

CHENOPODIACEAE (C. A. Backer, Heemstede)

Annual or perennial herbs or shrubs, often fleshy, glabrous, papillate or hairy. *Leaves* opposite or alternate, exstipulate, sometimes seemingly wanting, stalked or sessile, entire, dentate-serrate-lobed or irregularly gashed. *Flowers* solitary, 2-3-nate or glomerate, usually sessile, either axillary or in terminal or axillary dense or interrupted spikes or panicles, ♂ or unisexual, monochlamydous, rarely achlamydous, small; bracts present or absent, usually small, rarely leafy. *Perianth* herbaceous or sometimes scarious, rarely (in ♀) absent, 3-5-partite with (in bud) imbricate segments, or sometimes almost entirely gamophyllous and then shortly lacerate-dentate or unilaterally cleft, persistent, after anthesis accrescent or not. Stamens often the same number as tepals and opposite to them, sometimes fewer, usually inserted on or near base of perianth; filaments free or shortly connate; anthers dorsifixed or inserted in a basal cleft, 2-celled (4-locellate); cells bursting longitudinally. Ovary free or at the base adnate to the perianth, 1-celled; ovule 1, basal, sessile and erect or suspended from a funicle; styles or stigmas 2-5, linear. *Utricle* either enclosed by the perianth or not, indehiscent or rarely operculate; seed erect, oblique or horizontal, usually compressed; endosperm mostly present, peripheral, surrounding the embryo; embryo annular or spirally twisted.

Distr. Species numerous, inhabitants of the temperate and tropical zones of both hemispheres.

Ecol. Often in maritime, saline, or in permanently or periodically dry regions. Many are weeds of cultivation. In Malaysia restricted to maritime and mountainous districts.

Uses. In Malaysia some species are cultivated as vegetables, others as medicinal or ornamental plants, but *not* for the production of sugar.

(ARTIFICIAL) KEY TO THE GENERA

1. Apparently leafless; stem spuriously articulate. Leaves decussate; those of each pair connate throughout their length into a tubular fleshy sheath which tightly and entirely encloses the appertaining internode and is widened at the apex into a shallow cup. Flowers spicate; bracts decussate, crowded; flowers in the axil of one bract ± collateral; perianth gamophyllous, scarious, ± flagon-shaped; stamen 1 (sometimes 2?).
2. Floral bracts almost entirely connate into a cup; base of the cup on 2 opposite sides provided with collateral apertures for the protrusion of stamens and stigmas. Apex of perianth laterally split.
 5. *Arthrocnemum*
2. Floral bracts almost free; their margin dilated into a patent semi-orbicular scale, their base without apertures. Apex of perianth shortly dentate-lacerate 4. *Tecticornia*
1. Leafy in a normal way; leaves alternate:
 3. Leaves spine-tipped. Bracts exceeding the perianth. Tepals about the middle with a transverse thickening, above this thickening scarious 7. *Salsola*
 3. Leaves not spine-tipped. Tepals without a transverse thickening.
 4. Leaves sessile, narrowly linear, semi-terete, very succulent. Bracteoles distinct though small, transparent, after anthesis stellately spreading 6. *Suaeda*
 4. Leaves distinctly petioled, flat.
 5. Flowers (♂) (♀); ♂ flowers in spicate or paniced clusters; ♀ flowers solitary in leaf axils. No bracteoles. In Malaysia exclusively cultivated. 3. *Spinacia*
 5. Flowers all clustered, all or for the greater part ♂; the ♀, when present, in the same cluster as the ♂ ones.
 6. Ovary free. Flowers after anthesis not coalescent. No bracteoles 2. *Chenopodium*
 6. Ovary adnate to base of perianth. Flowers coalescent after anthesis. Bracteoles minute. In Malaysia only cultivated 1. *Beta*

1. BETA

LINNÉ, Sp. Plant (1753) 222.

In Malaysia not wild; 1 species frequently cultivated in the mountainous regions of Java.

1. *Beta vulgaris* LINNÉ, Sp. Plant. (1753) 222; ASCH. & GR. Syn. 5, 1 (1913) 12; OCHSE & BAKH. v. D. BR. Veget. (1931) 102.

In Java 2 forms cultivated, exclusively for the European table, not eaten by the Indonesians, both of them unfit for the manufacture of sugar:

f. cicla [LINNÉ, Sp. Plant. (1753) 222, *pro sp.*]. Dutch: *Snijbiet*. Leaves eaten as spinach; root rather tough, unfit for human food.

f. rapa [DUM., Fl. Belg. (1827) 21 *pro sp.*]. Dutch: *Kroot, roode biet*. Leaves not eaten. Root fleshy, dark red, edible after cooking.

2. CHENOPODIUM

LINNÉ, Sp.Pl. ed. 1 (1753) 218.

Annual or perennial herbs, sometimes strongly smelling; young parts often more or less densely clothed with minute, powdery, white or pink vesicles which, when young, contain a watery liquid but usually soon shrivel and lose their colour. *Leaves* alternate, petioled, herbaceous, variable as to shape, entire, dentate-serrate or irregularly gashed. *Flowers* ♂ or by abortion ♀, sessile, clustered; clusters solitary in the leaf axils or in axillary and terminal cymes, spikes or panicles; no bracteoles. *Tepals* 5 or sometimes 4, free or shortly connate, vaulted, herbaceous, often longitudinally thickened or keeled on the back, in the Malaysian species not fleshy after anthesis. Stamens in ♂ the same number as tepals, inserted on the base of the perianth or free from it, at the base sometimes connate into a fleshy disk. Ovary depressed globose; style short; stigmas 2-5. *Fruit* often embraced by conniving tepals, thin-walled indehiscent. Seed usually horizontal, sometimes oblique or vertical, shining or dull, smooth or finely tuberculate, lenticular; its margin keeled or not; testa thinly coriaceous; embryo annular, surrounding the usually mealy endosperm.

