Pollen Atlas for the Flora of Egypt
1. *Centaurea* L. and allied genera, Compositae

Zeinab A.R. El Karemy
Botany Department, Faculty of Science,
Assiut University, Assiut, Egypt

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Pollen grains of 15 species belonging to *Centaurea* and three allied genera of Compositae in Egypt were studied. Pollen characters, including those of size, shape, exine sculpture and structure of the aperture allowed the recogrition of three pollen types : *Centaurea, Amberboa* and *Carthamus.* A key for the separation of the different species is provided.

Key words: *Centaurea* and allied genera, Flora of Egypt, Pollen Atlas.

Introduction

The Pollen Atlas for the flora of Egypt, is a parallel work to "Flora Aegyptiaca" which is devoted to palynological studies relevant to the vascular plants represented in the Flora of Egypt.

Compositae, with more than 20000 species, stands as one of the largest families of Flowering plants. According to El-Hadidi & Fayed (1994/95), Compositae is represented in Egypt by 225 species, a number which is close to that of Boulos (1995). The species of the genus *Centaurea* was recently revised by Fayed & Karakish (unpublished work), based on the main morphological characters. A total of 14 species are represented in the Flora of Egypt.

Skvarla *et al*., (1977) gave an account of the pollen morphology in Compositae and in the morphologically related families. They pointed out that the Compositae would appear to be a prime family for palynological investigation.

The pollen of tribe Cynareae was intensively investigated by Wagenitz (1955), primarily the genus *Centaurea.* This work was reriewed by Dittrich (1977), who pointed out, that continued studies in the Cynareae should prove highly interesting, especially in *Centaurea* which should be thoroughly investigated. Other significant studies of Cynareae pollen morphology are those of Schtepa (1958), Avetisian (1964), Parra (1969-70) and Villodre & Garcia – Jacas (2000).

In Egypt, 37 species of Compositae, representing the subtribes Scorzonerinae and Crepidinae of tribe Lactuceae, were investigated (Abou El-Naga, 1990). The present account deals with pollen grains of 15 species belonging to the genera *Centaurea* and the allied genera *Amberboa , Carthamus* and *Carduncellus.*

Material and Methods

Pollen material were obtained from herbarium specimens kept in Cairo University Herbarium (CAI) and the herbarium of Agriculture Research Centre, Flora and

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Phytotaxonomy Reaearch Department (CAIM). Collecting localities for the investigated specimens are given in Table 1.

Table 1 . Specimens examined.

Taxa	Localities
Centaurea ammocyanus Boiss.	Wadi Hareidin, E. of el Arish, in sand, 11.4.1929; *Shabetai* s.n. (CAI).
C. scoparia Sieber ex Spreng.	Gebel el Galala el Qiblia, Deir St. Antonio, 23.3.1928; *Simpson* s.n. (CAI) - Sinai, Gebel el Deir, outside the monastry of St. Catherine, 10.5.1956; *Hadidi* s.n. (CAI) – Red Sea, Wadi Seyal, 3.5.1957; *Täckholm* s.n. (CAI).
C. aegyptiaca L.	Tahrir Province, at Amria, 3.7.1975; *Amin* s.n. (CAI) – In the desert, near Giza Pyramids, 10.4.1926; *Täckholm* s.n. (CAI) – Cairo – Suez road, 15.3.1974; *Hadidi et al.* s.n. (CAI).
C. calcitrapa L.	Abis farm, N. Alexandria, 11.5.1966; *Khattab* s.n. (CAIM)–Inshas, 3.4.1955; *Hadidi* s.n. (CAI) –Near Qaliub, 13.6.1924; *Simpson* 2830 (CAIM) – Bawiti, 7.5.1979; *Abdel-Ghani* s.n. (CAI).
C. Pallescens Delile	Ras el Hekma, 25.5.1954; *Migahid & Shafey* s.n. (CAI) – Cairo – Alexandria desert road, 5.5.1968; *Täckholm et al*. s.n. (CAI) – Cairo – Suez road, 29.4.1939; *Drar* 12 (CAIM)
C. alexandrina Delile	Sollum, Messaad, 14.4.1934; *Shabetai* Z 3170 (CAIM) – Burg el Arab, 30.4.1976; *Chrtek* s.n. (CAI) – Cairo – Alexandria desert road, 180 km from Cairo, 16.4.1967; *Täckholm et al.* s.n. (CAI).
C. eryngioides Lam.	Sinai, Wadi el Maghara, 23.4.1959; *Boulos* s.n. (CAI) – N. Galala, Wadi Um Rawais, 5.4.1924; *Simpson* 2638 (CAIM) – Sinai, Wadi el Arbain, 12.5.1956; *Täckholm* s.n. (CAI).
C. pumilio L.	On the Coastal road, 46 km. Before Mersa Matruh, 3.5.1966; *Tackholm* s.n. (CAI) – Mariut, Abusir, Spring 1963; *Täckholm* s.n. (CAI).
C. furfuracea Coss. & Durieu	Matruh – Barrani, 11.4.1932; *Shabetai* Z 2015 (CAIM).
C. glomerata Vahl	Sollum, Wadi el Nassara, 14.4.1934; *Shabetai* Z3172 (CAIM) – Sidi Abdel Rahman, 31.3.1969; *Merxmüller et al.* 108 (CAI) – Cairo – Alexandria desert rood, 5.5.1968; *Täckholm* s.n. (CAI).
Amberboa crupinoides (Desf.) DC.	Burg el Arab, March 1953; *Fawzi* s.n. (CAI) – Mariut, in the calcarious fields, N. of Amria station, 25.3.1927; *G. Täckholm* s.n. (CAI).
Carthamus lanatus L.	Mariut, 22.9.1948; *Shabetai* s.n. (CAI) – Alexandria – Rosetta road, 2.6.1961; *Täckholm* s.n. (CAI).
C. glaucus M. Bieb.	Mariut, Abusir, Spring 1961; *Täckholm* s.n. (CAI)- Burg el Arab, 20.3.1953, *Täckholm* s.n. (CAI).
Carduncellus eriocephalus Boies	Cairo-Suez desert road, 15.3.1957; *Imam & Ayyad* s.n. (CAI)-In the hills near the “dome” along the Giza Paramids-Abo Roash road, spring, 1960, Botany Dept., Excursion (CAI).
C. mareoticus (Delil) Hanelt	Maruit, Dabaa, 16.4.1972; *Girgis* s.n. (CAI)-Burg El Arab, 8.4.1955; Botany Dept. Excursion (CAI).

