

## Palynological Study of the *Geranium L.* Species in Iraq

Sirwan Hassan Salih

Biology Department, College of Education, University of Garmian

### Abstract

The pollen grains morphology of ten species of *Geranium* were investigated, two types of pollen surface configuration were found reticulate/gemmate and striate reticulate as well as the results showed two groups of species in pollen sizes the first with less than 100 $\mu$ m of diameter and the other with more the 100 $\mu$ m all illustrated by figures and tables. The average value of pollen polar axis ranged between 60- 94 $\mu$ m and equatorial diameter ranged between 58 $\mu$ m-85 $\mu$ m.

### 1- Introduction:

The application of pollen morphology in recognition and interpretation of relationships of plants at various hierarchical level in plant taxonomy and production of pollen keys has been reported in many angiosperm families (Erdtman 1966, Mulder 2003, Huysmans and et al. 2003, Al-Quran.2004), moreover the advent of scanning techniques has greatly enabled the study of pollen morphology with great precision, thereby making their application much more efficient and dependable. The pollen morphology of Geraniaceae or some of its representative has been studied by many researchers such as Bortenschlager (1967), Olthmann (1967), Verhoeven and Venter (1987), Stafford and Blackmore (1991) and Stafford and Gibby (1992). Recently Aedo, et al. (2007) who have used the palynological data in combination with morphological data in their taxonomic revision of Genus *Geranium*. Based on previous studies and investigations the pollen morphology of studied species in Iraq had not been described or studied previously.

The main objective of the present study was to investigate and describe the pollen morphology of the *Geranium* species those distributed in Kurdistan region-Iraq and to show how far the pollen morphological variations could be used to make distinction between the studied taxa.

### 2- Materials and Methods:

This study included 10 species of genus *Geranium*. Pollen samples of examined species was obtained from filed collections as well as from herbarium specimens (table 1). Pollen grains were prepared for light microscopy (LM) by using the standard method described by Erdtman (1960). Pollens mounted on glycerin jelly onto glass slides and stained with safranin finally observations were made with a Seizz microscope under E40 and E100 with 10x eyepiece. Pollen diameter, polar axis (P) and equatorial view (E) were measured on 20-25 pollens of each species and P/E was calculated and all of which were photographed by modern digital camera (SONY, 3x, 13.6 Mega pixels). The terminology was used accordance to Erdtman (1969), Walker and Doyle (1976) and Hesse and et al (2009)

### 3-Results and Discussion:

The results showed that the pollen grains were usually monad, isopolar, radially symmetrical, the mean value of polar axis (P) ranged between 60 $\mu$ m in *G. rotundifolium* and 94 $\mu$ m in *G. stepporum*, while the equatorial diameter (E) ranged between 58 $\mu$ m in *G. molle* and 85 $\mu$ m in *G. dissectum* (figure 1 and 2), then the size of grains in both polar and equatorial view of all examined species is approximately similar, visually the distances among pores are mostly equal. Pollen outline are circular to slightly triangular or semi ovate with convex sides in polar view shows circular to semi ovate in (*G. pusillum*, *G. divaricatum*).

*G. stepporum* and *G. tuberosum*) to elliptic in equatorial view in the others (table 2, figures 3). According to the pollen sizes, the studied species can divide into two groups, the first group included species with medium and large size pollen grains (41-98 $\mu$ m) as in *G. divaricatum*, *G. kurdicum*, *G. molle*, *G. purpureum*, *G. pusillum* and *G. rotundifolium* and the second group involved species with large pollen grains (more than 100 $\mu$ m) as in *G. dissectum*, *G. lucidum*, *G. stepporum* and *G. tuberosum* (table 2)

