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ASPECTS REGARDING SEEDS MORFOLOGY AND GERMINATION PECULIARITIES AT SOME TAXA FROM *SILENE* L. GENERA

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Abstract: Genus *Silene* L. is represented in the Romanian flora by 37 taxa that have different uses or an endemic species status. Highlighting morphological features of the seeds using light microscope provides very useful information in clarifying some taxonomic issues, but also in setting up a useful database for germplasm preservation. Regarding the germination, of interest were germination percentage and germination speed, plantlets development, the occurrence of the first pair of leaves, etc. The monitoring this process shows that differences between taxa occur in the early stages of development.

Key words: *Silene*, seeds morphology, germination

Introduction

Genus *Silene* L. is represented in Romanian flora by 37 herbaceous perennial species; some of them have of medicinal importance (eg. *S. vulgaris* (Moench) Garcke), others have decorative uses (eg. *S. acaulis* (L.) Jacq.), and *S. dinarica* Sprengel has the status of endemic species to southern Carpathians [CIOCÂRLAN, 2000]. Information on seed morphology in the description of the Romanian flora species is in some cases incomplete (*S. viscosa*) or missing altogether (*S. latifolia* subsp. *alba*, *S. nutans* subsp. *dubia*) [PRODAN, 1953]; for species such as *S. latifolia*, *S. nutans*, *S. vulgaris* more details are provided in the synthesis works [ДОБРОХОТОВ, 1961]. Thorough knowledge of structural features is very useful in clarifying taxonomic issues (especially for a botanical fragmentary material), in preparation for seed storage in germplasm banks or to identify seeds found in archaeological sites [BAŞLI & al. 2009, GÜNER & al. 2009].

The study of seed germination provides information on germination rate and speed which is useful for cultivating medicinal and decorative taxa or for monitoring invasive plant [BLAIR, 2004]. Differences in plantlet morphology arose interest from a theoretical point of view [CSAPODY, 1968; ВАСИЉЧЕНКО, 1965], but they also have practical use in agriculture [CIOCÂRLAN, 1975].

Material and methods

The material used in this paper consists of the seeds from seven taxa of the genus *Silene*, collected in 2009. The spontaneous taxa come from different locations in Romania, as follows: Făgăraş Mountains, Sibiu County (*Silene acaulis* (L.) Jacq. subsp. *acaulis, Silene dinarica* Sprengel); Iaşi, Iaşi County (*Silene latifolia* Poir. subsp. *alba* (Miller) Greuter & Burdet, *Silene viscosa* (L.) Pers., *Silene vulgaris* (Moench) Garcke subsp.

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vulgaris); Rarău Mountains, Suceava County (*Silene nutans* L. subsp. *dubia* (Herbich) Zapal); Broşteni, Suceava County (*Silene nutans* L. subsp. *nutans*).

For germination study 100 seeds were selected from each taxon and were placed in Petri dishes on filter paper moistened with water and maintained under controlled conditions (21 °C) in the climate chamber in the dark for 35 days (May 27, 2011 - June 29, 2011). All stages of germination were observed, the cracking of the seedcoat, the emergence of root, the cotyledons, and the first three pairs of leaves. Relevant images observed with binocular magnifier were photographed using Canon A540 camera.

The study was conducted in the Laboratory of micropropagation and germplasm preservation of the Botanical Garden, University "Alexandru Ioan Cuza" Iaşi.

Results and discussions

Most of the seeds of species of the genus *Silene* are of reniform type, but observation of macro-and micromorphology characteristics of the testa show differences from one taxon to another. Seed features description was made by well established parameters used in the literature [FAWZI & al. 2010]. Macromorphological issues pursued were: shape, color, lateral surface and dorsal surface of the seed. Micromorphological features of the testa cells in a frontal view were the outline and shape of the anticline and lateral walls (Fig. 2 A-G). A summary of the light microscope observations is shown in Tab. 1.

