*Contribuţii Botanice*, *XL*, **2005**
Grădina Botanică "Alexandru Borza"
Cluj-Napoca

# CONSIDERATIONS ON THE STEM STRUCTURE OF SOME *DROSERA* L. SPECIES

***Irina STĂNESCU*, *Irina TOMA*, *Constantin TOMA***
Universitatea "Al. I. Cuza" Iaşi, Facultatea de Biologie, Bd. Carol I, nr. 11, **RO-700506 Iaşi**

**Abstract:** The materials subjected to this analysis, coming from the collection of the "Alexandru Borza " Botanical Garden of Cluj-Napoca, belongs to 11 species, as follows: *Drosera aliciae* Hamlet, *D. binata* Labill, *D. brevifolia* Pursh, *D. burkeana* Planch, *D. capensis* L. with three sorts: *D. capensis "Alba"* L., *D. capensis "Narrow Leaf"* L., *D. capensis "Rubra"* L., *D. capillaris* Poir, *D. cuneifolia* Thunb, *D. dielsiana* Exell et Laundon, *D. intermedia* Hayne, *D. lovella* T. N. Bailey, *D. montana* St. Hill and *D. spathulata* Labill.

The aerial floriferous stem exhibits a primary structure in all the analyzed species. The epidermis is of stomatiferous type (stomata are more or less prominent above the external wall of the surrounding cells and have a large substomatic chamber), with many short-stalked or long-stalked secretory trichomes. Two of the investigated species (*D. capensis „Alba"*, *D. intermedia*) have protective trichomes too. The central cylinder has a variously thickened peripheral sclerenchyma ring with lignified or un-lignified cell walls, many collaterally closed vascular bundles (concentric-leptocentric type at *D. binata*), fundamental thin-walled, meatus type parenchyma or pith hollow.

The rhizome has short-stalked secretory trichomes on the epidermis of *D. brevifolia, D. burkeana, D. lovella, D. capensis „Alba", D. capensis „Narrow Leaf", D. capensis „Rubra", D. capillaris* and *D. intermedia*. All the species investigated have thick, amyliferous cortex type, with secondary type endodermis, thin peripheral secondary phloem ring, several vascular bundles of closed collateral or leptocentric type and parenchyma with intercellular spaces, consisting of large isodiametric cells with slightly waved walls.

## Introduction

*Drosera* (sundews) is well known because its insect prey is captured by becoming mired in droplets of mucilage produced by the tentacles of plant. They are sensitive and bend down after being touched, forcing their insect prey against the leaf surface.

The literature dealing with the anatomy of *Droseraceae* species, on carnivorous plants especially, is quite rich [2, 3, 4], but in our country just a few articles have been published until now [6, 7, 8]. Previous investigations [7] concerned the development and morphology of the stomata of *Drosera anglica* Huds., *D. binata* Labill, *D. capensis* L., *D. intermedia* Hayne, *D. rotundifolia* L. and *D. spathulata* Labill. The accommodations of carnivorous plants to their environment were underlined in other two papers [6, 8]. A previous investigation of the present authors dealt with the leaf structure of the same species [5]. There are only few records on the stem structure of *Drosera* species.

*Drosera* species are perennial herbaceous plants, with a basal rosette of leaves from the center of which raises the floriferous stem. The plant has a rhizome in the soil, which forms many adventitious roots [9].

## Material and Methods

The investigated samples, obtained from the collections of the Botanical Garden "Alexandru Borza" from Cluj-Napoca, belong to the following 11 species: *Drosera aliciae* Hamlet, *D. binata* Labill, *D. brevifolia* Pursh, *D. burkeana* Planch, *D. capensis* L. with three sorts: *D. capensis "Alba"* L., *D. capensis "Narrow Leaf"* L., *D. capensis "Rubra"* L., *D. capillaris* Poir, *D. cuneifolia* Thunb, *D. dielsiana* Exell et Laundon, *D. intermedia* Hayne, *D. lovella* T. N. Bailey, *D. montana* St. Hill and *D. spathulata* Labill.

