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Research Note

The Anatomical and Palynological Properties of *Alyssum obtusifolium* Steven ex DC. (*Brassicaceae*)

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Abstract: *Alyssum obtusifolium* Steven ex DC. was explored in terms of its anatomical and palynological aspects. The root is perennial and it has alternating concentric zones of xylem with large and small vessels respectively. The number of vascular bundles is 13-15 in the stem. The leaves are isolateral and have stomata cells which are anisocytic. Both surfaces of the leaves are covered with stellate hairs. The pollen type of the specimens is tricolpate.

Key Words: *Alyssum*, *Brassicaceae*, anatomy, morphology, pollen

Alyssum obtusifolium Steven ex DC. (*Brassicaceae*)'un Anatomik ve Palinolojik Özellikleri

Özet: *Alyssum obtusifolium* Steven ex DC.'un anatomik ve palinolojik özellikleri belirlenmiştir. Kök çok yıllık olup ksilem büyük ve küçük konsentrik zonlar oluşturmaktadır. Gövdedeki vaskuler demet sayısı 13-15 arasındadır, yapraklar isolateral ve stoma hücreleri anisositikdir. Yaprakların her iki yüzeyi stellat tüylerle örtülüdür. Polen tipi trikolpattır.

Anahtar Sözcükler: *Alyssum*, *Brassicaceae*, anatomi, morfoloji, polen

Introduction

The genus *Alyssum* L. consists of 170 species around the world. Ninety species were represented in Turkey and 49 of these are endemic (Davis, 1985; Dudley, 1964; Ball & Dudley, 1964).

The species examined in this study belong to the section *Odontarrhena* (C.A.Mey.) Hook., which was published as a new record for Turkey (Dudley et al., 1997). The general distribution of *Alyssum obtusifolium* Steven ex DC. is Russia, S.W. Europe, Bulgaria, Greece, Romania and Azerbaijan. The flowering time of the species is May-July and its habitat is dry and calcareous slopes, occasionally in forests. Although direct research is interested in the anatomic structure of the species, it was examined as a family by Metcalfe & Chalk (1950), Esau (1977) and Bhattacharya & Johri (1998).

The pollen morphology of the family *Brassicaceae* has been investigated by several authors (Erdtman, 1952). The pollen morphology of *Cardamine quinquefolia* (M. Bieb.) Schmalh and *Nasturtium officinale* R.Br. was studied by Aytuğ (1971). The pollen morphology of *Isatis* L., which belongs to *Brassicaceae*, was studied by Doğan & İnceoğlu (1990). İnce & Vural (1994) studied the pollen morphology of *Alyssum pateri* Nyar. and *A. praecox* Boiss. & Bal. along with other *Brassicaceae* species. The pollen morphology of *A. blepharocarpum* Dudley & Hub-Mor., *A. murale* Waldst. & Kit., *A. pateri, A. sibiricum* Willd. and *A. umbellatum* Desv. were examined by İnceoğlu & Karamustafa (1977).

Materials and Methods

The examined specimens were collected from the Eskişehir (B3) area. The specimens were kept in 70% alcohol for anatomical studies. Sartur, Sudan III and safranin-fast green dyes were used to distinguish the tissues in microscopic examinations and the sections were mounted with glycerine-gelatine.

The pollens supplied from herbarium specimens were prepared by Wodehouse's method (1965) and acetolysis (Erdtman, 1952). Measurements were obtained and microphotos were taken after allowing one month for the specimens to reach normal dimensions and pollen forms.

The measurements of dimensions of polar axis and equatorial diameter and other measurements (exine, clg, clt) of pollen grains were done by Olympus light microscope with a X100 objective until the Gaussian curve was obtained. The results were obtained with the formulas given below:

$M = m + a\ 1/n.\ \Sigma\ xy,\ \ \sigma = \pm\ a\ \sqrt{1/n}\ \Sigma\ (x^2y - u^2)$

Results

I- Anatomical Properties

Stem (Figure 1)

The stem has a secondary structure which is found in the epidermis with a thick membrane–periderm in thick stems. Stomatas, which are at the same level as the epidermis, occur sparsely. Endodermis was seen below the cortex parenchyma. Sclerenchyma groups were found in the cortex layer between the phloem and the cambium. The xylem was in the shape of a ring parallel to the outside. The primary xylem is distributed towards the pith zone. The number of vascular bundles is 13-15. The pith is composed of parenchyma.

