

## SEED CHARACTERS AS DIAGNOSTIC IN THE PERENNIAL SECTIONS OF THE GENUS *Silene* L. (FAMILY *Caryophyllaceae*) – I

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### Abstract

Seed of the perennial *Silene* species belonging to ten sections are studied. Superficial structures of the seed especially the ornamentation of the seed coat proved important in classifying the species into 5 seed types. A few species showed infraspecific seed type variation.

### Introduction

Seeds have often been regarded as a useful character in taxonomic studies. Because both the internal and external structure of a seed is remarkably stable, they provide valuable criteria for positive identification. Superficial structures of the seed or the ornamentation of the cells of the seed coat are frequently diagnostic.

Boissier (1867) was the first to use seed characters, together with other morphological characters to define his groups *Schaftae* and *Heliospermae* in the genus *Silene*. Later Rohrbach (1868), revising the genus, used the seed structure to divide his section *Cincinnosilene*, into *Aptospermae* and *Dipterospermae*. The former had seeds with a smooth back i.e., without undulate margins or wings; the latter had seeds with a characteristic undulate back. Later authorities have also used the seed characters as diagnostic for sections, but only in very obvious cases as section *Heliosperma* (seeds with a dorsal crest and papillae at the back), section *Rupifraga* (seeds not crested on the dorsal surface) and section *Dipterospermae* (seeds with wings at the back (Rohrbach, 1868; Chowdhuri, 1957; Chater & Walters, 1964).

This study is based on 10 perennial sections comprising 75 species. Depending on the characters of the ornamentation of the seed coat, the species are classified into 5 seed types.

### Materials and Methods

Seeds were selected directly from capsules of the herbarium sheets or from the

samples obtained via Botanic Garden Seed Exchange. Wrinkled, shrunken, immature, damaged or deformed seeds were rejected. Where the herbarium material was available in a reasonably good quantity, 10 seeds from one capsule were taken and usually 2 capsules from a sheet. Five samples of each species (each sample of 10 seeds) was examined. In some species where seeds were present in a very limited quantity, in such cases as many seeds as available in good condition were studied.

Seeds were examined under the binocular microscope at x 40 magnification. All the seeds were measured at the same magnification at their longest axis. In this case a line lying perpendicular to the laterally placed hilum was taken as the length of the seed. Terminology used in the description is based (with alterations) on Murley (1957) and Rohrbach (1868).

### Seed Types

In *Silene* the ovules are anatropous, and bitegmic with the outer integument being 2 cells thick. Corner (1976) classifies the development of the seeds of the family as 'non-multiplicative' in which the cells of the integuments divide anticlinally, enlarge and differentiate. The seeds have big outer cells with thickened walls giving different ornamentations to the testa.

The seeds of the species belonging to the perennial sections studied do not exhibit a lot of diversity. In all the sections examined, the seeds are plump, not compressed, in face view, they are usually reniform to subreniform. The hilum is marginal, placed laterally and usually in a notch. The cells located on the faces are commonly longitudinally elongated to hexagonal and point to the hilum, with sinuate, serrate or wavy margins. They may or may not be arranged in concentric rows. The marginal cells are less distinctly elongated and are arranged in longitudinal rows about the circumference. Those in the hilar zone are smaller and give a congested appearance. The seed faces are not plane but variously slanted or curved. The margin or back of the seeds is canaliculate, flat or convex. The ornamentation on the cells of the seed coat shows variations in different sections and species, which is classified under the following seed types.

Seed type I is the most common encompassing most of the perennial species in the sections studied. It is defined with tubercles either absent on the seed coat or when present low rounded to rounded on the faces; at the back region and the ridges the tubercles are rounded or low rounded. Cells of the testa or the tubercles are not granulate. (Plate I, Fig. 1) This seed type includes majority of the species in sections *Siphonomorpha*, *Sclerocalycinae* and *Auriculatae*. The seeds of all the species available for study in sections *Lasiostemones* and *Pinifoliae* belong to this type.

Seed type II, also frequently found, comprises species with seeds with the tuber-

