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PALYNOMORPHIC ASSESSMENT OF FLORA INHABITED IN AITCHISON COLLEGE LAHORE, PAKISTAN

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Abstract

The present research included micromorphological study of pollen of 43 species belonging to 22 different Dicotyledonous and Monocotyledonous families cultivated and wildly distributed in Aitchison College, Lahore. The observations and analysis were made by using light microscopy. However, pollen was prepared for microscopic studies by following standard methods of Erdtma (1952) and Sexana (1993). The observed characteristics were pollen shape, size, aperture and tectum. Pollen of all the species showed a great variation in size, tectum, aperture and shape. The polar length showed a great variation amongst species as it varied between 12.04µm in *Syzgium heyneanum* and 189.2µm in *Hibiscus rosa-sinensis*. However, the Equatorial diameter also ranged between 12.9 to 186.62µm in *Syzgium heyneanum* and *Hibiscus rosa-sinensis* respectively for the same species. Maximum pollen size was recorded in *Delonix regia* (166µm in polar view) belonging to family Fabaceae. The most common pollen shape was prolate and oblate spheroidal. They differed in tectum ranging from psilate, echinate to foveolate. Majority of the observed pollen were monocolpate, inaperturate, monoporate, pantoporate, pantocolpate, tricolpate, tricolporate, zonocolporate and dicolpate with respect to aperture.

Keywords: Aitchison, Aperture, Flora, Palynomorphic assessment, Standard method, Tricolporate.

Introduction

Palynology is the science of pollen based on the observation of palynomorphs that covers all aspects of pollen and spore. The term palynology was introduced by Hyde & Williams in 1944, derived from Greek word palynein which means to scatter, and is similar to Latin pollen where **palyno** meaning 'to sprinkle' and **pale** meaning "flour" or 'dust' (Halbritter *et al*., 2018). Spores and pollen have a lot of ultra structural and morphological features (Evrenosoglu and Misirli, 2009). Pollen wall is known as sporoderm that consists of two distinct domains that are intine and exine. This diversity of pollen morphology is directly linked with the plant classification. Exine sculpturing and other features of pollen make it enough recognizable features through which parent genera and species could be identified (Saxena 1993).

Taxonomy is the incorporation of all available data from different branches of botany and out of the characters from all these various branches palynological characters were also used in classification and led the beginning of new phase of palynotaxonomic applications of Palynology (Nath, 2012).

For taxonomic identification of flowering plants pollen are widely used as a

tool. For the clarification of arrangement of flowering plants into species rank or upto the variety state the botanists and taxonomists have documented the pollen morphology. Pollen morphological features can be significant in plant taxonomic studies because many of the traits of pollen are affected by various strong selective forces that concern with the lot of reproductive processes e.g., pollination, dispersal and germination. (Bahadur *et al*., 2019).

The shape of pollen refers to the ratio of the length of the polar axis (P) to the equatorial diameter (E). In spheroidal pollen, the polar axis of spheroidal pollen is equal to the equatorial diameter. Type of pollen, Prolate have a polar axis that is enough longer than the equatorial diameter. Oblate pollen possesses a polar axis that is shorter than the equatorial diameter. Pollen size varied from less than 10-micron meter to more than 100-micron meter (Michael *et al.,* 2009). An aperture is a pore of pollen wall that differed enough in the appearance and anatomy from the rest of wall. This section of pollen served the place of germination and plays a vital role in harmomegathy. Type of pollen without an aperture is known as Inaperturate. Type of aperture in gymnosperm slightly differs from aperture of angiosperm (Michael *et al*., 2009).

Their usefulness lied in a combination of their dispersal mechanisms, microscopic size, plentitude and morphology resistance to mechanical and chemical destruction, Because of their complex morphology, it allows identification to an individual parent plant taxon that can be recognized with a specific ecological habitat or a particular scene (Mildenhall *et al.,* 2006).

Pollen characteristics such as the position and number of the apertures, position ad number of the furrows and exine sculpturing details are of taxonomic importance. Exine of the pollen possesses unique morphological characters (Hanif *et al*., 2013). Taxonomists use many disciplines that are associated with taxonomy as assistance, or to improve the classification, identification and systematic position of taxa of the plant. Palynotaxonomy is one of the most significant tools amongst these disciplines that modern taxonomists use to differentiate and identify taxa of the plant that are closely related. Study of pollen morphology has direct significance in forestry, agriculture, horticulture, plant breeding and biotechnology. Pollen have significant usein monitoring of syto-toxic effect of bio-active chemical such as pesticides, herbicides and pollutants and in gene transfer understanding the function and organization of cyto-skeleton and association proteins. Pollen also have great importance in the studies of cloning and expression of genes and researches on intracellular polarity and differentiation. (Zafar *et al.,* 2007).

Aitchison College, Lahore is one of the most prestigious educational institution of its type in South Asia. It was initially established as the Punjab's Chief College on 2 January 1886 in the British India. It was renamed on 13 November 1886 as Aitchison College, Lahore. College occupies the total of 200 acres of area between 31.5502^{o}or 31^{o} 33' 0.9" N and 74.3456^{o} or 74^{o} 20' 44.2" E. It is situated on Shahrah-e -

Quaid-e-Azam, Lahore, Punjab. The average annual rainfall is 628.6mm. Grounds and gardens of Aitchison College cover the most of its area and have outstanding nursery with vast range of plant species. College has won many accolades because of its seasonal beauty. It has vast variety of flora that is either self-growing or wild.

Materials and Methods

The following plan of work was followed in the present study:

1. Documentation of Herbaceous Flora

The regular field trips were conducted for the documentation of plants of the study area during the months of September 2020 to June 2021.

2. Pollen collection

The anther containing pollen was removed from the flower with the help of scissors and collected in glass viols in glacial acetic acid. After collection, pollen was prepared for microscopic studies by using the standard procedure of Erdtman (1952) and Saxena (1993).

Preparation of pollen

i- Acetolysis

The pollen collected were acetolyzed according to the standard procedure of Erdtman (1952). In 5ml glacial acetic acid the anther containing pollen were crushed with the help of glass rod. The crushed pollen in centrifuge tubes were centrifuged for about 20 minutes at 4000 rpm in centrifuge machine. After centrifugation the glacial acetic acid was decanted and one part concentrated sulphuric acid was added to the left out sample. Nine parts of acetic anhydride were added to the residue drop by drop. The mixture containing acid anhydride was heated in a water bath upto boiling point. After cooling the mixture was centrifuged for about 20 minutes at 4000 rpm. Liquid part that was acetic acid was decanted from the centrifuged sample. The residual material obtained was then washed with 5ml distilled water by adding 1ml of distilled water five times each and then was sieved using a sieve having fine pores. Again, the filtrate was centrifuged and the material was ready for microscopic examination.

i. ii- Staining

The staining of pollen was also carried out as per the standard method of Saxena (1993). The sieved material obtained was preserved in refrigerator. This preserved material was then taken in centrifuge tubes and stained with 5% safranine in water. Washed the material repeatedly and then centrifuged and decanted the upper layer. The slides were prepared and mounted in glycerine jelly for further microscopic examination.

