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Study of Pollen Grain of *Eremurus* Genus in Iran

Fahimeh Fallah*, Seyyed Mohammad Masoumi, Abdolkarim Chehregani, Zhaleh Soheilikhah

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Abstract

The pollen grains of eight species of the genus Eremurus from Asphodelaceae family were studied using Light Microscope (LM) and Scanning Electron Microscopy (SEM). The pollen grains were collected from the nature and also the herbarium of Research Institute of Forests and Rangelands. The pollen grains of all studied species are monad, mono- furrow, navicular to elliptical with different sizes. The smallest pollen grain is E. olgae Regal with size of 13.86 µm. The P/E ratio of pollen grain of the studied specie is 0.50– 0.75 µm. So, the pollen grains are in oblate shape. Eremunus koletdaghensis has the lowest P/E ratio (0/57 µm). The surface ornamentation of Exine varies from reticulate, fine- reticulate, rough-reticulate to porous.

Keywords: Eremurus, Pollen Morphology, SEM.

Introduction

Scientifically, it is worth mentioning that the genus is the fundamental basis of palynology; in such a way that every experienced palynologist can recognize the genus of plants by catching their pollen in his/ her hand. Except in some cases, the genus can not been recognized by the pollen. The palynology is applied for determining the limits of plant families; in such a way that sometimes, the impediments which have separated the families from each other can be removed. Furthermore, it can be used for determining the family and genus to which one unknown plant belongs. The pollen is of special importance in the plants classification and recognition of their relationships. The specificity of pollen in most of herbaceous groups on one side and the relative facility of study of pollen grains on the other side have made it possible to, with regard to morphological and structural features of pollens, recognize the kind of its generator and even its station and importance in botanical classification and to scrutinize the relationships between the genera and even the species. The palynology information can generally be used at different levels of taxonomy (Bakhshi Khaniki, 2007). The pollen wall has been made of two major layers, outer layer termed exine and inner one named intine. The exine consists of two distinct layers; Ektexin (sexine) and Endexin; the foot layer or, Baculum and Tectum are determined in the sexine. The exine might be pore- free, mono-furrow, tri-furrow and polifurrow. The existence of mono-furrow pollen grain in Clavitopollenites has been confirmed by paleontological studies done in last three decades. The recent discovery revealed that the pollen is the most primitive pore- free angiosperm and different types of mono-furrow have been created later. The most of claims in regard of angiosperms' production before Cretaceous Period have been strongly rejected. Erdtman, G. (1952) described Eucommidites as tri- furrow dicotyledon pollen grain from Jurassic Period, although this pollen, instead of angiosperms' radial symmetry, had bilateral symmetry with grainy exine and blade endexine such as gymnosperms. The pollen grain of flowering plants has been formed from three concentric layers: a) The central layer which is live cell; b) The middle layer termed intine, no part of which has been recognized as fossil; c) Exine.The exine (pollen grain's external layer) has been formed of one of the hardest organic material and is the main subject of palynological studies. Obviously, the spurs which their wall has not been changed up until the present belong to the Paleozoic era and their wall includes some combinations similar to the current pollen grains. For Brooks & Shaw (1968), the exine wall has been composed of oxide polymers, Carotene or Carotenoid Asters that has been known as Sporopollenin.Two major layers can be recognized in exine structure: 1) The internal layer termed Endexine by Erdtman in 1945; 2) The external layer which has been named ectexine. The internal layer was homogeneous in the microscopic studies. Contrary to internal layer, various baculiform outgrowths are observed in the external layer of exine. The external exine is composed of three layers or

Fahimeh Fallah*, Seyyed mohammad Masoumi, Zhaleh Soheilikhah

Department of Biology, Faculty of sciences, University of Razi, Kermanshah, Iran.

Abdolkarim Chehregani

Department of Biology, Faculty of sciences, University of Buali, Hamedan, Iran.

