NOTES ON SOME SPECIES OF THE GENUS DELPHINIUM (RANUNCULACEAE) IN IRAN

F. Sharifnia, M. Hasan Barani & M. Assadi

Received 20.04.2013. Accepted for publication 06.11.2013.

Sharifnia, F., Hasan Barani, M & Assadi, M. 2013 12 31: Notes on some species of the genus *Delphinium* (*Ranunculaceae*) in Iran. -*Iran. J. Bot. 19 (2): 202-210.* Tehran.

During the taxonomic revision of the genus *Delphinium* in Iran, *Delphinium kurdicum* Boiss. & Hohen. was identified among the herbarium specimens. This species is reported as a new record for the flora of Iran. Also, *D. zalil* Aitch. & Hemsl. is introduced as a distinct species from *D. semibarbatum* Bienert ex Boiss. The species is compared with a closely related species, *D. ochrolecum* Stev. ex DC. Morphological, palynological and tepal epidermal patterns of the taxa concerned have been investigated and the results are presented here. A new identification key for all of the yellow flowering *Delphinium* species in Iran is given.

Fariba Sharifnia (correspondence <f_sharifnia@iau-tnb.ac.ir>), Department of Biology, North Tehran Branch, Islamic Azad University, P. O. Box: 19585-936 Tehran, Iran. –Masoomeh Hasan Barani, Department of Biology, North Tehran Branch, Islamic Azad University. – Mostafa Assadi <assadi@rifr-ac.ir>, Research Institute of Forests and Rangelands, P. O. Box 13185-116, Tehran, Iran.

Key words. New record, *Delphinium kurdicum*, morphology, palynology, epidermis, Iran, identification key.

نکاتی درباره چند گونه از جنس Delphinium در ایران

فریبا شریف‌نیا، دانشیار گروه زیست‌شناسی، دانشگاه آزاد اسلامی واحد تهران شمال، تهران، ایران.

معصومه حسن بارانی، دانشجوی کارشناسی ارشد سیستماتیک گیاهی، دانشگاه آزاد اسلامی واحد تهران شمال، تهران، ایران.

مصطفی اسدی، استاد پژوهش موسسه تحقیقات جنگلها و مراتع کشور، تهران، ایران.

در راستای بازنگری نمونه‌های هرباریومی متعلق به جنس *Delphinium*، گونه *D. kurdicum* Boiss. & Hohen. برای اولین بار از غرب ایران گزارش می‌گردد. همچنین، گونه *D. zalil* Aitch & Hemsl. به عنوان یک گونه مستقل از *D. semibarbatum* Bienert ex Boiss. معرفی شده است. این گونه با گونه مجاور خود *D. ochrolecum* Stev. ex DC. مقایسه شده است. این گونه‌ها براساس ویژگی‌های مورفولوژیکی، گرده‌شناسی و الگوی اپیدرمی گلپوش بررسی شده‌اند. کلید شناسایی جدید برای تمام گونه‌های گل زرد *Delphinium* در ایران ارائه می‌شود.

INTRODUCTION

The genus *Delphinium* L. (*Ranunculaceae*) belongs to the tribe *Delphinieae* and comprises about 385 species mainly from temperate parts of the Northern hemisphere and mountain regions of tropical Africa (Ilarslan et al. 1997). This genus includes 53 species in Flora Iranica area, 29 of which are reported from Iran (Iranshahr 1992). *Delphinium semibarbatum* occurs in NE of Iran (Khorassan), Afghanestan and Turkmenistan (Iranshahr 1992). This species was recognized as a synonymy of *D. zalil* in Flora Iranica (Iranshahr 1992) and Flora of the USSR (Nevskii 1937), but these two species were regarded as distinct species by Parsa (1951) and IPNI (International Plant Names Index). In this survey, *Delphinium kurdikum* Boiss. & Hohen. is recorded for the first time from Iran. Also, *D. zalil* Aitch. & Hemsl. is introduced as a distinct species from *D. semibarbatum* Bienert ex Boiss. A new identification key for yellow flowering *Delphinium* species in Iran is presented.

