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## Rediscovery of the endemic *Scrophularia exilis* (*Scrophulariaceae*) in the Crimean Mountains and comments on its taxonomic status

### Abstract

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*Scrophularia exilis*, known only from the type gathering in 1929 and a possible second report in 1969, has been rediscovered. The species was found in its type locality and additionally in another locality 5.6 km further west. *Scrophularia exilis* is regarded here as a Crimean endemic, not as a synonym of *S. heterophylla* subsp. *laciniata*. Diagnostic characters of *S. exilis* and its differences from *S. heterophylla* subsp. *laciniata* are given. The phytocoenotic characteristics of the habitats of the species are presented. An updated key to the species of Crimean *Scrophularia* is provided.

Additional key words: *Scrophularia heterophylla* subsp. *laciniata*, systematics, flora, distribution, Ukraine, ecology, glareophytes

### Introduction

The genus *Scrophularia* L. is represented in Crimea by seven species (Fateryga 2011; Yena 2012). Five of them, *S. canina* subsp. *bicolor* (Sibth. & Sm.) Greuter, *S. nodosa* L., *S. rupestris* Willd., *S. scopolii* Hoppe and *S. umbrosa* Dumort., are well studied and known from numerous localities. The sixth species, *S. olympica* Boiss., is known only by a single finding – “infra Baydara”, 21 Aug 1861, Ruprecht (LE); its identification is doubtful (Lall & Mill 1978). But the most extraordinary species is the seventh one, *S. exilis* Popl. It was found for the first time by Henrietta Poplavskaja in the Crimean Reserve on the slope of Mt Shagan-Kaya in 1926. The type specimens of this species were collected by her in 1929 and the species was described by her in 1931 as follows: “An absolutely unusual *Scrophularia* clearly distinct from other

ones known in the Crimea until now; it was discovered by me on a rocky scree at the riverhead of Avenda river near Gurzuf saddle in 1926... [translated from Russian]” (Poplavskaja 1931: 85).

There have been no additional findings of *Scrophularia exilis* in the type locality since then, although the species was also reported from Mt Chatyrdag (Kotova 1969). The species was regarded as endemic to the Crimean peninsula for a long time (Gorshkova 1955; Ivanina 1981; Golubev 1996; Yena 2001) until it was reduced to the synonymy of *S. heterophylla* subsp. *laciniata* (Waldst. & Kit.) Maire & Petitm. (Marhold 2011). However, the claimed synonymy of these taxa seems to have been established due to the poor condition of the type specimens of *S. exilis* (in particular the absence of ripe fruits and seeds) and the high morphological variability of *S. heterophylla* subsp. *laciniata*.

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Fig. 1. *Scrophularia exilis* and its habitats – A: habitat at Djunyn-Kosh; B: habitat at Shagan-Kaya (mobile part of the scree); C: general aspect of a flowering plant; D: flowers and buds; E: capsules; F: seeds. – Scale bar = 1 mm. – Photographs by A. Fateryga (A), A. Nikiforov (B) and S. Svirin (C–F).

In 2012, we were successful in rediscovering *Scrophularia exilis* in its type locality, as well as in a second locality, and in collecting new material for the first time since the collection of the type specimens in 1929. The purpose of this paper is to give the diagnostic characters of *S. exilis* according to our new data, to establish its differences from *S. heterophylla* subsp. *laciniata*, to ascertain coenotic conformity of the species and to provide an updated key to the species of *Scrophularia* in the Crimean flora.

