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Research Article

Scanning Electron Microscopy Study of Pollen in Some Turkish *Teucrium* L. (Labiatae)

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Abstract: Detailed exine sculpturing of the pollen of 32 Turkish *Teucrium* L. (Labiatae) taxa has been investigated under SEM. Two main exine sculpturing types, verrucate (in sections *Teucrium, Scordium,* Boiss, *Chamaedrys* Benth., *Polium* Benth.,*Stachyobotrys* Benth. and *Scorodonia* Benth.) and reticulate, (only in section *Isotriodon* Boiss.) have been defined and their photographs have been presented.

Key Words: Pollen morphology, *Teucrium, Labiatae*, Flora of Turkey.

Türkiye'de Yetişen Bazı *Teucrium* L. (Labiatae) Taksonlarının Polenlerinin Taramalı Elektron Mikroskobu ile İncelenmesi

Özet: Türkiye'de yetişen 32 *Teucrium* L. (Labiatae) taksonunun polenlerinin detaylı ekzin süslünmeleri taramalı elektron mikroskobu ile incelenmiştir. *Teucrium, Scordium* Boiss., *Chamaedrys* Benth., *Polium* Benth., *Stachyobotrys* Bent. ve *Scorodonia* Benth. seksiyonlarında verrukat ve *Isotriodon* Boiss. seksiyonunda ise retikülat ekzin süslenmeli belirlenmiş ve fotoğrafları sunulmuştur.

Anahtar Sözcükler: Polen morfolojisi, *Teucrium, Labiatae*, Türkiye Florası.

Introduction

In a previous study by Oybak and İnceoğlu [1] pollen morphology of some 32 Turkish *Teucrium* L. (*Labiatae*) taxa has been investigated using LM. In the study, most 3-colpate-operculate pollen grains have been found to be homogeneous and a tentative separation of four pollen types have been made on the basis on the basis of exine sculpturing.

Other earlier works on *Teucrium* pollen were mainly based on either LM or TEM [2, 3, 4].

In recent investigations by Abu-Asab and Cantino [5, 6], pollen morphology in many Labiatae members including *Teucrium* from various parts of the world has been shown under SEM and TEM, and its phylogenetic implications have been discussed.

In this study, a further examination of the pollen of 32 Turkish *Teucrium* taxa by SEM has been proposed to understand the exact nature of the exine sculpturing.

Materials and Methods

Some pollen grains from all the *Teucrium* specimens studied in the previous LM study were separated for a SEM investigation. They were directly placed on stubs and covered with gold. Photographs were taken with a JEOL 100 CXII scanning electron microscope. All the specimens were examined, but only the clearest photographs representing each exine sculpturing type were selected and presented.

Terminology follows Faegri and Iversen [7] while nomenclature follows Ekim [8].

Specimens investigated (in taxonomic order given by Ekmi [8].]

Section: ***Teucrium***

Teucrium creticum L. (Tarsus-Pozanlı, Krause 4776, ANK).

T. sandrasicum O. Schwarz (C2 Muğla: Sandros Da., 1100-1500 m, Davis 13559, ANK).

T. brevifolium Schreb. (Aykathonisi Island, 10-50 m, Gathorne-Hardy 198, E).

T. pestalozzae Boiss. (C3 Burdur: near the city, Pamukçuoğlu-Quezel, HUB).

T. alyssifolium Stapf. (C2 Muğla: Köyceğiz, Sandros Da., 1220 m, Özhatay 24126, ANK).

T. multicaule Montb. et Auch. (B7 Erzincan: Kemah, Munzur Da., 1500 m, Yıldırımlı 1654, HUB).

T. orientale L. var. orientale (C6 K. Maraş: Göksun, Kınıkkoz Köyü, Mezdedelipınar, mixed forest, 1600 m, Yıldız 1038, HUB).

T. orientale L. var *puberulens* T. Ekim (A4 Kastamonu: Ilgaz Da., Handüzü, Yayladere, 1100 mm, Akman-Yurdakulol-Demirörs 11596, ANK).

