

Palynodiversity in Dyspepsia (Indigestion) curing taxa of tribal areas in Adilabad District of Telangana State, India

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ABSTRACT

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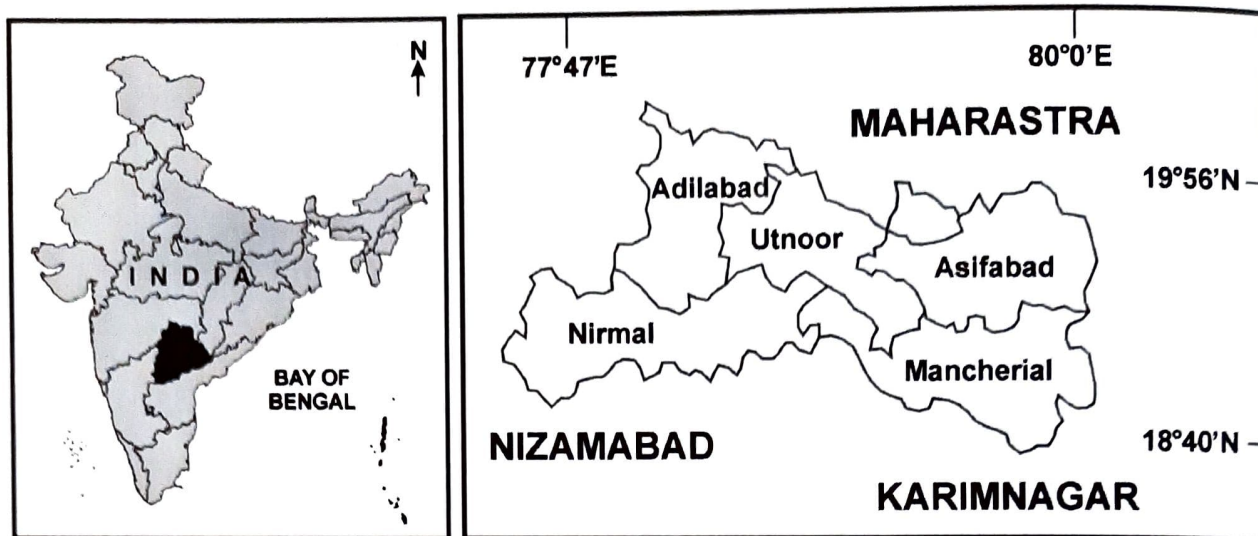
Dyspepsia (Indigestion) is a disease is common to the local tribes such as Gonds, Kolam, Koya, Thoties, Lambada, Naikapods, Pardhans, Manne and Yerukalas inhabiting Adilabad District. The ethnic tribes have been widely using different ethnomedicinally important plants like *Aegle marmelos*, *Artemesia vulgaris*, *Asparagus racemosus*, *Cassia fistula*, *Diospyros melanoxylon*, *Leonotis nepetaefolia*, *Manihot esculenta*, *Murraya koenigii*, *Ocimum tenuiflorum*, *Emblica officinalis*, *Piper longum*, *Plectranthes barbatus*, *Pongamia pinnata*, *Psidium guajava*, *Punica granatum* and *Tectona grandis* belonging to the families Rutaceae, Asteraceae, Liliaceae, Caesalpiniaceae, Ebenaceae, Lamiaceae, Euphorbiaceae, Piperaceae, Fabaceae, Myrtaceae, Punicaceae and Verbenaceae families to cure this disorder. The pollen of these ethnomedicinally important plants have diversity of apertural characters viz., tricolporate, trizonocolporate, monosulcate, tricolpate, inaperturate, hexazonocolpate, pentacolpate, hexacolpate, syncolpate, and diversity of sculpture viz., psilate, scabrate, microreticulate, reticulate, gammate and very faintly reticulate, besides variation in symmetry, shape and polarity. These variations in the pollen morphology of the aforesaid plants are useful in the identification and confirmation of various plants in curing the diseases by the tribal communities of Adilabad District.

Key-words: Pollen diversity, ethnomedicinal plants, Dyspepsia, Adilabad District.