The samples investigated consisting of aerial, floriferous stems and rhizomes have been fixed and preserved in 70% ethylic alcohol. The sections were cut with microtome, subsequently colored with iodine green and alum-carmine, than mounted in gel and analyzed in a Novex (Holland) light microscope. Drawings were obtained by employing a Romanian Projektionszeichenspiegel MC1 light microscope. The light micrographs were performed by means of Novex (Holland) microscope using Kodak CX7430 camera.

**Results and Discussions**

The aerial floriferous stem, analyzed at its middle portion reveals primary structures, resulted by the activity of the cauline apex, having the following well-known anatomical regions: epidermis, cortex and central cylinder (Fig. 1).

The epidermis consists of isodiametric cells; their external walls are not covered by cuticle. Stomata are more or less prominent above the surrounding cells and have a large substomatic chamber (Fig. 2).

In all species observed the epidermis presents short-stalked secretory trichomes consisting of two cells located among the epidermis ones, a short stalk of two rows each consisting of two cells and a two celled gland (forthcoming or distant) on the top (Fig. 3). Eight of the analyzed species (*D. brevifolia*, *D. capensis „Alba”*, *D. capensis „Rubra”*, *D. cuneifolia* (Fig. 4), *D. dielsiana*, *D. intermedia*, *D. lovella*, and *D. spathulata*) have long-stalked secretory trichomes (capitate trichomes) consisting of a bi-rowed-celled stalk and a multicellular gland (Fig. 4). Two species only, *D. capensis „Alba”* (Fig. 5) and *D. intermedia* have protective trichomes with bi- rowed-cells.

The cortex is assimilatory, with intercellular spaces (meatus) consisting of a single (Fig. 6) or of 2-3 cell layers (*D. binata*, *D. capensis „Narrow Leaf”* (Fig. 7) and *D. capensis „Rubra”*).

The central cylinder exhibits peripherally thick sclerenchyma sheath in *D. capensis* “Narrow Leaf” (Fig. 7) or sometimes much thicker (*D. capensis „Rubra”* and *D. intermedia*), consisting of polygonal cells with moderately thickened and lignified walls. In *D. binata* (Fig. 8), *D. brevifolia, D. capensis „Rubra”*, *D. montana* and *D. spathulata* the cell walls are not lignified. In the sclerenchyma ring (sheath), the size of cells raises from the peripheral cell row towards the internal ones.

The central cylinder has four (*D. cuneifolia, D. montana* and *D. lovella*) or 5-6 closed collateral vascular bundles of different diameter. The xylem consists of small vessels with lignified walls, showing in cross sections continuous (Fig. 10) or discontinuous (due to the presence of parenchyma cells) circular arc which is in contact with the sclerenchyma ring. In *D. brevifolia*, *D. burkeana* (Fig. 11), *D. capensis „Rubra”* and *D. cuneifolia* the circular arc of the bundle does not touch the sclerenchyma ring. Phloem consists of sieve tubes and companion cells. *D. binata* (Fig. 9) has six leptocentric vascular bundles, which are not in contact with the peripheral sclerenchyma ring.

The fundamental parenchyma of the stem consists of isodiametric cells with thin cellulose walls leaving many intercellular spaces (Fig. 12). *D. aliciae* (Fig. 13), *D. capillaris, D. lovella* and *D. montana* have disordered parenchyma, with pith hollow.

The epidermis of the rhizome consists of tangentially oblong cells with thick external wall. Except *D. aliciae, D. binata, D. cuneifolia, D. montana, D. spatulata*, the other species dealt with have short-stalked secretory trichomes (Fig. 14), similar to those occurring on their aerial stem. The epidermis of other species exhibit is mostly exfoliated together with parts of the cortex.

The cortex is thick, of amyliferous type, with secondary endodermis (thick, suberized cell walls – Fig. 15), having few closed collateral vascular bundles (Fig. 16).

The central cylinder exhibits thin peripheral ring of secondary phloem (Fig. 15) and many leptocentric vascular bundles. The xylem consists of vessels with thickened, lignified (Fig. 17) or non-lignified walls (Fig. 18). Rarely, the vascular bundles are of closed collateral type.

The rhizome contains meatus type parenchyma, consisting of large isodiametric cells with slightly wavy walls (Fig. 19). The pericycle forms 5-7 rows of adventitious roots.