Tab. 1. Macro- and micromorphological features for 7 taxa of genus *Silene*

Taxa	Seed shape	Seed colour	Lateral surface	Dorsal surface	Testa cell outline	Anticlinali walls	Periclinal walls
Silene acaulis (L.) Jacq. subsp. *acaulis*	reniform	brown	concave	convex	elongated polygonal	S-undulated	flat, smooth
Silene latifolia Poir. subsp. *alba* (Miller) Greuter & Burdet	reniform	brown	convex	convex	polygonal	V-undulated	convex, with tubercle in the central area
Silene dinarica Sprengel	reniform	brown	flat	convex	elongated polygonal	S-undulated	convex
Silene nutans L. subsp. *dubia* (Herbich) Zapal	reniform	brown	flat	convex	polygonal	V-undulated	convex, with tubercle in the central area
Silene nutans L. subsp. *nutans*	reniform	brown	flat	convex	polygonal	V-undulated	convex, with tubercle in the central area
Silene viscosa (L.) Pers.	reniform	brown	flat	flat-convex	polygonal	V-undulated	convex, with tubercle in the central area
Silene vulgaris (Moench) Garcke subsp. *vulgaris*	reniform -circular	brown	flat-concav	flat-convex	polygonal	V-undulated	convex, with tubercle in the central area

