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Comparative Palynological Characters on Four Species of the Family Poaceae (Gramineae).

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ABSTRACT: The result of the palynological studies on four species of the family *Poeceae* showed variations in their pollen shapes. The pollen shape was spheriodal-subspheriodal in *Zea mays, Panicum maximum* and *Oryza sativa* while it is more or less subspheriodal in *Sorghum vulgare*. All the species are characterized by monoporate and annulate aperture type of pollen. The pollen walls are scabrate in all while the exine thickness were observed to be medium sized in *Oryza sativa, Panicum maximum* and *Sorghum vulgare* but small in *Zea mays*. The general appearance of the pollen grain is circular in *Oryza sativa, Zea mays* and *Panicum maximum* but elliptic in *Sorghum vulgare.* The difference in pollen characters are not enough for reclassification of the species but the similarities in pollen structures among the investigated taxa showed significant interspecie relationships among the investigated taxa and therefore showed that pollen characters are useful tools in systematic botany.

KEY WORDS: Palynology, Pollen charaters, *Zea mays, Panicum maximum, Oryza sativa, Sorghum vulgaris,* Poaceae.

INTRODUCTION

The family *Poaceae* is the second largest family amongst monocotyledonous plants, which is of world wide distribution. Grass which refers to any of the low, green, non-woody plants belongs to the large family of *Poaceae*. This family contains between 500 and 650 genera and about 10,000 species (Vidyarthi and Tripathi, 2002). In Nigeria, it is represented by over 90 genera and 330 species. They grow mostly in open environment. The grass family is the most common and important family of flowering plants because they are cheap and edible food for man and animal. Most of them are herbaceous annual or perennials, rarely shrubs or tree.

Poaceae are generally characterized by their long, narrow leaves which form sheaths around their stems and in some, their flower lacks petals and sepals. Their roots are generally fibrous and branching with an extensive underground network or surface stems. The success of grasses is due to their ability to withstand being grazed or mowed (Dutta, 1964). The family *Poaceae* have cylindrical stems and distinct nodes and internodes. Their leaves are simple, alternate, arranged in two vertical rows or distinctions. *Poaceae* flowers are usually hermaphrodite, protandrous, sometimes unisexual but monoecious, zygomorphic and hypogynopus. They are usually bisexual (Vidyarthi and Tripathi, 2002).

Poaceae are the world most important plants supplying the world's highest food-stuff. They provide animal forage and food for man and animals. Human beings obtain major part of their food supply from grasses such as sugarcane, the most important source of sugar and jiggery. Man also obtains food from grasses especially the cereal grasses such as rice, maize, millet and wheat (Lowe, 1989). They also provide construction materials, utensils and shelter such as bamboos which are commonly used for making basket, furniture and other articles of domestic uses. *Poaceae* are also used as fodder. Domestic animals are fed mostly on them as in Jower, Bajar, Macca etc.

Species of *Poaceae* are used in paper industry. Many species of grasses are used in preparing pulp for making paper. Maize cobs are used for fuel (Dutta, 1964). Barley for beer production. They also produce oil and scent as in *Andropogon muricatus* which yields khas and it has scent (Hyde and Williams, 1945). Grasses give about 1,700,000,000 tons of food annually from important grain crops such as maize, oat, rye, rice, wheat, millet etc. (Vidyarthi and Tripathi, 2002; Dutta, 1964). Although evidences from palynology is one of the useful biosystematic tool but there is absolute lack of Palynological characters especially in the family *Poaceae* necessary to distinguish species under the family hence the need for this study.

The objective of this research work is to examine the structural morphology of pollen grains of the four species and use the pollen characters obtained from this study to establish interspecie relationships among the four species investigated.

MATERIALS AND METHODS

Four mature plant species namely: *Oryza sativa, Zea mays, Sorgum vulgare* and *Panicum maximum* were collected and palynologically analyzed. Four of them were freshly collected from different locations in Eastern Nigeria such as Abia, Ebonyi, Imo, Enugu and Anambra States (Table 1). They are freshly collected in the field when flowering and identified by a trained palynologist. This study was conducted at the Biological Science Laboratory of University of Nigeria, Nsukka, Enugu State, Nigeria in January, 2009.

Palynological Studies

The fresh specimens (anthers) were carefully collected with the aid of a pair of forceps and crushed in a beaker to bring out the anthers. 5mls of distilled water was added and the material filtered into a centrifuge test tube. Then 5% of KOH was added to each sample and heated for 20 minutes.

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The samples were then centrifuged and the filtrate decanted. 5mls of acetolysis mixture comprising acetic anhydride mixed with concentrated sulphuric acid (H_2SO_4) in the ratio of 9:1 was added to each of the centrifuge materials in the plastic test tubes containing the samples. These test tubes were then heated through a water bath for 5 minutes. After being allowed to cool, they were centrifuged and decanted for 5 minutes at 2000 revolutions per minutes (r.p.m). The residue was treated with glacial acetic acid, centrifuged and decanted. Then the residue was washed 3 times with water, each washing followed by centrifuged and decanting for about 10-20 minutes. The acetolysis residues containing pollen grains were treated with 2 drops of glycerin alcohol in the ratio of 2:1 were added to the precipitate in order to preserve them and also to help suspend it and make it more clearer. The precipitates were then stored in a labeled specimen bottles. Unstained acetolysed pollen grains were embedded in glycerin jelly and sealed with wax after covering with zero cover slip.

