

Two alien species of *Bidens* (Asteraceae) new to the Bulgarian flora

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Abstract. Two new alien species of *Bidens* have been recorded in Bulgaria. *Bidens bipinnatus*, native to South America, was found at the railway station and harbour in the city of Varna, the Black Sea Coast floristic region. *Bidens vulgatus*, native of North America, was recorded in several places near the Danube River in the Danubian Plain floristic region. The article presents the currently known distribution of the species in Bulgaria and some notes on the habitats of the taxa. Both species are illustrated. A key to all Bulgarian species of *Bidens* is provided.

Key words: alien species, *Bidens bipinnatus*, *Bidens vulgatus*, Bulgaria, *Compositae*

Introduction

Until recently, the genus *Bidens* (Asteraceae) has been believed to comprise two native species – *B. cernuus* L. and *B. tripartitus* L., and the alien *B. frondosus* L. – in the Bulgarian flora (Assyov & Petrova 2006). Studies in 2009, particularly on the alien flora of Bulgaria, have revealed that this genus is represented by at least two more species: *B. bipinnatus* L. and *B. vulgatus* Greene.

Material and methods

Morphological characters were registered from the plant material collected from the Bulgarian populations and compared with the data from relevant literature sources (Tutin 1976; Strother & Weedon 2006; Sirbu & Oprea 2008). Herbarium specimens were deposited in the Herbarium (SOM) of the Institute of Botany, BAS. Data about populations and habitats are based on visual observations.

Results and discussion

Key to the Bulgarian species of *Bidens* is provided below:

1. Lower and middle cauline leaves simple or lobed, but lobes not petiolulate 2
- 1*. Lower and middle cauline leaves pinnate, with petiolulate pinnae 3
2. All leaves simple (but strongly serrate); peduncles recurved just below the capitula; ligulate florets often present, conspicuous, yellow *B. cernuus*
- 2*. At least the lower leaves with 1–2 pairs of lobes; peduncles not recurved; ligulate florets absent *B. tripartitus*
3. Leaves 2(3)-pinnate; achenes linear, tetragonal, with (2)3–4 bristles *B. bipinnatus*
- 3*. Leaves 1-pinnate; achenes oblong-obovate to cuneate-obovate, flattened, with 2 bristles 4
4. Upper leaves usually with 3 (seldom 5) leaflets; outer phyllaries 5–8(10) *B. frondosus*
- 4*. Upper leaves with 5 leaflets; outer phyllaries 10–16(21) *B. vulgatus*

***Bidens bipinnatus* L., Sp. Pl. (1753) 832 (Fig. 1)**

Annual, 10–120 cm high, almost glabrous. Stem 4-angled, branched. Leaves opposite, long petiolate, sparsely hairy on the veins beneath, with up to four pairs of pinnae, the lower of which are also deeply lobed; ultimate segments ovate to rhombic-lanceolate, cuneate at base, entire or dentate. Capitula solitary, 6–8.5 × 5–6.5 mm (in flowering stage), erect; peduncles 2–10 cm; outer involucre bracts shorter than inner, herbaceous, all bracts linear-lanceolate to oblong. Receptacular scales shorter than the achenes, linear, scarious, with dark longitudinal lines. Flowers about as long as the involucre; ligulate florets 0–4, 2–3 mm long, yellow; disc florets with yellowish corolla. Achenes brown-blackish, the outer 8–10 mm, the inner 10–18 mm long, linear; pappus of (2)3–4 bristles, 2–4 mm long. Flowering in August to October, fruiting in September to October.

The species is native to South America. It was introduced in Europe in the 18th century (see references in Sirbu & Oprea 2008) and is currently naturalized or recorded as casual in numerous European countries, including in some close or adjacent to Bulgaria territories, e.g. Croatia, Hungary, Montenegro, Romania and Slovenia (Greuter 2006–2009, 2008).

