

POLLEN GRAIN MORPHOLOGY OF SOME SPECIES OF *HIBISCUS*

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ABSTRACT

Pollen grains of ten species of *Hibiscus* Linn. were collected from different locations within South Western Nigeria and acetolyzed. The various sizes, length of spines, distance between spines, diameter of apertures, distance between apertures and nature of spine end are useful tools in the taxonomy of the *Hibiscus* species studied.

INTRODUCTION

The genus *Hibiscus* Linn. belongs to the family Malvaceae. It is the largest genus with 300 species which are widely distributed (Heywood, 1978). Hutchinson and Dalziel (1958) reported 33 species for West Tropical Africa and 23 species for Nigeria.

The genus *Hibiscus* is composed mostly of tropical herbs, shrubs or rarely trees. It is certainly the most variable genus in the family with respect to its vegetative and floral expressions. The genus has basic chromosome numbers  $x = 7, 8, 9, 11, 12, 15, 17, 19, 20$  and 30 (Darlington and Wylie, 1956).

Pollen architecture has great significance in the taxonomy of angiosperms and in interpreting inter-relationships amongst them. The first successful attempt at using pollen characters in the classification of plants was made by Lindley, 1830 (in Prasad, 1963). Since then, Erdtman (1943, 1952), Patel and Datta (1958), Sowunmi (1973) and several other palynologist have worked on the morphology of pollen grains and have emphasized its phylogenetic significance. Pollen grains of some members of the family Malvaceae have been studied by Banerjee (1929), Prasad (1963) and Erdtman (1952). All of them reported pollen grains of Malvaceae to be spherical and echinate provided with circular apertures.

The aim of this study is to provide additional characters such as pollen grain shapes and sizes, structural details of the wall, spines and apertures as an aid in the taxonomy of the genus *Hibiscus*.

MATERIALS AND METHODS

Pollen grains from fresh flowers of *Hibiscus sabdariffa* Linn., *H. tiliaceus* Linn., *H. sterculiifolius*, (Guill. & Perr.) steud., *H. rostellatus* Guill. & Perr., *H. acetosella* Welw., *H. physaloides* Guill. & Perr., *H. lunariifolius* Willd., *H. scotellii* Bak. f., *H. vitifolius* var. *vitifolius*

Linn. and *H. surattensis* Linn. were collected for the study of the morphology of the pollen grains. Pollen grains from 3-4 different flowers of the same species were collected. These were acetolysed by treatment with acetic acid anhydride and concentrated sulphuric acid using Erdtman's method (1943). The acetolysed pollen grains were mounted in glycerine jelly. In each case, measurements of largest equatorial diameters of 50 pollen grains were taken. Photomicrographs of the prepared slides were taken with Leitz camera mounted on a Leitz research microscope.

## RESULTS

Generally, the pollen grains of the ten species of *Hibiscus* studied were spherical, colpate, with global apertures. Furthermore, the pollen grains were echinate, sticky and yellow to yellowish-brown in colour. The size of the pollen grains, length of spines, distance between spines, thickness of walls, diameter of apertures and distance between apertures showed variations from species to species as shown in Tables 1 and 2.

### *H. sabdariffa*

The mean diameter of the pollen grains was  $111.63 \pm 2.56 \mu\text{m}$ . The spines were small with blunt ends. The wall was fairly thick. The spines and apertures were densely situated (Plate 1A).

Table 1: Measurements of diameter of pollen grains, length of spines, thickness of wall, diameter of apertures and distances between spines and between apertures.

