jopat 12 2007 31 - 38

Journal Of Phytomedicine
And Therapeutics

The pollen morphology of Nigerian *Bignoniaceae juss.*

G.E. Ugbabe[1*], A.E. Ayodele[2], J.I .Okogun[1] and U.S. Inyang [1]

National Institute for Pharmaceutical Research and Development
P. M. B. 21 Garki Abuja, Nigeria.
[2]Department of Botany and Microbiology
University of Ibadan Ibadan Nigeria.
E-mail: bayodele@yahoo.com

Abstract

The Pollen grains of eleven species of the Bignoniaceae represented in Nigeria have been studied by the light Microscope. The pollen grains are mostly circular or elliptic. The circular ones include those of *Crescentia cujete* Linn. *Markhamia tomentosa* (Benth.) K.Schum., *Newbouldia laevis* Seem., *Oroxyllum indicum* Vent., *Spathodea campanulata* P.Beauv., *Stereospermum acuminatissimum* K.Schum., *Stereospermum kunthianum* Cham., and *Tabebuia rosea* (Berthol)DC.; while the Elliptic ones are: *Kigelia africana* (Lam) Benth., *Markhamia lutea* (Benth.) K.Schum. and *Tecoma stans* (Linn.) H.B & K. and the shape/class range from prolate, sub-prolate to prolate spheroidal. The Prolate ones are *Kigelia africana*, *Markhamia tomentosa*, and *Tecoma stans;* the Subpralate types includes those of *Crescentia cujete, Markhamia lutea, Oroxyllum indicum, Spathodea campanulata* and *Stereospermum acuminatissimum;* while the Prolate-Spheroidal types are those of *Stereospermum kunthianum* and *Tabebuia rosea*. They are either tetra-colporate or tri-colporate. The pollen of *Crescentia cujete* is Tetra-Colporate while the others are Tri-colporate (Tri-colporate = Pollen grains with three ectocolpi ;). The different pollen types are useful in the identification of the Nigerian Bignoniaceae.

Key words: Pollen grains, Morphology, Bignoniaceae, Nigeria.

Introduction

Bignoniaceae Juss. is a family of shrubs or lianas and rarely herbs and is made up of about 100 genera and 800 species (12). The family is distributed in the Tropics and forms an important part of the vegetation (10), while a few of the species are found in the temperate and sub-tropical regions. Hutchinson and Dalziel (4) recorded five genera in Nigeria. These are *Kigelia africana* (Lam.) Bent, *Markhamia lutea* (Benth.) K. Schum., *Markhamia tomentosa* (Benth.) K, Schum. *Newbouldia laevis* Seem. Spathodea *campanulata* P.Beauv. Stereospermum *acuminatissimum* K. Schum., and *Stereospermum kunthianum* Cham. Beside these are also introduced species such as *Crecsentia cujete* Linn, *Tabebuia rosea* (Berthol.) D.C, *Tecoma stans* (Linn.) H.B&K and *Oroxylum indicum* Vent in the country.

* Corresponding Author

Flowers of the Bignoniaceae are bisexual, zygomorphic, hypogynous with bracts and bractioles present. Placentation is axial. Seeds are exalbuminous, usually flattened with membranous wings although with few exceptions. The flowers are bell shaped. Members of this family are grown mostly for ornamental and medicinal purposes in Nigeria.

There are several reasons why pollen identification is important: firstly, most pollen grains are very distinctive, easily recognizable and identifiable to the family, genus or even species rank. Thus very specific information can be obtained about the plant that serve as adult host and foraging plants. Secondly, pollen is composed of sporopollinin. Sporopollinin is very durable and does not easily decay. Therefore, pollen remains as a durable natural marker in insects. Thirdly, from the identification of pollen, the geographical origin of the plant from which the pollen came can often be determined. This is especially important when there is temporal and geographical variation in the distribution of the identified plant.

Pollen architecture has great significance in the taxonomy of angiosperms and interpreting inter-relationship among them (6). The first successful attempt at using characters in the classification of plants was made by Lindley, (7). Since then, Erdthman (2, 3.)., Patel and Datta (7), Sowunmi (11) and several others have worked on the morphology of the pollen grains of different regions and have emphasized its phylogenetic significance.

