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Microstructure of seed coat in *Genisteae* (*Fabaceae*)

Abstract

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Structural features of two regions of seeds of 15 species of *Genisteae* were investigated by scanning electron microscopy procedure. Six basic microstructures types were found when analysing surface upper ×1000 magnification. Differences between the studied areas are clear; therefore the area of observation is relevant in order to find comparable patterns among different taxa.

Introduction

It is acknowledged that morphologic features of different seed structures provide a wide research field; these characters play an important role on the identification of taxa (Vaughan 1968) and have traditionally been used to solve systematic and phylogenetic problems.

The scanning electron microscopy (SEM) provides further insight where gross morphology did not and allow us to analyse seed coat structure and surface sculpture. These traits are of a great taxonomic value at generic and infra-generic status (Brisson & Peterson 1976, 1977).

Research on the *Fabaceae* proves that true. Studies on species of the tribe of *Vicieae* (Chernoff & al. 1992), the investigation on *Genisteae* (Saint-Martín 1986, Tahiri & al. 1999), as well as the work of Newell & Hymowitz (1978) on *Glycine* Willd., Heyn & Herrnstadt (1977) and Gammar Ghrabi & al. (1997) on *Lupinus* L., or Cubas & Pardo (1988) on species of *Ulex* L., are good examples of the use of seed characters in *Fabaceae*. Studies on testa sculpture in Mediterranean species of genus *Genista* L. were developed by Villa (1989) and Azzioui & Es-Sgaouri (1999).

The present work revealed new data on the seed coat of 15 species included in the group of *Genisteae*.

Materials and methods

Seed samples were taken either from Herbaria, Seed Banks or the wild. The origin of the material are listed below:

Genista dorycnifolia Font Quer (sect. *Asterospartum*) –Spain: Ibiza. Botanical Garden of Soller (92/0607).

Genista legionensis (Pau) Lainz (sect. *Erinacoides*) – Spain: Asturias, Somiedo. (J. Fagundez collect.).

Genista tinctoria L. (sect. *Genista*) – Germany: NRW, Warstein Stillenbergskopf. Botanical Garden of Münster University (458).

Genista umbellata (L'Hér.) Poir. (sect. *Lasiospartum*) - Spain: Alicante, Hondón de las Nieves, prox. Canalosa Alta, 30S XH 7941, own collection (N. Fuentes).

Genista anglica L. (sect. *Phyllospartum*) - Portugal: Serra da Estrella. Botanical Garden of Coimbra University.

Genista cinerea subsp. *murcica* (Coss.) Cantó & M. J. Sánchez (sect. *Spartioides*) – Spain: Alicante, Redovan, 30SXH82, own collection (J. Riera, F. Marco & E. Estrelles).

Genista florida subsp. *polygaliphylla* (Brot.) Cout. (sect. *Spartioides*) – Spain: León, Puerto Pajares, 30TTN7564, FCO 10206.

Genista obtusiramea Gay ex Spach (sect. *Spartioides*) – Spain: León, Panderrueda, 30TUN37, JACA 446385.

Genista pilosa L. (sect. *Spartioides*) - Spain: Navarra, Garralda, 30TXN3241, JACA 33762.

Genista ramosissima (Desf.) Poir. (sect. *Spartioides*) - Spain: Almería, Sorbas, 30SWG70, ALME 7875.

Genista aetnensis (Biv.) DC. (sect. *Spartocarpus*) – Italy: Sicily, Catania, Etna. Botanical Garden of Berlin-Dahlem (2121).

Genista tournefortii Spach (sect. *Voglera*) – Portugal: Serra do Boa Viagem, Figueira do Fog. Botanical Garden of Coimbra University.

Genista triacanthos Brot. (sect. *Voglera*) – Spain: La Coruña. Pico Sacro Boqueixon. (J. Fagundez collect.).

Chamaespartium sagittale (L.) P. Gibbs – Germany: Baden-Württemberg, Kreis Villingen-Schwenningen, Niedereschach, Botanical Garden of Berlin-Dahlem (2124).

