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Pollen morphotypes of some common tree flora of Allahabad

Dr. Swati Chaurasia

Assistant Professor, Department of Botany, Mahamaya Govt. Degree College, Kaushambi, Uttar Pradesh, India

Abstract
Pollen Grains are one of the biological components present in air. These are produced by the male reproductive part of the plants. Inspite of being small in size they play an important role in various studies forming separate disciplines, such as, areopalynology, archaeopalynology, forensic palynology, palaeopalynology, copropalynology, melissopalynology, etc. Therefore the identification of these tiny components becomes a necessity. In present investigation pollen morphology of 52 tree species of Allahabad was studied.

Keywords: pollen grains, pollen morphology, shape, size, exine ornamentation, apertural pattern

1. Introduction
Pollen grains are tiny particles produced by male reproductive part of the flowering plants for the purpose of fertilization. These particles, though very small act as an important marker in various studies. When they become suspended in air they give an idea about the local flora [1,2]. When become deposited in strata/sediments of any time period they indicate past flora and climate [3,4]. When studied in honey they demonstrate its geographical and botanical origin together with developing analytical standards for pollen, contributing to quality control of a product offered for export or for the home market.[5,6] When pollen stick to the body parts, clothes, shoes or any other article of a suspect, they become evidence in forensic analysis [7,8]. They sometimes become cause of allergy to human beings when inhaled. [9] In herbal mixtures pollen reveal adulteration.[10] The study of pollen and spore content of fossil excreta throw light on the life-style, environmental circumstances, dietary preferences and the place inhabited by animals and humans of past [11, 12]. The morphological features of pollen grains such as shape, size, exine ornamentation, apertural pattern, thickness of exine and intine etc. are helpful in taxonomic identification of plants [13, 14]. Keeping in view the above applications, recognition and identification of pollen grains found in various circumstances becomes necessary.
The present work provides the pollen characteristics of 52 common tree species growing in Allahabad along with their mode of pollination. This work will help in aeropalynological studies and identification of allergenically significant pollen grains in air of Allahabad.

2. Materials and Methods
In the present study morphological features of 52 common tree species of Allahabad belonging to 31 different families are studied. Fresh and mature flowers are collected at the time of anthesis from the field. Pollen slides for light microscopic examination were prepared using the Erdtman's acetolysis method (1952) [15] as well as Wodehouse method (1935) [16]. The families and their respective genera are arranged in alphabetical order.
Terminology used in the description of pollen grains is that of Erdtman (1952) incorporating the suggestions made by Reitsma (1970) [17]. Measurements mentioned in the text are averages of fifteen specimens. The shape and the size class of the pollen grains have been determined according to the tables proposed by Erdtman (1952). [15] Photomicrographs have been taken with Leica DMLB microscope and DC 300 camera with quin imaging system.

3. Results and Discussion
The present study revealed variations in pollen morphology of 52 tree flora belonging to 31 plant families of Allahabad.

Angiosperms Dicotyledons
Anacardiaceae
- *Mangifera indica* L. (Pl. 1, Fig. 1)
  Pollen grains oblate spheroidal, occasionally suboblate, size small (21.82 x 24.99 µm), amb triangular with convex sides, 3-zonocolporate, os lalongate, exine striate.

Annonaceae
- *Polyalthia longifolia* (Sonner.) Thwaites (Pl. 1, Fig. 2)
  Pollen grains spheroidal, size medium (30 µm), inaperturate, exine spinulose.

Bignoniaceae
- *Spathodea campanulata* Beauv. (Pl. 1, Fig. 3)
  Pollen grains subprolate, size medium (45.19 x 34.14 µm), amb circular, 3-zonocolpate, circulaperturate, exine retipilate.

Bombacaceae
- *Bombax ceiba* L. (Bombacaceae)(Pl. 1, Fig. 4)
  Pollen grains oblate, size medium (32.50 x 50 µm), amb triangular with rounded angles, 3-zonocolpate, colpi large (18 x 4.75 µm), planaperturate, exine reticulate, reticulations particularly fine at the angles of the grain.

Capparidaceae
- *Crateva nurvala* F. Ham (Pl. 1, Fig. 5)
  Pollen grains suboblate, size small (18.67 x 21.24 µm), amb circular, 3-zonocolporate, circulaperturate, os circular, exine reticulate.

