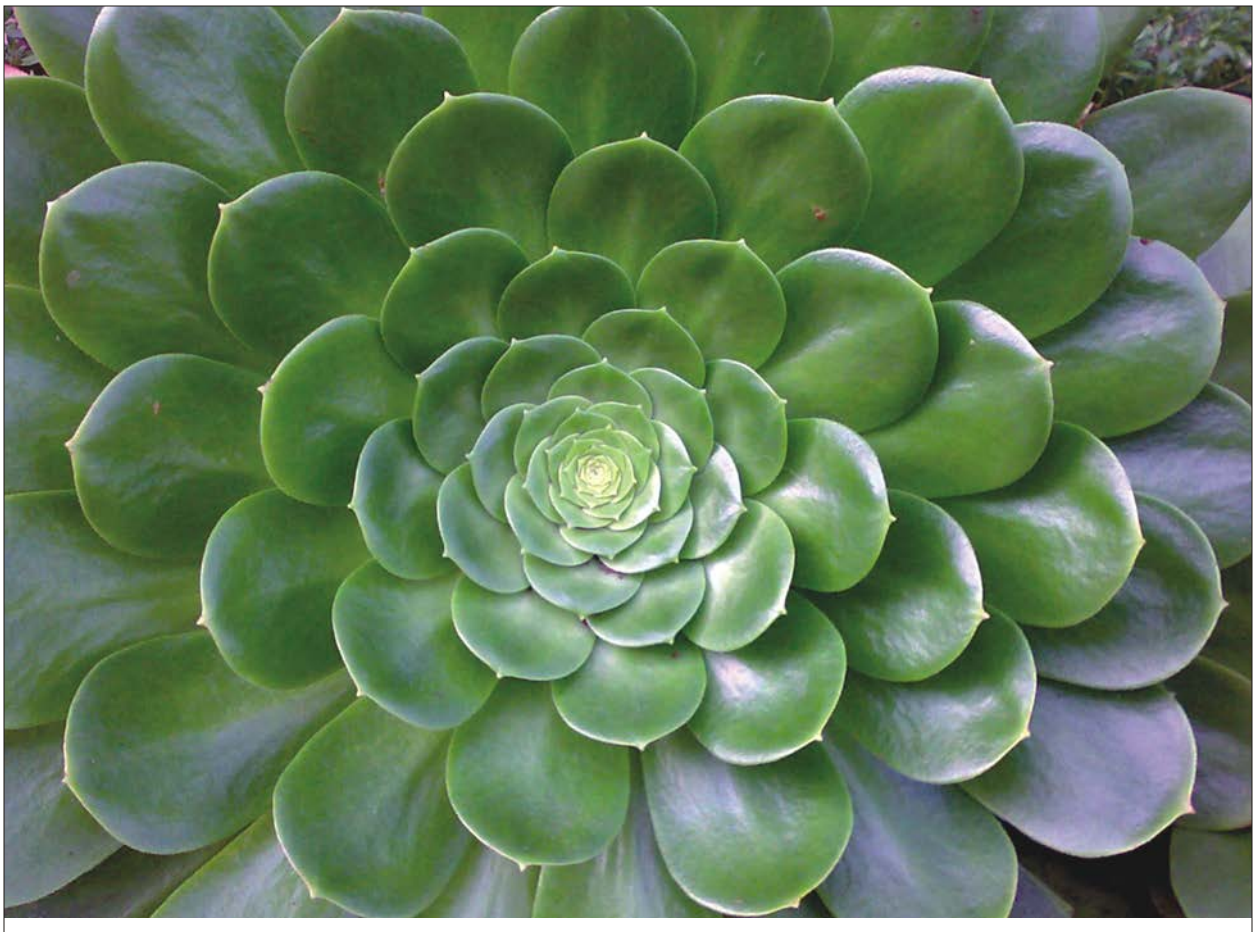


Journal of
Plant Sciences

ISSN 1816-4951

Academic
Journals Inc.