Teline linifolia (L.) Webb & Berth. - Morocco: Maâmora Forest (northwest of Rabat), own collection (J. Güemes). (From plants cultivated in the Botanical Garden of Valencia University).

Samples collected from the wild are distinguished by the name of the collector. The material provided by Herbaria and Seed Banks are referred to their original herbarium or accession number.

Seeds were submitted to the usual techniques of SEM. Three to four seeds of each sample were mounted on metal stubs and were sputter-coated with a 100-200 Å thick layer of gold and palladium by a Ion Sputter (Bio-rad SC-500). Seed surface analysis was performed at an accelerating voltage of 15 KV with a SEM Hitachi S-4100, file emission, from the SCSIE department, electronic microscopy section of the University of Valencia.

Two regions of the seed coat were systematically checked: perihilar and equatorial areas in order to verify the homogeneity of this character.

Features (seed coat surface patterns and epidermal cell structure) were described following the terminology by Barthlott (1984), Stearn (1992) and Font Quer (1993).

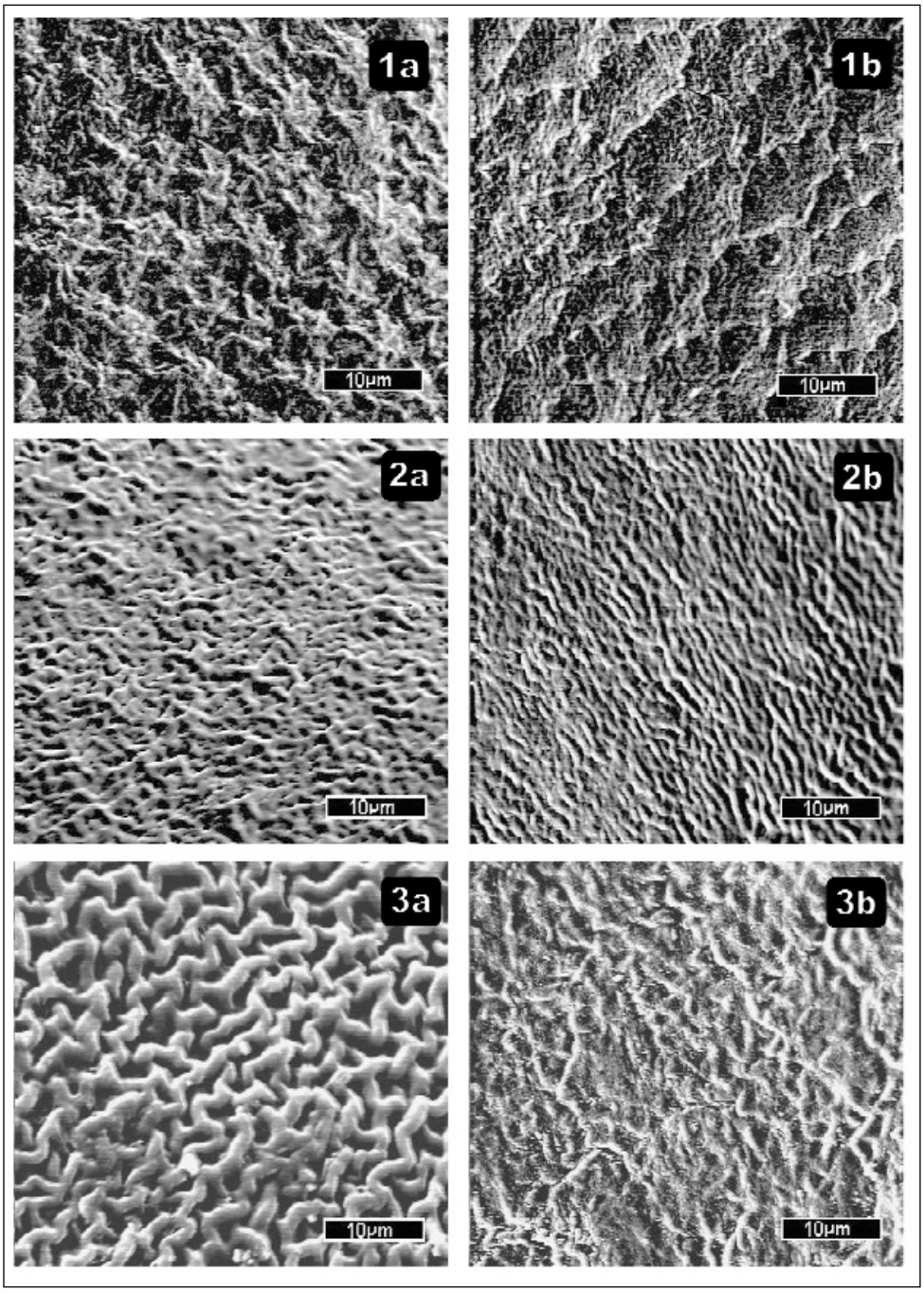

Fig. 1-3. **1.** *Genista dorycnifolia*; **2.** *Genista legionensis*; **3.** *Genista tinctoria*. (**a:** surrounding hilum area; **b:** equatorial area).