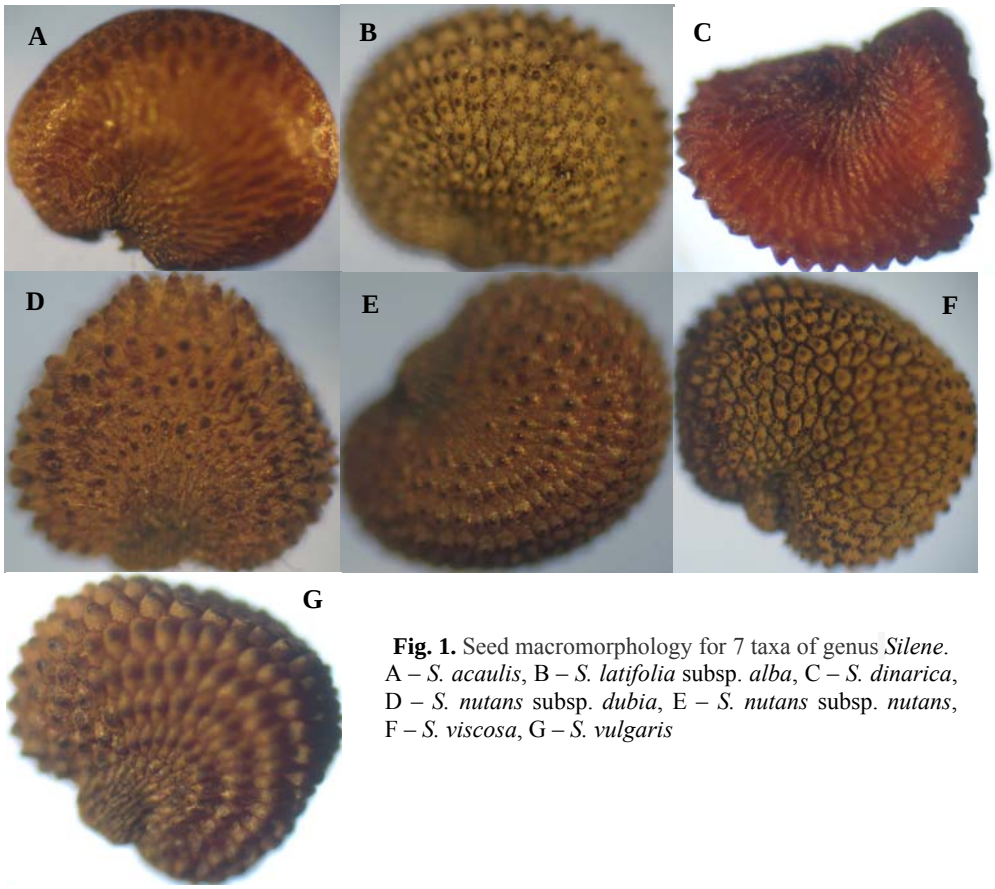

Fig. 1. Seed macromorphology for 7 taxa of genus *Silene*. A – *S. acaulis*, B – *S. latifolia* subsp. *alba*, C – *S. dinarica*, D – *S. nutans* subsp. *dubia*, E – *S. nutans* subsp. *nutans*, F – *S. viscosa*, G – *S. vulgaris*

Observation of the general appearance of the seeds highlights the species *Silene acaulis* for which the impression of smoothness is due to the fact that the grooves next to the anticline wall are shallow and lacking the tubercles on the anticline walls of the testa cells. The arrangement of cells on the surface of the testa shows an ordering in concentric and parallel rows for *S. acaulis*, *S. dinarica*, *S. nutans* subsp. *dubia*, *S. nutans* subsp. *nutans* and *S. vulgaris* (Fig. 1 A, C, D, E, G), concentric, but not parallel in *S. latifolia* subsp. *alba* (Fig. 1 B) and unordered in *S. viscosa* (Fig. 1 G).

Testa cell are approximately the same size across the seed's surface for *S. latifolia* subsp. *alba* and *S. viscosa*, while for the other taxa it changes from outside towards the hilum by tangential elongation. The hilum is embedded in *S. acaulis* and *S. dinarica*, while for the remaining taxa hilum is prominent.

The structure of the seed's testa is of practical "strategic" relevance being closely related to the functions it must fulfil: protection, dissemination and water absorption. The detailed morphological study highlights the theoretical importance of the seeds, as their characteristics can serve as diagnosis tools for taxonomic problems.

