

INSECTIVOROUS PLANTS OF KHASI AND JAINTIA HILLS MEGHALAYA, INDIA

(A Preliminary Survey)

**J. JOSEPH
AND
K.M. JOSEPH**

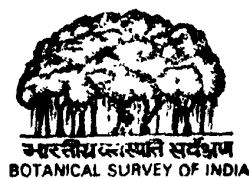
BOTANICAL SURVEY OF INDIA



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Price

Cover photo : *Nepenthes khasiana* Hook. f.

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FOREWORD

The Insectivorous plants form a curious group of plants exhibiting characteristic physiological behaviour in the struggle for existence. It has been estimated that the world flora consists of about 450 species of insectivorous plants.

Though Kanjilal's Flora of Assam has described only four species from the erstwhile Assam under the three genera, the present work deals with 13 species under the genera *Utricularia*, *Drosera* and *Nepenthes* from the State of Meghalaya out of the total Indian record of 36 species. Authors have studied this group of plants and has also introduced few of them in the Experimental Garden at Shillong. This was done when Dr. J. Joseph was in-charge of the Eastern Circle as Deputy Director.

The present work published by the department would be useful to students and scientific workers. It is hoped that this work would generate interest in the study of this group of interesting plants. From the point of survival of the species, since they are adapted to particular ecological niche, as a group in general, insectivorous plants are vulnerable due to habitat loss.

Botanical Survey of India
Calcutta
April 18, 1986

M.P. Nayar
Director

INTRODUCTION

Hitherto about 450 species of insectivorous plants have been known from all over the world and their maximum concentration is in the tropical and sub-tropical belts of this planet. It has been reported that the terrestrial ones grow in soil that is wet and acidic and deficient in nitrates and phosphates. Because their prey provides enough basic proteins to supplement the carbohydrates produced by photosynthesis, these plants survive even in poor soil. Khasi and Jaintia Hills afford congenial ecological niches and conducive environment to foster this curious group of plants capable of preying on insects and animalcules to augment the deficiency of nitrogenous nutrient in the soil where they grow. Warm and humid climatic conditions seem to be ideal for the luxuriant growth of this group.

Assam flora (Kanjilal *et al.* 1934 - 40) deals with only four species of insectivorous plants belonging to three genera. Even recent regional floras do not include many species dealt in this work. Thus there is a lacuna in the present knowledge of this group. As there are still many areas, especially in West Khasi Hills and Garo Hills, either unexplored or under-explored owing to inaccessability, there is every possibility of discovering some more species particularly of *Utricularia*.

The North Eastern region falls between N. lat. 22°—29°45' and E. long. 88°—97°50' and covers an area of about 1,16,600 sq. km (45,019.21 sq. miles) and Meghalaya is within N. lat. 25°10'—26°45' and E. long. 89°45'—92°45', covering an area of about 22,500 sq. km (8,687.26 sq. miles). This state is characterised by hilly tracts of different altitudes varying from 200 to 1800 m, receiving a heavy rainfall of 13,000 - 15,000 mm per annum.

Out of 36 species so far reported from India, 26 belonging to 5 genera are found in North-Eastern region and Khasi and Jaintia Hills have the credit of fostering 13 species belonging to 3 genera. Thus more than 60% of the species so far reported from India are from North Eastern India and more than 50% of them, from Meghalaya. The famous "pitcher plant" (*Nepenthes khasiana*) is endemic to these hills. And, *Utricularia tayloriana* and *U. khasiana* are the two new species recently collected. Besides two African species (*U. stanfieldii* and *U. pubescens*) could also be located in this region.

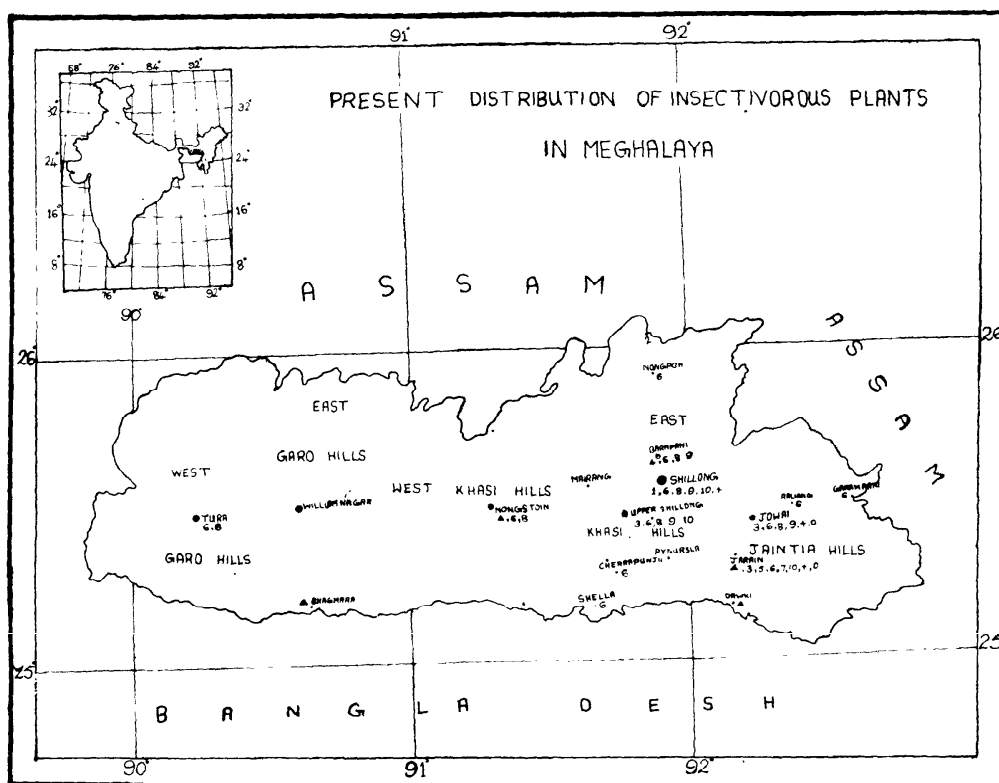
In the number of species *Utricularia* predominates and is represented by 10 species. Except 2 (*U. stellaris* and *U. khasiana*) which are typical

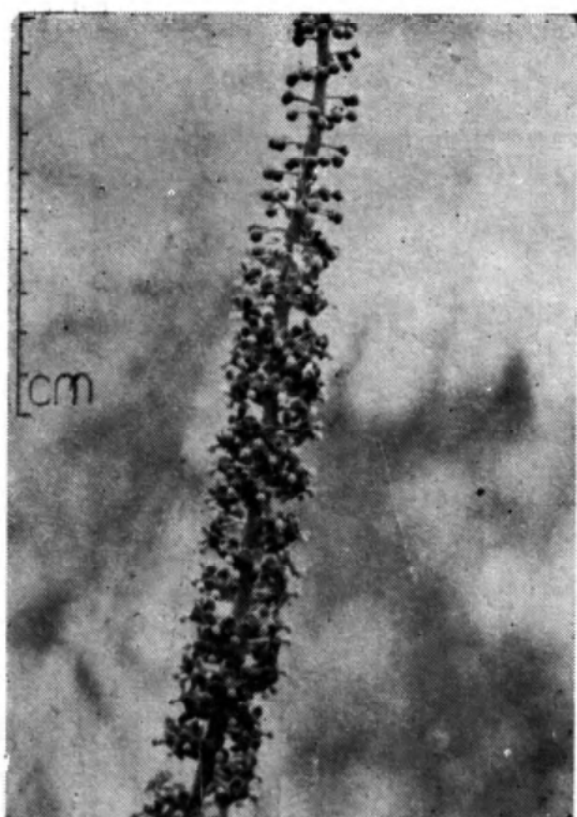
and Jaintia Hills along with analytical drawings, localities of collection, ecological data, etc. and distribution map so as to enable the students and naturalists for easy field identification.

