

Genista tetragona (Fabaceae), a neglected species in the Bulgarian flora

Stoyan Stoyanov

Department of Plant and Fungal Diversity and Resources, Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, Acad. Georgi Bonchev St., bl. 23, 1113 Sofia, Bulgaria, e-mail: tjankata@abv.bg

Received: March 24, 2014 ▷ Accepted: October 06, 2014

Abstract. *Genista tetragona*, so far known as a narrow endemic species for Moldova and Ukraine, was discovered in the river valleys of Cherni Lom and Mali Lom (in the basin of river Rusenski Lom, Northeast Bulgaria). The article presents data on the morphology, distribution, ecology, and the closest relatives of this species. A conservation assessment based on IUCN categories and criteria is provided. Examination of Velenovský's taxon *G. rhodopea* from Besaparski Hills (South Bulgaria) revealed that it is morphologically similar to *G. tetragona* and should be considered as a subspecies of the latter.

Key words: *Genista* sect. *Genista*, karyology, Leguminosae, nomenclature, taxonomy

Introduction

In the period 2006–2011, a dubious shrublet of *Fabaceae* was observed on the calcareous stony and scree slopes in different parts of the valley of river Rusenski Lom (Northeast Bulgaria). Owing to its procumbent-ascending stems, unifoliolate leaves and appressed hairs on the branches, leaves and legumes, it has been wrongly identified for a long time as *Cytisus procumbens* (Waldst. & Kit. ex Willd.) Spreng. [= *Corothismus procumbens* (Waldst. & Kit. ex Willd.) C. Presl] (Stoyanov 2005). Possibly, indication of *C. procumbens* from the valley of river Rusenski Lom by Kovachev (1900) was due to the same delusion. The key feature which focused the efforts on identifying the species properly was the presence of small subulate stipules. They are typical for most members of the genus *Genista* and are absent in the genera *Corothismus* and *Cytisus* s.l. Subsequently, according to the work of Kuzmanov (1976), the plant was identified as *Genista depressa* M. Bieb. subsp. *depressa* var. *rhodopea* (Velen.) Kuzmanov. By that moment,

this endemic taxon was indicated only for Besaparski Hills (South Bulgaria). It is based on the described by Velenovský *G. rhodopea*. The latter species was later regarded as a variety of *G. tetragona* Besser (Velenovský 1898). Velenovský's treatment and finding of *G. depressa* var. *rhodopea* in a new locality, at a distance 200 km to the northeast of the known one, have aroused doubts about its taxonomic status and infraspecific position and gave an impetus for this research.

Examination of herbarium specimens of *G. tetragona* from Moldovian and Ukrainian populations (including the type specimen) has found that their features undoubtedly match those of the plants from the valley of river Rusenski Lom. The characters of *G. depressa* var. *rhodopea* from Besaparski Hills showed that this taxon also belongs to *G. tetragona*, but some small morphological differences, as well as its geographical isolation and different ploidy level have proven sufficient reasons for it to be recognized as a separate subspecies, which in this article is regarded as *G. tetragona* subsp. *rhodopea* (Velen.) S. Stoyanov, **stat. nov.**

Genista tetragona, recorded for the first time in the Bulgarian flora by Velenovský with the infraspecific taxon *G. tetragona* var. *rhodopea* (Velen.) Velen., has been neglected throughout the 20th century in the Bulgarian botanical literature. Its distribution in Bulgaria is now confirmed. The typical subspecies found in the valleys of rivers Cherni Lom and Mali Lom is reported for the first time for the Bulgarian flora.

Materials and methods

The study was carried out with herbarium specimens (SOM, SO, SOA, Herbarium of the Regional Natural History Museum of Plovdiv, KW, CHIS, PRC) and field observations.

Specimina visa:

G. tetragona subsp. *tetragona*:

Bulgaria – Rusenski Lom Nature Park, 1999, S. Stoyanov (SO 101095, sub *G. rumelica* Velen.); North-east Bulgaria, W of Cherven village, Ruse district, on stony and rocky slopes of the left bank of river Cherni Lom, 25.04.2006, S. Stoyanov [SOM 163366, 163367, sub *Cytisus procumbens* (Waldst. & Kit. ex Willd.) Spreng.].

Moldova – W of Goian village, Dubosari district, on calcareous stony slopes, 14.06.1982, A. Istratiy (CHIS 126191); Goian village, Dubosari district, on calcareous slopes, 15.05.1984, L. Nikolaeva (CHIS 220541); near Goian village, Dubosari district, Jagorlyk Reserve, on a steep calcareous stony slope, 23.05.1989, G. Popesku (CHIS 231873); N of Bolshoy Molokish village, Rybnica district, on calcareous slopes of the valley of river Rybnica, 02.07.1987, L. Nikolaeva (CHIS 220540); Molokish village, Rybnica district, on calcareous slopes, 29.07.1934 (KW 00103534).

Ukraine – Ad Jaorlik et Tyram, Besser (KW 001001836, Lectotype); Podolia Austral., Besser (KW 001001837); Artyrivka village, Krasnooknyanskyi district, on calcareous steep slopes of river Jagorlyk, 08.07.1934 (KW 00103535, sub *G. depressa* M. Bieb.); between the villages of Tsekhanivka, Krasnooknyanskyi district and Doibani, Dubosari district (Moldova), on a steep bank of river Jagorlyk, in petrophilous steppe area of *Stipa lessingiana*, on calcareous outcrops, 18.05.1974, B. Zaveruha (KW 00103531–00103533, 00103536).

G. tetragona subsp. *rhodopea*:

Bulgaria – In submontanis calcareis m. Rhodope supra Tekir (today Trivodici village, Plovdiv district), 1893, J. Velenovský (PRC, sub *G. rhodopea* Velen., Lectotype); Tekir, in rocky places, 05.06.1893, V. Stříbrný (SOA 15936, sub *G. rhodopea* Velen.); Yavorovo (today Yavorovo village, Plovdiv district), V. Stříbrný (SOA 15937, sub *G. depressa* M. Bieb.); Besaparski Hills, above Ognyanovo Railway Station, in calcareous grassy places, 05.1994, D. Stoyanov [SO 96968, 96969, sub *G. depressa* M. Bieb. subsp. *depressa* var. *rhodopea* (Velen.) Kuzmanov]. The following specimens are stored in the Herbarium of the Regional Natural History Museum of Plovdiv, unregistered in the system of *Index Herbariorum*: Besaparski Hills, in stony pastures, 12.05.1971, S. Stanev [7347, 7348, sub *G. depressa* M. Bieb. var. *tetragona* (Besser) Stoj. & Stef. f. *rhodopea* (Velen.) Stoj. & Stef.]; Besaparski Hills, in stony pastures, 19.04.1972, S. Stanev [7297, sub *G. depressa* M. Bieb. var. *tetragona* (Besser) Stoj. & Stef. f. *rhodopea* (Velen.) Stoj. & Stef.]; Besaparski Hills, above Kurtovo Konare village, Plovdiv district, in dry stony places, 20.04.1977, S. Stanev (9533–9536, sub *G. rhodopea* Velen.); Rhodopi Mts, above Markovo village, Plovdiv district, on a calcareous stony slope, south-facing, 19.05.1978, S. Stanev [10394, 10395, sub *G. depressa* M. Bieb. var. *rhodopea* (Velen.) Kuzmanov]; Central Rhodopi Mts, above Markovo village, Plovdiv district, on calcareous stony slopes, 14.05.1983, S. Stanev [10375, 10376, sub *G. depressa* M. Bieb. subsp. *depressa* var. *rhodopea* (Velen.) Kuzmanov].