INTRODUCTION

Ethnomedicinal study is useful to know about the disease caused to the tribals and controlling methods by using various plants. Dyspepsia is one of the diseases to the tribes. Palynology is one of the taxonomic method to identify the plants which are useful to control this indigestion problem. Adilabad is one of largest districts of Telangana State, which occupies both irrigated and forest localities. It is situated in between 77° 47' and 80° 0' E longitudes and 18° 40' and 19° 56' N latitudes (Text figure 1). It has dry deciduous forest with a good

diversity of herbs, shrubs and trees used as medicinal plants by inhabitant tribes of Adilabad, Nirmal, Asifabad, Mancherial and Utnoor revenue divisions in Adilabad district to cure various ailments. Diversity of pollen characters are recorded in the ethnomedicinally important plants viz., *Aegle marmelos*, *Artemesia vulgaris*, *Asparagus racemosus*, *Cassia fistula*, *Diospyros melanoxylon*, *Leonotis nepetaefolia*, *Manihot esculenta*, *Murraya koenigii*, *Ocimum tenuiflorum*, *Emblica officinalis*, *Piper longum*, *Plectranthes barbatus*, *Pongamia pinnata*, *Psidium guajava*, *Punica granatum* and *Tectona grandis*.



Text figure 1. Map of the study area.

MATERIAL AND METHODS

The pollen material of these taxa was collected by means of field study and the ethnomedicinal data was generated by interacting with the inhabitant tribes in summer, rainy and winter seasons during 2011-2014 from various localities of Adilabad district in Telangana State. Polleniferous material in the form of mature floral buds of recorded taxa before dehiscence were collected and processed by using Erdtman's (1960) acetolysis technique. The collected pollen material was fixed in 70% ethyl alcohol and crushed with a glass rod. Thereafter the material was sieved through a fine brass mesh to remove the coarser fragments and pollen material was collected in a graduated glass centrifuge tube. The resultant sediment was treated with glacial acetic acid. Subsequently, the acetic acid was decanted and the pollen sediment was subjected traditional acetolysis technique. 6 ml of acetolysis mixture (1 ml concentrated H_2SO_4 added drop by drop to 5 ml of acetic anhydride) was added to the pollen sediment and then kept the tube in the water bath upto $70^\circ C$ boiling point, till the sediment turned into chestnut colour. After cooling of the pollen sediment with acetolysis mixture, it was again centrifuged and the supernatant liquid was decanted. The sediment was then treated with glacial acetic acid, later centrifuged and the supernatant liquid was decanted and then the sediment was washed with distilled water and later 50% aqueous glycerine (5 ml) was added and centrifuged for 10

minutes. The supernatant liquid was decanted and the tubes were inverted on a filter paper for few minutes. The pollen sediment was taken on a pellet of glycerine jelly and transferred to the centre of the slide. After being warmed slightly, the melted jelly with pollen sediment was covered by cover glass. Cover glass was later sealed with paraffin wax. Three slides were prepared for each sample and studied thoroughly for the pollen characters.

The palynotaxa of ethnomedicinal plants were documented by using photomicrographs (Plate 1) under Olympus trinocular microscope with digital camera attachment. The slides have been preserved in the Palynology laboratory, Department of Botany, University College of Science, Osmania University, Hyderabad.

OBSERVATIONS

Sixteen plants of ethnomedicinal value viz., *Aegle marmelos*, *Artemesia vulgaris*, *Asparagus racemosus*, *Cassia fistula*, *Diospyros melanoxylon*, *Leonotis nepetaefolia*, *Manihot esculenta*, *Murraya koenigii*, *Ocimum tenuiflorum*, *Embllica officinalis*, *Piper longum*, *Plectranthes barbatus*, *Pongamia pinnata*, *Psidium gujava*, *Punica granatum* and *Tectona grandis* were identified from Adilabad, Nirmal, Asifabad, Mancherial and Utnoor revenue divisions. These taxa exhibit diversity in pollen morphological characters viz. size, shape, symmetry, polarity, apertural character and sculpture (Table 1).