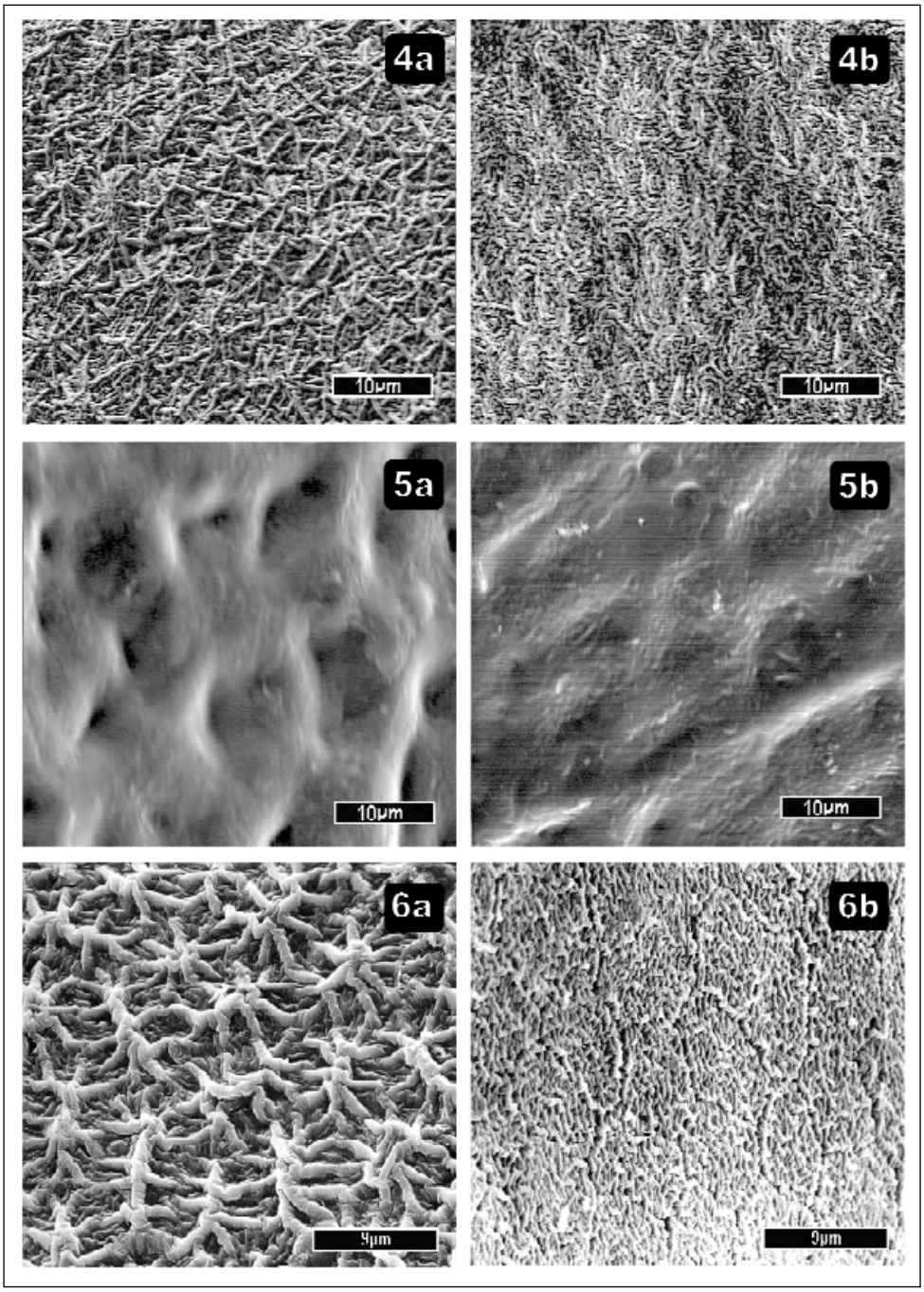

Fig. 4-6. **4.** *Genista umbellata*; **5.** *Genista anglica*; **6.** *Genista cinerea* subsp. *murcica*. (**a:** surrounding hilum area; **b:** equatorial area).

