

AIZOACEAE (C. A. Backer, Heemstede)

Annual or perennial herbs or undershrubs, sometimes fleshy. *Leaves* simple, entire or subentire, opposite, spread, or spuriously whorled, sometimes minute, stipulate or not. Stipules often small, scarios, fugacious. *Flowers* axillary, solitary, clustered or fascicled, cymose, pseudoracemose, or subumbellate, actinomorphic, usually ♂, often small and inconspicuous. *Tepals* 5, either free, imbricate in bud, herbaceous with scarios often white margins or entirely scarios, persistent, conniving before and after anthesis, or a distinctly gamophyllous, corolline or calycine 3-8-lobed perianth with usually persistent, herbaceous lobes imbricate or rarely valvate in bud. *Stamens* 1-∞, perigynous or hypogynous, free or connate at the base, either singly or in groups, often alternate with the perianth lobes. Anthers 2-celled, dehiscent lengthwise. Disk annular or absent. Ovary superior, semi-inferior or inferior, 1-9-celled. Ovules 2-∞, solitary or ∞, basal, apical or axile. Styles 1-∞. Capsule or drupe, 2-∞-seeded, often enclosed by the perianth and falling off with it.

Distr. About 23 genera (if *Mesembryanthemum* is split into segregates many more) and over a thousand *spp.* (over 800 belonging to *Mesembryanthemum*), distinctly centering in the S. hemispherical subtropics of the Old World, mainly in S. Africa, with a secondary centre of development in Australia, in *Malaysia* and other essentially forested tropics poorly represented by some widely distributed, partly peritropical genera and widely distributed weeds.

Ecol. On the whole preferring arid or periodically dry often sandy country, some maritime (*Sesuvium*, *Trianthema*).

Uses. Some vegetables (*Tetragonia*), some used for extracting potash, many ornamentals (*Mesembryanthemum*).

Notes. By some authors this family has been split into two separate families mostly called *Molluginaceae* (with a free perianth) and *Ficoidaceae* (with a gamophyllous perianth) but in my opinion this is unnecessary.

By some authors *Aizoaceae* have been merged with *Portulacaceae*. The Malaysian representatives of this allied family can easily be recognized by the presence of two connate or free distinct sepals outside the corolla and a 1-celled ovary.

KEY TO THE GENERA

1. Tepals 5, free.
 2. Seeds estrophiolate. Flowers in terminal cymes or pseudoracemes or in stalked umbels. Leaves narrow, glabrous 1. *Mollugo*
 2. Seeds distinctly strophiolate, strophiole with a long filiform appendix which is curved round the seed and closely resembles a funicle but is not attached to the placenta. Flowers in axillary fascicles. Leaves mostly not very narrow, often hairy 2. *Glinus*
1. Perianth 3-8-lobed, gamophyllous, corolline or calycine.
 3. Leaves opposite or spuriously whorled. Ovary superior. Fruit dehiscent by an operculum.
 4. Styles 3-4. Flowers solitary in the leaf axils, distinctly stalked. Leaves comparatively narrow 3. *Sesuvium*
 4. Styles 1-2 4. *Trianthema*
 3. Leaves spread. Ovary semi-inferior. Fruit indehiscent 5. *Tetragonia*

1. MOLLUGO

LINNÉ, Sp.Pl. 1 (1753) 463; Gen. Pl. ed. 5 (1754) no 99.

Erect or diffuse, slender, glabrous herbs, mostly annual. *Leaves* spuriously verticillate or partly subopposite, lanceolate, linear-lanceolate or for a greater or smaller part obovate-subspathulate, entire. *Flowers* small, in terminal cymes which often end in pseudoracemes or in stalked umbels; single flowers pedicelled. Tepals herbaceous, with scarios, often white margins. Stamens 3-5, alternating with the tepals, less often 6-10, free; filaments filiform, rarely (not in *Malaysia*) dilated in the middle. Ovary ovoid or broadly ellipsoid, 3-celled. Styles 3, filiform. *Fruit*, when falling off, leaving the persistent pedicel. Seeds estrophiolate; testa granulate or faintly reticulate; embryo annular.

Distr. Species \pm 15, distributed over the warmer regions of the globe, extending into Europe and N. America, in *Malaysia* thus far only one species; a second may be discovered.

Ecol. Mostly in settled areas as a weed of cultivation or in open or waste places.

Uses. Used as a potherb or for medicinal purposes.

Note. The distinction between the genera *Mollugo* and *Glinus* has been exposed by FENZL (Ann. Mus. Wien 1, 1836, 346–353, 372) who found an essential difference in the structure of the seeds. BENTHAM & HOOKER f. (Gen. Pl. 1, 1867, 857) hold this character insufficient, and some subsequent authors share this opinion, e.g. WILSON (N. Am. Fl. 214, 1932, 268), and the late Dr P. J. EYMA, whose notes have been used to complete this revision. EYMA's argument is that plants showing a very close resemblance are now assigned to two different genera, *Glinus* and *Mollugo*, merely on the strength of the seed structure which might be an artificial means of dividing what ought to be kept together. However, this was known to FENZL (l.c. p. 372), and I do not agree with EYMA.

KEY TO THE SPECIES

1. Ripe seeds very distinctly granulate. Leaves often more than 3 mm wide . . . 1. *M. pentaphylla*
 1. Ripe seeds not at all granulate but very faintly reticulately ribbed. Leaves less than 3 mm wide
 2. *M. cerviana*

