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Palynological Study for some Species of Rubiaceae in Iraq

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Abstract: The current investigation included study of pollen grains of some taxa belonging to the family Rubiaceae in Iraq. These taxa were: *Asperula laxiflora*, *A. astrocephala*, *A. comosa*, *A. friabilis*, *A. insingis*, *A. laxiflora*, *A. xylorhiza*, *A. setosa*, *Crucianella gilanica*, *C. chlorostachys*, *C. kurdistanica*, *C. exasperata*, *C. parviflora*, *Sherardia arvensis* and *Wendlandia ligustroides*. The study showed that these taxa varied in their shapes, dimensions on both polar and equatorial view, number of colpi and other characters, were been investigated with the aid of light microscopy (LM), in order to determinate the pollen micro-morphology of Rubiaceae genera and to find their significance in taxonomy of the group, qualitative and quantitative variables concern to shape, size and colpi were studied. In term of size, the pollen grains of all species were small. The shapes were oblate-spheroidal, oblate, sub-oblate and prolate-spheroidal. Significant differences in number of colpi ranged from three colpi in *Wendlandia ligustroides* to eleven colpi in *Sherardia arvensis*.

Keywords: *Asperula*, *Crucianella*, *Sherardia*, *Wendlandia*, Pollen grains

Introduction

The family Rubiaceae is the fourth largest family of dicotyledons, comprising 563-611 genera and 10900-13150 species (Simpson, 2010). In Iraq, this family included twelve genera (Townsend & Guest, 1980). The genus *Asperula* L. is represented by twelve species, *Crucianella* L. with eight species, *Sherardia* L. by one species and *Wendlandia* Bartle with one species (Townsend & Guest, 1980).

Palynology is one of the informative fields for understanding angiospermae biodiversity (Blackmore, 2007). Pollen morphology of the family Rubiaceae including these genera) has been examined by Erdtman (1952), Huysmans et al. (1994), Huysmans et al. (1998), Bremer & Manen (2002), Molina (2002), Huysmans et al. (2003), Perveen & Qaiser (2007), Dessein et al. (2005), Minareci et al. (2010), Xie & Zhang (2010) and Öztürk (2013).

There are no reports on pollen morphology of the family Rubiaceae in Iraq except the studies of Gharb & Al-Musawi (2013) and Al-Dabagh (2019) about *Galium*.

The present study focused on the pollen grains of the genera *Asperula*, *Crucianella*, *Sherardia* and *Wendlandia* in Iraq which would be helpful to classification and phylogenetic relationships in Rubiaceae.

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Material and Methods

The study was based on specimens in National Herbarium of Iraq (BAG) and the University Herbarium, College of Science, University of Baghdad (BUH). In addition to some fresh samples which were collected during field trips that took place between April to June 2019. These samples were preserved in Herbarium of College of Education, University of Baghdad.

The pollen grains prepared for light microscope by mounting in glycerin-safranin mixture, the measurements were based on 15-25 readings from each specimen. Pollen diameter, polar axis (P) and equatorial diameter (E), colpi length, number of colpi and exine thickness were measured.

Results

Quantitative and qualitative features of pollen grains are summarized in Table 1.

Polarity and Symmetry: All taxa had isopolar and radial symmetrical pollen grains. This agrees with Huysmans et al. (2003), Perveen & Qaiser (2007) and Öztűrk (2013).

Size: The pollen grain was relatively small, the average of polar view diameter ranged from 11.8 mm in *C. kurdistanica* to 24.8 mm in *A. setosa* in equatorial view. The polar axis ranged from 12.6 mm in *C. kurdistanica* to 24.4 mm in *A. setosa*, while the equatorial diameter ranged from 15.1 mm in *W. ligustroids* to 23.1 mm in *A. xylorhiza*. These agree with Huysmans et al. (2003), Perveen & Qaiser (2007), Minareci et al. (2010), Xie & Zhang (2010) and Öztűrk (2013).

Shape: Pollen grains of examined taxa varied in their shapes depending on the polar axis/ equatorial axis (P/E) ratio (Dessein et al., 2005).

