



Pollen morphology study of Leguminosae family from Manchippa Reserve Forest, Nizamabad district, Telangana

P. Ravi Raj and A. VijayaBhasker Reddy¹

Dept. of Botany, Girraj Govt. Degree College (A), Nizamabad District., Telangana State, India;

¹*Applied Palynology Research Laboratory, Department of Botany, Nizam College (A), Osmania University, Hyderabad, Telangana State, India – 500001.*

Email : pottavathri@gmail.com; avijayabhaskerreddy@gmail.com

DOI: 10.5958/2455-7129.2019.00019.0 **ABSTRACT**

Key Words:

Leguminosae, Manchippa reserve forest, Palynology.

Palynological studies were carried out in 68 plant species of Leguminosae family from Manchippa Reserve Forest, Nizamabad District. The pollen characters studied are type of pollen units, size, shape, aperture and ornamentation types. Spheroidal, subprolate, euprolate, prolate spheroidal, sub oblate and eu oblate type shapes of the pollen grains are recorded. Aperture types noticed are inaperturate, pantoporate, tetraporate, tricolpate, trizonocolporate and tetrazonocolporate. Ornamentations found are psilate, reticulate, microreticulate, faintlyreticulate, verrucate, gemmate, striate and echinate. The pollen morphology shows diversity, helps in identification of taxa and useful in taxonomy and Palynological studies of Nizamabad district in future.

INTRODUCTION

Nizamabad district situated in northern part of the Telangana state, lies between 18° 05' and 19° of northern latitudes and 77° 40' and 78° 37' of the eastern longitudes and bounded by Kamareddy District in south, Jagityal District in east, Nirmal District in north and Nanded District of Maharashtra in the west. Nizamabad District is situated in the table land of Deccan plateau. Godavari river flows through the district makes Godavari basin the northern boundary.

Forest type is Tropical dry deciduous Nizamabad District have two Forest Divisions, Nizamabad Division and Armour Division. Nizamabad Division is divided into four forest ranges i.e Nizamabad north, Nizamabad south, Varni range and Indalwai ranges. Manchippa Reserve Forest comes under Nizamabad south range. This Reserve Forest is distributed in 16,213.96 hectares (162 km²) of area covers more than 23 villages.

MATERIALS AND METHODS

Present work was carried out during 2018. Pollen material was collected from 68 plants of Leguminosae family from Manchippa reserve forest and diversity of pollen morphology was identified. The pollen material was processed and permanent pollen slides were prepared by Erdtman's method (1960). The pollen material was studied under a binocular research microscope LABOMED Lx 500, and pollen characters were recorded (Photo 1 - 3). The methodology described by Jain and Rao (1977) was followed for the preparation of Herbarium, and the Herbarium with Voucher numbers were deposited at Department of Botany, Nizam college (A), Osmania University, Hyderabad.

RESULTS

Caesalpinaceae

19 species are recorded in sub family Caesalpinaceae, in which all the grains are of monads. This family palynologically shows very much diversity. The diversity was observed in shape, aperture and ornamentation patterns (Table 1 and Photo 1 a & b). Key to the family is given in Fig. 1). Prolate spheroidal, trizonocolporate and reticulate ornamentation was found in *B. purpurea*, *B. racemosa*, *C. bonduc* and *Cassia fistula*. Oblate spheroidal, trizonocolporate and reticulate ornamentation in *Delonix elata*, *D. regia* and *P. pterocarpum*. Euprolate, trizonocolporate and reticulate ornamentation in *C. pulcherrima*, *B. tomentosa*, *P. aculeate*, *S. alexandrina* and *T. indica*. Subprolate, trizonocolporate and psilate ornamentation observed in *Cassia renigera*. Euprolate, trizonocolporate and psilate in *Chamaecrista absus*, *S. auriculata*. Prolate spheroidal, trizonocolporoidate and psilate ornamentation in *S. tora*. *S. occidentalis* shows prolate spheroidal shape, trizonocolporate and psilate ornamentation, whereas *Senna sophora* shows eurprolate shape, trizonocolporate and punctitegillate ornamentation.

Mimosoideae

Eurypalynous condition was observed in Mimosoideae family, with diversity in the type of grains. The pollen grains in this family occur as monads, tetrads, octads and polyads. Monad grains with trizonocolporate and punctuate – foveolate ornamentation in *L. leucocephala*, microreticulate in *P. cineraria* and psilate ornamentation in *P. juliflora*. Tetrads with inaperturate and verrucate ornamentation in *Dichrostachys cinerea* and *M. pudica*. Octad grains with inaperturate and foveolate ornamentation in *M. hamata*. Polyads with inaperturate and psilate ornamentation was found in *Acacia auriculiformis*. *A. cambagei*, *A. catechu*, *A. chundra*, *A. holosericea*, *A. pavonina*, *A. amara*, *A. lebbeck*, *A. odoratissima*, *A. procera*, *A. saman* and *Senegalia torta* (*syn. Acacia torta*). *P. biglandulosa* shows inaperturate and verrucose ornamentation (Table 1 and Photo 2 a & b). Key to the family is given in Fig. 2.

Papilionoideae

Twenty six palynomorphs were recorded from Papilionoideae sub family (Table 1 and Photo 3). Key to the family is given in Fig. 3. Diversified pollen morphological characters were recorded in this family. Triporate with reticulate ornamentation found in *E. variegata*, *R. minima*. Prolate, tricolporate, psilate ornamentation in *Crotalaria angulata*, *C. hirsuta*, *C. juncea*, *C. trifoliata*, *C. verrucosa*, *D. obovata*, *D. paniculata*, *D. sissoo*, *Desmodium oojeinense*, *Gliricidia sepium*, *Indigofera hirsuta*, *I. trifoliata*, *Macroptilium atropurpureum* and *P. marsupium*. Pollen grains with subprolate, tricolporate and reticulate ornamentation in *Butea monosperma*, *B. superba*, *C. scarabaeoides*. Prolate spheroidal, tricolporate and reticulate ornamentation in *Canavalia gladiata*. Euprolate, tricolporate and microreticulate ornamentation in *Abrus precatorius*, *Sesbania bispinosa*, *S. grandiflora* and *Tephrosia purpurea*. *Pongamia pinnata* shows euprolate, tricolporate and granular ornamentation.

DISCUSSION

Related to the arrangement of grains, Panicker (2004) stated that on the base of evolution monad type grains are primitive, while the grains with polyad arrangement are most advanced. On the base of studies by Elias et.al (1981) the evolutionary pattern of pollen grains through monads to tetrads to polyads which coincided with the development of bird and bat pollinated flowers. This work infers species showing monad arrangement evolved first, followed by polyad grains. In his study Pal (1993a) found that taxa having tricolporate pollen are advanced, whereas taxa with polyad / colpate type pollen shows primitive status

in the evolutionary scale.