Table 1 presents data on the localities of *G. tetragona* from which, in connection with this study, the herbarium materials were collected in the period 2011–2013. Seeds for karyological investigations were collected from the localities marked with an asterisk.

Flora of URSS (Shishkin 1945) and *Flora of URSR* (Visyulina 1954) were used for the morphological description of *G. tetragona* and supplemented with the author's measurements and observations.

Phytosociological descriptions of the communities were made in plots with an area of 16 m². The total vegetation cover was assessed by sight. The Braun Blanquet cover-abundance scale was used for determination of the abundance of species.

The conservation assessment is based on IUCN Categories and Criteria (IUCN 2001). The Extent of Occurrence (EOO) is calculated by means of the so-called minimum convex polygon. The territory covered by this polygon is divided into cells 2×2 km in

Table 1. Data of origin of the plant materials of *G. tetragona* used in the examination.

No	Locality	N	E	specimen No
subsp. tetragona				
1	Northeast Bulgaria. Razgrad District. SE of Kostandenets village, Tsar Kaloyan municipality, on the steep slopes of the right bank of Mali Lom river, open calcareous stony places, 300 m alt.	43.55468°	26.22365°	SOM 169891
2	Northeast Bulgaria. Razgrad District. SE of Kostandenets village, Tsar Kaloyan municipality, on the steep slopes of the right bank of Mali Lom river, calcareous scree, 270 m alt.	43.55425°	26.22144°	SOM 169892
3	Northeast Bulgaria. Razgrad District. SE of Kostandenets village, Tsar Kaloyan municipality, on the steep slopes of the right bank of Mali Lom river, calcareous scree, 270 m alt.	43.56006°	26.21591°	SOM 169893
4	Northeast Bulgaria. Razgrad District. NW of Kostandenets village, Tsar Kaloyan municipality, on the steep slopes of the right bank of Mali Lom river, calcareous scree, 170 m alt.	43.57842°	26.17187°	SOM 169894 SOM 169895
5	Northeast Bulgaria. Targovishte District. W of Garchinovo village, Opaka municipality, on the slopes of the right bank of Cherni Lom river, Garchinovski Terasi locality, calcareous stony places, 150 m alt.	43.51505°	26.09967°	SOM 169896
6	Northeast Bulgaria. Ruse District. E of Katselovo village, Dve Mogili municipality, Golyamoto Selishte locality, calcareous stony places, 200 m alt.	43.53169°	26.09202°	SOM 169897
7	Northeast Bulgaria. Ruse District. E of Pepelina village, Dve Mogili municipality, on the slopes of the left bank of Cherni Lom river, open calcareous stony and rocky places, 120 m alt.	43.58385°	25.94490°	SOM 169898 SOM 169899
8	Northeast Bulgaria. Ruse District. Between the Pepelina village and Orlova Chuka cave, Dve Mogili municipality, on the slopes of the left bank of Cherni Lom river, open calcareous stony places, 140 m alt.	43.58851°	25.95765°	SOM 169900
9	Northeast Bulgaria. Ruse District. E of Orlova Chuka cave, Dve Mogili municipality, on the slopes of the left bank of Cherni Lom river, calcareous stony grasslands, 170 m alt.	43.59653°	25.96590°	SOM 169901
10	Northeast Bulgaria. Ruse District. S of Tabachka village, Ivanovo municipality, on the slopes of the right bank of Cherni Lom river, Staneka locality, calcareous stony grasslands, 180 m alt.	43.58947°	25.97273°	SOM 169902 SOM 169903
11	Northeast Bulgaria. Ruse District. E of Tabachka village, Ivanovo municipality, on the slopes of the left bank of Cherni Lom river, calcareous stony grasslands, 140 m alt.	43.60387°	25.98724°	SOM 169904 SOM 169905
12*	Northeast Bulgaria. Ruse District. N of Cherven village, Ivanovo municipality, on the slopes of the left bank of Cherni Lom river, Moskov Dol locality, calcareous stony and rocky places, 100 m alt.	43.62486°	26.01895°	SOM 169906 SOM 169907
13	Northeast Bulgaria. Ruse District. N of Cherven village, Ivanovo municipality, on the slopes of the right bank of Cherni Lom river, calcareous stony places, 110 m alt.	43.62803°	26.03066°	SOM 169908
14	Northeast Bulgaria. Ruse District. SE of Koshov village, Ivanovo municipality, on the slopes of the left bank of Cherni Lom river, calcareous stony places, 100 m alt.	43.64352°	26.01439°	SOM 169909 SOM 169910
subsp. rhodopea				
15	Thracian Lowland. Pazardzhik District. Besaparski Hills, NE of Kapitan Dimitriev village, Peshtera municipality, calcareous stony places, 400 m alt.	42.11212°	24.34359°	SOM 169911
16	Thracian Lowland. Pazardzhik District. Besaparski Hills, S of Sinitovo village, Pazardzhik municipality, calcareous stony places, 250 m alt.			SOM 169912
17*	Thracian Lowland. Pazardzhik District. Besaparski Hills, S of Ognyanovo village, Pazardzhik municipality, calcareous stony places, 400 m alt.	42.12902°	24.41320°	SOM 169913 SOM 169914
18	Thracian Lowland. Plovdiv District. Besaparski Hills, W of Kurtovo Konare village, Stamboliyski municipality, calcareous stony places, 270 m alt.	42.08914°	24.47797°	SOM 169915 SOM 169916
19	Rhodopi Mts (Central). Plovdiv District. Foremountain belt of Rhodopes, S of Markovo village, Rhodopi municipality, calcareous stony places, 700 m alt.	42.05010°	24.70931°	SOM 169917 SOM 169918

size. The Area of Occupancy (AOO) represents the sum of areas of the cells in which the species is present. The third indicator used for making the assessment is the number of localities.

