

DROSERACEAE (C. G. G. J. van Steenis, Leyden)

Small terrestrial or aquatic, insectivorous herbs. Primary root often undeveloped, stembase with adventitious roots, sometimes tuberous. *Leaves* spirally arranged, often in basal rosettes, rarely whorled, provided with sessile or stipitate sticky glands, marginal glands longest, often circinate when young. Stipules mostly present. Inflorescence lateral or terminal, cymose, often circinate. Bracts absent or present. Bracteoles 0; pedicels not articulated. *Flowers* ♂, actinomorphic, (in Malaysia) 5-merous. *Sepals* imbricate, persistent, at the base \pm connate. *Petals* imbricate, free, thin, veined, marcescent, long persistent. Stamens (in Malaysia) 5, free, alternating with the petals; filaments filiform; anthers extrors; pollen in tetrads. Disk 0. Ovary superior, free; 1-celled; carpels 3–5 with parietal placentas. Styles 3–5, mostly free, simple or divided. Ovules mostly ∞ . *Capsule* mostly loculicid, 3–5-valved. *Seeds* small, mostly ∞ , albuminous; embryo straight; cotyledons short.

Distr. Of the 4 genera three are monotypic: *Drosophyllum* is endemic in the West Mediterranean, *Dionaea* is endemic in Atlantic N. America, and *Aldrovanda* is found from Europe through Asia to Australia. *Drosera* is predominantly developed in the S. hemisphere, specially in Australia and though distributed almost over the globe, it is absent from many regions.

Ecol. The family shows a remarkable display of wide ecological tolerance. In Australia *Drosera* penetrates into the very dry interior but other species occur in the humid tropics, in the temperate, or in the cold zones of the globe. *Aldrovanda* is aquatic. In Malaysia some *spp.* of *Drosera* are apparently bound to a seasonal climate (*D. indica*, *D. peltata*, and *D. petiolaris*), others are restricted to a everwet climate (*D. burmanni* & *D. spathulata*). *Droseras* distinctly prefer sandy or otherwise acid, mostly poor, oligotrophic soils.

Notwithstanding this plasticity in tolerance for the genus as a whole, collections of individual species are in Malaysia comparatively few and suitable conditions are apparently scarce even for widely distributed species. Moreover, specimens easily escape attention of collectors by their small size. Collectors are invited to make notes of the colour and structure of the flowers (specially the gynaeceum) on the spot facilitating later identification.

The trapping of small insects is in *Drosera* achieved by the sticky stalked glands of the leaf blades, and their protein substances are digested by the exuded juice.

In *Aldrovanda* a more specialized trapping mechanism is developed for catching crustaceans, diatoms, &c., the functioning of which has recently been reinvestigated by J. ASHIDA (Mem. Coll. Sc. Kyoto Imp. Univ. B, 9, 1934, 141–244). Sensitive hairs occur on the thickened inner portion of each leaf half. Through touch or other irritation the leaf halves move with the midrib as axis and are pressed against each other in a fraction of a second, by which movement the incurved margins close the leaf blade which is then transformed into a bladder-like organ. This motion is immediately followed by a second pressure shutting the bladder still closer. Cf. fig. 7. Digestion takes place in the bladder by protein-digesting substances emitted by glands, slowly disintegrating trapped things.

KEY TO THE GENERA

1. Terrestrial. Leaves spirally arranged, often condensed into basal rosettes. Leaf blade not articulated, provided with sticky capitate glands (tentacles). Petioles not connate. Flowers rarely solitary. 1. *Drosera*
1. Submerged aquatic. Leaves in whorls. Leaf blade articulated, without such glands. Petioles connate at the base. Flowers axillary, solitary 2. *Aldrovanda*

1. DROSERA

LINNÉ, Sp. Pl. (1753) 281; Gen. Pl. ed. 5 (1862) no 391; DIELS, Pfl. Reich Heft 26 (1906) 61.—Fig. 1–5, 7.