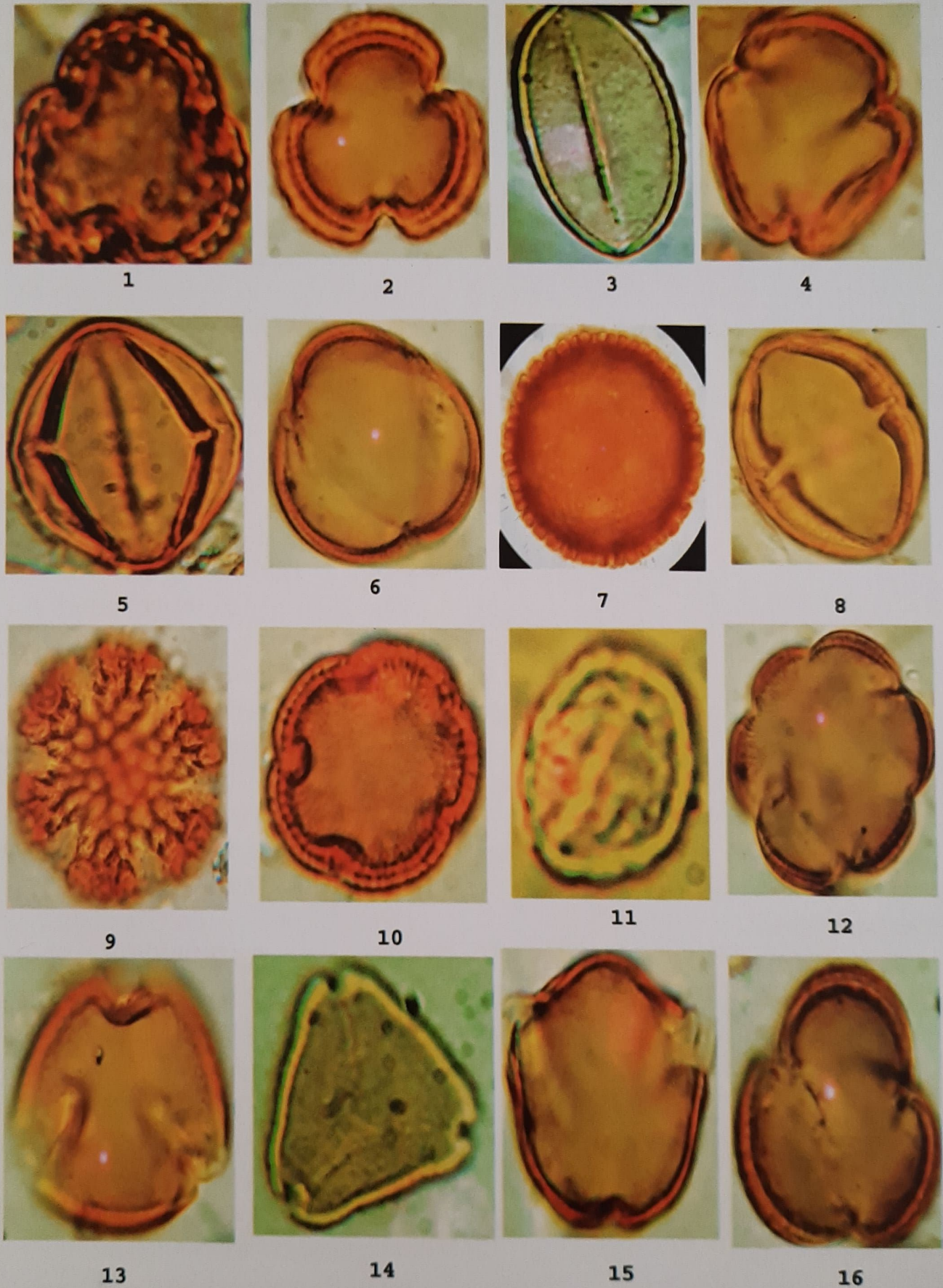


Plate 1

Pollen grains of plants having ethnomedicinal values. 1. *Aegle marmelos* 2. *Artemesia vulgaris* 3. *Asparagus racemosus* 4. *Cassia fistula* 5. *Diospyros melanoxylon* 6. *Leonotis nepetaefolia* 7. *Manihot esculenta* 8. *Murraya koenigii* 9. *Ocimum tenuiflorum* 10. *Embllica officinalis* 11. *Piper longum* 12. *Plectranthes barbatus* 13. *Pongamia pinnata* 14. *Psidium guajava* 15. *Punica granetum* 16. *Tectona grandis*. (All figures x 650)