Tricolporate pollen is the main and basic type found in most eudicots while other aperture types such as penta, hexacolpate, porate, colpate and pororate are regarded as derived among eudicots (Walker and Doyle 1975).

The diverse morphological characters of pollen grains give clue of the significance of palynology in separation of taxa. Palynological characters specially the exine sculpturing serves an aid in delimitation of taxa for identification and classification at species and generic level of family Leguminosae.

Table 1. Pollen morphology of 68 species of Leguminosae from Manchippa Reserve Forest

S. no	Name of the plant	Pollen units	Size P.A.	Size E.A.	P/Ex 100	Shape	Aperture	Ornamentation
Caesalpinaceae								
1	<i>Bauhinia purpurea</i> L.	Monad	56.65 µm	52.69 µm	1.07	Prolate spheroidal	Trizonocolporate	Straite reticulate
2	<i>Bauhinia racemosa</i> Lam.	Monad	25.93 µm	21.43 µm	1.20	Prolate spheroidal	Trizonocolporate	Reticulate
3	<i>Bauhinia tomentosa</i> L.	Monad	65.34 µm	41.76 µm	1.56	Euprolate	Trizonocolporate	Reticulate
4	<i>Caesalpinia bonduc</i> (L.) Roxb.	Monad	44.34 µm	41.39 µm	1.07	Prolate spheroidal	Trizonocolporate	Reticulate
5	<i>Caesalpinia pulcherrima</i> (L.) Sw.	Monad	64.24 µm	63.33 µm	1	Spheroidal	Trizonocolporate	Reticulate-rugulate
6	<i>Cassia fistula</i> L.	Monad	23.44 µm	20.88 µm	1.12	Prolate spheroidal	Trizonocolporate	Reticulate
7	<i>Cassia renigera</i> Benth.	Monad	33.42 µm	27.51 µm	1.21	Subprolate	Trizonocolporate	Psilate
8	<i>Chamaecrista absus</i> (L.) H.S. Irwin & Barneby	Monad	47.53 µm	27.36 µm	1.73	Euprolate	Trizonocolporate	Psilate
9	<i>Delonix alata</i> (L.) Gamble	Monad	56.77 µm	58.83 µm	0.96	Oblate spheroidal	Trizonocolporate	Retipilate
10	<i>Delonix regia</i> (Hook.) Raf.	Monad	47.45 µm	48.51 µm	0.97	Oblate spheroidal	Trizonocolporate	Reticulate
11	<i>Parkinsonia aculeata</i> L.	Monad	30.06 µm	18.72 µm	1.60	Euprolate	Trizonocolporate	Reticulate
12	<i>Peltophorum pterocarpum</i> (DC.) K. Heyne	Monad	54.67 µm	58.74 µm	0.93	Oblate spheroidal	Trizonocolporate	Reticulate
13	<i>Senna alexandrina</i> Mill.	Monad	32.55 µm	23.83 µm	1.36	Euprolate	Trizonocolporate	Faintly reticulate
14	<i>Senna auriculata</i> (L.) Roxb.	Monad	37.37 µm	25.68 µm	1.45	Euprolate	Trizonocolporate	Psilate

15	<i>Senna occidentalis</i> (L.)Link	Monad	38.97 µm	34.88 µm	1.11	Prolate spheroidal	Trizonocol porate	Psilate
16	<i>Senna siamea</i> (Lam.)H.S.Irwin & Barneby	Monad	40.15 µm	33.71 µm	1.19	Subprolate	Trizonocol pate	Psilate
17	<i>Senna sophera</i> (L.)Roxb.	Monad	35.52 µm	25.92 µm	1.37	Euprolate	Trizonocol porate	Punctite gillate
18	<i>Senna tora</i> (L.)Roxb.	Monad	38.65 µm	28.94 µm	1.33	Prolate spheroidal	Trizonocol poroidate	Psilate
19	<i>Tamarindus indica</i> L.	Monad	44.08 µm	22.88 µm	1.92	Euprolate	Trizonocol porate	Striate reticulate
Mimosoideae								
20	<i>Acacia auriculiformis</i> A.Cunn. ex Benth.	Polyad	38.81 µm	38.32 µm	1.02	Spheroida 1	Inaperturate	Psilate
21	<i>Acacia cambagei</i> R.T. Baker	Polyad	42.13 µm	41.32 µm	1	Spheroida 1	Inaperturate	Psilate
22	<i>Acacia catechu</i> (Linn f.) Willd.	Polyad	37.42 µm	38.32 µm	1	Spheroida 1	Inaperturate	Psilate
23	<i>Acacia chundra</i> Willd	Polyad	40.53 µm	41.32 µm	1	Spheroida 1	Inaperturate	Psilate
24	<i>Acacia farinose</i> Lindl.	Polyad	51.73 µm	52.32 µm	1	Spheroida 1	Inaperturate	Micro reticulate
25	<i>Acacia holosericea</i> A.Cunn. ex G.Don	Polyad	57.40 µm	56.32 µm	1.02	Spheroida 1	Inaperturate	Psilate
26	<i>Acacia leucocephala</i> Willd	Polyad	41.51 µm	40.32 µm	1.03	Spheroida 1	Inaperturate	Granulate
27	<i>Acacia nilotica</i> (L.) Willd. ex Delile	Polyad	135.1 1 µm	128.3 2 µm	1.05	Spheroida 1	Inaperturate	Granulate
28	<i>Adenanthera pavonina</i> L.	Polyad	85.76 µm	84.32 µm	1	Spheroida 1	Inaperturate	Psilate
29	<i>Albizia amara</i> (Roxb.) B.Boivin	Polyad	73.32 µm	66.76 µm	1.09	Prolate spherical	Inaperturate	Psilate
30	<i>Albizia lebbeck</i> (L.) Benth.	Polyad	66.31 µm	68.32 µm	0.97	Spheroida 1	Inaperturate	Psilate
31	<i>Albizia odoratissima</i> (L.f.) Benth.	Polyad	87.82 µm	88.12 µm	1	Spheroida 1	Inaperturate	Psilate
32	<i>Albizia procera</i> (Roxb.) Benth	Polyad	74.68 µm	72.32 µm	1.03	Spheroida 1	Inaperturate	Psilate
33	<i>Albizia saman</i> (Jacq.)Merr.	Polyad	99.05 µm	100.3 8 µm	0.94	Oblate spheroidal	Inaperturate	Psilate
34	<i>Dichrostachys cinerea</i> (L.)Wight & Arn.	Tetrad	43.65 µm	43.19 µm	1.01	Subprolate	Inaperturate	Verrucate
35	<i>Leucaena leucocephala</i> (Lam.) de Wit	Monad	58.32 µm	42.86 µm	1.36	Euprolate	Trizonocol porate	Punctuate - foveolate
36	<i>Mimosa hamata</i> Willd.	Octad	11.30 µm	12.03 µm	1	Circular	Inaperturate	Foveolate
37	<i>Mimosa pudica</i> L.	Tetrad	43.65 µm	42.32 µm	1.02	Spheroida 1	Inaperturate	Verrucate
38	<i>Parkia biglandulosa</i> Wight & Arn	Polyad	96.05 µm	98.02 µm	0.97	Spheroida 1	Inaperturate	Verrucate
39	<i>Pithecellobium dulce</i> (Roxb.) Benth	Polyad	77.62 µm	78.32 µm	1	Spheroida 1	Inaperturate	Psilate