Distr. Species about 60 in the temperate zones of both hemispheres. A small number naturalized in the mountainous districts of the tropics.

Ecol. For the greater part weeds of cultivation; many prefer a fertile soil.

Uses. A few species cultivated either for their oil-producing fruits, as a substitute for tea, or for ornamental purposes.

Notes. Most species flower and fruit freely. For the determination ripe fruits are of value. The colour of young leaves should be noted by Collectors.

BURMAN (Fl. Ind. (1768) 72) records *Chenopodium urbicum* L. as having been sent to him from Java. The specimen mentioned by him is conserved at Geneva and has been correctly named. Nevertheless I have omitted the species from my key as I feel not at all convinced that it was really collected in Java; BURMAN was often not careful in his records. *Ch. urbicum* was never afterwards collected in Malaysia.

KEY TO THE SPECIES

1. Top of ovary and fruit studded with (*in vivo* yellow) glands; stigmas 2-5; embryo encircling only $\frac{1}{2}$ - $\frac{2}{3}$ of the seed. Young vegetative parts and outside of perianth without powdery white or pink vesicles. Undersurface of leaves with (sometimes rather indistinct) yellow glands. Strongly smelling.
 1. *Ch. ambrosioides*
1. Top of ovary and fruit glandless; stigmas 2; embryo encircling almost the entire seed. Young vegetative parts and outside of perianth with powdery white or pink vesicles. Leaves without any yellow glands. Not or faintly smelling.
 2. Segments of perianth after anthesis widely patent, not covering the fruit. Young parts without powdery vesicles, quite glabrous 2. *Ch. polyspermum*
 2. Segments of perianth after anthesis connivent, covering the fruit. Young, or at least very young, parts with powdery white or red vesicles.
 3. Only very young parts with distinct vesicles; these white, very soon shrivelling and losing their colour; old leaves *on both surfaces* dark green and feebly shining. Seed (after removal of pericarp) dull black, rather obscurely papillate. Panicles small; terminal panicle not much larger than the axillary ones. 3. *Ch. murale*
 3. Vesicles white or red, not *very* soon losing their colour; old leaves *not* dark green *on both surfaces*.
 4. Larger leaves irregularly and rather coarsely serrate-dentate-laciniate or deeply gashed, often longer than 5 cm and wider than 3 cm; undersurface of leaves not *very* densely and persistently vesiculose. Seed after removal of pericarp shining blackish brown, almost smooth 4. *Ch. album*

4. Leaves quite entire, small (mostly 2-4 by 1½-3 cm), on the undersurface very densely and persistently vesiculose; hence *in a dried state* very pale beneath; their nerves and margins often reddish. Flower-clusters spicate; higher spikes united in a terminal, small, leafless, paniculate inflorescence; rachises of the inflorescence and outside of the perianth densely clothed with patent, oblong, reddish vesicles 5. *Ch. acuminatum*

1. *Chenopodium ambrosioides* LINNÉ, Sp.Pl. (1753) 219; BLANCO, Fl. Filip. (1837) 200; ed. 2 (1845) 140; ed. 3, 1 (1877) 253, tab. 69; MOQ. in DC. Prod. 13, 2 (1849) 72; WIGHT, Ic. 5 (1852) tab. 1786; MIQ. Fl. Ind. Bat. 1, 1 (1858) 1017; BTH. Fl. Austr. 5 (1870) 162; HOOK. f. Fl. Br. Ind. 5 (1886) 4; BAILEY, Queensl. Fl. pt 4 (1901) 1243; KOORD. in Nat. Tijds. N.I. 60 (1901) 256; BACK. in Ann. J.B.B. Suppl. 3 (1909) 398; COURCH. in Fl. gén. I.C. 5 (1910) 5; MERR. Fl. Man. (1912) 189; KOORD. Exk. Fl. 2 (1912) 189; ASCH. & GR. Syn. 5, 1 (1913); MERR. Sp. Blanc. (1918) 136; En. Philip. Fl.Pl. 2 (1923) 125; HEGI, Ill. Fl. Mitt. Eur. 3 (1912) 233; HEYNE, Nutt. Pl. 2 (1927) 602; DOMIN, Beitr. Pflanzengeogr. Austr. 1, 2 (1929) 618; BURK. Dict. Ec. Pr. 1 (1935) 523.