In *A. comosa*, *A. friabilis* and *C. exasperate*, the pollen grains were oblate to spheroidal, while they were suboblate in *A. astrocephala* and *C. gilanica* and oblate in *C. kurdistanica*. The pollen grains were prolate in *A. setosa*, *S. arvensis* and *Wendlandia ligustroides*.

Colpi: The examined taxa were zonocolpate, and they were varied in number of colpi. The pollen grains were tricolpate in *Wendlandia ligustroides* (Plate 3) and this agrees with Perveen & Qaiser (2007) and Xie & Zhang (2010). In *C. kurdistanica*, the pollen grains were tetracolpate (Plate 3), while in *A. comosa*, *A. friabilis* and *A. xylorhiza*, the pollen grains were hexacolpate (Plates 1 & 2). Öztűrk (2013) showed that number of colpi in *A. comosa* were seven to eight. In other taxa, the pollen grains were polycolpate where the number of colpi was eight. In *A. astrocephala*, *C. exasperata* and *C. gilanica* they had nine colpi (Plates 1 & 2), *S. arvensis* had eleven colpi in their pollen grains (Plate 3). The colpi were semielliptical in shape with acute ends.

Thickness of Exine: The examined taxa varied in the thickness of exine, as they ranged from 0.52 nanometers in *C. exasperata* to 2.8 nanometers in *S. arvensis*.

Table 1: Qualitative and quantitative characteristics of pollen grains of the studied species measured in micrometers.

Taxa	Polar view diameter	Equatorial view diameter	P/E	Number of colpi	Colpus Length	Thickness of exine
A. astrocephala	13-15.6 (14.17)	13-15.6 (13.9)	0.83	8	13-15.6 (14.8)	1.3
A. comosa	18.2-22.1 (19.5)	16.9-22.1 (20)	0.96	6	16.9-23.4 (19.6)	1.3
A. friabilis	20.8-16.9 (18.3)	15.6-20.8 (18.2)	0.93	6	13-15.6 (14.5)	0.78
A. setosa	23.4-26 (24.8)	23.4-26 (24.4)	1.09	8	20.8-23.4 (22.3)	1.3
A. xylorhiza	14.3-20.8 (17.5)	20.5-25.8 (23.1)	o.77	6	18.2-23.4 (20.8)	1.4
C. exasperata	15.6-20.8 (18.2)	18.2-20.8 (19.3)	0.82	8	15.6-19.5 (17.7)	0.52
C. gilanica	18.2-20.8 (19.1)	15.6-23.4 (19.6)	0.87	9	15.6-19.5 (17.6)	1.4
C. kurdistanica	11.6-12 (11.8)	12.2-13 (12.6)	0.64	4	15.6-18.2 (17)	1.3
S. arvensis	20.8-23.4 (22.3)	20.8-23.4 (21.7)	1.02	11	20.8-23.4 (22.1)	2.8
W. ligustroids	13-15.6 (14.5)	13.4-16.8 (15.1)	0.96	3	13-15.6 (14.8)	1.56