Casuarinaceae

- *Casuarina equisetifolia* J. R. & G. Forster (Pl. 1, Fig. 6)
  Pollen grains oblate spheroidal, size medium (25.25 x 27.82 µm), amb triangular with slightly convex sides, 3-zonoporate, occasionally 4-zonoporate, exine psilate.

Combretaceae

- *Terminalia arjuna* (Roxb. ex DC.)(Pl. 1, Fig. 7)
  Pollen grains spheroidal, size small (14 x15 µm), amb triangular, 3-zonocolporate, angulaperturate, colpi alternating with 3 pseudocolpi, os lalongate, exine psilate.

Ebenaceae

- *Diospyros malabarica* (Desr.) Kostel (Pl. 1, Fig. 8)
  Pollen grains prolate spheroidal, size medium (46.15 x 45 µm), amb ± circular, 3-zonocolporate, circulaperturate, os lalongate, exine reticulate.

Euphorbiaceae

- *Emblica officinalis* Gaertn. (Pl. 1, Fig. 9)
  Pollen grains spheroidal, size small (20.33 µm), 4-5 zonocolporate, circulaperturate, os circular, exine finely reticulate.
- *Putranjiva roxburghii* Wall. (Pl. 1, Fig. 10)
  Pollen grains oblate spheroidal, size medium (27.85 x 30.33 µm), amb circular, 3-zonocolporate, circulaperturate, os lalongate, exine thick, finely reticulate.

Fabaceae

a) Caesalpiniaceae

- *Bauhinia variegata* L. (Pl. 1, Fig. 11)
  Pollen grains oblate spheroidal, size large (56.29 x 62.17 µm), amb triangular with convex sides, 3-zonocolporate, angulaperturate, os lalongate, exine striate.
- *Cassia fistula* L. (Pl. 1, Fig. 12)
  Pollen grains oblate spheroidal, size medium (25.10 x 28.63 µm), amb ± circular, 3-zonocolporate, circulaperturate, os lalongate, exine punctitegillate.
- *Delonix regia* (Bojer ex Hooker) Raf. (Pl. 1, Fig. 13)
  Pollen grains oblate spheroidal, size large (51.01 x 55.77 µm), amb circular to subtriangular, 3-zonocolpate, circulaperturate, exine retipilate.
- *Parkinsonia aculeata* L. (Pl. 1, Fig. 14)
  Pollen grains prolate spheroidal, size medium (33 x 31 µm), amb triangular with convex sides, 3-zonocolporate, angulaperturate, exine reticulate.
- *Peltophorum roxburghii* (Pl. 1, Fig. 15)
  Pollen grains oblate spheroidal, size large (50.39 x 53.46 µm), amb ± triangular with rounded angles, 3-zonocolporate, planaperturate, os circular, exine reticulate, reticulations smaller near colpi.
- *Saraca asoka* (Roxb.)de Wilde (Pl. 1, Fig. 16)
  Pollen grains prolate spheroidal, size medium (40 x 38 µm), amb ± circular, 3-zonocolporate, circulaperturate, os lolongate, exine foveolate.
- *Tamarindus indica* L. (Pl. 1, Fig. 17)
  Pollen grains oblate spheroidal, size medium (28 x 29 µm), amb circular, 3-zonocolporate, circulaperturate, os lolongate, exine rugulate.

b) Mimosaceae

- *Acacia nilotica* (L.) Delile (Pl. 1, Fig. 18)
  Pollen grains in polyads of 16 cells (35 x 38 µm), with a block of eight central cells in two tiers of four each and eight peripheral cells surrounding the central block along the contact margins of two tiers. Individual cells square (12 x 12 µm), exine finely reticulate.
- *Leucaena glauca* (Willd.) Benth. (Pl. 7, Fig. 19)
  Pollen grains prolate spheroidal, size medium (44.04 x 39.99 µm), amb ± circular, 3-zonocolporate, circulaperturate, crassimarginate, os lalongate, exine granulose.
- *Prosopis juliflora* (Swartz.) DC. (Pl. 1, Fig. 20)
  Pollen grains suboblate, size medium (25.80 x 29.90 µm), amb ± circular with rounded angles, 3-zonocolporate, circulaperturate, os lalongate, exine finely reticulate.
- *Samanea saman* (Jacq.) Merr. (Pl. 1, Fig. 21)
  Pollen grains in polyads of 22 to 24 cells (105 x 86 µm). Individual cells rectangular to triangular with round angles, exine psilate.