Apertures (pores) tricolporate and the distances among them are usually equally organized. Tectum showed two types sculptures, reticulate/gemmate in *B. multifida*, *G. dissectum*, *G. molle* and *G. purpureum* whereas grains with minute appendages like gemmate and striate reticulate, in remain species the sculpture distinguished by the existence of straight reticulate ornamentation. The results of pollen morphology are agreed with the results of Erdtman (1971), Perveen (1999) and Shehata (2008). The two types of pollen in terms of surface ornamentations and exine structures recognized, type I: reticulate/gemmate is readily distinguished by the reticulate tectum which is heavily ornamented with bacula and gemmae, this type is characteristic of *G. dissectum*, *G. divaricatum*, *G. molle* and *G. purpureum* and the type II: striate reticulate tectum is characterized by a striate reticulate tectum were found in other remain species. Generally the pollen dissimilarities of these species are little, the apertures diameters and distances among them are semi- equal also the colors of pollen grains are ranged from light yellow, yellowish white to dirty white. However the most important features of pollen are the sculptures or ornamentation that could be used for splitting infrageneric taxa into groups and that which need to be studied in detail in future by scanning electron microscope (SEM) to show the variations obviously.

Table (1) Plant specimens used for palynology.

species	Specimens number	Herbarium	Localities	Collection Date
<i>Geranium dissectum</i>	1308	SUH	Kalar (Sarqala)	22-3-2008
	2712	SUH	Near Penjwen	10-5-1978
	1058	SUH	Sakran mt.	1-5-2008
	373	SUH	Kani Watman	8-4-2008
<i>G. divaricatum</i>	0013116	BUH	Halgurd mt.	28-5-1961
	0013119	BUH		
<i>G. kurdicum</i>	0013121	BUH	Halgurd mt.	7-6-1961
	0013122	BUH		7-6-1961
	0013117	BUH		15-8-1956
<i>G. lucidum</i>	927	SUH	Bekhal /Rowanduz	1-5-2008
	5352	SUH	Pirimagroon mt	23-5-1981
	233	SUH	Ahmedawa/ Khormal	3-4-2008
	1282	SUH	Sartaky Bamo mt.	20-3-2008
<i>G. molle</i>	1276	SUH	Sartaky Bamo mt.	20-3-2008
	5363	SUH	Pirimagroon mt.	16-1981
	1028	SUH	Gali Akoian/ Erbil	1-5-2008
	2280	SUH	Qashqoly/ Dukan	12-4-2008
<i>G. purpureum</i>	0013137	BUH	Shaqlawaw/ Erbil	11-4-1960
	241	SUH	Ahmedawa/ Khormal	3-4-2008
	1019	SUH	Gali Akoian/ Erbil	1-5-2008
	741	SUH	Bargalu/ Sulaimany	17-4-2008
<i>G. pusillum</i>	996	SUH	Gali Akoian/ Erbil	1-5-2008
	1039	SUH	Zerenok/ Rowanduz	1-5-2008
	1047	SUH	Galala/ Erbil	1-5-2008
	1249	SUH	Kani Bazi/ Amedy	2-5-2008
<i>G. rotundifolium</i>	0013145	BUH	Qopy Qaradagh	18-6-1959
	1112	SUH	Gali Zanta/ Aqra	2-5-2008
	147	SUH	Awa Khweri/ Kalar	31-3-2008
	912	SUH	Pirimagroon mt	24-4-2008
<i>G. stepporum</i>	784	SUH	Haibat Sultan mt.	17-4-2008

	398 823 1052	SUH SUH SUH	Azmer mt. Mlakawa/ Penjwen Sakran mt./ Erbil	9-4-2008 18-4-2008 1-5-2008
<i>G. tuberosum</i>	0029689 0013160 2002 1256	BUH BUH SUH SUH	Near Duhok Dukan Sarser/ Tawela Ahmedawa/ Khormal	4-5-1976 2-4-1967 22-4-2009 3-4-2008

Table (2). Dimensions and Morphology of Pollen grains.