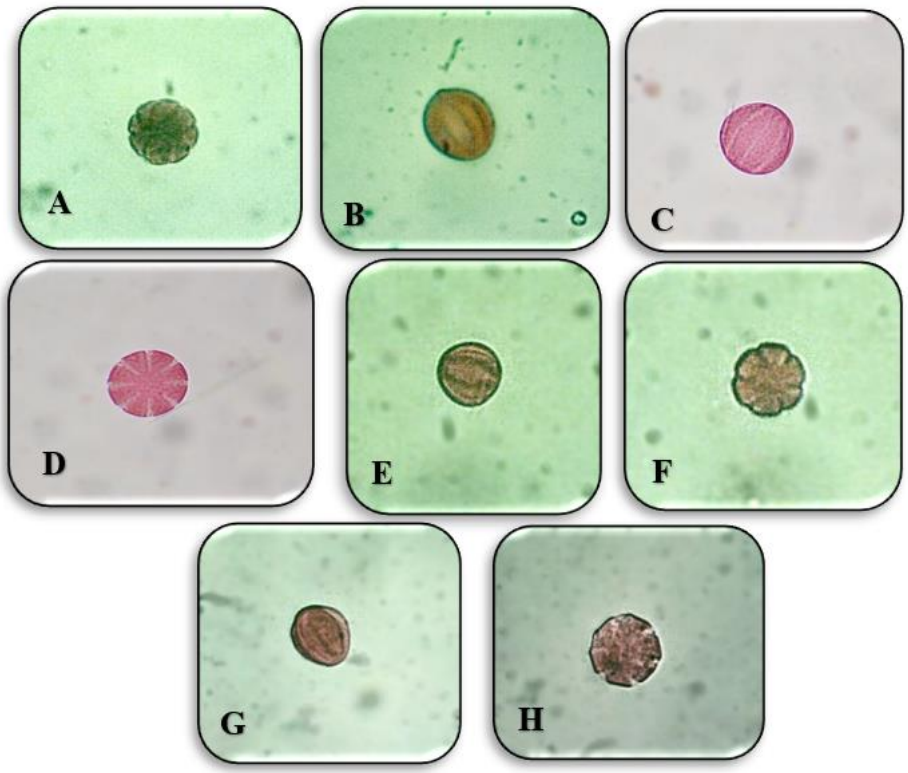

Plate 1: A- the pattern of pollen grain of *A. asterocephala* in polar view with colpi, B- equatorial view with colpi in pollen grain of *A. asterocephala*, C- equatorial view of *A. setosa* pollen grain, D- polar view in pollen grain of *A. setosa*, E- the pattern of pollen grain of *A. comosa* in equatorial view with colpi, F- polar view in pollen grain of *A. comosa*, G- equatorial view with colpi in pollen grain of *A. friabilis*, H- the pattern of pollen grain of *A. friabilis* in polar view with colpi. (Scale 10 µ).

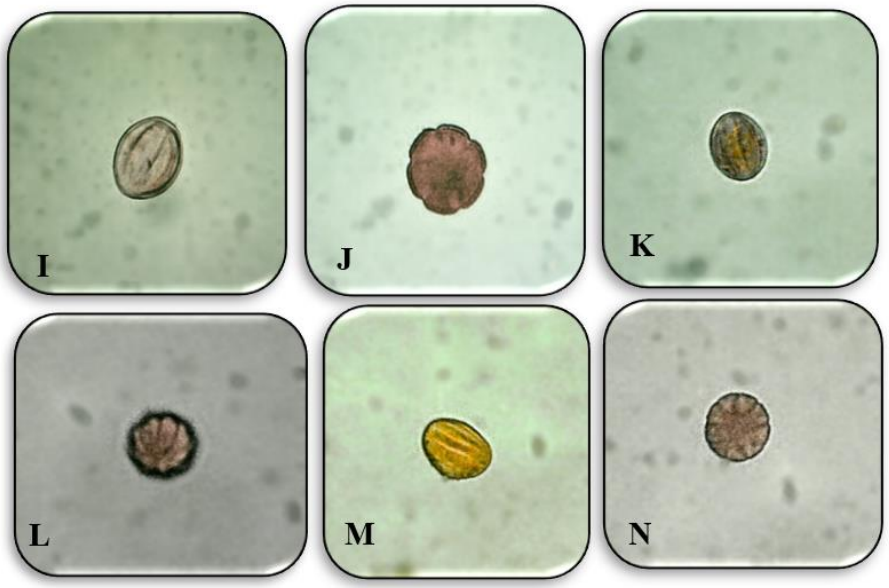

Plate 2: I- the pattern of pollen grain of *A. xylorrhiza* in equatorial view with colpi, J- polar view with colpi in pollen grain of *A. xylorrhiza*, K- equatorial view of *C. exasperata* pollen grain, L- polar view in pollen grain of *C. exasperata*, M- the pattern of pollen grain of *C. gilanica* in equatorial view with colpi, N- polar view in pollen grain of *C. gilanica*. (Scale 10 µ).