3. Microscopy of the pollen

After Acetolysis and staining procedure the prepared samples were subjected to microscopy using light microscope and micrometers.

Aitchison College is very old institution but up-till now no work has been done on its plant inventory. Therefore, the present research work has been done with the following objectives.

1. To enlist the plants of the study area
2. To use the polliniferous material of inhabited flora for identification.

Results

In present study pollen morphology and exine ornamentation of 43 species belonging to 22 families has been studied by using light microscopy as shown in **table 1**. Pollen features like pollen size, shape, aperture types and pollen wall ornamentation were considered for the results. Plants observed have very diverse aperture types i.e., monocolpate, inaperturate, monoporate, pantoporate, pantocolpate, tricolpate, tricolporate, zonocolporate and dicolpate. Pollen studied are all of very small size. The shapes of the observed pollen were prolate spheroidal, oblate spheroidal, oblate and sub-spheroidal. Amongst all these observed shapes the most common were prolate spheroidal and oblate spheroidal. The range of polar diameter varies from 12.04µm to 189.2µm and equatorial diameter varies from 9.675µm to 186.62µm. P/E ratio ranges from 63.889 (0.64) to 166.06 (1.66). Tectum observed was granulate, foveolate, scabrate, psilate, echinate, and regulate but most of the pollen were of psilate type.

General Pollen Characteristics

1. ***Nothoscordum bivalve* (L.) Britton (Plate 1. Fig. A)**

   Palynomorph: Pollen shape is oblate spheroidal in equatorial view, Pollen size: very small, aperture: monocolpate, pollen length (P): 31.778 ± 0.05, equatorial diameter (E), 33.566 ± 0.0004, P/E ratio: 94.67, Tectum: granulate.

2. ***Tabernaemontana divaricata* (L.) R.Br. (Plate 1. Fig. B)**

   Palynomorph: Pollen shape is prolate spheroidal in equatorial view. Pollen size is very small. It is inaperturate. Pollen length (P) is 46.44 ± 5.16 and equatorial diameter (E) is 43.86 ± 2.58. P/E ratio is 105.88. Tectum is Foveolate.

3. ***Jasmanium sambac* (L.) Aiton (Plate 1. Fig. C)**

   Palynomorph: Pollen shape is oblate spheroidal in equatorial view. Pollen size is small. Aperture is tricolpate. Pollen length (P) is 38.7 ± 2.58 and equatorial diameter (E) is 43.86 ± 2.58. P/E ratio is 88.24. Tectum is Scabrate.

4. ***Asparagus densiflorus* (kunth) (Plate 1. Fig. D)**

   Palynomorph: Pollen shape is oblate in equatorial view. Pollen size is medium. Aperture is dicolpate. Pollen length (P) is 39.56 ± 11.63 and equatorial diameter (E) is 61.92 ± 9.3. P/E ratio is 63.89. Tectum is Psilate.

5. ***Tradescantia pallid* (Rose) D.R.Hunt (Plate 1. Fig. E)**

   Palynomorph: Pollen shape is prolate spheroidal in equatorial view. Pollen size is medium. Aperture is tetraporate. Pollen length (P) is 52.46 ± 3.94 and equatorial diameter (E) is 52.46 ± 11.63. P/E ratio is 100. Tectum is rugulate.

6. ***Clerodendrum inerme* (L.) Gaertn. (Plate 1. Fig. F)**

   Palynomorph: Pollen shape is prolate spheroidal in equatorial view. Pollen size is small. Aperture is pantoporate. Pollen length (P) is 56.76 ± 4.47 and equatorial diameter (E) is 56.76 ± 5.16. P/E ratio is 100. Tectum is echinate.

Plate 1: A. *Nothoscordum bivalve*, **B.** *Tabernaemontana divaricata*, **C.** *Jasminum sambac*, **D.** *Asparagus densiflorus-sprengeri*, **E.** *Tradescantia pallida*, **F.** *Clerodendrum inerme*

7. ***Catharanthus roseus* (L.) (Plate 2. Fig. A)**

   Palynomorph: Pollen shape is prolate spheroidal in equatorial view. Pollen size is small. Aperture is pantoporate. Pollen length (P) is 46.44 ± 5.16 and equatorial diameter (E) is 43.86 ± 2.58. P/E ratio is 105.88. Tectum is foveolate.

8. ***Salvia splendens* Ker Gawl (Plate 2. Fig. B)**

   Palynomorph: Pollen shape is sub-spheroidal in equatorial view. Pollen size is small. Aperture is zonocolporate. Pollen length (P) is 47.3 ± 3.94 and equatorial diameter (E) is 44.72 ± 5.95. P/E ratio is 105.76. Tectum is foveolate.

9. ***Polygonum aviculare* L. (Plate 2. Fig. C)**

   Palynomorph: Pollen shape is prolate spheroidal in equatorial view. Pollen size is very small. Aperture is dicolpate. Pollen length (P) is 18.06 ± 2.58 and equatorial diameter (E) is 18.06 ± 2.58. P/E ratio is 100. Tectum is scabrate.

10. ***Eclipta prostrata* (L.) (Plate 2. Fig. D)**

    Palynomorph: Pollen shape is prolate spheroidal in equatorial view. Pollen size is very small. Aperture is pantoporate. Pollen length (P) is 22.36 ± 1.49 and equatorial diameter (E) is 21.5 ± 1.49. P/E ratio is 104. Tectum is echinate.

11. ***Euphorbia milli grandiflora* var. ek villain (Plate 2. Fig. E)**

    Palynomorph: Pollen shape is prolate spheroidal in equatorial view. Pollen size is small. Aperture is dicolpate. Pollen length (P) is 49.02 ± 6.83 and equatorial diameter (E) is 45.58 ± 7.45. P/E ratio is 107.54. Tectum is psilate.

12. ***Euphorbia milli* Var. *splendens* (L.) (Bojer ex Hook.) (Plate 2. Fig. F)**

Palynomorph: Pollen shape is prolate spheroidal in equatorial view. Pollen size is small. Aperture is pantocolpate. Pollen length (P) is 49.88 ± 6.49 and equatorial diameter (E) is 49.02 ± 11.25. P/E ratio is 101.75. Tectum is foveolate.

