INSECTIVOROUS PLANTS OF KHASI AND JAINTIA HILLS MEGHALAYA, INDIA

(A Preliminary Survey)

J. JOSEPH
AND
K.M. JOSEPH

BOTANICAL SURVEY OF INDIA

INSECTIVOROUS PLANTS OF KHASI AND JAINTIA HILLS

INSECTIVOROUS PLANTS OF KHASI AND JAINTIA HILLS MEGHALAYA, INDIA

(A Preliminary Survey)

J. JOSEPH
&
K.M. JOSEPH

भारतीय वनस्पति सर्वेक्षण
BOTANICAL SURVEY OF INDIA

BOTANICAL SURVEY OF INDIA

Price

Cover photo : *Nepenthes khasiana* Hook. f.

Published by the Director, Botanical Survey of India
P-8, Brabourne Road. Calcutta-700001 and printed at
Deep Printers, 3/26, Ramesh Nagar, New Deihi-110015

CONTENTS

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
Culcutta
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 augument 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 underexplored 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.

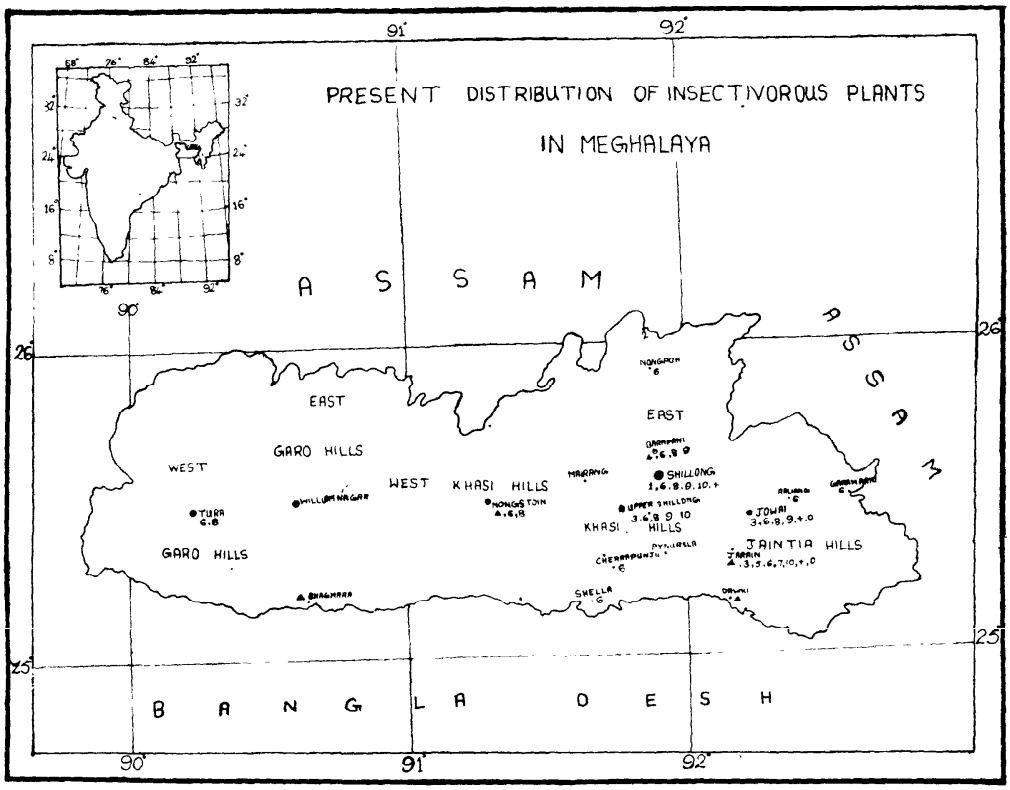
In the number of species *Utricularia* predominates and is represented by 10 species. Except 2 (*U. stellaris* and *U. khasiana*) which are typical

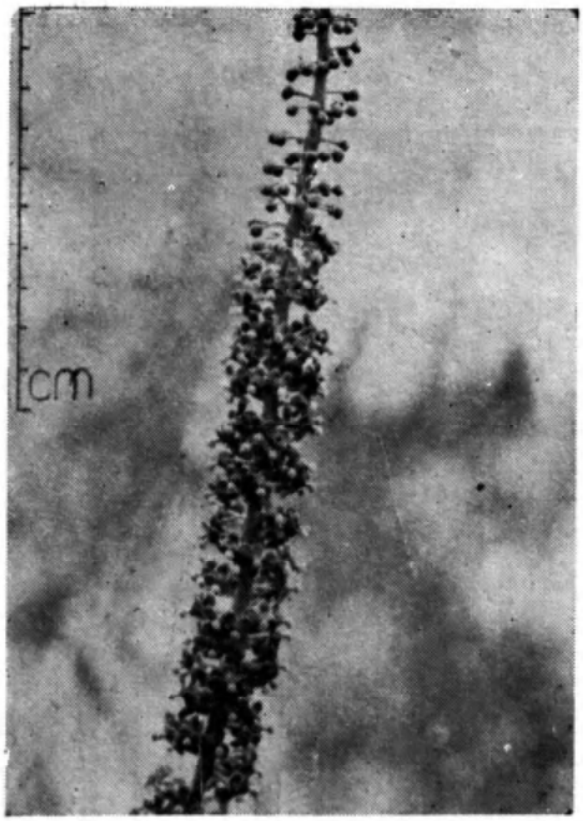
and Jaintia Hills along with analytical drawings, localities of collection, ecological data, etc. and distribution map so as to enable the students and naturalists for easy field identification.

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.

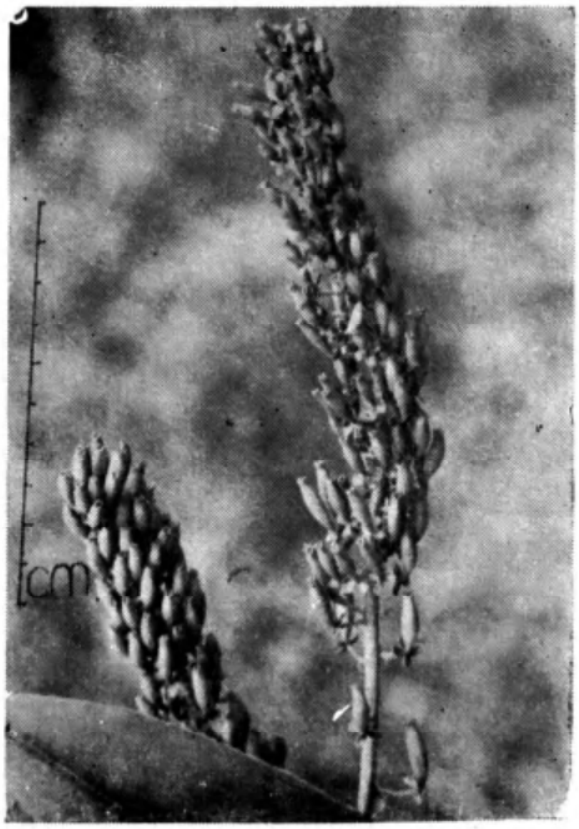
Plate I : Map


PRESENT DISTRIBUTION OF INSECTIVOROUS PLANTS
IN MEGHALAYA
A S S A M
B A N G L A D E S H
EAST
GARO HILLS
WEST
GARO HILLS
WEST KHASI HILLS
KHASI HILLS
JAINTIA HILLS
EAST
SHILLONG
TURA
JOWAI
91°
92°
90°
26°
25°



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 subcylindric 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 subobtuse 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

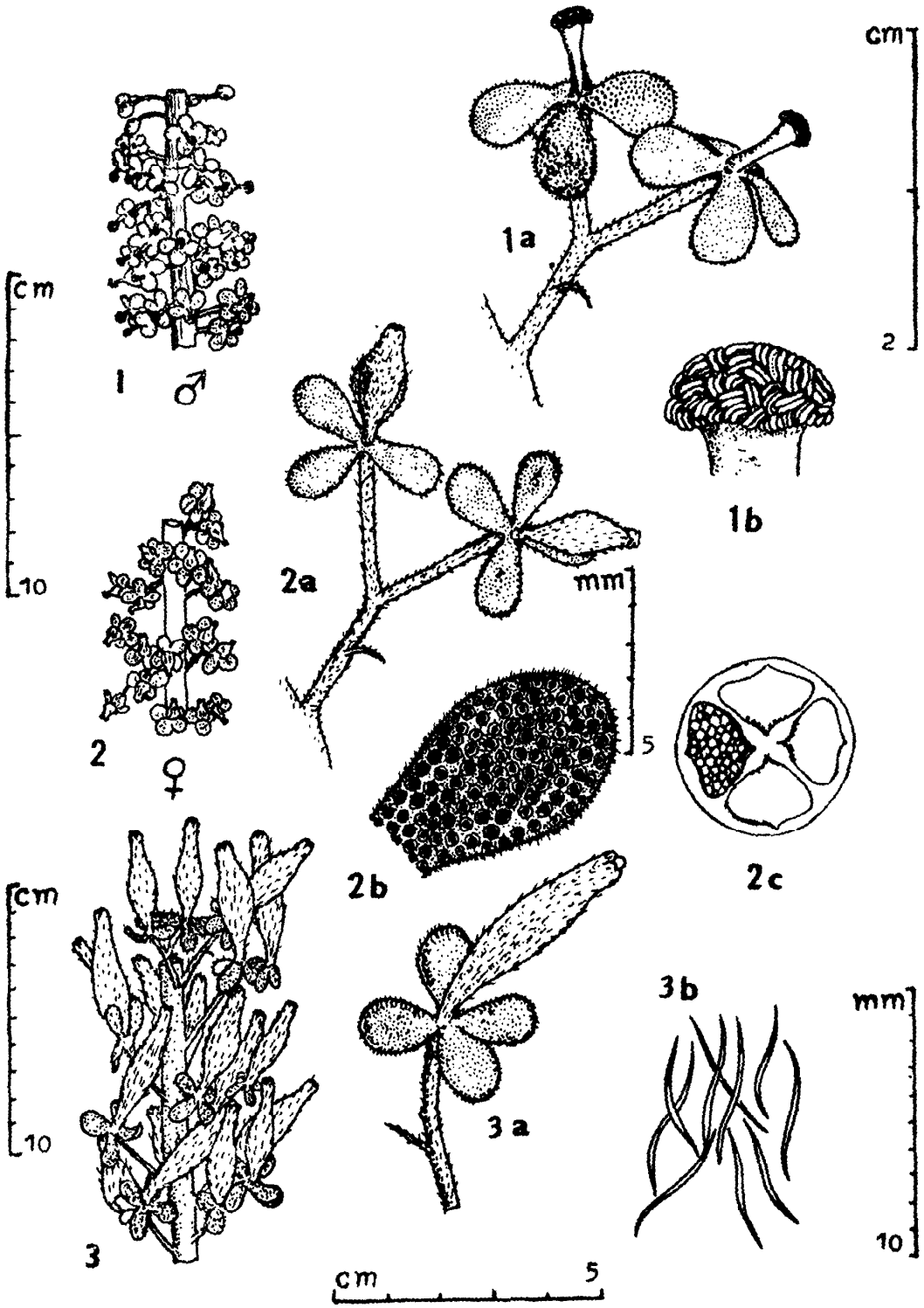


Plate III : Figs. 1 3b.

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. infructescene—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 traping insects.

