

PEDALIACEAE (C. A. Backer, Heemstede)

Annual or perennial *herbs*, often strongly smelling, frequently clothed with glandular or mucigenous hairs (the latter consisting of a very shortly stalked 4-lobed knob becoming slimy when wetted). *Leaves* opposite or the upper spirally arranged, exstipulate, petioled, simple or the lower 3-partite or palmately 3-foliolate. *Flowers* ♂, either solitary in leaf-axils (often between 2 glands), or in terminal racemes, nodding, zygomorphic. Calyx deeply 5-partite. Corolla much exceeding the calyx, gamopetalous, mostly very oblique; tube widened upwards; lobes 5, in bud imbricate, the anterior one much the largest. *Stamens* inserted near base of corolla, included, either 2 (anterior ones) perfect with 3 staminodes or 4 perfect, didynamous, with or without 1 posticous staminode; anthers free or cohering in pairs, 2-celled; connective often gland-tipped; cells parallel or widely diverging, opening lengthwise. Disk hypogynous, fleshy. Ovary superior, either 1-celled with 2 opposite parietal deeply intruded, T-shaped placentas touching in the middle and consequently spuriously 4-celled, or 2-4-celled and then the cells often halved by a parietal radial spurious dissepiment. Ovule either 1 in each compartment, or numerous and superposed. Style long; stigma 2-4-lamellate. *Drupe* or capsule; cells 1- of more-seeded. No endosperm; cotyledons flat.

Distr. About 60 *spp.* belonging to 3 genera (*Martyniaceae* proper) in the tropics and subtropics of America and to \pm 15 in the Old World which, the Australian *Josephinia* excepted, are confined to or centering in Africa; many genera are monotypic. Some *spp.* are now ubiquitous weeds having escaped from cultivation. Of the genera treated here only *Josephinia* is native to Malaysia.

Ecol. The bulk of the *spp.* is found in dry regions or on the beach. They often show structures adapted to a xerophytic habitat. The fruits of the *Pedaliaceae* are often provided with hooks, sometimes bizarre in shape, or wings.

Notes. *Martyniaceae* are included here in *Pedaliaceae*.

KEY TO THE GENERA

1. Flowers solitary, axillary. Pedicels inserted between 2 small sessile glands, short. Ovary densely hairy.
2. Ovules and seeds ∞ , superposed in each cell. Capsule oblong, unarmed, dehiscent. Higher leaves often spirally arranged. 1. *Sesamum*
2. Ovules and seeds 1 in each cell. Fruit ellipsoid to subglobose, spiny, indehiscent. Leaves opposite. 2. *Josephinia*
1. Flowers in erect terminal racemes. Pedicels not inserted between 2 glands, elongate. Ovary glabrous. 3. *Martynia*

1. SESAMUM

LINNÉ, Sp.Pl. (1753) 634; Gen. Pl. (1754) no 782.

Erect or decumbent *herbs*, beset with very short, white, mucigenous hairs, moreover often with much longer articulate hairs. *Leaves* opposite or the upper spirally arranged; the larger ones sometimes compound or deeply divided, the smaller simple, entire or shallowly serrate-dentate. *Flowers* solitary in the axils of the higher leaves. Calyx persistent, small. Corolla-tube decurved, gradually widened upwards, at the back of the base subgibbous, inside beneath the insertion-point of the filaments with a ring of hairs; lobes of limb patent, rounded. Stamens 4, didynamous; anthers free, with a bifid base; cells \pm parallel; connective gland-tipped; staminode minute or absent. Disk equal. Ovary (in normal flowers) 2-celled; cells halved by a parietal radial false dissepiment; each compartment containing many 1-seriate superposed ovules; stigma (in normal flowers) 2-lamellate. *Capsule* oblong or slightly broadened upwards, acuminate or obtuse-rounded, obtusely quadrangular with 4 longitudinal grooves, unarmed, dehiscing longitudinally from

the top more or less deeply down; the false dissepiments splitting longitudinally. Seeds in each compartment numerous, horizontal or suboblique, much compressed, obovate with a rounded apex, in their basal part or throughout their length margined or very narrowly winged; testa on the broad surfaces either smooth, finely scrobiculate or transversely ribbed. Seeds often rich in oil.