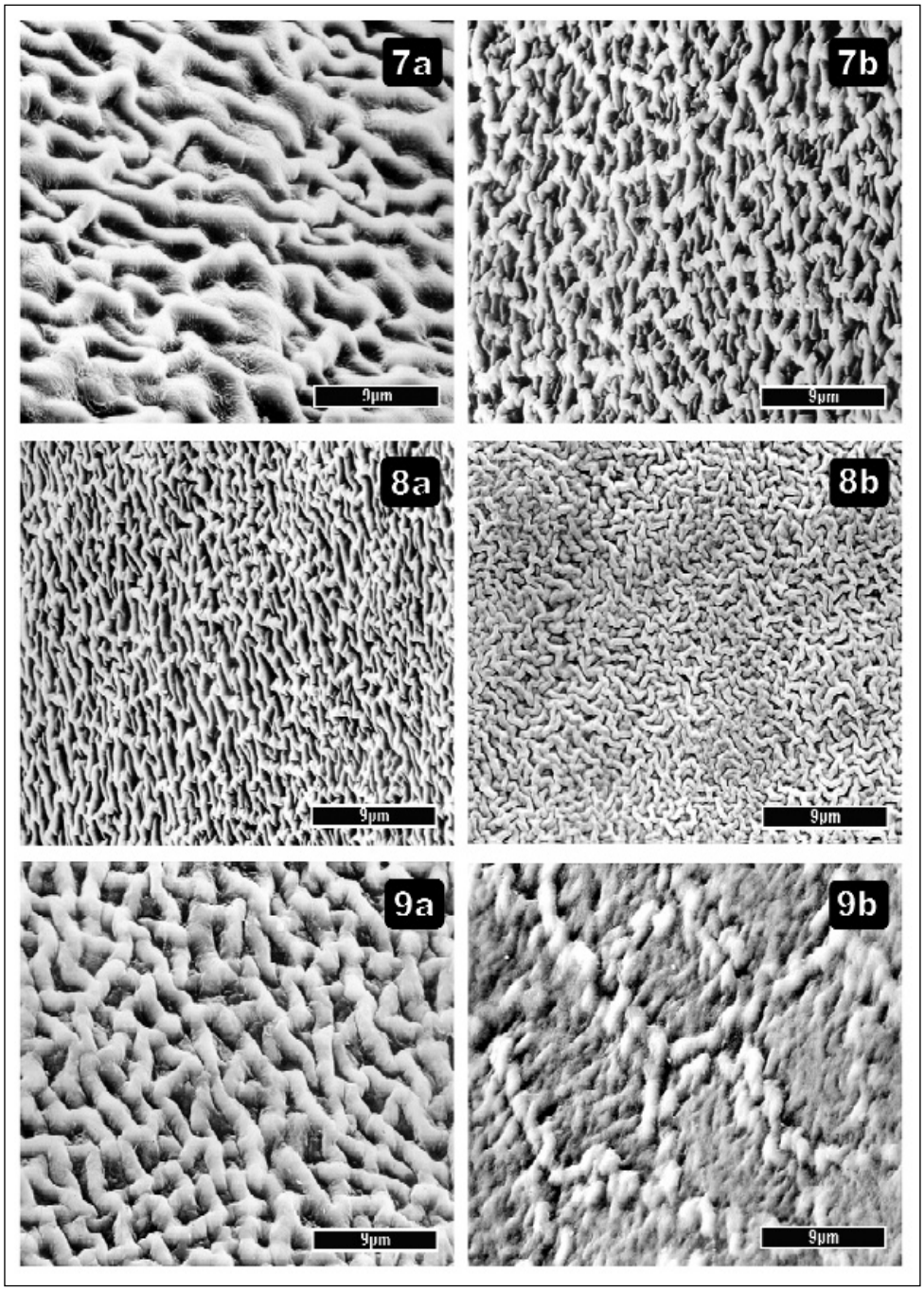

Fig. 7-9. **7.** *Genista florida* subsp. *polygaliphylla*; **8.** *Genista obtusiramea*; **9.** *Genista pilos*a. (**a:** surrounding hilum area; **b:** equatorial area).

