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CONTENTS

Studies on the reproductive biology of *Emilia* (Asteraceae - Senecioneae) 2. Floret number, reproductive propagules and seed germination

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Abstract

Floret number displayed low variability within each species and is statistically species-specific, and thus considered of great diagnostic value in taxonomic evaluation within the genus *Emilia* Cass. (Asteraceae-Senecioneae).

Two reproductive propagules were identified in the genus *Emilia*, viz. the seeds and the adventitious roots. The incidence of production of adventitious roots was highest in *E. coccinea*.

E. praetermissa Milne-Redh., the allotetraploid hybrid of *E. coccinea* (Sims) G. Don and *E. sonchifolia* (L.) DC., had the shortest number of days to germination and the highest percentage germination performance. The compensatory balance between the two reproductive propagules in the genus is highlighted.

Introduction

The attributes of the florets are emphasized by plant taxonomists in classification and identification of the Asteraceae (Burtt 1977). The constancy of the characteristics of florets, in spite of variation occurring in capitulum character, was one reason for the outstanding success of the Asteraceae (Burtt 1977). Ayodele (1995) used floret number to differentiate and separate some species in the genus *Vernonia* Schreb.

The features of sexual reproduction dominate flowering plant life cycles. But many species can also reproduce asexually by various modes of vegetative growth (Starr & Taggart 1998). Olorode (1984) reported exceptional cases of reproduction by vegetative (asexual) means in the genus *Vernonia*.

Salisbury (1961) had earlier identified the variability in the mode of seed germination even if conditions are favourable. *E. praetermissa* Milne-Redh. is an allotetraploid

hybrid (a hybrid and a polyploid) of *E. coccinea* (SIMS) G. DON and *E. sonchifolia* (L.) DC. (OLORODE & OLORUNFEMI 1973). The absence of highly widespread populations in the two diploid relatives of *E. praetermissa*, calls for an investigation on the efficiency or otherwise, of the seed germination performance among the species of the genus.

The objectives of this paper are, to document the reproductive propagules observed in the species of the genus *Emilia*, to dermine the importance or otherwise of floret number in the taxonomy of the genus, and also to document the seed germination performance of the genus in Nigeria. These data will enhance useful deductions on certain aspects of reproductive efficiency in the genus *Emilia*.

Materials and Methods

Capitula at anthesis were harvested randomly from *Emilia* plants among field populations, garden and screen-house plants. At least twenty-five capitula from twenty plants of each speices were used during each investigation for assessment of number of florets per capitulum. Each capitulum was dissected by means of a pair of forceps and a mounted needle to detach the florets from the receptacle. Floret counts were taken, using a tally-counter. Floret numbers were subjected to Analysis of Variance (ANOVA) and DUNCAN's Multiple Range Test (DMRT) for significant differences among the species.

Observations were made regularly on the field, garden and screen-house plants to establish the propagules for reproduction. One hundred plants of each species in the garden and screen-house carried labels on which regular entries were recorded. A bar diagram illustrating the percentage incidence of adventitious roots production in the species of *Emilia* was prepared.

For the germination studies, ripe capitula were harvested from field plant populations and bagged in sachets labelled according to their species numbers. The fruits (achenes) were separated from each capitulum by manual threshing. This also detached the pappus from the achenes. The threshed material was then winnowed to separate the seeds from the chaffs of involucral bracts and detached pappus. Three disposable plastic petri dishes were cleaned and the inside lined with moist filter paper. Fifty seeds were put on the moist filter paper in each petri dish. This was done for each of the species investigated. The dishes were kept on laboratory benches at room temperature for germination. The filter paper was kept moist (but not wet) regularly by adding more distilled water using a wash bottle. Germination observations were recorded for up to thirty days. The experiment was repeated five times at different intervals of the study. A bar diagram illustrating the mean percentage germination performance in the species of *Emilia* was prepared.

Observations/Results

There were significant differences among the species in the number of florets contained in each capitulum (Tables 1 & 2). *E. coccinea* and *E. praetermissa* are species with large-size capitula compared with *E. sonchifolia* and they were found to have higher number of florets; however, the variability in floret counts within each species was observed to be low (Table 1).

The study of the reproductive propagules in the species of the genus *Emilia* revealed two reproductive propagules, the seed (Fig. 1B & C) and the adventitious roots (Fig. 2A & B). It was observed that adventitious roots protruded out of the leaf nodes of lodged stems in the three species but the incidence of adventitious roots varied from one species to the other (Fig. 3). It was observed to be highest in *E. coccinea* and lowest in *E. sonchifolia,* with *E. praetermissa*, the tetraploid hybrid of the other two species, being intermediate.