species	Polar axis		Equatorial axis		Exine element thickness ( $\mu\text{m}$ )	Surface area (P. a. length x E.a.length) ( $\mu\text{m}$ )
	Diameter ( $\mu\text{m}$ )	Shape	Diameter ( $\mu\text{m}$ )	Shape		
<i>Geranium dissectum</i>	(68-107) 88	triangular, semi ovate	(61-102) 85	circular	(2-5) 4	88x85= 7480
<i>G. divaricatum</i>	(61-85) 76	triangular	(53-71) 60	circular, elliptic	(2-4) 3	76x60= 4560
<i>G. kurdicum</i>	(65-98) 83	Triangular	(60-91) 80	circular, elliptic	(2-4.5) 3	83x80= 6640
<i>G. lucidum</i>	(72-106) 90	triangular, circular	(57-97) 79	circular, semi ovate	(2.5-5) 4	90x79= 7110
<i>G. molle</i>	(54-81) 68	triangular, circular	(48-65) 58	circular, semi ovate	(2-4.5) 3	68x58= 3944
<i>G. purpureum</i>	(60-83) 75	triangular, circular	(41-74) 60	circular	(1.5-4) 3	75x60= 4500
<i>G. pusillum</i>	(55-88) 74	triangular	(55-82) 69	circular, semi ovate	(2-4.5) 3.5	74x69= 5110
<i>G. rotundifolium</i>	(49-72) 60	triangular, circular	(50-67) 59	circular, semi ovate	(2-5) 3.5	60x59= 3540
<i>G. stepporum</i>	(75-107) 94	triangular	(67-98) 82	circular, semi ovate	(1.5-4) 3	94x82= 7708
<i>G. tuberosum</i>	(60-106) 87	triangular, semi ovate	(59-100) 81	circular, elliptic	(2-4.5) 3.5	87x81= 7047

