

National reporting of Bulgaria about the invasive alien plants of EU concern in relation to Regulation (EU) 1143/2014

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Abstract. Regulation (EU) No 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species, Article 24(1), obliges the EU Member States to report by 1st June 2019, and every six years thereafter, the distribution of the invasive alien species of Union or regional concern. Currently, the List of invasive alien species of EU concern comprises eight species which are present in the Bulgarian flora. Of these, five species were included in the first national report: *Asclepias syriaca*, *Elodea nuttallii*, *Heracleum mantegazzianum*, *Impatiens glandulifera*, *Pennisetum setaceum*. The article presents the presently known distribution of these species in the Bulgarian flora and provides some guidance for gathering and publishing of new chorological records and data about the population size of these species in Bulgaria.

Key words: Bulgarian flora, mapping, Regulation (EU) 1143/2014, species distribution.

Introduction

Invasive alien species (IAS) are widely recognized as one of the major threats to biodiversity (e.g. Scalera & al. 2012; Roy & al. 2018). In response to this, the European Parliament and the Council of the European Union adopted Regulation (EU) No 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species. The later came into force on 01 January 2015. The core of this document is the *List of invasive alien species of Union concern* (Article 4). The first List was compiled, published and entered into force on 3 August 2016 (CIR 2016) based on comprehensive risk assessment and analysis of the available scientific data. Since then, the List has been updated twice: the first

update entered into force on 02 August 2017 (CIR 2017), and the second one – on 15 August 2019 (CIR 2019). The current consolidated List comprises a total of 66 species of which 36 (54.5%) are vascular plants.

The increased attention to alien and invasive alien species in Europe during the past two decades stimulated growing of the research interest to these species in Bulgaria as well. During the past decade, floristic studies in the country resulted in the discovery and reporting of numerous alien species for the first time for the Bulgarian flora (cf. Table 1 in Petrova & Vladimirov 2018). For example, only for the past 3 years, more than 20 new alien taxa have been recorded for the first time in the Bulgarian flora, e.g. *Acalypha australis* (Petrova 2017a), *Ammannia coccinea* (Vladimirov & al. 2017), *Cyperus eragrostis* (Stoyanov & Barzov 2018), *Hemerocallis fulva*, *Oxalis articulata* and *Phalaris*

arundinaceae var. *picta* (Petrova & Vladimirov 2019), *Hieracium petraeum* (Vladimirov 2018), *Larix decidua* (Petrova & Gerasimova 2017), *Oenothera laciniata* (Petrova & Barzov 2017), *Opuntia engelmannii* and *O. fragilis* (Naydenova & al. 2019), *Pinus pinaster* (Petrova & al. 2017), *Rosa rugosa* (Vladimirov & al. 2018), *Stachys byzantina* (Petrova 2017b), *Cosmos bipinnatus*, *Oenothera speciosa*, *Sedum sarmentosum* and *Tagetes patula* (Petrova 2017c), *Tulipa agenensis* (Stoyanov & Raycheva 2018), etc., including some which are of EU concern, e.g. *Heracleum mantegazzianum* and *H. sosnowskyi* (Vladimirov & al. 2019), *Humulus japonicus* (Vladimirov 2019). At present, the *List of invasive alien species of EU concern* comprises 8 vascular plant species which have been recorded in Bulgaria: *Ailanthus altissima* (Mill.) Swingle, *Asclepias syriaca* L., *Elodea nuttallii* (Planch.) St. John, *Impatiens glandulifera* Royle (cf. Petrova & al. 2013), *Pennisetum setaceum* (Forssk.) Chiov. (Velchev & Petrova 2011), *Heracleum mantegazzianum* Sommier & Levier, *H. sosnowskyi* Manden., *Humulus japonicus* Siebold. & Zucc. (syn. *H. scandens* (Lour.) Merr.)

Article 24(1) of the Regulation 1143, obliges the EU Member States to report by 1st June 2019, and every six years thereafter, the distribution of the invasive alien species of Union or regional concern. The first national report was submitted on 01 June 2019 and covered the alien species included in the Union List by 31 December 2018, i.e. the following five species: *Asclepias syriaca*, *Elodea nuttallii*, *Heracleum mantegazzianum*, *Impatiens glandulifera*, and *Pennisetum setaceum*.

The aim of the present article is to present the current distribution and habitat preferences of four of the above mentioned five species, as well as to discuss the major information-gaps and challenges for the next national reports. The data about *E. nuttallii* will be presented elsewhere.

Material and methods

Data about the distribution and habitat preferences of the species were collected from all available sources – published articles, project reports, existing collections (herbaria SO, SOA and SOM), as well as from field studies. Habitats have been determined according to the EUNIS classification (Davies & al. 2004; EEA, <https://eunis.eea.europa.eu/habitats-code-browser.jsp>).

Results and discussion

The species below are presented in alphabetical order.

Asclepias syriaca L. (Asclepiadaceae)

A North-American species which was first reported for Bulgaria in 1948 (Stojanov & Stefanov 1948). So far it has been recorded in the following floristic regions: Northeast Bulgaria, Danubian Plain, Forebalkan, Sofia region, Mt Belasitsa (needs confirmation), Valley of River Mesta, Rila Mts, Mt Sredna Gora (*Western*), Thracian Lowland and Tundzha Hilly Country (see Annex 1; Fig. 1).

The species is cultivated rarely in the country as an ornamental plant. It inhabits man-made or disturbed habitats – waste places, along roads and railways, canals, at the margin of forests and farmland (Petrova & al. 2013). Following the EUNIS classification, the habitats belong to the following types: **E2.7**: Unmanaged mesic grassland; **E5.1**: Anthropogenic herb stands; **J4.1**: Disused road, rail and other constructed hard-surfaced areas; **J4.2**: Road networks; **J4.3**: Rail networks; **X07**: Intensively-farmed crops interspersed with strips of natural and/or semi-natural vegetation; **X22**: Small city centre non-domestic gardens.

