

# COMPOSITAE 12

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**Studies on the reproductive biology of *Emilia*  
(Asteraceae – Senecioneae)  
1. Flowering and post-pollination developments  
in the capitulum**

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**Abstract**

A study of the flowering and post-pollination developments in the capitulum of the genus *Emilia* (CASS.) CASS. (Asteraceae – Senecioneae) was conducted in order to correlate and document various observations made on the stages of development of floral parts. The protectional role of floral parts is highlighted, both while flower is in bud and at fruit development phase. The co-operative features of floral parts (phyllaries, florets and receptacle) in the display of flowers for pollination and fruits for dispersal are elaborated. The probable reasons for the usual occurrence of *E. sonchifolia* and *E. coccinea* as isolated populations are discussed.

**Introduction**

The genus *Emilia* is represented in Nigeria and West Africa by three species (ADAMS 1963). These are *E. coccinea* (SIMS) G. DON, *E. sonchifolia* (L.) DC. and *E. praetermissa* MILNE-REDH. They are economically important. They can be eaten as vegetables and can also be used for medicinal purposes (BURKILL 1985, ABBIW 1990).

OLORODE & OLORUNFEMI (1973) reported a chromosome number of  $2n = 10$  for *E. coccinea* and *E. sonchifolia*, and  $2n = 20$  for *E. praetermissa*. They concluded that *E. praetermissa* is an allotetraploid hybrid between *E. sonchifolia* and *E. coccinea*.

In all plants, the demands of flowering and fruiting phases interact. According to BURTT (1975), the structure and organization of the capitulum of the Compositae (or Asteraceae) must meet the demands of both phases. He was also of the opinion that the study of the co-evolution of the flowering and fruiting phases of the life history of plants has been neglected. He therefore called for more studies of these two phases. The condition and exposure of a plant during the flowering and fruiting phase determines much the quality of fruits produced and the seeds set.

The objective of this study is to correlate and document the various observations made on the stages of development of floral parts (that is, the capitulum and its contents) via pre-pollination and post-pollination studies in the West African species of *Emilia*.

### Materials and Methods

Observations were made regularly on the field, garden and screen-house plants. 5–10 plants of each species in the garden and screen-house carried labels on which regular entries were recorded. Data gathered on capitulum development included: flower bud at anthesis; fertilization of florets; appearance of pappus on ripe fruits (achenes) in the capitulum and the mode of achene dispersal. Special observations on the post-fertilization events were made with respect to changes in the phyllaries and the receptacle of the capitulum. Photographs of important occurrences were recorded during the flowering and post-pollination stages of the capitulum.

Bar diagrams illustrating the incidence of receptacle reflexing and the incidence of withered florets adherent to pappus and seeds among the species were prepared.

### Results

A wall of phyllaries encapsulates the *Emilia* capitulum in bud (Fig. 1A). In all the species studied, the peripheral florets opened and were pollinated before the central florets (Fig. 1A & B). The post-pollination sign in all the species was the withering of the corolla of pollinated florets within 18 hours after pollination (Fig. 2A & B). This was followed by the gradual reclosure of the involucre, the diameter of the capitulum becoming smaller (Fig. 2A & B). The phyllaries remained green as the fruits from pollinated florets matured.

The capitulum thereafter reopens gradually with the diameter increasing, showing first the pappus of the peripheral matured achenes (Fig. 2C). The phyllaries become dried up, turning brown. With receptacle reflexing, all pappus subsequently radiates from matured achenes and the withered florets dropped off (Figs. 2D–E & 3A).

Capitulum receptacle may be completely reflexed in some cases, becoming turned inside-out when dry, like a closed umbrella (Fig. 4D). They may be partially reflexed (Fig. 4A–C) or not reflexed at all (Fig. 4A). However, the incidence of capitulum receptacle reflexing varied among and within the species (Fig. 5).

Dispersal of achenes is largely with the aid of wind. As the wind blows, the achenes are dispersed with the aid of the pappus on them (Fig. 3B). It was observed that efficient seed dispersal occurred only when the receptacle was completely reflexed

exhibiting all the seeds and pappus with the withered florets dropped off (Figs. 2E & 3A). However, a special event was observed where the receptacle was completely reflexed but the withered florets did not drop off from the top of the pappus separately (adherent to it) but pulled and eventually dropped off with the pappus and seeds, all together (Fig. 3C). The pappus was not fully exhibited for seed dispersal because the withered florets did not drop off. This was encountered more in *E. coccinea* followed by *E. sonchifolia*. It was a rare occurrence in *E. praetermissa*. The incidence of withered florets adherent to pappus and eventually dropping off with the pappus and seeds varied among the species (Fig. 6).

