

TURNERACEAE (C. A. Backer, Heemstede)

Erect or ascending herbs, annual or perennial, sometimes woody at the base. Leaves alternate, stipulate or not, simple, petioled, serrate or serrate-dentate, biglandular at the base or not, herbaceous. *Flowers* in the Malaysian species solitary in the leaf-axils or in terminal racemes, actinomorphic, ♀, homostylous or heterodistylous, ephemeral. Calyx gamophyllous, 5-fid, after anthesis circumsciss at the base; segments imbricate in bud. *Petals* 5, inserted in the throat of the calyx-tube, contorted in bud, free, shortly clawed or sessile, deciduous after anthesis. Stamens 5, inserted on calyx-tube, alternating with the petals; filaments filiform-subulate, free; anthers introrse, 2-celled; cells opening longitudinally. Ovary superior, sessile, 1-celled; placentas 3, parietal; ovules 3 to numerous. Styles 3, terminal, free, slender; stigmas penicilliform. *Capsule* globose or ovoid, loculicidally 3-valved. Seeds numerous, incompletely arillate, with a raised scalariform reticulation; endosperm copious, horny or fleshy; embryo large, straight.

Distr. Tropical America and Africa, represented there by 7 genera and about 80 to 100 species; 2 genera (3 species) naturalized in *Malaysia*.

Uses. Sometimes cultivated as ornamentals.

KEY TO THE GENERA

1. Flowers (in *Malaysia*) in terminal racemes. Calyx ebracteolate. Petals shorter than $1\frac{1}{2}$ cm. Throat of the calyx with a fimbriate corona, which passes also over the base of the petals. Leaves without basal glands, densely stellate-hairy beneath 1. *Piriqueta*
1. Flowers solitary in leaf-axils; pedicel adnate to the petiole. Calyx bibracteolate. Petals longer than $1\frac{1}{2}$ cm. Throat of the calyx without a corona. Leaves biglandular at base, not stellately hairy beneath. 2. *Turnera*

1. PIRIQUETA

AUBL. Hist. Pl. Guian. Franç. 1 (1775) 298.

Erect annuals, (perennials, shrubs, or trees); indumentum variable. *Leaves* without basal marginal glands, gland-dotted beneath. *Flowers* in erect, terminal racemes; pedicels jointed near the apex. Sepals (free or) connate in the lower $\frac{1}{3}$ – $\frac{1}{2}$; tube above the insertion-point of each stamen with a semicircular thickening, next the insertion-points of the petals with a fimbriate corona, which passes also over the base of the petals. Petals obovate from a cuneate base, glabrous. Stamens inserted a little above the base of the calyx-tube; filaments glabrous; anthers with an emarginate or bifid base and an emarginate apex. Stigmas multifid. *Capsule* globose-ellipsoid. Seeds curved, reticulate-ribbed, with a unilateral aril.

Distr. About ± 19 spp., most of them in the warmer regions of America, a few in S. Africa and Madagascar; a single American species naturalized in *Malaysia*.

1. *Piriqueta racemosa* (JACQ.) SWEET in STEUD. Nomencl. 2, ed. 2 (1841) 344, 724; URB. Monogr. Turner. (1883) 77; Fl. Bras. 13, 3 (1883) 107; BACK. Ann. J.B.B. Suppl. 3 (1909) 410; KOORD. Exk. Fl. 2 (1912) 655; BACK. Bekn. Fl. Jav. em. ed. 4 (1942) fam. 43, p. 1.—*Turnera racemosa* JACQ. Hort. Vindob. 3 (1776) 49, t. 94; DC. Prod. 3 (1828) 348.

Erect annual, 30–60 cm high; stem terete, moderately densely clothed with short, fine patent pubescence, moreover with scattered long, very acute, in sicco brownish, tubercle-based bristles. *Leaves* elliptic-oblong from a rounded or subcordate base, obtuse or acute, dentate-serrate, densely stellately pubescent and thinly bristly on both surfaces, 4–10

cm by $1\frac{1}{2}$ –5 cm; petiole $\frac{3}{4}$ –4 cm. Stipules absent. Racemes 10–40 cm, rather lax, leafy only in the basal part. *Flowers* (in Java) homostylous. Pedicels finely stellately pubescent and patently pilose, during anthesis 1–2 cm long, afterwards 2–4 cm, jointed 3–4 mm below the apex. Calyx thinly stellately hairy, 5-fid over $\frac{1}{2}$ – $\frac{2}{3}$ of its length; segments unequal, ovate, caudately acuminate, acute, with pellucid margins. Petals obovate, with a rounded-truncate, \pm crenate top, pale yellow, $3\frac{1}{2}$ –5 mm by $2\frac{1}{2}$ –3 mm. Filaments $\pm 2\frac{1}{2}$ mm; anthers $\pm \frac{3}{4}$ mm; their base sagittate. Ovary broadly ovoid, densely appressed pilose; styles ± 1 mm; stigmas as long or slightly shorter, yellow. *Capsule* smooth,

with an apical hairtuft. Seeds curved, reticulate-ribbed and distinctly tubercled, brown, glabrous, 1½–2 mm long.

