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A scanning electron microscopic study of the spermoderm in *Allium* subg. *Codonoprasum (Alliaceae)*

Abstract

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A study was made on the structural organization of the outer spermoderm surface in 18 Allium species of the Bulgarian flora. The spermoderm types in the different specific and supraspecific categories were established, and their taxonomic significance is discussed.

Introduction

The present paper is a continuation of our previous investigations on the spermoderm of *Alliaceae* in Bulgaria (Češmedžiev & Terzijski 1992; Terzijski & Češmedžiev 1994). The species of *Allium* subg. *Codonoprasum* (Rchb.) Zahar. are considered here.

Materials and methods

The materials investigated were collected from different floristic regions in Bulgaria. Vouchers have been deposited in the Herbarium of the Agricultural University in Plovdiv. The methods applied were described in an earlier paper (Češmedžiev & Terzijski 1992).

Results and discussion

Allium (sect. *Codonoprasum* (Rchb.) Endl.) subsect. ***Codonoprasum*** (Rchb.) Kamelin – *A. oleraceum* L. (Fig. 1), *A. paniculatum* L., *A. rhodopaeum* Velen., *A. pallens* L., *A. coppoleri* Tineo, *A. tenuiflorum* Ten., *A. fuscum* Waldst. & Kit. (Fig. 2), *A. longispathum* F. Delaroche

Spermoderm of the *convex type.* Epidermal cells polygonal, rarely 3-4-angular. Periclinal walls smooth, usually slightly convex, with one (rarely two) central and several (5-10) peripheral papillae. Cells oblong, sometimes with no central papilla or with only 2-3

