

**POLLENDIVERSITY OF ETHNOMEDICINAL PLANTS OF NIRMAL
FOREST DIVISION IN ADILABAD DISTRICT, TELANGANA STATE,
INDIA.**

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ABSTRACT

The present study deals with the study of pollen diversity in forty one important ethnomedicinal plants viz., *Alangium salvifolium*, *Aerva lanata*, *Catharanthus roseus*, *Nerium oleander*, *Plumeria alba*, *Aristolochia bractiolata*, *Phoenix sylvestris*, *Decalepis hamiltonii*, *Sphaeranthus indicus*, *Tridax procumbens*, *Dolichandrone atrovirens*, *Bauhinia racemosa*, *Cassia alata*, *Delonix regia*, *Carica papaya*, *Celastrus paniculata*, *Cleome gynandra*, *Terminalia arjuna*, *Evolvulus alsinoides*, *Jatropha curcus*, *Jatropha multifida*, *Abrus precatorius*, *Pongamia pinnata*, *Tephrosia villosa*, *Leucas indica*, *Plectranthus barbatus*, *Tinospora cordifolia*, *Pithecolobium dulce*, *Moringa oleifera*, *Musa paradisiaca*, *Syzygium cumini*, *Boerhaavia diffusa*, *Zizyphus mauritiana*, *Murraya konigii*, *Sapindus emarginatus*, *Manilkara zapota*, *Datura metel*, *Physalis minima*, *Eriolaena hookeriana*, *Sterculia urens*

and *Tectona grandis* of Nirmal forest division of Adilabad district in Telangana State. These plants have been used by the inhabitant 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 authentic identification of various taxa and thus may be useful in taxonomy.

KEY WORDS: Pollen diversity, Ethnomedicinal plants, Nirmal forest division, Adilabad district.

INTRODUCTION

The Nirmal division is situated in between 77° 58¹ of the eastern longitudes and 18° 48¹ and 19° 24¹ of northern latitudes and is bounded on north by Adilabad and Uttnoor divisions. The south by Karimnagar and Nizamabad districts and the west by Nanded district of Maharashtra state (Fig.1). The forest of this district falls under tropical dry deciduous and tropical thorn forest type. Lambada, Gonds and Naikapods are major tribes of this region and traditional practices for curing ailments by using the local plants are practiced by all these communities. Data on ethnomedicinal plants were collected through frequent interviews with tribes. Ethnomedicinal uses of some plants of Nirmal revenue division area were earlier recorded by Madhu and Suvartha (2009).

METHODOLOGY

The present study deals with the collection of polleniferous material of ethnomedicinal important plants of Nirmal forest division in Adilabad district and identified the diversity in pollen characters. The major tribes of this locality viz., Lambada, Gonds and Naikapods are using these plants to cure various ailments. 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 Nirmal forest division of Adilabad district in Telangana State. The polleniferous material was processed and prepared pollen slides by means of Erdtman's (1960) acetolyses technique. These pollen slides were studied under trinocular research microscope and recorded the pollen morphological characters (Plate -1). The ethnomedicinal uses of these taxa were collected from the inhabitant tribes and local people.

OBSERVATION

Pollen morphology of these 41 medicinal plants viz., *Alangium salvifolium*, *Aerva lanata*, *Catharanthus roseus*, *Nerium oleander*, *Plumeria alba*, *Aristolochia bractiolata*, *Phoenix sylvestris*, *Decalepis hamiltonii*, *Sphaeranthus indicus*, *Tridax procumbens*, *Dolichandrone atrovirens*, *Bauhinia racemosa*, *Cassia alata*, *Delonix regia*, *Carica papaya*, *Celastrus paniculata*, *Cleome gynandra*, *Terminalia arjuna*, *Evolvulus alsinoides*, *Jatropha curcus*, *Jatropha multifida*, *Abrus precatorius*, *Pongamia pinnata*, *Tephrosia villosa*, *Leucas indica*, *Plectranthus barbatus*, *Tinospora cordifolia*, *Pithecolobium dulce*, *Moringa oleifera*, *Musa paradisiaca*, *Syzygium cumini*, *Boerhaavia diffusa*, *Zizyphus mauritiana*, *Murraya konigii*, *Sapindus emarginatus*, *Manilkara zapota*, *Datura metel*, *Physalis minima*, *Eriolaena*

hookeriana, Sterculia urens and Tectona grandis belong to Alangiaceae, Amaranthaceae, Apocynaceae, Aristolochiaceae, Aricaceae, Asclepidaceae, Asteraceae, Bignoniaceae, Caesalpiniaceae, Caricaceae, Celastraceae, Cleomaceae, Combritaceae, Convolvulaceae, Euphorbiaceae, Fabaceae, Lamiaceae, Menispermaceae, Mimosaceae, Moringaceae, Musaceae, Myrtaceae, Nyctaginaceae, Rhamnaceae, Rutaceae, Sapindaceae, Sapotaceae, Solanaceae, Sterculiaceae and Verbenaceae families (Gamble 1935) were studied and observed the diversity of pollen morphological characters viz., symmetry, shape, polarity, apertural pattern and sculpture (Table-2). Leaves, Root, Root bark, Fruits, Stem bark, Flower, Latex, Seed, Tubers, Arils, Stem, Rhizome, Gum, Wood powder, Whole plant etc. of these medicinal plants are used by the local tribes viz., Lambada, Gonds and Naikapods etc. to cure Anthelmentic, Skin diseases, Cough, Fever, Purgative, Kidney stones, Blood pressure, Diabetes, Leucoderma, Asthma, Tuberculosis, Whooping cough, Skin diseases, Eczema, Cooling effect, Nervous weakness, Tooth ache, Ear problems, Poisoning, Fertility, Head ache, Cuts, Wounds, Diarrhoea, Dysentery, Arthritis, Dysmenorrhoea, Abortion, Ring worms, Body pains, Cancer, Leucorrhoea, Bone fracture, Mouth ulcers, Obesity, Chest pain, Hair growth, Liver disorders, Burns, Piles, Rheumatic pain, Sprains, Cold, Scorpion sting, Ulcers, Blisters, Boils, Skin diseases, Dyspepsia, Gonorrhoea, Leprosy, Snake bite, Worm killing, Haemorrhage, Stomach ache, Dog bite, Scurvy, Kidney stones, Rat bite, Diuretic, Anaemia, Jaundice, Malaria, Dandruff, Muscular pain, Labour pain etc. diseases (Table-1).