Heracleum mantegazzianum Sommier & Levier (Apiaceae)

The species is native to the Western Caucasus (Nielsen & al. 2005). The species was first recorded in Bulgaria in 2017 (Vladimirov & al. 2017, sub *H. sosnowskyi*). So far it has been reported from Sofia region and Rhodopi Mts (*Western*) floristic regions (Annex 1; Fig. 2).

The pathways for the introduction of the species to Bulgaria are not known yet. It grows in riparian vegetation dominated by *Salix* spp. and in strongly modified semi-natural grassland in urban environment. Following the EUNIS classifications, the species inhabits the following types of habitats in Bulgaria: **F9.1**: Riverine scrub; **G1.1**: Riparian and gallery woodland, with dominant *Alnus*, *Betula*, *Populus* or *Salix*; **X23**: Large non-domestic gardens.

Impatiens glandulifera Royle (Balsaminaceae)

The species is native to the Himalayas (Hejda 2009). In Bulgaria the species was first recorded as a naturalised garden escape in 1978 (Petrova & al. 2013). So far it

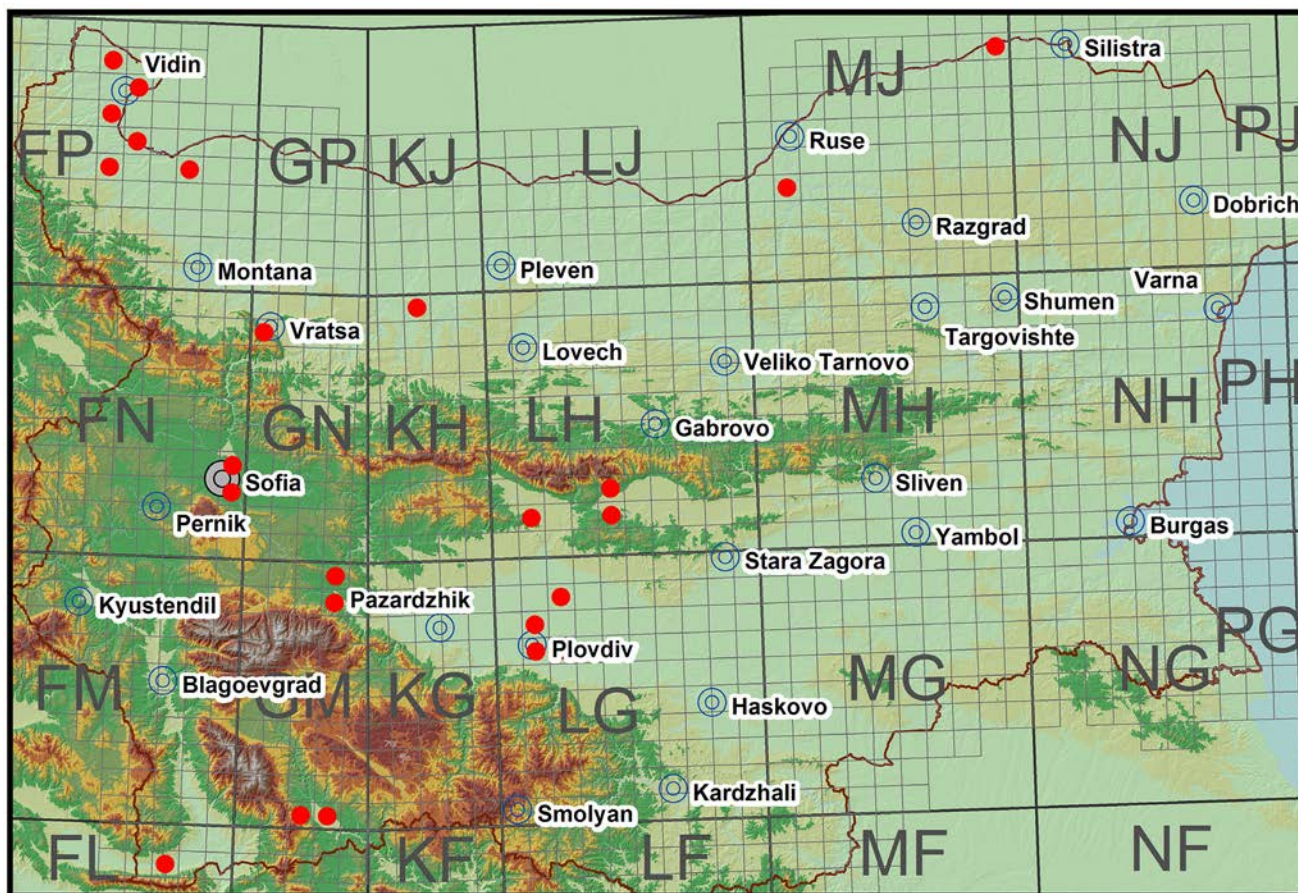


Fig. 1. UTM (10 × 10 km) distribution map of *Asclepias syriaca*.

has been reported in the following floristic regions: Forebalkan, Balkan Range (*Western, Central*), Sofia region, Vitosha region, Znepole region, West Frontier Mts, Valley of River Struma, Valley of River Mesta, Rila Mts, Mt Sredna Gora (*Western*), Rhodopi Mts (*Western, Central*), Thracian Lowland (Annex 1; Fig. 3).

The species is cultivated as an ornamental in many parts of the country, mainly in villages in mountainous regions. It commonly escapes from cultivation. Most often viable seeds of the species are discarded with the garden waste to dump sites and riversides, where it establishes and further colonizes suitable habitats nearby. It grows in riparian vegetation, wet roadsides, wet disturbed sites, damp to wet forest edges, wet places in settlements. It has been recorded in the following EUNIS habitat types in the country: **C3.6:** Unvegetated or sparsely vegetated shores with soft or mobile sediments; **E5.4:** Moist or wet tall-herb and fern fringes and meadows; **F9.1:** Riverine scrub; **G1.1:** Riparian and gallery woodland, with dominant *Alnus*, *Betula*, *Populus* or *Salix*; **J4.2:** Road networks; **J5.4:** Highly artificial non-saline running waters.

