

Flora of Singapore precursors, 50: New records and lectotypifications for Amaranthaceae and Crassulaceae

N.P. Taylor

Depto de Biologia, Universidade Federal de São Carlos,
Sorocaba, São Paulo 18052-780, Brazil
nigeltactus.taylor@gmail.com

ABSTRACT. Five species and one genus of Amaranthaceae are newly recorded for Singapore, all being either non-native, naturalised, casual or cryptogenic species. A lectotype is designated for *Chamissoa esculenta* Moq., a synonym of *Allmania nodiflora* (L.) R.Br. ex Wight. In Crassulaceae the status of *Bryophyllum* Salisb. is clarified and a lectotype is designated for *Cotyledon pinnata* Lam.

Keywords. *Alternanthera*, *Amaranthus*, *Bryophyllum*, *Deeringia*, *Gomphrena*, *Kalanchoe*, lectotypifications

Introduction

While preparing an account of Amaranthaceae for the *Flora of Singapore* during April 2024, the author uncovered one genus (*Deeringia* R.Br.) and five species in addition to those recorded in the Checklist of its native, naturalised and casual plant diversity (Lindsay et al., 2022). This reflects both the difficulty in circumscribing taxa in this family and the lack of certain specimens that were on long-term loan during previous studies from which the Checklist was derived. In Crassulaceae, the Checklist recognised the genus *Bryophyllum* Salisb. for some taxa as distinct from a species referred to *Kalanchoe* Adans., but generically these belong together.

New records and lectotypifications in Amaranthaceae

1. *Alternanthera* Forssk.

Hermaphrodite annual or perennial herbs and subshrubs, sometimes aquatic. **Leaves** opposite, sessile or petiolate. **Inflorescence** terminal and/or more often axillary, spicate, globose to shortly elongate, sessile or pedunculate, lacking bracts at base. **Flowers** all hermaphrodite or some female; tepals 5, free; stamens 2–5, filaments united at base, alternating with pseudo-staminodes, anthers monothecal, bisporangiate; ovary 2-carpellate, 1-ovulate. **Fruit** an indehiscent utricle.

1.1. *Alternanthera ficoidea* (L.) P.Beauv., Fl. Oware 2: 66, t. 99, fig. 1 (1818). – *Gomphrena ficoidea* L., Sp. Pl. 1: 225 (1753). – TYPE: ‘Habitat in America meridionali’, Herb. Linn. No. 290.23 (conserved type LINN, proposed by Veldkamp, Taxon 38: 299 (1989)). (Fig. 1)

Alternanthera paronychioides A.St.-Hil., Voy. Distr. Diam. 2: 439 (1833), as ‘*paronychyoides*’; Townsend, Revis. Handb. Fl. Ceylon 1: 50 (1980). – TYPE: Brazil, Rio de Janeiro, *Saint-Hilaire* 223 (lectotype P [P02441684], designated by Townsend (as ‘holotype’), loc. cit. (1980)).

A. ficoides Rchb. ex Moq. in de Candolle, Prodr. 13: 357 (1849), nom. inval.

Creeping herb, woody at base, laxly branched, densely white hairy at first. **Stems** c. 3 mm diam., sometimes rooting from the lower nodes, internodes 2–3(–5) cm long. **Leaves** arranged in a single plane, adaxial surface uppermost, to 3 cm long, petiole to 5 mm long, lamina elliptic, to 7 mm wide, entire, cuneate at base, bluntly acute-apiculate to rounded at apex, lateral veins usually indistinct. **Inflorescences** borne from every node on the plant, spicate, but $\pm$ globose, to 10×7 mm, composed of dense silvery white bracts almost hiding the flowers except for the slightly exerted yellow anthers and dull yellow stigma, ovary greenish. **Utricle** c. 2.4 mm long. **Seed** c. 1.8 mm long.

Distribution. Pantropical but likely originating in Latin America. In Singapore, *Alternanthera ficoidea* is a cryptogenic species.

Ecology. Open, often littoral vegetation and disturbed ground.