Root (Figure 2)

A secondary structure was seen, far from the periderm, the cortex layer is below it and composed of parenchyma with 8-10 layers containing plate collenchyma sparsely. The xylem was found as concentric rings below the cambium. Cambium periodically produces lignified and unlignified tissues. Sclerenchyma cells were

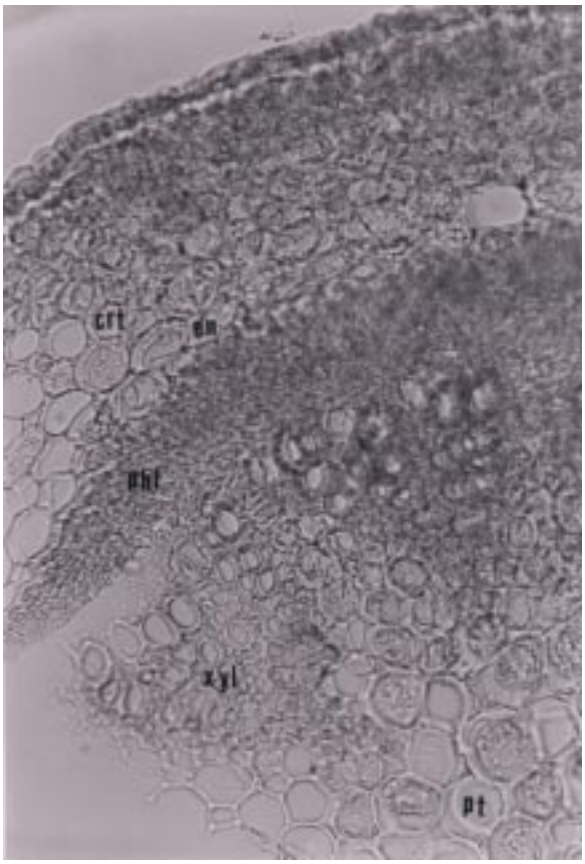

Figure 1. Stem, X 20, en: endodermis, crt: cortex, phl: phloem, xyl: xylem, pt: pith.

Figure 2. Root, X 4; prd: periderm, scl: sclerenchyma, unxyl: unlignified xylem, lg.xyl: lignified xylem, cb: cambium.

seen in the lignified xylem area. There are alternating concentric zones of xylem with large and small vessels respectively. The pith area consists of xylem elements.

Leaf (Figures 3-5)

In transverse section, isolateral (= equifacial) type, stellate hairs are on both surfaces. The epidermis is found with one layer at the outside. Mesophyll is differentiated into 2-3 layer palisade parechyma and spongy parenchyma in the middle area. Stomatas are on both surfaces of the leaf (= amphistomatic type) and raised above the surface. Vascular bundles are collateral type, surrounded by a parenchymatic bundle sheath.

