

When did *Buddleja davidii* become invasive in Slovenia?

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Abstract. Butterfly-bush (*Buddleja davidii*) is globally widespread invasive alien plant that originates in China. In Slovenia, a switch from benign naturalized plant to invasiveness occurred just recently, so in the last decade it has been spreading rapidly in the sense of geography and also forming viable competitively strong populations in (semi-)natural habitat types such as abandoned quarries, rocky slopes and river banks. In the article its spreading is presented with some older overlooked records and several new records that more than double our knowledge of the species' distribution in Slovenia. These data strongly confirm that it can be recognized as invasive alien species also in Slovenia, owing to its successful spread to natural habitat types in several parts of the country in the last decade.

Key words: *Buddleja davidii*, alien plant invasion, Slovenia

Izvleček. Kdaj je *Buddleja davidii* postala v Sloveniji invazivna? – Metuljnik (*Buddleja davidii*) je po vsem svetu razširjena invazivna rastlina, ki izvira s Kitajske. V Sloveniji je do prehoda iz neškodljive naturaliziranosti v invazivnost prišlo šele nedavno, tako da se v zadnjem desetletju vrsta intenzivno širi v geografskem smislu in na več mestih oblikuje konkurenčno močne populacije v (pol)naravnem okolju opuščanih kamnolomov, skalovja in obrečnih prodnatih bregov. V članku je predstavljeno njeno širjenje s starimi spregledanimi kot tudi številnimi novimi podatki, ki več kot podvojijo vednost o njen razširjenosti v Sloveniji. Podatki potrjujejo, da je tudi na območju Slovenije vrsta zanesljivo invazivna, saj se vsaj zadnje desetletje širi tudi na naravna rastišča na več koncih države.

Ključne besede: *Buddleja davidii*, širjenje tujerodnih invazivnih vrst, Slovenija

Introduction

Invasive alien species often develop their invasiveness in the newly occupied region after years of gradual adaptation. This is the so-called lag-phase (Kowarik 1995) and can last for years or even centuries. During this phase, populations of a new-comer are exposed to new environmental conditions that include abiotic (climatic and soil conditions, geological substrate structure, etc.) and biotic factors (competition, herbivory, parasitism, pollination biology, etc.). Among the latter, human interventions can also be listed, such as e.g. ruderalization of native habitat types, selective treatment of plant communities (e.g. logging, using selective herbicides), deliberate propagation of alien plant (e.g. for decoration, food, fiber production), etc. Quite few, perhaps even more than half of all invasive alien plant species, have been brought to new regions of the world intentionally, mostly for horticultural use as ornamental plants. For such introductions it is important that traditionally seed and other propagulae exchange had taken place between gardeners already in previous times, when spectrum of ornamental plants available in garden markets was not so diverse, as some of popular ornamentals spread quite quickly. And their speed had been definitely much quicker than their natural capacities of spread would allow and, on the other hand, with very irregular biogeographic pattern of spread.

As early as the 1950s it was documented in Slovenia that *Echinocystis lobata* became popular and that its seeds were exchanged by mail (Petkovšek 1952). Several late flowering melliferous alien species were spread by bee-keepers, *Helianthus tuberosus* by hunters as winter food for wild boar, etc. Of course, only ornamental plants that are easy to maintain and propagate spread by direct informal support of gardeners, but this means that those species were better adapted to the local ecological conditions and subsequently their sub-spontaneous meta-population quickly scatters over huge areas. So the propagule pressure on the environment grew extremely fast and, in such conditions, the probability that some types become better adapted to the local natural habitat types rose as well. Often it is not possible to trace the source of better adapted populations as the naturalization pattern is blurred by high number of populations ranging from ephemerophytes to already naturalized ones. On the other hand it is not possible to monitor all the plant species in a wider territory in real time and systematically, so the availability of field data is mostly a result of random floristic activity. But when a species really goes beyond the lag phase, it becomes »common« very quickly indeed. That is what obviously happened in Slovenia with American *Erigeron annuus* just recently; at the end of the 1990s we personally observed how it switched from only ruderal habitat types to semi-natural grasslands, and today it can be found literally everywhere up to the montane altitudinal belt. A similar switch was reported for *Ambrosia artemisiifolia* in the 1990s, when its populations became well adapted to dry ruderal habitat types, especially along main roads, and from scattered distribution pattern turned to linear pattern linked to the main road network (Jogan & Vreš 1998). On a local scale, similar happened with *Cornus sericea* in the area of Ljubljana where it switched from ornamental gardens to wetland shrub communities (Bačič et al. 2015). Lag-phase between introduction in a new region and species naturalization is often several dozens to several hundred years long. For the 45 studied invasive species in Brandenburg (S Germany), the shortest lag-phase between 30 and 60 years has been reported for *Prunus serotina* (29), *Mahonia aquifolium* (38), *Prunus mahaleb* (54) and *Buddleja davidii* (56 years) (Kowarik 1995).