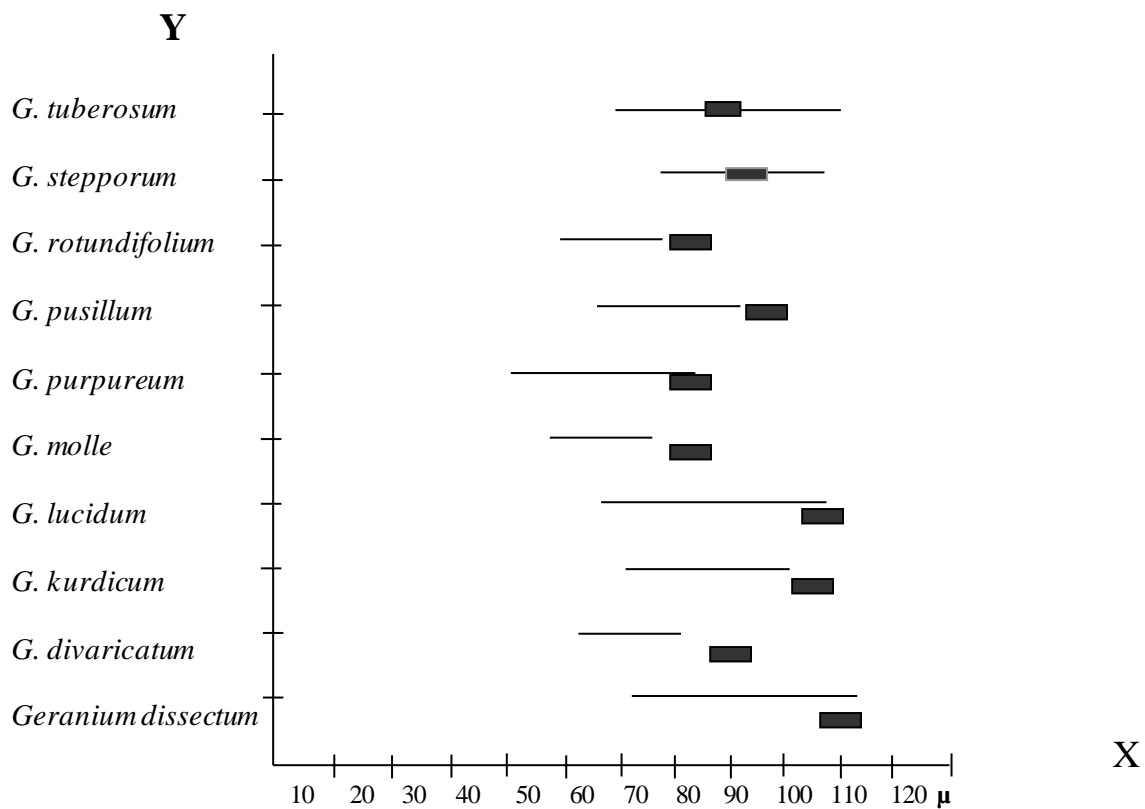


Figure (1) Equatorial dimension of pollen grains (X= pollen polar diameters Y= examined species)

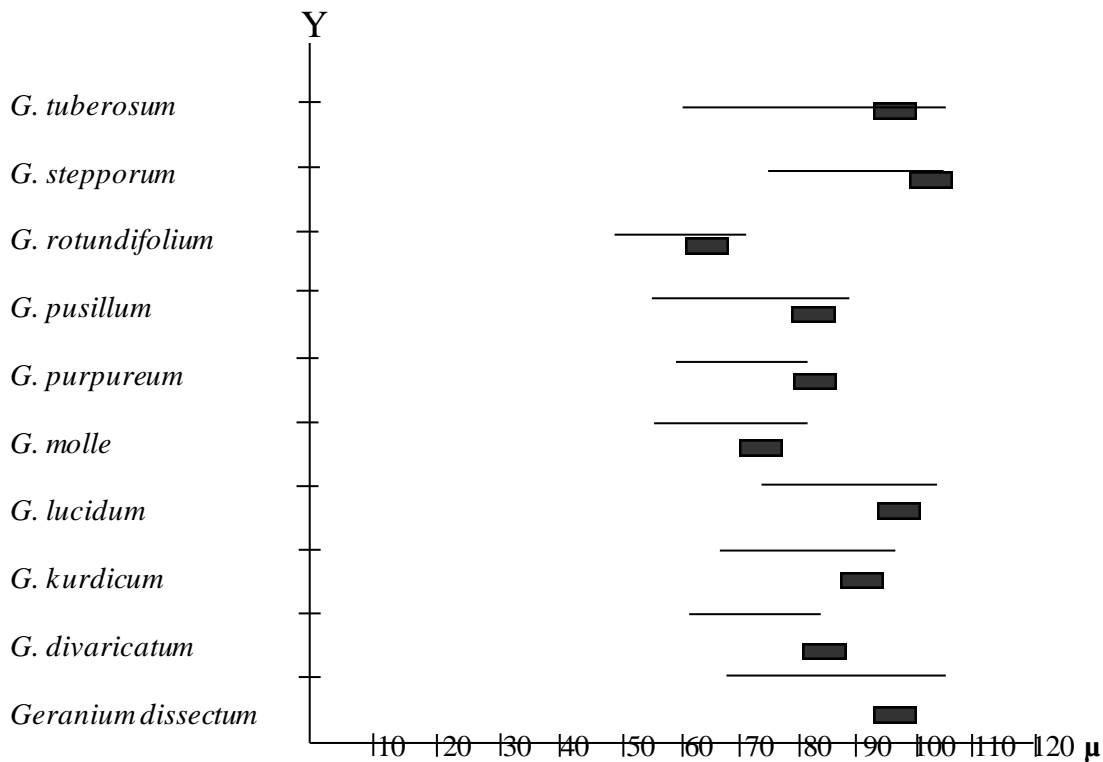


Figure (2) Polar dimensions of pollen grains. (X= pollen polar diameters Y= examined species)