2. DROSERA

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

Distribution : Tropical and temparate 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 spathulate ; calyx entire at margins ; styles 5, long, shortly pencillate at tips — *D. burmannii* 1

1b. Caulescent herbs ; leaves alternate on the erect stem, semilunate-orbicular, peltate ; calyx irregularly toothed at margins ; styles 3, short, fimbriate at tips — *D. peltata* var. *lunata* 2

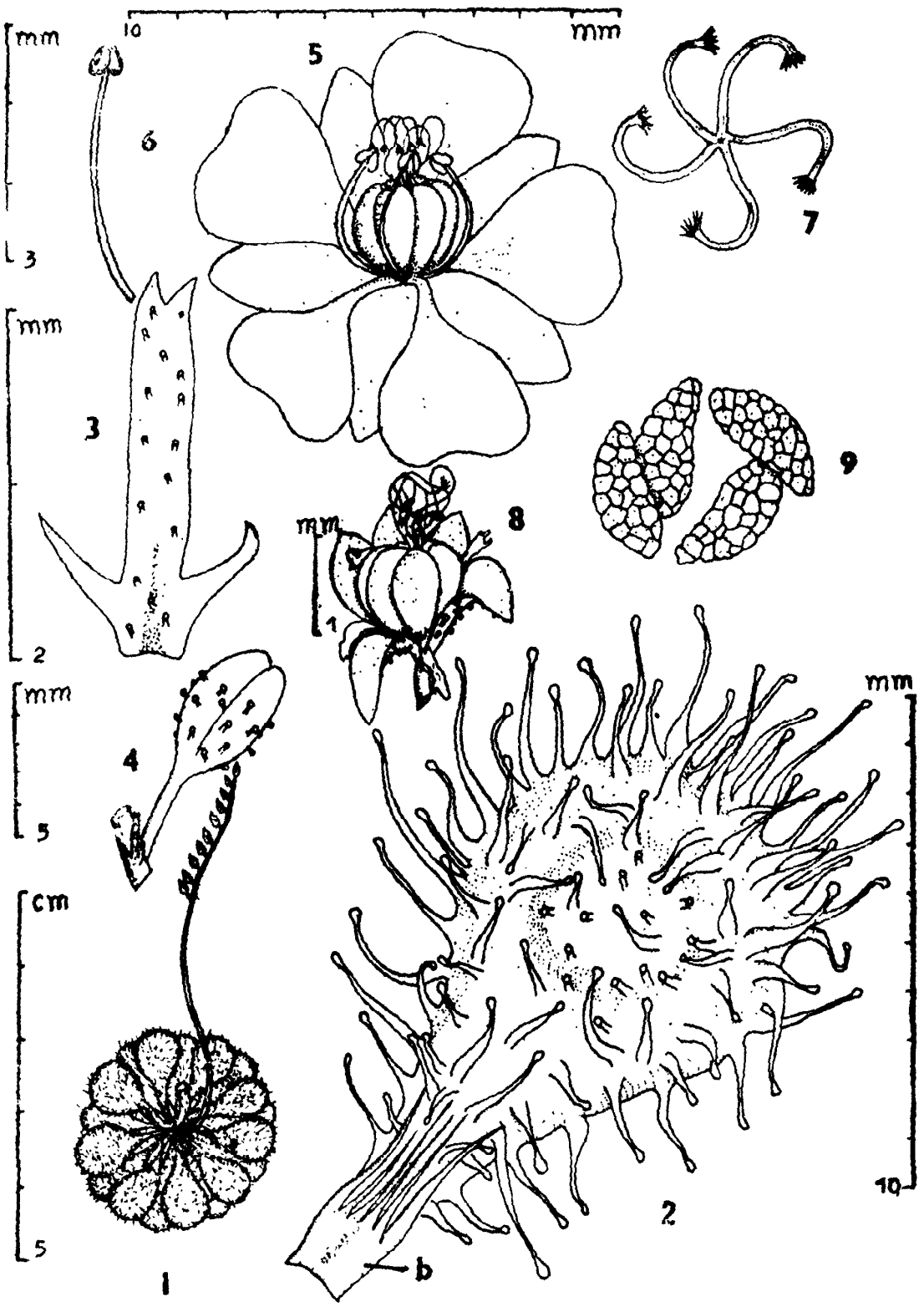


Plate IV : Figs. 1-9.

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. 1974 ; 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 spathulate, 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-secund 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, spathulate, 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

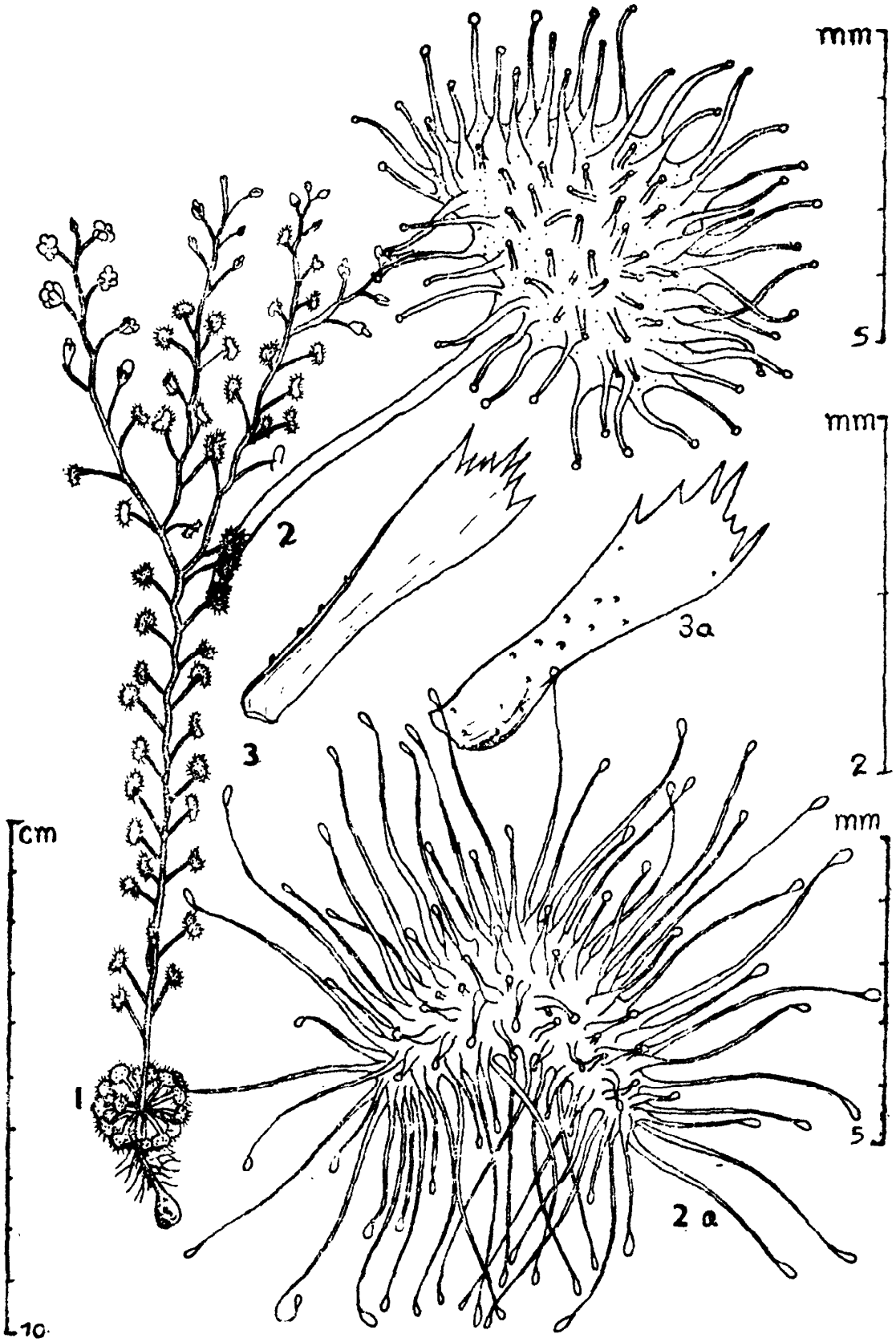


Plate V : Figs. 1-3a.

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

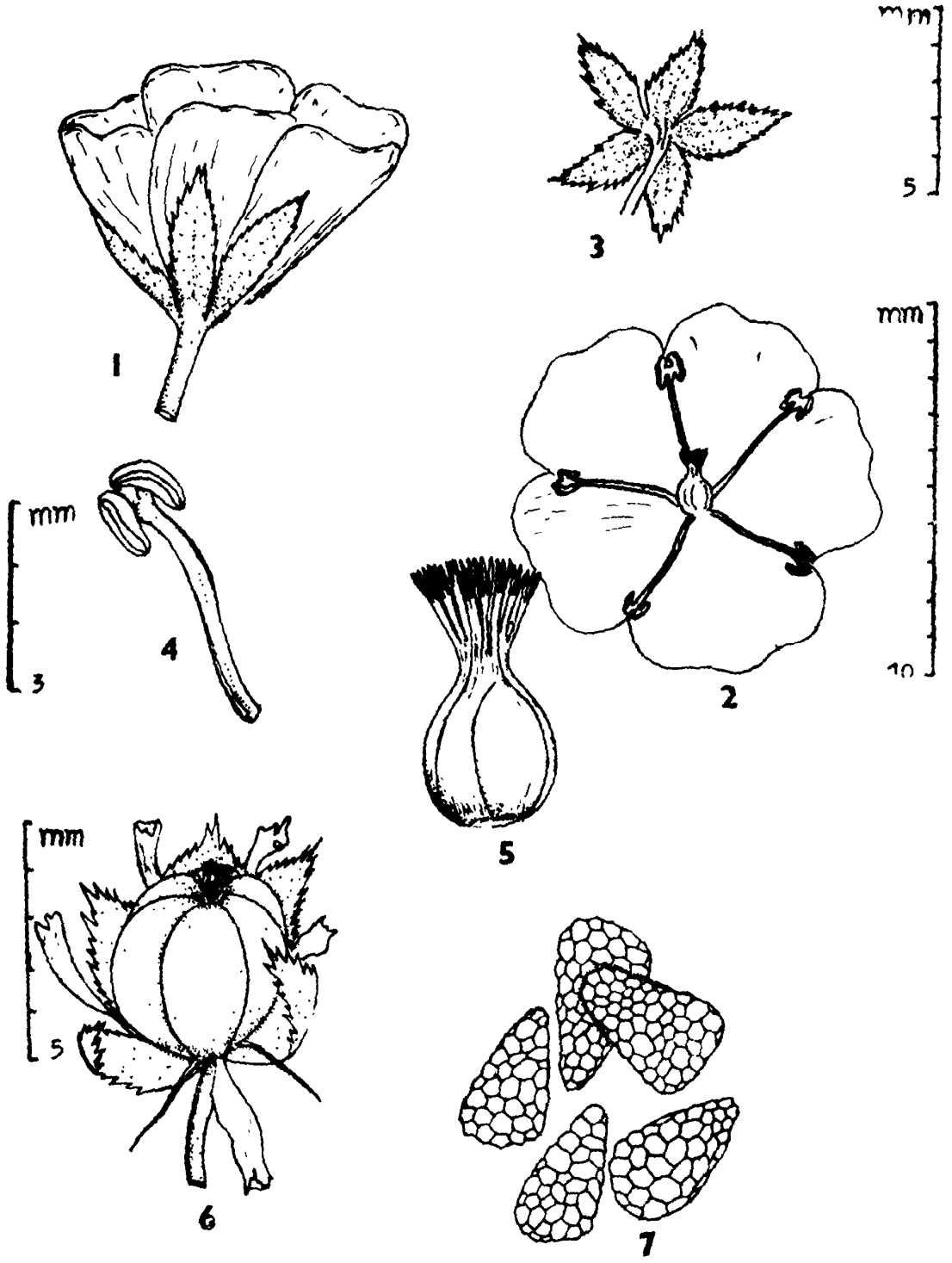


Plate VI : Figs. 1-7.

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* dimophic, 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.

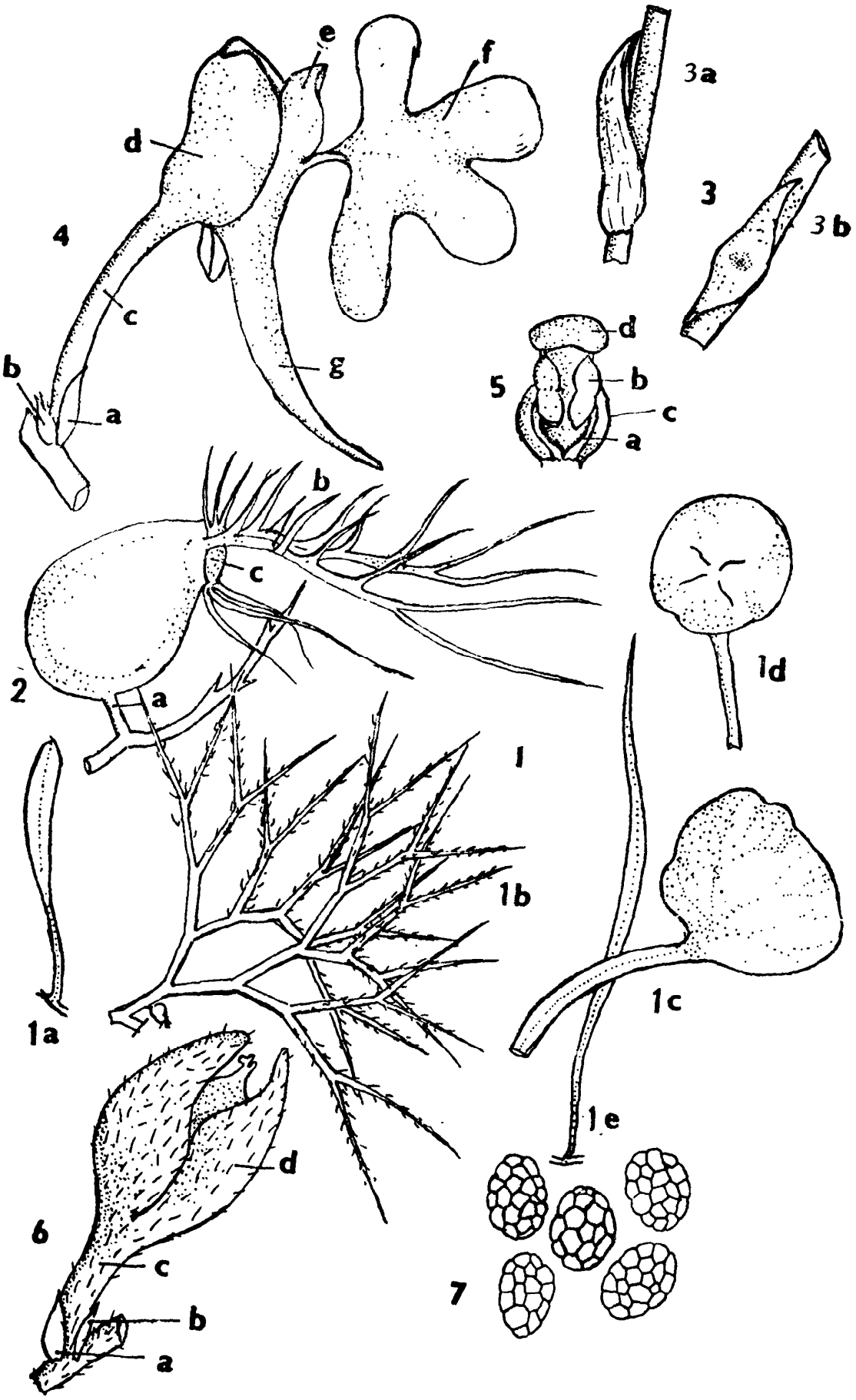


Plate VII : Figs. 1-7. (not to scale)

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 spathulate ; 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* 6

7b. Stem filiform, twinning ; bladder with porrect antennae — *U. scandens* 7

5b. Flowers violet - white.

