

Silene pendula (CARYOPHYLLACEAE),
A NEW ALIEN SPECIES FOR THE FLORA OF BULGARIA

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Abstract

Silene pendula has been found on lawns near a gas station in the vicinity of Gelemenovo village, Pazardzhik Municipality. It is the first finding of spontaneous growth of this species in Bulgaria that allows accepting *S. pendula* as a new alien species for the flora of the country. Though the true origin of *S. pendula* in the discovered location is unknown, two hypotheses are considered. Also, a short description of the location, morphological characteristics of the species, as well as its differences from close species are given in this article.

Key words: *Silene pendula*, alien species, flora, Bulgaria

Introduction. There are no continents and countries, except Antarctica, where nowadays plant invasions are unknown. Certainly, this phenomenon is interesting from a biological point of view, but due to its multifactor impact it is a serious challenge for natural ecosystems, the global economy and the health of the human population nowadays [1]. Though Bulgaria has no tradition in the study of alien species, unlike many other countries in Europe, 60 invasive and potentially invasive species of vascular plants have already been reported [2]. Moreover, new alien species for Bulgaria, as well as new locations of already known alien species, have been recently reported within the country [3,4 and others], which indicates an increase in interest among researchers to this problem. However, the total number of alien plants in the flora of the country remains undefined.

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The main aim of this paper is to describe the first discovery of spontaneous growth of *Silene pendula* L. (Caryophyllaceae) near Gelemenovo village, Pazardzhik Municipality that allows accepting it as a new alien species for the Bulgarian flora. Also, it is going to discuss the true origin of *S. pendula* in the discovered location, its range, as well as its morphological characteristics with focus on differences from similar species.

Material and methods. For the first time, *Silene pendula* was noted by us on lawns (42.264388°, 24.307952°) near a gas station not far away from Gelemenovo village (Pazardzhik Municipality, Bulgaria) on May 11, 2021. However, the plants that were found were identified after a short discussion as *Silene conica* L., which, as time has shown, was incorrect. Nevertheless, we took a picture of the plant, which has been posted on *iNaturalist*¹ later. After two days, this observation was re-identified as *Silene pendula* by MARTYNYUK [5] who defended her PhD thesis about the *Sileneae* DC. tribes in the flora of Ukraine.

The mentioned place was visited on May 29, 2021 for the second time with the aim to identify the total area occupied by *S. pendula* as well as for detailed description of its habitat. Unfortunately, there were no plants of this species or anything left of them at the same place, because of unfavourable conditions. However, in the continued fieldwork, close to the original location (42.263861°, 24.305111°; 239 m a.s.l.) several specimens of *S. pendula* were found (Fig. 1a). A few individuals of the species were collected and inserted into the Herbarium of the Institute of Biodiversity and Ecosystem Research of the Bulgarian Academy of Science (SOM, #177654) (Fig. 1b). Also, it was established, that according to EUNIS system [6], this biotope belongs to the category I2.11 “Park flower beds, arbours and shrubbery”. There were *Poa pratensis* L., *Lolium perenne* L., *Dactylis glomerata* L., *Phleum pratense* L., *Arrhenatherum elatius* (L.) J. Presl & C. Presl, *Trifolium pratense* L., *T. repens* L., *Lotus corniculatus* L., *Malva sylvestris* L., etc.

Results and discussion. *S. pendula* has never been noted for the natural flora of Bulgaria before, excepting the database of the Royal Botanic Gardens of Kew, containing information on “Plants of the World Online” (<https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:158042-1>). However, we think that this database does not have enough proof concerning the “native” status of this species in Bulgaria. That is because there is a single publication, cited with data about the Bulgarian flora, named “The identification guide of plants of Bulgaria” edited by DELIPAVLOV and CHESHMEDZHIEV [7], where it is specified that *S. pendula* “is cultivated in gardens and parks”. The same information has recently been duplicated by STOYANOV et al. [8]. So, the confirmation about the native status of *S. pendula* in Bulgaria is a mistake. Nonetheless, the species is known in some neighbouring countries like Turkey and Greece within its natural range [9,10], as well as in Romania as an alien species [11].

¹<https://www.inaturalist.org/observations/79174839>



Fig. 1. a) *Silene pendula* L. found on 29.05.2021 in the area of Gelemenovo village;
b) *Silene pendula* L. herbarium (collected on 29.05.2021 in the area of Gelemenovo village)

Because this discovery is the first record of *S. pendula* for the natural flora of Bulgaria, we give its characteristics and comparison with its relative species below. This species belongs to the *Silene* L. genus, which is represented by 55 species in the country [12,13]. Such a big number is conditioned by the fact, that the Southern part of the Balkan Peninsula and southwest Asia, located close to Bulgaria, are considered the two main centres of diversity for the genus, which comprises about 700 species in the World's flora [14]. *S. pendula* had been included in the *Silene* subgenus, section *Psammophilae* (Talavera) GREUTER [14]. However, according to the new system, based on molecular phylogenetic studies, this species has recently been moved to the *Behenantha* (Otth) Torr. & A. Gray subgenus, section *Behenantha* Otth in Candolle [15]. If section *Psammophilae* was not represented by any other species in Bulgaria, then section *Behenantha* also includes *Silene graeca* Boiss. & Spruner and *S. vulgaris* (Moench) Garcke.