Additional specimens examined. SINGAPORE: **Geylang:** s.l., 20 Jan. 1933, *Teruya* 2219 (SING [SING0042577]).

Notes. The historic collection cited above was long misidentified as *Alternanthera frutescens* R.Br. in SING, but matches a recent gathering of *A. ficoidea* from Peninsular Malaysia, Selangor, Kuala Selangor Nature Park, 1 July 2009, *Lim & Nazri FRI 65035* (KEP, SING [SING0198366]), from which the above description is partly drawn up. This species is readily distinguished from other *Alternanthera* species in Singapore by its ground-hugging habit and very abundant, conspicuous inflorescences at every node.

2. *Amaranthus* L.

Hermaphrodite annual herbs or subshrubs. **Leaves** alternate, petiolate, generally glabrous at maturity. **Inflorescence** a terminal spiciform raceme or panicle, or globose and also sometimes lateral in the leaf axils, with bracts subtending the flowers. **Flowers** unisexual, the sexes mixed together, almost sessile; tepals 3–5, united at base;

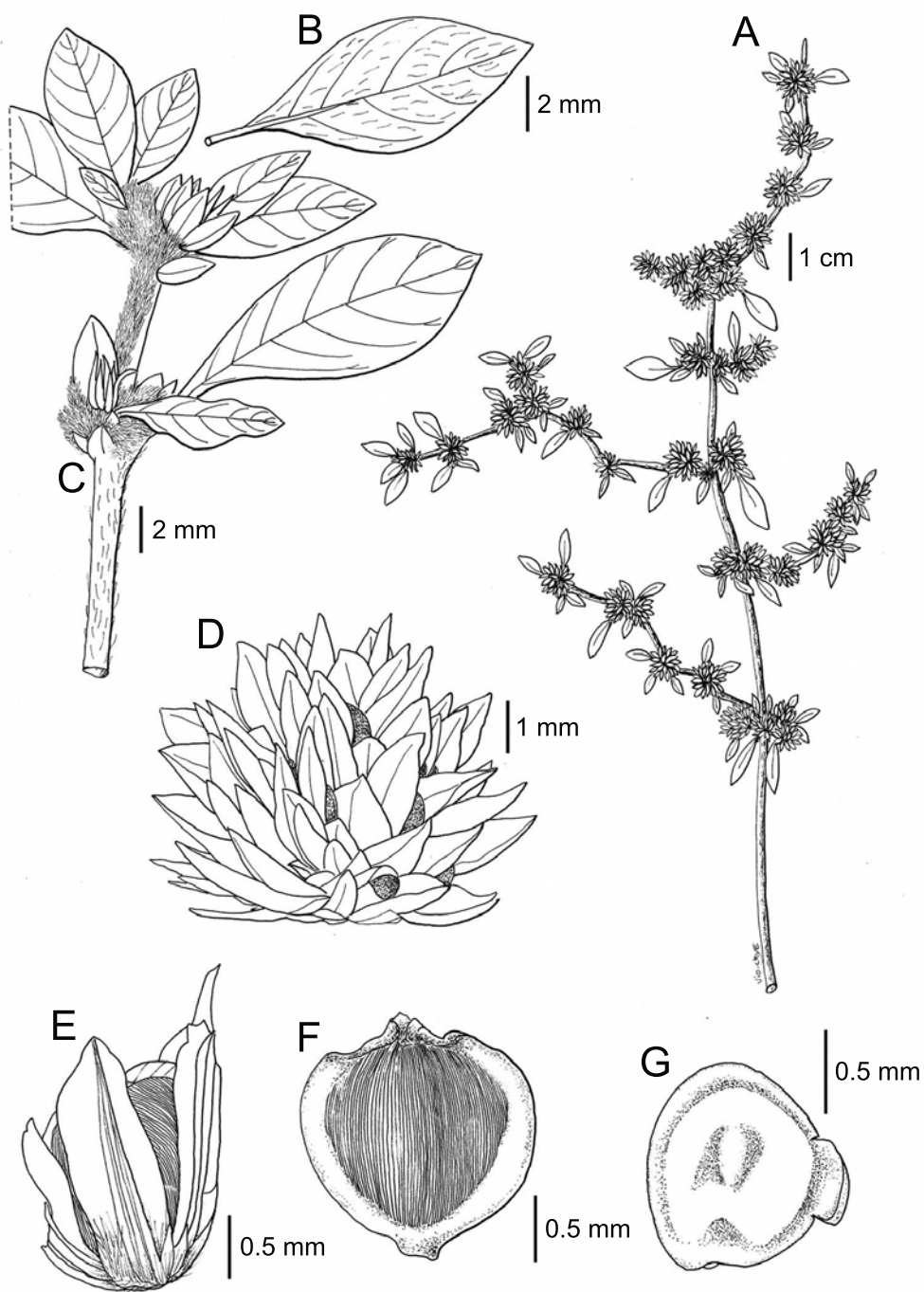


Fig. 1. *Alternanthera ficoidea* (L.) P.Beauv. **A.** Habit. **B.** Abaxial view of leaf. **C.** Young growth with hairs. **D.** Inflorescence. **E.** Young fruit with perianth remains. **F.** Fruit. **G.** Seed. From Singapore, Geylang, *Teruya* 2219 (SING). Drawn by V. Chye.

males with 3–5 stamens, filaments free, lacking pseudo-staminodes, anthers bithecal, tetrasporangiate; females with a (2–)3-carpellate ovary, 1-ovulate. **Fruit** a capsule or utricle.

2.1. *Amaranthus caudatus* L., Sp. Pl. 2: 990 (1753); Ridley, Fl. Malay Penins. 3: 6 (1924); Burkill, Econ. Prod. Malay Penins. 1: 127 (1935); Walker, Fl. Okinawa: 438 (1976); Townsend, Revis. Handb. Fl. Ceylon 1: 14 (1980). – TYPE: Herb. Linn. No. 1117.26 (lectotype LINN, designated by Townsend, Fl. W. Pakistan 71: 10 (1974)).

Amaranthus cruentus L., Syst. Nat., ed. 10, 2: 1269 (1759). – TYPE: Herb. Linn. No. 1117.25 (lectotype LINN, designated by Townsend, loc. cit., 12 (1974)). – *Amaranthus hybridus* L. subsp. *cruentus* (L.) Thell., Fl. Advent. Montpellier: 205 (1912).