8a. Leaves long spathulate, 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* 9

9b. 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 massess, 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 secund 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.

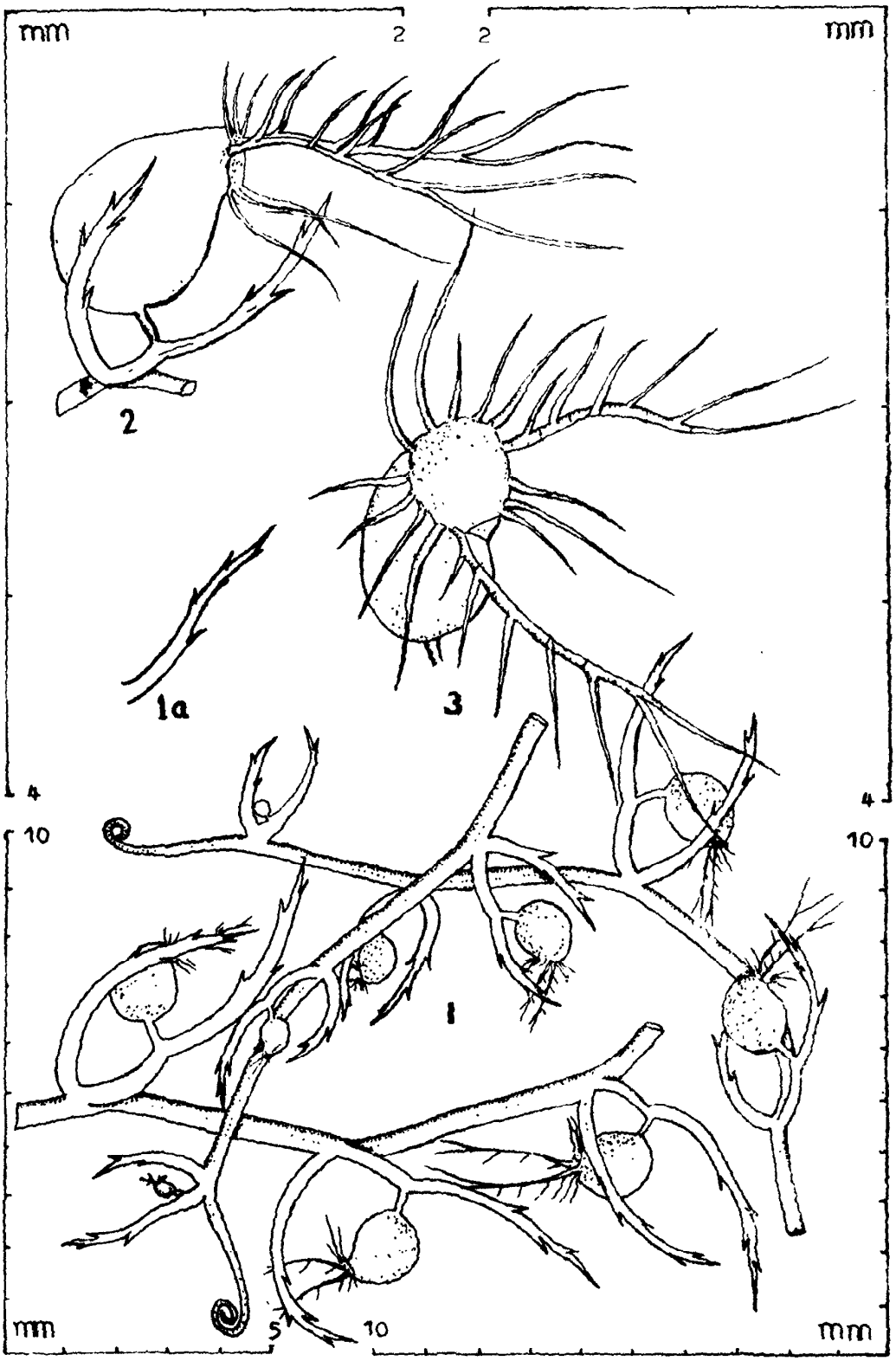


Plate VIII : Figs. 1-3.

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

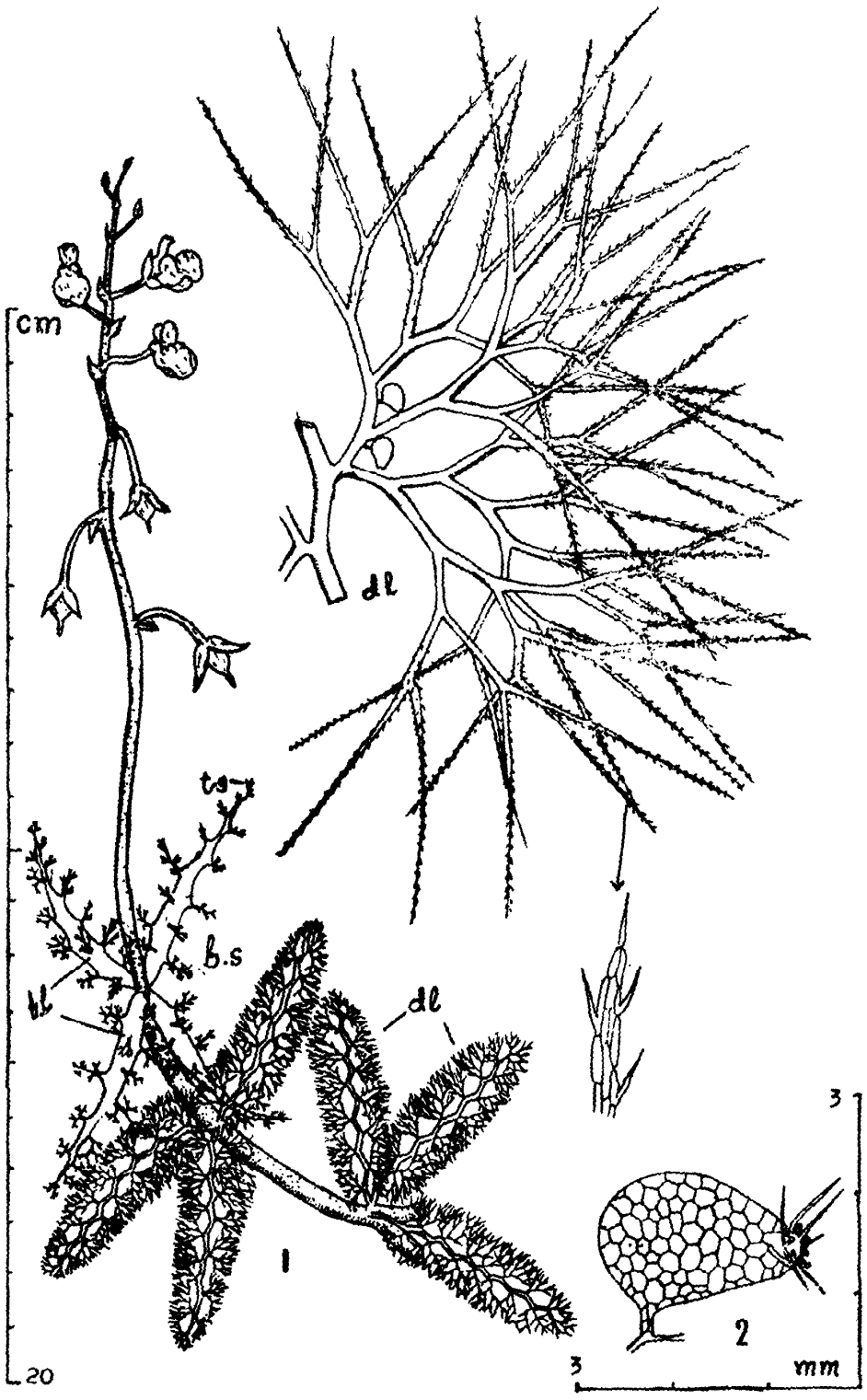


Plate IX : Figs. 1 & 2.

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 setacious 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-porrect, shorter than the lower lip faintly puberulous throughout, tapering into a blunt tip having a shallow subterminal 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. :

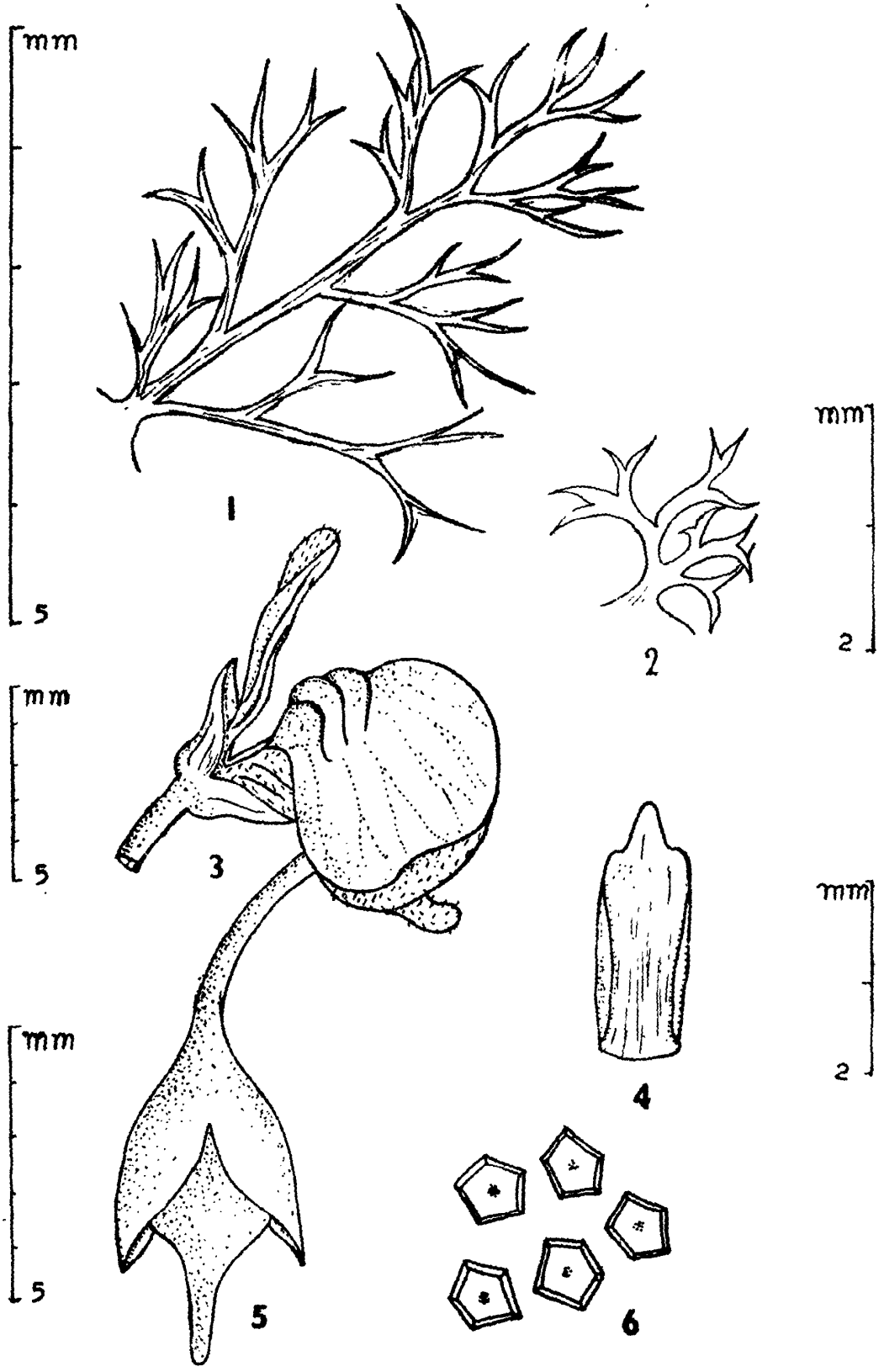


Plate X : Figs. 1-6.