All the specimens cited in this work are deposited for further reference in the Kanjilal Herbarium (ASSAM), Botanical Survey of India, Eastern Circle, Shillong, if not mentioned otherwise.

Authors are thankful to Dr. M. P. Nayar, Director, Botanical Survey of India, for the encouragement and to Dr. A. S. Rao (late), Consultant (Plant Resources, North Eastern Council for his suggestions.

Plate I: Map

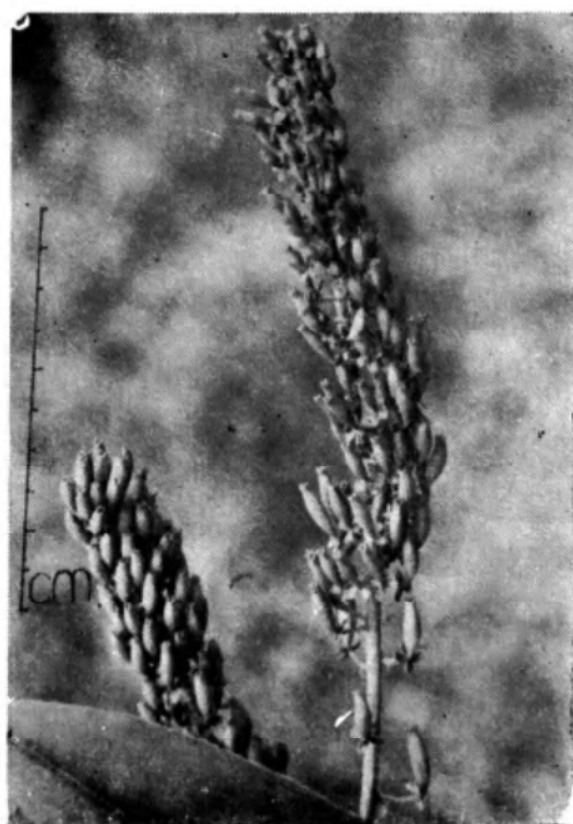




1



2



3

Plate II : Figs. 1-3 *Nepenthes khasiana* Hook. f. : 1. male inflorescence, 2. female inflorescence, 3. infructescence.

ENUMERATION

KEY TO THE GENERA

- 1a. Large scandent or climbing shrubs ; flowers unisexual, dioecious ;
stamens united ; midrib excurrent, tendrillar, ending in a subcyl-
indric pitcher NEPENTHES 1
(*Nepenthaceae*)
- 1b. Small erect or free-floating herbs ; flowers bisexual ; stamens
free ; leaves otherwise.
- 2a. Traps absent ; leaves conspicuous with sensitive glandular
hairs ; flowers actinomorphic, pentamerous ; stamens five DROSERA 2
(*Droseraceae*)
- 2b. Traps [present ; leaves inconspicuous, without glandular
hairs ; flowers zygomorphic, 2 - lipped ; stamens two UTRICULARIA 3
(*Lentibulariaceae*)

1. NEPENTHES

L. Sp. Pl. 955. 1753 & Gen. Pl. ed. 5 ; 409. 1754. (*Nepenthaceae*).

Distribution : Ceylon, Assam, S. China, Indo-China, Malaya, N. Queensland, New Caledonia.

Species : 67.

Only one species is known so far from India.

Climbing or scandent evergreen shrubs, dioecious. *Leaves* alternate, exstipulate ; midrib stout, excurrent into a coiled tendril ending in a pitcher ; pitcher cylindric with two longitudinal ribs or wings, closed by a lid in young stage which opens on maturity and becomes erect or reflexed ; mouth rimmed with a ribbed margin (peristome) ; about one third of the pitcher is filled with liquid secreted by the glands present. *Inflorescence* raceme, simple or panicle, terminal or lateral, green or brownish ; perianth (tepals) usually 4 - partite, rarely 3 - partite ; segments obovate, glandular within. *Male flowers* : stamens 4 - 16, united into a column (androphore) crowned by the connate anthers. *Female flowers* : ovary superior, usually 4 - rarely 3 - celled ; stigma sessile, discoid, three or four lobed ; ovules numerous in axile placentation. *Capsule* coriaceous, loculicidal 3- to 4-valved ; seeds filiform ; testa membranous.

Nepenthes khasiana Hook. f. in DC. Prodr. 17 : 102. 1873 & in Hook. f, Fl. Brit. Ind. 5 : 70. 1886 ; Kanjilal *et al.* Fl. Assam 4 : 25. 1940.

Scandent evergreen undershrubs or large straggling climbers among large shrubs, reaching up to 4 m, hairy all over, dioecious. Endemic to this region.

Stem cylindric, reddish brown. *Leaves* 15-16 × 3-10 cm, amplexicaul, sessile, decurrent with excurrent tendrillar midrib, ending in a pitcher, narrowed at both ends. *Pitchers* 15-20 × 4-7 cm, subcylindric, contracted at the mouth with two longitudinal ribs, more or less leathery, glabrous, yellowish green ; lid sub-orbicular closely gland dotted, corrugated at the rim, brownish green. *Inflorescence* ca 25 cm long, lateral (leaf opposed) or terminal racemes of two-flowered cymes, puberulous ; male inflorescence larger, stouter and dense than female, cymes usually two flowered on forked peduncle (rarely 3 flowered) subtended by a (rarely 2) setaceous persistent bract (ca 3 mm) about the middle of the peduncle. *Flowers* regular, greenish red or brown ebracteolate pedicellate ; pedicels hairy ; tepals 4 in decussate pairs, united at base, spreading or reflexed, with narrow pubescent curved thin margin, adpressed hairy without and pitted glandular within ; glands ovate or orbicular, smooth, greenish. *Male Flowers* : pedicels 6-7 mm ; 1.2-1.5 cm across, tepals 0.6-0.7 × 0.4-0.5 cm, obovate, rounded or subobtusate at tip. *Androecium* : anthers yellow, connate into a globular head on a stout erect columnar androphore (ca 4 mm). *Female flowers* : pedicels 3-6 mm ; ca 1 cm across, tepals 3.5-4 × 2-3 cm, obovate oblong, rounded at tip, sometimes mucronate. *Gynoecium* 4-6 × 3-4 mm, flask shaped, with a short narrow neck, adpressed silky hairy ; ovary 4 celled ; ovules on swollen axile placenta ; stigmatic lobes 4, radiating from a depressed centre, each lobe notched at apex. *Capsule* 3-8 × 0.8-1 cm, ellipsoid, obscurely 8 grooved, shining pubescent, with persistent spreading tepals ; seeds ca 0.5 mm long, spindle shaped, tailed at both ends.

Plate II : figs. 1-3 ; Plate III : figs. 1-3b.

Fl. & Fr. : June - October.

Jarain, Bhagmara, Nongstoin, Mukthapur (Khasi and Jaintia Hills, Garo Hills).

alt. : 1000 - 1500 m.

Balakrishnan 43266, 46159 ; G. K. Deka 5037, 10148, 17219 ; H. Deka 24458 ; U.N. Kanjilal 5818 ; Panigrahi 21928, 24598 ; R.S. Rao 5037.