Pennisetum setaceum (Forssk.) Chiov. (*Poaceae*)

The species was first reported for Bulgaria by Velchev & Petrova (2011) from the Black Sea Coast (*Northern*) floristic region. It grows in the EUNIS habitat: **J4.2:** Road networks; **X22:** Small city centre non-domestic gardens. However, the plants in the mentioned locality differ from the typical *P. setaceum* by being very laxly caespitose to long-rhizomatous perennials, not forming tufts, and by some other characters. Further studies are in progress to correctly identify the species. At present, the occurrence of *P. setaceum* in Bulgaria is doubtful and needs confirmation.

Recommendation for publishing the chorological information about IAS of EU concern in Bulgaria

The IAS report format under Article 24(1) of Regulation 1143/2014 consists of three distinct sections: **A).** Information on IAS of Union concern and IAS of regional concern; **B).** Information on IAS of Member State concern; **C).** Horizontal information. The distribution data and the state of the populations of the invasive alien species are relevant and reported

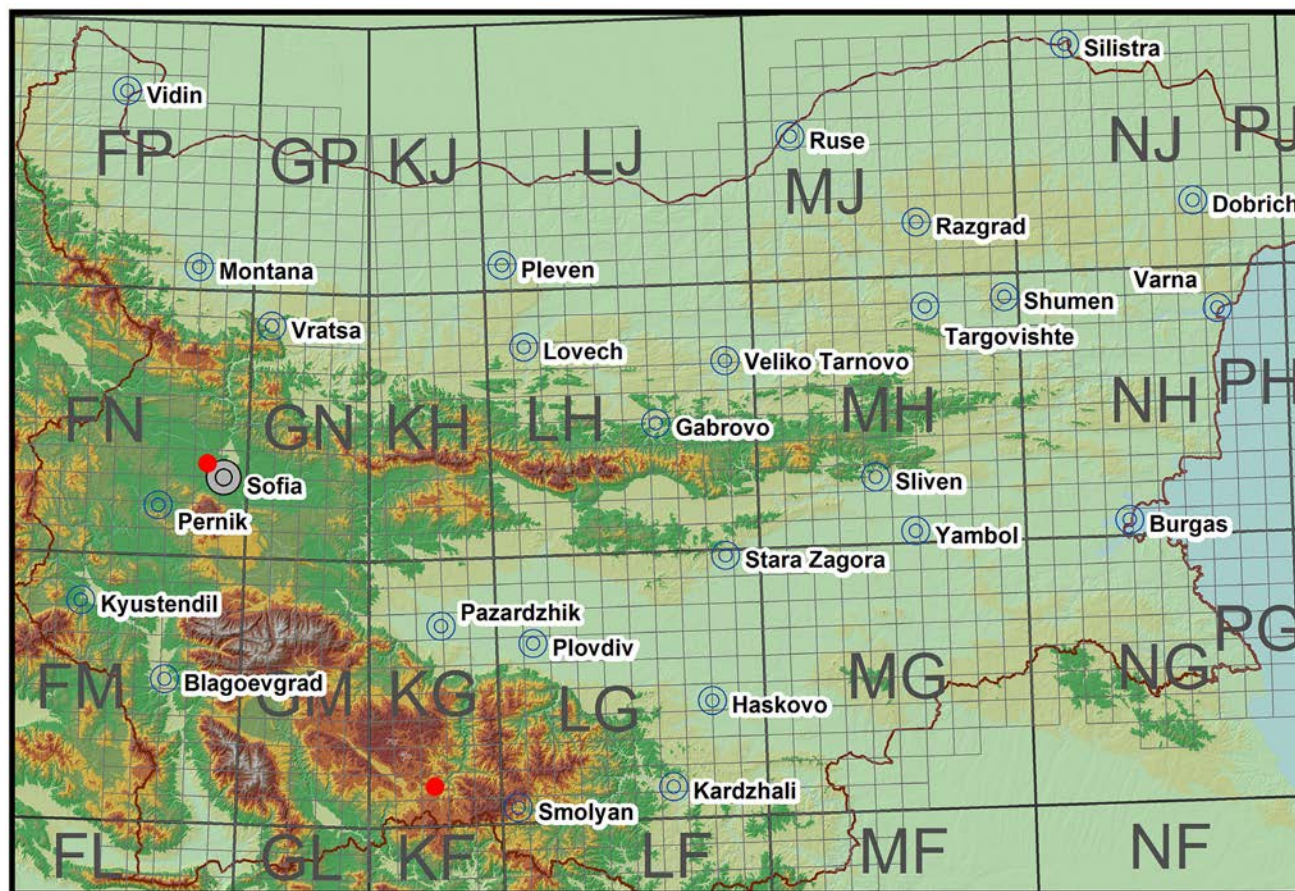


Fig. 2. UTM (10 × 10 km) distribution map of *Heracleum mantegazzianum*.

under section A. Analysing the distribution data of the species mentioned above, two major information-gaps can be highlighted: 1) the precise location of most of occurrences is not known, and 2) there is no data about the size of the recorded populations. Thus, the existing chorological information is rather inadequate for planning and implementing any control measures. It is firmly believed that this paper will stimulate further gathering and publishing of primary field data about the IAS of vascular plants of EU concern in Bulgaria. The series 'New floristic records in the Balkans' published in *Phytologia Balcanica* provides an excellent opportunity for reporting of such data. It is recommended that at least the following information is provided (minimal requirements) when publishing new chorological data: scientific name of the species and family, precise description of the locality (incl. mention of the nearest settlement), altitude, unprojected geographic coordinates in decimal degrees format (commonly referred as DD format in GPS receivers), date of collection/observation, name of collector/observer, herbarium where a herbarium specimen is deposited or a photo of the

species from the particular locality (the photo/photos must be of a sufficient quality to enable unambiguous identification of the species), data about the population size of the species in the particular locality. The population size may be presented as the actual number of specimens/flowering shoots/vegetative shoots, etc. (when they can be counted, e.g. when less than 100) or providing some classes of number of units, e.g. a few hundred (100 to 500 specimens/units), several hundred (500–1000), a few thousands (1000–5000), many thousands (over 5000); when counting is not a feasible option, the population size may be presented as the actual cover of the species in the locality in m² or ha (including the number of the occupied spots and the approximate size of the spots, or at least the range of the spot-cover – the minimal size and the maximal size of the occupied spots). Additionally, information about the impact of the species may be provided in cases when this is obvious in the field, e.g. the invasive species grows in close proximity to a plant species of conservation concern and negative impact is suspected or projected, or a habitat of conservation concern is affected, etc.