www.academicjournals.com

Journal of Plant Sciences 2 (2): 195-201, 2007
ISSN 1816-4951

Pollen Morphological Studies on Selected Taxa of *Asteraceae*

E. Jafari and Gh. Ghanbarian
Research Center of Natural Resources, P.O. Box 71555-617, Shiraz, Iran

Abstract: The pollen morphology of 30 species belonging to 24 genera representing 6 tribes of *Asteraceae* have been investigated with the aid of the light microscope. The results confirm pollen grains of this family exhibit considerable variation in their morphological characteristics as size, aperture type and pattern of exin sculpturing. Pollen grains of all taxa examined are single and can be divided into 2 groups: I-Simple trizonocolporate with echinate or subechinate or verrucate sculpturing pattern on the exin surface which has been founded in following tribes: *Cynareae*, *Anthemideae*, *Inuleae*, *Calenduleae* and *Arctotideae*. This group include diffrent types of pollen exin. II- Fenestrate with echinate or echinolophate sculpturing pattern on the exine surface has been founded in *Lactuceae*.

Key words: *Asteraceae*, pollen, morphology

INTRODUCTION

Morphological studies of pollen regardless of sexual system, diversity of distribution and knowing of special environment for preservation or growth, is important for knowing of past and present of typical growth. In addition, it is used for basic study of systematic and taxonomy of new plants, special diet provision and knowing of original honey against copy, studying of immonology and alergy (Faegri and Iversen, 1992).

Asteraceae has been variously divided into groups. Wodehouse (1935) collected and presented investigating information of 1500 title that is published by him. Erdtman (1960, 1969 and 1971) has also studied about it.

The first survey on the pollen morphology and structure of *Anthemideae* were made by Wodehouse (1926, 1928). He commented that the species of *Anthemis*, *Leucanthemum* and *Chrysanthemum* which are insect pollinated, have grains with well developed spines and a thick exine while species of *Artemisia* which are wind pollinated have grains with vestigial or absent spines and a much less thick exine.

Wodehouse (1935) characterized the basic exomorphology of *Lactuceae* pollen and described 2 basic pollen type (echinate and echinolophate). Tomb (1975) and Blackmore (1982, 1984) studied pollen grains of *Lactuceae*.

The evolution of pollen morphological characters for the systematics of the *Cynareae* has gained through the pioneer studies on the *Centaurea* by Pehlivan (1995). And through those on the *Echinops* by Blackmore (1990).

Stix (1960) characterized the basic morphology of *Asreraceae* pollen in central Europe and discribed 12 basic pollen types.

It has very scientific usage and necessity to studying and knowing of pollen grains in flora of Iran.

The present study aimed to describe the pollen morphology of the selected Iranian taxa of *Asteraceae* to find out the inter-generic and specific relationships and to solve some taxonomic problems.

Corresponding Author: E. Jafari, Research Center of Natural Resources, P.O. Box 71555-617, Shiraz, Iran

MATERIALS AND METHODS

For the purpose of studying pollen grains in *Asteraceae*, specimens were collected in their flowering period. Pollen grains have been taken from anther and were acetolysed according to Erdtman (1960) method. Thirty samples of each species have been examined. All pollen samples were prepared for light microscope and their size measured by micrometer. Total information shows in Table 1-3 and Fig. 1-3.

RESULTS AND DISCUSSION

The pollen morphology of 30 species belonging to 24 genera representing 6 tribes of *Asteraceae* have been investigated with the aid of the light microscope (Table 1, 2 and Fig. 1-3).

The results confirm pollen grains of this family exhibit considerable variation in their morphological characters as size, aperture type and pattern of exin sculpturing. Pollen grains all of examined taxa are single and distinguished to two groups:

Table 1: Taxa that used in pollen studies

Tribe	No. of genera	No. of species
Lactuceae	5	6
Cynareae	10	14
Anthemideae	4	5
Inuleae	3	3
Calenduleae	1	1
Arctotideae	1	1