***E-mail:** f.falah1221@gmail.com.

sections named Pedicel, pedestal or Bacula and Tectum. The Asphodelaceae family, as it was defined by Dahlgren et al. (1985), has 17 genera and about 800 species in the world. Takhtajan (1987) has presented a more wide definition of Asphodelaceae that has 46- 50 genera and 1400- 1500 species and includes subfamilies of Anthericoideae and Asphodeloideae. The Asphodeloideae genera were categorized by Takhtajan in three families including Asphodeloideae, Kniophoieae and Aloeeae. Song-Yan & Zhang (1985) studied the morphology of pollen grain of 16 known species of Asphodelus genus of Liliaceae family by the use of Light Microscope (LM) and Scanning Electron Microscopy (SEM) and based on the variety in Polar size, Equatorial size and also in exine structure and ornamentation, four types of pollen grain were recognized and he divided the genus into subcategories related in respect of pollen grain size and some biological features that are indicative of procedure of pollen grain development in the genus. Also, some studies have been done by Hesse (1981) and Larsen (1961) in regard of different layers of exine and its substructure by the use of Transmission Electron Microscope (TEM). Brooks et al., (1968) studies the nucleosynthesis (ontogenic) process of pollen grain wall of a kind of lily by using Transmission Electron Microscope (TEM). Jones and Chung (1989) studied the pollen grain of 22 Taxon of the genus *Hosta* and the other nine genera related to that from Liliaceae by the use of Light Microscope (LM), Scanning Electron Microscope (SEM), and Transmission Electron Microscope (TEM); according to the obtained results based on exine ornamentation and pollen wall macrostructure, the genus *Hosta* (Liliaceae) was divided into several types: reticulate, wrinkled, and grained wrinkled which is the most prevalent one. Based on palynology of eight subgroups with regard to the variety in form and size of pollen grain and exine structure which has been divided into fine and subtle wrinkles, it was proposed that *Hosta*, *Hesperocallis* and *Leucocrinum* genera might belong to common ancestor. Radulescu (1973) examined several monocots by LM and SEM. The flowers of the genus *Eremurus* are connected and bell- form at base and the stamens anthers are at the same height and are attached at base. In this genus, the perianth is segmental. Pehlival and Özler (2003) analyzed the pollen grain of 14 species of Muscari and 5 native species in Turkey by the use of Light Microscope (LM), Scanning Electron Microscope (SEM) and also, studied pollen grain of two species by using Transmission Electron Microscope (TEM). The pollen grain is monad, mono- furrow and homogenous in poles with bilateral symmetry. In *M. coeleste*, the pollen grains are sometimes Diad and the pollen ornamentation observed in exine micrograph (SEM) is reticulate and rough reticulate. Kuppriyaniva (1938) analyzed most of monocotyledon pollens such as the genus Eremurus in his extensive studies. Kosenko et al. (1999a) analyzed the pollen grain of 72 species of *Asphodelaceae* by using Light Microscope (LM) and Scanning Electron Microscope (SEM) for the purpose of systematic study of them. The pollen grain of all the studied species is poles apart, mono- furrow, without cap and different in size, structure and ornamentation of exine. The Eremurus species are palynologically homogenous.

Khokhijacov (1965) examined about 60- 70 species of *Eremurus* from 31 species of all the parts and revealed that the pollen grains of Eremurus are morphologically similar. The pollen of all these species are mono- furrow and show trivial difference in respect of exine structure and furrow width; but these characteristics do not distinct different species. The present research aims to study the morphological features of pollen grain by using Light Microscope and Electron Microscope of the species of genus Eremurus existing in Iran.

Procedure

The herbaceous samples, of which the pollen grain has been studied, were collected from herbarium samples of Research Institute of Forests and Rangelands and the nature of south of Iran (Boushehr). The stamens of each herbaceous sample are put in test tube; then, about 5 to 6 cc Acetic Acid and Sulfuric Acid with ratio of 9 to 1 are added to every test tube and are situated in the warm bath or Bain-Marie for 5 minutes at 90˚c. In this time lag, the samples are mixed by an agitator. Accordingly, the intine and the other ingredients are solved except exine. Then, the samples are dislodged from the Bain- Marie and are put in the centrifuge for 10 minutes with 1500 rounds per minutes. Then, the samples are dislodged from the centrifuge and the solution thereon is thrown off and the distilled water is added to its remaining and is mixed regularly. Then, after 15 minutes, it is centrifuged on the same previous conditions and after centrifugation, the contents thereon are discharged and the distilled water is added to its remaining and is mixed again. After one hour, the centrifugation is done on the same previous conditions and after the termination of centrifugation, the contents thereon are thrown off again and distilled water is added to its remaining and is mixed. At the final stage, the samples are kept motionless for 24 hours and then, the centrifugation is repeated for the fourth time and the contents thereon are discharged and the glycerin of about quintuple the sample volume remained at the bottom of test tube is added. After 5 to 7 days, the glycerin is penetrated into the pollen and the samples are ready for microscopic slides (Erdtman, 1960).

At first, paraffin sheet is put on the slide. For this, an empty cylindrical pipe dipped in liquid paraffin is used and or a little solid paraffin can be put on the slide and melted by heating and then, a vacant space is created in the middle of the slide. Then, a drop of sample pollen prepared in previous stage is put in the middle of this section and one drop of mixture of glycerin and jelly is poured on it in order that the pollen grains be fixed on the slide. Then, the dropper is put on the slide and the paraffin is melted again by heating and the sides of glycerin is surrounded by that. Thus, the sample is ready to be observed by Light Microscope.

The dimensions of 25 pollen grains of each herbaceous sample was examined by a graduated eyepiece with magnifying power of 400 times of the Leitz Light Microscope, model HM_LUX3.