Pollen morphological features including those of shape, size, exine sculpture and the aperture structure were studied using light microscope. For each species, several specimens were studied. A minimum of 30 pollen grains/ specimen were examined.

Materials for SEM were prepared by mounting dry pollen grains directly onto clean stubs using double-side sellotape and silver best. These stubs were sputter-coated with gold in a Polaron E 5000. Pollen grains were then examined in a JOEL JSM scanning electronic microscope at 15 Kv in the Unit of Electron Microscopy, Assiut University.

Results and discussion

Table 2 summarizes the available information of the pollen features among the investigated taxa.

The morphology of the pollen grains, in particular the structure of the aperture, the shape and size of the grain and the structure and sculpturing of the exine, allowed the recognition of three pollen types: ***Centaurea***, ***Amberboa*** and ***Carthamus*** types***:***

Table 2. Mean measurments of the investigated pollen grains in microns : Polarar axis (P); Equatorial diameter (E).

Taxa	P	E	P/E	Shape Category
***Centaurea*-type**				
Centaurea ammocyanus Boiss.	26.9	20.7	1.29	Subprolate
C. scoparia Sieber ex Spreng. (Fig. 2,e)	30	21.3	1.4	Prolate
C. aegyptiaca L. (Fig. 1,d)	25.8	16	1.6	Prolate
C. calcitrapa L. (Fig. 1,e)	27	16	1.68	Prolate
C. pallescens Delile (Fig. 1, f & Fig. 2,b)	22	18.6	1.18	Subprolate
C. alexandrina Delile (Fig. 1,b & Fig. 2,a)	46	24	1.9	Prolate
C. eryngioides Lam.	37	30.3	1.2	Subprolate
C. pumilio L. (Fig. 2,d)	34	28	1.2	Subprolate
C. furfuracea Coss. & Durieu (Fig. 1,c)	44.8	23.4	1.9	Prolate
C. glomerata Vahl (Fig. 1,a & Fig. 2,c)	29.7	21.3	1.39	Prolate
***Amberboa*-type**				
Amberboa crupinoides (Desf.) DC. (Fig. 1,g)	35.8	35.8	1	Spheroidal
***Carthamus*-type**				
Carthamus lanatus L.	46.3	46.3	1	Spheroidal
C. glaucus M. Bieb.	42.7	42.7	1	Spheroidal
Carduncellus eriocephalus Boiss. (Fig. 2,f)	46.5	46.5	1	Spheroidal
C. mareoticus (Delile) Hanelt (Fig. 1,h)	25.5	25.5	1	Spheroidal

1. The *Centaurea* – type

Pollen grains isopolar, radiosymmetric, trizonocolporate, 22-25x 16-30.5 µ m, subprolate – prolate. Colpus long, wide, distinctly sunken, margins distinct regular, ends rounded or slightly acute. Exine scabrate, tectate; tectum psilate verrucate or/and punctate.