Mostly perennial, often stemless, often with a subterranean tuber. *Leaves* with glandular, irritable, capitate tentacles. Stipules present or absent, often split. *Flowers* in simple (or branched), bracteate inflorescences (in *extra*-Mal. *spp.* sometimes solitary), white, pink, or purple, 5(–4)-merous. *Sepals* imbricate, connate at the base. *Petals* in Mal. *spp.* 5, spathulate or obovate, marcescent, after

anthesis contracted and sticking together with the anthers and stigmas as a hood over the ovary and the capsule. *Carpels* 3–5; *styles* 3–5, free or connate at the base, often divided in various ways.

Distr. *Ca* 90 *spp.*, nearly throughout the world, centering in the S. hemisphere, specially in *extra-tropical* Australia, absent from large areas in S. Asia, the Near East, the N. & E. parts of Africa and the W. parts of S. America.

Ecol. See under the family description.

Uses. Among the Igorots the leaves of *D. peltata* are dried and powdered and the powder is placed into the cavity of an aching tooth (QUISUMBING 1951). From Billiton TEYSMANN (Nat. Tijd. N.I. 36, 1876, 223) reported that *D. burmanni* should break up teeth. Acc. to BURKILL (Dict. 1935) Chinese import *Drosera* into the Malay Peninsula for use in pharmacies, but it is unknown for what specific purpose.

Vern. *Zonnedaaw*, *D. sundew*, E. The name is derived from the fact that the leaf glands excrete so much juice that the plants seem covered with dew drops. This holds for the Malaysian species.

KEY TO THE SPECIES

1. Leaves in a basal rosette, with stipules.
2. Styles and carpels 5. Leaves nearly sessile, obovate to orbicular 1. *D. burmanni*
2. Styles and carpels 3, styles sometimes divided from near the base. Leaves petioled.
3. Style-arms 2–4 times forked. Sepals outside fulvous-lanuginose. Petiole contracted at the apex; blade orbicular, concave. Stipules not prominent, entire or the upper half split into subulate segments 2. *D. petiolaris*
3. Style-arms split near the base into 2 filiform arms. Sepals glandular outside, glabrous. Petiole broadened towards the apex into a flat, obovate-spathulate blade. Stipules conspicuous, rufous, 3-fid 3. *D. spathulata*
1. Leaves cauline, without stipules.
4. Leaves linear. Petiole indistinct. Stem without subterranean tuber. Styles 3, forked at the base into 2 thickened, ascendent arms 4. *D. indica*
4. Leaves semi-orbicular, peltate, at the base with 2 caudate, fimbriate elongations. Petiole distinct. Stem originating from a subterranean tuber. Styles 3, towards the apex brush-shaped divided. 5. *D. peltata*

1. *Drosera burmanni* VAHL, *Symb.* 3 (1794) 50; MIQ. *Fl. Ind. Bat.* 1, 2 (1858) 120; KING, *J. As. Soc. Beng.* 66, ii (1897) 306; *ibid.* 71, ii (1902) 47; DIELS, *Pfl. Reich Heft* 26 (1906) 75; MERR. *En. Philip.* 2 (1923) 216; RIDL, *Fl. Mal. Pen.* 1 (1922) 688; DAMMERMAN, *Nat. Tijd. N.I.* 86 (1926) 109–110, f. 12; *Trop. Natuur* 15 (1926) 80, f. 10; STEEN, *Bull. Jard. Bot. Btzg III*, 13 (1933) 107; J. Arn. *Arb.* 28 (1947) 421; HENDERSON, *Mal. Nat. J.* 4 (1949) 103, f. 105.—*Fig. 1, 2, 7e.*