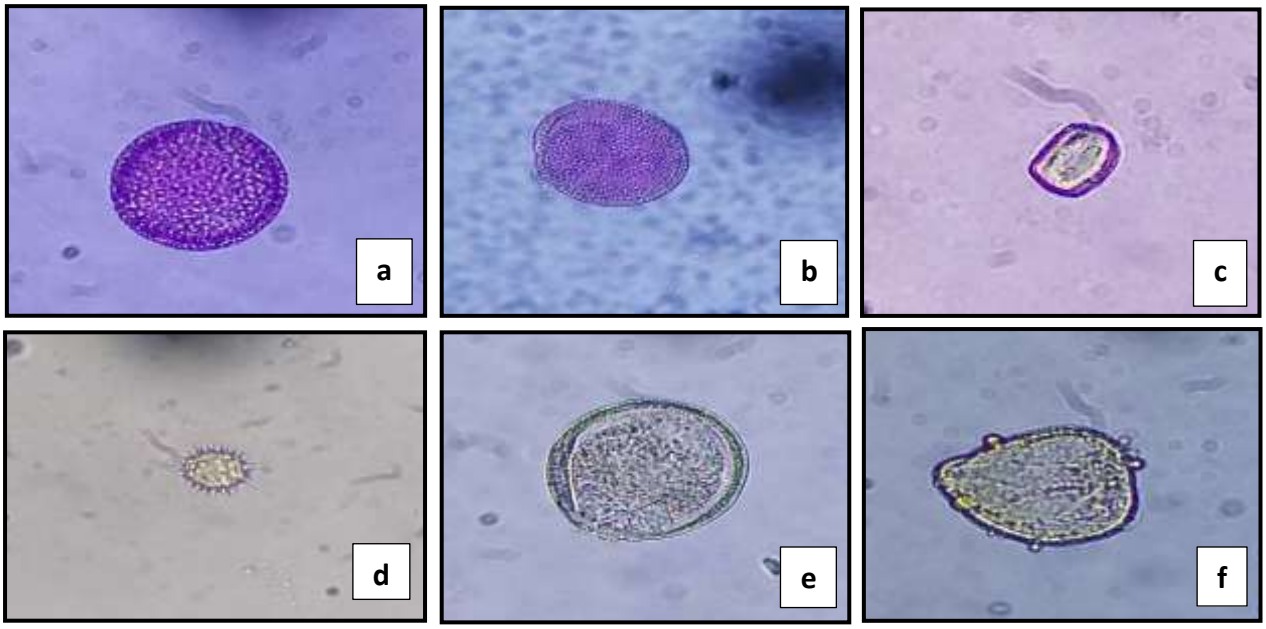

Plate 2: A. *Catharanthus roseus*,**B.** *Salvia splendens*, **C.** *Polygonium aviculare*, **D.** *Eclipta prostrata*, **E.** *Euphorbia milli grandiflora var. ek villain*, **F.** *Euphorbia milli* var. *splendens.*

13. ***Lantana camara* L. (Plate 3. Fig. A)**

Palynomorph: Pollen shape is prolate spheroidal in equatorial view. Pollen size is small. Aperture is tricolpate. Pollen length (P) is 48.16 ± 9.06 and equatorial diameter (E) is 45.58 ± 9.06. P/E ratio is 105.66. Tectum is psilate.

14. ***Euphorbia milli f. lutea* (Plate 3. Fig. B)**

Palynomorph: Pollen shape is prolate spheroidal in equatorial view. Pollen size is small. Aperture is tricolporate. Pollen length (P) is 36.12 ± 2.58 and equatorial diameter (E) is 36.98 ± 1.49. P/E ratio is 97.67. Tectum is psilate.

15. ***Lantana indica* Roxb. (Plate 3. Fig. C)**

Palynomorph: Pollen shape is prolate spheroidal in equatorial view. Pollen size is small. Aperture is monoporate. Pollen length (P) is 48.16 ± 9.06 and equatorial diameter (E) is 45.58 ± 9.06. P/E ratio is 105.66. Tectum is psilate.

16. ***Cascabela thevetia* (L.).(Plate 3. Fig. D)**

Palynomorph: Pollen shape is prolate spheroidal in equatorial view. Pollen size is medium. Aperture is monoporate. Pollen length (P) is 92.88 ± 6.83 and equatorial diameter (E) is 92.02 ± 2.98. P/E ratio is 100.93. Tectum is striate.

17. ***Hamelia patens* Jacq. (Plate 3. Fig. E)**

Palynomorph: Pollen shape is oblate spheroidal in equatorial view. Pollen size is very small. Aperture is tricolpate. Pollen length (P) is 20.64 ± 0 and equatorial diameter (E) is 21.5 ± 1.49. P/E ratio is 96. Tectum is striate.

18. ***Helianthus annuus* L. (Plate 3. Fig. F)**

Palynomorph: Pollen shape is oblate spheroidal in equatorial view. Pollen size is small. Aperture is pantoporate. Pollen length (P) is 24.94 ± 2.98 and equatorial diameter (E) is 27.52 ± 5.37. P/E ratio is 90.6. Tectum is echinate.

19. ***Sphngneticola trilobata* (Plate 4. Fig. A)**

Palynomorph: Pollen shape is prolate spheroidal in equatorial view. Pollen size is small. Aperture is tricolporate. Pollen length (P) is 32.68 ± 3.94 and equatorial diameter (E) is 30.1 ± 7.88. P/E ratio is 108.57. Tectum is echinate.

20. ***Gerbera spectablis daisies* L. (Plate 4. Fig. B)**

Palynomorph: Pollen shape is prolate spheroidal in equatorial view. Pollen size is small. Aperture is dicolpate. Pollen length (P) is 42.14 ± 3.94 and equatorial diameter (E) is 36.98 ± 2.98. P/E ratio is 113.95. Tectum is psilate.

21. ***Amaranthus viridis* L. (Plate 4. Fig. C)**

Palynomorph: Pollen shape is prolate spheroidal in equatorial view. Pollen size is small. Aperture is dicolpate. Pollen length (P) is 35.26 ± 1.49 and equatorial diameter (E) is 35.26 ± 1.49. P/E ratio is 100. Tectum is rugulate.

22. ***Rosa aachenerdom* L. (Plate 4. Fig. D)**

Palynomorph: Pollen shape is prolate spheroidal in equatorial view. Pollen size is small. Aperture is tricolpate. Pollen length (P) is 34.4 ± 2.98 and equatorial diameter (E) is 30.96 ± 2.58. P/E ratio is 111.11. Tectum is psilate.