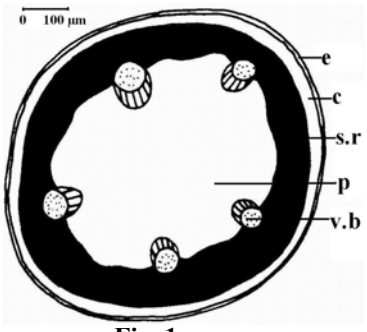



Fig. 1

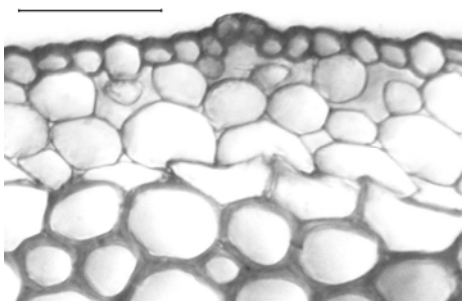


Fig. 2



Fig. 3

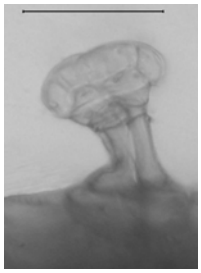


Fig. 4




Fig. 5

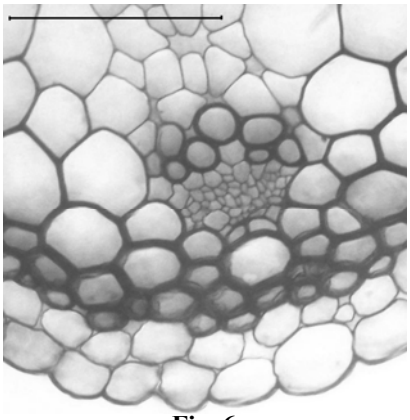


Fig. 6

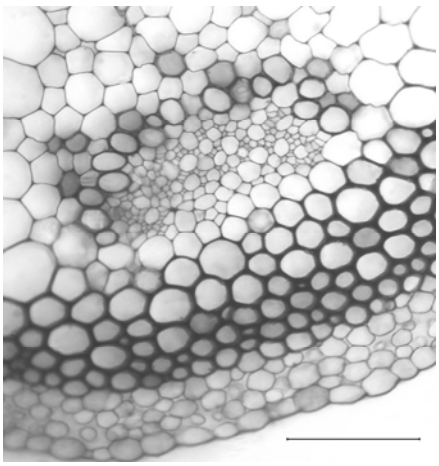


Fig. 7

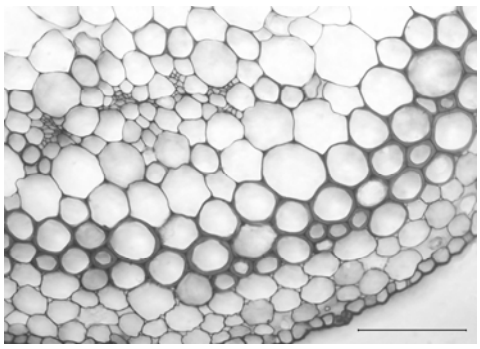


Fig. 8

## Plate I.

**Fig. 1: Cross section cut through the aerial stem of *D. dielsiana* (c=cortex, e=epidermis, p=parenchyma, s. r.=sclerenchyma ring, v. b.=vascular bundle).**
**Fig. 2: Cross section cut through the aerial stem of *D. binata* (bar=50 µm).**
**Fig. 3: Short-stalked secretory trichome of *D. brevifolia* (bar=50 µm).**
**Fig. 4: Long-stalked secretory trichome of *D. cuneifolia* (bar=50 µm).**
**Fig. 5: Protective trichome of *D. capensis "Alba".***
**Fig. 6: Cross section cut through the aerial stem of *D. brevifolia* (bar=100 µm).**
**Fig. 7: Cross section cut through the aerial stem of *D. capensis "Narrow Leaf"* (bar=100 µm).**
**Fig. 8: Cross section cut through the aerial stem of *D. binata* (bar=100 µm). All micrographs are original.**