The karyotype was studied on somatic metaphase plates using the squash technique. Seeds were collected and germinated in Petri dishes to obtain the chromosome counts. Root tips were cut and pretreated with colchicine (0.01%) for 1 h at room temperature. Then the roots were fixed in ethanol/glacial acetic acid (3:1) for 24 h in a refrigerator, hydrolyzed in 1N HCl for 15 min at 60 °C, transferred in HCl/ethyl ether (1:1) for 15 min at room temperature, stained with Gomori's haematoxylin for 40 min at 60 °C (Melander & Wingstrand 1953), and finally squashed in 45 % acetic acid.

Results and discussion

Genista tetragona* Besser subsp. *tetragona (Fig. 1-2)

Enum. Pl.: 73. 1822. – **Lectotype** (designated by L. Krytska & M. Shevera in Krytska & al., Ukrayins'k.



Fig. 1. *Genista tetragona* subsp. *tetragona*: A – whole plant; B – flowering branch.

Bot. Zhurn. 56(6): 612. 1999): Ukraine. *Ad Jaorlik et Tyram, Besser* (KW 001001836!).

Genista tetragona* subsp. *rhodopea (Velen.)
S. Stoyanov, **stat. nov.**

Genista rhodopea Velen., Sitzungsber. Königl. Böhm. Ges. Wiss. Math.-Naturwiss. Cl. 37: 20. 1894; Hayek, Prodr. Fl. Penins. Balc. 1: 916. 1927. – *G. tetragona* Besser var. *rhodopea* (Velen.) Velen., Fl. Bulg. Suppl. I: 66. 1898. – *G. depressa* M. Bieb. var. *tetragona* (Besser) Stoj. & Stef. f. *rhodopea* (Velen.) Stoj. & Stef., Fl. Balg. Ed. 1, 2: 618-619. 1925. – *G. depressa* M. Bieb. subsp. *depressa* var. *rhodopea* (Velen.) Kuzmanov, Fl. Reipubl. Popularis Bulgaricae. 6: 45. 1976. – *G. depressa* M. Bieb. subsp. *rhodopea* (Velen.) D.V.G., God. Sofiisk. Univ. Kliment Ohridski Biol. Fak., 88(4): 77. 1997. – **Lectotype** (designated here): *Genista rhodopea*, Bulgaria. *In submontanis calcareis m. Rhodope supra Tekir, Velenovský* (PRC!).

Shrublet, 8–25(30) cm high, branched from the base; branches quadrangular, decumbent or oblique-



Fig. 2 Lectotype of *Genista tetragona* Besser.

ly ascending, opposite or subopposite; young branchlets densely covered with appressed sericeous hairs, sterile ones slightly flexuous, slender, elongated, with sparse uppermost opposite leaves, exceeding inflorescence, flowering ones erect, 4–7 cm long, with alternative or opposite leaves. Leaves oblong-lanceolate, the lower oblong-spatulate, 6–20(30) mm long and (0.5)2–4(5) mm wide, acute to obtuse, appressed-pubescent, almost hairless in the summer; stipules filiform, subulate, 1–2 mm long, persistent. Inflorescence a loose raceme; flowers yellow; pedicels appressed-pubescent, 2–3 mm long, with minute cuneate-subulate bracteoles at summit; calyx 3–5 mm long, densely appressed-hairy (or partially with subpatent hairs), the teeth half length of calyx, the two upper triangular and *ca.* 1 mm wide at base, the three lower linear-lanceolate and 0.3–0.7 mm wide at base; standard broadly-ovate, (7)8–12 mm long and *ca.* 7 mm wide, obtuse at the apex, glabrous; keel as long as standard; wings slightly shorter than standard; legume densely pubescent with appressed sericeous hairs, hairless in late summer, 15–30 mm long and 3–4 mm wide, with 4–10 seeds.

Table 2 presents a comparison of the two subspecies of *G. tetragona*.

Table 2. Comparison of *G. tetragona* subsp. *tetragona* and *G. tetragona* subsp. *rhodopea*.

Character	<i>G. tetragona</i> subsp. <i>tetragona</i>	<i>G. tetragona</i> subsp. <i>rhodopea</i>
Height	up to 30 cm	up to 20 cm
Branches	obliquely ascending, flexuous	decumbent, rarely procumbent
Leaves	(1)2–4(5) mm width	(0.5)1–2 mm width
Calyx	5–6 mm long, with appressed hairs; lower teeth linear oblong, 0.5–0.7 mm width at base	3–4 mm long, with appressed or subpatent hairs; lower teeth linear subulate, 0.3–0.4 mm width at base
Flowers	9–12 mm long	7–9(10) mm long
Chromosome number	$2n = 4x = 48$	$2n = 8x = 96$

Review of *Genista rhodopea* treatment

According to Velenovský, *G. rhodopea* is close to the species *G. triangularis* Willd. (= *G. januensis* Viv.), *G. depressa* and *G. lydia* Boiss., due to its linear legume, unarmed branches, glabrous corolla, and downward bended keel. It is also close to *G. rumelica* Velen., due to its often opposite leaves, but is well dis-

tinguished from them all by its slender, broadly procumbent branches, with flexuous-procumbent white-sericeous pubescent sterile branches and narrowly linear leaves. These first taxonomic notes made in 1894 clearly showed the relationships of *G. rhodopea*. After that, however, for more than a century, its taxonomic position has been quite variable and complicated. During that period, only Hayek (1927) had adopted the specific status of *G. rhodopea*. In other sources commented below, the taxon *rhodopea* was treated at different infraspecific ranks under the species *G. tetragona* and *G. depressa*. Velenovský (1898) first considered *G. rhodopea* as a variety of *G. tetragona*. Citing Janka (1884), he noted that in the typical *G. tetragona* the upper leaves usually exceed the flowers, the three lower calyx-teeth are linear oblong, and the two lateral are almost twice wider than the middle; while in var. *rhodopea* these traits are not represented and, furthermore, the lower teeth of the calyx are linear subulate, all uniform. Stojanov and Stefanov (1925) first considered *G. rhodopea* as an infraspecific taxon of *G. depressa*, lowering its rank to form. In the second and third edition of the *Flora of Bulgaria* (Stojanov & Stefanov 1933, 1948), the name *G. rhodopea* was completely suppressed. In the fourth edition of the *Flora of Bulgaria* (Stojanov & al. 1967), *G. tetragona* var. *rhodopea* was mentioned as a synonym for *G. rumelica*. Then *G. rhodopea* again was accepted as an infraspecific taxon of *G. depressa*, that time as a variety (Kuzmanov 1976). Finally, Georgieff (1997) elevated var. *rhodopea* to the rank of subspecies of *G. depressa*, considering it a termophilous ecotype inhabiting calcareous terrains at lower altitudes and is geographically isolated from the subsp. *depressa*. Such a long treatment of *G. rhodopea* within *G. depressa* has dimmed the original view of Velenovský about its belonging to *G. tetragona*, which proved to be the most accurate.