A ripe capitulum is usually dry and crowned with pappus (Fig. 1A). This gives the capitulum the appearance of a full bloom flower. The colour of the pappus in the three species is usually white to dirty white (Fig. 1A–C). All the species have small-sized seeds. Germination performance studies reveal that *E. praetermissa* seeds were quick in germination (2–3 days after sowing) and had the highest mean germination performance of 94 %. *E. sonchifolia* and *E. coccinea* follow closely with 3–5 days to germination and mean percentage germination performance values of 91 % and 80 %, respectively (Fig. 4). Seed germination period for the germinated seeds in the three species ranges from 7 to 10 days.

Discussion

The low variability trend in the number of florets per capitulum within each species is noteworthy. Statistical analysis reveals that floret numbers in the genus are significantly different and species-specific and thus can be used to identify, separate and classify each species of the genus (Tables 1 & 2).

Two reproductive propagules, the seed and the adventitious roots were observed in the genus *Emilia*. The seed (Fig. 1) is the propagule of sexual reproduction while adventitious root (Fig. 2) is the propagule for vegetative or asexual reproduction. According to STARR & TAGGART (1998), asexual reproduction proceeds by way of mitosis, so offspring are genetically identical to the parent, they are a clone.

E. praetermissa had the shortest number of days to germination and the highest percentage germination performance. According to SWANSON (1968), the increased size of seeds which accompanies polyploidy increases seed and seedling vigour and hence helps in the process of stabilization and establishment in new habitats.

Generally in the genus, the seeds germinated within 2–5 days and completed the process of germination for germinated seeds within 7 to 10 days. This is an advantage for species that produce small fruits, which have very limited food stored in them (SALISBURY 1942). This stored food must be utilized as soon as the seeds find a favourable environment. Finding a favourable environment is an important determinant of the germination performance of these small-seeded species of *Emilia*. It was observed that despite the fact that *E. sonchifolia* and *E. coccinea* had considerably high seed germination performance, they still lack relatively large and widespread populations in the natural habitats. This could be due to two reasons, firstly, the seeds of these species may not readily find suitable favourable sites for germination in the wild and hence lose the viability. Secondly, even where the seeds germinate, not many of the seedlings reach adult stage because of the slow rate of growth of the seedlings, and other plants in the community soon overtake them and they get smothered.

We can see the compensatory balance between the reproductive propagules in the genus. *E. coccinea* with the highest incidence of adventitious roots (Fig. 3) has the lowest percentage germination performance of seeds (Fig. 4), while *E. praetermissa* and *E. sonchifolia* with the highest percentage germination performance have the lowest incidence of adventitious roots.

In the genus, dispersal of achenes is largely with the aid of wind because of the pappus (Fig. 1A & B). The combined strategies of seed dispersal and germination in *Emilia* species serve more of a colonization function than escape from pests. No significant or noticeable insect pests or any plant diseases of the seeds (fruits) were observed during this study.

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Table 1. Number of florets per capitulum in the species of *Emilia*

Species grouping* from DUNCAN's multiple range test	Species name	Mean	Range	CV%**
A	*E. praetermissa*	97.25	88ñ110	6.56
B	*E. coccinea*	92.70	86ñ101	6.90
C.	*E. sonchifolia*	41.70	40ñ43	2.59

Note: * Means with the same letter are not significantly different (conversely, means with different letters are significantly different).

** Coefficient of variation of attribute.

Table 2. Analysis of Variance (ANOVA) in number of florets per capitulum of *Emilia*

Character	Source of variation	Sums of Squares (SS)	Degree of freedom (DF)	Mean Square (MS)	F-value
Number of florets per capitulum in *Emilia*	Model	38050.03	2	19025.02	658.76*
	Error	1646.15	57	28.88	
	Corrected total	39696.18	59		

* Significant at 0.05% level.

