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CHARACTERIZATION OF THE LEAF EPIDERMIS OF TWO *SESLERIA* SPECIES

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Abstract: Leaf epidermis has been used as character in taxonomy of *Poaceae* family since the 1930s. The purpose of present study was to determine leaf epidermal features helpful in distinguishing two species of *Sesleria* genus – *Sesleria heufleriana* Schur and *Sesleria uliginosa* Opiz.
Both the abaxial and the adaxial epidermis have been examinated for each species.
So both examined species have Festucoid type of epidermis, but differences of some epidermal features exist at the species level. This include variation in number and size of epidermal cells and distribution patterns of stomata.

Keywords: *Sesleria*, epidermis, anatomy

Introduction

Sesleria heufleriana Shur and *Sesleria uliginosa* Opiz. form a very closely related group. They have some fundamental common characters, such as pruinous leaves, three floretted spikelets, dense spikes and the occurrence in lower altitudes. *S. heufleriana* is a limestone species, often tolerating a rare wood growth, while *S. uliginosa* is a species of calcareous swamps or clay soils which often withstands even the summer drying, growing sometimes also in the undergrowth of woods [DEYL, 1946].

The taxonomic value of the leaf epidermis in grass systematics has been demonstrated by many scientists [PRAT, 1932, 1936, 1948, 1961; TATEOKA et al., 1959; METCALFE, 1960; ELLIS, 1976, 1979]. Microscopic studies have found leaf surface characters of value in angiosperm taxonomy including size and shape of cells, cell wall undulations, morphology of stomata and stomatal patterning [STACE, 1984].

The aim of this study was to determine the patterns of variation in epidermal characteristics, assess their value in species identification and classification, and also to use the epidermal studies in establishing the taxonomic relationship between this two analysed species.

Material and methods

The plants were collected in 2010 from Hărman (*S. uliginosa*) and Turda Gorges (*S. heufleriana*), and transferred to Botanical Garden in Bucharest for cultivation. Voucher specimens of collected material were deposited in the Herbarium of Gradina Botanica "D. Brandza" in Bucharest (BUC). *S. uliginosa* was collected from alkaline swamp some 10 km east of Braşov in Hărman village, while *S. heufleriana* was collected in Turda Gorge (Cheile Turzii, Apuseni Mountains) from carbonate rocky grounds.

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For anatomical observations we have used leaves from living plants. We have examined adaxial and abaxial epidermis at the middle of the leaf blade.

The leaf blades were placed with the adaxial side upwards, and then scraped gently with a razor blade. The same procedure was followed to prepare the adaxial side of epidermis but the leaf was placed abaxial surface uppermost. After the upper epidermis and mesophyllous tissue were completely cleared away, the lower epidermis, which has great significance in taxonomy, was used for further investigations. It was stained with 1% safranin for half a minute, and immediately put under the light microscope for study and photographing.

All the leaves that were used for analyses were mature leaves, while the uppermost and the lowest ones were avoided.

For the description of the anatomical features, we use the nomenclature of PRAT (1932), METCALFE (1960) and ELLIS (1979).

The measurements of the individual structures were done with Digimizer programme 3.7.0. (MedCalc Software 2005-2010).

Results

Both adaxial and abaxial epidermis can be divided into costal and intercostal zones. The two mentioned zones differ adaxially and abaxially.

In *Sesleria uliginosa* abaxial side (Fig. 1A) in the costal zone consists of 1-3 layers of cells (Fig. 1B), and the intercostal zone (Fig. 1C) of 6-8 layers of cells. Prickle hairs are present on the leaf border in great numbers (Fig. 1D). Short cells are both costal and intercostal abundant. The long cells from costal zone are much shorter than those from the intercostal zone. On the adaxial side the costal zone consists of 2-3 layers of cells, and the intercostal zone of 8-12 layers of cells. Prickle hairs are present on the leaf border in great numbers.

