



The rediscovery of *Silene surculosa* Hub.-Mor. endemic for Turkey

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Abstract

Silene surculosa Hub.-Mor. (Caryophyllaceae) was first collected in 1951 by Huber-Morath from Pülümür-Mutu (Tunceli). After that it was lastly collected from Pülümür by Davis and Hedge. Based on these two samples, it was introduced to the scientific world by Huber-Morath in 1967. It is an endemic species that is known from just two localities close together. Despite the investigations till today, there was found no trace of this species in the nature, and thus it has been evaluated as Extinct (EX) according to the World Conservation Union Red List Categories. By this study, firstly, the species was recollected in nature. Secondly, its description was rewritten comprehensively. Thirdly, its pollens and seeds were examined under the SEM (Scanning Electron Microscope) and LM (Light Microscope). Lastly, the new IUCN category for the species was suggested.

Key words: Tunceli, Caryophyllaceae, *Silene surculosa*, Turkey

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Türkiye için endemik olan *Silene surculosa* Hub.-Mor. türünün yeniden keşfi

Özet

Silene surculosa Hub.-Mor. (Caryophyllaceae) ilk olarak 1951 yılında Huber-Morath tarafından Pülümür- Mutu (Tunceli) arasından toplanmıştır. Son olarak Davis ve Hedge tarafından Pülümür'den toplanmıştır. Bu iki örneğe dayanılarak 1967 yılında Huber-Morath tarafından bilim dünyasına tanıtılmıştır. Sadece birbirine yakın iki lokaliteden bilinen endemik bir türdür. Günümüze değin yapılan araştırmalarda izine rastlanamayan bu türün IUCN kriterlerine göre doğada yok olduğu kabul edilmiştir. Bu çalışmayla, tür doğada yeniden toplanmış, deskripsiyonu yeniden yazılmış, polen ve tohumları SEM (Taramalı Elektron Mikroskobu) ve LM (Işık Mikroskobu)'de incelenmiş, ayrıca tür için yeni IUCN kategorisi önerilmiştir.

Anahtar kelimeler: Tunceli, Caryophyllaceae, *Silene surculosa*, Türkiye

1. Introduction

The Caryophyllaceae family has about 2,200 species of 86 genera all of the World (Bittrich, 1993) and it is represented by 494 species belong to 32 genera in Turkey (Özçelik and Muca, 2010). *Silene* L., the biggest genus of Caryophyllaceae, consists of 167 taxa in 31 sections and 72 of them are endemic to Turkey (Güner et al., 2012).

Silene surculosa Hub.-Mor. was firstly collected in 1951 from Pülümür by Huber-Morath. It is endemic and only known from two localities in the Flora of Turkey (Coode and Cullen, 1967). During my field works, we have ascertained six different populations along a line parallel to the Munzur Mountains.

This taxon was not found in studies carried on Tunceli and the other parts of Turkey until today (Yıldırım, 1995; Akgöz, 2013). Thus, this taxon was evaluated in category of EX that means no longer known to exist in the nature according to IUCN criteria (Ekim et al., 2000).

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2. Materials and methods

All the samples belonging to *Silene surculosa*, were collected from Tunceli province during several excursions between 2014 and 2015. The specimen was determined using Flora of Turkey (Coode and Cullen, 1967) as a reference. Identification of the specimens was also confirmed by type photos in the herbaria of Geneva (G) and Kew (K). Descriptions of the species were re-written, based on its descriptions in Flora of Turkey (Coode and Cullen, 1967). Data about their ecology and newly proposed IUCN category are given (IUCN, 2014). All the specimens are kept in the herbarium of Adnan Menderes University (AYDN).

2.1. Light microscopy (LM)

By implementing Wodehouse (1935) method, pollen samples were taken from plants and then, slides were prepared by using basic fuchsin mixture. At least 30 pollen samples for the species were examined in LM and micrographs of these samples taken by Leica DM 750 digital imaging system. Different morphological characters of pollen parts, such as pollen diameter, pore diameter, distance between two pores and exine thickness, were measured by means of light microscopy. Seeds were examined in stereomicroscope and micrographs were taken with Olympus SZ2-LGB digital imaging system. After the examination of each species, measurements were done for seed shape, color and size. The seed terminology of Stearn (1992), Bojnanský and Fargašová (2007), Punt et al. (2007), Amini et al. (2011), and Mitra Arman (2013) was used.