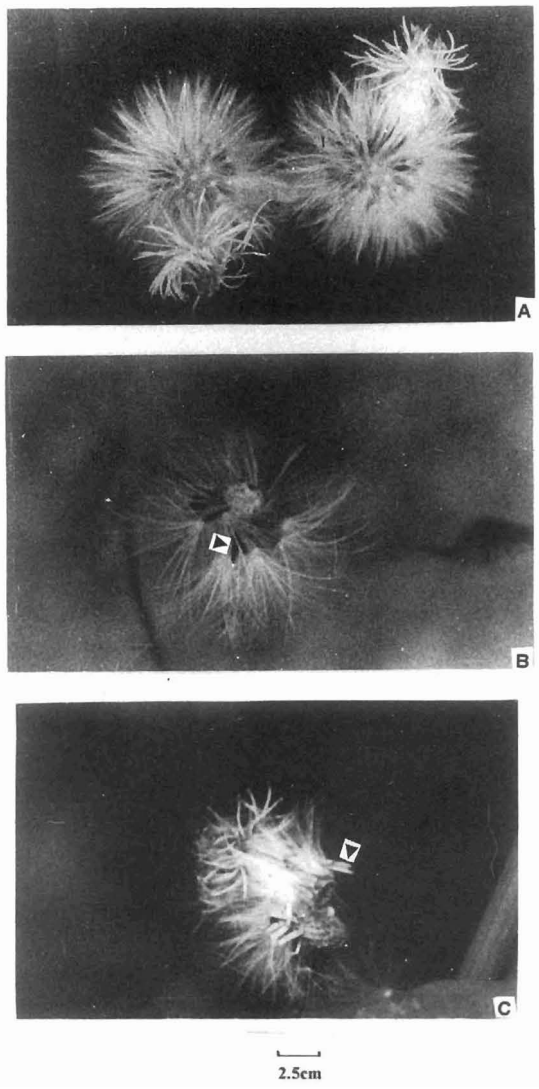

Fig. 1.

Ripe capitula in *Emilia*.
A: Capitulum with pappus and seeds.
B: Capitulum with few seeds and their attached pappus (arrow head indicates seed).
C: Capitulum with seeds and pappus (arrow head indicates seed).

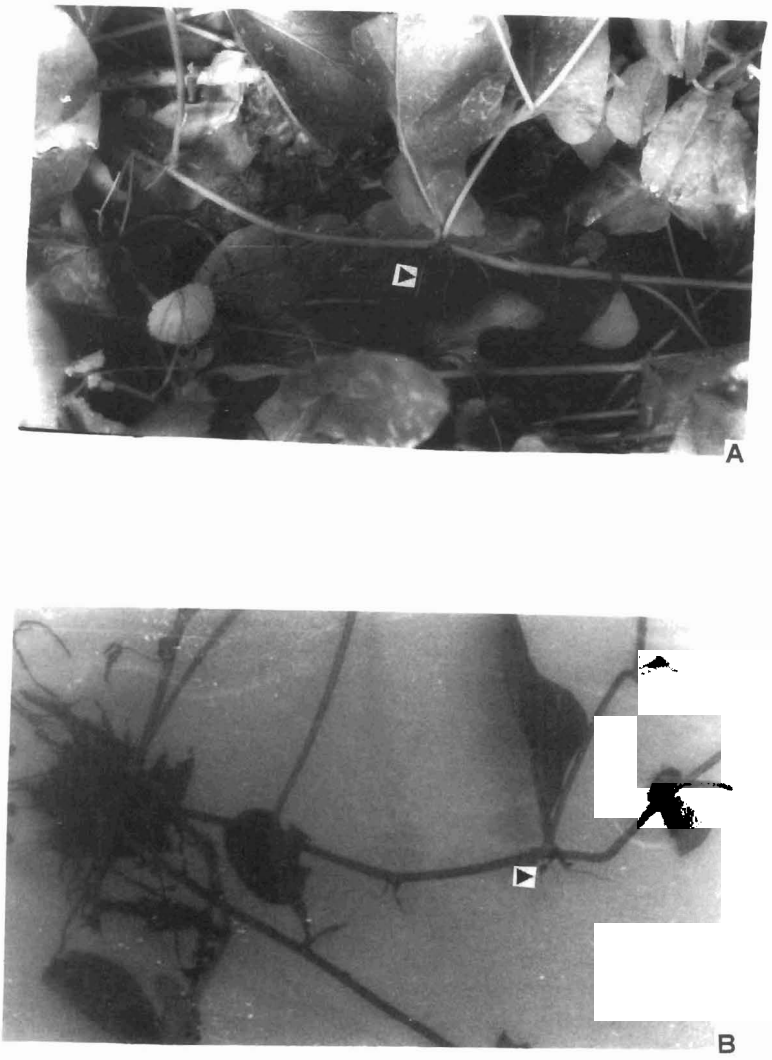

Fig.2.

Asexual reproduction in *Emilia.*
A & B: Adventitious roots (arrow head) on the stem.