Utricularia stellaris L. f. : 1. basal segment of the float leaves. 2. terminal segment of the float leaves. 3. flower. 4. bract. 5. capsule with persistant calyx. 6. seeds.

Float leaves spindle-shaped instead of ovate oblong; dissected leaves all over the floats instead of only at their apices.

3. **Utricularia tayloriana** Joseph & Mani in Bull. Bot. Surv. India 24(1 4) : 108 109. 1982.

Terrestrial, erect, hairy, simple herbs, in moist level grounds covered with slimy algal substratum.

Rhizoids fasciculate, profusely ramifying, filiform, forming an inextricable mesh with the algal substratum, bearing long-stalked bladders and spathulate leaves scattered all over. *Leaves* 5.0 6.0 × 0.4 - 0.5 mm, profuse at anthesis, piercing through the substratum, long - petioled, narrowly spathulate, green, simple (rarely palmately 2 to 3 segmented), glabrous, obtuse at apex, uninerved, with or without bladders. *Bladders ca* 0.5 mm, numerous, ovoid, long stalked ; mouth terminal, oblique, upper lip projecting with only two hairs. *Scape* 3.0 9.5 cm tall, simple, capillary, erect, hairy, dull purple, scales 1 5 (or absent), 1 or 2 flowers at the tip ; hairs multicellular. Scale 1.0 1.5 mm long, basifixed, ovate, lanceolate, acute, closely appressed to the scape. *Flowers* one or two, *ca* 8 mm long to the tip of spur and *ca* 4 mm broad across the lower lip, voilet with orange yellow blotch on the palate surrounded by a radiating white hallow, shortly pedicellate, erect, long spurred. *Bracts ca* 0.5 mm, basifixed, oblong, obtuse, erect, closely supressed to the pedicel. *Bracteole ca* 1.0 mm similar to bracts but longer, erect on either side of the bract on the some level with a slight gap. *Pedicel ca* 2 mm, hispid hairy, erect, capillary. *Calyx ca* 3.0 × 3.5 mm, deeply bilobed ; lobes subequal, ovate, concave, entire, obtuse or blunt at tip, closely appressed corolla, densely hairy externally, faintly 8 nerved. *Corolla ca* 4 mm across, conspicuous, deeply bilobed, deciduous, long spurred. *Upper lip ca* 5 × 2 mm, up to one and a half times as long as the upper calyx lobe, obovate, erect, and slightly retuse at tip, abruptly cuneate with a short concave broad base, minutely papillose along the margin at the base, reticulately 4 - nerved, hyaline. There are two short ovate lamellae above the concave base being separated by a semicircular ridge. *Lower lip ca* 4 mm across semiorbicular, reticulately nerved, usually 4— to 5— lobed (rarely 2 or 3) ; lobes shallow and unequal, strongly reflexed and not hugging the spur, much shorter than it, palate raised and with two short humps. *Spur ca* 8 mm long projecting much beyond the lower lip, horizontal, infundibular, abruptly narrowed to obtuse tip, with a subterminal constriction, sparsely hairy ; hairs long and short, multicellular. Androecium and Gynoecium within the basal cavity of the upper lip of the corolla. *Stamens* two, held in front of the ovary ; filament incurved, *ca* 1 mm long, uninerved, dialated at base. *Ovary ca* 2 mm, with a short neck ; stigma discoid, subpeltate, subsessile. *Capsule ca* 3 × 2 mm, erect, smooth, ovoid, concealed

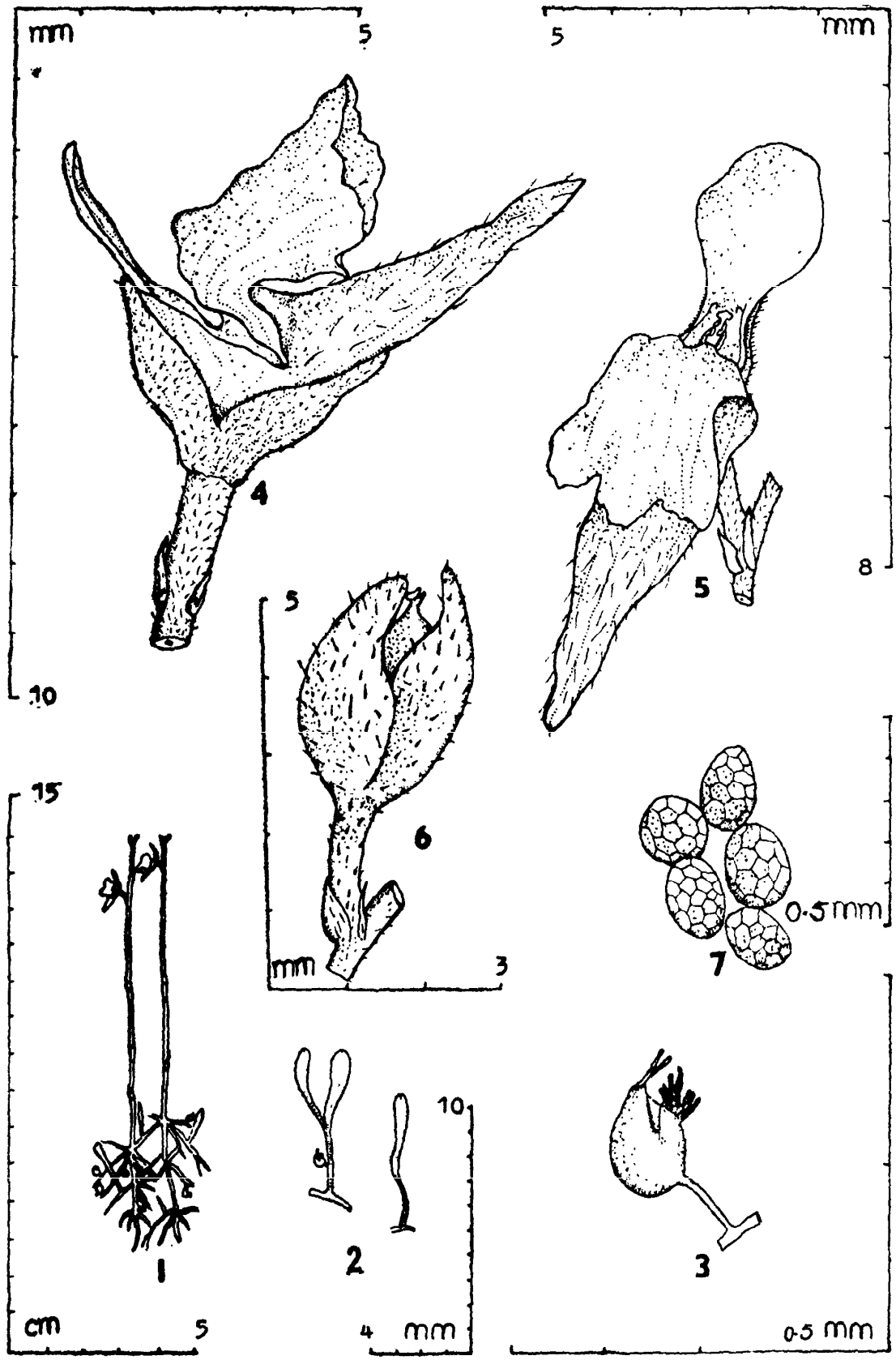


Plate XI : Figs. 1-7.

Utricularia tayloriana Joseph & Mani : 1. habit. 2. leaves. 3. bladder. 4. flower (lateral view). 5. flower (front view). 6. capsule with persistent calyx. 7. seeds.

within the persistent accrescent calyx ; seeds *ca* 0.2 mm, more or less spherical to ovoid, testa cells distinct, isodiametric.

Plate XI : figs. 1-7.

Fl. & Fr. : August September.

alt. : 1000 1500 m.

Pynursla, Jowai.

J. Joseph 73568 ; *K.M. Joseph* 79368 ; *H. Deka* 77232.

U. hitra Klein reported by the senior author (Joseph & Ramamurthy 1961) from peninsular India is more or less similar to this new species but distinct mainly in having entirely different morphology for the corolla with a constriction of the upper lip about the middle, conspicuously raised hump with 2 yellow dots and spur being retuse at tip with 2 lateral yellow spots about the middle and in the general lobulation of the lower lip.

4. **Utricularia pubescens** Sm. in Rees, Cyclop. 37(53) : 1819 ; P. Taylor in Kew Bull. 18(1) : 101 107. 1964 ; Saxena, H. O. in Indian For. 91 : 73 75. 1965 ; Rao, A. S. & Joseph, J. in Indian For. 93 : 32 33. 1967.

Distribution : Found throughout tropical Africa from Guinea to Angola, South America and India.

Ephemeral slender herbs, on moist soil, amidst moss and grasses, on hill slope.

Rhizoids thread like, several, much branched. *Leaves* few to several at base of scape and on stolons ; petiole *ca* 2.5 mm long, stout, peltate ; amina discoid, fleshy, entire, 1 to 5 mm across, papillose, mucus covered. *Bladders ca* 0.5 mm in diameter, several on petioles and rhizoids, slender stalked, globose, upper lip projecting, orifice rim studded with gland tipped hairs. *Inflorescence* 2.5 to 6.5 cm tall, slender, setulose, dark-purplish, 2 to 5 flowered, with one or two distant scales. *Flowers* 5 7 mm long, subsecund, subsessile, distant, bright mauve with a median darker band on the lower lip ; bracts and bracteoles basifixed, ridged at base. *Bracts* subequal in length, twice as broad as bracteoles. *Calyx* bilobed, subequal, dark-purplish ; the lower lobe bidentate at its tip. *Corolla* : upper, lip *ca* 3.5 2.0 mm broad and concave at base, strap shaped above and arched, margins finely puberulent at base, glabrous above ; lower lip *ca* 3.5 2.5 mm, reflexed, hugging the spur, distinctly double crested and tuberculate at the palate, obscurely 3 lobed. *Spur* 4 to 6 mm long, porrect, longer than the lower lip, obtuse. *Stamens* two, within the concavity of the upper lip. *Ovary* globose, style distinct ; stigma unequally bifid, obtuse. *Capsule* concealed within the slightly accrescent persistent calyx ; seeds many, minute, obovoid to obcuneoid ; testa brown, reticulate.

Plate XII : figs. 1-8.

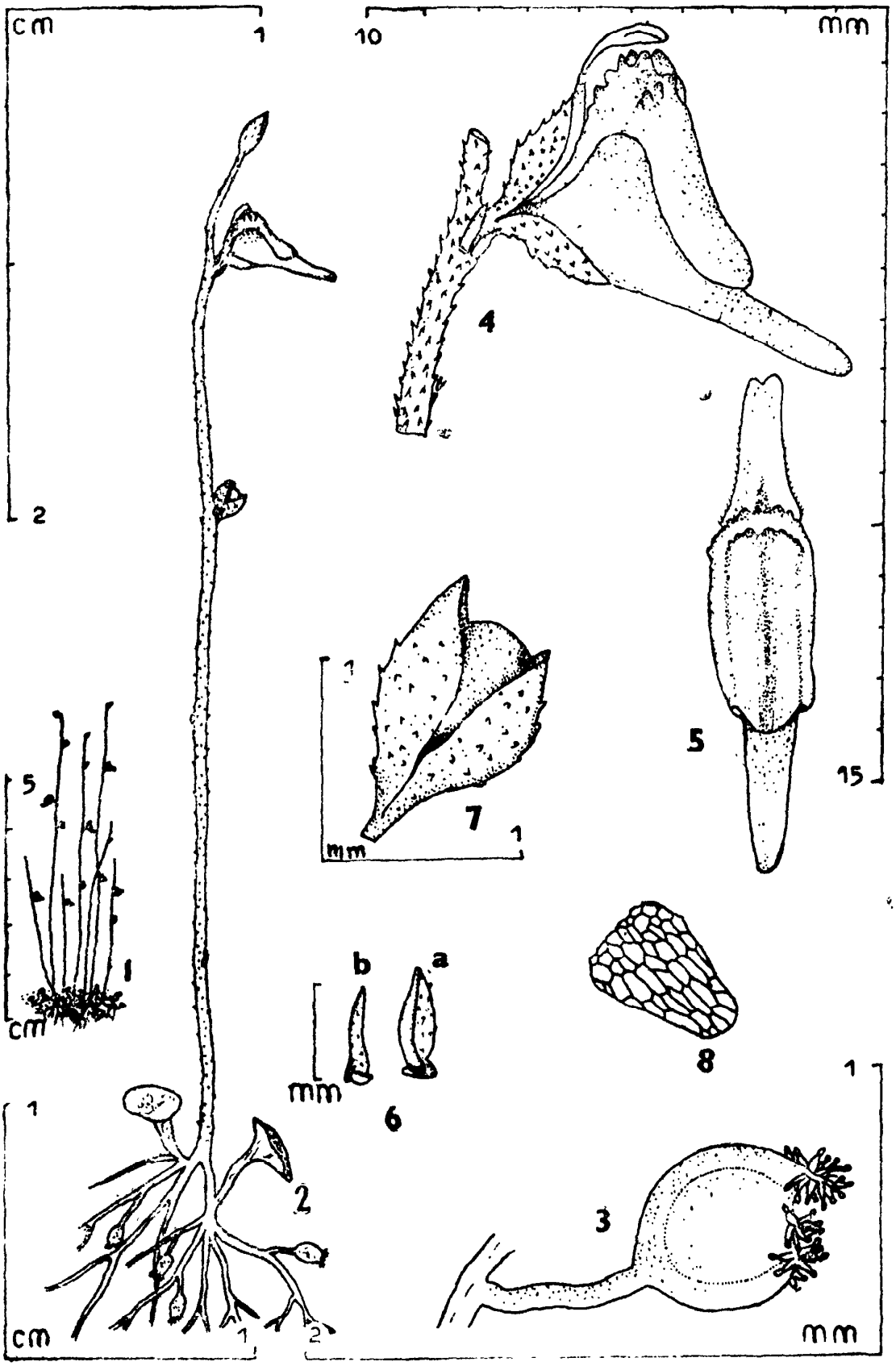


Plate XII : Figs. 1-8.