Erect or ascending annual, often very much branched; entire plant strongly smelling, without powdery vesicles, 15 cm to 1 m high; stem angular-ribbed, glabrous or finely pubescent. *Leaves* oblong-lanceolate from a narrowed or contracted, acute, often more or less decurrent base, acute or rather obtuse; larger ones coarsely or shallowly serrate-dentate; smaller ones less deeply incised; highest entire, gradually changing into bracts; all leaves herbaceous, bright green, on the undersurface more or less densely studded with *in vivo* yellow (sometimes very inconspicuous) glands, otherwise subglabrous or sparingly beset with short white hairs, 1½-15 by ½-5 cm; midrib prominent beneath; other nerves thin; petioles short or medium-sized; those of highest leaves obsolete. *Flower-clusters* small, 3-25-flowered, in the axils of successive, conspicuous, narrow, ± bractlike leaves, united in short or longish, rather lax spikes, forming together a leafy panicle; floral leaves much surpassing the clusters, acute, with a strongish midrib. *Flowers* ♂ or partly ♀, sometimes partly ♂ and then with 4-5 stamens and a rudimentary, densely glandular ovary. *Perianth* light green with a pale base, 1¼-1½ mm long, 4-5-cleft to near the base; segments ovate-triangular, rather acute, very concave, not or indistinctly keeled. Stamens in ♂ 4-5, rarely 1-3; filaments slightly exceeding the perianth. Ovary depressed globose, on top with many small, *in vivo* yellow glands; stigmas 2-5, usually 3 or more. Ripe *fruit* entirely concealed by the conniving tepals. *Seeds* horizontal, or a few (rarely many or all) erect, broadly oval-obovoid, shining brownish black, 2½-4½ mm diam.; embryo encircling 1/3-2/3 of the seed.

Distr. Native of tropical America, introduced in many other regions: Europe, Asia, Africa, Australia, in *Malaysia*: naturalized throughout the Philippines, in Java and in N. Celebes (Minahasa). At present found in a wild state in the western and the eastern part of Java between 1600 and 2000 m.

Ecol. Road-sides, locally often very numerous. In Celebes collected in dry ricefields. Fl. Jan.-Dec.

Uses. The slightly poisonous oil distilled from the seeds is used as a remedy against ankylostomiasis. For this purpose the plant has been cultivated in Java, but its cultivation was abandoned as being insufficiently remunerative.

Notes. In Java the seeds are all or nearly all horizontal. The Celebian specimen has *vertical* seeds (see also the description by MOQUIN, *l.c.* p. 73) but in all other respects it completely agrees with the Javan material. It was collected in 1840 by FORSTEN and had as late as 1949 still distinctly retained its peculiar smell.

2. *Chenopodium polyspermum* LINNÉ, Sp.Pl. (1753) 220; MOQ. in DC. Prod. 13, 2 (1849) 62; ASCH. & GR. Syn. 5, 1 (1913) 26; HEGI, Ill. Fl. Mitt. Eur. 3 (1912) 222; MERR. in Philip. J.Sc. 5 (1910) Bot. 145; En. Philip. Fl.Pl. 2 (1923) 126.

Annual, erect or ascending, quite glabrous, glandless, without a distinct smell, without powdery vesicles, 4-100 cm (mostly 15-75 cm) long, dull green, rarely shining, in a living state often more or less strongly tinged with purple, frequently much branched (often from quite near the base); branches obliquely erect or the lower widely patent-ascending, not rarely partly prostrate; stem and branches angular. *Leaves* herbaceous, rarely fleshy, entire or the larger ones sometimes with one or a few triangular teeth near the base; lower leaves on rather long petioles, ovate or ovate-oblong from a cuneate or obtuse, rarely hastate base, shortly contracted into the petiole, acute or obtuse, rarely subretuse, frequently very shortly mucronate, 4-11 by 1½-6 cm; highest leaves much smaller, oblong-lanceolate. *Cymes* very numerous, most variable as to size, dense or rather loose, few- to many-flowered; highest very often collected in a narrow, paniculate inflorescence (remining of *Amaranthus gracilis*). *Flowers* sessile; tepals oval-obovate or oval-oblong, obtuse, thin, with a very distinct, not-keeled midrib, 1½-1½ by 1/3-1/2 mm, after anthesis widely patent, not concealing fruit; stamens 5, on the base of the perianth, ± equalling tepals; stigmas 2, erect or suberect, minute, persistent. *Fruit* depressed-globose, ± 1½ mm diam., very thin-walled. Seed blackish brown, feebly shining, very faintly striolate.

Distr. Europe, continental Asia; elsewhere locally introduced.

Ecol. Weed of fields and gardens; waste places.

Notes. I have seen no Malaysian specimen but MERRILL *l.c.* records the plant as a casual weed in the Philippines. The species is very variable.

3. *Chenopodium murale* LINNÉ Sp.Pl. (1753) 219; MOQ. in DC. Prodr. 13, 2 (1849) 69; MIQ. Fl. Ind. Bat. 1, 1 (1858) 1016; BTH. Fl. Austr. 5 (1870) 160; HOOK. f. Fl. Br. Ind. 5 (1886) 4; BAIL. Queensl. Fl. pt 4 (1901) 1243; KOORD. in Nat. Tijdsch. N.I. 60

(1901) 256; BACK. in Ann. J.B.B. Suppl. 3 (1909) 398; KOORD. Exk. Fl. 2 (1912) 190, 191; ASCH. Gr. Syn. 5, 1 (1913) 33; HEGI, Ill. Fl. Mitt. Eur. 3 (1912) 223; DOMIN, Beitr. Pflanzengeogr. Austr. 1, 2 (1929) 618.

