PALYNOLOGICAL STUDIES ON SELECTED EIGHT SPECIES OF *ACACIA*, Willd IN SOUTH INDIA

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Acacia is one among the tribes of the family Mimosaceae of the order Leguminales. The Palynological study of *Acacia* genus is of great interest, since there is an apparent difference in the size and pollen apertures. In this present study the author selected 8 rare and important species of *Acacia* collected from various part of Tamilnadu, south India viz. *Acacia* auriculiformis cunn. ex Benth, *Acacia catechu* Willd, *Acacia dealbata* Link, *Acacia latronum* Willd, *Acacia leucophloea* Willd, *Acacia longifolia* Willd, *Acacia mangium* Willd and *Acacia planifrons*. W & A for studying pollen morphology. Also an attempt is made to interpret this diversity on the basis of the fundamental Palynological characters. The size differences mainly the number of pores is of great use in the identification of species. The pollen unit is of polyad type in all the 8 taxa, taken for this study. Aperture morphology showed *Acacia auriculiformis* cunn. ex Benth, *Acacia leucophloea* Willd and *Acacia planifrons* are 3–4 porate, *Acacia catechu* Willd and *Acacia dealbata* Link are indistinct, *Acacia latronum* Willd and *Acacia mangium* Willd are 4 porate, *Acacia longifolia* Willd is 3 porate respectively. The ornamentation is foveolate in *Acacia catechu* Willd, *Acacia dealbata* Link, *Acacia latronum* Willd and *Acacia leucophloea* Willd and faintly faveolate in *Acacia auriculiformis* cunn. ex Benth, *Acacia longifolia* Willd, *Acacia mangium* Willd and *Acacia planifrons*. W & A.

Key words: *Acacia*, palynology, pollen unit, aperture, ornamentation.

INTRODUCTION

The term "pollen" was first introduced by the great Swedish botanist Linnaeus. Pollen is a highly reduced male gametophyte and it is a unique entity utilized by higher plants for their reproduction through which the genetic information is transmitted. Pollen unit is the most vital unit of the angiosperm flower, both with regard to form and function and represents an essential genetic bridge between one generation and the next (Erdtman, 1952; Nair, 1970a). The first comprehensive attempt to study the pollen was made by Wodehouse (1935) published in his book "Pollen Grains". This was followed by the signal contribution of Erdtman (1952) who laid a strong foundation for the study with the

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publication of the book "Pollen Morphology and Plant Taxonomy". The study of pollen grains gave rise to a separate branch of biology, namely "Palynology" the term being first coined by Hyde and Williams (1945). Among the cases of angiosperms, phylogeny, pollen morphology is considered to be unique in as much as no other single discipline can obtain as great an amount of information from so little material within a short period Walker and Doyle (1975).

Nair (1964a) has presented a scheme explaining the fundamental principles for the resolution of various aspects of research in palynology and has elucidated the application of pollen morphology in studies concerning the origin and evolution of plant kingdom (Nair, 1970b, 1964b). The principal pollen characters which are phylogenetically useful at different taxonomic levels include the aperture type, pollen wall sculpture, symmetry, shape and size of which the aperture characteristics are considered to be of paramount importance especially at the generic and lower levels (Nair, 1964; Walker, 1976). It has also been authentically demonstrated that not only the aperture features, but also the exine stratification (Nair, 1972) and pollen size as well constitute the various structural entities of taxonomic and evolutionary value.

Mimosaceae is one of the three subfamilies of the order Leguminales and our knowledge on the palynology of the group especially of the South Indian region is scanty and scattered. The present palynological study has been undertaken as an attempt to carry out detailed, pollen morphological studies in a sizable number of 8 species of Mimosaceae from South India and to use the data for tackling the taxonomic tangles confronting the group Acacieae.

Acacia (Willd.) is a large genus belonging to the tribe Acacieae (Mimosaceae) distributed mostly in arid zones. Although apparently a well knit taxonomic unit, concerning its composition there is some amount of controversy. Palynological data have been well recognized as a potential supplementary tool for tackling taxonomic problems and systematic relationship of related plant groups (Nair, 1974). However, palynological information on species of this genus is very scanty and the available information is only on a handful of alien taxa Cookson (1955); Sorsa (1969); Caccavari (1970); Guinet (1981). Hence an attempt has been made to study the pollen characters of 8 species of *Acacia* in the present investigation. Pollen is a very good experiment in the hands of biologists and the programs in the near future would be much more fascinating than in the past.

MATERIAL AND METHODS

COLLECTION OF POLLEN GRAINS. The polleniferous materials were collected from various localities of South India, including a number of exotic taxa which have been known under cultivation as garden plants for medicinal use. Polleniferous materials were procured mostly from live plants. Anthers from

mature flower buds were fixed in glacial acetic acid and pollen preparations made by acetolysis method (Erdtman, 1969). Various pollen features were studied by LM observations. The morphological characters of the pollen were analyzed following Nair's terminology (Nair, 1964). The size of the pollen grains was measured using Ocular micrometer and the details are recorded.