Butterfly-bush (*B. davidii*) as a widespread plant in China was described quite late. The first known specimens were brought to Europe at the end of the 19th century and in 1887 it was described, but at approximately the same time became popular as ornamental plant and entered the intense horticultural trade (Tallent-Halsell & Watt 2009). First reports of its spontaneous spread are from the 1930s (Fritsch 1933, Tallent-Halsell & Watt 2009). In Central Europe, Hegi (1966) reported only a couple of escapes in NW Germany and S Switzerland. In all neighboring countries sub-spontaneous occurrence of *B. davidii* is reported and recognized as invasive in N Italy (Celesti-Grapow et al. 2010), potentially invasive in Austria (Walter et al. 2002), locally naturalized in N Croatia (Boršić 2018), and adventitious in some parts of W Hungary (Bartha & Kiraly 2015).

Butterfly-bush is still among very popular ornamental plants with dozens of cultivars especially admired for its attraction to butterflies. It can be found at every garden market and subsequently in Slovenia in several gardens all over the country. In the general Slovenian floristic literature *B. davidii* was first reported in 1999 (Martinčič 1999) as ornamental, locally escaped and naturalized with 4 mentioned localities. The first explicit mention of the species as invasive in Slovenia dates from 2009 (Kus Venvliet et al. 2009) and later reassessed in 2012 (Jogan et al. 2012). Today it is recognized also as a harmful species that needs local control and administrative prohibition of deliberate spread (Simončič 2011).

Comparable to many other invasive trees and shrubs, *B. davidii* has the smallest seeds that are easily dispersed by wind during winter and spring months, when ripe inflorescences from previous year are persisting on branches, with capsules gradually opening in dry weather. From just 10 collected ripe inflorescences with thousands of ripe capsules, about 1 g of seeds was gathered after drying (original data). But as the weight of 1 seed is only about 0.05 mg, here are c. 20,000 seeds in 1 g. So the whole well developed shrub with hundreds of inflorescences can produce several 100,000 to several millions of seeds every year.

Materials and methods

Stratified floristic sampling in Slovenia follows the Central-European method with grid divided into base fields 10' latitude × 6' geographical longitude, which are divided in 4 quarters, the so-called »quadrants« (Niklfeld 1971). Each quadrant covers approximately 35 km².

All available published records of *B. davidii* in the territory of Slovenia and all original records as a results of random floristic mapping were organized in a database with special emphasis on age of the record, type of occurrence of *B. davidii* in locality (ephemeral, individual, naturalized, invasive) and habitat type distinguishing between ruderal, semi-natural and natural. From the database, a distribution map with data structured by their age and another analysis of discrepancy between the known localities in certain period and those compiled in three previously published maps (Jogan et al. 2001, 2012, Mavrič & Strgulc Krajšek 2017) were prepared.

Special attention was paid to »grey« literature, e.g. project reports and internet publication of data, of course with checking the reliability of sources.

Results

In addition to already compiled and published data (Mavrič & Strgulc Krajšek 2017), more than 30 new quadrants were filled with new or overlooked records of *B. davidii* that gives us a much different picture of its presence and spreading in Slovenia. Obviously (Fig. 1) in eastern and central Slovenia, its distribution is scattered but frequent, mostly linked to ruderal places. In western Slovenia it is naturalized especially in the Soča valley but also with few scattered occurrences elsewhere.

In the recently published article, Mavrič & Strgulc Krajšek (2017) provided a negligible number of their own new records but tried to compile several older published (and unpublished) records organized in 4 groups, so that the first impression is completeness of the study. But this compilation of the same available sources just a year later resulted in more than twice as many quadrants with confirmed records of *B. davidii*, which is a substantial change in knowledge. In addition to several authors' original records and already mentioned »grey« sources, a study that resulted in more than 20 new records in 2012 and 2013 (Jogan et al. 2013) had been completely overlooked.

In such a quick spread it is impossible to trace the bio-geographic pattern of propagule pathways, and it is also a hard work to compile all the known records at certain period. So there is always a gap between the known occurrences and reported and compiled ones, and it is simply not sufficient to rely only on data available in some databases or even on the internet. In Fig. 1, three distribution maps of *B. davidii* in Slovenia are shown, published in 2001 (Jogan et al. 2001), 2012 (Jogan et al. 2012) and now (2018). These temporal borders are used also for a structured presentation of distribution data on the actual map, so we can compare the available knowledge of distribution in certain period with data more or less successfully compiled by certain author. These relations are better shown in Fig. 2, where another recently published distribution maps (Jogan et al. 2001, 2012, 2018 and Mavrič & Strgulc Krajšek 2017) are taken into consideration. Here we can clearly see discrepancies between the available and compiled records number, which is due not only to the author's willingness to prepare a complete compilation but to a certain extent also to complexity of network of sources where one can search for records. Among other sources for such easily recognizable shrub like butterfly-bush, it is important to check also some portals on the internet as e.g. iNaturalist (<https://www.inaturalist.org>), FotoNarava (<http://www.foto-narava.com/>) and Geopedia (<http://www.geopedia.si>). In each of the three mentioned sources, at least one reliable record in a new quadrant has been found.

