Thaiszia - J. Bot., Košice, 15: 1-9, 2005
http://www.upjs.sk/bz/thaiszia/index.html

THAISZIA
JOURNAL OF
BOTANY

Pollen morphology of the three species of the genus *Emilia* CASS. (Asteraceae) from Nigeria

OLUBUKOLA ADEDEJI

Department of Botany, Obafemi Awolowo University, Ile-Ife, Osun State, Nigeria,
oadedeji@oauife.edu.ng

Adedeji O. (2005): Pollen morphology of the three species of the genus *Emilia* CASS. (Asteraceae) from Nigeria. – Thaiszia – J. Bot. 15: 1-9. – ISSN 1210-0420.

Abstract: The structural morphology of the pollen grains of the three species of *Emilia* occurring in Nigeria is reported. The report is based on the study carried out with a light microscope on acetolysed pollen grains. Observations from this investigation show that *E. coccinea* with more acolpate and monocolpate pollen grains is the most primitive out of the three species studied. Tetracolpate pollen grain which is an advanced type of pollen grain was observed in *E. praetermissa* alone affirming that this taxon is more advanced than the other two taxa investigated. So based on this study, the order *E. coccinea* followed by *E. sonchifolia* followed by *E. praetermissa* in ascending order of recent evolutionary development is strongly affirmed. Moreover out of all the pollen grain attributes statistically analysed, number of pores on the pollen grains is an attribute that can be used effectively and reliably to separate, delimit and classify the species of *Emilia*.

Keywords: acolpate, monocolpate, bicolpate, tricolpate, tetracolpate, primitive, advanced, classify.

Introduction

The genus *Emilia* CASS. belong to the family Asteraceae. It is represented in Nigeria and West Africa by three species, namely *E. coccinea* (SIMS) G. DON, *E. sonchifolia* (L.) DC. and *E. praetermissa* MILNE-REDHEAD (HUTCHINSON & DALZIEL 1958 – 1972). The genus can also be found in different parts of the world. They are edible and can be used for medicinal purposes (ABBIW 1990, AZUINE 1998). *E. praetermissa* is an allotetraploid hybrid of *E. sonchifolia* and *E.*

coccinea (OLORODE & OLORUNFEMI 1973). *E. praetermissa* has chromosome number 2n = 20 while *E. coccinea* and *E. sonchifolia*, the diploid relatives have chromosome number 2n = 10.

Palynological attributes of plants have attracted attention of many researchers in recent time. NYANANYO & OLOWOKUDEJO (1986) used seed coat morphology and palynological features of *Talinum* and *Calandrinia* to produce a more acceptable classification of the species in these taxa. AKINWUSI & ILLOH (1996) on pollen morphology of the *Hibiscus* showed that palynology provides useful data for the taxonomy of the genus. EDEOGA et al. (1996) and (1998) have utilized pollen attributes to establish probable evidence of relationships among certain groups of flowering plants in Nigeria. The main characters of taxonomic value in pollen grain are the number and position of apertures (colpi and pores), pollen wall morphology and sizes of pollen grains. There is no known work on the pollen morphology of the genus *Emilia*. The aim of this study is therefore to use the characters of the pollen to delimit, classify and trace evolutionary relationships among the three species of *Emilia*.

Materials and methods

Pollen grains inside anthers were collected from mature plants of the three species of *Emilia* (found largely in the South-western part of Nigeria) namely, *E. coccinea, E. sonchifolia* and *E. praetermissa*. Collections were made from Ondo and Ipe-Akoko in Ondo State; Ile-Ife and Osogbo in Osun State; Ibadan and Ikire in Oyo State; Abeokuta in Ogun State; Lagos in Lagos State; Ilorin in Kwara State and Ado-Ekiti in Ekiti State (Fig. 1). Pollen grains were collected from at least 20 plant stands per species in each state. These were acetolysed following the method of ERDTMAN (1960) with slight modifications. The acetolysed pollen grains were mounted in glycerine jelly. In each case, measurements were taken from 1500 pollen grains. Photomicrograph of the prepared slides were taken with Leitz camera mounted on a Leitz research microscope. The means, standard deviation and ranges of the pollen grain attributes taken were computed. The coefficient of variation were also computed to compare the variation in pollen attributes of the three species together. Statistical analysis include Analysis of Variance (ANOVA) and Duncan Multiple Range Test (DMRT) for significant differences among the species. A bar diagram illustrating the incidence of mean percentage number of colpi per pollen grain among the three species of *Emilia* was prepared.