40	<i>Prosopis cineraria</i> (L.) Druce	Monad	34.69 µm	27.99 µm	1.23	Subprolate	Trizonocolporate	Microreticulate
41	<i>Prosopis juliflora</i> (Sw.)DC.	Monad	32.79 µm	23.58 µm	1.39	Euprolate	Trizonocolporate	Psilate
42	<i>Senegalia torta</i> (Roxb.) Maslin, Seigler & Ebinger	Polyad	85.50 µm	84.32 µm	1	Spheroidal	Inaperturate	Psilate
Papilionoideae								
43	<i>Abrus precatorius</i> L.	Monad	40.32 µm	21.84 µm	1.84	Euprolate	Trizonocolporate	Microreticulate
44	<i>Butea monosperma</i> (Lam.) Taub.	Monad	46.22 µm	35.50 µm	1.30	Subprolate	Trizonocolporate	Striatereticulate
45	<i>Butea superba</i> Roxb.	Monad	33.58 µm	26.95 µm	1.24	Subprolate	Trizonocolporate	Microreticulate
46	<i>Cajanus scarabaeoides</i> (L.) Thouars	Monad	25.72 µm	19.80 µm	1.29	Subprolate	Trizonocolporate	Reticulate
47	<i>Canavalia gladiata</i> (Jacq.) DC.	Monad	53.32 µm	47.62 µm	1.11	Prolate spheroidal	Trizonocolporate	Reticulate
48	<i>Crotalaria angulata</i> Mill.	Monad	27.56 µm	16.20 µm	1.70	Euprolate	Trizonocolporate	Psilate
49	<i>Crotalaria hirsuta</i> Willd.	Monad	25.92 µm	14.35 µm	1.80	Euprolate	Trizonocolporate	Psilate
50	<i>Crotalaria juncea</i> L.	Monad	22.23 µm	12.73 µm	1.74	Euprolate	Trizonocolporate	Psilate
51	<i>Crotalaria trifoliolata</i> Baker f.	Monad	26.01 µm	19.76 µm	1.31	Euprolate	Trizonocolporate	Psilate
52	<i>Crotalaria verrucosa</i> L.	Monad	25.18 µm	17.19 µm	1.46	Euprolate	Trizonocolporate	Psilate
53	<i>Dalbergia latifolia</i> Roxb.	Monad	20.17 µm	17.13 µm	1.17	Subprolate	Trizonocolporate	Microreticulate
54	<i>Dalbergia obovata</i> E. Mey	Monad	18.57 µm	13.34 µm	1.39	Euprolate	Trizonocolporate	Psilate
55	<i>Dalbergia paniculata</i> (Roxb.) Thoth	Monad	18.33 µm	15.45 µm	1.18	Subprolate	Trizonocolporate	Psilate
56	<i>Dalbergia sissoo</i> DC.	Monad	38.28 µm	21.49 µm	1.78	Euprolate	Trizonoporate	Psilate
57	<i>Desmodium oojeinense</i> H. Ohashi	Monad	24.05 µm	18.40 µm	1.30	Subprolate	Trizonocolporate	Psilate
58	<i>Erythrina variegata</i> L.	Monad	25.18 µm	17.19 µm	1.46	Euprolate	Trizonocolporate	Reticulate
59	<i>Gliricidia sepium</i> (Jacq.) Walp.	Monad	25.34 µm	14.37 µm	1.76	Euprolate	Trizonocolporate	Psilate
60	<i>Indigofera hirsuta</i> L.	Monad	30.18 µm	32.55 µm	0.92	Oblate spheroidal	Trizonocolporate	Psilate
61	<i>Indigofera trifoliata</i> subsp. trifoliata L.	Monad	37.26 µm	31.56 µm	1.18	Subprolate	Trizonocolporate	Psilate
62	<i>Macroptilium atropurpureum</i> (DC.)Urb.	Monad	23.21 µm	21.86 µm	1.06	Prolate spheroidal	Trizonocolporate	Psilate
63	<i>Pongamia pinnata</i> (L.)Pierre	Monad	25.61 µm	18.19 µm	1.40	Euprolate	Trizonocolporate	Granular
64	<i>Pterocarpus marsupium</i> Roxb.	Monad	15.69 µm	14.43 µm	1.08	Prolate spheroidal	Trizonocolporate	Psilate

65	<i>Rhynchosia minima</i> (L.) DC.	Monad	30.46 µm	34.51 µm	0.88	Oblate spheroidal	Trizonoporate	Reticulate
66	<i>Sesbania bispinosa</i> (Jacq.) W.Wight	Monad	25.63 µm	17.19 µm	1.46	Euprolate	Trizonocolporate	Psilate
67	<i>Sesbania grandiflora</i> (L.)Pers.	Monad	28.49 µm	17.56 µm	1.62	Euprolate	Trizonocolporate	Microreticulate
68	<i>Tephrosia purpurea</i> (L.)Pers.	Monad	23.30 µm	13.63 µm	1.70	Euprolate	Triczonoolporate	Microreticulate

Key

1a. Psilateexine	----	2
2a. Trizonocolporate grains, syncolporate		---- <i>Senna siamea</i>
2b. Trizonocolporate/ trizonocolporoidate grains	----	3
3a. aperture trizonocolporoidate, indistinct pore		--- <i>Senna tora</i>
3b. aperture trizonocolporate, distinct pore	----	4
4a. ora circular, large distinct pore		---- <i>Chamaecrista absus</i>
4b. oralolongate / lalongate	----	5
5a. oralolongate, included in colpi		---- <i>Senna auriculata</i>
5b. oralolongate	----	6
6a. brevicolpatecolpi	----	7
7a. colpilength > 30 µm		---- <i>Senna occidentalis</i>
7b. colpilength < 30 µm		---- <i>Senna alexandrina</i>
6b. longicolpatecolpi	----	8
8a. apocolpia > 5 µm, syncolporate		---- <i>Cassia fistula</i>
8b. apocolpia < 5 µm		---- <i>Cassia renigera</i>
1b. Ornamented exine	----	9
9a. ornamentation punctitegillate grains, euprolate shaped	----	<i>Senna sophera</i>
9b. ornamentation reticulate	----	10
10a. grains with spheroidal shape	----	11
11a. prolatespheroidal,reticulate ornamentation	----	<i>Caesalpina bonduc</i>
11b. Spheroidal, reticulate – regulate ornamentation	----	<i>Caesalpina pulcherrima</i>
10b. grains with oblate/ prolate shape	----	12
12a. grains with oblate shape	----	13
13a. lumina polygonal with duplibacula	----	<i>Peltophorum pterocarpum</i>
13b. lumina polygonal with simplibacula	----	14
14a. exine > 6 µm thick		---- <i>Delonix regia</i>
14b. exine < 6 µm thick		---- <i>Delonix elata</i>
12b. Grains with prolate shape	----	15
15a. ora oblate included in colpi	----	16
16a. exine > 2 µm		---- <i>Parkinsonia aculeata</i>
16b. exine < 2 µm		---- <i>Tamarindus indica</i>
15b. ora elliptic not included in colpi	----	17
17a. grains euprolate in shape		-- <i>Bauhenia tomentosa</i>
17b. grains prolate spheroidal in shape	----	18
18a. ornamentation reticulate		---- <i>Bauhenia racemosa</i>
18b. ornamentation striate reticulate		---- <i>B. purpurea</i>