The aim of this study is to obtain characters of the pollen grains of the family Bignoniaceae in Nigeria which may contribute to the understanding of the taxonomy of the family and the identification and delimitation of the taxa.

Materials and methods

Pollen samples were obtained from fresh and herbarium specimens (the herbarium specimens were obtained from Forestry Herbarium Ibadan (FHI) and University of Ibadan Herbarium (UIH). The sample areas are: *Crescentia cujete* from U.I Botanical garden (FHI 106915), *Kigelia africana* from Akoko-Oba (FHI 106899); *Markhamia lutea* from Abeokuta (FHI 40321); *Markhamia tomentosa* from University Ibadan, Ibadan (UIH 19117); *Newbouldia laevis* from University of Ibadan (FHI 106905); *Oroxyllum indicum* from U.I (UIH 19114); *Spathodea campanulata* from U.I (FHI 1106900); *Stereospermum acuminatissimum* from Olokomeji Forest Reserve (FHI 1106904) *Stereospermum kunthianum* from Nigeria (FHI 19737); *Tabebuia rosea* from U.I (FHI 1106901); *Tecoma stans* from National Institute for Pharmaceutical Research and Development NIPRD (FHI 106902). These were acetolysed by treatment with acetic acid anhydride and concentrated tri-Oxonitrate V acid using Erdthman's method (3). The acetolysed pollen grains were mounted in glycerin jelly. In each case, measurements of widest equatorial diameter (E) and polar axis (P) of eleven pollen grains were taken. Mean,

range and standard error were calculated for all quantitative variables based on eleven measurements chosen randomly. Photomicrographs of the prepared slides were taken with NIKON X 35 DX camera mounted on a NIKON-AFX-DX microscope.

Results

The pollen grain characters of the Bignoniaceae in Nigeria are shown on Table1 and the photomicrographs on Plates I-III (1-11). The pollen grains of the species studied are mostly circular or elliptic. They range from prolate, sub-prolate to prolate spheroidal (Table 1) and are tetra-colporate or tri-colporate. The prolate types are found in *Kigelia africana, Markhamia tomentosa***,** *Newbouldia laevis* and *Tecoma stans.* Subprolate types occur in *Crescentia cujete, Markhamia lutea, Oroxylum indicum Spathodea campanulata* and *Stereospermum acuminatissimum.* Prolate-spheroidal was recorded in *Stereospermum kunthianum* and *Tabebuia rosea*. Most of the pollen grains are tri-colporate grains with 3 colpi and 3 furrows. The mean exine thickness ranges from 0.8µm in *Tabebuia rosea* to 1.7µm in *Markhamia tomentosa*. The lowest equatorial diameter of 16.8µm was recorded in *Markhamia tomentosa* and the highest of 48.8µm was recorded in *Oroxylum indicum*. Polar axis, ranges from 20.8µm in *Spathodea campanulata* ***to*** 76.8 µm in *Oroxylum indicum*. The equatorial axis has the lowest mean record of 23.6µm in *Spathodea campanulata* and *Tecoma stans* and the highest of 46.0µm in *Oroxylum indicum*. The lowest P/E% of 90.0.µm was recorded in *Spathodea campanulata* and the highest of 184.0µm was recorded in *Oroxylum indicum*. The lowest mean P/E% of 106 was recorded in *Stereospermum kunthianum* and the highest of 149.2 µm in *Spathodea campanulata.*

The size of the pollen grains show variation from species to species as shown in Table 1.The shape of the pollen grains in the taxa show more uniformity: while those of *Kigelia africana, Markhamia lutea* and *Tecoma stans* are mainly elliptic, the rest are circular.

C. cujete: Plate 1, Table1. Mean diameter of: 28.4±4.8µm; shape: subprolate; size: media/rather small; pollen: circular.

*K. africana***:** Plate 2 and Table 1. Mean diameter: 28.4±2.5µm; shape: prolate, size: media/medium .Pollen: elliptic

*M. lutea***:** Plate 3, Table1.Mean diameter: 24.8 ± 4.4µm, shape: subprolate size: media/rather small. Pollen: elliptic.

