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The Pollen Morphology and its Sharing in the Taxonomy of Some Plant Species in Saudi Arabia

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The aim of the present study deals with the pollen morphology of *Zygophyllum simplex, Zygophyllum migahidii, Tribulus terrestris, Tribulus macropterus, Fagonia glutinosa, Fagonia indica* in the species of Saudi Arabia. In this study, we have performed the scanning electron microscopy method for the analysis of pollen grains by herbarium species. Pollen grains were squashed and mounted under the microscope. The results of this study specifies the observation of pollen grains in all the species collected from Saudi Arabia region. The largest polar diameter was observed in Tribulus terrestris, which is 41.6μm and the shortest diameter was observed in Zygophyllum simplex, which was 9.5 μm. In all the species except the members of genus *Tribulus*, the pollen type were tricolporate but in *T.terrestris* and *T.macropterus*, pantoporate pollens were also observed. Palynological study had been done to the six species by using light and scanning electron microscopes. The shape, ornamentation at the surface and sizes of pollen grains had been done, and they were found great similarities among the species which are belong to same genus and some variations among different genera. Our results demonstrate the observation of pollen grains collected in the Saudi Arabian herbarium species.

Key words: Pollen grain; herbarium; scanning electron microscopy; Saudi species.

Palynology is the study of pollen grains and spores and certain microscopic plankton organisms in both living and fossil form. Pollen morphology is the borderline fields between palynology. The other multiple scientific fields of palynology for the mankinds are cytology, taxonomy, iatropalynology, geopalynology, aeropalynology, mellittopaly-nology, copropaly-nology and pharmacopalynology [Hughes JD *et al* 2011; Meo AA *et al* 2003]. Pollen grains survive well in archaeological and geological situations. The microscopic analysis can be segregated, usually to genus or even species. Investigation of a pollen core, with assistance from radiocarbon dating, can show the changing abundance of the pollen rain and the relative frequency of kinds of pollen over a period of time [Hughes JD *et al* 2011]. Palynology also obviously intergrades with pollination biology and reproductive biology. For taxonomic purposes most emphasis has been placed so far on the comparative features of the pollen grains themselves, especially those of apertures and wall structure. Although pollen grains are small and the features only observable with compound light and electron microscopes. The usefulness of palynology has become so obvious that it is now routinely incorporated into most systematic and evolutionary studies [Keating *et al* 1979].

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The present study compacts with the pollen morphology of *Z.simplex, Z.migahidii, T.terrestris, T. macropterus, F.glutinosa, F.indica.* There are few studies about the pollen grains of the species. It was difficult to find study about pollen grains of species *Z.migahidii* and *T. macropterus,* so our study is the first about pollen grains morphology. And also, there was one previous study about pollen grains of the species *T.terrestris* and *F.indica* [Ahmad *et al* 2010]. There was only one study about pollen morphology of *Z.simplex, T.terrestris, F.glutinosa, F.indica* in Pakistan [Parveen & Qaiser *et al* 2006]. Beier *et al* [2005] group described pollen grains morphology of genus *Fagonia* in general. In Bulgaria there was a study about *T.terrestris* established the pollen grains, oblate-spheroidal, radially symmetric, pantoporate [Semerdjieva *et al* 2011]. In this study, we aimed to compacts with the pollen morphology of *Z.simplex, Z.migahidii, T.terrestris, T. macropterus, F.glutinosa, F.indica* in the species of Saudi Arabia.

MATERIALS AND METHODS

Herbarium plant specimen were collected from the Saudi Arabia. The pollen material was obtained from herbarium specimens as tabulated in Table 1. The standard methods described by [Erdtman *et al* 1952], several anthers from mature flowers were placed in a watch glass and squashed with the addition of a few drops of wetting agent. Then the floral fragments were drawn to the side of the watch glass with fine forceps and a mounted needle under a dissecting microscope, leaving just the pollen grains to dry. An acetolysis mixture was made by mixing nine parts of acetic anhydride with one of conc. sulphuric acid (acetolysis time: 9 to 15 seconds). This was added with a bulb pipette to the dry pollen in the watch glass on the heating block. When the pollen grains darkened, they were allowed to cool for a few minutes and methylated spirit was added drop by drop to the center of the remaining acetolysis mixture. The acetolysis mixture formed a ring around the rim of the watch glass and was wiped away with a tissue. The pollen grains were transferred to the stubs, which were already prepared with double-sided adhesive tape for scanning electron microscopy (SEM) study. For preparing light microscope slides, the remaining pollen grains in the watch glasses were transferred onto the slides on a small block of glycerin jelly with safranine stain added. When the glycerin jelly melted on the heating block, cover slips were added. For the SEM study, stubs were coated with gold for 5-6 minutes. The measurements were carried out using light microscopy and based on 15 readings for each specimen. Pictures of the pollen grains were taken by a JEOL T20 SEM and using a Zeiss light microscope. The terminology used in the present study is according to (Punt *et al.*, 1994).