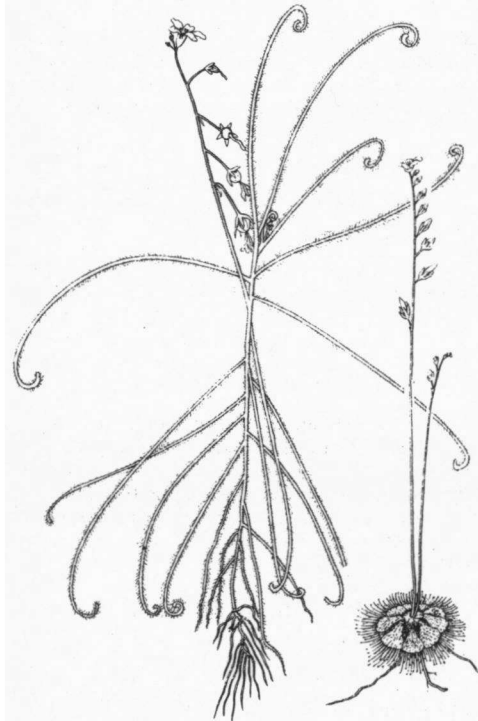


Fig. 1. *Drosera indica* L. (left) and *Drosera burmanni* VAHL (right), both $\times \frac{1}{2}$ (after resp. BACKER 20136 from the Island of Madura and BOUMAN-HOUTMAN 80 from Celebes).

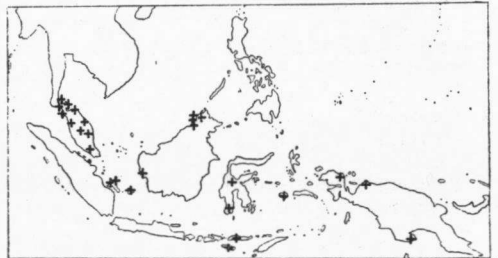


Fig. 2. Distribution in Malaysia of *Drosera burmanni* VAHL.

Rosulate. *Leaves* red or green, appressed to the soil, obovate to orbicular; blade 6–10 by 4–6 mm. *Stipules* mostly 3-parted, each segment with lanceolate acute lobes. *Peduncles* 1–3, erect, 4–27 cm, *rhachis* 1–9 $\frac{1}{2}$ cm, 2–25-flowered. *Pedicels* erect, 1 $\frac{1}{2}$ –4 mm. *Sepals* oblong, blunt, 2 $\frac{1}{2}$ –3 mm long. *Petals* white, obovate, *ca* 4 mm long. *Styles* 5, at

their apex split into very short lobes. *Capsule* ca 1½ mm long. *Seeds* dark, very fine-scrubulate.

Distr. India to S. Japan, Micronesia (Palau) and NE. Australia, throughout *Malaysia* but not yet found in Sumatra and Java. Fig. 2.

Ecol. On open sandy or peaty soils, mostly between grass, often not far from the sea, in many islands very local, apparently under everwet climatic conditions, 2-900(-1400) m. *Fl. fr.* Jan.-March. Highest locality is in M. Celebes (Mamasa).

Vern. *Punggu api*, Billiton, W. Borneo, *serenta bumi*, Karimata.

2. *Drosera petiolaris* R.Br. in DC. Prod. 1 (1824) 318; F.v.M. Descr. Not. Pap. Pl. 9 (1890) 54; DIELS, Pfl. Reich Heft 26 (1906) 102, f. 33 A-D; STEEN. Bull. Jard. Bot. Btzg III, 13 (1933) 107; J. Arn. Arb. 28 (1947) 420.—Fig. 5, 7h.

Rosulate. *Leaves* appressed to the soil. Petiole narrow-lanceolate, sometimes subterete, sericeous, narrowed towards both ends, constricted below the blade, 1½-2½ (-5) cm; blade orbicular, 2-2½ mm, margin with capitate fimbriae. Stipules not prominent, scarious, unnerved, narrow, entire or split into subulate segments, 8-10 by ¾-1 mm. *Inflorescences* densely hairy, peduncle glabrescent. Peduncles 1-2, ascending, 5-12(-30) cm, pedicels short, recurved after anthesis, 10-35-flowered. *Sepals* obovate to subspathulate, inside glabrous, 2½-4 by 1¼-2 mm. *Petals* pink to purple, broad-ovate, 7 by 5-5½ mm. Stamens 2½-3 mm long; filaments terete. Styles 3, base forked, apex of each arm with short, repeatedly forked clavate segments. *Seeds* ellipsoid, shortly mamillate.