In Bulgaria, *G. rhodopea* is perceived as infraspecific taxon by different authors, while in the European botanical literature it is considered a synonym of *G. depressa* (Greuter & al. 1989) or *G. lydia* (Gibbs 1968). In Euro+Med Plantbase, its position is also uncertain and tangled: either listed as a provisional synonym of *G. depressa*, or placed in the synonymy of *G. lydia*.

Taxonomic notes on *Genista tetragona* and its relatives

Genista tetragona belongs to sect. *Genista* so far presented in Bulgaria by the species *G. tinctoria* L., *G.*

ovata Waldst. & Kit., *G. januensis*, *G. depressa*, *G. lydia*, and *G. rumelica* (Kuzmanov 1976). The diagnostic characters of the last three species will be discussed here, because taxonomy and nomenclature of *G. tetragona*, and in particular of subsp. *rhodopea*, were associated with them.

Among the representatives of *Genista* sect. *Genista* in Bulgaria, *G. tetragona* (including subsp. *rhodopea*) is distinguished by its 4-costate branches, predominantly opposite branches and leaves (especially leaves in sterile branchlets), and appressed sericeous to subsericeous hairs on young branches, on both sides of young leaves, the calyx, and the young legume.

Genista depressa and *G. tetragona* are close in their habit, hairs and size and structure of flowers. The similarity of the two species has caused many nomenclature changes in the past, as well as reason for their erroneous identification. *Genista depressa* is distinguished with oblong-elliptical mucronate leaves, pubescent only beneath and on the leaf margin, with appressed to subpatent hairs. Its branches have subpatent hairs mingled with patent hairs. *Genista depressa*, described from the mountain areas of the Crimea, has distinct ecological and height differentiation. It occurs on siliceous terrains, above the treeline, on the stony ridges of the mountains, unlike *G. tetragona*, which is a strongly calciphilous species and grows at low altitudes. In his *Flora Bulgarica*, Velenovský (1891) for the first time reported *G. depressa* for Bulgaria and recognized it as a separate and distinct species from *G. tetragona*. That is why he emphasized expressly “non *G. tetragona* Bess.” Gibbs (1968) considered *G. depressa* and *G. tetragona* within the content of *G. tinctoria* s.l. Because of their morphological closeness, he placed both species in one of the four groups defined by him.

When Boissier (1843) described *G. lydia*, he mentioned it also for the historic district of Rumelia (nowadays part of it falls in Bulgaria) after materials from Frivaldszky, incorrectly identified as *G. tetragona*. Even then, he pointed out the main differences between these two species: “*G. tetragona* habet ramos exactè tetragonos nec multiangulatos, folia sericeos nec glabros”. Indeed, in *G. lydia* single, scattered setaceous hairs on the branches, leaves, and the calyx are observed, and more or less dense hairs on flower pedicels, but nevertheless the difference in hairs with *G. tetragona* is tangible. In *G. lydia*, the leaves are linear-oblan-ceolate, more often obtuse at the apex, alternative, while

in *G. tetragona* they are oblong-lanceolate, more often acute at the apex, and opposite. With all these differences it is incorrect to place the taxon *G. rhodopea* (part of *G. tetragona*) in the synonymy of *G. lydia*.

The last controversial species, *G. rumelica*, is very similar to *G. lydia*. Both species are almost entirely glabrous, similar in size and shape of leaves, flowers and legumes, and with the same ecological requirements: they grow on rocky and stony silicate terrains in the hilly plains, foothills and low parts of the mountains. The differences between them are in the habit, branches and leaves: *G. lydia* has procumbent stems, green non-pruinose young branches and leaves falling late in the season, while *G. rumelica* is with erect stems, glaucous-pruinose young branches and early caducous leaves (they drop off at the end of flowering). In Euro+Med Plantbase and in *Flora Europaea* (Gibbs 1968), *G. rumelica* is viewed as a synonym of *G. lydia*. The opposite leaves, mentioned by Velenovský for *G. rumelica* are rather rare and should not be considered as a diagnostic feature of this species, as it is for *G. tetragona*. With its erect habit, *G. rumelica* is clearly distinguishable from the procumbent-ascending habit of *G. tetragona*.

Table 3 presents a comparison of the morphological characters and ecological requirements of the species *G. tetragona*, *G. depressa*, *G. lydia* and *G. rumelica*.

Phenology

Flowering in April-May, fruiting in July.

Distribution in Bulgaria (Fig. 3)

G. tetragona subsp. *tetragona*:

Northeast Bulgaria (valley of river Cherni Lom – in the area between villages Garchinovo, Targovishte district and Katselovo, Ruse district, and in the area between villages Pepelina, Tabachka, Cherven, and Koshov, Ruse district; the valley of river Mali Lom – SE and NW of Kostandenets village, Razgrad district).

G. tetragona subsp. *rhodopea*:

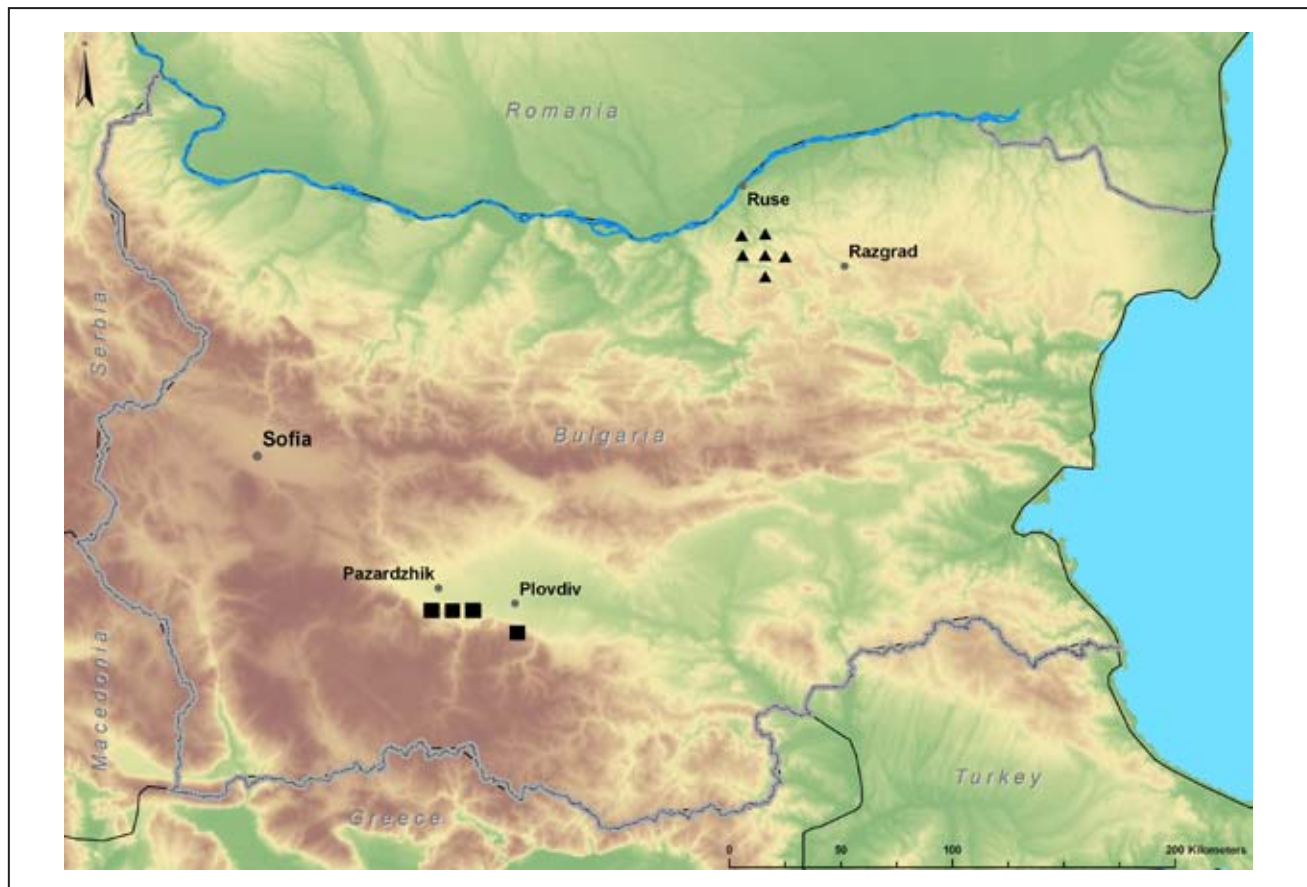
Foremountain belt of the Central Rhodopi Mts (above the villages of Markovo and Yavrovo, Plovdiv district) and the Thracian Lowland (Besaparski Hills, Pazardzhik and Plovdiv districts).