2.2. Scanning Electron Microscopy (SEM)

For SEM, pollen grains and seeds were directly mounted on stubs and covered with gold and surface ornamentations of pollen grains were examined in detail with Jeol Tescan MAIA3 XMU model electron microscope in Bartın University Central Research Laboratory. Shape classification follows Erdtman (1969), based on P/E ratio in Table 1.

3. Results

Silene surculosa was re-discovered in the present study. In this paper, description of the species was re-identified after many samples from different populations were examined. Differences between female and hermaphrodite flowers were not mentioned in the Flora of Turkey (Coode and Cullen, 1967). It was found that anthophore is hairy. In addition, stem length, leaf lengths, flower lengths, etc. of the plant have been determined again with this study.

***Silene surculosa* Hub.-Mor. in Notes R.B.G. Edinb. 28: 2 (1967) (Figure 1-3).**

Perennial, gynodioecious plants. Stems decumbent to ascending, up to 30 cm, some parts retrorse-puberulent, the stock bearing numerous sterile rosettes. Leaves all petiolate, fleshy, mucronate, spatulate, papillose-ciliate along the margins, the cauline leaves with sterile shoots in their axils (7-12 mm); basal leaves smaller than stem leaves (5-7 mm). Inflorescence a few-flowered panicle (3-15-flowered), sometimes shortly glandular-puberulent. Calyx 7-8 mm in functionally female flowers, 10-11 mm in hermaphrodite flowers, violet, densely glandular-pubescent. Petals white, the claw ciliate, c. 8 mm in functionally female flowers, c. 12 mm in hermaphrodite flowers. Anthophore hairy, 1.5-2.0 mm in functionally female flowers, 4.0-4.5 mm in hermaphrodite flowers. Capsule ovoid, 5 mm, included in the calyx.

Type: Turkey. B7Tunceli: Pülümür-Mutu, Serpentschutt 8 km ob Mutu, 1760 m, 26 vi 1951, *Huber-Morath* 11170 (holo. G-00000093!).

Paratype: Turkey. B7Tunceli: above Pülümür, 1850 m, stony igneous mountainside, 08.06.1957, *Davis & Hedge* 29289 (K-000728686!).

Examined specimens: *Silene surculosa* Hub.-Mor.: B7Tunceli: Pülümür, 11 km to northwest of Ardıçlı (Gersunut) village, Munzur mountains (near to border of Erzincan province), 2380 m, 18.06.2014, *Armağan* 4900; B7Tunceli: Ovacık, 6. km from Işıkvuran to Eskigedik village, 2250 m, 19.06.2014, *Armağan* 4917; B7Tunceli: Ovacık, 5. km from Ovacık-Tunceli road to Yakatarla village, 1620 m, 04.06.2014, *Armağan* 4222; B7Tunceli: Pülümür, 2.5 km from Kocatepe to Sarıgül village, 1970 m, 05.06.2014, *Armağan* 4345; B7Tunceli: Ovacık, 17 km from Ovacık to Hozat district, the east of Halıtpınar village, 1895 m, 17.06.2014, *Armağan* 4719; B7Tunceli: Pülümür, 7 km from Pülümür to Tunceli, 1841 m, steppe, 29.05.2015, *Armağan* 6496.

Flowering and fruiting time: June

Distributions and Habits: *Silene surculosa* is an endemic species growing on serpentine rocks and alpine meadows at 1620-2380 m a.s.l. in Tunceli (Figure 4).

Conservation Status: *Silene surculosa* only occurs in Tunceli province (Turkey) where covers an area of about 1400 km². There is a distance about 65 km between two farthest localities of *S. surculosa*. The estimating distance between each small population is 10 km. We suggest that the *S. surculosa* should be placed under Endangered

[B1, B2 (a, b (iii))] category according to IUCN. The reason behind this suggestion is that Area of Occupancy (AOO) is less than 20 km² and the population is fragmented severally. (IUCN, 2014).