Distr. Species \pm 18 centering in the warmer regions of Africa, few in Asia; 2 of them frequently cultivated as an oil-seed, viz *S. indicum* and *S. radiatum*. Both of these occur in *Malaysia*, where *S. indicum* is very common, *S. radiatum*, on the whole, very rare.

Note. For abnormal flowers see the note under *S. indicum*.

KEY TO THE SPECIES

1. Quite ripe seeds on their broad surfaces with finely reticulate ribs or almost smooth. Fruit crowned by a very conspicuous subulate beak. Lowest leaves often deeply divided or palmately compound. 1. *S. indicum*
1. Quite ripe seeds on their broad surfaces, especially on the flatter one, with many transverse ribs emanating from a central longitudinal field. Fruit with a rounded or very obtuse apex, not or hardly beaked. Lowest leaves simple, not deeply divided 2. *S. radiatum*

1. *Sesamum indicum* LINNÉ, Sp. Pl. (1753) 634; BURM. f. Fl. Ind. (1768) 133; BLUME, Bijdr. (1826) 778; BLANCO, Fl. Fil. (1837) 507; ed. 2 (1845) 353; ed. 3, 2 (1878) 290, t. 273; CURTIS, Bot. Mag. 41 (1815) t. 1688; SPAN, Linnaea 15 (1841) 327; DC. Prod. 9 (1845) 250; MIQ. Fl. Ind. Bat. 2 (1858) 760; CLARKE in HOOK. f. Fl. Br. Ind. 4 (1884) 387; GRESH. Schets. Nutt. Ind. Pl. (1894) 21-24, f.; KOORD. Versl. Minah. (1898) 553; BAILEY, Queensl. Fl. 4 (1901) 250; TROMP DE HAAS, Teysm. 14 (1903) 389; BOORSMA, *ibid.* 15 (1904) 39; STAPP in Fl. Trop. Afr. 4, 2 (1906) 558; KOORD. Exk. Fl. 3 (1912) 186; RIDLEY, Fl. Mal. Pen. 2 (1912) 553; OCHSE & BAKH. V. D. BR. Veg. (1931) 583, f. 354; NOHARA, J. Coll. Agr. Tokyo 12 (1933) 228; GAGNEP. in Fl. Gén. I.C. 4 (1935) 609; LANGHAM, J. Hered. 38 (1947) 347; STEEN. Fl. Schol. Ind. (1949) 357; BACKER, Bekn. Fl. Java em. ed. 9 (1949) fam. 197, p. 3.—*Sesamum orientale* LINNÉ, Sp. Pl. (1753) 634; BURM. f. Fl. Ind. (1768) 133; GAERTN. Fruct. 2 (1791) 132, t. 110; MOR. Syst. Verz. (1846) 46; MERR. Fl. Man. (1912) 431; Interpr. Herb. Amb. (1917) 469; Sp. Blanc. (1918) 351; Bibl. En. Born. Pl. (1921) 526; W. H. BROWN, Minor Prod. Philip. For. 2 (1921) 168-172, f. 58; MERR. En. Philip. 3 (1923) 448; HEYNE, Nutt. Pl. (1927) 1372; BACK. Onkr. Suiker (1931) 630; HILDEBRAND, Bull. Appl. Bot. Leningr. I, No 2 (1932) 3; BURK. Dict. Ec. Prod. 2 (1935) 1994; HENDERSON, Mal. Wild Fl. 2 (1950) 363, f. 339.—*Volkameria orientalis* O.K. Rev. Gen. 2 (1891) 481.—*Sesamum indicum nigrum* and *album* RUMPH., Herb. Amb. 5, 204, t. 76, f. 1.

Strongly smelling annual, 0.15-1.50, rarely up to 2 m high, often branched. Stems and branches in their upper part obtusely quadrangular, with furrowed sides. Lower leaves opposite, rather long petioled, ovate from a rounded or obtuse base, acute or rather obtuse, in robust specimens often 3-lobed, 3-partite or palmately 3-foliolate, in feebler ones undivided; higher leaves gradually shorter petioled, more ovate-oblong-lanceolate or even linear from an acute base; petioles of lower leaves 2-15 cm, of highest leaves frequently only a few mm; limb 4-20 cm by 1/2-15 cm, in large leaves

