the present work, these are formally transferred to the genus, which now extends to 17 species.

**Key Words.** liana, *Merremia*, Merremieae, morning-glories, woody climbers.

## Introduction

Recent taxonomic rearrangements in tribe Merremieae (Convolvulaceae) have resulted in the dissolution of the pantropical genus *Merremia sensu lato* into six genera: *Merremia* Hallier f. (*sensu stricto*), *Decalobanthus* Ooststr., *Camonea* Raf., *Distimake* Raf., *Xenostegia* D.F.Austin & Staples and *Operculina* Silva Manso (Simões *et al.* 2015; Simões & Staples 2017). A considerable number of species are still placed in *Merremia s.l.* (Simões & Staples 2017), awaiting further phylogenetic, morphological and palynological studies to ascertain their generic placement.

*Decalobanthus*, in particular, results from the expansion of a previously monotypic genus endemic to Sumatra (Indonesia), with the type species *D. sumatranus* Ooststr. This genus was initially described by Van Ooststroom (1936) for the presence of a small tubular corolla, the lobes of which are reflexed, with each lobe further parted into two. As the flowers of Convolvulaceae are pentamerous, this creates a particular "10-lobed" arrangement of the corolla fauce, that inspired the generic name *Decalobanthus*. As morphological and molecular studies recently brought to light that this species is nested within a clade of other woody climbers from SE Asia (Simões *et al.* 2015; Simões & Staples 2017), the generic delimitation was expanded, accommodating 12 additional species previously placed in *Merremia s.l.* The genus now comprises 13 species, the monophyly of which is strongly supported in molecular phylogenetic analyses based on ITS and three plastid markers (Simões *et al.* 2015; Fig. 1).

*Decalobanthus* is not characterised by unequivocal synapomorphies, viz. characters that uniquely evolved in this genus. However, species of *Decalobanthus* are robust woody climbers or lianas, for which they are very easily separated from the herbaceous or slender twining herbs of *Merremia s.s.* (Fig. 2). A combination of other morphological characters helps to differentiate them from closely related genera: leaves simple, entire, commonly large and broadly cordate; inflorescences paniculate or corymbiform, the lowermost bract often foliaceous; sepals strongly convex (boat-shaped); corolla bright yellow to white, usually glabrous outside; anthers spirally twisting at dehiscence; fruits valvate capsules with the exocarp delaminating above the middle (lower half is dark brown, upper half is straw-coloured); seeds always pubescent, often with long golden hairs either covering the entire surface or concentrated along the edges of the seeds (Simões & Staples 2017; Fig. 2). The genus is distributed mostly across SE Asia and the Pacific (Map 1), with one species being widespread to Eastern Africa and Madagascar (*D. peltatus* (L.) A.R.Simões & Staples) and Santa Cruz Island of North America (*D. bracteatus* (P.S.Bacon) A.R.Simões & Staples) (Map 1).