Utricularia pubescens Sm. : 1. a clump of plants. 2. single plant. 3. bladder. 4. flower (lateral view). 5. flower (top view). 6. a. bract, b. bracteole. 7. capsule with persistent calyx. 8. seed (not to scale).

Fl. & Fr. : June August.

alt. : 1000 m.

Barapani.

A. S. Rao 45172. (more than a dozen specimens).

Fresh specimens could not be collected for the present study in spite of thorough search from the area of previous report or anywhere else.

5. **Utricularia stanfieldii** P. Taylor in Taxon 12 : 294. 1963 ; & in Kew Bull. 18(1) : 88 91. t. 28 & 29. 1964 ; Joseph & Mani in Bull. Bot. Surv. India 24(1 4) : 109 111. 1982.

Distribution : West Africa and North East India.

Ephemeral erect terrestrial yellow flowered herbs not gregarious, in moist sandy soil overlying rocks and stones.

Rhizoids 5 6, from the base of the scape with many bladders, branched. *Leaves ca* 5 mm long, a few very linear at the base of the scape and also along the rhizoids, uninerved, with a few bladders along the margins. *Bladders ca* 1 mm long (with stalk), ovoid, mouth oblique, more on the rhizoids, long stalked. *Scape* 2 to 4 cm tall, erect, usually with only one flower at the apex, simple, capillary, finely papillose towards the base and smooth above. *Scale ca* 1 mm long, 2 to 5 on the scape, elliptic, both scales and bracts closely adpressed to the axis, attached about the middle, persistent ; the portion above the attachment *ca* 2.5 times longer than the lower part and acute to acuminate at apex ; lower portion obtuse at tip. Flowers long pedicellate, bright yellow, usually solitary (rarely two), many alternating sterile bracts in the African specimen (Taylor *loc. cit.*), bracteate, ebracteolate. *Bracts* similar to scales but slightly larger and oblong. *Pedicels* 3 to 5 mm long, slender, erect. *Calyx* bilobed ; lobes subequal, cupular, prominently 6 nerved ; nerves converging and united at the apex. Corolla bilobed with a conspicuous raised bigibbous palate ; upper lobe *ca* 3 × 3 mm, 2.5 times longer than the calyx lobe, orbicular ; lower lip *ca* 6 mm broad, very conspicuous and larger than the upper, deflexed, 3 lobulate, shortly clawed at the base ; mid-lobe slightly larger than the side ones. *Spur* arising from a conical base, shortly acuminate, as long as the lower lip or slightly shorter, held closely below and concealed by the lip. *Capsule ca* 1 mm in diameter, globose, with slightly accrescent and closely enveloping calyx ; seeds ovoid, faintly longitudinally striated.

Plate XIII : figs. 1-8.

Fl. & Fr. : August - September.

alt. : 1450 m.

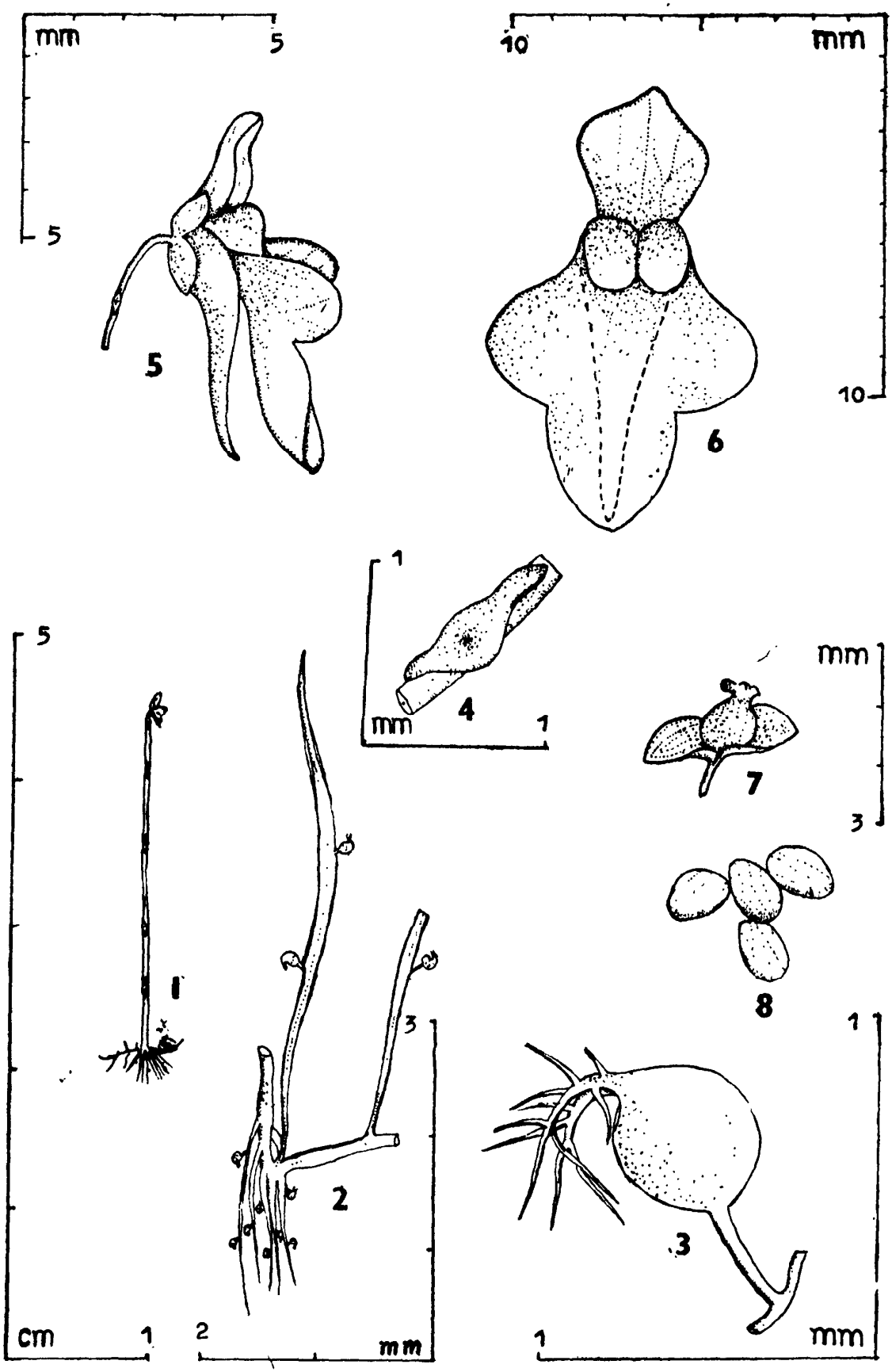


Plate XIII : Figs. 1-8.

Utricularia stanfieldii P. Taylor : 1. habit, 2. basal portion, 3. bladder, 4 scale, 5. flower (lateral view), 6. flower (front view), 7. capsule with persistent calyx (spread out), 8. seeds (not to scale).

Jarain.

J. Joseph 50993.

6. **Utricularia bifida** L. Sp. Pl. 18. 1753 ; Clarke in Hook. f. Fl. Brit. India 4 : 332. 1884 ; Gamble, Fl. Pres. Madras 2 : 688. 1957 (repr.) ; Abraham & Subramanyam in Proc. Indian Acad. Sci. 62 B : 98. 1965.

Distribution : Throughout India, Nepal, Ceylon, Malacca, and E. Asia from Japan to Borneo and Philippines.

Simple yellow flowered terrestrial herbs, ubiquitous on the moist slopes along the way side, scattered.

Rhizoid a few from the base of the scape, filamentous, branched (spinuliferous), with bladders and leaves. *Leaves* up to 16 mm long, numerous during anthesis, linear spathulate, uninerved, simple. *Bladders ca* 1 mm long, globose, short stalked ; stalk *ca* 0.4 mm long ; mouth basal ; upper lip with only two recurved short horn like antennae. Scape 3 to 24 cm tall, slender, terete. *Scales ca* 2 mm long, usually two (rarely more up to five), basifixed, appressed to the scape triangular, obtuse. *Flowers ca* 3 mm broad across the lower lip, bright yellow, in 2 to 7 - flowered raceme, lax, bracteate bracteolate, shortly pedicellate. *Bracts ca* 3 mm, basifixed, erect, appressed to the pedicel, ovate, acute. *Bracteoles ca* 1 mm long, much narrower than bract, subulate, erect, acuminate. *Pedicel ca* 3.5 mm long, laterally compressed and narrowly winged, recurved in fruit or not. *Calyx lobes ca* 4 mm, ovate obtuse, persistent ; upper lobe slightly larger than the lower. Corolla : upper lip *ca* 5 × 3 mm, 6 to 8 nerved, obovate ; lower lip *ca* 5 × 3 mm, orbicular obtuse, reflexed, with or without a small median erect scale towards the base ; palate prominently bigibbous. *Spur* 6 8 mm, much longer than the lower lip, projecting downwards and slightly curved inwards at tip. *Stamens ca* 1.5 mm long, filament laterally winged or not. *Ovary ca* 2 × 1 mm, ovoid ; stigma bilobed, very unequal. *Capsule ca* 2.5 ×2.5 × 1.5 mm, laterally compressed, usually arcuate, dehiscing longitudinally ; seeds *ca* 0.5 × 0.25 mm, rotund, numerous, prominently reticulate, cells anisodiametric.

Plate XIV : figs. 1-3 ; Plate XV : figs. 1-7.

Wide range of variations has been perceived in the size of plants, in the length of the inflorescence, number and size of flowers.

Fl. & Fr. : August November.

alt. : 200 - 1800 m.

Common throughout Khasi and Jaintia Hills - Shillong, Barapani, Nongpoh, Jowai, Raliang, Garampani, Jarain, Pynursla, Tura.

Balakrishnan 50145, 46998, 46117 ; *G.K. Deka* 18683, 17071, 18300 ;

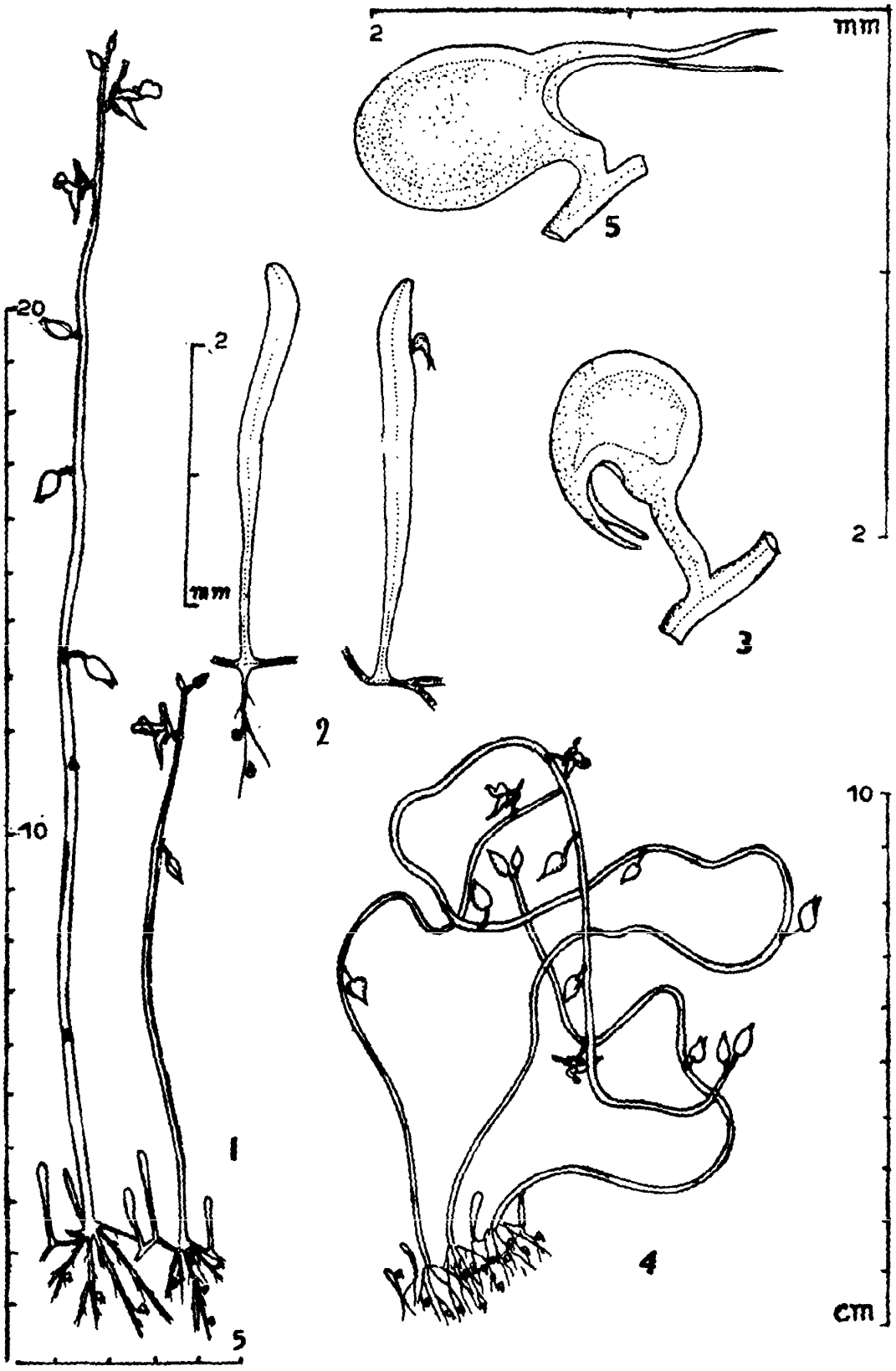


Plate XIV : Figs. 1-5.

