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Psilate pollen in the arborescent plants of Karimnagar district, Telangana state, India

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Abstract

The present paper deals with the study of psilate pollen in the arborescent taxa of Karimnagar district. The ornamentation is classified as smooth, depression or elevation on the tectum of pollen grains. The smooth walled grains are called as psilate pollen grains. Thirty three taxa viz, *Albiza saman F.Muell. Albizia lebbeck* (L.) *Benth. Albizia amara* (Roxb.) *B.Boivin Acacia chundra* (Roxb. ex Rottler) ,*Alstonia scholaris, Eucalyptus tereticornis* Sm. *Dolichandrone atrovirens* (Roth), *Dalbergia sissoo* Roxb. *Calosanthes indica* (L.) *Blume Callistemon citrinus* (Curtis). *Manilkara zapota* (L.) *Lawsonia alba* L. *Lagerstroemia indica* (L.) Pers. *Jacaranda mimosifolia* D.Don. *Haldina cordifolia* (Roxb.) *Gyrocorphus americanus* Jacq, *Gliricidia maculata* (H. B. K.) *Plumeria alba* L. *Pithecolobium dulce* (Roxb.) *Benth. Phoenix sylvestris* (L.) Roxb., *Pandanus tectorious* Parkinson, *Muntingia calabura* L. *Musa paradisiaca* L.*Mornga oleifera* Lam. *Mimosa farnesiana* (L.) *Tectona grandis* L.f. *Terminalia bellirica* (Gaertn.) Roxb. *Terminalia catappa* L. *Swietenia mahagoni* (L.) Jacq. *Sapindus emarginatus* L. *Psidium guajava* L. and *Prosopis cineraria* (L.) of various pollen taxa have common psilate ornamentation but have diversity in other pollen morphological characters which helps for conformation and identification of taxa.

Key-Words: Psilate ornamentation and Karimnagar district

Introduction

Palynology is the study of pollen and spores. Pollen morphology has diversity in characters hence useful for taxonomy. Exine ornamentation is one of the unique features of Palynology due to variation in ornamentation between different taxa. Palynological studies are not only helpful in solving many taxonomic problems but also useful to know the incidence of pollen which causes pollenosis and also to know the bee forage plants by means of melittopalynological studies. (Chaya P.K .& Varma Y.N.R. 2004. Devender R. Ramakrishna H and Padal S.P. 2014. Ganga Kailas J. Ramakrishna H. and Prabhakar R. 2014. Mamatha K. Ramakrishna H. and Swathi S. 2014. Padal S.P. Ramakrishna H. and Devender R. 2013. Ramakrishna H. and Swathi S. 2013. Reddy A.V.B., Chaya P. and Ramakrishna H. Swathi S. and Ramakrishna H. 2012,2013 and 2014)

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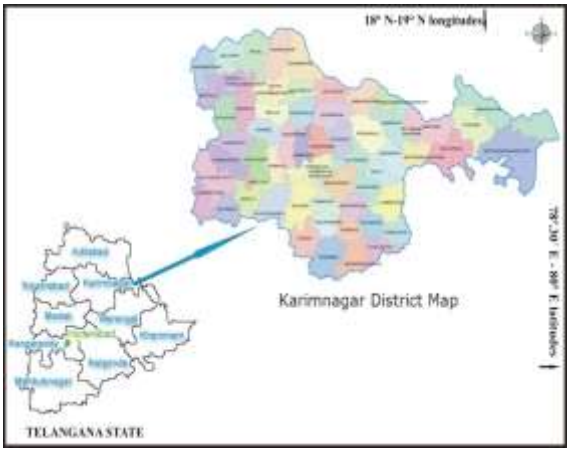
These pollen of arborescent plants of Karimnagar district of Telangana state shows the more diversity in pollen morphology is the interesting aspect to the taxonomists and in particular to the palynologists. These morphological characters viz., symmetry, shape, polarity, apertural pattern and ornamentation, are useful for the further confirmation of identification of taxa recorded from this area.

Material and Methods

The pollen material was collected from Karimnagar district which lies between 18° N to 19° N longitudes and 78º.30´ E to 80° E latitudes and is situated in the Northern part of Telangana state and is surrounded by Adilabad in north, Nizamabad in west, Warangal in south and south west by Medak(Map: 1). The fresh flowers of these taxa were collected from this region and the taxa were identified with relevant literature (Gamble, 1935). The anther materials of these flowers were processed by using Erdtman's (1960) acetolysis technique to recover the pollen.