By the use of Dino Capture camera installed on Leitz Microscope model HM_LUX3 with magnifying power of 400 times, the valve (furrow) feature and surface ornamentatons of exine of the pollen grains have been taken into account ; also, the needed measurements have been done from either polar aspect or equatorial one.

Steps of preparation of samples for providing Scanning Electron Microscope (SEM) graphs

At first, a little pollen grain is separated from the anther of samples and is put on an aluminum sheet; then, specific blocks which have circle ending with 1cm diameter and 2cm height (sample stub) are selected (similar to the letter T) and its diameter is covered by a thin layer of jelly glue and are put slowly on the aluminum sheet including pollen grains in order for the pollen grains be stuck to them. Then, the ready blocks are put inside the sputter coater.

Physical Vapor Deposition (P.V.D) is the method used for coating the gold or platinum and the sputter coater system is used for dispensing the ions and is made in BEL-TEC Corporation in Switzerland and its model is SCDOOS.

Among the studies done by the use of Scanning and Electron Microscope (SEM) with Model XL30 made in Philips Corporation in Netherlands, it can be referred to the one done by Tarbiat Modares University which prepared electronic pictures with magnifying power of 1000. By these picture, the wall details including the kind of surface decorations and the structure of pores and furrows can be detected. The size of pores and the thickness of netting wall are calculated by the use of ruler based on the micrographs.

Table 1: list of studied species and place of their collection

row	Scientific Name	Collection place	Herbarium No.
1	*Eremurus. koletdaghensis*	Gorgan: Gelestan Wildlife Park, Alme, height 1300m	R.I.F.R -12705
2	*E. luteus* Baker	Isfahan: Near to Talighan- southeastern Ardestan- height 2000m	R.I.F.R -11552
3	*E. olgae* Regel.	Khorasan: Nishabour, Mount Binalud, height 2500m	R.I.F.R -82295
4	*E.persicus* (J.et.Sp.) Boiss.	Chaharmahal va Bakhtiari: Handoman, height 2600	R.I.F.R -79965
5	*E.inderiensis*(Stev.)Boiss.	Chaharmahal va Bakhtiari: Poul Shahriari to Kuhrang, height 2000m	R.I.F.R -77881
6	*E. spectabilis* M.B.	Kermanshah: Karand GharbKuh Noa, height 1500m	R.I.F.R -4748
7	*E. stenophylus* Boiss.	Khorasan: Kashmar, Nishabur, after Ribash, height 1850m	R.I.F.R -35661

Table 2: features of pollen grain of studied species of Asphodelaceae by Scanning Electron Microscope (SEM)

Other features	**Pores diameter (µm)**	**Wall thickness (µm)**	**Surface ornamentations**	**Scientific name**
Navicular, the pores besides the furrow are larger. The poles are irregular.	0.13- 1.74	0.1- 50.20	Mono-furrow - reticulate	***E. koletdaghensis* M. B. Fedtsch.**
The poles are heterogeneous. The size of pores becomes large in the middle and a little fine in the poles.	0.66- 2/00	0.0- 30.90	Mono-furrow - reticulate	***E. luteus* Baker**
The pores become very large in the middle and very fine in the poles – irregular	0.33- 2.66	0.33- 1.00	Mono-furrow - reticulate	**Regel *E. olgae***
The pores are disappeared at two ends. The pores are very larger in the middle.	0.16- 1.16	0.26- 1.00	Mono-furrow - reticulate	***E.persicus* (J.et.Sp.) Boiss**
Spindle- like, the cells are fine at two ends and large in the middle.	0.16- 1.80	0.0-16.66	Mono-furrow - reticulate	***E. spectabilis* M.B.**
The poles are homogeneous. The pores become larger in the middle and are disappeared at the end.	0.10- 1.40	0.16- 0.90	Mono-furrow - reticulate	***E. stenophylus* Boiss**

Table 3: features of pollen grain of studied species of Asphodelaceae by Transmission Electron Microscope (TEM)

Plant name	Pollen grain size (µm)	Polar axis dimensions (µm) P	Equatorial axis dimensions (µm) E	P/E	Form of pollen grain	Size of pollen grain
Asphodelus tenuifolius Cav.	62.54	47.39- 52.01- 56.63	70.48- 62.54- 54.61	%83	oblate	Large
E. inderiensis (Stev.) Boiss.	39.00	17.21- 25.44- 38.22	35.70- 0.39- 50.2	%65	oblate	average
Eremurus. koletdaghensis M. B. Fedtsch	43.30	21.59- 25.30- 32.40	36.70- 90.30- 52.43	%57	oblate	average
E. luteus Baker.	44.60	19.92- 30.07- 35.80	39.35- 44.60- 53.45	%67	oblate	average
E. olgae Regel.	38.15	13.86- 26.16- 32.80	33.71- 38.15- 49.22	%68	oblate	average