Utricularia bifida L. : 1. habit. 2. leaves. 3. bladder. *U. scandens* Benj. 4. habit. 5. bladder.

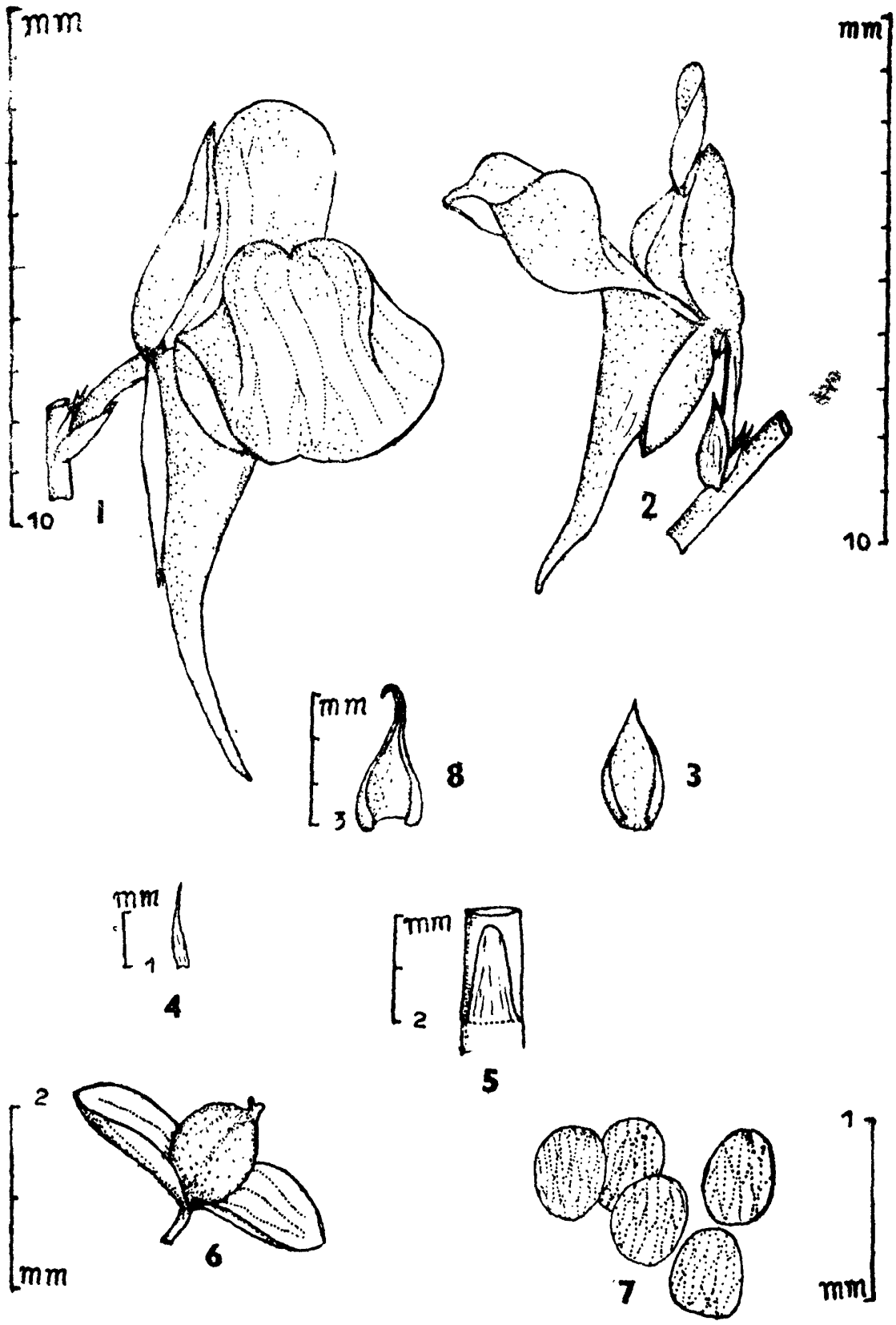


Plate XV : Figs. 1-7.

Utricularia bifida L. : 1. flower (front view), flower2.(lateral view), 3. bract, 4. bracteole, 5. scale, 6. capsule with persistent calyx (spread out). 7. seeds. *U. scandens* Benj.: 8. bract.

H. Deka 76949 ; *N. C. Deori* 38294 ; *Joseph* 76936, 76947 ; *Joseph K. M.* 76941 ; *Panigrahi* 4191 ; *Y. Kumar* 5403 (NEHU).

Medicinal uses : Plant used in urinary diseases.

7. **Utricularia scandens** Benj. in Linnaea 20 : 309. 1847 ; Balakrishnan, Fl. Jowai 2 : 343. 1983. *U. wallichiana* Wt. Ic. Pl. Ind. Or. 4(4) : 9 t. 1572. 1850 ; Clarke in Hook. f. Fl. Brit. Ind. 4 : 332. 1884 ; Gamble, Fl. Pres. Madras 2 : 688. 1957 (repr.) : Kanjilal *et al.* Fl. Assam 3 : 470. 1939.

Distribution : Khasi hills, S. Deccan Peninsula and Ceylon.

Terrestrial herbs with yellow flowers, stem slender, often branched, twining, with very restricted distribution. Very much similar to *U. bifida.*

Rhizoids numerous from the base of the scape, branched, capillary, smooth, bearing linear spathulate leaves and short stalked bladders. *Leaves ca* 13 mm long, spathulate, numerous during anthesis, uninerved, green, obtuse at apex. *Bladders ca* 1 mm, globose, short stalked, numerous ; mouth basal with two antennae ; antenna porrect, longer than the bladder. *Scape* 4 to 24 cm long, twining, glabrous. *Scape ca* 3 mm, ovate-lanceolate, acuminate. *Flowers ca* 10 mm to the tip of spur and *ca* 9 mm across the lower lip, bright yellow, 2 to 6 flowered raceme, lax, bracteate, bracteolate, pedicellate. *Bracts ca* 2 mm long, basifixed, narrowly lanceolate, acuminate. *Bracteoles ca* 1 mm, similar to bracts, arranged on either side of the bract. *Pedicel* 3.5 mm or more long, 4 ridged towards the base, laterally compressed towards the tip. *Calyx lobes ca* 3 mm, broadly ovate ; upper lobe *ca* 3.0 × 2.5 mm, abruptly acuminate ; lower lobe *ca* 3 × 2 mm, narrowly ovate, acute to acuminate. *Corolla* : upper lip *ca* 5 × 4 mm, entire, obovate, wavy at margin, faintly nerved, dark violet striations from the base reaching up to 1/3 of the lip ; lower lip *ca* 6 9 mm, much larger than the upper, flabellate orbicular, entire, uneven at margin, palate prominent, deep yellow. *Spur ca* 7 mm, more or less equal to the lower lip, curved outwards, acuminate. *Stamens ca* 1.5 mm long, filiform; anther thecae distinct. *Ovary ca* 2 × 1 mm, laterally compressed, ovate ; stigma bilobed. *Capsule* (not collected by the authors).

Plate XIV : figs. 4&5 ; Plate XV : figs. 8

Fl. : September.

alt. : 1500 m.

Jowai, Pynursla.

Balakrishnan 46871 ; *Joseph* 79364.

8. **Utricularia caerulea** L. Sp. Pl. 18. 1753 ; Wt. Ic. Pl. Ind. Or. 4 (4) : t. 1583. 1850 ; Santapau in Journ. Bombay Nat. Hist. Soc. 49 : 219.

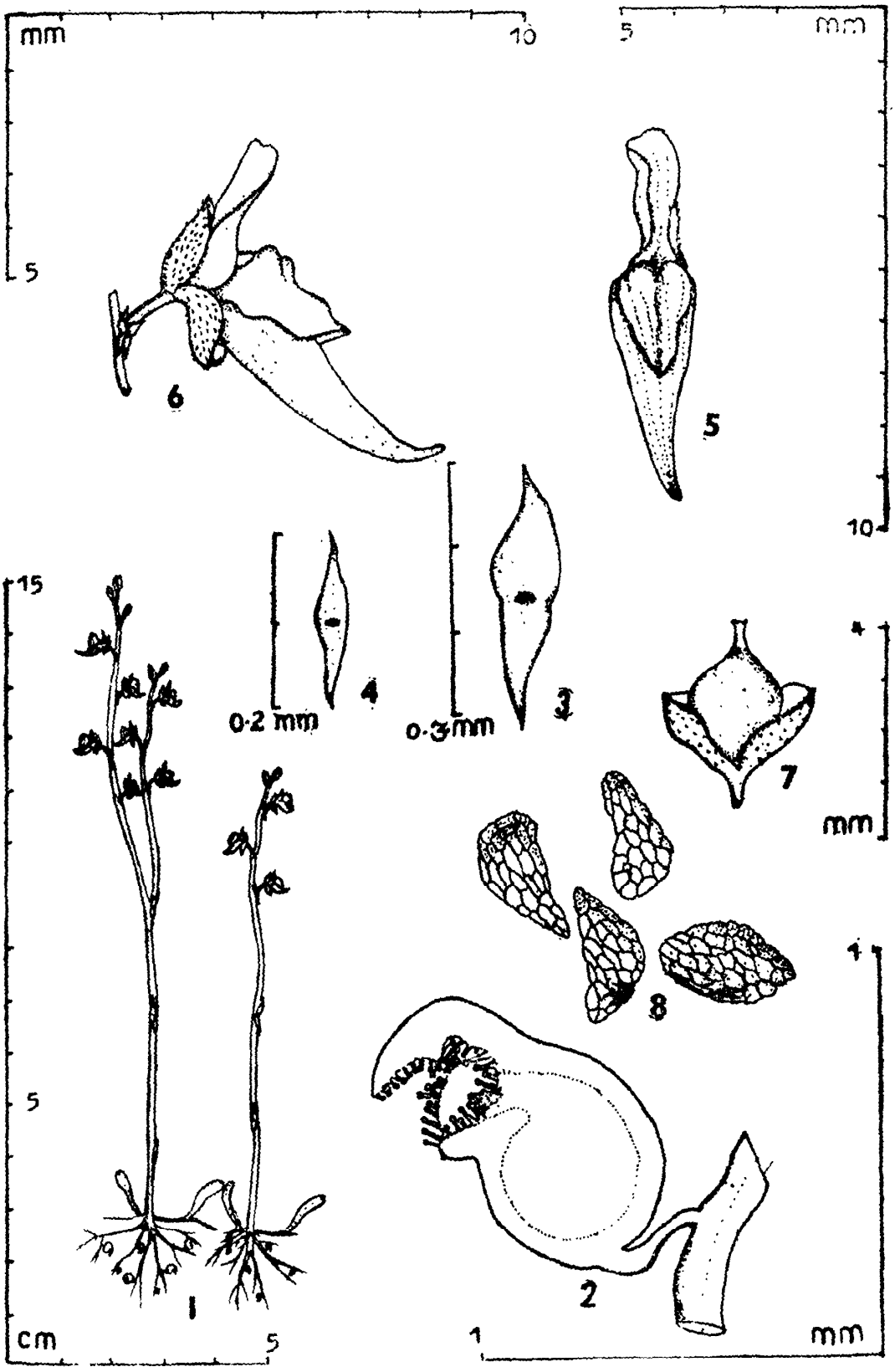


Plate XVI : Figs. 1-8.