Fig. 1.Key of species for family Caesalpinaceae

Key

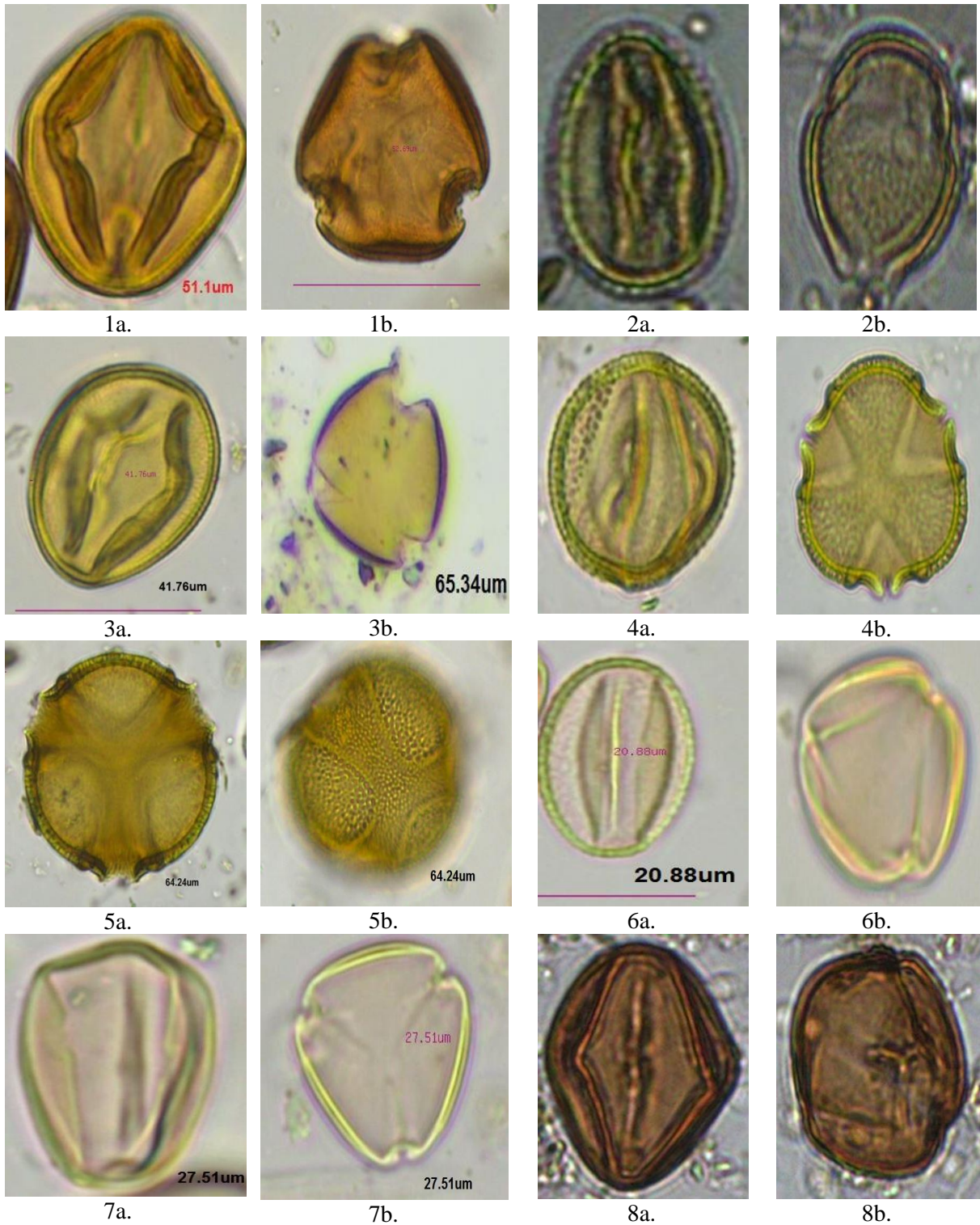
1a .Pollen grains are monads	----	2	
2a. Grains subprolate shaped, microreticulate			---- <i>Prosopis cineraria</i>
2b. Grains euprolate shaped	----	3	
3a. ornamentation psilate			---- <i>Prosopis juliflora</i>
3b. ornamentation punctate – foveolate			---- <i>Leucaena leucocephala</i>
1b. Pollen grains are polyads	----	4	
4a. Polyads< 16 monads	----	5	
5a. Polyadswith 8 monads			---- <i>Mimosa hamata</i>
5b. Polyadswith 4 monads (tetrads)	----	6	
6a. Subprolate shaped and verrucate ornamentation			---- <i>Dichrostachy scinerea</i>
6b. Spheroidal shape, verrucate			---- <i>Mimosa pudica</i>
4b. Polyads with 16 / > 16 monads	----	7	
7a. Polyads with 32 monads			---- <i>Albizia saman</i>
7b. Polyads with 16 monads	----	8	
8a. Ornamentation psilate	----	9	
9a. size < 50 µm	----	10	
10a. monad shape squarish	----	11	
11a. monad size 15.34 µm			---- <i>Acacia auriculiformis</i>
11b. monad size 18.22 µm			---- <i>Acacia chundra</i>
10b. monad shape squarish – rectangular	----	12	
12a. monad size 12.22 µm			---- <i>Acacia catechu</i>
12b. monad size 14.73 µm			---- <i>Acacia cambagei</i>
9b. size > 50 µm			
13a. grains prolate spheroidal in shape			---- <i>Albizia amara</i>
13b. grains spheroidal in shape	----	14	
14a. monads squarish in shape			---- <i>Acacia holosericea</i>
14b. monads rectangular/ squarish rectangular in shape	----	15	
15a. monad squarish rectangular shape, 31.24 µm in size			---- <i>Adenantha pavonina</i>
15b. monads rectangular shape	----	16	
16a. monads size < 20 µm	----	17	
17a. exine 1.5 µm in thickness			---- <i>Pithecellobium dulce</i>
17b. exine 2.5 µm in thickness			---- <i>Senegalia torta</i>
16b. monads size > 20 µm	----	18	
18a. exine> 2.5 µm thick			---- <i>Albizia odoratissima</i>
18b. exine< 2.5 µm thick	----	19	
19a. exine 2.34 µm thick			---- <i>Albizia lebbeck</i>
19b. exine 2.4 µm thick			---- <i>Albizia procera</i>
8b. Ornamentation other than psilate	----	20	
20a. size> 100µm	--		-- <i>Acacia nilotica</i>
20b. Size< 100µm		----	21
21a. ornamentation verrucate			---- <i>Parkia biglandulosa</i>
21b. Ornamentation other than verrucate	----	22	
22a. Ornamentation granulate			---- <i>Acacia leucocephloea</i>
22b. Ornamentation microreticulate			---- <i>Acacia farinosa</i>