coarsely or superficially serrate-dentate. Pedicels erecto-patent, 2-5 mm. Calyx 4 1/2-7 mm long, in fruit thickened and obconical; segments oblong or ovate-oblong, rather obtuse. Corolla totalling 2 1/4-3 1/2 cm, in pale-seeded forms white, in brown- and black-seeded forms violet, often spotted with yellow. Filaments glabrous; anthers 2 1/2-4 mm, glabrous or along the margins thinly hairy; staminode minute, reflexed, or wanting. Ovary densely pilose; style glabrous, white, 1-1 1/4 cm; stigmata lamellae lanceolate, rather acute. Capsule erect, prismatic from a rounded base or slightly broadened upwards, at the rounded apex abruptly contracted into a conspicuous shortly subulate, rather obtuse beak, 1 3/4-3 cm (beak included) by 6-12 mm, finally splitting down to the very base; endocarp of the valves with an acuminate apex. Seeds 2 1/2-3 mm long, yellowish white, brown or black, finely reticulate or almost smooth; one of the broad surfaces of the seed very narrowly margined all round, often with a longitudinal midrib; the opposite surface slightly more convex and margined only at the base, without a midrib.

Distr. Herb of ancient cultivation, native country not known with certainty: Africa or possibly Asia. At the present time grown for its oleiferous seeds throughout the warm regions of the world; rather commonly cultivated throughout *Malaysia*; not yet reported from New Guinea.

Ecol. In *Malaysia* cultivated from the plains up to \pm 1000 m, especially in the drier regions. Frequently met with on fields as a relic of cultivation, also on road-sides and in open grassy localities, but there, as a rule, not firmly established. In 1919 I saw in several islands of the Kangean Archipelago apparently wild specimens in places where, according to the natives, the plant had never been cultivated and where it bore no vernacular name.

Uses. The seeds are pressed to obtain oil; also used as an ornament for the top of cakes.

Vern. Many names of which *widjèn* and *lenga* with some variants are the commonest.

Notes. A monstrous white-flowered cultivated form of this species is characterized by a 4-celled ovary and 4 stigmatic lamellae; in this form also

each ovary-cell is halved by a longitudinal parietal false dissepiment, which may be only partially developed. The capsule is proportionally much broader than that of normal forms.

2. *Sesamum radiatum* SCHUM. in SCHUM. & THONN. Beskr. Guin. Pl. (1827) 282; BOORSMA, Teysm. 15 (1904) 39; STAFF, Fl. Trop. Afr. 4, 2 (1906) 557; ALSTON, Handb. Fl. Ceyl. 6 (1931) 221; BACKER, Bekn. Fl. Java, em. ed. 9 (1949) fam. 197, p. 3.—*Sesamum occidentale* REGEL & HEER, Ind. Sem. Hort. Turic. (1842) ex DC. Prod. 9 (1845) 250.—*Sesamopteris radiata* DC. Prod. 9 (1845) 251.

Disagreeably smelling annual, 0.40–1.20 m high or sometimes higher, usually branched; stems and branches in their upper parts obtusely quadrangular, with furrowed sides. Leaves varying from ovate-elliptic (the lower) to narrowly oblong (the upper), at the base and apex acute or rather obtuse, 3½–11 cm by 1¼–4 cm; lower more or less coarsely dentate-serrate, but never deeply divided or compound; higher entire or nearly so; petioles ¼–2½ cm, from the base of the stem upwards gradually diminishing in length. Pedicels erect, 4–8 mm, in fruit thickened and obconical. Calyx 5–7 mm,

segments oblong or ovate-oblong, rather obtuse. Corolla totalling 3–4 cm, violet or violet with white. Filaments glabrous; anthers 4–5 mm, hairy on the back; staminode absent. Ovary densely pilose; style glabrous, white; stigmatic lamellae oblong or lanceolate. Capsule erect, prismatical from a rounded base, with a rounded or very obtuse apex, rather densely pilose, 2½–3 cm by 8–10 mm, finally splitting down to the very base; endocarp of valves slightly retuse at the apex, crowned by a short central point. Seeds ± 3 mm long, brown or black, dull or feebly shining; on both surfaces, especially on the flatter one, with several subhorizontal ribs emanating from a central longitudinal field; the flatter surface all around with a sharp margin; the opposite surface distinctly more convex, on the one side delimited by the same margin, on the other in the lower part delimited by a second sharp margin uniting with the other one beneath the apex of the seed; margins much more pronounced than in the preceding species.

Distr. Native of tropical W. Africa, where, according to BURKILL, it is cultivated for its oil-containing seeds. In other warm countries run wild. In Malaysia: Malay Peninsula, Sumatra, N. Borneo.