Utricularia caerulea L. : 1. habit, 2. bladder, 3. bract, 4. bracteole, 5. flower (front view), 6. flower (lateral view), 7. capsule with persistent calyx, 8. seeds (not to scale).

1950 ; Abraham & Subramanyam in Proc. Ind. Acad. Sci. 62B : 98. 1965. *U. racemosa* Wall. ex DC. Prodr. 8 : 21. 1844 ; Wt. Ic. Pl. Ind. Or. 4(4) : t. 1584(a). 1850 ; Clarke in Hook. f. Fl. Brit. Ind 4 : 332. 1884.

Distribution : Khasi and Jaintia Hills, Chota Nagpur, Deccan peninsula, Ceylon, Cambodia and China.

Terrestrial herbs, not gregarious, with violet or pinkish white shortly stalked flowers, in open moist ground, sometimes found along with *U. bifida.*

Rhizoids numerous from the base of the scape, capillary, slender, branched, bearing short- stalked bladders and spathulate leaves. *Leaves ca* 5.0 × 1.5 mm, linear spathulate, uninerved, very few during anthesis. *Bladders ca* 1 mm. long, ovate ; stalk *ca* 0.2 mm ; mouth terminal; upper lip projecting outwards forming a hood over the mouth, inner side of the hood and the periphery of the mouth covered with single celled gland-tipped short hairs. *Scape* 3 to 15 cm long, slender, capillary erect (rarely branched). *Scale ca* 0.5 × 3 mm, 2 or 3, midfixed, lanceolate, acute at both ends, well appressed to the scape. *Flowers ca* 6 mm to the tip of spur, 3 to 6, bracteate, bracteolate, shortly pedicellate. *Bracts ca* 0.3 mm long, midfixed ; upper ends lobed broader than the lower, lanceolate, acute at both ends. *Bracteoles ca* 0.2 mm long, similar to bracts but narrower and subulate. *Pedicel ca* 1 mm, slender, capillary. *Calyx lobes ca* 2 mm. equal, ovate obtuse, minutely papillose, orbicular and persistant in fruit. *Corolla* pale blue or pinkish upper lip *ca* 3 × 1.5 mm, retuse at tip, faintly veined ; lower lip *ca* 4 × 3 mm, entire and wavy at margin, well hugging the spur ; palate raised. *Spur ca* 4.5 mm long, subhorizontal, slightly curved upwards at tip. *Stamens ca* 1 mm long. *Ovary ca* 1.5 × 1.0 mm, ovate ; stigmatic lobes orbicular. *Capsule ca* 3 × 2 mm, globose, exceeding the fruiting calyx ; seeds *ca* 0.5 mm, irregular in shape, smooth, numerous.

Plate XVI : figs. 1-8.

Fl. & Fr. : September October.

alt. : 100 1500 m.

Barapani, Jowai, Pynursla, Shillong, Tura.

G.K. Deka 18537 ; *Joseph* 7634 ; *Joseph K.M.* 76948 ; *K. Haridasan* 10088 (NEHU).

9. **Utricularia striatula** Sm. in Rees. Cyclop. 37 ; 17. 1819 ; Gamble, Fl. Pres. Madras 2 : 691. 1957 (repr.) ; Taylor in Kew Bull. 18 : 91, 1964. *U. orblculata* Wall. ex DC. Prodr. 8 : 18. 1844 ; Clarke in Hook. f. Fl. Brit. Ind. 4 : 334. 1884. *U. glochidiata* Wt. in Hook. Kew Journ. Bot. 1 : 374. 1859 ; Ic. Pl. Ind. Or. 4(4) ; t. 1581. 1850.

Distribution : Throughout India ; From Nepal to Bhutan, Khasi and Jaintia Hills, W. Deccan, Peninsular India ; Ceylon, Malaya and S. China.

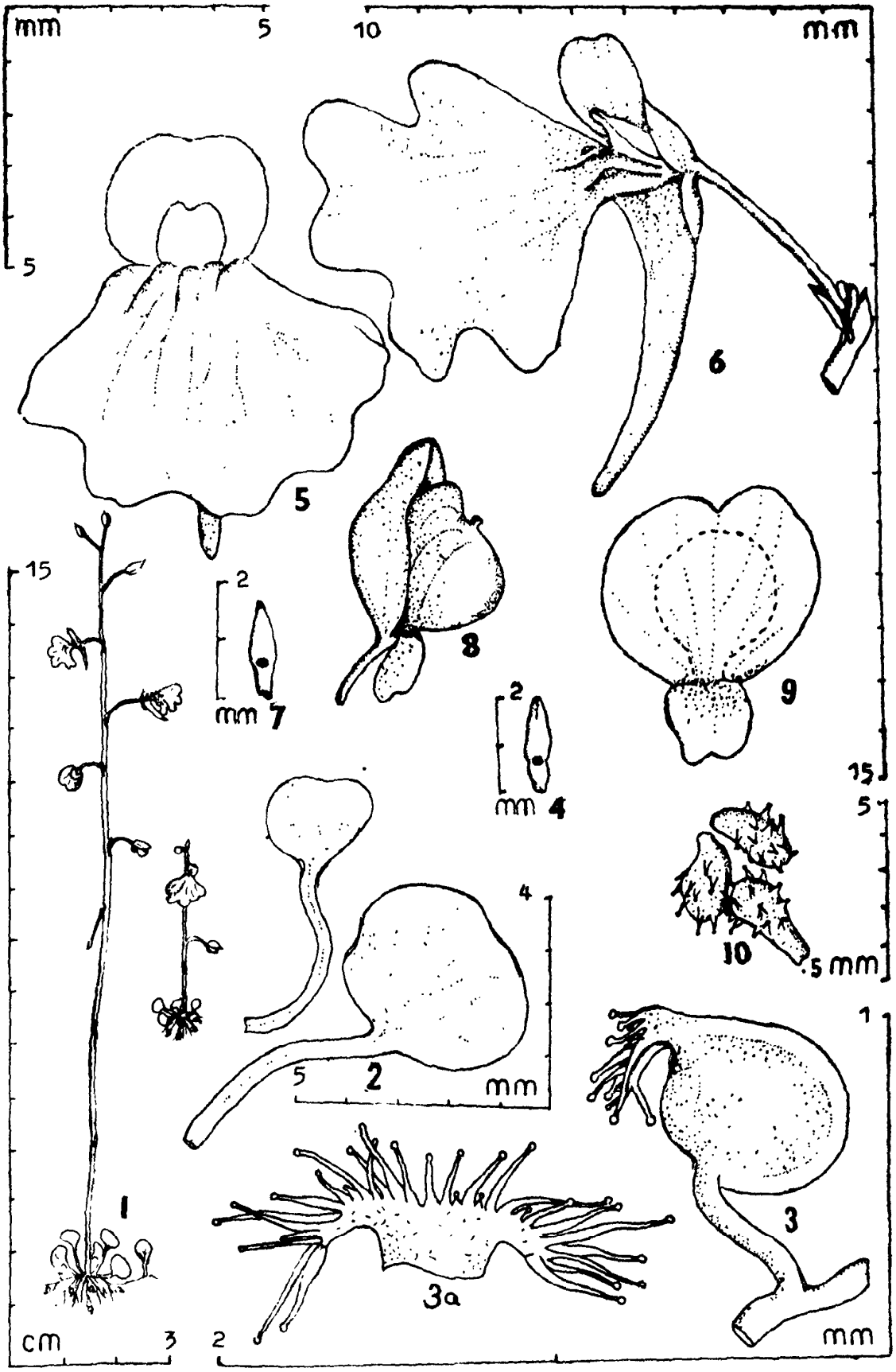


Plate XVII : Figs 1-10

Utricularia siriatula Sm. : 1. habit, 2. leaves, 3. bladder, 3a. upper lip of the bladder (spread out), 4. scale, 5. flower (front view), 6. flower (lateral view), 7. bract, 8. capsule with persistent calyx, 9. calyx, 10. seeds.

Gregarious small herbs with violet flowers, lithophyte or epiphyte at the base of moss covered stems of small trees and woody shrubs.

Rhizoids numerous from the base of the scape, capillary, branched, clad with bladders. *Leaves ca* 7 mm long, numerous at the time of anthesis, arranged in rosette at the base of scape, ovatc to orbicular or reniform, long petiolate; petiole *ca* 4 mm; lamina *ca* 3 mm. *Bladders ca* 0.75 mm, numerous, obliquely ovoid, long stalked; stalk *ca* 0.5 mm; mouth lateral, oblique; upper lobe projecting outwards into two divergent appendages, covered with gland tipped hairs. *Scape* 2 to 14 cm long, erect, filiform glabrous, reddish brown. *Scales ca* 2 mm long, one or two (rarely three), midfixed; upper lobe narrowly lanceolate, acute or obtuse; lower lobe smaller than the upper, irregularly ovate, emarginate. *Flowers ca* 1 cm long to the tip of spur, 1 10, bracteate, bracteolate, pedicellate, *Bracts ca* 1.5 mm long similar to scales, constricted at the point of attachment. *Bracteoles* similar to bracts but smaller. *Pedicel ca* 7 mm slender, capillary, slightly reflexed in fruit. *Calyx* lobes very unequal, emarginate, accrescent; upper lobe *ca* 2.5 mm long, orbicular, 7 to 9 nerved; lower lobe *ca* 1 mm long, reflexed, ovate. *Corolla* white or pinkish white; upper lip *ca* 2 × 2 mm, smaller than the upper calyx lobe and concealed by it; lower lip ca 6 × 6 mm, orbicular to flabellate, porrect, much larger than upper lobe; regularly 5 - lobulate; lobule rounded; palate slightly raised. *Spur ca* 6 mm, subulate, slightly inflexed, obtuse. *Stamens ca* 1 mm long, filiform, incurved. *Ovary ca* 1 mm, globose; style short; stigma bilobed; lower lobe semiorbicular; upper obsolete. *Capsule ca* 2.0×2.5 mm, globose, obliquely dorsi-ventrally compressed, dehiscing vertically; seeds *ca* 0.5 mm long, many, sub-ovid glochidiate.

Plate XVII : fig. 1-10

Fl. & Fr. : August - October.

alt. : 100 - 1500 m.

Jowai, Mawphlang, Pynursla, Shillong.

G.K. Deka 21634. 18351; *N.C. Deori* 38295; *Joseph* 76935; *Panigrahi* 4741.

10. **Utricalaria furcellata** Oliver in Journ. Linn. Soc. 3 : 189. 1859; Clarke in Hook. f. Fl. Brit. Ind. 4 : 334. 1884.

Distribution : Sikkim Himalaya, Darjeeling, Khasi and Jaintia Hills.

Gregarious small terrestrial herbs found on moist rocks with purplish pink flowers and rosette of leaves at the base of the scape.

Rhizoids few at the base of the scape, capillary, bearing numerous bladders. *Leaves ca* 1 cm long, broadly spathulate orbicular, numerous at the time of anthesis (*ca* 9), lushy green, arranged in rosette at the base