Results

Generally, the pollen grains of the three species of *Emilia* studied are aperturate. Both types of aperture, the colpi and pores are present in all the species studied. Colpi are fissure-like apertures while pores are round. All the species studied are polyporate. The pollens in the three species are acolpate (Fig. 2A), monocolpate (Fig. 2B), bicolpate (Fig. 2C) and tricolpate (Fig. 2D, 3A – C). The acolpate and monocolpate pollen grains were encountered more in *E.*

coccinea while the tricolpate pollens were found to be occurring more in *E. sonchifolia* and *E. praetermissa* (Fig. 4). *E. praetermissa*, the allotetraploid hybrid of *E. coccinea* and *E. sonchifolia* is unique in having the tetracolpate (Fig. 2E) pollen which is conspicuously absent in the other two species. It also has the largest size (Tab. 2). According to SWANSON (1968), the most immediate and universal effect of polyploidy is an increase in cell size.

The simple descriptive statistics of the pollen grain attributes (Tab. 1) show that number of pores (X 6) has the highest coefficient of variation of 62.99% followed by distance between pores (X 5) with a coefficient of variation of 53.35%. These are the two attributes that has contributed more to the variability in the pollen grains.

Analysis of Variance (ANOVA) reveal that there are significant differences within each attribute studied. Among the species, Duncan Multiple Range Test grouping of the *Emilia* species based on the pollen grain attributes reveal that there is no significant difference between the pollen grain diameter of *E. coccinea* and *E. sonchifolia* (Tab. 2). Also there is no significant difference in the pollen wall thickness and pore diameter of *E. praetermissa* and *E. coccinea*. There is no significant difference in the distance between pores of *E. praetermissa* and *E. coccinea*. It is noteworthy, however, that there is significant difference in number of pores in the three species of *Emilia* studied (Tab. 2). This attribute also has the highest coefficient of variation, contributing more to the variation in the pollen grains than other attributes statistically analysed. It is therefore an attribute that can be used effectively and reliably to separate, delimit and classify the species of *Emilia* studied.

Some evolutionary interpretations come to focus from the nature of the pollen grains among these *Emilia* species. According to WALKER (1976), two main kinds of pollens are found in angiosperms, these are the monocolpate and tricolpate types. Monocolpate types are characteristic of the primitive dicotyledon and advanced monocotyledon, tricolpate pollens are characteristic of the advanced dicotyledons. Thus, based on this, one can strongly argue that *E. coccinea* with more acolpate and monocolpate pollen grains is more primitive than *E. sonchifolia* and *E. praetermissa* with a higher occurrence of tricolpate pollen grains.

According to OLORODE & OLORUNFEMI (1973), *E. praetemissa* is an allotetraploid hybrid of *E. coccinea* and *E. sonchifolia*, that is, *E. praetermissa* is more recently developed or more advanced than *E. coccinea* and *E. sonchifolia*. From this study, tetracolpate pollen grain which is a more advanced type of pollen was found to be present only in *E. praetermissa* but absent in *E. coccinea* and *E. sonchifolia*, the diploid relatives. It can thus be affirmed that the tetracolpate pollen grain observed in only this species of the *Emilia* genus studied is a mark of recent evolutionary development in the species, that is in *E. praetermissa*. The occurrence of more tricolpate pollen grains in *E. sonchifolia* than in *E. coccinea* and more acolpate and monocolpate pollen grains in *E. coccinea* than *E. sonchifolia* (Fig. 4) strongly suggest that out of the two diploid relatives of *E. praetermissa*, *E. sonchifolia* is more advanced than *E. coccinea*.

References

ABBIW D.K. (1990): Useful plants of Ghana. Intermediate Technology Publications and The Royal Botanic Gardens Kew, London. Available at: www.ipgri.cgiar.org/publications/HTMLPublications/500/ch03.htm. Accessed Nov. 11, 2003.