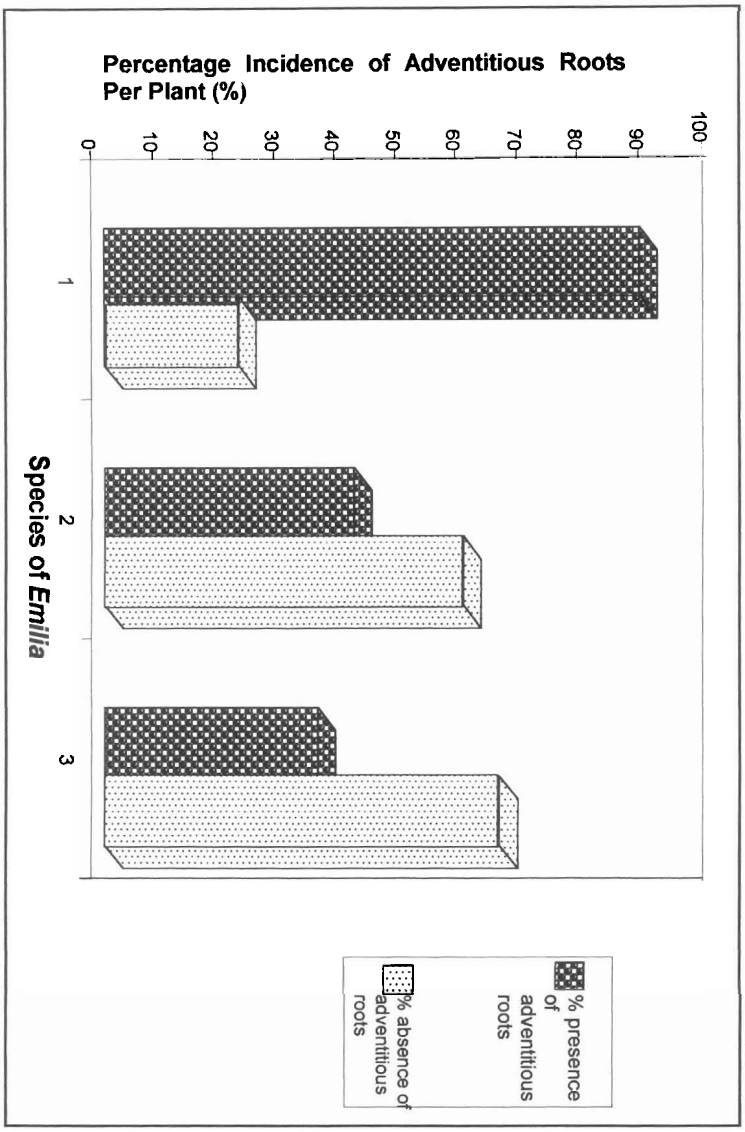

Fig. 3.
Incidence of adventitious roots per plant in the species of *Emilia*.
Key to speceis numerals:
1. *E. coccinea* 2. *E. praetermissa* 3. *E. sonchifolia*

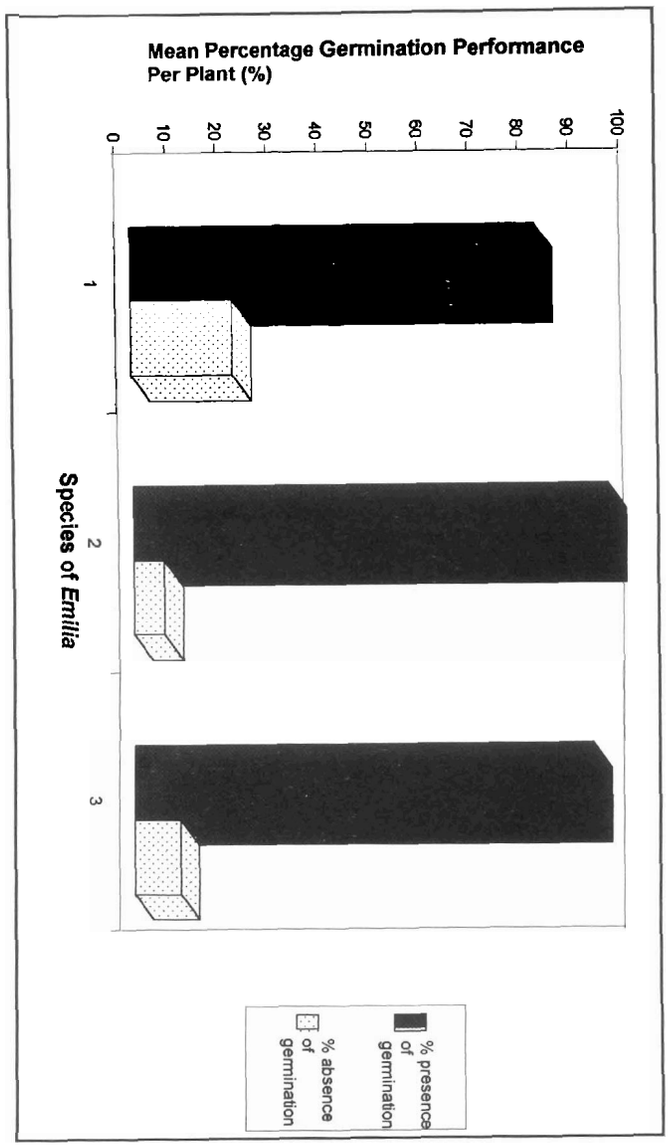

Fig. 4.
Mean percentage germination performance in the species of *Emilia*.
Key to species numerals:
1. *E. coccinea* 2. *E. praetermissa* 3. *E. sonchifolia*