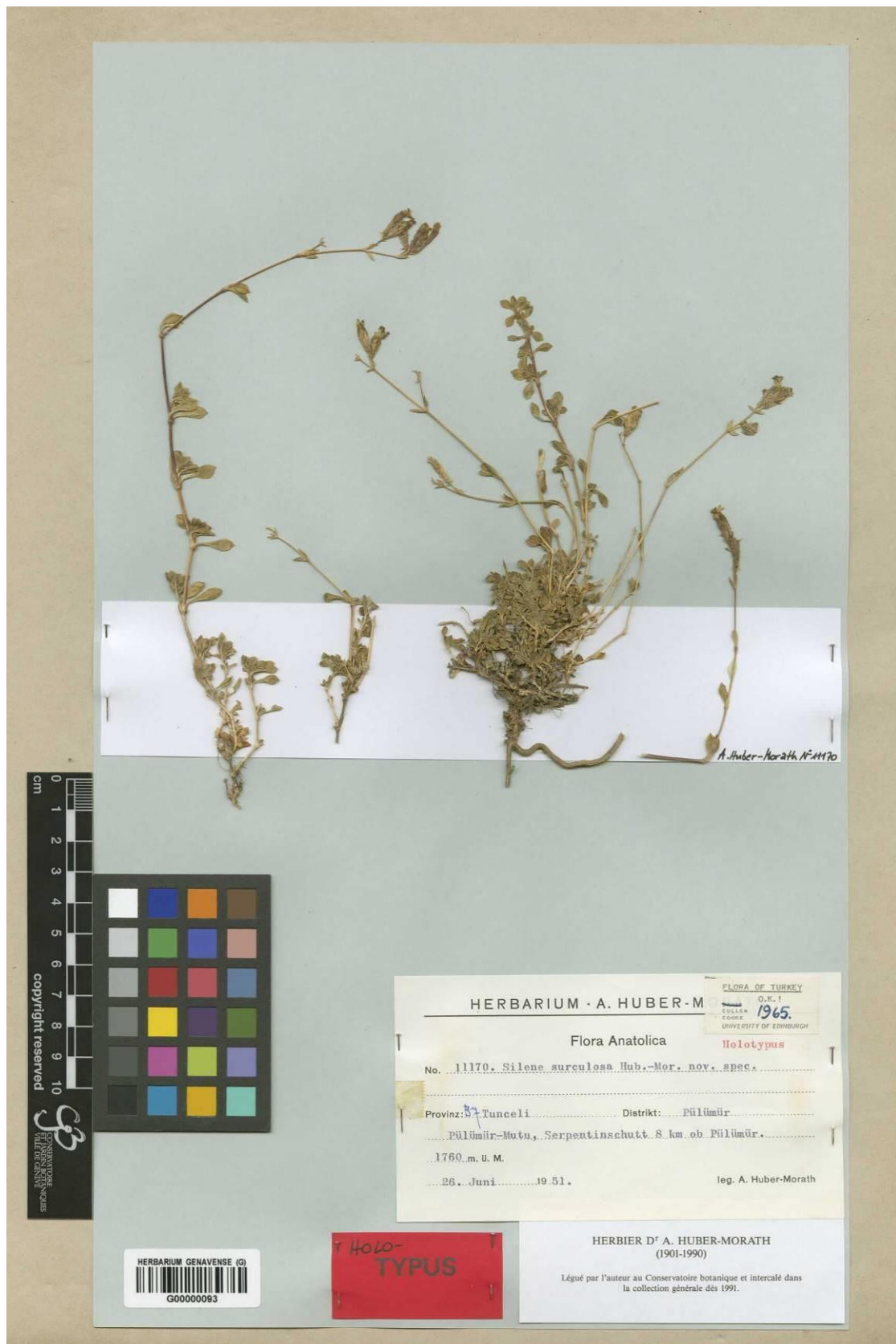


Figure 1. The holotype of *Silene surculosa* (G-0000093!)



