STUDIES ON SEEDS OF VARIOUS TAXA OF *UTRICULARIA* OCCURRING IN WEST BENGAL

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Oliver (1859) states, "Finally I may be allowed to express my conviction that in the investigation of the development and general morphology of the bladderworts, there is a wide field for extended observation, and I believe that a monograph of the genus thoroughly worked out in respect of these would be, although a work of much labour and difficulty, a most valuable contribution to science". Muenscher (1944, p. 320) also while describing the seeds of *Utricularia* remarks, "Seeds various and mostly characteristic for each species". Recently Santapau (1952, p. 217) in his notes on the Lentibulariaceae of Bombay has pointed out that "A monograph on the family or at least on the genus *Utricularia* is long overdue". Very recently, Taylor (1964) has published a detailed monograph on the genus *Utricularia* L. in Africa and Madagascar.

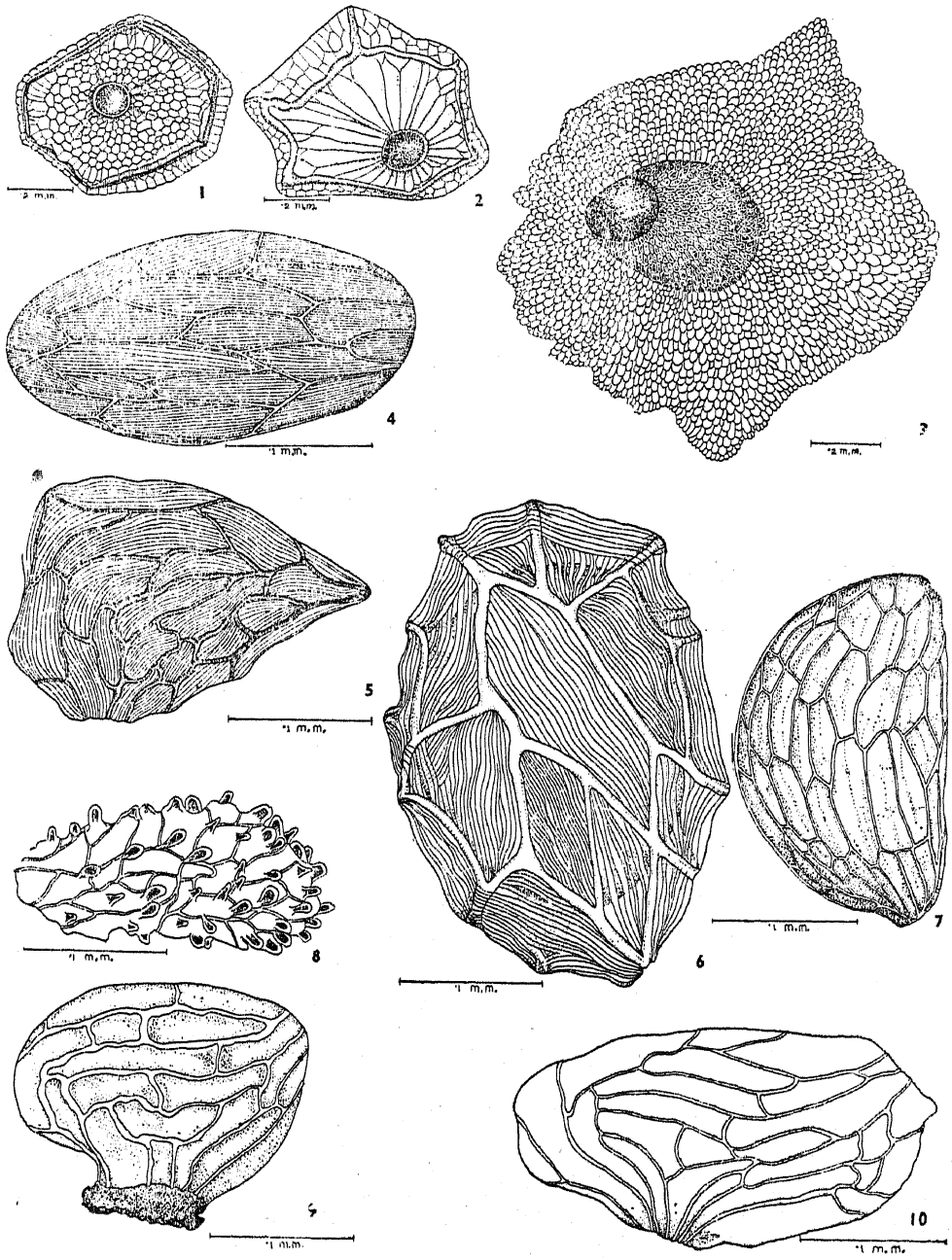
Since the exomorphic characters in seeds of various species of *Utricularia* are distinct, a comprehensive study has been undertaken. The present account deals with the external morphology of the seeds of ten taxa of *Utricularia* occurring in West Bengal (Prain, 1963). Herbarium specimens of all these taxa are present in the Central National Herbarium, Botanical Survey of India, Sibpur, and the seeds from them have been carefully studied. Since it is rather difficult to have all vegetative and reproductive parts properly preserved in the herbarium sheets, fresh materials of many of these taxa were collected round about Calcutta and the exomorphic characters of the seeds were examined under the microscope. Measurements of one hundred seeds of these taxa have been taken and it was noticed that they differ from species to species (*see* Table I).

It will be seen from this table that among these ten taxa, the seeds of *U. gibba* subsp. *exoleta* are largest in size with a length breadth measurement of 1427/1193 μ; they are comparatively the smallest in *U. nivea* with a length/breadth measurement of 223/108·3 μ. The length and breadth ratio in microns in the seeds of *U. inflexa* var. *stellaris* and *U. aurea* are the same.