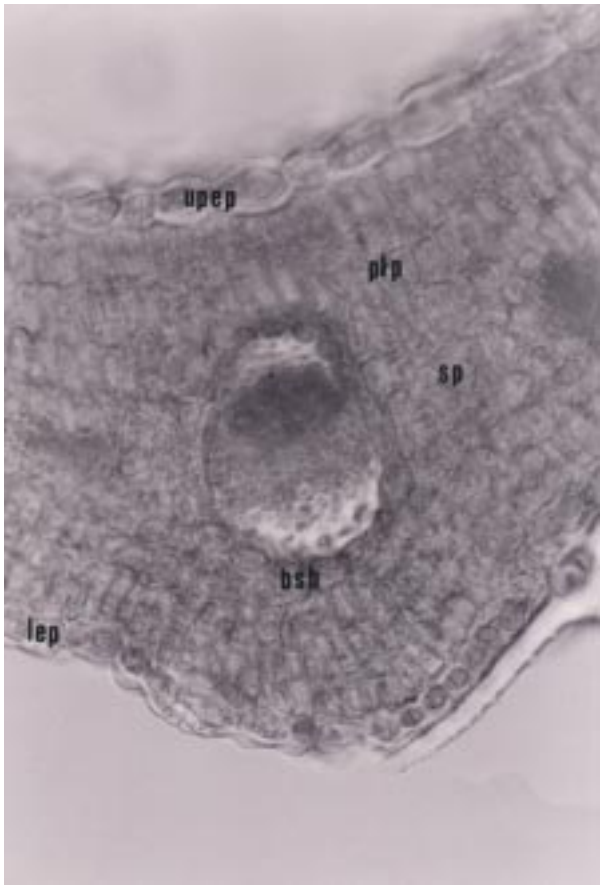

Figure 3. The transversal section of leaf, X 20, up.ed.: upper epidermis, l.ep: lower epidermis, pl.p.: palisade parenchyma, s.p.: spongy parenchyma, bsh: bundle sheath.

In surface sections, stomatas are Cruciferae type and anisocytic type. On lower surfaces at stem leaves, the number of stomatas is higher and the epidermis membrane is more undulating than sterile leaves. On upper surfaces at stem leaves, the number of stomatas is almost the same and the epidermis membrane is less undulating than sterile leaves.

II- Palynological Properties (Figure 6)

Alyssum obtusifolium Steven ex DC.

Sample origin: Türkmen Dağı, Eskişehir

Date: 25.05.1990

Pollen type: Tricolpate

Pollen shape: Prolate, P/E: 1.13 µm (W), 1.47 µm (E)

Exine: Average thickness: 1.09 µm (W), 1.06 µm (E)

Apertures: Colpi thin and long, edges indefinite. µm clg/clt: 11.95 µm (W), 10.67 µm (E)

Structure: Intectate, ect / end ≅ 3/1

Sculpture: Simple bacule which was seen as reticule

Intine: Very thin

	Fresh pollen		Fossilized Pollen	
	M	σ	M	σ
P:	15.40 µm	± 1.28 µm	14.58 µm	± 1.34 µm
E:	13.52 µm	± 0.82 µm	9.87 µm	± 0.76 µm
clg:	14.02 µm	± 1.22 µm	12.24 µm	± 1.38 µm
clt:	1.17 µm	± 0.80 µm	1.14 µm	± 0.41 µm
Ex:	1.09 µm	---------	1.06 µm	-------
t:	----	---------	----	--------

Discussion

In this study, *Alyssum obtusifolium* was studied anatomically and palynologically.

The species was perennial and cambium was seen on the stem and root sections. On the anatomical structure of the root, concentric rings in the cambium are characteristic. This was found by some researchers (Metcalfe & Chalk, 1950; Toma, 1987). Metcalfe & Chalk (1950) mentioned that *A. spinosum* L. has concentric rings at the stem; Toma (1987) reported that *A. borzaeanum* Nyar. does not have these structure. In addition, in the stem structure of the examined specimen, this structure was not seen.

According to the table, while the number of stomatas on the lower surface of sterile leaves is lower than that on the upper surface in Toma's study (1977), it is the same in the present study. The epidermis membrane of the lower surface of the stem leaf is the same as that of