Distribution in Bulgaria (Fig. 2)**Black Sea Coast (Northern):**

1. Varna, railway station, 43.20098°N, 27.90023°E, NH-78, ca. 20 m, 31.08.2009, coll. A.S. Petrova (SOM 165330, 165331, 165332) and 02.10.2009, coll. A.S. Petrova, V. Vladimirov & I. Yankov (SOM 165344, 165345);
2. Varna, Varna Harbour – East, 43.19598°N, 27.90740°E, NH-78, ca. 10 m, 02.10.2009, coll. A.S. Petrova, V. Vladimirov & I. Yankov (SOM 165346, 165347).

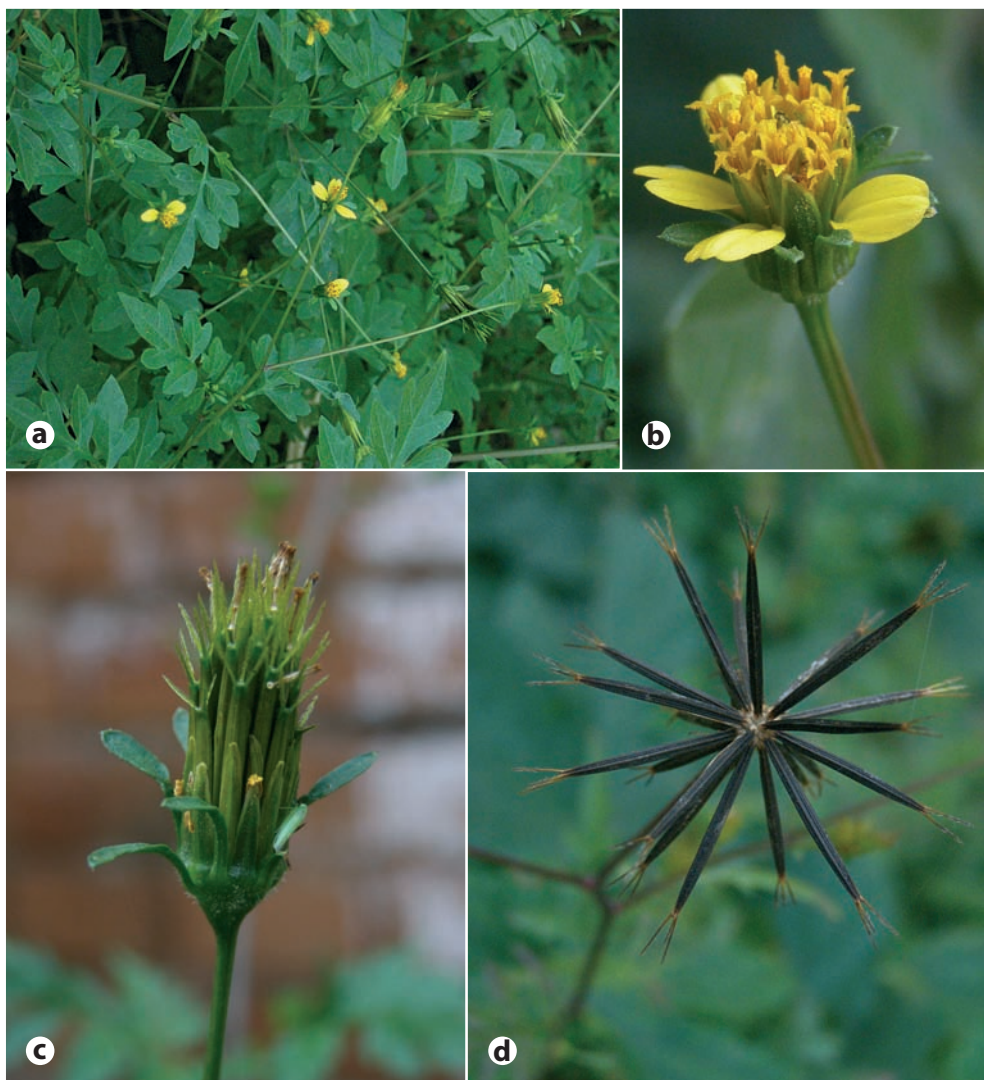


Fig. 1. *B. bipinnatus*:
a – Plant habit;
b – Flowering capitula;
c – Young fruits;
d – Ripe fruits
 (photos A.S. Petrova).