Observations

1. ***Acacia chundra*** (Roxb. ex Rottler) **Mimosaceae**
Pollen subprolate 16 monads in polyad complex, spheroidal 77-78µm, monads with hemispherical outer and conical inner portions 16-17µm. Exine 1.8µm thick, sexine as thick as nexine. Ornamentation psilate.

2. ***Albizia amara*** (Roxb.) B.Boivin. **Mimosaceae**
Pollen spheroidal, 16-celled polyad with central 8 cells of two superimposed groups of 4 cells each and peripheral 8 cells (4+4+8 condition) 72-74µm. monads 22-22.5µm, Pantoporate. Exine 2-2.5µm thick sexine thicker than nexine. Ornamentation psilate

3. ***Albizia lebbeck*** (L.) Benth. **Mimosaceae**
Pollen spheroidal 16-celled polyad with central 8 cells of two superimposed groups of 4 cells each and peripheral 8 cells (4+4+8 condition) 85-87µm. monads 17-19µm amb of individual cell squarish, triporate pores faint. Exine 1.6µm thick, sexine as thick as nexine. Ornamentation psilate.

4**.** ***Alstonia scholaris*** L. R. Br. **Apocynaceae**
Amb rounded 22-24 µm, isopolar, radially symmetrical, tricolporate, oblate- spheroidal 21-22 µm x22-24 µm, exine 1.5 µm thick, sexine as thick as nexine. Ornamentation psilate.

5. ***Callistemon citrinus*** (Curtis). **Myrtaceae**
Amb triangular 18-20 µm, oblate, tricolporate, colpi linear 8 µm long, 0.6 µm wide, tips acute, exine 2-3 µm thick sexine thicker than nexine. Ornamentation psilate.

6. ***Calosanthes indica*** (L.) Blume **Bignoniaceae**
Amb circular (22-24µm). Radially Symmetrical. Isopolar. Tetracolporate, annulate pores almost round. Spheroidal (22-23 µm in diam). Exine 1-2µm thick sexine as thick as nexine. Ornamentation Psilate.

7. ***Dalbergia sissoo*** Roxb. **Fabaceae**
Amb triangular acute-convex isopolar, radilly symmetrical, prolate, 42-43 µm x 28-30 µm, tricolpate, colpi long 7 µm, tips acute, exine 2-3 µm, sexine thicker than nexine. Ornamentation psilate.

8. ***Dolichandrone atrovirens*** (Roth) **Bignoniaceae**
Amb triangular 19-20 µm, isopolar, radially symmetrical, tricolporate, ora lalongate, spheroidal, 18-20 µm x18-20 µm, exine 1-2 µm, sexine as thick as nexine. Ornamentation psilate.

9. ***Eucalyptus tereticornis*** Sm. **Myrtaceae**
Amb triangular (22-23 µm), radially symmetrical. Isopolar. Tricolporate, syncolporate. Prolate (21-23x13.5-15 µm). Exine 1.5 µm thick sexine as thick as nexine. Ornamentation psilate.

10. ***Ficus mollis*** Vahl. **Moraceae**
Amb circular 14-15 µm, heteropolar, bilaterally symmetrical, diporate, spheroidal, 12-14 µm diam, exine 1 µm thin, sexine as thick as nexine. Ornamentation psilate.

11. ***Ficus religiosa*** L. **Moraceae**
Amb 13-14 µm rounded heteropolar, bilaterally symmetrical, diporate, spheroidal 12- 13 µm x13-14 µm, exine 1-1.5 µm, sexine as thick as nexine. Ornamentation psilate.

12. ***Getonia floribunda*** Roxb., **Combretaceae**
Amb round 60-62 µm, isopolar, radially symmetrical, pollen are tetrahedral tetrads, individual grains 30-33 µm, each pollen is triporate, exine 2 µm thick sexine as thick as nexine. Ornamentation psilate.

13. ***Gliricidia maculata*** (H. B. K.) **Fabaceae**
Amb sub-spheroidal, isopolar, radially symmetrical, oblate-spheroidal 32-33 µm x 26-26 µm, tricolporate colpi long with tapering towards ends, ora lalongate, exine 1.5 µm thick sexine as thick as nexine. Ornamentation psilate.