Medicinal uses : Fluid in the unopened pitcher is used by the locals as eye drops and also for stomach troubles, urinary troubles, diabetes and

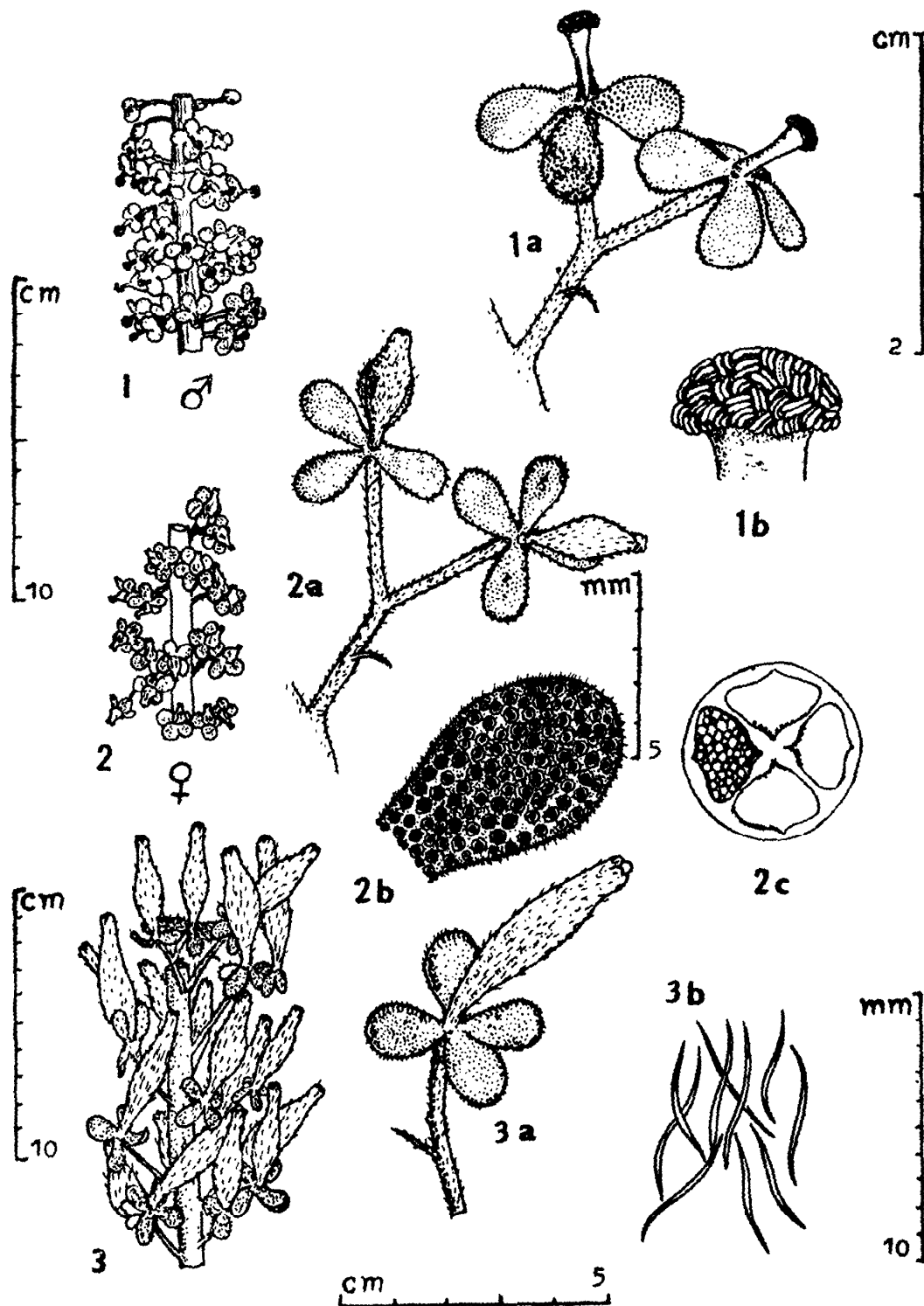


Plate III : Figs. 1 3b.

Nepenthes khasiana Hook. f. : 1. male (♂) inflorescence—a portion, 1a. cyme, 1b. connate anthers, 2. female (♀) inflorescence—a portion, 2a. cyme, 2b. tepal, 2c. c.s. of the ovary : 3. infructescence—a portion, 3a. capsule with persistent tepals, 3b. seeds.

for female diseases. The pitcher with its contents is made into a paste and applied on affected parts of leprosy patients.

It is interesting to report that a few mosquito larvae have been collected from the liquid of the pitchers and the mosquito emerged out of them in laboratory have been identified as *Aedes* sp.

Vern. names : *Memang-koksi* (Garo) means basket of the devil (the remains of the prey inside the pitcher might have led to this nomenclature). *Tiew-rakot* (Khasi) - demon flower or devouring flower. *Ksete-phare* (Jaintia) a device for trapping insects.

2. DROSERA

L. Sp. Pl. 281. 1753. & Gen. Pl. ed. 5 : 136. 1754. (Droseraceae).

Distribution : Tropical and temperate regions of the world.

Species : 100.

Only three species are reported so far from India of which two are found in Meghalaya. Both prefer open sandy, wet rocky ground. Insects are enticed perhaps by the attractive colour of the leaves and the glistening glandular hairs.

Perennial glandular herbs. *Leaves* often rosulate or cauline, circinate in bud, covered with viscid stalked glands for trapping small insects. *Inflorescence* a raceme. *Flowers* white or pink, bisexual, hypogynous. *Calyx* 4 to 8 partite, free from the ovary, imbricate. *Petals* 4 - 8. *Stamens* as many as petals. *Ovary* free, 1 celled, ovules many in parietal placentation; styles 2 - 5. *Capsule* 3 - 5 valved, loculicidal; seeds numerous, testa reticulate.

KEY TO THE SPECIES

- | | |
|--|---|
| 1a. Acaulescent herbs ; leaves large, radical in rosette, cuneate spatulate ; calyx entire at margins ; styles 5, long, shortly pencilate at tips | <i>D. burmannii</i> 1 |
| 1b. Caulescent herbs ; leaves alternate on the erect stem, semilunate-orbicular, peltate ; calyx irregularly toothed at margins ; styles 3, short, fimbriate at tips | <i>D. peltata</i> var.
<i>lunata</i> 2 |