DESCRIPTION OF POLLEN MORPHOLOGY

Aegle marmelos L. Correa

Table 1: List of plants and their parts used for curing dyspepsia disease

S.no	Name of the taxa	Parts used
1	<i>Aegle marmelos</i>	Fruit
2	<i>Artemesia vulgaris</i>	Leaves
3	<i>Asparagus racemosus</i>	Roots
4	<i>Cassia fistula</i>	Leaves
5	<i>Diospyros melanoxylon</i>	Fruit
6	<i>Embllica officinalis</i>	Fruit
7	<i>Leonotis nepetaefolia</i>	Leaves
8	<i>Manihot esculenta</i>	Tuberous root
9	<i>Murraya koenigii</i>	Leaves
10	<i>Ocimum tenuiflorum</i>	Leaves
11	<i>Piper longum</i>	Root
12	<i>Plectranthes barbatus</i>	Root
13	<i>Pongamia pinnata</i>	Leaves
14	<i>Psidium guajava</i>	Leaves
15	<i>Punica granatum</i>	Fruit
16	<i>Tectona grandis</i>	Wood powder

Family: Rutaceae

Pollen grains sub prolate; Amb, triangular, 22.5µm; P.V. 22.5µm; E.V. 19.5µm;

Tricolporate; Colpi narrowly oblong; 28µm long; 2.5 µm wide; tips acute; ora lalongate;

Exine 2.6µm thick; sexine 1.6µm; nexine 1µm thick; sculpturing psilate.

Artemesia vulgaris L.**Family: Asteraceae**

Pollen grains prolate spheroidal; Amb, triangular, 24µm; P.V. 22.5µm; E.V. 21µm; trizonocolporate; Colpi narrowly elliptic; 18µm long, 3µm wide; sides tapering; tips acute; ora faint; mesocolpia 17.5µm long,

Exine 3µm thick; sexine thicker than nexine; scabrate sculpture.

Asparagus racemosus Willd.**Family: Liliaceae**

Pollen grains prolate, Amb, rounded. 19.5 µm; P.V. 28.5 µm; E.V. 15 µm in diameter; monosulcate. Sulcus 21 µm long; 1.5 µm in wide, tips obtuse. Exine 2 µm thick; sexine as thick as nexine;

sculpturing micro reticulate.

Cassia fistula L.**Family: Caesalpinaceae**

Pollen grains are prolate spheroidal, Amb, triangular, 30µm;

P.V. 30µm; E.V. 27µm; tricolporate.

Colpi narrowly elliptic, 24µm long, 2µm wide at equator, sides tapering; tips acute; ora narrowly oblong.

Exine 2.25µm thick; sexine as thick as nexine; columellae distinct; lumina polygonal; sculpturing reticulate.

Diospyros melanoxylon Roxb.**Family: Ebenaceae**

Pollen grains are prolate, Amb, rounded, 21µm; P.V. 21µm; E.V. 13.5µm.

Colpi long 11µm long; 2µm wide; tips acute; sides tapering.

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

Embllica officinalis L.**Family: Euphorbiaceae**

Pollen grains spheroidal, Amb, rounded with distinctly lobed look (star shaped), 21µm; P.V. 18.5µm; E.V. 18µm; pentacolporate.

Colpi elliptic; 12µm long; 3µm wide; sides tapering; tips obtuse; ora lalongate.

Exine 2.5µm thick; sexine thicker than nexine; much thicker near aperture; sculpturing micro reticulate.

Leonotis nepetaefolia (Linn.) R. Br.**Family: Lamiaceae**

Pollen grains are prolate, Amb, circular, 31.5µm; P.V. 33µm; E.V. 21µm; tricolporate.

Colpi narrowly elliptic; 27µm long; 2.5µm wide; sides tapering; tips acute; ora lalongate.

Exine 3µm thick; sexine as thick as nexine; columella distinct; sculpturing microreticulate.

Manihot esculenta Crantz. Inst.**Family: Euphorbiaceae**

Pollen grains are spheroidal, Amb, rounded; 126µm; inaperturate.

