



ISSN 2395-650X

International Journal of
Life Sciences Biotechnology Pharma Sciences

IJLBPS

www.ijlbps.org

E-mail: editorijlbps@gmail.com editor@ijlbps.org

Bellis L. (Asteraceae) cypsela surface microsculpture in Libya

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Abstract

In this work, electron microscopy was used to examine in depth the cypsela surfaces of three species from the genus *Bellis* L. This research set out to better understand the microsculpture of the cypsela surface in Libyan species of *Bellis*. (Asteraceae). Each cypsela's surface was described in great detail. The findings showed that there were substantial differences between the cypselae surfaces of the analyzed taxa, and these differences are crucial for understanding the taxonomic relationships among the species under discussion. According to the findings, a taxonomist might utilize pericarp texture and color to identify a species. It is possible that the shady appearance and varying decoration of the fruit's coat might serve as a valuable taxonomic microcharacter for separating closely related species. The examined taxa were all characterized by a hairy pericarp surface.

Key words: *Bellis*, Asteraceae, fruit surface, micromorphology, Libya

Introduction:

There are over 1700 genera and approximately 27,000 acknowledged species in the Asteraceae family (Moreira et al., 2019), which is a big family under the order Asterales (Sennikov et al., 2016). The Asteraceae family is important to the economy because of the usefulness of its members as food, medicine, decoration, and weeds. In the categorization of the Asteraceae, cypselae features

have been widely employed due to their taxonomic interpretation and value in general, with a focus on the Cichoreae tribe in particular (Roque & Funk, 2013). Achenes of *Bellis* taxa have been studied by Faruk (2020), who observed that they are one-seeded, compressed, obovate or obovoid in form, and lack aClamps called cypsellaewere noted among the taxonomic groups.

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Cypselae were arid, indehiscent, unilocular, and contained one seed that was not adnate to the pericarp (connected solely by the funicle), since it developed from an inferior ovary (Marzinek et al., 2008). *Bellis annua* L. cypselae are about 1-1.25 mm long and 0.5 mm broad, while those of *B. sylvestris* Cyr. are around 1.6-2.25 mm long and 1-1.2 mm wide; both species are glabrous, vary in color from light brown to yellow, and lack a pappus (Faruk, 2020). Previous research on Cypselae microsculpture had been seen as more of a taxonomic tool, with implications for both high- and low-level classifications within the family (Bremer, 1994; Anderberg, 1991). were various shades of brown and yellow. The surface hairs of an achene's coat were short and shaped like rectangles. Therefore, there are no major variations in seed shape. At the tribal level, Asteraceae were being classified based on two physical characteristics: the cypselae and the pappus (Talukdar, 2008; Frangiote-Pallone and Antonio de Souza 2014; Talukdar and Mukherjee 2014). The morphological variety of cypselae has been utilized to delimit the Heliantheae and Eupatorieae tribes from the rest of the tribes in the Asteraceae family (Bremer 1994). When it comes to higher and medium level categorization within the Asteraceae family, microsculpture study of Cypselae has been seen as a better taxonomic tool (Anderberg, 1991; Bremer, 1994). The Asteraceae taxa were studied primarily based on their size, beak, pappus branching, and surface structure (Karaismailoglu, 2015). Ghimire, Suh, Lee, Heo, and Jeong (2018) suggest that the micromorphological characteristics of cypselae in the Asteraceae might be useful diagnostic criteria for elucidating various taxonomic relationships within the family. In their creation of floristic reports, various floristic workers have often included brief descriptions of the exterior aspects of cypselae. The diacritical marks on cypselas, according to Basak and Mukherjee (2003), are crucial for separating species from one another. Features of Cypselae may differ across

subspecies and variants of species and between specimens of *Cisium* taxa, as stated by (Ghimire et al., 2020). No statistically significant cypselae morphological changes were observed (Faruk, 2020).

While much is understood about their macroscopic appearance, our understanding of their microscopic structure is still in its infancy. This research aims to: *Bellis* taxa in Libya were studied so that (i) their cypselae morphological traits could be described and (ii) comparisons could be made between species. (ii) To assess the potential use of cypselae for taxonomic purposes. (iii) Figure out how useful this micromorphological information will be as a taxonomic identifier. Microsculpture on the surface of the cypselae of the three or so taxa (*Bellis annua* L., *Bellis nigra* L., and *Bellis nigra*) native to Libya are described here. Both *B. sylvestris* var. *sylvestris* Cyr. and *B. sylvestris* var. *cyrenaica* Béguinot. substances and Techniques The cypselae of three species of *Bellis* were collected from various locations in Libya between January 2017 and December 2019 for this study. Only fully grown cypselae were collected for study. We used a light microscope to look at the dried cypselae and check for their exomorphic properties including shape, size, color, and surface roughness. In order to capture the whole spectrum of diversity within each taxon, anything from 3–5 cypselae were collected. For examination under a scanning electron microscope (SEM), cypselae were adhered to specimen stubs and then placed on the spinning discs of a Joel fine coat ion sputter (Joel, JFC 1100). Gold coatings 20-30 nm thick were applied equally to each cypselae. These fragments were placed in the specimen holder of a scanning electron microscope (Joel JSM 350) operated at an accelerating potential voltage of 15 Kv, and photographs were taken at various magnifications (cypselae in whole mount at X=100-150 and cypselae scan at X=2000-5000). Stearn (1992) and Koul et al. (2000) have been utilized to adapt the terminology for characterizing the surface patterns of cypselae. All images were captured in 2018 in the Central Laboratory of Alexandria University.