Plant to 100 cm or more tall, sparingly branched from near the base or only in upper half, or simple, slightly hairy throughout. **Stem** base thickened, to 2 cm diam., upper parts 3–7 mm diam., cylindrical, not ridged, internodes to 6 cm long. **Leaves** to 18 cm long, the petioles usually slightly less than half of the length of the leaf, to 8 cm long but only c. 1 mm diam. in dried material, lamina green, paler abaxially, glabrous, ovate-lanceolate, to 10 × 6.5 cm, margins entire or slightly undulate, sometimes purplish, base cuneate, apex acute to acuminate, principal lateral veins up to 13 from each side of the midvein, darker than the lamina, curved towards and ending in the margin. **Inflorescence** terminal, to 50 cm or more long, a many branched panicle of spikes, these more or less pendulous, to 18 cm or more long and 3.5–7 mm diam., leafless or with a few small leaves, bracts green. **Flowers** with 5 tepals to 2.5 mm long, mucronate, greenish white to purplish; stamens yellow; ovary white with 3 brown styles/stigmas at apex. **Utricle** exceeding the perianth, circumscissile. **Seed** c. 1.2 mm diam., shiny dark brown.

Distribution. Western South America (Andes), but cultivated and often escaped in many other countries with tropical or subtropical climates. In Singapore a non-native naturalised species.

Ecology. Cultivated ground and disturbed open areas.

Additional specimens examined. SINGAPORE: **Changi:** Loyang Avenue, 10 Apr. 2024, Ong LCMJ 2024-002 (SING [SING0398588, SING0398589]). **Neo Tiew:** Turut Track off Neo Tiew Road, 22 Jan. 1991, Chua 359 (SINU [SING0349490, SING0349491, SING0349497]). **Southern Islands:** St John's Island, near jetty, 6 Aug. 2019, Chen *et al.* 33 (SING [SING0401766]). **Sungei Buloh:** Bird Sanctuary, 22 May 1991, Chew *et al.* SB 1025 (SINU [SING0349492]). **Yishun:** near Khatib Bonsu, 10 Dec. 1993, Chua *et al.* 970 (SINU [SING0349493, SING0349494, SING0349495]).