DESCRIPTION OF POLLEN GRAINS MORPHOLOGY

***Alangium salvifolium* (L.F.) Wang.**

Family: Alangiaceae

Pollen grains are oblate spheroidal, Amb 85-92µm in diameter, spheroidal, P.V. 72-89µm, E.V. 80-94µm, tetra to hexaporate.

Pores obscure due to heavy sculpturing circular to elliptic 9-12 in diameter.

Exine 4-6µm thick, tectate, surface verrucate, sexine as thick as nexine, sculpturing in between verrucae granular.

***Aearva lanata* Juss.**

Family-Amaranthaceae

Pollen grains spheroidal, P.V. 17.95µm, E.V. 14.95µm, polyporate.

Pores small or large, pori 3.4µm in diameter long, interpolar distance 13.5µm.

Exine 1.15µm thick, sexine as thick as nexine, sculpturing scabrate.

Catharanthus roseus* (Linn).*Family: Apocynaceae**

Pollen grains are prolate spheroidal, Amb 45µm in diameter, triangular, concave, P.V. 48µm, E.V. 46.5µm in diameter, tricolporate.

Colpi narrowly elliptic, 34.5µm long, 2µm wide, tips acute, sides tapering, ora lalongate.

Exine 1.5µm thick, sexine thicker than nexine, sculpturing microreticulate.

Nerium oleander* L.*Family: Apocynaceae**

Pollen grains are subprolate, pollen grain in monad, Amb 45µm in diameter, tricolporate

Exine 3µm thick, sexine as thick as nexine, sculpturing granulate.

Plumeria alba* (Linn).*Family: Apocynaceae**

Pollen grains are sub prolate, Amb 24µm in diameter, triangular, convex, P.V. 30µm, E.V. 24µm in diameter, tricolporate.

Colpi narrowly elliptic, 22.5µm long, 2µm wide, tips acute, sides tapering, ora lalongate.

Exine 2µm thick, sexine as thick as nexine, sculpturing psilate.

Aristolochia bractiolata* Lamk.*Family: Aristolochiaceae**

Pollen grains are spheroidal, Amb 52.5µm in diameter, triangular, trichotomosulcate.

Sulcate long 30µm in diameter, 15µm wide in diameter, tips obtuse.

Exine 2µm thick, sexine as thick as nexine, sculpturing reticulate.

Phoenix sylvestris* Roxb.*Family: Aricaceae**

Pollen grains are prolate, P.V. 21 -30µm, E.V. 14-18µm in diameter, circular, monosulcate.

Sulcate long 16µm in diameter, 1.5µm wide in diameter, tips obtuse.

Exine 1.5µm thick, sexine as thick as nexine, sculpturing psilate.

Decalepis hamiltonii* W & A.*Family: Periplocaceae**

Pollen grains united in tetrads (Pollinia). tetrads 25-45µm in diameter.

Tetrads of varying shape (tetrahedral, rhomboidal, linear etc). There are 3-6 apertures per grain. The exine is very thin and its sculpturing obscure.

Sphaeranthus indicus* L.*Family: Asteraceae**

Pollen grains are subprolate, Amb 18µm in diameter, spheroidal.

P.V. 18.5µm, E.V. 21µm, tricolporate.

Colpi linear, 13.5µm long, 2µm wide, tips acute, ora lalongate.

Exine 3µm thick, sexine as thick as nexine, sculpturing echinate. echinae 4 – 5 µm long, 3µm broad at the base.

Tridax procumbens* L.*Family: Asteraceae**

Pollen grains oblate spheroidal, Amb 21µm in diameter, tri or tetracolporate.

Colpi elliptic, 16.75µm long, 5.25µm wide, sides abruptly tapering towards the poles, tips acute, ora narrowly elliptic.

Exine 6.25µm thick, sexine 3.2µm, nexine 3µm, sculpturing echinate, echinae narrowly triangular in outline 6.25µm long, 3.25µm in diameter at base.

Dolichandrone atrovirens* Sprag.*Family: Bignoniaceae**

Pollen grains are spheroidal, Amb 19.5µm in diameter, triangular, obtuse, convex.

P.V. 18µm, E.V. 17.5µm, tricolporate.

Colpi linear, 9.5µm long, 1.5µm wide, tips acute, sides tapering ora lalongate.

Exine 1µm thick, nexine thicker than sexine, sculpturing psilate.

Bauhinia racemosa* Lam.*Family: Caesalpiaceae**

Pollen grains are prolate spheroidal, Amb 57µm in diameter, circular.

P.V. 52.5µm, E.V. 46.5µm, trizonocolporate.

Colpi narrowly elliptic, 20µm long, 3µm wide, tips acute, sides tapering ora lalongate.

Exine 1.5µm thick, sexine thicker than nexine, lumina polygonal condition, columellae indistinct, sculpturing reticulate.

Cassia alata* Linn.*Family: Caesalpiaceae**

Pollen grains are prolate spheroidal, Amb 30µm in diameter, triangular, obtuse, convex,

P.V. 25.5µm, E.V. 24µm, tricolporate.

Colpi narrowly elliptic, 22µm long, 2µm wide, sides tapering, tips acute, ora narrowly oblong.

Exine 1.5µm thick, sexine thicker than nexine, sculpturing psilate.

Delonix regia* Raf.*Family: Caesalpiaceae**

Pollen grains are oblate to sub oblate, Amb 50-62µm in diameter, sub triangular.

P.V. 53-56µm, E.V. 57-60µm, tricolporate.

Colpi long with blunt ends, ora faint, more or less rounded.

Exine 5.2µm thick, subtectate, sculpturing coarsely reticulate,

Heterobrochate, meshes smaller near the apertural regions and larger elsewhere, lumina polygonal with number of free bacules, muri thick, sinuous simpli to locally duplibaculate.

Carica papaya* Linn.*Family: Caricaceae**

Pollen grains are spheroidal, Amb 30µm in diameter, rounded, P.V.30µm, E.V.29.5µm in tricolporate.

Colpi 19µm in diameter long, ora lalagate, tapering ends.

Exine 1.5µm thick, sexine as thick as nexine, sculpturing reticulate.

Celastrus paniculata* Willd.*Family: Celastraceae**

Pollen grains in monads, monads are prolate, Amb 14 µm in diameter, triangular, trizonocolporate.

Colpi narrowly elliptic, 18.5µm long, sides tapering towards the poles, tips acute, ora oblong to circular, mesocolpia 14.5µm long.

Exine 2.5 µm thick, sexine thicker than nexine, columella distinct, 0.5µm long, sculpturing reticulate, lumina variously polygonal.