2. JOSEPHINIA

VENT. Jard. Malm. 2 (1804) 67, t. 67;

Erect or decumbent herbs, beset with very short, mucigenous hairs, moreover often with shorter or longer ordinary hairs. Leaves dentate or divided into 3 distinct segments. Flowers in the higher leaf-axils. Calyx persistent, small, segments subequal or posterior one smaller. Corolla-tube decurved, much widened upwards, at the back of the base subgibbous, inside beneath the insertion-point of the filaments with a dense ring of short hairs; lobes of limb patent. Stamens 4, didynamous; anthers free; cells ± parallel, with a deeply bifid base; connective gland-tipped. Disk on the posterior side slightly thickened. Ovary 2–4-celled, cells halved by a parietal radial false dissepiment; each compartment containing a single basal erect ovule; stigmatic lamellae equal in number to ovary-cells. Fruit ovoid-oblong-globular, beaked or not, aculeate, 4-, 6- or 8-celled; cells 1-seeded. Seeds erect, oblong, not winged.

Distr. Species 4 in Australia: one of them extending to Malaysia as far West as Java.

1. *Josephinia imperatricis* VENT. Jard. Malm. 2 (1804) 67, t. 67; R.Br. Prod. (1810) 520; DECNE, Nouv. Ann. Mus. 3 (1834) 404; SPAN, Linnaea 15 (1841) 327; DC. Prod. 9 (1845) 255; MIQ. Fl. Ind. Bat. 2 (1858) 761; BTH. Fl. Austr. 4 (1869) 557; TEYSM. Nat. Tijd. N.I. 34 (1874) 462; FORBES, Nat. Wand. (1885) 513; KOORD. Versl. Minah. (1898) 554; Exk. Fl. 3 (1912) 186; BACK. Bull. J.B.B. II, 12 (1913) 20; Trop. Natuur 12 (1923) 19–21, f. 2; DE VOOGD, Trop. Natuur 26 (1937) 163; BACKER, Bekn. Fl. Java em. ed. 9 (1949) fam. 197, p. 4.—*Josephinia celebica* Bl. Bijdr. (1826) 779.—*J. grandiflora* R.Br. Prod. (1810) 520; BTH. Fl. Austr. 4 (1869) 556; F.v.M. Descr. Not. Pap. Pl. 1 (1875) 11; HEMSL. Bot. Chall. 3 (1885) 172; BAILEY, Queensl. Fl. (1901) 1140; WHITE, J. Arn. Arb. 10 (1929) 273.

Rather long-lived herb, strongly smelling (like *Sesamum indicum*), frequently woody at the base, with a robust, often very long (penetrating into the soil to a depth of many dm), reddish brown taproot. Stem frequently divided at or near the base in widely divaricating, ascending, long, often sinuous, terete branches, ½–1¾ m long, at the top densely and finely hoary-pubescent. Leaves ovate, ovate-oblong or oblong, from a rounded, obtuse or acute base, gradually tapering upwards or shortly acuminate, acute, entire or the larger ones coarsely dentate-serrate, upper side less densely hairy than below; lower 3–12 cm by ¾–6 cm; topmost often small; petiole densely hoary-pubescent, that of lower leaves 2–7 cm, of higher gradually shorter. Pedicels erecto-patent, 3–5 mm, rather densely hoary-pubescent, after anthesis somewhat thick-