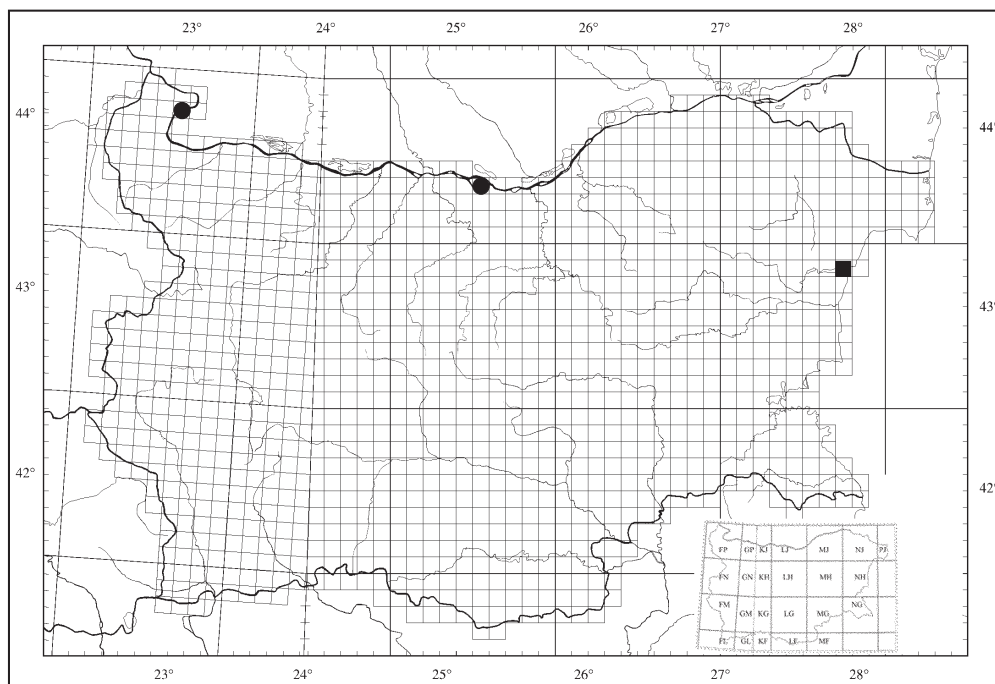


Fig. 2. UTM-distribution map of *Bidens vulgatus* (●) and *B. bipinnatus* (■).

Both subpopulations have significant area and are ample in numbers. Distance between the endmost recorded plants along the railroad tracks is 1.3 km, the width varies up to 0.35 km. Space structure is uneven. Although *B. bipinnatus* grows on drier places, as compared to most species of genus *Bidens*, it prefers partially shady places, with comparatively damp soil. It is locally abundant near some buildings (engine-repair depot of the railway station and harbour warehouses), near walls, under bridges, etc. and is absent from sunny, dry places. Several hundred (to more than a thousand) flowering and fruiting specimens were noted in each of the two localities.

Other alien and/or ruderal species were found in close proximity: *Ailanthus altissima*, *Amaranthus albus*, *A. retroflexus*, *Ambrosia artemisiifolia*, *Crepis foetida*, *Cynodon dactylon*, *Erigeron canadensis*, *E. sumatrensis*, *Galinsoga parviflora*, *Kochia scoparia*, *Salsola ruthenica*, *Digitaria sanguinalis*, *Setaria* spp., etc.

Taking into consideration the number of individuals and occupied territory, it can be inferred that *B. bipinnatus* was introduced more than a decade ago. In Europe, it is a characteristic wool alien (Stace 1997). It is difficult to decide how it got unintentionally introduced in Bulgaria. Considering the observed human activities and mobility in the area, it can be presumed that other populations may exist in the Varna urban area.

Mowing and herbicides are used to control the weedy vegetation in the area of the railway station.

Our observations have shown that the cut *B. bipinnatus* plants branch abundantly from the base and soon afterwards flower and fruit again. In the area of the platforms, small individuals of *B. bipinnatus* survive the chemical treatment in the shade of the platform wall. Thus efforts to control the weeds at Varna railway station are not really effective for this species.