14. ***Gyrocorphus americanus***Jacq. **Hernandiaceae**
Amb 7-9 µm circular, isopolar, radially symmetrical, inaperturate, spheroidal 8-10 µm x8-10 µm exine 1-1.5 µm sexine as thick as nexine. Ornamentation psialte.

15. ***Haldina cordifolia*** (Roxb.) **Rubiaceae**
Amb triangular 13-14 µm, radially symmetrical, isopolar, Prolate-spheroidal 15-16µm x 13-14 µm, tricolpate, colpi long 5 µm tips acute, exine 1-2 µm thick sexine as thick as nexine. Ornamentation psilate.

16. ***Jacaranda mimosifolia*** D.Don. **Bignoniaceae**
Amb triangular (48-50 µm), radially symmetrical, isopolar, tricolpate colpi long 9 µm tips acute, prolate (45-46 µm x 30-32 µm), exine 3 µm thick, sexine 1 µm thicker than nexine 1 µm. Ornamentation psilate.

17. ***Lagerstroemia india*** (L.) Pers. **Lythraceae**
Amb circualar 27-29 µm, Sub-prolate 30-32 µm x 24-26 µm, radially symmetrical, isopolar, tricolporate, colpi 5 µm long, tips acuminate, ora lolongate, exine 1-2 µm thick sexine thicker than nexine. Ornamentation psilate.

18. ***Lawsonia alba*** L. **Lythraceae**
Amb rounded 15-16 µm, isopolar, radially symmetrical, tricolporate colpi long tips acute tapering towards ends, ora lalongate, prolate 18-20 µm-18-19 µm, exine 1.5 µm sexine as thick as nexine. Ornamentation psilate.

19. ***Manilkara zapota*** (L.) **Saporataceae**
Amb quadrangular, radially symmetrical, isopolar, tetra colporate colpi linear, 10 µm long, 1 µm wide at equator, tips acuminate, ora oblate-elliptic, oblate spheroidal, 4-35 µm x34-35 µm, exine 2-3 µm thick, sexine thicker than nexine. Ornamentation psilate.

20. ***Mimosa farnesiana*** **(L.) Mimosaceae**
Pollen subprolate 16 monads in polyad complex 52-55µm. monads with hemispherical 15µm, outer and conical inner portion, inaperturate. Exine 1.5µm thick sexine as thick as nexine. Ornamentation psilate.

21. ***Moringa oleifera*** Lam. **Moringaceae**
Amb rounded 45-46 µm, isopolar, radially symmetrical, tricolporate, colpi linear tips acute ora lolongate, prolate-spheroidal 47-51 µm x38-43 µm , exine 2 µm thick sexine as thick as nexine. Ornamentation psilate.

22. ***Musa paradisiaca*** L. **Musaceae**
Pollen grains spheroidal, P.V.35 µm in diam, inaperturate. Exine 0.5µm thin, sexine as thick as nexine. Ornamentation psilate.

23. ***Muntingia calabura*** L. **Muntingiaceae**
Amb circular 10-12 µm, isopolar, radially symmetrical, tricolporate, spheroidal 10-12 µm in diam, colpi long 6 µm tips acute sides tapering, ora lalongate, exine 1-2 µm thin, sexine as thick as nexine. Ornamentation psilate.

24. ***Pandanus tectorious*** Parkinson **Pandanaceae**
Amb triangular 28-29 µm, isopolar, radially symmetrical, sub oblate 24-24 µm x28-29 µm, tricolporate, colpi long 11 µm tips acute, ora lalongate, exine 1.5 µm thick sexine as thick as nexine. Ornamentation psilate.

25. ***Phoenix sylvestris*** (L.) Roxb. **Arecaceae**
Amb circular to ellipsoidal in polar view, hetero polar, bilaterally symmetrical, plane convex 21-26 µm x 14-16 µm, monosulcate, sulcus long and narrow, exine 1-2 µm thick sexine as thick as nexine. Ornamentation psilate.

26. ***Pithecolobium dulce*** **(Roxb.) Benth. Mimosaceae**
Pollen spheroidal-subspheroidal, 16 celled polyad with central 8 cells of 2 superimposed groups of 4 cells each and peripheral 8 cells (4+4+8) 75-78µm, monads 18-20µm in diam, inaperturate. Exine 1.2µm, sexine as thick as nexine. Ornamentation psilate.