## PLATE I

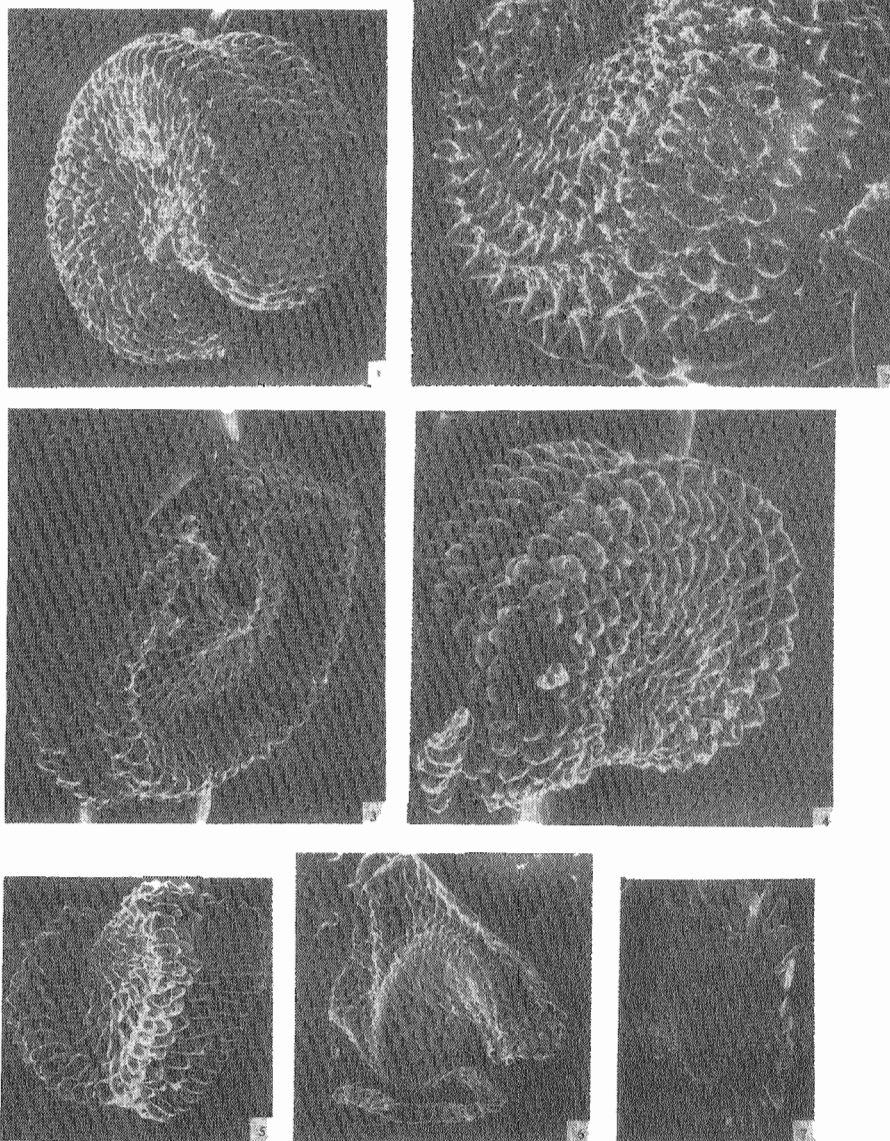


Plate 1. Fig.1. Seed Type I: *S. lucida* x 50. Fig.2. Seed Type II: *S. nutans* x 100.  
 Fig.3. Seed Type III: *S. brevicaulis* x 100. Fig.4. Seed Type II: *S. viridiflora* x 50;  
 Fig.5. Seed Type III: *S. pseudovelutina* x 50; Fig.6. Seed Type IV: *S. furcata* x 50;  
 Fig. 7. Seed Type V: *S. alpestris* x 50.

cles granulate or non-granulate, low rounded to rounded on the faces or absent. The back and the ridges have cylindrical, clavate or conical tubercles, with or without rounded tubercles. (Plate I, Fig. 2, Plate I, Fig. 3) Section *Inflatae* (of the species studied) could be characterised by such a seed type. The cells of the faces of this section also show a distinct concentric zonation which is quite characteristic and could be used as a diagnostic feature.

Seed type III is present in relatively few species. This seed type is characterized by the tubercles being low rounded or absent on the faces; cells of the faces frequently granulate; on the back the tubercles are rounded,  $\pm$  granulate, with umbonate tubercles amongst them. (Plate I, Fig. 4 and Plate I, Fig. 5) This seed type is present in only 7 species in section *Siphonomorpha* and 3 species in section *Spergulifoliae*.

Seed type IV is characteristic of species belonging to section *Gastrolychnis*. Wing-like outgrowths are present on the dorsal edges of the seed, which may be swollen or narrow and flattened. (Plate I, Fig. 6.)

Seed type V is present in the species belonging to section *Heliosperma*. The seeds are characterised by having 2-3 rows of papillae on the dorsal part of the seed. (Plate I, Fig. 7).

#### Discussion

The five main seed types and their species representatives is given in Table 1. It is clear from looking at the table that the majority of the species analysed for seed characters fall under seed type I.

TABLE 1. Sections, Seed-Types and Species Representatives in the Perennial Sections of *Silene*

Section	Seed-Type	Species
Siphonomorpha Otth	I	<i>brachypoda</i> Rouy, <i>catholica</i> Ait., <i>damboldtiana</i> Greuter, & Melzh., <i>hifacensis</i> Rouy ex Willk., <i>mellifera</i> Boiss. et Reut, <i>nemoralis</i> Waldst. et Kit., <i>nodulosa</i> Viv.
	II	<i>paradoxa</i> L., <i>viscarioposis</i> Bornm. <i>fruticosa</i> L., <i>galataea</i> Boiss., <i>goulimyi</i> Tur-rill, <i>leucophylla</i> Boiss., <i>nutans</i> L. <i>viridiflora</i> L.

