

Chenopodium pratericola (Chenopodiaceae): a new alien species for the Bulgarian flora

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Abstract. *Chenopodium pratericola* Rydb. is reported as a new species for the Bulgarian flora. It was discovered in two localities at the Black Sea Coast. Its chromosome number was counted as $2n = 18$. Information about the species' morphology, habitats, distribution and possible pathways of its introduction in the Bulgarian flora is provided.

Key words: Bulgaria, *Chenopodium pratericola*, distribution, karyology, morphology

Introduction

Along with globalization and expansion of trade relations in the past decade, a tendency for invasion of foreign plant species into the European flora becomes ever more prominent. During field work at the Black Sea Coast, *Chenopodium pratericola* Rydb., a new alien species for the country, has been found. The species is native to a greater part of western and central North America, but has spread with the imported items, especially cereals to many parts of Europe, South America and Asia (Allen 1960; Al-Turki & Ghafoor 1996). So far *C. pratericola* has been found in at least 13 Central, North and East European territories (Uotila 2011), reaching as far as the Ukraine in the south.

Material and methods

Morphological description of the species is based on personally collected data. The morphology of the species was studied by measuring the quantitative and recording the qualitative characteristics of 47 specimens from two studied populations. The following char-

acteristics became object of study: 1. height of plant; 2. length of basal leaf; 3. width of basal leaf (length/width ratio); 4. length of basal leaf petiole; 5. length of middle leaf; 6. width of middle leaf (length/width ratio); 7. length of middle leaf petiole; 8. length of upper leaf; 9. width of upper leaf (length/width ratio); 10. length of upper leaf petiole; 11. number of perianth lobes; 12. length of lobes; 13. width of lobes; 14. diameter of flower; 15. length of seed; 16. width of seed (length/width ratio); 17. thickness of pericarp. The following qualitative features were noted down: colour of stem; type of inflorescence; degree of perianth concrescence; presence of keeled perianth lobes; colour of perianth, seed and pericarp.

For a more detailed study of the perianth and seed morphology and structure of pericarp and seed surface, the Scanning Electron Microscope (SEM) method was used. The electron microscope tests were conducted at the laboratory for X-ray analysis of the Faculty of chemistry and pharmacy at St Kl. Ohridski University of Sofia.

The karyotype characteristics are based on metaphase plates obtained from root tops of seeds germinating in laboratory conditions. The roots were treated and squashed according to Grozeva (2007).

The voucher specimens are deposited in the herbarium of the Institute for Biodiversity and ecosystem research, Bulgarian Academy of Sciences (SOM) and in the herbarium of the Botany section at the Department of Biology and Aquaculture of Trakia University, Stara Zagora.

Results and discussion

Chenopodium pratericola Rydb., Bull. Torrey Bot. Club 39: 310. 1912 (Fig. 1)

Annual, densely to moderately covered with collapsed bladder hairs (Plate I: 1). Stem (7)15.1–61.8(87.7) cm, erect, simple or branched in the middle and upper parts, with longitudinal whitish and green stripes, occasionally slightly reddening at the base. Leaf lamina (0.8)1.6–3.1(4.3) cm × (0.3)0.6–1.1(1.3) cm, often 3-nerved, green or greyish-green on the upper and white-mealy on the lower surface



Fig. 1. Herbarium specimen of *Chenopodium pratericola* from Obzor town (photo K. Srebrevna).