In *Sesleria heufleriana* abaxial side (Fig. 1E) in the costal zone (Fig. 1F) consists of 1-2 layers of cells and the intercostal zone (Fig. 1G) of 8-11 layers of cells. Prickle hairs are present on the leaf border in great numbers (Fig. 1H). The long cells from costal zone are much shorter than those from the intercostal zone. On the adaxial side the costal zone consists of 6-9 layers of cells and the intercostal zone of 8-15 layers of cells. In the right of grooves formed by median rib, two groups of bulliform cells were observed.

Detail qualitative and quantitative differences of characters of leaf epidermis of *S. uliginosa* and *S. heufleriana* are shown in Tab. 1 and Tab. 2.

Tab. 1. Comparative qualitative characters of two *Sesleria* species

Characters	*Sesleria uliginosa*	*Sesleria heufleriana*
ABAXIAL		
SHORT CELL		
Silica cell	Costal paired with cork cell Over the veins spherical or elliptical, between the veins saddle-shaped	Over the veins, spherical or elliptical and between the veins, saddle-shaped
LONG CELL	Rectangular, elongated, with sinuous walls The side-walls parallel, sometimes more or less inflated outwards	Rectangular, elongated, with sinuous walls The side-walls parallel, sometimes are more or less inflated outwards

PRICKLES	Very large, present only on the mid-rib and on the leaf edge	On leaf edge and over the veins . Prickle base size very large
BULLIFORM CELLS	Not observed	Not observed
STOMATA	Rare, 1-2 stomata, just over intercostal zone	Rare, 1-2 stomata, just over intercostal zone
MACROHAIRS	Not observed	Not observed
ADAXIAL		
SHORT CELL		
Silica cell	Costal with irregular shape; intercostal saddle-shaped	Intercostal saddle-shaped and costal with irregular shape
LONG CELL	Rectangular, elongated, with sinuous walls, sometimes more or less inflated outwards	Rectangular, elongated, narrow, width uniform, with sinuous walls, the side one parallel
PRICKLES	Abundant on margin and costal. Prickle base size large	Not seen between the veins and abundant over the veins. Prickle base size very large
BULLIFORM CELLS	On the adaxial surface only. In groups of 8-11 cell	On the adaxial surface only. In groups of 12-13 cells
STOMATA	Abundant, intercostal only. The stomata rows generally adjacent	Abundant, intercostal only. The stomata rows adjacent, not separated by files of intercostal long cells
MACROHAIRS	Just on mid-rib	Not observed

Tab. 2. Comparative quantitative characters of the two species

Characters	*Sesleria uliginosa*	*Sesleria heufleriana*
ABAXIAL		
Intercostal zone		
Long cells - length (μm)	91 - 374	44 - 503
Silica cells - length (μm)	5,2 - 10,6	4,4 - 17,2
Costal zone		
Long cells - length (μm)	55 - 202,2	32 - 100
Silica cells - length (μm)	12,9 - 24	13,1 - 20,8
Prickle hairs - length of base(μm)	62 - 164	40,2 - 65,1

ADAXIAL		
Intercostal zone		
Long cells - length (μm)	40 - 158,5	16 - 152,7
Silica cells - length (μm)	10,7 - 15,3	10,2 - 17,7
Stomata - density (number/visual field)	41- 53	49-85
Costal zone		
Long cells - length (μm)	32 - 254	34 - 232
Silica cells - length (μm)	10,2 - 16,7	8,8 - 18,1
Prickle hairs - length of base(μm)	17,5 - 24	17,2 - 23,5
Macrohairs - length (μm)	23 - 106	-
Number of **bulliform cells**	8 - 11	12 - 13

Conclusion

The present work has shown that two analysed *Sesleria* species (*S. heufleriana* and *S. uliginosa*) exhibit Festucoid type of leaf epidermis: micro-hairs absent; stomata subsidiary cells are parallel-sides [PRAT, 1936; METCALFE, 1960].