Notes. Distinguished from other *Amaranthus* species in Singapore by the combination of its much greater size and very large, often semi-pendulous greenish inflorescences with 5-merous flowers.

2.2. *Amaranthus tricolor* L., Sp. Pl. 2: 989 (1753); Backer, Fl. Males., ser. 1, 4: 77 (1949); Walker, Fl. Okinawa: 439 (1976); Townsend, Revis. Handb. Fl. Ceylon 1: 15 (1980). – TYPE: ‘Habitat in India’, Herb. Linn. No. 1117.7 (lectotype LINN, designated by Townsend, Fl. W. Pakistan 71: 14 (1974)).

Amaranthus melancholicus L., Sp. Pl. 2: 989 (1753). – TYPE: ‘Habitat in India’, Herb. Linn. No. 1117.4 (lectotype LINN, designated by Townsend in Bosser et al., Fl. Mascareignes 142: 11 (1994)).

Amaranthus mangostanus L., Cent. Pl. I: 32 (1755); Ridley, Fl. Malay Penins. 3: 7 (1924). – TYPE: Herb. Linn. No. 1117.10 (lectotype LINN, designated by Iamónico, Taxon 63(1): 147 (2014)).

Amaranthus polygamus L., Cent. Pl. I: 32 (1755); Hooker, Fl. Brit. India 4: 721 (1885). – TYPE: Herb. Linn. No. 1117.9 (lectotype LINN, designated by Iamónico, Taxon 63(1): 148 (2014)).

Amaranthus gangeticus auct. non L.: Ridley, Fl. Malay Penins. 3: 6 (1924); Burkill, Econ. Prod. Malay Penins. 1: 127 (1935).

Plant to 60 cm or more tall. **Main stem** at least 5 mm diam., somewhat fleshy, internodes to 3.5 cm or more long. **Leaves** green, but when the species has recently escaped from gardens brightly coloured in contrasting shades of green, yellow and red, to 17 cm or more long, the petiole often almost as long as the lamina or longer, 1–1.5 mm diam., lamina ovate, sometimes broadly so, to 10 × 7 cm, glabrous but finely papillose, margins entire or slightly sinuate, cuneate at base, apex rounded to bluntly acute-acuminate, principal lateral veins up to 10 from each side of the midrib, somewhat paler than the lamina. **Inflorescences** usually reddish to pinkish, both terminal and lateral, the latter spherical and encircling the bases of the branches, to 1.5 cm diam., the terminal to 17 cm or more long, panicle, with numerous lateral spikes in the lower half, to 4 cm long and 5 mm diam., bracts long-awned. **Flowers** with paired long-awned bracteoles at base; tepals 3, long-awned, green or purplish, in males 3.5–6 mm long, shorter at first in females then accrescent in fruit; stamens often shorter than the perianth, anthers yellow; styles/stigmas 3, to 2.5 mm long. **Utricle** circumscissile below the middle. **Seed** c. 1 mm diam., shining blackish brown or brown.

Distribution. Native of and cultivated in tropical Asia, but also frequently cultivated and escaped elsewhere. In Singapore recorded as escaped from cultivation and naturalised.

Ecology. Cultivated ground and disturbed open areas.

Additional specimens examined. SINGAPORE: **Seletar:** Nature Reserve around the Seletar Reservoir, 11 May 1992, *Lim et al.* 913 (SINU [SING0349507, SING0349508]).

Notes. Distinguished from the preceding species by the number of tepals (3 vs 5) and the lowermost inflorescences being $\pm$ spherical in the leaf axils.

3. *Deeringia* R.Br.