Distr. Native of Brazil, long ago introduced into the Bogor Botanical Gardens, since long naturalized in the region between Djakarta and Bogor.

Ecol. Waste places, road-sides, dry fields, 1–

250 m, locally not rarely numerous but on the whole rather scarce.

Note. The Javan plant markedly differs from the description by URBAN, *l.c.*, by the much smaller, homostylous flowers and the possession of many long bristles. Yet I cannot reduce it to another species.

2. TURNERA

LINNÉ, Sp. Pl. (1753) 271; Gen. Pl. ed. 2 (1754) no 338.

Erect or ascending perennial (or annual) herbs, (shrubs or trees), invested with simple (or stellate) hairs. Leaves often with 2 marginal basal glands, above the base dentate-serrate, distinctly gland-dotted beneath. *Flowers* solitary in the leaf-axils, heterodistylous or homostylous; pedicel adnate to the petiole, with 2 apical bracteoles. Calyx-tube often with thickenings above the insertion-point of the stamens, segments often very acute. Petals on a short hairy claw, obovate, caducous after anthesis. Stamens inserted above base of calyx-tube, margins of the filaments cohering with base of calyx-tube. Ovary globose-ovoid; stigmas multifid. *Capsule* broadly ovoid, obtuse, verruculose, 3-valved down to near the base; valves with recurved tops. Seeds globular to oblong, often curved, with a raised scalariform reticulation and a unilateral aril.

Distr. Upwards of 50 *spp.* in the warmer regions of the New World from Mexico to Argentina; 2 of these naturalized in other warm countries, both in *Malaysia*.

Ecol. Both species possess, in their fat-containing aril, an elaiosome, attracting ants; consequently their seeds are dispersed by ants, and both *spp.* are myrmecochorous (*cf.* LOCK, Ann. R. Bot. Gard. Perad. 2, 1904, 107). In *T. subulata* J.SM. cross-fertilisation is a necessary condition for setting fruit (*cf.* VAN WELSEM, Trop. Natuur 1, 1912, 148; VAN DER PILL, *ibid.* 19, 1930, 147; DOCTERS VAN LEEUWEN, *ibid.* 24, 1935, 1). Many insects have been found visiting the flowers.

Note. URBAN, in his monograph, *cf. infra*, accepted the two species distinguished here as belonging to one polymorphic specific population. The observed intersterility, the many morphological and physiological differences induce us to accept them as two good species, though we admit that it is possible that in the centre of the native habitat a swarm of intermediate forms may show them to represent extreme forms of one large collective species.

KEY TO THE SPECIES

1. Pedicel throughout its length adnate to the petiole. Bracteoles linear-subulate, 1-nerved, entire, without marginal glands, ¾–1¼ cm by 1–1¼ mm. Calyx 1¾–2 cm high. Flowers heterodistylous. Petals at the base dark purple, higher sulphureous, at the broadly rounded apex light yellow, overlapping at the base. Corolla at last widely expanded with a campanulate centre. Ovary without apical tubercles. Fruit 5–7 mm high. Seeds fewer than 20. Often bushy from near the base . . . *T. subulata*
1. Pedicel at the apex free over a length of 3–5 mm; the free part obconic. Bracteoles lanceolate, penninerved, serrate, with 2 large marginal glands, 1–3½ cm by 2½–6 mm. Flowers homostylous. Calyx 2–2½ cm high. Petals canary-yellow, selfcoloured, with a truncate, ± dentate apex, not overlapping at the base, 2¼–2½ cm by 11–13 mm, at last almost expanded flat. Ovary with 6 apical tubercles. Fruit 9–10 mm high. Seeds more than 30. Leaves lanceolate or ovate-lanceolate, acute, 4–15 by 1–3½ cm, rather soon deciduous, leaving on the bare stems a knotty scar; petiole ¾–2 cm. Erect, branched in the apical part, not bushy . . . *T. ulmifolia*