Table 2: Specimens and collecting data

Voucher No.	Locality	Taxa
12611	Fars, Dasht-e- Arjan, Bil mountain, 1700 m	*Cichorium pumilum* Jacq.
12628	Fars, Firuzabad, Farashband, 1430 m	*Scorzonera mucida* Rech.f., Aell. and Esfand
12603	Fars, Abadeh, Ezad khast, 2000 m	*Scorzonera tortuosissima* Boiss.
12645	Fars, Firuzabad. 1050 m	*Picris strigosa* M.B.
12631	Fars, Eghlid, Bazoobache, 2300 m	*Lactuca scarioloides* Boiss
12639	Fars, Eghlid, Bazoobache, 2300 m	*Scariola orientalis* (Boiss.) Sojak
12602	Fars, Sepidan, 2000 m	*Echinops macrophyllus* Boiss. and Hausskn
12635	Fars, Estahban, 1600 m	*Arctium lappa* L.
12623	Fars, Eghlid, 2300 m	*Cousinia eriobasis* Bunge
12621	Fars, 20 km S Abadeh, 1800 m	*Jurinea bungi J* Boiss.
12607	Fars, Shiraz, 1500 m	*Outreya carduiformis* Jaub. and Spach
12612	Fars, Shiraz, Perspolis, 800 m	*Carduus arabicus* Jacq. ex Murray
12625	Fars, Sepidan, Komehr, 2660 m	*Cirsium bracteosum* DC.
12614	Fars, Dasht-e-Arjan, 1700 m	*Centaurea virgata* Lam
12626	Fars, Sepidan, 2450 m	*Centaurea aucheri* (DC.) Wagenitz
12632	Fars, Dasht-e- Arjan, Bil mountain, 1700 m	*Centaurea solstitialis* L.
12609	Fars, Firuzabad, Meaymand, kuh-e- Sefidar, 1800 m	*Centurea bruguieriana* (DC.) Hand-Mzt(
12624	Fars, Shiraz, 1500 m	*Centaurea depressa* M.B.
12627	Fars, Kazerun, 1700 m	*Zoegea leptaurea* L.
12630	Fars, NW, Kazerun, 700 m	*Carthamus oxyacantha* M.B.
12649	Fars, Shiraz, 1800 m	*Anthemis pseudocotula* Boiss.
12638	Fars, Shiraz, Bamoo national park, 1750 m	*Wilhelmsii* C. Koch *Achillea*
12618	Fars, Shiraz, Bamoo national park, 1750 m	*Achillea eriophora* DC.
12613	Fars, 16 km N Farashband, 750 m	*Matricaria aurea* (Loefl.) Schultz
12610	Fars, Sepidan, 2450 m	*Tanacetum polycephalum* schultz.-Bip
12620	Fars, Dasht-e- Arjan, Bil mountain, 1700 m	*Grantia aucheri* Boiss.
12643	Fars, Dasht-e- Arjan, Bil mountain, 1700 m	*Platychaete aucheri* (Boiss.) Boiss.
12600	Fars, Dasht-e- Arjan, Bil mountain, 1700 m	*Anvillea garcinii* (Burm.) DC.
12641	Fars, Shiraz, 1800 m	*Calend ula persica* C.A. Mey.
12606	Fars, Dasht-e- Arjan, Bil mountai, Fars, Dasht-e-	*Gundelia tournefortii* L.

Table 3: Pollen characters of *Asteraceae* taxa examined pollen shape (S), measurment (μm) of the polar (P), equatoral (E) axes and shape index (P/E)