Annual, erect or ascending, often much branched, slightly fetid, without any yellow glands, 15–80 cm long; all vegetative parts and outside of perianth, when very young, clothed with white, powdery vesicles, otherwise glabrous; vesicles soon shrivelling up and losing their colour; stem and leaves then darkgreen, somewhat shining; stem angular or ribbed; leaves ovate-rhomboid-elliptic-oblong from a cuneate base, acute, irregularly coarsely acutely dentate-serrate, herbaceous, 1½–12 by ¾–7½ cm; petioles of lower leaves 3–5 cm, of higher leaves gradually smaller, of topmost ones often very short. Flowers in axillary and terminal, 1–4 cm long panicles with erecto-patent branches, densely clustered, 5-merous; ♂; terminal panicle not or hardly longer than the axillary ones; perianth herbaceous. Tepals distinctly connate at the base, oval, with rounded or very obtuse tips, faintly keeled on the back, 1½–2 mm long; stamens 5, on the very base of the perianth; stigmas 2, short. Fruit tightly enclosed by incurved tepals, depressed globose, 1¼–1½ mm diam.; pericarp very thin, not readily separating from the seed. Seed horizontal, encircled by a very distinct rather sharp keel; testa (after removal of the pericarp) dull black, very finely papillate; embryo encircling almost the entire seed.

Distr. Possibly originating from continental Asia but since long widely spread in Europe, America, Africa and Australia. In Malaysia: introduced in Java already more than 90 years ago, but as yet still confined to Mt Tengger in the eastern part between 1900 and 2300 m.

Ecol. Fields and gardens, road-sides, locally very common.

Vern. Dieng, J, dieng dempo, J, dieng idjo, J.

4. *Chenopodium album* LINNÉ, Sp. Plant. (1753) 219; MOQ. in DC. Prod. 13, 2 (1849) 70; MIQ. Fl. Ind. Bat. 1, 1 (1858) 1017; BTH. Fl. Austr. 5 (1870) 159; HOOK. f. Fl. Br. Ind. 5 (1886) 3; BAIL. Queensl. Fl. pt 4 (1901) 1242; KOORD. in Nat. Tijd. N.I. 60 (1901) 256; BACK. in Ann. J.B.B. Suppl. 3 (1909) 398; KOORD. Exk. Fl. 2 (1912) 191; ASCH. & GR. Syn. 5, 1 (1913) 38; HEGI, Ill. Fl. Mitt. Eur. 3 (1912) 225; DOMIN, Beitr. Pflanzen geogr. Austr. 1, 2 (1929) 617.

Erect annual, often much branched, not markedly smelling, without any yellow glands, 15 cm–1½ m high; all vegetative parts and outside of perianth, when young, densely clothed with white or partly amaranthine powdery vesicles, otherwise glabrous; the amaranthine vesicles soon turning white; all old vesicles shrivelling up and losing their colour. Stem angular, ribbed, with longitudinal dark green or red streaks. Lower leaves long-petioled, ovate-rhomboid, irregularly and rather coarsely dentate-serrate-laciniate or deeply gashed; higher ones gradually shorter-petioled, elliptic-oblong-lanceolate from an acute or contracted

base, acute or obtuse, less deeply incised or entire; all leaves herbaceous, 1½–15 by ½–13 cm. Flowers in paniced clusters, 5-merous, ♂; panicles often collected in a large terminal leafy paniculate inflorescence. Perianth herbaceous, not becoming fleshy after anthesis. Tepals distinctly connate at the base, oval, very concave, obtuse, with a strong, rounded midrib, 1½–2¼ mm long. Stamens slightly longer than the perianth. Ovary depressed globose; stigmas 2, short. Fruit in the living plant en-

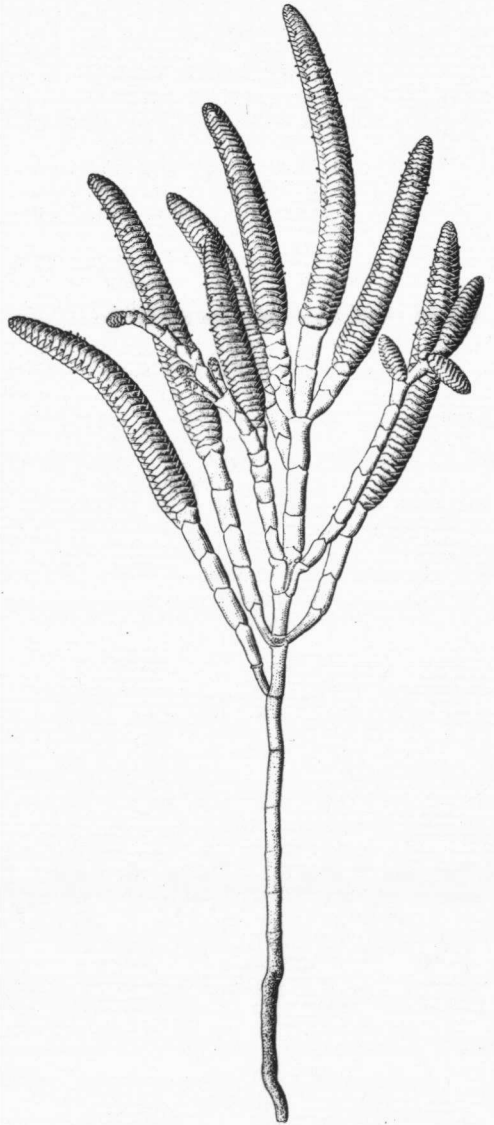


Fig. 1. *Tecticornia cinerea* (F.v.M.) BAIL. from saline coastal flats N of Mt Baluran; drawn after a living specimen by A. HAMZAH, Nov. 1941, × ½.

tirely enclosed by the incurved tepals, depressed-globose, finely papillate. Seed horizontal, lenticular, surrounded by an obtuse keel, shining blackish brown, smooth or nearly so, $1\frac{1}{4}$ – $1\frac{3}{4}$ mm diam.