(Fig. 2). Basal leaves [length/width ratio (1.8)1.92–2.8(3.6)] rhombic-ovate to narrowly rhombic-ovate, frequently with a pair of lobes near the base, pointed or acute apex, cuneate base and petioles up to 1.5 cm. Middle leaves [length/width ratio (1.9)2.4–3.3(3.8)] narrowly rhombic-ovate or narrowly ovate, entire, with acute apex, cuneate base and petioles up to 1.2 cm. Upper leaves [length/width ratio (2.2)2.6–3.7(4.5)] narrowly ovate to linear, entire with pointed apex, cuneate base and petioles up to 0.8 cm. Flowers bisexual, sessile or with petioles up to 0.8 mm, 6–10(12) in small glomerules, forming paniculate spikes (Fig. 2). Tepals (perianth segments) 5, (0.8)0.9–1.1(1.3) × (0.5)0.6–0.7(0.9) mm, ovate, entire, with acute apex and two white stripes at the sides, free nearly to the base, usually keeled, covered with collapsed bladder hairs (Plate I: 2), preserved at the fruit and not covering it completely. Stamens 5. Stigmas 2. Pericarp light-yellowish, semi-transparent, not adherent to the seed, with scale-like structure and thickness of 5–8 μm (Plate I: 3-4). Seeds horizontal [length/width ratio 0.9–1.1(1.32)], 0.9–1.2(1.25) mm in diameter, ±oval to flat spherical. Testa (seed coat) black, the sculptural cover on both sides in the shape of deeper longitudinal and shallower transverse notches turning into ±elongated loops (Plate I: 5-6).

Morphological description of the Bulgarian representatives of the species is almost fully consistent with that in *Flora Nordica* (Uotila 2001) and in *Flora of North America* (Clemants & Mosyakin 2003). Bulgarian representatives differ from the rest only in the length of the leaf lamina, which is shorter. The size of their seeds is closer to the



Fig. 2. *Chenopodium pratericola* – branch with leaves and inflorescences (photo K. Srebrevna).

Plate I.