1. *Mollugo pentaphylla* LINNÉ, Sp. Pl. (1753) 89; BURM. f. Fl. Ind. (1768) 31; SER. in DC. Prod. 1 (1824) 391; MIQ. Fl. Ind. Bat. 1, 1 (1858) 1064; MERR. Sp. Blanc. (1918) 141; EN. Born. Pl. (1921) 246; RIDL. Fl. Mal. Pen. 1 (1922) 867; MERR. En. Philip. 2 (1923) 135; HOCHR. Candollea 2 (1925) 356, incl. var. *stricta* (L.) HOCHR.; HEYNE, Nutt. Pl. (1927) 611; BACK. Onkr. Suiker. (1930) 238, Atl. t. 248; OCHSE & BAKH. v. D. BR. Veg. (1931) 4, f. 3; BURK. Dict. (1935) 1484; MERR. & PERRY, J. Arn. Arb. 23 (1942) 386; BACK. Bekn. Fl. Java, em. ed. 4 (1942) fam. 57, p. 1; HEND. Mal. Wild Fl. 1 (1949) 172, f. 165.—*M. stricta* LINNÉ, Sp. Pl. ed. 2 (1762) 131; BURM. f. Fl. Ind. (1768) 131, t. 5, f. 3; SER. in DC. Prod. 1 (1824) 391; BLUME, Bijdr. (1825) 62; DECNE, Nouv. Ann. 3 (1834) 429; BLANCO, Fl. Fil. (1837) 52; ed. 2 (1845) 35; ed. 3, 1 (1877) 64; SPAN. Linnaea 15 (1841) 167; MIQ. Fl. Ind. Bat. 1, 1 (1858) 1064, Sum. (1860) 150; BRITTON in FORB. Nat. Wand. (1885) 506 (*sphalmate: striata*); F.V.M. Not. Pap. Pl. 8 (1888) 43; KOORD. Exk. Fl. 2 (1912) 206; WINKL. Bot. Jahrb. 49 (1913) 369.—*M. sumatrana* GAND. Bull. Soc. Bot. Fr. 65 (1918) 29.

Glabrous throughout, often much and widely branched (frequently from the very base), annual, with a thin main root, 2–35 cm high, erect or with prostrate main-branches, when old often tinged brownish red. Stem thin, angular. Leaves usually in false whorls of 3–9, mostly 3–5, not rarely partly opposite, entire, pale beneath, 10–50 by 1½–10 mm; lowermost ones (often disappearing before anthesis) \pm rosulate, oblong-obovate-spathulate, distinctly petioled; higher leaves rarely of the same shape, mostly lanceolate or linear-lanceolate from a narrowed acute base, shortly petioled or sessile, acute; midrib prominent beneath. Flowers in terminal or leaf-opposed peduncled lax cymes with often long racemiform ultimate branches. Bracts small, persistent. Pedicels erecto-patent, thin, 1½–6 mm, persistent and decurved till long after the fall of the fruiting perianth. Tepals oval-oblong, obtuse, inside white, outside green with white margins, at an advanced age often turning brown, 1¼–2 mm long, during anthesis (in sunny morning-hours) widely patent, afterwards con-
 niving to a globe. Stamens 3; filaments filiform, not

dilated in the middle, short. Styles white. Capsule broadly ellipsoid, faintly 3-lobed, \pm 2 mm long. Seeds reniform, darkbrown, finely granulate, \pm ¼ mm diam.

Distr. Tropics and subtropics of the Old World, apparently very rare in Australia; throughout *Malaysia*, also in New Britain, Micronesia, New Caledonia.

Ecol. In dry as well as in moist regions, mostly in settled areas, often in sandy or stony localities, sometimes on old lava-streams (Ternate), 5–1200 m, fields, gardens, premises, open places, teak-forests, locally often abundant.

Uses. Eaten as a potherb and used for medicinal purposes.

Vern. Java: *Djukut kulut*, *dj. taridi*, *dj. said*, *dj. titiran*, *S. galingsa*, *J.* moreover several local names; in the medicine-trade sold under the name of *daun mutiara*. Philippines: *Lepouo* (Bon.), *mala-goso*, *maligoso* (Tag.), *pisig-pisig* (Bag.), *salsalida* (Bis.), *sudlai*, *sulanggang* (Sub.).

Note. BOORSMA found a saponin in it and much saltpetre. Its small dimensions make it worthless as a fodderplant.

2. *Mollugo cerviana* (LINNÉ) SER. in DC. Prod. 1 (1824) 392; BTH. Fl. Austr. 3 (1866) 334; BAIL. Queensl. Fl. 2 (1900) 712; KOORD. Exk. Fl. 2 (1912) 206.—*Pharnaceum cerviana* LINNÉ, Sp. Pl. (1753) 272; BURM. f. Fl. Ind. (1768) 76.

Glabrous, glaucous annual, usually pluricauline, 3–20 cm high, with an often longish but not thick main-root. Stems mostly numerous from a broad root-crown, erect, erecto-patent or prostrate, very slender, with somewhat thickened nodes, frequently much branched. Radical leaves (often withering before anthesis) rosulate, linear, linear-narrowly lanceolate or subspathulate from a narrowed base, 5–30 mm long. Cauline leaves in spurious whorls of 3–8 or higher ones opposite, sessile or very shortly petioled, narrowly linear or subspathulate from a narrow base, obtuse or obscurely apiculate, 6–18 by 1–1¼ mm. Peduncles subumbellate or solitary at the tops of the branches, rather long, thin, stiffish. Flowers in lax pseudoracemes or 2–4 subumbellate at the ends of the peduncles. Pedicels erect or patent, filiform, stiffish, 6–18 mm long.

Tepals patent during anthesis, before and after anthesis erect, oval-oblong, with an obtuse or rounded apex, with broad, white scarious margins, 2½-3½ mm long. Stamens 3-5; filaments longish, filiform. Styles erecto-patent or spreading, hardly ¼ mm long, comparatively thickish. *Capsule* broadly ellipsoid, equalling the perianth. Seeds closely packed, reniform-subsemiorbicular, brown, not granulate but laxly and slightly prominently, irregularly reticulately ribbed, less than ½ mm long.

Distr. S. Europe, tropical and S. Africa, S. to

SE. Asia, Ceylon, and Australia, not yet recorded from *Malaysia*, but, considering the general distribution, possibly occurring there somewhere.

Ecol. Dry regions at low altitudes, often in sandy localities.

Uses. According to TRIMEN (Fl. Ceyl. 2, 1894, 272) in Ceylon much used as a medicine against fever. FENZL (Ann. Wien. Mus. 2, 1839, 304) states that according to a manuscript note in BURMAN's herbarium the plant is used in Hindustan as a remedy for bilious fever and syphilis.

2. GLINUS

LINNÉ, Sp.Pl. (1753) 463; Gen. Pl. ed. 5 (1754) no 537.—*Tryphera* BL. Bijdr. (1825) 549.