The adaxial epidermis (Fig. 2) of both species consists of long cells, short cells, prickles hairs, stomata and bulliform cells. The macrohairs are present just in *S. uliginosa*. Bulliform cells are gradually larger than the rest of the epidermal cells. They are present in two groups on the adaxial side only and their number is different in this two *Sesleria* species.

The stomata are abundant, but are more numerous in *S. heufleriana*.

The abaxial epidermis of both species consists of long cells, short cells, prickles hairs and stomata.

The dimensions of prickles hairs on the leaf margins are much larger in *S. uliginosa* then in *S. heufleriana*.

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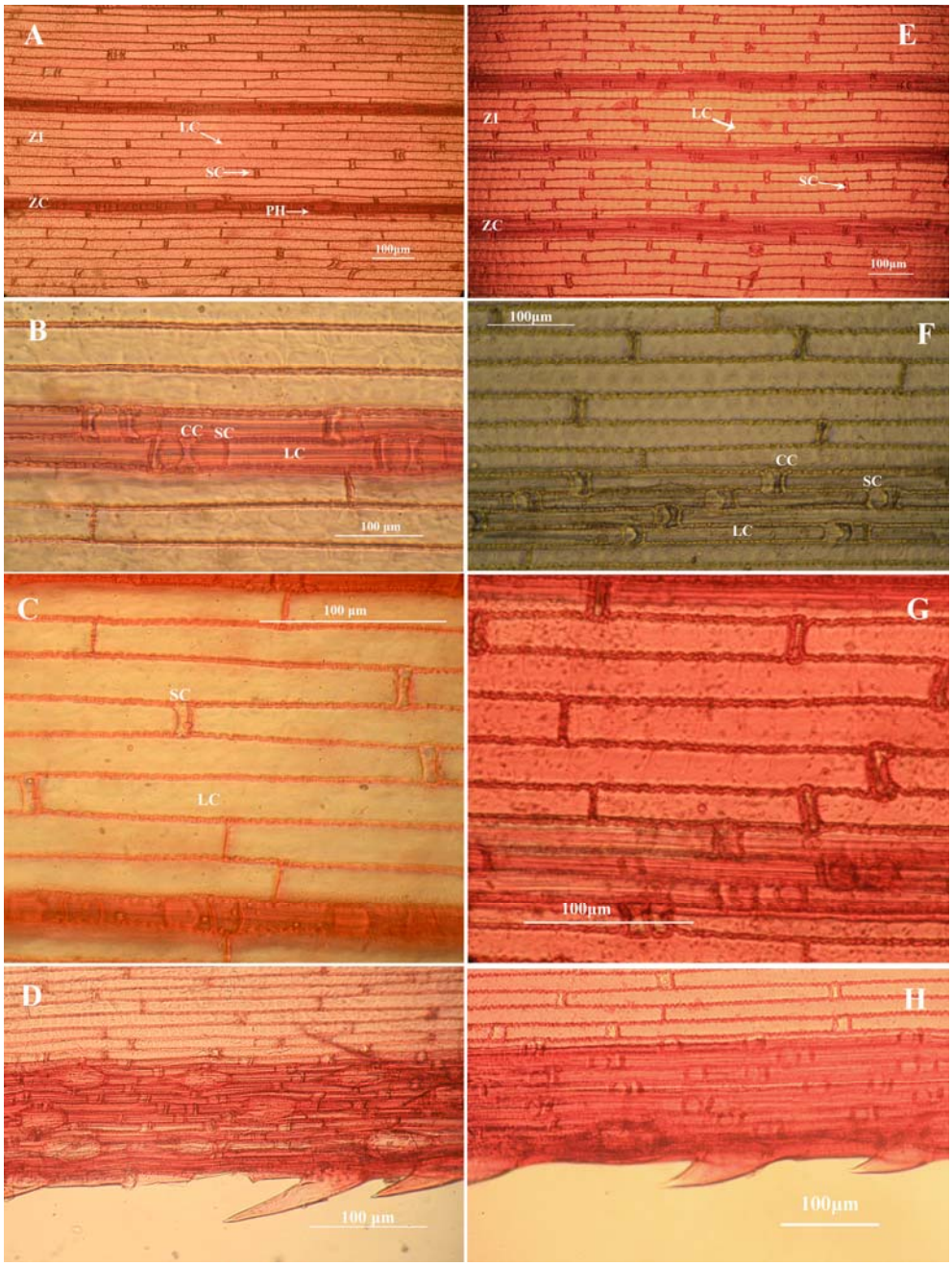

