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Pollen morphology of some plants from Allahabad University area

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ABSTRACT

The morphological study of pollen grains find their use in various disciplines like taxonomic identification of plants, in identifying past and present vegetation, in adulteration, in honey studies, in crime, in allergy, etc. The present study provides structural features of fifteen herbs and shrubs growing as ornamental or as weeds in the garden and surroundings of Allahabad University area. The result revealed that out of 15 pollen species studied six belonged to 3-zonocolporate class, two to pantoporate, two to 3-zonocolpate, two to 1-zonosulculate, one to 3-zonoporate, one to 4-zonocolporate and one to 1-monocolpate class. Ten species accounted for medium size pollen, three for small size pollen, one large size pollen and 1 very large size pollen. The present study and prepared acetolysed pollen slides of studied taxa are useful in future aeropalynological identifications.

1. Introduction

Pollen are the male gametophytes of phanerogams that develops within the anther and consists of two sperm cells. They are ubiquitous in nature and unlike other plant parts they are highly resistant to decay (Basarkar, 2017). Pollen of different taxa have their unique morphological attributes in the form of their dictinct shape, size, symmetry, aperture, exine ornamentation, etc. On account of these unique characters pollen and spores are referred as nature's fingerprint of plant (Bera *et al.,* 2007). The morphological study of pollen is of great significance in taxonomy, phylogeny, palaeobotany, aeropalynology, pollen allergy, food and pharmaceutical industries, melissopaynology and many other applied disciplines (Paul *et al.*, 2014; Egbe *et al.*, 2018).

The aim of the present study is to provide morphological features & mode of pollination of pollen grains of fifteen herbs and shrubs growing as ornamental or as weeds in the garden and surroundings of Allahabad University area.

2. Materials and Methods

In the present study pollen morphological features of 10 herbs, 4 shrubs and 1 climber plant of Allahabad University area belonging to 11 different families were studied during 2017. Pollen samples were obtained from fresh and mature flowers at the time of anthesis from the field. Pollen slides were prepared using the Erdtman's acetolysis method (1952) as well as Wodehouse method (1935) for light microscopic examination. Terminology used in the description of pollen grains is that of Erdtman (1952) incorporating the suggestions made by Reitsma (1970). Measurements mentioned in the text are averages of fifteen specimens. The table proposed by Erdtman (1952) was followed to calculate the shape and the size class of the pollen grains. Photomicrographs have been taken with Leica DMLB microscope and DC 300 camera with quin imaging system.

3. Results and Discussion

Total 15 types of pollen grains from different plants were collected. Among these 12 were of dicot and 3 of monocot. Three pollen types were from family Euphorbiaceae, two from Asteraceae and one pollen from each family of Caryophyllaceae, Brassicaceae, Linaceae, Malvaceae, Rosaceae, Rubiaceae, Solanaceae, Araceae, Liliaceae and Nymphaeaceae.

The morphological features of studied pollen types are as follows:

Dicotyledons

- *Centaurea* sp. (Pl. 1, Fig.1)
  Family- Asteraceae
  Pollen grains prolate, size medium (44.71 x 29.19 µm), amb triangular, 3-zonocolporate, planaperturate, os lalongate (12.36 x 8.94 µm), exine granulose.

- *Vernonia cinerea* (L.) Lees. (Pl. 1, Fig.2)
  Family- Asteraceae
  Pollen grains oblate spheroidal, size medium (30.75 x 33.18 µm), amb triangular with convex sides, 3-zonoporate, angulaperturate, pore 8.7 µm, exine echinolophate.

- *Stellaria media* (L.) Vill. (Pl. 1, Fig. 3)
  Family- Caryophyllaceae
  Pollen grains spheroidal, size medium (39.73 µm), pantoporate, exine punctitegillate, spinulose.

- *Euphorbia hirta* L. (Pl. 1, Fig. 4)
  Family- Euphorbiaceae
  Pollen grains prolate spheroidal, size small (23.79 x 21.14 µm), amb ± circular, 3-zonocolporate, circulaperturate, os lalongate, exine granulose.

- *Euphorbia splendens* (Pl. 1, Fig. 5)
  Family- Euphorbiaceae
  Pollen grains oblate spheroidal, size medium (33.57 x 35.70 µm), amb ± circular, 3-zonocolporate, circulaperturate, os lalongate, exine tegillate.

- *Euphorbia pulcherrima* Willd. Ex Klotsch (Pl. 1, Fig. 6)
  Family- Euphorbiaceae

Pollen grains oblate spheroidal, size medium (40.12 x 43.34 µm), amb ± triangular, 3-zonocolporate, planaperturate, os lalongate, exine retipilate.