Name of species of pollen	Diameter of grains ( $\mu\text{m}$ )	Length of spines ( $\mu\text{m}$ )	Thickness between walls ( $\mu\text{m}$ )	Distance of spines ( $\mu\text{m}$ )	Diameter between apertures ( $\mu\text{m}$ )	Distance between apertures ( $\mu\text{m}$ )
A. <i>H. sabdariffa</i>	$111.63 \pm 2.56$	$14.38 \pm 0.47$	$4.84 \pm 0.28$	$12.88 \pm 0.42$	$7.00 \pm 0.28$	$12.97 \pm 0.40$
B. <i>H. tiliaceus</i>	$119.75 \pm 2.40$	$15.50 \pm 0.32$	$5.18 \pm 0.33$	$13.13 \pm 0.94$	$8.19 \pm 0.37$	$10.56 \pm 0.47$
C. <i>H. sterculiifolius</i>	$103.50 \pm 2.51$	$26.58 \pm 0.31$	$5.63 \pm 0.24$	$15.50 \pm 0.50$	$7.68 \pm 0.33$	$15.13 \pm 0.51$
D. <i>H. rostellatus</i>	$118.75 \pm 1.46$	$22.64 \pm 0.70$	$4.84 \pm 0.28$	$14.00 \pm 0.36$	$8.13 \pm 0.24$	$14.31 \pm 0.52$
E. <i>H. acetosella</i>	$115.13 \pm 1.47$	$18.13 \pm 0.39$	$5.00 \pm 0.33$	$14.63 \pm 0.56$	$7.88 \pm 0.27$	$11.25 \pm 0.69$
F. <i>H. physaloides</i>	$100.00 \pm 1.79$	$16.96 \pm 0.25$	$4.69 \pm 0.20$	$12.63 \pm 0.47$	$5.31 \pm 0.20$	$11.41 \pm 0.37$
G. <i>H. lunari folius</i>	$116.71 \pm 3.08$	$16.67 \pm 0.42$	$5.36 \pm 0.23$	$14.13 \pm 0.38$	$6.67 \pm 0.42$	$13.75 \pm 0.37$
H. <i>H. scotellii</i>	$119.25 \pm 2.86$	$23.33 \pm 0.29$	$5.00 \pm 0.33$	$12.63 \pm 0.80$	$5.14 \pm 0.25$	$11.11 \pm 0.87$
I. <i>H. vitifolius</i> var. <i>vitifolius</i>	$107.25 \pm 1.46$	$15.91 \pm 0.51$	$4.11 \pm 0.23$	$17.38 \pm 0.88$	$4.75 \pm 0.17$	$23.00 \pm 0.62$
J. <i>H. surattensis</i>	$100.00 \pm 1.44$	$15.00 \pm 0.38$	$4.38 \pm 0.24$	$11.88 \pm 0.50$	$7.08 \pm 0.21$	$11.00 \pm 0.36$

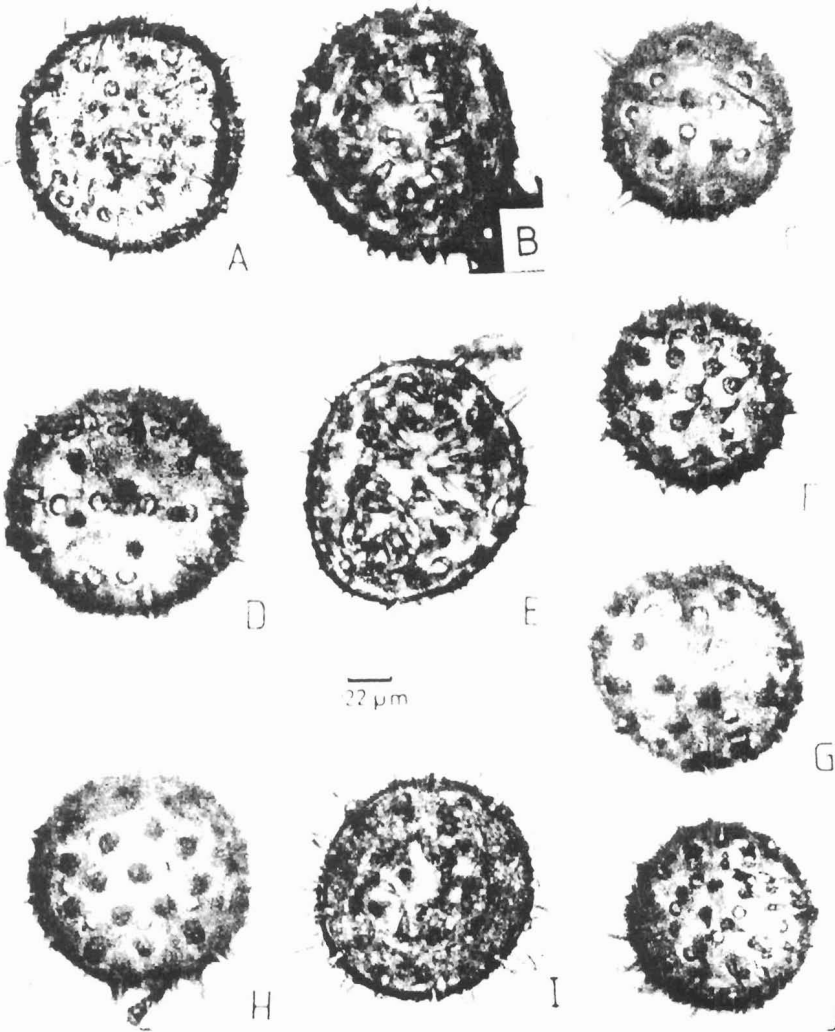


Plate 1: Pollen grains of the *Hibiscus* species

A. *H. sabdariffa* Linn. B. *H. tiliaceus* Linn. C. *H. sterculiifolius* (Guill. & Perr.) Steud. D. *H. rostellatus* Guill. & Perr.  
 E. *H. acetosella* Welw. F. *H. physaloides* Guill. & Perr. G. *H. lunarifolius* Willd. H. *H. scotellii* Bak. f. I. *H. vitifolius* var.  
*vitifolius* Linn. J. *H. surattensis* Linn.