E.persicus (J.et.Sp.) Boiss.	43.15	20.92- 25.90- 48.1	32.1- 43.15- 49.8	%60	oblate	average
E. spectabilis M.B.	45.54	18.66- 27.76- 34.6	30.34- 45.54- 53.98	%60	oblate	average
E. stenophylus Boiss.	41.34	13.32- 30.10- 40.20	31.77- 41.34- 60.33	%72	oblate	average

Results:

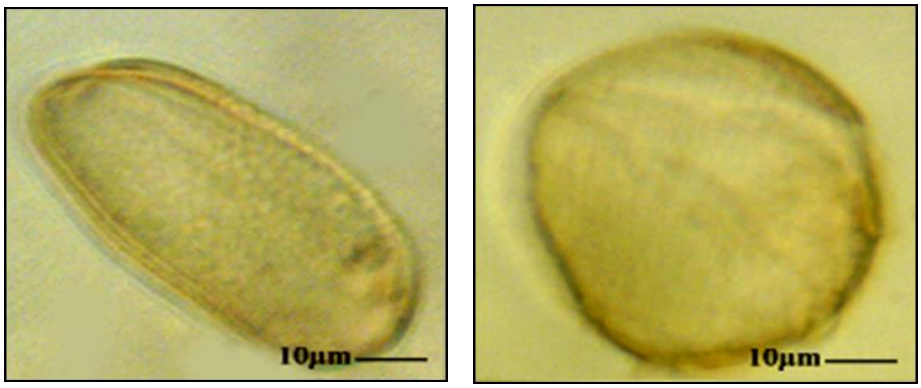
1. Eremurus inderinsis (stev) Boiss

Botanical features

A perennial plant with very coarse fleshly- rooted fibers or filaments, spindle- like and lengthy, leaf, hairless, totally linear, sharp-pointed, shorter than stalk, flower, brown milky- white and spotted in inside, more or less irregular perianth and eyelash- edged and a little shorter than peduncle, peduncle articulated at the end, bracts longer that peduncle, smooth and non- wried flagpole collected in a simple raceme, capsular fruit, winged grains, with unequal wings, flower time: April 21 to 21 June, geographical spreading: Shoorab-Isfahan province, Azarbaijan, Zanjan.

Pollen grain features

monad, elliptical, average (42.43 ± 0.87), mono-furrow, reticulate, homogeneous in poles, circled from polar aspect and elliptical from equatorial aspect, polar axis dimensions (38.22- 25.50- 17.21 µm), equatorial axis dimensions (50.20- 42.43- 34.83 µm), polar axis to equatorial axis ratio: %60 µm.



(A) **(B)**

Figure 1: A and B: graph of pollen grain of *Eremurus inderinsis* (stev) Boiss from equatorial aspect by Light Microscope

Study of Scanning Electron Microscope (SEM)

Navicular; reticulate surface ornamentations; the pores are larger besides the furrow and in the middle of pollen grain; the thickness of wall of netlike cells is 0.90- 0.33 µm. The size of wall pores is 0.1 – 2.0 µm.

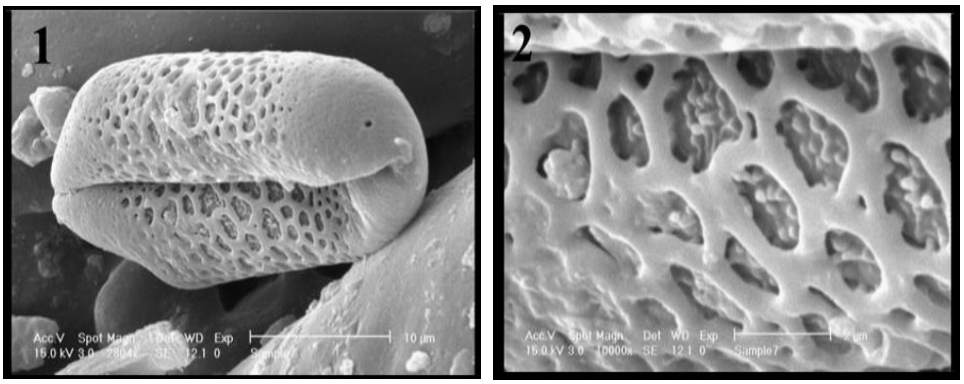


Figure 2: SEM micrograph of pollen grain of *Eremurus Inderinsis*; 1- A general view of the furrow is obvious and pored ornamentations is observed at the end of pollen grain. 2. The reticulate surface ornamentations that the Columellae and Caput is totally obvious.