- *Raphanus sativus* L. (Pl. 1, Fig. 7)
  Family- Brassicaceae
  Pollen grains spheroidal to prolate spheroidal, size small (21.84 x 20.85 µm to 19.84 x 21.66 µm), amb ± triangular, 3-zonocolpate, angulaperturate, exine retipilate.

- *Linum usitatissimum* L. (Pl. 1, Fig. 8)
  Family- Linaceae
  Pollen grains oblate spheroidal, size large (47.50 x 53 µm), amb triangular with convex sides, 3-zonocolpate, angulaperturate, exine pilate, pila dimorphic, thicker pila less in numbers and with minute projections.

- *Althaea rosea* L. (Pl. 1, Fig. 9)
  Family- Malvaceae
  Pollen grains spheroidal, size very large (117.50 µm), pantoporate, pore circular, exine tegillate, provided with dimorphic spines, long spines pointed (11.28 µm) and short spines blunt (3 µm).

- *Rosa* sp. (Pl. 1, Fig. 10)
  Family- Rosaceae
  Pollen grains oblate spheroidal, occasionally prolate spheroidal, size medium (30.63 x 34.38 to 34 x 31 µm), amb triangular with round angles, 3-zonocolporate, occasionally 4-zonocolporate, angulaperturate, os lalongate, exine psilate.

- *Murraya koenigii* (L.) Spreng. (Pl. 1, Fig. 11)
  Family- Rubiaceae
  Pollen grains oblate spheroidal, size medium (40.75 x 43.75 µm), amb circular, 3-zonocolporate, circulaperturate, os lalongate, exine tectate, pattern obscure.

- *Solanum nigrum* L. (Pl. 1, Fig. 12)
  Family- Solanaceae
  Pollen grains oblate spheroidal, size medium (26.50 x 27.53 µm), amb triangular with convex sides, 3-zonocolporate, occasionally 4-zonocolporate, angulaperturate, os lalongate, exine granulose.

Monocotyledons

- *Monstera deliciosa* (Pl. 1, Fig. 13)
  Family- Araceae
  Pollen grains ± elliptical, size medium (24.65 x 27.82 µm), 1 - zonosulculate, sulculus covers major part of the equator, exine pattern obscure.

- *Asparagus racemosus* Willd. (Pl. 1, Fig. 14)
  Family- Liliaceae
  Pollen grains monocolpate, size small (16.41 x 21.92 µm), exine pattern obscure.

- *Nymphaea* sp. (Pl. 1, Fig. 15)
  Family- Nymphaeaceae
  Pollen grains suboblate, size medium (longest diameter 30.94-45.63 µm), 1-zonosulculate, exine provided with warts and spinules.

Documenting the diversity of pollen morphology remains a highly important task not just because it adds the phylogenetic studies but because it also contributes to more precision in the identification of dispersed pollen and spores (Blackmore, 2007). Out of 15 studied pollen types maximum types i.e. *Centaurea* sp., *Euphorbia hirta*, *Euphorbia pulcherrima, Euphorbia splendens*, *Rosa* sp. and *Murraya koenigii* showed 3-zonocolporate pollen. Of the remaining types *Stellaria media* and *Althaea rosea* showed pantoporate pollen; *Raphanus sativus* and *Linum usitatissimum* had 3-zonocolpate condition; *Monstera deliciosa* and *Nymphaea* sp. had 1-zonosulculate condition; *Vernonia cinerea* had 3-zonoporate pollen; *Solanum nigrum* had 4-zonocolporate condition and *Asparagus racemosus* had monocolpate pollen. Taxa having tricolporate pollen reveals their advanced status while taxa with colpate type pollen showed its primitive status (Pal, 1992; Pal *et al.* 1993a; Pal *et al.* 1993b). All the 15 studied pollen types were entomophilous. Whilst entomophilous plants produce significantly less pollen per individual it is evident that pollen grains and spores are produced and released into the environment in vast quantities (Blackmore, 2007).

Similar pollen morphological studies for taxonomic identification of plant were conducted by various workers (Jumah, 1991-96; Bera *et al.*, 2007; Bhattacharya *et al.*, 2013; Ghosh and Mandal, 2016; Ekeke *et al.*, 2016; Egbe *et al.*, 2018).

4. Conclusion

The similarities and variations observed in the morphological characters of pollen grains are helpful in separation of taxa. The present study and prepared acetolysed pollen slides of studied taxa are useful in future aeropalynological identifications.