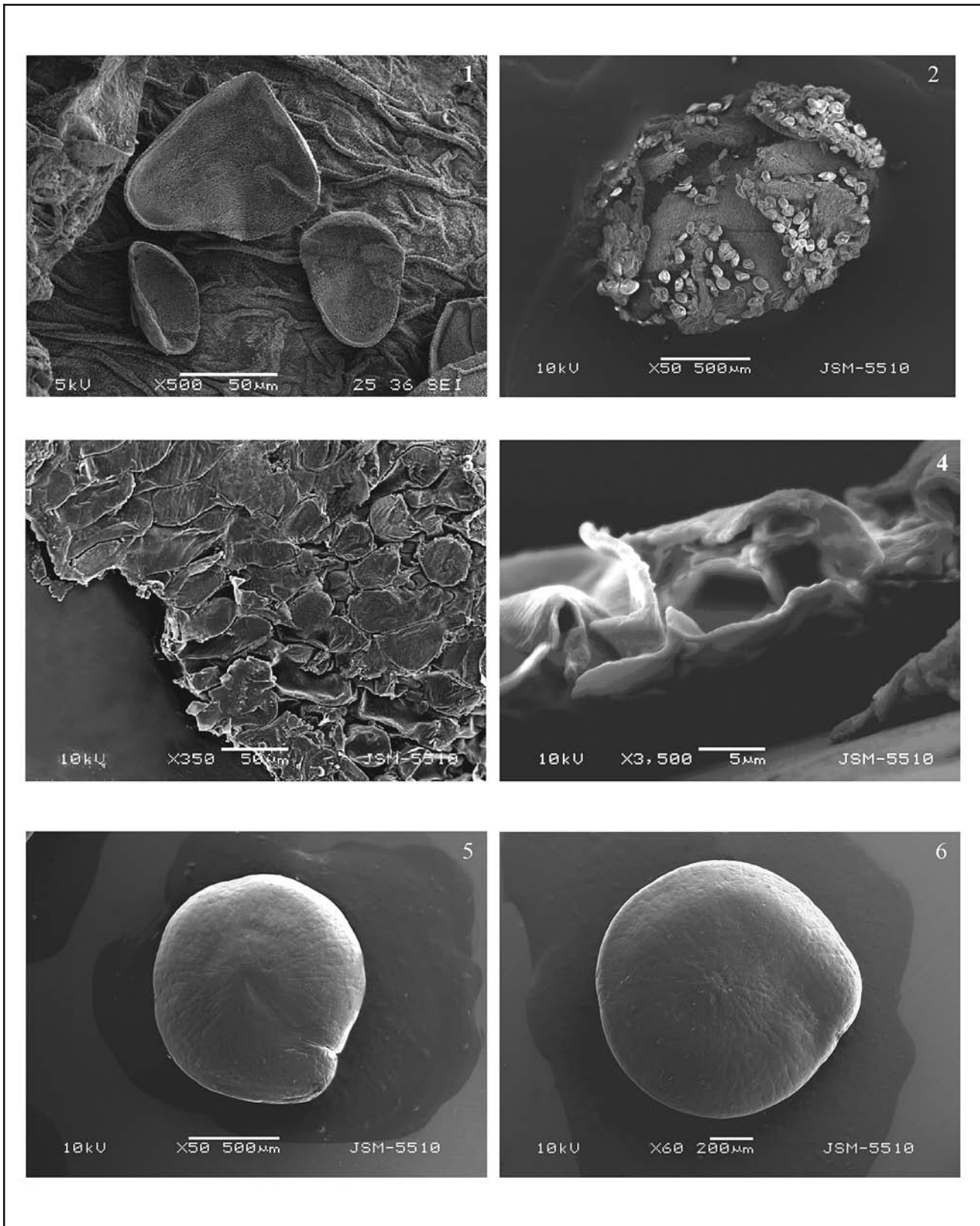


Plate I. Scanning electron micrographs of *Chenopodium pratericola*: 1, Collapsed bladder hairs; 2, Flower; 3-4, Pericarp; 5-6, View of the seed from the lower surface (5) and the upper surface (6).

size of the seeds of the North American representatives, and the length of leaf petiole – to that of the European representatives.

Phenology. Flowering and fruiting from July to October.

Karyology. $2n = 18$ (Fig. 3.). The karyotype of the two studied populations consists of meta- and submetacentric chromosomes. The chromosome number counted in the Bulgarian material corresponds to the data reported by Kjellmark (1934), Basset & Crompton (1982), and Stepanov (1994).

Distribution in Bulgaria. The species has been found in the following two localities (Fig. 4.): the Black Sea Coast (*Northern*), Obzor town, near the coastline north of the town, 18.08.2010, 22.09.2011 at 1 m, 42°49'43"N 27°52'55"E, NH 74 (SOM 168462, 168463); the Black Sea Coast (*Southern*), Ahtopol town, near the coastline south of the town, 12.09.2007, 17.09.2008, 05.09.2009, 23.09.2011, at 6 m, 42°05'40.15"N 27°56'59.98"E, NG 76, Grozeva (SOM 163847, 163848, 168459, 168460, 168461).

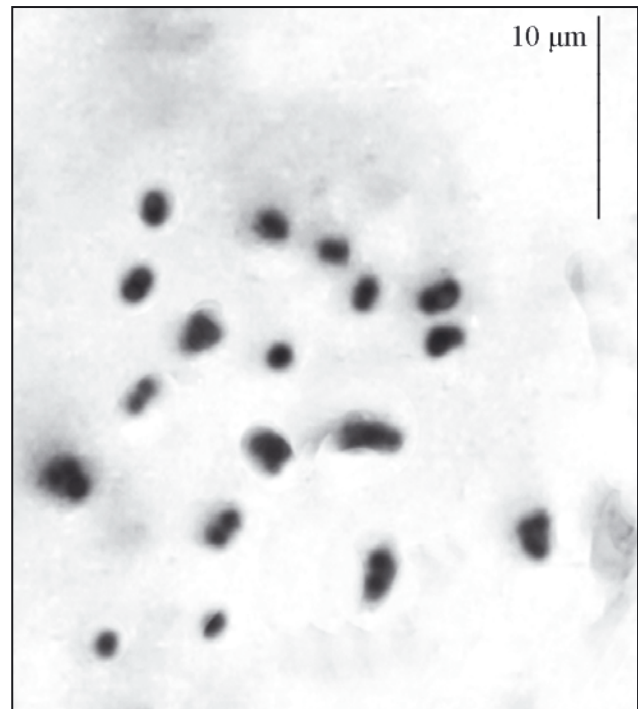


Fig. 3. Microphotograph of the metaphase plate of *Chenopodium pratericola*, $2n = 18$.