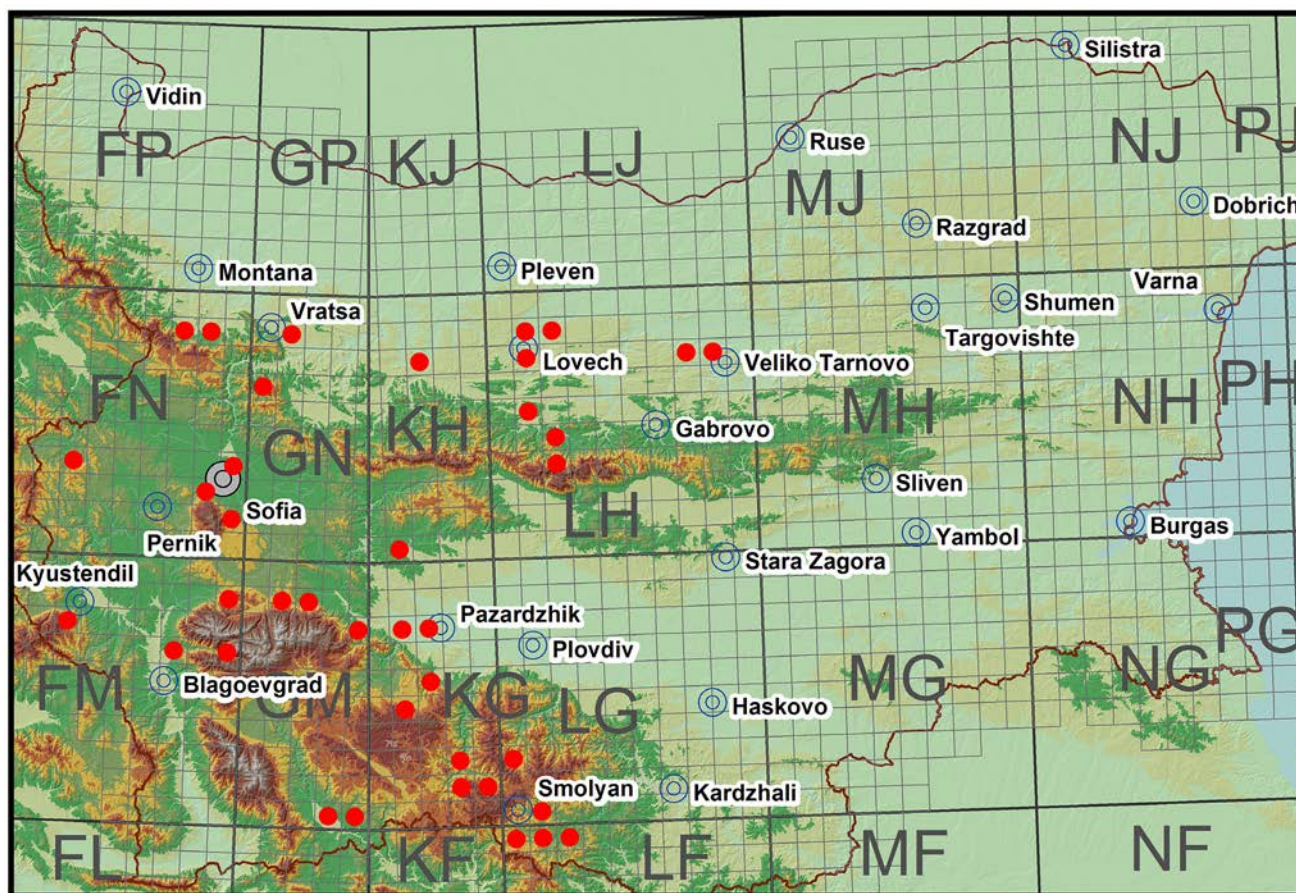


Fig. 3. UTM (10 × 10 km) distribution map of *Impatiens glandulifera*.

New chorological information is welcome to be published for any of the IAS plants of EU concern irrespective whether the species has already been published for the particular floristic region or subregion. It must be demonstrated that the new locality is clearly distinct from the already reported ones (e.g. it lies at least 5 km away from the previously reported localities, or it is in a different water basin, river valley, etc.). An exception must be made for the widespread and already very common invasive alien species, such as *Ailanthus altissima*. In these cases, new chorological data are wel-

come only when: 1). The species is new for a particular protected area; 2) the species is new for a particular site of the NATURA 2000 network in Bulgaria.

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Annex 1. List of the localities of the IAS species of EU concern in Bulgaria.

| No. | Locality | UTM coordinates | GPS coordinates | Data source |
|--------------------------|--|-----------------|----------------------------|--------------------------|
| ASCLEPIAS SYRIACA | | | | |
| 1. | Bulgaria, Northeast Bulgaria : by River Danube near Garvan village, Silistra district, 10.06.1989, coll. G. Baeva (SOM 147350) | MJ98 | not available | Herbarium specimen (SOM) |
| 2. | Bulgaria, Northeast Bulgaria : in the Smesite locality at the confluence of Beli Osam and Cherni Osam rivers, E of Ivanovo village, Ruse district, 60–65 m a.s.l., 26.07.2014, V. Vladimirov obs. | MJ13 | 43.684743°N 26.000170°E | V. Vladimirov (unpubl.) |
| 3. | Bulgaria, Danubian Plain : on the dyke of River Danube, E of Dunavtsi town, 2010, K. Petkova obs. | FP46 | not available | K. Petkova (pers. comm.) |

Annex 1. Continuation.

