

SEM SURVEY OF POLLEN MORPHOLOGY IN IRANIAN SPECIES OF HYOSCYAMUS L. (SOLANACEAE)

M. Khatamsaz & E. Zangirian

Khatamsaz, M. & E. Zangirian 1998 05 25: SEM survey of pollen morphology in Iranian species of *Hyoscyamus* (*Solanaceae*). -*Iran. Journ. Bot.* 7 (2): 151-163. Tehran.

Descriptions of *Hyoscyamus* pollen grains based on scanning electron microscopic observations are presented. Three shapes and some namely ellipsoid, spheroid and subspheroid ornamentation types can be distinguished. The aperture type is colporate and ornamentation types are striate, rugulate, striate - perforate, and perforate. The species studied were *H. insanus*, *H. bornmulleri*, *H. pusillus*, *H. tenuicaulis*, *H. leptocalyx*, *H. malekianus*, *H. senecionis* var. *senecionis*, *H. senecionis* var. *bipinnatisctus*, *H. squarosus*, *H. arachnoideus*, *H. kurdicus*, *H. niger*, *H. reticulatus* and *H. turcomanicus*.

Mahboubeh Khatamsaz, Research Institute of Forests and Rangelands, P. O. Box 13185-116, Tehran, Iran. -Ebrahim Zangirian, Ministry of Jihad-e Sazandegi, Engineering Research Centre, P. O. Box 13445-754, Tehran, Iran.

ریخت شناسی دانه گرده گونه های ایرانی جنس *Hyoscyamus* L.

محبوبه خاتم ساز و ابراهیم زنجیریان

ویژگیهای دانه های گرده گونه های ایرانی جنس *Hyoscyamus* با استفاده از میکروسکوپ الکترونی اسکن مورد بررسی قرار گرفته است. دانه های گرده به سه شکل بیضی، کروی و

تقریباً کروی دیده می‌شوند. سطح دانه‌های گرده شیاردار و تزیناتی مثل رگه‌دار، زگیل‌دار، رگه - منفذدار و منفذدار در گونه‌های مختلف دیده می‌شود. گونه‌هایی که مورد بررسی قرار گرفته‌اند عبارتند از:

Hyoscyamus insanus, *H. bornmulleri*, *H. pusillus*, *H. tenuicaulis*, *H. leptocalyx*, *H. malekianus*, *H. senecionis* var. *senecionis* and var. *bipinnatisectus*, *H. squarrosus*, *H. arachnoideus*, *H. kurdicus*, *H. niger*, *H. reticulatus*, *H. turcomanicus*.

INTRODUCTION

In Flora Iranica 18 *Hyoscyamus* species were reported from Iran (Schönbeck - Temesy 1972), however, recent taxonomic studies carried out by Khatamsaz (in press) considered some of the species as synonym and introduced a new species. (Ghahreman & Khatamsaz 1996). Now *Hyoscyamus* is represented by 13 species and 2 varieties in Iran. Pollen grains of all species are examined in the present study.

Hyoscyamus pollen has been poorly known to date, *H. niger* L. which has been studied by Reynolds, (1984) and Polo, et al. (1986) is the exception. The identification of the species of the genus is very complex, difficult and often confused. The present investigation supports some taxonomic changes in this genus (Ghahreman & Khatamsaz, 1996).

MATERIALS AND METHODS

Pollen grains for study were taken from herbarium specimens in the Central Herbarium of Iran (TARI). A list of the species investigated is given in table 1. All pollen samples were prepared for SEM according to Lynch et al. (1975) and they

were sputtercoated with gold, then observed in SEM Leica S 360. The dimensions are based on the measurements of 30 grains on each specimen in the SEM. The terminology follows the "Glossary" of Punt et al. (1994).

DESCRIPTION

Hyoscyamus pollen grains are medium or large-sized ($P=31.8$ (44.17) $74.1 \mu\text{m}$; $E=28.2$ (32.56) $44.6 \mu\text{m}$). Pollen grain shape is ellipsoid to spheroid ($P/E=0.9$ (1.37) 2.51). The equatorial outline (=polar view) is subcircular. The meridional outline (=equatorial view) is elliptic or subcircular.