S	P/E	E	P	Species
Prolate spherical	1.02(1.01-1.03)	41.0-42.0	41.5-43.1	*Cichorium pumilum*
Prolate spherical	1.13(1.12-1.13)	46.0-49.4	51.6-56.0	*Scorzonera mucida*
Prolate spherical	1.05(1.01-1.08)	44.5-49.3	45.0-53.4	*Scorzonera tortuosissima*
Prolate spherical	1.04(1.01-1.06)	39.5-43.5	40.0-46.0	*Picris strigosa*
Sub prolate	1.15(1.15-1.16)	23.0-26.3	26.5-30.5	*Lactuca scarioloides*
Spherical	1.0(1.0-1.0)	34.0-38.0	34.0-38.0	*Scariola orientalis*
Prolate	1.39(1.36-1.42)	75.0-77.0	102-110	*Echinops macrophyllus* (Equatorial view)
Prolate spherical	1.04(1.02-1.06)	103-109	105-115	*Echinops macrophyllus* (Polar view)
Prolate spherical	1.06(1.05-1.08)	42.0-45.0	44.0-48.4	*Arctium lappa*
Sub prolate	1.30(1.30-1.31)	41.5-44.5	54.0-58.4	*Cousinia eriobasis* (Equatorial view)
Sub prolate	1.22(1.20-1.24)	29.0-32.6	35.0-40.4	*Jurinea bungi* (Equatorial view)
Prolate spherical	1.05(1.03-1.08)	39.0-42.6	40.0-46.0	*Jurinea bungi* (Polar view)
Prolate spherical	1.13(1.11-1.15)	38.8-42.8	43.1-49.3	*Outreya carduiformis*
Spherical	1.0(1.0-1.0)	35.0-38.8	35.0-38.8	*Carduus arabicus*
Spherical	1.0(1.0-1.0)	44.0-48.4	44.0-48.4	*Cirsium bracteosum*
Spherical	1.0(1.0-1.0)	23.0-27.8	23.0-27.8	*Centaurea virgata*
Prolate	1.34(1.32-1.36)	24.1-26.5	32.6-35.0	*Centaurea aucheri* (Equatorial view)
Prolate spherical	1.05(1.02-1.07)	29.5-33.5	30.0-36.0	*Centaurea aucheri* (Polar view)
Sub prolate	1.16(1.14-1.18)	25.0-30.4	28.6-36.0	*Centaurea solstitialis*
Prolate spherical	1.06(1.05-1.08)	21.0-25.2	22.0-27.2	*Centurea bruguierian* (Equatorial view)
Prolate spherical	1.03(1.02-1.04)	20.5-24.1	21.0-25.0	*Centurea bruguieriana* (Polar view)
Sub prolate	1.29(1.28-1.30)	22.5-28.3	29.0-37.0	*Centaurea depressa*
Prolate spherical	1.05(1.04-1.06)	27.8-30.6	29.0-32.6	*Zoegea leptaurea*
Sub prolate	1.29(1.29-1.30)	13.9-16.9	18.0-22.0	*Carthamus oxyacantha*
Prolate spherical	1.11(1.11-1.12)	22.5-29.9	25.0-33.4	*Anthemis pseudocotula*
Prolate spherical	1.06(1.04-1.08)	23.0-26.2	24.0-28.4	*Achillea wilhelmsii*
Spherical	1.0(1.0-1.0)	21.0-26.6	21.0-26.6	*Achillea eriophora*
Spherical	1.0(1.0-1.0)	23.0-26.2	23.0-26.2	*Matricaria aurea*
Spherical	1.0(1.0-1.0)	21.0-25.2	21.0-25.2	*Tanacetum polycephalum*
Spherical	1.0(1.0-1.0)	25.0-29.0	25.0-29.0	*Grantia aucheri*
Prolate spherical	1.07(1.06-1.08)	18.9-22.7	20.0-24.6	*Platychaete aucheri*
Prolate spherical	1.08(1.06-1.10)	26.9-28.5	28.5-31.5	*Anvillea garcinii*
Spherical	1.0(1.0-1.0)	31.3-33.3	31.3-33.3	*Calendula persica*
Spherical	1.0(1.0-1.0)	43.0-47.8	43.0-47.8	*Gundelia tournefortii*

- Trizonocolporate with echinate or subechinate or verrucate sculpturing pattern on the exin surface which has been founded in following tribes: *Cynareae*, *Anthemideae*, *Inuleae*, *Calenduleae* and *Arctotideae*. This group includes different types of pollen.
- Fenestrate with echinate or echinolophate sculpturing pattern on the exine surface has been founded in *Lactuceae*.

Pollen grains of *Lactuceae* have systematical and phylogenetical value because of special pattern of exin sculptusing. Echinate is more primitive than echinolophate (Woodehouse, 1935; Blackmore, 1984). Pollen grain in *Anthemideae* has coarse columellae visible under the structured tectum and echinae (Heywood and Humphries, 1975).

It shows comparisons of pollen grain in different taxa of *Asteraceae* that *Cynareae* has diversity. You can see 5 different types of pollen (*Echinops* type, *Carduus* type, *Cirsium* type, *Centaurea* type and *Serratula* type). These investigations show that most of the pollen grains of *cynareae* are echinate or subechinate but seldom they are verrucate. They are in circular or elleptical shapes and existence of endocolpus in equatorial pole is special character.