MATERIALS AND METHODS

The herbarium materials deposited in TARI were studied using Flora Iranica (Iranshahr 1992), Flore de´l Iran (Parsa 1951), Flora of Turkey (Davis 1965) and Flora of the USSR (Nevskii 1937). The localities of *Delphinium* species are presented in table 1.

Table1. *Delphinium* specimens included in the morphological study and SEM (indicated by an asterisk✹).

Species	Locality
D. semibarbatum Bienert ex Boiss.	Khorassan, 58 km N of Mashhad on the road to Kalate-Naderi,1300 m, Assadi and Maassoumi 21388.
D. semibarbatum Bienert ex Boiss. ✹	Khorassan, on the road from Mashhad to Sarakhs, N of Mozduran, 800-900 m, Runemark and sardabi 23341.
D. semibarbatum Bienert ex Boiss.	Khorassan, 96 km from Mashhad on the road to Torbat-e- Heydariyeh, Robat-sefid, 1800-2000 m, Assadi and Maassoumi 21295.
D. zalil Aitch. &Hemsl.✹	Khorassan, Mashhad, Cheshmeshoor, 490 m, Foroughi 7952.
D. biternatum Huth	Khorassan, Esferayen, Shahjahan Mt. region, deep valley with rocky wall east of Danj village, 1400-1800 m, Mozaffariant 48647.
D. szowitsianum Boiss.	Mazandaran, ca 50 km SW of Chalous, near the village Delir, 1800 m, Assadi & Maasoumi 51679.
D. ochrolecum Stev. ex DC. ✹	Azerbaijan, Oroumieh, Pesan, Marmishu vally,1737 m, Mozaffarian 87255.
D. kurdicum Boiss. & Hohen. in Boiss. ✹	Azerbaijan, between Oroumieh and salmas, 1900 m, Assadi 78944.

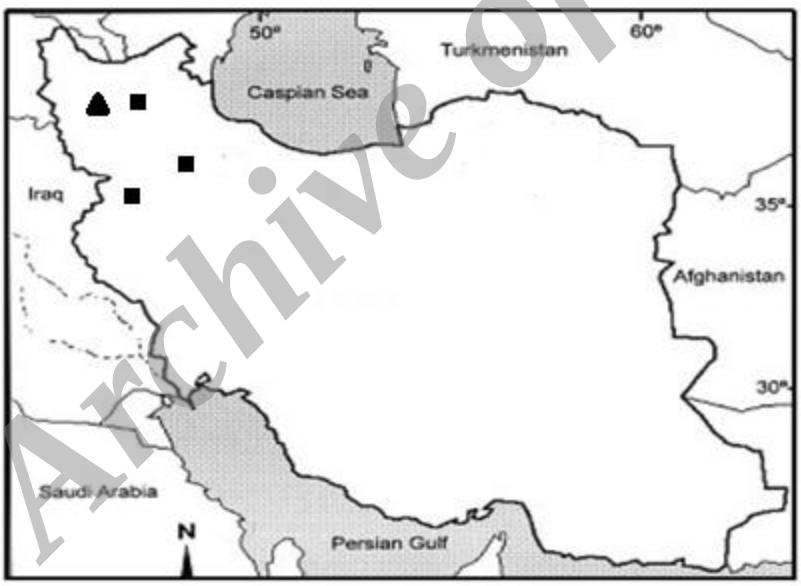
Table 2. Morphological and michromorphological characters useful in separating *Delphinium zalil* and *D. semibarbatum.*