Microscopic examination were made with Leica Galen III Binocular microscope, fitted with ocular micrometer for the measurement and fine morphological studies were done at x100 magnification using Anisol which serves as oil immersion for phase contrast applied on the slide. The figures recorded for the various pollen grains were generally the average of 10 measurements for each sample. The terminology used is that of Erdtman (1971) Moore and Webb (1978).

Photomicrographs of the specimens were taken using Leitz Wetzler Ortholux microscope fitted with vivitar-v-335 camera at x100 magnification

Collection No	Taxa	Locality	Collector	Place of Deposition
001	*Panicum maximum*	Amakohia Owerri	Okolo Anthonia	IMSUH
002	*Zea mays*	Enugu	Okolo Anthonia	IMSUH
003	*Oryza sativa*	Abakiliki Ebonyi	Okolo Anthonia	IMSUH
004	*Sorghum vulgare* Abia	Isialangwa	Okolo Anthonia	IMSUH

IMSUH = Imo State University, Herbarium

RESULT

Table 2: Pollen morphology of the four species of *Poaceae* investigated

Pollen Characters	***Oryza sativa***	***Zea mays***	***Panicum maximum***	***Sorghum vulgare***
Pollen Shape	Spheriodal-Subspheriodal	Spheriodal-Subspheriodal	Spheriodal-Subspheriodal	More or less Subspheriodal
Pollen aperture	Monoporate and annulate	Monoporate and annulate	Monoporate and annulate	Monoporate and annulate
Pore Diameter	3µm	3µm	3µm	2µm
Pollen wall	Scabrate	Scabrate	Scabrate	Scabrate
Number of Aperture	Monoporate	Monoporate	Monoporate	Monoporate
Exine Thickness	Medium	Small	Medium	Medium
General Appearance	Circular	Circular	More or less circular	Elliptic

The result of the pollen morphology of the four species of *Poaceae* studied showed that the pollen shape of *Oryza sativa*, *Zea mays* and *Panicum maximum* are spheriodal-subsheriodal while that of *Sorghum vulgare* is more or less subspheriodal. The pollen aperture of all the species studied are monoporate and annulate. The four species investigated showed scabrate pollen wall. The pore diameter of all the species studied is 3µm except *Sorghum vulgare* which is 2µm.

For exine thickness, *Oryza sativa, Panicum maximum* and *Sorghum vulgare* were observed to have medium exine thickness while *Zea mays* has small exine thickness. In their symmetry that is general appearance, *Panicum maximum*, is more or less circular while *Oryza sativa* and *Zea mays* are circular and *Sorghum vulgare* is elliptic. (Fig 1)

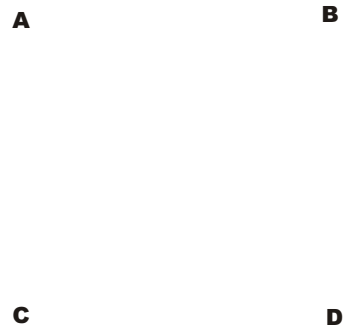

Fig 1 (a-d)

A = *Panicum maximum* with monoporate aperture And circular symmetry.
B = *Oryza sativa* with monoporate aperture and circular symmetry.
C = *Sorghum vulgare* with monoporate aperture and elliptic symmetry.
D = *Zea mays* with monoporate aperture and circular symmetry.

Discussion

The palynological studies on the four species investigated showed the same similarities and little variations between them. This differences and similarities in pollen morphology of the investigated species are significant and could be exploited for biosystematic purposes. Applying these variations in pollen morphology to the *Poaceae* species studied, the circular nature of some of the pollen grains are related to structural adaptation for effective pollination by insects (Gimenes, 1991; Edeoga *et al,* 1996). However, it has been noted that variations exist in size, pore diameter and exine thickness of the pollen grains investigated and these feature could serve as point of differentiation between the different species of *Poaceae* investigated. The aperture which is of primary significance in palynology (Ogbebor, 1996) showed much similarities between the four pollen grains studied and this goes a long way showing the relationship between the four species investigated and it confirmed the placement of the four species under one family.

Although the elliptic symmetry more or less subspheriodal in shape and the pore diameter of *Sorghum vulgare* differentiates it from the three other species which are mostly circular in symmetry, spheriodal-subspheriodal in shape and greater pore diameter. However, these differences are not significant enough to suggest placing *Sorghum vulgare* under another family because pollen shape plays a minor role in classification (Ogbebor, 1996).

From this study, it is likely that the nature of pollen grains could be an evolutionary modification often inherited to determine the mode of pollination and thereby perpetuate a particular group of plants in a given environment (Lowe and Soladoye, 1990). From the pollen size and type, one can strongly argue that hybridization may be operating because the relatively large pollen size and the smallest pollen are features that suggest that there are indiscriminate mating leading to hybridization (Edeoga and Okoli, 1996). The differences in pollen grains are not enough for reclassification of the species studied, but the similarities in structure among the investigated taxa showed interspecific relationships of the individual species (Mbagwu and Edeoga, 2006).

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