Equatorial diameter (E) and Polar length (P) were measured then the ratio of P/E were calculated and timed by 100, pollen grains shape for each specimen was recorded based on this ratio.

$$\text{Ratio} = \frac{P}{E} \times 100$$

RESULTS AND DISCUSSION

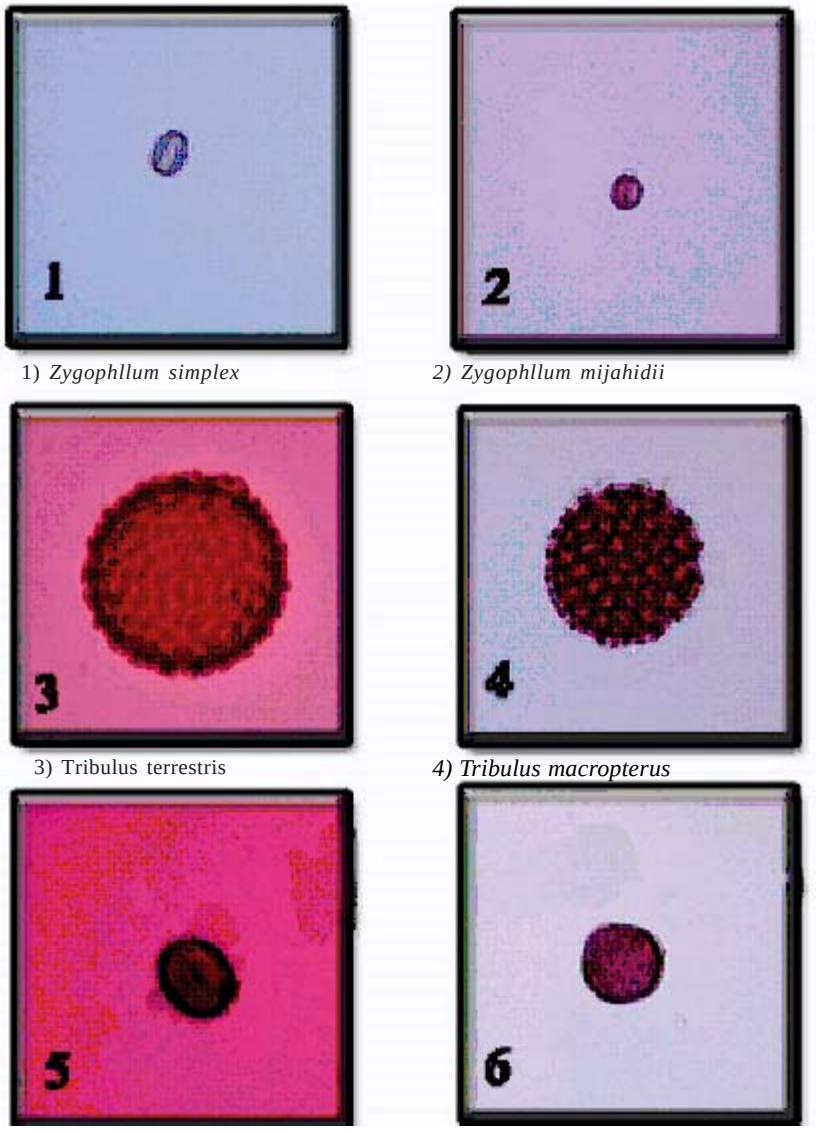
The glossary of pollen terminology was first presented to the international palynological community as the final outcome of the Working Group on Palynological Terminology at the 8th International Palynological Congress in Aix-en Provence in 1992. It became widely accepted as reference guide for palynologists to assist in the preparation of accurate and consistent descriptions of their material. It also serves as a practical source of information for non-specialists who wish to understand the meaning of the large number of existing palynological terms [Punt *et al.*, 2007].

Palynology also obviously intergrades with pollination biology and reproductive biology. For taxonomic purposes most emphasis has been placed so far on the comparative features of the pollen grains themselves, especially those of apertures and wall structure. Although pollen grains are small and the features only observable with compound light and electron microscopes, "The usefulness of palynology has become so obvious that it is now routinely incorporated into most systematic and evolutionary studies (Keating, 1979). To the naked eye, pollen grains of the flowering plants appear simply as yellow powdery substance. However, under light microscope and scanning electron microscope, each pollen grain

Table 1. Pollen grains measurements of Zygophllum *sp, Tribulus sp and Fagonia sp* in Saudi Arabia

S. No	Taxa	*Polar Length	*Equatorial Diameter (p µm)	P/E× 100 (E µm)	Shape
1.	*Zygophllum simplex*	9.85	6.91	142.5	Prolate
2.	*Zygophllum migahidii*	9.5	8.6	110.5	Spheroidal
3.	*Tribulus terrestris*	41.6	40	104	Spheroidal
4.	*Tribulus macropterus*	32.05	31.14	103	Spheroidal
5.	*Fagonia glutinosa*	23.3	14.6	154	Prolate
6.	*Fagonia indica*	18.75	18.5	101.4	spheroidal