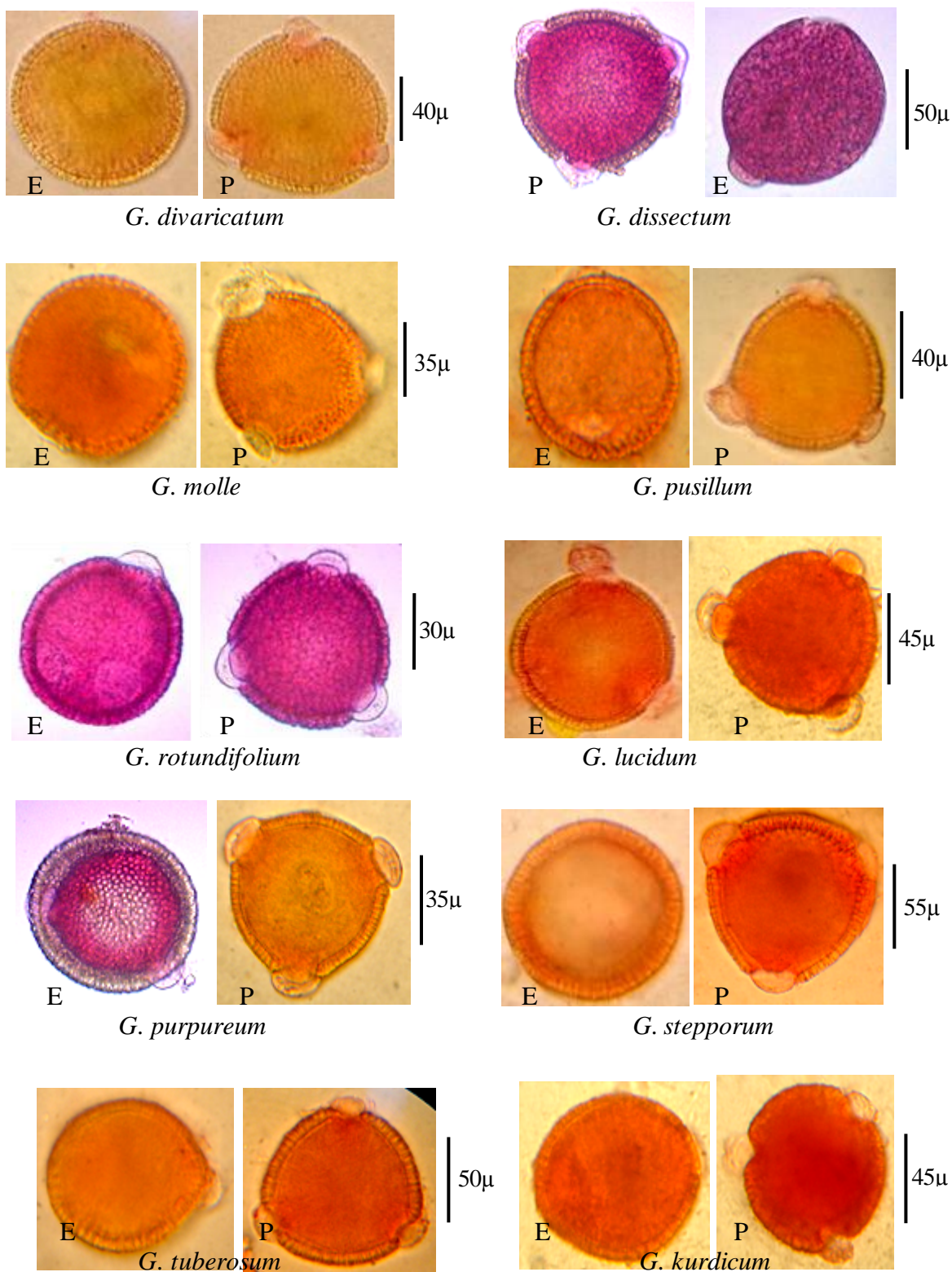


Figure (3) Pollen grain morphology of studied species. (E= Equatorial view, P= polar view)

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