General distribution

Genista tetragona has limited distribution in Bulgaria, Moldova and Ukraine. In Moldova, it oc-

Table 3. Comparison of morphological characters and ecological requirements of selected species of *Genista* sect. *Genista*.

Character	<i>G. tetragona</i>	<i>G. depressa</i>	<i>G. lydia</i>	<i>G. rumelica</i>
Branches	obliquely ascending or decumbent, sterile ones flexuous, each 4-costate, subopposite or opposite, young ones with densely appressed sericeous hairs	decumbent, alternate, multiangular, young ones with sparsely to densely pubescent with subpatent and patent hairs	procumbent to slightly ascending, alternate, multiangular, young ones pubescent with scattered setaceous hairs	erect, robust, glaucous-pruinose, alternate or rarely opposite, multiangular, young ones pubescent with scattered setaceous hairs or glabrous
Leaves	(1)2–4 mm width, glaucous, often opposite, oblong-lanceolate acute or oblong-spatulate obtuse, appressed subsericeous-pubescent on both sites, hairless in summer	2–4(5) mm width, green, shining, alternate, oblong-lanceolate to oblong-elliptical, mucronate, lower surface and margin with setaceous appressed and subpatent hairs	1–2 mm width, alternate, linear-oblong to linear-oblancoate, obtuse or acute, subglabrous	1–2 mm width, alternate or rarely opposite, linear-spatulate to linear-oblancoate, obtuse, subglabrous, fall off during the end of the flowering
Stipules	1–2 mm long	up to 1 mm long	up to 1 mm long	up to 1 mm long
Calyx	4–6 mm long, with appressed sericeous hairs, lower teeth linear oblong to linear subulate, 0.3–0.7 mm width at base	4–5 mm long, with appressed setaceous hairs; lower teeth linear subulate, 0.4–0.5 mm width at base	3–4 mm long, glabrous or with scattered setaceous hairs, lower teeth linear subulate, 0.3–0.4 mm width at base	3–4 mm long, glabrous or with scattered setaceous hairs, lower teeth linear subulate, 0.3–0.4 mm width at base
Legume	15–30 mm × 3–4 mm, young one densely pubescent with appressed sericeous hairs, later hairless	15–30 mm × 3–4 mm, young one densely covered with setaceous appressed and subpatent hairs	15–30 mm × 3–4 mm, glabrous	15–30 mm × 3–4 mm, glabrous
Habitat	open, chalk or limestone grasslands, steep rocky slopes and calcareous outcrops, lowlands and foothills, up to 700 m alt.	siliceous rocky slopes and stony grasslands in the mountains, above upper forest line, above 1500 m alt.	siliceous rocky slopes sandstone, sandy terrains, hilly lowlands, foothills and low mountains, up to 1000 m alt.	siliceous rocky slopes sandstone, sandy terrains, rarely on limestone, foothills and mountains, up to 1500 m alt.

**Fig. 3.** Distribution map of *G. tetragona* in Bulgaria (▲ – subsp. *tetragona*; ■ – subsp. *rhodopea*).

curs in the valley of river Dniester and its tributaries Reut, Okna, Rybnica, and Jagorlyk. In Ukraine, the species is found only in the valley of river Jagorlyk (Melnyk 2011).

Ecology and habitats (Fig. 4)

Genista tetragona is a strongly calciphilous species and grows on dry shallow stony soils and chalky outcrops. In Bulgaria, *G. tetragona* takes part in open stony grassland communities, with total vegetation cover from 30% to 70% and in chasmophytic vegetation. In the basin of river Rusenski Lom, it occurs in all non-forest habitats on limestone substrate. In the valley of river Cherni Lom, the species inhabits calcareous stony grassy places in sparse communities of *Carpinus orientalis* Mill. and *Paliurus spina-christi* Mill., rock platforms near the edge of the canyon-like valley and steep rocky calcareous slopes. These three ecologically similar habitats refer to the following habitat types of Directive 92/43/EEC (1992): '6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*)', '6110 Rupicolous calcareous or basophilic grasslands of the *Alyso-Sedion albi*', and '8210 Calcareous rocky slopes with chasmophytic vegetation'. In the valley of river Mali Lom, *G. tetragona* occurs on calcareous outcrops of steep, slightly eroded slopes, which belong to the habitat type '6240 Sub-Pannonic steppic grasslands'. In South Bulgaria (Besaparski Hills and foothills of Rhodopi Mts), *G. tetragona* takes part in the same habitats as listed above, except in 6240. In addition, this species is found in the communities of habitat type '62A0 Eastern sub-Mediterranean dry grasslands', which are rich in sub-Mediterranean species.

The populations of *G. tetragona* are stable and with high numbers, especially those in the valley of river Cherni Lom and on Besaparski Hills, but occupy limited area. This is probably due to the poor competitiveness of the species, so it prefers rocky, steep, occasionally eroded terrains, with low participation of perennial tufted grasses and shrubs. The low migration potential of *G. tetragona* and the scattered habitats are reasons for the relatively constant size of its localities. This makes the species vulnerable and particularly sensitive to anthropogenic impacts.