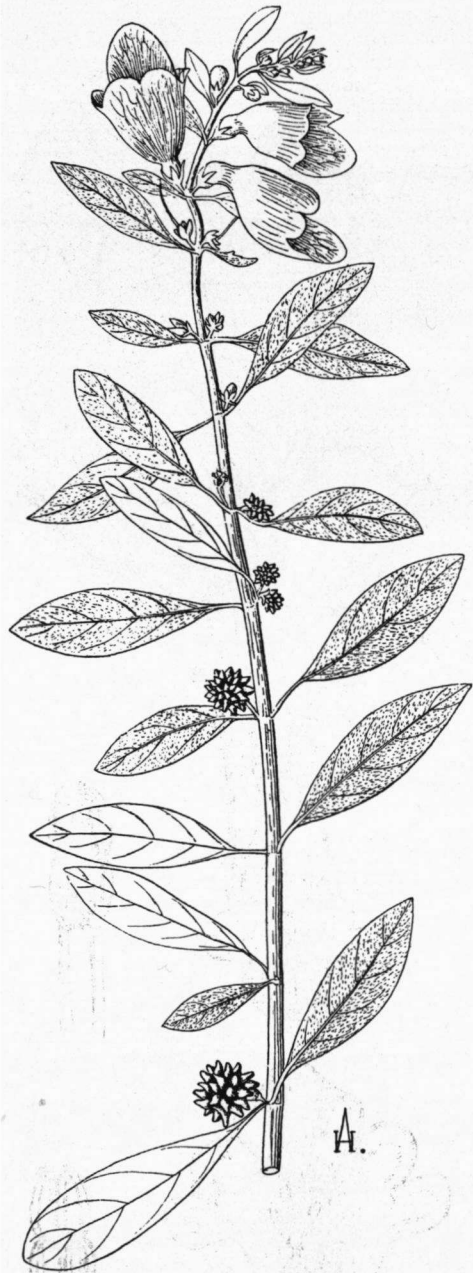


FIG. 1. *Josephinia imperatricis* VENT. Stem with flowers and fruits, $\times 2/3$.

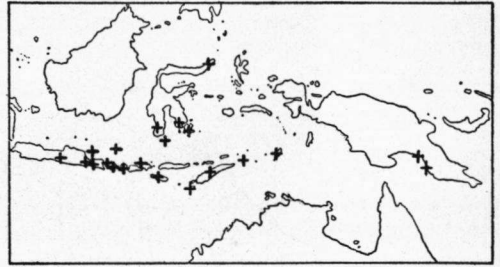


Fig. 2. Localities of *Josephinia imperatricis* VENT. in Malaysia.

ened, not or hardly lengthened. *Calyx* externally densely hoary-pubescent, 4–5 mm long; segments oblong, rather acute or rather obtuse; posterior segment shorter, 2 anterior ones longer than the others. *Corolla* pale pink or pale violet, in the throat and on the anterior segment dotted with red or violet, externally densely shortly pubescent, totalling $2\frac{3}{4}$ – $3\frac{1}{4}$ cm; narrow basal part of tube $2\frac{1}{2}$ –4 mm; posterior and lateral lobes of corolla very short; anterior lobe much larger, broadly ovate, rounded, 1– $1\frac{1}{4}$ cm long. Disk thick. Ovary densely appressed hairy, usually 3-, sometimes 4-celled (consequently with 6 or 8 compartments); stigma 3- or sometimes 4-lamellate. *Fruit* globose or broadly ellipsoid, crowned by a narrowly pyramidal, short, obtuse beak, 11–15 mm diam. (spines included), densely patently hoary; spines rather strong, conical, $2\frac{1}{2}$ – $3\frac{1}{2}$ mm long, obtuse as long as the fruit remains attached to the plant, afterwards drying up and becoming much sharper; endocarp woody. Testa thick.

Distr. N-NE. Australia and *East Malaysia*: South- and eastcoast of the eastern half of Java, Madura, Kangean Arch., Lesser Sunda Islands (Bali, Lombok, Sumba, Timor, Leti, Moa), Saleyer, Buton, S. & NE. Celebes, Tanimber Islands, and SE. New Guinea (incl. adjacent isl.).

Ecol. Beach-wall and sandy fields behind it, usually 1–5 m above sealevel, but sometimes much higher (up to 300 m), on the whole rather rare but locally often gregarious. The fruits are transported by the sea and by tillage of the soil. They are produced in great numbers.

Vern. Several but very local and of little value.

Note. TEYSMANN recorded from Timor a second species of *Josephinia* (Nat. Tijd. N.I. 34, 1874, 462) but his material belongs to *J. imperatricis*. I can find no argument for separating *J. grandiflora* from the latter, the difference in the fruit-structure as described by R. BROWN being due to the appearance of false dissepsiments during ripening.

3. MARTYNIA

LINNÉ, Sp.Pl. (1753) 618; Gen. Pl. (1754) no 671.

