THE VALUE OF LEAF MICROMORPHOLOGICAL IN THE TAXONOMIC DELIMITATION OF EMILIA CASS, (ASTERACEAE) SPECIES

B.C. NDUKUWU and I.O. AGBAGWA

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ABSTRACT

Studies were carried out on the leaf epidermis of the three species of Emilia: E. coccinea (Simso) G. Don, E. praetermissa Milne-Redhead, and E. sonchifolia (L.) DC using light microscope. Epidermal cells in the species are irregular with anticlinal wall pattern sinuous in E. coccinea, sinuous in E. sonchifolia, and straight to arcuate in E. praetermissa. Epidermal cell dimensions were highest in E. praetermissa with 52.50μm and 49.64μm for the length and breadth respectively. The epidermis is hypotomistic with anomocytic stomata in all species, semi-contiguous to contiguous stomata in E. coccinea, and E. sonchifolia. Stomata index (S.I.) frequency and size differed in all species. While S.I. of 34.60 in E. sonchifolia was the highest in the genus, E. coccinea had the lowest S.I. of 21.90. Stomata ledge occur in E. coccinea and E. praetermissa. Simple unicellular trichomes were observed only on the abaxial surface of E. coccinea. The usefulness of these data to the taxonomic delimitation of the Emilia is discussed.

KEYWORDS: Emilia, Epidermis, Stomata, Taxonomy, Trichome

INTRODUCTION

Emilia Cass. consists of three species in Nigeria (E. coccinea (Simso) G. Don, E. praetermissa Milne-Redhead, and E. sonchifolia (L.) DC), which occur as regrowths in cleared forests, abandoned farmlands, edges of footpaths and track roads. Morphological features of these species have been described by Hutchinson and Dalziel (1963), Olorde and Olorunfemi (1973), and Akobundu and Agyakwa (1987). The species are semi-evergreen with hollow, weak stems, which do not usually branch below the inflorescence. The leaves are simple and alternate, semi-fleshy and ovate; upper leaves are sessile and dilated at their bases. Burkii (1985) reported that leaves of these species are used as vegetables.

Olorde and Olorunfemi (1973) and Olorde (1974) established a basic chromosome number of n = 5 for the genus. They further reported a diploid chromosome number of 10 (2n=10) for both E. coccinea and E. sonchifolia, while E. praetermissa had 2n=20 (tetraploid). Thus, E. praetermissa is a hybrid of E. coccinea and E. sonchifolia, the diploid progenitors. Taxonomic data on the genus especially in relation to the phylogenetic relationships among the species is very scanty. No known study has been carried out on aspects of micromorphology and micromorphology. The present study investigates epidermal epidermal characteristics (epidermal cells, stomata, trichome etc) of these three species with the aim of improving the information on their taxonomy. Similar characters have been reported and utilized in taxonomic elucidation by Metcalfe and Chalk (1970), Patil and Patil (1987), Oladele (1990), Edeoga and Qaswe (1996), Ogundipe and Akintunde (1998), and Agbagwa and Ndukwu (2001). A taxonomic key based on the outstanding epidermal characteristics of the species has been developed to further demonstrate the value of these micromorphological features in taxa delimitation of Emilia.

MATERIALS AND METHODS

Fresh mature leaves of the three species (E. coccinea, E. praetermissa, and E. sonchifolia) were collected from living plants grown in the Botanical Garden of University of Port Harcourt, Nigeria. Samples for study were all taken from identical regions of the leaf, usually midway between the base and apex of the lamina including the margins. The adaxial and abaxial leaf surfaces of the species were peeled following the methods of Cutler (1978) as modified by Okoli and Ndukwu (1992). The peels were bleached for 3 to 5 minutes with parazone (domestic bleach), and washed in several changes of clean water. With camel hairbrush the peels were transferred to 10% aqueous solution of safranin for 5 minutes, and subsequently washed in clean water before mounting in glycerine. The slides were examined under a light microscope at Objective Lens 10 and 40 and photomicrographs of the epidermis taken using LEITZ DIAPLAN microscope fitted with LEICA WILD MPS 52 camera at Objective Lens 40. All quantitative measurements were made with an ocular eyepiece graticule at Objective Lens 40. 10 different peels were examined per species.

RESULTS

EPIDERMIS: The epidermis is composed of single layer of cells covered by smooth cuticle. It is thick on the upper surface (Fig. 1A) while thin on the lower surface. Basically, the epidermal cells are irregular in the species, anticlinal wall pattern sinuous in E. coccinea, sinuous in E. sonchifolia and straight to arcuate in E. praetermissa (Figs 1A-D). The costal cells are mostly tetragonal. The epidermal cell wall of E. praetermissa was thicker than the other two species. Epidermal cell lengths of 52.50μm and 49.64μm on the adaxial and abaxial surfaces of E. praetermissa respectively were the highest in the genus. The minimum length and breadth of 17.25μm and 2.80μm respectively were recorded in E. sonchifolia. The frequency of epidermal cell per field view at Objective Lens 40 on the upper leaf surface of the species range from 256 in E. praetermissa to 428 in E. coccinea. The trend is similar on the lower surface with 340 in E. praetermissa and 508 in E. coccinea.