Hyoscyamus pollen is 3 aperturate, and colporate. The pollen grains are isopolar. The ornamentation is essentially striate, perforate, rugulate or intermediate. Table 2 lists the values / states of a number of the above mentioned characters for the individual species. The description of the pollen grains presented below is at the specific level, in a taxonomic sequence.

H. insanus Stocks (Fig 1, 2): Pollen large-sized, $P=67.5$ (68.2) $70 \mu\text{m}$, $E=31.8$ (33) $35.9 \mu\text{m}$; ellipsoid, $P/E=1.95$ (2.06) 2.12; outline elliptic in equatorial view and

Table 1. List of herbarium specimens used for pollen studies in alphabetical order.

1. *H. arachnoideus* Pojark.; Azarbaijan, Arasbaran, between Vaighan & Veinagh, 1000 m, Khatamsaz & Farzaneh 73089.
2. *H. bornmulleri* Khatamsaz; Fars, Shiraz, Bamou Park, 1900 m, Dehbozorgi 32707.
3. *H. insanus* Stocks; Khuzistan, Ramhormoz, Baba-Ahmadi, 700 m, Khatamsaz 72964.
4. *H. kurdicus* Bornm; Zanjan, Naudehak, 71 km S. of Ghazvin, 1250 m, Mousavi & Amin 21731.
5. *H. leptocalyx* Stapf; Kermanshah, Kuh-e Bimar, near Deh-e Hukani, S. of Kerend, 1500 m, Wendelbo & Assadi 16763.
6. *H. malekianus* Parsa; Baluchestan, Taftan, S. slope above the village of Torshab, 1900-2300 m, Runemark & Assadi 22630.
7. *H. niger* L.; Azarbaijan, Arasbaran, Kalibar to Marzrud, 1930 m, Khatamsaz et al. 73059.
8. *H. pusillus* L.; Tehran, Karaj-Chalus pass, Kandavan, mount above the tunnel, 2400 m, Khatamsaz 72890.
9. *H. reticulatus* L.; Esphahan, Semirom, Kuh-e Surmandeh, 3000-3500 m, Khatamsaz 72979.
10. *H. senecionis* Willd.; Fasa, Mian-Jangal, 1850 m, Khatamsaz & Yusefi 73013.
11. *H. senecionis* var. *bipinnatisectus* (Boiss.) Boiss.; Yazd, Deh-Bala, Shirkuh, 2700 m, Foroughi & Assadi 17931.
12. *H. squarrosus* Griff.; Khorassan, Mashhad, 30 km on Sarakhs road, 1020 m, Foroughi 8513.
13. *H. tenuicaulis* Schönbeck-Temesy; Bushehr to Khurmoj, 200 m, Khatamsaz & Mollai 72993.
14. *H. turcomanicus* Pojark.; Khorassan, Mashhad, Sad-e Karde, 1300 m, Mozaffarian 67704.

circular in polar view, 3-colporate, colpi length 62.6-67.7 μm . Tectum striate.

H. bornmulleri Khatamsaz (Fig. 3, 4): Pollen large-sized, P= 73 (73.2) 73.6 μm ,

E= 29 (29.5) 30 μm ; ellipsoid, P/E= 2.43 (2.48) 2, 51; outline elliptic in equatorial

view and circular in polar view, colpi length 66.8 μm . Tectum striate.

Table 2. Pollen characters in *Hyoscyamus* species.