T. orientale L. var *glabrescens* Hausskn. ex Bornm. (B7 Tunceli: Ovacık, Karagöl Valley, 1300-1500 m, Yıldırımlı 3501, HUB).

T. pruinosum Boiss. (Kayseri: Erciyes Da., İncesu, 1300 m, Çetik 4208, ANK).

T. parviflorum Scherb. (C6 Adıyaman. Gölbaşı, Pamukçuoğlu, HUB).

Section: ***Scordium*** Boiss.

T. scordium L. ssp. *scordium* (C3 Antalya: Kemer, 500 m, west of the village, 10 m, Peşmen-Güner 4058, HUB).

T. scordium L. ssp. *scordiodies* (Schreb.) Maire et Petit (B6 K. Maraş: Göksun, Kınıkkoz Köyü, 1500 m, Yıldız 1521, HUB).

Section: ***Chamaedrys*** Benth.

T. chamaedrys L. ssp. *chamaedrys* (Eskişehir: Türkmen Da., 1500 m, Ekim 2421, ANK.).

T. chamaedrys ssp. Iydium O. Schwarz (C3 Isparta: Eğridir, Aksu, Karacahisar Köyü, calcareous valley, 1000 m, Peşmen-Güner 1646, HUB).

T. chamaedrys ssp. *trapezunticum* Rech. fil. (A8 Trabzon: Soğanlı Da., Çaykara, 1300 m, Davis-Hedge 32086, HUB).

T. chamaedrys ssp. *tauricolum* Rech. fil. (Mersin: Anamur, Olucak, Davis, ANK).

T. chamaedrys ssp. *syspirense* (C. Koch) Rech. fil. (B7 Elazığ: Hazargölü, 1800 m, Davis 32072, ANK).

T. chamaedrys ssp. *sinuatum* (Celak) Rech. fil. (Kars: Ardahan, steppe, 1800 m, Çetik, ANK),

T. divaricatum Sieb. ssp. *divaricatum* (C1 Aydın: Kuşadası, Dilek Peninsula, Samsun Dağı, 200 m, Akman 7715, ANK).

T. divaricatum Sieb. sspb *villosum* (Celak) Rech. fil. (B1 İzmir: Kemalpaşa, Nif Da., maquie, 400 m, Seçmen, HUB).

T. flavum L. ssp. *hellenicum* Rech. fil. (Manisa, Spil Da, Sülüklü maquie, 600-700 m, Duman, ANK).

Section: ***Polium*** Benth.

T. montanum L. (C3 Isparta: Eğridir, Aksu, Yaka Köyü, 1640-1670 m, Peşmen-Güner 1690, HUB).

T. polium L. (B7 Erzincan: Yaylabaşı Köyü, 1300 m, Yıldırımlı 3872, HUB).

Section: ***Isotriodon*** Boiss.

T. montbretii Benth. ssp. *montbretii* (Hatay: Antakya, St. Peteris Church, 150 m, Davis-Hedge 27260, ANK).

T. montbretti Benth. ssp. *pamphylicum* P.H. Davis (Antalya: Konyaaltı. rocky slopes, 20 m, Çetik-Vural-Ocakverdi, ANK).

T. odontites Boiss. et Bal. (C2 Muğla: near Fethiye, rocks, Polunin, 13974, ANK)

T. cavernarum P.H. Davis (C4 Konya: Ermenek, 1400 m, Vural 915, ANK).

T. antitauricum T. Ekim (B6 Adana: 7 km north of Saimbeyli, rocky slopes, 1450 m, Ekim 3596, ANK).

T. paederotoides Boiss et Hausskn. (C6 Gaziantep: Nafak, rocks, 950 m, Ekim-Arslantürk 8226, ANK).

Section: ***Stachyobotrys*** Benth.