*H. tiliaceus*

The mean diameter of the pollen grains was  $11.75 \pm 40\mu\text{m}$ . The spines were small with blunt ends. The wall was thick. Spines and apertures densely situated (Plate 1B).

*H. sterculiifolius*

Mean diameter  $103.50 \pm 2.51\mu\text{m}$ , spines very long with blunt ends, wall thick; spines and apertures not densely situated (Plate 1C).

**Table 2: Summary of the Hibiscus spp. Pollen grains studied:**

	<i>H. sabdariffa</i>	<i>H. tiliaceus</i>	<i>H. sterculiifolius</i>	<i>H. rostellatus</i>	<i>H. acetosella</i>	<i>H. physaloides</i>	<i>H. lunariifolius</i>	<i>H. scotellii</i>	<i>H. vitifolius</i> var. <i>vitifolius</i>	<i>H. strarriensis</i>
Pollen grain diameter permagna ( $111.63 \pm 2.56\mu\text{m}$ - $119.75 \pm 2.40\mu\text{m}$ )	+	+	-	+	+	-	+	+	-	-
Pollen grain diameter magna to permagna ( $100.00 \pm 1.44$ - $107.25 \pm 1.46\mu\text{m}$ )	-	-	+	-	-	+	-	-	+	+
Long spines ( $22.64 \pm 0.70\mu\text{m}$ - $26.58 \pm 0.31\mu\text{m}$ )	-	-	+	+	-	-	-	+	-	-
Short spines ( $14.38 \pm 0.47\mu\text{m}$ - $18.13 \pm 0.39\mu\text{m}$ )	+	+	-	-	+	+	+	+	+	+
Thin walls ( $4.11 \pm 0.23\mu\text{m}$ - $4.84 \pm 0.28\mu\text{m}$ )	-	-	-	+	-	+	-	-	+	-
Thick walls ( $5.00 \pm 0.33\mu\text{m}$ - $5.63 \pm 0.24\mu\text{m}$ )	-	+	+	-	+	-	+	+	-	-
Sparse spines ( $14.00 \pm 0.36$ - $17.38 \pm 0.88\mu\text{m}$ )	-	-	+	+	+	-	+	-	+	-
Dense spines ( $11.88 \pm 0.50\mu\text{m}$ - $13.13 \pm 0.94\mu\text{m}$ )	+	+	-	-	-	+	-	+	-	-
Wide diameter of aperture ( $7.00 \pm 0.28$ - $8.19 \pm 0.37\mu\text{m}$ )	+	+	+	+	+	-	-	-	-	+
Narrow diameter of aperture ( $4.75 \pm 0.17\mu\text{m}$ )	-	-	-	-	-	+	+	+	+	-
Large aperture distance ( $23.00 \pm 0.62\mu\text{m}$ )									+	
Small aperture distance ( $10.56 \pm 0.47\mu\text{m}$ - $15.13 \pm 0.51\mu\text{m}$ )	+	+	+	+	+	-	+	+	-	+
Blunt spine end	+	+	+	+	+	-	+	-	-	-
Pointed spine end	-	-	-	-	-	-	-	+	+	-

KEY: + Present - Absent

*H. rostellatus*

Mean diameter of pollen grains  $118.75 \pm 1.46 \mu\text{m}$ ; spines long with blunt ends; wall fairly thick; spines and apertures fairly densely situated (Plate 1D).

*H. acetosella*

Mean diameter of pollen grains  $115.13 \pm 1.47 \mu\text{m}$ ; spines fairly long with blunt ends; wall thick; spines and apertures fairly densely situated (Plate 1E).

*H. physaloides*

Mean diameter of pollen grains  $100.00 \pm 1.79 \mu\text{m}$ ; spines short with very pointed ends; wall fairly thick; spines and apertures densely situated (Plate 1F).

*H. lunarifolius*

The mean diameter of pollen grains was  $116.71 \pm 3.08 \mu\text{m}$ . Spines short with blunt ends; wall thick; spines and apertures fairly densely situated (Plate 1G).

*H. scotellii*

Mean diameter  $119.25 \pm 8.6 \mu\text{m}$ . Spines long with almost pointed ends; wall thick; spines and apertures densely situated (Plate 1H).

*H. vitifolius* var. *vitifolius*

Mean diameter of pollen grains  $107.25 \pm 1.46 \mu\text{m}$ . Spines short with pointed ends; wall thin; spines and apertures were not densely situated (Plate 1I).

