



Research Article

Pollen Morphology of Angiosperms of Central Nepal

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Abstract

Morphological structures of pollen-grains of fifteen species of angiosperms collected from Central Nepal were cytologically carried out. Pollen structure of fifteen species viz. *Antirrhium majus* from family Plantaginaceae, *Brunfelsia pauciflora* and *Petunia hybrida* from Solanaceae, *Centurea cyanus* and *Chrysanthemum morifolium* from Asteraceae, *Malvaviscous arboreus* from Malvaceae, *Lantana camera* from Verbenaceae, *Chlorophytum comosum* from Asperagaceae, *Oxalis europia* from Oxilidaceae, *Jasminum officinale* from Oleaceae, *Geranium roseous* from Geranaceae, *Mirabilis jalapa* from Nyctaginaceae, *Phlox paniculata* from Polymoniaceae and *Tradescantia brivifolia* from commelinaceae studied in this investigation. Most of the structure of pollen found to be spheroidal, some irregular, oval, elongated and circular. The present study gives an account of variations of pollen grain structure within the angiosperms family. Triporate to polyprate aperture and echinate to smooth walled exine were observed in present study. Pollen morphology of the angiosperm is significantly helpful at the generic and specific level in plant taxonomy.

Keywords: Angiosperms; Pollen grain; Aceto-carmin; Nepal

Introduction

Pollen grain is a fine to coarse powder containing the microgametophytes of flowering plants, which produce the male gametes. Morphological study of pollen grain is very useful in paleoecology, paleontology, archeology, and forensics. Pollen morphological investigation are also useful in the systematics of the Asteraceae family, as well as that of some of its genera and species according to (Moore *et al.* 1991). Jafari and Ghanbarian (2007) studied pollen morphology of 30 species of Asteraceae and found variation in their morphological characters such as in size, aperture type and pattern of exine sculpturing. In the present

study, pollen characters (pollen shape, size and ornamentation) proved to be useful characters for classification. Pollen morphological characters are useful tool in the taxonomic disputes and classification of plants and employed in several angiosperm families by (Dutta *et al.*, 2015). The main objective of the present study is to investigate and describe the pollen morphology of the angiospermic plants. The spine index character was used to describe pollen of the genus *Malva* L. and was found to be of significant in plant taxonomy by (Shaheen, *et al.*2009). The study of pollen morphology generates information on genetic identity and parentage of genotypes,

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which is important for the exploration of germplasms aimed at maximizing the use of genetic diversity according to (Adedeji and Akinniyi, 2009).

Material and Methods

The studied pollen grains of 15 species of angiosperms were taken from fresh plant specimens collected from their natural habitats. Then all buds of each plant stained in solution of 1% aceto-carmin separately and heated it for few seconds over spirit lamp and left it for one hour for proper staining. A single mature anther was dissected from the buds and teased with a needle in a thin film of 1 % aceto-carmin on a glass slide. After removing the debris, the cover slip was placed over it. Excess stain was drained off with blotting paper and observed under 10x eye piece and 40x objective magnification of compound microscope. Photomicrographs were taken with the help of digital camera of 12.1 megapixel using 10x eye pieces and 40x objective of compound microscope. Later on photographs were enlarged to suitable sizes. This study was conducted in Tribhuvan University, Tri-Chandra Multiple Campus, Kathmandu. The methodology was used according to Mallick (2017).

Results and Discussion

Pollen morphology is a useful tool to study the interrelationship of plant taxa. Pollen morphological structure study is an accurate method of relating and differentiating one plant genus to another. Agababian (1972) studied pollen morphology of the family Magnoliaceae and found most species have pollen with a finely granular exine and a perforated tectum. Klimko *et al.* (2004) studied pollen morphology of nine species of genus *Plantago* from the family Plantaginaceae and medium-sized or small, spherical or prolate spheroidal pollen grain observed. Perveen and Qaiser (2007) studied pollen morphology of 13 species of Verbenaceae and found pollen grains are radially symmetrical, isopolar, tricolporate or tricolpate, mostly prolate-spheroidal to sub-prolate. Pollen pattern plays an important role in demarcating definite evolutionary level (Kulkarni, 2012).

Details of the morphological observations of the studied taxa for the present works are given below.

I. *Antirrhium majus* L.

The genus *Antirrhium majus* belongs to the family Plantaginaceae. The plant commonly called snapdragon, old garden plants. Pollen structure of *Antirrhium majus* is spheroidal, irregular, rough exine wall, *tricolporate*, prolate, tectate.

II. *Brunfelsia pauciflora* L.

The plant *Brunfelsia pauciflora* is flowering plants of the family Solanaceae. These are small tree. Its common names include yesterday-today-and-tomorrow plant. Pollen structure of these taxa is small, round, smooth walled exine.