| No. | Locality | UTM coordinates | GPS coordinates | Data source |
|---------------------------------|--|------------------------------|----------------------------|--|
| 4. | Bulgaria, Danubian Plain : by a forest left of the road from Florentin to Novo Selo villages, ca. 105 m a.s.l., 11.07.2011, V. Vladimirov obs. | FP48 | 44.14229°N 22.81713°E | V. Vladimirov (unpubl.) |
| 5. | Bulgaria, Danubian Plain | FP44 FP55 FP57 FP74 | not available | Petrova & al. (2013) |
| 6. | Bulgaria, Forebalkan (Western) : St. Ioan Pusti Monasterium (Bistretski Manastir) near Vratsa town, 11.06.2014, coll. M. Langurov (SOM 172875) | GN08 | not available | Herbarium specimen (SOM); Vutov & Dimitrov (2016) |
| 7. | Bulgaria, Forebalkan (Eastern) : along the road from Yablanitsa town to Pleven town, at the end of Radomirts village, 01.10.2009, coll. A.S. Petrova & V. Vladimirov (SOM 165419) | KH79 | 43.25486°N 24.18660°E | Herbarium specimen (SOM); Vladimirov & Petrova (2009) |
| 8. | Bulgaria, Sofia region : Sofia city, residential area Iliyantsi, by the railway from Sofia to Svoje town, ca. 520 m a.s.l., 29.09.2005, V. Vladimirov obs. | FN93 | 42.76167°N 23.33056°E | Vladimirov (2006) |
| 9. | Bulgaria, Sofia region : near Sofia city, on the right bank of a river ca. 20 m off the railway Sofia – Svoje, ca. 515 m a.s.l., 29.09.2005, V. Vladimirov obs. | FN93 | 42.77444°N 23.33556°E | Vladimirov (2006) |
| 10. | Bulgaria, Sofia region : Sofia City, Iliyantsi railway station, by the railways, ca. 525 m a.s.l., 2010, V. Vladimirov obs. | FN93 | 42.74878°N 23.32574°E | V. Vladimirov (unpubl.) |
| 11. | Bulgaria, Sofia region : Sofia City, in the arboretum of the University of Forestry, ca. 585 m a.s.l., 10.2018, V. Vladimirov obs. | FN92 | 42.65309°N 23.35859°E | V. Vladimirov (unpubl.) |
| 12. | Bulgaria, Mt Belasitsa | FL78 | not available | Petrova & al. (2013) |
| 13. | Bulgaria, Valley of River Mesta : along the road from Gotse Delchev town to Koprivlen village, 10.08.1999, coll. D. Stoyanov (SO 100006) | GM20 GM30 | not available | Herbarium specimen (SO) |
| 14. | Bulgaria, Valley of River Mesta : along the road from Gotse Delchev town to Koprivlen village, 20.06.2009, V. Vladimirov obs. | GM20 | 41.55167°N 23.77111°E | V. Vladimirov (unpubl.) |
| 15. | Bulgaria, Rila Mts : ca. 2.7 km SE of Kostenets town along the road to Momina Klisura village, ca. 470 m a.s.l., 24.09.2017, V. Vladimirov obs. | GM38 | 42.28572°N 23.88551°E | V. Vladimirov (unpubl.) |
| 16. | Bulgaria, Mt Sredna Gora (Western) : W of Momin Prohod town, Kostenes Municipality, 1957 | GM38 GM39 | not available | Kolev (1959) |
| 17. | Bulgaria, Thracian Lowland : near Filipovo Railway Station in Plovdiv city, 1948 | LG17 | not available | Stojanov & Stefanov (1948) |
| 18. | Bulgaria, Thracian Lowland : Plovdiv city, Botanical Garden, cultivated, 20.06.1978, coll. I. Cheshmedzhiev (SOA 47214) | LG16 | not available | Herbarium specimen (SOA) |
| 19. | Bulgaria, Thracian Lowland : on the bank of river Stryama near Chekeritsa State Hunting Enterprise, 12.10.1994, coll. D. Stoyanov (SO 96895) | LG28 | not available | Herbarium specimen (SO) |
| 20. | Bulgaria, Thracian Lowland | LH11 LG26 | not available | Petrova & al. (2013) |
| 21. | Bulgaria, Tundzha Hilly Country : meadow W of Gabarevo village, Stara Zagora district, 31.07.2008, coll. A.S. Petrova & G. Trifonov (SOM 164323) | LH41 | 42.62611°N 25.15667°E | Herbarium specimen (SOM); Petrova & al. (2009) |
| 22. | Bulgaria, Tundzha Hilly Country (probably related to the previous record) | LH42 | not available | Petrova & al. (2013) |
| HERACLEUM MANTEGAZZIANUM | | | | |
| 1 | Bulgaria, Sofia region : Sofia City, grasslands among the blocks of flats in Lyulin-1 residential district, ca. 560 m a.s.l., 28.06.2017, coll. V. Vladimirov & B. Assyov | FN83 | 42.727026°N 23.254605°E | Vladimirov & al. (2017, sub <i>H. sosnowskyi</i>) |
| 2 | Bulgaria, Rhodopi Mts (Western) : near Borino village, on the right bank of Borinska river, under <i>Salix</i> spp. trees and mixed with <i>H. sosnowskyi</i> , ca. 1100 m a.s.l., 13.07.2019, V. Vladimirov obs. (photo) | KG71 | 41.67143°N 24.30037°E | Vladimirov & al. (2019) |
| IMPATIENS GLANDULIFERA | | | | |
| 1. | Bulgaria, Forebalkan (Western) : Varshets town, along the river, 22.08.1979, coll. D. Delipavlov (SOA 36204). | FN88 | not available | Herbarium specimen (SOA) |
| 2. | Bulgaria, Forebalkan (Western) : on the right bank of the river in Varbeshnitsa village, Mezdra Municipality, 31.07.2011, coll. D. Dimitrov (SOM 167603) | GN18 | not available | Herbarium specimen (SOM); Dimitrov & Vutov (2015) |
| 3. | Bulgaria, Forebalkan (Eastern) : between the asphalt road from Brestnica village and a river ca. 2.5 km before Balgarski Izvor village, Teteven Municipality, 25.08.2005, V. Vladimirov obs. | KH77 | not available | V. Vladimirov (unpubl.) |
| 4. | Bulgaria, Forebalkan (Eastern) : along River Osam near Devetashka cave, ca. 110 m a.s.l., 27.06.2012, V. Vladimirov obs. | LH28 | 43.23455°N 24.88425°E | V. Vladimirov (unpubl.) |
| 5. | Bulgaria, Forebalkan (Eastern) : along River Osam in the center of Lovech town, ca. 175 m a.s.l., 27.06.2012, V. Vladimirov obs. | LH17 LH18 | 43.13018°N 24.71455°E | V. Vladimirov (unpubl.) |