Exine 4.5µm thick; sexine thicker than nexine; gemmatesculpture; gemmae 4µm high.

Murraya koenigii (Linn.) Spreng.

Family: Rutaceae

Pollen grains subprolate, Amb, triangular, 30µm; trizonocolporate,

P.V.37.5 µm; E.V.28.5 µm,

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

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

Ocimum tenuiflorum L.

Family: Lamiaceae

Pollen grains subprolate, Amb, rounded, 31.5µm; P.V.27µm; E.V.22.5µm; hexazonocolpate.

Colpi linear; 13.5µm long; 2µm wide; sides tapering; tips acute; ora indistinct.

Exine 4.5µm thick; sexine thicker than nexine; lumina irregularly polygonal condition; sculpturing reticulate.

Piper longum L.

Family: Piperaceae

Pollen grains oblate subprolate, P.V.10.5µm; E.V.9µm; monosulcate,

Sulcus long 7.5µm; wide 1µm; tips acute.

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

Plectranthus barbatus Andr.

Family: Lamiaceae

Pollen grains prolate spheroidal, Amb, rounded; 25.5µm;

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.

Pongamia pinnata Vent.

Family: Fabaceae

Pollen grains subprolate, Amb, subtriangular, 29-31 µm;

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 lalongate.

Exine 1.5 µm thick; subtectate; surface granular to locally sculpturing faintly microreticulate.

Psidium guajava L.

Family: Myrtaceae

Pollen grains oblate spheroidal, Amb, subtriangular; 24-25 µm;

P.V.14-16 µm; E.V.26-28 µm; tricolporate; syncolpate; parasyncolpate.

Colpi elliptic; 12.5 µm long; 1.5 µm wide; sides tapering; tips acute; ora lalongate.

Exine 1.5 µm thick; sexine as thick as nexine; sculpturing granular to psilate.

Punica granatum L.

Family: Punicaceae

Pollen grains subprolate, Amb, spheroidal; 21µm;

P.V. 22.5µm; E.V. 18µm; tricolporate.

Colpi narrowly elliptic; 15µm long; 1.5µm wide; sides tapering; tips acute; ora lalongate.

Exine 1.5µm thick; sexine slightly thicker than nexine; columellae distinct; sculpturing reticulate.

Tectona grandis L.f.

Family: Verbenaceae

Pollen grains subprolate, Amb, triangular; 29-31µm;

P.V.22.5µm; E.V.19.5µm; trizonocolpate,

Colpinarrowly elliptic; 16.5µm long; 1.5µm wide; tips acute; sides tapering; ora lalongate.

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

DISCUSSION

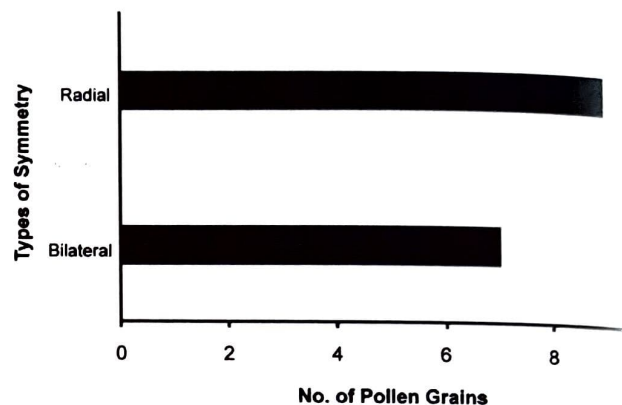
Pollen morphological characters of 16 taxa belonging to various families viz., Rutaceae, Asteraceae, Liliaceae, Caesalpiniaceae, Ebenaceae, Lamiaceae, Euphorbiaceae, Piperaceae, Fabaceae, Myrtaceae, Punicaceae and Verbanaceae (Gamble 1935) have been described here. On the basis of variation in symmetry, shape, polarity, apertural pattern and

sporoderm the plants which were utilized by the local populace especially the tribal community inhabiting the Adilabad District in curing dyspepsia/indigestion were identified (Table 2).