Distr. N. Australia. in *Malaysia*: SE. New Guinea (Wassi Kussa). Fig. 5.

Ecol. Periodically wet savannah areas under periodically dry climatic conditions at low altitude, acc. to BRASS one of the first herbs to flower on wet sandy flats near Tarara in Dec. 1936.

3. *Drosera spathulata* LABILL. Nov. Holl. Pl. Sp. 1 (1804) 79, t. 106, f. 1; MIQ. Fl. Ind. Bat. 1, 2 (1858) 120; Bot. Mag. 87 (1861) t. 5240; DIELS, Pfl. Reich Heft 26 (1906) 83, f. 31 A-B; MERR. En. Philip. 2 (1923) 216; STEEN. Bull. Jard. Bot. Btzg III, 13 (1933) 108; J. Arn. Arb. 28 (1947) 420.—Fig. 3, 7g.

Rosulate. *Leaves* appressed to the soil. Petiole ca 8-10 mm, glabrous at the base; fimbriate towards the apex; blade ca 5 mm diam., often spathulately widening towards the 5 mm large, obovate to spathulate blade. Stipules membranous, rufous, ca 5-7 mm long, mostly 3-fid, segments unequal, ending in a bristle. *Peduncles* 1-2, ascending, 1-20 cm, towards the apex often glandular-pubescent, 1-15-flowered. Pedicels short, erect, ½-3 mm. *Petals* obovate, cuneate at the base, white or pink, 3½-6 mm long. Stamens 2½-3 mm long. Styles 3, ca 2½ mm long, bifurcate from the base, arms simple, ascending, curved, incrassate towards the base. *Seeds* minute, ellipsoid, dark, very fine granular.

Distr. S. Japan, China, and Formosa to E. Australia, Tasmania, and New Zealand, in *Ma-*

laysia: N. Sumatra (Gajo Lands), Mal. Peninsula, Br. N. Borneo (Kinabalu), the Philippines (Luzon, Mindoro), and SE. New Guinea (Tarara). Fig. 3.

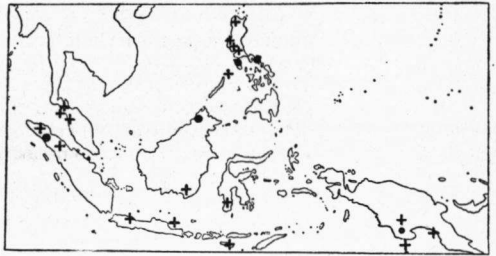


Fig. 3. Distribution in *Malaysia* of *Drosera indica* L. (+) and *Drosera spathulata* LABILL. (●).

Ecol. Open mountain heaths, on Mt Kinabalu on damp serpentine rocks, in the Gajo Lands on damp sandy or clayey soils between sedges, under everwet climatic conditions, rarely on wet ground in savannah forest at low altitude, (10-)1200-2800 m. *Fl. fr.* Jan.-March.

Notes. The Sumatran and Philippine specimens differ slightly from those of Mt Kinabalu by obovate, not acute petals with slight crenulations towards the apex, by broader bracts, and by a scarcely capitate-glandular inflorescence. The style-arms are sometimes halfway forked for a second time.