Diffuse, glabrous or hairy, often much branched annuals. *Leaves* opposite or spuriously whorled, oblong, oval, ovate or spathulate, entire or obscurely dentate. *Flowers* axillary in few-flowered clusters or fascicles, pedicelled or subsessile. Tepals with scarious, frequently white margins, often unequal. Stamens 3-20, free or, when numerous, fascicled, in the Malaysian specimens usually 3-15 and free; filaments filiform. Ovary oval or oblong, 3-5-celled. Styles erect, spreading or recurved, linear or oblong-elliptic, persistent. *Capsule* 3-5-valved. Seeds ∞, distinctly strophiolate; strophiole with a long, thin appendix encircling a considerable part of the seed and resembling a funicle but not attached to the placenta; testa finely granulate.

Distr. Probably about 10 spp. in the tropics and subtropics of both hemispheres, elsewhere sometimes introduced.

Ecol. The 2 Malaysian spp. inhabit by preference dried-up pools and ditches and fallow rice-fields, less often waste places. They often grow gregariously and intermixed.

Uses. Sometimes used for medicinal purposes.

Note. For the distinction of *Mollugo* and *Glinus* see the notes under the former genus.

KEY TO THE SPECIES

- 1. Tepals acute, outside usually with many stellate, white hairs, often densely woolly, 6-10 mm long. Stamens 5-15, rarely more. Styles usually 5, linear, erect or erecto-patent, 1¼-1½ mm long. Capsule usually 5-valved. Flowers often sessile or subsessile. 1. *Gl. lotoides*
- 1. Tepals obtuse, glabrous or thinly pubescent outside, 3-5 mm long. Stamens 3-4. Styles 3, less often 4, oval-oblong, widely patent or recurved, less than ½ mm long. Capsule 3-, less often 4-valved. Flowers always very distinctly (4-15 mm) pedicelled 2. *Gl. oppositifolius*

1. *Glinus lotoides* LINNÉ, Sp. Pl. (1753) 463; BURM. f. Fl. Ind. (1768) 112, t. 36, f. 1; DC. Prod. 3 (1828) 455; BLANCO, Fl. Fil. (1837) 413, ed. 2 (1845) 288, ed. 3, 2 (1878) 169; ZOLL. Syst. Verz. (1854) 141; MIQ. Fl. Ind. Bat. 1, 1 (1858) 1063, Sum. (1860) 150; KOORD. Exk. Fl. 2 (1912) 206; BACK. Onkr. Suiker. (1930) 239, Atl. t. 249; Bekn. Fl. Java, em. ed. 4 (1942) fam. 57, p. 2.—*Gl. dictamnoides* LINNÉ, Mant. 2 (1771) 243; DECNE, Nouv. Ann. 3 (1834) 449; SPAN. Linnaea 15 (1841) 207.—*Mollugo hirta* THUNB. Prod. Fl. Cap. 1 (1794) 24; SER. in DC. Prod. 1 (1824) 391; F.-VILL. Nov. App. (1880) 100; VIDAL, Plant. Cuming. Philip. (1835) 16; Rev. Pl. Vasc. Filip. (1886) 144.—*Tryphera prostrata* BL. Bijdr. (1825) 549; ZOLL. Syst. Verz. (1854) 141 (*sphal-mate: Triphera*); DC. Prod. 13, 1 (1859) 423, 424.—*Pharnaceum pentagynum* ROXB. Fl. Ind. ed. CAREY 2 (1832) 103.—*Glinus astrolasion* ZIP. ex SPAN. Linnaea 15 (1841) 207.—*Mollugo glinus* A. RICH. Fl. Abyss. 1 (1847) 48.—*Mollugo lotoides* W. & A.

ex CLARKE in HOOK. f. Fl. Br. Ind. 2 (1879) 776; MERR. Fl. Man. (1912) 199; Sp. Blanc. (1918) 140; En. Philip. 2 (1923) 135.

Prostrate or ascending pluricauline annual, often with a long, strongish taproot. Entire plant when young greyish green, at an advanced age often reddish brown. Stems spreading in all directions, much branched, 15-90 cm long, terete, with thickened nodes, especially in the higher part clothed with white, stellate hairs. Stipules linear, acute. Radical *leaves* rosulate, fugacious; higher leaves opposite or spuriously 3-nate, broadly oval or oval-obovate from a cuneate base, obtuse or rounded at the apex, often minutely apiculate, frequently with undulate margins, on both surfaces more or less densely (often very densely) clothed with white, stellate hairs or glabrescent above, 10-35 by 6-21 mm; petiole 4-15 mm. *Flowers* usually in fascicles of 3-8, rarely more (up to 16), mostly very shortly pedicelled or subsessile.

Pedicels 1–2 mm, stellately hairy, sometimes much longer (up to 15 mm). Tepals during anthesis (sunny morning-hours) erecto-patent, before and after anthesis erect or conniving, oblong, distinctly mucronate, 6–10 mm long, inside quite glabrous, outside more or less densely stellate-hairy, green, the in bud overlapped margins white. Stamens (in Malaysian specimens) 5–15; filaments filiform or very narrowly ligulate; anthers white. Ovary glabrous, during anthesis \pm 3 mm high. Styles 5, erect or obliquely patent, $1\frac{1}{4}$ – $1\frac{1}{2}$ mm long. *Capsule* 5-valved. Seeds very numerous, closely packed, reniform, brown, finely granulate, \pm $\frac{2}{3}$ mm long; strophiole broad, white, \pm $\frac{1}{2}$ mm long.

Distr. S. Europe, N. & trop. Africa, S.-SE. Asia, Ceylon, and Malaysia to Australia and America, in *Malaysia*: Sumatra, Java, Lesser Sunda Islands (Bali, Sumba, Timor), Celebes (also Saleyer Island), and Philippines.

Ecol. In settled areas of the dry regions up to \pm 800 m in seasonally swampy and again desiccated localities on heavy soils, in dried-up pools and ditches and on fallow rice-fields, locally often very numerous and then very conspicuous by its white or reddish brown colour, often growing intermixed with the following species.

Vern. *Kumpait*, *mata lèlè*, *sèmbung rambat*, J. Philippines: *Amargóso-babi* (Pamp.), *lobio* (Tag.), *pápaít-ti-nuáng* (Ilk.).

Note. Flowers and fruits very profusely.

