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Palynodiversity in Boath mandal forest division of Adilabad district, Telangana State, India

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Abstract

The present study deals with the study of pollen diversity of fifty four important ethnomedicinal plants of Boath mandal forest division in Adilabad district, Telangana State. These 54 taxa belong to various families viz,. Acanthaceae, Agavaceae, Amaranthaceae, Anacardiaceae, Apiaceae, Apocynaceae, Asclepiadaceae, Asteraceae, Bombacaceae, Brassicaceae, Caesalpiniaceae, Cactaceae, Celastraceae, Cucurbitaceae, Euphorbiaceae, Fabaceae, Hypoxiadaceae, Lythraceae, Malvaceae, Muntingiaceae, Meliaceae, Menispermaceae, Nyctaginaceae, Papavaraceae, Plumbaginaceae, Rubiaceae, Rutaceae, Sapindaceae, Simarubiaceae, Sapotaceae, Typhaceae, Verbenaceae and Zingiberaceae (Gambel 1935). These plants have been used by the inhabitant local tribes for medicinal purpose to cure various ailments. The pollen of these plants have diversity of morphological characters viz,. symmetry, shape, polarity, apertural pattern and sculpture. This diversity may help in identification of various taxa and thus may be useful in taxonomy.

Key-Words: Pollen diversity, Ethnomedicinal plants, Boath mandal, Adilabad district

Introduction

Boath mandal forest division located in Adilabad revenue division of the Adilabad district in Telangana State, with an area of 30,878 ha, is primarily a foreste tract (40% of the total land area) north of river Godavari.(Fig.1) It has dry deciduous forest with diversity in flora of herbs, shrubs and trees used as medicinal plants by inhabitant local tribes of Boath mandal forest division in Adilabad district to cure various ailments.Ethnomedicinal uses of some plants of Boath area were earlier recorded by Venkat Ramana (2008).

Methodology

The present study deals with collection of polleniferous material and identification of diversity in pollen characters and their ethnomedicinal importance of Boath mandal forest division in Adilabad district. The pollen material of these taxa was collected by means of field study and recorded the ethnomedicinal data by interacting with the inhabitant tribes in summer, rainy and winter seasons during 2012-2013 from various localities of Boath mandal forest division of Adilabad district inTelangana State. The polleniferous material was processed and prepared pollen slides by means of Erdtman's (1960) acetolyses technique.

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These pollen slides were studied under trinocular research microscope and recorded the pollen morphological characters (Plate 1). The ethnomedicinal uses of these plants pollen taxa were collected from the inhabitant tribes and local people of the present study localities

Observations

Pollen morphology of these 54 medicinal plants viz., *Adathoda zeylanica, Aloe barbadensis, Achyranthes aspera, Celosia argentea, Aearva lanata, Buchanania lanzan, Mangifera indica, Semicarpus anacardium, Phyllanthus emblica, Holarrhena antidysenterica, Plumeria rubra, Calotropis gigantea, Eclipta alba, Lactuca runcinata, Vicoa indica, Pulicaria wightiana, Bombax ceiba, Brassica nigra, Caesalpinia bonduc, Cassia fistula, Tamarindus indica, Opuntia stricta, Maytenus emarginatus, Momordica charantia, Ricinus communis, Crotalaria verrucosa, Erythrina variegate, Trigonella foenumgraecum, Butea monosperma, Bauhinia purpurea, Acacia farnesiana, Curculigo orchioides, Woodfordia fruticosa, Lawsonia inermis,Abutilon indicum, Gossypium herbaceum, Hibiscus rosasinensis, Muntingia calabura, Azadiracta indica, Tinospora cordifolia, Bougainvilleae spectabilis, Argemone mexicana, Plumbago zeylanica, Ixora arborea, Morinda bracteata, Mitragyna parvifolia, Citrus aurantifolia, Cardiospermum halicacabum, Dodonaea viscose, Madhuca longifolia,*

Ailanthus excelsa, Typha angustata, Vitex negundo, Elattaria cardamomum belong to Acanthaceae, Agavaceae, Amaranthaceae, Anacardiaceae, Apiaceae, Apocynaceae, Asclepiadaceae, Asteraceae, Bombacaceae, Brassicaceae, Caesalpiniaceae, Cactaceae, Celastraceae, Cucurbitaceae, Euphorbiaceae, Fabaceae, Hypoxiadaceae, Lythraceae, Malvaceae, Muntingiaceae, Meliaceae, Menispermaceae, Nyctaginaceae, Papavaraceae, Plumbaginaceae, Rubiaceae, Rutaceae, Sapindaceae, Simarubiaceae, Sapotaceae, Typhaceae, Verbanaceae and Zingiberaceae familes are studied and observed the diversity of pollen morphological characters viz., symmetry, shape, polarity, apertural pattern and sculpture (Table-2). These plants are used by local tribes as medicinal plants to cure various ailments viz,. Asthma, Cough, Chickenpox, Whooping cough, Eye infection, Gonorrhea,Piles, Fistula, Syphilis, Kidney stones, Blisters, Boils, Skin diseases, Cuts, Diarrhoea, Back ache, Head ache, Rheumatic pain, Sores, Ulcers, Sprains, Stomach ache, Earache, Headache, Scorpion sting, Anthelmentic, Joint pains, Liver disorders, Rheumatic pain, Snake bike, Heart attack, Cooling effect, Ring worm etc.(Table-1).