1. *Turnera subulata* J. E. SMITH in REES, Cycl. 36 (1819) no 2; DC. Prod. 3 (1828) 346; STEEN. Trop. Nat. 20 (1931) 227, f. 2b; DOCT. v. LEEUWEN, Trop. Natuur 24 (1935) 1–8, f. 1–5; BACK. Bekn. Fl. Jav. em. ed. 4 (1942) fam. 43, p. 2; STEEN. Fl. Sch. Indon. (1949) 289.—*T. trioniflora* SIMS, Bot. Mag. (1820) 2106; RIDLEY, Fl. Mal. Pen. 1 (1922) 838; BURK. Ec. Prod. 2 (1935) 2193.—*T. elegans* OTTO in NEES, Hort. phys. Berol. (1820) 36.—*T. ulmifolia* LINNÉ var. *elegans* (OTTO) URB. Monogr. Turn. (1883) 139; in MART. Fl. Bras. 13, 3 (1883) 159; O.K. Rev. Gen. 1 (1891) 252; BOERL. Handl. 1, 2

(1890) 567; LOCK, Ann. R. Bot. Gard. Perad. 2 (1904) 107–119; BALL, The New Phyt. 32 (1933) 13–36.—*T. ulmifolia* AUCT. DIV. (*non* L.) BACK. in Ann. J.B.B. Suppl. 3 (1909) 419; VAN WELSEM, Trop. Natuur 1 (1912) 147, *cum tab.*; VAN DER PILL, Trop. Natuur 19 (1930) 193, f. 10.—*T. virgata* WILLD. *msc.* in SCHULT. Syst. Veget. 6 (1820) 678; DC. Prod. 3 (1828) 348.

Perennial herb, often woody at the base, 30–80 cm high, with a frequently very strong taproot; stems terete, leafy over a considerable length, densely appressed pubescent. *Leaves* not crowded, ovate-

elliptic or ovate-oblong from a cuneate entire base, acute or rather obtuse, very distinctly dentate-serrate, rather densely gland-dotted beneath, on both surfaces, especially the lower, appressed white-pubescent (hairs on the nerves longer and more closely set), $1\frac{3}{4}$ –9 cm by $\frac{3}{4}$ –4 cm; midrib and



Fig. 1. *Turnera subulata* J.Sm. near Bogor, W. Java, Oct. 1929.

usually also the erecto-patent lateral nerves distinctly prominent beneath. Petiole with 2 rather large apical lateral glands, appressed hairy, $\frac{1}{2}$ – $1\frac{1}{4}$ cm long. Stipules erect, very minute, long-hairy. Flowers in the higher leaf-axils. Pedicel $\frac{1}{3}$ – $\frac{1}{2}$ cm. Bracteoles at the calyx-base, broadest at the base, very acute. Calyx densely appressed pubescent and gland-dotted without, glabrous within except on the pilose base; tube rather abruptly widened in the upper half $\frac{1}{2}$ – $\frac{3}{4}$ cm long; segments narrow, very acute, 1 – $1\frac{1}{2}$ cm long. Petals with a slightly hairy, 3–4 mm long claw, blade obovate, broadly rounded, entire, above the claw glabrous, finally above the base much spreading or subreflexed, 2 – $3\frac{1}{2}$ cm by $1\frac{3}{4}$ – $2\frac{1}{2}$ cm. Filaments with broad membranous-margined bases; anthers inserted dorsally a little above their base. Ovary ovoid, densely clothed with appressed white hairs, with 3 glabrous apical depressions (style-scars). Capsule ovoid, obtuse, finely verruculose, hairy, rather thick-walled. Seeds subprismatical, on one end crowned by a semiglobular boss, brownish yellow, $2\frac{3}{4}$ –3 by $\pm \frac{4}{5}$ –1 mm; aril white.

Distr. Native of tropical America, introduced into Java more than a century ago, probably as an ornamental, since long naturalized in Java in the region between Djakarta and Bogor and in Central Sumatra (Padang).

Ecol. Inhabitant of sunny localities, fields, waste places, railway-embankments, railway-yards, old brick walls, 10–250 m, locally often copious,

very conspicuous when bearing open flowers which are very showy and most fugacious.

Uses. Ornamental. In the Malay Peninsula poultices made from the roots are applied to boils.

Vern. *Kembang pukul dëlapan*, M (8 o'clock flower).

Notes. The flowers expand at \pm 8 a.m. and wither \pm 3 hours afterwards or, when the forenoon is very rainy, in the beginning of the afternoon. Cut branches, even when put at once in water, wilt very rapidly.