### Discussion

BURTT (1977) itemized four major factors necessary to meet demands of both the flowering and fruiting phases. Two of these factors are related to the flowering phase, namely the efficiency of pollination and the balance of the breeding system (i.e. the ratio of inbreeding to outbreeding). The other two factors have to do with the fruiting phase, namely the protection of the maturing achenes and their adequate dispersal.

The structure of the capitulum in *Emilia* and the organization of the constituent parts, namely the phyllaries, florets and receptacle, show meaningful adaptive values which meet the demands of both the flowering and fruiting phases. For instance, the phyllaries which encapsulate the capitulum buds, serve as protection for the internal structures. This protectional role recurs after pollination, as the involucre recluses (Fig. 2A & B), ensuring the safety of the developing achenes (fruits).

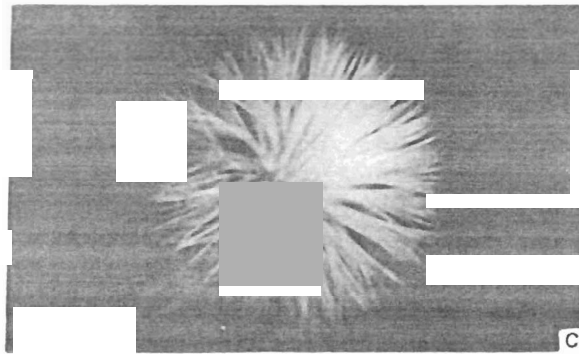
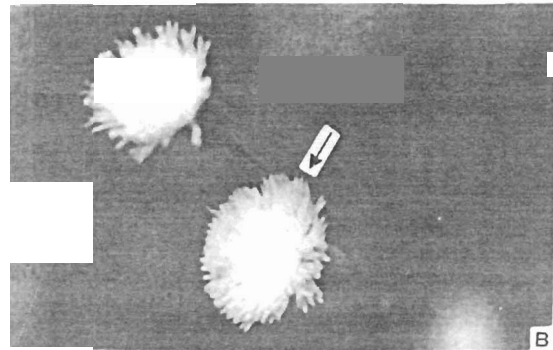
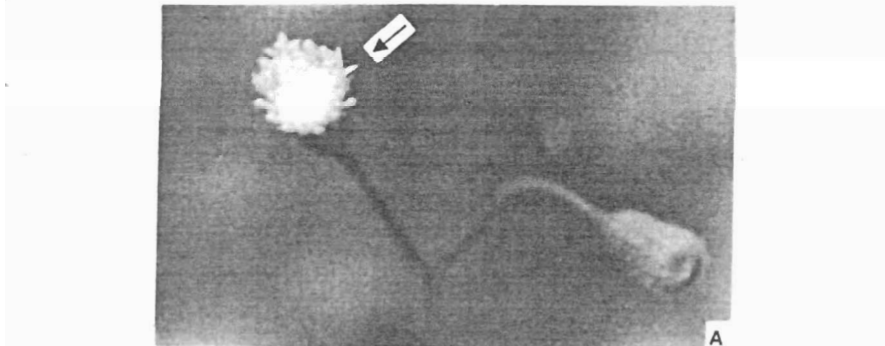
The phyllaries remain green while the fruits are maturing, becoming dry only in matured flower heads. A participatory role of the phyllaries in the net provision of photosynthetic products in the fruits is a possibility. Just as the phyllaries open initially at anthesis to expose the florets, so they are reopened when the fruits are matured for dispersal (Figs. 1A & 2C).

Receptacle reflexing was observed as an essential phenomenon aiding efficient fruit dispersal (AYODELE 1992). This can be compared with the explosive mechanism in some Euphorbiaceae. A combination of light-weight fruits and fully reflexed receptacle resulted in a longer distance of fruit dispersal, even in the absence of wind (AYODELE 1992). However, in this study two factors are observed to be hindering adequate seed dispersal largely in *E. coccinea* and *E. sonchifolia*, rarely in *E. praetermissa*. Firstly, partial reflexing and no reflexing of the receptacle is encountered in them (Fig. 4A – C). Secondly, even when receptacle reflexing is complete, occasionally, the withered florets do not drop off from the pappus preventing the pappus from radiating adequately for seed dispersal and eventually drop off with the pappus and seeds, all together (Fig. 3C). These may probably be some of the reasons why *E. coccinea* and

*E. sonchifolia* are not as widely and evenly distributed as *E. praetermissa*. They usually occur in scattered isolated populations.