Fig. 2. Key of species for family Mimosaceae

Key

1a. Aperture triporate	----	2	
2a. angulaperturate grains, oblate spheroidal shape			---- <i>Rhynchosia minima</i>
2b. circulaperturate grains, euprolate shape			---- <i>Erythrina variegata</i>
1b. Aperture tricolporate	----	3	
3a. ornamentation reticulate		----	4
4a. prolate spheroidal grains			---- <i>Canavalia gladiata</i>
4b. prolate grains		----	5
5a. subprolate shape, micro reticulate ornamentation		----	6
6a. apocolpia > 5 µm			---- <i>Butea monosperma</i>
6b. apocolpia < 5 µm		----	7
7a. longicolpate			---- <i>Butea superba</i>
7b. Brevicolpate			---- <i>Cajanus scarabaeoides</i>
5b. euprolate shape, micro reticulate ornamentation		----	8
8a. apocolpia > 5 µm			---- <i>Abrus precatorius</i>
8b. apocolpia < 5 µm		----	9
9a. colpi linear			---- <i>Tephrosia purpurea</i>
9b. colpi dumb - bell shaped		----	10
10a. mesocolpia 16.3 µm across			---- <i>Sesbania grandiflora</i>
10b. mesocolpia 12.3 µm across			---- <i>Sesbania bispinosa</i>
3b. ornamentation psilate	----	11	
11a. oblate grains		----	12
12a. colpi linear, apocolpi < 6µm			---- <i>Inidgofera hirsuta</i>
12b. colpi elliptic, apocolpi > 6µm			---- <i>Inidgofera trifolia</i>
11b. Prolate grains		----	13
13a. grains euprolate shaped		----	14
14a. ornamentation granular			---- <i>Pongamia pinnata</i>
14b. Ornamentation psilate		----	15
15a. Colpi elliptic			--- <i>Gliricidia sepium</i>
15b. Colpi linear		----	16
16a. exine < 2.5 µm		----	17
17a. polar outline triangular		----	18
18a. ambangulaperturate			---- <i>Crotalaria juncea</i>
18b. ambfossaperturate			---- <i>Crotalaria hirsuta</i>
17b. Polar outline circular		----	19
19a. mesocolpia < 12 µm			---- <i>Crotalaria angulata</i>
19b. mesocolpia > 12 µm		----	20
20a. apocolpia 7.5 µm			---- <i>Crotalaria trifoliolata</i>
20b. Apocolpia 8.55 µm			---- <i>Crotalaria verrucata</i>
16b. Exine > 2.5 µm		----	21
21a. apocolpia 6.25 µm			---- <i>Dalbergia obovata</i>
21b. Apocolpia 8.2 µm			---- <i>Dalbergia sissoo</i>
13b. grains sub prolate/ prolate spheroidal shaped		----	22
22a. prolate spheroidal		----	23
23a. colpi linear, ora elliptic			---- <i>Macroptilium atropurpuream</i>
23b. colpi elliptic, ora circular			---- <i>Pterocarpus marsupium</i>
22b. subprolate grains		----	24
24a. sculpturing psilate – perforate			---- <i>Desmodium oojeinense</i>
24b. Sculpturing psilate		----	25
25a. mesocolpia 13.3 µm			---- <i>Dalbergia latifolia</i>
25b. mesocolpia 11.3 µm			--- <i>Dalbergia paniculata</i>

