THE SECRETORY HAIRS PRESENT ON THE *DROSERA ROTUNDIFOLIA* L. LEAFS, OPTIC MICROSCOPY AND SCANNING ELECTRONIC MICROSCOPY ASPECTS

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ABSTRACT. The realized cell investigations allowed us to emphasize on the *Drosera rotundifolia* L. vitroplantules leafs, several categories of pluricellular hairs: *secretors glandular hairs, (tentacular hairs, sessile hairs),* and *tectorial hairs*. Regarding the presence and number of the *secretors sessile hairs* from the inferior epidermis, we observed that there are not many differences from the point of view of the number, between the *Drosera* individuals cultivated *in vitro* and individuals cultivated in septic, greenhouse conditions. In the majority of the investigated fields, the secretors sessile hairs are more numerous on *Drosera* plants cultivated *in vitro*, than those cultivated in greenhouse, and the secretors tentacular hairs on *Drosera* plants grown in septic media, than to the ones cultivated *in vitro*. In the same time, we observe that on the ventral face of the leaf there are no tentacular hairs.

Keywords: *Drosera rotundifolia*, secretors tentacular hairs, secretors sessile hairs

INTRODUCTION

Drosera rotundifolia L. (Sundew) is one of the very interesting plant species from the point of view of their biology, being a plant populating (in Romania too), muddy, humid peat areas, poor in chemical compounds (mostly in nitrogen salts), fact which made this plant to adapt to a mixotrophic life regime, respectively *carnivorous*, being photoautotrophic and heterotrophic. Due to this reason, they complete their nutrition with organic mater resulted by digestion of the cached insects, at the level of the superior leaf lamina.

Due to this complex metabolism, we put up the problem of vitrocultivating *Drosera* and monitoring some aspects of plant reactivity to vitrocultivation, in comparison with the plants cultivated in greenhouse conditions.

Three types of hairs were identified, for *D. rotundifolia* plants that grow in the wild: *secretors glandular hairs, tentacular sessile hairs,* and *tectorial hairs* (Stănescu, 2008).

Because we are interested in realizing *D. rotundifolia* vitrocultures, we put the problem of analyzing the *secretory* hairs present on the *D. rotundifolia* leaflet epidermis. Optical, frequency and morphology aspects at the greenhouse and vitrocultivated plants were observed. These studies took into consideration not only optical and scanning electronic microscopy observations, but also realizing drawings with the clear chamber. The most representative images were microcaptured.

MATERIAL AND METHODS

Part of the *D. rotundifolia* leafs, harvested from the greenhouse or vitrocultivated plants were directly examined, according with the practiced optical microscopy classic procedures, without initial preparation.

Leaves (or only fragments), were fixed with glutaraldehyde (2.7% in PBS), dehydrated in acetone and critical point dried (Polaron CPD), gold sputter coated (Agar Auto Sputter Coater) and examined in an Jeol JEM5510LV scanning electron microscope (Cachiţă et al, 2006).

RESULTS AND DISCUSSIONS

The biggest and most interesting hairs are the *secretors* ones, named also tentacular or sensitive hairs, which have a long knobbed pedicle, characteristic for this genus. To the mature *Drosera* plantules, grown in the greenhouse or in the wild, the tentacular hairs (present on the surface of the leaf lamina) have the pedicle and the glandular head colored in red (fig. 1 A), an impressive attractant for the possible "prays", along with the sparkly, mucilaginous drop which covers the tentacular apex. Both the pedicle and the gland are pluricellular, multistratified, with elongated cells – in the first case – and much shorter in the case of the sessile, glandular hairs with no pedicle (fig. 2 A-F). The length of the tentacles is decreasing, starting from the edge of the lamina to its middle part, but in all cases the gland dimensions remains similar. The tentacular hairs secrete continuously a sugar reach

mucilaginous substance. In the moment an insect is captured, the tentacular hairs get curvy and immobilize the pray. The glandular tissues are arranged in the basal part of the tentacular apex (head) (fig. 1 F and H). They abundantly secrete digestive enzymes, afterwards the hairs cells absorb the resulted compounds, helped by the sessile hairs (fig. 2 A-F), present on the all lamina surface, in between the tentacular hairs and even on the basal part of their pedicle and on the leaf's petiole.