Distr. Europe, continental Asia, Africa, Australia, America, in *Malaysia*: in Java introduced already very long ago, naturalized in the eastern part of the island, 800–1800 m.

Ecol. Fields, gardens, locally common.

Vern. *Dieng*, *J*, *dieng putih*, *J*.

Notes. Extremely polymorphous, buried by fanatic species-splitters under a mountain of unnecessary and useless names.

subsp. amaranticolor COSTE & REYN. in Bull. Herb. Boiss. II, 5 (1905) 979; HEYNE, Nutt. Pl. (1927) 602. —*Chenopodium amaranticolor* (COSTE & REYN.) COSTE & REYN. in Bull. Soc. Bot. Fr. 54 (1907) 181; ASCH. & GR. Syn. 5, 1 (1913) 66.

Young parts and outside of perianth densely clothed with amaranthine vesicles, retaining their colour during a long time but at last turning pale and shrivelling. Plant up to $2\frac{1}{2}$ m high. Otherwise like the main species and in a dried state indistinguishable from it. Introduced in Java long ago, at present naturalized in the western and the eastern part between 1200 and 2300 m above sea-level. Roadsides, fields, locally often numerous. By the Indonesians sometimes cultivated as a vegetable.

Note. In a living state very conspicuous by the bright amaranthine colour of the young parts. A specimen (LÖRZING 7168) of *Ch. album* was in 1920 collected in N. Sumatra. I have seen it only in a dried state and it bears no note indicating the colour of the young leaves, so that it is impossible to make out whether it belongs to the typical species or to its *subsp. amaranticolor*.

5. *Chenopodium acuminatum* WILLD. (*non* SCHUR) Acta Nat. Cur. 2 (1799) 124, tab. 5, fig. 2; MOQ. in DC. Prod. 13, 2 (1849) 62; MERR. in Philip. J. Sc. 3 (1908) Bot. 405; En. Philip. Fl. Pl. 2 (1923) 125.

Annual, erect or ascending, 20–30 cm high, branched or not; all young parts, especially under-surface of leaves, clothed with oblong, red or white vesicles; stems and branches angular; branches obliquely erect; their vesicles, except on the angles, subpersistent. *Leaves* entire, *in sicco* thickish, retaining their indumentum of vesicles during a long time especially on the undersurface where it is very dense, hence *in sicco* very pale beneath, often with a reddish margin and a reddish undersurface of nerves; lower leaves on rather long, reddish vesiculose petioles, ovate from a very obtuse or rounded-subtruncate, shortly contracted base and an obtuse or rounded, very shortly pointed apex, 2–4 by $1\frac{1}{2}$ –3 cm; higher leaves on shorter petioles, shorter, narrower, acute, distinctly and finely acuminate. *Rachises of inflorescence* densely clothed with reddish vesicles. Flower-clusters subglobose, small, dense, spicate, crowded or the lower rather distant; higher spikes united in a terminal, rather small leafless panicle inflorescence. *Flowers* sessile, outside densely reddish-vesiculose. *Tepals* 5, broadly oval, obtuse or rounded, very concave thin, 1-nerved, $1\frac{1}{3}$ – $1\frac{1}{2}$ mm long, before and after anthesis connivent. *Stamens* 5, about equalling the perianth; anthers thick; ovary (in our specimens) minute. *Style* short, 2-armed. *Fruit* (not seen) finely wrinkled; seed dull black or shining.

Distr. Siberia, China, Japan, Formosa; in *Malaysia*: Philippines (Batan Isl., between Formosa and Luzon).

Ecol. Waste places.

Note. I could examine only 2 specimens, neither of them collected in Malaysia.

3. SPINACIA

LINNÉ, Sp. Pl. (1753) 1027.

In *Malaysia* not wild; 1 species, the true spinach, occurs but rarely cultivated.

1. *Spinacia oleracea* LINNÉ, Sp. Pl. (1753) 1027, the true spinach, is but very rarely cultivated in *Malaysia* and only by way of experiment. It is substituted by two quite different species, *Amaranthus*

tricolor L. (*Amaranthaceae*), *bayam*, and *Tetragonia expansa* MURR. (*Aizoaceae*), *New-Zealand spinach*, *kabak*, M.

4. TECTICORNIA

HOOK. f. in BTH. & HOOK. f. Gen. Pl. 3 (1880) 65.

Only seemingly jointed and leafless, glabrous, softly succulent herb. *Leaves* decussate; those of each pair connate throughout their length in a tubular fleshy sheath tightly and entirely enclosing the appertaining internode and widened at the apex into a shallow, faintly bilobed cup, which embraces the slightly attenuate base of the next higher sheath. *Flowers* minute, spicate; spikes terminal and frequently also in highest leaf axils, oblong or shortly cylindrical, very obtuse, bracteate; bracts decussate, densely crowded, almost free, not provided with basal apertures, fleshy; their margin dilated into a semi-orbicular, \pm patent, thin-margined scale. *Flowers* often in threes, sessile, collateral, ♀; perianth flask-shaped, very thin, with

a narrow, dentate-lacerate mouth. Stamen 1; filament short; anther exsert, oblong-linear. Ovary ovoid-oblong, compressed, narrowed into a longish, shortly bifid style; ovule subsessile. *Utricle* erect, pericarp very thin, hyaline. Seed oblong, compressed, densely papillate; albumen hard; embryo slender, radicle inferior.

Distr. Monotypic, Australia and *S. Malaysia*.