Figure 2. The photo of *Silene surculosa* in nature

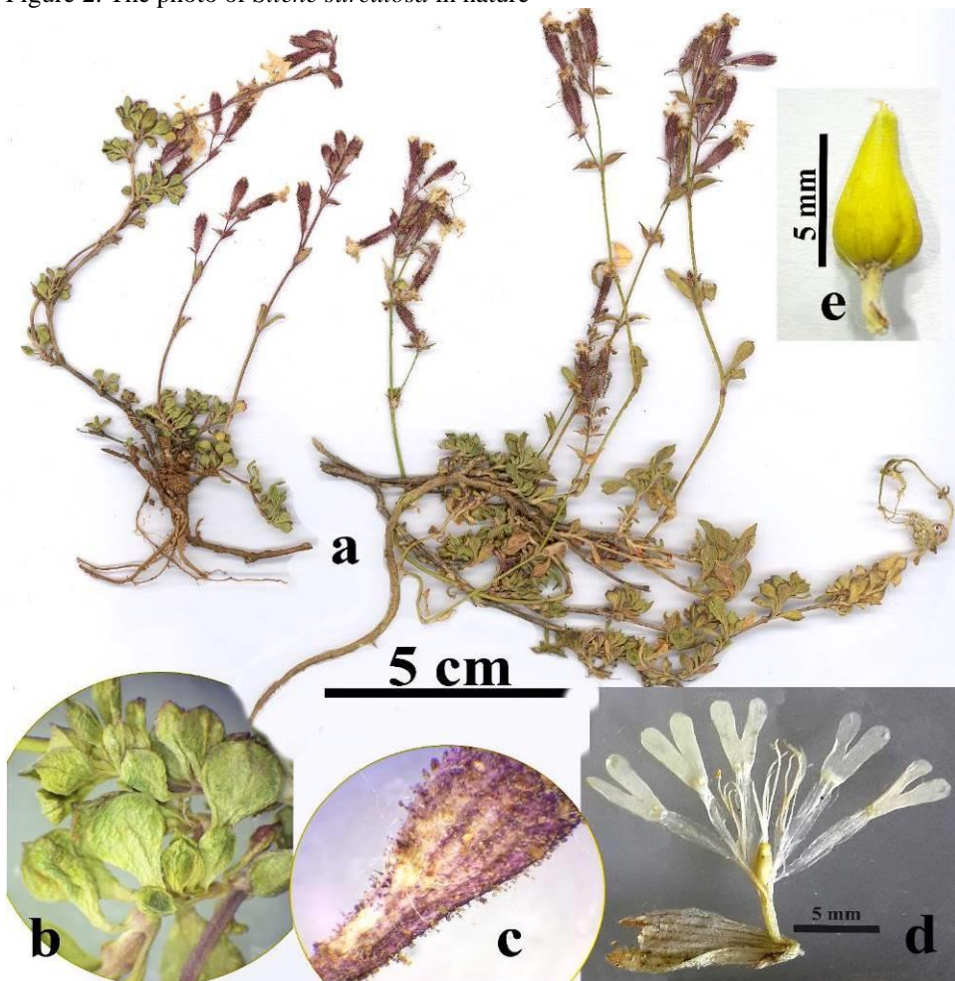


Figure 3. *Silene surculosa* (Armağan 4345): **a**) Habit, **b**) Basal leaves, **c**) Calyx, **d**) Hermaphrodite flower, **e**) Capsule

3.1. Pollen morphology

Pollen grains are radially symmetrical and isopolar. Polar axes is 30.57(23.70-41.09) μm , equatorial axes is 29.91 (22.75-40.68) μm . Pollen shape is P/E:1.02, subprolate. The pollen grains are operculate and pantoporate, generally 11-28 porate. Pores polar length of 4.58 (3.15-7.55) μm , equatorial width 4.15 (2.03-8.58) μm (plg/plt):1.1, prolate-spheroidal. There are 10-15 conical spinules on operculum. Distance between two pori is 4.88 (2.56-7.78) μm . The exine is tectate and 1.86 (1.09-2.63) μm in thickness. Intine thickness is 0.54 (0.43-0.6) μm . Pollen ornamentation was scabrate-punctate. There were 45-70 spinules in 100 μm^2 area. Supratectal spinules are 0.36 (μm) (see table 1, figure 5-6).