Annex 1. Continuation.

| No. | Locality | UTM coordinates | GPS coordinates | Data source |
|-----|--|-----------------|----------------------------|---|
| 6. | Bulgaria, Forebalkan (Eastern) | LH77 LH87 | not available | Petrova & al. (2013) |
| 7. | Bulgaria, Balkan Range (Western) : above Berkovitsa town along Barzia river, 18.08.1979, coll. <i>D. Delipavlov</i> (SOA 36216) | FN78 | not available | Herbarium specimen (SOA) |
| 8. | Bulgaria, Balkan Range (Western) : along the river under Brezov Dol village, 01.08.2012, coll. <i>A. Petrova, R. Vasilev & I. Gerasimova</i> (SOM 169051) | GN06 | not available | Herbarium specimen (SOM) |
| 9. | Bulgaria, Balkan Range (Central) : Vidima village, Lovech district, 18.08.1989, coll. <i>G. Baeva</i> (SOM 147637) | LH23 LH24 | not available | Herbarium specimen (SOM) |
| 10. | Bulgaria, Balkan Range (Central) : wet places in the upper valley of Vidima river, ca. 1100 m a.s.l., 26.07.1989, coll. <i>E. Vladimirova, L. Tserovska & H. Kochev</i> (SOM 150499). | LH23 | not available | Herbarium specimen (SOM) |
| 11. | Bulgaria, Balkan Range (Central) : Troyan town, along the river in the central part of the town, 08.09.2012, <i>V. Vladimirov</i> obs. | LH15 | 42.88619°N 24.71297°E | V. Vladimirov (unpubl.) |
| 12. | Bulgaria, Sofia region : Sofia city, in the gardens, with flowers, 1976, coll. <i>N. Vihodtsevski</i> (SO 86185) | FN93 | not available | Herbarium specimen (SO) |
| 13. | Bulgaria, Vitosha region : along the riverbanks of Selska river in Zheleznitsa village and its vicinities, escaped from culture and quite common, 29.08.2002, coll. <i>B. Assyov & R. Vassilev</i> | FN91 | not available | Herbarium specimen (SOM) |
| 14. | Bulgaria, Vitosha region | FN82 | not available | Petrova & al. (2013) |
| 15. | Bulgaria, Znepole region : along the river in Milkyovtsi village, 15.07.2010, coll. <i>D. Venkova, A. Petrova & N. Nikolov</i> (SOM 166119) | FN33 | 42.760194°N 22.701692°E | Herbarium specimen (SOM) |
| 16. | Bulgaria, West Frontier Mts : Osogovo Mts, left bank of River Novoselska after Orehovitsa neighbourhood of Novo Selo village, Kyustendil district, 20.08.2009, coll. <i>D. Dimitrov</i> (SOM 165078) | FM37 | not available | Herbarium specimen (SOM) |
| 17. | Bulgaria, Valley of River Struma : wet places near the bridge above River Rilska, in Stob village and north of it, 12.09.2003, coll. <i>D. Dimitrov</i> (SOM 159041) | FM76 | not available | Herbarium specimen (SOM) |
| 18. | Bulgaria, Valley of River Struma : on the right bank of River Rilska, S of Rila town, 02.10.2009, coll. <i>D. Dimitrov</i> (SOM 165077) | FM76 | not available | Herbarium specimen (SOM) |
| 19. | Bulgaria, Valley of River Struma : on the right bank of River Rilska, E of Rila town, 01.10.2016, coll. <i>D. Dimitrov</i> (SOM 172975) | FM76 | not available | Herbarium specimen (SOM) |
| 20. | Bulgaria, Valley of River Mesta : near River Mesta in Baroto locality near Gotse Delchev town, 500 m a.s.l., 10.07.1986, coll. <i>I. Pashaliev</i> (SOM 150688) | GM30 | not available | Vladimirov (2001); herbarium specimen (SOM) |
| 21. | Bulgaria, Rila Mts : Rila Monastery, 22.09.1981, coll. <i>D. Delipavlov & I. Cheshmedzhiev</i> (SOA 41730) | FM96 | not available | Herbarium specimen (SOA) |
| 22. | Bulgaria, Rila Mts : Maritsa village, 16.09.1984, coll. <i>I. Cheshmedzhiev</i> (SOA 43956) | GM28 | not available | Herbarium specimen (SOA) |
| 23. | Bulgaria, Rila Mts : Borovets resort, 16.09.1984, coll. <i>I. Cheshmedzhiev</i> (SOA 43954) | GM18 | not available | Herbarium specimen (SOA) |
| 24. | Bulgaria, Rila Mts : wet places along the road from Sestrimo village to Sestrimo Railway Station, Belovo Municipality, 10.08.2012, <i>V. Vladimirov</i> obs. | GM47 | 42.23226°N 23.92677°E | V. Vladimirov (unpubl.) |
| 25. | Bulgaria, Rila Mts : along a river just above Sestrimo village, Belovo Municipality, ca. 520 m a.s.l., 10.08.2012, <i>V. Vladimirov</i> obs. | GM47 | 42.22214°N 23.32249°E | V. Vladimirov (unpubl.) |
| 26. | Bulgaria, Rila Mts : Klisura village, Samokov Municipality, wet places along the road to Samokov town, 12.08.2012, <i>V. Vladimirov</i> obs. | FM98 | not available | V. Vladimirov (unpubl.) |
| 27. | Bulgaria, Mt Sredna Gora (Western) : Mt Lozenska, the western mountain side over the bank of river Iskar, in the Darvodeletska area locality, 02.08.2018, coll. <i>P. Glogov, M. Georgieva & D. Pavlova</i> (SO 107966) | FN91 | 42.567067°N 23.430214°E | Herbarium specimen (SO); Glogov & al. (2018) |
| 28. | Bulgaria, Mt Sredna Gora (Western) | KH60 | not available | Petrova & al. (2013) |
| 29. | Bulgaria, Rhodopi Mts (Western) : along River Stara, between Batak and Peshtera towns, 19.09.1979, coll. <i>I. Cheshmedzhiev</i> (SOA 36222) | KG75 | not available | Herbarium specimen (SOA) |
| 30. | Bulgaria, Rhodopi Mts (Western) | GM40 KG64 | not available | Petrova & al. (2013) |
| 31. | Bulgaria, Rhodopi Mts (Central) : Chepelare town, in gardens (cultivated) and in wet places, 20.08.1978, coll. <i>I. Cheshmedzhiev</i> (SOA 44360) | LG02 | not available | Herbarium specimen (SOA); Čheshmedzhiev (1994) |
| 32. | Bulgaria, Rhodopi Mts (Central) : in Shiroka Laka village by the river, 17.09.1998, <i>V. Vladimirov</i> obs.; at several places by the river from Shiroka Laka village to the confluence with Vacha river, 17.09.1998, <i>V. Vladimirov</i> obs. | KG91 KG82 | not available | Vladimirov (2001 and pers. obs.) |
| 33. | Bulgaria, Rhodopi Mts (Central) : by a river ca. 0.6 km S of Sopotot village, Rudozem Municipality, near the fork to Breza village, 09.07.2011, <i>V. Vladimirov</i> obs. | LF29 | 41.457597°N 24.856047°E | V. Vladimirov (unpubl.) |