2. *Glinus oppositifolius* (LINNÉ) A.DC. Bull. Herb. Boiss. 2, 1 (1901) 552; BACK. Onkr. Suiker. (1930) 239, Atl. t. 250; Bekn. Fl. Java, em. ed. 4 (1942) fam. 57, p. 2; MERR. & PERRY, J. Arn. Arb. 23 (1942) 3860.—*Mollugo oppositifolia* LINNÉ, Sp. Pl. (1753) 89; BURM. f. Fl. Ind. (1768) 31; SER. in DC. Prod. 1 (1824) 391; PULLE in Nova Guin. 8 (1910) 355; MERR. Fl. Man. (1912) 199; Sp. Blanc. (1918) 141; En. Philip. 2 (1923) 135.—*M. spergula* LINNÉ, Syst. ed. 10 (1759) 881; BURM. f. Fl. Ind. (1768) 31, t. 5, f. 4; SER. in DC. Prod. 1 (1824) 391.—*Pharnaceum mollugo* LINNÉ, Mant. 2 (1771) 561; ROXB. Fl. Ind. ed. CAREY 2 (1832) 102.—*Mollugo erecta* BURM. f. Fl. Ind. (1768) 32.—*Pharnaceum parviflorum* ROTH, Nov. Pl. Sp. (1821) 186.—*Mollugo parviflora* SER. in DC. Prod. 1 (1824) 391.—*Polycarpa frankenioides* PRESL, Rel. Haenk. 2 (1830) 6; F.-VILL. Nov. App. (1880) 15.—*M. verticillata* ROXB. (non LINNÉ) Fl. Ind. ed. CAREY 1 (1832) 360.—*M. subserrata* BLANCO, Fl. Fil. (1837) 51, ed. 2 (1845) 34, ed. 3, 1 (1877) 63.—*Glinus mollugo* FENZL, Ann. Mus. Wien. 1 (1836) 359, 360; 2 (1839) 303; ZOLL. Syst. Verz. (1854) 141; MIQ. Fl. Ind. Bat. 1, 1 (1858) 1063; RIDL. Fl. Mal. Pen. 1 (1922) 867.—*Glinus spergula* FENZL in SPRENG.

Nom. Bot. ed. 2, 1 (1840) 688; K. SCH. & LAUT. Fl. D. Sch. Geb. Süds. (1900) 308; PULLE, Nova Guin. 8 (1910) 355; KOORD. Exk. Fl. 2 (1912) 206.—Fig. 1.

Erect, ascending or almost prostrate, usually pluricauline, often much branched annual with a strongish taproot; stems 10–60 cm long, terete, with thickened nodes. *Leaves* for the greater part in spurious whorls of 3–5 of which usually 2 leaves larger than the others, oblong-obovate-spathulate from a tapering or slightly contracted base, with a rounded, obtuse, acute or minutely cuspidate apex, glabrous or thinly hairy, 6–40 cm by 3–15 mm; petiole 1–8 mm. *Flowers* in fascicles of 2–6, always distinctly pedicelled; pedicels thin, glabrous, 4–15 mm long when adult. Tepals during anthesis (sunny morning-hours) erecto-patent, before and after anthesis erect, oblong, obtuse, green with scarious margins or the inner almost entirely scarious, quite glabrous, 3–5 mm long. Stamens 3–4; filaments filiform. Ovary glabrous; styles 3–4, widely patent or recurved, oval-oblong, less than $\frac{1}{2}$ mm long. *Capsule* oblong, 3– $3\frac{1}{2}$ mm long, 3–4-valved. Seeds closely packed, reniform, brown, finely granulate, \pm $\frac{1}{2}$ mm long.

Distr. Trop. Africa and Asia throughout *Malaysia* to N. Australia.

Ecol. In settled areas of the dry regions, from the plains up to \pm 100(–275) m, in seasonally swampy or inundated and again desiccated localities, in dried-up pools and ditches and on rice-fields, either fallow or used for a second crop (in crop-rotation), locally often very numerous, frequently growing intermixed with the preceding species but less conspicuous than this and, on the whole, less common, often also on lighter soils, sometimes in sandy localities near the sea.

Uses. According to FENZL (Ann. Wien. Mus. 2, 1839, 303) this herb is considered in Hindustan as promoting digestion and salivation and, moreover, used as a medicine for bowel-complaints and syphilitic affections.

Vern. *Kailon padi* (Sumbawa). Philippines: *Amargóso-babi*, *margóso-damúlag* (Pamp.), *mala-góso*, *sarsalida* (Tag.), *pápaít* (Ilk.).

Note. Often profusely flowering and fruiting. Where *Gl. lotoides* and *Gl. oppositifolius* grow intermixed, as is often the case, an intermediate form, probably a hybrid, is not rarely found. This form has distinctly petioled leaves, agreeing in shape with those of *Gl. lotoides*, but, on the whole, smaller and less densely hairy; flowers subsessile, smaller than those of *Gl. lotoides*, 3–4 mm long; tepals acute, hairy. Like in *Gl. oppositifolius* there are 3–4 stamens; fruit 3-valved; styles agreeing in shape with those of *Gl. lotoides* but shorter.

3. SESUVIUM

LINNÉ, Syst. ed. 10 (1759) 1058.

Prostrate, creeping, ascending or erect succulent herbs or undershrubs. *Leaves* opposite, exstipulate, often by their sheathing bases connected in pairs, linear, lanceolate or oblong, very fleshy. *Flowers* axillary (only spuriously so?), solitary, clustered or cymose, sessile or stalked, bibracteolate, actinomorphic, ♀. Perianth