## Material and methods

The first coenopopulation of *Scrophularia exilis* was found on the slope of Mt Djunyn-Kosh near the border between the Crimean Nature Reserve and the Yalta Mountain-Forest Nature Reserve, 44°33'27"N, 34°09'41"E, 1290 m, 6 Jun 2012 (geographic coordinates and altitude were taken with the help of Google Earth 7; Google 2013). The second coenopopulation was rediscovered in the type locality, 5.6 km from the first coenopopulation,



Fig. 2. Holotype of *Scrophularia exilis* at LE.

on the slope of Mt Shagan-Kaya in the Crimean Nature Reserve, 44°34'44"N, 34°13'36"E, 1345 m, 11 Jun 2012. Both localities were on east-facing rocky scree slopes (Fig. 1A) formed of fragments of Jurassic limestone and divided into relatively stable parts and mobile parts (Fig. 1B). The plants of *S. exilis* grew only on the mobile parts in three areas (c. 200, 800 and 850 m<sup>2</sup>) on Mt Djunyn-Kosh and one area (about 2400 m<sup>2</sup>) on Mt Shagan-Kaya. There were more than 400 individuals on Mt Djunyn-Kosh and more than 700 individuals on Mt Shagan-Kaya.

Live plants were morphologically studied, as were the herbarium specimens that were made: Crimea, Mt Djunyn-Kosh, 7 Jun 2012, *S. Svirin* (CSAU, PHEO, YALT [1 sheet at each]); *ibid.*, 15 Jul 2012, *A. Fateryga* (KW [1 sheet], PHEO [2 sheets]); Crimea, Mt Shagan-Kaya, 18 Jul 2012, *A. Nikiforov* (PHEO [2 sheets]). The holotype of *Scrophularia exilis* at LE and the isotype at YALT were also examined. Several measurements were made with the

help of an MBS-9 stereo microscope. Morphology of *S. heterophylla* subsp. *laciniata* was taken from literature (Waldstein & Kitaibel 1803–1805; Richardson 1972; Raus 1991; Bojňanský & Fargašová 2007) and by studying herbarium specimens (Dalmatia, “in fundis et valleculis umbrosis montis Boikovo”, *Pichler*, KW; Herzegovina, [locality illegible], 1300 m, 12 Jul 1933, *P. Sillinger & M. Deyl*, LE).

Geobotanical descriptions were made according to the Braun-Blanquet method: on 15 Jul 2012 at Mt Djunyn-Kosh and on 18 Jul 2012 at Mt Shagan-Kaya.

## Results

*Scrophularia exilis* Popl., Spisok Rast. Sobr. Krymsk. Gos. Zapov.: 85. 1931. – Holotype: Crimea, State Reserve near Alushta, rocky scree at the riverhead of Avenda river near Gurzuf saddle, 22 Jun 1929, *H. Poplavskaja* (LE [photo.]; isotype: YALT!) – Fig. 2.

**Diagnosis** — *Scrophularia exilis* differs from *S. heterophylla* subsp. *laciniata* by its lower height, arrangement of leaves at the base of the stem, smaller leaves, fewer cymes per stem, significantly fewer flowers per cyme, glandular pubescent calyx, maroon corolla, usually rhomboid staminodium and significantly larger seeds (Table 1).

**Description** — Herbs perennial, 9–23 cm tall, with 1–19 generative stems (Fig. 1C). **Root** erect, yellowish, much longer than stems, thin. **Stems** erect, reddish green, later dark red, indistinctly tetraquetrous. **Leaves** arranged at base of stem (Fig. 3A), dark green to reddish green, lower ones lobed, middle and upper ones pinnatifid to pinnatisect (Fig. 3B), 1–3.5 × 0.5–1.6 cm, thick, glabrous. **Inflorescences** cymes, 5–13 per plant, alternate to nearly opposite (Fig. 1D); flowers 1–3 per cyme. **Calyx** green, glandular pubescent; sepals 2.5–2.7 mm long, with narrow marginal fringe (Fig. 3D). **Corolla** maroon, 4.9–6.1 mm long; upper petals curved upward, lateral petals ± straight. **Staminodium** rhomboid to elliptic or absent (Fig. 3E). **Stamens** and **pistil** 1.1–1.3 × longer than corolla. **Capsule** yellowish (Fig. 1E), 4–7 mm in diam., with 4–22 seeds, apex very acute (Fig. 3C). **Seeds** brown, ± curved, 2.3–2.5 × 1–1.1 mm, reticulate (Fig. 1F).