Results and Discussion

These 54 ethnomedicinal plants are not only useful to cure various ailments but also show diversity in pollen morphological characters viz,. symmetry, shape, polarity, apertural pattern and sporoderm.

These palynotaxa have bilateral, radial and irregular symmetry. Bilaterally symmetric palynotaxa include *Adathoda zeylanica, Aloe barbadensis, Buchanania lanzan, Mangifera indica, Semicarpus anacardium, Plumeria rubra, Brassica nigra, Maytenus emarginatus, Momordica charantia, Crotalaria verrucosa, Trigonella foenumgraecum, Curculigo orchioides, Woodfordia fruticosa, Lawsonia inermis, Tinospora cordifolia, Morinda bracteata, Mitragyna parvifolia, Madhuca longifolia, Typha angustata and Vitex negundo,*while radially symmetric palynotaxa are *Achyranthes aspera, Celosia argentea, Aearva lanata, Phyllanthus emblica, Holarrhena antidysenterica, Calotropis gigantea, Eclipta alba, Lactuca runcinata, Vicoa indica, Pulicaria wightiana, Bombax ceiba, Caesalpinia bonduc, Cassia fistula, Tamarindus indica, Opuntia stricta, Ricinus communis, Erythrina variegata, Butea monosperma, Bauhinia purpurea, Abutilon indicum, Gossypium herbaceum, Hibiscus rosasinensis, Muntingia calabura, Azadiracta indica, Bougainvillaea spectabilis, Argemone mexicana, Plumbago zeylanica, Ixora arborea, Citrus aurantifolia, Dodonaea viscosa, Ailanthus excelsa, Elattaria cardamomum* and *Acacia farnesiana. Cardiospermum halicacabum* shows irregular symmetry.radially symmetric grains are dominant over bilaterally symmetric grains show meagre representation (Fig.2).

The shape of pollen includes prolate, spheroidal, sub prolate, prolate spheroidal, oblate spheroidal and sub oblate. The prolate grains are *Adathoda zeylanica, Aloe barbadensis, Buchanania lanzan, Semicarpus anacardium, Crotalaria verrucosa, Trigonella foenumgraecum, Curculigo orchioides, Tinospora cordifolia, Morinda bracteata, Mitragyna parvifolia, Typha angustata and Vitex negundo.* Spheroidal pollen are recorded in *Achyranthes aspera, Celosia argentea, Aearva lanata, Phyllanthus emblica, Eclipta alba, Lactuca runcinata, Butea monosperma, Abutilon indicum, Gossypium herbaceum, Hibiscus rosasinensis,* and *Elattaria cardamomum*. Sub prolate species are seen among *Mangifera indica, Plumeria rubra, Brassica nigra, Maytenus emarginatus, Momordica charantia, Woodfordia fruticosa, Acacia farnesiana, Lawsonia inermis* and *Madhuca longifolia.* Prolate spheroidal pollen character exhibited in *Holarrhena antidysenterica,Vicoa indica, Caesalpinia bonduc, Cassia fistula, Ricinus communis, Erythrina variegata, Bauhinia purpurea, Muntingia calabura, Azadiracta indica, Argemone mexicana, Plumbago zeylanica, Citrus aurantifolia* and *Dodonaea viscosa.* Oblate spheroidal pollen are *Calotropis gigantea, Pulicaria wightiana, Tamarindus indica, Bougainvilleae spectabilis, Ixora arborea,Cardiospermum halicacabum* and *Ailanthus excelsa. Bombax ceiba* and *Opuntia stricta* have suboblate condition. The polarity is either hetero or isopolar. Except *Acacia farnesiana, Cardiospermum halicacabum, Typha angustata* and *Vitex negundo* the remaining genera show isopolar.

The pollen grains had Monosulcate, Monocolpate, Dizonocolporate, Triporate, Tricolpate,Tricolporate,Trizonocolpate,Trizonocolporate,Tetracolporate,Tetrazonocolporate,Pentacolporate, Stephanocolporate, Inaperturate, Polyporate and Pollinia. *Aloe barbadensis* and *Typha angustata* are monosulcate pollen grains. whereas monocolpate grain is *Curculigo orchioides,* dizonocolporate grain is *Adathoda zeylanica* and inaperturate grains are *Elattaria cardamomum* and *Acacia farnesiana. Holarrhena antidysenterica* and *Erythrina variegata* are triporate pollen grains. *Bougainvillaea spectabilis, Argemone mexicana, Plumbago zeylanica* and *Cardiospermum halicacabum* are tricolpate pollen grains. *Buchanania lanzan, Mangifera indica, Semicarpus anacardium, Plumeria rubra, Eclipta alba, Vicoa indica, Pulicaria wightiana, Bombax ceiba, Caesalpinia bonduc, Cassia fistula, Tamarindus*