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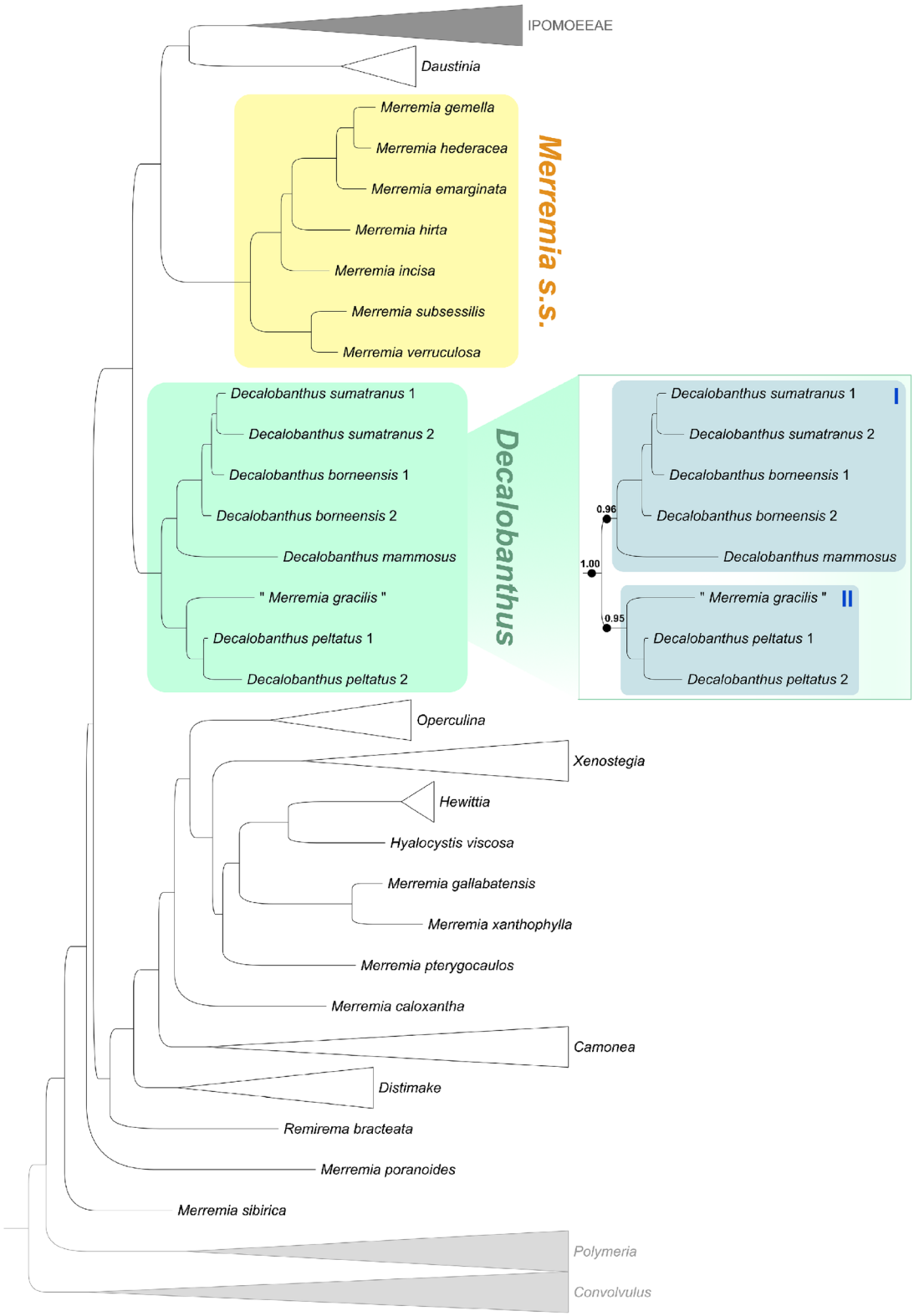



**Fig. 1.** Phylogenetic tree of the relationships in the former tribe Merremieae, adapted from Simões *et al.* (2015), showing the position of *Decalobanthus* and *Merremia s.s.*, following the newly generic circumscriptions for the group (Simões & Staples 2017). *Decalobanthus* and *Merremia s.s.* are resolved, along with *Daustinia*, as sister to tribe Ipomoeeae, while the remaining species of former *Merremia s.l.* and other allied genera, are resolved in a separate clade. The relationships between the genera have low support and are still mostly unresolved, although the clade of *Decalobanthus* is maximally supported (PP = 1.00) Two clades within the genus are also well supported (Clade I: PP = 0.96; Clade II: PP = 0.95), albeit with limited taxonomic sampling (Simões *et al.* 2015).

**Table 1.** List of currently accepted species of *Decalobanthus* Ooststr. (*sensu* Simões & Staples 2017), the four species here combined under *Decalobanthus* are included.

| ***Decalobanthus* Ooststr. (*sensu* Simões & Staples 2017)** | **Distribution** |
|---|---|
| ***Decalobanthus bimbim*** (Gagnep.) A.R.Simões & Staples | China (Yunnan) to Vietnam |
| ***Decalobanthus boisianus*** (Gagnep.) A.R.Simões & Staples | S China to Indo-China, Indonesia (Sumatra) |
| var. *boisianus* | S China to N Vietnam |
| var. *fulvopilosus* (Gagnep.) A.R.Simões & Staples | S China to N Vietnam |
| var. *sumatranus* (Ooststr.) A.R.Simões & Staples | Indonesia (Sumatra) |
| ***Decalobanthus borneensis*** (Merr.) A.R.Simões & Staples | Peninsular Malaysia, Indonesia (Borneo) |
| ***Decalobanthus bracteatus*** (P.S.Bacon) A.R.Simões & Staples | Solomon to N America (Santa Cruz) |
| ***Decalobanthus calyculatus*** (Ooststr.) A.R.Simões & Chatrou comb. nov. | Fiji (Taveuni) |
| ***Decalobanthus clemensianus*** (Ooststr.) A.R.Simões & Chatrou comb. nov. | Indonesia (Borneo-Sarawak) |
| ***Decalobanthus crassinervius*** (Ooststr.) A.R.Simões & Chatrou comb. nov. | Indonesia (Borneo) |
| ***Decalobanthus gracilis*** (E.J.F.Campb. & Argent) A.R.Simões & Chatrou comb. nov. | Indonesia (Borneo-Sabah, Kalimantan) |
| ***Decalobanthus eberhardtii*** (Gagnep.) A.R.Simões & Staples | C Vietnam |
| ***Decalobanthus elmeri*** (Merr.) A.R.Simões & Staples | Indonesia (Borneo) |
| var. *elmeri* | Indonesia (Borneo) |
| var. *glaberrimus* (Ooststr.) A.R.Simões & Staples | Indonesia (Borneo) |
| ***Decalobanthus korthalsianus*** (Ooststr.) A.R.Simões & Staples | Indonesia (Borneo) |
| ***Decalobanthus mammosus*** (Lour.) A.R.Simões & Staples | E India to Indo-China |
| ***Decalobanthus pacificus*** (Ooststr.) A.R.Simões & Staples | New Guinea to W Pacific |
| ***Decalobanthus peltatus*** (L.) A.R.Simões & Staples | Tanzania, W Indian Ocean, Trop. Asia to Pacific |
| ***Decalobanthus pulcher*** (Ooststr.) A.R.Simões & Staples | Indonesia (Borneo) |
| ***Decalobanthus similis*** (Elmer) A.R.Simões & Staples | Philippines |
| ***Decalobanthus sumatranus*** Ooststr. | Indonesia (Sumatra, Borneo) |