Within this type, the scabra are usually dense, medium-sized and the sculpture of the tectum is psilate. *Centaurea furfuracea* and *Centaurea eryngioides* are characterized by small-sized, sparsely distributed scabra and the tectum is punctate.

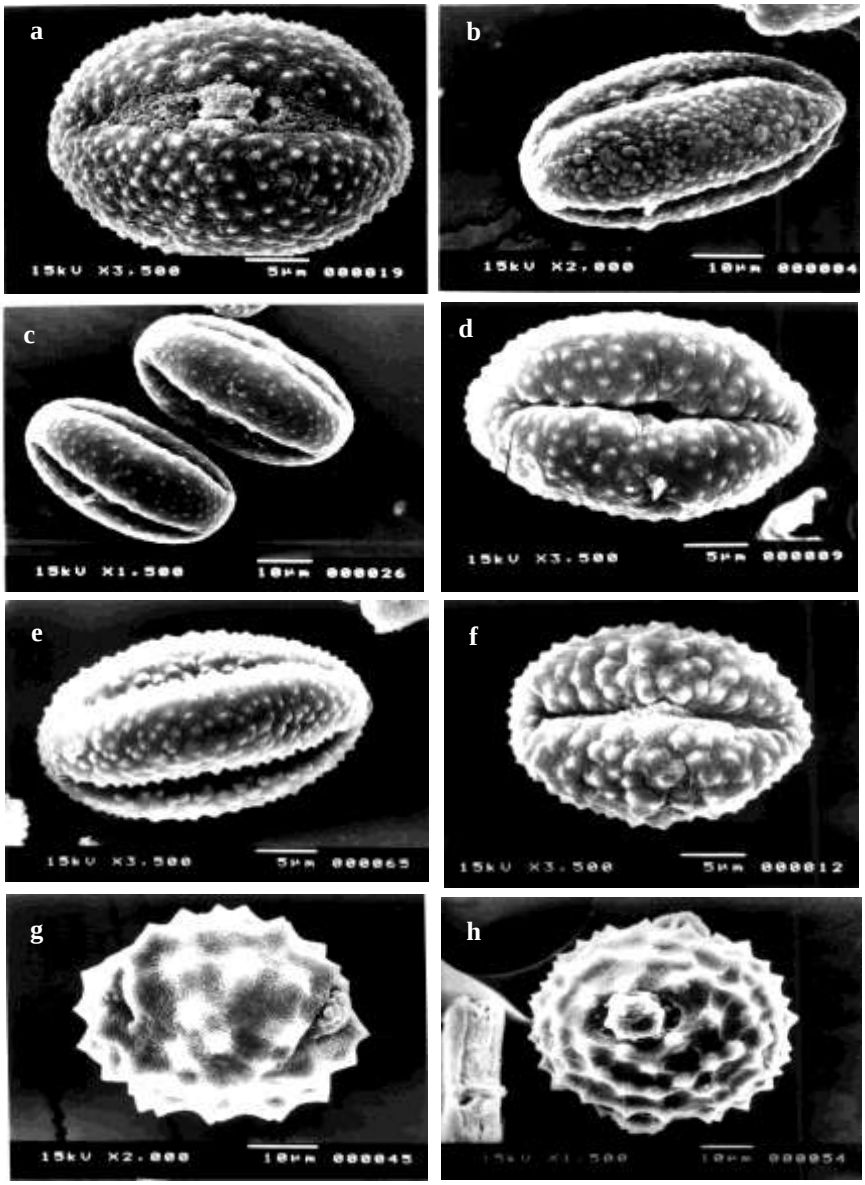

Fig. 1 : SEM micrographs of pollen grains of the studied species (equatorial view).
a. ***Centaurea glomerata*** **b.** ***Centaurea alexandrina***
c. ***Centaurea furfuracea*** **d.** ***Centaurea aegyptiaca***
e. ***Centaurea calcitrapa*** **f.** ***Centaurea pallescens***
g. ***Amberboa crupinoides*** **h.** ***Carduncellus mareoticus***