The species composition, cover-abundance and vegetation cover (%) of the different communities inhabited by *G. tetragona* are given in Table 4.

Conservation status and regional IUCN assessment of *G. tetragona*

Genista tetragona is a tertiary relict with disjunct distribution area, which includes the middle part of the Dniester river basin, the middle part of the Rusenski Lom river basin, Besaparski Hills and a small part of the foremountain belt of the Central Rhodopi Mts. Because of its high conservation value (so far known as endemic to the Dniester river basin), the species is included in Appendix I of the Bern Convention (Vinichenko 2006) and the IUCN Red List of Threatened Plants (Walter & Gillet 1998), in the category Endangered. In Bulgaria, *G. tetragona* is represented by two remote and isolated populations, without suitable habitats in the geographic space between them. Therefore, EOO of each of these habitats is calculated separately. In Northeast Bulgaria, the EOO covering part of the basin of river Rusens-

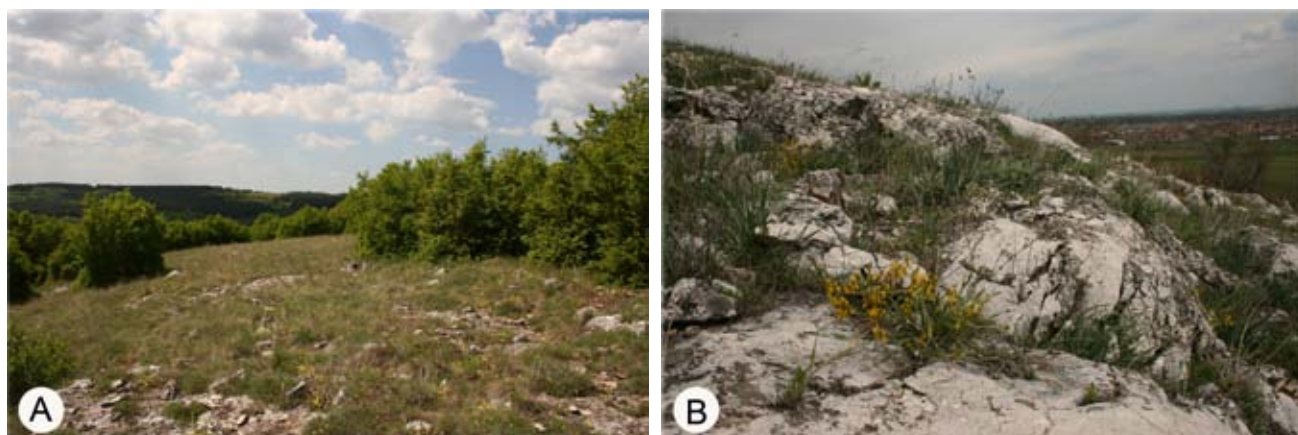


Fig. 4. Habitats of *G. tetragona*: **A** – calcareous stony grasslands S of Tabachka village, Ruse district; **B** – calcareous stony and rocky slopes W of Kurtovo Konare village, Plovdiv district.

Table 4. Species composition and species cover-abundance of the communities inhabited by *G. tetragona*. Braun Blanquet cover-abundance scale: r – single individual with small cover, <1 %; + – few individuals with small cover, <1 %; 1 – many individuals with cover <5 %, or scattered with cover up to 5 %; 2 – any number of plants covering 5–25 %; 3 – any number of plants covering 25–50 %; 4 – any number of plants covering 50–75 %; 5 – any number of plants covering >75 %.

Habitat type (according Directive 92/43/EEC)		6110	6210	6240	62A0
Locality		SE of Koshov	S of Tabachka	SE of Kostandenets	NE of Kapitan Dimitriev
Latitude, N		43.64352°	43.58947°	43.56006°	42.11212°
Longitude, E		26.01439°	25.97273°	26.21591°	24.34359°
Altitude (m)		100	180	270	400
Cover total %		30–40	60–70	40–50	60
1	<i>Achillea clypeolata</i> Sm.	+	+	+	
2	<i>Agropyron cristatum</i> (L.) Gaertn.				1
3	<i>Allium flavum</i> L.				+
4	<i>Allium sphaerocephalon</i> L.				+
5	<i>Alyssum alyssoides</i> (L.) L.	+			
6	<i>Asperula tenella</i> Degen	+			+
7	<i>Asplenium ruta-muraria</i> L.	+			
8	<i>Astragalus vesicarius</i> L.			+	
9	<i>Calamintha nepeta</i> (L.) Sav			+	
10	<i>Campanula sibirica</i> L.		+	1	+
11	<i>Carex hallerana</i> Asso			+	
12	<i>Carpinus orientalis</i> Mill.		1		
13	<i>Centaurea cuneifolia</i> Sm.			+	
14	<i>Cerastium semidecandrum</i> L.	+			
15	<i>Chrysopogon gryllus</i> (L.) Trin.		1		2
16	<i>Convolvulus cantabrica</i> L.	+	+		+
17	<i>Coronilla varia</i> L.	+		+	
18	<i>Crataegus monogyna</i> Jacq.		r	+	
19	<i>Dianthus moesiacus</i> Vis. & Pančić				+
20	<i>Dichanthium ischaemum</i> (L.) Roberty			2	+
21	<i>Digitalis lanata</i> Ehrh.			+	
22	<i>Dorycnium herbaceum</i> Vill.			+	
23	<i>Eryngium campestre</i> L.		+		+
24	<i>Erysimum diffusum</i> Ehrh.	+			
25	<i>Euphorbia myrsinites</i> L.				+
26	<i>Euphorbia nicaeensis</i> All.			+	
27	<i>Festuca dalmatica</i> (Hack.) K. Richt.				+
28	<i>Festuca valesiaca</i> Gaudin		3		
29	<i>Filipendula vulgaris</i> Moench		1		
30	<i>Fraxinus ornus</i> L.			+	
31	<i>Galium flavescens</i> Borbás			+	
32	<i>Galium rhodopeum</i> Velen.				1
33	<i>Genista tetragona</i> Besser subsp. <i>tetragona</i>	1	+	1	
34	<i>Genista tetragona</i> subsp. <i>rhodopea</i> (Velen.) S. Stoyanov				1
35	<i>Gypsophila glomerata</i> M. Bieb.	+			
36	<i>Haplophyllum suaveolens</i> (DC.) G. Don			+	
37	<i>Hieracium echioides</i> Lumn.			+	
38	<i>Hieracium hoppeanum</i> Schult.			+	
39	<i>Hypericum elegans</i> Willd.			+	

Table 4. Continuation.

