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Full Length Research Paper

Palynological studies on five species of Asteraceae

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Palynological studies on five species of the family Asteraceae namely *Guternbergia nigritiana*, *Emilia praetemissa*, *Vernonia guineensis*, *Lagera pterodonta* and *Chromolena odorata* was carried out. Results obtained from this investigation showed that the pollen shape is spheroidal in *G. nigritiana*, *E. praetermissa* and *C. odorata* while it is elliptic in *V. guineensis* and *L. pterodonta*. The pollen aperture is porate in all except in *L. pterodonta* where it is elliptic. The pollen wall is echinate in all except in *C. odorata* where it is smooth. The general appearance of the pollen grains is circular in *G. nigritiana*, *E. praetermissa* and *C. odorata* but longer than wide in *V. guinensis* and *L. pterodonta*. It is therefore likely that the nature of the pollen grains in these species could be an evolutionary modification often inherited to determine the mode of pollination and thereby perpetuate a particular group of plants. The similarities in structure showed interspecies relationships and reasons for them to be in the same family while the differences in structures showed reasons for them to exist as distinct species.

Key words: Palynomorphology, pollen grains, structure, taxa, asteraceae.

INTRODUCTION

Members of the Asteraceae family are herbs or shrubs; they are rarely twiners or trees. The leaves are simple, alternate or opposite, rarely compound. The inflorescence is a head or capitulum with an involucre of bracts. Flowers are of two kinds -the central ones called disc florets are tubular and the marginal ones called ray florets are ligulate (Dutta, 1974). For its many characters, Asteraceae is assigned an advanced position in systematic botany. Thus the family is of recent origin. Fossil records showed that the genus *Senecio* came into existence first and other genera developed from it in due course. It is likely Asteraceae and Rubiaceae have risen from a common ancestry. Asteraceae maintains a phylogenetic connection with Unbelliferae through inflorescence and floral mechanism. Asteraceae is remarkable in many respects; it has the maximum number of species, its worldwide distribution, its variety of forms and its very effective mechanism for cross-pollination (Dutta, 1974).

Pollen or flower sperm is a fine to coarse powder consisting of microgametophytes (pollen grains) which carry the male gametes of seed plants (Wagner et al., 1990). Palynology is the science that studies contemporary and fossil palynomorphs, including pollen, spore, dinoflagelate cysts, acritarchs, chitinozoans and scolecodonts, together with particulate organic matter and kerogen found in sedimentary rocks and sediments (Walker, 1976). The palynological attributes of plants have attracted the attention of many scientists. For example, Nyananyo (1985) on pollen morphology of *Talineae* showed that palynology provides useful data for the intrageneric classification of the large genera. Nyananyo (1987), Nyananyo and Olowokudejo (1986) also used seed coat morphology and other palynological features of *Talinum* and *Calandrinia* to produce a more acceptable classi-fication of the species in these taxa. Similarly, Edeoga et al. (1996, 1998), Edeoga and Gomina (2001), Nyananyo (1990) and Mbagwu and Edeoga (2006) have utilized pollen attributes to establish probable evidence of relationships among certain groups of flowering plants in Nigeria. According to these authors, the main characters of taxonomic value in pollen grain are the number and position of furrows, pollen wall morphology, symmetry and shapes and sizes of pollen grains. Edeoga and Ikem (2002) also showed that *Boerhavia coccinea* is characterized by tricolpate pollen

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grians while *Boerhavia erecta* and *Boerhavia diffusa* have alcopate pollen grains hence *B. coccinea could* therefore be distinguished from other Nigerian collections of *Boerhavia* based on pollen characters. The variation in shape, aperture, polar unit, symmetry and difference in wall sculpture of pollen grains has been used by many authors in the delimitation of various taxa (Agwu and Uwakwe, 1992; Agwu and Osibe, 1992; Edeoga et al., 1996; Lezine and Edorh, 1991; Angeles, 1992; Mbagwu and Edeoga, 2006).

This study is based on the hypothesis that palynological studies have played a vital role in the delimitation of various taxa but has not been used to delimit the above five species of Astereceae to the author's knowledge. Hence the need for the study with the objectives of examining the pollen morphology of five species of Asteraceae and using the pollen characters for the establishment of interspecies relationships among the five species investigated.