*H. surattensis*

Mean diameter  $100.00 \pm 1.44 \mu\text{m}$ . The spines were short with pointed ends. Wall thin; spines and apertures densely situated (Plate 1J).

### DISCUSSION

In general appearance, the pollen grains of all the species of *Hibiscus* looked similar. They were spherical, colporate with global apertures. Wodehouse (1935) interpreted these apertures on the wall surface as furrows which have become so shortened that they coincided in extent with their enclosed germ pores. All the pollen grains were echinate, sticky and yellow to yellowish-brown in colour.

Apart from the common generic features, there were also some differences in other morphological details which characterise the species. Erdtman (1952) classified pollen grains according to size into groups, e.g. *perminuta* (diameter less than  $10 \mu\text{m}$ ), *minuta* (diameter  $10-25 \mu\text{m}$ ), *media* (diameter  $25-50 \mu\text{m}$ ), *magna* (diameter  $50-100 \mu\text{m}$ ), *permagna* (diameter  $100-200 \mu\text{m}$ ), *giganta* (diameter greater than  $200 \mu\text{m}$ ). According to his classification, the pollen

grains of the genus *Hibiscus* belonged to the groups magna and permagna. *H. sabdariffa*, *H. tiliaceus*, *H. rostellatus*, *H. acetosella*, *H. lunarifolius* and *H. scotellii* were mainly in the group permagna (Table 2) while *H. sterculiifolius*, *H. physaloides*, *H. vitifolius* var. *vitifolius* and *H. surattensis* ranged between the two groups magna and permagna.

Short spines occurred in *H. sabdariffa*, *H. tiliaceus*, *H. acetosella*, *H. physaloides*, *H. lunarifolius*, *H. vitifolius* var. *vitifolius* and *H. surattensis* (Table 2) while long spines occurred in *H. sterculiifolius*, *H. rostellatus* and *H. scotellii*. Spines occurred sparsely in *H. sterculiifolius*, *H. rostellatus*, *H. acetosella*, *H. lunarifolius* and *H. vitifolius* var. *vitifolius* while they occurred densely in *H. sabdariffa*, *H. tiliaceus*, *H. physaloides*, *H. scotellii* and *H. surattensis*.

*H. vitifolius* var. *vitifolius* was quite distinct in having the largest distance between any pair of apertures (Tables 1 and 2), the least frequency of spines and apertures and in having the smallest aperture diameter.

The pollen grains of *H. tiliaceus* (Plate 1B) were distinct in having the largest size and the highest aperture diameter. *H. physaloides* (Plate 1F) possessed the most pointed spine end, this distinguished it from the other species. The pollen grains of *H. sterculiifolius* (Plate 1C) were distinctly different from the other in having the longest spines and the thickest wall (Table 1). The pollen grains of *H. sabdariffa* were distinct in having the shortest spines. They also had the same wall thickness with *H. rostellatus* (Plate 1D, Table 1).

The species of the genus *Hibiscus* studied have some common generic features which support their classification as members of the same genus and also some features which are useful tools in delimiting the different species as distinct species.

#### REFERENCE

- Banerjee, I. (1929): Studies in the cotton pollen. *Agricultural Journal of India*. 24: 332-340.
- Darlington, C.D. and Wylie, A.P. (1956): *Chromosome Atlas of Flowering Plants*. Hafner Publishing Co., New York, p.123-124.
- Erdtman, G. (1943): *An introduction to Pollen Analysis* Chronica Botanica Co, Waltham, Mass., U.S.A.
- Erdtman, G. (1952): *Pollen Morphology and plant Taxonomy*. Chronica Botanica Co., Waltham, Mass., U.S.A. P. 6-10.
- Heywood, V.H. (1978): *Flowering plants of the world*. Oxford University Press, Oxford, London. P. 94-95.
- Hutchinson, J. and Dalziel, J.M. (1958): *Flora of West Tropical Africa. Vol. 1, Part 2*. Whitefriars Press, London. Revised by Crown Agents, London, P. 343-348.
- Patel, G.I. and Datta, R.M. (1958): Pollen grain studies in various types of *Corchorus olitorius* L., *C. capsularis* L. and some other species of *Corchorus*. *Grana Palynologica* 1: 18-24.
- Prasad, S.S. (1963): Pollen Grain Morphology of certain Malvaceae. *Journal of Indian Botanical Society*. 42: 463.
- Sowunmi, M.A. (1973): Pollen grains of Nigerian Plants. *Grana*. 13: 145-186.
- Wodehouse, R.P. (1935): *Pollen grains*. McGraw-Hill Book Co. New York.