Annual or perennial herbs, erect or long-scandent, hermaphrodite. **Leaves** alternate, entire, petiolate. **Inflorescences** simple lateral racemes and/or terminal panicles, the flowers subtended by a bract. **Flowers** with (4–)5 tepals and stamens, the latter united below, pseudo-staminodes lacking, anthers bithecal, tetrasporangiate; ovary sessile or shortly stalked, ovules > 2 to many. **Fruit** an often coloured berry.

3.1. *Deeringia amaranthoides* (Lam.) Merr., Interpr. Herb. Amboin.: 211 (1917); Backer, Fl. Males., ser. 1, 4: 71, fig. 1 (1949). – *Achyranthes amaranthoides* Lam., Encycl. 1: 548 (1785). – TYPE (syntypes): Java, *Sonnerat s.n.* (P); [published illustration] Rumphius, Herb. Amboin. 5: 235, t. 83 (1741).

Deeringia celosioides R.Br., Prodr. Fl. Nov. Holland: 413 (1810), nom. illeg. superfl.; Hooker, Fl. Brit. India 4: 714 (1885); Ridley, Fl. Malay Penins. 3: 4 (1924). – *Celosia baccata* Retz., Observ. Bot., fasc. V: 23 (1788). – TYPE: *Unknown collector [König] s.n.* (lectotype LD [LD1760928], designated by Kanis, Contr. Herb. Australiense 1: 13 (1972)).

Semi-perennial, scandent shrub, adpressed pubescent at first. **Stems** to 6 m long or more, slender, obscurely angled when young, later terete. **Leaves** to 12×8 cm or smaller near the inflorescences, petiole 1–3 cm or more long, lamina ovate to oblong-lanceolate, often obtuse to truncate at base, apex acute to acuminate or caudate, mucronate at first, soon glabrescent. **Inflorescences** axillary and terminal, racemose, lateral to 30 cm long, the terminal in a much larger panicle, shortly pedunculate, racemes to 40-flowered or more, bracts subtending the flowers narrowly acute. **Flowers** solitary or clustered, said to be unpleasantly scented; pedicels to 2 mm long; tepals patent to reflexed at anthesis, greenish with white margins; stamens c. 2 mm long, fused only at the base; stigmas 3, later recurved on the fruit. **Fruit** a red (rarely white) berry, $\pm$ globose, c. 5 mm diam., to 5(–9)-seeded. **Seeds** c. 1 mm diam., emarginate at the hilum, testa smooth.

Distribution. Tropical southern Asia (India to China) and northern Australia. In Singapore it is a cryptogenic species recorded only once.

Ecology. Climbing in forest and scrub, usually in drier environments or those with a dry season; often collected on calcareous substrates.

Additional specimens examined. SINGAPORE: **Telok Kurau:** Lorong L, 10 Apr. 1924, *Chan s.n.* (SING [SING0397033]).

Notes. Townsend (1974) appears to have selected a specimen in the Lamarck herbarium (P) as lectotype of *Achyranthes amaranthoides*; if that choice is not effective, the Rumphius illustration would be preferable as it was cited by Lamarck, who otherwise mentions only living material. The specimen selected as the lectotype of *Celosia baccata* by Kanis has no annotation, though it is probably material sent to Retzius by König and possibly collected by König himself.

This species is readily distinguished from other Amaranthaceae species in Singapore by its scandent habit and berries (rather than utricles). Although widespread in the Malesian region its native status in Singapore may be questioned in view of its ecological preference and it has been collected only once. The above century old record does not indicate the habitat of the plant, which is known to have been cultivated elsewhere in the region for its medicinal properties (Backer, 1949), a possible scenario here, as it was found by an old road that still exists. Maps from the period indicate that the Telok Kurau area in south-eastern Singapore was largely occupied by rubber plantations and Backer states that the species can be found in secondary vegetation, so it could also have survived from a former native stand.

4. *Gomphrena* L.

Hermaphrodite herbs or subshrubs, mostly hairy throughout. **Stems** often swollen at the nodes. **Leaves** opposite or congested at plant base, sessile or shortly petiolate. **Inflorescence** terminal, globose to shortly spicate, pedunculate or sessile. **Flowers** with 5 tepals, free or united at base; stamens 5, united into a tube, lacking pseudo-staminodes, anthers monothecal, bisporangiate; ovary 2-carpellate, 1-ovulate. **Fruit** a utricle.