Fig. 3.Key of species for family Papilionaceae



1a,b *Bauhinia purpurea*

2a,b *Bauhinia racemosa*

3a,b *Bauhinia tomentosa*

4a,b *Caesalpinia bonduc*

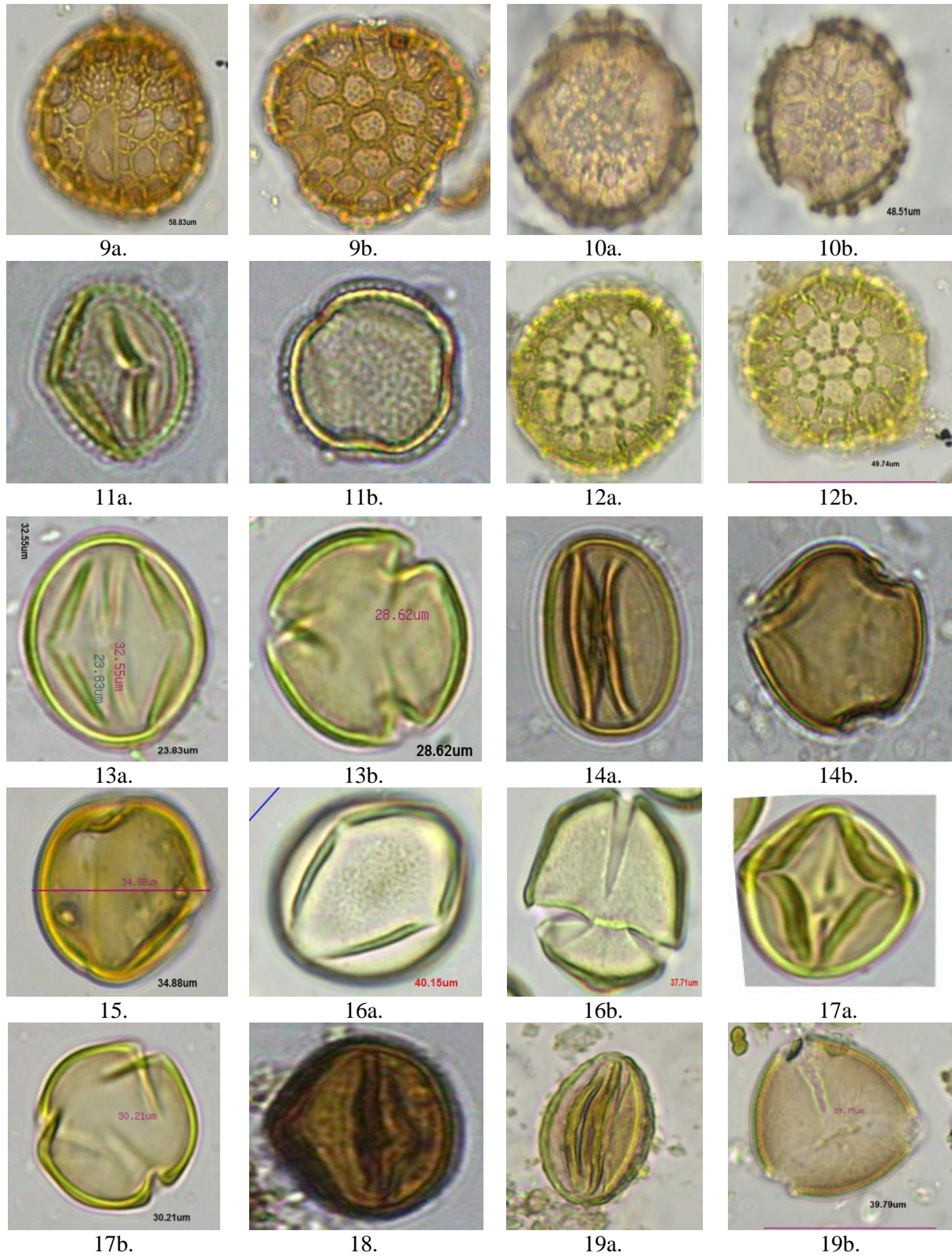
5a,b *Caesalpinia pulcherrima*

6a,b *Cassia fistula*

7a,b *Cassia renigera*

8a,b *Chamaecrista absus*

Photo 1a. Pollen photomicrographs of Caesalpinoideae



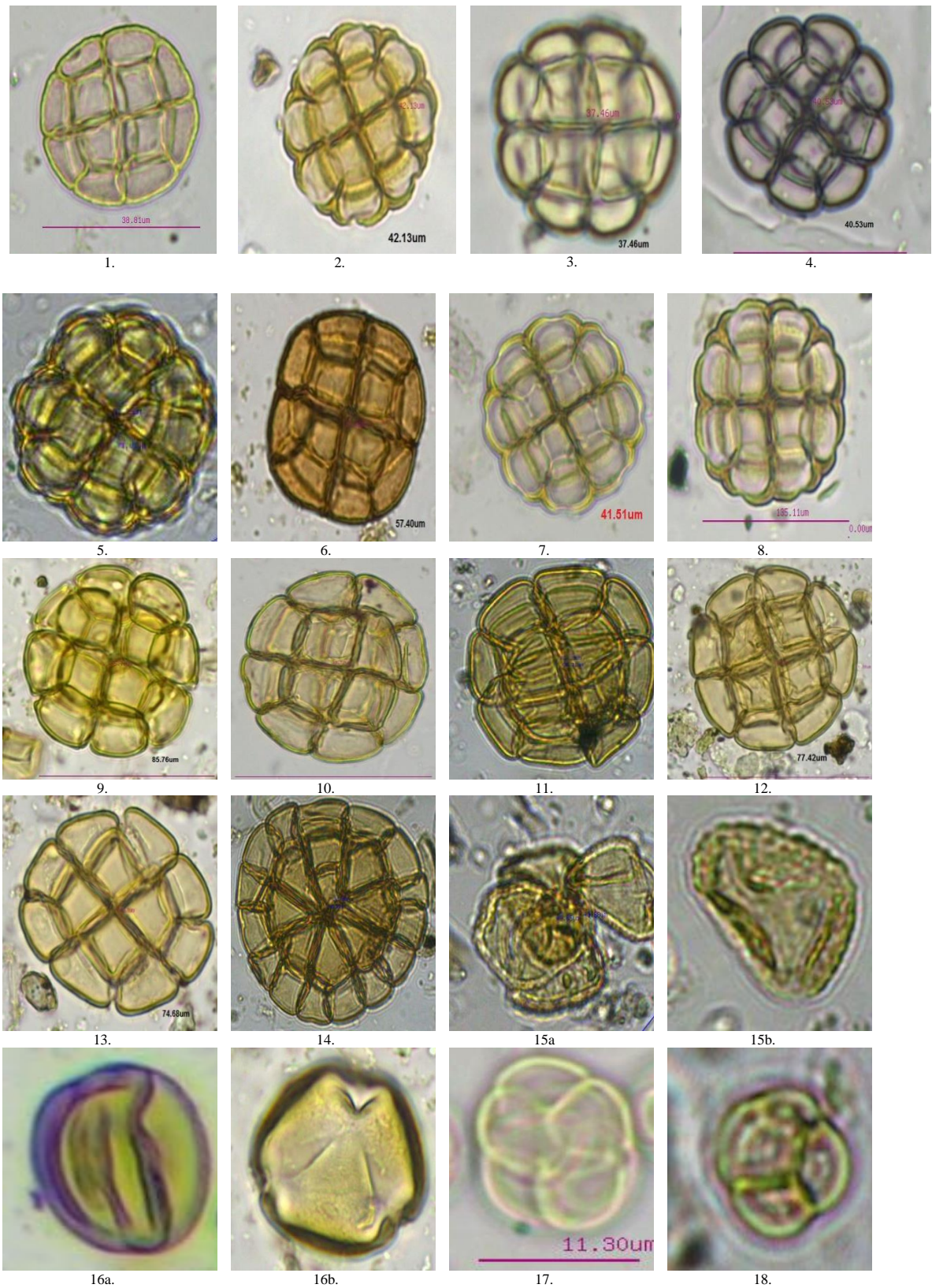
9a,b *Delonix elata* 10a,b *Delonix regia* 11a,b *Parkinsonia aculeate* 12a,b *Peltophorum pterocarpum*