<i>Hyoscyamus</i> spp.	Polar axis (P) µm	Equatorial diam. (E) µm	P/E	Shape	Colpi length µm	Ornamentation
<i>H. arachnoideus</i>	32(33.5)35.8	29.8(30.1)32.9	1.02(1.03)1.07	spheroidal	24.7-25.2	perforate
<i>H. bornmulleri</i>	73(73.2)73.6	29(29.5)30	2.45(2.48)2.51	ellipsoid	66.8	striate
<i>H. insanus</i>	67.5(68.2)70	31.8(33)35.9	1.95(2.06)2.12	ellipsoid	62.6-67.7	striate
<i>H. kurdicus</i>	34(34.6)35	33.8(34)34.6	1.01(1.02)1.03	spheroidal	32.8	perforate
<i>H. leptocalyx</i>	47(48)48.6	39(43.5)44.6	1.0(1.1)1.2	subspheroidal	40.6-42	striate
<i>H. malekianus</i>	31.8(32)32.6	30(30.4)30.8	1.04(1.05)1.06	spheroidal	28.5	striate
<i>H. niger</i>	31(33.5)34	30(33.6)34.2	0.9(1.0)1.1	spheroidal	31.7	perforate
<i>H. pusillus</i>	73.5(74)74.1	31.3(32)32.4	2.28(2.31)2.33	ellipsoid	67.9	striate
<i>H. reticulatus</i>	36.6(37)37.6	36(36.7)37	1.0(1.01)1.02	spheroidal	32.7	perforate
<i>H. senecionis</i> var. <i>senecionis</i>	36.8(37)37.3	32.5(33)33.8	1.1(1.12)1.14	subspheroidal	32.8	striate-perforate
<i>H. senecionis</i> var. <i>bipinnatisectus</i>	32(33.5)35	28.2(30)31.6	1.0(1.15)1.2	subspheroidal	32.35	striate-perforate
<i>H. squarrosus</i>	46.1(46.3)46.5	37.4(37.6)37.9	1.21(1.22)1.23	subspheroidal	40.4	perforate
<i>H. tenuicaulis</i>	37.5(38.2)39	22(22.4)23	1.69(1.70)1.71	ellipsoid	34.5	rugulate
<i>H. turcomanicus</i>	28.3(29.5)30	29.5(30)30.7	1.0(1.0)1.0	spheroidal	26.7	striate-perforate

H. pusillus L. (Fig. 5.6): Pollen large-sized, $P = 73.5$ (74) $74.1 \mu\text{m}$, $E = 31.3$ (32) $32.4 \mu\text{m}$; ellipsoid, $P/E = 2.28$ (2.31) 2.32; outline elliptic in equatorial view and circular in polar view, subterminal 3-colporate, colpi length $67.9 \mu\text{m}$. Tectum striate.

H. tenuicaulis Schönbeck-Temesy (Fig. 7, 8): Pollen medium - sized, $P = 37.5$ (38.2) $39 \mu\text{m}$, $E = 22$ (22.4) $23 \mu\text{m}$; ellipsoid $P/E = 1.69$ (1.70) 1.71; outline obtuse elliptic in equatorial view and circular in polar view, 3-colporate, colpi length $34.5 \mu\text{m}$. Tectum rugulate.

H. leptocalyx Stapf (Fig. 9, 10): Pollen medium-sized, $P = 47$ (48) $48.6 \mu\text{m}$, $E = 39$ (43.5) $44.6 \mu\text{m}$; subspheroidal, $P/E = 1.0$ (1.1) 1.2; outline circular in equatorial and polar view, 3-colporate, colpi length $40.6\text{-}42 \mu\text{m}$. Tectum striate.

H. malekianus Parsa (Fig. 11, 12): Pollen medium-sized, $P = 31.8$ (32) $32.6 \mu\text{m}$, $E = 30$ (30.4) $30.8 \mu\text{m}$; spheroidal, $P/E = 1.04$ (1.05) 1.06; outline circular in equatorial and polar view; 3-colporate, colpi length $28.5 \mu\text{m}$. Tectum striate.

H. senecionis Willd. var. *senecionis* (Fig. 13, 14): Pollen medium-sized; $P = 36.0$ (37) $37.3 \mu\text{m}$, $E = 32.5$ (33) $33.8 \mu\text{m}$, subspheroidal $P/E = 1.10$ (1.12) 1.4; outline

elliptic in equatorial view and circular in polar view, subterminal 3-colporate, colpi length $32.8 \mu\text{m}$. Tectum striate-perforate.