Cleome gynandra* L.*Family: Cleomaceae**

Pollen grains are subprolate, Amb 15µm in diameter, P.V. 16.5µm, E.V. 13.5µm, tricolporate.

Colpi narrowly elliptic, 12µm long, 1µm wide, sides tapering, tips acute, ora circular, mesocolpia 6µm long.

Exine 1.5µm thick, sexine as thick as nexine, columellae distinct, sculpturing reticulate.

Terminalia arjuna* (Roxb.Ex DC.) Wt.Et Arn*Family: Combretaceae**

Pollen grains are subprolate, Amb 22-24µm in diameter, spheroidal.

P.V. 15µm, E.V. 12µm, tricolporate.

Colpi long alternating with 3pseudocolpi, tips acute, ora more or less rounded.

Exine 2µm thick, tectate, sexine as thick as nexine, sculpturing surface psilate to faintly granular.

Evolvulus alsinoides* L.*Family: Convolvulaceae**

Pollen grains are spheroidal, Amb 28.5µm in diameter, circular, trizonocolporate.

Colpi narrowly elliptic, 22µm long, 7.2µm wide, sides tapering, tips acute, ora circular.

Exine 3µm thick, sexine thicker than nexine, columellae distinct, sculpturing reticulate. lumina polygonal.

Jatropha curcus* L.*Family: Euphorbiaceae**

Pollen grains are spheroidal, Amb 75µm in diameter, rounded, inaperturate.

Exine 6µm thick, sculpturing clavate.

Jatropha multifida* L.*Family: Euphorbiaceae**

Pollen grains are spheroidal, Amb 57µm in diameter, circular, inaperturate.

Exine 6µm thick, sculpturing gemmate, gammae 4µm high, capita 1.5µm in diameter

Abrus precatorius* L.*Family: Fabaceae**

Pollen grains are subprolate, Amb 28.5 µm in diameter, rounded, P.V.27µm, E.V.22.5 µm, Tricolporate

Colpi elliptic, 22.5 µm long, 2 µm wide, sides tapering, tips acute, ora lolangate.

Exine 1.5 µm thick, sexine thicker than nexine, sculpturing reticulate.

Pongamia pinnata* Vent.*Family: Fabaceae**

Pollen grains are subprolate, Amb 29-31 µm in diameter, sub triangular.

P.V.22.5 µm, E.V.19.5 µm, Tricolporate

Colpi linear to narrowly elliptic, 16.5 µm long, 2 µm wide, sides tapering, tips acute, ora lolangate.

Exine 1.5 µm thick, subtectate, surface granular to locally sculpturing faintly micro reticulate.

Tephrosia villosa* W&A.*Family: Fabaceae**

Pollen grains are subprolate, P.V. 22.5µm, E.V. 18µm, equatorial elliptic, tricolporate.

Colpi linear, 18µm long, 1µm wide, sides tapering, tips obtuse, ora lalongate.

Exine 3µm thick, sexine as thick as nexine, sculpturing microreticulate.

Leucas indica* (L) R.Br.Ex Vatke.*Family: Lamiaceae**

Pollen grains are subprolate, Amb 16.5µm in diameter, circular to triangular, P.V.18µm, E.V.15µm, tricolpate.

Colpi narrowly elliptic, 13.5µm long, 1.5µm wide, sides tapering, tips acute, ora indistinct.

Exine 3µm thick, sexine as thick as nexine, columella distinct, sculpturing microreticulate

Plectranthus barbatus* Andr.*Family: Lamiaceae**

Pollen grains are prolate spheroidal, Amb 25.5µm in diameter, rounded.

P.V.30µm, E.V.27µm, hexacolpate.

Colpi narrowly elliptic, 25.5µm long, 10.5µm wide, sides tapering, tips acute, ora indistinct.

Exine 3.5µm thick, sexine as thick as nexine, sculpturing reticulate.

Tinospora cordifolia* (Willd.) Hook.Fet.Thoms.*Family: Menispermaceae**

Pollen grains prolate, P.V.16.5 µm, E.V.12µm in diameter, tricolporate.

Colpi linear, operculate, 12 μm long, 3 μm wide, sides almost parallel, ora not distinct.

Exine 1.5 μm thick, sexine thicker than nexine, lumina polygonal conditions, sculpturing microreticulate.

***Pithecolobium dulce* (Roxb.) Benth.**

Family: Mimosaceae

Pollen grains in polyads of 16 cells. 8 cells centrally placed – 4 upon, 4 surrounded on the periphery by 8 cells, polyad spheroidal – sub spheroidal, aperture obscure, longer axis 68 μm , Exine 1 μm thick, sculpturing psilate.

***Moringa oleifera* Lamk.**

Family: Moringaceae

Pollen grains subprolate, Amb 45 μm in diameter, spheroidal.

P.V.47 μm , E.V.38 μm in diameter, tricolporate.

Colpi linear, 31 μm long, 1 μm wide, sides tapering, tips acute, ora oblate.

Exine 2 μm thick, nexine thicker than sexine, columellae distinct, sculpturing psilate.

***Musa paradisiaca* L.**

Family: Musaceae

Pollen grains spheroidal, P.V.35 μm , E.V.34.5 μm in diameter, inaperturate.

Exine 0.5 μm thick, sexine as thick as nexine, sculpturing psilate.

***Syzygium cumini* (Linn.) Skeels**

Family: Myrtaceae

Pollen grains prolate spheroidal, Amb 16-18 μm in diameter, triangular to rarely quadrangular, side's slightly concave, obtuse-plane.

P.V.15 μm , E.V.13.5 μm in diameter, tricolporate, rarely tetra colporate, syncolporate, para syncolporate.

Colpi linear, 12 μm long, 0.75 μm wide, sides tapering, tips acute, ora lobangate.

Exine 1.25 μm thick, tectate, sexine as thick as nexine, surface granular to smooth, sculpturing psilate.

***Boerhavia diffusa* L.**

Family: Nyctaginaceae

Pollen grains spheroidal, Amb 60 μm in diameter, circular, pantoporate,

Pori circular 3 μm in diameter, interpolar distance 13.5 μm long.

Exine 3 μm thick, sexine thicker than nexine, sculpturing echinate, echinate 3 μm long, tips acute, 2 μm in diameter at swollen base.

***Zizyphus mauritiana* Lamk.**

Family: Rhamnaceae

Pollen grains prolate spheroidal, Amb 22.5 μm in diameter, triangular, trizonocolporate,

Colpi narrowly elliptic, 16.5 μm long, 2.5 μm wide, slightly narrowed at equator, tips acute, ora included in the colpi.