13a,b *Senna alexandrina* 14a,b *Senna auriculata* 15 *Senna occidentalis*

16a,b *Senna siamea*

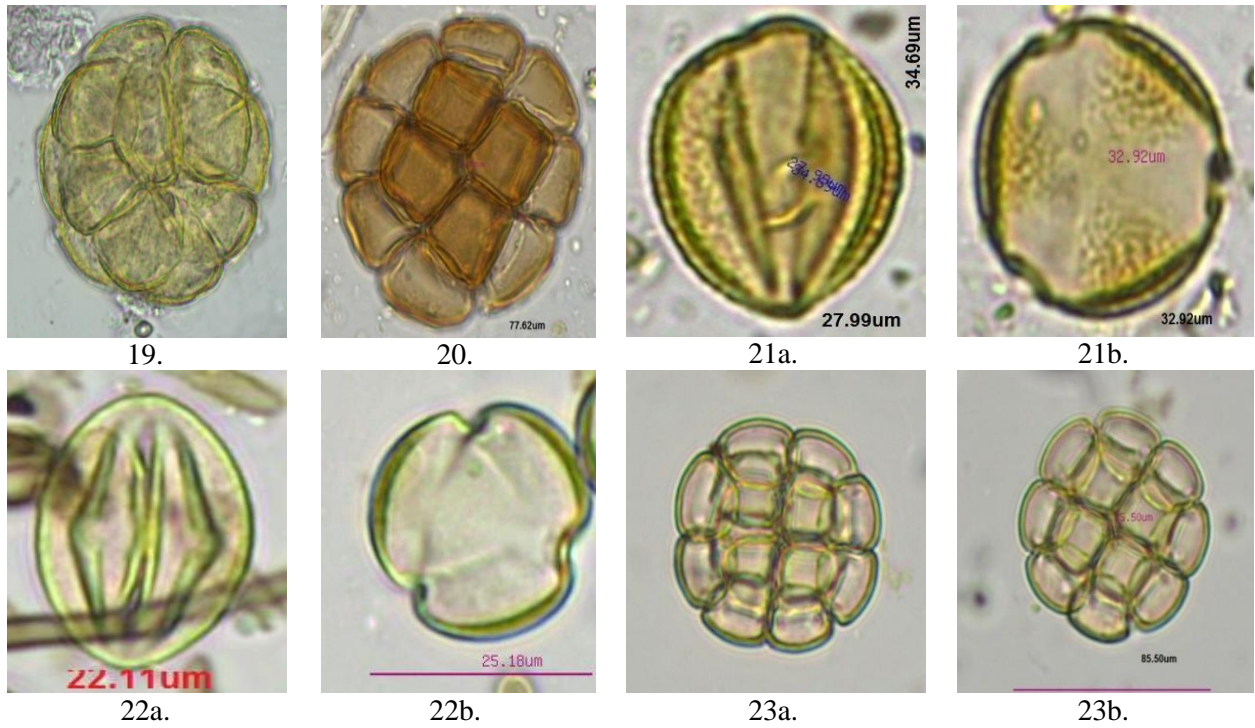
17a,b *Senna sophora* 18 *Senna tora* 19a,b *Tamarindus indica*

Photo1b. Pollen photomicrographs of Caesalpinoideae



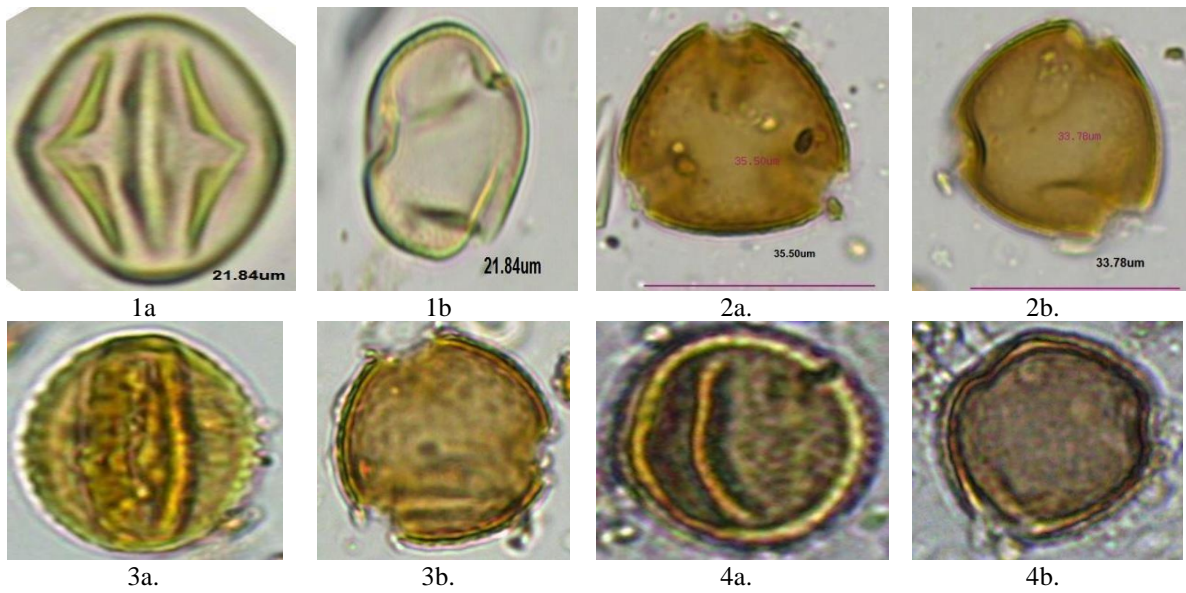
1. *Acacia auriculiformis* 2. *Acacia campbagei* 3. *Acacia catechu* 4. *Acacia chundra* 5. *Acacia farinose*
 6. *Acacia holosericia* 7. *Acacia leucophloea* 8. *Acacia nilotica* 9. *Adenantha pavonina* 10. *Albizia amara*
 11. *Albizia lebbek* 12. *Albizia odoratissima* 13. *Albizia procera* 14. *Albizia saman* 15a,b. *Dichrostachys cineraria*
 16a,b. *Leucaena leucocephala* 17. *Mimosa hamata* 18. *Mimosa pudica*

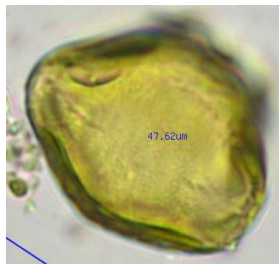
Photo 2a. Pollen photomicrographs of Mimosoideae



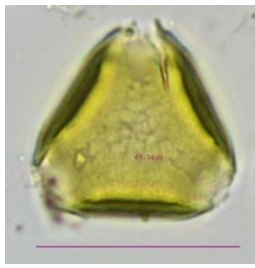
19. *Parkia biglandulosa* 20. *Pithecellobium dulce* 21a,b *Prosopis cineraria*
 22a,b *Prosopis julifera* 23a,b *Senegalia torta*

Photo 2b. Pollen photomicrographs of Mimosoideae

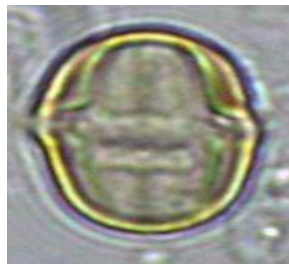




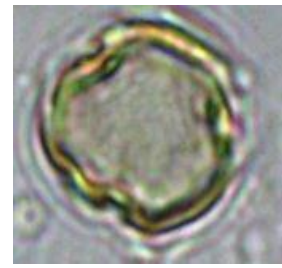
5a



5b



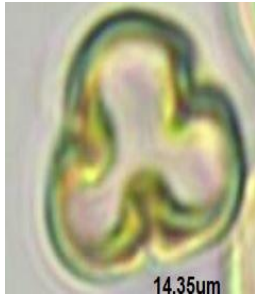
6a.



6b.



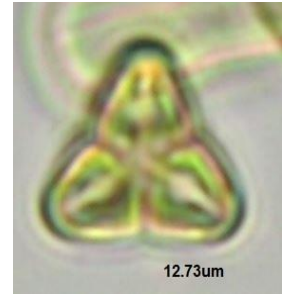
7a.



7b.



8a.



8b.



9a.



9b.



10a.



10b.