H. senecionis Willd. var. *bipinnatisectus* (Boiss.) Boiss. (Fig. 15): Pollen medium-sized, $P = 32$ (33.5) $35 \mu\text{m}$, $E = 28.2$ (30) $31.6 \mu\text{m}$, subspheroidal $P/E = 1.0$ (1.15) 1.2; outline elliptic in equatorial view and circular in polar view, 3-colporate, colpices connected in polar, $32\text{-}35 \mu\text{m}$. Tectum striate-perforate.

Comment: The pollen grains of two varieties investigated are very similar in shape and tectum, but differ in size and colpi.

H. squarrosus Griff. (Fig. 16, 17): Pollen medium-sized, $P = 46.1$ (46.3) $46.5 \mu\text{m}$, $E = 37.4$ (37.6) $37.9 \mu\text{m}$, subspheroidal, $P/E = 1.21$ (1.22) 1.23; outline subcircular in equatorial view and circular in polar view, 3-colporate, colpi length $40.4 \mu\text{m}$. Tectum perforate.

H. arachnoideus Pojark (Fig. 18, 19): Pollen medium-sized, $P = 32$ (33.3) $33.8 \mu\text{m}$, $E = 29.8$ (30.1) $32.9 \mu\text{m}$, spheroidal, $P/E = 1.02$ (1.03) 1.07, outline circular in equatorial and polar views, 3-colporate, colpi length $24.7\text{-}25.2 \mu\text{m}$. Tectum perforate.

H. kurdicus Bornm. (Fig. 20, 21): Pollen medium-sized, $P = 34$ (34.6) $35 \mu\text{m}$, $E =$

33.8 (34) 34.6, spheroidal, P/E= 1.01 (1.02) 1.03; outline circular in equatorial and polar views, 3-colporate, colpi length 32.8 μm . Tectum perforate.

H. niger L. (Fig. 22, 23): Pollen medium-sized, P= 31 (33.5) 34 μm , E= 30 (33.6) 34.2, spheroidal, P/E= 0.9 (1.0) 1.1; outline circular in equatorial and polar views, 3-colporate, colpi length 31.7 μm . Tectum perforate.

H. reticulatus L. (Fig. 24, 25): Pollen medium-sized, P= 36.6 (37) 37.6 μm , E= 36 (36.7) 37 μm , spheroidal, P/E= 1.0 (1.01) 1.02; outline circular in equatorial and polar views, 3-colporate, colpi length 32.7 μm . Tectum perforate.

H. turcomanicus Pojark. (Fig. 26): Pollen medium-sized, P= 28.3 (29.5) 30 μm , E= 29.5 (30) 30.7 μm , spheroidal, P/E= 1.0 (1.0) 1.0, outline circular in equatorial and polar views, 3-colporate, colpi length 26.7 μm . Tectum striate-perforate.

RESULTS AND DISCUSSION

According to pollen morphology, *Hyoscyamus* species can be subdivided into three more or less distinct groups.

1. Species with ellipsoid shape; P/E \geq 1.69.

This group can be further subdivided into striate ornamentation including: *H. bornmulleri*, *H. insanus* and *H. pusillus* (Plate 1), and rugulate ornamentation including *H. tenuicaulis* (plate 2).

2. Species with subspheroidal shape; 1.69 \geq P/E \geq 1.10. The group can be further subdivided into striate ornamentation including *H. leptocalyx*, *H. malekianus* (plate 3), and striate-perforate ornamentation including: *H. senecionis* var. *senecionis*, *H. senecionis* var. *bipinnatisectus* (plate 4) and perforate ornamentation including *H. squarosus* (plate 5).

Species with spheroidal shape (P/E \cong 1) and perforate ornamentation including *H. arachnoideus*, *H. kurdicus*, *H. niger*, *H. reticulatus*, *H. turcomanicus* (plate 6).