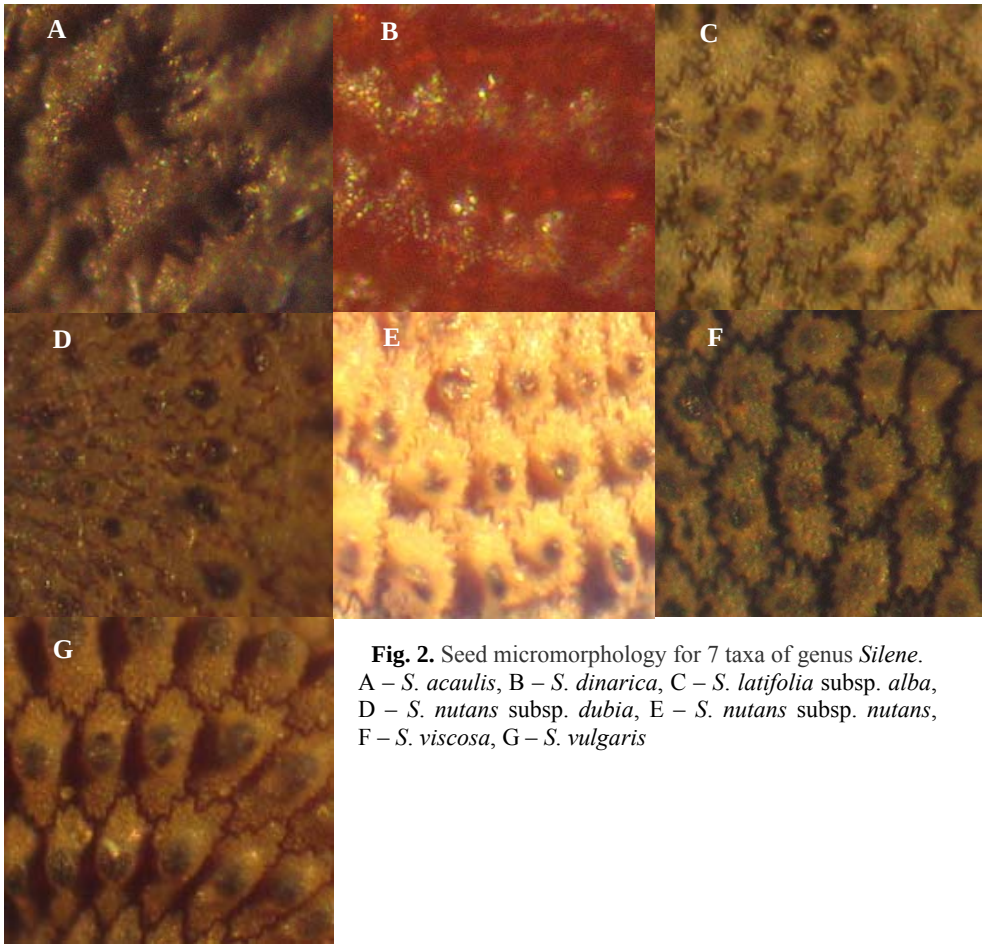

Fig. 2. Seed micromorphology for 7 taxa of genus *Silene*. A – *S. acaulis*, B – *S. dinarica*, C – *S. latifolia* subsp. *alba*, D – *S. nutans* subsp. *dubia*, E – *S. nutans* subsp. *nutans*, F – *S. viscosa*, G – *S. vulgaris*

Ongoing monitoring of the germinating seeds shows differences in the germination rate and speed of the seeds [INDREA, 2007]. Since the seeds were collected during 2009, a low germination rate was expected, but the results show that it varied widely, from 82% in *Silene vulgaris*, to 52% for *S. acaulis* and 8% for *S. nutans* subsp dubia. Germination speed showed very large variations, being high (5 days) in *S. vulgaris* and *S. acaulis*, but reduced (10 days) in *S. nutans* subsp. *dubia* (Fig. 3).

The occurrence of the first pair of leaves was observed after 18 days in *S. acaulis* and *S. latifolia* subsp. *alba*, but only after 25 days in *S. nutans* subsp. *dubia*. The daily observations of the evolution process of germination showed a uniform germination in *S. viscosa* and uneven for *S. acaulis*. This latter taxon had individuals at very different stages of germination towards the end of the experiment (Fig. 4).

Comparison of morphological characteristics of the first pair of leaves reveals notable differences from one taxon to another. Thus, the leaf shape is linear-lanceolate in *S.*

acaulis, ovate la *S. latifolia* subsp. *alba* and *S. vulgaris*, obovate in *S. viscosa*; the tip of the leaf is acuminate in *S. acaulis* and rounded in most taxa. The most significant differences concern the distribution, number, shape and size of trichomes (Fig. 5) on the leaf surface.