1. *Tecticornia cinerea* (F.V.M.) BAIL. Queensl. Fl. 4 (1901) 1261; VALET. Bull. Dép. Agr. Ind. Néerl. 10 (1907) 9; KOCH in ZW. Nieuw-Guin. Exp. 1904/5 (1908) 505; PULLE in Nova Guin. 8 (1910) 349.—*Halocnemum cinereum* F.V.M. Fragm. 1 (1858) 140.—*Salicornia cinerea* F.V.M. Fragm. 6 (1868) 251.—Fig. 1.

Perennial (?), much branched, erect or prostrate with erect branches, 15–30 cm long; young stems after removal of leaf-sheaths thinly wiry, tough; old stems rather robust, cylindrical, woody; adult internodes 1–2 cm; whole plant in a dried state greyish. *Spikes* usually 1 terminal and 2–6 in higher axils; the latter spikes opposite, widely patent, $\frac{1}{2}$ – $2\frac{1}{4}$ cm long. *Utricle* brown, $1\frac{1}{4}$ – $1\frac{3}{4}$ mm long; seed yellowish brown.

Distr. N. Australia, in *Malaysia*: SW. New Guinea, S. coast near Merauke, (long. 140° E, G. M. VERSTEEG 1895; 8.9.07, KOCH *s.n.*) and coast near Mt Baluran, E. Java (long. $114^{\circ}25'$ E, HOOGERWERF *s.n.* Nov. 1941).

Ecol. Low, clayey, seasonally swampy and again completely desiccating localities, cut up after a prolonged dry period in their upper layers into hard clumps by criss-crossing cracks, locally gregarious. According to KOCH the loamy plain was inundated in the rainy season, and had (had) probably connection with the mouth of the Digul river; possibly the soil was, therefore, saline. It is also said to have been collected in *Imperata*-fields, but we should bear in mind that non-botanists are apt to confound *Imperata* with other grasses.

Notes. Making an accurate detailed description of this species based on herbarium-specimens is impossible, owing to the extreme shrinking of dried materials and their pappiness after soaking. A new description after the living plant is urgently needed. Though HOOKER based his new genus *Tecticornia* on this species only, he did not create the binomial, which is often wrongly ascribed to him.

5. ARTHROCNEMUM

MOQ. Chenop. Enum. (1840) 111.

Only seemingly jointed and leafless herbs or undershrubs. *Leaves* decussate; those of each pair connate almost throughout their length in a tubular fleshy sheath, tightly and entirely enclosing the appertaining internode and widened at the apex into a rather shallow, faintly 2-lobed cup which embraces the shortly attenuate base of the next higher sheath. *Flowers* minute, spicate; spikes terminal, on often very short lateral branches, bracteate; bracts crowded, decussate, pairwise connate into a very faintly 2-lobed cup, embracing the base of the next higher cup; cups very fleshy at base, gradually thinner upwards, at the base on 2 opposite sides with 3 small collateral apertures for the protrusion of the adult anthers and stigmas (over the margin of the next lower cup); pairs of aperture-triads decussate. *Flower* usually 1 behind each aperture, $\bar{\sigma}$ or unisexual; bracteoles narrowly linear-spathulate, thinly membranous. Perianth thinly membranous, gamophyllous, at the apex or also deeper unilaterally cleft. Stamen 1 (sometimes 2?); filament short; anther thick. Ovary membranous; stigmas 2, subulate, rather long. *Utricle* (not seen in a ripe state) membranous or hard. Seed compressed; albumen well-developed, one-sided, mealy; embryo comma-shaped.

Distr. Species \pm 12, along the Mediterranean coast and in the warmer regions of N. America, Asia and Australia, in the coastal districts and salt-marshes, in *Malaysia* 1 species.

1. *Arthrocnemum indicum* (WILLD.) MOQ. Chenop. Enum. 113; in DC. Prod. 13, 2 (1849) 151; MIQ. Fl. Ind. Bat. 1, 1 (1858) 1020; FORB. Nat. Wand. (1885) 515; Hook. f. Fl. Br. Ind. 5 (1886) 12.—*Salicornia indica* WILLD. in Nova Acta Hist. Nat. 5, 111, t. 4, fig. 1; ROXB. Fl. Ind. ed. 1, 1 (1820) 185;

DECNE in Nouv. Ann. 3 (1834) 370; SPAN. in Linnaea 15 (1841) 345; WIGHT, Ic. 3 (1845) 737.—*S. fruticosa* DECNE (*non* L.) in Nouv. Ann. 3 (1834) 370; SPAN. in Linnaea 15 (1841) 345.—*Salicornia spec.* in ZOLL. Syst. Verz. (1854) 108, Z. 3339 (*sphal-mate* 3329).—*S. brachiata* MIQ. (*non* ROXB.) Fl.

Ind. Bat. 1, 1 (1858) 1019; KOORD. Exk. Fl. 2 (1912) 192.—*Salicornia australasica* MOQ. (*ubi?*) ex SCHINZ in E. & P. ed. 2, 16c (1934) 552.