AKINWUSI O. & ILLOH H.C. (1996): Pollen grain morphology of some species of *Hibiscus* Linn. Nig. J. Bot. 9: 9 – 14.

AZUINE M.A. (1998): Cancer and ethnobotany of Nigeria, Shaker Verlag, Aachen.

EDEOGA R.O. OGBEBOR N.O. & AMAYO A.O. (1996): Pollen morphology of some Nigerian species of *Aneilema* R. Br. and *Ludwigia* L. – New Botanist, 23: 223 – 231.

EDEOGA R.O. UGBO R.N. & OSAWE P.I. (1998): Palynomorphology of species of *Commelina* L. and *Senna* Toum. ex. Mill. from Nigeria. – New Botanist, 25: 1 – 10.

ERDTMAN G. (1960): Pollen morphology and taxonomy. The Chronica Botanica Co. Waltham, Mass U.S.A.

HUTCHINSON J. & DALZIEL J.M. (1954 – 1972): Flora of West Tropical Africa, ed. 2, revised by R.W.J. Keay and F.N. Hepper, 3 Vols. Crown Agents, Millbank, London.

NYANANYO B.L. & OLOWOKUDEJO J.D. (1986): Taxonomic studies in the genus *Talinum* (Portulacaceae) in Nigeria. – Willdenowia, 15: 456 – 463.

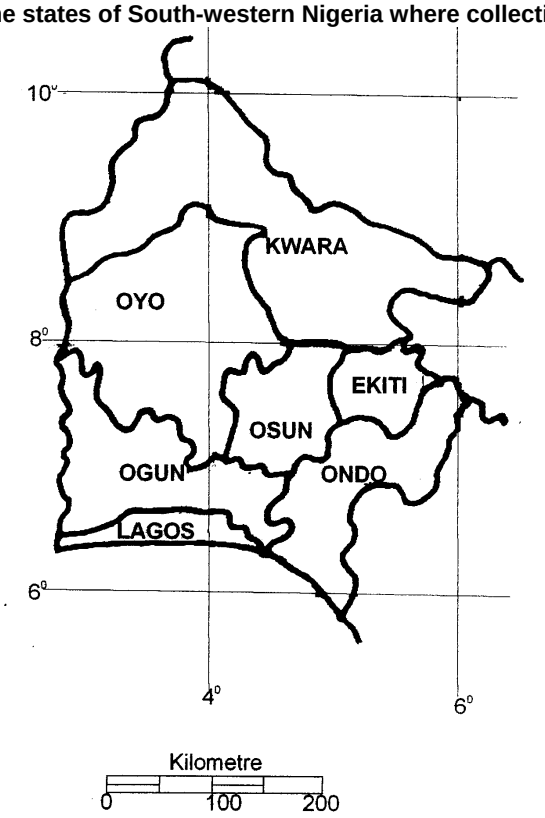
OLORODE O. & OLORUNFEMI A.E. (1973): The hybrid origin of *Emilia praetermissa* (Senecioneae : Compositae). – Ann. Bot. 37: 185 – 191.

SWANSON C.P. (1968): Cytology and cytogenetics. 2nd edition. Prentice-Hall Inc., New Jersey, chapter 5, pp. 124 – 154.

WALKER I.W. (1976): Evolution of exine structure in the pollen of primitive angiosperms. – Amer. J. Bot. 61: 891 – 902.

Received: 1 February 2004
Revised: 10 January 2005
Accepted: 10 January 2005

Fig. 1. Map of the states of South-western Nigeria where collections were made.



Tab. 1. Simple descriptive statistics of pollen grain attributes of the *Emilia* species studied.

Variable	Minimum	Maximum	Mean	Standard Deviation	Standard Error	Coefficient of Variation (C.V.) %
X2	24.00	51.00	34.41	6.69	0.55	19.43
X3	1.50	4.50	3.00	0.89	0.16	29.83
X4	1.20	4.50	3.14	0.94	0.17	29.87
X5	0.60	3.00	1.41	0.75	0.14	53.35
X6	11.00	56.00	26.47	16.67	3.04	62.99

Key to variables:

X2 Pollen diameter (μm)
X3 Pollen wall thickness (μm)
X4 Pore diameter (μm)
X5 Distance between pores (μm).
X6 Number of pores.