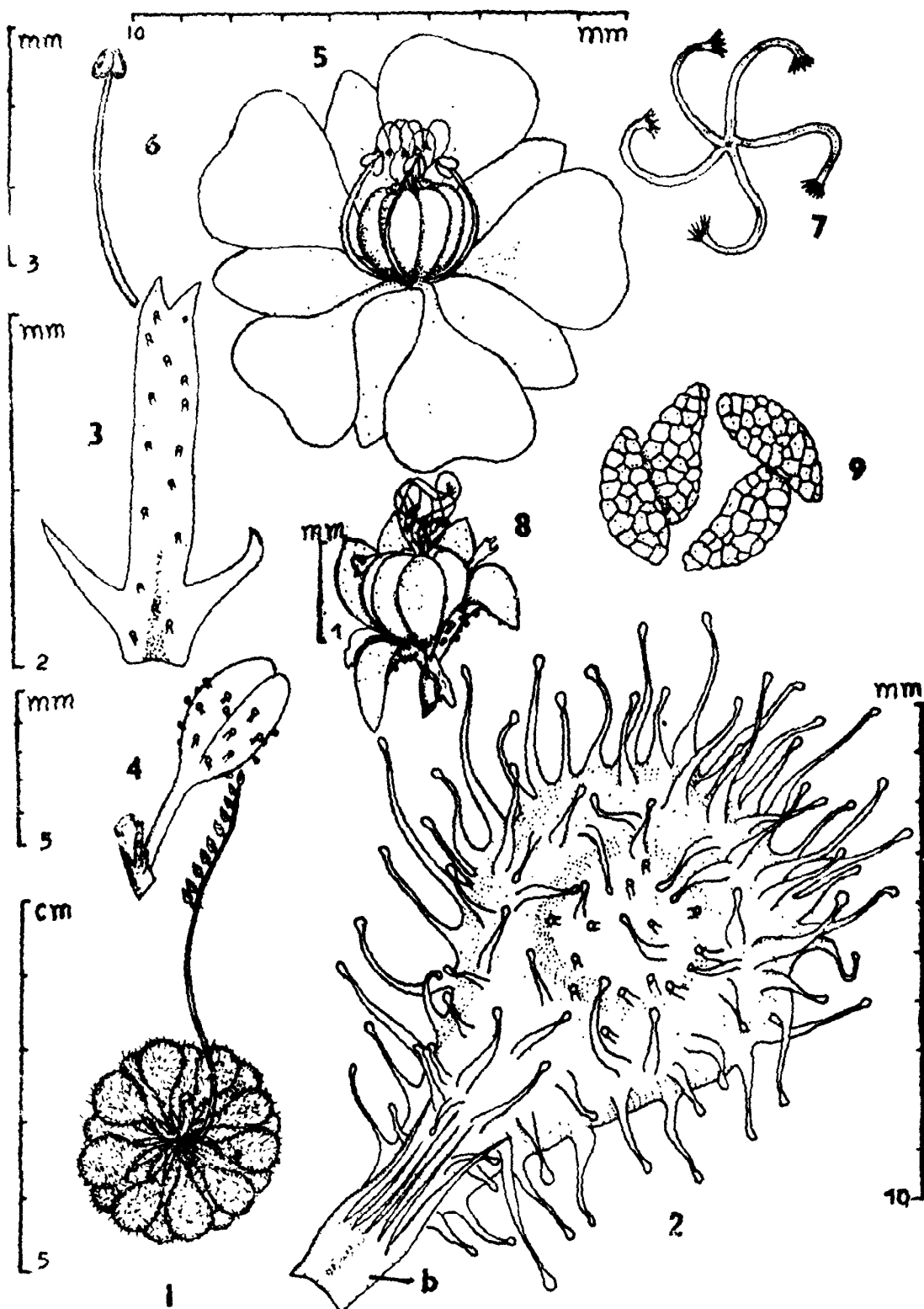


Plate IV : Figs. 1-9.

Drosera burmannii Vahl : 1. habit, 2. leaf, 2b. ligule, 3. bract, 4. flower bud, 5. flower (front view), 6. stamen, 7. styles (not to scale), 8. capsule with marcescent floral parts, 9. seeds (not to scale).

1. *Drosera burmannii* Vahl, Symb. 3 : 50. 1774 ; Wt. Ic. Pl. Ind. Or. 3(3) : t. 944. 1850 (style not correct) ; Clarke in Hook. f. Fl. Brit. Ind. 2 : 424. 1878 ; Prain, Beng. Pl. 1 : 341. 1903 (repr.) & in Rec. Bot. Surv. Ind. 3 : 210. 1905 ; Kanjilal *et al.* Fl. Assam 2 : 235, 1938 ; van Steenis in Fl. Males. Ser. I, 4(4) : 378. 1953 ; Gamble, Fl. Pres. Madras 1 : 320. 1957 (repr.) ; Basak in Bull. Bot. Surv. Ind. 17(1-4) : 105. 1975.

Distribution : Throughout India, Ceylon, Malaya, Australia, China and West Africa.

Stemless small herbs in open swampy ground with showy leaves covered with sensitive glandular tentacle-like out-growths for catching prey.

Perennial herbs. *Leaves* ca 1.0 × 0.6 cm, obovate to spatulate, abruptly narrowed into a flat petiole, clothed with gland tipped tentacles on the adaxial side, rounded at tip, marginal tentacles longer and broader at base, ligulate at the base. *Ligule* ca 4 mm, scaly, fimbriate at tip. *Inflorescence* ca 5-10 cm, racemes arising from the axils of older leaves with secund or sub-sekund flowers restricted towards the apex ; scape long, erect, glabrous and bare. *Flowers* ca 1 cm across, white, pentamerous, regular, bisexual, hypogynous, bracteate (not from the axils of the bract, often opposite to bract), pedicellate. *Bracts* ca 2 mm, trilobed with a forked midlobe being much longer than laterals, sparsely glandular hairy without. *Pedicels* ca 5 mm, short, glabrous. *Sepals* five ca 3 mm long, broadly lanceolate, free, entire, sparsely glandular hairy outside. *Petals* five, ca 5 mm long, free, spatulate, clawed, obcordate. *Stamens* five, alternating the petals ; filaments ca 3 mm long, filiform. *Ovary* ca. 1.5 mm, globose ; styles five, long, ending in penicellate stigmatic tips. *Capsule* ca 3 × 3 mm, ovoid, 5-valved with marcescent sepals and petals ; seeds numerous, minute ; testa black, reticulate.

Plate IV : figs. 1-9

Fl. & Fr. : January-March.

Jowai, Jarain.

alt. : ca 1500 m.

Joseph 76954.

Medicinal uses : The plant is powerfully rubefacient due to the presence of naphthoquinone.

2. *Drosera peltata* Sm. var. *lunata* C.B. Clarke in Hook. f. Fl. Brit. Ind. 2 : 424. 1876.

Distribution : Throughout the hilly regions of India.