	III	<i>gigantea</i> L. var. <i>gigantea</i> , var. <i>incana</i> (Griseb.) Chowdh., <i>mollissima</i> Pers., <i>patula</i> Desf., <i>pseudovehutina</i> Roth, <i>Sicula ucria</i> , <i>vehutina</i> Pourr.
	I & II	<i>italica</i> , <i>nutans</i>
	I & III	<i>coutinhoi</i> , <i>spinescens</i>
Lasiostemones (Boiss.) Schischk.	I	<i>afghanica</i> Rohrb., <i>gasimailikensis</i> B. Fedtsch., <i>longipetala</i> Vent., <i>marschallii</i> C.A.Mey., <i>olympica</i> Boiss., <i>puberula</i> Boiss., <i>saxatilis</i> Sims.
Sclerocalycinae (Boiss.) Chowdh.	I	<i>armena</i> Boiss., <i>bupleuroides</i> L. <i>cholorifolia</i> Sm., <i>laxa</i> Boiss. & Ky., <i>radicosa</i> Boiss. & Heldr. ssp. <i>radicosa</i> , ssp. <i>pseudoradicosa</i> Rech. f., <i>swertifolia</i> Boiss., <i>tatarica</i> Pers.
	II	<i>litwinowii</i> Schischk. <i>viscosa</i> (L.) Pers.
Gastrolychnis (Fenzl) Chowdh.	IV	<i>furcata</i> Rafin., <i>wahlbergella</i> Chowdh.
Otites Otth	I	<i>otites</i> (L.) Wibel
	II	<i>densiflora</i> D'Urv.
Spergulifoliae (Boiss.)	I	<i>cappadocica</i> Boiss. & Heldr., <i>montbretiana</i> Boiss., <i>multicaulis</i> Guss., <i>schwarzenbergeri</i> Halacsy, <i>spergulifolia</i> Boiss., <i>supina</i> M. Beib. subsp. <i>supina</i> , subsp. <i>pruinosa</i> (Boiss.) Chowdh.
	III	<i>arguta</i> Fenzl, <i>brahuica</i> Boiss., <i>ericalycina</i> Boiss.
Inflatae (Boiss.) Chowdh.	II	<i>fabaria</i> Sibth. & Sm., <i>vulgaris</i> (Moench) Garcke subsp. <i>vulgaris</i> , subsp. <i>maritima</i> (With.) A&D. Love
	I	<i>vulgaris</i> subsp. <i>thorei</i> (Duf.) Chater & Walters.
Pinifoliae Chowdh.	I	<i>caryophylloides</i> (Poir.) Otth subsp. <i>stentoria</i> (Fenzl) Coode & Cullen, <i>falcata</i> Sibth. & Sm., <i>nodulosa</i> Boiss. non Viv. <i>pungens</i> Boiss.

Auriculatae (Boiss.) Schischk.	I	<i>argaea</i> Fisch., <i>boryi</i> Boiss., <i>commelinifolia</i> Boiss., <i>delectabilis</i> Turill, <i>erimicana</i> Stapf, <i>lucida</i> Chowdh., <i>meyeri</i> Fenzl ex Reut. <i>moorcroftiana</i> Wall. ex Rohrb., <i>vallesia</i> L.
	II	<i>araratica</i> Schischk. <i>brevicaulis</i> Boiss.
Heliosperma Reichenb.	V	<i>alpestris</i> Jacq., <i>pusilla</i> Waldst. & Kit., <i>veselskyi</i> (Janka) Bég.

Intraspecific seed type variation was found to occur in a few species. Although the majority of the species possessed a single seed type, *S. italica*, *S. spinescens*, *S. nutans* and *S. coutinhoi* diverged from this pattern and showed structural variation of the seed coat which could be classified under a separate seed type. However, seed variation was not found within the seeds of a single capsule or different capsules on the same plant. Where the species showed variability in seed type, it was not possible to correlate this with any other morphological features.

The analysis of the seed characters in the perennial species showd that the structure and ornamentation of the seed coat has very limited use in the identification of the species. Within some sections which have more than a single seed type, these characters can be used (together with other morphological features of the species). For example, *S. goulimyi* and *S. fruticosa* can be separated on account of their distinctly cylindrically tuberculate seeds; similarly *S. litwinowii* and *S. viscosa* can be separated from the rest of the species in section *Sclerocalycinae* in having different seed types. This is also true for *S. araratica* and *S. brevicaulis* in section *Auriculatae*.

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