Rather robust perennial herb, woody beneath, divaricately branched from the base; branches ascending, much divided; young shoots after removal of leaf sheaths very thin, wiry, afterwards growing thick and woody, not breaking up into joints. *Leaf sheaths* on young branches 7–10 mm long; their widened top with a thin, very minutely dentate upper margin, gradually drying up, long persistent. *Spikes* erect or erecto-patent, cylindrical, very obtuse, 1½–4½ cm long, distinctly thicker than the branches by which they are borne; bracteal cups 12–30, from the narrowed base to the upper margin 2½–3 mm long, at last separating

from the thin rachis on which they seem to be strung. Spikes apparently unisexual, but both sexes present on a single plant. *Flowers* free from each other; ♂ perianth obtriangular, more or less deeply split; stamen 1, anther exsert; ♀ perianth obliquely flagon-shaped, unilaterally split at the apex, 1½–2 mm long. *Utricle* compressed, indurate. *Seed* erect, orbicular; testa membranous.

Distr. Coasts of tropical Africa, Hindustan, Bengal, in *Malaysia*: Java, Madura, Kangean Archipelago, Sumbawa, Sumba, Timor.

Ecol. Near the sea on salt clayey soils, which may be covered by a thin layer of sand, often more or less gregarious. *Fl.* Jan.–Dec.

Vern. *Kemalahala* (Sumba).

6. SUAEDA

FORSK. Fl. Aeg.–Arab. (1775) 69, 18.

Annual, biennial or perennial herbs, or shrubs, erect, ascending or prostrate; stems not conspicuously articulate. *Leaves* alternate, sessile, narrowly linear, terete or semiterete, succulent. *Flowers* small, ♀ or partly unisexual, sessile, clustered or higher ones solitary; clusters in the axil of a leaf or a bract, 2–∞-flowered, often united in paniculate inflorescences. Flowers 2–3-bracteolate; perianth herbaceous, deeply 5-cleft; segments subequal or 2–3 outer ones swollen on the back into tubercle; rarely all of them winged. Stamens 5, on base of perianth. Ovary free or at the base adnate to the base of the perianth, globose, ovoid or flask-shaped; styles 2–5, subulate or filiform. *Fruit* enclosed by the enlarged, more or less succulent perianth; pericarp membranous or spongy. *Seed* horizontal, oblique or erect, smooth; embryo planospiral, often green.

Distr. Few spp., all over the world.

1. *Suaeda maritima* (LINNÉ) DUM. Fl. Belg. (1827) 22; BTH. Fl. Austr. 5 (1870) 206; HOOK. f. Fl. Br. Ind. 5 (1886), 14; BAILEY, Queensl. Fl. 4 (1901) 1263; KOORD. Exk. Fl. 2 (1912) 192; ASCH. & GR. Syn. 5, 1 (1913) 240; HEGI, Ill. Fl. Mitt. Eur 3 (1912) 257; DOMIN, Beitr. Pflanzengeogr. Austr. (1929) 626; HEYNE, Nutt. Pl. (1927) 604; BACK. Onkr. Suiker. (1930) 214; Atlas t. 225; OCHSE & BAKH. v. D. BR. Veget. (1931) 105 *cum icone*.—*Chenopodium maritimum* LINNÉ, Sp.Pl. (1753) 221.—*Salsola indica* WILLD. Sp. Plant. I (1797) 1317; BL. Bijdr. (1825) 536.—*Chenopodium australe* R. BR. Prodr. (1810) 407.—*Suaeda indica* MOQ. in Ann. Sc. Nat. 23 (1831) 316.—*S. australis* MOQ. in Ann. Sc. Nat. 23 (1831) 318; COURCH. in Lec. Fl. Gén. I.C. 5 (1910) 8.—*Chenopodia maritima* MOQ. in DC. Prodr. 13, 2 (1849) 161.—*Ch. australis* MOQ. in DC. Prodr. 13, 2 (1849) 163.—*Suaeda nudiflora* MOQ. in DC. Prodr. 13, 2 (1849) 155; VAL. in Bull. Dept. Agr. 10 (1907) 9; KOORD. Exk. fl. 2 (1912) 192.

Perennial glabrous herb, 7–45 cm long, at an advanced age often woody at the base, usually divided from the base into obliquely erect or ascending branches, often rooting from the lower joints; old stems tuberculate by scars of fallen leaves. *Leaves* rather crowded, linear, semiterete, with well-developed aquiferous tissue, glaucous or more or less tinged with purple or entirely purple, 1–4½ cm

long, with a saltish taste. *Inflorescence* usually paniculately branched, 2½–15 cm; flowers in clusters of 2–5 or highest solitary, all ♀; lower bracts rather large, foliaceous; higher ones gradually smaller; bracteoles at the base of perianth 2–3, oblong obtuse, transparent, 2/3–1 mm long, persistent, after fall of the fruit ± stellately spreading. Perianth green of more or less suffused with purple; segments at first (♀ stage) conniving, leaving only at top a small orifice for the protrusion of the styles, afterwards (♂ stage) spreading, after anthesis once more conniving and enclosing the fruit, ovate, obtuse, with ± transparent margins and top; perianth in the ♀ stage ± 1¼ mm diam., in the ♂ stage ± 2½ mm; anthers broad, bilobed at the base. ± ½ mm long. Ovary free from perianth, ovoid-conical; styles 2, rarely 3, rather long. *Fruiting perianth* depressed, without either tubercles or wings, in the living plant 2–2½ mm diam., succulent. Seed usually horizontal, rarely vertical, shining brown; albumen very scanty.

Distr. Europe, N. Africa, Asia, Australia, N. America, in *Malaysia*: West and East Java, Madura, New Guinea (?).

Ecol. Moist or swampy, clayey, saltish soils near the sea, often gregarious, frequently very conspicuous by its purple colour. Red and green specimens often grow intermixed.

Vern. *Alur*, J.