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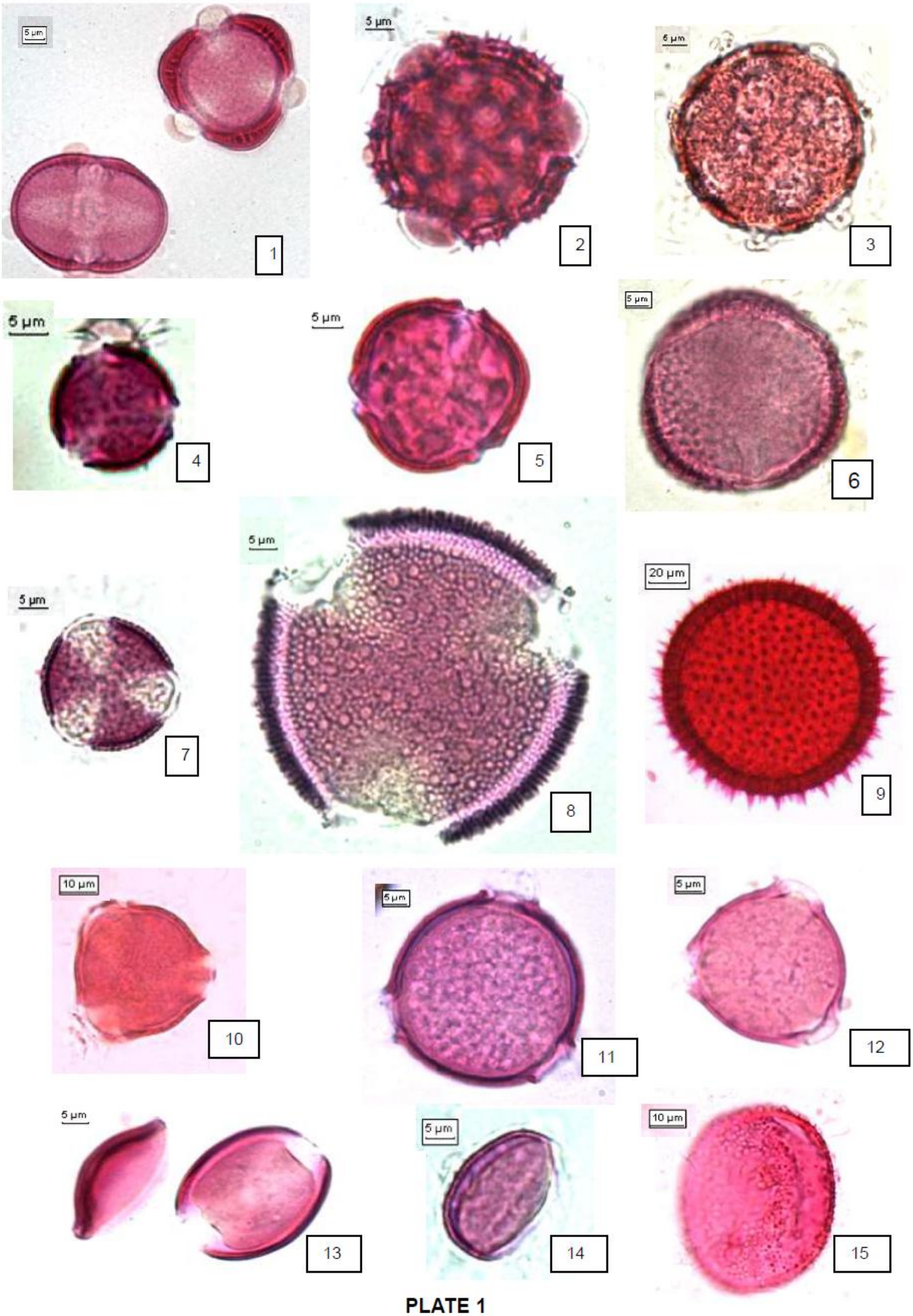

PLATE 1

PLATE 1: 1.*Centaurea* sp. 2.*Vernonia cinerea* 3.*Stellaria media* 4.*Euphorbia hirta* 5.*Euphorbia splendens* 6.*Euphorbia pulcherrima* 7.*Raphanus sativus* 8.*Linum usitatissimum* 9.*Althaea rosea* 10. *Rosa* sp. 11.*Murraya koenigii* 12.*Solanum nigrum* 13.*Monstera deliciosa* 14.*Asparagus racemosus* 15.*Nymphaea* sp.

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