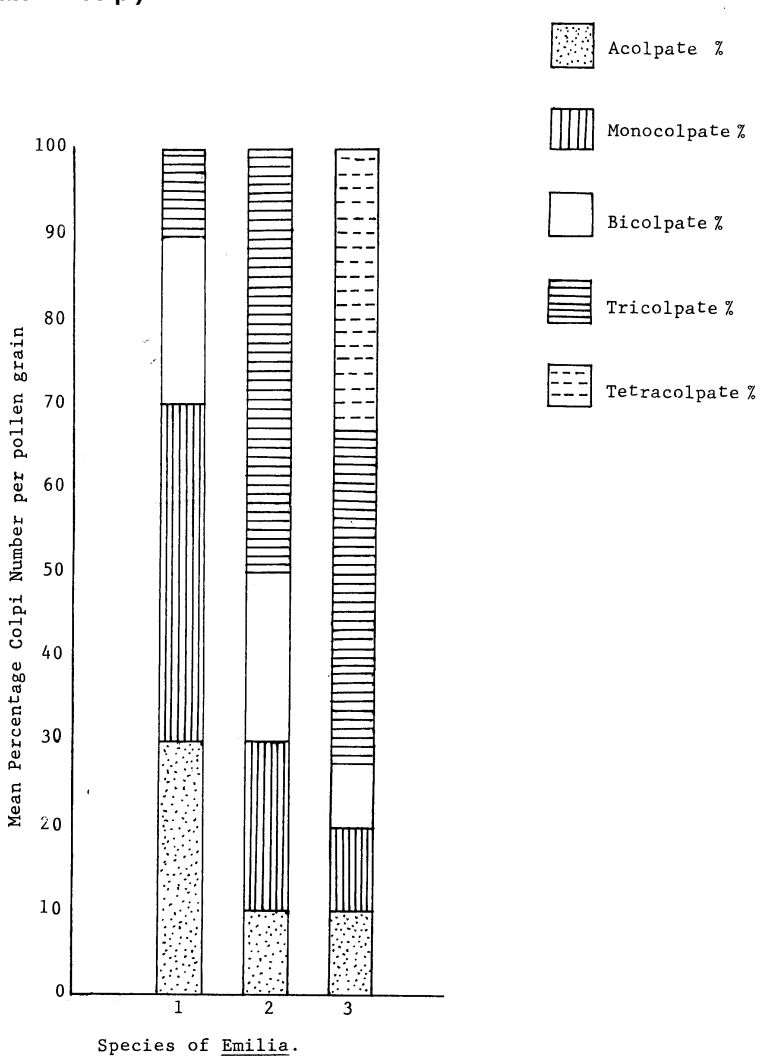
Tab. 2. Duncan grouping of the *Emilia* species based on the pollen grain attributes (means with the same letter are not significantly different).

Species	Total number of pollen measured per species (n)	Pollen grain diameter (μm)	Pollen wall thickness (μm)	Distance between pores (μm)	Number of pores	Pore diameter (μm)
E. praetermissa	1,500	(42.54 ± 5.46) A	(3.60 ± 0.84) A	(0.90 ± 0.24) A	(49.10 ± 4.15) A	(3.81 ± 0.38) A
E. coccinea	1,500	(30.60 ± 2.46) B	(3.12 ± 0.57) A	(1.05 ± 0.32) A	(18.10 ± 1.97) B	(3.48 ± 0.30)A
E. sonchifolia	1,500	(30.10 ± 2.66) B	(2.28 ± 0.62) B	(2.28 ± 0.61) B	(12.20 ± 1.14) C	(2.13 ± 0.75) B

Fig. 2.

Fig. 3.

Fig. 4. Incidence of mean percentage number of colpi per pollen grain. (acolpate = 0 colpus; monocolpate = 1 colpus; bicolpate = 2 colpi; tricolpate = 3 colpi; tetracolpate = 4 colpi).



Key to species numerals:

1. *E. coccinea*
2. *E. sonchifolia*
3. *E. praetermissa*