Erect herbs, more or less flexuous and zigzag, with underground

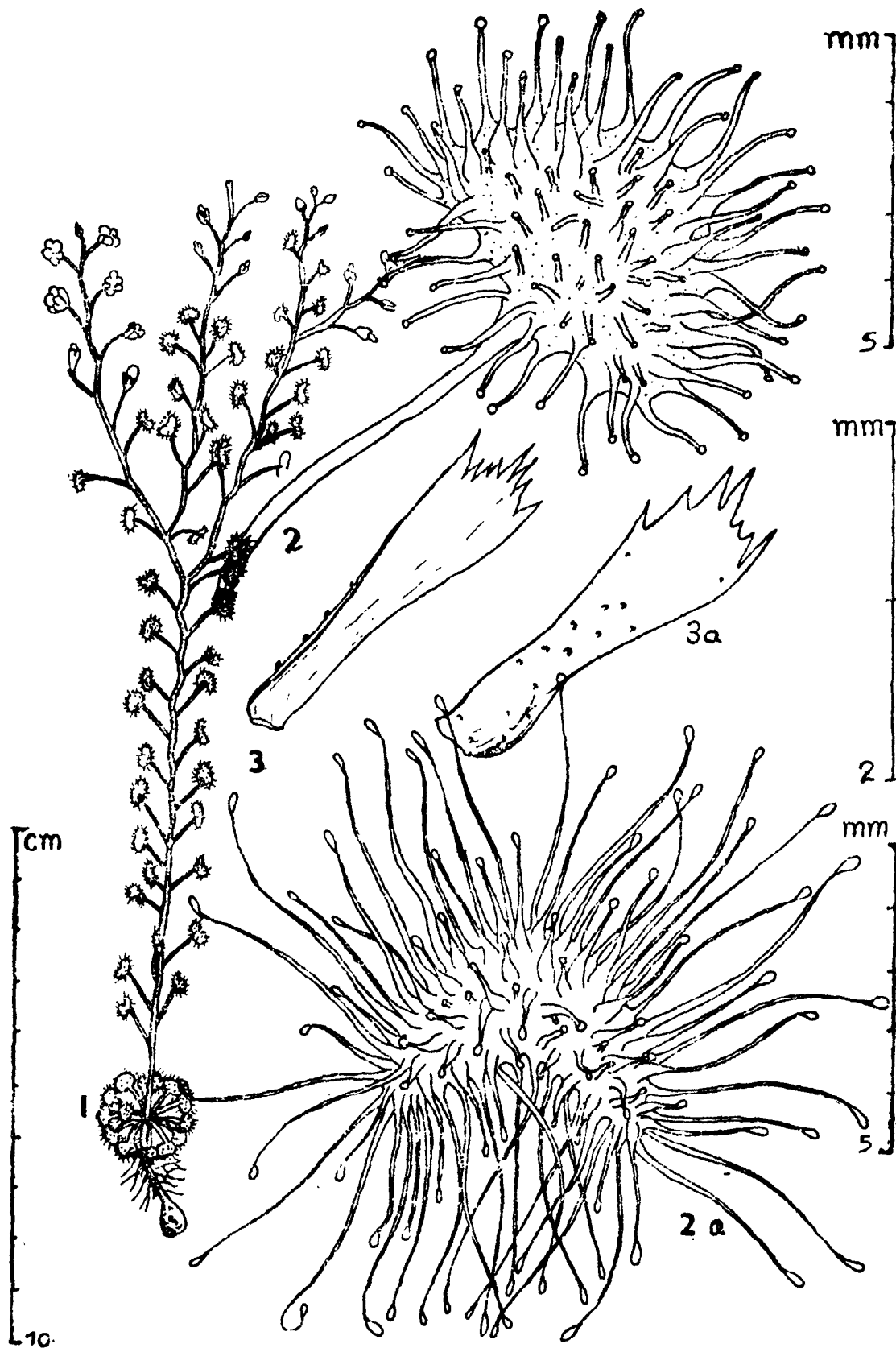


Plate V : Figs. 1-3a.

Drosera peltata Sm. var. *lunata* Cl. : 1. habit, 2. basal leaf, 2a. cauline leaf, 3. bract (adaxial view), 3a. (abaxial view.)

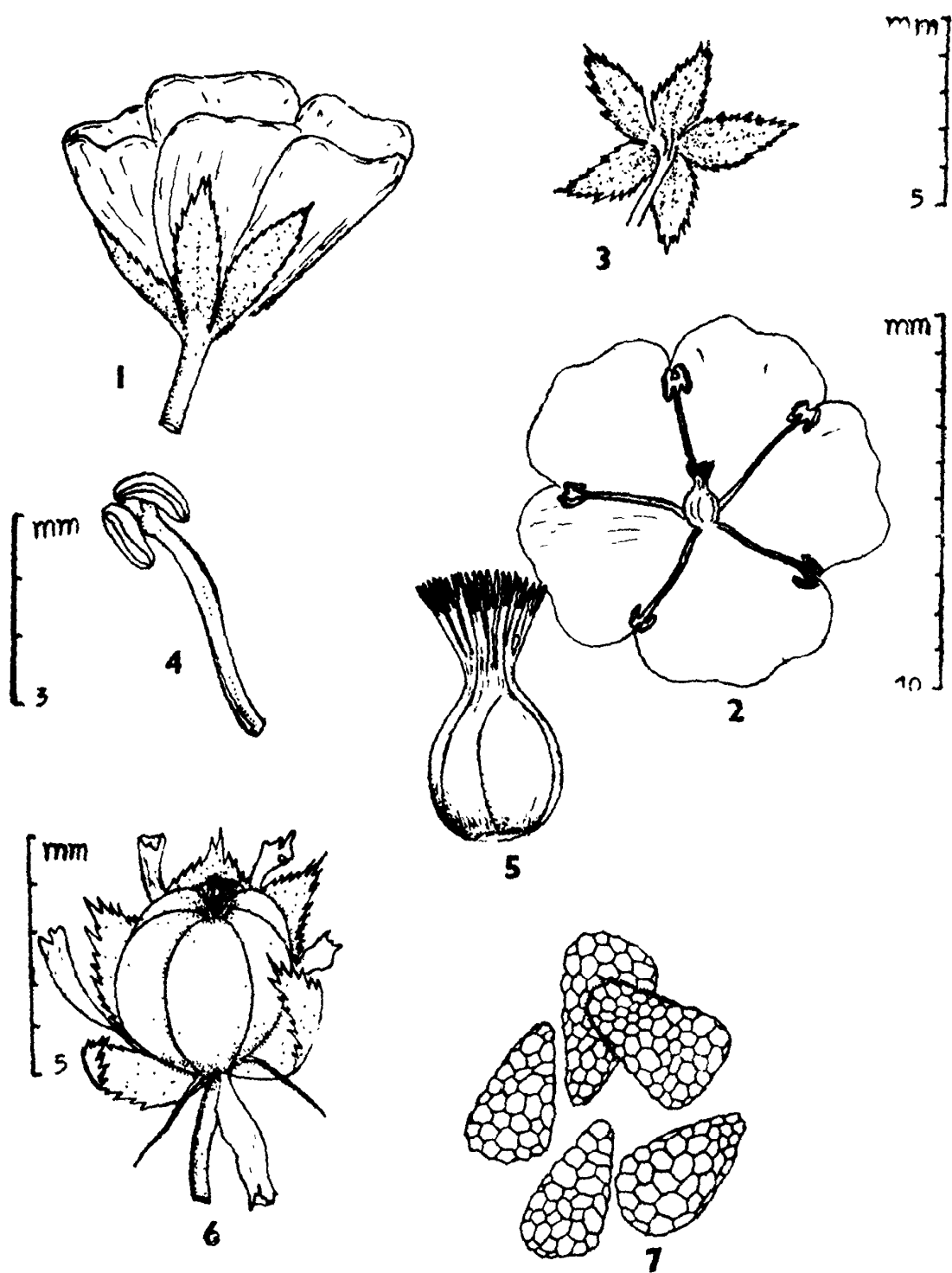


Plate VI : Figs. 1-7.

Drosera peltata Sm. var. *lunata* Cl. : 1. flower (lateral view), 2. flower (dorsal view), 3. calyx, 4. stamen, 5. pistil, 6. capsule with marcescent floral parts, 7. seeds (not to scale).

tubers and peltate leaves, beset with tentacle-like glandular outgrowths for catching the prey.