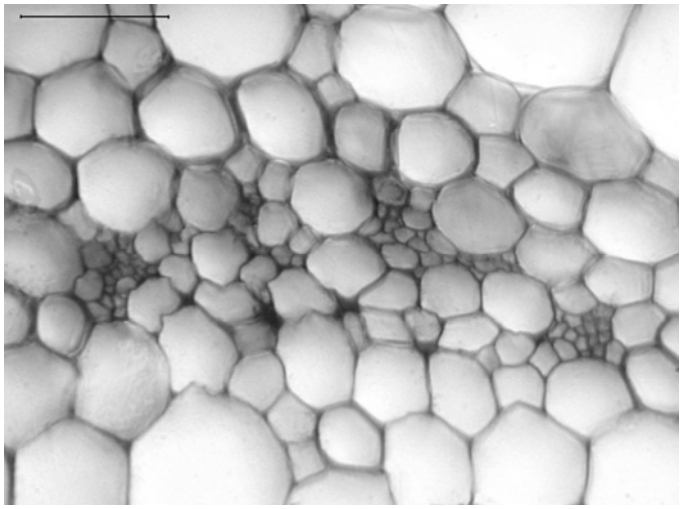


Fig. 9

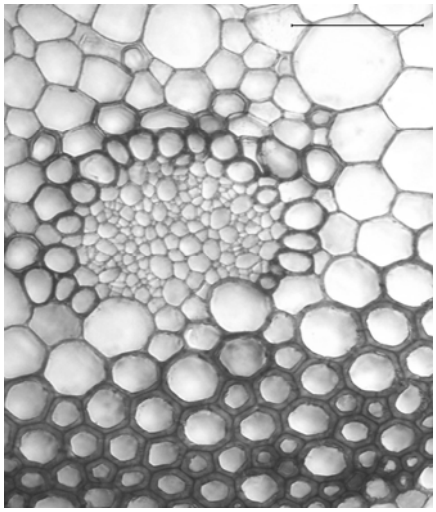


Fig. 10

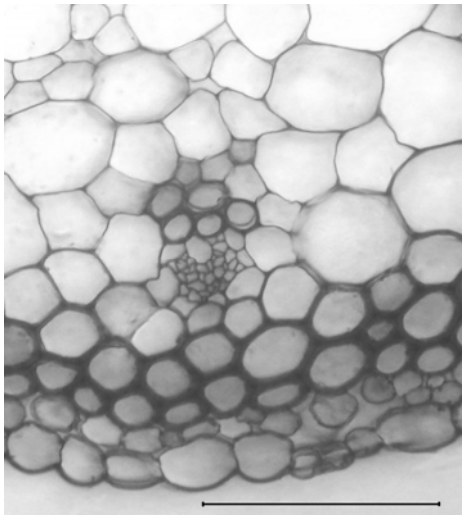


Fig. 11

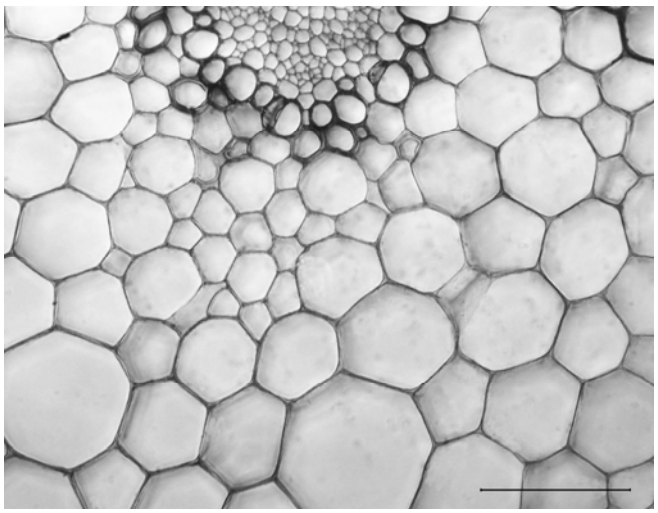


Fig. 12

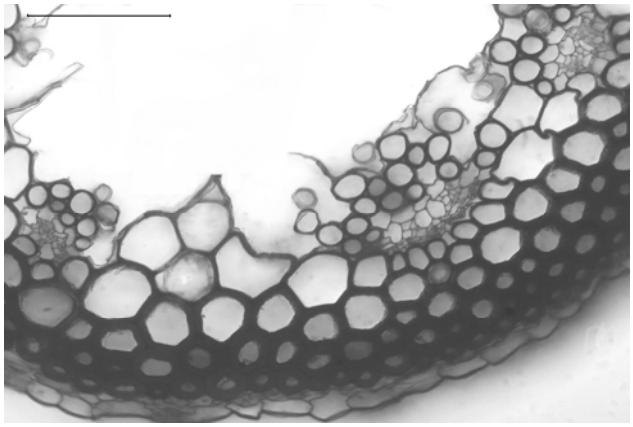


Fig. 13

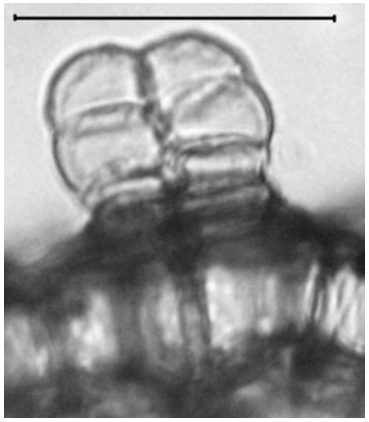


Fig. 14

## Plate II.

**Fig. 9: Cross section cut through the aerial stem of *D. binata* (bar=50 µm).**
**Fig. 10: Cross section cut through the aerial stem of *D. capensis "Alba"* (bar=100 µm).**
**Fig. 11: Cross section cut through the aerial stem of *D. burkeana* (bar=100 µm).**
**Fig. 12: Cross section cut through the aerial stem of *D. capensis "Alba"* (bar=100 µm).**
**Fig. 13: Cross section cut through the aerial stem of *D. aliciae* (bar=100 µm).**
**Fig. 14: Short-stalked secretory trichome from the rhizome of *D. capensis "Narow Leaf"* (bar=50 µm). All micrographs are original.**