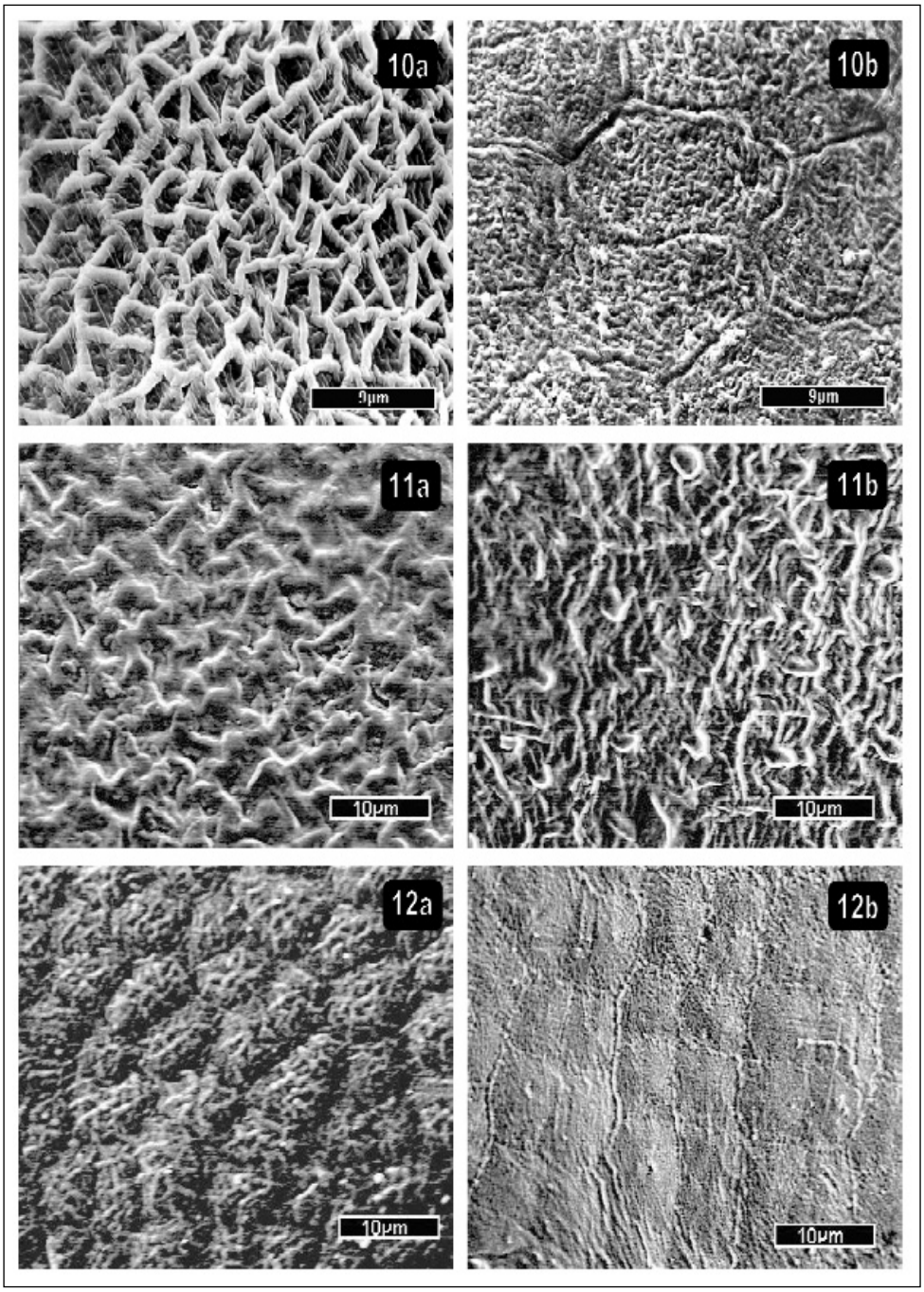

Fig. 10-12. **10.** *Genista ramosissima*; **11.** *Genista aetnensis*; **12.** *Genista tournefortii*. (**a:** surrounding hilum area; **b:** equatorial area).