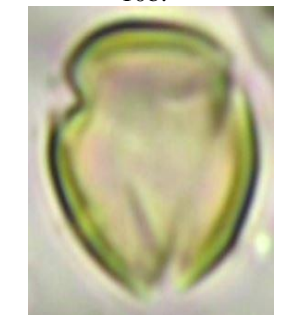
11a.



11b.



12.



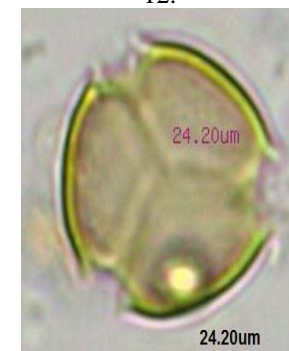
13.



14a.



14b.



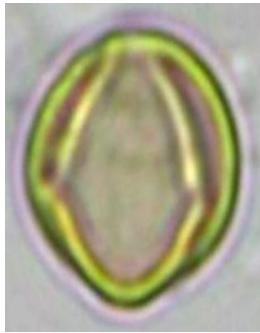
15.



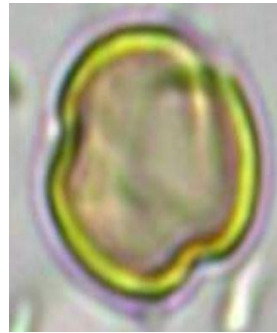
16a.



16b.



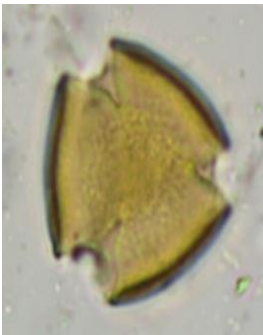
17a.



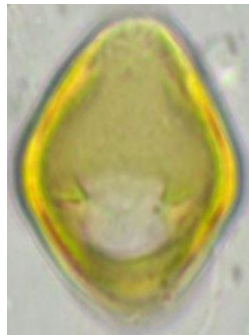
17b.



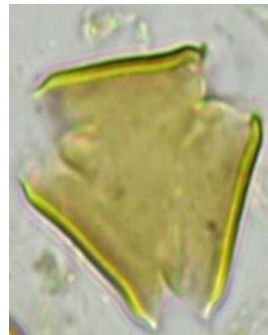
18a



18b.



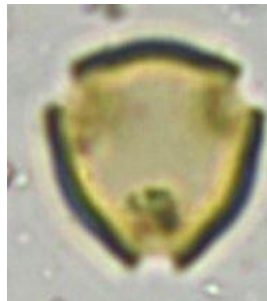
19a.



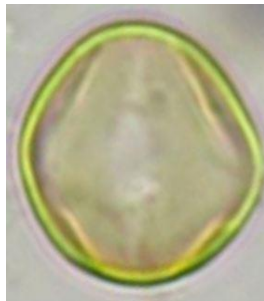
19b.



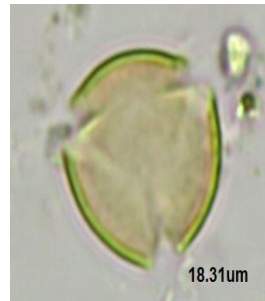
20a



20b.



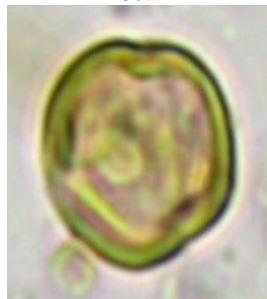
21a.



21b.



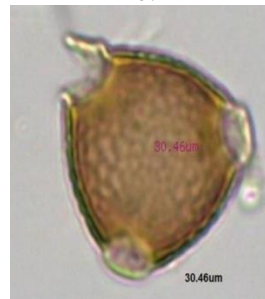
22a.



22b.



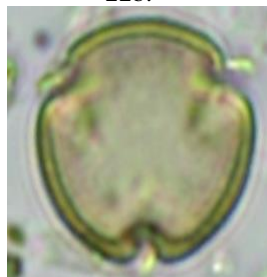
23a.



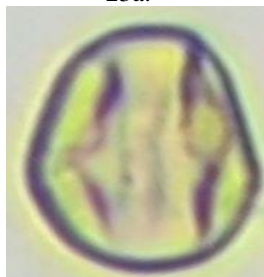
23b.



24a.



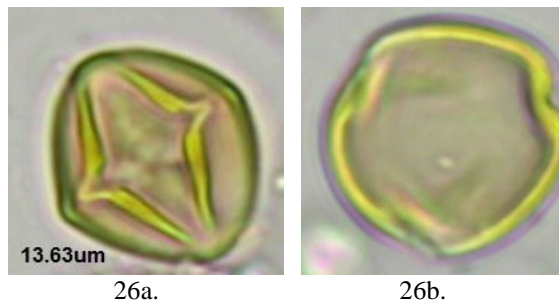
24b.



25a.



25b.



- 1a,b *Abrus precatorius* 2a,b *Butea monosperma* 3a,b *Butea superba* 4a,b *Cajanus scarabaeoides*
 5a,b *Canavaliagradiata* 6a,b *Crotalaria angulata* 7a,b *Crotalaria hirsuta* 8a,b *Crotalaria juncia*
 9a,b *Crotalaria trifolia* 10a,b *Crotalaria verrucosa* 11a,b *Dalbergia latifolia* 12. *Dalbergia obovata*
 13. *Dalbergia paniculata* 14a,b *Dalbergia sissoo* 15. *Desmodium oojeinense* 16a,b *Erythrina variegata*
 17a,b *Glirecidium sepium* 18a,b *Indigofera hirsuta* 19a,9 *Indigofera trifoliata* 20a,b *Macroptelium atropurpureum*
 21a,b *Pongamiapinnata* 22a,b *Pterocarpus marsupium* 23a,b *Rhynchosia minima*
 24a,b *Sesbania bispinosa* 25a,b *Sesbania grandiflora* 26a,b *Tephrosia purpurea*

Photo 3. Pollen photomicrographs of Papilionoideae

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REFERENCES

- Elias TS. 1981. Mimosoideae- Parkieae. In advances in legume systematics part I. Royal botanic gardens, Kew. Polhill, RM. and Raven, PH. (ed) : 153 p.
- Jain SK. and Rao RR. 1977. A handbook of field and herbarium. Today & Tomorrow's printers and publishers, New Delhi.
- Pal JK, Datta BK, Mandal S and Bhattacharya GN. 1993a. Cyto-palynological investigation in *Cassia fistula* L., Environment & Ecology, 11(2): 435 – 438.
- Panicker KTC. 2004. Studies in the pollen morphology of mimosaceae monads, tetrads and octad taxa. Journal of Palynology, 40: 9 – 21.
- Walker JW. and Doyle JA. 1975. The bases of angiosperm phylogeny: Palynology. Annals of Missouri botanical garden, 62:664-723.