**Remarks** — All characters of *Scrophularia exilis* were present in the previous descriptions (Poplavskaja 1931;

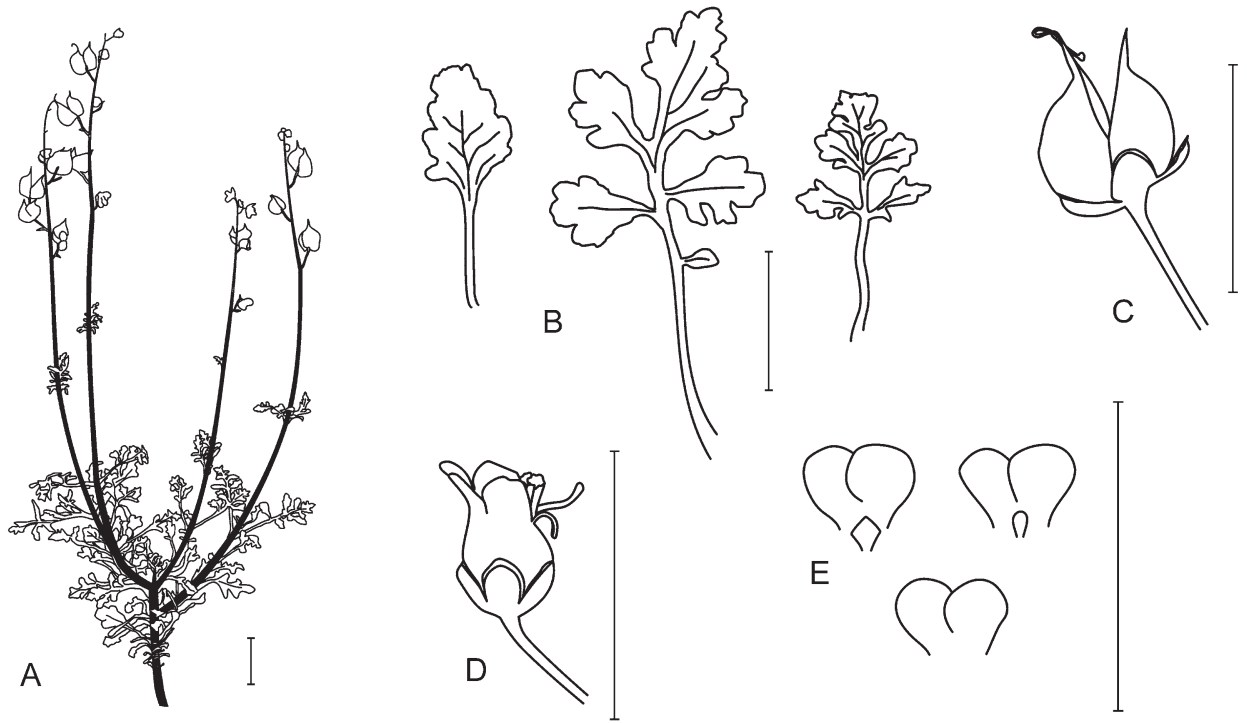


Fig. 3. *Scrophularia exilis* – A: general aspect; B: lower, middle and upper leaves; C: capsule; D: flower; E: upper petals with staminodium. – Scale bars = 1 cm.

Table 1. Comparison of the main diagnostic characters of *Scrophularia exilis* and *S. heterophylla* subsp. *laciniata*. – R = range, M = mean, S = standard deviation, \* = data from literature.