4. *Drosera indica* LINNÉ, Sp. Pl. (1753) 282; MIQ. Fl. Ind. Bat. 1, 2 (1858) 120; F.v.M. Descr. Not. Pap. Pl. 6 (1885) 4; KING, J. As. Soc. Beng. 66, ii (1897) 305; *ibid.* 71, ii (1902) 48; DIELS, Pfl. Reich Heft 26 (1906) 77, f. 29; RIDL. Fl. Mal. Pen. 1 (1922) 688; MERR. En. Philip. 2 (1923) 216; BACKER, Onkr. Suiker. (1930) 257; STEEN. Bull. Jard. Bot. Btzg III, 13 (1933) 108; BACKER, Bckn. Fl. Java, em. ed. 4 (1942) fam. 53; STEEN. J. Arn. Arb. 28 (1947) 420; HENDERSON, Mal. Nat. J. 4 (1949) 107.—*D. hexagynia* BLANCO, Fl. Filip. (1837) 226 (*hexagynia*).—Fig. 1, 3, 7f.

Stem flexible, slightly compressed, short glandular-hairy, 5-30 cm. Lower *leaves* recurved, often as stiltroots supporting the stem, central leaves spreading, upper ones erect, linear, light-green, petiole 1-15 mm; blade with tentacles, 2-11 cm by ½-3 mm. Stipules absent. *Inflorescences* lateral, mostly extra-axillary, spreading or arching, glandular-hairy, 3-20-flowered; peduncle ½-5½ cm; rhachis 3-15 cm. Bracts minute, linear. Pedicels ¾ cm, in fruit to 2 cm long. *Sepals* lanceolate, acute, 3-5 mm long. *Petals* obovate, ¾-1 cm long, pink to pale-purple. Anthers hastate. Styles 3, from the base divided into 2 thickened, simple ascendent arms. *Capsule* broadly oblong. *Seeds* apiculate, nigrescent, scrubulate.

Distr. Trop. Africa and Ceylon to Japan and Australia, in *Malaysia*: not yet found in the Moluccas, in many other islands very scarce. Fig. 3.

Ecol. In periodically wet grasslands, on mud, fallow rice-fields, in Indramaju on bog-iron asso-

ciated with *Fimbristylis dallachyi* F.v.M., locally sometimes abundant, in Java restricted to the regions with a distinct dry monsoon, 10–900 m. *Fl.* Febr.–April (Java), Sept. (N.G.).

Vern. *Bintipálo*, Tag.

Note. White-flowered specimens have hitherto not been collected in Malaysia.

5. *Drosera peltata* J. E. SMITH, in WILLD. Sp. Pl. 1 (1797) 1546; KURZ, J. As. Soc. Beng. 45, ii (1876) 310; KING, J. As. Soc. Beng. 71, ii (1902) 48; DIELS, Pfl. Reich Heft 26 (1906) 110; BACKER, Schoolf. Java (1911) 474; MERR. En. Philip. 2 (1923) 216; STEEN. Bull. Jard. Bot. Btzg III, 13 (1933) 108; BACKER, Bekn. Fl. Java, em. ed. 4 (1942) fam. 53.—*D. lunata* BUCH. HAM. in DC.



Fig. 4. *Drosera peltata* J.E.SM. Island of Sumba (DE VOOGD).

Prod. 1 (1824) 319; MIQ. Fl. Ind. Bat. 1, 2 (1858) 120; FORBES, Wand. (1885) 422.—*D. lobbiana* TURCZ. Bull. Soc. Nat. Mosc. 27² (1854) 343.—Fig. 4–5.

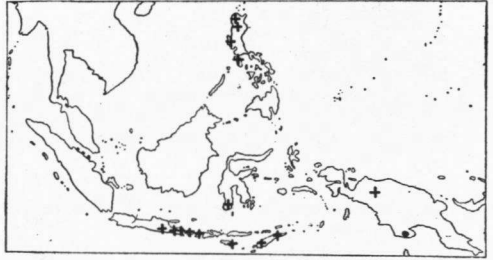


Fig. 5. Distribution in Malaysia of *Drosera peltata* J.E.SM. (+) and *Drosera petiolaris* R.BR. (●).