Pollens in *Echinops* type (includes: *Echinops*) are very big. Grain usually are >90 μm in polar axes with pattern of subechinate sculpturing on the exin surface and thick columellae. *Serratula* type (includes: *Arctium* and *Zoegea*) has circular shape with subechinate pattern and Columellae visible underneath the tectum (tectum and echinae are traversed by rods which are much finer and more

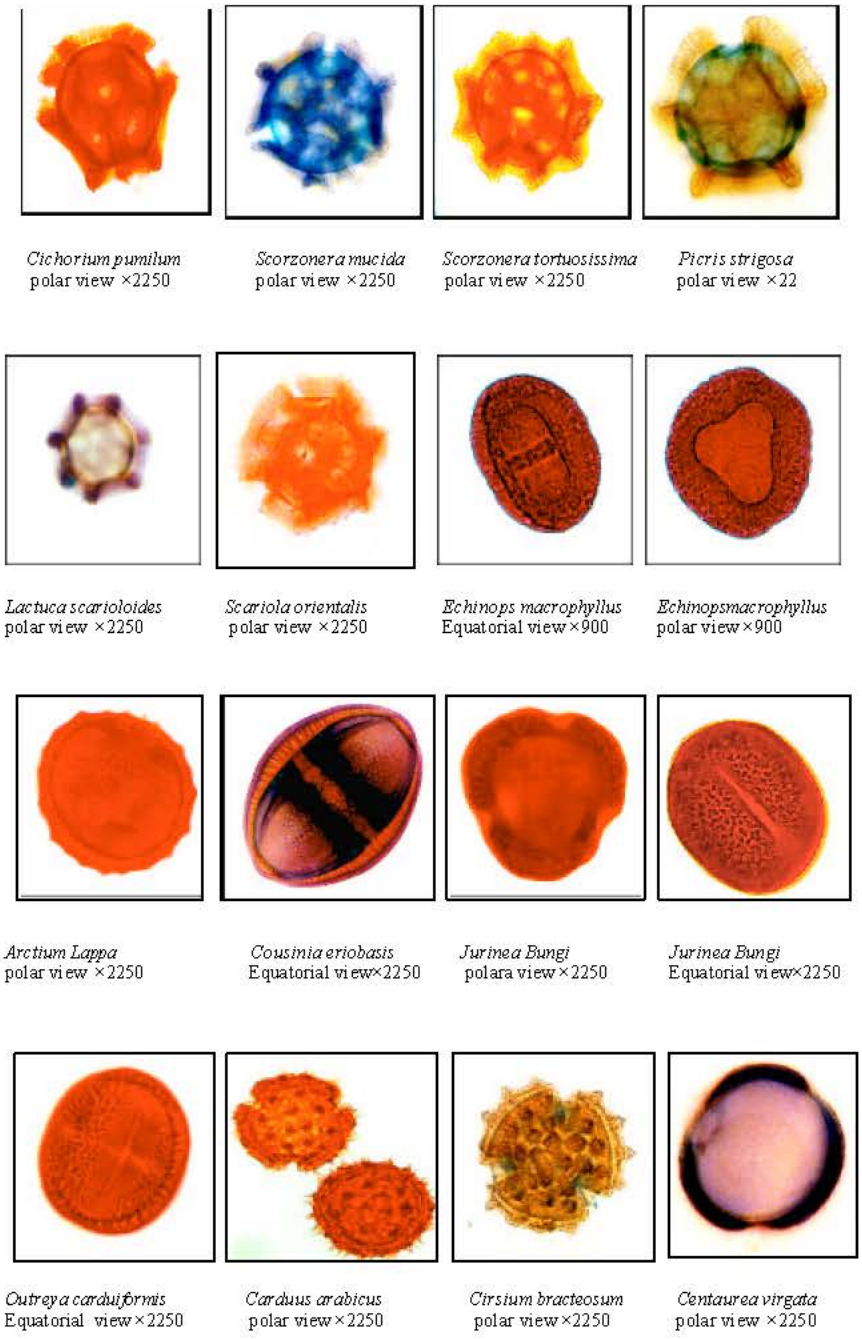


Fig. 1: Light microscopic photographs of the Asteraceae *pollen grains*

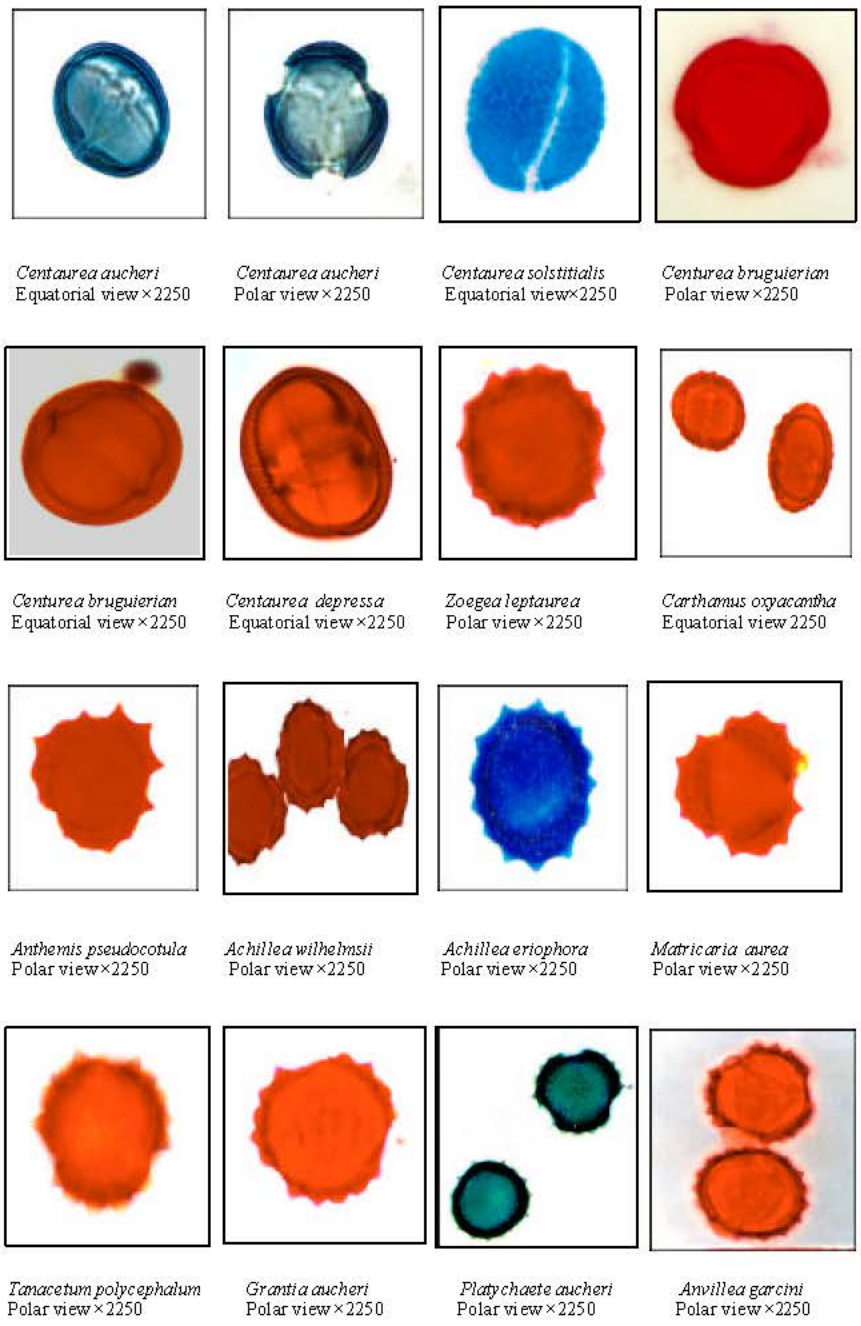
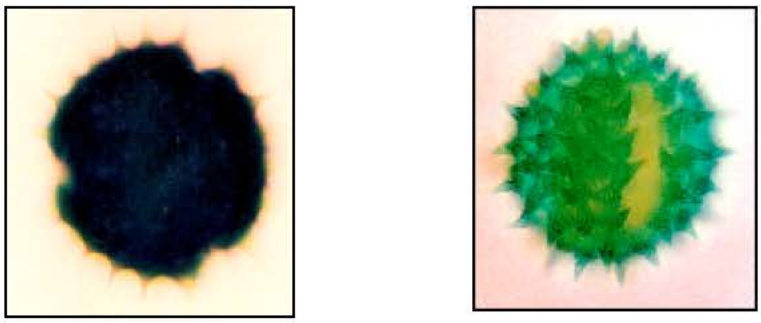