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2.5cm

**Fig. 1.** Capitulum development in *Emilia*.

- A: Peripheral florets opening first (with arrow)  
Capitulum in bud (without arrow)
- B: Florets fully opened (with arrow)
- C: Capitulum with pappus

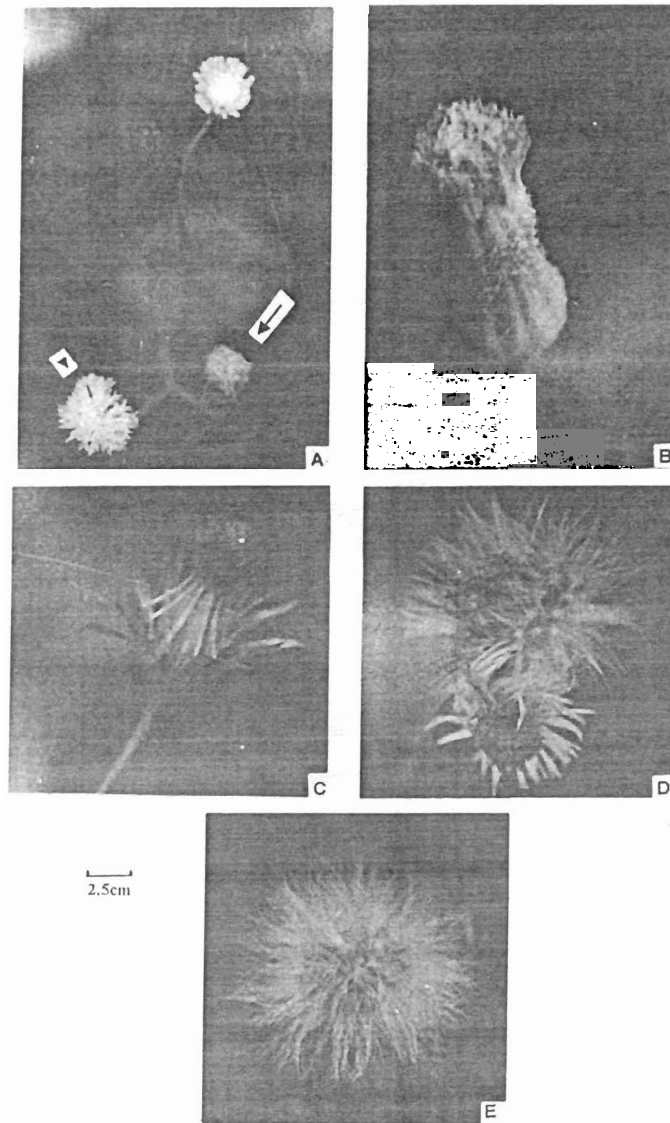
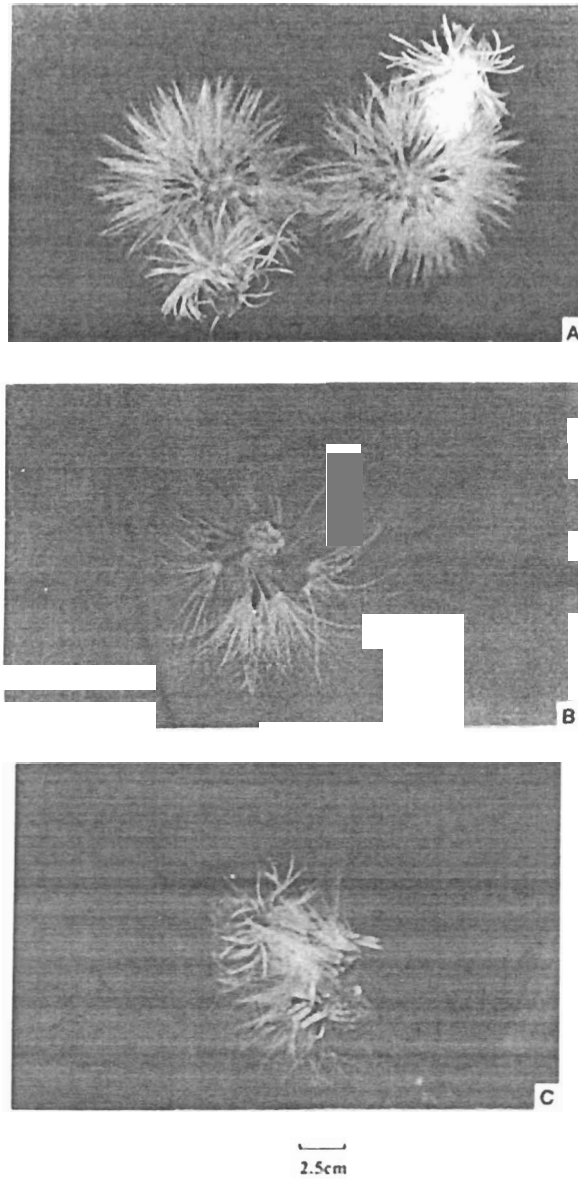


Fig.2. Capitulum development in *Emilia* (contd.).