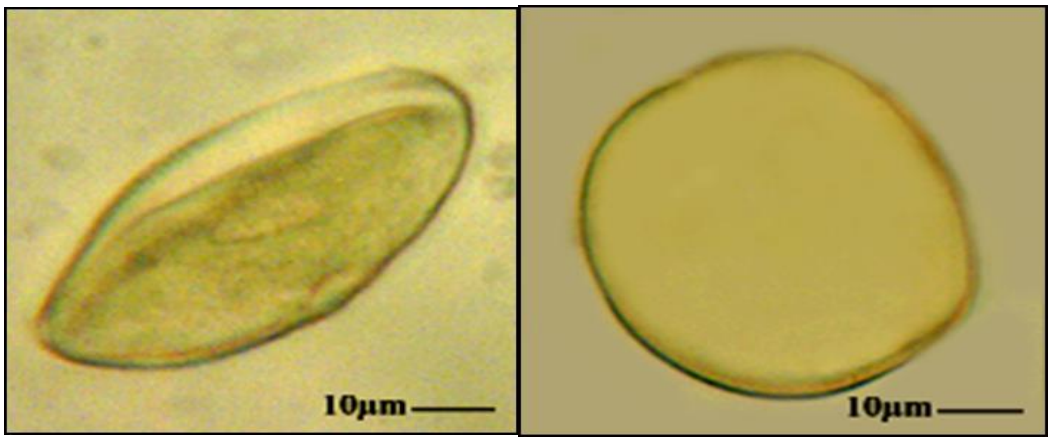
2- *Eremurus koletdaghensis* M. B. Fedtsch

Botanical features

A perennial, standing plant with very coarse fleshly- rooted fibers or filaments, spindle- like and lengthy, with webbed and narrow leaves covered by long and turned cracks, standing Hump Shaft, racemose inflorescence, tubular perianth inclined to white-bell- color and yellow-colored at the base, Bracteole is staggered at the base; at the end, narrow and setaceous and shorter than peduncle; smooth and non- wried flagpole, circular capsule, winged reticulated grain; flower time: April 21 to June 21; geographical spreading: Khorasan, Gorgan, East of Iran and Afghanistan.

Pollen grain features

Monad, elliptical, average (44.92 ± 0.68), mono-furrow; general design: circled from polar aspect and oblate from equatorial aspect, polar axis dimensions (32.90- 25.76- 21.59 µm), equatorial axis dimensions (52.90- 44.92- 36.70 µm); polar axis to equatorial axis ratio is %57 µm.



(A) **(B)**

Figure 3: A and B: graph of pollen grain of *Eremurus koletdaghensis* M. B. Fedtsch from equatorial view by Light Microscope

Study of Scanning Electron Microscope (SEM)

By surface ornamentations of reticulate kind, the pores size is large in the middle of pollen grain and the ornamentations in the poles are of fine-reticulate kind. The thickness of wall of netlike cells and the size of wall pores are 0.5- 1.2 and 0.13- 1.74, respectively.

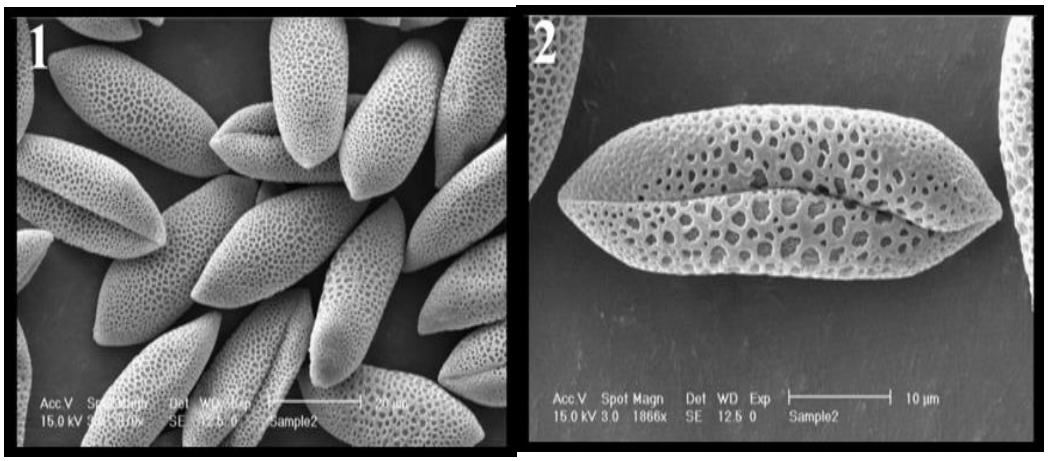


Figure 4: SEM micrograph of pollen grain of *Eremurus Koletdaghensis* M. B. Fedtsch; 1- little magnification of different kinds of pollen grain from dorsal and ventral surfaces in navicular form. 2- The general form of pollen grain that the furrow is observed well.