Charcters / species	*D. semibarbatum*	*D. zalil*
Petiole indumentum	glabrous	hairy
Basal leaves indumentum	glabrous	pilose
Stem leaves indumentum	strigose	pilose
Sepal shape	ovate	ovate-elliptic
Raceme density	loose	dense
Width of leavf segments (mm)	1-2.5	3-5
Length of pedicel (mm)	5-10	ca. 20-30
Polar axis length of pollen (P) (µm)	36.6 – 38.25	26 - 26.98
Average of polar axis length of pollen (P) (µm)	37.2	26.49
Equatorial diameter of pollen (E) (µm)	18.2 -18.57	16.5-17.07
Average of Equatorial diameter of pollen (E) µm	18.39	16.8
Average of P/E	2.03	1.69
Pollen shape	prolate–perprolate	prolate
Ornamentation pollen	scabrate	scabrate
Tepal epidermal patterns	rugose	papillose with striate epidermis
Tepal apex	glabrous	hairy

Pollen grains and outer tepal epidermal pattern were studied using SEM. From each herbarium specimen, 3 pollen grains was studied. Pollen grains and tepals were stabilized on aluminium stocks and coated with a thin layer of gold using coating equipments. Then, the specimens were studied using Scanning Electron Microscope, model EM 3200. Micro-morphological measurements were performed using Carnoy, a digital measurement software (Schols et al. 2002).

Table 3: Morphological and michromorphological characters useful in separating *Delphinium kurdicum* and *D. ochrolecum*.

Characters / Species	*D. kurdicum*	*D. ochrolecum*
Plant length	40-45 cm	60-68 cm
Stem indumentum	without glandular hairs	with glandular hairs
Racem length	20-25 cm	30-45 cm
Sepal indumentum	glabrous	strigose
Pedicel length	5-6 mm	18-20 mm
Polar axis length of pollen grains (P) µm	28.3-29.59	21.5-22.6
Average of polar axis length of pollen grains (P) µm	28.79	22.2
Equatorial diameter of pollen grains (E) µm	16.2- 16.31	20.5-20.95
Average of equatorial diameter of pollen grains (E) µm	16.3	20.7
Average of P/E ratio	1.78	1.05
Pollen shape	prolate	spheroidal
Ornamentation of pollen grains	scabrate	scabrate
Tepal epidermal pattern	paving with hair	rugose and glabrous



Map 1. Distribution map of *Delphinium kurdicum* ▲ and *D. ochrolecum* ■ in Iran.

Terminology for pollen grains is according to that of Moore et al. (1991) and Punt et al. (1994) and tepal epidermal pattern is according Christensen & Hansan (1998).

RESULTS AND DISCUSSION

Delphinium semibarbatum is related to *D. zalil,* both of them occur in the same area, but they differ mainly in the characters given in (table 2). SEM images (pollen grain and tepal epidermal patterns) of these two species are shown in Fig. 1 and Fig.2.

Pollen shape in *Delphinium zalil* is prolate with scabrate ornamentation and in *D. semibarbatum* is prolate-perprolate with scabrate ornamentation. Tepal patterns in *D. zalil* is papilate with striate epidermis and in *D. semibarbatum* is rugose that confirms clearly

separation of the two species.

New record

Delphinium kurdicum Boiss. & Hohen. In Boiss., Diagn. Pl. Or. Nov. Ser.1, 1: 67 (1843).

Prov. Azerbaijan: between Uromieh and Salmas, 1900 m, Assadi 78944.

Perennial, 30-60 cm. high. Stem terete and striate, crisped-pubescent below. Stem leaves slenerly petiolate, palmatisect; segments deeply divided, lanceolate-laciniae, often withered at flowering. Raceme lax, linear, 2-2.5 mm broad, axis crisped or glandular-pubescent; pedicels divergent. Bracts and bracteoles linear. Flowers dirty white, 12-18 mm long. Sepals crisped-puberulent; spur cylindrical, ascending, saccate and upturned at apex, 1.3-2×sepals. Follicles glabrous (Fig. 3).

Delphinium kurdicum was originally described from Iraq, near Mousel, and so far is known to be distributed in Iraq and E. Turkey (Iranshahr 1992). The present record extends its distribution to Iran as well. As this species has a distribution in Iran similar to the distribution of another yellow *Delphinium* species i. e. *D. ochroleucum* (Map. 1), morphological and michromorphological studies of the two species are presented in table 3.

