The study of foliar epidermis at species of succulents flowery plants belonging to the *Senecio* genre (Fam. Asteraceae)

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Abstract The study of the features belonging to the foliar epidermis and to the epidermal productions (stomata, protective hair) is of a huge importance because all of these represent a taxonomical identification criterion of species. In the present work, there were taken into discussion five species of succulents, flowery plants (*Senecio articulatum, Senecio jacobisenii, Senecio kleiniformis, Senecio piramidatum, Senecio rowleyanus*) and the purpose was to determine the structural features of the foliar epidermis (epidermal cells and stomata).

Following the observations carried out, it had been ascertained that, among the species belonging to this type, there are significant differences from the point of view of the features of the epidermal cells, on one hand (form, dimension) and from the characteristics of the stomata (dimensions, density, type of stomata device), on the other hand.

Key words stomata, epidermal cells, succulents flowery plants.

Material and Work Method

The biological material used was represented by mature leaves belonging to the five species of succulents, flowery plants (*Senecio articulatum, Senecio jacobisenii, Senecio kleiniformis, Senecio piramidatum, Senecio rowleyanus*). The samples were gathered from the collection belonging to the discipline Floriculture and to the greenhouse of the “Alexandru Buia” Botanic Garden from Craiova. In order to emphasize the epidermis cells and the stomata, at the level of the foliar lamina, there were achieved peripheral sections, thus being analysed the superior epidermis (adaxial) and the inferior one (abaxial). The microscopic examination of devices was done at the OPTECH B4 microscope and the photos were achieved with the help of a CANNON device.

The obtained data were processed with the help of the mathematical statistic methods. As statistic indexes of the samples, there were used: the arithmetical media, the standard deviation of the media and the variability coefficient.

Results and Discussions

The structural features of the epidermis cells (form, dimensions) and of the stomata (dimensions, density) at the species of the *Senecio* genre.

1. *Senecio articulatum* (figure 1; figure 2)
   - the epidermic cells have their walls powerfully corrugated
2. **Senecio jacobsenii** (figure 3; figure 4)

- the epidermic cells are polygonal, have straight walls, with 6 – 7 sides
- for the length of the epidermic cells:
  - the superior epidermis – the value of the mathematical media (\( \overline{X} \)) is of 193,5 \( \mu m \) and the coefficient of variability (S%) is of 15,67 %, indicating a medium variability of this behavior.
  - the inferior epidermis - the value of the mathematical media (\( \overline{X} \)) is of 185,3 \( \mu m \) and the variability coefficient (S%) is of 10,56 %, indicating a medium variability of this behavior.

- for the width of the epidermis cells
  - the superior epidermis – the value of the mathematical media (\( \overline{X} \)) is of 198 \( \mu m \) and the coefficient of variability(S%) is of 13,36%, indicating a medium variability of this behavior.
  - The inferior epidermis - the value of the mathematical media (\( \overline{X} \)) is of 174,5 \( \mu m \) and the variability coefficient (S%) is of 11,27 %, indicating a medium variability of this behavior.

- for the length of the stomata – the value of the mathematical media (\( \overline{X} \)) is of 13,54 stomata/mm\(^2\) and the variability coefficient (%) is of 8,47%, indicating a small variability of this behavior.

- for the density of the stomata:
  - the superior epidermis – doesn’t have stomata
  - The inferior epidermis - the value of the mathematical media (\( \overline{X} \)) is of 18,84 stomata/mm\(^2\) and the variability coefficient (%) is of 24,37 %, indicating a small variability of this behavior.

- stomata device of ciclocitic type.

2. **Senecio jacobsenii** (figure 3; figure 4)

- the epidermic cells are polygonal, have straight walls, with 6 – 7 sides
- for the length of the epidermic cells:
  - the superior epidermis – the value of the mathematical media (\( \overline{X} \)) is of 198 \( \mu m \) and the coefficient of variability (S%) is of 13,36%, indicating a medium variability of this behavior.
  - The inferior epidermis - the value of the mathematical media (\( \overline{X} \)) is of 174,5 \( \mu m \) and the variability coefficient (S%) is of 11,27 %, indicating a medium variability of this behavior.

- for the width of the epidermis cells
  - the superior epidermis – the value of the mathematical media (\( \overline{X} \)) is of 198 \( \mu m \) and the coefficient of variability(S%) is of 13,36%, indicating a medium variability of this behavior.
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- stomata device of ciclocitic type.

3. **Senecio kleiniformis** (figure 5; figure 6)

- the epidermic cells are polygonal, have straight walls, with 6 – 7 sides
- for the length of the epidermic cells:
  - the superior epidermis – the value of the mathematical media (\( \overline{X} \)) is of 207µm and the coefficient of variability(S%) is of 14,30 %, indicating a medium variability of this behavior.
  - the inferior epidermis - the value of the mathematical media (\( \overline{X} \)) is of 207,2 \( \mu m \) and the variability coefficient (S%) is of 14,50 %, indicating a medium variability of this behavior.