Detailed morphological description of *Silene pendula* is given in "Flora Europaea" [16], therefore we do not duplicate it. However, we completed Table 1 which shows diagnostic morphological differences between *S. pendula*, *S. graeca*, *S. vulgaris*, as well as *S. conica* and *S. subconica* Friv., which have many similar morphological characteristics, based on literature data [17–19]. Nevertheless, if we focus only on the main differences of *S. pendula* from the mentioned species, first of all, it is important to pay attention to the number of their calyx veins:

T a b l e 1
Diagnostic morphological characters of *Silene pendula*, *S. graeca*, *S. vulgaris*, *S. conica* and *S. subconica*

Characters	<i>S. pendula</i>	<i>S. graeca</i>	<i>S. vulgaris</i>	<i>S. conica</i>	<i>S. subconica</i>
Stem	15–40 cm, procumbent-ascending, branched, pubescent	(10–) 20–40 (–60) cm, usually not branched, erect, glabrous	up to 60 cm, erect, usually branched, glabrous or pubescent, often glaucous	15–50 cm, erect, branched, pubescent	15–50 cm, erect, branched, pubescent
Leaves	ovate to ovate-lanceolate, acute, pubescent; cauline leaves 2–5 cm	obovate to elliptical, up to 3.5 cm long, 1.5 cm wide, glabrous; leaves opposite, but not usually overlapping	up to 12 cm, variable in shape from broadly ovate to linear, glabrous or pubescent	Oblong- to linear-lanceolate, acute, pubescent	Oblong- to linear-lanceolate, acute, pubescent
Inflorescences	very lax, of raceme-like monochasial cymes; pedicels usually erect in flowers, patent or deflexed in fruit	dichotomously branched at base with one alar flower and two equal, raceme-like, monochasial cymes; pedicels very short, flowers not overlapping	with numerous flowers; flowers inclined, somewhat zygomorphic (especially functional female ones)	Dichasia 5- to 30-flowered	Dichasia 5- to 30-flowered
Calyx	13–18 mm long, obovoid in fruit, contracted at mouth, very inflated and loose, with wide hyaline bands between prominent, narrow veins; teeth short, ovate or triangular, obtuse	9–15 mm long, glabrous, cylindrical, with ten parallel veins; oblong-subclavate in fruit; teeth ovate, obtuse, usually greenish	13–18 mm long, 20-veined, inflated, persistent, loosely investing ripe capsula	8–15 mm long, shortly pubescent, 30-veined, obovoid-cylindrical in flower, broadly obovoid in fruit	13–18 mm long, shortly pubescent, 30-veined, cylindrical in flower, broadly obovoid in fruit

T a b l e 1
(Continued)

Characters	<i>S. pendula</i>	<i>S. graeca</i>	<i>S. vulgaris</i>	<i>S. conica</i>	<i>S. subconica</i>
Petals	petal-limb 7–10 mm; pink, rarely white, emarginate	petal-limb 5–10 mm; white or pink, deeply bifid	petal-limb 3–6 mm; large; white, greenish or pink with poorly-developed coronal scales, deeply bifid	petal-limb 3–5 mm; comparative narrow; pink, rarely white, bifid	petal-limb 3–5 mm, comparative wide; pink, emarginate
Capsule	9–12 mm, ovoid-conical; carpophore 3–6 mm	6–9 mm, ovoid-oblong, with curved backwards teeth; carpophore 2–4 mm, stout	up to 13 mm, with neck 2–3 mm wide and erect or patent teeth	7–12 mm, ovoid-conical; carpophore less than 1 mm	7–9 mm, ovoid-conical; carpophore 1–4 mm
Seeds	1.3–1.4 mm, subglobose, blackish, faces convex or plano-convex, with concentric rings of small tubercles; back convex or plano-convex, with 7 or 8 rows of tubercles	1–1.3 mm, reniform; faces slightly concave, tuberculate-striate; back very wide, more or less plane, with 4 or 5 rows of low, rounded tubercles	1–2 mm, usually tuberculate	0.75–1 mm, pruinose	0.75–1 mm, pruinose
2n	24	24	24, 48	18, 20, 24	20

S. pendula and *S. graeca* have 10, *S. vulgaris* – 20, and *S. conica*, *S. subconica* – 30. *S. pendula* and *S. graeca* also have clear morphological distinctions among themselves, the basic ones are: 1) plants of *S. pendula* – pubescent/*S. graeca* – glabrous; 2) petals of *S. pendula* – emarginate/*S. graeca* – deeply bifid.

S. pendula is a Mediterranean species. In its native range, it occupies Italy, North-Eastern Greece to Western Turkey [9,10,16]. However, according to data from the Global Biodiversity Information Facility (<https://www.gbif.org>) and some publications [11,17], this species is also distributed in many locations of North America (Canada and USA), South America (Argentina and Uruguay), Africa (Algeria, Egypt and the Republic of South Africa), Europe (Austria, Belarus, Belgium, Czechia, Denmark, Estonia, England, Finland, Hungary, Latvia, Norway, Portugal, Romania, Russia (European part), Scotland, Slovakia, Spain, Sweden, and Ukraine), Asia (Armenia, Azerbaijan, China, Georgia, Japan, and Iran), Australia and New Zealand as an introduced or alien species. It often is specified that the species escapes from cultivation [11,16,17,19].

The true origin of *Silene pendula* in the discovered location is unknown. There are two hypotheses. The first one, its seeds from areas where *S. pendula* is cultivated in Bulgaria or it grows in natural conditions in Turkey reached this place binding to car wheels. The second one, there could be a flower bed near the gas station before the lawn or close to it, so this species was able to survive and distribute around from that time.

Conclusions. In any way, this case confirms the presence of *S. pendula* in the flora of Bulgaria as an alien species. Unfortunately, there is not enough data, in order to establish the current invasive status of this species, using the accepted terminology of RICHARDSON et al. [20] in Bulgaria. It may be considered an alien plant, casual alien plant, or even naturalized species. Thus, it is needed to monitor this location for the final conclusion in the future.

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