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Full Length Research Paper

Palynomorphological characterization of some species of *Ficus* L. from Pakistan

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The present study was confined to pollen morphology and pollen fertility estimation using a taxonomic description of 11 species of genus *Ficus* family Moraceae. The species were *Ficus bengalensis* L, *Ficus microcarpa* L.f., *Ficus palmata* Forrsk., *Ficus religiosa* L., *Ficus lacor* Ham., *Ficus pumila* L., *Ficus hispida* L.f., *Ficus sarmentosa* Buch.Ham, *Ficus auriculata* Wall., *Ficus virens* Dryand. and *Ficus racemosa* Roxb. A palynomorphic study of the following species was conducted for the first time not only in Asia, but worldwide. As such, no published details were available for such comprehensive morphopalynological studies of the following species of genus *Ficus* L. It was found that pollen characters (that is, shape, surface of exine and pollen morphology) were considered as important characters and were used as tools in the taxonomy of these species. In the present research, the highest (97.82%) value was observed in *F. palmata Forrsk.* (Table 1) and the lowest (60%) was observed in *F. bengalensis* L. The present study shows that the flora of the selected species is a stable one. However, genetic diversity and molecular studies may also be helpful in this regard.

Key words: *Ficus*, palynology, pollen fertility.

INTRODUCTION

There are many disciplines associated with taxonomy, which are used by taxonomists as an aid, or to improve the identification, classification and systematic position of plant taxa. Among these disciplines, palynology is one of the most significant tools used by modern taxonomist to identify and differentiate closely related taxa (Zafar et al., 2007). Pollen grains from Moraceae of different phytogeographic regions have been studied in several papers; although previous references can be found in Erdtman (1952). The flora of Pakistan is highly diverse and is reported to be represented by nearly 6000 species of flowering plants, occurring mainly in the Northern and North Western parts of Pakistan (Munsif et al., 2007). The genus *Ficus*, both cultivated and wild, is represented by 27 in Pakistan. It is an extremely natural taxon, with its unique floral theme. It has syconia, in which flowers grow inside the fruit and pollination occurs through the female wasp Agaonoid and micro-morphological features including those of pollen grains. For a taxonomist, the data about fertility of pollen is an important means to differentiate the potential hybrid and parental plant. It is also supportive to conclude the level of fertility in vegetation developed under adverse circumstances (Lawrence, 1951). Pollen fertility is a significant determinant of whether or not there will be enough regeneration in a population, through sexual reproduction, to ensure the survival of that species (Reijieli and Anand, 2002). Pollen morphology and fertility is closely related to its function because many of the features present in pollen grains have helped the species

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Table 1. Percentage of pollen fertility estimation of 11 species of genus *Ficus.*

Species	Fertile pollen	Sterile pollen	% fertility
F. microcarpa	39	3	92.85
F. palmata	45	1	97.82
F. religiosa	31	4	88.57
F. lacor	58	2	96.66
F. pumila	90	15	85.71
F. racemosa	10	2	83.33
F. bengalensis	6	2	75
F. hispida	20	3	86.95
F. sarmentosa	14	1	93.33
F. auriculata	20	4	83.33
F. virens	30	20	60

of plants to which it belongs to adapt to life. On a particular geography, it has the ability to disperse its pollen and fertilize the female eggs to produce new seeds that would give rise to new plants (Zafar et al., 2006). In the present work, pollen morphology and pollen fertility was done on native, as well as introduced species of genus *Ficus* L. found in Pakistan.

MATERIALS AND METHODS

Fresh materials were collected from male flowers and were separated, while for the study of pollen morphology and pollen fertility, pollens were separated from anthers. Fresh polleniferous material was used according to a special technique known as Wodehouse technique (Ronald, 2000). Pollens were stained by using glycerin jelly prepared according to modified method of Meo and Khan (2005). The percentage was determined by the formula:

Percentage pollen fertility = No. of total pollens / No. of fertile pollens.

RESULTS AND DISCUSSION

In the present study, a report which was confined to the detailed palynological studies of both pollen morphology and fertility estimation of genus *Ficus* was made. All of these species had monad and dicolpate pollens, and they showed very little variation in their exine thickness as shown in Table 2. *Ficus* pollens tend to have thinner and smoother exine, and they tend to become more asymmetric than other diporate Moraceae. Also, they have species which are occasionally monoporate or triporate (Jago and Boyd, 2003). However, it is not possible to establish relationships within the Moraceae on the basis of surface characteristics only (Barth, 1976b).