These palynotaxa have bilateral and radial symmetry. Bilateral symmetric palynotaxa are *Asparagus racemosus*, *Cassia fistula*, *Diospyros melanoxylon*, *Piper longum*, *Pongamia pinnata*, *Punica granatum* and *Tectona grandis*. The remaining genera show radial symmetry. The radial symmetric grains are dominant over bilaterally symmetric grains (Text figure 2).

Pollen have diversity of shapes viz., sub prolate, prolate spheroidal, prolate, spheroidal and oblate spheroidal. The sub prolate grains are of *Aegle marmelos*, *Manihot esculenta*, *Murraya koenigii*, *Ocimum tenuiflorum*, *Piper longum*, *Pongamia pinnata*, *Punica granatum* and *Tectona grandis*. Prolate spheroidal pollen is recorded in *Artemisia vulgaris* and *Plectranthes barbatus*. Prolate grains are *Asparagus racemosus*, *Cassia fistula*, *Diospyros melanoxylon* and *Leonotis nepetaefolia*. Spheroidal character is exhibited in *Emblica officinalis*. *Psidium guajava* has oblate spheroidal condition.

The polarity was either hetero or isopolar. Except for *Piper longum*, *Pongamia pinnata*, *Punica*



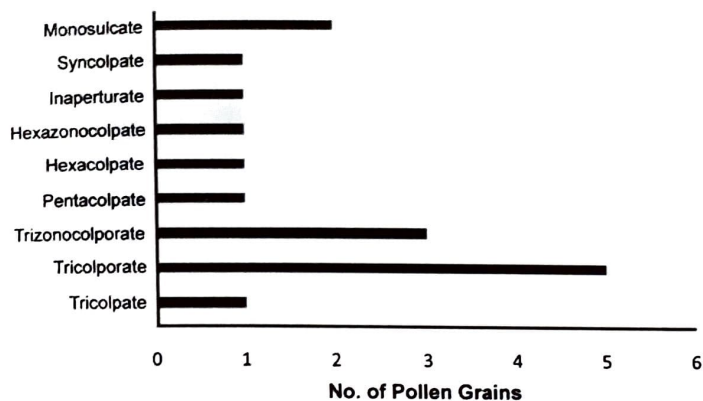
Text figure 2. Diversity in Symmetry.

granatum and *Tectona grandis*, the remaining genera show isopolar.

The pollen grains had monosulcate, tricolpate, tricolporate, trizonocolporate, pentacolporate, hexacolpate, hexazonocolpate, inaperturate and syncolpate. *Asparagus racemosus* and *Piper longum* are monosulcate grains but *Leonotis nepetaefolia* is tricolpate whereas *Aegle marmelos*, *Cassia fistula*, *Diospyros melanoxylon*, *Pongamia pinnata* and *Punica granatum* are tricolporate and *Artemisia vulgaris*, *Murraya koenigii* and *Tectona grandis* are trizonocolporate. *Emblica officinalis* is pentacolporate grain, whereas *Plectranthes barbatus* is hexacolpate and *Ocimum tenuiflorum* is hexazonocolpate grain.

Table 2. Pollen morphological characters of the ethnomedicinally important plant taxa