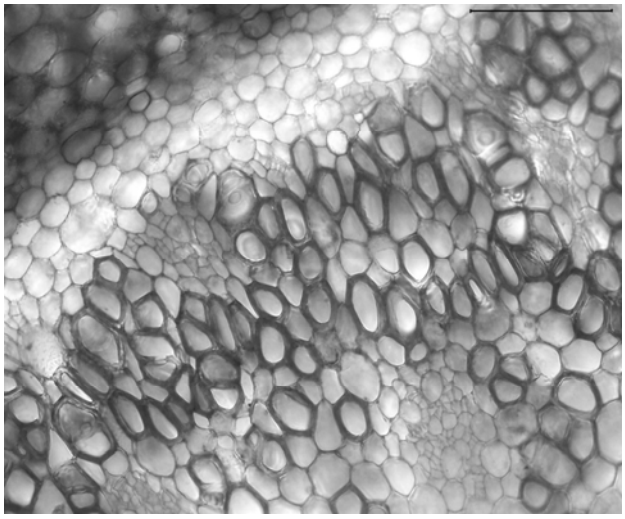


**Fig. 15**

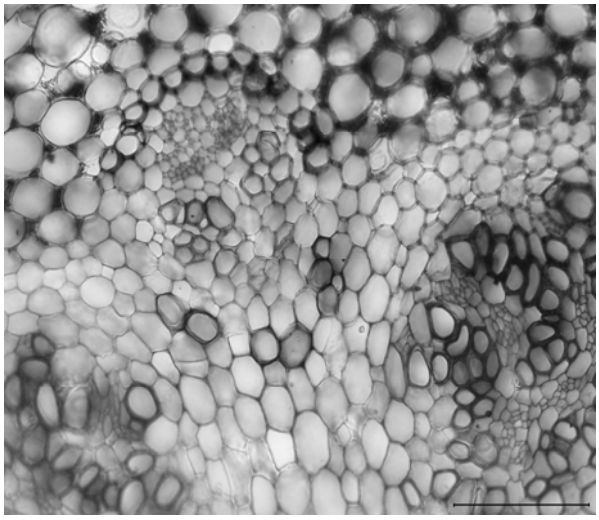


**Fig. 16**

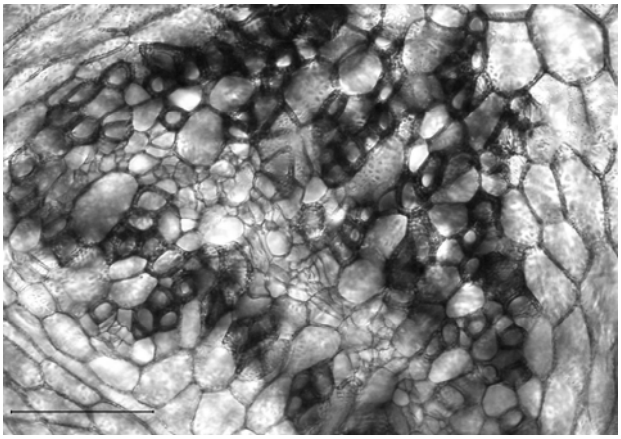


**Fig. 17**

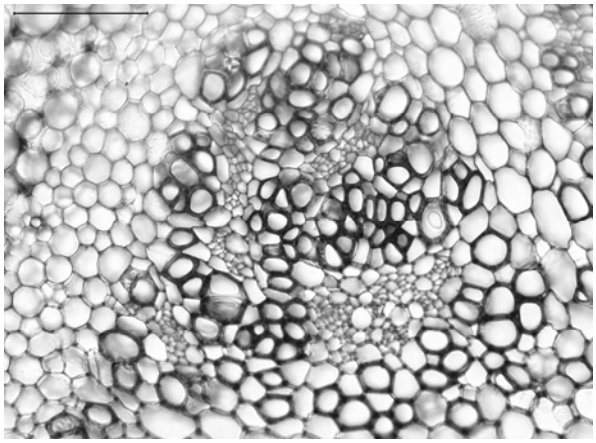


**Fig. 18**

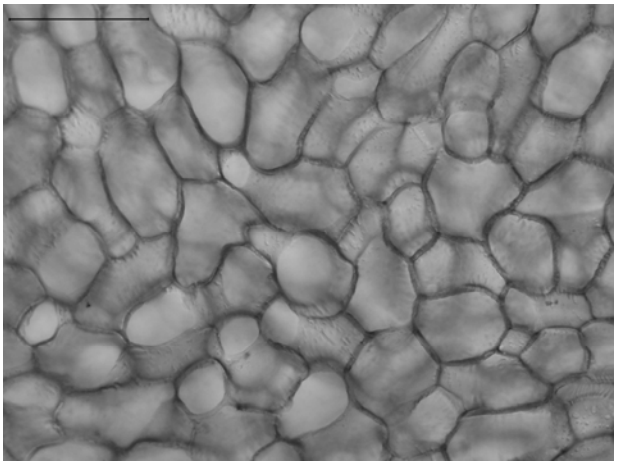


**Fig. 19**

## Plate III.

**Fig. 15: Cross section cut through the rhizome of *D. capensis "Narow Leaf"* (bar=100 µm).**
**Fig. 16: Cross section cut through the rhizome of *D. capensis "Rubra"* (bar=100 µm).**
**Fig. 17: Cross section cut through the rhizome of *D. montana* (bar=100 µm).**
**Fig. 18: Cross section cut through the rhizome of *D. capensis "Rubra"* (bar=100 µm).**
**Fig. 19: Cross section cut through the rhizome of *D. burkeana* (bar=100 µm). All micrographs are original.**

## Conclusions

The structure of the aerial floriferous stem of the species dealt remains primary. The epidermis is of stomatiferous type, with short-stalked or long-stalked secretory trichomes. Two of the analyzed species (*D. capensis „Alba”* and *D. intermedia*) have protective trichomes. The central cylinder is surrounded by peripheral sclerenchyma ring of various thicknesses. The stele contains many closed collateral vascular bundles (leptocentric type in *D. binata*). The central part of the stem is filled with fundamental parenchyma (medulla) with many meatus or exhibits central pith hollow.