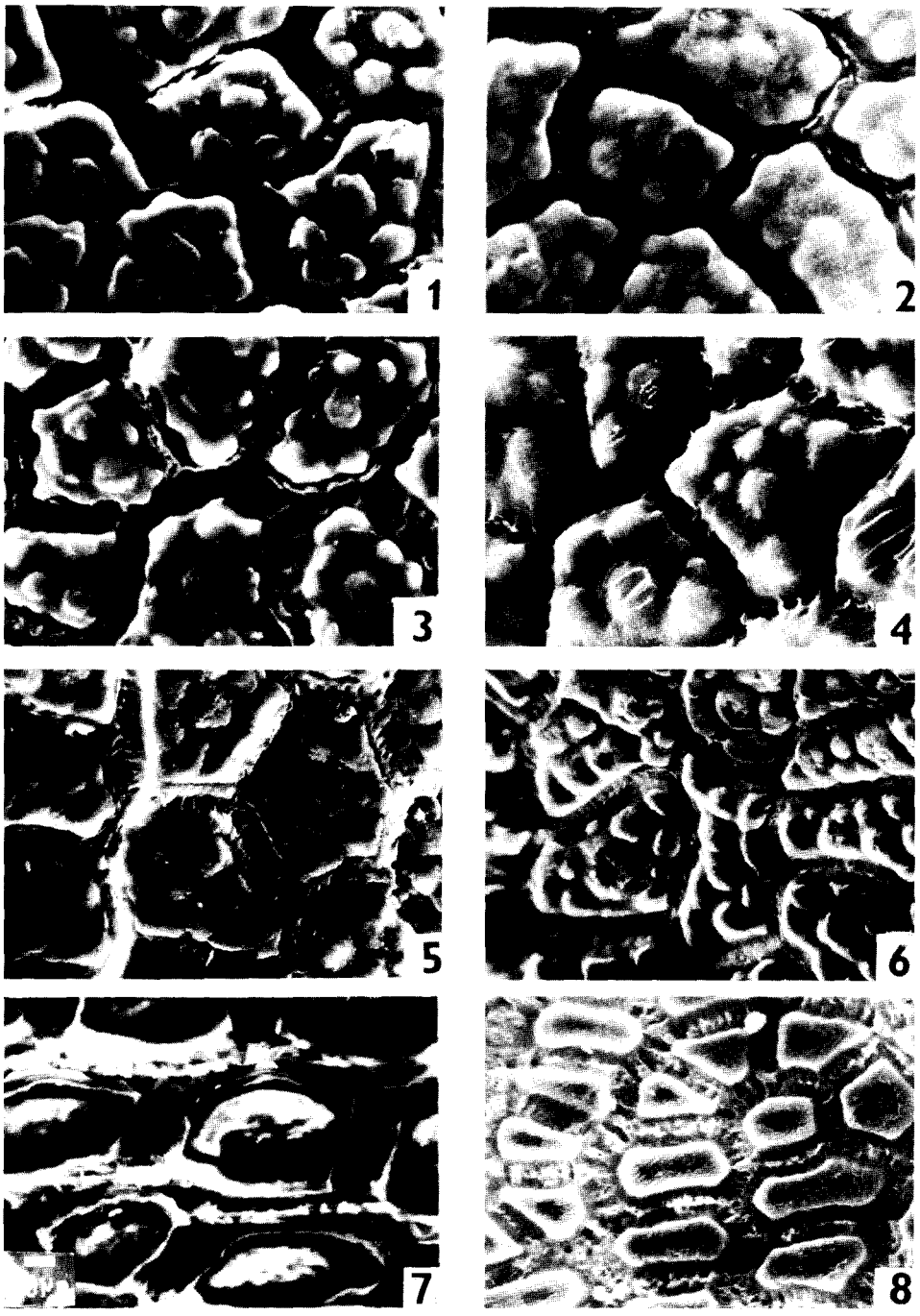

Fig. 1-8. Scanning electron micrographs of the spermoderm of Bulgarian *Allium* species. – 1, *A. oleraceum;* 2, *A. fuscum;* 3, *A. flavum;* 4, *A. webbii;* 5, *A. melanantherum;* 6, *A. thracicum;* 7, *A. moschatum;* 8, *A. cupanii.* Scale bar (bottom left) = 10 μm.

papillae situated in a row. Papillae usually equal in size, or the central a little larger. Sometimes the peripheral papillae coalesce into a rounded edge *(Allium tenuiflorum).* Anticlinal walls straight, hollow, of variable width, their field with dense transversal striae. Our data confirm the observations of Pastor (1981) for *A. oleraceum,* and of Pastor (l. c.) and Kruse (1984) for *A. paniculatum.* For *A. pallens,* our results coincide with those of Kruse (l. c.) but differ somewhat from those obtained by Pastor (l. c.).

Allium (sect. *Codonoprasum)* subsect. ***Longistamineum*** Cheshm. ex Omelczuk – *A. flavum* L. (Fig. 3), *A. webbii* Clemente (Fig. 4), *A. paczoskiamun* Tuzson, *A. carinatum* L., *A. cirrhosum* Vand., *A. nanum* (Asch. & Graebn.) Cheshm.

Spermoderm of the *convex type.* Epidermal cells usually polygonal, of rather different sizes. Periclinal walls smooth, slightly convex, with one (rarely 2-3 or none) central papilla and a row of peripheral papillae. In *Allium flavum* and *A. webbii,* striae are often observed on the periclinal walls. Anticlinal walls straight, with a clear field and fine transversal striae. A similar spermoderm structure has been reported for *A. flavum* by Kruse (1992) and for *A. carinatum* and *A. cirrhosum* by Kruse (1992) and Pastor (1981).

Allium (sect. *Codonoprasum*) subsect. ***Haemoprason*** (F. Herm.) Cheshm. – *A. melananthertum* Pančić, *A. thracicum* Halácsy & Georgiev (Fig. 5, 6).

Spermoderm of the *convex type.* Epidermal cells polygonal, rarely 3-4-angular. Periclinal walls smooth or *(A. thracicum)* scabrous, ± convex, usually with one (rarely two) central and several peripheral papillae. Sometimes *(A. thracicum)* the latter are crateriform. Anticlinal walls straight, with a narrow field, slightly convex in the middle part and with fine transversal plicae.

Allium sect. ***Scorodon*** W. D. J. Koch – *A. moschatum* L. (Fig. 7).

Spermoderm of the *tabular type.* Epidermal cells polygonal, rarely 4-angular. Periclinal walls flat or slightly convex, microverrucose. Anticlinal walls straight, with a clear field, linearly connected with a convex middle edge. Our results coincide with those of Pastor (l. c.).

Allium sect. ***Brevispatha*** Vals. – *A. cupanii* Raf. (Fig. 8).

Spermoderm of the *convex type.* Epidermal cells quadrangular to polygonal. Periclinal walls convex, concave in the centre, with a large, rounded edge. Anticlinal walls straight, with a large field and fine transversal plicae.

Conclusion

The investigation of spermoderm features of 18 Bulgarian species of *Allium* subg. *Codonoprasum* showed a general similarity in the structure of the anticlinal and periclinal walls of the epidermal testa cells. Significant differences were found only in the testa structure of two species, *A. moschatum* and *A. cupanii,* which supports their placement each in a particular section *(A.* sect. *Scorodon* and sect. *Brevispatha)* within the subgenus.

This separate placement is in conformity with their characteristic morphology, caryology and anatomy, too.

The investigation supports the taxonomic status of *Allium* subg. *Codonoprasum* and emphasizes its distinctness from subg. *Allium*. The differences between the two subgenera can be summarized as follows:

1. Inner filaments tricuspidate; ovary with 3 transversal crests; spathe entire, deciduous or persistent; SAT-chromosomes usually with satellites larger than the arms on which they are attached; anticlinal spermoderm walls plicate ..... *Allium* subg. *Allium*
- Inner filaments simple; ovary lacking transversal crests; spathe 2-valvate, rarely 1-valvate, persistent; SAT-chromosomes with satellites shorter than the arms on which they are attached (rarely equal to them); anticlinal spermoderm walls straight ..... *Allium* subg. *Codonoprasum*

The differences mentioned support the assumption that *Allium* subg. *Allium* and subg. *Codonoprasum* represent two distinct evolutionary lines.

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