

Trichome Micromorphology of Some *Minuartia* L. Species in Türkiye

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Abstract

In this study, *Minuartia imbricata* (M.Bieb.) Woronow, *M. aizoides* (Boiss.) Bornm., *M. circassica* (Albow) Woronow of the genus *Minuartia* L. belonging to the family *Caryophyllaceae* have been investigated according to their trichome features micromorphology. The trichomes of leaf margins, leaf surfaces, pedicels, and sepals of the three closely related species have been compared and illustrated by using Scanning Electron Microscopy (SEM) and Light Microscopy (LM). *M. imbricata* and *M. aizoides* were observed leaf margins as long pubescent of their leaf margins. However, *M. circassica* was rare puberulous. Although *M. aizoides* and *M. circassica* have glandular hairs on pedicel, *M. imbricata* have not got glandular hairs on pedicel. Also, the taxa have different hair lengths.

INTRODUCTION

Caryophyllaceae Juss. is one of the largest families of Angiosperms with 100 genera and about 3000 species (Thorne and Reveal, 2007). The family is worldwide in distribution with exception of the wet tropics but the family is found usually in the northern hemisphere (Chanra *et al.*, 2019). Marked swollen nodes; simple opposite leaves; dichasial cymes inflorescence or solitary flowers are found in the family. Flower is generally actinomorphic; pentamerous with distinct clawed petals; stamens obdiplostemonous, ten or lesser; ovary superior; placentation free-central; and fruit capsule opening by teeth or valve (Bittrich 1993a, b). *Minuartia*, which is indicated by almost 175 taxa in the northern hemisphere, is one of the richest genera in the family *Caryophyllaceae*. The

number of taxa of the genus in Türkiye has increased in recent years and has reached 78 taxa (Koç *et al.*, 2021). The genus *Minuartia* involving concerning 54 species, usually take place in the Mediterranean basin, and eastward into south-central Asia. The flora of Türkiye contains 42 *Minuartia* species (Dirmenci and Yıldız, 2022).

Trichomes are established on the plant surface that are epidermis cells. They show variability in terms of shape, size and structure (Werker, 2000). The family has not been studied sufficiently about trichomes. Metcalfe & Chalk (1950) researched trichomes diversity of some of the family species. Bittrich (1993b) compiled the family's morphological features and focused on trichome diversity of some taxa.

This study, intends to determine trichomes diversity and distribution in three

Minuartia taxa namely *Minuartia imbricata* (M.Bieb.) Woronow, *Minuartia aizoides* (Boiss.) Bornm. and *Minuartia circassica* (Albow) Woronow.

MATERIAL and METHODS

In present work, trichome micromorphology of 3 species of the genus *Minuartia* from Türkiye was researched. To determine the pubescence patterns on the sepal, pedicel, leaf surface and leaf margins of the taxa SEM and light microscopy techniques were used. The trichome structure of 30 randomly selected individuals from each population was studied. In the Caryophyllaceae family, *Minuartia* species were used in determining trichome micromorphological characters and these species were evaluated for micromorphological analysis. Trichome colors were examined using light microscope. For SEM micrographs, images were obtained from the sepal, pedicel, leaf sheath and leaf surfaces at 3 different magnifications ($\times 200$, $\times 500$, $\times 1.000$) and the micrographs were taken by the JCM-5000 SEM (Metcalf and Chalk, 1972; Ascensao and Pais, 1998; Werker *et al.*, 1985; Giuliani and Bini, 2008; Satıl *et al.*, 2011; Cantino, 1990). The following species were examined; *Minuartia imbricata* (M.Bieb.) Woronow, *Minuartia aizoides* (Boiss.) Bornm., *Minuartia circassica* (Albow) Woronow. The place of origin and herbarium numbers of the researched species are shown in Table 1. The examine taxa are stored at AYBU (Traditional, complementary and integrative medicine Botany Herbarium, in Ankara Yıldırım Beyazıt University).

RESULTS and DISCUSSION

The surface patterns were determined at 3 different magnifications for Scanning electron microscopy analysis. The sepal, pedicel, leaf margin and leaf surface features researched are given. Four types of trichomes were recorded in the studied taxa; glandular trichomes, puberulous, pubescent, glabrous trichomes. The results showed that the sepal length is between 0,01 and 0,26 mm. Pedicel is 0,035–0,8 mm long. Sepal is intensively pubescent, rarely glandular. Leaf margins and leaf surfaces cells have pubescent, glabrous or puberulous. Results of SEM and light microscope analysis of these species are as follows;

Minuartia imbricata (M.Bieb.) Woronow

Leaf margins pubescent, hairs 0,17-0,75 mm long; leaf surfaces glabrous or puberulous. Hairs 0,1-0,25 mm long; pedicels densely pubescent, hairs 0,2-0,8 mm long. Sepals intensively pubescent, hairs 0,17-0,95 mm long (Figure 1-4).

Minuartia aizoides (Boiss.) Bornm.