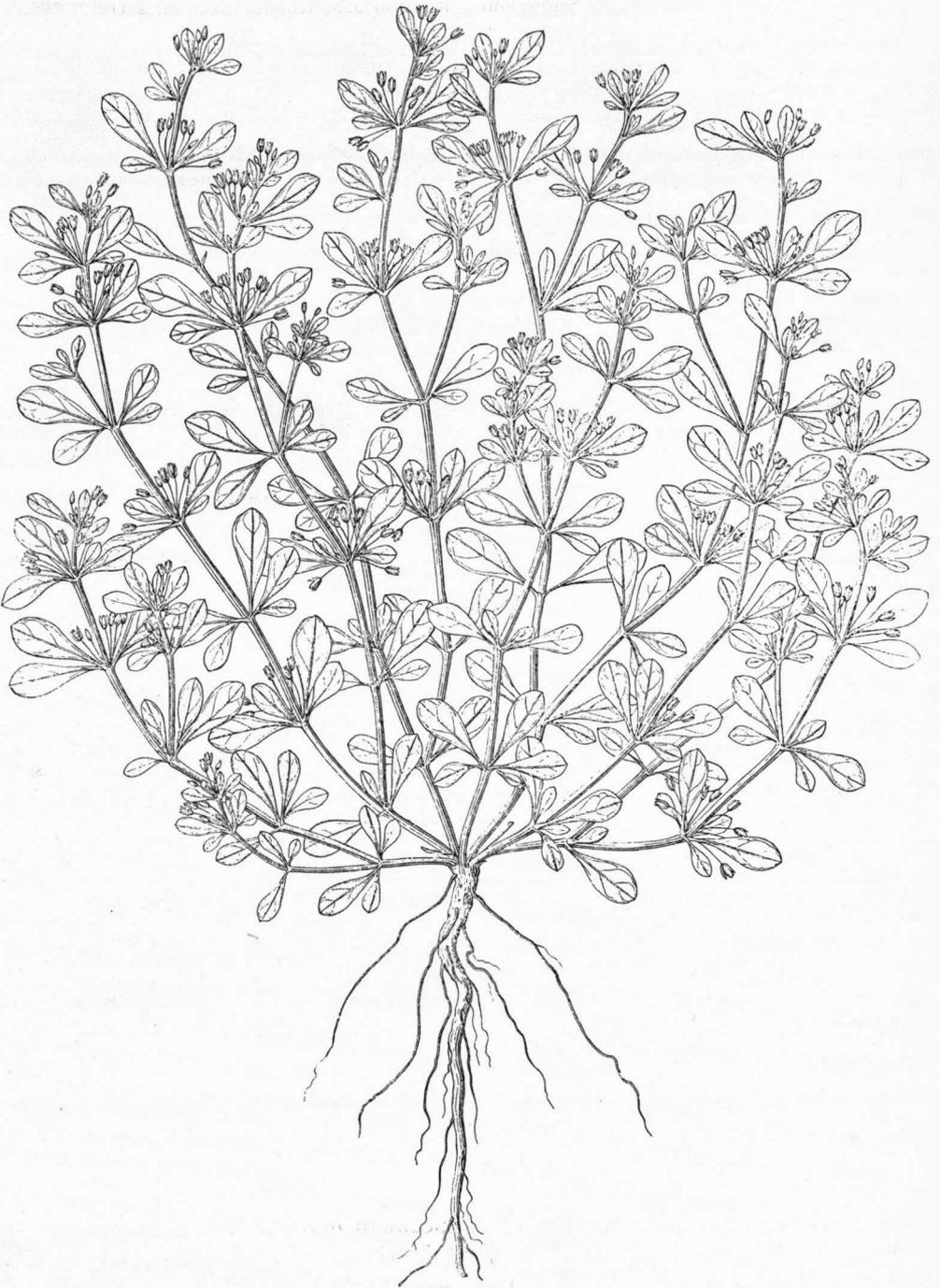


Fig. 1. *Glinus oppositifolius* (L.) DC., $\times \frac{1}{2}$.

gamophyllous, deeply 5-partite; tube obconical; segments oblong, obtuse, just below the apex often dorsally apiculate, coloured inside. *Stamens* either 5, alternating with the perianth-segments, or ∞ , inserted in the mouth of the perianth-tube; filaments filiform or very narrowly linear, free or connate at the base; anthers 2-celled. Ovary superior, 3–5-celled; cells ∞ -ovuled. Styles 3–5, filiform, stigmatose on the inner side. *Capsule* oblong, thin-walled, 3–5-celled, operculate. Seeds several in each cell, globose-reniform; testa smooth; embryo annular.

Distr. Species \pm 8 in the tropics and subtropics of both hemispheres, often littoral, in *Malaysia* only the cosmopolitan *S. portulacastrum* L.

1. *Sesuvium portulacastrum* (LINNÉ) LINNÉ, Syst. ed. 10 (1759) 1058; BURM. f. Fl. Ind. (1768) 117; ROXB. Fl. Ind. ed. CAREY, 2 (1832) 509; BLANCO, Fl. Fil. (1837) 426, ed. 2 (1845) 297, ed. 3, 2 (1878) 187; KOORD. Minah. (1898) 487; K. SCH. & LAUT. Fl. D. Sch. Geb. Süds. (1901) 309; MERR. Govt. Lab. Publ. 27 (1905) 50; VALET. Bull. Dép. Agr. Néerl. 10 (1907) 10; PULLE, Nova Guin. 8 (1910) 355; KOORD. Exk. Fl. 2 (1912) 206; MERR. Fl. Man. (1912) 198; Interpr. Herb. Amb. (1917) 217; BACK. Trop. Natuur 8 (1919) 7, f. 14; RIDL. Fl. Mal. Pen. 1 (1922) 866; MERR. En. Philip. 2 (1923) 135; HOCHR. Candollea 2 (1925) 356; HEYNE, Nutt. Pl. (1927) 611; BACK. Onkr. Suiker. (1930) 240, t. 251; OCHSE & BAKH. v. D. BR. Veg. (1931) 5, f. 4; BURK. Dict. (1935) 1998; BACK. Bekn. Fl. Java, em. ed. 4 (1942) fam. 58, p. 2; HEND. Mal. Wild Fl. 1 (1949) 171, f. 164; STEEN. Fl. Sch. Indon. (1949) 175.—*Crithmus indicus ruber & albus* RUMPH. Herb. Amb. 6 (1750) 165, t. 72, f. 1.—*Portulaca portulacastrum* LINNÉ, Sp. Pl. (1753) 446.—*Sesuvium repens* WILLD. En. Hort. Ber. 1 (1809) 521; DC. Prod. 3 (1828) 453; MIQ. Fl. Ind. Bat. 1, 1 (1858) 1060.—*Trianthema polyandrum* BL. Bijdr. (1826) 1137; DECNE, Nouv. Ann. Mus. 3 (1834) 448; SPAN. Linnaea 15 (1841) 207.—*Pyxipoma polyandrum* FENZL, Ann. Mus. Wien 2 (1839) 293; ZOLL. Syst. Verz. (1854) 140; MIQ. Fl. Ind. Bat. 1, 1 (1858) 1060.—*Sesuvium polyandrum* FENZL ex BRITT. in FORB. Wand. (1885) 506.—Fig. 2.