The rhizome has short-stalked secretory trichomes on the epidermis in *D. brevifolia, D. burkeana, D. lovella, D. capensis „Alba”, D. capensis „Narrow Leaf”, D. capensis „Rubra”, D. capillaries* and *D. intermedia*, similar to those present on the aerial stem. All the species dealt with have thick, amyliferous cortex, with secondary endodermis, thin peripheral, secondary phloem ring, several vascular bundles of closed collateral or leptocentric type and a meatus type parenchyma, the later consisting of large isodiametric cells with slightly wavy walls.

**Acknowlegement:** The authors' grateful thanks are due to Felician Micle PhD, Director of the Botanical Garden and to Elena Rânba for supplying the Drosera material suitable to fulfill the present investigations.

## REFERENCES

1. Darwin, Ch., 1965, *Plante insectivore*, Ed. Acad. R. S. R., Bucureşti.
2. Metcalfe, C. R., Chalk, L., 1972*, Anatomy of the Dicotyledons*. **1**, Clarendon Press, Oxford: 581-585.
3. Napp-Zinn, K., 1984, Anatomie des Blattes. II. Blattanatomie der Angiospermen. B. Experimentelle und ökologische Anatomie der Angiospermenblattes. Karnivore Angiospermen. In: *Handbuch der Pflanzenanatomie, VIII, B1* Gebrüder Borntraeger, Berlin, Stuttgart: 394-422.
4. Solereder, H., 1899, *Systematische Anatomie der Dicotyledonen*. Fr. Enke, Verlag, Stuttgart.
5. Stănescu, I., Toma, I., Toma, C., 2004, Leaf structure considerations of some *Drosera* L. species, *Acta Horti Bot. Bucurestiensis* (in press).
6. Tarnavschi, I. T., 1957, Adaptările morfologice la plantele carnivore, *Natura*, **4**: 76-92.
7. Tarnavschi, I.T., Rădulescu, D., 1958, Contribuţii la cunoaşterea dezvoltării şi morfologiei stomatelor la unele plante carnivore, *Stud. Cerce. Biol.*, Ser. *Biol. veget.*, **1**, Tom X, Ed. Acad. R. P. R.
8. Toma, C., Toma, I., 2002, Plantele carnivore – un caz particular de adaptare la mediul de viaţă, *Prelegeri Academice*, Iaşi, **1**: 103-130.
9. Ţopa, E., 1961, *Drosera* L. In: *Flora Republicii Populare Române*, Ed. Acad.R.P.R., Bucureşti, **3**: 545-553.

## OBSERVAŢII ASUPRA STRUCTURII TULPINII DE LA UNELE SPECII DE *DROSERA* L.

### (Rezumat)

Materialul biologic luat în studiu este reprezentat de tulpini aparţinând la 11 specii de *Drosera*, aflate în colecţia Grădinii Botanice „Alexandru Borza” din Cluj-Napoca: *D. aliciae* Hamlet, *D. binata* Labill, *D. brevifolia* Pursh, *D. burkeana* Planch, *D. capensis* L. (soiurile: *D. capensis „Alba”* L., *D. capensis „Narow Leaf”* L., *D. capensis „Rubra”* L.), *D. capillaris* Poir, *D. cuneifolia* Thunb, *D. dielsiana* Exell et Laundon, *D. intermedia* Hayne, *D. lovella* T. N. Bailey, *D. montana* St. Hill şi *D. spathulata* Labill.

La toate speciile investigate, tulpina aeriană este primară. Epiderma este stomatiferă, cu numeroşi peri secretori scurt sau lung pedicelaţi. Doar două dintre speciile analizate prezintă peri tectori (*D. capensis „Alba”* şi *D. intermedia*). Cilindrul central diferă, la speciile analizate, prin grosimea inelului de sclerenchim, numărul fasciculelor conducătoare şi prezenta sau absenţa cavităţii aerifere.

Rizomul prezintă la nivelul epidermei peri secretori scurt pedicelaţi asemănători celor de la nivelul tulpinii. Toate speciile prezintă scoarţă amiliferă groasă, inel de liber secundar şi numeroase fascicule conducătoare libero-lemnoase de tip concentric-leptocentric şi colateral-închis.