*Mean of the measurements of the 15 pollen grains by light microscope



1) *Zygophllum simplex* 2) *Zygophllum mijahidii*

3) Tribulus terrestris 4) *Tribulus macropterus*

5) Fagonia glutinosa *6) Fagonia indica* in Saudi Arabia

Fig. 1. Light microscope showing of the pollen grains genus

generally exhibits a varying sculpturing pattern on its outer wall (exine) surface. This variability of sculpturing pattern helps in identification of plant species, thus exhibiting the beautiful art work of nature. Like other disciplines, pollen grains have an important part in modern issue of plant taxonomy (Bashir & Khan, 2003).

Palynology also helps in solving taxonomic problems concerned with hybrid plants. Pollen grains have various sculpturing on its outer resistant coat (exine) like spines, spores, grooves, reticulates, etc. and such variations provide a means of identifying a pollen grain of particular taxa. Palynological characters are useful in solving complicated problems of inter-relationship between various taxa and assessment of their status in the classification, particularly with reference to the families, sub-families, tribes, genera, species and subspecies. With the help of characters like pollen size, shape, surface structures and internal detail, identification of pollen source to the appropriate botanical taxonomic level can be made (Ahmad *et al*., 2010).

The history of palynology is tangled with that of embryology, cytology, and pollination biology (Wodehouse, 1935; Nair, 1970). The understanding of pollen grain structure and function clearly has depended to some extent on advances in microscopy, especially in the earliest years As (Keating, 1979).

In this study the detailed palynological description of 6 species, belonging to Zygophllaceae family and 3 genera were made. The overall view of the palynological study with the largest polar diameter (41.6 µm) was observed in *Tribulus terristris* and the smallest (9.5 µm) in *Zygophllum simplex.* In all the species except the members of genus *Tribulus,* the pollen type were tri-colporate but in *T.terristris* and *T.macropterus,* pantoporate pollen were also observed.

The pollen grains in *Zygophllum simplex* prolate, apolar aperture system Tri-colporate. Ornamentation micro-reticulate rarely regulate-reticulate or reticulate-voveolate. Measurements: P = 8- (9.85) - 10, E = 5.4 - (6.91) -7.3, P / E =142.5. The study agrees with (Perveen & Qaiser, 2006).
The pollen grains in *Zygophllum migahidii* spheroidal, isopolar aperture system Tri-colporate. Sculpturing exine micro-reticulate. Measurements: the average polar diameter was 9.5 µm, the average equatorial diameter was 8.6 µm.

In the genus of *Tribulus* (*Tribulus terrestris, Tribulus macropterus*), the pollens were of same types, sculpturing and polar view that is pantoporate, coarsely macro-reticulate and spheroidal, respectively, which are the characteristic of *Tribulus sp.* The average polar diameter was 41.6 µm in *Tribulus terrestris*, the average equatorial diameter was 40 µm, the P\E was 104. Measurements in *Tribulus macropterus:* P = 30- (32.05) - 33, E = 28.1 - (31.14) -35, P / E =103. The present study of *Tribulus terrestris* agrees with (Semerdjieva *et al*.,2011), also with (Perveen & Qaiser, 2006), in the shape, sculpturing of the surface of the pollen grains, but it disagrees with same study in polar length of pollen grains it was 41.6 µm in our study, but it was 32.4-39.5 µm in (Perveen & Qaiser, 2006). Also, it agrees with (Ahmad *et al*., 2010) in aperture type and in the shape of the pollen grains, but it disagrees with the same study in sculpturing of the surface of the pollen grains it was reticulate in our study , but it was echidnae in (Ahmad *et al*., 2010).

The pollen grains of *Fagonia glutinosa* was prolate, 3-colporate. Ornamentation micro-reticulate sculpturing. Dimensions: P =20 - (23.3) - 25, E = 11 - (14.6) -15.8, P / E =154. According to (Ahmad *et al*., 2010).

The pollen grains of *Fagonia indica* was spheroidal, 3-colporate, had both the polar and equatorial views with diameter of 18.75 and 18.5 µm respectively. It's P / E was 101.4. Ornamentation micro-reticulate sculpturing. The study disagrees with (Perveen & Qaiser, 2006) in the shape of the pollen grains it was spheroidal in our study, but it was prolate in (Perveen & Qaiser, 2006).

Also, the study disagrees with (Ahmad *et al*., 2010) in sculpturing of the exine of the pollen grains it was micro-reticulate in our study, but it was psilate in (Ahmad *et al*., 2010).

In conclusion, Palynological study had been done to the six species by using light and scanning electron microscopes. The shape, ornamentation at the surface and sizes of pollen grains had been done, and they were found great similarities among the species which are belong to same genus and some variations among different genera.

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