Perennial, prostrate or creeping herb, with a strong taproot, often much branched and densely caespitose, quite glabrous. Stems rooting from the nodes, terete, rather thick, solid, succulent, green or very often red, 20–80 cm long. *Leaves* mostly lanceolate, linear-lanceolate or linear, less often oblong, broadest above the middle, very succulent, flat above, convex underneath, green or, at the base, red, finely pale-punctate, 25–70 by 6–15 mm. Petioles 7–15 mm long, dilated at the base into a scarious semi-amplexicaul sheath. *Flowers* solitary in the leaf-axils. Pedicels thickened upwards, $1/2$ – $1\frac{1}{2}$ cm long, rarely longer. Perianth 8–10 mm long, 5-cleft to far below the middle. Segments with a dorsal, subapical, erect, subulate, obtuse, fleshy, $\pm 1\frac{1}{2}$ mm long apiculus; the parts exposed in bud fleshy, green outside, overlapped margins membranous pink, inside of perianth pink. *Stamens* ∞ , filaments free, pink or pinkish violet, shorter than the perianth-lobes, anthers darker-coloured. Ovary glabrous, 3- or sometimes 4-celled. Styles as many as cells, white. *Capsule* included by the perianth,

oblong, 9–11 mm long. Seeds long-funicled, shining black.

Distr. Cosmopolitan in the tropics, throughout *Malaysia*, but not yet reported for Borneo. In Celebes thus far only collected in the extreme NE. part, in Sumatra only in the NE. part.—



Fig. 2. *Sesuvium portulacastrum* (L.) L. on the sandy beach of W. Bali (DE VOOGD).

Ecol. Saline, clayey or sandy, humid or muddy localities near the sea and along tidal creeks between 0 en 1 m above sealevel, often in dense patches; frequently conspicuous by bright red stems.

Uses. Furnishes an inferior vegetable, edible only after having been repeatedly cooked (in order to remove the salt taste).

Vern. Many local names of which *gèlang*, *gèlang pasir*, *saruni air*, M, and *krokot*, J, are the

commonest. Philippines: *Bilang-bilang*, *dampalit* (Bis.), *tarumpalit* (Bis.), *karampalit* (Pamp.).

Note. The cooked plant smells and tastes of purslane. The late Dr P. J. EYMA made a note on the interpretation of the original Linnean descriptions in *Species Plantarum* (1753) of *Trianthema*

portulacastrum and *Portulaca portulacastrum* (now *Sesuvium portulacastrum*), the described habit of which coincides with the recent conception of these species, but the floral description of which seems to be reversed; LINNÉ seems to have corrected this himself in his later editions.

4. TRIANTHEMA

LINNÉ, Sp.Pl. (1753) 223; Gen. Pl. ed. 5 (1754) no 278.

Procumbent, diffuse, glabrous, papillose or hairy herbs, rarely undershrubs. *Leaves* opposite, obovate, ovate or oblong-linear, entire, those of one pair often very unequal; petioles dilated and sheathing at the base, often pairwise connate. Stipules minute or absent. *Flowers* axillary, solitary, glomerate or fascicled, sessile or stalked. Perianth gamophyllous, tube in the Malaysian species short. Segments 5, small or rather large, beneath the apex with a dorsal mucro, coloured inside. Stamens 5-∞, alternating with the perianth segments, solitary, paired or in groups. Filaments filiform; anthers short. Ovary superior, with a truncate or impressed apex, 1-2-celled; placentas basal, usually adnate to the septum; cells 1- or few-ovuled. Styles 1-2, longitudinally stigmatose. *Capsule* terete or turbinate, with an obtuse, truncate or impressed apex, rarely beaked, 1-2-celled, operculate; operculum thick-walled, containing 0-2 seeds, indehiscent; basal part of fruit thin-walled, 2-9-seeded. Seeds long-funicled, globose-reniform; testa ribbed or granulate; embryo annulate.

Distr. Species ± 15, widely distributed in the tropics and subtropics of both hemispheres, especially in Australia.

KEY TO THE SPECIES

1. Style 1.
 2. Perianth-tube free from the petioles. Stamens 5. Flowers all or for the greater part clustered, ± 3 mm long. Young leaves distinctly papillate 1. *Tr. triquetra*
 2. Perianth-tube throughout its length adnate to the basal part of the petioles. Stamens 10-25. Flowers solitary, 4-5 mm long. Leaves not distinctly papillate 2. *Tr. portulacastrum*
1. Styles 2, free. Flowers clustered. Perianth free from the petioles. Stamens 10-15 3. *Tr. decandra*

1. *Trianthema triquetra* ROTTL. ex WILLD. Neue Schr. Naturfr. Berlin 4 (1803) 181; DC. Prod. 3 (1828) 352; TRIMEN, Fl. Ceyl. 2 (1894) 269; COOKE, Fl. Bomb. 1 (1903) 554.—*Tr. crystallina* (AUCT. div. non VAHL) ROXB. Fl. Ind. ed. CAREY 2 (1832) 444; CLARKE in HOOK. f. Fl. Br. Ind. 2 (1879) 660; KOORD. Exk. Fl. 2 (1912) 207; BACK. Onkr. Suiker. (1930) 241, t. 252; Bekn. Fl. Java, em. ed. 4 (1942) fam. 58, p. 2.—*Tr. sedifolia* VISIANI, Pl. Aeg. ac Nub. (1836) 19, t. 3, f. 1; ZOLL. Syst. Verz. (1854) 140; MIQ. Fl. Ind. Bat. 1, 1 (1858) 1059.—*Tr. glaucifolia* F.v.M. Fragm. 1 (1859) 172.