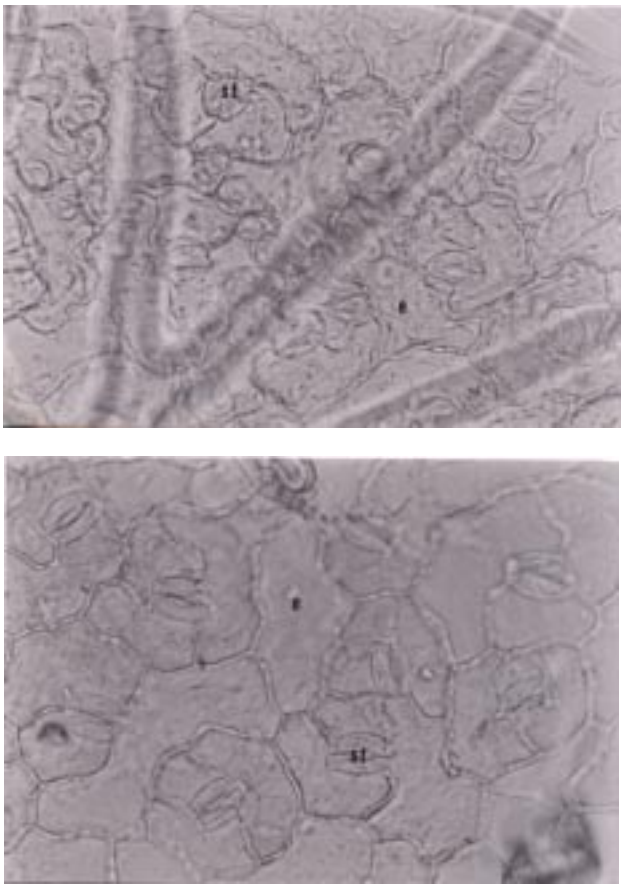

Figure 4. The lower of the leaves. X 40. I- stem leaf. II- sterile leaf. e: epidermis. st: stomata.

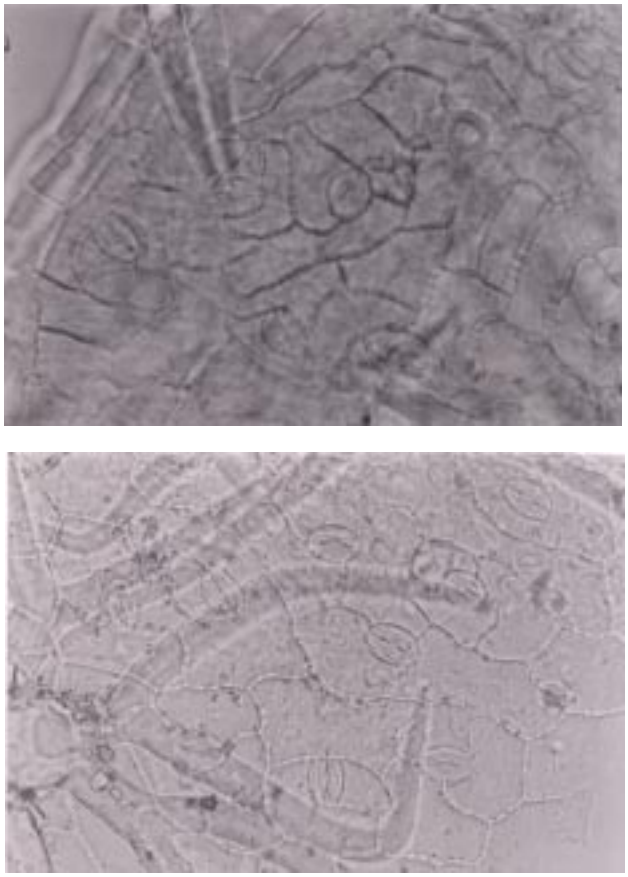

Figure 5. The upper surfaces of the leaves. X 40. I- stem leaf. II- sterile leaf.

Table 1. A comparative representation of the structure of leaf surface in this study with those in Toma's study.

	Sterile leaf		Stem leaf	
	The stomata number	Epidermis membrane	The stomata number	Epidermis membrane
Toma (1987)	On lower surface, the stomata number is lower and the epidermis membrane is more undulating		On lower surface, the stomata number and the epidermis membrane is the same	
This study	On lower surface, the stomata number is the same and the epidermis membrane is more undulating		On lower surface, the stomata number is almost the same and epidermis membrane is more undulating	

the upper surface in Toma's study; it is more undulating in this study.

Brassicaceae is a stenopalynous family (Erdtman, 1952). From the palynological measurements and examinations the properties of the pollen morphology were determined. Our results were compared with those from related species of the same genus studied by İnceoğlu & Karamustafa (1977), and Vural & İnce (1994). Some differences were found among the results in terms of measurements of the dimensions of the pollens. In particular our values of P and E were lower than those given by İnceoğlu & Karamustafa (1977). However, these measurements are not used as diagnostic properties.