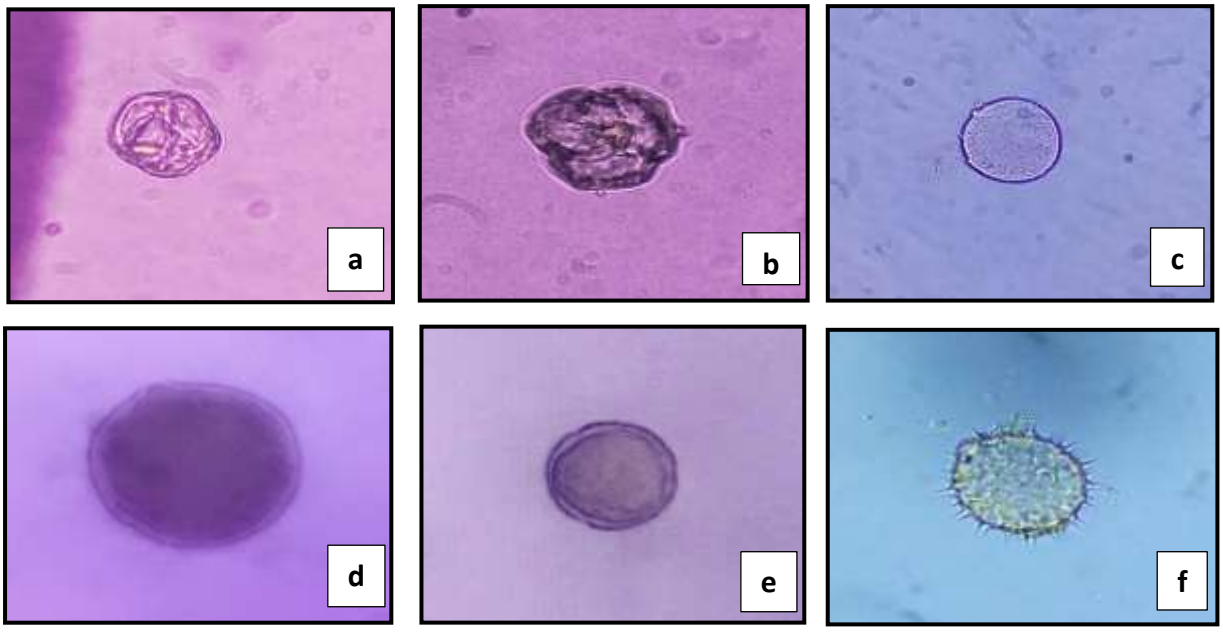

Plate 3: A. *Lantana camara***, B.** *Euphorbia milli f. lutea***, C.** *Lantana indica***, D.** *Cascabela thevetia***, E.** *Hamelia patens***, F.** *Helianthus annuus.*

23. ***Rosa michelangelo* L. (Plate 4. Fig. E)**

Palynomorph: Pollen shape is prolate spheroidal in equatorial view. Pollen size is small. Pollen is inaperturate. Pollen length (P) is 20.64 ± 4.47 and equatorial diameter (E) is 19.78 ± 7.45. P/E ratio is 104.54. Tectum is psilate.

24. ***Bougainvillea spectablis* var. glabra (Plate 4. Fig. F)**

Palynomorph: Pollen shape is prolate spheroidal in equatorial view. Pollen size is small. Pollen is inaperturate. Pollen length (P) is 39.56 ± 19.36 and equatorial diameter (E) is 37.84 ± 21.01. P/E ratio is 104.54. Tectum is rugulate.

25. ***Kalanchoebloss feldiana*(Plate 5. Fig. A)**

Palynomorph: Pollen shape is oblate spheroidal in equatorial view. Pollen size is small. Aperture is tricolpate. Pollen length (P) is 27.52 ± 2.98 and equatorial diameter (E) is 28.38 ± 4.47. P/E ratio is 96.97. Tectum is psilate.

26. ***Jasmenium grandiflorium* L. (Plate 5. Fig. B)**

Palynomorph: Pollen shape is prolate spheroidal in equatorial view. Pollen size is small. Aperture is tricolpate. Pollen length (P) is 38.7 ± 6.83 and equatorial diameter (E) is 36.12 ± 14.36. P/E ratio is 107.14. Tectum is foveolate.

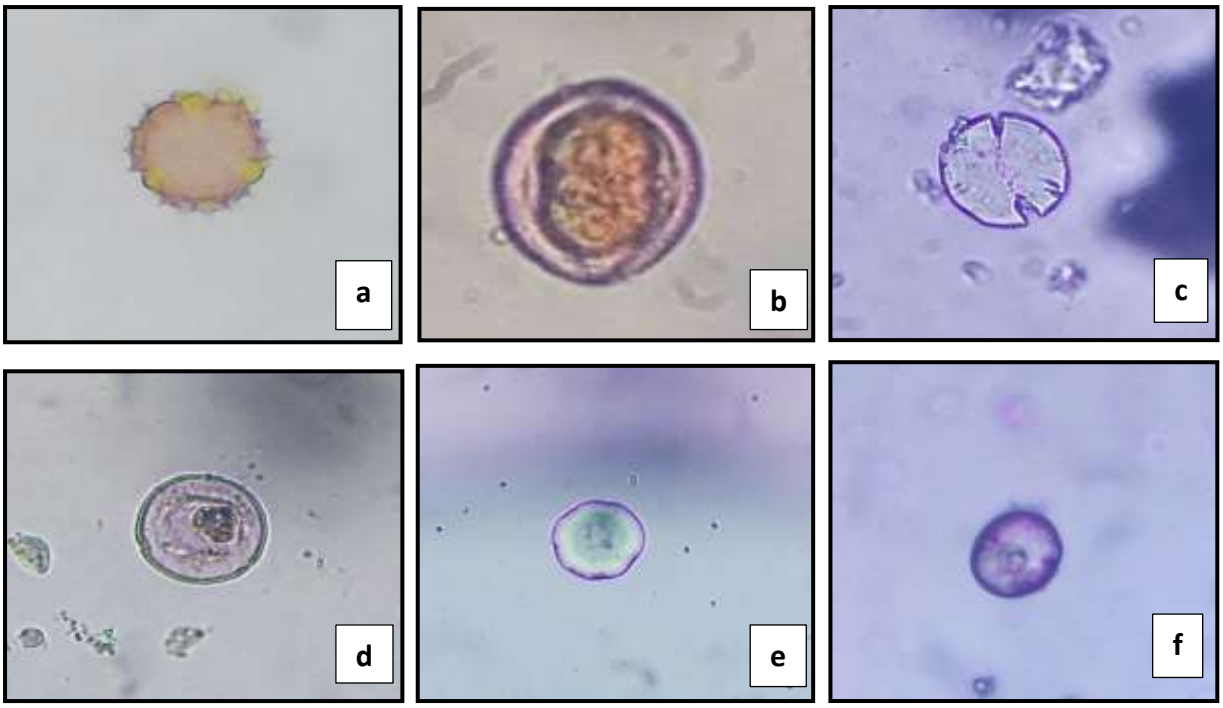

Plate 4: A. *Sphngneticola trilobata***, B.** *Gerbera spectablis var. daisies***, C.** *Amaranthus viridis***, D.** *Rosa aachenerdom*, **E.** *Rosa Michelangelo*, **F.** *Bougainvillea glabra*

27. ***Cassia fistula* L. (Plate 5. Fig. C)**

Palynomorph: Pollen shape is prolate spheroidal in equatorial view. Pollen size is very small. Aperture is tricolporate. Pollen length (P) is 32.68 ± 1.49 and equatorial diameter (E) is 30.1 ± 1.49. P/E ratio is 108.57. Tectum is psilate.

28. ***Plumeria rubra* L. (Plate 5. Fig. E)**

Palynomorph: Pollen shape is prolate spheroidal in equatorial view. Pollen size is

very small. Aperture is trizonoporate. Pollen length (P) is 32.68 ± 1.49 and equatorial diameter (E) is 29.24 ± 1.49. P/E ratio is 111.76. Tectum is psilate.