2. *Turnera ulmifolia* LINNÉ (*s.str.*), Sp. Pl. (1753) 271; J. E. SMITH in REES, Cycl. 36 (1819) no 1; DC. Prod. 3 (1828) 346; TRIMEN, Fl. Ceyl. 2 (1894) 239; BACKER, Ann. J.B.B. Suppl. (1910) 410; KOORD. Exk. Fl. 2 (1912) 655; MERR. En. Born. (1921) 416; RIDL. Fl. Mal. Pen. 1 (1922) 838; STEEN. Trop. Natuur. 20 (1931) 227, f. 1, 2a; BURK. Ec. Prod. 2 (1935) 2194; BACK. Bekn. Fl. Jav. em. ed. 4 (1942) fam. 43, p. 2; STEEN. Fl. Sch. Ind. (1949) 289; HENDERSON, Mal. Wild Fl. 1 (1949) 169, fig. 163.—*T. angustifolia* MILL. Dict. ed. 8 (1768) no 2; Bot. Mag. t. 281, 4137.—*T. ulmifolia* L. var. *angustifolia* WILLD. ex URB. Mon. Turn. (1883) 141; Fl. Bras. 13, 3 (1883) 161; BOERL. Handl. 1, 2 (1890) 567.

Perennial herb, often woody at the base, 40–150 cm high, with a frequently strong taproot; stem terete, usually leafy only in the upper part, densely appressed pubescent. Leaves at the tops of the branches often approximate or even crowded, from a cuneate, entire base rather coarsely dentate-serrate, moderately densely and not very distinctly glandular beneath, on both surfaces moderately densely clothed with longish, \pm patent or appressed

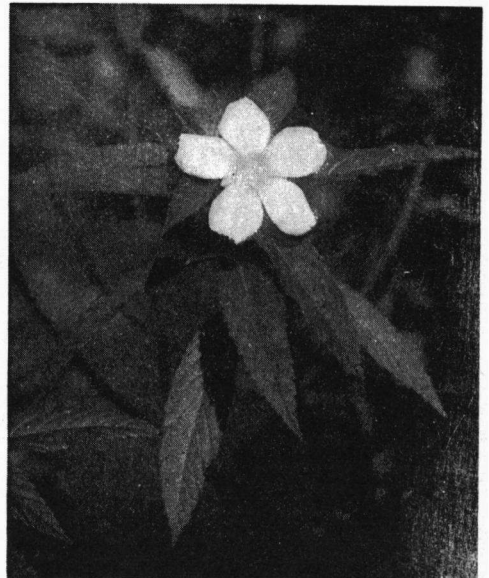


Fig. 2. *Turnera ulmifolia* L.

white hairs; midrib strongly prominent beneath; petiole with 2 rather large, apical, lateral glands. Stipules erect, triangular, $\pm 1\frac{1}{2}$ mm, long-hairy. Flowers in the higher leaf-axils. Bracteoles lanceolate, broadest far above the middle, very acute. Calyx densely appressed-pubescent without, not distinctly gland-dotted, glabrous within; tube cylindrical, widened only at the very top, $\frac{1}{2}$ – $\frac{3}{4}$ cm long; segments lanceolate, caudately acuminate, up to 2 cm long. Petals with a short, slightly hairy claw; lowermost part of flower not campanulate, blade obovate, $2\frac{1}{4}$ –3 cm by 11–15 mm. Ovary ovoid with 6 small apical tubercles and between them 3 minute style-scars, densely white-hairy with a glabrous green top; styles (stigmas included) $\pm 2\frac{1}{2}$ cm. Capsule ovoid, obtuse, rather thick-walled, 3-valved to below the middle; valves recurved in the upper part. Seeds cylindric-clavate, at the narrow end crowned by a semiglobose boss, brown, $2\frac{1}{4}$ – $2\frac{1}{2}$ cm by $\frac{5}{6}$ – $1\frac{1}{4}$ mm; aril white.

Distr. Native of the West Indies, already very long ago, as an ornamental, introduced into other warm countries, also into *Malaysia*, and there naturalized in many regions: Sumatra, Malay Peninsula, Riouw, Java, Madura, Borneo.

Ecol. In Java in sunny dry localities, 1–20 m, especially in the coastal regions: grassy fields, waste places, under coconuts, often on sandy soil, light jungles, as a rule in scattered specimens. The statement by VAN WELSEM (*Trop. Natuur* 1, 1912, 147) that he found the plant in great numbers in W. Java between Padalarang and Tjimahi (700–750 m alt.) was erroneous. VAN WELSEM saw the plant from a rapidly moving railway-carriage (oral statement of VAN WELSEM); it afterwards proved to be *Argemone mexicana*.

Uses. In Java sometimes, but rarely, cultivated as an ornamental.

Note. The flowers expand at about 6 in the morning and wither at 11 a.m. Cut branches, when at once put into water, do not wilt rapidly.