Annual or perennial, often pluricauline, frequently with a very strong taproot, usually much branched from the very base. Branches prostrate, 20-60 cm long, terete, much tinged with purple, thin, narrowly fistular. Young parts studded with glassy papillae. *Leaves* linear or linear-lanceolate, greyish green, glabrous, fleshy-succulent, with a well-developed central aquiferous tissue, 20-30 by 2½-4 mm; those of one pair not very much differing in size. Petiole much shorter than the lamina, dilated at the base into a semi-amplexicaul sheath, usually bearing on the top, on either side, a minute dentiform stipule; sheaths of one leaf pair free

from each other. *Flowers* in clusters of 2-6, or rarely, and only a few, solitary, often crowded on short lateral branchlets, sessile, free from the petiolar sheaths. Perianth ± 3 mm long, throughout its length longitudinally ribbed, 5-cleft ± half-way down; tube obconical. Segments obliquely erect or at last spreading-recurved, ovate-triangular, rather acute or rather obtuse, with a dorsal subapical minute obtuse mucro, inside sordidly white with green markings. Stamens 5, much shorter than the tepals; anthers purplish. Ovary with an obconical base, its apex rounded-truncate, impressed in the centre. Style 1, excentric, very short. *Capsule* enclosed by the calyx-tube, its operculum thick; its apex seedless inside but with its inverted-cupshaped basal part narrowly surrounding a single seed which it carries away in falling off; basal part of the fruit cup-shaped, thin-walled, likewise 1-seeded; both seeds in unopened fruits appressed against each other. Seeds subhorizontal orbicular, concavo-convex, brownish black, faintly reticulate-ribbed and especially around the margin studded with short white papillae which swell up when wetted, 1-1¼ mm diam.

Distr. Tropical Africa and Asia to Victoria, in

Malaysia: NE. Java & Lesser Sunda Islands (Bali).

Ecol. Periodically very dry regions, in clayey or rocky, often saltish localities, from the sea-shore up to ± 10 m altitude, often gregarious, especially on the dikelets between the fish-ponds along the sea; less often on fallow rice-fields.

Vern. *Gelang*, *J. krokot*, Md.

Note. Often confused with *Tr. crystallina* VAHL from Nubia and Arabia which differs by oval or lanceolate, smaller ($1\frac{1}{2}$ –2 cm long) often unequal-sided leaves.

2. *Trianthema portulacastrum* LINNÉ, Sp. Pl. (1753) 223; PULLE, Nova Guinea 8 (1910) 355; MERR. Fl. Manila (1912) 198; En. Philip. 2 (1923) 136; BACK. Onkr. Suiker. (1930) 242, t. 253; Bekn. Fl. Java, em. ed. 4 (1942) fam. 58, p. 2; STEEN. Fl. Sch. Indon. (1949) 174.—*Tr. monogyna* LINNÉ, Mant. 1 (1767) 69; DC. Prod. 3 (1828) 352; ZOLL. Syst. Verz. (1854) 140; MIQ. Fl. Ind. Bat. 1, 1 (1858) 1059; KOORD. Exk. Fl. 2 (1912) 207.—*Tr. obcordata* ROXB. Fl. Ind. ed. CAREY 2 (1832) 445; MIQ. Fl. Ind. Bat. 1, 1 (1858) 1059.—*Portulaca toston* BLANCO, Fl. Fil. (1837) 408.—*P. axilliflora* (non PERS.) BLANCO, Fl. Fil. ed. 2 (1845) 285, ed. 3, 2 (1878) t. 165.

Prostrate or ascending often much branched annual with a firm taproot. Stems subterete or slightly angular, thickened and flattened on the nodes, glabrous or finely pubescent, 15–50 cm long. Branches in the axils of the smaller leaves of the pairs, alternating. Leaves thin-fleshy, quite entire, purple-margined, barring the petiole quite glabrous; those of one pair very unequal in size; larger ones oval-obovate-obcordate from a cuneate base, obtuse, rounded or retuse, $1\frac{1}{2}$ –5 by 1–4 $\frac{1}{2}$ cm; smaller ones either of the same shape or more oblong, 8–30 by 4–25 mm. Petioles 4–30 mm, on the top of the flattened upper surface with a few short, thick hairs; their sheathing membranous bases connate pairwise below into a funnelshaped pouch which bears on its apex on the right and the left a small stipule. Stipules acuminate from a pale base, with an acute red apex, on the midrib thinly beset with short thick hairs, 2–2 $\frac{1}{2}$ mm long. Flowers sessile, solitary in the leaf axils; their lower part hidden by the petiolar pouch. Perianth totalling 4–5 mm, usually pale pink, rarely white; tube adnate throughout its length to the base of 1 or 2 petioles, segments rather obtuse with a longish dorsal, subapical micro. Stamens 10–25; filaments white, glabrous, 2–3 mm; anthers pale pink. Ovary \pm turbinate, truncate, glabrous, incompletely divided into 2 superposed cells by a transverse inner ring; both cells ovulate. Style 1, ± 3 mm long, unilaterally stigmatose throughout its length. Capsule partly exerted, with a truncate bilobed apex; operculum fleshy, containing 1–2 seeds, indehiscent; basal part of the fruit thin-walled, 2–9-seeded. Seeds reniform, dull black, with faint wavy ribs, $1\frac{3}{4}$ –2 $\frac{1}{2}$ mm broad.

Distr. Pantropic, in *Malaysia*: Malay Peninsula, Philippines, Java, Madura, Lesser Sunda Islands (Sumbawa, Flores, Timor), Moluccas (Ternate), S. New Guinea.

Ecol. In Java throughout the drier parts of the island from quite near the sea up to ± 200 m, in sunny, periodically dry localities, either saline or not, in cultivated or fallow fields, on roadsides, preferably on clay near the sea, locally often numerous.

Use. VAN STEENIS (*l.c.* p. 175) states that the young leaves are sometimes eaten as a vegetable.

Vern. *Krokot*, *télékan*, *J. kradjep*, Md. Philippines: *Ayam*, *ulisuman* (Bis.), *toston* (Tag.).

Note. For the interpretation of the Linnean description see the note under *Sesuvium portulacastrum*.