Table 1. Pollen morphology of species *Silene surculosa*

Polar axes (μm)	Mean	30.57 (23.70-41.09)
	Median	29.3
	Variation	19.84
	Standard error	0.99
	Standard deviation	4.45
Equatorial axes (μm)	Mean	29.91 (22.75-40.68)
	Median	28.63
	Variation	21.839
	Standard error	1.04
	Standard deviation	4.67
Exine thickness (μm)	Mean	1.86 (1.09-2.63)
	Median	1.81
	Variation	0.14
	Standard error	0.08
	Standard deviation	0.37
Intine thickness (μm)	Mean	0.54 (0.43-0.6)
	Median	0.55
	Variation	0.003
	Standard error	0.011
	Standard deviation	0.53
Pore length (μm)	Mean	4.58 (3.15-7.55)
	Median	4.04
	Variation	1.65
	Standard error	0.2873
	Standard deviation	1.28
Pore width (μm)	Mean	4.15 (2.03-8.58)
	Median	3.7
	Variation	2.682
	Standard error	0.3662
	Standard deviation	1.637
Pore distance (μm)	Mean	4.88 (2.56-7.78)
	Median	4.9095
	Variation	1.568
	Standard error	0.28
	Standard deviation	1.125
Pore number		20 (11-28)
Spinules on operculum		10-15
Spinules (100 μm^2)		45-70
Plg/plt		1.1
Operculum shape		Prolate-spheroidal
Pollen shape		Subprolate
Pollen dimension(P/E)		1.02
Pollen class		Pantoporate
Pollen aperture type		Tectate
Supratectal spinules(μm)		0.36
Pollen ornamentation		Scabrate-punctate