27. ***Plumeria alba*** L. **Apocynaceae**
Amb triangular 23-24 µm, isopolar radially, symmetrical, tricolporate, colpi long narrowly elliptic, ora lalongate. Subprolate 30-32 µm x 24 µm. Exine 2 µm thick sexine as thick as nexine. Ornamentation psilate.

28. ***Psidium guajava*** L. **Myrtaceae**
Amb Sub-triangular (24-25µm). Radially Symmetrical. Isopolar. Tricolporate colpi long colpi margins thick. Ora lalongate. Oblate (14-16 x 26-28µm). Exine 1.5-2µm thick sexine as thick as nexine. Ornamentation Psilate.

29. ***Sapindus emarginatus*** L. **Sapindaceae**
Amb triangular 16-20 µm, isopolar, radially symmetrical, tricolporate, colpi narrowly elliptic ora lolongate, oblate-spheroidal 15-16 µm x 16-18 µm, exine 2 µm thick sexine as thick as nexine. Ornamentation psilate.

30. ***Swietenia mahagoni*** (L.) Jacq. **Meliaceae**
Amb circular, 30-32 µm, isopolar, radially symmetrical, spheroidal 22-24 µm diam, tetracolporate, colpi 7 µm long, 2 µm wide, tips acute, ora lolongate, exine 1-2 µm thick, sexine as thick as nexine. Ornamentation psilate.

31. ***Tectona grandis*** L.f.**Verbinaceae**
Amb triangular 29-31µm radially symmetrical. Isopolar. Tricolporate colpi elliptic tips acuminate margine thick. Prolate-spheroidal (25.5-27x25-28µm). Exine 2.25µm thick sexine thicker than nexine. Ornamentation psilate.

32. ***Terminalia bellirica*** (Gaertn.) Roxb**Combretaceae**
Amb circular 15-17 µm, isopolar, radially symmetrical, tricolporate colpi alternating with psedocolpi, colpi linear, 12 µm, 1 µm wide, sides tapering gradually to acuminate tips, pseudocolpi almost equal the size of colpi, ora oblate13-14 µm x 25-36 µm, exine 2-2.5 µm, sexine thicker than nexine. Ornamentation psilate.

33. ***Terminalia catappa*** L. **Combretaceae**
Amb triangular 27-28 µm, isopolar, radially symmetrical, tricolporate colpi alternating with pseudocolpi colpi linear 5 µm long, 0.75 µm wide, spheroidal 20-25 µm x 18-24 µm diam, exine 2 µm thick, sexine as thick as nexine. Ornamentation psilate.

In this present study these thirty three taxa have psilate ornamentation but have variation in other pollen morphological characters (Table: 1).

Discussion

These pollen grains of arborescent plants belong to 19 families have various frequencies i.e. 15% in Mimosaceae, 9% in Combretaceae, 9% in Myrtaceae, 9% in Bignoniaceae, 6% in Fabaceae, 6% in Apocynaceae, 6% in Moraceae, Verbinaceae, Sapotaceae, Rubiaceae, Sapindaceae, Pandanaceae,

Muntingiaceae, Musaceae, Moringaceae, Meliaceae and Hernandiaceae.

Though all these palynotaxa have psilate ornamentation but recorded diversity in other pollen morphological characters. The pollen shapes included 22%% as Prolate, 44% as Spheroidal, 10% as Oblate, 9% as Perlate-spheroidal, 3% as Subproalte, (Fig: 3). The prolate pollen grains comprised of *Jacaranda mimosifolia, Dalbergia sissoo, Lagerstroemia india, Ficus religiosa. Musa paradisiaca, Muntingia calabura* and *Eucalyptus tereticornis.* Spheroidal pollen comprised of *Calosanthes indica, Dolichandrone atroviren,Terminalia catappa, Getonia flori bunda, Gyrocorphus americanus, Lawsonia alba, Swietenia mahagoni, Albizia lebbeck, Albizia amara, Acacia chundra, Pithecolobium dulce, Mimosa farnesiana, Ficus mollis* and *Manilkara zapota*. Oblate pollen are of *Psidium guajava, Callistemon citrinus* and *Terminalia bellirica.* While Prolate-spheroidal pollen grains of *Moringa oleifera* and *Tectona grandis.* Sub-prolate pollen are recorded in *Plumeria alba.*