According to SEM images (Figs. 4 & 5), pollen shape, pollen ornamentation and tepal epidermal patterns are diagnostic characters for distinguishing *D. ochrolecum* from *D. kurdicum.* Pollen shape in *D. kurdicum* is prolate (polar axis is longer than the equatorial diameter) with scabrate ornamentation, but in *D. ochrolecum* is spheroidal (polar axis and the equatorial axis are equal) with scabrate ornamentation, also tepal epidermal patterns in *D. kurdicum* is coverd with hairs and in *D. ochrolecum* is rugose and glabrous. The results indicate that pollen and tepal micromorphology provide more effective characters for distinguishing these two species from each other.

Key to yellow flowering *Delphinium* species in Iran

1a. Sepal and carpel glabrous 2
b. Sepal and carpel pubescent 4

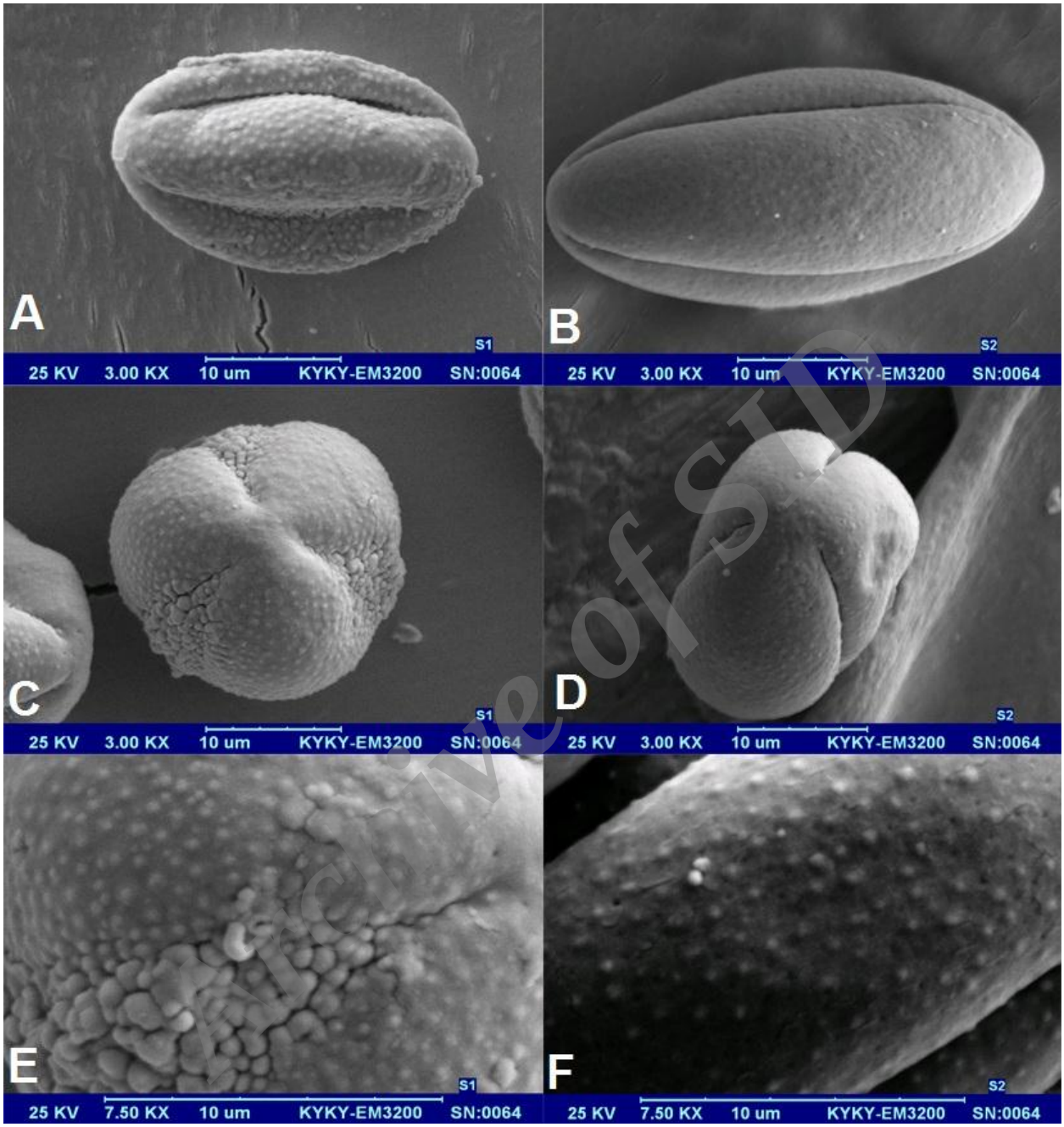


Fig. 1. SEM micrographs of pollen morphology of *Delphinium zalil (* A) equatorial view, (C) polar view, (E) Ornamentation and *Delphinium semibarbatum* (B) equatorial view, (D) polar view,(F) Ornamentation.