Stem erect, originating from a small roundish subterranean tuber, thin, glabrous, simple or branched, 10–35 cm. Basal leaves rosulate, or reduced, rapidly vanishing. Petiole distinct, $\frac{1}{2}$ – $1\frac{1}{2}$ cm long, spreading or recurved; blade peltate, with long tentacles, semilunar with elongated angles, 2–6 mm. Inflorescences opposite to or laterally of the leaves, unbranched, 2–10-flowered. Peduncle 1–3 cm, rhachis $\frac{1}{2}$ – $4\frac{1}{2}$ cm. Bracts linear, pedicels erect, $\frac{1}{2}$ –2 cm. Sepals ovate to elliptic, glabrous, with fimbriate margin, 2–3 by $1\frac{1}{2}$ mm. Petals white, spatulate-obovate, 5–6 by 2–3 mm. Stamens $2\frac{1}{2}$ –3 mm long. Styles 3, their upper half several times forked, digitately branched, brush-shaped. Seeds ovoid, oblong, black, minutely costulate.

Distr. Ceylon SE. Asia, China, and Japan, to Australia and Tasmania, in *Malaysia*: East Java (Mts Idjen, Wilis, and Tengger), Lesser Sunda Islands (Bali, Lombok, Timor), S. Celebes, Philippines (Luzon), and New Guinea. Fig. 5.

Ecol. Grassy places, old lavastreams, open grassy slopes in thin pine and *Casuarina* forests, along road-sides as a kremenophyte, on heaths, or on wet peaty soils containing a good deal of sand (Lake Habbema, acc. to BRASS), except in the Papuan localities mostly restricted to regions with a pronounced dry monsoon, 800–2400(–3225) m. *Fl. fr.* Dec.–June, in Luzon May–July, at Lake Habbema in Aug., on Mt Giluwe in May.

Vern. *Bain, ruut, sanabúgan*, Ig., *gumgumayéng*, Bon.

Note. KING's record for the Malay Peninsula is wrong; it was probably based on the assumption that *D. lobbiana* had been found in the Peninsula; its type came from Moulmein.

2. ALDROVANDA

LINNÉ, Sp. Pl. (1753) 281; Gen. Pl. ed. 5 (1862) no 390; DIELS, Pfl. Reich Heft 26 (1906) 59.—Fig. 6–7.

Rootless, submersed, floating aquatic plant, with simple or seemingly forked stem. Leaves in whorls of 7–9, connate at the base. Blade articulated, upper surface irritable by hairs and provided with glands; petiole swollen, lacunose, the apex