Leaf margins pubescent, hairs 0,13-0,65 mm long; leaf surfaces glabrous or puberulous, hairs 0,1-0,35 mm long. Pedicels densely pubescent-glandular, hairs 0,1-0,25 mm long. Sepals intensively pubescent-glandular, hairs 0,35-0,53 mm long (Figure 2 and 4).

Minuartia circassica (Albow) Woronow.

Leaf margins sparsely puberulous, hairs 0,04-0,07 mm long; leaf surfaces glabrous. Pedicels densely pubescent-glandular, hairs 0,035-0,3 mm long. Sepals intensively pubescent-glandular, hairs 0,07-0,3 mm long (Figure 3 and 4).

Table 1. List of the examined taxa, herbarium number and place of origin.

Taxa	Herbarium number	Place of origin
<i>M. imbricata</i>	Koç 1607	Ardahan: Above Posof Kol Village, Arsiyan Mountain, 2450 m, 03.07.2014.
<i>M. aizoides</i>	Koç 1564	Muş: Varto, descent from Koğ Hill to Goşkara, 2850 m, 02.07.2014, alpine stony places
<i>M. circassica</i>	Koç 1609	Ardahan: Above Posof Kol Village, Arsiyan Mountain, 2450 m, 03.07.2014.

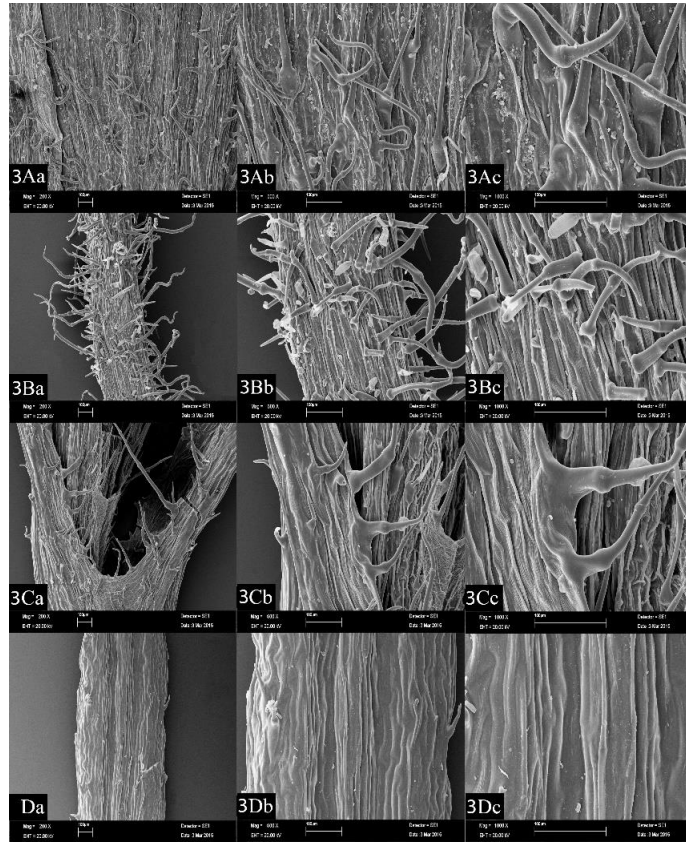


Figure 1. SEM images of *M. imbricata* 3A; Sepal, 3B; Pedicel, 3C; Leaf margins, 3D; Leaf surfaces.

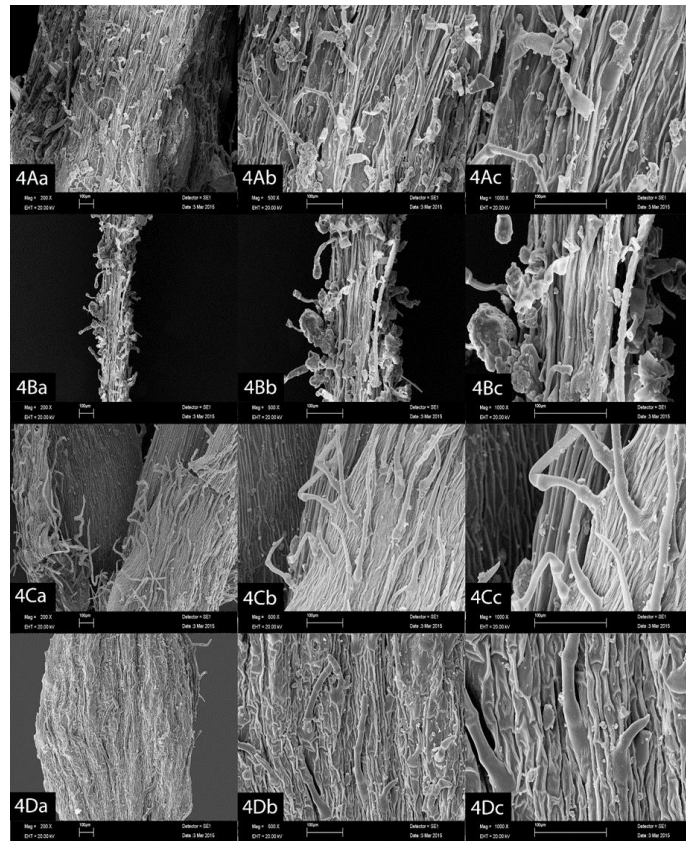


Figure 2. SEM images of *M. aizoides* 4A; Sepal, 4B; Pedicel, 4C; Leaf margins, 4D; Leaf surfaces.