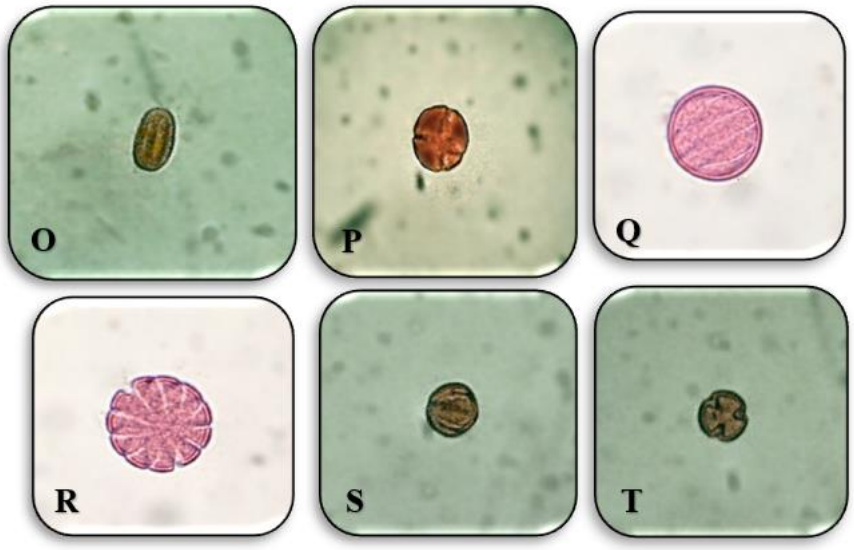

Plate 3: O- the pattern of pollen grain of *C. kurdistanica* in equatorial view with colpi, P- polar view with colpi in pollen grain of *C. kurdistanica*, Q- equatorial view of *S. arvensis* pollen grain, R- polar view in pollen grain of *S. arvensis*, S- the pattern of pollen grain of *W. ligustroides* in equatorial view with colpi, T- polar view in pollen grain of *W. ligustroides*. (Scale 10 µ).

Discussion

The present study of the pollens from taxa belong to the Rubiaceae showed that the pollen grains were small in size and this agree with Perveen & Qaiser (2002), Huysmans et al. (2003), Minareci et al. (2010) and Öztűrk (2013).

The study showed that apertures were colpate and the number of colpi varied from 3-11. Perveen & Qaiser (2002) mentioned that frequent aperture type in Rubiaceae was colpate and the number of colpi varied from 3-11. In the present study, *W. ligustroides* were 3-colpate and this agrees with Xie & Zhang (2010) in their study of pollen morphology of *Wendlandia* in China and Perveen & Qaiser (2002) of *W. exerta* (Roxb.) DC. in Pakistan as the result showed that *A. comosa* were 6-colpate. The result showed that pollen grains of *A. setosa* had eight colpi and this agrees with Perveen & Qaiser (2002) in their study of *A. setosa* which had 8-9 colpi, while *S. arvensis* had 11 colpi in the present study. Huysmans et al. (2003) mentioned that *S. arvensis* pollen grains were 10-13 colpi. The colpi varied in their lengths also. Their average ranged from 14.5 µm in *A. friabilis* to 22.3 µm in *A. setosa*. The average of colpus length in *A. comosa* was 19.6 µm (Perveen & Qaiser, 2002) comparing with 12.4 µm in Öztűrk (2013).

Pollen grains of examined taxa were varied in their shapes depending on P/E ratio. The pollen were oblate-spheroidal, suboblate, oblate and prolate- spheroidal. Pollen grains of *A. comosa* were oblate- spheroidal and this agrees with Öztűrk (2013). Pollen grains of *A. setosa* were prolate- spheroidal in the current study and agreed with Perveen & Qaiser (2002). In the present study, *S. arvensis* pollen grains were prolate- spheroidal, while in Huysmans et al. (2003) they were spheroidal.

The different characters of pollen grain; size, number and length of colpi, shape and other characters would be helpful to classification and phylogenetic relationships in Rubiaceae. More palynological studies on the other taxa of Rubiaceae are recommend.

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