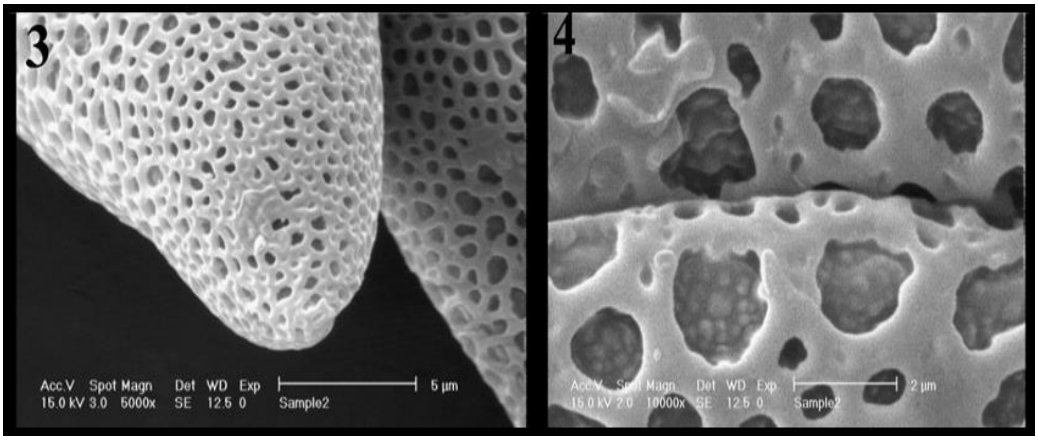


Figure 5: SEM micrograph of pollen grain of *Eremurus Koletdaghensis* M. B. Fedtsch; 1- fine- reticulate surface ornamentations in polar area; 2- reticulate surface ornamentations in furrow area.

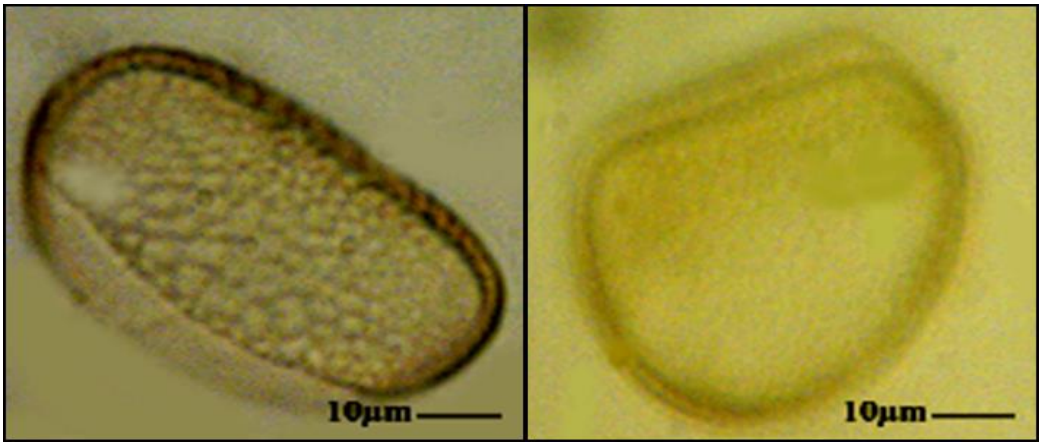
3. Eremurus Luteus. Baker

Botanical features

A perennial plant with very coarse fleshly- rooted fibers or filaments, spindle- like and lengthy; stalk or hump flowering by 60- 100cm; leafless; hairless leaf surface; leaves borders are smooth or coarse; perianth segments are yellow, irregular and eyelash- edged and a little shorter than peduncle; the perianth is articulated at the end; unequal, smooth and non-wried flagpole, tubular perianth inclined to bell; capsular fruit, smooth capsule segments; wrinkled grain; flower time: April 21 to June 21; geographical spreading: Jandagh, small desert between Yazd and Isfahan, Nain Desert, Hari Rud River.

Pollen grain features

Monad, elliptical, average (44.60 ± 0.68), mono-furrow; general design: circled from polar aspect and oblate from equatorial aspect, polar axis dimensions (35.80- 30.07- 19.92 µm), equatorial axis dimensions (53.45- 44.60- 39.35 µm); polar axis to equatorial axis ratio is %67 µm.



(A) **(B)**

Figure 6: picture of pollen grain of *Eremurus* Luteus by Light Microscope; A: from equatorial aspect that the furrow has been placed on the side; B: from other aspect.

Study of Scanning Electron Microscope (SEM)

The poles are heterogeneous; the surface ornamentations are reticulate; the pores size in the middle becomes large and it becomes fine in the poles; the thickness of wall of netlike cells is 0.30- 0.60 µm. The size of wall pores is 0.66 – 2.00 µm.