All of the species have psilate sculpturing under light microscopy as shown in plates of different species (Plates 1, 2 and 3). The surface sculpturing of *Ficus* is psilate (Burn and Mayle, 2008) and the species always seems to be smooth in LM observations (Barth, 1976a; Palacios, 1968).

The highest pollen fertility rate observed in *F. palmata* was 97.82%, while the lowest rate observed in *F. virens* was 60% (Table 1). The results obtained showed that the well established flora among all the species within the genera was that of *F. palmata* with high pollen fertility rate in Pakistan, while low rate of pollen fertility was shown in *F. bengalensis* as it is a very slow growing plant having less chances of growth. According to Jennersten and Nilssen (1993), pollen fertility was obviously reduced in little disjointed populations. Pollen fertility investigation is an important feature of palynology, which shows the fertility status of plants. It indicates the viability of pollen grains, seen in their ability to develop into male gametophyte and continue their generation through fertilization.

It may indicate the adaptability of pollen grains to the environment and it is also suggested that their ploidy level may exist due to higher level of pollen fertility (Awan et al., 2001).

Conclusion

The present study focused on palynological screening of some species of genus *Ficus* L. through light microscopy. Pollen fertility and morphopalynology were studied for the first time in Asia. All the parameters studied played an important role in the identification of plant species within genus and critical taxonomic problems.

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Table 2. Quantitative and qualitative measurements of pollen grains of *Ficus* L. species through light microscopy.

Species	Type of pollen	No. of colpi	Exine sclupturing	Exine thickness (µm)	Equatorial view	Polar view	Colpi	
							Length (µm)	Width (µm)
F. bengalensis L	Monad	Dicolpate	Psilate	0.625	Prolate	Tubular	2.3	0.625
F. microcarpa L.f.	Monad	Dicolpate	Psilate	0.425	Subprolate	Tubular	0.625	0.625
F. palmata Forrsk.	Monad	Dicolpate	Psilate	0.5	Prolate to subprolate	Tubular	2.5	3.33
F. religiosa L.	Monad	Dicolpate	Psilate	0.65	Subprolate	Tubular	0.625	0.625
F. lacor Ham.	Monad	Dicolpate	Psilate	0.55	Subprolate	Tubular	0.625	0.625
F. pumila L.	Monad	Dicolpate	Psilate	0.46	Subprolate	Tubular	2.18	2.91
F. hispida L.f.	Monad	Dicolpate	Psilate	1.25	Subprolate	Tubular	2.5	4.37
F. sarmentosa Buch. Ham.	Monad	Dicolpate	Psilate	0.3	Prolate	Tubular	2.08	3.33
F. auriculata Wall.	Monad	Dicolpate	Psilate	0.5	Prolate to subprolate	Tubular	2.5	1.25
F. virens Dryand.	Monad	Dicolpate	Psilate	0.62	Subprolate	Tubular	3.33	4.58
F. racemosa Roxb.	Monad	Dicolpate	Psilate	0.7	Subprolate	Tubular	3.0	3.33