Annex 1. Continuation.

| No. | Locality | UTM coordinates | GPS coordinates | Data source |
|-----|---|-----------------|--------------------------|------------------------------------|
| 34. | Bulgaria, Rhodopi Mts (Central) : by the river E of Smilyan village, 18.10.2012, V. Vladimirov obs. | LF19 | not available | V. Vladimirov (unpubl.) |
| 35. | Bulgaria, Rhodopi Mts (Central) : along a river by the road from Smolyan to Madan towns after Vlahovo village, ca. 740 m a.s.l., 18.08.2017, V. Vladimirov obs. | LG10 | 41.56910°N 24.81769°E | V. Vladimirov (unpubl.) |
| 36. | Bulgaria, Rhodopi Mts (Central) : along River Arda in Srednogortsi village, Madan Municipality, ca. 630 m a.s.l., 18.08.2017, V. Vladimirov obs. | LF29 | 41.53210°N 24.91251°E | V. Vladimirov (unpubl.) |
| 37. | Bulgaria, Rhodopi Mts (Central) : damp to wet places along the road from Smilyan to Mogilitsa villages near the fork to Uhlovitsa cave, 900–920 m a.s.l., 18.08.2017, V. Vladimirov obs. | LF09 | 41.51308°N 24.66811°E | V. Vladimirov (unpubl.) |
| 38. | Bulgaria, Thracian Lowland : sandy places along River Maritsa near the bridge near Zlokuchene village, 30.08.2011, coll. A. Petrova (SOM 169062) | KG67 | not available | Herbarium specimen (SOM) |
| 39. | Bulgaria, Thracian Lowland : near Maritsa river, NE from village Mokrishte, 220 m a.s.l., 29.09.2016, V. Georgiev & S. Tsoneva obs. | KG77 | 42.19522°N 24.28644°E | V. Georgiev & S. Tsoneva (unpubl.) |