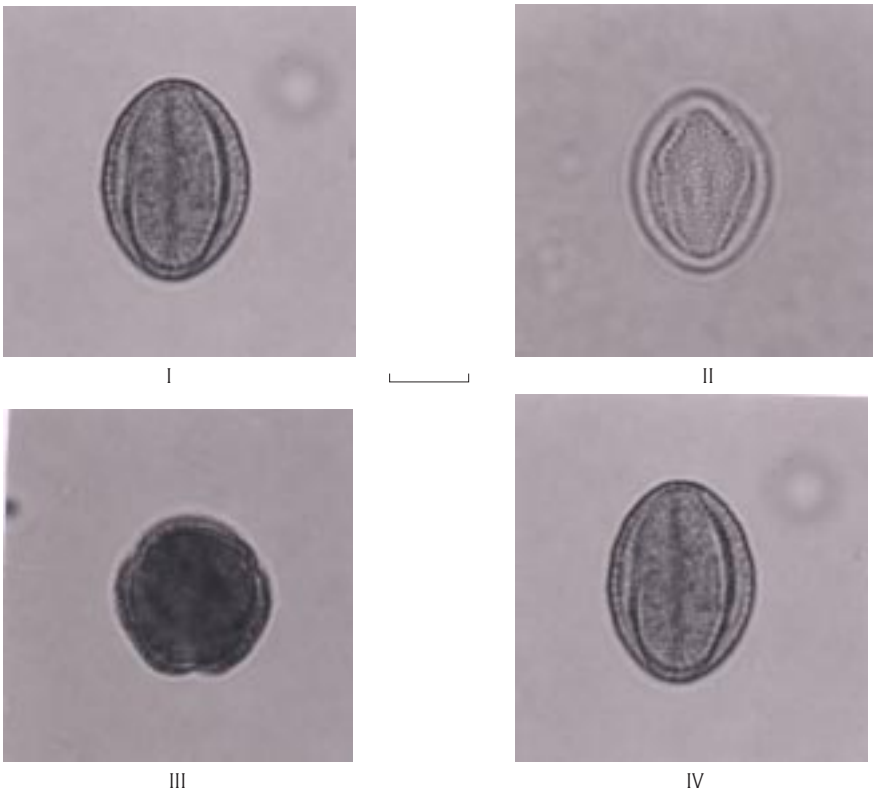

Figure 6. I-II- Fossilized pollen, III-IV- fresh pollen (Scale = 10 µm).

As seen in Table 2, the pollen shape of *Alyssum blepharocarpum* is subprolate (W), prolate (E), that of *A. murale* is prolate-spheroidal (W) prolate (E), that of *A. pateri* is subprolate, that of *A. sibiricum* is subprolate (W), prolate (E) and that of *A. umbellatum* is prolate. İnceoğlu & Karamustafa (1977) and Vural & İnce (1994) mentioned that *A. pateri* pollens are subprolate and those of *A. praecox* are prolate. It was determined that *A. obtusifolium* pollens are subprolate (W), prolate (E).

Table 2. A comparative representation of the results of the present study with those from related studies.

	İnceoğlu & Karamustafa (1977)					Vural & İnce (1994)		present study
species	*Alyssum blephocarpum*	*Alyssum murale*	*Alyssum pateri*	*Alyssum sibiricum*	*Alyssum umbellatum*	*Alyssum pateri*	*Alyssum praecox*	*Alyssum obtusifolium*
type	tricolpate	tricolpate	tricolpate	tricolpate	tricolpate	tricolpate	tricolpate	tricolpate
shape	subprolate W prolate E	Prolate-spheroidal W, prolate E	subprolate	subprolate W prolate E	prolate	subprolate	prolate	subprolate W prolate E
P	19.1 W 20.4 E	18.9 W 17.8 E	20.2 W 19.5 E	20 W 22 E	37.1 W 38.6 E	18.48	24.8	15.4 W 14.5 E
E	16.3 W 14.2 E	16.7 W 13.2 E	15.6 W 14.7 E	15.5 W 14.6 E	26.2 W 28.2 E	14.37	18.33	13.5 W 9.8 E
Exine	1.2 W 1.1 E	1.2 W 1.3 E	1.1 W 1.2 E	1.1 W 1.3 E	1.7 W 1.9 E	0.92	1.02	1.09 W 1.06 E
Intine	0.8	0.6	0.6	0.6	0.7	0.43	0.94	--------

Abbreviations: P: polar axis, E: equatorial axis, P/E: polar to equatorial diameter ratio, W: Wodehouse method, m: average, s: standard deviation, c: colpus (colpi), p: porus (pori), clt: colpus wideness, clg: colpus length, t: the border of the polar triangle, Ex: exine, Int: intine.

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