PREPARATION OF POLLEN GRAINS. Pollen grains are fixed in 70% ethyl alcohol and crushed with glass rod and collected in two tubes. Centrifuge the first tube and add 1% Safranin and then add water for washing until supernatant is colorless. After washing add 2 ml dilute glycerine (50% glycerine in water). Centrifuge another tube and add 5 ml glacial acetic acid, decant again after centrifuge. Now the sediment is subjected to acetolysis method (Nair, 1970b), (1 ml concentrated sulphuric acid in 9 ml acetic anhydride) followed by adding 10 ml glacial acetic acid and then add 2 ml dilute glycerine. Add one or two drops of saturated chlorate solution in water and then one or two drops of concentrated hydrochloric acid. Finally add few drops of methyl green to the sediment. Between each steps washing in water and centrifugation and decantation is essential. Now the pollen grain is mounted in glycerin jelly and place a coverslip gradually, seal with wax. Microscopic examination, the acetolysed pollen grains look brown, the untreated ones red and chlorinated green.

PLANT TAXONOMY. The collected plants were identified with the help of flora of British India, Flora of presidency of Madras and Flora of Tamilnadu Carnatic.

RESULTS

Acacia Willd

The genus *Acacia* consists of 430 species (Baker, 1879). About 20 species are reported in south India (Santapau and Henry, 1973) of which 8 have been studied here. The pollen grains were micro-photographed and the details are recorded (Table 1).

1. *Acacia auriculiformis cunn. ex Benth.*

The plants were procured from Nagercoil. The pollen grains study showed polyads with 16 grains in each arranged in a regular pattern (eight grains in the centre arranged four and four in two planes, the plane lying directly one above the other and these eight surrounded in turn by eight peripheral grains), polar outline circular, equatorial outline elliptic, polyad diameter range (46.11–47.7 µm), individual grains aperture 3–4 porate; exine 1.9 µm thick, surface faintly foveolate (Fig. 1).

2. *Acacia catechu* Willd

The materials were collected from Marthandam. Pollen grains in polyads with 16 grains in each arranged in a regular pattern, polyad diameter range (44.52–

47.7 μm), individual grain aperture not discernible; exine 2.54 μm thick surface foveolate (Fig. 2).

Table 1

Palynological character of studied taxa of *Acacia*

S. No	Name of the Taxa	Pollen unit	Aperture	Size (μm)	Ornamentation
1.	*A.auriculiformis* cunn. ex Benth.	Polyad	3-4 porate	46.11–47.7	Faintly foveolate
2.	*A.catechu* Willd.	Polyad	Indistinct	44.52–47.7	Foveolate
3.	*A.dealbata* Link.	Polyad	Indistinct	60.20–63.6	Foveolate
4.	*A.latronum* Willd.	Polyad	4-porate	54.06–55.65	Foveolate
5.	*A.leucophloea* Willd.	Polyad	3-4-porate	38.16–41.34	Foveolate
6.	*A.lonifolia* Willd.	Polyad	3-porate	52.7–55.65	Faintly foveolate
7.	*A.mangium* Willd.	Polyad	4-porate	42.93–44.99	Faintly foveolate
8.	*A.planifrons* W. & A.	Polyad	3-4-porate	55.65–56.6	Faintly foveolate

3. ***Acacia dealbata*** **Link**

The plant materials were collected from Udagamandalam. Pollen grains in polyads with 16 grains in each arranged in a regular pattern, polar outline circular, equatorial outline elliptic, polyad diameter range (60.2–63.6 μm), individual grain aperture not discernible; exine 2.22 μm thick, surface foveolate (Fig. 3).

4. ***Acacia lantronum*** **Willd**

The plant materials were collected from Nagercoil. Pollen grains in polyads with 16 grains in each arranged in a regular pattern, polar outline circular, equatorial outline elliptic, polyad diameter range (54.06–55.65 μm), individual grain aperture 4-porate, exine 2.54 μm thick, surface foveolate (Fig. 4).

5. ***Acacia leucophloea*** **Willd**

The plant materials were procured from Thuckalay. Pollen grains in polyads with 16 grains in each arranged in a regular pattern, polar outline circular, equatorial outline elliptic, polyad diameter range (38.16–41.34 μm), individual grain aperture 3-porate, exine 1.59 μm thick, surface foveolate (Fig. 5).

6. ***Acacia longifolia*** **Willd**

The plant materials were collected from Udagamandalam. Pollen grains in polyads with 16 grains in each arranged in a regular pattern, polar outline circular, equatorial outline elliptic, polyad diameter range (52.7–55.65 μm), individual grain aperture 3-porate, exine 1.9 μm thick, surface faintly foveolate (Fig. 6).