indica, Maytenus emarginatus, Momordica charantia, Ricinus communis, Crotalaria verrucosa, Trigonella foenumgraecum, Butea monosperma, Bauhinia purpurea, Woodfordia fruticosa, Abutilon indicum, Muntingia calabura, Tinospora cordifolia, Ixora arborea, Morinda bracteata, Mitragyna parvifolia,Dodonaea viscosa and *Ailanthus excelsa* are having tricolporate pollen grains.where as trizonocolpate pollen grains present in *Brassica nigra, Vitex negundo* and *Lawsonia inermis* is trizonocolporate pollen grain. *Citrus aurantifolia* is tetracolporate pollen grain and tetrazonocolporate pollen grain is *Azadiracta indica*. Whereas pentacolporate pollen grain is *Phyllanthus emblica* and *Madhuca longifolia* is stephanocolporate pollen grain. *Opuntia stricta ,Achyranthes aspera, Celosia argentia, Aearva lanata, Lactuca runcinata, Gossypium herbaceum* and *Hibiscus rosasinensis* are polyporate. Pollinia are recorded in *Calotropis gigantea.*Tricolporate grains are more than 25% and occupied the dominant position when compared to other apertural grains (Fig.3).

In these pollen grains the sculptur of the pollen varies i.e. reticulate, scabrate, microreticulate, perforate, psilate, obscure, echinate, striate, foveolate, faintly reticulate, granular, verrucate, faintly granular and faintly perforate. *Achyranthes aspera*, *Celosia argentea* and *Aearva lanata* show scabrate. *Phyllanthus emblica*, *Curculigo orchioides, Lawsonia inermis, Tinospora cordifolia, Dodonaea viscosa, Ailanthus excelsa* and *Vitex negundo* show microreticulate. *Holarrhena antidysenterica* has perforate and *Acacia farnesiana, Plumeria rubra, Muntingia calabura, Azadiracta indica* and *Ixora arborea* have psilate. *Calotropis gigantea* has obscure. Whereas *Eclipta alba, Lactuca runcinata, Vicoa indica, Pulicaria wightiana, Abutilon indicum* and *Hibiscus rosasinensis* have echinate. *Tamarindus indica* and *Bauhinia purpurea* show striate. *Opuntia stricta* has foveolate. *Ricinus communis, Mitragyna parvifolia* shows faintly reticulate. *Madhuca longifolia* has faintly granular and *Plumbago zeylanica* has verrucate. *Elattaria cardamomum* is faintly perforate. The remaining genera show reticulate. The sculpture of pollen signifie the dominance of reticulate pattern in all the recorded grains of Boath mandal (Fig.4).

These ethnomedicinally important plants viz,. *Brassica nigra, Abutilon indicum, Ricinus communis, Tinospora cardifolia, Tamarindus indica, Bombax ceiba, Madhuca longifolia, Cardiospermum halicacabum* and *Celosia argentea* recorded from Boath mandal were already recorded as bee forage plants from Adilabad district (Swathi and Ramakrishna.2012, Ramakrishna and Swathi.2013, Swathi and Ramakrishna.2013).

Hence the Boath mandal forest division is not only ethnomedicinal recognised locality but also a prime area for honey production by means apiary.

Conclusion

The 54 ethnomedicinal plants recorded from the Boath mandal of Adilabad district are useful to cure various ailments and these have been used by the local tribes for the past somany years. These taxa are having diversity is useful for the further confirmation of taxa i.e.athentic identification of plants recorded from the study area.