	<i>Scrophularia exilis</i>			<i>Scrophularia heterophylla</i> subsp. <i>laciniata</i>		
<b>Qualitative characters</b>						
Leaf arrangement	basal only			positioned along stem		
Middle leaf shape	pinnatifid to pinnatisect			simple and serrate or deeply pinnatifid to 2-pinnatisect		
Calyx glandular pubescence	present			absent*		
Corolla color	maroon			reddish purple to greenish*		
Staminodium shape	rhomboid to elliptic or absent			reniform to orbicular*		
<b>Quantitative characters</b>						
	R	M	S	R	M	S
Plant height [cm]	9–23	15.3	4.4	23–58	39.8	13.3
Number of generative stems	1–19	7	5.3	usually several*	?	?
Middle leaf length [cm]	1.7–3.5	2.5	0.9	2.7–8.4	5.4	2
Middle leaf width [cm]	0.7–1.6	1.1	0.5	1.1–4.4	2.3	1.2
Number of cymes per stem	5–13	8.5	1.9	8–24	16.2	5.8
Number of flowers per cyme	1–3	1.8	0.6	3–14	7.3	3
Sepal length [mm]	2.5–2.7	2.6	0.1	1.8–2.8	2.3	0.4
Corolla length [mm]	4.9–6.1	5.6	0.4	5.6–6.2	5.9	2.7
Capsule diameter [mm]	4–7	5.5	0.7	3–6*	?	?
Number of seeds per capsule	4–22	11.5	5.4	?	?	?
Seed length [mm]	2.3–2.5	2.4	0.1	0.8–0.9*	?	?
Seed width [mm]	1–1.1	1.05	0.03	0.6–0.7*	?	?

Table 2. Composition and coverage of vascular plant species in the two localities with *Scrophularia exilis* (\* indicates taxa endemic to Crimea).

	Mt Djunyn-Kosh	Mt Shagan-Kaya
<i>Rumex scutatus</i> subsp. <i>hastifolius</i> (M. Bieb.) Borod.	2a	+
<i>Heracleum stevenii</i> Manden.	2b	–
<i>Scrophularia exilis</i> Popl.*	1	1
<i>Asperula supina</i> M. Bieb.	1	–
<i>Elytrigia strigosa</i> (M. Bieb.) Nevski*	R	1
<i>Galium album</i> subsp. <i>prusense</i> (K. Koch) Ehrend. & Krendl	1	+
<i>Allium nathaliae</i> Seregin*	+	+
<i>Alyssum murale</i> Waldst. & Kit.	–	+
<i>Asperula taurica</i> Pacz.	+	+
<i>Bromopsis xtaurica</i> Sjlussar.	+	–
<i>Bupleurum exaltatum</i> M. Bieb.	–	+
<i>Convolvulus arvensis</i> L.	+	–
<i>Crepis purpurea</i> (Willd.) M. Bieb.	–	+
<i>Cruciata taurica</i> (Willd.) Ehrend.	+	+
<i>Heracleum ligusticifolium</i> M. Bieb.*	+	+
<i>Lamium glaberrimum</i> (K. Koch) Taliev*	+	+
<i>Melica ciliata</i> subsp. <i>monticola</i> (Prokudin) Tzvelev	+	–
<i>Melica ciliata</i> subsp. <i>taurica</i> (K. Koch) Tzvelev	–	+
<i>Myosotis popovii</i> Dobrocz.	–	+
<i>Onosma polyphylla</i> Ledeb.	–	+
<i>Paronychia cephalotes</i> (M. Bieb.) Besser	–	+
<i>Pimpinella tragium</i> subsp. <i>lithophila</i> (Schischk.) Tutin	+	+
<i>Securigera varia</i> (L.) Lassen	+	–
<i>Sedum acre</i> L.	–	+
<i>Sedum hispanicum</i> L.	–	+
<i>Sideritis catillaris</i> Juz.	+	+
<i>Teucrium chamaedrys</i> L.	+	+
<i>Teucrium montanum</i> L.	–	+
<i>Thymus roegneri</i> K. Koch	–	+
<i>Cerastium biebersteinii</i> DC.*	R	–
<i>Urtica dioica</i> L.	R	–
<i>Vincetoxicum schmalhauseni</i> (Kusn.) Stank.	R	–

Gorshkova 1955; Ivanina 1981; Kotova 1969), but they have been revised in the present paper according to the new material collected in the field. The shape of the staminodium significantly varies, but normally it is rhomboid in more than 90 % of flowers. Flowers with an elliptic staminodium or without one occur mainly at the end of the flowering period and independently of the position of the flower in the inflorescence.