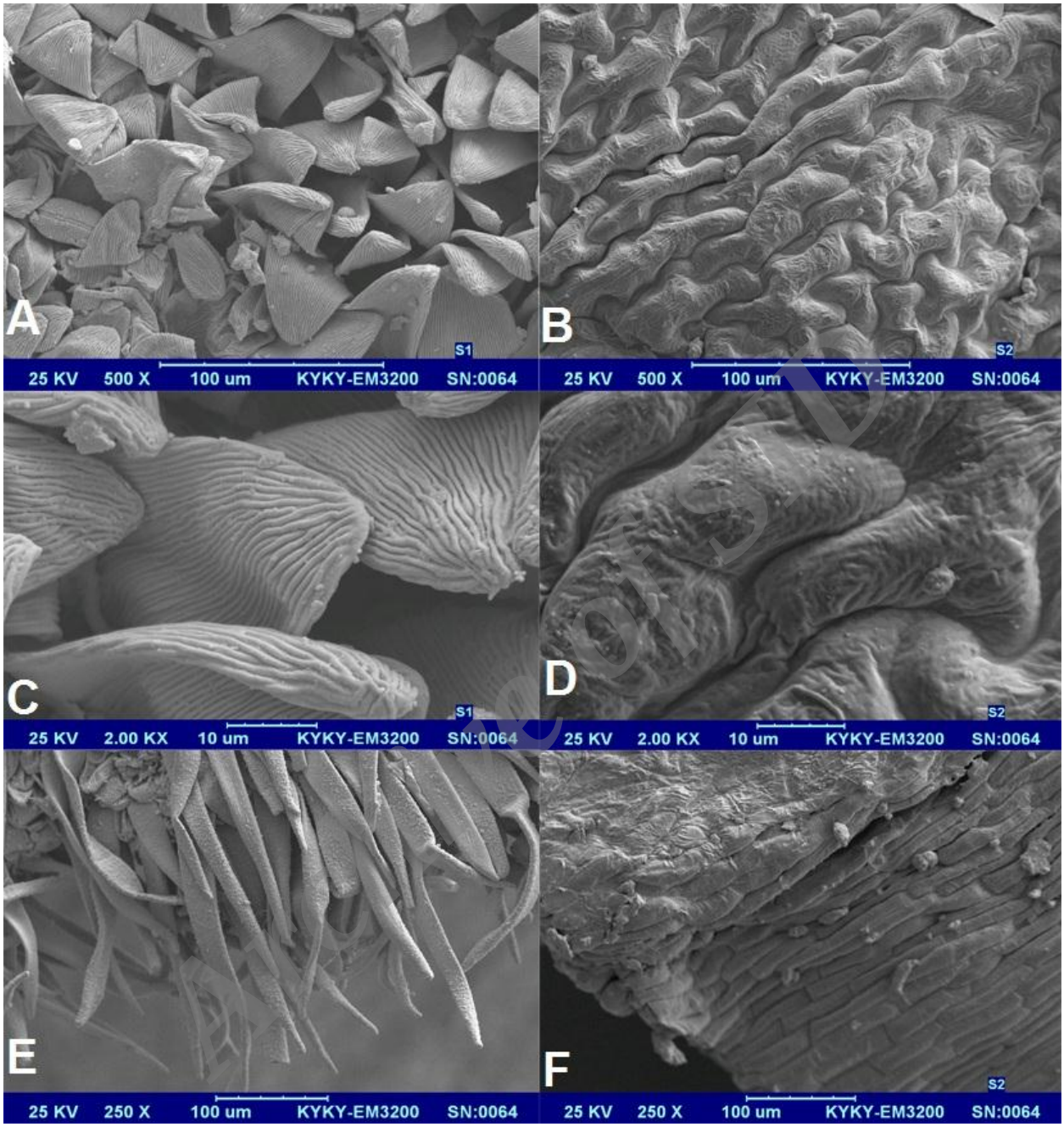


Fig 2. SEM micrographs of tepal epidermal patterns morphology: (A), (C) & E. *Delphinium zalil* and (B), (D) & (F) *D. semibarbatum.*

Fig. 3. *Delphinium kurdicum* (×0.7); flower (×2).