The pollen had 3% as monosulcate, 6% as diporate, 3% as tricolpate, 3% as pantoporate, 38% tricolporate, 16% as inaperturate, 9% as tetracolporate and 3% triporate. (Fig: 2). Monosulate pollen are in *Phoenix sylvestris,* where as diporate pollen are recorded in *Ficus mollis* and *Ficus religiosa.* Tricolpate pollen present in *Eucalyptus tereticornis, Psidium guajava* and *Haldina cordifolia.* While pantoporate pollen are in *Albizia amara. Alstonia scholaris Plumeria alba, Dolichandrone atrovirens, Terminalia bellirica, Gliricidia maculate, Lawsonia alba, Lagerstroemia india, Moringa oleifera, Muntingia calabura, Pandanus tectorious, Sapindus emarginatus* and *Tectona grandis*. Tetracolporate pollen are recorded in *Calosanthes indica, Swietenia mahagoni* and *Manilkara zapota. Getonis floribunda* pollen are triporate. Inaperturate pollen are recorded in *Gyrocorphus americanus, Albizia lebbeck, Albizia amara, Acacia chundra, Pithecolobium dulce, Mimosa* farnesiana and Musa *paradisiaca.* (Fig: 2).

Though these thirty three palynotaxa having diversity of pollen morphological characters but have significantly all these taxa have psilate ornamentation, which is useful for reliable and convincing identification of these taxa.

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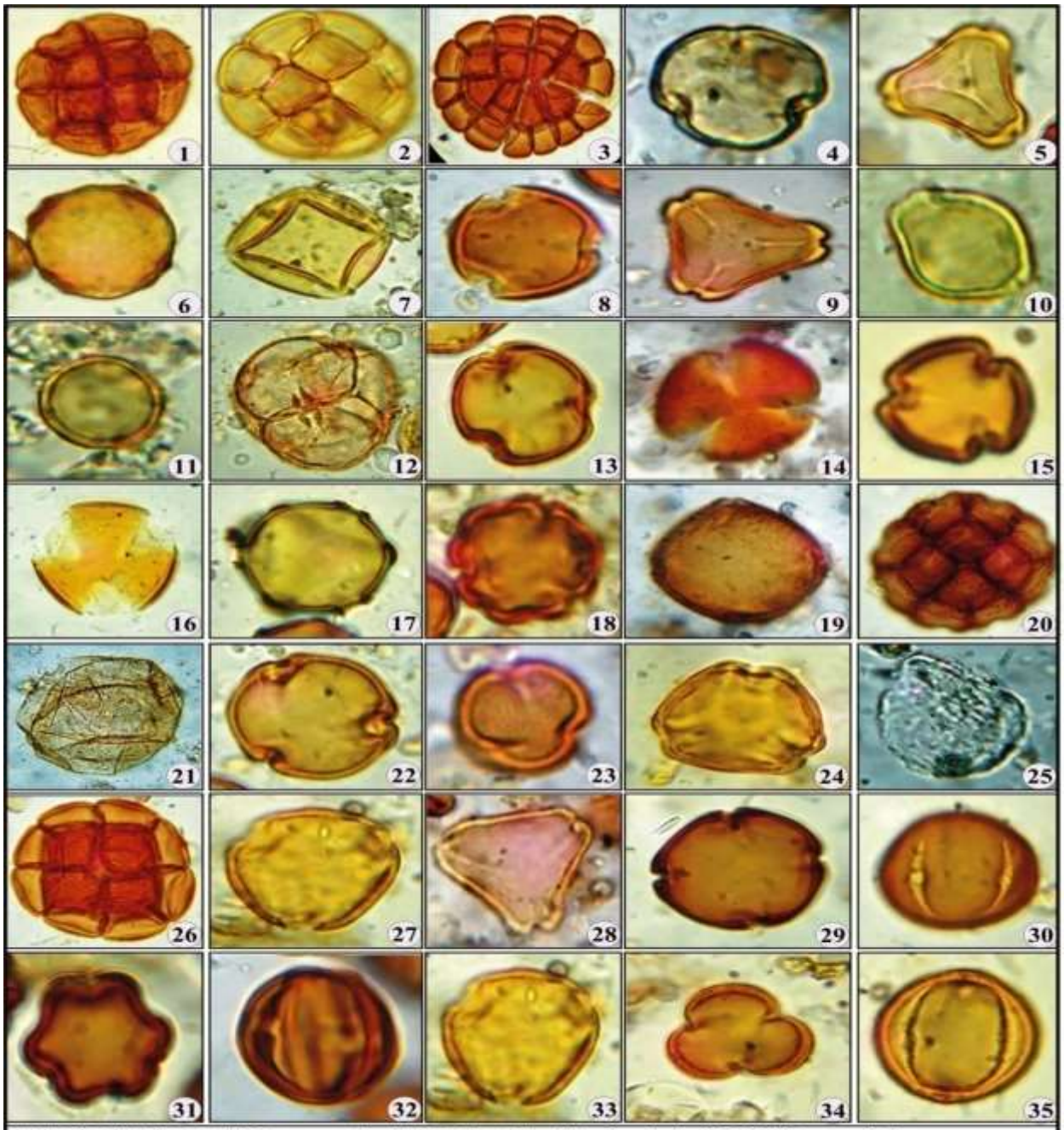
PLATE: 1