Papilionaceae

- *Dalbergia sissoo* Roxb. (Pl. 1, Fig. 22)
  Pollen grains prolate spheroidal, size small (24.54 x 23.30 µm), amb triangular with convex sides, 3-zonocolporate, angulaperturate, os lalongate, exine psilate.
- *Pongamia pinnata* (L.) Pierre (Pl. 1, Fig. 23)
  Pollen grains oblate spheroidal, size small (21.06 x 23.24 µm), amb triangular, 3-zonocolporate, angulaperturate, os circular, exine faintly reticulate.

Lecythidaceae

- *Barringtonia acutangula* (L.) Gaertn. (Pl. 1, Fig. 24)
  Pollen grains subprolate, size medium (38.58 x 32.15 µm), amb ± circular, 3-zonocolporoidate, circulaperturate, syncolpate, colpi margins thick, exine thicker at poles and slightly raised.

Loganiaceae

- *Strychnos nux-vomica* L. (Pl. 2, Fig. 25)
  Pollen grains subprolate, size small (15.18 x 13.26 µm), amb ± hexagonal with round angles, 3-zonocolporate, angulaperturate, colpi alternating with 3 pseudocolpi, os ± circular, exine finely reticulate.

Lythraceae

- *Lagerstroemia indica* L. (Pl. 2, Fig. 26)
  Pollen grains prolate spheroidal, size medium (32.99 x 29.33 µm), amb ± triangular or quadrangular, 3-zonocolporate, occasionally 4-zonocolporate, angulaperturate, os circular, exine punctitegillate.

Malvaceae

- *Thespesia* sp. (Pl. 2, Fig. 27)
  Pollen grains spheroidal, size large (61.88 µm), pantoporate, exine spinose, spines (6.68 µm) with broad base.

Meliaceae

- *Azadirachta indica* Juss. (Pl. 2, Fig. 28)
  Pollen grains spheroidal, size medium (38.75 x 35.33 µm), amb circular, 4-5 zonocolporate, circulaperturate, os lalongate, exine finely reticulate.
- *Toona ciliata* Roemer (Pl. 2, Fig. 29)
  Pollen grains oblate spheroidal, size small (23.83 x 25.38 µm), amb circular, 4-5 zonocolporate, circulaperturate, os lalongate, exine reticulate.

Moraceae

- *Artocarpus heterophyllus* Lam. (Pl. 2, Fig. 30)
  Pollen grains oblate spheroidal, size small (13 x 13.65 µm), amb ± circular, 3-zonoporate, occasionally 4-zonoporate, circulaperturate, exine psilate.
- *Morus alba* L. (Pl. 2, Fig. 31)
  Pollen grains bilateral, size small (10 x 13 µm), amb ellipsoidal, 2-zonoporate, circulaperturate, pore circular, exine psilate.

Moringaceae

- *Moringa* sp. (Pl. 2, Fig. 32)
  Pollen grains prolate spheroidal, size medium (36 x 30 µm), amb ± circular, 3-zonocolporate, circulaperturate, os lalongate, exine psilate.

Myrtaceae

- *Callistemon citrinus* (Curtis) Skeels (Pl. 2, Fig. 33)
  Pollen grains oblate, size small (13.73 x 18.82 µm), amb triangular, 3-parasyncolporate, os lalongate, exine granulose.
- *Eucalyptus citriodora* Hooker (Pl. 2, Fig. 34)
  Pollen grains suboblate, size small (14.60 x 17.50 µm), amb triangular, 3- zonocolporate, angulaperturate, exine granulose.
- *Psidium guajava* L. (Pl. 2, Fig. 35)
  Pollen grains suboblate, size small (13.44 x 16.95 µm), amb triangular, sometimes quadrangular, 3-zonocolporate, occasionally 4-zonocolporate, angulaperturate, exine granulose.
- *Syzygium cumini* (L.) Skeels (Pl. 2, Fig. 36)
  Pollen grains suboblate, size small (10.61 x 13.16 µm), amb triangular, occasionally quadrangular, 3-syncolporate, occasionally 4-syncolporate, angulaperturate, os lalongate, exine psilate.