As a new expanded circumscription of *Decalobanthus* is adopted and contributes to a better understanding of the relationships and biogeographical patterns of this group of species, several challenges come in the way of a full revisionary study of this genus. Unlike many Convolvulaceae taxa, *Decalobanthus* are woody vines that grow in primary forests and require targeted fieldwork in undisturbed and well-conserved patches of forest. Many collections are available in Asian and European herbaria. Still, a significant proportion of the specimens is relatively old, preserved in alcohol, or have been treated with pest-control chemicals, which has impeded adequate molecular sampling of the genus. Also, the wide geographic range, with several narrow endemic species from hardly accessible areas, as the islands in the Pacific, further complicates the mission of sampling and morphologically comparing the taxa. Taxonomic studies are underway with the aim of improving our knowledge of the genus, namely by Pisuttimarn, who has conducted targeted fieldwork for specimen collection, and fresh samples for DNA analysis. However, it could be some time until we have the deep knowledge of the full morphological characterisation of the genus, a good understanding of the interspecific relationships, and a finer-tuned delimitation of the species.

The current expanded delimitation of *Decalobanthus* encompasses in the most part the species of *Merremia* previously placed in two sections: 1) section *Hailale* Hallier f., emended by Van Ooststroom (1939) (*Merremia borneensis* Merr., *M. boisiana* (Gagnep.) Ooststr., *M. clemensiana* Ooststr., *M. crassinervia* Ooststr., *M. elmeri* Merr., *M. korthalsiana* Ooststr., *M. mammosa* (Lour.) Hallier f., *M. peltata* (L.) Merr. and *M. pulchra* Ooststr.); and 2) section *Wavula* Ooststr. (which included *M. similis* Elmer, *M. calyculata* Ooststr. and *M. pacifica* Ooststr.) (Van Ooststroom 1939; Van Ooststroom & Hoogland 1953). A few additional species were described or transferred into *Merremia* afterwards (*M. bracteata* P.S.Bacon, *M. gracilis* E.J.F.Campb. & Argent, *M. eberhardtii* (Gagnep.) T.N.Nguyen and *M. bimbim* (Gagnep.) Ooststr.).

In the light of molecular phylogenetic results (Simões *et al.* 2015; Fig. 1), and considering that these species present the diagnostic characters of *Decalobanthus* as expanded by Simões & Staples (2017; Fig. 2), they have, for the most part, been combined under this name (Simões & Staples 2017). However, two species in section *Hailale* (*Merremia clemensiana* Ooststr. and *M. crassinervia* Ooststr.), one in section *Wavula* (*Merremia calyculata* Ooststr.) and one without an assigned section (*M. gracilis* E.J.F.Campb. & Argent) have not been, up until now, formally transferred to *Decalobanthus*, although they confidently belong in this genus. *Merremia gracilis* was even included in the molecular phylogenetic studies of Simões *et al.* (2015), and resolved as a member of the *Decalobanthus* clade. However, these names were never combined under *Decalobanthus* in Simões & Staples (2017), for uncertainty about the species delimitation.