Use. Leaves sometimes eaten by the Indonesians as a vegetable.

Notes. Very polymorphous species.

The two specimens recorded as *Suaeda nudiflora*

by KOORDERS *l.c.* for the Karimon Djawa Isl. belong both to *Salsola kali*. ZOLLINGER 2909 from Banjuwangi (E. Java) is *Suaeda maritima*; ZOLLINGER (Syst. Verz. (1854) 108) could not place it.

7. SALSOLA

LINNÉ, Sp.Pl. (1753) 222.

Herbs or shrubs, glabrous or hairy; stems not conspicuously jointed. *Leaves* alternate or lowest opposite, sessile, linear or triangular, often spine-tipped. *Flowers* axillary, solitary or glomerate, sessile, ♂, bibracteolate at the base; bracteoles exceeding perianth. Perianth 5-partite down to the base; segments ovate-oblong, in or below the middle with a transverse thickening, above the thickening scarious, after anthesis completely embracing the fruit; the thickening after anthesis often excrescent into a horizontal wing; basal part of perianth unchanged or slightly indurate. Stamens 5, inserted on annular disk; filaments linear or subulate; anthers short or long; connective either produced into a point or not. Ovary globose-ovoid; style short or long, split into 2 long arms. *Fruit* falling off together with perianth; pericarp membranous or fleshy. Seed usually horizontal, exalbuminous; embryo coiled in a conical spire, often green.

Distr. Species ± 100, in Europe, Africa and Asia; a few introduced species in America and Australia, in *Malaysia* only the ubiquitous *S. kali* L.

1. *Salsola kali* LINNÉ, Sp.Pl. (1753) 222; MOQ. in DC. Prodr. 13, 2 (1849) 187; BTH. Fl. Austr. 5 (1870) 207; HOOK. *f.* Fl. Br. Ind. 5 (1886) 17; BAILEY, Queensl. Fl. 4 (1901) 1264; PULLE in Nova Guin. 8 (1910) 349; KOORD. Exk. Fl. 2 (1912) 192; ASCH. & GR., Syn. 5, 1 (1913, 1914) 207; HEGI, Ill. Fl. Mitt. Eur. 3 (1912) 258; BACK. Trop. Natuur 11 (1922) 135, tab. 2, 3.—*Salsola tragus* LINNÉ, Sp. Pl. Ed. 2 (1763) 322; DCNE in Nouv. Ann. Mus. 3 (1834) 370; SPAN. in Linnaea 15 (1841) 345.—*S. australis* R.Br. Prodr. (1810) 411; MOQ. in DC. Prodr. 13, 2 (1849) 188; MIQ. Fl. Ind. Bat. 1, 1 (1858) 1022; FORB. Nat. Wand. (1885) 515.—*S. brachypteris* MOQ. in DC. Prodr. 13, 2 (1849) 189; ZOLL. Syst. Verz. (1854) 168 (specimen not seen); MIQ. Fl. Ind. Bat. 1, 1 (1858) 1022; FORB. Nat. Wand. (1885) 515.

Psammophilous, glabrous or slightly pubescent annual, usually branched from the base and forming dense tufts; stems erect, or prostrate beneath, often woody at the base, 30–60 cm long. Lower *leaves* of young Malaysian specimens narrowly linear, rather flaccid, 2–7½ cm long; higher leaves gradually shorter, proportionally broader; highest tapering from a broad amplexicaulous membranous-margined base, channelled, rigid, recurved, ½–1 cm long; all leaves spine-tipped, fleshy, ± glaucous. *Flowers* solitary in axil of floral leaves, remote or in small numbers densely crowded on short axillary branchlets and then seemingly in axillary fascicles, which, when fruits are ripe, fall off as a whole; bracteoles recurved, rigid, tapering from a broad base, channelled, pungent, 4–5 mm long; perianth-segments ovate-oblong acute, 3–

3½ mm. Filaments linear; anthers short, bilobed at the base, ± 1½ mm; connective not or hardly produced. Style arms far exerted from perianth; base of fruiting perianth campanulate, pergameous, ± 2 mm high, closely embracing the fruit; wings varying from very short to well-developed, often pink; 3 of them usually much broader than the rest, often emarginate; tips of the perianth-segments conniving above the fruit into a cone, thinly scarious. *Fruits* shortly obconical, truncate, tipped by the style-base, ± 1½ mm diam., at last circumsciss; apical part falling away. Seed horizontal, subglobose, shining black.

Distr. Europe, N. Africa, Asia, Australia, N. America, in *Malaysia*: Java (said to have been collected in 1828 by BÉLANGER; I saw no Javan specimens), Karimon Djawa Arch., Madura, Bali, Kanegan Arch., Celebes, Saleier, Buton, Timor, Key Isl., New-Guinea.

Ecol. Sandy sea-shores, very local. Flowers in dry regions in the rainy season; disappears in the latter half of the dry monsoon.

Vern. *Landep*, *J. sundepan*, *J.*

Note. Very polymorphous plant.

TEYSMANN (in Nat. Tijd. Ned. Ind. 11 (1856) 202) records *Salsola* for the region between Surabaya and Tuban, but in a manner which suggests that he was mistaken. He says: 'The road crosses coastal swamps in which grow *Rhizophora*, *Avicennia*, *Salsola*, *Trianthema* and other marsh-plants.' As a matter of fact, *Salsola* never grows in marshes; TEYSMANN, whose knowledge of plants was ample but superficial, may have confounded it with *Suaeda*.