STOMATA: The leaves were hypotomistic in all species; the stomata were randomly distributed and irregularly oriented in the intercostal areas. The stomata in all the species are anomocytic with each stoma surrounded by 3 to 4 epidermal cells. Semi-contiguous to contiguous stomata were observed in E. praetermissa and E. sonchifolia (Figs 1C & D). These were, however, more frequent in E. praetermissa. Stoma in E. praetermissa.
Figure 1A-D: A- showing adaxial epidermis of *E. coccinea* with sinuous wall pattern. B- abaxial epidermis of *E. coccinea*. Arrow points to a simple unbranched trichome. C- *E. praetermissa*. Arrow indicates a semi-contiguous stomata. D- *E. sonchifolia*. Mag. X 400

Fig. 2A – F: *Emilia* species. A – adaxial epidermis. B – section of the abaxial epidermis of *E. coccinea* showing clearly the stomata with ledges. C; D – abaxial epidermises of *E. praetermissa* and *E. sonchifolia* respectively. E, F – simple unbranched trichomes in *E. coccinea*. 

1 mm
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Coccinea was characterized by the occurrence of two stomatal leaves (upper and lower ledges) as shown in Fig. 2B. In E. praefermis, only one ledge was observed. Ledges were scarcely present in E. sonchifolia. The frequency of stomata per unit area varies from 115 in E. praefermis to 210 in E. coccinea, while the stomatal index was found to be highest in E. sonchifolia (34.80) and lowest in E. coccinea (21.90). Stomatal dimensions of 42.70μm and 29.28μm for the length and breadth respectively in E. coccinea were the highest in the genus. The least were observed in E. sonchifolia (20.50μm and 12.20μm for length and breadth).

**TRICHOMES:** Among the three species, trichomes were observed only on the abaxial surface of E. coccinea. The trichomes are unicellular and simple. They are distributed with a reduced frequency of 25 per field view and a low trichome density of 0.7.

**DISCUSSION**

The data obtained from the studies indicate a certain level of uniformity in the qualitative epidermal characters of the *Emilia* species investigated. For instance, cell shape is the same in all three species (Table 1). The predominant anticlinal wall pattern as demonstrated in Figs 1A-D is sinuous (wavy). This uniformity confirms their phylogenetic relatedness. However, it was relatively more sinuous in E. coccinea and occasionally straight to arcuate in E. praefermis. Another taxonomic identity of the species is the occurrence of anomocytic stomata in all species and contiguous stomata in E. praefermis and E. sonchifolia. Both anomocytic and contiguous stomata have been reported in the Asteraceae (Metcalf and Chaik, 1950; Cladele, 1990; Sasikala and Narayanan, 1998). Amidst similarities in stomatal features that further suggest phylogenetic relatedness include the stomatal distribution pattern per unit area, the different stomatal indices

<table>
<thead>
<tr>
<th>Taxa</th>
<th>Leaf surface</th>
<th>Epidermal cell shape</th>
<th>Anticlinal cell wall pattern</th>
<th>Stomata type</th>
<th>Trichome type</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. coccinea</td>
<td>Adaxial</td>
<td>Irregular</td>
<td>Sinuous</td>
<td>Absent</td>
<td>Absent</td>
</tr>
<tr>
<td></td>
<td>Abaxial</td>
<td>Irregular</td>
<td>Sinuous</td>
<td>Anomocytic, contiguous</td>
<td>Simple, unicellular</td>
</tr>
<tr>
<td>E. praefermis</td>
<td>Adaxial</td>
<td>Irregular</td>
<td>Straight to arcuate</td>
<td>Absent</td>
<td>Absent</td>
</tr>
<tr>
<td></td>
<td>Abaxial</td>
<td>Irregular</td>
<td>Straight to arcuate, sinuous</td>
<td>Anomocytic, contiguous</td>
<td>Absent</td>
</tr>
<tr>
<td>E. sonchifolia</td>
<td>Abaxial</td>
<td>Irregular</td>
<td>Sinuous</td>
<td>Absent</td>
<td>Absent</td>
</tr>
</tbody>
</table>

The seemingly large epidermal cell size and stomatal dimensions observed in E. praefermis is particularly noteworthy. Olorode and Olorunfemi (1973) investigated stomatal distribution, frequency, index and size in the leaves of 11 species and varieties of Chlorophytum and pointed out that these characters were significant at the level of the subgenera. Ogundipe and Akinniade (1998) and Agha and Ndukwu (2001) reported similar observations in Albizia and Cucurbita species respectively. Essau (1965) and W. Metcalfe and Chaik (1979) observed that frequently extended extensions of the cuticular membrane known as outer stomatal ledges or ridges rise from the guard cell surface like an incompletely roofed dome, in protective manner over the stomatal pore. The presence or absence of this feature, as is in this genus, can confer higher taxonomic significance on the stomata. In E. coccinea for instance, the ledges occur on both polar and distal ends of the stomata as against E. praefermis where it occurs on one side. However, this stomatal feature in E. sonchifolia is at best described as vestigial in this taxon (Fig 1D). It is to be noted that the hybrid E. praefermis seems to have acquired this feature midway from its putative parents, as expected of a typical hybrid.
In conclusion, similarities of epidermal features observed amongst the three species support their phylogenetic relationship. Certain features like large and contiguous stomata and epidermal cells reported in *E. praeternissa* is a confirmation of earlier reports of the polyploid status of the species. However, the species-specific occurrence pattern of stomata ledges, and the presence of trichomes on the abaxial surface of *E. cocinea* establish the individuality of these species. Such features standout for easy identification of the species. Based on the epidermal features as observed in the genus, the following artificial key has been construct Artificial Identification Key to the species

<table>
<thead>
<tr>
<th>Stomata ledge present</th>
<th>..................</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1' Stomatal ledge absent</td>
<td>E. sonchifolia</td>
<td></td>
</tr>
<tr>
<td>2 Two stomata ledges, trichome present on foliar surface</td>
<td>E. cocinea</td>
<td></td>
</tr>
<tr>
<td>2' One stomatal ledge, trichome absent on foliar surface</td>
<td>E. praeternissa</td>
<td></td>
</tr>
</tbody>
</table>

**REFERENCES**