Three of the species (*Merremia clemensiana*, *M. crassinervia* and *M. gracilis*) are morphologically similar to *Decalobanthus korthalsianus* (Ooststr.) A.R.Simões & Staples and overlap in geographical distribution (all documented as endemic to Borneo). *Merremia calyculata* is known only from the type specimen, collected on the Fiji Island of Taveuni (Smith 1991). The morphological and distributional overlap with *D. pacificus* (Ooststr.)

**Fig. 2.** Diagnostic morphological characters of *Decalobanthus*. **A** climbing habit, *D. sumatranus*, Indonesia, Sumatra (*Staples* 2532 [BM]); **B** woody stem, *D. eberhardtii* in cultivation at Suan Luang Rama IX Park, Bangkok, Thailand (*Pisuttimarn* 396 [KKU]); **C** entire, cordate leaves, *D. sumatranus*, Indonesia, Sumatra (*Staples* 2532 [BM]); **D – E** inflorescence with campanulate white and bright yellow flowers, *D. boisianus* var. *sumatranus*, Vietnam (not collected); **F** tubular bright yellow flower, *D. sumatranus,* Indonesia, Sumatra (*Staples* 2532 [BM]); **G** detail of the inside of the corolla tube, showing twisted anthers and biglobose stigmas, *D. eberhardtii* in cultivation at Suan Luang Rama IX Park, Bangkok, Thailand (*Pisuttimarn* 396 [KKU]); **H – I** fruit: **H** capsule dehiscing by 4 valves, each valve further splitting, *D. peltatus*, Phang Nga, Thailand (*Pisuttimarn* 251 [KKU]); **I** darker outside layer of the exocarp shedding and exposing the lighter layer below, *D. bimbim* in cultivation at Xishuangbanna Tropical Botanical Garden (not collected); **J** seeds with long golden hairs along the edges, *D. mammosus*, Ubon Ratchathani, Thailand (*Pisuttimarn* 246 [KKU]). PHOTOS: **C**, **F** A. R. SIMÕES; **B**, **G**, **H**, **K** P. PISUTTIMARN; **D**, **E** JANA LEONG; **J** SVEN LANDREIN.

A.R.Simões & Staples is considerable, for which its status as a distinct species is also dubious and should deserve attention in future studies (Staples 2009, 2010).

In the context of this study, we propose to combine the names of these four species under *Decalobanthus*, given the confidence in their generic placement, to avoid ambiguity in systematic and floristic studies of the region.

Hence, in total, 17 taxa are now considered to belong in *Decalobanthus*, based on genetic markers and conspicuous morphology (Table 1). It is hoped that ongoing systematic, morphological, palynological and anatomical studies will contribute to further elucidation of the relationships between these species and the remainder of the genus.

## New combinations

1. **Decalobanthus calyculatus** (*Ooststr.*) *A.R.Simões & Chatrou*, **comb. nov.**

http://www.ipni.org/urn:lsid:ipni.org:names:77213102-1

*Merremia calyculata* Ooststr., *Blumea* 3: 265 (Van Ooststroom 1939). Type: Fiji, Taveuni, June 1860, *Seemann* 324 (holotype K [K000830927]; isotypes BM [BM000884662], GH [GH00054678])

2. **Decalobanthus clemensianus** (*Ooststr.*) *A.R.Simões & Chatrou*, **comb. nov.**

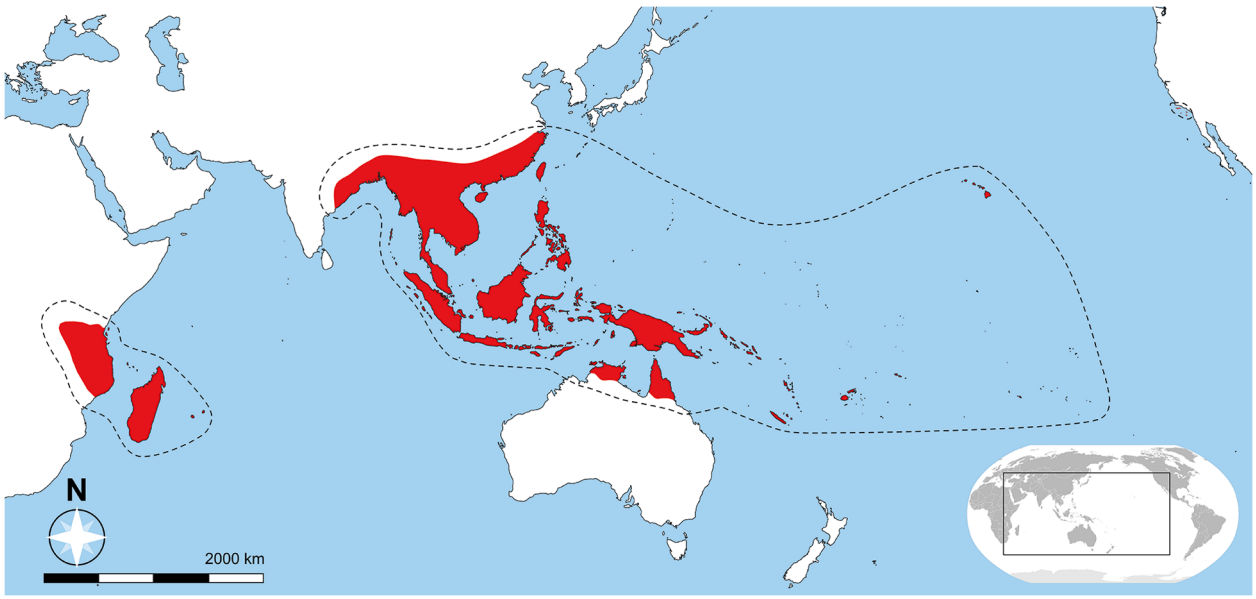
http://www.ipni.org/urn:lsid:ipni.org:names:77213103-1