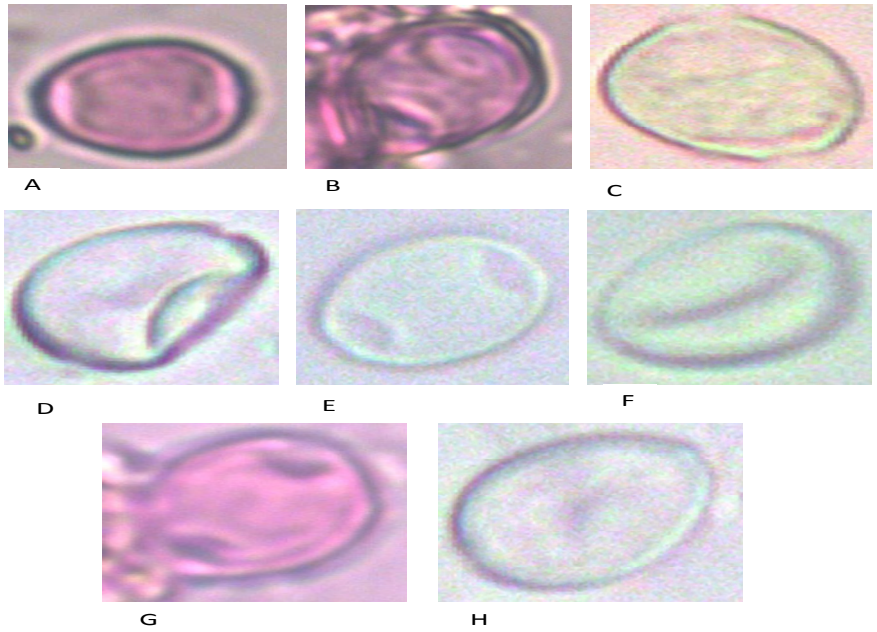

Plate 1. (A) and (B) Polar view of *F. bengalensis*, (C) polar view of *F. microcarpa*, (D) equatorial view of *F. microcarpa*, (E) polar view of *F. palmata*, (F) equatorial view of *F. palmata*, (G) polar view of *F. religiosa*, and (H) equatorial view of *F. religiosa.*

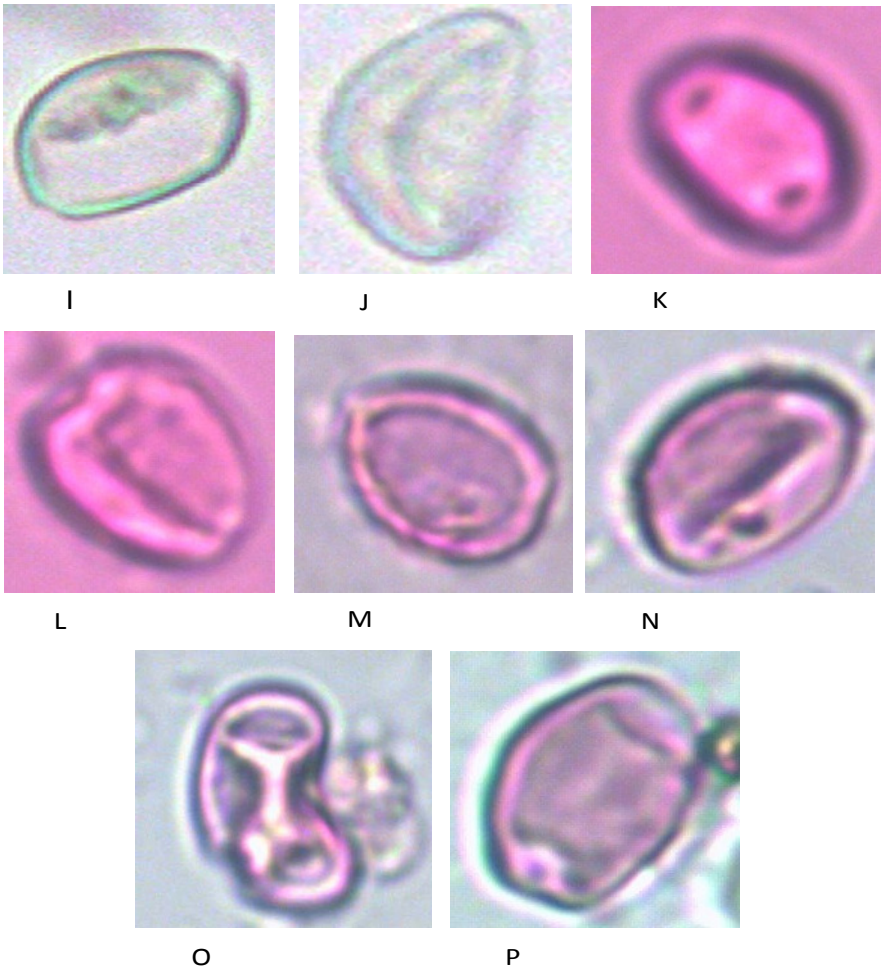

Plate 2. (I) Polar view of *F. lacor*, (J) equatorial view of *F. lacor*, (K) polar view of *F. pumila*, (L) equatorial view of *F. pumila*, (M) polar view of *F. hispida*, (N) equatorial view of *F. hispida*, (O) and (P) polar view of *F. sarmentosa*.

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