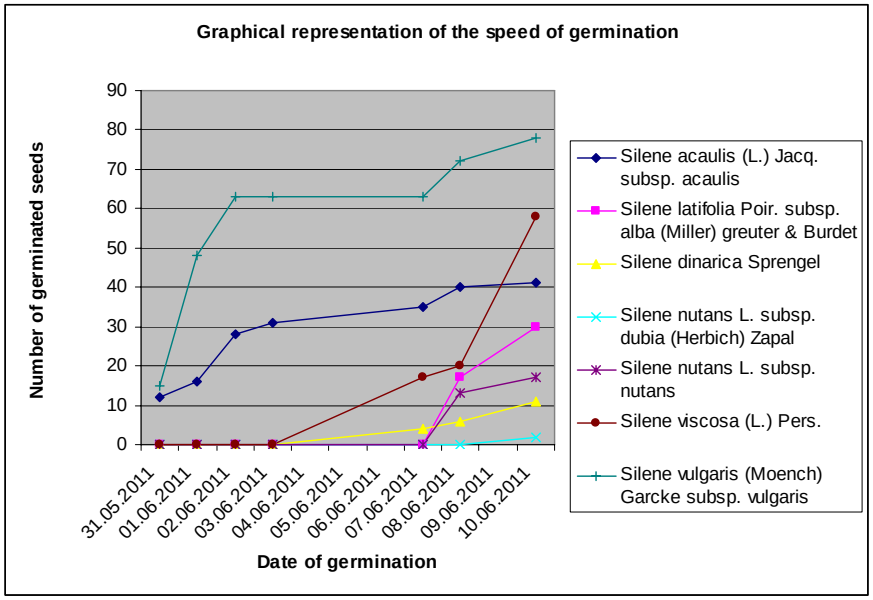

Fig. 3. Graphical representation of the speed of germination for seven taxa of genus *Silene*

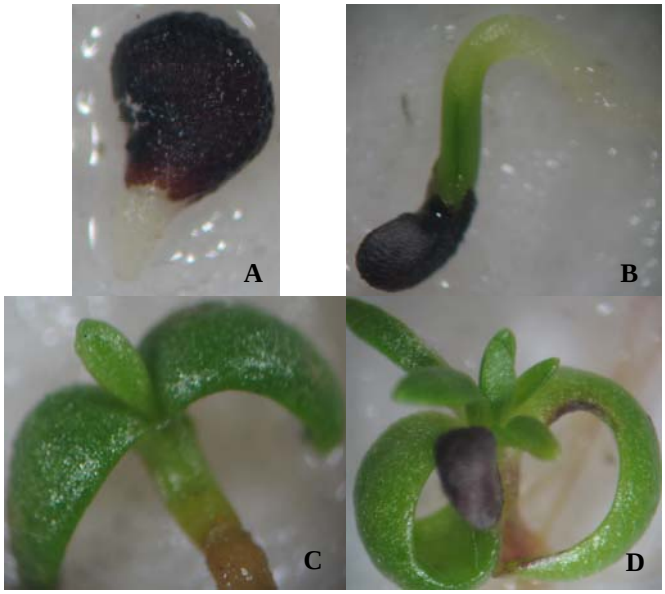

Fig. 4. *Silene acaulis*, June 29, different stages of germination. A – root appearance, B – cotyledons appearance, C – appearance of first pair of leaves, D – plantlet with three pairs of leaves

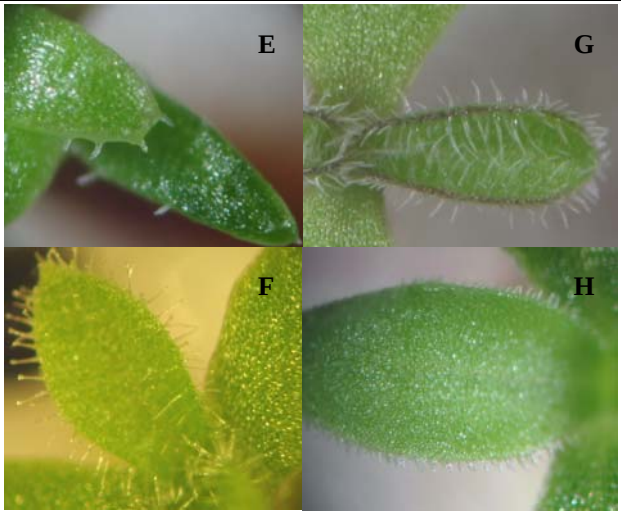

Fig. 5. Morphological characteristics of the first pair of leaves for:
E – *Silene acaulis*, F – *S. latifolia* subsp. *alba*, G – *S. viscosa*, H – *S. vulgaris*

Conclusions

Macro- and micromorphological study of the seeds of 7 taxa of the genus *Silene* may provide diagnostic characteristics information useful in solving taxonomy problems.

The evolution of germination process varies from one taxa to another and observed features can be used for obtaining biological material for medicinal, ornamental or ecological restoration use.

Morphology of seedlings (especially the leaves) highlights the differences between taxa from the early stages of development, which is useful in the case of invasive plants or weeds.

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