1. *Acacia chundra* 2. *Albizia amara* 3. *Albizia lebbeck* 4. *Alstonia scholaris* 5. *Callistemon citrinus* 6. *Calosanthes indica* 7. *Dalbergia sissoo* 8. *Dolichandrone atrovirens* 9. *Eucalyptus tereticornis* 10. *Ficus mollis* 11. *Ficus religiosa* 12. *Getonia floribunda* 13. *Gliricidia maculata* 14. *Gyrocorphus americanus* 15. *Haldina cordifolia* 16. *Jacaranda mimosifolia* 17. *Lagerstroemia india* 18. *Lawsonia alba* 19. *Manilkara zapota* 20. *Mimosa farnesiana* 21. *Moringa oleifera* 22. *Musa paradisiaca* 23. *Muntingia calabura* 24. *Pandanus tectorious* 25. *Phoenix sylvestris* 26. *Pithecolobium dulce* 27. *Plumeria alba* 28. *Psidium guajava* 29. *Swietenia mohagoni* (P.V) 30. *S. Mohagoni* (E.V) 31. *Terminalia bellirica* (P.V), 32. *T. Bellirica* (E.V), 33. *T. Catappa* (P.V), 34. *Tectona grandis* (P.V), 35. *T. Grandis* (E.V)

Table: 1 Morphological characters of the Pollen Taxa

S.no	Family	Scientific Name	Shape	Apertures	Ornamentation
1	Arecaceae	*Phoenix sylvestris*	Plano-convex	Monosulcate	Psilate
2	Apocynaceae	*Alstonia scholaris* *Plumeria alba*	Oblate spheroidal Subprolate	Tricolporate Tricolporate	Psilate Psilate
3	Bignoniaceae	*Calosanthes indica* *Dolichandrone atrovirens* *Jacaranda mimosifolia*	Spheroidal Spheroidal Prolate	Tetracolporate Tricolporate Tricolpate	Psilate Psilate Psilate
4	Combretaceae	*Terminalia bellirica* *Terminalia catappa .* *Getonia flori bunda*	Oblate Spheroidal Spheroidal (Tetrahedral tetrad)	Tricolporate Tricolpate Individual pollen triporate	Psilate Psilate Psilate
5	Fabaceae	*Dalbergia sissoo* *Gliricidia maculata*	Prolate Oblate spheroidal	Tricolpate Tricolporate	Psilate Psilate
6	Hernandiaceae	*Gyrocorphus americanus*	Spheroidal	Inaperturate	Psilate
7	Lythraceae	*Lawsonia alba* *Lagerstroemia india*	Spheroidal Prolate	Tricolporate Tricolporate	Psilate Psilate
8	Meliaceae	*Swietenia mahagoni*	Spheroidal	Tetracolporate	Psilate
9	Mimosaceae	*Albizia lebbeck* *Albizia amara* *Acacia chundra* *Pithecolobium dulce* *Mimosa farnesiana*	Spheroidal Spheroidal Spheroidal Spheroidal Spheroidal	Inaperturate Pantoporate Inaperturate Inaperturate Inaperturate	Psilate Psilate Psilate Psilate Psilate
10	Moringaceae	*Moringa oleifera*	Prolate-spheroidal	Tricolporate	Psilate
11	Moraceae	*Ficus mollis* *Ficus religiosa*	Spheroidal Prolate	Diporate Diporate	Psilate Psilate
12	Musaceae	*Musa paradisiaca*	Prolate	Inaperturate	Psilate
13	Muntingiaceae	*Muntingia calabura*	Prolate	Tricolporate	Psilate
14	Myrtaceae	*Callistemon citrinus* *Eucalyptus tereticornis* *Psidium guajava*	Oblate Prolate Oblate	Tricolporate Tricolpate Tricolpate	Psilate Psilate Psilate
15	Pandanaceae	*Pandanus tectorious*	Sub-oblate	Tricolporate	Psilate
16	Rubiaceae	*Haldina cordifolia*	Prolate-spheroidal	Tricolpate	Psilate
17	Sapindaceae	*Sapindus emarginatus*	Oblate-spheroidal	Tricolporate	Psilate
18	Sapotaceae	*Manilkara zapota*	Spheroidal	Tetracolporate	Psilate
19	Verbinaceae	*Tectona grandis*	Prolate-spheroidal	Tricolporate	Psilate