Exine 1 μm thick, sexine thicker than nexine, sculpturing psilate.

***Murraya konigii* (L.)spreng.**

Family: Rutaceae

Pollen grains subprolate, Amb 30 μm in diameter, triangular, trizonocolporate, P.V. 37.5 μm , E.V. 28.5 μm in diameter.

Colpi narrowly elliptic, 28 μm long, 4 μm wide, ora lalongate.

Exine 2.5 μm thick, sexine as thick as nexine, sculpturing very faintly reticulate.

***Sapindus emarginatus* Vahl.**

Family: Sapindaceae

Pollen grains oblate spheroidal, Amb 18 μm in diameter, triangular, obtuse, trizonocolporate, P.V. 15 μm , E.V. 16.5 μm in diameter.

Colpi narrowly elliptic, 12.5 μm long, 2 μm wide, sides tapering, tips acute, ora lalongate.

Exine 1.5 μm thick, nexine thicker than sexine, columellae indistinct, sculpturing psilate.

***Manilkara zapota* (Linn) Van Royen.**

Family: Sapotaceae

Pollen grains prolate spheroidal, tetrazonocolporate, P.V. 39 μm , E.V. 37.5 μm in diameter

Colpi linear, 10 μm long, 0.2 μm wide, sides tapering, tips acute, ora oblate.

Exine 12 μm thick, sexine as thick as nexine, columellae not fairly distinct, sculpturing psilate.

***Datura metel* L.**

Family-Solanaceae

Pollen grains prolate spheroidal, Amb 39 μm in diameter, trizonocolporate, Colpi faint, linear, 21 μm long, 2 μm wide, tips acute, sides tapering, ora faint, oblong or elliptic.

Exine 1.5 μm thick, sexine thicker than nexine, sculpturing striate reticulate.

***Physalis minima* Linn.**

Family-Solanaceae

Pollen grains prolate spheroidal, Amb 25.5 μm in diameter, triangular.

P.V. 27 μm , E.V. 24 μm , trizonocolporate, Colpi narrowly elliptic, 24 μm long, 2 μm wide, tips acute, sides parallel, ora lalongate.

Exine 1.5 μm thick, sexine and nexine undefined, sculpturing psilate.

***Eriolaena hookeriana* W & A.**

Family-Sterculiaceae

Pollen grains subprolate, Amb 45 μm in diameter, triangular, P.V. 57 μm , E.V. 45 μm , tricolporate,

Colpi linear to narrowly elliptic, 45µm long, 4.5µm wide, tips acute, sides tapering, ora lolangate.

Exine 3.75µm thick, sexine thicker than nexine, lumina polygonal condition, sculpturing reticulate.

***Sterculia urens* Roxb.**

Family-Sterculiaceae

Pollen grains prolate spheroidal, Amb 21µm in diameter, triangular, obtuse, concave.

P.V. 19.5µm, E.V. 18µm, trizonocolporate, Colpi narrowly elliptic, 16µm long, 2.5µm wide, tips acute, sides tapering, ora lolangate.

Exine 2.5µm thick, sexine thicker than nexine, lumina polygonal condition, columellae distinct, sculpturing reticulate.

***Tectona grandis* L.F.**

Family-Verbenaceae

Pollen grains subprolate, Amb 29-31µm in diameter, triangular.

P.V. 22.5µm, E.V. 19.5µm, trizonocolpate, Colpi narrowly elliptic, 16.5µm long, 1.5µm wide, tips acute, sides tapering, ora lolangate.

Exine 2.25- 2.4µm thick, sexine thicker than nexine, columellae distinct, sculpturing psilate to faintly eureticulate.

DISCUSSION

These 41 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 and radial symmetry. Bilateral symmetric palynotaxa are *Nerium oleander*, *Plumeria alba*, *Phoenix sylvestris*, *Celastrus paniculata*, *Cleome gynandra*, *Terminalia arjuna*, *Abrus precatorius*, *Pongamia pinnata*, *Tephrosia villosa*, *Leucas indica*, *Tinospora cordifolia*, *Moringa oleifera*, *Murraya konigii*, *Eriolaena hookeriana* and *Tectona grandis*. The remaining genera show radial symmetry. Radially symmetric grains are dominant over bilaterally symmetric grains (Fig.2). The pollen shapes includes oblate spheroidal, spheroidal, prolate spheroidal, sub prolate, prolate and sub oblate. The oblate spheroidal grains are of *Alangium salvifolium*, *Decalepis hamiltonii* and *Sapindus emarginatus*. Spheroidal pollen are recorded in *Aerva lanata*, *Dolichandrone atrovirens*, *Carica papaya*, *Evolvulus alsinoides*, *Jatropha curcus*, *Jatropha multifida*, *Pithecolobium dulce*, *Musa paradisiaca* and *Boerhaavia diffusa*. Prolate spheroidal grains are recorded in *Catharanthus roseus*, *Bauhinia racemosa*, *Cassia alata*, *Plectranthus barbatus*, *Syzygium cumini*, *Zizyphus mauritiana*, *Manilkara zapota*, *Datura metel*, *Physalis minima* and *Sterculia*

urens. Sub prolate character exhibits in *Nerium oleander*, *Plumeria alba*, *Cleome gynandra*, *Terminalia arjuna*, *Abrus precatorius*, *Pongamia pinnata*, *Tephrosia villosa*, *Leucas indica*, *Moringa oleifera*, *Murraya konigii*, *Eriolaena hookeriana* and *Tectona grandis*. Prolate pollen are in *Phoenix sylvestris*, *Celastrus paniculata* and *Tinospora cordifolia*. *Delonix regia* and *Sphaeranthus indicus* have sub oblate condition. The polarity was either hetero or isopolar. Except *Boerhaavia diffusa*, *Pithecolobium dulce* the remaining genera show isopolar.