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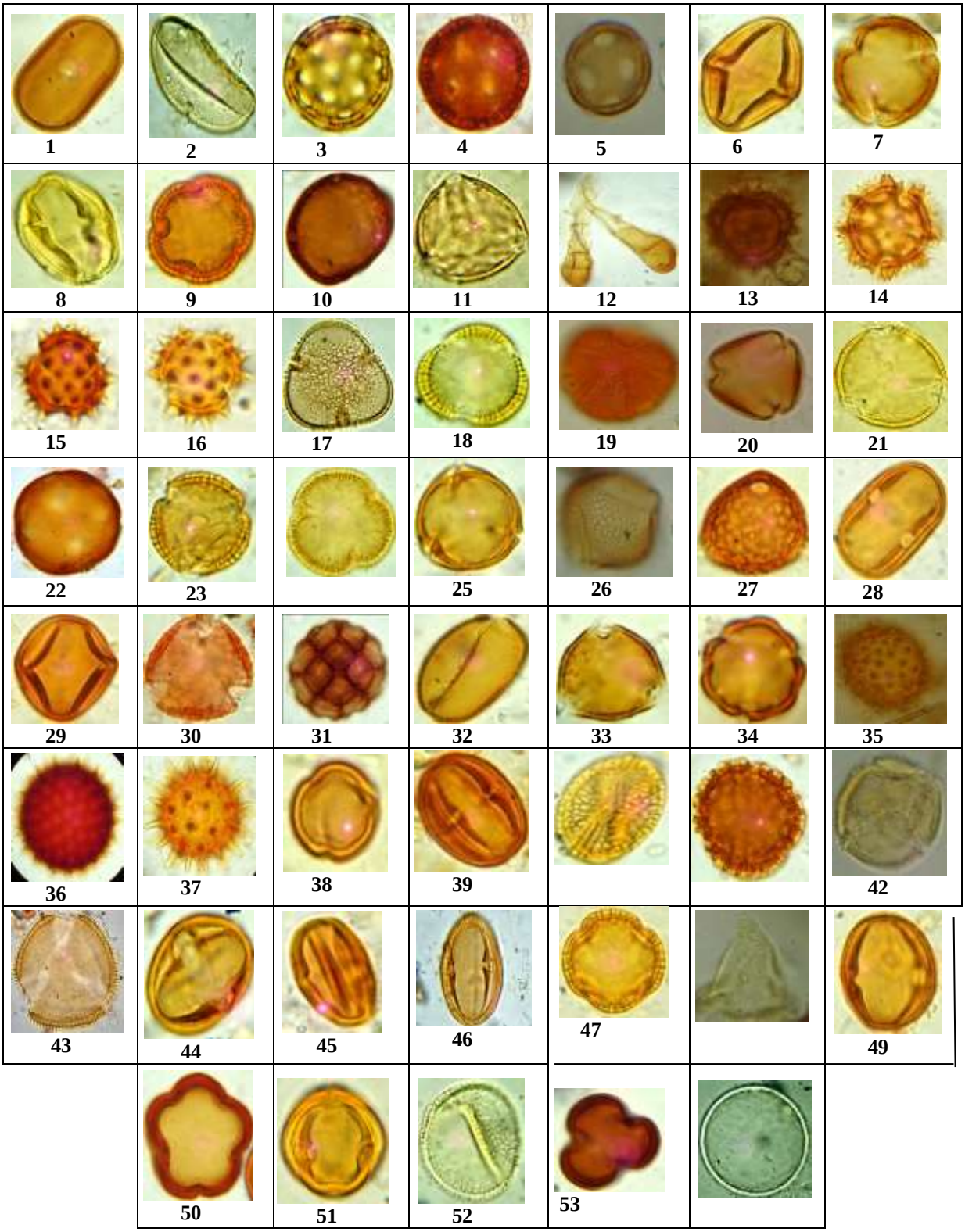
Ethnomedicinal plants Pollen grains (Plate -1)



Explanation of Plate – 1 :(All figures 500x)

1. *Adathoda zeylanica* **2.** *Aloe barbadensis* **3.** *Achyranthes aspera*
4. *Celosia argentea* **5**. *Aearva lanata* **6.** *Buchanania lanzan*
7. *Mangifera indica* **8.** *Semicarpus anacardium* **9**. *Phyllanthus emblica*
10. *Holarrhena antidysenterica* **11**. *Plumeria rubra* **12.** *Calotropis gigantea*
13. *Eclipta alba* **14**. *Lactuca runcinata* **15.** *Vicoa indica*
16. *Pulicaria wightiana* **17.** *Bombax ceiba* **18.** *Brassica nigra*
19. *Caesalpinia bonduc* **20**. *Cassia fistula* **21**. *Tamarindus indica*
22. *Opuntia stricta* **23**. *Maytenus emarginatus* **24**. *Momordica charantia*
25. *Ricinus communis* **26.** *Crotalaria verrucosa* **27.** *Erythrina variegata*
28. *Trigonella foenumgraecum* **29.** *Butea monosperma* **30**. *Bauhinia purpurea*
31. *Acacia farnesiana* **32.** *Curculigo orchioides* **33.** *Woodfordia fruticosa*
34. *Lawsonia inermis* **35**. *Abutilon indicum* **36**. *Gossypium herbaceum*
37. *Hibiscus rosasinensis* **38.** *Muntingia calabura* **39.**.*Azadiracta indica*
40. *Tinospora cordifolia* **41**. *Bougainvilleae spectabilis* **42.** *Argemone mexicana*
43. *Plumbago zeylanica* **44.** *Ixora arborea* **45.** *Morinda bracteata*
46. *Mitragyna parvifolia* **47.** *Citrus aurantifolia* **48.** *Cardiospermum halicacabum*
49. *Dodonaea viscose* **50.** *Madhuca longifolia* **51.** *Ailanthus excelsa*
52. *Typha angustata* **53.** *Vitex negundo* **54.** *Elattaria cardamomum*