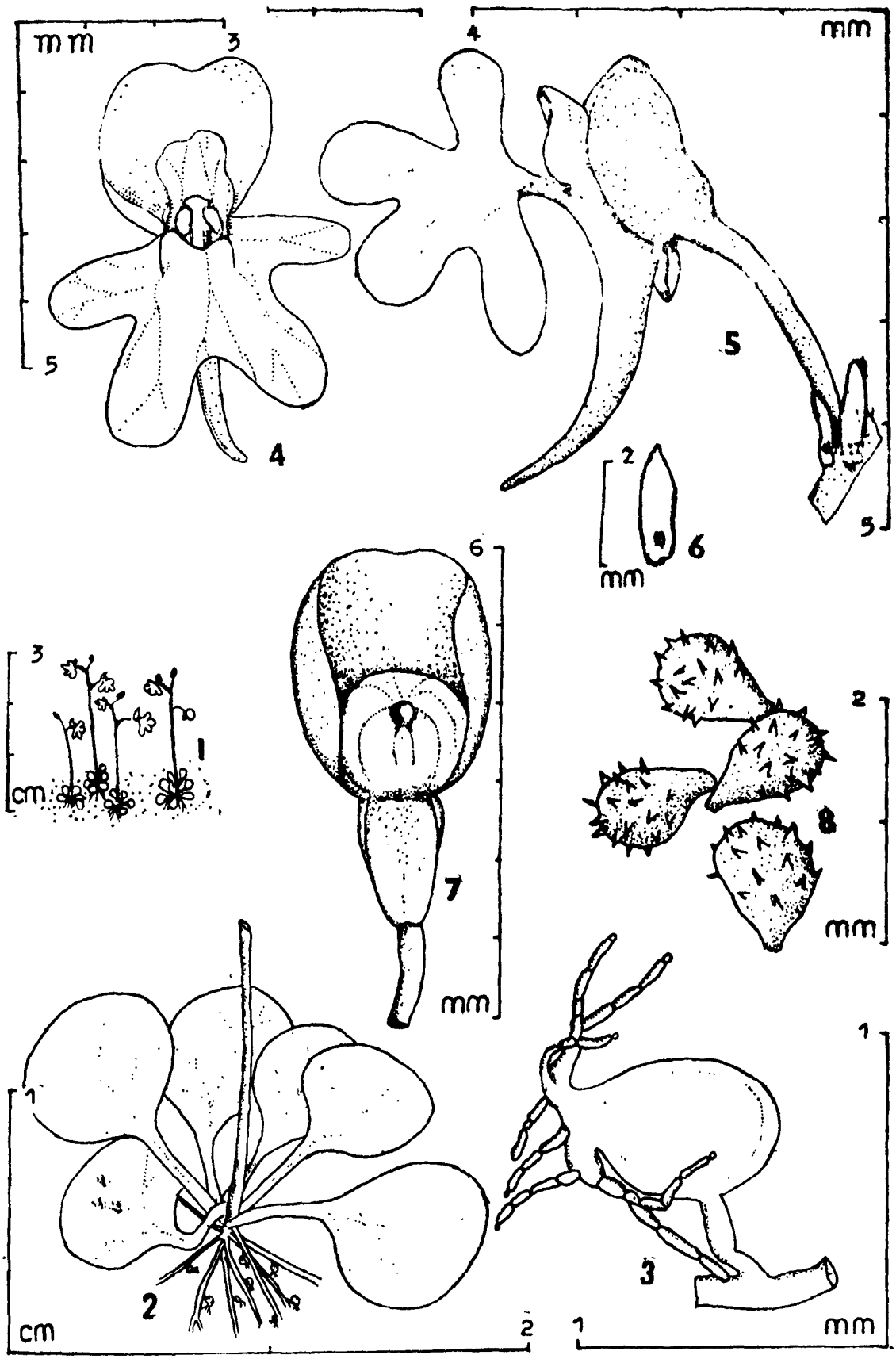


Plate XVIII : Figs. 1-8.

Utricularia furcellata Oliver : 1. habit, 2. basal portion of the scape with leaves, 3. bladder, 4. flower (front view), 5. flower (lateral view), 6. bract, 7. capsule with persistent calyx, 8. seeds.

of the scape; lamina 1 - 6 mm. *Bladders ca* 1 mm (without stalk), horizontal; stalk *ca* 0.25 mm, mouth lateral, oblique; upper lip bifurcate into two divergent appendages with a few multicellular gland tipped hairs. *Scape* 2 7 cm, capillary, slender, erect, rarely branched, scales absent. Flowers *ca* 4 mm to the tip of spur, 3 6, purplish pink, bracteate, bracteolate, pedicellate. *Bract ca* 2 mm long, midfixed, well, appressed to the pedicel, ovate-obtuse. *Bracteoles ca* 1 mm long, arranged on either side of the bract, similar to bracts. Pedicel *ca* 3.5 mm, capillary green, slender. *Calyx* lobes very unequal, accrescent; upper lobe *ca* 2 × 3 mm, orbicular-obcordate; much longer than lower, lobe; lower lobe *ca* 1 mm long, smaller to upper lobe. *Corolla*: upperlip *ca* 1.5 × 1.0 mm similar to upper calyx lobe, faintly nerved, minutely papillose at the basal margins; lower lip *ca* 3 × 2 mm, throat deep yellow, with violet and white border at margin, deeply 4 lobed, minutely papillose at base; lobes unequal, faintly nerved. *Spur ca* 3.5 mm, longer than the lower lip, inflexed, obtuse. *Stamens ca* 1 mm, filiform. *Ovary ca* 1 × 1 mm, globose, adnate to the calyx lobe; style short, stigma 2 lobed. *Capsule ca* 2 mm, globose, obliqnely dorsiventrally compressed, well within the accrescent upper calyx lobe; lower fruiting calyx lobe reflexed; seeds *ca* 1 mm, ovoid, numerous, glochidiate, hilum prominent, lateral.

Plate XVIII, figs. 1-8.

Fl. & Fr. : August October.

alt. : 1500 m.

Shillong, *Joseph.* 76932.

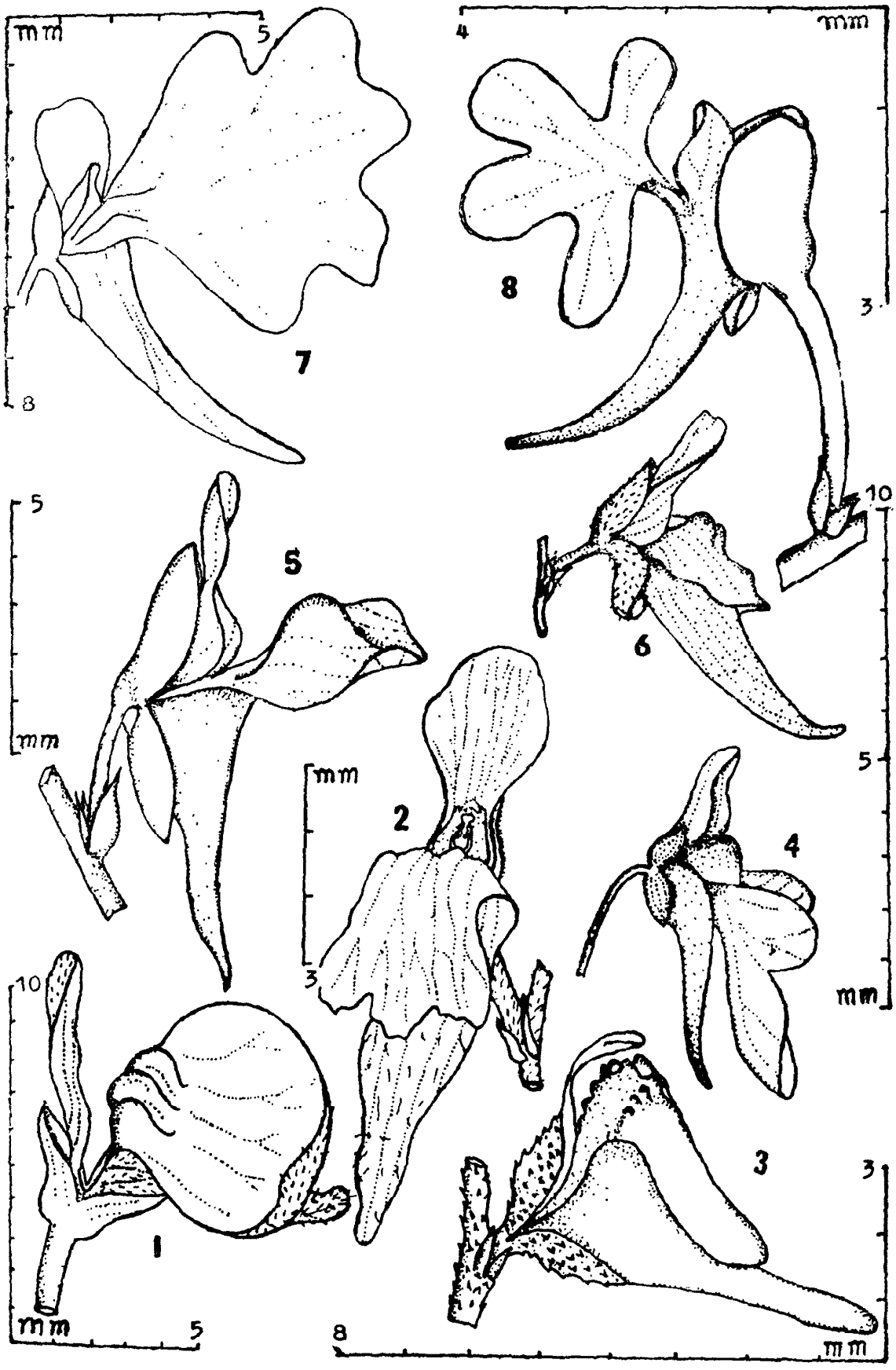


Plate XIX : Figs. 1-8.

Utricularia L. : Flowers of different species dealt with.

1. U. stellaris L., 2. U. tayloriana Joseph et Mani, 3. U. pubescens Sm., 4. U. stanfieldii P. Taylor, 5. U. bifida L., 6. U. caerulea L., 7. U. Striatula Sm., 8. U. furcellata Oliver.

Plate I : Map showing the present distribution of insectivorous plants in Meghalaya.

1. *Utricularia khasiana* Joseph & Mani
2. *U. stellaris* L.f.
3. *U. tayloriana* Joseph & Mani
4. *U. pubescens* Sm.
5. *U. stanfieldii* P. Taylor
6. *U. bifida* L.
7. *U. wallichiana* Wt.
8. *U. caerulea* L.
9. *U. striatula* Sm.
10. *U. furcellata* Oliver

●. *Drosera burmannii* Vahl

+. *D. peltata* Sm. var. *lunata* Clarke

▲. *Nepenthes khasiana* Hook. f.

REFERENCES

Abraham, V. & K. Subramanyam, 1965. Studies on seeds of various taxa of *Utricularia* occurring in West Bengal. *Proc. Indian Acad. Sci.* 62B : 97 102.

Balakrishnan, N.P. 1981. Flora of Jowai, 2 vols. Calcutta.

Basak, R.K. 1978. Distribution of carnivorous plants in West Bengal. *Bull. Bot. Surv. India* 17 (1 4) : 97 103.

Clarke, C.B. 1884. Lentibulariaceae, in Hook. f. Flora of British India 4 : 328 336.

Joseph, J. 1978. Future strategical approach of florestic studies and Belt Biosphere Conservation (B. B. C.). Paper presented in the Futurology workshop at Regional Research Laboratory, Jorhat.

——— 1980. Conservation is Preservation plus Regeneration. Proc. of the Symposium Development without destruction, Forest Dept., Meghalaya (H.C. Saratchandra, J. Joseph and N. Goswami Ed.) 106 111.

——— 1982. Report of the task force on environment and development in Sikkim. Department of Environment, Govt. of India, New Delhi.

——— 1983. Flora of Nongpoh. Forest Dept., Meghalaya.

——— & K. Ramamurthy, 1961. Occurrence of *U. hirta* in S. India. *Journ Bombay Nat. Hist. Soc.* 58 : 701 703.

Kanjilal, U.N. *et al.* 1934 1940. Flora of Assam, 5 vols. (Vol 5 by N.L. Bor), Shillong.

Lawrence Millichamp, T. 1979. The occurrence of Ladyslipper orchids and insectivorous plants, Part I. *Orchid Digest.* 43 (3) : 108 113.

Lloyd, F.E. 1942. The carnivorous plants. Chronica Botanica Co. Waltham.

Oliver, D. 1859. The Indian species of *Utricularia. Journ. Proc. Linn. Soc. Bot.* 3 : 170 190.

Paul, A.Z. 1961. Plants that eat insects. *National Geographic.* 119 (5) : 640 660.

——— 1964. Malayaias Giant Flowers and Insect traping plants. *Ibid.* 125 (5) : 680 - 701.

Rao, A.S. & J. Joseph. 1967. *Utricularia pubescens* Sm.—First report of its occurrence in India. *Indian Forester* 92 : 32 33.

Robert Wight, 1850. Icones Plantarum Indiae Orientalis

Santapau, H. 1960. Notes on the Lentibulariaceae of Bombay. *Journ Bombay Nat. Hist. Soc.* 49 : 217 221.

Saxena, H.O. 1965. *Utricularia pubescens* Sm. A new record for India. *Indian Forester* 91 : 73 75.

——— 1966. *Utricularia arenaria* A. DC.—A new record for India from Madhya Pradesh. *Ibid.* 92 : 493 494.

——— 1970. *Utricularia australis* R. Br.—A New record for India from Indore (Madhya Pradesh). *Ibid.* 96 : 249 250.

Subramanyam, K. 1962. Aquatic Angiosperms. Lentibulariaceae. C.S.I.R. Botanical Monograph No. 3 : 32 38.

———1977. Studies on the Indian *Utricularia* L. 1. *U. minutissma* Vahl. History and distribution in India. *Vignana Bharati* 3 : 76 81.

——— 1979. Studies on the Indian *Utricularia* L.—A review. *Journ Indian Bot. Soc.* 58 (8) : 1 16.

——— & V. Abraham, 1967. Studies on the traps of some Indian species of *Utricularia* L. *Bull. Bot. Surv. India* 9 : 201 205.

——— & N.P. Balakrishnan, 1960. *Urticularia lilliput* Pelligrin—A new record for India *Ibid.* 2 : 347 348.

——— & L.K. Banerjee, 1968. *Utricularia roseo-purpurea* Stapf. ex Gamble (Lentibulariaceae)—A little known species. *Ibid.* 10 : 103 106.

Taylor, P. 1964. The genus *Utricularia* L. (Lentibulariaceae) in Africa (South of Sahara) and Madagascar. *Kew. Bull.* 18 (1) : 1 245.

INDEX TO BOTANICAL NAMES