Habitat type (according Directive 92/43/EEC)	6110	6210	6240	62A0
Locality	SE of Koshov	S of Tabachka	SE of Kostandenets	NE of Kapitan Dimitriev
Latitude, N	43.64352°	43.58947°	43.56006°	42.11212°
Longitude, E	26.01439°	25.97273°	26.21591°	24.34359°
Altitude (m)	100	180	270	400
Cover total %	30–40	60–70	40–50	60
40	<i>Hypericum rumeliacum</i> Boiss.			+
41	<i>Inula aschersoniana</i> Janka			+
42	<i>Iris pumila</i> L.	1		
43	<i>Jurinea consanguinea</i> DC.			+
44	<i>Koeleria macrantha</i> (Ledeb.) Schult.		+	
45	<i>Koeleria nitidula</i> Velen.			+
46	<i>Leontodon crispus</i> Vill.	+	+	
47	<i>Linum tenuifolium</i> L.	+	+	
48	<i>Medicago minima</i> (L.) Bartal.	+		
49	<i>Melica ciliata</i> L.			1
50	<i>Minuartia setacea</i> (Thuill.) Hayek	+		
51	<i>Nigella arvensis</i> L.			+
52	<i>Onobrychis gracilis</i> Besser			+
53	<i>Orlaya grandiflora</i> (L.) Hoffm.		+	
54	<i>Paliurus spina-christi</i> Mill.		+	
55	<i>Paronychia cephalotes</i> (M. Bieb.) Besser	+		
56	<i>Poa bulbosa</i> L.	1		
57	<i>Potentilla argentea</i> L.		+	
58	<i>Potentilla astracantha</i> Jacq.	+		
59	<i>Potentilla pirotensis</i> (Borbás) Markova			+
60	<i>Sanguisorba minor</i> Scop.	+	1	+
61	<i>Satureja coerulea</i> Janka		2	
62	<i>Scabiosa triniifolia</i> Friv.			+
63	<i>Scutellaria orientalis</i> L.		+	
64	<i>Sedum hispanicum</i> L.	1		
65	<i>Sideritis montana</i> L.			+
66	<i>Stachys atherocalyx</i> K. Koch	+		+
67	<i>Stipa capillata</i> L.		1	2
68	<i>Stipa pennata</i> L.		1	
69	<i>Teucrium chamaedrys</i> L.		+	+
70	<i>Teucrium montanum</i> L.	+		
71	<i>Teucrium polium</i> L.			2
72	<i>Thesium simplex</i> Velen.	+		
73	<i>Thymus glabrescens</i> Willd.	+	1	
74	<i>Thymus moesiacus</i> Velen.			2
75	<i>Trachynia distachya</i> (L.) Link			+
76	<i>Trigonella monspeliaca</i> L.			+
77	<i>Xeranthemum annuum</i> L.		+	
78	<i>Verbascum nobile</i> Velen.			+
79	<i>Viola kitaibeliana</i> Schult.	+		

ki Lom amounts to about 200 km². It includes three localities that have AOO of 44 km². In South Bulgaria, the EOO of the species covering the territory enclosed by the Pazardzhik-Stamboliyski-Asenovgrad line in the north and Kapitan Dimitriev-Perushtitsa-Yavrovo line in the south amounts to about 350 km². It includes the localities at Besaparski Hills and at the villages Markovo and Yavrovo (the latter unconfirmed), which have AOO 80 km². In total, *G. tetragona* has EOO 550 km², AOO 124 km² and five currently known localities, and that is why it is rated at regional level as Endangered species [EN B1ab(i,ii,iii)+2ab(i,ii,iii)].

Almost entire population of the Rusenski Lom river basin falls within the Special Area of Conservation BG 0000608 'Lomovete' under Directive 92/43/EEC on conservation of natural habitats and of wild fauna and flora. Part of the valley of river Cherni Lom between the villages Koshov and Cherven, where some of the largest found habitat of *G. tetragona* lies, falls within the borders of Rusenski Lom Nature Park.

The population of *G. tetragona* subsp. *rhodopea* on Besaparski Hills is within the Ognyanovo-Sinitevski Rid Protected Site and the Special Area of Conservation BG 0000254 'Besaparski Vazvishenia' under Directive 92/43/EEC on conservation of natural habitats and of wild fauna and flora. Without protection remain the localities above the villages of Markovo and Yavrovo. The most significant threat to the species in South Bulgaria seems to be the expanding quarrying of limestone, which leads to slow but irretrievable loss of suitable habitats.

Chromosome number (Fig. 5)

A chromosome number of $2n = 4x = 48$ was found in the examined cells of three root tips of *G. tetragona* subsp. *tetragona*. A chromosome number $2n = 8x = 96$ was found for *G. tetragona* subsp. *rhodopea*, also in the cells of three root tips.

The chromosome counts in the two infraspecific taxa of *G. tetragona* are the first ever recorded for the species. The difference in ploidy levels in both Bulgarian populations of *G. tetragona* is another reason for considering them in the content of different subspecies.

All species of sect. *Genista* present chromosome numbers which can be traced back to $x = 12$. Tetraploid cytotypes are most frequent among the representatives of this section, but in some cases octoploid cytotypes appear. Various numbers were also counted for *G. depressa*, including some infraspecific taxa: $2n = 48$ and $2n = 96$ (Krusheva 1975, 1986).

Acknowledgements. The author is grateful to Milko Belberov, recently retired Director of the Directorate of Rusenski Lom Nature Park for support in the field work. He also extends his thanks to Dr. Natalia M. Shiyani, Head Curator of the National Herbarium of Ukraine (KW), Dr. Valentina Cantemir, Curator of the Herbarium of Botanical Garden of the Academy of Sciences of Moldova, Laboratory of Spontaneous Flora and Herbarium (CHIS), and Yuliy Marinov, Curator of Herbarium of the Regional Nature History Museum of Plovdiv for the provided herbarium materials. He owes gratitude to colleague Nadezhda Hristova for the laboratory assistance and to Romyana Dimova for the help with translation. Special thanks are extended to Dr. Anna Petrova for her valuable advice in preparation of the manuscript and to Dr. Jerzy Zieliński, the paper's reviewer, for his critical notes.