Figure 4. The distribution map of *Silene surculosa*

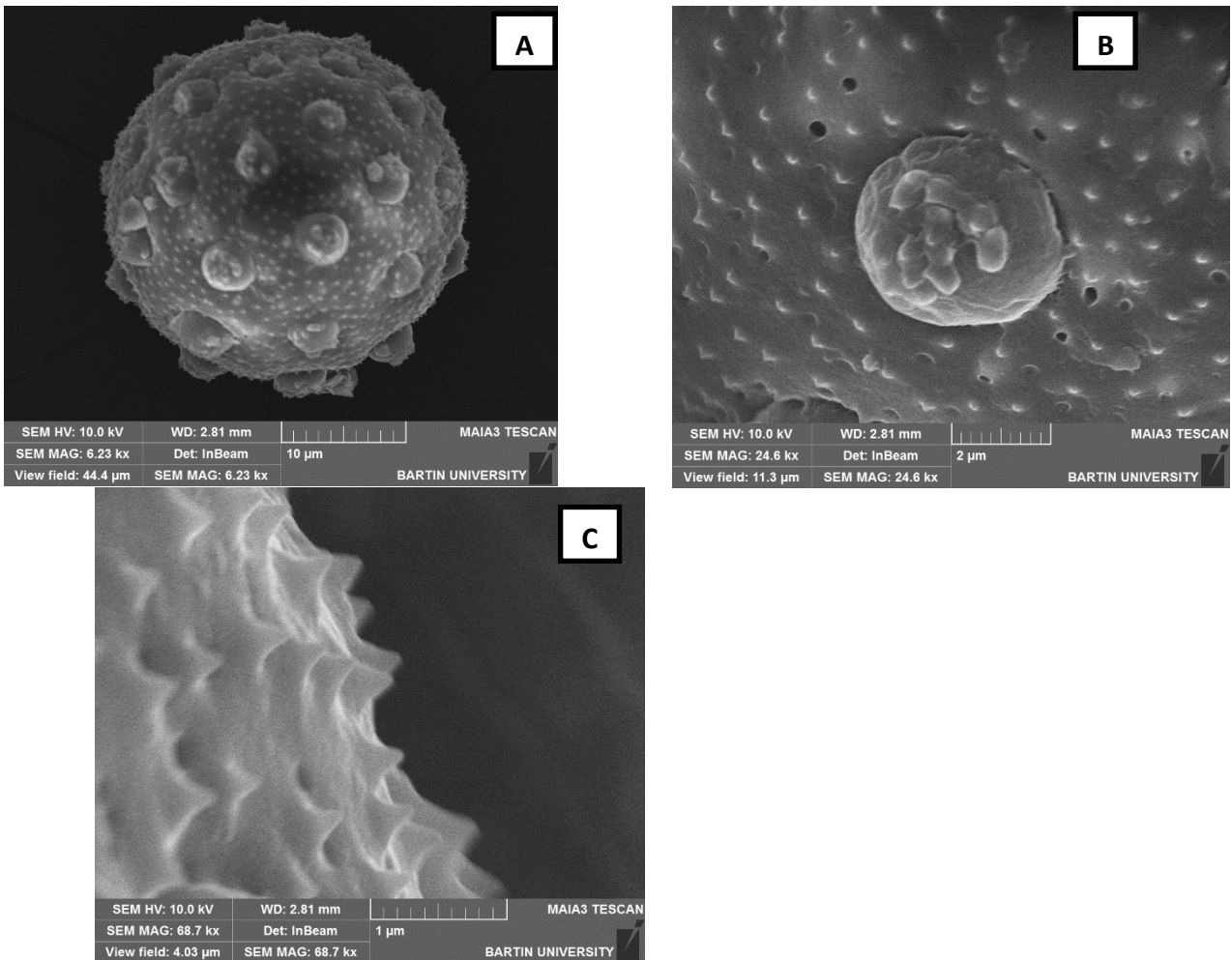


Figure 5. SEM of pollen morphology of *Silene surculosa*: A) General appearance, B) Pore, C) Ornamentation

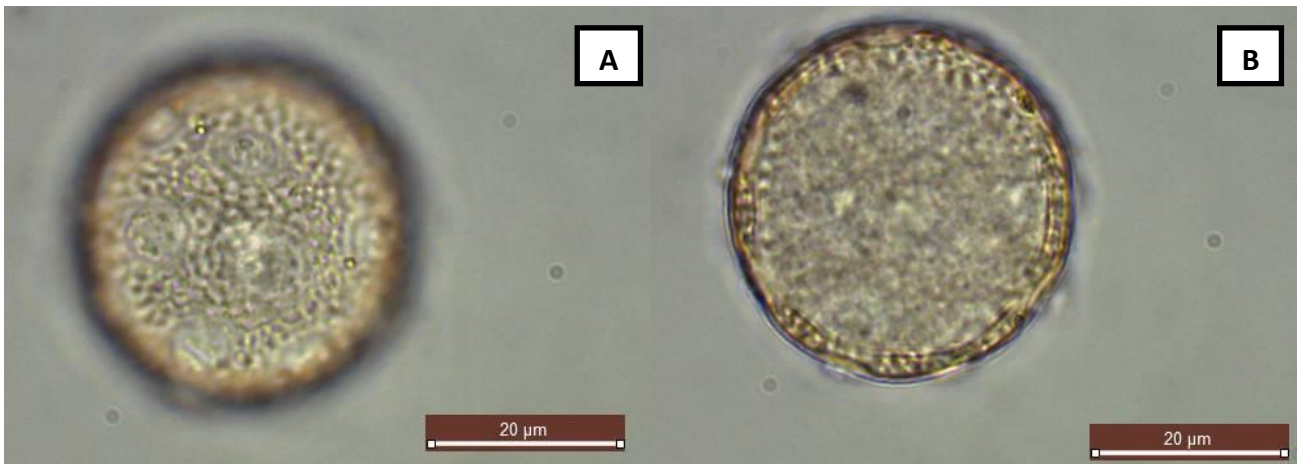


Figure 6. Light microscope micrographs of pollen grains of *Silene surculosa*: **A)** Polar view, **B)** Equatorial view