References

- CIR 2016. Commission implementing regulation (EU) 2016/1141 of 13 July 2016 adopting a list of invasive alien species of Union concern pursuant to Regulation (EU) No 1143/2014 of the European Parliament and of the Council. – Official Journal of the European Union, **L 189**: 4-8.
- CIR 2017. Commission implementing regulation (EU) 2017/1263 of 12 July 2017 updating the list of invasive alien species of Union concern established by Implementing Regulation (EU) 2016/1141 pursuant to Regulation (EU) No 1143/2014 of the European Parliament and of the Council. – Official Journal of the European Union, **L 182**: 37.
- CIR 2019. Commission implementing regulation (EU) 2019/1262 of 25 July 2019 amending Implementing regulation (EU) 2016/1141 to update the list of invasive alien species of Union concern. – Official Journal of the European Union, **L 199**: 1-4.
- Česhmedziev, I. 1994. Reports (313–366). – In: Kamari, G. & al. (eds), Mediterranean chromosome number reports – 4. – Fl. Medit., **4**: 269-279.
- Davies, C.E., Moss, D. & Hill, M.O. 2004. EUNIS Habitat Classification Revised 2004. Report to the European Topic Centre on Nature Protection and Biodiversity. European Environment Agency.
- Dimitrov, D. & Vutov, V. 2015. New chorological data of the vascular flora of Bulgaria. – Bulg. J. Agric. Sci., **21**: 504-506.
- Glogov, P., Georgieva, M. & Pavlova, D. 2018. Reports 130–141. – In: Vladimirov, V. & al. (comp.), New floristic records in the Balkans: 37. – Phytol. Balcan., **24**(3): 412-415.
- Hejda, M. 2009. *Impatiens glandulifera* Royle, Himalayan balsam (*Balsaminaceae*, *Magnoliophyta*). – In: DAISIE, Handbook of Alien Species of Europe, p. 351. Springer.
- Kolev, I. 1959. Floristic notes. – Nauchni Trudove, Vissh Selskostopanski Institut 'Georgi Dimitrov', Agron. Fak., **6**: 413-426 (in Bulgarian).
- Nielsen, C., Ravn, P., Nentwig, W. & Wade, M. (eds). 2005. The Giant Hogweed Best Practice Manual. Guidelines for the Management and Control of an Invasive Weed in Europe. Forest & Landscape Denmark, Hoersholm.
- Naydenova, Ts., Vladimirov, V. & Bancheva, S. 2019. Contribution to the knowledge of naturalised *Opuntia* species (*Cactaceae*) in the Bulgarian flora. – Phytol. Balcan., **25**(1): 39-46.
- Petrova, A. 2017a. On the identity and distribution of the alien *Acalypha* species (*Euphorbiaceae*) in Bulgaria. – Phytol. Balcan., **23**(1): 31-34.
- Petrova, A. 2017b. Reports 236–246. – In: Vladimirov, V. & al. (comp.), New floristic records in the Balkans: 33. – Phytol. Balcan., **23**(2): 299-301.
- Petrova, A. 2017c. Reports 103–113. – In: Vladimirov, V. & al. (comp.), New floristic records in the Balkans: 34. – Phytol. Balcan., **23**(3): 423-427.
- Petrova, A. & Barzov, Z. 2017. *Oenothera laciniata* Hill (*Onagraceae*), a new alien species to the Bulgarian flora. – Acta Zool. Bulg., **Suppl. 9**: 43-46.
- Petrova, A. & Gerasimova, I. 2017. A naturalised population of *Larix decidua* Mill. (*Pinaceae*) in the Rhodope Mountains, Bulgaria. – Acta Zool. Bulg., **Suppl. 9**: 29-32.
- Petrova, A.S., Trifonov, G., Venkova, D. & Ivanova, M. 2009. Reports 51–74. – In: Vladimirov, V. & al. (comp.), New floristic records in the Balkans: 10. – Phytol. Balcan., **15**(1): 128-132.
- Petrova, A. & Vladimirov, V. 2018. Recent progress in floristic and taxonomic studies in Bulgaria. – Botanica Serbica, **42**(1): 35-69.
- Petrova, A. & Vladimirov, V. 2019. Reports of some ornamental plants as aliens for the Bulgarian flora. – Phytol. Balcan., **25**(3): 387-394.
- Petrova, A., Vladimirov, V. & Georgiev, V. 2013. Invasive Alien Species of Vascular Plants in Bulgaria. IBER-BAS, Sofia.
- Petrova, A., Vladimirov, V. & Tashev, A. 2017. The Maritime Pine, *Pinus pinaster* Aiton (*Pinaceae*), a naturalised alien on the Bulgarian Black Sea Coast. – Acta Zool. Bulg., **Suppl. 9**: 33-38.
- Roy, H.E., Bacher, S., Essl, F., Adriaens, T., Aldridge, C. & al. 2018. Developing a list of invasive alien species likely to threaten biodiversity and ecosystems in the European union. – Global Change Biology (2018): 1-17. doi: 10.1111/gcb.14527
- Scalera, R., Genovesi, P., Essl, F., Rabitsch, W. 2012. The Impacts of Invasive Alien Species in Europe. EEA Technical Report, vol. 16. European Environmental Agency, Copenhagen.

- Stojanov, N. & Stefanov, B.** 1948. Flora na Balcaria [Flora of Bulgaria], ed. 3. Univ. Press, Sofia (in Bulgarian).
- Stoyanov, S. & Barzov, Zh.** 2018. *Cyperus eragrostis* – an addition to the Bulgarian alien flora. – Phytol. Balcan., **24**(2): 239-242.
- Stoyanov, K. & Raycheva, Ts.** 2018. Reports 150–157. – In: **Vladimirov, V. & al.** (comp.), New floristic records in the Balkans: 33. – Phytol. Balcan., **23**(2): 302-304.
- Velchev, V. & Petrova, A.** 2011. Reports 104–127. – In: **Vladimirov, V. & al.** (comp.), New floristic records for the Balkans: 15. – Phytol. Balcan., **17**(1): 151-154.
- Vladimirov, V.** 2006. Reports 83–95. – In: **Vladimirov, V. & al.** (comp.), New floristic records in the Balkans: 1. – Phytol. Balcan., **12**(1): 125-126.
- Vladimirov, V.** 2001. New chorological data on four alien species in the Bulgarian flora. – Phytol. Balcan., **7**(1): 33-37.
- Vladimirov, V.** 2018. *Hieracium petraeum* (Asteraceae): a new casual record in the Bulgarian flora. – Phytol. Balcan., **24**(3): 365-368.
- Vladimirov, V.** 2019. First record of *Humulus japonicus* (Cannabaceae) in the Bulgarian flora. – In: **Trajanovski, S. & al.** (eds), Joint ESENIAS and DIAS Scientific Conference and 9th ESENIAS Workshop 'Species, ecosystems and areas of conservation concern under threat from the invasive alien species.' Book of Abstracts. 03-06 September 2019. HIO, ESENIAS, DIAS, IBER-BAS, Ohrid, Republic of North Macedonia. – Review, vol. **44**(1): 97.
- Vladimirov, V., Assyov, B. & Petrova, A.** 2017. First record of an invasive alien plant species of EU concern in Bulgaria: *Heracleum sosnowskyi* Manden. (Apiaceae). – Acta Zool. Bulg., **Suppl. 9**: 47-51.
- Vladimirov, V., Delcheva, M., Georgiev, V., Tsoneva, S. & Gushev, C.** 2017. *Ammannia coccinea* Rottb. (Lythraceae), first report for the Bulgarian alien flora. – Acta Zool. Bulg., **Suppl. 9**: 39-42.
- Vladimirov, V. & Petrova, A.S.** 2009. Reports 92–102. – In: **Vladimirov, V. & al.** (comp.), New floristic records in the Balkans: 12. – Phytol. Balcan., **15**(3): 449-451.
- Vladimirov, V., Petrova, A., Barzov, Zh. & Gudžinskas, Z.** 2019. The alien species of *Heracleum* (Apiaceae) in the Bulgarian flora revisited. – Phytol. Balcan., **25**(3): 395-405.
- Vladimirov, V., Petrova, A., Stoyanov, S., Bancheva, S. & Delcheva, M.** 2018. *Rosa rugosa* (Rosaceae): an alien species in the Bulgarian flora. – Phytol. Balcan., **24**(3): 337-341.
- Vutov, V. & Dimitrov, D.** 2016. Reports 190–216. – In: **Vladimirov, V. & Tan, K.** (comp.), New floristic records in the Balkans: 31. – Phytol. Balcan., **22**(3): 460-462.
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