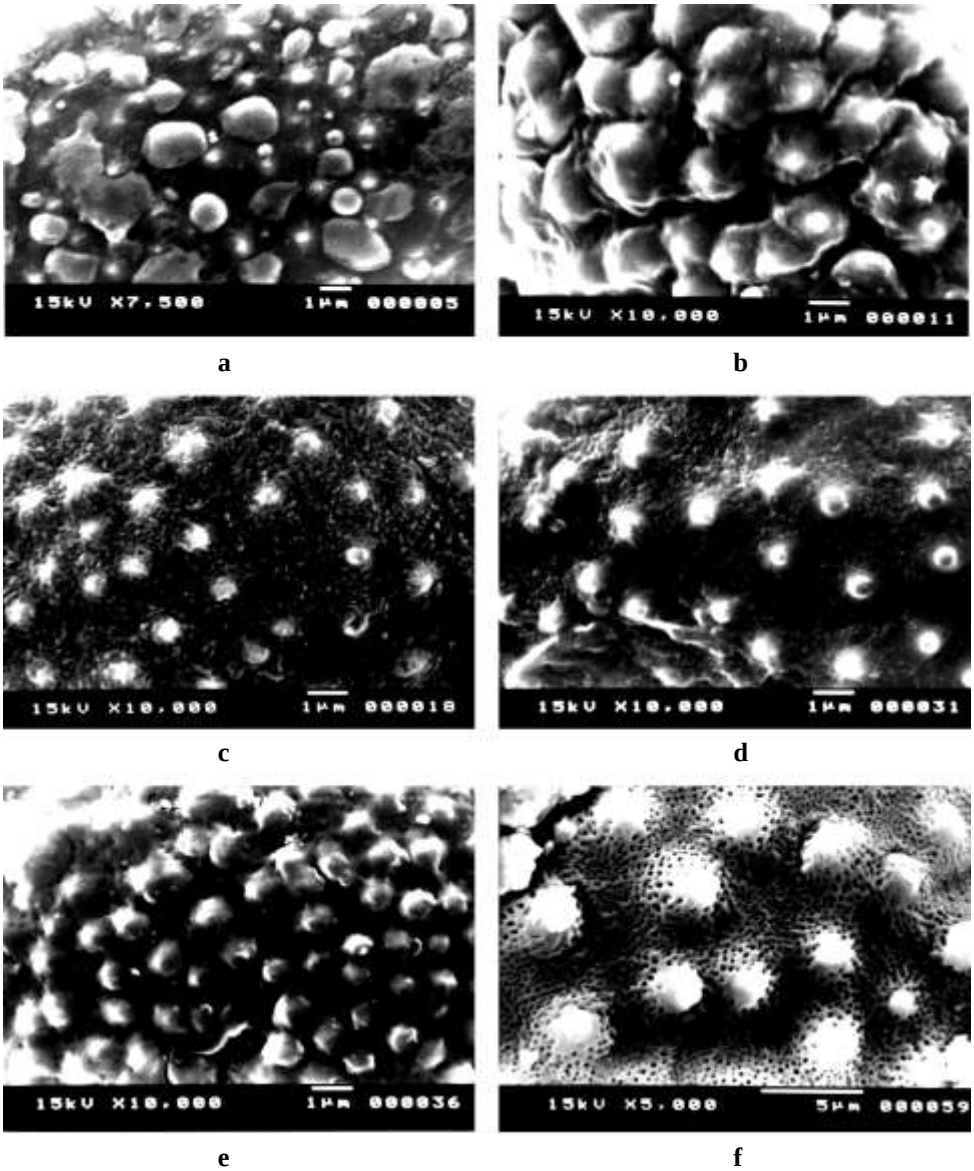

Fig. 2 : SEM micrographs of exine sculpture among the studied species
a. ***Centaurea alexandrina*** b. ***Centaurea pallescens***
c. ***Centaurea glomerata*** d. ***Carduncellus pumilio***
e. ***Centaurea scoparia*** f. ***Carduncellus eriocephalus***

2. The *Amberboa* – type

Pollen grains, isopolar, radiosymmetric, trizonocolporate, 35.8 x35.8 μm, spheroidal. Colpus long, 3-4 radius, margins regular; ends acute. Exine echinate, tectate; tectum verrucate, punctate.

This pollen type is characteristic to *Amberboa.* The punctate tectum resembles that of *Centarea furfuracea* and *Certaurea eryngioides* but differs in the shape and size of scabra.

3- The *Carthamus* – type

Pollen grains isopolar, radiosymmetric, trizonocolporate, 25.5–46.5 x 25.5-46.5μm, spheroidal. Colpus short, 6-7 radius, margins regular; ends acute or slightly rounded. Exine echinate, tectate; tectum verrucate, punctate.