29. *Hibiscus rosa-sinensis* L. (Plate 5. Fig. D)

Palynomorph: Pollen shape is oblate spheroidal in equatorial view. Pollen size is very small. Aperture is pantaporate. Pollen length (P) is 176.3 ± 7.45 and equatorial diameter (E) is 180.6 ± 0. P/E ratio is 97.61. Tectum is echinate.

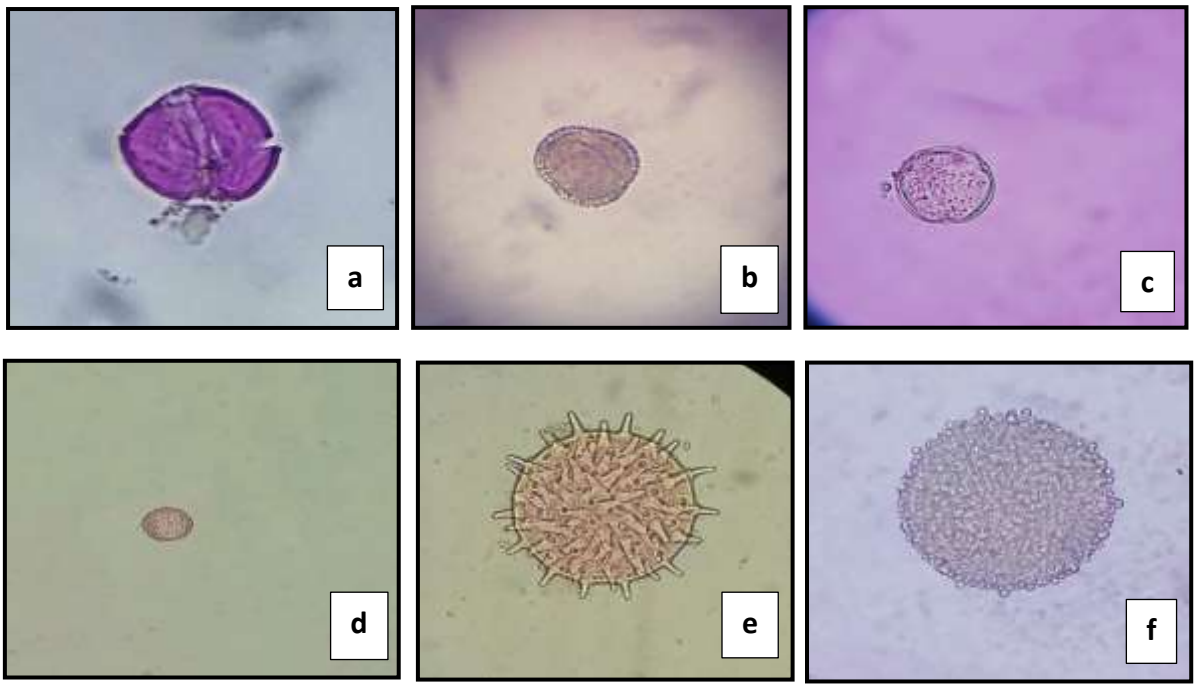

Plate 5: A.*Kalanchoebloss feldiana,* **B**. *Jasmenium grandiflorium***, C.** *Cassia fistula***, D.** *Hibiscus rosa-sinensis,* **E.** *Plumeria rubra* **F.** *Jatropha panduifolia.*

30. *Jatropha pandurifolia* Andrew. (Plate 5. Fig. F)

Palynomorph: Pollen shape is oblate spheroidal in equatorial view. Pollen size is very small. Aperture is porate. Pollen length (P) is 103.2 ± 34.13 and equatorial diameter (E) is 104.6 ± 34.64. P/E ratio is 99.17. Tectum is rugulate.

31. *Ficus virens* Ation. (Plate 6. Fig. A)

Palynomorph: Pollen shape is subprolate in equatorial view. Pollen size is very small. Aperture is dicolpate. Pollen length (P) is 22.36 ± 1.49 and equatorial diameter (E) is 18.92 ± 2.98 P/E ratio is 118.18. Tectum is reticulate.

32. *Nerium oleander* L. (Plate 6. Fig. B)

Palynomorph: Pollen shape is prolate spheroidal in equatorial view. Pollen size is very small. Aperture is dicolpate. Pollen length (P) is 81.7 ± 6.49 and equatorial diameter (E) is 74.82 ± 9.3. P/E ratio is 109.19. Tectum is granulate.

33. *Dalbergia sisso* Roxb. (Plate 6. Fig. C)

Palynomorph: Pollen shape is prolate spheroidal in equatorial view. Pollen size is

very small. Aperture is pantoporate. Pollen length (P) is 108.36 ± 9.3 and equatorial diameter (E) is 105.2 ± 3.46. P/E ratio is 103. Tectum is echinate.

34. *Lagerstoemia speciose* (L.) Pers. (Plate 6. Fig. B)

Palynomorph: Pollen shape is oblate spheroidal in equatorial view. Pollen size is very small. Aperture is tricolporate. Pollen length (P) is 33.54 ± 2.58 and equatorial diameter (E) is 36.12 ± 2.58. P/E ratio is 92.8. Tectum is scabrate.

35. *Cassia nodosa* L. (Plate 6. Fig. F)

Palynomorph: Pollen shape is oblate spheroidal in equatorial view. Pollen size is very small. Pollen is inaperturate. Pollen length (P) is 26.66 ± 1.49 and equatorial diameter (E) is 27.52 ± 3.94. P/E ratio is 96.88. Tectum is psilate.

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Plate 6: **A.** *Ficus virens* **B**. *Lagerstoemia speciose* **C.***Dalbergia sisso* (polar view) **D.** *Dalbergia sisso* (equatorial view) **E.** *Tabernaemontana divaricata* **F.***Cassia nodosa*

36. *Mangifera indica* L. (Plate 7. Fig. A)

Palynomorph: Pollen shape is prolate spheroidal in equatorial view. Pollen size is very small. Pollen is inaperturate. Pollen length (P) is 30.1 ± 1.49 and equatorial diameter (E) is 29.24 ± 1.49. P/E ratio is 102.94. Tectum is granulate.

37. *Syzgium cumini* (L.). (Plate 7. Fig. B)

Palynomorph: Pollen shape is prolate spheroidal in equatorial view. Pollen size is very small. Aperture is dicolpate. Pollen length (P) is 20.64 ± 4.47 and equatorial diameter (E) is 19.78 ± 3.94. P/E ratio is 104.34. Tectum is scabrate..

38. *Terminalia arjuna* Roxb. (Plate 7. Fig. C)

Palynomorph: Pollen shape is subspheroidal in equatorial view. Pollen size is very small.

Aperture is 3-zonocolporate. Pollen length (P) is 18.92 ± 3.94 and equatorial diameter (E) is 24.94 ± 3.94. P/E ratio is 75.86. Tectum is psilate.