Fig: 1

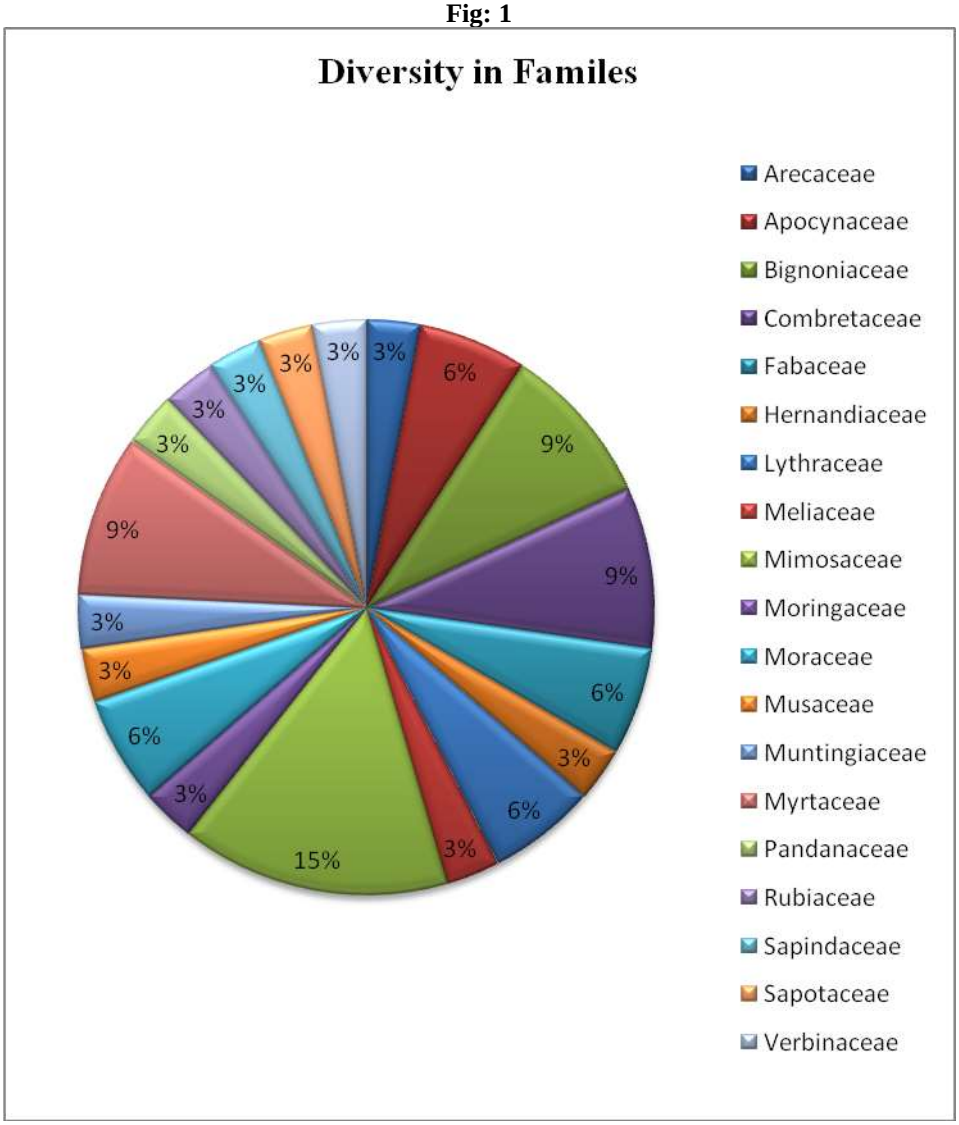

Diversity in Familes
Arecaceae
Apocynaceae
Bignoniaceae
Combretaceae
Fabaceae
Hernandiaceae
Lythraceae
Meliaceae
Mimosaceae
Moringaceae
Moraceae
Musaceae
Muntingiaceae
Myrtaceae
Pandanaceae
Rubiaceae
Sapindaceae
Sapotaceae
Verbinaceae
3%
6%
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Fig: 2