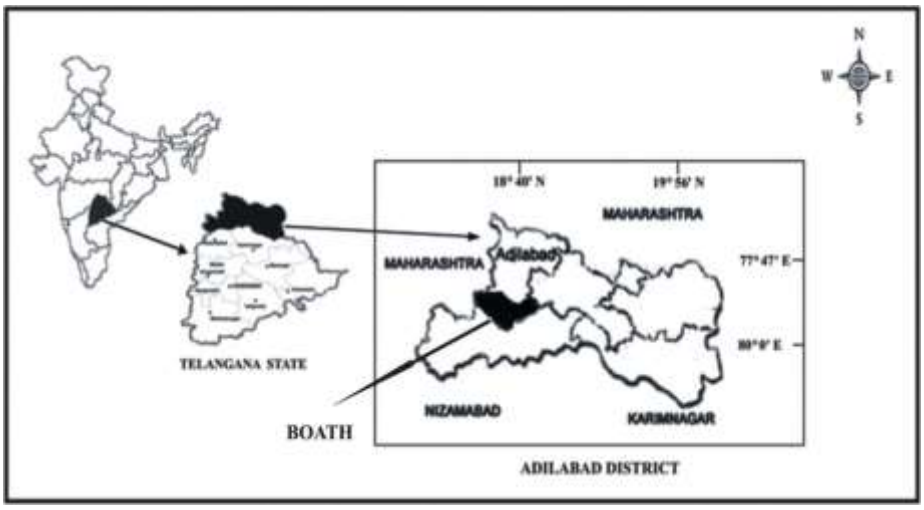


Fig. 1: Map showing location of Study area

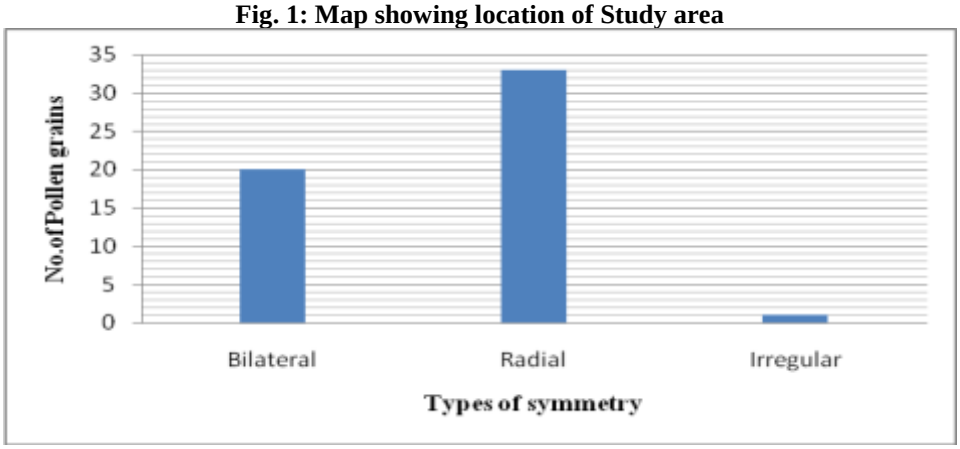


Fig.: 2: Diversity in Symmetry

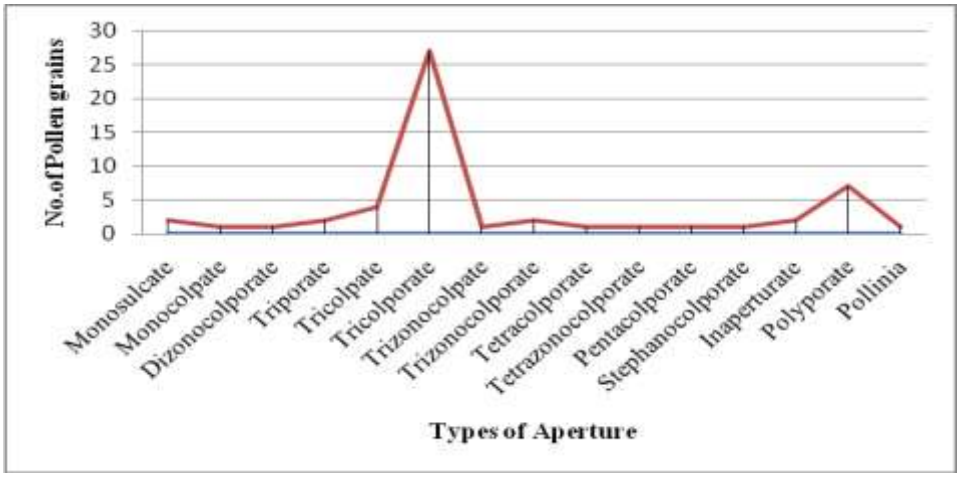


Fig. 3: Diversity in Aperture

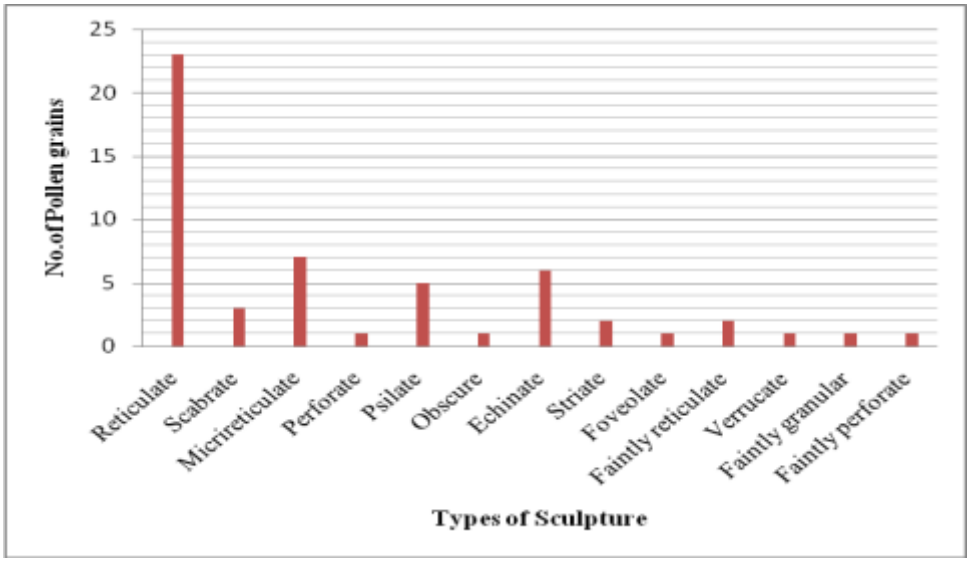


Fig.4: Diversity in Sculpture

Table 1: List of plants used for various diseases

S/No.	Name of the taxa	Part of used	Diseases
1	*Adathoda zeylanica* Medic.inHist&comm.	Leaf, Flower	Asthma, Cough, Gonorrhea, Chickenpox, Whooping cough
2	*Aloe barbadensis* Mill.	Leaves	Eye infection, Gonorrhea, Head ache, Piles, Fistula, Syphilis
3	*Achyranthes aspera* L.	Whole plant, Leaves, Root	Body swelling, Foot mouth, Obesity, Tooth infection
4	*Celosia argentea* L.	Whole plant, Leaf	Dysentery, Tooth ache
5	*Aearva lanata*, Juss.	Whole plant	Kidney stones
6	*Buchanania lanzan* Spreng.	Leaves, Gum	Blisters, Boils, Skin diseases, Cuts, Diarrhea
7	*Mangifera indica* L.	Gum, Flower, Stem	Cold, Cough, Cuts, Wounds, Diarrhea, Dysentery, Menorrhagia
8	*Semicarpus anacardium* L.f.	Seed, Gum, Stem	Back ache, Head ache, Rheumatic pain, Sores, Ulcers, Sprains, Stomach ache, Syphilis
9	*Phyllanthus emblica* L.	Fruit, Stem	Anemia, Asthma, Bone fracture, Dandruff, Dyspepsia, Scurvy, Cold, Cough
10	*Holarrhena antidysenterica*	Stem, Seed, Root	Cough, Dysentery, Tooth ache

	Roxb.Wall.ex A.Dc.		
11	*Plumeria rubra* Linn.	Latex, Root, Leaves	Skin diseases, Gonorrhea, Purgative, Scabies
12	*Calotropis gigantea* (L) R.Br.	Leaves, Latex, Root	Arthritis, Cuts, Wounds, Purgative, Stomach ache
13	*Eclipta alba*(L) Hassk.	Leaves	Dandruff
14	*Lactuca runcinata* Dc.in wt.Contrib.	Whole plant, leaves	Diuretic, Asthma
15	*Vicoa indica* Dc.	Leaves, Root, Seed	Asthma, Earache, Headache, Scorpion sting
16	*Pulicaria wightiana* CB.Clarke.	Leaves	Fever, Rheumatism
17	*Bombax ceiba* Linn.	Seed	Body swellings
18	*Brassica nigra* (L.) Koch	Seed	Skin diseases, Bruises, Rheumatic pain
19	*Caesalpinia bonduc* Linn.Roxb.	Stem bark	Fertility in woman
20	*Cassia fistula* L.	Flowers	Kidney stones
21	*Tamarindus indica* L.	Fruit	Scorpion sting
22	*Opuntia stricta* (Haw.) Haw.	Stem, Fruit	Asthma, Contraceptive, Whooping cough
23	*Maytenus emarginatus*(Wiild.) Ding Hau.	Leaves, Stem	Body swelling, Lice killing, Rheumatic pain, Sores, Ulcers