Herbs, 10 - 25 cm high. *Tubers* ca 5 mm, globose. *Stem* slender, erect, glabrous, often branching towards tip, leafy. *Leaves* dimorphic, radical (ephemeral or persisting) as well as cauline, long petiolate, semilunar-deltoid or sub-orbicular, shallowly cupular, brownish green, more or less fleshy, upper surface and margin of the lamina beset with viscid gland tipped tentacles; tentacles 2 - 4 mm long, usually with broader bases. *Radical leaves* crowded at the very base, decussate, many (15 - 18), usually ephemeral at the reproductive phase; petiole ca 8 mm long attached to the base of the lamina; lamina ca 6 × 4 mm. *Cauline leaves* many (40 - 60), at long intervals, persisting, alternate, peltate, usually one at each node (rarely two); internodes 2.6 - 6 mm; lamina 4 × 2 mm. *Inflorescence* 2 to 10 flowered raceme (rarely one flowered), terminal or upper axillary. *Flower* ca 1 cm across, bisexual, pentamerous, white, hypogynous, regular, bracteate, pedicellate. *Bracts* ca 2 mm long, fimbriate at tip, sparsely warted without. *Pedicel* 5 - 20 mm long, slender, glabrous. *Sepals* five, ca 3 mm long, ovate, acute, gland dotted, puberulus, irregularly finely toothed at margins. *Petals* five, ca 5 × 6 mm obovate to orbicular, more or less wavy at apical margins. *Stamens* five, alternating the petals; filament ca 3.5 mm long, filiform. *Ovary* ca 1 mm, ovoid; styles three, further twice tri-partite into fimbriate tips. *Capsule* ca 4 × 3 mm, ovoid, 3 - 5 - valved, with marcescent sepals and petals; seeds numerous minute; testa black, reticulate.

Plate V : figs. 1-3 ; Plate VI : figs. 1-7

Fl. & Fr. : May - October.

Jarain, Jowai, Pynursla, Shillong, Raliang.

alt. : 1400 - 1500 m.

Deb 24427 ; *Joseph* 79301 ; *Panigrahi* 24503 ; *A.S. Rao* 42501 ; *R.S. Rao* 2331.

Medicinal uses : The leaves bruised, mixed with salt used as a blistering agent. The plant is used in the preparation of "gold bhasma" which in turn is used as tonic.

3. UTRICULARIA

L. Sp. Pl. 18: 1753. & *Gen. Pl.* ed. 5 : 11. 1754 ; Taylor in *Kew Bull.* 18(1) : 23 - 25. 1964. (Lentibulariaceae).

Distribution : Tropical & temperate regions of the world.

Species : 150.

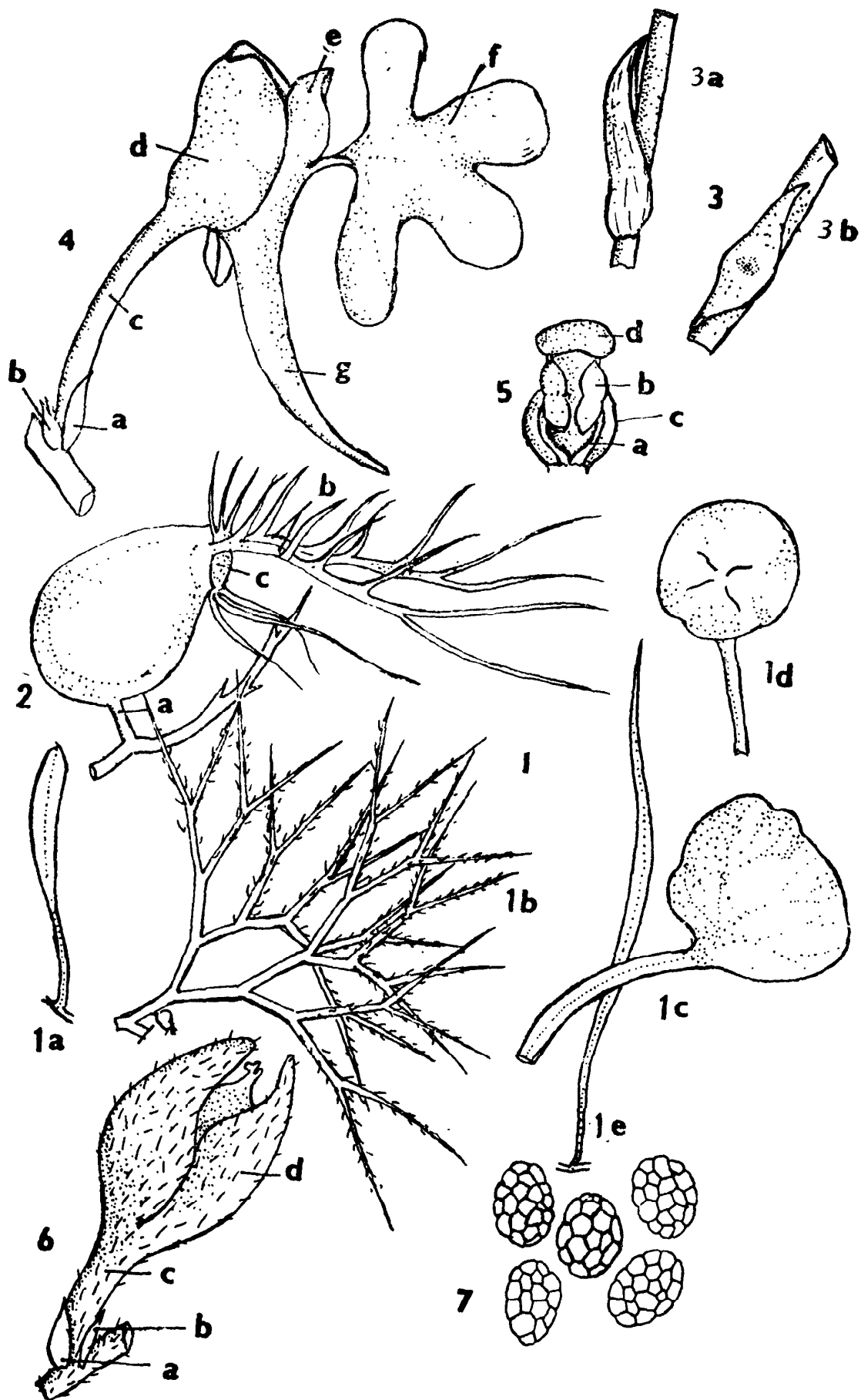


Plate VII : Figs. 1-7. (not to scale)

Utricularia L. : Morphology. 1a-1e. leaves, 2. bladder : a. stalk b. antennae, c. orifice (mouth), 3. scales : a. basifixed, b. midfixed, 4. flower : a. bract, b. bracteole, c. pedicel, d. calyx, e. upper lip of the corolla, f. lower lip of the corolla, g. spur, 5. androecium and gynoecium : a. filament, b. anther, c. ovary, d. stigma, 6. capsule : a. bract, b. bracteole, c. stalk, d. accrescent calyx, 7. seeds.

From India so far about 34 species of *Utricularia* have been reported, of which 10 hail from Khasi & Jaintia Hills. In general, it could be observed that open moist sandy soil overlying rocky slopes is the ideal habitat for many species of *Utricularia*. Invariably the terrestrial ones are annuals which appear after the first showers of monsoons and disappear in the early part of winter. While the vegetative part is very inconspicuous with evanescent leaves (generally leaves are prolific during anthesis), the *inflorescence* raceme or spikes is very attractive with small bilipped flowers, blossoming usually gregariously. Of all the species *U. caerulea*, *U. stellaris*, *U. striatula*, and *U. bifida* enjoy a wider distribution throughout India.

Annual or perennial, aquatic, terrestrial or epiphytic herbs, with or without true roots or leaves, but stems modified into various ways to function as rhizoids, stolons and leaf-like photosynthetic organs. *Leaves* many partite with segments in the floating species and entire in erect species; bearing bladders on the rhizoids and leaves to capture small organisms for their prey. *Scape* simple or branched, with or without scales. *Inflorescence* pedunculate, one or more flowered raceme or spikes; flowers bracteate; bracts basifixed or midfixed; bracteoles usually two rarely absent. *Calyx* bilobed, entire, often enlarged in fruit. Corolla gamopetalous, 2-lipped; upper lip entire or rarely 2-lobed; lower lip entire or 2 to 5-lobed. *Spur* curved or straight. Stamens two, inserted at the base of the corolla. Ovary superior, unilocular; style usually short; stigma 2-lobed; ovules numerous. *Capsule* globose to ovoid; seeds numerous, small, of various shapes.