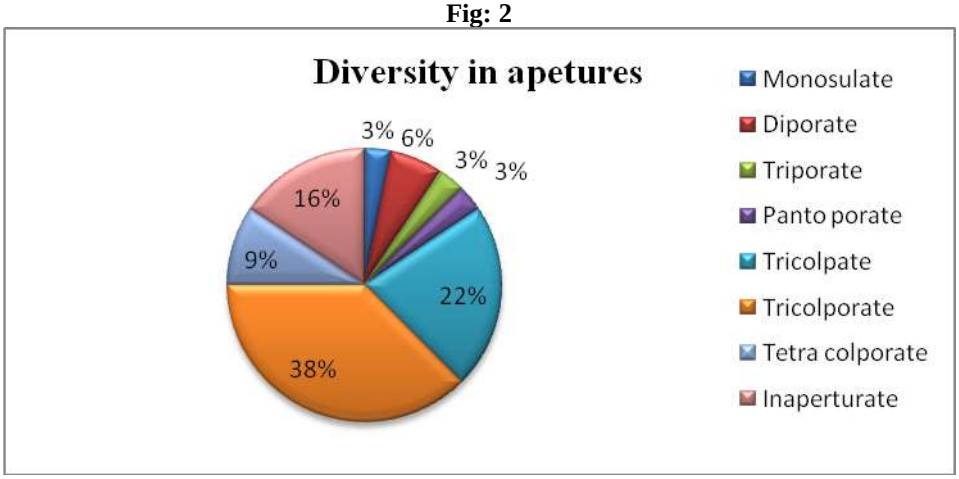
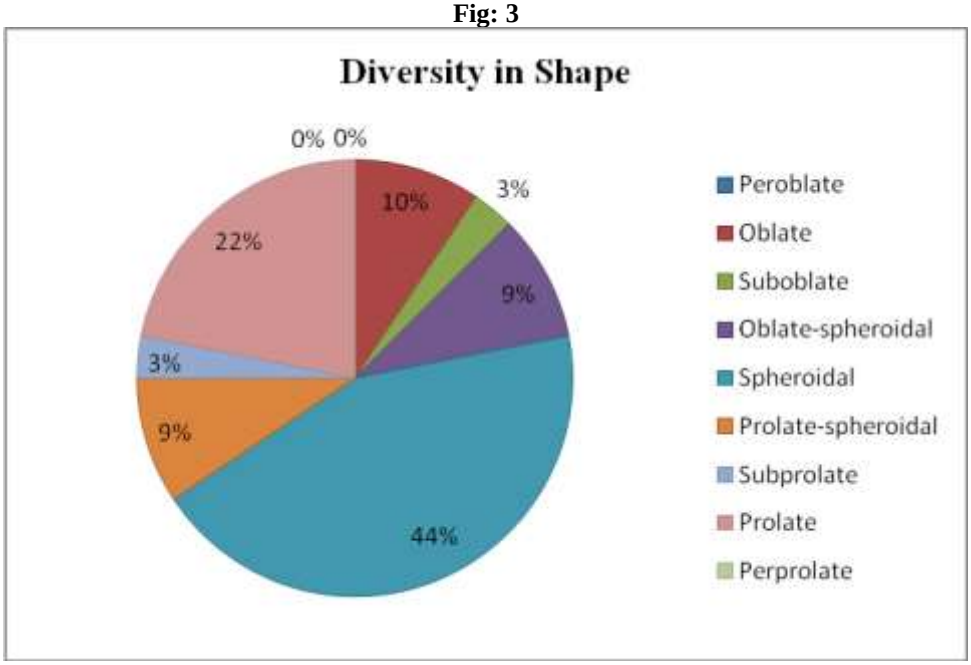

Diversity in apetures
Monosulate
Diporate
Triporate
Panto porate
Tricolpate
Tricolporate
Tetra colporate
Inaperturate
3%
6%
3%
3%
22%
38%
9%
16%

Fig: 3



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