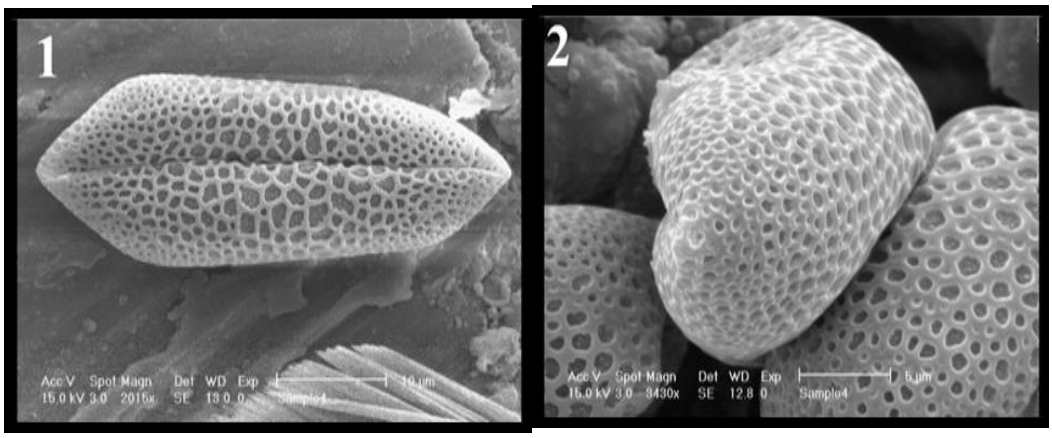


Figure 7: SEM micrograph of pollen grain of *Eremurus. Luteus*. 1- A general view from equatorial aspect that the furrow and reticulate surface ornamentations at ventral level are observed well. 2- From polar aspect, the ornamentations are fine- articulate in the polar area.

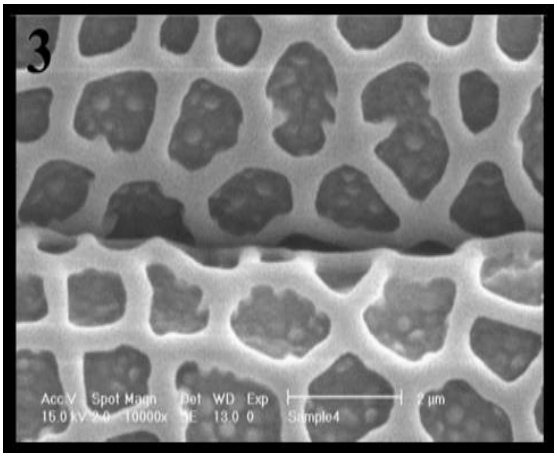


Figure 8: SEM micrograph of pollen grain of *Eremurus. Luteus:* the surface ornamentations besides the furrow that the wart- like outgrowths are seen well.

Discussion and Conclusion

Panelatti (1960), in a research, studied pollen grain of five species of Asphodelus pertinent to three different sections. He observed some differences among the species and also at the level of sections of this genus. These differences are observable in the ornamentations of exine and the size of pores of netlike cells. The species *aestivus, Asphodelus, A.microcarpus and A..ramosus* were attributed to Ngamo; because they were not palynologically different. In this study, the pollen grain is Monad, mono-furrow and the furrow is in ventral area of *Asphodelus tenuifolius.* The size of large pollen grain is 48.61- 70.54µm. the surface ornamentations of *Gomphrena* is porous and the very fine pores are 0.1- 0.6µm. The P/E ratio of this specie is %83 that according to Tokarev's (2002) categorization, the grain shape becomes oblate provided the P/E ratio is 0.75- 0.95. According to Maassoumi (2004) and Romanov (1954), the pollen grain in the genus *Lilium candidum* L. is Diad; but in the studied genus (*Eremurus*) they are Monad. The studied pollen grains had average size. This condition is observed in most of *Liliales* genera. The pollen grains have different forms in Liliales that most of them have navicular form (Kosenko, 1996). The genus *Eremurus* is seen in this form, too. In Liliaceae family, the surface ornamentations of pollen grain is observed in different forms from smooth to coarse reticulate (Maassoumi, 2004, 2005; Kosenko, 1999a) that it is reticulate (mostly reticulate) in the genus *Eremurus.* The results obtained from the study done by the use of TEM microscope reveals that the intine thickness in the furrow place and under the exine is 0.1 and 0.02µm, respectively; the Caput form is circle to oblate. The width and thickness of Caput are 0.56- 0.24 and 0.3- 0.26 µm, respectively; the length and width of Columellae are 0.4- 0.24 and 0.26- 0.19 µm, respectively; the thickness of foot layer, Tectum, and exine are respectively 0.3, 0.3- 0.26, and 0.8 and the ratio of Tectum to foot layer is 1.0 µm. The form of Caputs in the studied species of this family is so different. The Caput is seen in circle, elliptical, and or rectangular or in average forms (Maassoumi, 2006). In some genera of Liliales family, the Endexine is observed from regularly coarse to irregularly separate, sectional and fine form and or without Endexine (Maassoumi, 2005). Intine is seen in a tri- layer form in the other genera of Liliales family. The most important information for the specie studied from morphological aspect and the comparison of pollen of the genus Eremurus is expressed by Ryabkova (1983). He mentioned some details about the features of pollen grain of 15 species of