III. *Centurea cyanus* L.

The plant *Centurea cyanus* is a flowering plant of the family Asteraceae. The plant *Centurea cyanus* is commonly known as cornflower or bachelor's button. Pollen structure of the taxa *Centurea cyanus* is oval, wide, tectate, polyporate, medium sized with rough exineous wall.

IV. *Chrysanthemum morifolium* Ramat.

The taxa *Chrysanthemum morifolium* is also a flowering species from the family Asteraceae. The plant is commonly known as an ornamental flower. Pollen grains of *Chrysanthemum morifolium* are circular, echinate exine wall, triporate aperture, spine short.

V. *Malvaviscous arboreus* L.

The plant *Malvaviscous arboreus* is flowering plants of the family Malvaceae. It is also called as a sleeping Hibiscus. Pollen structure of *Malvaviscous* is spheroidal, polypantaporate, exine wall echinate, spines monomorphic and long, slender, pointed.

VI. *Geranium roseous* L

The plant *Geranium roseous* L is a flowering species in the family Geraniaceae, commonly known as the cranesbills. Pollen grain structure of taxa *Geranium roseous* L is spheroidal, reticulate-clavate, tricolporate apertures with tectate exine wall.

VII. *Lantana camera* L.

The taxa *Lantana camera* belongs to family Verbenaceae. The common name of this plant is shrub verbenas or lantanas. Pollen structure of the plant *Lantana camera* is circular, tricolporate, reticulate, polyporate and smooth walled exine.

VIII. *Chlorophytum comosum* (Thumb.) Jaques

The taxa *Chlorophytum comosum* is a flowering plant of a monocot family Asparagaceae commonly called spider plant and also known as airplane plant. Pollen structure of the taxa *Chlorophytum comosum* is triangular, tricolporate with spinulate exine wall.

IX. *Oxalis europa* L.

The plant *Oxalis europa* belongs to the family Oxalidaceae. The pollen grain structure is 3-colpate and the shape is prolate spheroidal. The exine is microreticulate. The brochi are circular to polygonal.

X. *Jasminum officinale* L.

The taxa *Jasminum officinale*, known as the common jasmine, is a species of flowering plant in the olive family Oleaceae. The pollen grains of *Jasminum officinale* is spheroidal, large-sized and poly zonocolporate with reticulate exine ornamentation.

XI. *Mirabilis jalapa* L.

Pollen grain of plant *Mirabilis jalapa* of the family Nyctaginaceae is large, circular, and spheroidal with spinule exine wall. *Mirabilis jalapa*, commonly known as Four

o'clock plant. This species is generally cultivated for the brilliant color and pleasing odor of its flowers.

XII. *Petunia hybrida* L.

The taxa *Petunia hybrida* belongs to family Solanaceae. This plant is known as garden Petunia. The pollen structures of *Petunia hybrida* are spheroidal, irregular tricolporate, striate, small sized with smooth walled exine.

XIII. *Phlox paniculata* L.

Phlox paniculata is a species of flowering plant in the family Polemoniaceae commonly known as garden flox. The pollen grain of plant *Phlox paniculata* of the family Polemoniaceae is spheroidal, medium sized pantaporate, with smooth walled exine. pantaporate with smooth walled exine.

XIV. *Rosa indica* L.

Rosa indica is a species flowering plant in the family Rosaceae, common name of this plant is Rose. The pollen structure of *Rosa indica* is circular, spheroidal, polyporate, medium sized with rough exineous wall

XV. *Tradescantia brivifolia* L.

The taxa *Tradescantia brivifolia* is a species of flowering plant of the family commelinaceae commonly called as spiderwort. The pollen grain of *Tradescantia brivifolia* is an oval, elongated, polyporate, medium sized with smooth walled exine.

Pollen grains characters of present investigated taxa are given in Table 1.