***Bidens vulgatus* Greene, Pittonia 4 (1899) 72 (Fig. 3)**

Annual, 50–100(150) cm high, almost glabrous. Stem \pm 4-angled, branched. Leaves opposite, long petiolate, pinnate, with two pairs of lateral stalked pinnae and a larger terminal pinna; pinnae oblong-lanceolate to ovate, acute, coarsely serrate, the lowest pinnae occasionally lobed. Capitula usually solitary (seldom 2–3), erect, in fruiting stage hemispheric or wider than long, 11–16 \times 12–25 mm; peduncles (1)4–15 cm; outer involucre bracts 10–16(21), 10–20(40) mm long, ascending to spreading, herbaceous, spatulate to linear, seldom foliaceous, hispid-ciliate, the inner ovate-oblong. Receptacular scales shorter than the achenes, linear, scarious, with dark longitudinal lines. Flowers as long as the involucre; ligulate florets 0–4(5), 2–3 mm long, inconspicuous, pale-yellow; disc florets with yellowish corolla. Achenes brown to stramineous, the outer 6–10 mm, the inner 8–12 mm long, obovate to cuneate, \pm flattened; pappus of 2 bristles, 3–4(7) mm long, erect to divergent. Flowering in August–September, fruiting in September–October.

The species is native to North America. It was introduced to Europe in the mid-20th century and first recorded in France and Romania (Tutin 1976). Now the species is spread across several European countries, including the Balkan Serbia and Slovenia (Greuter 2006–2009, 2008).

Distribution in Bulgaria (Fig. 2)

Danubian Plain:

1. Near the town of Vidin, in a damp place at the road to the ferry harbour, close to the border customs office, 44.00719°N, 22.90359°E, FP-57, 21.09.2009, coll. V. Vladimirov (SOM 165348, 165349, 165350);
2. Near the town of Vidin, on the bank of Danube River close to the ferry complex, 44.00869°N,



- 22.93702°E, FP-57, 21.09.2009, coll. V. Vladimirov (SOM 165351, 165352);
3. On the bank of Danube River N of the road from Belene to Svishtov, ca. two km E of Belene town, 43.63926°N, 25.15254°E, 01.10.2009, LJ-53, coll. V. Vladimirov & A.S. Petrova (SOM 165353, 165354, 165355, 165356).

Hundreds of flowering and fruiting specimens were observed in each of the three localities. In the third locality, plants were found also in the belt between the river bank (here 2.5–3.5 m high) and the preventive dike, an area with abundant weedy vegetation. It grew together with the North American *Bidens frondosus*, from which it differed during that season, among the other characters (see the determination key above), by the green stem and leaves, whereas *B. frondosus* usually had reddish stems and leaves. Other visual differences are the larger heads and achenes. According to Crowe & Parker (1981), *B. vulgatus* grows in drier sites than *B. frondosus*, including gravel areas and cracks in the asphalt and cement roads and pavements.

Bidens vulgatus was probably repeatedly introduced by the waters of the Danube and further spread along the banks (the distance between the presently known localities in Bulgaria is over 220 km).

The populations of both species are viable and persistent, without further introduction or intervention by humans, which implies that the species may be considered naturalized in the sense meant by Richardson & al.



Fig. 3. *B. vulgatus* Greene: a – Plant habit; b – Upper part of stem with the synflorescence; c – Flowering capitula (photos V. Vladimirov).

(2000). Both species have abundant seed-set and some very effective means for dispersal through achene adhesion to cloth, animal fur or wool (Fig. 4). They are widespread across the world, especially in regions with climatic conditions similar to the Bulgarian, which means that the species can be regarded as potentially invasive in the Bulgarian flora. *Bidens* is among the richest genera in the European alien flora, with 10 alien to Europe species (Lambdon & al. 2008). Very likely their other species, e.g. *B. connatus* Willd. and *B. pilosus* L. (Greuter 2006–2009) growing in the neighbouring countries, are also introduced in the Bulgarian flora. *Bidens ferulifolius* (Jacq.) DC., which has larger yellow ligulate flowers and narrow linear lobes of the leaves, is occasionally cultivated as ornamental and thus is a potential alien to the Bulgarian flora.



Fig. 4. Means of dispersal of *B. bipinnatus*: V. Vladimirov's shoe after passing through the locality of the species (photo A.S. Petrova).

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