The *sessile glandular hairs* (fig. 2 A – E) are composed of 2 basal cells, 2 pedicle cells, and 2 glandular cells, which form the hair head (fig. 2 E-F). They have a major role in absorbing the substances resulted from the captured and digested insect protein hydrolysis, substances trickled out from the tentacles all over the leaf lamina surface and sometimes on their petiole too.

To the *in vitro* cultivated Drosera plants, on the superior face of the lamina and on it's edge too, lots of secretors, tentacular hairs can be found, called also sensitive, long-pedicle hairs (fig. 1 B and C). Both the pedicle and the gland are pluricellular, multistratified, for the pedicle with long cells and for much shorter cells for the gland. The tentacular length is decreasing from the lamina edge to it's middle part, but in all the cases the gland dimensions remain similar.

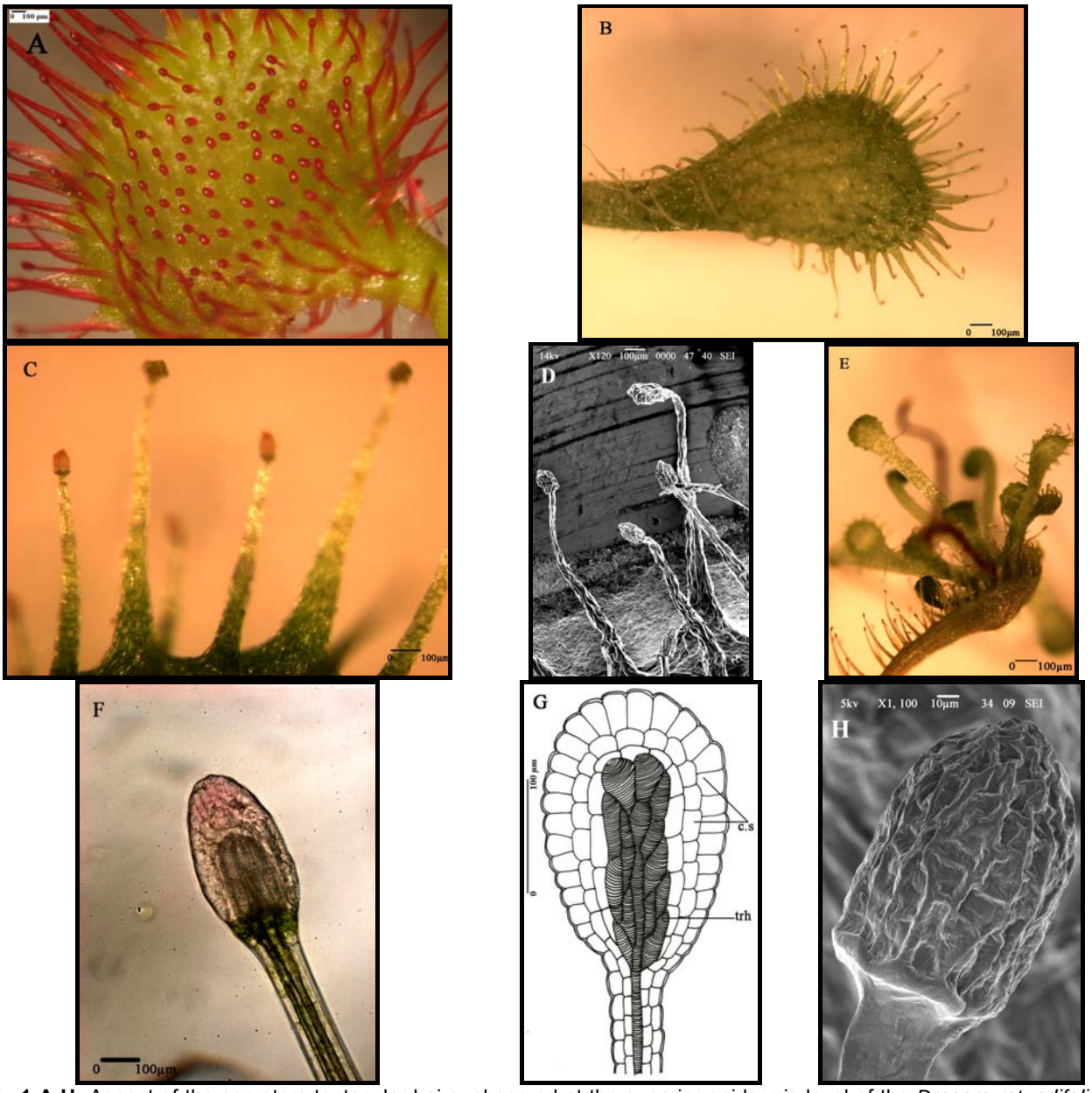

Fig. 1 A-H: Aspect of the secretors tentacular hairs, observed at the superior epidermis level of the *Drosera rotundifolia* L. leafs, cultivated in greenhouse, or from the vitroplantules regenerated from propaguls passed through a slow growth regime, in an acclimatized chamber in the Suceava Bank Gene, where: **A**. leaf from greenhouse cultures; **B.** leaflet from vitrocultures; **C-D:** images with details of tentacular hairs (**C.** detail observed with the magnifying glass; **D.** detail observed with the scanning electronic microscopy); **E.** tentacular hairs present on the vitroleaflets petiole and on the microleaflets lamina regenerated on the leaf lamina; **F-H:** details of the tentacular hair apex (head) (**F.** image taken with the optical microscope; **G.** drawing realize with the help of clear chamber; **H.** the image of the tentacular hair seen with the scanning electronic microscopy)