3. *Trianthema decandra* LINNÉ, Mant. 1 (1767) 70; ROXB. Fl. Ind. ed. CAREY 2 (1832) 444; DC. Prod. 3 (1828) 352; KOORD. Exk. Fl. 2 (1912) 207.—*Tr. pentandra* (auct. non LINNÉ) DECNE, Nouv. Ann. Mus. 3 (1834) 448; SPAN. Linnaea 15 (1841) 120; ZOLL. Syst. Verz. (1854) 140; MIQ. Fl. Ind. Bat. 1, 1 (1858) 1158.—*Zaleya decandra* BURM. f. Fl. Ind. (1768) 110, t. 31, f. 3.

Herb with a strong taproot. Stems prostrate, more or less (usually not very much) branched, angular and striate, sometimes up to 2 m long but mostly much shorter (50–75 cm); young parts rather densely beset with small white papillae, tardily glabrescent. Leaves oval-oblong-obovate-subspathulate from an acute base, acute, obtuse or rounded at the apex, rather densely studded (especially on the midrib and along the margins, moreover on the petiole) with small, white, at last shrivelling white papillae, \pm fleshy, $1\frac{1}{2}$ –5 cm by 5–18 mm, those of one pair \pm unequal. Petioles rather long, 3–20 mm, scarious-margined; their much dilated sheathing bases not connate into a pouch and not concealing the flowers. Flowers few to rather many in dense, sessile or subsessile clusters, shortly pedicelled or subsessile. Bracteoles oblong-lanceolate, thinly membranous. Perianth ± 4 mm long, deeply 5-partite; tube free from the petioles, shortly obconical. Segments much longer, oval, with broad membranous margins and a thicker, longitudinally nerved central field, ending near the top of the segment in a longish dorsal micro, glabrous, green outside, pink within. Stamens 10–15, free, shorter than perianth. Ovary cylindrical-obpyramidal, crowned by 2 recurved shortish styles. Capsule ± 4 mm long, with a cylindrical, faintly 2-lobed, solid beak; beak separating from the basal part of the fruit by a circular cleft; beak containing 2 seeds; lower part of the fruit with 2 superposed seeds. Seeds orbicular-reniform, with slightly prominent ribs on the back and faint tubercles on the sides, dull-black, $\pm 1\frac{1}{2}$ mm diam.

Distr. Ceylon, Hindustan, Australia, in *Malaysia*: Lesser Sunda Islands (Sumbawa and Timor).

Ecol. Grassy localities in seasonally dry regions, only rarely collected.

Vern. *Ngépa tanah* (Sumbawa).

Note. According to TRIMEN *l.c.* the fully expanded flowers are very pretty.

5. TETRAGONIA

LINNÉ, Sp.Pl. (1753) 480; Gen. Pl. ed. 5 (1754) no 551.

Erect, ascending, prostrate or climbing herbs or undershrubs, studded all over with minute, shining, white papillae. *Leaves* spirally arranged, flat or slightly undulate, fleshy, exstipulate. *Flowers* axillary, solitary or fascicled, sessile or stalked, greenish or yellowish. Perianth-tube produced above the ovary; segments 3–5, short, often unequal. Stamens 1 or more in the mouth of the perianth tube, alternating with the segments, solitary or in groups. Ovary semi-inferior, 2–9-celled, with 1 pendulous ovule in each cell. Styles equal in number to the cells, linear, stigmatose along the inner side. *Fruit* turbinate or obovoid with a hard, almost woody endocarp; the herbaceous or almost fleshy epicarp tipped with the enlarged calyx-limb, with apical tubercles or hornlets which not rarely develop into a flower, a branchlet or a spine, indehiscent.

Distr. Species 50–60, mainly in the S. hemisphere, especially in S. Africa and Chile, a few in Australia, Tasmania, New Zealand, Polynesia, and Japan, in *Malaysia* only a cultivated species.

1. *Tetragonia tetragonioides* (PALLAS) O.K. Rev. Gen. (1891) 264.—*Demidovia tetragonioides* PALLAS, En. Pl. Demidof (1781) 150, t. 1.—*Tetragonia expansa* MURR. Comm. Goett. 6 (1783) 13; CURT. Bot. Mag. (1823) t. 2362; DC. Prod. 3 (1828) 452; HEYNE, Nutt. Pl. (1927) 611; OCHSE & BAKH. V. D. BR. Veg. (1931) 6, f. 5; BURK. Dict. 2 (1935) 2143; BACK. Bekn. Fl. Java, em. ed. 4 (1942) fam. 58, p. 3.—*T. cornuta* GAERTN. Fruct. 2 (1791) 483.—*T. inermis* F.v.M. Linnæa 25 (1852) 384.

Fleshy, widely branched (often from the very base), annual. Stems erect when young, afterwards trailing-ascending, thick, terete or slightly angular, light green, 10–100 cm long. *Leaves* ovate-rhomboid-triangular from a ± decurrent, cuneate or contracted base, obtusely acuminate or obtuse, flat or slightly undulate, darkgreen above, light green or pale green beneath, dull on both sides, 1½–11 by 1–7½ cm; petiole thick, ½–2½ cm. *Flowers* solitary or 2–3 together. Pedicels ± 2 mm. Perianth-tube turbinate, during anthesis 1½–2 mm high, under each segment with a short hornlet, which enlarges after anthesis and sometimes de-

velops into a flower or a branchlet. Segments 3–5, often 4, during anthesis patent with recurved margins, afterwards erect or connivent, green externally, yellowish green or pale green inside, 2–3 mm long, unequal; 1–2 of them broadly ovate or semi-orbicular, obtuse or rounded, the 2 lateral ones narrower, ovate-triangular, obtuse. Stamens 4–10; filaments yellow, 1–1½ mm. *Fruit* turbinate, obtusangular, subtruncate, 2–5-horned, ¼–1¼ cm long, 4–10-seeded.

Distr. Wild in the coastal regions of Australia, Tasmania, New Zealand, Japan, and the Pacific Islands.

Uses. In *Malaysia*, especially in the mountainous regions, cultivated as a potherb, mostly 1000–1700 m, e.g. in W. Java and N. Sumatra.

Vern. *Nieuw-Zeelandse spinazie*, D, *New Zealand spinach*, E, *kabak*, M.

Excluded

Adenogramma oppositifolia HASSK. = *Alternanthera sessilis* (L.) R.Br. (*Amaranthaceae*), cf. p. 92, bottom of first column.