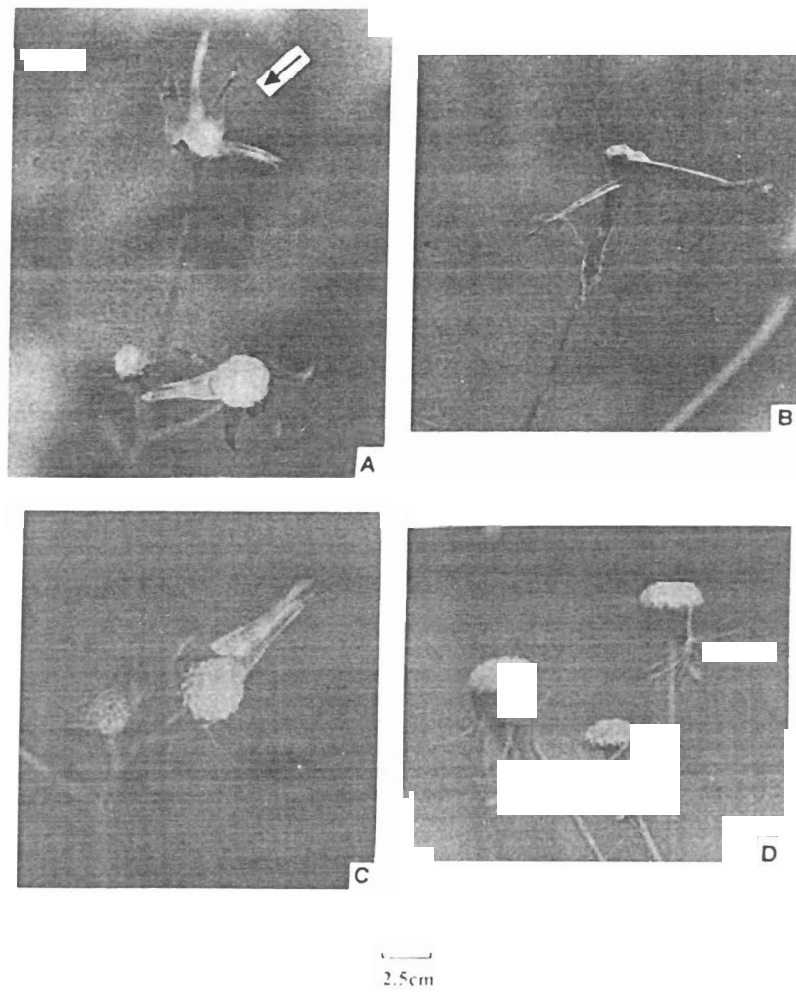
- A: Capitulum with withered florets (with arrow)
- B: Capitulum reclosure
- C: Capitulum re-opening
- D: **Withered floret dropping off** (after capitulum re-opening)
- E: Capitulum with pappus



**Fig. 3.** Capitulum development in *Emilia* (contd.).

- A: Capitulum with pappus and seeds (showing withered florets dropping off)
- B: Capitulum with few seeds
- C: **Withered florets adherent** to pappus and seeds, dropping off together





**Fig. 4.** Capitulum development in *Emilia* (contd.).

- A: No receptacle reflexing (with arrow)  
Partial receptacle reflexing (without arrow)
- B: Partial receptacle reflexing
- C: Partial receptacle reflexing
- D: Total receptacle reflexing