MATERIALS AND METHODS

Mature plants of the five species of Asteraceae namely *Gutenbergia nigritiana*, *Emilia praetermissa*, *Vernonia guineensis*, *Lagera pterodonta* and *Chromolaena odorata* were collected around the Agricultural Garden of Imo State University Owerri, Nigeria. This study was conducted in January, 2006 at the Science laboratory of the Department of Plant Science and Biotechnology of Imo State University, Owerri, Nigeria. The specimens were taken to Forestry Herbarium Ibadan (FHI) for proper identification. The voucher specimens were deposited at the Imo State University Owerri Herbarium Nigeria.

Mature flower head of each of the five species were collected and teased out on a slide. Samplings were made on fresh flowers from plants in their natural conditions as these do not undergo any form of deterioration (Edeoga et al., 1996, 1998). Samples for light microscope were acetolysed (Erdtman, 1960) which involves the introduction of the acetolysed mixture comprising acetic anhydride mixed with concentrated sulphuric acid (H_2SO_4) in the ratio of 9:1 to the centrifuged materials in the plastic test tubes. The tubes were immersed in boiling water bath for 3 - 5 min after which they were allowed to cool and the supernatant decanted. The residue was washed twice with water and decanted, about 5 drops of glycerine alcohol in the ratio of 2:1 was added to the precipitates and transferred into labeled specimen tubes for storage. Unstained actolysed pollen grains were embedded in glycerine jelly and sealed with wax after covering with zero cover slip. Phtomicrographs of the pollen grains were taken using a Leitz Wetzler ortholux microscope fitted with vivitar-V-335 camera (Figure 1)

RESULTS AND DISCUSSION

The palynomorphological studies of the five species of Asteraceae investigated is quite different but of generalized types found among the dicotyledons (Table 1). The pollen shape is spheroidal in *G. nigritiana*, *E. praetermissa* and *C. odorata* but elliptic in *V. guineensis* and *L. pterodonta* (Figure 1). The pollen aperture is pora-te in all except in *L. pterodonta* where it is elliptic. Polyporate

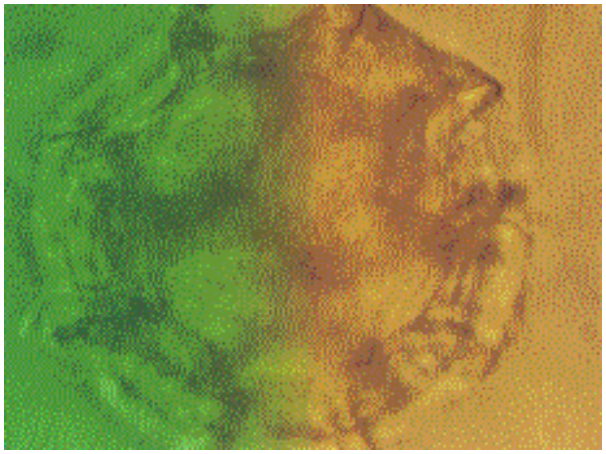

Figure 1a. *Gutenbergia nigritiana* with reticulate pollen wall.

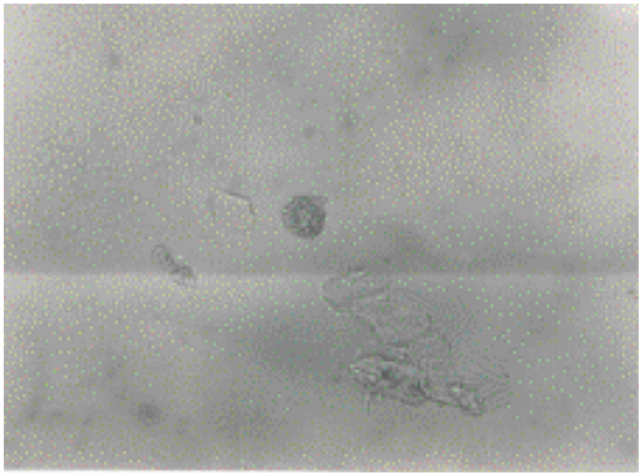

Figure 1b. *Emilia praetermissa* with polyporate aperture and echinate pollen wall.