Oleaceae

- *Nyctanthes arbor-tristis* L. (Pl. 2, Fig. 37)
  Pollen grains spheroidal, size large (49 x 52 µm), amb circular, 3-zonocolporate, circulaperturate, colpi 24.62 µm long and 7.8 µm broad, exine retipilate, lumina studded with granules.

Punicaceae

- *Punica granatum* L. (Pl. 2, Fig. 38)
  Pollen grains prolate spheroidal, size small (21 x 19.98 µm), amb circular, 3-zonocolporate, os circular (7.2 µm), exine psilate.

Rhamnaceae

- *Zizyphus jujuba* (L.) Lam.(Pl. 2, Fig. 39)
  Pollen grains oblate spheroidal, size small (18.46 x 20.83 µm), amb triangular, 3-zonocolporate, angulaperturate, os circular, exine psilate.

Rubiaceae

- *Anthocephalus cadamba* (Roxb.) Miq. (Pl. 2, Fig. 40)
  Pollen grains suboblate, size small (12 x 14 µm), amb triangular, 3-zonocolporate, angulaperturate, os lolongate, exine finely reticulate.

Rutaceae

- *Aegle marmelos* (L.) Corr. (Pl. 2, Fig. 41)
  Pollen grains prolate spheroidal to oblate spheroidal, size medium (26.45 x 25.88 µm to 25.53 x 27.75 µm), amb ± circular, 4 zonocolporate, occasionally 5-zonocolporate, circulaperturate, os lalongate, exine reticulate.
- *Citrus* sp. (Pl. 2, Fig. 42)
  Pollen grains oblate spheroidal, size small (24.70 x 22.85 µm), 4-zonocolporate, occasionally 5-zonocolporate, circulaperturate, os lalongate (5.35 x 3.4 µm), exine reticulate.
- *Feronia limonia* (L.) Swingle (Pl. 2, Fig. 43)
  Pollen grains oblate spheroidal, size small (24.70 x 22.85 µm), 4-zonocolporate, occasionally 5-zonocolporate, circulaperturate, os lalongate (5.35 x 3.4 µm), exine reticulate.

Santalaceae

- *Santalum album* L. (Pl. 2, Fig. 44)
  Pollen grains subprolate, size small (24.25 x 18.88 µm), amb ± triangular with convex sides, 3-zonoporate, angulaperturate, exine faintly reticulate, incrassate at the margins of the pore.

Sapotaceae

- *Madhuca longifolia* (Koenig) Macbride (Pl. 2, Fig. 45)
  Pollen grains prolate spheroidal, size medium (43 x 40 µm), amb almost circular, 4-5 zonocolporate, circulaperturate, os lalongate, exine finely reticulate.

Simaroubaceae

- *Ailanthus Excelsa* L. (Pl. 2, Fig. 46)
  Pollen Grains Oblate Spheroidal, Size Medium (25 X 29 µm), Amb Sub-Triangular, 3-Zonocolporate, Angulaperturate, Os Lalongate, Exine Finely Reticulate.

Sterculiaceae

- *Pterospermum Acerifolium* (L.) Willd. (Pl. 2, Fig. 47)
  Pollen Grains Oblate Spheroidal, Size Large (72.41 X 76.73 µm), Amb Circular, 3-Zonoporate, Exine Spinulose, Thick Around Pores, Inter-Spinal Area Granulose.

Ulmaceae

- *Holoptelea integrifolia* (Roxb.) Planch. (Pl. 2, Fig. 48)
  Pollen grains suboblate, size small (19.40 x 22.25 µm), amb circular, 4-5 zonoporate, circulaperturate, exine coarsely granular.

Angiosperms Monocotyledons

Arecaceae

- *Caryota urens* L. (Pl. 2, Fig. 49)
  Pollen grains elliptical, size small (12.12 x 18.59 µm), monocolpate, exine tegillate.