M. tomentosa: Plate 4, Table1.Mean diameter: 25.6 ± 3.6µm shape: prolate, size: media/medium. Pollen: circular.

N. laevis: Plate5, Table1.Mean diameter: 28.4 ± 3.0µm shape: prolate; size: rather media/medium. Pollen: circular.

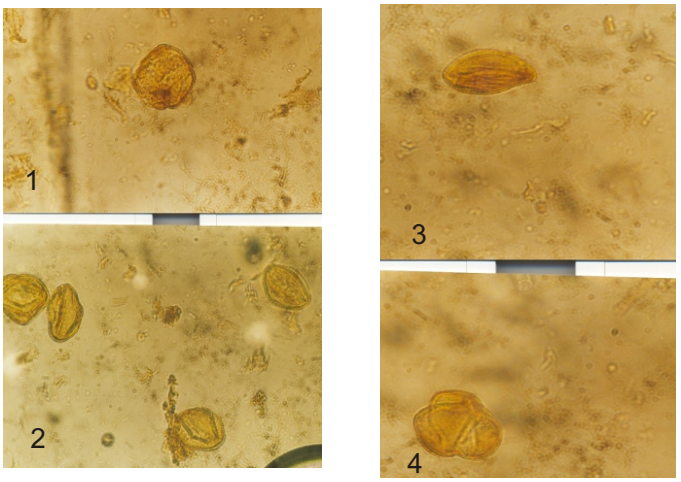
Oroxylum indicum: Plate 6, Table1: Mean diameter 46.0 ± 8.4µm shape:

Table 1 : Pollen grain Characters of the Family Bignoniaceae in Nigeria

S/ No	Genus/species	AMB	Shape	Type	Exine thickness	Polar Axis (P)	Equatorial Axis (E)	P/E %
1	*Crescentia cujete*	Circular	Subprolate	Tetra-Colporate	1.2(1.6±0.3)2.4	22.4(32.0±4.1)36.0	18.4(28.4±4.8)33.6	105(113±14.1)148
2	*Kigelia africana*	Elliptic	Prolate	Tri-colporate	1.2(1.5±0.2)1.6	34.4(38±2.6)42.4	24.8(28.4±2.5)32	123(135.21±17)171
3	*Markhamia lutea*	Elliptic	Subprolate	Tri-colporate	1.6(1.6±0)1.6	24(32.8±5.2)42.4	19.2(24.8±4.4)32	97(132.3±25)176
4	*Markhamia tomentosa*	Ciecular	Prolate	Tri-colporate	1.2(1.7±0.4)2.4	26.4(34±3.6)39.2	16.8(25.6±3.6)31.2	106(132.8±22) 186
5	*Newbouldia laevis*	Circular	Prolate	Tri-colporate	1.2(1.5±0.2)1.6	38.4(41.6±2.2)46.4	24.8(28.4±3)30.4	124(146.5±12)162
6	*Oroxylum indicum*	Circular	Subprolate	Tri-colporate	0.2(11.5±0.1)1.6	47.2(56.8±0.8)76.8	34.4(46±8.4)48.8	94(123.5±26)184
7	*Spathodea campanulata*	Circular	Subprolate	Tri-colporate	0.8(1.4±0.5)2.4	20.8(35.2±5.2)38.4	19.2(23.6±3.8)30.4	90(149.2±15)149
8	*Stereospermum acuminatissimum*	Circular	Subprolate	Tri-colporate	0.8(1.5±0.2)1.6	23.2(30.8±3.6)35.2	19.2(27.2±4.4)32.8	100(113.2±19)150
9	*Stereospermum kunthianum*	Circular	Prolate Spheroidal	Tri-colporate	1.2(1.4±0.4)1.6	24(30.4±4)37.6	23.2(28.8±3.7)36	100(106±5)116
10	*Tabebuia rosea*	Circular	Prolate Spheroidal	Tri-colporate	0.8(0.8±0)0.8	30(30±3.4)36	25.6(27.6±1.6)31.2	97(108.7±11)132
11	*Tecoma stans*	Elliptic	Prolate	Tri-colporate	0.8(1.0±0.2)1.2	24(33.2±3.5)36.8	17.6(23.6±4.4)30.4	111(140.7±22)183