The pollen grains had monosulcate, triporate, tricolporate, trizonocolporate, trizonocolpate, trichtomosulcate, tetracolporate, tetrazonocolporate, hexaporate, hexacolpate, inaperturate, polyporate and pollinia. *Phoenix sylvestris* is a monosulcate grain and *Leucas indica* is tricolpate grain. whereas *Catharanthus roseus*, *Nerium oleander*, *Plumeria alba*, *Sphaeranthus indicus*, *Dolichandrone atrovirens*, *Cassia alata*, *Delonix regia*, *Carica papaya*, *Cleome gynandra*, *Terminalia arjuna*, *Abrus precatorius*, *Pongamia pinnata*, *Tephrosia villosa*, *Tinospora cardifolia*, *Moringa oleifera*, *Syzygium cumini*, *Sapindus emarginatus*, *Physalis minima* and *Eriolaena hookeriana* are having tricolporate. *Bauhinia racemosa*, *Celastrus paniculata*, *Zizyphus mauritiana*, *Murraya konigii*, *Datura metel* and *Sterculia urens* are trizonocolporate grains. Trizonocolpate grains are having in *Evolvulus alsinoides* and *Tectona grandis*. Trichotomosulcate grain is *Aristolochia bractiolata* and tetracolporate grain is *Tridax procumbens*. *Manilkara zapota* has Tetrazonocolporate pollen grain but *Alangium salvifolium* is hexaporate and wheras *Plectranthus barbatus* is hexacolpate pollen grain. But *Pithecolobium dulce*, *Jatropha curcus*, *Jatropha multifida* and *Musa paradisiaca* are having inaperturate. *Aerva lanata* and *Boerhaavia diffusa* are polyporate. Pollinia are recorded in *Decalepis hamiltonii*. Tricolporate grains are more than 18% and are occupied the dominant position when compared to other apertural grains (Fig.3). In these pollen grains the sculpture of the pollen varies i.e. verrucate, scabrate, microreticulate, granulate, psilate, reticulate, obscure, echinate, coarsely reticulate, faintly granular, clavate, faintly microreticulate, faintly reticulate and striate – reticulate. *Alangium salvifolium* show verrucate and *Aerva lanata* has scabrate. *Catharanthus roseus*, *Tephrosia villosa*, *Leucas indica* and *Tinospora cordifolia* have microreticulate. *Nerium oleander* has granular. *Plumeria alba*, *Phoenix sylvestris*, *Dolichandrone atrovirens*, *Cassia alata*, *Pithecolobium dulce*, *Moringa oleifera*, *Musa paradisiaca*, *Syzygium cumini*, *Zizyphus mauritiana*, *Sapindus emarginatus*, *Manilkara zapota*, *Physalis minima* and *Tectona grandis* have psilate. *Aristolochia bractiolata*, *Bauhinia racemosa*, *Carica papaya*, *Celastrus paniculata*, *Cleome gynandra*, *Evolvulus alsinoides*, *Abrus precatorius*, *Plectranthus barbatus*, *Eriolaena hookeriana* and *Sterculia urens* show

reticulate. *Decalepis hamiltonii* has obscure. *Sphaeranthus indicus*, *Tridax procumbens* and *Boerhaavia diffusa* show echinate. *Delonix regia* has coarsely reticulate and *Terminalia arjuna* has faintly granular. *Jatropha curcus* and *Jatropha multifida* show clavate. *Pongamia pinnata* has faintly microreticulate, *Murraya konigii* has faintly reticulate and *Datura metel* has striate reticulate. The sculpture of pollen signifies the dominance of psilate pattern in all the recorded grains of Nirmal forest division (Fig.4). Hence this study clearly indicates more diversity in the pollen grains of various ethnomedicinal plants of Nirmal forest division in Adilabad district, Telangana State, India.

Table – 1: List of Plants Used For Various Diseases

S.no	Name of the taxa	Part of used	Diseases
1	<i>Alangium salvifolium</i>	Root	Anthelmintic, Skin diseases, Cough, Fever, Purgative
2	<i>Aerva lanata</i>	Whole plant	Kidney stones
3	<i>Catharanthus roseus</i>	Leaves	Blood pressure, Diabetes, Leucoderma
4	<i>Nerium oleander</i>	Flower, Leaves	Asthma, Tuberculosis, Whooping cough
5	<i>Plumeria alba</i>	Root bark	Purgative
6	<i>Aristolochia bractiolata</i>	Root, Leaves, Whole plant	Skin diseases, Diabetes, Blood pressure, Anthelmintic Eczema
7	<i>Phoenix sylvestris</i>	Leaf	Cooling effect, Nervous weakness, Tooth ache
8	<i>Decalepis hamiltonii</i>	Root	Asthma, Ear problems, Poisoning
9	<i>Sphaeranthus indicus</i>	Leaves, Root	Fertility, Head ache
10	<i>Tridax procumbens</i>	Leaves	Cuts, Wounds, Diarrhoea, Dysentery
11	<i>Dolichandrone atrovirens</i>	Leaves	Arthritis, Fever, Head ache
12	<i>Bauhinia racemosa</i>	Fruits, Leaves stem bark	Asthma, Cough, Fever, Diarrhoea, Dysentery, Head ache
13	<i>Cassia alata</i>	Leaves, Flower	Ring worms, purgative
14	<i>Delonix regia</i>	Flower	Dysmenorrhoea
15	<i>Carica papaya</i>	Latex, Leaves	Abortion
16	<i>Celastrus paniculata</i>	Leaves, Root	Body pains, Cancer, Fever, Leucorrhoea
17	<i>Cleome gynandra</i>	Leaves	Head ache, Diabetes, Ear problems
18	<i>Terminalia arjuna</i>	Bark, Leaves	Bone fracture, Blood pressure, Mouth ulcers, Obesity
19	<i>Evolvulus alsinoides</i>	Leaves, Whole plant	Chest pain, Hair growth, Liver disorders, Tooth ache
20	<i>Jatropha curcus</i>	Leaf, Stem bark, Seed	Burns, Cuts, Piles, Rheumatic pain, Sprains, Tooth ache,
21	<i>Jatropha multifida</i>	Seed	Purgative
22	<i>Abrus precatorius</i>	Seed, Leaf, Root	Cough, Cold, Scorpion sting, Ulcers, Wounds
23	<i>Pongamia pinnata</i>	Seed, Flower, Leaf, Stem bark	Blisters, Boils, Skin diseases, Diabetes, Dyspepsia, Gonorrhoea, Leprosy, Leucorrhoea, Piles
24	<i>Tephrosia villosa</i>	Root bark	Leucoderma
25	<i>Leucas indica</i>	Leaves	Snake bite, Worm killing