- *Roystonea regia* (H. B. K.) O. F. Cook (Pl. 2, Fig. 50) Pollen grains elliptical, size medium (longest diameter 41.34 µm), monocolpate, exine pattern obscure.

Gymnosperms

Cycadaceae

- *Cycas* sp. (Pl. 2, Fig. 51)
  Pollen grains ovate, size small (longest diameter 24.66 µm), monocolpate, exine psilate.

Pinaceae

- *Pinus roxburghii* Sarg. (Pl. 2, Fig. 52)
  Pollen grains saccate, size large (50 x 55 µm), sacci two, furrow one on ventral surface, reticulations on sacci appear as prominent ridges on inner surface.

Out of 52 pollen morphotypes studied from the flora of Allahabad maximum number of pollen types is 3-zonocolporate (23 types). Other types in descending order are 4-5 zonocolporate (4 type), 3-zonocolpate (4 types), 3-zonoporate (3 types), monocolpate (3 types), 4-zonocolporate (3 types), polyads (2 types), 3-zonocolporate with three pseudocolpi (2 types), and one each of pantoporate, 3-parasyncolporate, 3-syncolporate, 3-zonocolporoidate, 2-zonoporate, 4-5 zonoporate, inaperturate and saccate. Tricolporate pollen grains have been shown to have advanced and polyad and colpate type primitive status [18, 19, 20]. Among studied types, 34 trees have entomophilous mode of pollination while 14 are amphiphilous and 4 are anemophilous. The liberation percentage of pollen grains with anemophilous mode of pollination was reported to be more as compared to amphiphilous and entomophilous plants [21].

Majority of studied pollen morphotypes belong to small to medium size class (44 types) and few belong to large/very large class (08 types) (Table 1). The chances of aerial incidence and long distance dispersal of small and medium size class pollen types is more as compared to large types. However other morphological features also contribute to overcome significant distances with the wind air flow [22]. This is why in some aeropalynological investigations few pollen grains also belong to non-local flora [2]. Pollen morphological studies of surrounding vegetation provide useful information to aeropalynologist in identification of airborne pollen belonging to local and non local flora.

Similar work on pollen morphology for identification purpose has been conducted at various places in India [23, 24, 25, 26] and outside [27, 28, 29, 30, 31].

Aerial incidence in correlation with allergenicity of various pollen types like *Acacia*, *Eucalyptus*, *Holoptelea*, *Morus*, *Ricinus*, *Madhuca*, *Parthenium*, *Prosopis*, etc. has been reported in different studies [32, 33, 34, 35, 36, 37, 38, 39].