Plate VII, figs. 1-7; Plate XIX, figs. 1-8

KEY TO THE SPECIES

- 1a. Aquatic herbs, free floating; leaves filiform dissected.
 - 2a. Slender herbs, filamentous (algae like); floats absent; bladders with 2 long antennae besides simple ones *U. khasiana* 1
 - 2b. Stout herbs, brush like; with stellate floats at the base of the raceme; bladders with only simple hairs *U. stellaris* 2
- 1b. Terrestrial or rarely epiphytic herbs; leaves flat and entire.
 - 3a. Scape puberulous or hairy.
 - 4a. Hairy; leaves narrowly spatulate; flowers distinctly stalked; palate with humps; upper lip of the corolla erect *U. tayloriana* 3
 - 4b. Puberulous; leaves orbicular; flowers subsessile; palate tuberculate; upper lip of the corolla closely curved over the lower lip *U. pubescens* 4
 - 3b. Scape glabrous.

5a. Flowers yellow.

6a. Scape pinkish ; bracts midfixed ; lower lip trilobed *U. stanfieldii* 5

6b. Scape green ; bracts basifixed ; lower lip obcordate.

7a. Stem slender but erect ; bladder with recurved antennae *U. bifida* 67b. Stem filiform, twinning ; bladder with porrect antennae *U. scandens* 7

5b. Flowers violet - white.

8a. Leaves long spatulate, scattered on the stolon ; calyx lobes equal or sub-equal ; lower lip of corolla entire, wavy or not at margin ; seeds smooth *U. caerulea* 8

8b. Leaves orbicular or reniform in rosette, at the base of the scape ; upper lobe of the calyx much larger than the lower ; lower lip of corolla 4 - 5 lobed ; seeds glochidiate.

9a. Scales present ; lower lip 5 lobed *U. striatula* 99b. Scales absent ; lower lip 4 - lobed *U. furcellata* 10

1. *Utricularia khasiana* Joseph & Mani in Bull. Bot. Surv. India 25(1 4) : 192 194. 1983.

Free floating, filamentous, algae-like herbs, in entangled masses, in shallow water along the margins of the fresh water lake.

Stolons ca 0.2 mm thick, capillary, profusely branching circinate at tip. *Leaves* 1 5 mm long, acicular, at long intervals (up to 10 mm), very unequally forked from the base, curved, beset with spiny scales (ca 4) towards the apex, bearing solitary bladders. *Bladders* ca 1 × 1 mm, subtended on the larger leaf segment, pyriform, shortly stalked ; stalk ca 0.3 mm long, mouth oblique, laterally terminal with obscure upper and lower lips beset with acicular hairs ; lower lip with 3 diverging hairs of which the mid one longer ; upper lip with 3 8 (rarely more) short hairs along the rim in between the lateral antenna - like hairs ; antennae filiform, multicellular, twice longer (ca 2 mm) than the bladder, branched, beyond the middle and with usually 5 (3 or 4) simple lateral second hairs.

Plate VIII : figs. 1-3

Flowering has not been observed since its discovery in 1964.

This species could be located only in Ward lake in Shillong.

alt. : 1496 m.

G. K. Deka 21877 ; *Joseph* 76945.

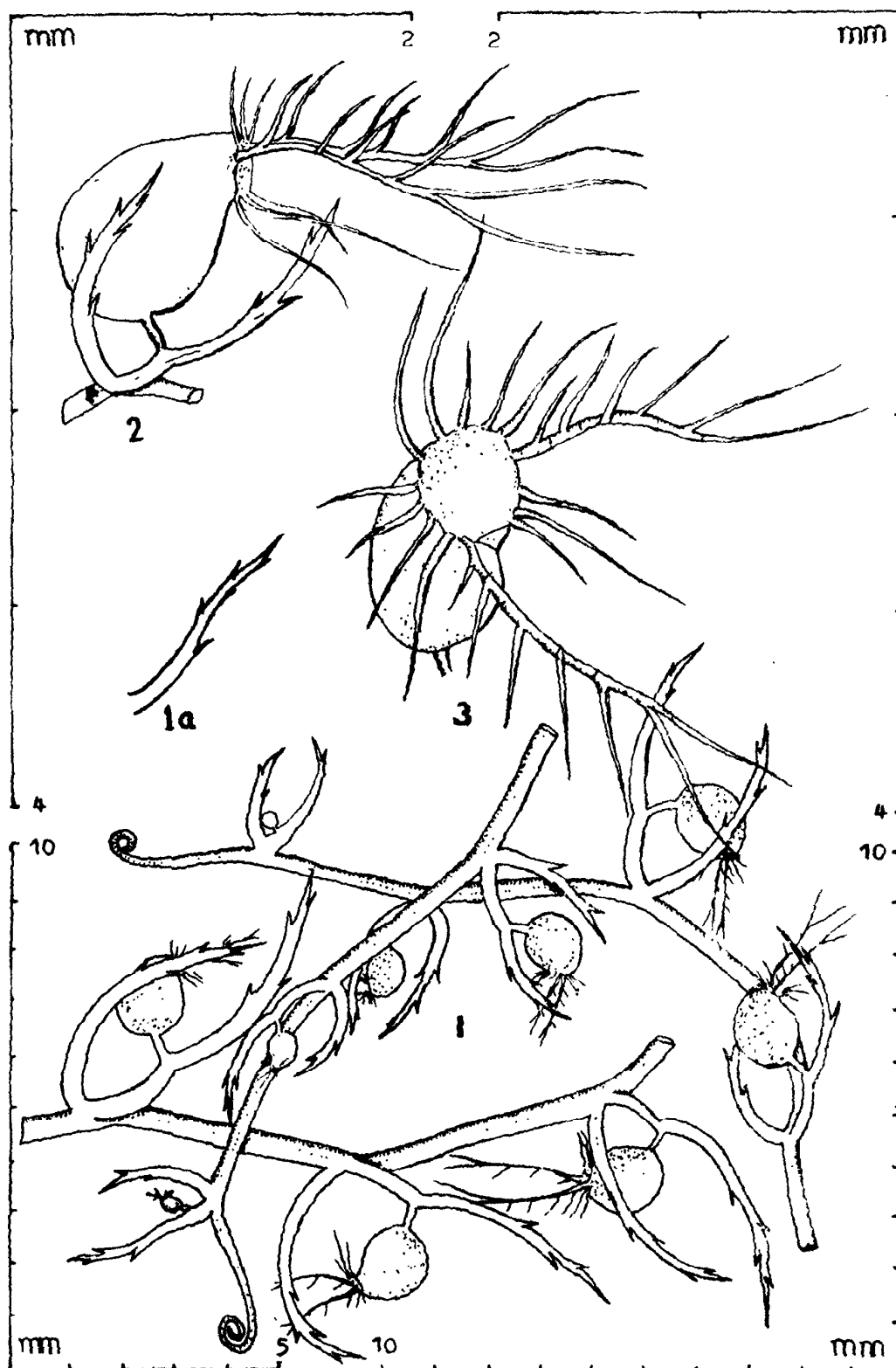


Plate VIII : Figs. 1-3.