24	*Momordica charantia* L.	Seed, Fruit	Anthelmentic, Joint pains, Liver disorders, Rheumatic pain,
25	*Ricinus communis* L.	Root, Leaves, Seed	Fever, Head ache, Purgative, Rheumatic pain, Sunstroke
26	*Crotalaria verrucosa* L.	Root	Snake bike
27	*Erythrina variegate* Linn.	Leaves	Immunity, Cough
28	*Trigonella foenumgraecum* L.	Seed	Eczema
29	*Buteamonosperma*(Lamk.) Taub.	Seed	Ring worms
30	*Bauhinia purpurea* Linn.	Bark, Flower	Dysentery, Piles, Fistula
31	*Acacia farnesiana* Willd.	Leaves	Dogbite
32	*Curculigo orchioides* Gaertn.	Rhizome	Asthma,Body swelling, Skin disease, Inflammation, Jaundices,Piles
33	*Woodfordia fruticosa* (L) Kurz.	Leaves, Flower	Diarrhea, Rheumatic pain
34	*Lawsonia inermis* L.	Leaves, Stem	Alopecia, Burns, Dandruff, Head ache, Psoriasis ,Small pox
35	*Abutilon indicum* G.Don.	Stem, Root, Leaves	Diuretic, Dysentery, Tooth ache
36	*Gossypium herbaceum* L.	Root	Snake bite
37	*Hibiscus rosasinensis* L.	Leaves	Alopecia
38	*Muntingia calabura* L.	Flowers	Antiseptic
39	*Azadiracta indica* A.Juss.	Seed, Leaves, Root, Stem	Reduced heat, Anthelmentic, Eczema, Malaria, Ring worm, Scabies
40	*Tinospora cordifolia* (Willd.) Hook.fet.Thoms.	Leaves, Fruit, Tubers root	Blood pressure, Cough, Diabetes, Fever, Leucoderma, Scorpion sting, Snake bite, Stomach ache
41	*Bougainvilleae spectabilis*Willd.	Leaves	Diabetes
42	*Argemone mexicana* Linn.	Leaves	Boils
43	*Plumbago zeylanica* L.	Root, Leaves	Abortion, Rheumatic pain, Chest pain
44	*Ixora arborea* Roxb.ex Smith	Root, Leaf	Urinary Disorders, Dysentery
45	*Morinda bracteata* Roxb.	Fruit	Tuberculosis, Indigestion, Throat problems
46	*Mitragyna parvifolia* Korth.	Root, Leaves, Fruit	Diabetes, Dropsy, Eye infection, Stomach pain
47	*Citrus aurantifolia* (Christm.) Swingle in Joum	Root, Fruit, Stem	Fertility in woman, Joint pains, Tuberculosis
48	*Cardiospermum halicacabum* L.	Leaves, Dry roots	Heart attack, Cooling effect, Ring worm
49	*Dodonaea viscose* L.	Leaves	Body swellings, Bone fracture, Cuts, Wounds
50	*Madhuca longifolia* (Koen.) Macbr.	Stem, Seed	Abdominal pain, Male reproductive disorders, Galactagogue, Rheumatic pains
51	*Ailanthus excelsa* Roxb.	Stem bark, Leaves	Antiseptic,Asthma, Bronchitis, Constipation, Dysentery, leucorrhoea