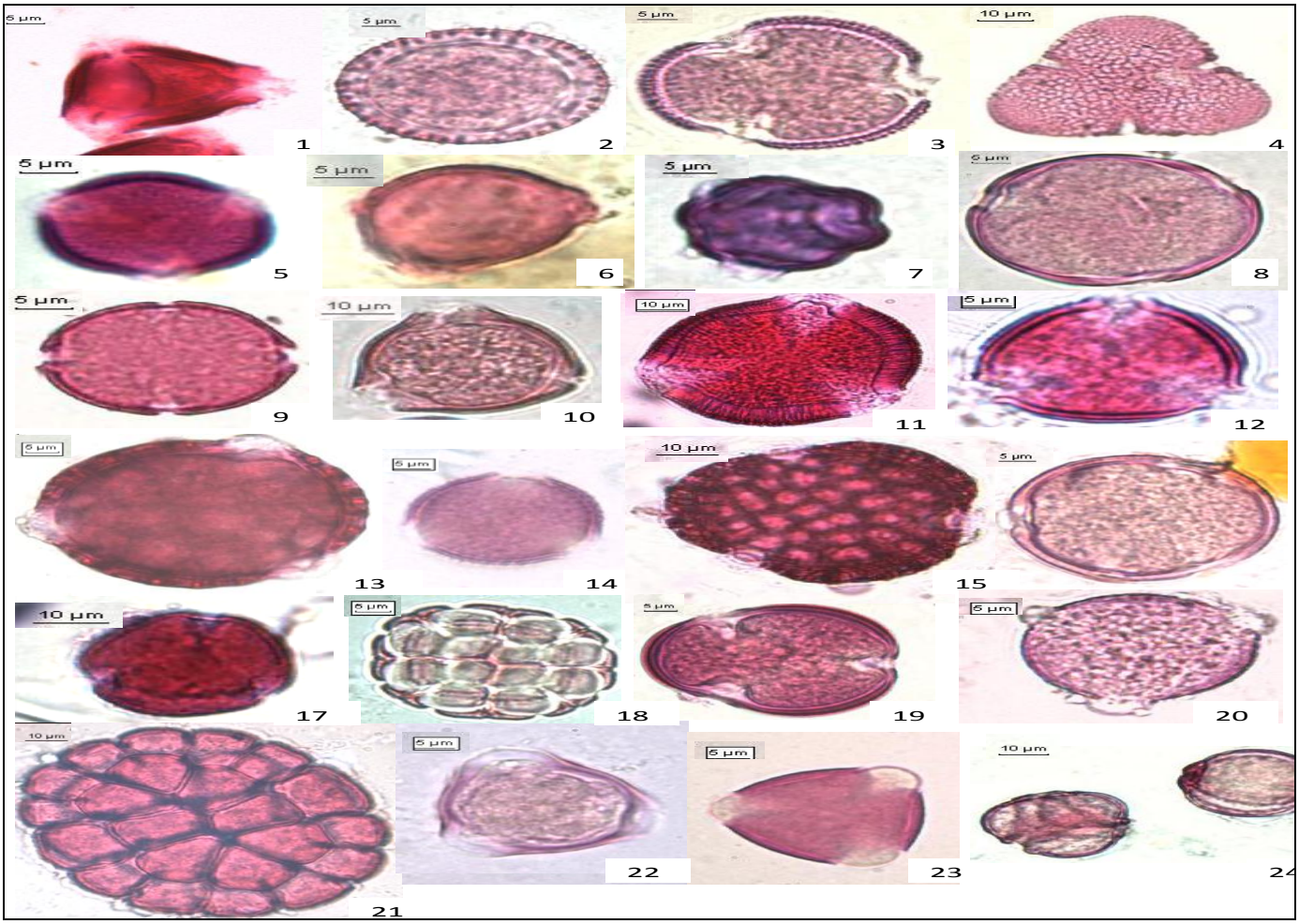

Plate 1: 1.Mangifera indica, 2.Polyalthia longifolia, 3. Spathodea campanulata, 4. Bombax ceiba, 5. Crateva nurvala, 6. Casuarina equisetifolia, 7. Terminalia arjuna, 8. Diospyros malabarica, 9. Emblica officinalis, 10. Putranjiva roxburghii, 11. Bauhinia variegata, 12. Cassia fistula, 13. Delonix regia, 14. Parkinsonia aculeate, 15. Peltophorum roxburghii, 16. Saraca asoka, 17. Tamarindus indica, 18. Acacia nilotica, 19. Leucaena glauca, 20. Prosopis juliflora, 21. Samanea saman, 22. Dalbergia sissoo, 23. Pongamia pinnata, 24. Barringtonia acutangula.