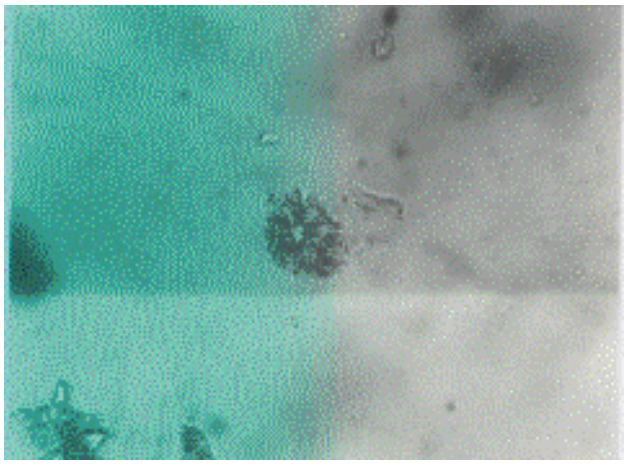

Figure 1c. *Vernonia guineensis* with echinate pollen wall and polyporate apertural type.

Table 1. Pollen morphology of the five species of Asteraceae studied.

Pollen Characters	*G. nigritiana*	*E. practemissa*	*V. guineensis*	*L. pterodonta*	*C. odorata*
Pollen shape	Spheroidal	Spheroidal	Elliptic	Elliptic	Spheroidal
Pollen aperture	Porate	Porate	Porate	Elliptic	Porate
No. of aperture	Polyporate	Polyporate	Polyporate	Polyporate	Polyporate
Pollen wall	Echinate	Echinate	Echinate	Echinate	Smooth
Aperture type	Porate	Porate	Porate	Porate	Porate
Appearance of pollen grains	Circular	Circular	Longer than wide	Longer than wide	Circular

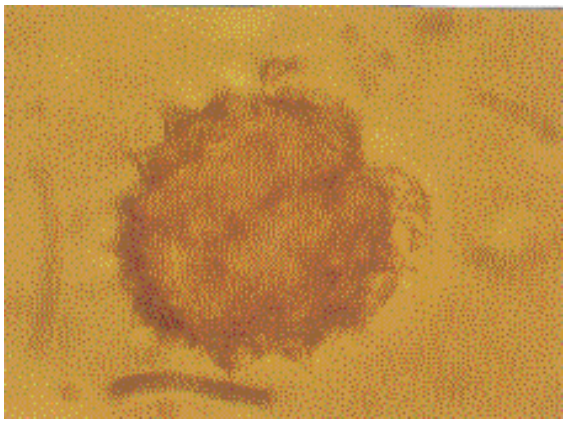

Figure 1d. *Lagera pterodonta* with echinate pollen exine and polyporate aperture.

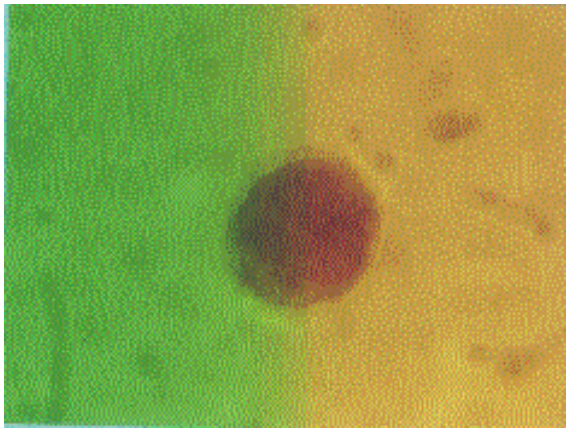

Figure 1e. *Chromolaena odorata* with smooth pollen exine.

number of aperture and porate type of aperture characterized all the species investigated. The pollen wall is echinate in all except in *C. odorata* where it is smooth. The general appearance of the pollen grains is circular in *G. nigritiana*, *E. praetermissa* and *C. odorata* but longer than wide in *V. guineensis* and *L. pterodonta*. In some of the species where the pollen grains are longer than wide, this is attributed as a structural adaptation for effective dispersal by wind while 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; Mbagwu and Edeoga, 2006). 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; Ogwal, 1990).

The 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 species investigated showed that species in the family with similar pollen characters are more closely related and thus exhibit interspecies relationships suggesting reasons for them to be in the same family while those with different pollen characters are not very closely related and suggest reasons for them to be as distinct species.

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