4.1. *Gomphrena globosa* L., Sp. Pl. 1: 224 (1753); Hooker, Fl. Brit. India 4: 732 (1885); Ridley, Fl. Malay Penis. 3: 10 (1924); Burkill, Dict. Econ. Prod. Malay Penins. 1: 1115 (1935); Walker, Fl. Okinawa: 443 (1976); Townsend, Revis. Handb. Fl. Ceylon 1: 55 (1980). – TYPE: ‘Habitat in India’, Herb. Linn. No. 319.1 (lectotype LINN, designated by Townsend, Fl. W. Pakistan 71: 46 (1974)).

Shrub-like herb to 60 cm tall, with adpressed whitish hairs throughout. **Stems** of basal branches c. 4 mm diam., internodes up to 9 cm long, nodes swollen, to 1 cm thick, sometimes reddish tinged. **Leaves** to 8.5 cm long, petiole to 2 cm long but often less, lamina elliptic to slightly obovate, entire, principal lateral veins up to 4 from each side of the midvein, distally almost parallel, base cuneate, apex acuminate to apiculate. **Inflorescence** terminal, sessile, globose to oblong, to 2.5 cm diam., purplish or magenta at first, comprised of densely arranged bracts almost hiding the flowers, below it the ultimate stem internode much elongated and resembling a peduncle, terminated by a pair of small bract-like leaves. **Flowers** bearing conspicuous yellow anthers slightly exserted from the bracts at anthesis. **Utricle** 1-seeded; seeds brown, shiny.

Distribution. Central America, but escaped from gardens in many warmer regions of the world. In Singapore a non-native casual species of recent occurrence, known mainly from the coast and offshore islands.

Ecology. Disturbed open habitats.

Additional specimens examined. SINGAPORE: **Pulau Retan Laut:** s.l., 20 Jun. 1994, *Chen et al. RL14* (SINU [SING0349530]). **Pulau Sakeng:** s.l., 20 Jun. 1994, *Tan et al. SK304* (SINU [SING0349531]). **Pulau Ubin:** s.l., 20 Jun. 1990, *Sim 31* (SINU [SING0349532]). **Yishun:** Khatib Bongsu, 10 Dec. 1993, *Chua et al. 969* (SINU [SING0349533, SING0349534]).

Notes. Readily distinguished from the other naturalised species in Singapore, *Gomphrena celosioides* Mart., by its more upright habit and much wider leaves and inflorescences, the latter brightly coloured when young, not whitish.

Another lectotypification in Amaranthaceae

Allmania nodiflora (L.) R.Br. ex Wight (Fig. 2)

Allmania nodiflora (L.) R.Br. ex Wight var. *esculenta* (Moq.) Hook.f., Fl. Brit. India 4: 717 (1885); Gamble, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 75: 8 (1912). – *Chamissoa esculenta* Moq. in de Candolle, Prodr. 13: 249 (1849). – TYPE: ‘India’ [Singapore], 1822, *Wallich s.n.* [Cat. No. 6892] (lectotype P [P00799265], designated here; isolectotype K [K001126069]).

Notes. A lectotype is designated for *Chamissoa esculenta* Moq., a synonym of *Allmania nodiflora* (L.) R.Br. ex Wight which is native to Singapore (Lindsay et al., 2022).

Crassulaceae: the status of *Bryophyllum* Salisb. and a lectotype for *Kalanchoe pinnata* (Lam.) Pers.

Kalanchoe Adans., Fam. 2: 248 (1763); Descoings in Eggli (ed.), Ill. Handb. Succ. Pl., Crassulaceae: 143 (2003); Thiede & Eggli in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 9: 83 (2007). – TYPE: *Kalanchoe laciniata* (L.) DC. (= *Cotyledon laciniata* L.).

Bryophyllum Salisb., Parad. Lond., tab. 3 (1805). – TYPE: *Bryophyllum calycinum* Salisb. (= *Kalanchoe pinnata* (Lam.) Pers.).

Notes. As demonstrated by gene sequence studies, this genus should include species formerly segregated as *Bryophyllum* Salisb., in which two of the three species treated in the Singapore Checklist (Lindsay et al., 2022) were classified (see Gehrig et al. (2001), Mort et al. (2001) and the standard treatments cited under *Kalanchoe* above).

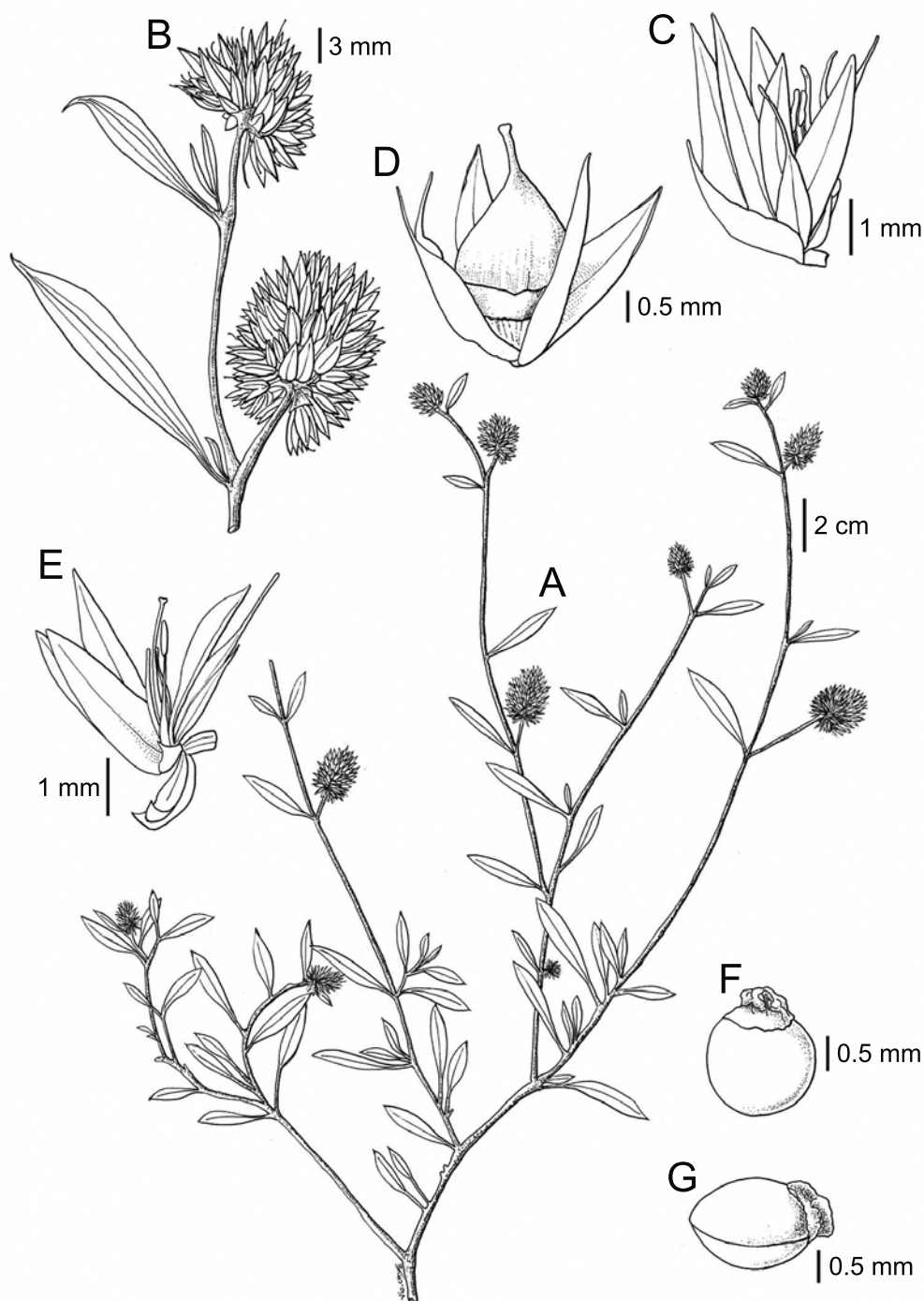


Fig. 2. *Allmania nodiflora* (L.) R.Br. ex Wight. **A.** Habit. **B.** Inflorescences. **C.** Male flower with vestigial pistil. **D.** Fruit with perianth remains. **E.** Female flower with vestigial stamens. **F, G.** Different views of a seed. From Singapore, Pulau Tekong, *Lai 402* (SING). Drawn by V. Chye.



Fig. 3. *Kalanchoe pinnata* (Lam.) Pers. **A.** Plants (indicated by yellow arrows) growing on an abandoned old retaining wall along Upper Bukit Timah Road. **B.** Close-up of individuals. (Photos: Y.W. Jong)

This segregate is distinguished from *Kalanchoe* s.s. by its pendent flowers and leaf-margins/apices or inflorescences bearing detachable plantlets, which enables its species to become weedy or invasive.

Kalanchoe pinnata (Lam.) Pers., Syn. Pl. 1: 446 (1805); Backer, Fl. Males., ser. 1, 4(3): 199 (1951); Keng, Gard. Bull. Singapore 27: 249 (1974); Walker, Fl. Okinawa: 509 (1976); Keng, Concise Fl. Singapore 1, Gymn. Dicot.: 25, fig. 22.1 (1990); Turner et al., J. Singapore Natl. Acad. Sci. 18 & 19: 65 (1990); Turner, Gard. Bull. Singapore 45: 61 (1993); Turner & Tan in Wee & Ng (eds), First Look Biodivers. Singapore: 113 (1994); Philcox, Revis. Handb. Fl. Ceylon 13: 62 (1999); Hu, Fl. Hong Kong 2: 16 (2008); Chong et al., Checkl. Vasc. Pl. Fl. Singapore: 52, 123, 263 (2009); Lok et al., Cosmos 6: 75 (2010); Lindsay et al., Gard. Bull. Singapore 74 (Suppl. 1): 266 (2022). – *Cotyledon pinnata* Lam., Encycl. 2(1): 141 (1786). – TYPE: France, Île de France, Commerson s.n. (lectotype P [P00443565], designated here). (Fig. 3)

Bryophyllum pinnatum (Lam.) Oken, Allg. Naturgesch. 3(3): 1966 (1841); Burkill, Dict. Econ. Prod. Malay Penins. 1: 376 (1935); Liu & Chuang, Fl. Taiwan, ed. 2, 3: 10–11 (1992); Sarwar, Fl. Pakistan 209: 17 (2002).

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References

- Backer, C.A. (1949). Amaranthaceae. In: van Steenis, C.G.G.J. (ed.), *Flora Malesiana*, ser. I, vol. 4, part 1, pp. 69–98. Djakarta: Noordhoff-Kolff N.V.
- Gehrig, H., Gaußmann, O., Marx, H., Schwarzott, D. & Kluge, M. (2001). Molecular phylogeny of the genus *Kalanchoe* (Crassulaceae) inferred from nucleotide sequences of the ITS-1 and ITS-2 regions. *Pl. Sci.* 160: 827–835.
- Lindsay, S., Middleton, D.J., Ho, B.C., Chong, K.Y., Turner, I.M., Ibrahim, A., Alonso-Garcia, M., Ang, W.F., Ashton, P.S., Athen, P. et al. (2022). Flora of Singapore: Checklist and bibliography. *Gard. Bull. Singapore* 74(Suppl. 1): 3–860.
- Mort, M.E., Soltis, D.E., Soltis, P.S., Francisco-Ortega, J. & Santos-Guerra, A. (2001). Phylogenetic relationships and evolution of Crassulaceae inferred from *matK* sequence data. *Amer. J. Bot.* 88: 76–91.
- Townsend, C.C. (1974). Amaranthaceae. In: Nasir, E. & Ali, S.I. (eds), *Flora of West Pakistan*, no. 71. Karachi: Department of Botany, University Karachi.