39. ***Saraca asoca* (Roxb.) Willd (Plate 7. Fig. D)**

Palynomorph: Pollen shape is prolate spheroidal in equatorial view. Pollen size is very small. Aperture is monocolpate. Pollen length (P) is 32.68 ± 1.49 and equatorial diameter (E) is 32.68 ± 5.37. P/E ratio is 100. Tectum is scabrate.

40. ***Syzgium heyneanum* J.Graham (Plate 7. Fig. E)**

Palynomorph: Pollen shape is oblate spheroidal in equatorial view. Pollen size is very small. Aperture is colporate. Pollen length (P) is 12.04 ± 2.98 and equatorial diameter (E) is 12.9 ± 0. P/E ratio is 93.33. Tectum is reticulate.

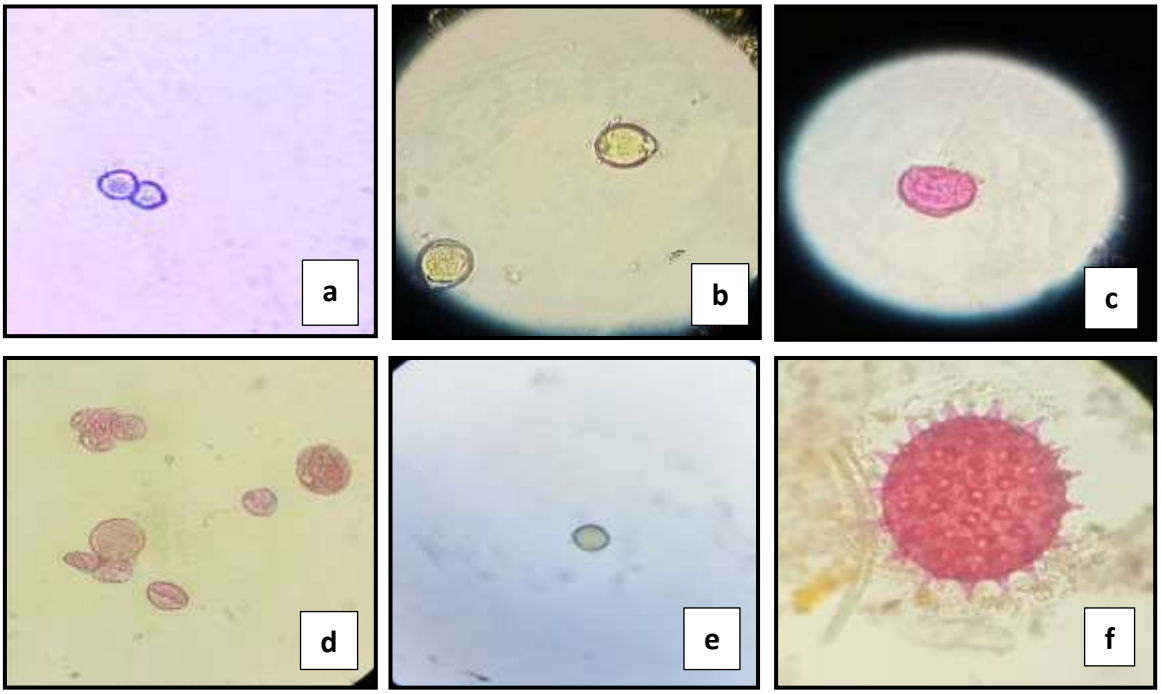

Plate 7: **A.** *Mangifera indica* **B.** *Syzgium cumini* **C.** *Terminalia arjuna* **D.** *Saraca asoca* **E.** *Syzgium heyaeanum* **F**. *Hibiscus rosa-sinensis*

41. ***Delonix regia* (Bojer ex Hook.) (Plate 8. Fig. A)**

Palynomorph: Pollen shape is prolate in equatorial view. Pollen size is very small. Aperture is 3-zonoclporate. Pollen length (P) is 117.82 ± 23.97 and equatorial diameter (E) is 70.95 ± 48.83. P/E ratio is 166.06. Tectum is granulate.

42. ***Hetrophragma adenophylum* (wallich ex. G. Don.) (Plate 8. Fig. B)**

Palynomorph: Pollen shape is prolate spheroidal in equatorial view. Pollen size is

very small. Aperture is tricolpate. Pollen length (P) is 24.94 ± 7.88 and equatorial diameter (E) is 24.94 ± 9.76. P/E ratio is 100. Tectum is psilate.

43. *Lagerstoemea indica* Linn. C.P. Khare (Plate 8. Fig. D)

Palynomorph: Pollen shape is prolate spheroidal in equatorial view. Pollen size is very small. Aperture is 3-4 zonocolporate. Pollen length (P) is 25.8 ± 0 and equatorial diameter (E) is 23.22 ± 0. P/E ratio is 111.11. Tectum is psilate.

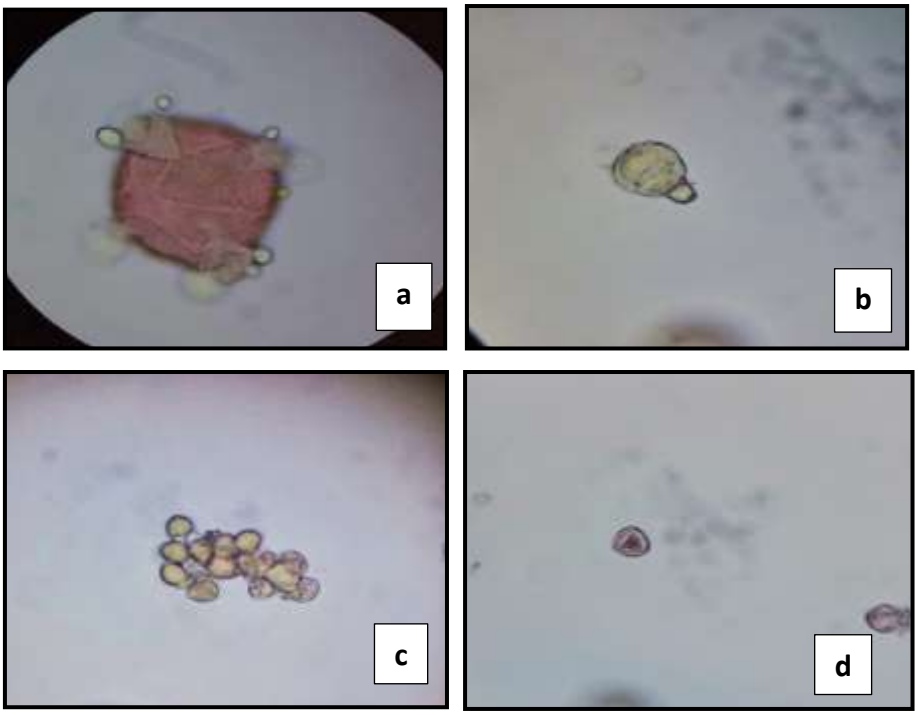

Plate 8: A. *Delonix regia* **B.** *Hetrophragma adenophylum* (Equatorial view) **C.** *Hetrophragm aadenophylum* (group form) **D**. *Lagerstoemea indica.*

Table 1: Palynomorphic Details of Flora Inhabited in Aitchison College, Lahore.