T. lamiifolium d'Urv. ssp. *lamiifolium* (C3 Isparta: Sarkikaraağaç, Yenişarbademli, 1600-1700 m, Peşmen-Güner 1388, HUB).

Section: ***Scorodonia*** Benth.

T. kotschyanum Poech (Mersin: Yeniköy, Kızıldere, Akman 6129, ANK).

Results

Two main exine sculpturing in Turkish *Teucrium* taxa have been defined by SEM as follows:

(A) VERRUCATE (wart-like projections with pits): Members of the sections *Teucrium, Scordium, Chamaedrys, Polium, Stachyobotrys* and *Scorodonia* exhibit such characters (Figs. 1-2).

(B) RETICULATE (ridges form a reticulate pattern with pits in lumina): Only members of the *Isotriodon* section show reticulate pattern (Figs. 3-4).

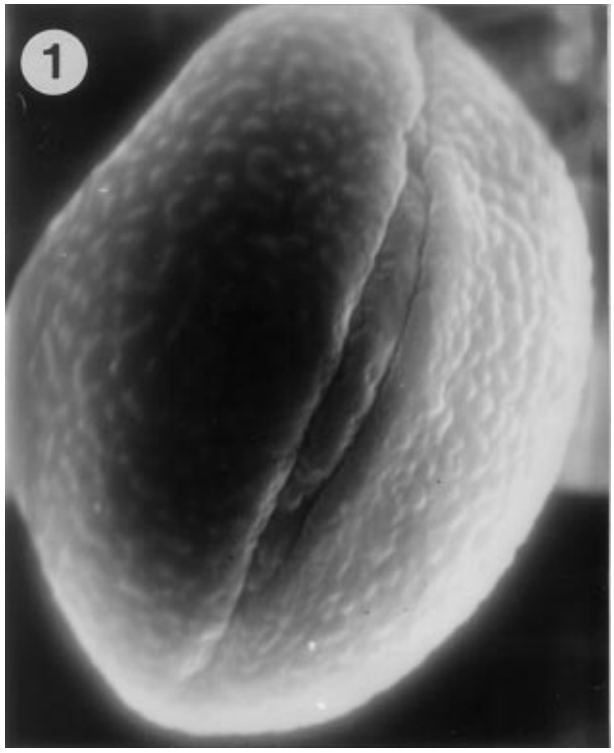

Figure 1. SEM photographs of the pollen of some *Teucrium* taxa. 1. *A general* view of *T. divaricatum* ssp. *villosum* pollen, showing verrucate exine sculpturing and a colpus with operculum, x3000.

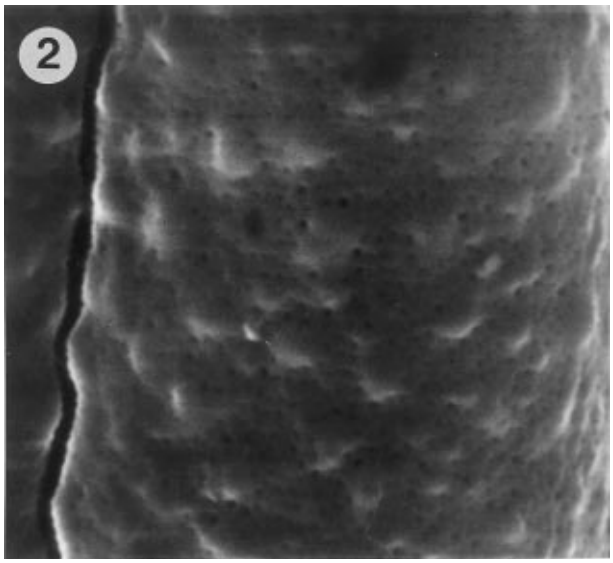

Figure 2. A closer view of verrucate exine with pits and a part of colpus in *T. chamaedrys* ssp. *lydium* pollen, x10000.