26	<i>Plectranthus barbatus</i>	Whole plant	Piles, Cough, Haemorrhage
27	<i>Tinospora cordifolia</i>	Leaves, Fruit, Tubers, Root	Anthelmintic, Cough, Fever, Leucoderma, Scorpion sting, Snake bite, Stomach ache
28	<i>Pithecolobium dulce</i>	Arils, Leaves	Blood pressure, Dog bite
29	<i>Moringa oleifera</i>	Leaves, Stem, Root	Blood pressure, Body swelling, Cold, Cough, Scurvy
30	<i>Musa paradisiaca</i>	Stem, Rhizome, Root	Diarrhoea, Dysentery, Fertility, Kidney stones, Gonorrhoea, Rat bite
31	<i>Syzygium cumini</i>	Stembark, Seed, Leaf	Skin diseases, diabetes, Diarrhoea, Diuretic, Dysentery
32	<i>Boerhaavia diffusa</i>	Whole plant, Root	Anaemia, Asthma, Jaundice
33	<i>Zizyphus mauritiana</i>	Stembark, Fruit, Leaf	Blood pressure, Malaria, scorpion sting, Diarrhoea
34	<i>Murraya konigii</i>	Leaves, Stem bark	Dandruff, Dysentery, dyspepsia, Diuretic, Diabetes
35	<i>Sapindus emarginatus</i>	Leaf, Fruit	Cooling effect, Dandruff, ear ache
36	<i>Manilkara zapota</i>	Fruit, Stem bark	Cooling effect, Piles
37	<i>Datura metel</i>	Fruit, Flower, Root, Leaves	Astma, Dandruff, Earache, Hair fall, Muscular pain, Sprains
38	<i>Physalis minima</i>	Root, Leaf, Whole plant	Dysuria, Diabetes, Fever, Asthma, Purgative, Diuretic, Gonorrhoea
39	<i>Eriolaena hookeriana</i>	Root, Leaf, Flower, Seed	Wounds, Cuts, Burns, Rheumatic Pain
40	<i>Sterculia urens</i>	Stem bark, Gum	Cooling effect, Dysentery, Labour pain,
41	<i>Tectona grandis</i>	Wood powder, Seed	Body swelling, Diuretic, Dyspepsia, Head ache

Table – 2: Morphological Characters of the Plants Pollen Taxa

S.no	Taxa name	Family	Symmetry	Shape	Polarity	Aperture	Sculpture
1	<i>Alangium salvifolium</i>	Alangiaceae	Radial	Oblate spheroidal	Isopolar	Hexaporate	Verrucate
2	<i>Aerva lanata</i>	Amaranthaceae	Radial	Spheroidal	Isopolar	Pantoporate	Scabrate
3	<i>Catharanthus roseus</i>	Apocynaceae	Radial	Prolate spheroidal	Isopolar	Tricolporate	Micro reticulate
4	<i>Nerium oleander</i>	Apocynaceae	Bilateral	Sub prolate	Isopolar	Tricolporate	Granular
5	<i>Plumeria alba</i>	Apocynaceae	Bilateral	Sub prolate	Isopolar	Tricolporate	Psilate
6	<i>Aristolochia bractiolata</i>	Aristolochiaceae	Radial	Spheroidal	Isopolar	Trichotomosulcate	Reticulate
7	<i>Phoenix sylvestris</i>	Arecaceae	Bilateral	Prolate	Isopolar	Monosulcate	Psilate
8	<i>Decalepis hamiltonii</i>	Periplocaceae	Radial	Oblate spheroidal	Isopolar	Pollinia	Obscure
9	<i>Sphaeranthus indicus</i>	Asteraceae	Radial	Sub oblate	Isopolar	Tricolporate	Echinate
10	<i>Tridax procumbens</i>	Asteraceae	Radial	Oblate spheroidal	Isopolar	Tetralcolporate	Echinate
11	<i>Dolichandrone atrovirens</i>	Bignoniaceae	Radial	Spheroidal	Isopolar	Tricolporate	Psilate
12	<i>Bauhinia racemosa</i>	Caesalpiniaceae	Radial	Prolate spheroidal	Isopolar	Trizonocolporate	Reticulate

13	Cassia alata	Caesalpiniaceae	Radial	Prolate spheroidal	Isopolar	Tricolporate	Psilate
14	Delonix regia	Caesalpiniaceae	Radial	Sub oblate	Isopolar	Tricolporate	Coresly reticulate
15	Carica papaya	Caricaceae	Radial	Spheroidal	Isopolar	Tricolporate	Reticulate
16	Celastrus paniculata	Celastraceae	Bilateral	Prolate	Isopolar	Trizono colporate	Reticulate
17	Cleome gynandra	Cleomaceae	Bilateral	Sub prolate	Isopolar	Tricolporate	Reticulate
18	Terminalia arjuna	Combretaceae	Bilateral	Sub prolate	Isopolar	Tricolporate	Faintly granular
19	Evolvulus alsinoides	Convolvulaceae	Radial	Spheroidal	Isopolar	Trizono colporate	Reticulate
20	Jatropha curcus	Euphorbiaceae	Radial	Spheroidal	Isopolar	Inaperturate	Clavate
21	Jatropha multifida	Euphorbiaceae	Radial	Spheroidal	Isopolar	Inaperturate	Clavate
22	Abrus precatorius	Fabaceae	Bilateral	Sub prolate	Isopolar	Tricolporate	Reticulate
23	Pongamia pinnata	Fabaceae	Bilateral	Sub prolate	Isopolar	Tricolporate	Faintly micro reticulate
24	Tephrosia villosa	Fabaceae	Bilateral	Sub prolate	Isopolar	Tricolporate	Micro reticulate
25	Leucas indica	Lamiaceae	Bilateral	Sub prolate	Isopolar	Tricolporate	Micro reticulate
26	Plectranthus barbatus	Lamiaceae	Radial	Prolate spheroidal	Isopolar	Hexacolporate	Reticulate
27	Tinospora cordifolia	Menispermaceae	Bilateral	Prolate	Isopolar	Tricolporate	Micro reticulate
28	Pithecolobium dulce	Mimosaceae	Radial, Polyad	Spheroidal	Hetero polar	Inaperturate	Psilate
29	Moringa oleifera	Moringaceae	Bilateral	Sub prolate	Isopolar	Tricolporate	Psilate
30	Musa paradisiaca	Musaceae	Radial	Spheroidal	Isopolar	Inaperturate	Psilate
31	Syzygium cumini	Myrtaceae	Radial	Prolate spheroidal	Isopolar	Tricolporate Parasyncolporate	Psilate
32	Boerhaavia diffusa	Nyctaginaceae	Radial	Spheroidal	Hetero polar	Pantoporate	Echinate
33	Zizyphus mauritiana	Rhamnaceae	Radial	Prolate spheroidal	Isopolar	Trizono colporate	Psilate
34	Murraya konigii	Rutaceae	Bilateral	Sub prolate	Isopolar	Trizono colporate	Faintly reticulate
35	Sapindus emarginatus	Sapindaceae	Radial	Oblate spheroidal	Isopolar	Tricolporate	Psilate
36	Manilkara zapota	Sapotaceae	Radial	Prolate spheroidal	Isopolar	Tetrazono colporate	Psilate
37	Datura metel	Solanaceae	Radial	Prolate spheroidal	Isopolar	Trizono colporate	Striate-reticulate
38	Physalis minima	Solanaceae	Radial	Prolate spheroidal	Isopolar	Tricolporate	Psilate
39	Eriolaena hookeriana	Sterculiaceae	Bilateral	Sub prolate	Isopolar	Tricolporate	Reticulate