REFERENCES

- Ghahreman, A. & M. Khatamsaz 1996: The genus *Hyoscyamus* L. (Solanaceae) in Iran. -Iran. Journ. Bot. 7 (1): 31-37. Tehran.
- Khatamsaz, M. 1978: Solanaceae in Flora of Iran, no. 24. -Tehran, in press.
- Lynch, S. P. & G. L. Webster 1975: A new technique of preparing pollen for scanning electron microscopy. -Grana 15:

127-136.

Polo, J. M. & M. J. Diez 1986: Contribution al atlas palinogico de punt, W. S. Blackmore, S. Nilsson & A. le Thomas. 1994: Glossary of pollen and spore terminology. Lab. palaeobot. Palynol. Contr. ser I. LPP Foundation, -Utrecht.

Reynolds, T. L. 1984: An ultrastructural and streological analysis of pollen grains of *H. niger* during normal ontogeny and included embryogenetic development. -*Amer. J. Bot.* 71: 490-504.

Schönbeck-Temesy, E. 1972: *Hyoscyamus* in K. H. Rechinger (ed.) *Flora Iranica* no. 100: 49-79. -Graz.

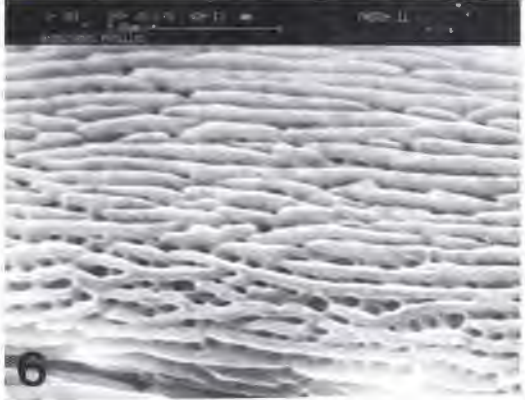
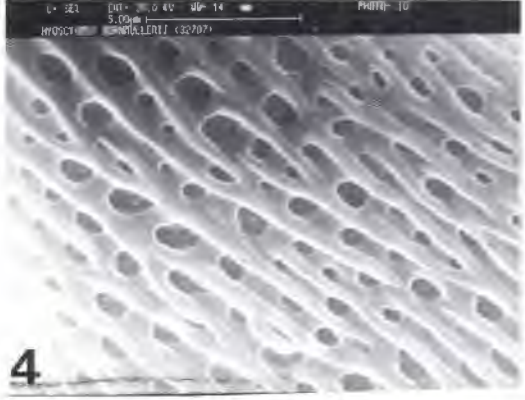
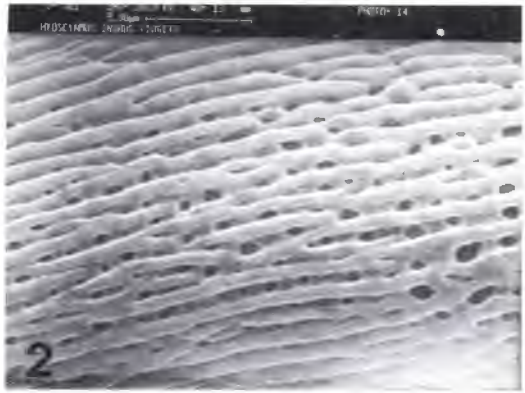


Fig. 1-6. Pollen grains of *Hyoscyamus* species, equatorial view (left) and ornamentation (right). -Fig. 1-2. *H. insanus*; Fig. 3-4. *H. bornmulleri*; Fig. 5-6. *H. pusillus*.