S. No	Taxa name	Family	Symmetry	Shape	Polarity	Aperture	Sculpture
1	<i>Aegle marmelos</i>	Rutaceae	Radial	Subprolate	Isopolar	Tricolporate	Psilate
2	<i>Artemisia vulgaris</i>	Asteraceae	Radial	Prolate spheroidal	Isopolar	Trizonocolporate	Scabrate
3	<i>Asparagus racemosus</i>	Liliaceae	Bilateral	Prolate	Isopolar	Monosulcate	Micro reticulate
4	<i>Cassia fistula</i>	Caesalpinaceae	Bilateral	Prolate	Isopolar	Tricolporate	Reticulate
5	<i>Diospyros melanoxylon</i>	Ebenaceae	Bilateral	Prolate	Isopolar	Tricolporate	Reticulate
6	<i>Emblica officinalis</i>	Euphorbiaceae	Radial	Spheroidal	Isopolar	Pentacolpate	Micro reticulate
7	<i>Leonotis nepetaefolia</i>	Lamiaceae	Radial	Prolate	Isopolar	Tricolpate	Micro reticulate
8	<i>Manihot esculenta</i>	Euphorbiaceae	Radial	Subprolate	Isopolar	Inaperturate	Gemmate
9	<i>Murraya koenigii</i>	Rutaceae	Radial	Subprolate	Isopolar	Trizonocolporate	Very faintly reticulate
10	<i>Ocimum tenuiflorum</i>	Lamiaceae	Radial	Subprolate	Isopolar	Hexazonocolpate	Reticulate
11	<i>Piper longum</i>	Piperaceae	Bilateral	Subprolate	Hetero polar	Monosulcate	Psilate
12	<i>Plectranthes barbatus</i>	Lamiaceae	Radial	Prolate spheroidal	Isopolar	Hexacolpate	Reticulate
13	<i>Pongamia pinnata</i>	Fabaceae	Bilateral	Subprolate	Hetero polar	Tricolporate	Micro reticulate
14	<i>Psidium guajava</i>	Myrtaceae	Radial	Oblate spheroidal	Isopolar	Syncolpate	Psilate
15	<i>Punica granatum</i>	Punicaceae	Bilateral	Subprolate	Hetero polar	Tricolporate	Reticulate
16	<i>Tectona grandis</i>	Verbenaceae	Bilateral	Subprolate	Hetero polar	Trizonocolporate	Psilate

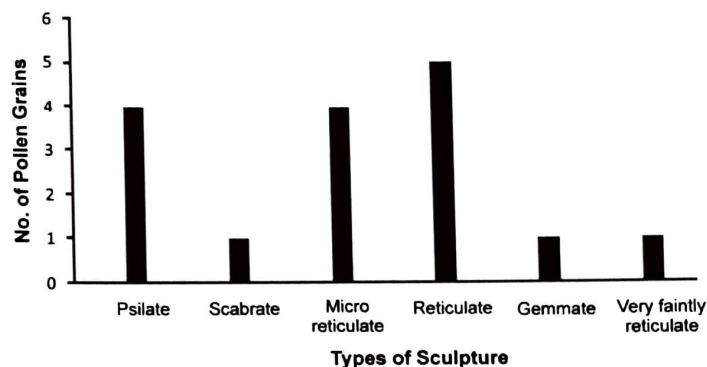


Text figure 3. Diversity in Aperture.

Manihot esculenta is inaperturate and *Psidium guajava* is syncolpate grain (Text figure 3).

The sculpture of the pollen varies as psilate, scabrate, micro reticulate, reticulate, gemmate and very faintly reticulate. *Aegle marmelos*, *Piper longum*, *Psidium guajava* and *Tectona grandis* have psilate. But *Artemesia vulgaris* shows scabrate condition. *Manihot esculenta* has gemmate and *Asparagus racemosus*, *Leonotis nepetaefolia*, *Emblicoefficialis* and *Pongamia pinnata* show microreticulate pattern. *Murraya koenigii* has very faintly reticulate pattern and *Cassia fistula*, *Diospyros melanoxylon*, *Ocimum tenuiflorum*, *Plectranthes barbatus* and *Punica granetum* have reticulate pattern. The sculpture of pollen signifies the dominance of reticulate pattern in all the recorded grains of dyspepsia curing taxa of Adilabad forest divisions (Text figure 4).

Pollen diversity of *Leonotis nepetaefolia*, *Ocimum tenuiflorum*, *Plectranthes barbatus*, *Piper longum*, *Asparagus racemosus*, *Piper longum*, *Murraya koenigii*, *Emblica officinalis*, *Cassia fistula*, *Artemesia vulgaris*, *Manihot esculenta*, *Asparagus racemosus* from Adilabad district. *Tectona grandis* and *Psidium guajava* from Karimnagar district, which are useful to cure dyspepsia were earlier recorded by Prabhakar et al. (2014), Prabhakar and Ramakrishna (2014a), Prabhakar and Ramakrishna (2014b), Prabhakar and Ramakrishna (2014c), Prabhakar and Ramakrishna (2015), Ganga Kailas et al. (2015).



Text figure 4. Diversity in Sculpture.

This pollen morphotaxonomical study from Adilabad district is useful for further confirmation of the identification of the taxa used to cure dyspepsia.

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