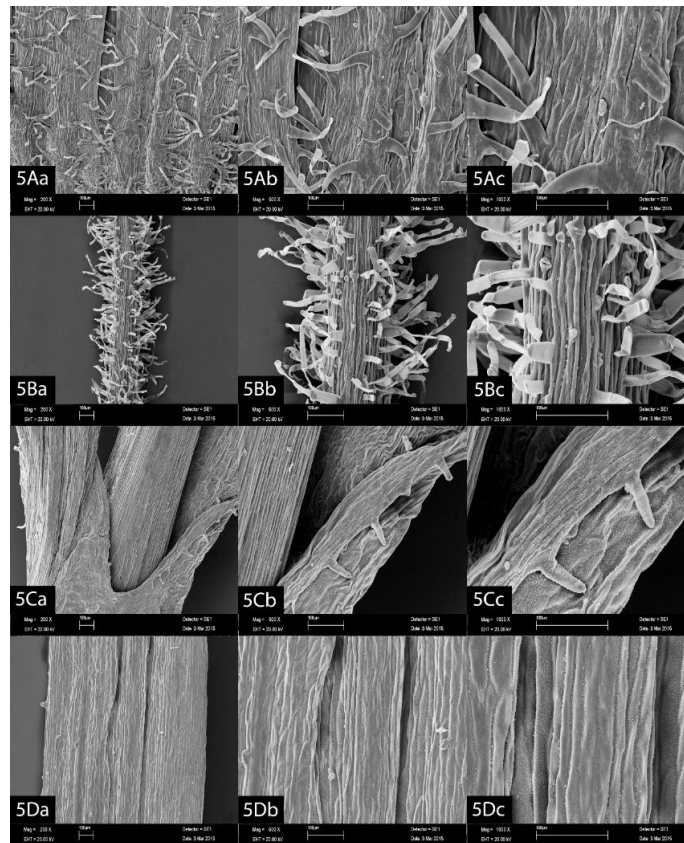


Figure 3. SEM images of *M.circassica* 5A; Sepal, 5B; Pedicel, 5C; Leaf margins, 5D; Leaf surfaces.



Figure 4. LM images of the taxa 3A-D; *M. imbricata*, 4A-D; *M. aizoides*, 5A-D; *M.circassica*. A: leaf margin, B: leaf surfaces, C: pedicel, D: sepal.

M. imbricata and *M. aizoides* were observed to be leaf margins long pubescent, however; *M. circassica* is puberulous sparsely. Although *M. aizoides* and *M. circassica* have glandular hairs on pedicel, *M. imbricata* have not got glandular hairs on pedicel. Also, hair lengths are different from each other. While, *M. imbricata* and *M. aizoides* have leaf surfaces glabrous or puberulous, *M. circassica* have just glabrous.

Whereas sepal characters are intensively pubescent or glandular in all taxa. Leaf anatomy of some genera of Caryophyllaceae has been shown to be important in species-level recognition. The use of anatomical characters is essential because they are reliable and stable within a taxon (Amini *et al.*, 2018).

The micromorphological characters of trichomes benefit significant concerning specific

subfamily, tribes, genera and species relationship (Ullah *et al.*, 2018b). The diversity of trichomes and their dispersion does not play any important role in the taxonomic limitation of both common and tribal levels of the family Caryophyllaceae (Chandra *et al.*, 2019). But, in terms of existence of trichomes or surface patterns can be distinguished in some closely allied species (Chandra *et al.*, 2019). *Minuartia* species have different trichome types which are pubescent, glabrous and glandular hair.

This study demonstrates trichome micromorphology as a distinctive feature in species identification but these features are not enough alone in the definition of a species. The diversity of trichomes and their dispersion does not play any important role in the taxonomic limitation of both common and tribal levels of the family Caryophyllaceae but some of the studied species have peculiar trichome morphology which may be beneficial to distinguish them from other species. Furthermore, trichomes or other micromorphological features can be used to distinguish some closely allied species.

CONCLUSION

This study determines that the trichomes features on sepal, petal, leaf margins, leaf surface. Trichomes features gave similar results for the 3 *Minuartia* species and made a decision that, they have not got enough characteristics to separate common and species level in the family. No significant differences were found between the studied *Minuartia* species in the results.

ADDITIONAL INFORMATION

This research was presented at the 1st International Symposium of Biodiversity Studies and was published in the abstract e-book in the proceedings of the Symposium.

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