TABLE I

Taxa	Length in microns	Breadth in microns
1. *Utricularia gibba* subsp. *exoleta*	1427	1193
2. *U. inflexa* var. *stellaris* ..	802·4	802·4
3. *U. aurea*	829·6	829·6
4. *U. stricticaulis*	329	174·2
5. *U. baouleënsis*	301	170·2
6. *U. bifida*	405·5	261·3
7. *U. caerulea*	256	147
8. *U. nivea*	223	108·3
9. *U. hirta*	276·2	207·5
10. *U. scandens*	324·4	172·3

It is seen that the seeds of the ten taxa differ from one another in their shape, pattern of arrangement of epidermal cells of the seedcoat, presence of striations on the outer surface, presence of epidermal projections and wings. An artificial dichotomous key has been proposed for their classification at the end of the paper. In *Utricularia inflexa* Forsk. var. *stellaris* (L.f.) P. Taylor (= *U. stellaris* L.f.) and *U. aurea* Lour. (= *U. flexuosa* Vahl) the seeds are tabular prismatic and have a faint winged margin (Figs. 1, 2). But in *U. gibba* L. subsp. *exoleta* (R.Br.) P. Taylor (= *U. exoleta* R.Br.) they are lenticular and each seed has a prominent, corky, crenulate wing made up of loosely arranged cells (Fig. 3). Among the remaining taxa which are terrestrial and semi-marshy the seeds are ovoid in *U. nivea* Vahl (= *U. racemosa* Wall. ex DC. var. *filicaulis* Clarke) and *U. hirta* Klein (Figs. 8, 9), obovoid (Figs. 4, 5, 6, 7) in *U. stricticaulis* Stapf (=*U. reticulata* Smith var. *uliginosa* Clarke), *U. baouleënsis* A. Chev. (= *U. scandens* sensu Prain), *U. bifida* L. and *U. caerulea* L. (= *U. racemosa* Wall. ex DC.) and ellipsoid (Fig. 10) in *U. scandens* Benj. (= *U. wallichiana* Wt.).



FIGS. 1–10. Seeds of ten species of *Utricularia.* Fig. 1. *U. inflexa* var. *stellaris*; Fig. 2. *U. aurea*; Fig. 3. *U. gibba* subsp. *exoleta*; Fig. 4. *U. stricticaulis*; Fig. 5. *U. baouleënsis*; Fig. 6. *U. bifida*; Fig. 7. *U. caerulea*; Fig. 8. *U. nivea*; Fig. 9. *U. hirta*; Fig. 10. *U. scandens.*

The striations noticed on the outer surface of epidermal cells of the seed form another distinctive character. They are thus striated in *U. stricticaulis*, *U. baouleënsis*, and *U. bifida* (Figs. 4, 5, 6); further the epidermal cells

end in blunt projections in *U. bifida* (Fig. 6). Lastly, the seedcoat is beset with characteristic clavate projections in *U. nivea* (Fig. 8).

KEY TO THE SPECIES OF *Utricularia* BASED ON MATURE SEEDS

1. Seeds slightly or distinctly winged:
    2. Seeds tabular prismatic and polygonal:
        3. Seeds with slightly winged margins —usually 1–2 layers thick ..... *U. inflexa* var. *stellaris*
        3. Seeds with distinctly winged margins—usually 3–4 layers thick ..... *U. aurea*
    2. Seeds lenticular with a crenulate, corky wing ..... *U. gibba* subsp. *exoleta*
1. Seeds not winged:
    4. Seeds obovoid or ovoid:
        5. Seeds obovoid:
            6. Epidermal cells striated:
                7. Epidermal cells finely striated and scrobiculate *U. stricticaulis*
                7. Epidermal cells prominently striated and reticulate:
                    8. Epidermal cells with wavy outline ... *U. baouleënsis*
                    8. Epidermal cells end in blunt projections *U. bifida*
            6. Epidermal cells not striated .. *U. caerulea*

5. Seeds ovoid:

9. Seedcoat with minute clavate projections ..... *U. nivea*

9. Seedcoat without clavate projections and with a slightly wavy outline ..... *U. hirta*

4. Seeds ellipsoid ..... *U. scandens*

SUMMARY

Since the exomorphic characters in the seeds of the various species of *Utricularia* L. are distinct, a comprehensive study has been undertaken. The present account deals with the external morphology of the seeds of ten taxa of *Utricularia* occurring in West Bengal (Prain, 1963). This study shows that shape of seeds, pattern in the arrangement of epidermal cells of the seedcoat, striations, if any, in these cells, epidermal projections and wings, and measurements of seeds are distinct from species to species and they could be used for their identification. A dichotomous key has been proposed, for their classification. In *Utricularia inflexa* Forsk. var. *stellaris* (L.f.) P. Taylor and *U. aurea* Lour. the seeds are tabular prismatic and have faint-winged margins. But in *U. gibba* subsp. *exoleta* (R.Br.) P. Taylor, they are lenticular with a prominent, crenulate, corky wing. Among the remaining taxa, the seeds are ovoid in *U. nivea* Vahl and *U. hirta* Klein, obovoid in *U. stricticaulis* Stapf, *U. baouleënsis* A. Chev., *U. bifida* L., and *U. caerulea* L., and ellipsoid in *U. scandens* Benj.

The striations noticed on the outer surface of the epidermal cells of the seed form another distinctive character. They are striated in *U. stricticaulis*, *U. baouleënsis*, and *U. bifida*; further the epidermal cells end in blunt projections in *U. bifida*. Lastly, the seedcoat is beset with characteristic clavate projections in *U. nivea*. Measurements of one hundred seeds for each taxon show that they differ from species to species.

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