The investigated pollen characters would show its taxonomic significance when combined with other morphological characters and (vide Fayed & Karakish, in press) to construct the following key:

1.a.	Pollen shape in equatorial view subprolate to prolate; exine sculpture scabrate …..	2
b.	Pollen shape in equatorial view spheroidal; exine sculpture microechinate–echinate ……..……...……...……...……...……...……...……...……..……	10
2.a.	Spine of the intermediate bracts not exceeding 1.0 cm long, palmate–like ……..…...	3
b.	Spine of the intermediate bracts more than 1.0 cm long , not palmate–like ……..….	5
3.a.	Heads in clusters; stem procumbent ……..……..	***Centaurea glomeratea***
b.	Heads solitary; stem erect ……..……..	4
4.a.	Heads radiant ; pollen grains in equatorial view subprolate, pollar axis not exceeding 27 μ m ……..……	***Centaurea ammocyanus***
b.	Heads not radiant ; pollen grains in equatorial view prolate, polar axis more than 44 μ m ……..……...…	***Centaurea furfuracea***
5.a.	Middle spine without lateral spinules ……...……...……..……..	***Centaurea pumilio***
b.	Middle spine with lateral spinules ……...……...……...……...……...……...……..	6
6.a.	Heads on nearly 2.8 cm long peduncle ……..……	***Centaurea eryngioides***
b.	Heads sessile or subsessile ……...……...……...……...……...……...……...……...…	7
7.a.	Upper leaves not subtending the heads ……..	***Centaurea scoparia***
b.	Upper Leaves subtending the heads ……...……...……...……...……...……...……..	8
8.a.	Involucral bracts hairy ; polar axis of the pollen grains ca. 46 μ m ……...……...……...……...……...……...……...…….	***Centaurea alexandrina***
b.	Involucral bracts glabrous ; polar axis of the pollen grains 25 – 27 μ m ……..……..	9
9.a.	Intermediate bracts with entire coriaceous margins ……..……..	***Centaurea aegyptiaca***
b.	Intermediate bracts with hyaline margins	***Centaurea calcitrapa***
10.a.	Leaves unarmed ; pollen colpus long, 3-4 radius	***Amberboa crupinoides***
b.	Leaves spiny ; pollen colpus short, 6-7 radius	11
11.a.	Pappus plumose	12
b.	Pappus absent or consisting of scales or bristles ……...……...……...……...……	13

12.a. Heads solitary ; polar axis of the pollen grains exceeding 46 µ m ……...……...……...……...……...……...……...…….. ***Carduncellus eriocephalus***

b. Heads numerous ; polar axis of the pollen grains less than 26 µ m ……...……...……...……...……...……...……...…….. ***Carduncellus mareoticus***

13.a. Flowers yellow ; pappus – scales acute ……...……...……...……...… ***Carthamus lanatus***

b. Flowers purple ; pappus – scales not acute ……...……...……...…….. ***Carthamus glaucus***

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References

Abou El – Naga, A.Z. 1990. Taxonomic and palynological studies of some species of Compositae in Egypt, unpublished Ph. D. Thesis, El-Mansoura University, Egypt.

Avetisian E.M. 1964. Palynosystematique de la tribu des Centaureinae des Asteraceae. *Tr. Bot. Inst. Akad. Nauk Sci. Armen*., **14** : 31-47.

Boulos L. 1995. *Flora of Egypt, Checklist,* Al Hadara Publshing. Cairo.

Dittrich M. 1977. Cynareae – systematic review. In *The biology and chemistry of the Compositae.* (V.H. Heywood, J.B. Harborne and B.L. Turner, eds.). Academic Press, London and New York.

El Hadidi M.N. & Fayed A.A. 1994/95. Materials for Excursion Flora of Egypt. *Taeckhalmia* **15** : 154-178.

Parra O. 1969 – 1970. Morfologia de los granos de polen de las Campuestas Cynareas *Chilenos. Bol. Soc. Biol. Concepcion* **42** ; 89-96.

Schtepa I.S. 1958. Ad cognitionem pollinis morphologiae generum nonnulorum tribus cynareae familiae Compositae. *Notulae systematiceae Instituti Botanici Thbilissiensis* **20** : 53-62.

Skvarla J.J., B.L. Turner, V.C. Patel & A.S. Tomb. 1977. Pollen morphology in the Compositae and in morphologically related families. In *The biology and chemistry of Compositae.* (V.H. Heywood, J.B. Horborne and B.L. Turner, eds.) Academic Press, London and New York.

Villodre J.M. & Garcia – Jacas N. 2000. Pollen studies in subtribe Centaureinae (Asteraceae) : the *Jacea* group analysed with electron microscopy. *Bot. Joun. Linn. Soc.* **133** :473-484.

Wagenitz G. 1955. Pollenmorphologie and systematik in der gattung *Centaurea* L. *Flora, Jena* **142** : 213-279.