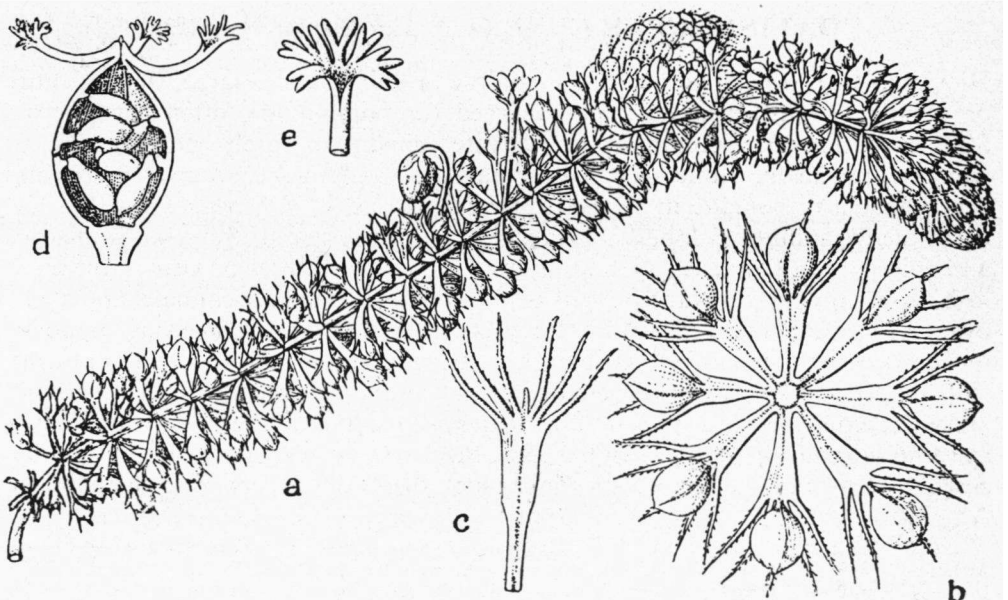


Fig. 6. *Aldrovanda vesiculosa* L. a. Plant, nat. size, b. leaf whorl, blades closed, $\times 2$, c. reduced leaf from flowering whorl without blade, $\times 3$, d. gynaecium, in section, e. style apex with stigma (after DIELS).

bearing subulate dentate segments; blade reniform to orbicular when flattened, reduced in the flowering whorl and sometimes the foregoing one. *Flowers* solitary, axillary. Pedicels robust, reflexed in fruit. *Sepals* 5, imbricate, coherent at the base. *Petals* white, originally calypttrate connivent. Styles 5, filiform, patent, incurved, apex dilate and penicillate. *Capsule* 5-valved.

Distr. Monotypic, Europe and Asia to Queensland, with many gaps, in *Malaysia* once found in Timor.

Ecol. See under the family description.

1. *Aldrovanda vesiculosa* LINNÉ, *l.c.*; DIELS, *l.c.*; STEEN. Bull. Jard. Bot. Btzg III, 13 (1933) 109; Trop. Natuur 24 (1935) 64-68; v. MALM in FEDDE, Rep. 41 (1937) 295.—Fig. 6-7.

Stem up to 20 cm. Petiole 3-9 mm, apical subulate segments (1-3)-4-6, 6-8 mm long; flattened blade 4-7 by 4½-10 mm. *Flowers* few; pedicels slightly curved, 1-1½ cm. *Sepals* ovate-elliptic, to elliptic-oblong, 3-4 by 1½ mm. *Petals* narrow-obovate, 4-5 by 2½ mm. Filaments subulate, 3-4 mm; anthers broad. Ovary and capsule subglobose. *Seeds* mostly 6-8, rarely few, abbreviate-ovoid, black, 1½ by 1 mm.

Distr. Central Europe, Caucasus, SE. & E. Asia, to Queensland, in *Malaysia*: Lesser Sunda Islands (Port. Timor: Nikki Nikki Supul swamp), once found.

Ecol. Clear, shallow stagnant water apparently poor in lime and rich in organic substance, in Bengal not avoiding brackish water, at low altitude.

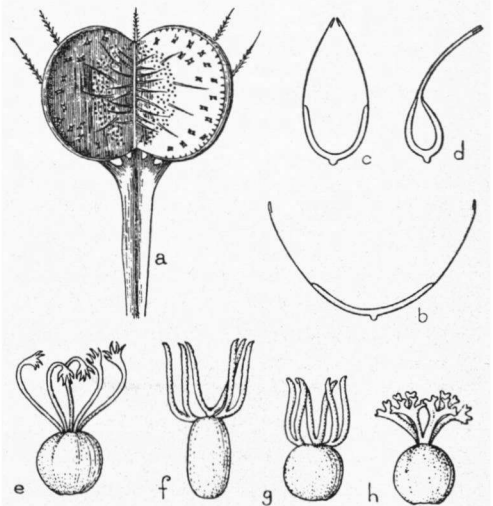


Fig. 7. *Aldrovanda vesiculosa* L. a. Open leaf blade from above, b. ditto, in section, c. ditto, first stage of closing, d. ditto, final stage.

e-f. Gynaecium of *Drosera*, viz of e. *D. burmanni* VAHL, f. *D. indica* L., g. *D. spathulata* LABILL., h. *D. petiolaris* R.Br., all $\times \frac{6}{11}$ (after ASHIDA, and DIELS).