Sr. No.	Botanical names	Family	P (µm)	E (µm)	P/E	Pollen shape	Pollen size	Aperture	Tectum
1.	*Amaranthus viridis*	Amaryllidaceae	35.26 ± 1.49	35.26 ± 1.49	100	Prolate spheroidal	Very large	Dicolpate	Rugulate
2.	*Nothoscordum bivalve*	Amaryllidaceae	31.778 ± 0.05	33.566 ± 0.0004	94.6	Oblate Spheroidal	Large	Monocolpate	Granulate
3.	*Mangifera indica*	Anacardiaceae	30.1 ± 1.49	29.24 ± 1.49	102.9	Prolate Spheroidal	Very Large	Inaperturate	Granulate
4.	*Tabernaemontana divaricata*	Apocynaceae	46.44 ± 5.16	43.86 ± 2.58	105.8	Prolate spheroidal	Very Large	Inaperturate	Foveolate
5.	*Catharanthus roseus*	Apocynaceae	46.44 ± 5.16	43.86 ± 2.58	105.8	Prolate spheroidal	Very Large	Pantoporate	Foveolate
6.	*Cascabela thevetia*	Apocynaceae	92.88 ± 6.83	92.02 ± 2.98	100.9	Prolate spheroidal	Large	Monoporate	Striate
7.	*Plumeria rubra*	Apocynaceae	32.68 ± 1.49	29.24 ± 1.49	111.7	Prolate Spheroidal	Very Large	Trizonoporate	Psilate
8.	*Nerium oleander*	Apocynaceae	81.7 ± 6.49	74.82 ± 9.3	109.1	Prolate spheroidal	Very Large	Dicolpate	Granulate
9.	*Asparagus densiflorus*	Asparagaceae	39.56 ± 1.63	61.92 ± 1.3	63.89	Oblate	Large	Dicolpate	Psilate
10.	*Eclipta prostrata*	Asteraceae	22.36 ± 1.49	21.5 ± 1.49	104	Prolate spheroidal	Very Large	Pantoporate	Echinate
11.	*Helianthus annuus*	Asteraceae	24.94 ± 2.98	27.52 ± 5.37	90.6	Oblate spheroidal	Large	Pantoporate	Echinate
12.	*Sphngneticola trilobata*	Asteracea	32.68 ± 3.94	30.1 ± 7.88	108.5	Prolate spheroidal	Very Large	Tricolporate	Echinate
13.	*Gerbera spectabilis* var.daisies	Asteraceae	42.14 ± 3.94	36.98 ± 2.98	113.9	Prolate spheroidal	Very Large	Dicolpate	Psilate
14.	*Hetrophragma adenophylum*	Bignoniaceae	24.94 ± 7.88	24.94 ± 9.76	100	Prolate Spheroidal	Large	Tricolpate	Psilate
15.	*Terminalia arjuna*	Combritaceae	18.92 ± 3.94	24.94 ± 3.94	75.86	Subspheroidal	Large	3-zonocolporate	Psilate
16.	*Tradescantia pallid*	Commelinaceae	52.46 ± 3.94	52.46 ± 11.63	100	Prolate spheroidal	Large	Tetraporate	Rugulate
17.	*Kalanchoeblos sfeldiana*	Crassulaceae	27.52 ± 2.98	28.38 ± 4.47	96.9	Oblate spheroidal	Large	Tricolpate	Psilate
18.	*Euphorbia milli grandiflora* var. ek villain	Euphorbiaceae	49.02 ± 6.83	45.58 ± 7.45	107.5	Prolate spheroidal	Very Large	Dicolpate	Psilate
19.	*Euphorbia milli splendens*	Euphorbiaceae	49.88 ± 6.49	49.02 ± 11.25	101.7	Prolate spheroidal	Very Large	Pantocolpate	Foveolate
20.	*Euphorbia milli* f. lutea	Euphorbiaceae	36.12 ± 2.58	36.98 ± 1.49	97.67	Prolate spheroidal	Large	Tricolporate	Psilate

21.	*Jatropha pandurifolia*	Euphorbiaceae	103.2 ± 34.13	104.6 ± 34.64	99.17	Oblate spheroidal	Large	Porate	Regulate
22.	*Cassia fistula*	Fabaceae	32.68 ± 1.49	30.1 ± 1.49	108.5	Prolate Spheroidal	Very Large	Tricolporate	Psilate
23.	*Cassia nodosa*	Fabaceae	26.66 ± 1.49	27.52 ± 3.94	96.88	Oblate spheroidal	Large	Inaperturate	Psilate
24.	*Dalbergia sisso*	Fabaceae	108.36 ± 9.3	105.2 ± 3.46	103	Prolate Spheroidal	Very Large	pantoporate	Echinate
25.	*Delonix regia*	Fabaceae	117.82±23.97	70.95 ± 48.83	166.0	Prolate	Very Large	3-zonocolporate	Granulate
26.	*Saraca asoca*	Fabaceae	32.68 ± 1.49	32.68 ± 5.37	100	Prolate Spheroidal	Large	monocolpate	Scabrate
27.	*Clerodendrum inerme*	Lamiacae	56.76 ± 4.47	56.76 ± 5.16	100	Prolate spheroidal	Large	Pantoporate	Echinate
28.	*Salvia splendens*	Lamiacae	47.3 ± 3.94	44.72 ± 5.95	105.7	sub-spheroidal	Large	Zonocolporate	Foveolate
29.	*Lagerstoemia indica*	Lytheraceae	25.8 ± 0	23.22 ± 0	111.1	Prolate Spheroidal	Very Large	zonocolporate,	Psilate
30.	*Lagerstoemia speciosa*	Lythraceae	33.54 ± 2.58	36.12 ± 2.58	92.8	Oblate spheroidal	Large	tricolporate	Scabrate
31.	*Hibiscus rosa-sinensis*	Malvaceae	189.2 ± 14.89	186.62 ± 6.49	101.3	Prolate Spheroidal	Very Large	pantoporate	Echinate
32.	*Ficus virens*	Moraceae	22.36 ± 1.49	18.92 ± 2.98	118.1	Subprolate	Very Large	Dicolpate	Reticulate
33.	*Syzgium cumini*	Myrtaceae	20.64 ± 4.47	19.78 ± 3.94	104.3	Prolate Spheroidal	Very Large	dicolpate	Scabrate
34.	*Syzgium heyneanum*	Myrtaceae	12.04 ± 2.98	12.9 ± 0	93.33	Oblate spheroidal	Large	colporate	Reticulate
35.	*Bougainvillea glabra*	Nyctaginaceae	39.56 ± 19.36	37.84 ± 21.01	104.5	Prolate spheroidal	Very Large	Inaperturate	Rugulate
36.	*Jasminum sambac*	Oleaceae	38.7 ± 2.58	43.86 ± 2.58	88.24	Oblate Spheroidal	Large	Tricolpate	Scabrate
37.	*Jasmenium grandiflorium*	Oleaceae	38.7 ± 6.83	36.12 ± 14.36	107.1	Prolate Spheroidal	Very Large	Tricolpate	Foveolate
38.	*Polygonium aviculare*	Polygonaceae	18.06 ± 2.58	18.06 ± 2.58	100	Prolate spheroidal	Large	Dicolpate	Scabrate
39.	*Rosa aachenerdom*	Rosaceae	34.4 ± 2.98	30.96 ± 2.58	111.1	Prolate spheroidal	Very Large	Tricolpate	Psilate
40.	*Rosa michelangelo*	Rosaceae	20.64 ± 4.47	19.78 ± 7.45	104.3	Prolate spheroidal	Very Large	Inaperturate	Psilate
41.	*Hamelia patens*	Rubiaceae	20.64 ± 0	21.5 ± 1.49	96	Oblate spheroidal	Large	Tricolpate	Striate
42.	*Lantana camara*	Verbenaceae	48.16 ± 9.06	45.58 ± 9.06	105.6	Prolate spheroidal	Very Large	Tricolpate	Psilate
43.	*Lantana indica*	Verbenaceae	48.16 ± 9.06	45.58 ± 9.06	105.6	Prolate spheroidal	Very Large	Monoporate	Psilate