7. ***Acacia mangium*** **Willd**

The plant materials were collected from Nagercoil. Pollen grains in polyads with 16 grains in each arranged in a regular pattern, polar outline circular, equatorial outline elliptic, polyad diameter range (42.93–44.99 μm), individual grain aperture 4-porate, exine 1.59 μm thick, surface faintly foveolate (Fig. 7).

8. ***Acacia planifrons* W. & A.**

The plant materials were collected from Rajakkamangalam. Pollen grains in polyads with 16 grains in each arranged in a regular pattern, polar outline circular, equatorial outline elliptic, polyad diameter range (55.65–56.6µm), individual grain aperture 3-4-porate; exine 1.27 µm thick, surface faintly foveolate (Fig. 8).

Fig. 1. *Acacia auriculiformis* cunn.ex Benth.

Fig. 2. *Acacia catechu* Willd.

Fig. 3. *Acacia dealbata* Link.

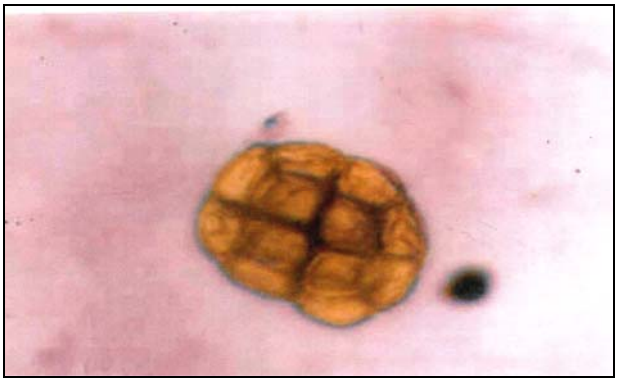

Fig. 4. *Acacia latronum* Wild.

Fig. 5. *Acacia leucophloea* Willd.

Fig. 6. *Acacia longifolia* Willd.

Fig. 7. *Acacia mangium* Willd.

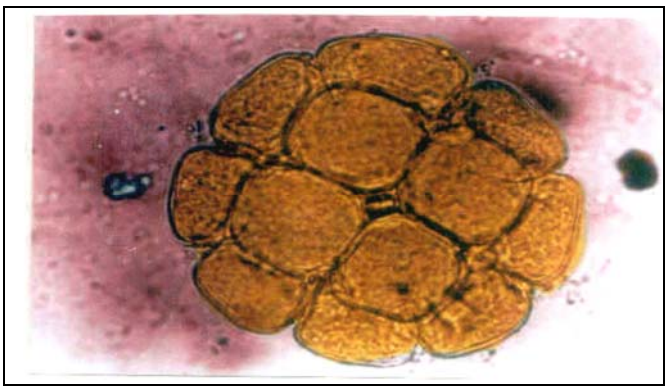

Fig. 8. *Acacia planifrons* W&A.

DISCUSSION

Pollen morphology as a useful tool in solving problems of taxonomy at various taxonomic levels has been stressed by Nair (1964). In terms of morphological evolution of pollen grains, the characters relating to the germinal apertures are considered to be of primary importance as they are most conservative and constitute genetically a stable attribute, while exine sculpturing and exine stratification secondary and the others viz., pollen size and shape tertiary (Chanda and Ghosh, 1976).

In Acacieae the most advanced 3-porate and 4-porate occur together, based on the degree of resemblance of the pollen characters, Rosanoff (1865). There is a general thinking that pollen similarities cannot wholly be used in the systematic of the Mimosaceae. However, Guinet (1981) has recognized large groups in the sub family by arranging them according to decreasing degree of homogeneity. The

elevation of the sub family Mimosaceae to the rank of a family finds support from pollen morphology because of the notable difference, particularly palynological, it has from the rest of the Leguminosae.

Both Hutchinson (1964) and Bentham and Hooker (1865) have considered Acacieae as a monogenetic tribe, while Vassal (1969, 1972a, 1972b) included the monotypic genus Faidherbia in the Acacieae from Ingeae. Bentham (1844) was the first to restrict the tribe Acacieae to the genus *Acacia*. Faidherbia, formerly placed in the Acacieae was assigned to Ingeae on the basis of pollen morphology; it forms a link between Ingeae and Acacieae. On the basis of ontogenic and morphological evidences these three subgenera correspond to the three groups defined by Guinet (1981). In addition to pollen characters such as porate versus colporate a combination of other characters also have aided in circumscribing the subgenera within *Acacia*, Bentham recognized six sections such as Phyllodineae, Botrycepalae, Pulchellae, Gummiferae, Vulgares and Fillicinae. The 8 species of *Acacia* studied here are almost homogeneous in pollen grain composition (Polyad) and aperture from (3-4 zonoporate). As regards exine ornamentation also the prominent pattern is foveolate. Thus palynological evidences do not appear to offer any direct evidence supporting subdivision of the genus *Acacia*.

CONCLUSION

In the family Mimosaceae the tribe Acacieae shows the more advanced 3 porate and 4 porate condition and hence the tribe Acacieae appears to occupy the most highly advanced state of aperture evolution.

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