Eremurus in Central Asia and generally described the genus *Eremurus.*Kosenko (1999b) examined the pollen grain of the genus Asphodelus. In this study, from the polar aspect, the mono-furrow pollen grains are broad elliptical and onionlike spherical in shape. The two ends are sometimes sharp- pointed or almost circle. The size of (*refractus .A*) in equatorial axis is more than 53.8- 71 µm and in polar axis, it is 48- 55.7 µm. the (*refractus .A*) in equatorial axis is 4.9 – 86. 97 µm and in polar axis, it is 77.7- 92.2. In *(fistueasus. A)*, the furrow is long that reaches the end of pollen grain or is shorter. The exine thickness is 1.5- 3.8 µm. the surface of Gomphrena exine is coarse and porous and the pore size reaches lower than 1 µm, too. The diameter of pores is 0.2- 3 µm. the pores and their surface are larger and have wart-like outgrowths and the results obtained for the studied specie confirm this study. Some researchers such as Koprianova (1948, 1983), Sokolovskaya (1969) and Kosenko (1999a) have done many studies about the palynology of *Eremurus* genera. These studies revealed that the pollen grain are mono- furrow, poles apart, elliptical with sharp or circle end and they are rectangular, elliptical, pyramidal and almost triangular or ovoid. The average size, from 32.6- 38-4 µm in equatorial aspect, 19.2- 22.1 µm in polar aspect (*Sogdianus .E*) to 44.2- 49.9 µm in equatorial aspect, 25.9- 29.8 in polar aspect *(Korolkow .Eii*) or some are larger. The larger equatorial pole was pertinent *to elwesii .E kaufmanii. E, anisopterus .E, albwrtii., E .uworowiis* that is only a little more than 50 µm. The larger pollen grain was observed in *luteus .E*, 5.60- 53 µm in equatorial view and 28.8- 32.6 µm in polar veiw. The furrow is usually elongated to two ends of pollen grain and the exine has the thickness of 1.1- 1.9 µm and its surface is reticulate or fine- reticulate; the diameter of pores is 0.3- 2 µm. In most of pollens, the dispersion and uniformity of the pores is reduced toward two ends of pollen and the gap edge. The furrow edge and the surface of larger cells is wart- like or prominent. The furrow wall is smooth or prominent. Ryabkova (1987) examined 23 species of Eremurus by Light Microscope. In *E.indernsis*, the size of pollen grain collected from Chaharmahal va Bakhtiari (35.7- 50.2 µm) is larger than the pollen grain reported by RyabKova from the west of Tajikistan (29.9- 44.3 µm). In *E .olgae*, the size of studied pollen grain is almost equal to the one measured by RyabKova. In *E.kolpdagensis* collected from Gorgan (36.7- 52.9 µm) is smaller than the pollen grain measured by RyabKova (6.5- 60.40 µm). The pollen grain of E. luteus collected from Isfahan (35.39- 53.45 µm) is smaller than the grain measured by RyabKova (3.6- 47.66 µm). The pollen grain of *E. persecus* collected from Chaharmahal va Bakhtiari and the one of *E. spectabilis* collected from Korand are almost equal to the pollen grains measured by RyabKova. Khokhrjakov (1965) studied about 60- 70 herbaceous samples of Eremurus from 31 species of all subgenera and revealed that the pollen grain of eremurus is morphologically similar. The pollens of all these species are mono- furrow and show subtle differences in regard of exine structure and furrow width. Kosenko and Ryabcova revealed that the genus *Eremurus* is symmetrical in the morphology of its pollen. The pollens of all these species are mono- furrow and are slightly different in regard of details of exine structure. The considerable variety in form is a special feature off pollen grain and the difference that is on the furrow width by the form of pollen grain is not special feature of the specie. The obtained data confirm the previous viewpoint in regard of dividing the genus into four sections because of its large size. But it does not correspond to Khokhrjakov's viewpoint in regard of necessity of division of the genera *Henningia, Selonia,* and *Ammolirion*. In exine structure, the differences of the genus Eremurus in Ammolirion section is considerable. The species *E. comosus* and i. Enderinsis have the finest exine and usual fine- reticulate ornamentations, whereas the species of other sections have reticulate exine. The largest pollen grain is observed in the species of Henningia section. The existence of smallest pollen grain with fine- articulate and finer exine in the specie Ammolirion corresponds to the hypothesis expressed by Khokhrjakov in regard of being primary of this specie in this section in comparison to the other sections. The present hypothesis certifies this fact and it does not directly involve the exine development. The exine structure is different in the genus *Asphodelus*.

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