Fig. 2: Light microscopic photograph of the Asteraceae pollen grains



Calendula persica
Polar view ×2250

Gundelia tournefortii
Polar view ×2250

Fig. 3: Light microscopic photographs of the *Asteraceae* pollen grains

densly packed than the columellae. *Cousinia* type has verrucate pattern. *Centaurea* type (includes: *Cousinia*, *Centaurea jurinea* and *Outreya* has pollen grains <90 μm with subechinate or verrucate pattern. *Carduus* type (includes: *Carduus* and *Carthamus*) has echinate pattern and no endocolpus around equator of grain and no Columellae visible underneath the tectum (only the fine, densly packed rods of tectum are visible. In *Circium* type (includes: *Circium*) columella slanding slightly underneath the tectum at the point where the echinae are situated, thus giving a star pattern to each echina. Colpi fairly short.

With paying attention to it, that some genera of *Cynareae* (e.g., *Cousinia eriobasis Centaurea depressa*, *Centaurea bruguieran*, *Centaurea depressa*, *Outreya* and *Centaurea jurinea*) have verrucate pattern so, they are considered primitive (Moor *et al*., 1991). During the evolutional improvement verrucate pattern change to echinate pattern. Also polar view change from triangular- circular to circular shape. So *Carduus* is considered as evolutional turning point in this tribe. In *Lactuceae genera* with evolutional improvement echinate pattern change to echinolophate. Echinolophate can be seen in most of taxa in this tribe and in a few other tribe (e.g., *Vernonieae*) of this family but it has not been seen in other families and it shows that *Asteraceae* is very advanced.

According to shape index (P/E) there are 4 shapes such as: spherical (1.00), Prolatespherical (1.01-1.13), subprolate (1.14-132) and prolate (1.33-2.00) in *Asteraceae* (Table 3).

ACKNOWLEDGMENT

We would like to grateful to Mrs. Khatereh Emadzade for her co-operation.

REFERENCES

Blakmore, S., 1982. Palynology of subtribe scorzonerinae (*Compositae*: *Lactuceae*) and its taxonomic significance. Grana, 21: 146-160.

Blakmore, S., 1984. The northwest european pollen flora. (*Compositae*: *Lactuceae*). Rev. Palaeobot. Palynol., 45: 45-85.

Blakmore, S., 1990. Sporoderm homologies and morphogenesis land plants, with discussion of *Echinops sphaerocephala* (*Compositae*). Plant Sys. Evol., 5: 1-12.

Erdtman, G., 1960. The acetolysis method. Svensk. Bot. Tidskr., 54: 561-564.

Erdtman, G., 1969. Handbook of palynology. Morphology, Taxonomy, Ecology. Munksgaard, Copenhagen.

Erdtman, G., 1971. Pollen morphology and taxonomy. Angiosperms. Hafner New York, Vol. 1.

Faegri, K. and J. Iversen, 1992. Textbook of pollen analysis, 4th Edn., John Wiley and Sons. Chichester.

Heywood, V.H. and C.J. Humphries, 1975. A systematic survey of the Anthemideae. A joint international *Symposium* on the biology and chemistry of the Compositae.

Moor, P.D., J.A. Webb and M.E. Collinson, 1991. Pollen Analysis. 2nd Edn., Blackwell Scientific Publication, Oxford.

Pehlivan, S., 1995. Pollen morphology of some Turkish endemic *Centaurea*. Grana, 34: 29-38.

Stix, E., 1960. Pollen morphologic investigation at *Compositae*. Grana, 2: 41-104.

Tomb, A.S., 1975. Systematic Report on Tribe *Lactuceae*. In: The Biology and Chemistry of the *Compositae*. Harborne, J.B. and V.H. Heywood, (Eds.), Academic Press, London.

Wodehouse, R.P., 1926. Morphology of pollen grain in relation to plant classification. Ny Bot. Gard. J., 27: 145-154.

Wodehouse, R.P., 1928. The phylogenetic value of pollen- grain characters. Ann. Bot., 42: 891-934.

Wodehouse, R.P., 1935. Pollen grains: Their Structure, Identification and Significance in Science and Medicine. McGraw Hill. New York and London.