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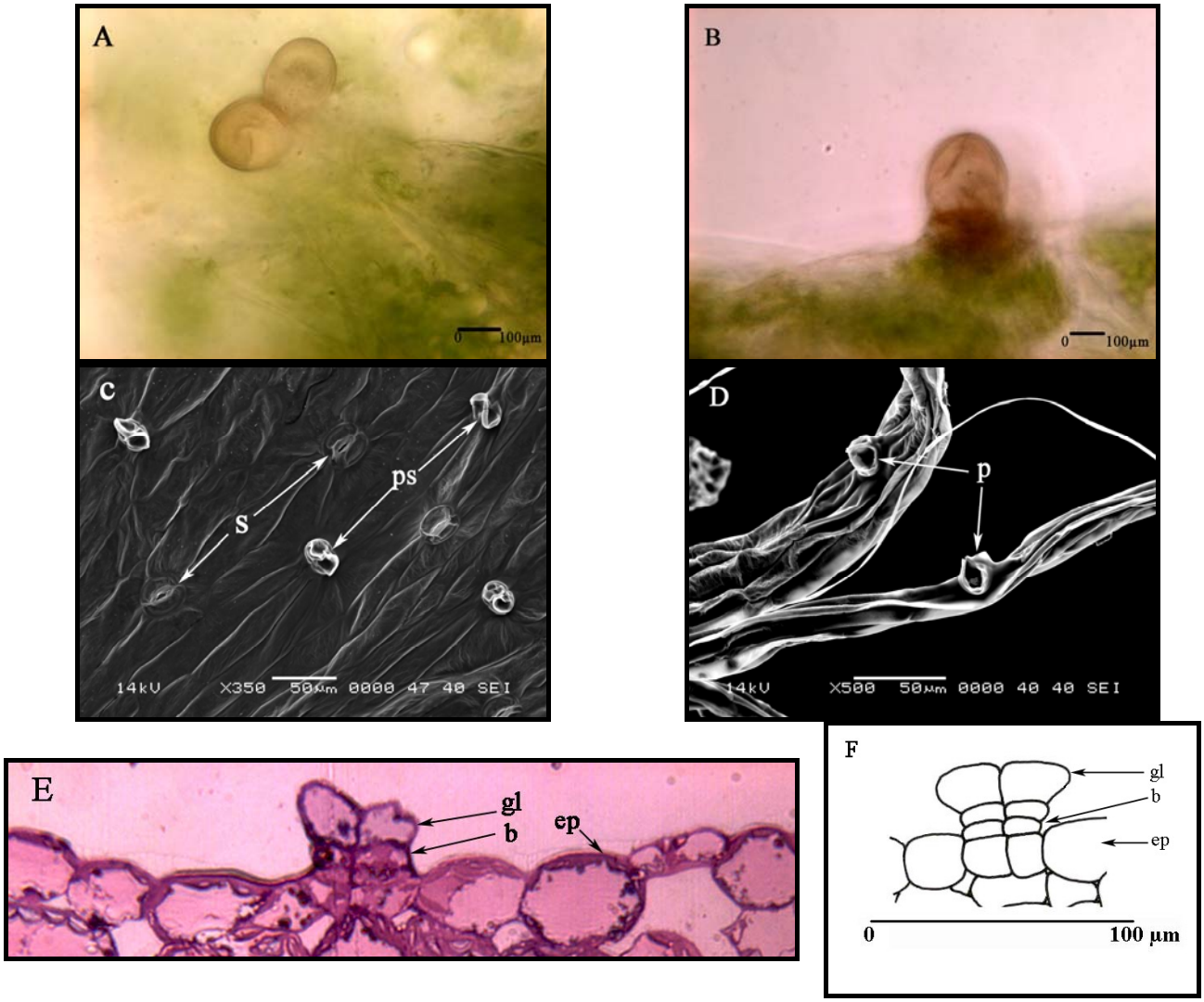

Fig. 2 Morphology of the secretors sessile hairs, identified on the superior and inferior epidermis of the *Drosera rotundifolia* L. vitroleaflets, from the vitroplantules generated on the same kind of media as in the case of the secretors tentacular hairs; **A.** optical microscopy detail; **B.** later view of the hair; **C and D:** scanning electronic microscopy detail of the secretors sessile hair – (ps) leaf epidermis surface view (s – stomata); (**C.** on the leaf lamina; **D.** on the tentacular hair filament); **E-F:** detail of the sessile glandular hairs, where: **E.** image taken with the optical microscope; **F.** drawing realize with the help of clear chamber (where: ep – epidermis; b - basal and pedicle cells; gl – glandular cells)