*Merremia clemensiana* Ooststr., *Blumea* 3: 350 (Van Ooststroom 1939). Type: "Borneo. Sarawak, Kapit, upper Rejang R., 1929, *J. & M. S. Clemens* 21133 (holotype BO [BO177795]; isotypes A [A00054674] B [B_10_0241997, B_10_0241997], BISH [BISH1001147], BM [BM000797179], K [K000830845], L [L0004223, L0640533], MO [MO-694686], NY [NY00336580, NY00336581], P [P00622203]).

3. **Decalobanthus crassinervius** (*Ooststr.*) *A.R.Simões & Chatrou*, **comb. nov.**

http://www.ipni.org/urn:lsid:ipni.org:names:77213104-1

*Merremia crassinervia* Ooststr., *Blumea* 3: 350 (Van Ooststroom 1939). Type: "Borneo. Sarawak, Saribas, Paku, 6 Dec. 1893," *Haviland & Hose* 3523E (holotype L [L0004224]; isotype K [K000830846], SAR [Hav. 3523A]).




**Map 1.** Broad view of the distribution of the species of *Decalobanthus*.

4. **Decalobanthus gracilis** (*E.J.F.Campb. & Argent*) *A.-R.Simões & Chatrou*, **comb. nov.**

http://www.ipni.org/urn:lsid:ipni.org:names:77213105-1

*Merremia gracilis* E.J.F.Campb. & Argent, *Notes Roy. Bot. Gard. Edinburgh* 45: 345 (Campbell & Argent 1988). Type: Malaysia. Sabah: Lahad Datu Distr., Ulu Segama, Danum Valley Field Centre, roadside, 4 Nov. 1985, *Argent & Campbell* 411854 (holotype SAN!; isotypes A [A00054677], BM [BM000797174], E [E00273914]).

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## References

Campbell, E. J. F. & Argent, G. C. G. (1988). New *Merremia* from Sabah. *Notes Roy. Bot. Gard. Edinburgh* 45: 345.

Simões, A.R., Culham, A. & Carine, M. (2015). Resolving the unresolved tribe: a molecular phylogenetic framework for the Merremieae (Convolvulaceae). *Bot. J. Linn. Soc.* 179: 374 – 387.

& Staples, G. (2017). Dissolution of Convolvulaceae tribe Merremieae and a new classification of the constituent genera. *Bot. J. Linn. Soc* 183: 561 – 586.

Smith, A.C. (1991). *Flora Vitiensis nova: a new Flora of Fiji (spermatophytes only)* 5: 1 – 626. Pacific Tropical Botanical Garden, Lawaii, Hawaii.

Staples, G.W. (2009). *Merremia pacifica* (Convolvulaceae) recharacterised, with notes on other Pacific species. *Kew Bull.* 64: 333 – 338.

____ (2010). A checklist of *Merremia* (Convolvulaceae) in Australasia and the Pacific. *Gard. Bull. Singapore* 61: 483 – 522.

Van Oststroom, S. J. (1936). On *Decalobanthus*, a new genus of Convolvulaceae from Sumatra. *Blumea* 2: 99 – 100.

____ (1939). The Convolvulaceae of Malaysia II. *Blumea* 3: 276 – 366.

____ & Hoogland, R. D. (1953). Convolvulaceae. In: C. G. G. J. Van Steenis (ed.), *Flora Malesiana* ser. I, vol. 4, part 4: 388 – 512. Noordhoff-Kolff N.V., Jakarta, Indonesia.

## Publisher's Note