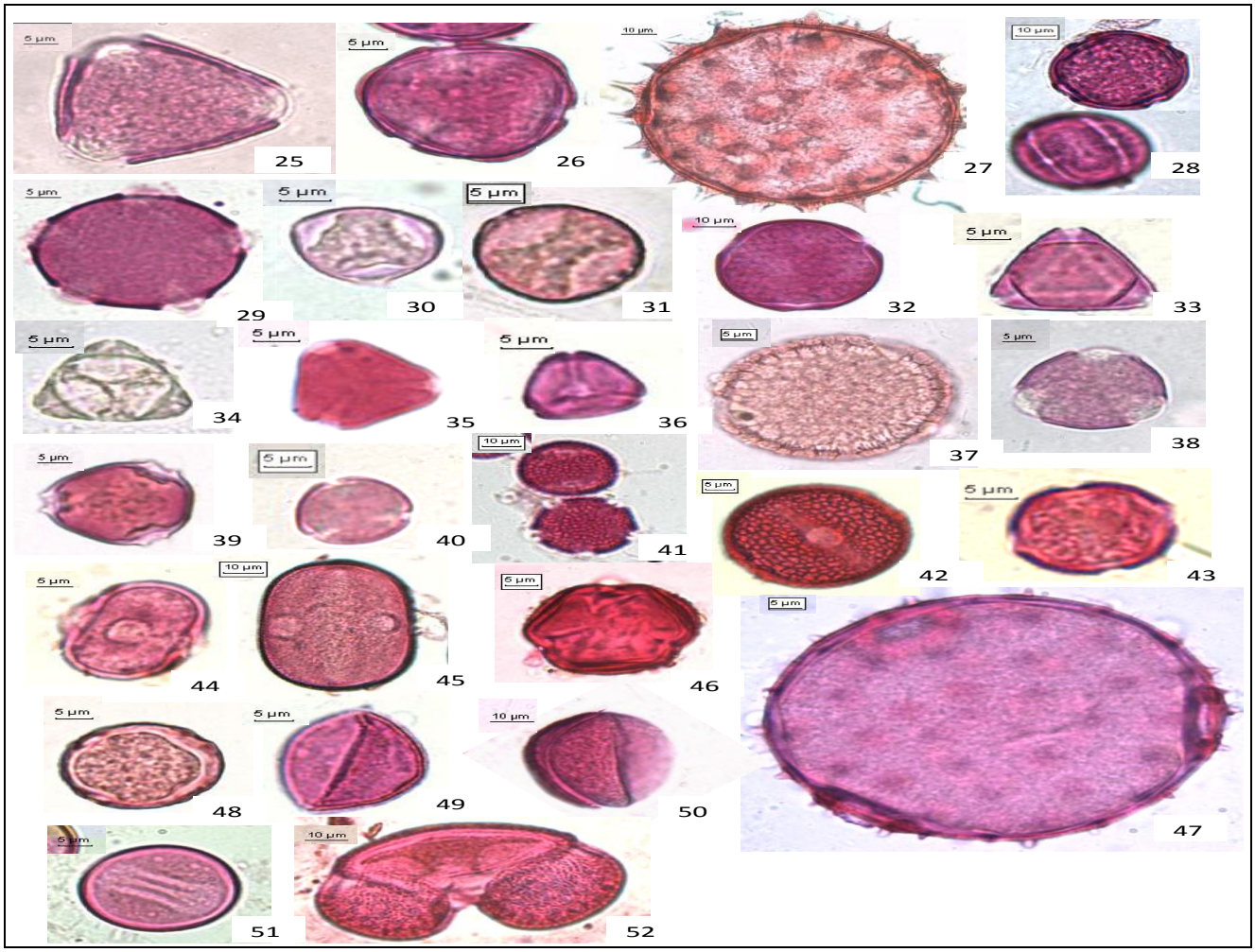

Plate 2: *25. Strychnos nux-vomica, 26. Lagerstroemia indica, 27. Thespesia sp. 28. Azadirachta indica, 29. Toona ciliata, 30. Artocarpus heterophyllus, 31. Morus alba, 32. Moringa sp., 33. Callistemon citrinus, 34. Eucalyptus citriodora, 35. Psidium guajava, 36. Syzygium cumini, 37. Nyctanthes arbor-tristis, 38. Punica granatum, 39. Zizyphus jujuba, 40. Anthocephalus cadamba, 41. Aegle marmelos, 42. Citrus* sp., 43. *Feronia limonia, 44. Santalum album, 45. Madhuca longifolia, 46. Ailanthus excelsa, 47. Pterospermum acerifolium, 48. Holoptelea integrifolia, 49. Caryota urens, 50. Roystonea regia, 51. Cycas* sp., 52. *Pinus roxburghii.*

Table 1: Morphological features, mode of pollination and percentage contribution of airborne pollen grains in the atmosphere of Allahabad