Discussion

Polarity, Aperture, size and shape types are the significant characteristics for cataloging and identification of pollen (Walker and Doyle, 1975). In family Asteraceae there is great variations in all the characteristics e.g., *Helianthus annuus*, *Sphngneticola trilobata*, *Gerbera daisies* and *Eclipta prostrate* have Two types of pollen shape i.e. prolate spheroidal and oblate spheroidal. Aperture types observed are pantoporate, tricolporate and dicolporate. Tectum is echinate and psilate. Same is also reported by Meo and Khan (2004). These variations in micromorphological features amongst different species of the same family may effect the taxonomic dererminants. However, the pollen grains of the species of family Euphorbiaceae showed great stability in the shape of all the species i.e. *Euphorbia milli grandiflora* var. ek villain, *Euphorbia milli splendens* and *Euphorbia milli* f. lutea belonging. The prolate spheroidal shape is common in all these species. Aperture is tricolporate, pantocolpate and dicolpate. Tectum of pollen observed were of two types i.e. The results shown spheroidal pollen shape but my pollen of all the species of this family are of prolate-spheroidal shape (Htun, 2011). Pollen grain variations and stability is the key factor in evolutionary lines. All the pollen released in monads in studied plant species, which means that most of the species belongs to the primitive angiosperms. It reveals interrelationship with the study area and plant species.

Conclusion

Due to various biotic and abiotic factors airborne pollen spectrum of a place keeps on changing as in the family euphoriaceae, rosaceae, Verbenaceae another in the present study. This affects the vegetation growth and phonology of that area. Thus it is necessary to carry out periodical phonological surveys and pollen morphological studies of different areas become a necessity. Pollen studies of some common plant species of Aitchison College is carried out in this perspective. The present study is all about the microscopic morphological evaluation of pollen characters that help in taxonomy. Thedocumentation of flora of Aitchison College, Lahore is one of its purposes. This study will help in future for the identification of the species and will sort out taxonomic problems.

References

Bahadur, S., M. Ahmad, M. Zafar, S. Sultana, N. Begum, S. Ashfaq, S. Gul, M.S. Khan, S.N. Shah, F. Ullah, S. Saqib and A. Ayaz. 2019. Palyno-anatomical studies of monocot taxa and its taxonomic implications using light and scanning electron microscopy. *Microsc. Res. Tech.*, 82(4): 373-393.

Christensen, N.L. and Lubbers, A.E. 1986. Intraseasonal variation in seed production among flowers and plants of Thalictrum thalictroides (Ranunculaceae). *Am. J. Bot.*, 73(2): 190-203.

Erdtman, G. 1952. Pollen Morphology and Plant Taxonomy, Angiosperms. Almqvist and Wiksell, Stockholm. 406-409.

Evrenosoglu, Y. and A. Misirli. 2009. Investigations on the pollen morphology of some fruit species. *Turk. J. Agric. For.*, 33(2):181-190.

Faegeri, K. and J. Iverson. 1964. The textbook of the pollen analysis. Edt. (2) Munksgaard, Copenhagen.

Halbritter, H.S., F. Ulrich, M. Grimsson, M. Weber, R. Zetter, M. Hesse. and A. Frosch-Radivo. 2018. Palynology: History and Systematic Aspects. *Illustrated Pollen Termin.*, 3-21.

Hyde, H.A., and D.A. Williams. 1944. Studies in atmospheric pollen. I. A daily census of pollens at Cardiff, 1942. *New Phytol.*, 43(1): 49-61.

Kahraman, A., H. Cildir, M. Dogan, F. Genus, F. Genus and F. Celep. 2012. Pollen morphology of the genus *Lathyrus* L. (fabaceae) with emphasis on its systematic implications. *Aust. J. Crop Sci*., 6(3): 599-566.

Martin, R. D., A. C. Walker, and G. A. Doyle. (Eds.). 1976. *Prosimian Biology: Prosimian anatomy, biochemistry and evolution*. Duckworth.

Michael, H.R., R. Zetter, H. Halbritter, A. Frosch-Radivo and S. Ulrich. 2009. Pollen terminology- An illustrated handbook. *Springer Wien New York*., 2(105): 9-16.

Mildenhall, D. C. 2006. Hypericum pollen determines the presence of burglars at the scene of a crime: an example of forensic palynology. *Forensic Sci. Int.*, 3(163): 231-235.

Nath, N. 2012. Comparative Palynotaxonomic Study of Some Species of Scrophulariaceae Acanthaceae, Verbenacea, and Lamiaceae. *Environ. Ecol.*, 30(3A): 821-823.

Parveen, A. and M. Qaiser. 2007. Pollen flora of Pakistan-LIII Verbenaceae. *Pak J. Bot*., 42: 175-191

Sahney, M., S. Rahi, A. Kumar and R. Jaiswal, 2018. Melissopalynological studies on winter honeys from Allahabad, Uttar Pradesh, India. *Palynol.*, 42(4): 540-552.

Saxena M. R. 1993. Pylonology: A treatise. Oxford and IBH Publishing CompanY, 2-5.

Wodehouse R. P. 1928. Phylogenetic value of pollen grain characters. *Ann. Bot*., 42: 891-934.

Zafar, M., M. Ahmad and M. A. Khan. 2007. Palynology of family Asteraceae from Flora of Rawalpindi- Pakistan, *Int. J. Agric. Biol*., 9(1): 156-161.