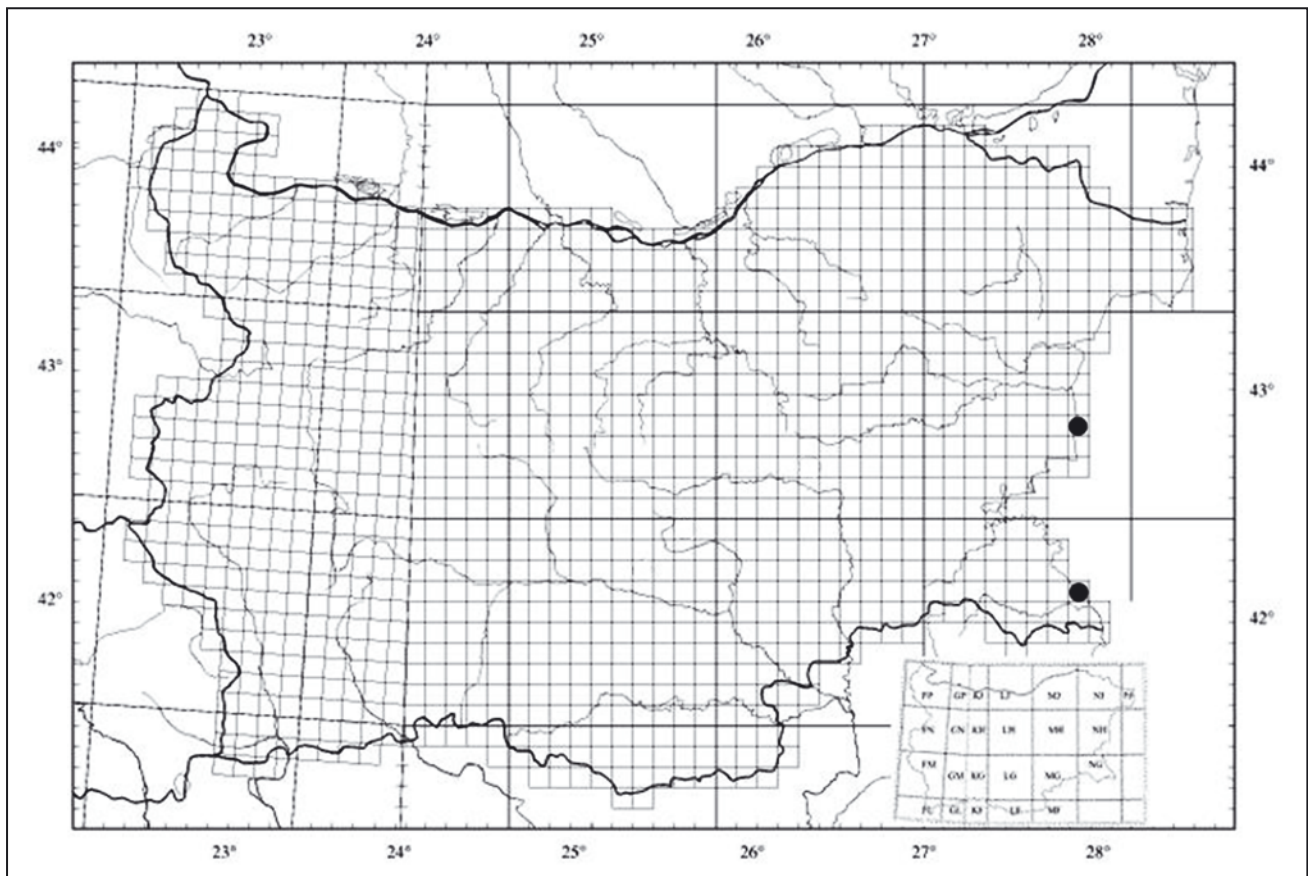


Fig. 4. Distribution map of *Chenopodium pratericola* in Bulgaria. The localities given on a UTM grid map of Bulgaria, according to Kožuharov & al. (1983).