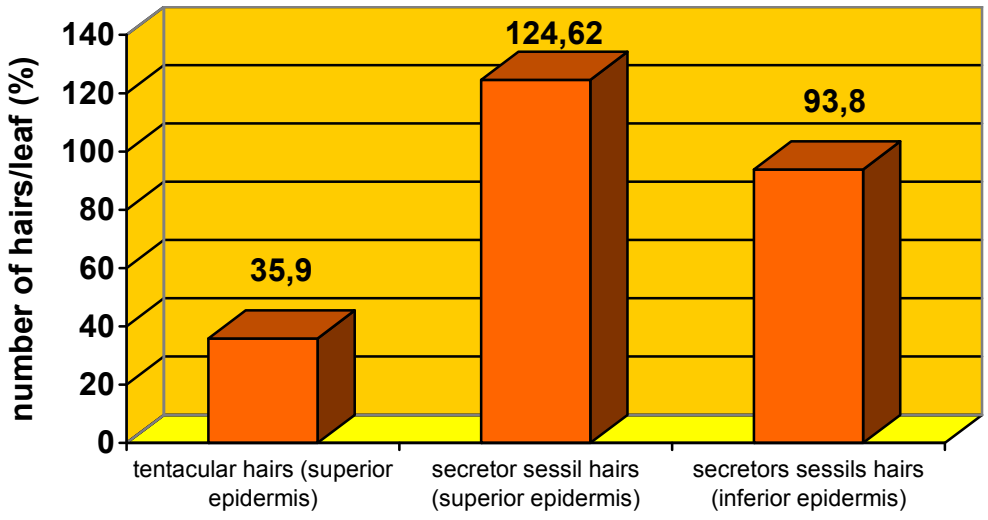

Fig. 3 The graphic representation of the percentages regarding the number of secretors hairs on the vitroleaflets epidermises of *Drosera rotundifolia* L., reported with the values of this parameter identified at the leafs from greenhouse (reference lot, considered 100%); variants: 1 – tentacular hairs (superior epidermis); 2 – sessile secretors hairs (superior epidermis); 3 – sessile secretors hairs (inferior epidermis)

In the same time, along those mentioned previously, we considered of great importance the number of hairs present on the leaf lamina. This is the reason why we count the tentacular hairs from the superior epidermis and the sessile hairs on the both epidermis of the mature leafs (at the basis of the rosettes) from *D. rotundifolia* plants grown in natural environment and from the individuals obtained *in vitro*. The number of hairs from 20 microscopic fields was noted separately, randomly selected (from the same leaf, but also from different leafs of the same exemplar or from different individuals, till we counted 20 fields).

In the figure 3 is illustrated the comparative situation regarding the number of secretors hairs on the *D. rotundifolia* leaf epidermis, originating from the greenhouse cultures – reference lot, considered as 100% and those originating from vitrocultures.

In the case of secretors *tentacular hairs*, present only on the superior epidermis it was observed that their number on the vitroleaflets is 60% lower than on the greenhouse leafs.

The number of secretors *sessile hairs*, on the superior epidermis of the vitroleaflets was higher with 10%, reported with the same type of hairs on the leafs originating in the septic media; on the inferior epidermis the number of secretors sessile hairs is about the same.

CONCLUSIONS

Our studies revealed that the ultrastructural details, of the three cells which realize each half of the sessile hair, the two apical ones are the biggest. They have spherical shape and present a very thin cell wall. By dehydration their external wall will implode. The sessile hairs are constituted of 6 cells, arranged in 2 columns of 3 cells each, partially linked of each other.

As novelty, we identified sessile hairs on the place of the tentacular hairs too, on the vitroleaflets petiole and on the inflorescence rachis, developed in the vitroplantules minirosettes.

Both, the secretors tentacular hairs and the sessile hairs are present on the *D. rotundifolia* vitroleaflets, with the specification that on the plants obtained *in vitro*, their number is 60% lower than on the greenhouse plants, observing a growth of 109% of the hairs present on the vitroleaflets superior epidermis, and on the inferior epidermis the numbers emphasized the presence of a number almost equal of this type of hairs, on the two types of leaf taken in study (greenhouse or *in vitro*).

The minirosettes neogenesis at the *D. rotundifolia* vitrocultures, is developed at some vitroleaflets situated at the basis of the minirosettes, from primordial foils regenerated from the laminas superior epidermis cells. The primordial foil present sessile secretors hairs emphasized with scanning electronic microscopy investigations.

REFERENCES

Cachiţă C.D., Beleş D., Barbu-Tudoran L., Studiu privind aspectul epidermei frunzelor de *Pistia stratiotes* L., normale sau provenite din vitrocultură, examinată la microscopul electronic cu baleaj, Analele Societăţii Naţionale de Biologie Celulară, Vol. XI, pp.462-472, 2006

Stănescu I., Cercetări citologice şi histo-anatomice asupra unor specii de plante carnivore, PhD Thesis, "Alexandru Ioan Cuza" University Iaşi, 2008