- for the width of the epidermis cells
  - the superior epidermis – the value of the mathematical media (\( \overline{X} \)) is of 117\( \mu m \) and the variability
coefficient(S%) is of 19,80 %, indicating a medium variability of this behavior.
- the inferior epidermis - the value of the mathematical media ( $\bar{X}$ ) is of 111,7µm and the variability coefficient ( S%) is of 21,30 %, indicating a medium variability of this behavior.
- for the length of the stomata – the value of the mathematical media ( $\bar{X}$ ) is of 89,55 µm and the variability coefficient (S%) is of 6,88 %, indicating a small variability of this behavior.
- for the density of the stomata:
  - the superior epidermis – the value of the mathematical media ( $\bar{X}$ ) is of 7,06 stomata /mm² µm and the variability coefficient (%) is of 35 %, indicating a big variability of this behavior.
  - the inferior epidermis - the value of the mathematical media ( $\bar{X}$ ) is of 29,44 stomata/mm² µm and the variability coefficient (%) is of 16,2 %, indicating a medium variability of this behavior.
- stomata device of anizocitic type.
4. Senecio piramidatum ( figure 7; figure 8)
- the epidermic cells are polygonal, have straight walls, with 4 – 6 sides
- for the length of the epidermic cells:
  - the superior epidermis – the value of the mathematical media( $\bar{X}$ ) is of 214,2µm and the coefficient of variability(S%) is of 18,30 %, indicating a medium variability of this behavior.
  - the inferior epidermis - the value of the mathematical media ( $\bar{X}$ ) is of 210 µm and the variability coefficient (S%) is of 17,50 %, indicating a medium variability of this behavior.
- for the width of the epidermis cells
  - the superior epidermis – the value of the mathematical media ( $\bar{X}$ ) is of 87,3µm and the variability coefficient(S%) is of 4,80%, indicating a medium variability of this behavior.
  - the inferior epidermis - the value of the mathematical media ( $\bar{X}$ ) is of 79µm and the variability coefficient (S%) is of 9,30%, indicating a small variability of this behavior.
- for the length of the stomata – the value of the mathematical media ( $\bar{X}$ ) is of 124,65µm and the variability coefficient (S%) is of 11,76 %, indicating a medium variability of this behavior.
- for the density of the stomata:
  - the superior epidermis – the value of the mathematical media ( $\bar{X}$ ) is of 12,36 stomata/mm² µm and the variability coefficient (%) is of 8,21 %, indicating a small variability of this behavior.
  - the inferior epidermis - the value of the mathematical media ( $\bar{X}$ ) is of 13,10 stomata/mm² µm and the variability coefficient (%) is of 6,26 %, indicating a small variability of this behavior.
- stomata device of anizocitic type.
5. Senecio rowleyanus ( figure 9; figure 10)
- the epidermic cells are polygonal, have straight walls, with 6 sides
- for the length of the epidermic cells:
  - the superior epidermis – the value of the mathematical media( $\bar{X}$ ) is of 100,35 µm and the coefficient of variability(S%) is of 9,19 %, indicating a small variability of this behavior.
  - the inferior epidermis - the value of the mathematical media ( $\bar{X}$ ) is of 98,6µm and the variability coefficient ( S%) is of 12,12%, indicating a medium variability of this behavior.
- for the width of the epidermis cells
  - the superior epidermis – the value of the mathematical media ( $\bar{X}$ ) is of 70,65µm and the variability coefficient(S%) is of 14,39%, indicating a medium variability of this behavior.
  - the inferior epidermis - the value of the mathematical media ( $\bar{X}$ ) is of 70,11 µm and the variability coefficient (S%) is of 12,9%, indicating a medium variability of this behavior.
- for the length of the stomata – the value of the mathematical media ( $\bar{X}$ ) is of 41.4 µm and the variability coefficient (S%) is of 9,89%, indicating a medium variability of this behavior.
- for the density of the stomata:
• the superior epidermis – the value of the mathematical media (\( \bar{X} \)) is of 22.96 stomata/mm\(^2\) µm and the variability coefficient (%) is of 18.71%, indicating a medium variability of this behavior.

• the inferior epidermis - the value of the mathematical media (\( \bar{X} \)) is of 26.50 stomata/mm\(^2\) µm and the variability coefficient (%) is of 14.55%, indicating a small variability of this behavior.

- stomata device of anizocitic type.
Conclusions

1. The leaves of the studied species are amfistomatic (present stomata on both the superior epidermis and on the inferior one), with the exception of Senecio articulatum whose leaves are hipostomatic (they have stomata only on the inferior epidermis).

2. All the studied species of the Senecio genre display a certain uniformity in what concerns the form of the epidermic cells (polygonal cells with straight walls), with the exception of Senecio articulatum whose epidermis cells have corrugated walls.

3. At the studied species, there are differences regarding the dimensions of epidermis cells, the dimension and the density of the stomata, thus:
   - for the length of the epidermis cells, at the level of the superior epidermis, the values are between 100,35 µm at Senecio rowleyanus and of 214,2 µm at Senecio piramidatum, and at the level of the inferior epidermis, these are between 98,6 µm at Senecio rowleyanus and of 210 µm at Senecio kleiniformis;
   - for the width of the epidermis cells, at the level of the superior epidermis, the values are between 70,65 µm at Senecio rowleyanus and of 117 µm at Senecio kleiniformis, and at the level of the inferior epidermis, these are between 70,11 µm at Senecio rowleyanus and of 117,7 µm at Senecio kleiniformis;
   - for the length of stomata, the values are between 41,4 µm at Senecio rowleyanus and of 124,65 µm at Senecio piramidatum;
   - for the density of stomata, on the superior epidermis they vary between 7,06 stomata/mm² at Senecio kleiniformis and 22,96 stomata/mm² at Senecio rowleyanus and on the inferior epidermis, between 13,10 stomata/mm² at Senecio piramidatum and 29,44 stomata/mm² at Senecio kleiniformis, displaying values that are characteristic to the succulents plants.

4. Three of the five studied species have stomata device of anizocitic type (Senecio piramidatum, Senecio kleiniformis, Senecio rowleyanus), while Senecio articulatum has stomata device of anomocitic type, and Senecio jacobsenii has stomata device of ciclocitic type. This contradicts both the hypothesis of the stability of the stomata device for the species belonging to Senecio genre, hypothesis elaborated by B.V Gopal and the one belonging to Metcalfe C.R and Chalk L regarding the types of stomata devices, characteristic to Compositae family.

References