Utricularia khasiana Joseph et Mani : 1. stolon, 1a. leaf, 2. bladder (lateral view), 3. bladder (front view).

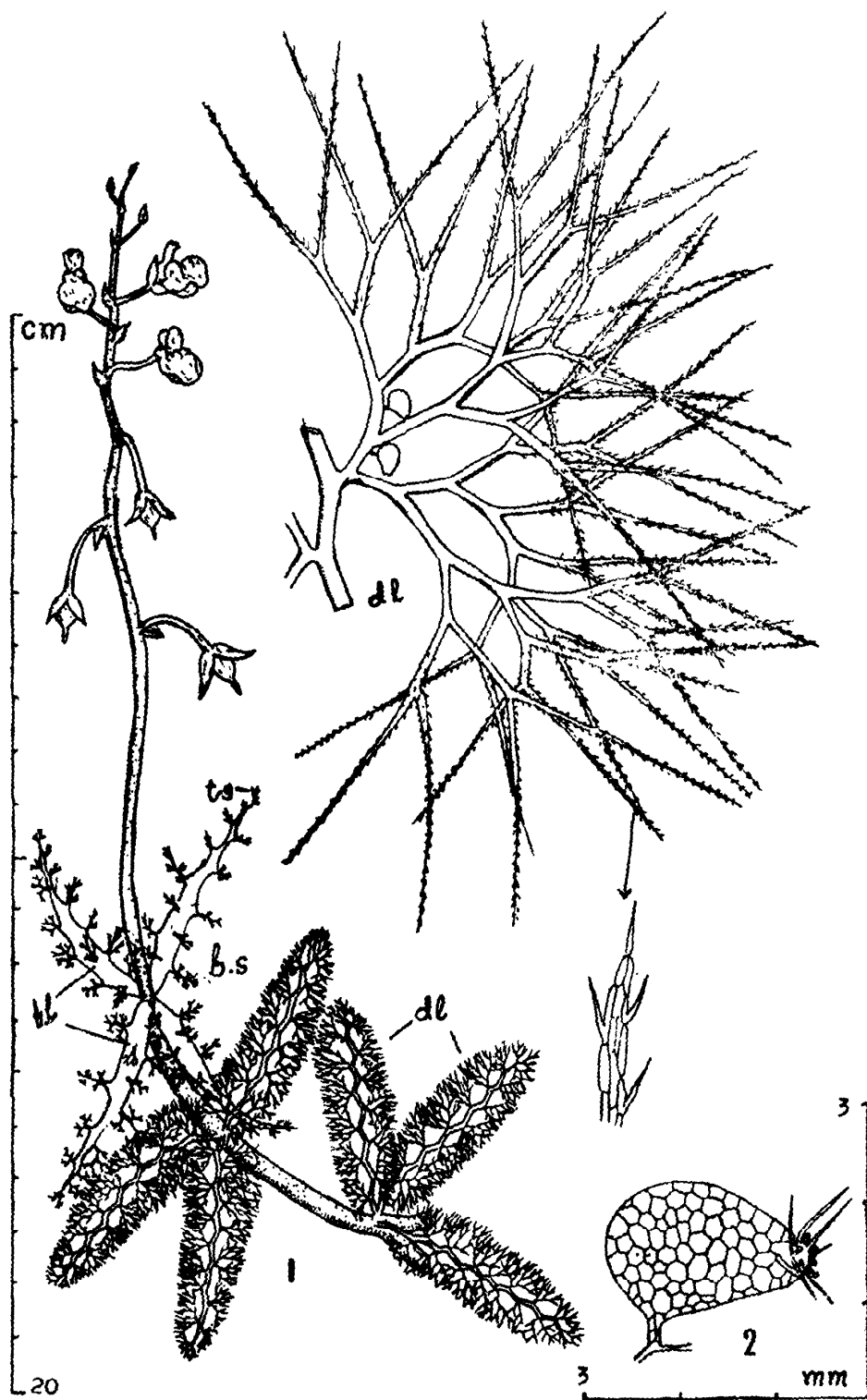


Plate IX : Figs. 1 & 2.

Utricularia stellaris L. f. : 1. habit ; dl. dissected leaves, fl. float leaves, bs. basal segment, ts. terminal segment, 2. bladder.

2. *Utricularia stellaris* L. f. Suppl. 86. 1781 ; Roxb. Fl. Ind. 1 : 143. 1820 ; Wt. Ic. Pl. Ind. Or. 4(4) : 9, t. 1567. 1850 ; Clarke in Hook. f. Fl. Brit. Ind. 4 : 328. 1884 ; Gamble, Fl. Pres. Madras 2 : 687. 1957 (repr.) : *U. inflexa* var. *stellaris* P. Taylor in Kew Bull. 18 : 189. 1964.

Distribution : Found all over tropical Africa, India and S. E. Asia to N. Australia.

Profusely branching yellow-flowered aquatic herbs with numerous bladders in standing waters.

Rhizoids absent. Stolons capillary, branched, bearing dissected leaves. Leaves heteromorphic : dissected leaves and float leaves, verticillate or whorled, 2-4 at each node. *Dissected leaves* 2 or 3 at each node ; primary rachis verticillate, zigzag with alternate secondary pinnule (up to 15) with subtended bladders (usually 2) which in turn dichotomously pinnulate repeatedly (4 or 5) ; ultimate pinnules bearing setaceous scales. *Float leaves* 2.0 to 4.5 cm long, 3 or 4 in whorl, spongy, obclavate to spindle-shaped, with long tapering slightly curved tip. *Bladders* ca 2.0×1.5 mm, numerous (absent in float leaves), one or two in each pinna, obliquely ovoid, shortly stalked ; stalk ca 0.25 mm long ; mouth lateral, rimmed with multicellular long hairs and gland tipped short hairs. *Inflorescence* ca 16 cm long, erect, 10 to 12-flowered raceme. *Flowers* bright yellow, bracteate, ebracteolate, pedicellate. *Bracts* ca 2.0×0.5 mm, basifixed, ovate, entire, or obscurely lobed at apex, nerveless. *Pedicels* 6-12 mm long, erect, capillary (stout and bent in fruit). *Calyx* ca 3 mm long ; lobes sub-equal, ovate, obtuse, shorter than the lip, 9 nerved. *Corolla* ca 12 mm across, faintly nerved ; upper lip 9×8 mm, ovate-oblong, faintly puberulous without ; lower lip ca 12×9 mm, sub-orbicular ; palate much raised with deep yellow striations. *Spur* ca 6 mm long, sub-erect, shorter than the lower lip faintly puberulous throughout, tapering into a blunt tip having a shallow sub-terminal constriction, prominently 5 nerved. *Filaments* ca 2 mm, filiform. *Ovary* ca 1.5 mm long, ovoid, with peltate stigma. *Capsule* ca 7 to 9 mm long (with stalk), arcuate, with terminal beak, almost equalling the fruiting calyx ; fruiting calyx 5-8 mm, spreading, acrescent ; seeds ca 1.0×0.3 mm, dense, flattened, smooth, 3 (6-) angled, prismatic, obscurely winged or not.

Plate IX : figs. 1&2 ; Plate X : figs. 1-6

Fl. & Fr. : June-December.

Nongpoh Gauhati : in perennial standing waters along the foot hills bordering Assam plains.

H. Deka 76953 ; *U.N. Kanjilal* 7371 ; *Panigrahi* 5401.

Our specimens differ from those of Taylor's (1964) in the following. :