Annual erect herb, clothed with patent, long, glandular-viscid hairs. *Leaves* opposite, long-petioled, broad, palmatinerved. *Flower* in the axil of a deciduous bract,

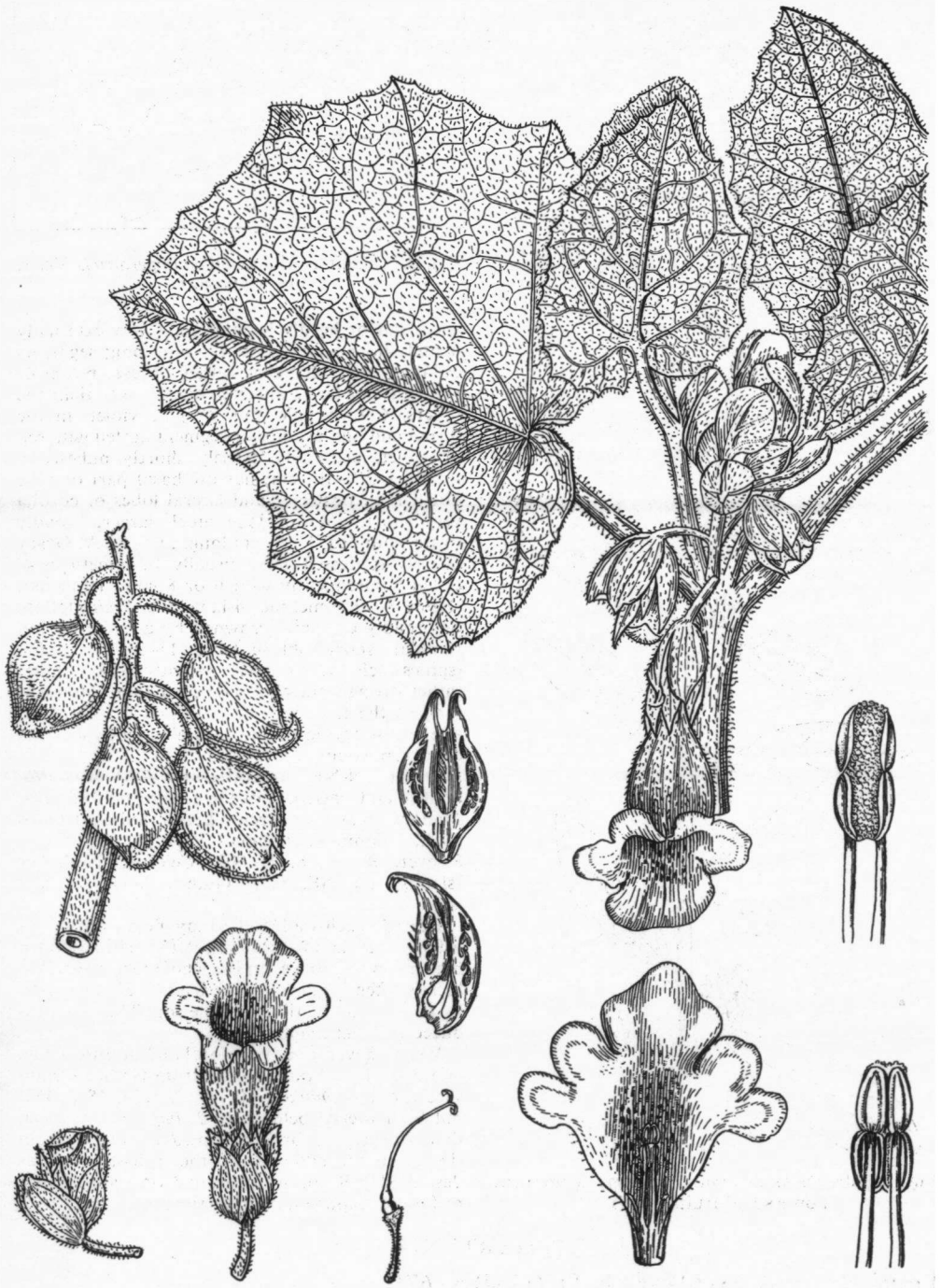


Fig. 3. *Martynia annua* L. Flowering stem-top, a branch with fruits, two pyrenes, and details of flowers, all $\times \frac{2}{3}$, anthers $\times 3$.

at the base with 2 membranous bracteoles. Calyx 5-partite to the base; segments unequal, 2 anterior ones broader than the others, posterior segment longest. *Corolla* obliquely campanulate-thimbleshaped, on the anterior side much dilated above the short basal part; lobes broad, very unequal, anterior one much the largest. Perfect stamens 2 (anterior ones); anthers cohering; cells widely divergent; connective glandless; staminodes 3. Disk unequalsided. Ovary 1-celled, divided into 4 compartments by 2 deeply intruding, parietal, opposite, T-shaped placentas touching in the middle rendering the ovary spuriously 4-celled; each compartment with 1 ovule pendent from its apex; stigma unequally 2-lamellate. *Fruit* a beaked drupe; pericarp rather thin, 2-valvate, deciduous; endocarp remaining attached during a long time to the pedicel, crowned by 2 strong, clawlike very sharp hooks, woody, with 8 strong, rounded longitudinal ribs and a central empty cavity; compartments 1-seeded. Seed oblong.