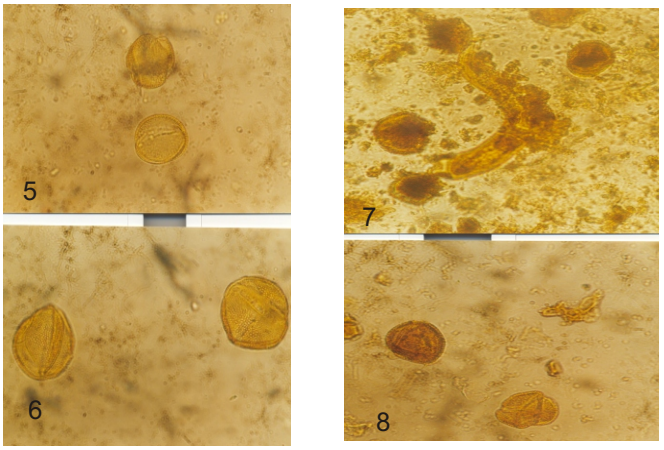
Minimum (Mean ± Standard error) Maximum.
All measurement in Microns. AMB=Ambient.

Plate I



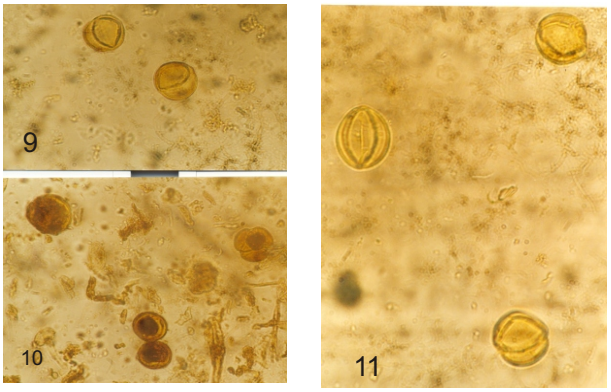
1: *Crescentiia cujete.* Pollen type: Tetra-colporate
2: *Kigelia africana.* Pollen type: Tri-colporate
3: *Markhamia lutea.* Pollen type: Tri-colporate
4: *Markhamia tomentosa.* Pollen type: Tri-colporate

Plate II



5: *Newbouldia laevis.* Pollen type: Tricolporate
6: *Oroxyllum indicum.* Pollen type: Tri-colporate
7: *Spathodea campanulata.* Pollen type: Tri-colporate
8: *Stereospermum acuminatissimum.* Pollen type: Tri-colporate

Plate III



9: *Stereospermum kunthianum.* Pollen type: Tri-colporate
10: *Tabebuia rosea.* Pollen type: Tricolporate
11: *Tecoma stans.* Pollen type: Tri-colporate

subprolate, size: magna/rather large, pollen: Circular.

Spathodea campanulata: Plate 7, Table1.Mean diameter: 23.6 ± 3.8µm, shape: subprolate; size: minuta/small. Pollen: Circular.

Stereospermum acuminatissimum: Plate 8, Table1: Mean diameter 27. 2 ± 4.4µm, shape: subprolate, size: media/medium. Pollen: circular.

S. Kunthianum: Plate 9, Table1 Mean diameter: 28.8 ± 3.7µm, shape: prolate spheroidal, size: media/medium. Pollen: circular.

Tabebuia rosea: Plate 10, Table1. Mean diameter 27.6 ± 1.6µm, shape: prolate spheroidal, size: media/medium. Pollen: circular.

Tecoma stans: Plate 11, Table1 Mean diameter 23.6 ± 4.4µm, shape: prolate, size: minuta/small. Pollen: elliptic.