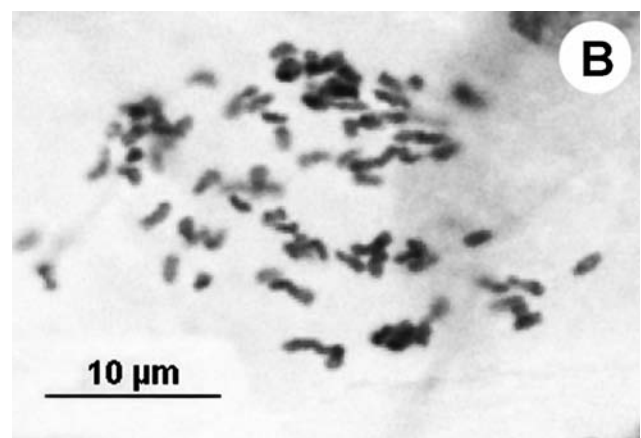
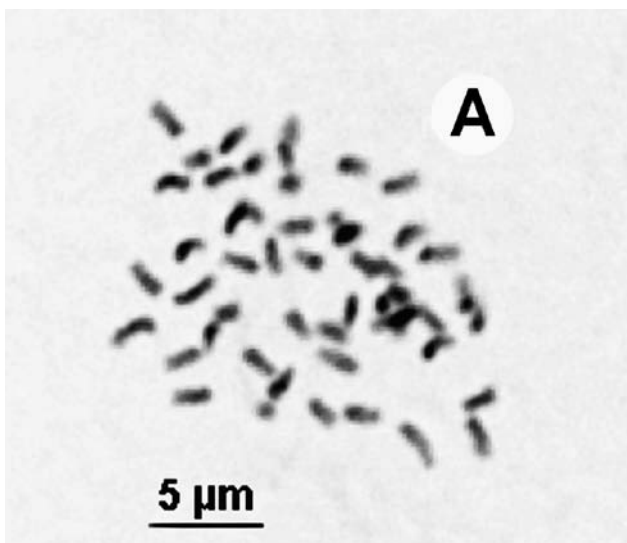


Fig. 5. Microphotographs of metaphase plate of *G. tetragona*: A – subsp. *tetragona* $2n = 4x = 48$; B – subsp. *rhodopea* $2n = 8x = 96$.

References

- Boissier, E.** 1843. Diagnoses Plantarum orientalium novarum. Ser. 1, 2: 8-9.
- Directive 92/43/EEC.** 1992. Council Directive 92/43/EEC of 21 May 1992 on the Conservation of Natural Habitats and of Wild Fauna and Flora. – OJ L 206, 22.07.1992. pp. 7-50.
- Euro+Med Plantbase.** <http://www.emplantbase.org/home.html> (access: 24.02.2014).
- Georgieff, D.** 1997. New taxon plants on Bessapara Hills. – God. Sofiisk. Univ. "St Kliment Ohridski" Biol. Fak., **88**(4): 76-137.
- Gibbs, P. E.** 1968. *Genista* L. – In: **Tutin T. G. & al.** (eds), Flora Europaea. Vol. **2**, pp. 94-100. Cambridge Univ. Press, Cambridge.
- Greuter, W., Burdet, H. M. & Long, G.** (eds). 1989. Med-Checklist. A Critical Inventory of Vascular Plants of the Circum-Mediterranean Countries. Vol. **4**. Dicotyledones (*Lauraceae-Rhamnaceae*). Conservatoire et Jardin botaniques de la Ville de Genève, Med-Checklist Trust of OPTIMA, Genève & Berlin.
- Hayek, A.** 1927. Prodrumus Florae Peninsulae Balcanicae 1. – Repert. Spec. Nov. Regni Veg. Beih., **30**(1): 907-916.
- IUCN.** 2001. IUCN Red List Categories and Criteria: Version 3.1. IUCN Species Survival Commission. IUCN, Gland & Cambridge.
- Janka, V.** 1884. *Genisteae* Europaea. – In: Természetrzaji Füz., **8**(2): 57-73.
- Kovachev, V.** 1900. Materials for the flora of Ruse region. – Trav. Soc. Bulg. Sci. Nat., **1**: 22-61 (in Bulgarian).
- Krusheva, R.** 1975. Reports. – In: Löve, Á. (ed.), IOPB Chromosome Number Reports L. – Taxon, **24**(5/6): 676-677.
- Krusheva, R.** 1986. Reports. – In: Löve, Á. (ed.), IOPB Chromosome Number Reports XCII. – Taxon **35**(3): 610-613.
- Krytska, L., Mosyakin, S., Novosad, V., Fedoronchuk, M., Tsarenko, O. & Shevera, M.** 1999. Typification of species of vascular plants described from Ukraine: Family *Fabaceae* Lindl. – Ukrayins'k. Bot. Zhurn., **56**(6): 606-616 (in Ukrainian).
- Kuzmanov, B.** 1976. *Genista* L. – In: **Jordanov, D.** (ed.), Fl. Reipubl. Popularis Bulgaricae. Vol. **6**, pp. 36-61. In Aedibus Acad. Sci. Bulgaricae, Serdicae (in Bulgarian).
- Melander, Y. & Wingstrand, K.G.** 1953. Gomori's haematoxylin as a chromosome stain. – Stain Technol., **28**: 217.
- Melnyk, V.** 2011. *Genista tetragona*. – In: IUCN 2013. IUCN Red List of Threatened Species. Version 2013.1. <<http://www.iucnredlist.org/>>. Downloaded on 24 February 2014.
- Shishkin, B.** 1945. *Genista* L. – In: **Komarov, V.** (ed.), Flora of URSS. Vol. **11**, pp. 54-69. Editio Acad. Sci. URSS, Moscow-Leningrad (in Russian).
- Stojanov, N. & Stefanov, B.** 1925. Flora of Bulgaria. Ed. 1, vol. **2**. State Printing House, Sofia (in Bulgarian).
- Stojanov, N. & Stefanov, B.** 1933. Flora of Bulgaria. Ed. 2. Guttenberg Press, Sofia (in Bulgarian).
- Stojanov, N. & Stefanov, B.** 1948. Flora of Bulgaria. Ed. 3. Univ. Press, Sofia (in Bulgarian).
- Stojanov, N., Stefanov, B. & Kitanov, B.** 1967. Flora of Bulgaria. Ed. 4, Vol. **2**. Nauka & Izkustvo, Sofia (in Bulgarian).
- Stoyanov, S.** 2005. The vascular flora of the catchment basin of the river Roussenski Lom in the beginning of the 21st century. – Fl. Medit., **15**: 351-383.
- Velenovsky, J.** 1891. Flora Bulgarica. Descriptio et enumeratio systematica plantarum vascularium in principatu Bulgariae sponte nascentium. Prague.
- Velenovsky, J.** 1898. Flora Bulgarica. Supplementum I. Prague.
- Vinichenko, T.** 2006. Plants of Ukraine protected by the Bern Convention. 176 p. Himgest, Kiev (in Ukrainian).
- Visyulina, O.** 1954. *Genista* L. – In: **Zerov, D.** (ed.), Flora of URSS. Vol. **6**, pp. 319-329. Editio Acad. Sci. URSS, Kiev (in Ukrainian).
- Walter, K.S. & Gillet, H.J.** 1997. IUCN Red List of Threatened Plants. Compiled by the World Conservation Monitoring Centre. IUCN. – The World Conservation Union, Gland, Switzerland & Cambridge.