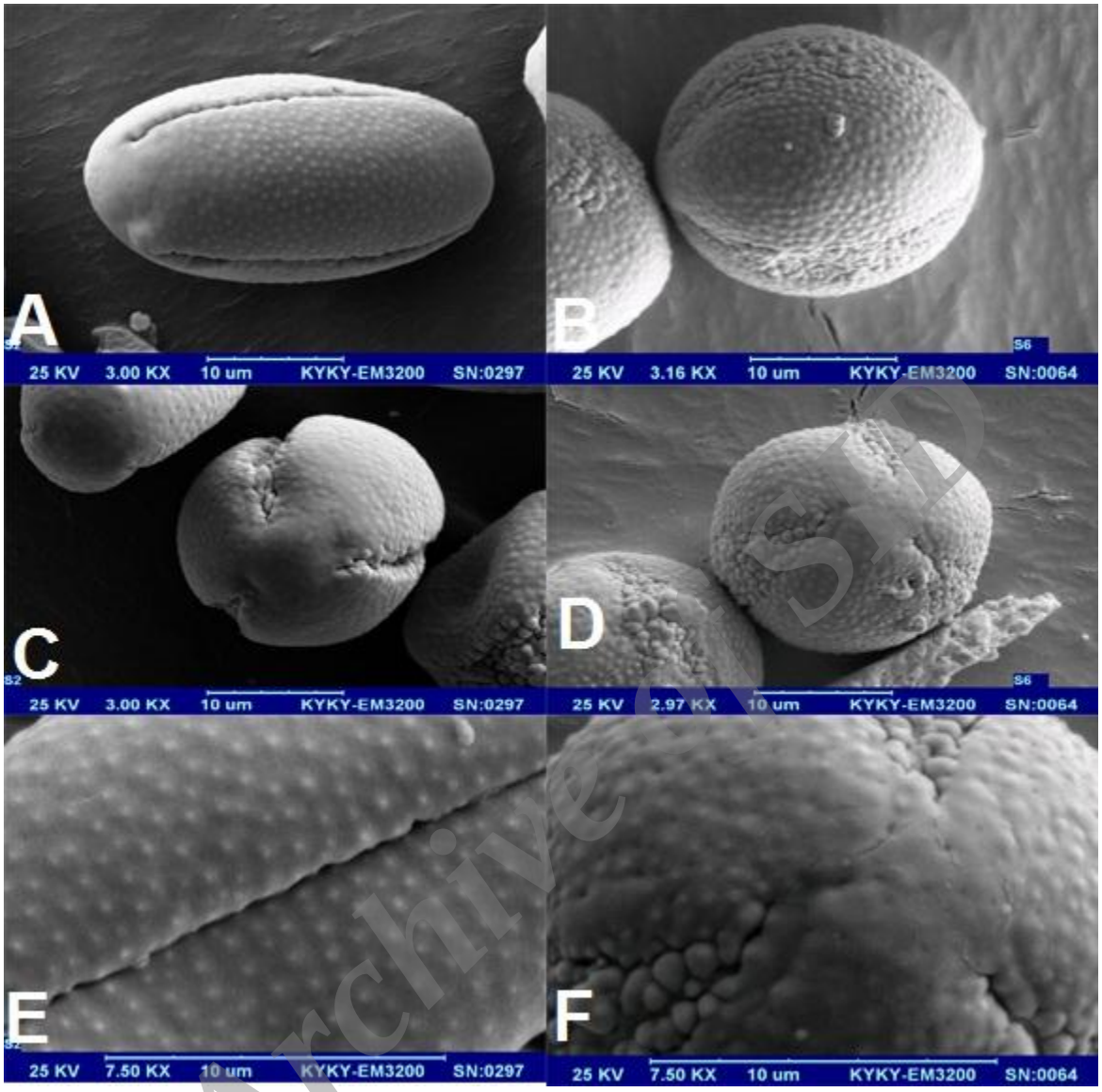


Fig. 4. SEM michrograps of pollen morphology of *Delphinium ochrolecum (*A) equatorial view, (B) polar view, (E) ornamentation and *Delphinium kurdicum (*B) equatorial view, (D) polar view, (F) ornamentation.

2a. Stems with glandular hair *D. ochrolecum*
b. Stems without glandular hair 3
3a. Pedicel up to 10 mm long. Petiole glabrous. Leaf segments up to 1.5 mm boad *D. semibarbatum*
b. Pedicel up 20-30 mm long. Petiole pubesecent. Leaf segments up to 4 mm broad *D. zalil*
4a. Apical petal blue *D. szowitsianum*
b. Apical petal yellow or dirty white 5
5a. Spur 13-14 mm long. Leaves trifid; leaf segments mucronate *D. biternatum*
b. Spur 10-11 mm long. Leaves lanceolate; leaf segments acute *D.kurdicum*

ACKNOWLEDGMENT

We wish to thank Miss. R. Habibi the artist in TARI herbarium for drawing the illustration and so Mr. Rezaee for preparing of tepal and pollen micrographs.