Discussion

The size of the pollen grains show variations from species to species. The shapes of the pollen grains show more uniformity-they are either prolate, sub- prolate or prolate spheroidal. While *K. africana, M. tomentosa, N. laevis and T. stans* are the prolate type those of *C. cujete, M. lutea O. indicum, S. campanulata* and *S. acuminatissimum* are of the sub-prolate type and those of *S. kunthianum* and *T. stans* are of the prolate spheroidal type. They are either circular or elliptic, while those of *Kigelia africana, Markhamia lutea* and *Tecoma stans* are mainly elliptic, the rest are circular. The pollen types in the Bignoniaceae studied here are Tri-colporate and Tetra-colporate. *C. cujete* has tetra-colporate Pollen while the rest are Tri-colporate. This shows that the position of *C. cujete* in this family should be reconsidered. And

moreover *C. cujete* has simple leaves while the other members of the family in this study have compound leaves.

Erdthman (3) classified pollen grains into groups according to sizes e.g. perminuta (diameter less than 10µm), minuta (diameter 10-25µm), media (diameter 25-50µm), magna (diameter 50-100µm), permagna (diameter 100-200 µm), giganta (diameter greater than 200µm); while Hydes and Adams (5) on the other hand, classified pollen grain size into less than 10µm (very small), 10-25µm (small), 25-30µm (rather small), 30 40 µm (medium) 40 50µm (rather large), 50 100µm (large) greater than 100 µm (very large). So based on these two groupings, and from the measurements of Polar and Equatorial axis, the pollen grains of *Crescentia cujete, Kigelia africana, Markhamia lutea, M. tomentosa, Newbouldia laevis, Stereospermum acuminatissimum, S. kunthianum and Tabebuia rosea* belong to the group media/medium, those of *Spathodea campanulata and Tecoma stans* belong to the group minuta/rather small while that of *Oroxyllum indicum* belongs to the group magna/rather large. While the type of pollen grain and the AMB are useful characters in the taxonomy of the Bignoniaceae, characters like shape/class and exine thickness have little or no significance in the taxonomy of the members of this family.

Acknowledgement

We would like to acknowledge the following people, Dr. (Mrs.) Y. Kunle, Dr. (Mrs.) Chidime, Mrs. G. Ajoku, Mr. J. Akinloye, Mr. & Mrs. C. Mpama, Mrs. J. Ibrahim, Mall. M. Muazzam, Mr. A. Jegede, A. Usman and all M.P.R & T.M Dept. N.I.P.R.D Abuja who have contributed in one way or the other to make this work a success.

References

1. Darlington, C. D. and Wylie, A. P (1956). *Chromosome Atlas of Flowering Plants.* Hefner Publishing Co. New York P. 318 320
2. Erdthman, G. (1943): *An Introduction to Pollen Analysis.* Chronica Botanica Co. Waltham, Mass, U. S. A.
3. Erdthman G. (1952). *Pollen Morphology and Plant Taxonomy.* Chronica Botanica Co. Waltham, Mass U. S. A. P. 6-10.
4. Hutchinson, J. and Dalziel, J. M (1954**).** *Flora of West Tropical African*. Vol. II. Part 1. Crown Agents for Oversea Government and Administrations London P. 383 388.
5. Hydes, H. A and Adams, K. F. (1958). *Atlas of Airborne Pollen Grains.* London Macmillan and Co. Ltd. P.105-109.
6. Olubukola, A. and Illoh, H. C. (1996). *Pollen Grain Morphology of Some Species of Hibiscus. Nigerian Journal of Botany* 9: 9-14.
7. Patel, G. I. and Datta, R. M. (1958). *Pollen Grain Studies in Various Types of Corchorus Olitorius L, C. coprulans L. and some other species of Corchorus*. *Grana Palynologica* 1:18 24.

8. Peter Hoen, (1999). Glossary of Pollen and Spore Terminology (Revised and 2nd edition). Parts 1-5. .
9. Prasat, S. S. (1963). *Pollen Grain Morphology of Certain Malvaceae*. Journal of *Indian Botanical Society*. 42:463.
10. Shashina, G. (1989). *Savanna Plants. An Illustrated Guide.* Macmillan P. 157- 158
11. Sowunmi, M. A. (1973). *Pollen Grains of Nigerian Plants*. *Grana* 13:145 186.
12. Watson, L. and Dallwitze, M. J. (1992). *The families of Flowering Plants. Description, Illustration, Identification and Information* Retrieval Version P. 1-13