Pollen Types	Mode of Pollination	Size		Aperture Types
		(µm)	Class	
Acacia nilotica	AM	35 x 38	Medium	Polyad
Aegle marmelos	AM	26.45 x 25.88	Medium	4-zonocolporate
Ailanthus excelsa	AM	25 x 29	Medium	3-zonocolporate
Anthocephalus cadamba	EN	12 x 14	Small	3-zonocolporate
Artocarpus heterophyllus	EN	13 x 13.65	Small	3-zonoporate
Azadirachta indica	AM	38.75 x 35.33	Medium	4-5-zonocolporate
Barringtonia acutangula	EN	38.58 x 32.15	Medium	3-zonocolporoidate
Bauhinia variegata	EN	56.29 x 62.17	Large	3-zonocolporate
Bombax ceiba	EN	32.50 x 50	Medium	3-zonocolpate
Callistemon citrinus	EN	13.73 x 18.82	Small	3-parasyncolporate
Caryota urens	AM	12.12 x 18.59	Small	Monocolpate
Cassia fistula	EN	25.10 x 28.63	Medium	3-zonocolporate
Casuarina equisetifolia	AM	25.25 x 27.82	Medium	3-zonoporate
Citrus sp.	EN	24.70 x 22.85	Small	4—zonocolporate
Crateva nurvala	EN	18.67 x 21.24	Small	3-zonocolporate
Cycas sp.	AN	Longest diameter 24.66	Small	Monocolpate
Dalbergia sissoo	EN	24.54 x 23.30	Small	3-zonocolporate
Delonix regia	EN	51.01 x 55.77	Large	3-zonocolpate
Diospyros malabarica	EN	46.15 x 45	Medium	3-zonocolporate
Emblica officinalis	AN	20.33	Small	4-5-zonocolporate
Eucalyptus citriodora	AM	14.60 x 17.50	Small	3-zonocolporate

Feronia limonia	EN	24.70 x 22.85	Small	4- zonocolporate
Holoptelea integrifolia	AN	19.40 x 22.25	Small	4-5 zonoporate
Lagerstroemia indica	EN	32.99 x 29.33	Medium	3-zonocolporate
Leucaena glauca	EN	44.04 x 39.99	Medium	3-zonocolporate
Madhuca longifolia	AM	43 x 40	Medium	4-5 zonocolporate
Mangifera indica	EN	21.82 x 24.99	Small	3-zonocolporate
Moringa sp.	EN	36 x 30	Medium	3-zonocolporate
Morus alba	AM	10 x 13	Small	2-zonoporate
Nyctanthes arbor-tristis	EN	49 x 52	Large	3-zonocolporate
Parkinsonia aculeata	EN	33 x 31	Medium	3-zonocolporate
Peltophorum roxburghii	EN	50.39 x 53.46	Large	3-zonocolporate
Pinus roxburghii	AN	50 x 55	Large	One furrow on ventral surface
Polyalthia longifolia	EN	30	Medium	Inaperturate
Pongamia pinnata	EN	21.06 x 23.24	Small	3-zonocolporate
Prosopis juliflora	AM	25.80 x 29.90	Medium	3-zonocolporate
Psidium guajava	EN	13.44 x 16.95	Small	3-zonocolporate
Pterospermum acerifolium	EN	72.41 x 76.73	Large	3-zonocolpate
*Punica granatum**	EN	21 x 19.98	Small	3-zonocolporate
Putranjiva roxburghii	AM	27.85 x 30.33	Medium	3-zonocolporate
Roystonea regia	AM	Diameter 41.34	Medium	Monocolpate
Samanea saman	EN	105 x 86	Very large	Polyad
Santalum album	EN	24.25 x 18.88	Small	3-zonoporate
Saraca asoka	EN	40 x 38	Medium	3-zonocolporate
spathodea campanulata	EN	45.19 x 34.14	Medium	3-zonocolpate
Strychnos nux-vomica	EN	15.18 x 13.26	Small	3-zonocolporate with 3 pseudocolpi
Syzygium cumini	EN	10.61 x 13.16	Small	3-syncolporate
Tamarindus indica	EN	28 x 29	Medium	3-zonocolporate
Terminalia arjuna	AM	14 x 15	Small	3-zonocolporate with 3 pseudocolpi
Thespesia sp.	EN	61.88	Large	Pantoporate
Toona ciliata	AM	23.83 x 25.38	Small	4-5-zonocolporate
Zizyphus jujuba	EN	18.46 x 20.83	Small	3-zonocolporate

4. Conclusion

Airborne pollen spectrum of a place keeps on changing due to various biotic and abiotic factors which affect vegetation growth and phenology. Thus periodic phenological surveys and pollen morphological studies of different areas become a necessity, of pollen types of some common tree species of Allahabad.

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