Habitat and population data. The two registered populations of the species were located on open sandy soils, not far from the seashore, in close proximity to two of the tourist settlements at the Black Sea coast. The open sandy soils and saline or alkaline habitats are typical habitats for the species in its homeland, North America (Clemants & Mosyakin 2003). In Europe, *C. pratericola* is mainly recorded in waste places, ports, chicken-runs, along railways and roadsides (Uotila 2001; Mosyakin & Yavorska 2002; Yavorska 2009). The Bulgarian population of the species was not localized in typical waste places, but throughout the period of study significant anthropogenic impact has been recorded (trampling, contamination with household and construction waste, etc.)

The population on the beach of Ahtopol town was observed in 2007, 2008, 2009, and 2011. It covered an area of 380–400 m² and had a relatively constant number of 42–47 individuals throughout the years of study. The plants were scattered singularly, or in groups of two or three in a ruderal population dominated by *Cynodon dactylon* (L.) Pers. The accompanying species were *Salsola ruthenica* Iljin, *Datura stramonium* L., *Polygonum maritimum* L., *Ecballium elaterium* (L.) A.Rich., etc. Regardless of the high seed production of the species noted during our observations, the relatively constant number of the population is mostly explained by the failure of seeds to mature. Only 35–40% of seeds managed to reach full maturity and most of them, due to the close proximity to the sea, have been carried away by the sea waves. An additional factor was the low competitiveness of the species, as compared to the aggressive species *Cynodon dactylon* dominating in the population.

The population on the beach of Obzor town was observed in 2010 and 2011. It covered an area of 100 m² and numbered seven specimens in the first and 15 specimens in the second year of the study. The plants were scattered singularly along the coastal sands, along with *Crambe maritima* L., *Polygonum maritimum* L., *Chenopodium polyspermum* L., etc. *Salsola soda* L. and *S. ruthenica* prevailed in the population. The small number of the population is mainly explained as in the above case by the small percentage of seeds reaching maturity and their proximity to the sea, while the recorded increase most probably results from lack of aggressive perennial species in the population.

Possible pathways of introduction into the Bulgarian flora. In the past 20 years, 20 alien species occurring naturally in North America have been introduced into the Bulgarian flora, the greatest number belonging to the *Asteraceae* family: seven species (Petrova & al. 2012). For the specified period, two new species have been found from the *Chenopodiaceae* family: *Chenopodium probstii* Aellen and *Chenopodium missouriense* Aellen (Grozeva 2010). The main pathways along which foreign species enter the Bulgarian flora are the big rivers, the Black Sea and the Danube river ports, international highways and railways (Petrova & al. 2012).

The first recorded population of *C. pratericola* near the town of Ahtopol is 14 km off the international highway E87, and 88 km southwards of the port of Burgas. The second population of the species near the town of Obzor is in close proximity to international highway E87, 65 km southwards of the port of Varna and 74 km northwards of the Port of Burgas. The distance between the two populations is 162 km and, owing to their geographical remoteness and isolation, most probably they have emerged independently from each other.

C. pratericola, considered a casual grain and cotton alien (Uotila 2001), presumably has reached the territory of the country via import of grain and/or other agricultural goods. In support of this assumption, a survey has been planned in search of a population located further northwards than the currently recorded ones, especially around the ports of Varna and Burgas. Bearing in mind that the closest recorded localities of *C. pratericola* to Bulgaria are in the Ukraine and Russia and that part of the import of corn and wheat to Bulgaria in the past 15 years has come namely from these two countries, we could assume that it has entered the Bulgarian flora from East Europe. Possibly, it could have been also introduced via the imported agricultural products from the EU member countries, such as Poland. Bearing in mind similarity of the species habitats in Bulgaria and in its homeland, we should not eliminate a possibility of its introduction through import of grain and/or other agricultural products directly from North America. Transmission of *C. pratericola* seeds by foreign tourists (luggage, vehicles, etc.) cannot be ruled out, too, since both recorded populations are in close proximity to some of the most frequented resort areas at the Bulgarian Black Sea coast.

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