40	<i>Sterculia urens</i>	Sterculiaceae	Radial	Prolate spheroidal	Isopolar	Trizono colporate	Reticulate
41	<i>Tectona grandis</i>	Verbanaceae	Bilateral	Sub prolate	Isopolar	Trizono colpate	Psilate

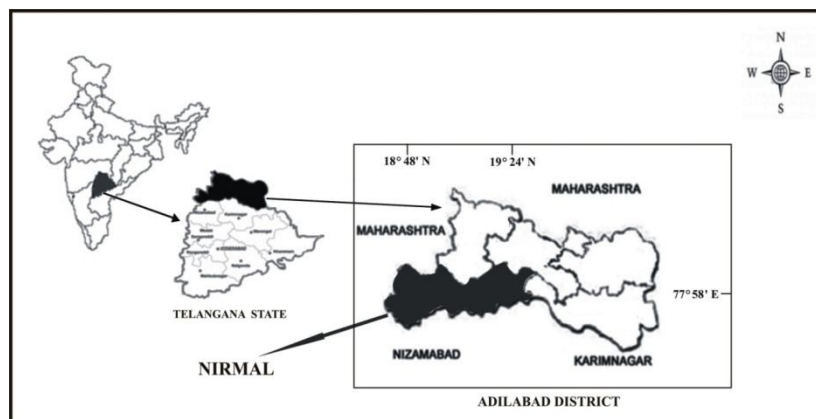
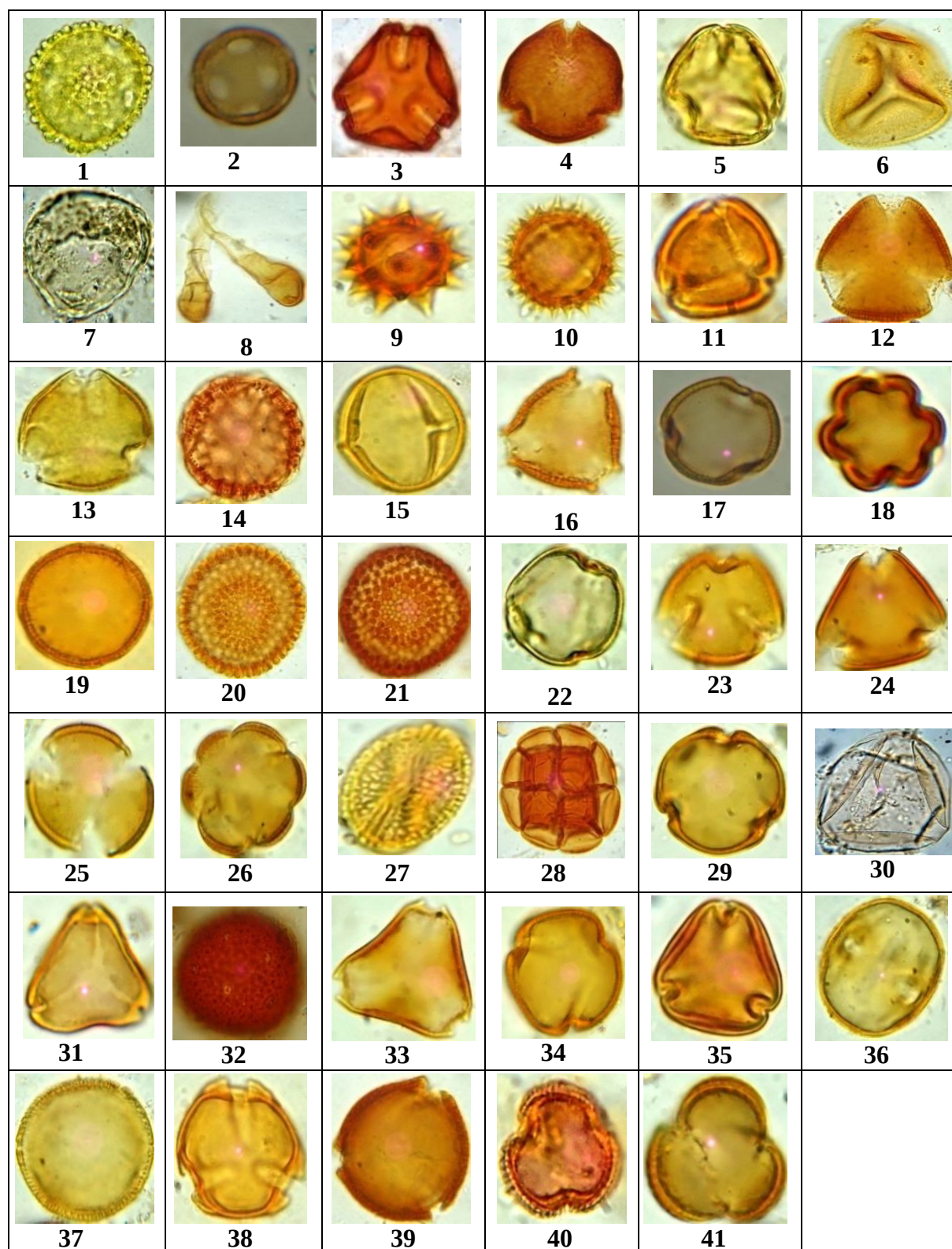


Fig.1. location Map.