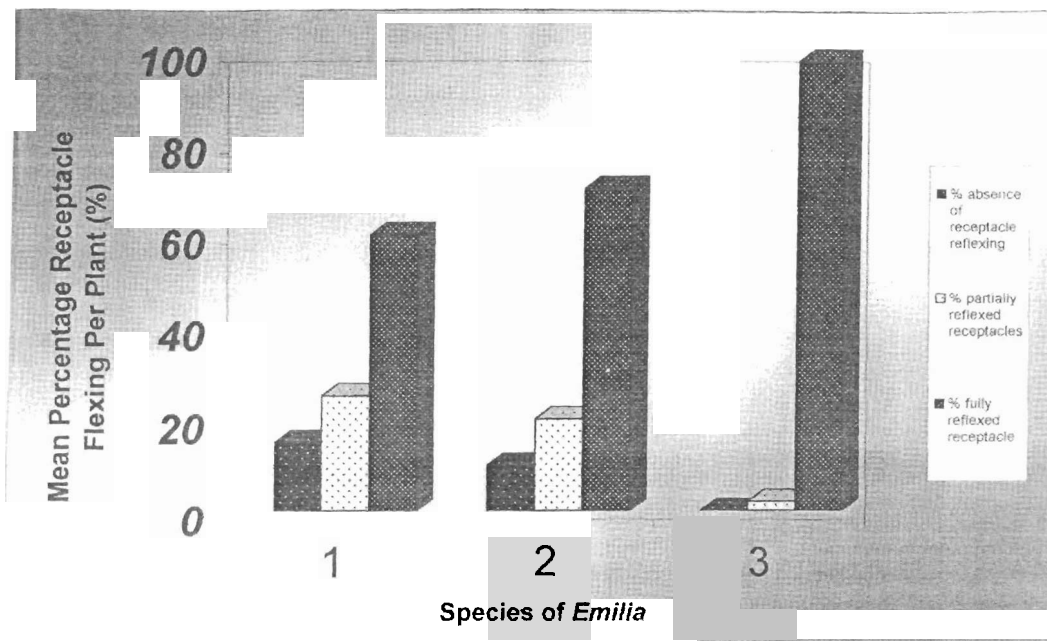


Fig. 5. Incidence of receptacle reflexing in ripe capitula on plants of the *Emilia* species.

Key to species numerals:

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

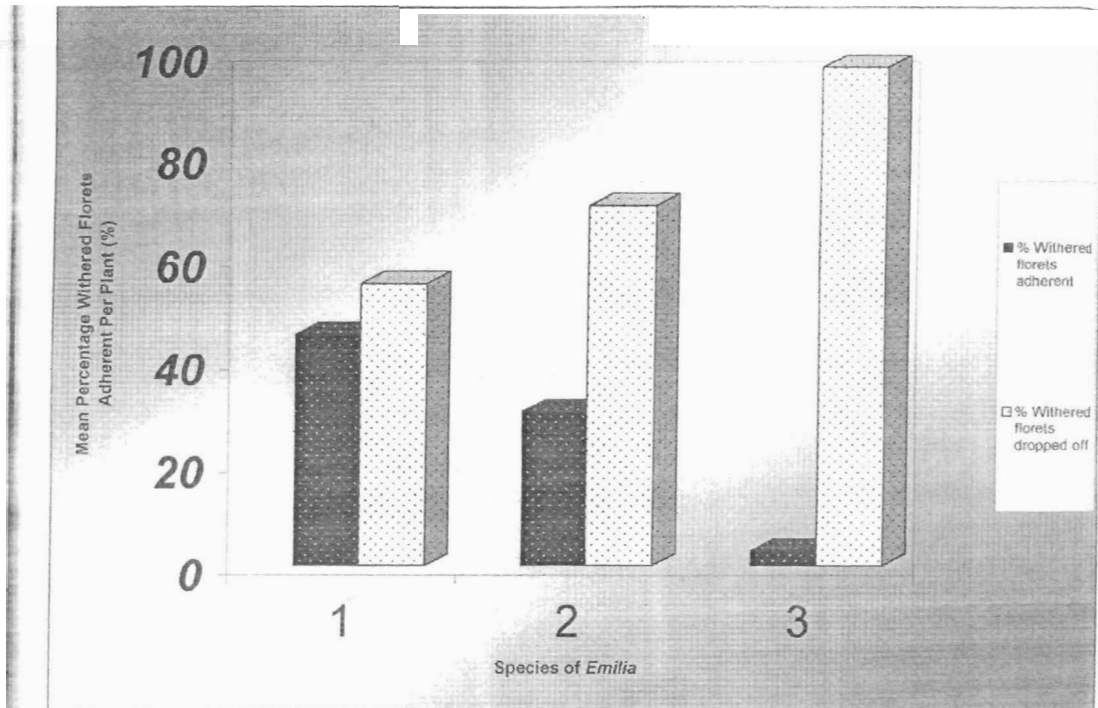


Fig. 6. Incidence of withered florets adherent to pappus and seeds on some plants of the *Emilia* species.

Key to species numerals:

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