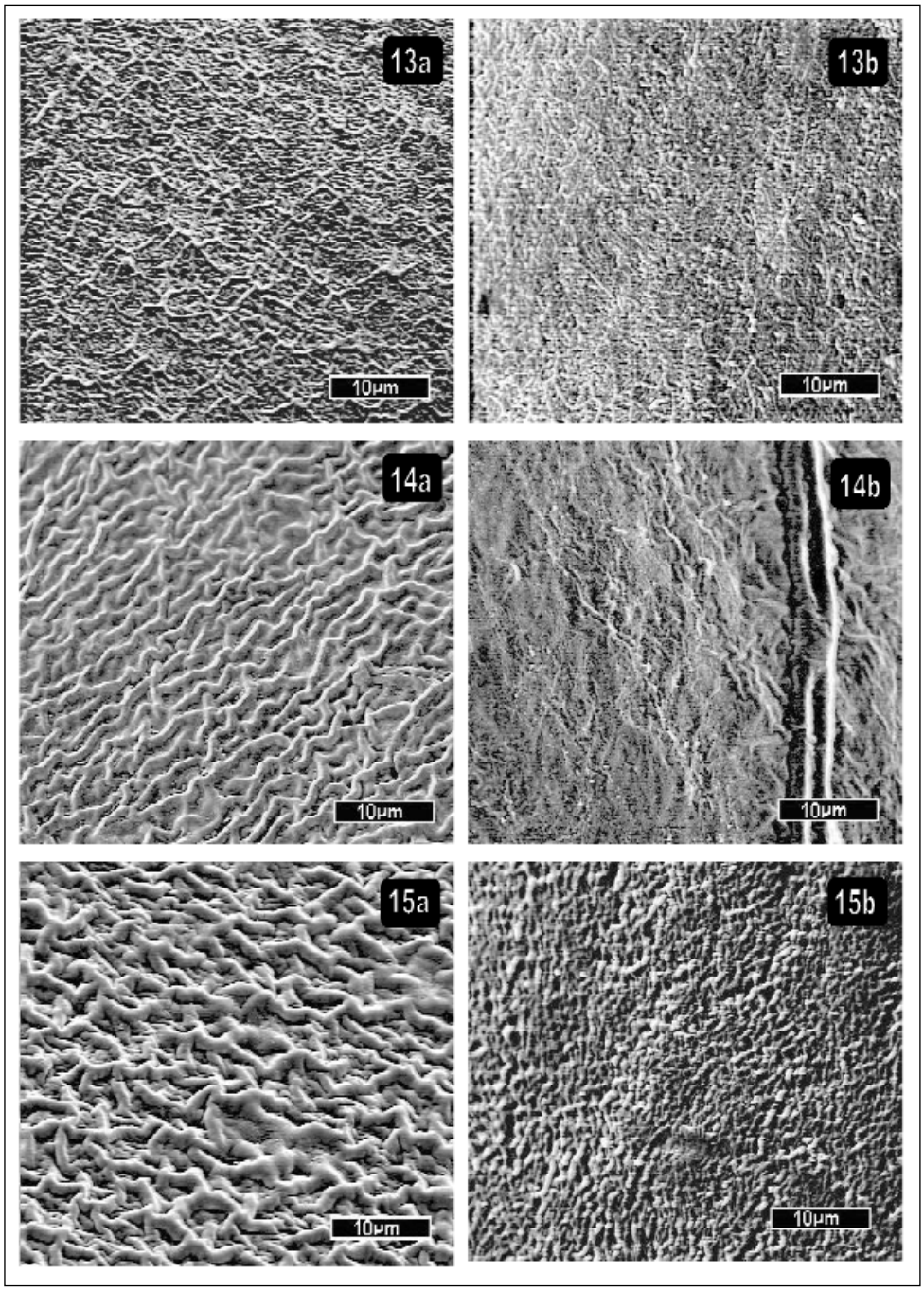

Fig. 13-15. **13.** *Genista triacanthos*; **14.** *Chamaespartium sagittale*; **15.** *Teline linifolia*. (**a:** surrounding hilum area; **b:** equatorial area).

Results and discussion

Seed coat structure traits of the checked areas are shown as follows: in every picture the perihilar ornamentation has been set on the left side while the equatorial area is shown on the right side.

Applying Barthlott terminology, the seeds show a primary ornament, characterised by the presence or absence of hexa or pentagonal cells, and a typical secondary sculpture with basically six microstructure types: I. Rugose-reticulate (wrinkled), II. Reticulate (network pattern), in any cases microreticulate, III. Stellate, IV. Pappilate, V. Reticulate-annulate and VI. Foveate. Many different combinations of these characters are noticed. Type I and II are the most frequent patterns in the studied taxa.

It seems that there are no clear patterns to separate taxonomic groups, species or sections, within the genus *Genista*. These findings have been found in accordance to those by Villa (1989) and Azzioui & Es-Sgaouri (1999) while investigating another species belonging to the group of *Genista*.

It must be noted that our study reveals the occurrence of distinguishing features on both checked areas within the same seed. This fact should always be taken into account when attempting investigations in this specific group.

Slight differences can be seen when comparing different populations of the same species stimulating subsequent studies on the issue.

In some cases, seed traits could not be distinguished due to the presence of an upper layer that covers up the ornamentation (Fig 16). We hypothesise that there is a relationship between this fact and the development degree of the seed.