Explanation of Plate – 1(All Figures 500 X)

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|-------------------------------------|----------------------------------|---------------------------------|
| 1. <i>Alangium salvifolium</i> | 16. <i>Celastrus paniculata</i> | 31. <i>Syzygium cumini</i> |
| 2. <i>Aearva lanata</i> | 17. <i>Cleome gynandra</i> | 32. <i>Boerhaavia diffusa</i> |
| 3. <i>Catharanthus roseus</i> | 18. <i>Terminalia arjuna</i> | 33. <i>Zizyphus mauritiana</i> |
| 4. <i>Nerium oleander</i> | 19. <i>Evolvulus alsinoides</i> | 34. <i>Murraya konigii</i> |
| 5. <i>Plumeria alba</i> | 20. <i>Jatropha curcus</i> | 35. <i>Sapindus emarginatus</i> |
| 6. <i>Aristolochia bractiolata</i> | 21. <i>Jatropha multifida</i> | 36. <i>Manilkara zapota</i> |
| 7. <i>Phoenix sylvestris</i> | 22. <i>Abrus precatorius</i> | 37. <i>Datura metel</i> |
| 8. <i>Decalepis hamiltonii</i> | 23. <i>Pongamia pinnata</i> | 38. <i>Physalis minima</i> |
| 9. <i>Sphaeranthus indicus</i> | 24. <i>Tephrosia villosa</i> | 39. <i>Eriolaena hookeriana</i> |
| 10. <i>Tridax procumbens</i> | 25. <i>Leucas indica</i> | 40. <i>Sterculia urens</i> |
| 11. <i>Dolichandrone atrovirens</i> | 26. <i>Plectranthus barbatus</i> | 41. <i>Tectona grandis</i> |
| 12. <i>Bauhinia racemosa</i> | 27. <i>Tinospora cordifolia</i> | |
| 13. <i>Cassia alata</i> | 28. <i>Pithecolobium dulce</i> | |
| 14. <i>Delonix regia</i> | 29. <i>Moringa oleifera</i> | |
| 15. <i>Carica papaya</i> | 30. <i>Musa paradisiaca</i> | |

(Plate-1)



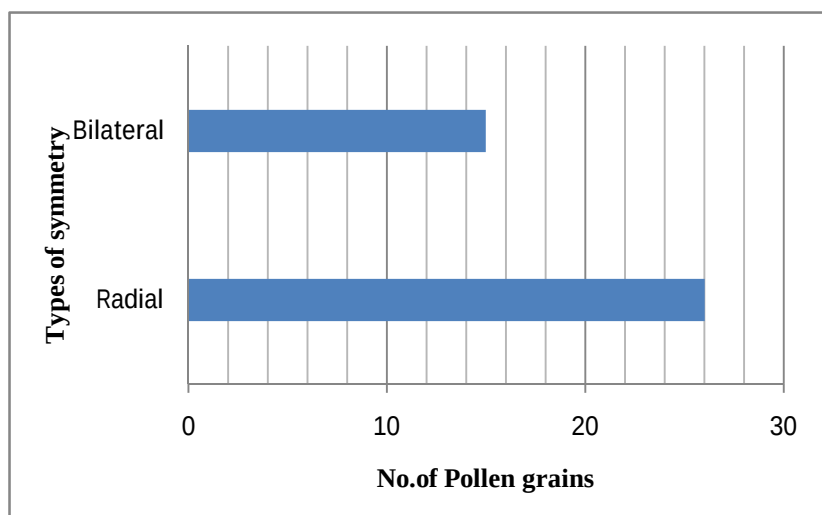


Fig.2: Diversity in Symmetry.

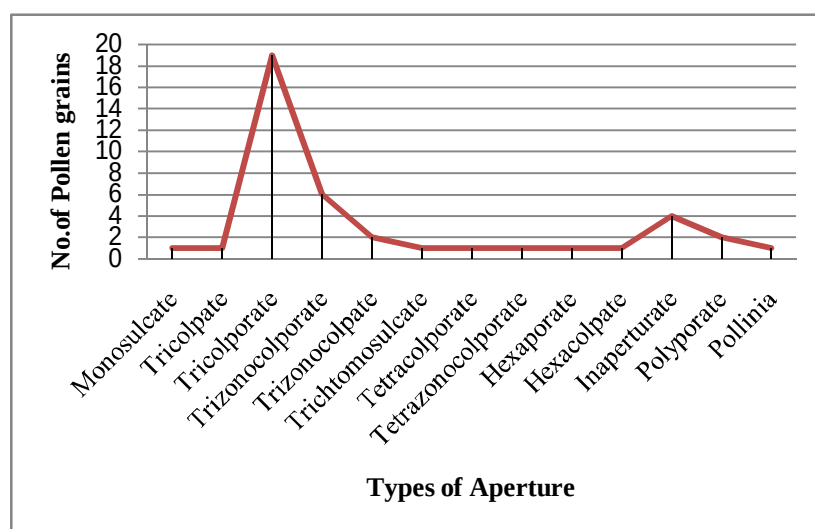


Fig.3: Diversity in Aperture.

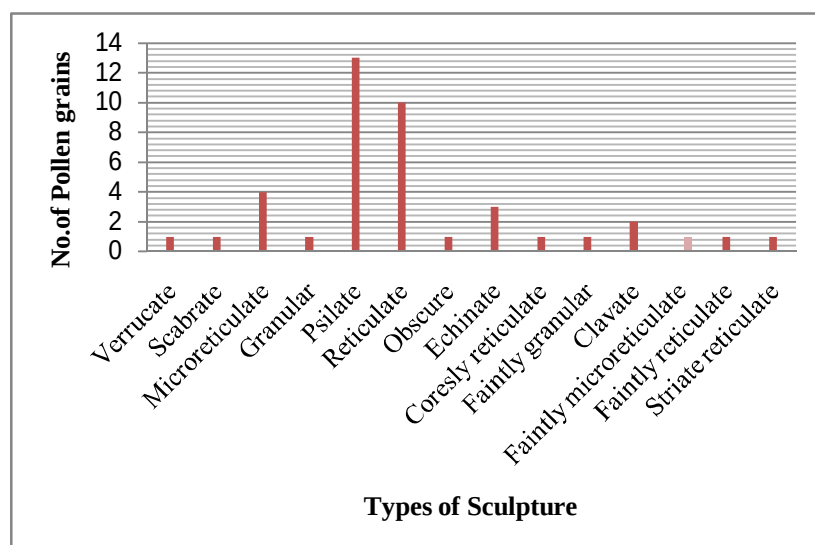


Fig.4: Diversity In Sculpture.

CONCLUSION

The forty one ethnomedicinal plants recorded from Nirmal forest division in Adilabad district, Telangana State, India are useful to cure various ailments and these have been used by the local tribes for the past so many years. These taxa which are having pollen diversity is useful for the further confirmation of taxa i.e. authentic identification of plants recorded from the study area.

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REFERENCE

1. Erdtman G. 1960. The Acetolysis Method. A revised description. *Sevens. Bot. Tidskr.* 54: 561 – 564.
2. Gamble J.S. 1935. *Flora of Presidency of Madras*. Vol I.II.III.
3. Madhu V and Suvartha C.2009. Ethnobotanical and Ethnomedicinal observation in Nirmal Division of Adilabad district, Andhra Pradesh, India. *Ethnobotanical Leaflets* 13: 1003-16.