52	*Typha angustata* B & Ch.	Root	Anthelmentic, Diabetes
53	*Vitex negunda* L.	Leaves	Arthritis, Asthma, Bruises, Head ache
54	*Elattaria cardamomum* Maton.	Seed, Fruit	Throat problems, Vomiting, Asthma, Cough, Diuretic

Table 2:.Morphological characters of the plants pollen taxa

S/No.	Taxa name	Family	Symmetry	Shape	Polarity	Aperture	Sculpture
1	*Adathoda zeylanica*	Acanthaceae	Bilateral	Prolate	Isopolar	Dizono colporate	Reticulate
2	*Aloe barbadensis*	Agavaceae	Bilateral	Prolate	Isopolar	Monosulcate	Reticulate
3	*Achyranthes aspera*	Amaranthaceae	Radial	Spheroidal	Isopolar	Pantoporate	Scabrate
4	*Celosia argentea*	Amaranthaceae	Radial	Spheroidal	Isopolar	Pantoporate	Scabrate
5	*Aearva lanata*	Amaranthaceae	Radial	Spheroidal	Isopolar	Pantoporate	Scabrate
6	*Buchanania lanzan*	Anacardiaceae	Bilateral	Prolate	Isopolar	Tricolporate	Reticulate
7	*Mangifera indica*	Anacardiaceae	Bilateral	Subprolate	Isopolar	Tricolporate	Reticulate
8	*Semicarpus anacardium*	Anacardiaceae	Bilateral	Prolate	Isopolar	Tricolporate	Reticulate
9	*Phyllanthus emblica*	Apiaceae	Radial	Spheroidal	Isopolar	Penta colporate	Microreticulate
10	*Holarrhena antidysenterica*	Apocynaceae	Radial	Prolate spheroidal	Isopolar	Triporate	Perforate
11	*Plumeria rubra*	Apocynaceae	Bilateral	Subprolate	Isopolar	Tricolporate	Psilate
12	*Calotropis gigantea*	Asclepiadaceae	Radial	Oblate spheroidal	Isopolar	Pollinia	Obscure
13	*Eclipta alba*	Asteraceae	Radial	Spheroidal	Isopolar	Tricolporate	Echinate
14	*Lactuca runcinata*	Asteraceae	Radial	Spheroidal	Isopolar	Pantoporate	Echinate
15	*Vicoa indica*	Asteraceae	Radial	Prolate spheroidal	Isopolar	Tricolporate	Echinate
16	*Pulicaria wightiana*	Asteraceae	Radial	Oblate spheroidal	Isopolar	Tricolporate	Echinate
17	*Bombax ceiba*	Bombacaceae	Radial	Suboblate	Isopolar	Tricolporate	Reticulate
18	*Brassica nigra*	Brasicaceae	Bilateral	Subprolate	Isopolar	Trizono colporate	Reticulate
19	*Caesalpinia bonduc*	Caesalpiniaceae	Radial	Prolate spheroidal	Isopolar	Tricolporate	Reticulate
20	*Cassia fistula*	Caesalpiniaceae	Radial	Prolate spheroidal	Isopolar	Tricolporate	Reticulate
21	*Tamarindus indica*	Caesalpiniaceae	Radial	Oblate spheroidal	Isopolar	Tricolporate	Striate
22	*Opuntia stricta*	Cactaceae	Radial	Suboblate	Isopolar	Hexaporate	Foveolate
23	*Maytenus emarginatus*	Celastraceae	Bilateral	Subprolate	Isopolar	Tricolporate	Reticulate
24	*Momordica charantia*	Cucurbitaceae	Bilateral	Subprolate	Isopolar	Tricolporate	Reticulate
25	*Ricinus communis*	Euphorbiaceae	Radial	Prolate spheroidal	Isopolar	Tricolporate	Faintly reticulate
26	*Crotalaria verrucosa*	Fabaceae	Bilateral	Prolate	Isopolar	Tricolporate	Reticulate
27	*Erythrina variegata*	Fabaceae	Radial	Prolate spheroidal	Isopolar	Triporate	Reticulate
28	*Trigonella foenumgraecum*	Fabaceae	Bilateral	Prolate	Isopolar	Tricolporate	Reticulate
29	*Butea monosperma*	Fabaceae	Radial	Spheroidal	Isopolar	Tricolporate	Reticulate
30	*Bauhinia purpurea*	Fabaceae	Radial	Prolate spheroidal	Isopolar	Tricolporate	Striate
31	*Acacia farnesiana*	Fabaceae	Radial	Subprolate	Hetero polar	Inaperturate	Psilate