Distr. Monotypic genus, native of Mexico, naturalized in several tropical and subtropical regions.

1. *Martynia annua* LINNÉ, Sp. Pl. (1753) 618; KOORD. Exk. Fl. 3 (1912) 187; DAMMERMAN, Nat. Tijd. N.I. 86 (1926) 44; Trop. Natuur 15 (1926) 74; BACKER, Bekn. Fl. Java em. ed. 9 (1949) fam. 197, p. 2.—*Martynia diandra* GLOXIN, Obs. (1785) 14, t. 1; JACQ. Hort. Schoenbr. 3 (1798) 21, t. 289; LINDL. Bot. Reg. n.s. 9 (1836) t. 2001; DC. Prod. 9 (1845) 253; CLARKE, Fl. Br. Ind. 4 (1884) 386; FORBES, Nat. Wand. (1885) 513; BAILEY, Queensl. Fl. 4 (1901) 1188; BACK. Ann. J.B.B. Suppl. 3 (1909) 407; ALSTON, Handb. Fl. Ceyl. 6 (1931) 221; GAGNEP. Fl. gén. I.C. 4 (1935) 610.—Fig. 2.

Erect rank *herb*, frequently widely branched, $1/2$ – $1\frac{1}{2}$ m high. Stem subterete, thick, fistular. *Leaves* broadly ovate from a cordate base, with a triangular apex, repand-dentate, herbaceous, pale green, 15–30 by 15–22 cm; petiole thick, fistular, often tinged with purple, 12–25 cm. *Racemes* by the development of a branch in each of the highest leaf-axils often seemingly in bifurcations of the stem, erect, 5–13 cm, not very dense. *Flowers* not very many. Bracts and bracteoles pale pink; bracts clawed, $1\frac{1}{2}$ – $3\frac{1}{2}$ cm long; their blade oval or oval-obovate, 1–2 cm wide, distinctly veined. Pedicels 1 – $2\frac{1}{2}$ cm. Bracteoles at the calyx-base during anthesis still present, ovate-oblong, $1\frac{1}{2}$ – $2\frac{1}{4}$ cm long. Calyx yellowish white or greenish white, $1\frac{1}{2}$ –2 cm long, falling off after anthesis. *Corolla* totalling

$5\frac{1}{2}$ – $6\frac{1}{2}$ cm, tube $3\frac{1}{2}$ – $4\frac{1}{2}$ cm, outside pale pink, on the anterior side within with stalked glands and yellow and purple dots; segments broadly rounded, pink with a dark purple blotch; anterior segment much larger than the others, with a yellow blotch beneath the purple one. Filaments white, glabrous, $1\frac{1}{2}$ – $1\frac{3}{4}$ cm; lateral staminodes 4–6 mm, posterior one $1\frac{1}{2}$ –2 mm. Disk broadest on the back, glabrous. Ovary glabrous. Style $2\frac{1}{2}$ –3 cm, posterior lamella of stigma obtuse, anterior one slightly longer, acute. *Drupe* green, ovoid, with a short upturned beak; endocarp black, very hard, \pm 3 cm long.

Distr. Native of Mexico, locally naturalized in India and Queensland and in *Malaysia*: Java (only surroundings of Batavia) and Lesser Sunda Islands (Sumba, Timor).

Ecol. Lower regions, in waste places, on refuse-dumps, locally sometimes numerous, but, on the whole, scarce, apparently preferring periodically dry regions.

Vern. *Kuku matjan* (tiger's claw), M, *karikuku* (Sumba).

Excluded

Sesamum javanicum BURM. f. Fl. Ind. (1768) 133, 'habitat in India' according to MERRILL (Philip. J.Sc. 19, 1921, 380) = *Artanema longifolium* (L.) BOLD. (*Scroph.*).