Fig. 1. A – *S. heufleriana* Shur, abaxial epidermis with general aspect; B – costal zone (ZC); C – intercostal zone (ZI); D – Border of the leaf with prickle hairs; E – *S. uliginosa* Opiz, abaxial epidermis with general aspect; F – costal zone (ZC); G – intercostal zone (ZI); H – Border of the leaf with prickle hairs. CC – cork cell, LC – long cell, SC – silica cell, PH – prickle hair.

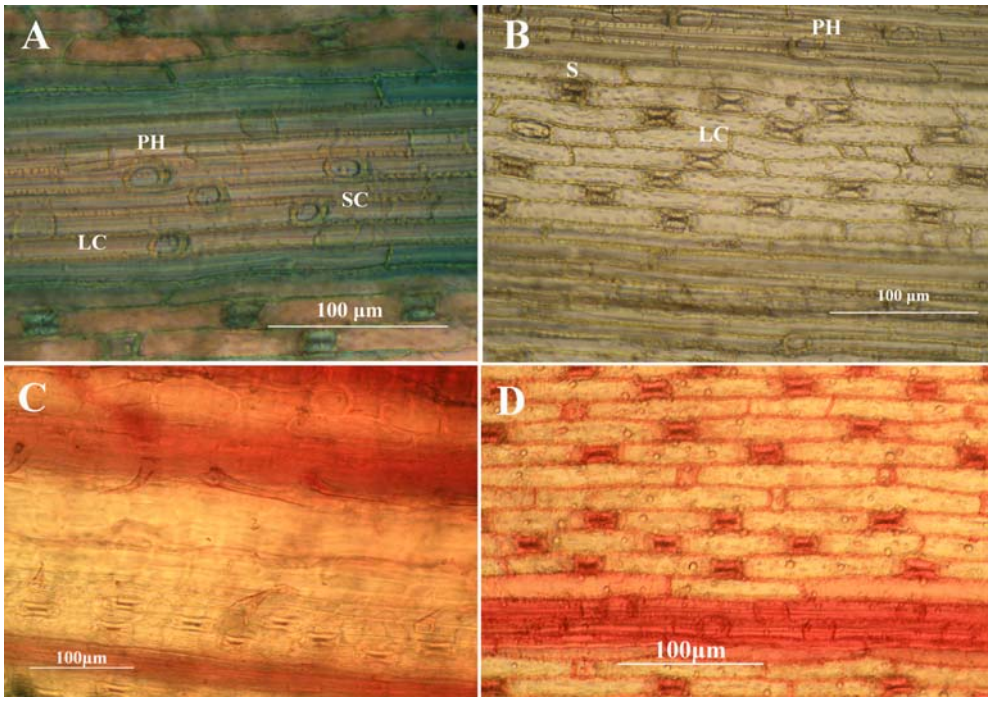

Fig. 2. A – *S. heufleriana* Schur, adaxial epidermis with costal (ZC) zones; B – Adaxial epidermis with intercostal zone (ZI); C – *S. uliginosa* Opiz, middle of adaxial epidermis with bulliform cells; D – Adaxial epidermis with intercostal zone. S – stomata, M – macrohairs, Ph – prickle hair, LC – long cell, SC – silica cell