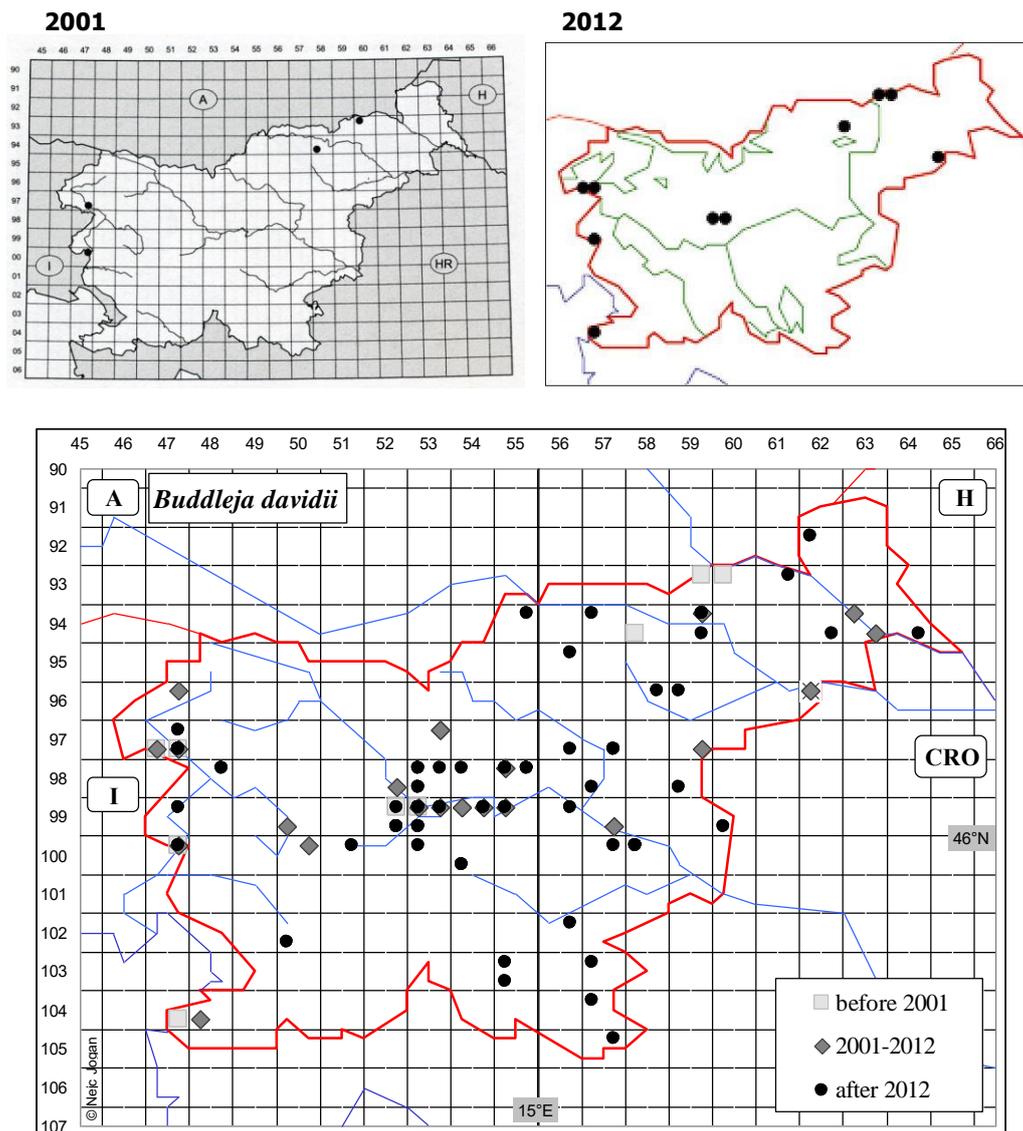


Figure 1. Three distribution maps of *B. davidii* in Slovenia as published in 2001, 2012 and now, with the same temporal boundaries used in the last map to compare the published patterns with available records at the same time.

Slika 1. Trije zemljevidi razširjenosti *B. davidii* v Sloveniji objavljeni 2001, 2012 in tukaj z enakimi starostnimi intervali prikazanih podatkov, da lahko primerjamo objavljene vzorce razširjenosti z realnimi znanimi vzorci na podlagi tedaj zbranih podatkov.

Here is a list of additional compiled (or published in rarely consulted places) records of *B. davidii* in Slovenia. In addition to the records cited in Mavrič & Strgulc Krajšek 2017, some records of the species kindly provided by the FloVegSi database manager Branko Vreš and some records published by other authors (Bakan 2011, Dakskobler et al. 2011, 2014) were taken into consideration:

- 0047/2 Primorska, Solkan, SE slopes of mount Sabotin, at Solkanski bridge, screes. 90 m s. m. 30. 6. 2006. Leg. Vreš B., Čelik T. (FloVegSi database)
- 0051/2 vicinity of Ljubljana, Vrhnika, E, individual shrubs in ruderal places. Det. D. Cenčič, 18. 9. 2012 (results of Thuja 2 project)
- 0053/1 vicinity of Ljubljana, Staje pri Igu, individual shrubs in ruderal places. Det. B. Dolinar, 5. 9. 2012 (results of Thuja 2 project)
- 0054/3 vicinity of Ljubljana, