GOODENIACEAE (P. W. Leenhouts, Leyden)

Herbs or shrubs. *Leaves* spirally arranged—often radical or in tufts at the end of the twigs—very rarely opposite, simple, penninerved, exstipulate. Indument, if present, either consisting of simple, or fasciculate, or stellate hairs; leaf-axils often with hair tufts. *Inflorescences* cymose, bracteate, or flowers solitary, in the latter case sometimes together resembling racemes. *Flowers* 5-merous, epi- (or peri-) gynous, bisexual, protandrous. *Calyx* gamosepalous, tube nearly always adnate to the ovary, lobes usually well-developed. *Corolla* gamopetalous, nearly always zygomorphous by a dorsal slit; the free segments with very thin, sharply indupli-cative, membranous margins. *Stamens* 5, episepalous, free (rarely the anthers cohering in a tube), usually fully glabrous; filaments slender, linear, usually slightly narrowed from base to apex; anthers basifixed, introrse, rather long and narrow, 2-celled, cells opening lengthwise by a slit. *Disk* absent. *Ovary* 2- or (often imperfectly) 1-celled; style cylindrical, simple (in *Calogyne* bi- or trifid at the apex); stigma surrounded by a cup-shaped (in *Lechenaultia* distinctly 2-lobed) indusium, the margin of which is often ciliate. *Ovules* ∞–1, either axillary or $\pm$ basally attached, anatropous, rarely campylotropous. *Fruits* usually capsular, sometimes drupaceous; calyx persistent. *Seeds* ∞–1, provided with endosperm.

Distribution. Fourteen genera comprising *c.* 300 *spp.*, almost exclusively Australian, in (mostly *East-*)*Malaysia* 5 genera with 7 *spp.* conspecific with or allied to Queensland species.

Among the 14 genera 8 are strictly confined to Australia (1 also in Tasmania), one is distinctly sub-antarctic in the S. Pacific (*Selliera*), two possess a stray representative through Malaysia to SE. Asia (*Calogyne*, *Goodenia*), two others have a stray representative in New Guinea and the Aru Islands (*Lechenaultia*, *Velleia*), and one genus is wider distributed (*Scaevola*). Besides two littoral species which are widely distributed in the Old and New World, *Scaevola* centers in Australia but possesses also species in SE. Asia (1), Malaysia (2), Melanesia (several), New Zealand (1), Hawaii (several), and the Marquesas (2).

Ecology. The family is nearly exclusively confined to rather arid or periodically dry regions with open vegetation, consequently in *Malaysia* representatives are collected on sandy beaches, on open slopes, in savannahs, on dry rice-fields, and along forest edges. Only one species is important physiognomically, *viz Scaevola sericea;* it is a typical constituent of the littoral *Barringtonia*-formation behind the sandy beach. In places it may grow socially and form a pure, tall, shrubby fringe. In small islands, notably in the Pacific atolls, it is often very abundant and occurs not infrequently in the more open sandy or bouldery areas towards the centre of the islands. On rocky shores it is found on cliffs up to several tens of metres above sea-level.

Pollination. KRAUSE gave a rather extensive review on the flower biology of the representatives of this family (Pfl. R. Heft 54, 1912, 13). The flowers appear to be protandrous, the anthers releasing the pollen when the flowers are still in bud. This pollen is deposited in the cupular indusium surrounding the stigma. At that stage the style equals the stamens in length and the stigma is not yet receptive, and often not developed. The pollen remains in the indusium and becomes available immediately after anthesis and may then be carried away by visiting insects, mainly bees and butterflies. The style enlarges during anthesis and the stigma becomes receptive at a later stage. Though self-fertilization is possibly not quite excluded, cross-fertilization seems to be the rule. A remarkably parallel flower biology is found in the also predominantly Australian family *Proteaceae* (*cf.* p. 149).

Dispersal. The fruits of most genera are capsular, opening by valves or slits. The seeds are usually small, light, flattened, and margined or rather narrowly winged, a structure suitable for dispersal by wind. The fruits of *Scaevola*, however, are drupaceous; their pericarp is more or less fleshy, the stone very hard, woody or sometimes corky. Dispersal will obviously be effected by frugivorous birds. In two littoral species, *viz S. sericea* and *S. plumieri*, fruits float very well in seawater retaining their viability for a long time (see GUPPY, Plants, seeds & currents, 1917, p. 227–236). Their social occurrence, consequently an abundant production of fruit, and the easy means of dispersal by seawater and currents, is apparently mainly responsible for their large area of distribution.

Anatomy. See METCALFE & CHALK, Anat. Dicot. 2 (1950) 807–810.

Taxonomy. *Goodeniaceae* are closely related to the *Campanulaceae-Lobelioideae*, from which they are mainly different by the absence of latex and by the much stronger development of the indusium. The monotypical Australian family *Brunoniaceae* has by some authors—among which recently ERDTMAN,

on palynological grounds—been united with the *Goodeniaceae*. Furthermore, there is some relationship with the *Stylidiaceae*.

Phytochemically, the presence of *dipsacaan* in *Scaevola sericea* is interesting as this pigment is otherwise known only from the *Dipsacaceae* (see TAMMES, Rec. Trav. Bot. Néerl. 5, 1908, 84). Furthermore, the presence of *inuline* has been recorded, a starch common to many *Synantherae*.

KEY TO THE GENERA

1. Shrubs or lianas. Fruits drupaceou . . . . . **5. Scaevola**
1. Herbs. Fruits capsular.
2. Leaves narrowly linear, *c.* 1 mm wide. Fruits linear, long-beaked, in the basal half opening by longitudinal slits . . . . . **4. Lechenaultia**
2. Leaves at least 5 mm wide. Fruits ellipsoid, not long-beaked, opening by valves.
3. All leaves radical. Flowers in cymes. Calyx free. Corolla adnate to the basal half of the ovary. Capsules 4-valved . . . . . **1. Velleia**
3. Part of the leaves cauline. Flowers solitary. Calyx-tube fully adnate to the ovary. Corolla epigynous. Capsules 2-valved.
4. Style simple. Leaves distinctly petioled, obovate to spathulate . . . . . **2. Goodenia**
4. Style 3-fid at the apex. Leaves sessile, linear . . . . . **3. Calogyne**

1. VELLEIA

J. E. SMITH, Trans. Linn. Soc. 4 (1798) 217; KRAUSE, Pfl. R. Heft 54 (1912) 27.

Herbs. *Leaves* radical, spathulate. *Inflorescences* from the axils of the rosette leaves, peduncled, repeatedly (cymosely) forked, erect or ascending. *Sepals* free or at the base slightly adnate to the ovary. *Corolla* hypo- or sometimes perigynous. *Ovary* superior or semi-inferior, imperfectly 2-celled. *Capsule* (2- or) 4-valved. *Seeds* few, compressed, margined or winged.

Distr. About 20 *spp.*, all but one restricted to Australia and Tasmania.

1. Velleia spathulata R. BROWN, Prod. (1810) 580; JUSSIEU, Ann. Mus. Hist. Nat. 18 (1811) t. 1, f. 3; DON, Gard. Dict. 3 (1834) 726; DC. Prod. 7 (1839) 518; DE VRIESE, Nat. Verh. Holl. Mij Wet. II, 10 (1854) 174; KRAUSE, Pfl. R. Heft 54 (1912) 29, f. 7 E–F; MERR. & PERRY, J. Arn. Arb. 22 (1941) 387; STEEN. Blumea 7 (1954) 597.

Apparently perennial herb, *c.* 10 cm high (Australian specimens somewhat larger). *Leaves* 3½–5 by 1–1½ cm, herbaceous, glabrous (white-bearded in the axils); margin entire to faintly sinuate, sometimes with a few small teeth; apex rounded. *Cymes* 2–6, ascending, 7–12 cm long, laxly branched, few-flowered, mainly towards the apex with some scattered, reverse, appressed short hairs; bracts spathulate, up to 5 by 1½ mm. *Flowers* 8–9 mm long. *Sepals* 3, free, ovate, 5 by 2 mm, acute, outside glabrous, inside minutely tomentose towards the apex. *Corolla* adnate to the lower half of the ovary, 8 mm long, light-yellow, outside in the lower half sparsely pubescent, dorsally slit up to *c.* 1½ mm from the base, dorsal and lateral petals connate for 3½ mm, lateral ones and ventral one for 6 mm, ventral lobe slightly longer, dorsal ones slightly shorter than lateral ones, all with broad membranous wings, those at both sides of the dorsal slit being longer than the other ones. *Stamens* 3 mm long. *Ovary* 1½–2 mm long, halfway connate with the corolla, glabrous, with *c.* 7 ± basal ovules; style 3½ mm long, with some scattered short hairs; indusium membranous, ciliate, in the basal part adnate to the semi-discoid, crenulate stigma which is 1½–2 mm in diam. *Capsules* 3 mm, the upper half opening by 4 valves. *Seeds* 2–3, elliptic, *c.* 2 mm long, margined.

Distr. E. Australia (Queensland, New South Wales) and *Malaysia:* SE. New Guinea (Western Div.: Oriomo River, Wassi Kussa).

Ecol. Damp places in the savannah-forests at low altitude in seasonal regions. *Fl.* Dec.–March.

Note. This species belongs to sect. *Velleia* (*Velleiae verae* R. BROWN, *sect. Trisepala* KRAUSE), characterized by the 3-merous calyx.

2. GOODENIA

J. E. SMITH, Sp. Bot. New Holl. pt 1 (1793) 15; Trans. Linn. Soc. 2 (1794) 346; KRAUSE, Pfl. R. Heft 54 (1912) 41.—**Fig. 1.**

Herbs or shrubs. *Calyx-tube* adnate to the ovary. *Ovary* (sub-)inferior, usually imperfectly 2-celled. *Capsule* 2-(or 4-)valved. *Seeds* usually compressed, margined.

Distr. About 110 *spp.* all but one restricted to Australia and Tasmania.

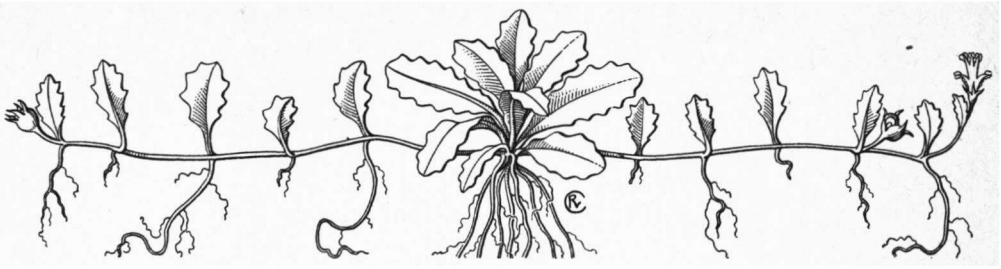

Fig. 1. *Goodenia koningsbergeri* (BACK.) BACK., × 2/3 (COERT 937).

1. Goodenia koningsbergeri (BACK.) BACK. *ex* BOLD. Zakfl. (1916) 88; BACK. Onkr. Suiker. (1931) 744; MERR. Brittonia 5 (1943) 32; BACK. Bekn. Fl. Java (em. ed.) 8 (1949) fam. 185, p. 1.—*Selliera koningsbergeri* BACK. Bull. Jard. Bot. Btzg II, 12 (1913) 36.—*Calogyne cambodiana* DANGUY, Not. Syst. 3 (1914) 22, *cum fig.*—*G. cambodiana* KERR, Fl. Siam. En. 2 (1936) 301.—Fig. 1.

Creeping, glabrous (except hair-tufts in the axils of young leaves), slightly succulent, annual herb. *Stems* rooting, terete, slender, up to 50 cm long, internodes 1 1/2–2 cm. *Leaves* radical and cauline; pale green, obovate to spathulate, 1 1/2–6 1/2 by 3/4–3 cm, slightly fleshy, narrowed towards the base; margin coarsely scattered-dentate; apex blunt to acute; petiole flattened, 1/2–4 cm. *Flowers* solitary, axillary, 7–10 mm long, glabrous; pedicel *c.* 1/2–1 1/2 cm long; bracteoles 0. *Calyx-lobes* lanceolate, 2–3 1/2 by 3/4–1 mm, acute. *Corolla* 5–8 mm long, pale yellow, white at base, the margin sometimes violet, and with some brown blotches on the inner side, dorsally slit up to 1 mm from the base, ventral and lateral lobes connate for 5–6 mm, dorsal ones slightly shorter and connate with the lateral ones for 1 1/2 mm, all lobes with a pair of deltoid, membranous wings at the apex, dorsal lobes moreover with a second wing along the dorsal margin. *Stamens* 2 1/2–5 mm long, connective acuminate. *Ovary* inferior, 1-celled, with 8 basally inserted ovules; style 3–5 mm, glabrous; indusium 1 by 1 1/2 mm, ciliate, including the cupular *c.* 1 1/2 mm high, crenulate stigma. *Capsules* on up to 2 1/2 cm long, recurved pedicels, slightly flattened-globular, 5–6 mm diam., 2-valved. *Seeds* 2–6, elliptic, compressed, *c.* 5–6 by 4 mm.

Distr. Siam, Cambodia, and *Malaysia:* Java (from Indramaju eastwards), Madura, Kangean, and Timor.

Ecol. A weed of dry rice-fields, of heavy, poorly drained clay-flats, in open places, restricted to low altitudes, up to 400 m, in distinctly seasonal regions, often gregarious. *Fl.* Dec.–Aug., *fr.* Febr.–May.

Note. This species belongs to *sect. Goodenia* (*Eugoodenia* BENTH.) *subsect. Ebracteolatae* KRAUSE. I doubt whether the subdivision of the section based on the presence or absence of the bracteoles is a natural one.

3. CALOGYNE

R. BROWN, Prod. (1810) 579; KRAUSE, Pfl. R. Heft 54 (1912) 94.—*Balingayum* BLANCO, Fl. Filip. (1837) 187.

Annual herbs. *Leaves* spirally arranged, irregular-dentate. *Flowers* axillary, without bracteoles. *Calyx-tube* adnate to the ovary. *Ovary* inferior, imperfectly 2-celled; style 2- or 3-branched, indusium 2-lobed, ciliate; stigma inconspicuous. *Capsules* 2-valved. *Seeds* flattened, margined to narrowly winged.

Distr. Species 3–8, with the exception of *C. pilosa* restricted to Australia.

1. Calogyne pilosa R. BROWN, Prod. (1810) 579; DC. Prod. 7 (1839) 517; DE VRIESE, Nat. Verh. Holl. Mij Wet. II, 10 (1854) 180; BAILL. Hist. Pl. 8 (1886) f. 180; E. & P. Nat. Pfl. Fam. 4, 5 (1889) f. 43 R; BANKS & SOL. Bot. Cook's Voy. 2 (1901) 55, t. 177 B; MERR. Publ. Gov. Lab. Philip. *no* 35 (1905) 68; KRAUSE, Pfl. R. Heft 54 (1912) 95, f. 17 A.B; MERR. Sp. Blanc. (1918) 374; En. Philip. 3 (1923) 589; MERR. & PERRY, J. Arn. Arb. 22 (1941) 388.—*Balingayum decumbens* BLANCO, Fl. Filip. (1837) 187; ed. 2 (1845) 132; ed. 3, 1 (1877) 237; F.-VILL. Nov. App. (1880) 93; MERR. Publ. Gov. Lab. Philip. *no* 27 (1905) 48.

Erect, annual herb, (3–)10–25 cm high, the few leafy and flower-bearing stems creeping after flowering. *Stems* terete, slender, laxly branched, laxly appressedly short-pubescent, mainly at the apex. *Leaves* spirally arranged, most of them contracted into basal rosettes and at the ends of the stems, sessile, linear, 4–8 by 1/2–3/4 cm, herbaceous, bluish green, laxly subpatently short-pilose, upper surface sometimes subglabrous; base narrowed to hastate; margin coarsely irregularly dentate; apex acute; midrib rather prominent beneath. *Pedicels* 1 cm. *Flowers* 9 mm, sparsely pubescent. *Calyx-lobes* linear-lanceolate, 3 by

1 mm; throat inside with a ring of hairs. *Corolla* 8 mm long, outside light brownish purple, inside yellow with an orange spot; dorsally slit up to *c.* 1½ mm from the base, ventral and lateral lobes connate for *c.* 5 mm, dorsal and lateral ones for *c.* 2 mm, all lobes with membranous wings at both sides at the apex, those along the dorsal slit being rather long, all other ones deltoid; outside mainly with some cilia on the nerves in the apical part of the lobes, inside glabrous. *Stamens* 5(–3?), 3 mm long, connective mucronate. *Ovary* 1 mm long, septum nearly invisible, with 6 ovules, inserted on both sides of a low rim at the base; style 4 mm, with a few patent, long, and stiff hairs, 3-branched, indusium deeply 2-lobed. *Capsules* ellipsoid, 4–5 by 2–2½ mm, laxly pubescent; calyx slightly enlarged (lobes *c.* 4 mm long). *Seeds* 5, ovate, 4 by 2 mm.

Distr. N. Australia to S. China, in *Malaysia:* Philippines (Luzon: Rizal, Zambales, and Bulacan Prov.; Culion), Moluccas (Tenimber Isl.: P. Jamdena), and S. New Guinea (Merauke & Oriomo River).

Ecol. In Luzon apparently rather common in fallow rice-fields, in New Guinea and the Tenimber Isl. in rather dry savannahs and savannah-forests, apparently always under seasonal climatic conditions, up to 100 m. *Fl.* and *fr.* Nov.–March.

Vern. *Baliñgáyo*, Tag.

4. LECHENAULTIA

R. BROWN, Prod. (1810) 581; KRAUSE, Pfl. R. Heft 54 (1912) 97 *(Leschenaultia).*— **Fig. 2.**

Herbs or small, often ericoid, shrubs. *Leaves* spirally arranged, linear. *Flowers* solitary, in the upper leaf-axils or in racemes. *Stamens* 5, anthers usually connate surrounding the style. *Ovary* inferior, linear, 2-celled; ovules ∞, inserted on 2 parietal placentas; indusium 2–3-lobed. *Capsule* linear, ∞-seeded, sometimes beaked, opening by 4 slits caused by decay of internerval tissue.

Distr. About 20 *spp.*, all but the present one restricted to Australia.

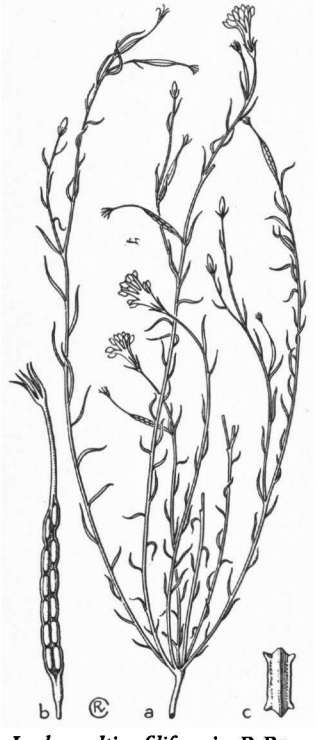

Fig. 2. *Lechenaultia filiformis* R.Br. *a.* Habit, *b.* fruit, *c.* seed (*a* × ¾, *b* × 3, *c* × 7½; *a* VAN ROYEN 5054, *b–c* BUWALDA 5527).

1. Lechenaultia filiformis R. BROWN, Prod. (1810) 581; DC. Prod. 7 (1839) 519; F.v.M. Fragm. 6 (1868) 9, t. 48; F. M. BAIL. Queensl. Fl. 3 (1900) 892; KRAUSE, Pfl. R. Heft 54 (1912) 108; MERR. & PERRY, J. Arn. Arb. 30 (1949) 60; STEEN. Blumea 7 (1954) 598.—**Fig. 2.**

Erect, apparently annual, herb, 10–25 cm. *Stems* terete, with 4 ridges, slender, stiff, glabrous or with very few appressed, short hairs, the internodes rather long. *Leaves* sessile, glabrous, 1–2 cm by 1 mm, entire, mucronate, midrib prominent beneath. *Flowers* few, in the upper leaf-axils, stalked, 2–2½ cm long. *Calyx-tube* adnate to the ovary; lobes linear, acute, dorsal one and both ventral ones 2 by ⅓ mm, lateral ones 3½ by ½ mm. *Corolla c.* 1½ cm long, dorsally slit up to *c.* 3 mm from the base, lobes connate for *c.* 7 mm, dorsal lobes *c.* 1 cm long, lateral and ventral ones distinctly longer, all—specially the larger ones—with broad membranous margins, which are undulate at the base and *c.* 2 mm longer than the corolla segments; corolla outside minutely pubescent at the base, mainly on the nerves, inside sparsely pilose; cream-coloured at the base, pale lilac towards the apex. *Stamens* 4½ mm long, anthers emarginate at the apex. *Ovary c.* 1 cm long, as slender as the pedicel; style 7½ mm long, glabrous; indusium 1½ mm high, 3-lobed, inside velvety pubescent, stigma not prominent. *Capsules* 1½ cm long, constricted between the seeds when dry, with a 6–7 cm long, sterile beak, basal 1–2 mm also sterile; slits only in the fertile part. *Seeds* ellipsoid, 1¾ by ¾ mm, distinctly flattened, strongly truncate and acuminate at both ends; testa hard.

Distr. Queensland, North Australia, and *Malaysia:* New Guinea (Wassi Kussa & Kebar Valley), S. Moluccas (Aru Isl.: P. Trangan).

Ecol. Among grasses of savannahs and savannah-forests on acid soil under seasonal climatic conditions, up to 650 m. *Fl.* July, Nov.–Dec.

Note. This is the type species of *sect. Latouria* ENDL. Gen. (1838) 508, which is mainly characterized by the beaked fruits.

5. SCAEVOLA

LINNÉ, Mant. (1771) 145; KRAUSE, Pfl. R. Heft 54 (1912) 117.—**Fig. 3–5.**

Shrubs *(Mal. spp.). Leaves* spirally arranged or opposite, entire to dentate. Pubescence, if dense, often consisting of stellate hairs. *Inflorescences* axillary, cymose, provided with bracts and bracteoles. *Flowers* subsessile. *Calyx-tube* adnate to the ovary. *Ovary* (sub-)inferior, 2(–1)-celled, every cell with 1 axillary ovule. *Stigma* 2-lobed *(Mal. spp.). Drupes* sometimes more or less fleshy; stone rather hard, containing 1 or 2 seeds.

Distr. The genus *Scaevola* has been subdivided into 6 sections, in total comprising *c.* 80 *spp.* Three of these sections, with *c.* 60 *spp.*, are nearly exclusively Australian (one *sp.* also in Tasmania, one exclusively in the Kermadec Isl.). Of the remaining three sections two are monotypical, one being restricted to SE. Asia (Formosa, Hainan, and Tonkin), the other (*Enantiophyllum*) to E. Malaysia & N. Australia.

Sect. Scaevola contains 19 *spp.*; 2 of its species are littoral and widely distributed (*S. sericea* from Madagascar through SE. Asia, *Malaysia*, and tropical Australia to the Central Pacific and *S. plumieri* from the Galapagos Isl. through tropical America and Africa to Ceylon and India). The remaining species are all extra-Australian: 2 are endemic in the Marquesas Isl., 8 in the Hawaiian Isl., 1 in Fiji, 1 in the New Hebrides, 4 in New Caledonia, and 1 in Malaysia.

KEY TO THE SPECIES

1. Leaves spirally arranged, usually tufted at the ends of the branches (*sect. Scaevola*).
2. Flowers 2–2½ cm long. Calyx-lobes usually 2½ mm or more. Fruits globular, white, *c.* 1 cm. **1. S. sericea**
2. Flowers 1 cm long. Calyx-lobes 1 mm. Fruits ellipsoid, black, 5–6 mm long . **2. S. micrantha**
1. Leaves opposite (*sect. Enantiophyllum*) . . . . . **3. S. oppositifolia**

1. Scaevola sericea VAHL, Symb. Bot. 2 (1791) 37; BL. Bijdr. (1826) 730; PRESL, Reliq. Haenk. 2 (1835) 57; DC. Prod. 7 (1839) 506; DE VRIESE, Ned. Kruidk. Arch. I, 2 (1850) 31; Nat. Verh. Holl. Mij Wet. II, 10 (1854) 29; MIQ. Fl. Ind. Bat. 2 (1856) 581; MERR. Philip. J. Sc. 5 (1910) Bot. 250; FOSBERG & SACHET, Taxon 5 (1956) 7, with full discussion of synonymy.—*Buglossum litoreum* RUMPH. Herb. Amb. 4 (1743) 116, t. 54.—*Lobelia plumieri* (*non* L.) BURM. *f.* Fl. Ind. (1768) 189.—*Lobelia frutescens* MILL. Gard. Dict. ed. 8 (1768) *p.p. pro syn.*—*S. lobelia* MURR. Syst. Veg. ed. 13 (1774) 178, *p.p., nom. illeg.*; WILLD. Sp. Pl. 1 (1798) 955; BLANCO, Fl. Filip. (1837) 147; ed. 2 (1845) 104; ed. 3, 1 (1877) 193, t. 210; DE VRIESE, Ned. Kruidk. Arch. I, 2 (1850) 20; Nat. Verh. Holl. Mij Wet. II, 10 (1854) 20; VIDAL, Sinopsis, Atlas (1883) 29, t. 59.—*Lobelia taccada* GAERTN. Fruct. 1 (1788) 119, t. 25 f. 5.—*S. koenigii* VAHL, Symb. Bot. 3 (1794) 36; R. & S. Syst. 5 (1819) 160; SPRENGEL, Syst. 1 (1825) 752; BL. Bijdr. (1826) 730; CURTIS, Bot. Mag. (1827) t. 2732; DECNE, Nouv. Ann. Mus. Hist. Nat. Paris 3 (1835) 408; DC. Prod. 7 (1839) 505, *sphalm. kaenigii*; HASSK. Pl. Jav. Rar. (1848) 525; MIQ. Fl. Ind. Bat. 2 (1857) 580, *incl.* also *var. macrocalyx*; F. SINCL. Indig. Fl. Hawai. (1885) t. 32; VIDAL, Rev. Pl. Vasc. Filip. (1886) 165; SCHÖNLAND, E. & P. Nat. Pfl. Fam. 4, 5 (1889) 76, f. 43 S–T, 47; SCHIMPER, Bot. Mitt. Tropen 3 (1891) 172, t. 7 f. 25; KING & GAMBLE, J. As. Soc. Beng. 74, ii (1906) 50; KOORD. Exk. Fl. Java 3 (1912) 305; GUPPY, Plants, Seeds, and Currents (1917) 227; RIDL. Fl. Mal. Pen. 2 (1923) 199, f. 88.—*S. taccada* ROXB. Hort. Beng. (1814) 15; Fl. Ind. 2 (1824) 146; ed. 2, 1 (1832) 527; DC. Prod. 7 (1839) 505.—*S. plumieri* (*non* VAHL) BL. Bijdr. (1826) 730.—*S. velutina* PRESL, Reliq. Haenk. 2 (1835) 58.—*S. leschenaultii* DC. Prod. 7 (1839) 506.—*S. macrocalyx* DE VRIESE, Ned. Kruidk. Arch. I, 2 (1851) 138; Nat. Verh. Holl. Mij Wet. II, 10 (1854) 26, t. 3 f. 1–4.—*S. piliplena* MIQ. Fl. Ind. Bat. 2 (1857) 581; KOORD. Exk. Fl. Java 3 (1912) 305.—*S. frutescens* (*non Lobelia frutescens* MILL.) KRAUSE, Pfl. R. Heft 54 (1912) 125, f. 25; MERR. Philip. J. Sc. 7 (1912) Bot. 353, *incl.* also *var. sericea*; Int. Rumph. (1917) 496; Sp. Blanc. (1918) 374; Bibl. En. Born. Pl. (1921) 586; En. Philip. 3 (1923) 590; DOCTERS VAN LEEUWEN, Ann. Jard. Bot. Btzg 37 (1927) t. 4 f. 12–13; HEYNE, Nutt. Pl. (1927) 1428; SKOTTSB. Bull. Bish. Mus. *no* 43 (1927) f. 14 h; BURK. Dict. (1935) 1970; DOCTERS VAN LEEUWEN, Ann. Jard. Bot. Btzg 46/47 (1936) 423; CORNER, Ways. Trees 1 (1940) 310, f. 101; BACK. Bekn. Fl. Java (em. ed.) 8 (1949) fam. 185, 2; STEEN. Fl. Sch. Indon. (1949) 378; HENDERS. Mal. Wild Fl. 2 (1950) 253, f. 236. **Fig. 3–4, 5g.**

Erect or spreading shrub, sometimes a small tree (up to 7 m). *Branchlets* ½–1 cm thick, terete, usually glabrous, but the leaf-axils provided with

stiff tufts of white hairs. *Leaves* spirally arranged, the majority crowded at the ends of the branches, sessile, spathulate to obovate, 12–26 by 5–10 cm, herbaceous to thin-fleshy, glabrous (rarely short-tomentose on both sides), narrowed towards the base, margin entire or sinuate to dentate, apex blunt to rounded. *Inflorescences* laxly branched, *c.* 4 cm long, few-flowered, glabrous (to densely woolly pubescent); peduncle *c.* 1 cm long. Bracts persistent, narrowly triangular, up to 3 mm long, white-pilose in the axils. *Flowers* 2–2½ cm long, glabrous or (specially the corolla) more or less densely appressed-pubescent, scentless. *Calyx-lobes* linear to narrowly elliptic, (1½–)2½–5(–15) by ½(–5) mm, blunt,

Fig. 3. *Scaevola sericea* (MILL.) KRAUSE in flower and fruit, Udjung Genteng (SW. Java).

erect to faintly recurved. *Corolla* pale yellow, at first lilac-veined, white inside; tube inside densely pubescent, membranous margins of the lobes fimbriate towards the base. *Style* faintly pubescent at the base, sometimes in addition with some scattered long hairs. *Drupe* globular, faintly 2-lobed when dry, *c.* 1–1½ cm in diam., with 4 faint ribs on every lobe, fleshy, (sub)glabrous, pellucid-white when ripe; stone 8 by 6 mm, rugose, septum distinctly prominent.

Distr. Madagascar, SE. Asia, throughout *Malaysia*, tropical Australia, Micronesia, Melanesia, and Hawaii.

Ecol. Restricted to the sea-shore, usually on the open sandy beach or on coastal cliffs of rocky coasts. *Fl.* and *fr.* Jan.–Dec.

One of the commonest, sometimes gregarious, shrubs fringing the tropical sandy beach behind the pescaprae formation, an early, euredaphic pioneer on fresh littoral sands, gravel, and rocks. The drupes are very probably dispersed by birds; the stones are certainly water-borne and are dispersed by sea currents; they are often found washed ashore. They owe their power of buoyancy to the corky outer layer of the stone (see GUPPY, *l.c.*).

DOCTERS VAN LEEUWEN (1927) found flowers frequently visited by large bees; in addition self-fertilization seems also to occur.

Uses. Several parts of this plant are used in native medicine (see HEYNE, *l.c.*). The wood of the basal part is rather hard, but the pieces are small; as it is resistent against sea-water, it is used for making nails for canoes. The thick, soft pith of the young twigs is used in microscopical technique, replacing elder-pith. As this pith can easily be cut and painted, people (specially in the Moluccas) make flowers, small birds, and fruits *etc.* from it.

Vern. *Sea-lettuce tree*, E, *strand ossetong*, D, *ambong-ambong*, *ambung-ambung*, *among-among*, *běruwas laut*, *buwas-buwas laut*, *gabusan*, *kaju*

Fig. 4. Beach vegetation on the westcoast of Humboldt Bay, West New Guinea; on the right *Scaevola Sericea* VAHL, to the left *Hibiscus tiliaceus* L. and *Pandanus sp.*, in the background *Terminalia catappa* L. with *Cassytha filiformis* L. (Photogr. L. VAN DER HAMMEN, 1954).

ambong, merambong, moh among, pĕlampong, M, *subang-subang (subĕng-subĕng, subong-subong)*, Sum., *tjilekle*, Mentawei, *babakoan, b. lalaki, gagabusan, niangka, porang*, S, *dudulan (wudulan), gabus, g. tjina, pohodo'elang*, J, *djati pasir*, Md, *klindo, pĕlĕnda laut (polindo l.)*, Bali, *bodjo*, Sumbawa, *tabuté*, Alor, *batang lampung*, Borneo; Philippines: *balak-bálak, balok-bálok, bokabok, bosboron, boto, linu, mosboron, panabolong, pañgangtolon*, Tag., *bokabok, bosboron, boto, mosboron, panabolong, pangangtolon, tagustus*, Bis., *chalmalukung, dudukdukin*, Ilk., *hulbo*, Bik., *linog*, Sbl.; *bawuntulon, bodjolo, bukolako, kokolĕ, panimburang, papatjèda, wintungtasi*, Cel., *anas, boppa tseda, gilitopa, hokal, kanum-búlan'a, kationgale, lotiek, mokal (mokar, morat), ndarimbu, nesnas, panimbúran'a, (pa)patjèda*, Mol., *rauw rauw*, Aru Isl., *fufum, kaikikira, paimeh*, N. Guinea, *dodogo kubar*, N. Britain.

2. Scaevola micrantha PRESL, Rel. Haenk. 2 (1835) 58; DC. Prod. 7 (1839) 507; MIQ. Fl. Ind. Bat. 2 (1856) 582; MERR. Philip. J. Sc. 5 (1910) Bot. 250; KRAUSE, Pfl. R. Heft 54 (1912) 121; MERR. En. Philip. 3 (1923) 590; HOLTHUIS & LAM, Blumea 5 (1942) 252.—*Temminckia micrantha* DE VRIESE, Ned. Kruidk. Arch. I, 2 (1850) 145; Nat. Verh. Holl. Mij Wet. II, 10 (1854) 11.—*S. pedunculata* MERR. Philip. J. Sc. 5 (1910) Bot. 251, *incl.* also *var. mollis*; GIBBS, J. Linn. Soc. Bot. 42 (1914) 100; MERR. Bibl. En. Born. Pl. (1921) 586; En. Philip. 3 (1923) 591.—*S. merrillii* ELM. Leafl. Philip. Bot. 4 (1912) 1491.—**Fig. 5h.**

Shrub, up to *c.* 2 m. *Branchlets* 1/4–1 cm thick, terete, glabrous to densely tomentose; leaf-axils provided with tufts of silky white hairs. *Leaves* spirally arranged, crowded at the ends of the branches, obovate to elliptic, 3 1/2–20 by 1 1/2–8 cm, coriaceous to herbaceous, glabrous to tomentose mainly on the lower side; attenuate to the distinctly petioled base; margin scattered denticulate, mainly towards the apex; apex rounded to acute, mucronulate; nervation rather conspicuous, specially beneath. *Inflorescences* laxly to rather densely branched, 2 1/2–10 cm long, glabrous to densely greyish-tomentose; peduncle 1–6 cm long. Bracts linear, up to 2 by 1/2 cm, with axillary hair-tufts. *Flowers* 1 cm long, glabrous to rather densely pubescent. *Calyx-lobes* deltoid, acute, erect, 1 mm high. *Corolla* greenish-white within and outside at the base, lobes violet; tube inside densely pubescent, membranous margins of the lobes narrowed towards the base, entire. *Style* with some scattered long hairs, mainly at the base. *Fruits* ellipsoid, 5–6 by 2 1/2 mm, smooth, glabrous to pubescent, black when ripe.

Distr. *Malaysia:* Borneo (Mt Kinabalu), Philippines (Palawan, Luzon, Sibuyan, Mindanao), and Talaud Islands.

Ecol. On open, sunny slopes, 300–2500 m. *Fl.* and *fr.* Nov.–May.

Vern. *Panimburan'a*, Talaud.

Note. Part of the specimens from Mt Kinabalu and Palawan differ slightly by a densely stellate tomentum in all parts, rather thick twigs, long-petioled and rather large leaves—not unlike those of *S. sericea*—and denser, many-flowered inflorescences; they have been distinguished as *S. pedunculata var. mollis* MERR. The differences mentioned are grading, however, and vary possibly even in one individual plant.

3. Scaevola oppositifolia R. BROWN, Prod. (1810) 583.—*S. oppositifolia* ROXB. [Hort. Beng. (1814) 85, *nomen*] Fl. Ind. 2 (1824) 148; ed. 2, 1 (1832) 528; DON, Gard. Dict. 3 (1834) 728; DC. Prod. 7 (1839) 507; MIQ. Fl. Ind. Bat. 2 (1857) 582; Ann. Mus. Bot. Lugd. Bat. 1 (1864) 210; KRAUSE, Pfl. R. Heft 54 (1912) 132.—*S. corsoniana* DON *ex* LOUDON, Gard. Mag. 18 (1842) 370.—*S. amboinensis* MIQ. Ann. Mus. Bot. Lugd. Bat. 1 (1864) 210; KRAUSE, *l.c.* 133.—*S. enantophylla* F.v.M. Fragm. 8 (1873) 58.—*S. novo-guineensis* K. SCH. Bot. Jahrb. 9 (1887) 222; K. SCH. & LAUT. Fl. Schutzgeb. (1901) 594; *do*, Nachtr. (1905) 402, *incl. var. glabra*; KRAUSE, *l.c.* 133.—*S. scandens* F. M. BAIL. Rep. Exp. Bellenden-Ker (1889) 47.—*S. similis* HEMSL. Kew Bull. (1896) 38; KRAUSE, *l.c.* 131.—*S. minahassae* KOORD. Minah. (1898) 628, 513; MERR. Philip. J. Sc. 2 (1907) Bot. 427; KRAUSE, *l.c.* 131; KOORD.-SCHUM. Syst. Verz. 3 (1914) 125; MERR. En. Philip. 3 (1923) 591.—*S. dajoensis* MERR. Philip. J. Sc. 2 (1907) Bot. 427; KRAUSE, *l.c.* 131; MERR. En. Philip. 3 (1923) 590.—*S. acuminatissima* MERR. Philip. J. Sc. 5 (1910) Bot. 249; En. Philip. 3 (1923) 590.—*S. mindorensis* MERR. Philip. J. Sc. 5 (1910) Bot. 250; En. Philip. 3 (1923) 591.—*S. merrilliana* KRAUSE, *l.c.* 131, *nom. superfl.*—*S. lauterbachiana* KRAUSE, *l.c.* 132; GIBBS, Arfak (1917) 183.—*S. forbesii* KRAUSE, *l.c.* 133.—*S. wollastonii* WERNHAM, Trans. Linn. Soc. Bot. II, 9 (1916) 88.—**Fig. 5a–f.**

Scrambling (rarely erect) shrub or climber. *Branchlets* slender, terete, with long internodes; lateral twigs transverse. *Leaves* decussate, usually pseudo-distichous, distinctly petioled, ovate to ovate-lanceolate, 5–14 by 2–6 cm, chartaceous, glabrous or more or less pubescent, sometimes even densely woolly pubescent beneath; base acute; margin slightly revolute, usually entire to distantly dentate, sometimes lobed; apex acuminate, usually mucronate. *Inflorescences* axillary—often 2 in one leaf-axil and then the upper one stronger developed—widely and laxly branched, 2–5 cm long peduncled, mostly many-flowered, rarely 1–3-flowered, sometimes exceeding the leaves, usually thinly and shortly appressedly pubescent. Bracts persistent, narrowly triangular, up to 1/2 cm. *Flowers* 1 1/4–1 1/2(–2) cm long, more or less densely pubescent. *Calyx-lobes* linear, *c.* 2 1/2 mm. *Corolla* yellow or outside greenish, in the basal half more or less brownish to purple, tube inside densely velvety pubescent, membranous margins of the lobes entire. *Style* glabrous, the indusium excepted. *Fruits* (in dry state) obovoid to ellipsoid, 5–7 by 2 1/2–3 mm, with 2 (septal) grooves, furthermore slightly tuberculate, subglabrous, rarely scattered appressed-pubescent, black when ripe.

Distr. North Queensland and *Malaysia:*

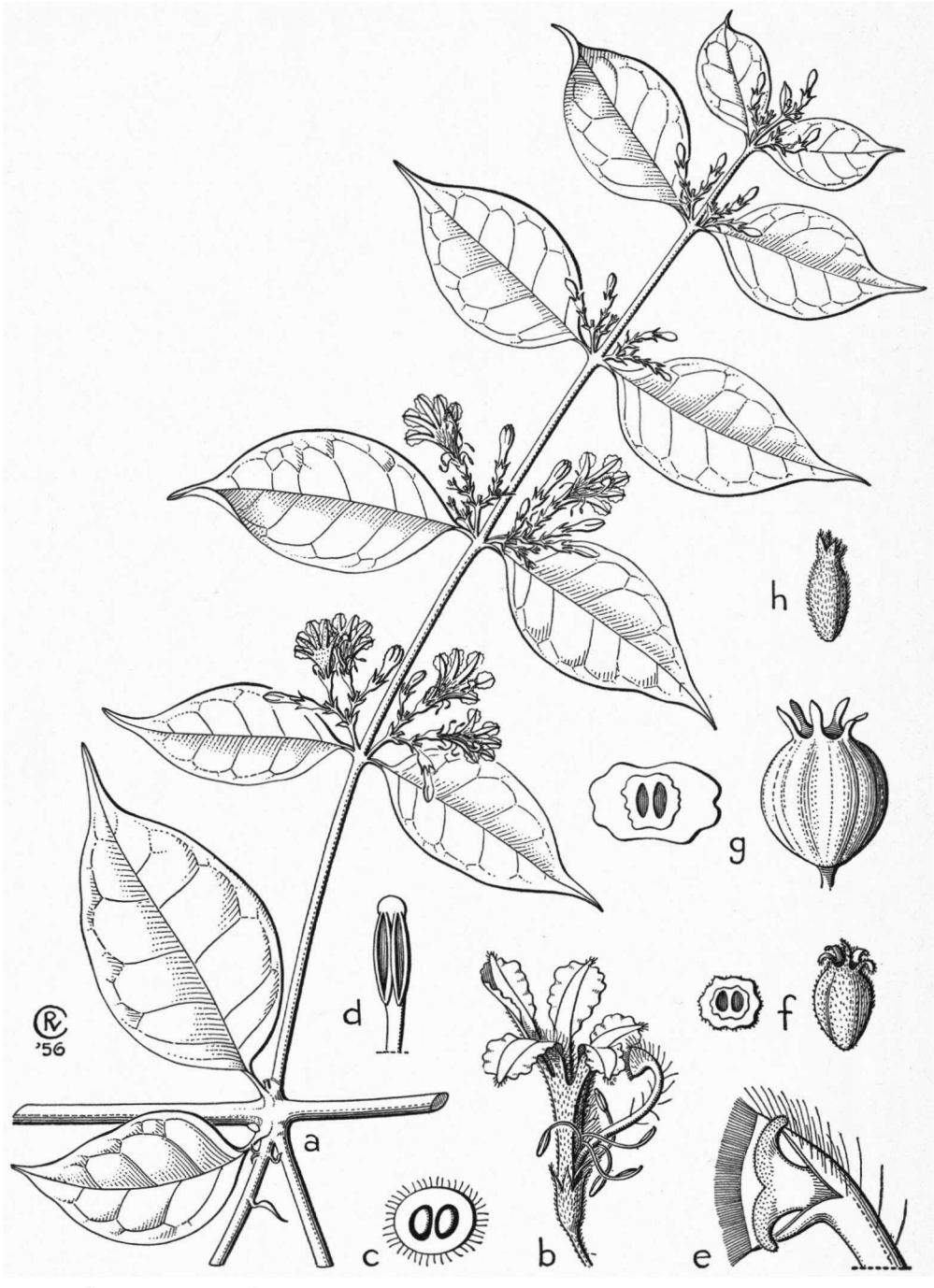

Fig. 5*a–f. Scaevola oppositifolia* R.BR. *a.* Flowering twig, *b.* flower, *c.* ovary in cross-section, *d.* anther, opened, *e.* stigma (indusium partly removed), *f.* fruit with cross-section.—*g. Scaevola sericea* VAHL, fruit with cross-section.—*h. Scaevola micrantha* PRESL, fruit. (*a* × 2/3, *b* and *f–h* × 2, *c* × 6, *d* × 16, *e* × 10; *a–b* KAUDERN 518, *f* VAN ROYEN 3202, *g* NGF 3314, *h* BS 34598).

Philippines (Mindoro, Negros, Sulu Isl., and Mindanao), Celebes, Moluccas (Morotai, Ternate, Sula Islands, Ceram, and Ambon), and New Guinea (incl. New Ireland).

Ecol. Mostly in rather open places, along forest edges, road- and river-sides, in shrubberies and secondary vegetation, rarely in forest, 0–2700 m. *Fl.* and *fr.* Jan.–Dec.

Vern. *Saroka*, Bag., *kakane-mapo*, Minahasa, *gambi, njeo bata*, Ternate, *hamboro*, New Guinea.

Notes. This species is specially variable in the degree of pubescence and in the incision of the leaf-margins. Part of the material from E. New Guinea is densely white-woolly pubescent, especially on the lower side of the leaves; this has been distinguished as *S. novo-guineensis*. Specimens from N. Celebes—and to a lesser degree some from the Philippines—possess small, ovate, coriaceous, short-petioled, rather pubescent leaves with a strongly dentate to lobed margin, the nervation being sunken above (*S. minahassae*). Furthermore, the degree of branching of the inflorescence is apparently increasing from west to east. All these characters are grading, however.

The name *S. merrilliana* KRAUSE is superfluous, as one of its syntypes is the type-collection of *S. mindorensis* MERR.

This is the single representative of *sect. Enantiophyllum* B. & H. (Gen. Pl. 2, 1876, 540) which is, in my opinion, monotypic. It is the only section with opposite leaves and a ± climbing habit.

Excluded

Camphusia glabra (H. & A.) DE VRIESE, Ned. Kruidk. Arch. I, 2 (1850) 149.—*Scaevola glabra* H. & A. Bot. Beechey (1832) 89.—A Hawaiian species, erroneously mentioned by Index Kewensis 1 (1895) 408 as being described from Malaysia.

Lemairea amboinensis DE VRIESE, Nat. Verh. Holl. Mij Wet. II, 10 (1854) 189, t. 38.—The description (with plate) of this monotypic genus was based on a sheet, said to have been collected in Ambon, from the herbarium of VENTENAT, preserved in the Herbier Delessert at Geneva; it consisted of a loose flower and a fruiting twig. According to the drawing and description the loose flower is doubtless belonging to *Scaevola sp.*; the twig with fruits, which has kindly been traced at Geneva by Dr. BECHERER appeared exactly to match the rubiaceous *Mycetia javanica* (BL.) KORTH.

BENTHAM & HOOKER and others have all treated *Lemairea* as a *genus delendum*. The name *Lemairea amboinensis* clearly falls under art. 76 of the rules of nomenclature and must be rejected as its characters were derived from two entirely discordant elements.