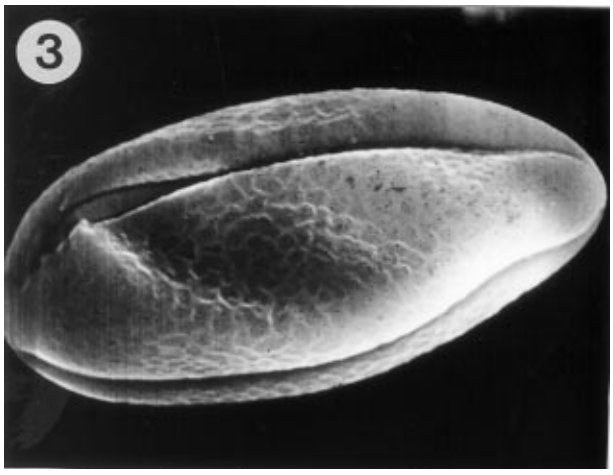

Figure 3. A general view of *T. montbretii* ssp. *montbretii* pollen, x2000.

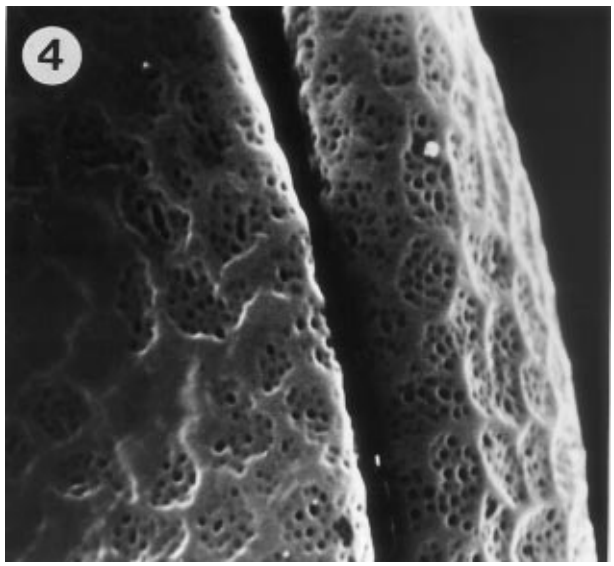

Figure 4. Reticulate exine in *T. montbretii* ssp. *montbretii* pollen, x8000.

Conclusions and discussion

This study has provided a better understanding of exine sculpturing of the pollen of Turkish *Teucrium* taxa studied previously with LM by Oybak and İnceoğlu [1]. Verrucate and obscurely verrucate-granulate exine surface patterns noted in the sections *Teucrium*, *Scordium*, *Chamaedrys*, *Polium*, *Stachyobotrys* and *Scorodonia*, under LM, could be interpreted as merely verrucate under SEM because all these patterns exhibit wart-like projections. All the members of the section

Isotriodon, on the other hand, have shown a reticulate pattern under SEM, which was interpreted as verrucate under LM. Some other investigators also wrote that the exine in *Teucrium* pollen is with verrucae under LM [2] or usually with suptratectal verrucae, less often with a supratectal reticulum under SEM and TEM [5, 6].

Abu- Asab and cantino [5, 6] also noted (supra] reticulate exine sculpturing under SEM and TEM in some members of the section *Isotriodon,* including *T. montbretii* collected from Syria and other species not grown in Turkey. They suggest that the (supra) reticulate sculpturing in the genus probably evolved through coalescence of supratectal verrucae. For the authors of this present study, it is difficult to establish an evolutionary line for *Teucrium* taxa investigated with respect to pollen morphology alone because there are not stable changes in exine sculpturing from one section to another. Verrucate sculpturing again appears in the sections *Stachyobotrys* and *Scorodonia* which are more advanced than *Isotriodon*. Ekim [8] writes that *Isotriodon* is an isolated East Meditteranean section whose species are all rare. We may therefore attribute the presence of reticulate exine pattern in Turkish *Isotriodon* to the isolation of the section whose members are mainly restricted to southern Anatolia.

Acknowledgements

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