Discussion and Results

There were notable differences in the cypselae of the three analyzed species. Each cypselum lacked a pappus, was indehiscent, somewhat compressed on both sides, and had an ellipsoid form ranging from narrow to broad. Every single species was a shade of brown. The length of the cypselum was 1-2 mm, while the breadth was 0.5-1 mm. Each and every cypselum had a hairy exterior. A research using SEM revealed variation in cypselae across all species. The bristle density and surface ornamentation were two major distinguishing features. The examined taxa displayed three distinct surface patterns.

Type I, cypselae with undulating striations: The surface of the cypselae is undulating and striate, with fewer twisted bristles. The periclinal wall was depressed and striate whereas the anticlinal wall was elevated, smooth, and thin. These kinds of patterns may be seen in *Bellis annua* L. (Fig. 1A-D). Type II: Papillose folded cypselae: Cypselae a folded surface, irregular papillae with less density curved bristles on cypselae. Anticlinal wall raised, folded and wide whereas the periclinal wall was deep and folded. *Bellis sylvestris* var. *cyrenaica* have this type of patterns (Fig. 2 A-D). Type III: Irregular reticulate cypselae: Cells elongated, with four to five sides, with

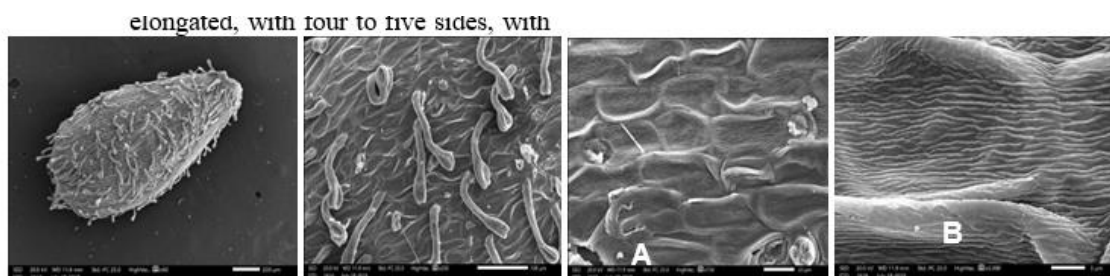


Fig. 1. Scanning electron micrographs: *B. annua*. A. Cypselum, B. bristles, C-D. Surface ornamentation

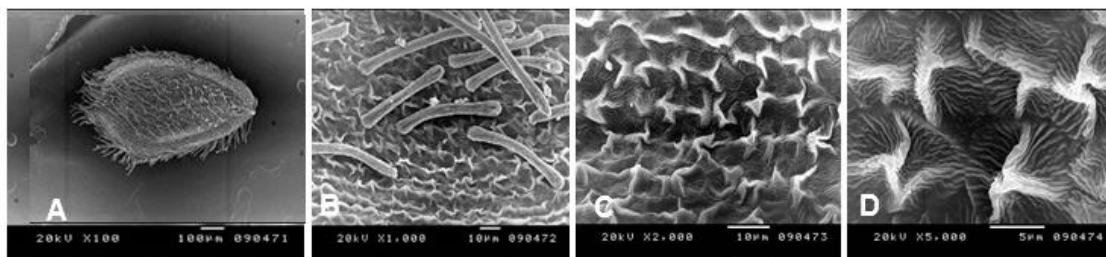


Fig. 2. Scanning electron micrographs: *B. sylvestris* var. *cyrenaica*. A. Cypselum, B. bristles, C-D. Surface ornamentation

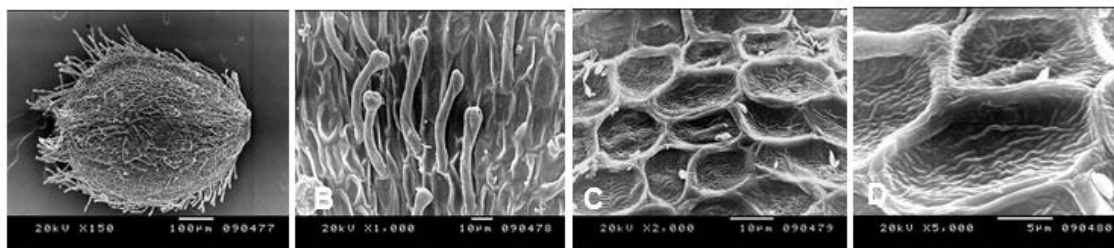


Fig. 3. Scanning electron micrographs: *B. sylvestris* var. *sylvestris*. A. Cypselum, B. bristles, C-D. Surface ornamentation

The taxonomic status of many genera and species of Asteraceae has been clarified in the light of their cypselae morphological features especially when they are studied under SEM (Abid & Ali, 2010).

Achene micro-morphological characters have been found useful in systematics of the family Asteraceae (Abid and Qaiser, 2009; Garg and Sharma, 2007; Akcin and Akcin, 2010, 2014). more density erect bristles on cypselae surface. Anticlinal wall raised, folded and narrow whereas the periclinal wall was depressed folded. *Bellis sylvestris* var. *sylvestris* Cirillo have this type of patterns (Fig.3 A-D). This is the first detailed study on cypselae macro- micromorphology of the genus *Bellis* L. in Libya. Our observations of cypselae under SEM had been found very useful in identifying the examined taxa at species and variety levels. Although Our findings appear inconsistent with that of Faruk, (2020) in the ornamentation and surface patterns of cypselae but they appear consistent with that of (Ghimire et al.(2020) of Conclusion

Studies of cypselae micromorphology under SEM reveal substantial diversity at the species and variety level, making them useful for identifying and delimiting species within the genus *Bellis*.

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