Table-1: Pollen grain characters of Angiosperms of studied taxa

Name of taxa	Family	Pollen shape	Pollen size	Aperture pattern	Exine ornamentation
<i>Antirrhium majus</i> L.	Plantaginaceae	Spheroidal	Medium	Tricolporate	Tected
<i>Brunfelsia pauciflora</i> L.	Solanaceae	Round	Small	Pantaporate	Smooth
<i>Centurea cyanus</i> L.	Asteraceae	Oval	medium	Triporate	Rough
<i>Chrysanthemum morifolium</i> Ramat.	Asteraceae	Spherical	Medium	Triporate	Echinate
<i>Chlorophytum comosum</i> (Thumb) Jaques	Asparagaceae	Triangular	Medium	Tricolporate	Smooth
<i>Geranium roseous</i> L.	Geraniaceae	Spheroidal	Large	Tricolporate	Tected
<i>Jasminum officinale</i> L.	Oleaceae	Spheroidal	Large	Polyporate	Reticulate
<i>Lantana camera</i> L.	Verbinaceae	Circular	Small	Tricolporate	Smooth
<i>Malvaviscous arboreus</i> L.	Malvaceae	Spheroidal	Large	polyporate	Echinate
<i>Mirabilis jalapa</i> L.	Nyctaginaceae	Circular	Large	Polyporate	Spineous
<i>Petunia hybrida</i> L.	Solanaceae	spheroidal, irregular	small	Triporate	Smooth
<i>Phlox paniculata</i> L.	Polemoniaceae	spheroidal	medium	pantaporate	Smooth
<i>Rosa indica</i> L.	Rosaceae	Circular, spheroidal	medium	polyporate	Rough
<i>Tradescantia brivifolia</i> L.	Commelinaceae	Oval, elongated	medium	polyporate	Smooth
<i>Oxalis europia</i> L.	Oxalidaceae	Prolate spheroidal	medium	tricolporate	Micro-reticulate