3.2. Seed morphology

The seed type of *Silene surculosa* is reniform-orbicular, seed length 1.227 (1.123-1.372) mm, seed width is 0.82 (0.6-1.035) mm. Seed color varies from brown or light brown. Seed surface type is slightly convex to straight and seed back is concave. Tubercles are mostly elongated. Seed surface granulation is medium, hylar zone type recessed, suture outline serrate (see table 2, figure 7-8).

Table 2. Seed morphology of species *Silene surculosa*

Seed type	Reniform-orbicular
Seed color	Brownish
Seed surface type	Slightly convex to straight
Seed back	Concave
Surface granulation	Medium
Shape of testa cell	Elongate
Hylar zone type	Recessed
Margin of testa cell	Serrate
Seed length (mm)	1.227 (1.123-1.372)
Seed width (mm)	0.82 (0.6-1.035)
Seed length/width ratio (mm)	1.49
Testa cell length (µm)	78-150
Testa cell width (µm)	34-55
Number of suture point per plate	20-38
Ridge	Conspicuous ridge

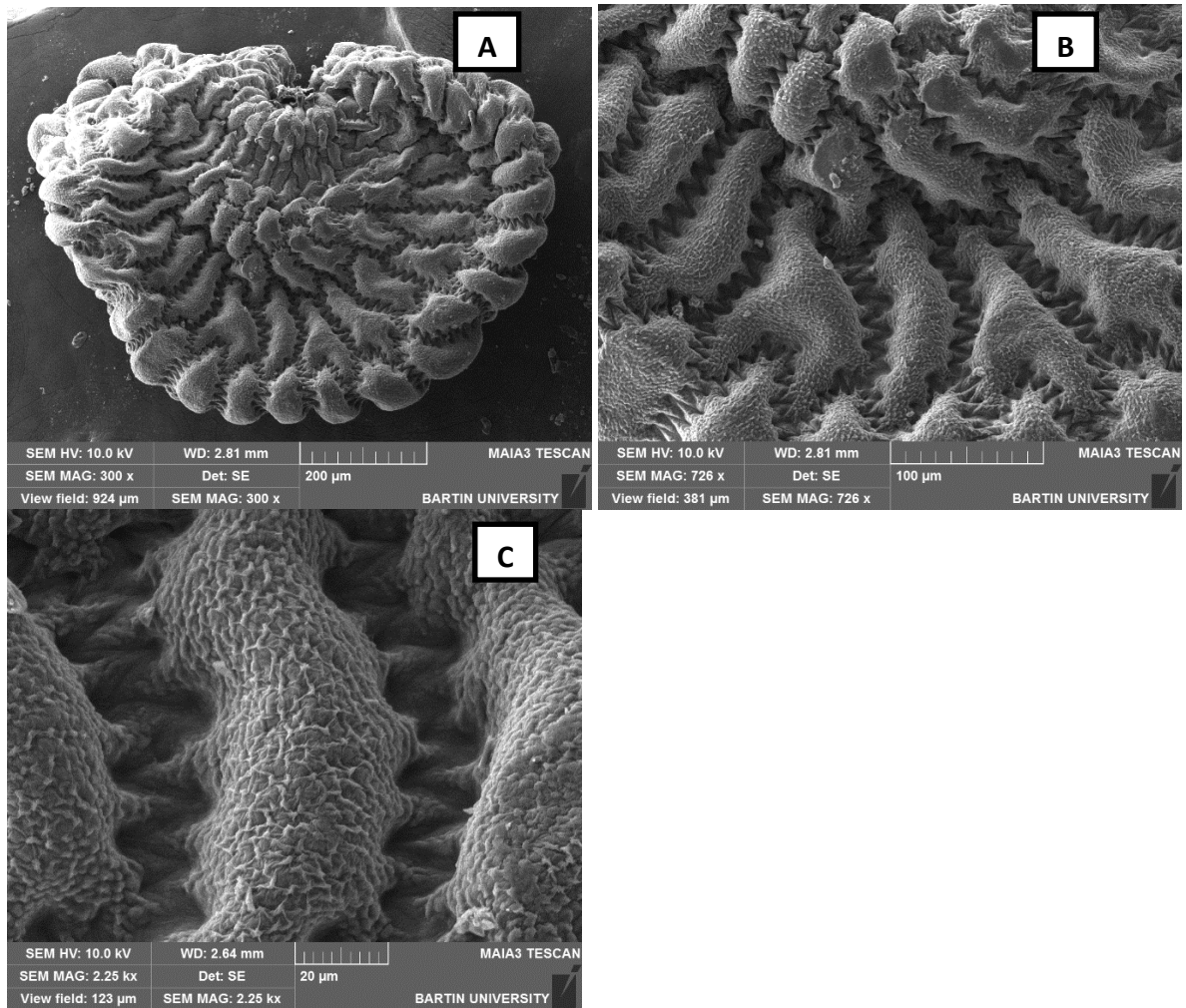