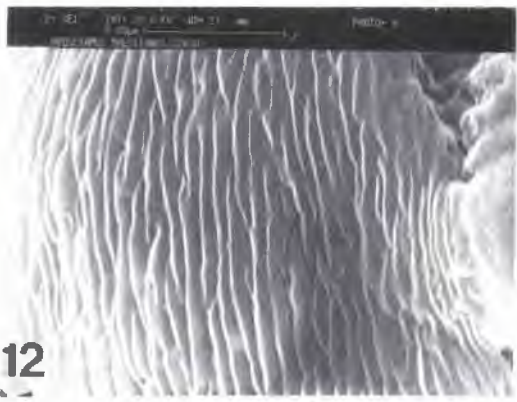
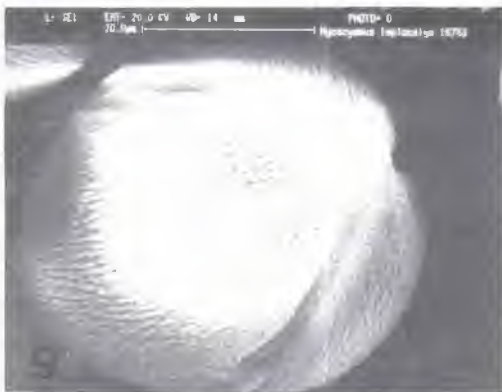


Fig. 7-12. Pollen grains of *Hyoscyamus* species. -Fig. 7-8. *H. tenuicaulis*, equatorial view and colpi (left), ornamentation (right); Fig. 9-10. *H. leptocalyx*, oblique polar and equatorial view; Fig. 11-12. *H. malekianus*, equatorial view (left) and ornamentation (right)



Fig. 13-18. Pollen grains of *Hyoscyamus* species. -Fig. 13-14. *H. senecionis* var. *senecionis*, equatorial view and ornamentation; 15. *H. senecionis* var. *bipinnatisectus*; Fig. 16-17. *H. sgarrosus*, equatorial view and ornamentation; Fig. 18. *H. arachnoideus*, polar view.

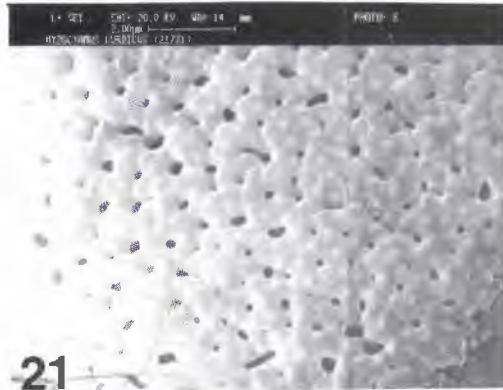


Fig. 19-24. Pollen grains of *Hyoscyamus* species. -Fig. 19. *H. arachnoideus*, ornamentation; Fig. 20-21. *H. kurdicus*, oblique polar view and ornamentation; Fig. 22-23. *H. niger*, polar and oblique equatorial view, ornamentation; Fig. 24. *H. reticulatus*, polar and equatorial view.

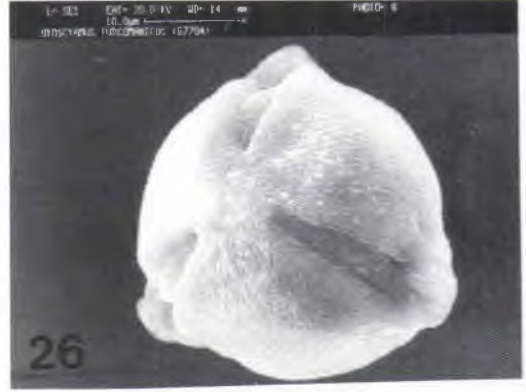
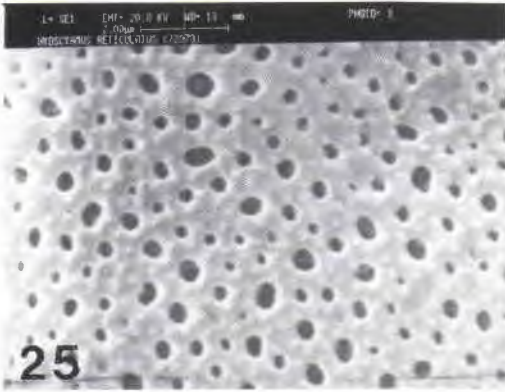


Fig. 25-26. Pollen grains of *Hyoscyamus* species. -Fig. 25. *H. reticulatus*, ornamentation; Fig. 26. *H. turcomanicus*, oblique polar view.