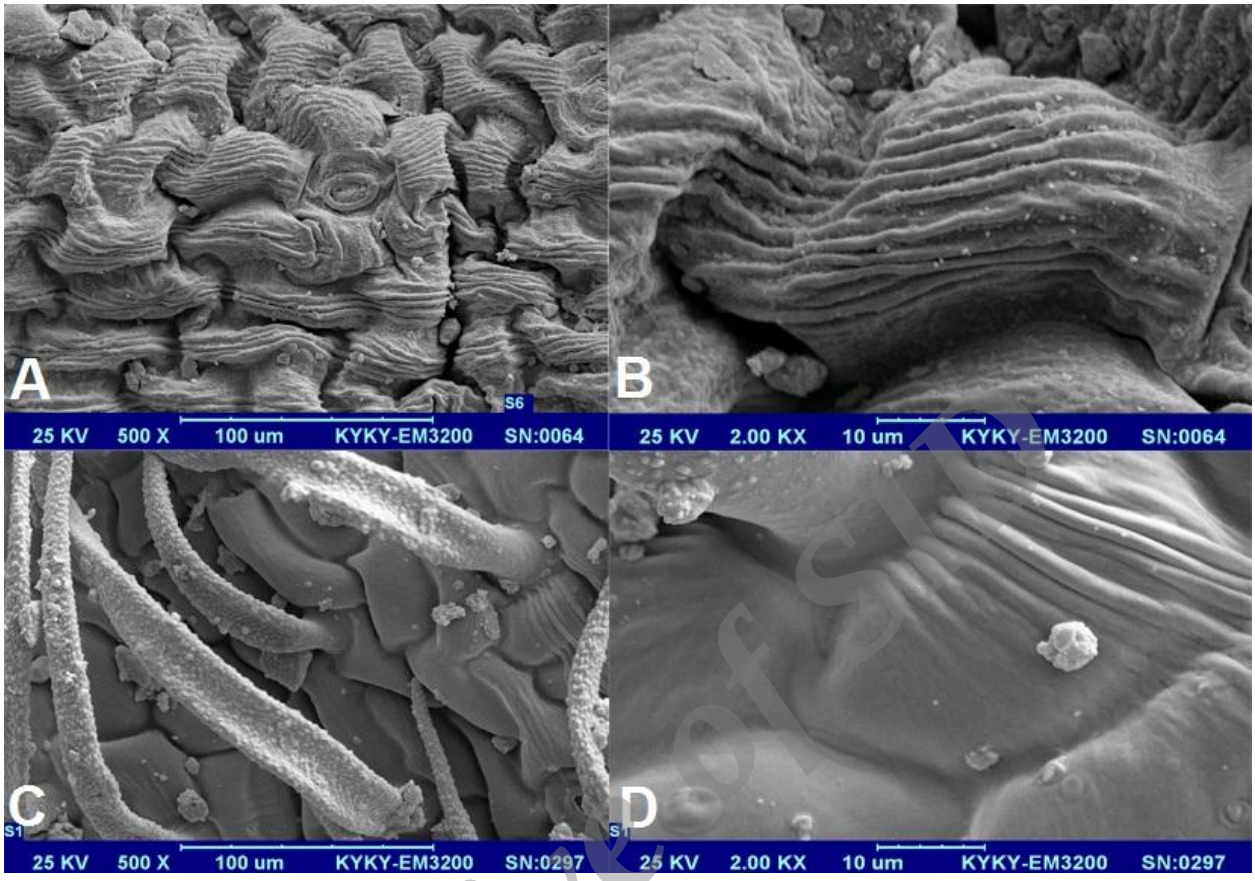


Fig. 5. SEM micrographs of tepal epidermal patterns morphology: (A) & (B) *Delphinium ochrolecum*, and (C) & (D) *D. kurdicum.*

REFERENCES

Boissier, P. E.1867: Delphinium in Flora Orientalis, vol. 1: 112-136. -Basileae et Genevae. Christensen, K. I. & Hansen, H. V. 1998: SEM studies of epidermal patterns of petals in Angiosperms. -Opera Botanica, no.135.

Davis, P. H., 1965: Delphinium in Flora of Turkey, vol. 1: 108-134. -Edinburgh at the University Press. http://ipni.org/ipni/plantnamesearchpage.

Ilarslan, H., Ilarslan, R. & Blanch, C. 1997: Seed morphology of the genus Delphinium L. (Ranunculaceae) in Turkey. -Collect. Bot. (Barcelona) 23: 79-95.

Iranshahr, M. 1992: Delphinium in K. H. Rechinger Flora Iranica, no. 171: 44-89. -AkademischeDRruck-u.Verlagsanstalt Graz-Austria.

Moore, P. D., Webb, J. A. & Couirson, M. E. 1991: Pollen Analysis. -Oxford Black Well Scientific Publication.

Nevskii, S. A. 1937: Delphinium in V. L. Komarov Flora of the USSR vol. 7: 99-183 (translated from Russian by Israel Program for Scientific Translations Jerusalem 1970).

Punt, W, Blackmore, S, Nilsson, S & Thomas, A. 1994: Glossary of Pollen and Spore Terminology. -Utrecht: LPP Foundation.

Parsa, A., 1951: Delphinium in Flore de´ l Iran, vol. 1: 424-442. -Tehran University.

Scholes, P., Dessein, S., D'Hondt, C., Huysmans, S. & Smets, E. 2002: CARNOY: a new digital measurement tool for palynology. -Grana vol. 41: 124-126.