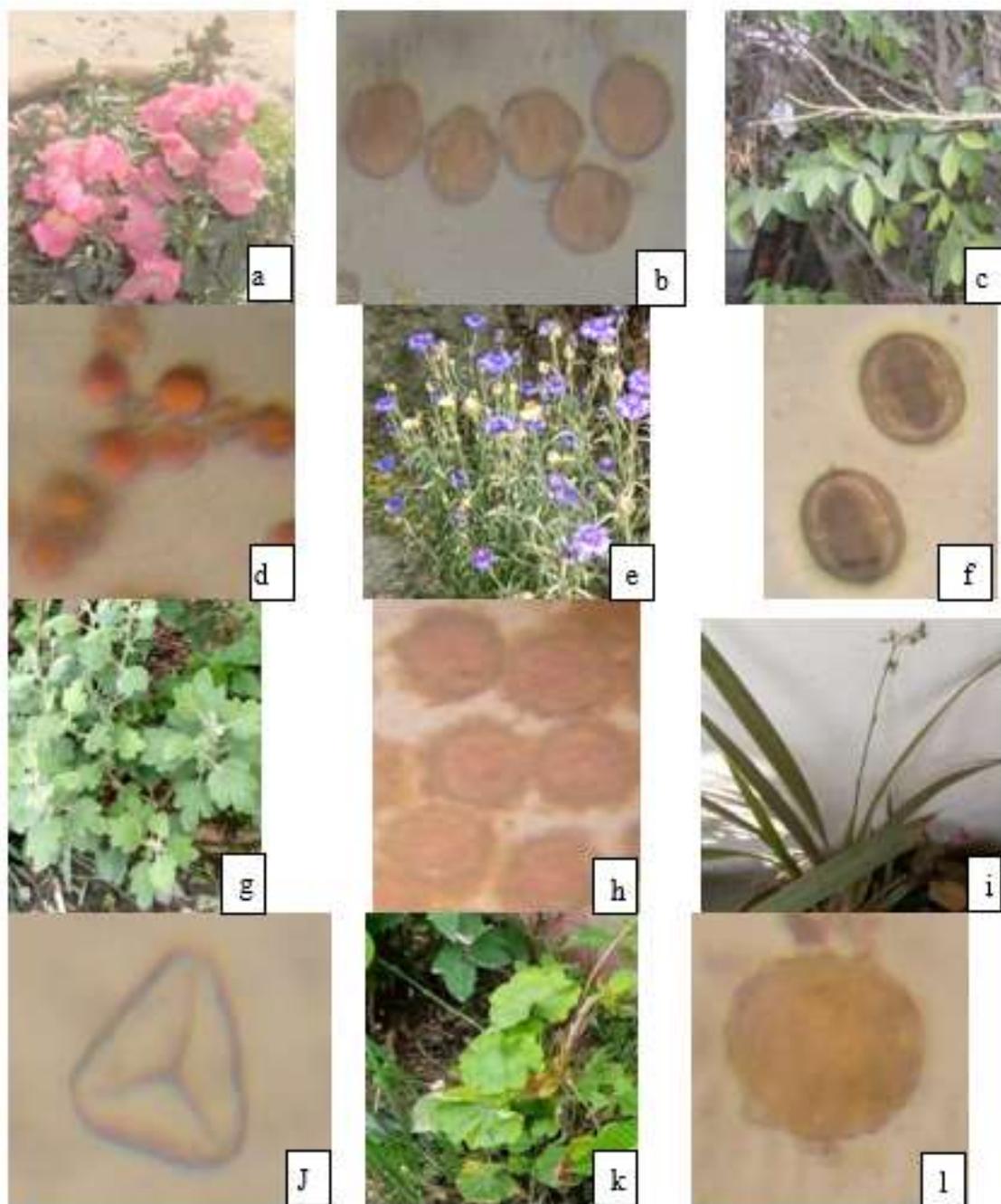


Fig.1: a. Photograph of living plant of *Antirrhium majus* ; b. Spheroidal, tectate pollen grains of *Antirrhium majus*; c. Photograph of living plant of *Brunfelsia pauciflora* ; d. Small, round, smooth walled pollen grains of *Brunfelsia pauciflora*; e. Photograph of living plant of *Centurea cyanus* L.; f. Oval tectate pollen grains of *Centurea cyanus* L.; g. Photograph of living plant of *Chrysanthemum morifolium*; h. Echinate, triporate pollen grains of *Chrysanthemum morifolium* ; i. Photograph of living plant of *Chlorophytum comosum* ; j. Triangular, tricolporate pollen grain of *Chlorophytum comosum*; k. Photograph of living plant of *Geranium roseous* ; l. Spheroidal, reticulate-clavate, pollen grain of *Geranium roseous*

Deniz *et al.* (2013) studied 13 species of geranium pollen and found that almost all species have reticulate clavate exine ornamentation and tricolporate apertures. Numbers of colpi on pollen grains have been a useful tool in tracing evolutionary relationships among the species of a genus Adedeji and Akinniyi (2015). The number of colpi is more in advanced dicotyledons than the primitive dicotyledons plants found according to study. Pramanick *et*

al. (2015) studied 12 species of Nyctaginaceae family and found that pollens are spheroidal to oblate spheroidal and apertures are pantaporate type.

The investigation of pollen morphological characters in present study concluded that pollen grains of angiosperms are vary in shape, size and ornamentation which are taxonomic importance.



Fig.2: a. Photograph of living plant of *Jasminum officinale*; b Spheroidal, poly zonocolporate Pollen grain of *Jasminum officinale*; c. Photograph of living plant of *Lantana camera* ;d. Reticulate, polyporate pollen grains of *Lantana camera* ;e. Photograph of living plant of *Malvaviscous arboreus* ;f. Spheroidal, polypantaporate, pollen grains of *Malvaviscous arboreus*;g. . Photograph of living plant of *Mirabilis jalapa* ; h . Large, circular pollen grain of *Mirabilis jalapa* ;i. Photograph of living plant of *Oxalis europia* ;j. Prolate spheroidal pollen grain of *Oxalis europia* ;k. Photograph of living plant of *Phlox paniculata*; l. Spheroidal, pantaporate Pollen grain of *Phlox paniculata*.

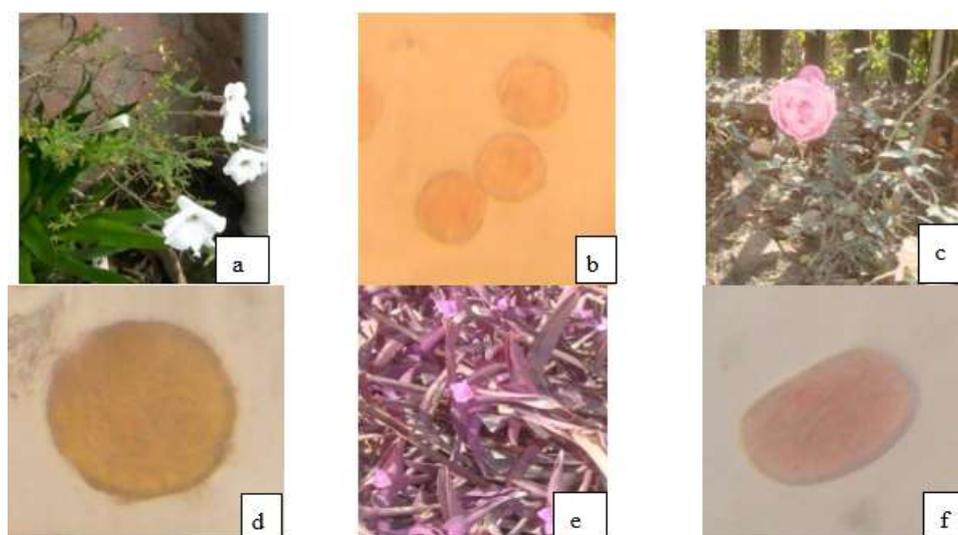


Fig.3: a. Photograph of living plant of *Petunia hybrida* ; b. Small tricolporate pollen grains of *Petunia hybrid*; c. Photograph of Living plant of *Rosa indica* ; d. Spheroidal, polyporate, pollen grain of *Rosa indica*; e. Photograph of living plant of *Tradescantia brivifolia*; f. Oval, elongated pollen grain of *Tradescantia brivifolia*.

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