*Distribution, ecology and phytocoenology* — *Scrophularia exilis* grows in a very specific habitat: rocky scree slopes immediately below high vertical cliffs. This habitat is characterized by specific plant associations found only there. Thirty-two species were found growing together with *Scrophularia exilis*; seven of them (including *S. exilis*) are endemic to the Crimean flora (Table 2). Among the endemic taxa, *Allium nathaliae* Seregin, *Heracleum ligusticifolium* M. Bieb., and *Lamium glaberrimum* (K. Koch) Taliev are obligate glareophytes, i.e. strictly confined to these habitats (Ryff 2001). *Scrophularia exilis* can be also regarded as an obligate glareophyte, but it is significantly rarer than the other three species. The distribution of *S. exilis* known until now comprises two localities (or three counting the report from Mt Chatyrdag) with a total area of less than 5000 m<sup>2</sup> and an altitudinal range of 1200–1400 m. Flowering of the species occurs from the beginning of June to the middle of September, and fruiting from the middle of June to the middle of September. Reproductive biology, pollination and ontogenesis of the species were not studied. Plant communities with *S. exilis* belong to the subassociation *Sobolewskio sibiricae-Heracleetum ligusticifolii lamietosum glaberrimi* subass. nov. prov., association *Sobolewskio sibiricae-Heracleetum ligusticifolii* ass. nov. prov., alliance *Rumici scutati-Heracleion stevenii* all. nov. prov., order *Thlaspietalia rotundifolii* Braun-Blanq. in Braun-Blanq. & H. Jenny 1926 and class *Thlaspietea rotundifolii* Braun-Blanq. 1948. The new syntaxa mentioned above had already been described by Ryff (2007), but they require validation according to Articles 3 and 5 of the International Code of Phytosociological Nomenclature (Weber & al. 2000).

## Conclusions

*Scrophularia exilis* is a rather distinct species that differs well from *S. heterophylla* subsp. *laciniata*. The species is endemic to the southern macroslope of the Crimean Mountains and is strictly confined to glareophytic habitats of isolated rocky scree slopes immediately below high vertical cliffs.

## Key to the species of *Scrophularia* in the Crimean flora

1. Stem clearly tetraquetrous, edges strongly angular or winged; leaves undivided, 4–17 × 2–8 cm; plants of wet or mesophytic habitats . . . . . 2
- Stem indistinctly tetraquetrous, edges ± rounded; leaves usually lobed to pinnatisect, if undivided, then smaller, 1–3.5 × 0.5–1.5 cm; plants of xerothermal, often rocky habitats . . . . . 4
2. Edges of stem and petioles winged . . . *S. umbrosa*
- Edges of stem and petioles not winged . . . . . 3

3. Sepals with narrow marginal fringe; upper side of corolla convex at base, then concave; upper petals curved upward; leaves pubescent . . . . . *S. scopoli*
- Sepals without distinct marginal fringe; upper side of corolla ± flat; upper petals ± straight; leaves glabrous . . . . . *S. nodosa*
4. Leaves undivided to lobed; stem glandular pubescent . . . . . *S. rupestris*
- Leaves pinnatifid to pinnatisect; stem usually glabrous . . . . . 5
5. Plants 9–23 cm tall; leaves arranged at base of stem; corolla unicoloured, maroon; capsule 4–7 mm in diam. . . . . *S. exilis*
- Plants usually 30–60 cm tall; leaves arranged proportionally along stem; corolla bicoloured, purple or maroon with whitish or greenish parts; capsule 3–4 mm in diam. . . . . 6
6. Stamens 1.1–1.3 × longer than corolla; staminodium usually cordate, sometimes longer than wide . . . . . *S. olympica*
- Stamens 1.6–1.9 × longer than corolla; staminodium lanceolate, up to 2.5 × longer than wide, or absent . . . . . *S. canina* subsp. *bicolor*

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