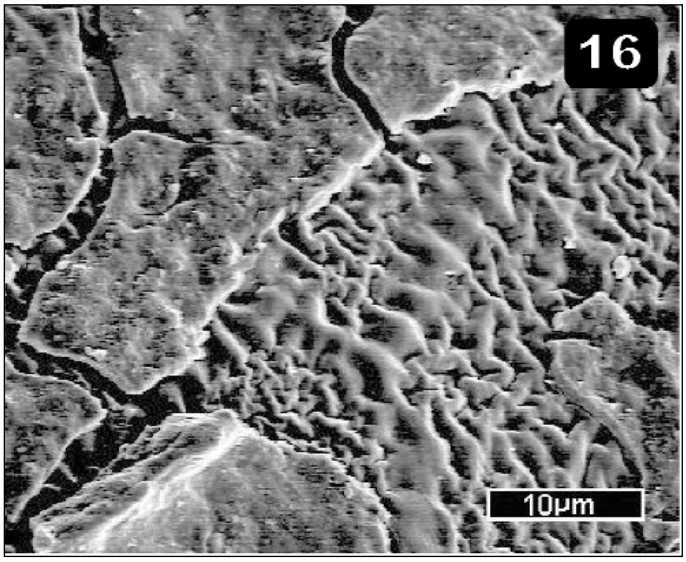

Fig. 16. Detail of a seed of *Genista florida* subsp. *polygaliphylla* showing an upper layer that covers the real ornamentation of the surface.

Conclusions

The results of our research, covering 15 species of *Genisteae*, seem not to be much helpful to the determination of species limits into this group. Given the complex group taxonomy, further studies including a larger number of species are needed.

Nevertheless, in the light of what it has been shown, it can be concluded that the maturation degree of the seed must be carefully chosen and the investigated seed coat area must be indicated given the remarkable difference between the studied ones.

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References

Azzioui, O. & Es-Sgaouri, A. 1999: Étude du tégument des graines du genre *Genista* L. (*Fabaceae*) au Maroc. – Acta Bot. Malacitana **24:** 43-51.

Barthlott, W. 1984: Microstructural features of seed surfaces. – Pp. 95-105 in: Heywood V. H. & D. M. Moore (eds.), Current Concepts in Plant Taxonomy. – London.

Brisson, J. D. & Peterson, R. L. 1976: A critical review of the use of scanning electron microscopy in the study of the seed coat. – Proceedings of the workshop on plant science applications of the SEM-IIT Research Inst. Chicago, **7(2):** 477-495.

— & — 1977: The scanning electron microscope and X-ray microanalysis in the study of seeds: a bibliography covering the period of 1967-1976. – Scanning Electron Microscopy-IIT Research Inst. Chicago, **2:** 697-712.

Chernoff, M., Plitmann, U. & Kislev, M. E. 1992: Seed characters and testa texture in species of the *Vicieae*: Their taxonomic significance. – Israel J. Plant Sci. **41:** 167-186.

Cubas, P. & Pardo, C. 1988: Morfología de las semillas del género *Ulex* L. (*Genisteae*, *Papilionoideae*). – Lagascalia **15(Extra):** 275-283.

Font Quer, P. 1993: Diccionario de Botánica.– Barcelona.

Gammar Ghrabi, Z., Puech, S., Zouaghi, M. & Nabli, M. A. 1997: Le tégument des graines chez les *Lupinus* (*Fabaceae*) de Tunisie. – Bot. Gallica **38:** 5-21.

Heyn, C. C. & Herrnstadt, I. 1977: Seed coat structure of Old World *Lupinus* species. – Bot. Not. **130:** 427-435.

Newell, C. A. & Hymowitz, T. 1978: Seed coat variation in *Glycine* Willd. subgenus *Glycine* (*Leguminosae*) by SEM. – Brittonia **30:** 76-88.

Saint-Martin, M. 1986: Micromorphologie tégumentaire des graines de *Papilionaceae*. – Bull. Soc. Bot. Fr., Lettres Bot. **133(2):** 137-153.

Stearn, W. T. 1992: Botanical Latin. – London.

Tahiri, H., Ouyahya, A. & El Alaoui-Faris, F.-E. 1999: Étude du tégument des graines des genres *Cytisus* L., *Argyrocytisus* (Maire) Rainaud, *Chamaecytisus* Link. et *Genista* L. (section *Teline* Medik.) (*Fabaceae*) au Maroc. – Acta Bot. Malacitana **24:** 53-61.

Vaughan, F. G. 1968: Seed anatomy and taxonomy. – Proc. Linn. Soc. Lond. **179:** 251-255.

Villa, R. 1989: Studi sul rivestimento del seme in alcune specie del genere *Genista* L. – Webbia **43(1):** 41-49.

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