32	*Curculigo orchioides*	Hypoxidaceae	Bilateral	Prolate	Isopolar	Monocolpate	Microreticulate
33	*Woodfordia fruticosa*	Lythraceae	Bilateral	Subprolate	Isopolar	Tricolporate	Reticulate
34	*Lawsonia inermis*	Lythraceae	Bilateral	Subprolate	Isopolar	Trizono colporate	Microreticulate
35	*Abutilon indicum*	Malvaceae	Radial	Spheroidal	Isopolar	Tricolporate	Echinate
36	*Gossypium herbaceum*	Malvaceae	Radial	Spheroidal	Isopolar	Pantoporate	Reticulate
37	*Hibiscus rosasinensis*	Malvaceae	Radial	Spheroidal	Isopolar	Pantoporate	Echinate
38	*Muntingia calabura*	Muntingiaceae	Radial	Prolate spheroidal	Isopolar	Tricolporate	Psilate
39	*Azadiracta indica*	Meliaceae	Radial	Prolate spheroidal	Isopolar	Tetrazono colporate	Psilate
40	*Tinospora cordifolia*	Menispermacea e	Bilateral	Prolate	Isopolar	Tricolporate	Microreticulate
41	*Bougainvilleae spectabilis*	Nyctaginaceae	Radial	Oblate spheroidal	Isopolar	Tricolpate	Reticulate
42	*Argemone mexicana*	Papavaraceae	Radial	Prolate spheroidal	Isopolar	Tricolpate	Reticulate
43	*Plumbago zeylanica*	Plumbaginaceae	Radial	Prolate spheroidal	Isopolar	Tricolpate	Verrucate
44	*Ixora arborea*	Rubiaceae	Radial	Oblate spheroidal	Isopolar	Tricolporate	Psilate
45	*Morinda bracteata*	Rubiaceae	Bilateral	Prolate	Isopolar	Tricolporate	Reticulate
46	*Mitragyna parvifolia*	Rubiaceae	Bilateral	Prolate	Isopolar	Tricolporate	Faintlyreticulate
47	*Citrus aurantifolia*	Rutaceae	Radial	Prolate spheroidal	Isopolar	Tetra colporate	Reticulate
48	*Cardiospermum halicacabum*	Sapindaceae	Irregular	Oblate spheroidal	Hetero polar	Tricolpate	Reticulate
49	*Dodonaea viscosa*	Sapindaceae	Radial	Prolate spheroidal	Isopolar	Tricolporate	Microreticulate
50	*Madhuca longifolia*	Sapotaceae	Bilateral	Subprolate	Isopolar	Stephano colporate	Faintly granular
51	*Ailanthus excelsa*	Simarubiaceae	Radial	Oblate spheroidal	Isopolar	Tricolporate	Micro reticulate
52	*Typha angustata*	Typhaceae	Bilateral	Prolate	Hetero polar	Monosulcate	Reticulate
53	*Vitex negundo*	Verbaceae	Bilateral	Prolate	Hetero polar	Trizono colpate	Microreticulate
54	*Elattaria cardamomum*	Zingiberaceae	Radial	Spheroidal	Isopolar	Inaperturate	Faintlyperforate

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