Figure 7. SEM of seed morphology of *Silene surculosa*: A) General appearance, B) Testa cells, C) Surface granulation and suture outline.

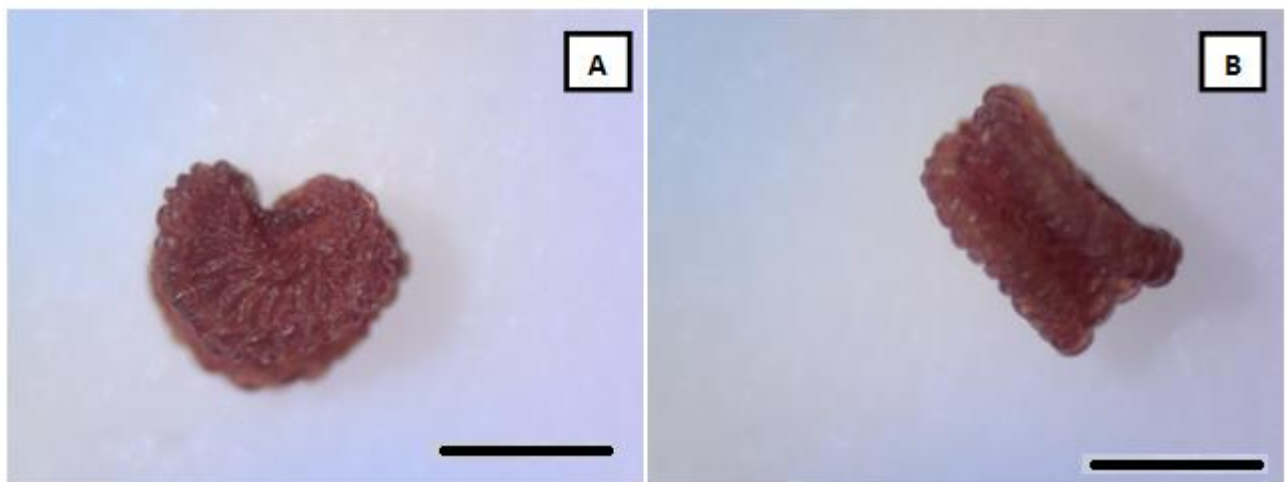


Figure 8. Stereo microscope micrographs of seed of *Silene surculosa*: A) Seed surface, B) Seed back, Scala bar=1 mm

4. Conclusions and discussion

Sect. *Spergulifoliae* Boiss. includes some perennials and usually gynodioecious taxon. Functionally female flowers' characteristics have shorter than hermaphrodite flowers of the same species. If collectors did not note the different sex forms in an area, as without enough material, the taxon of this section can easily be confused with each

other. Only carefully field studies can solve these taxonomic problems adequately. Because of this we prepared comprehensive description of *Silene surculosa* Hub.-Mor. by field observations and adequate samples.

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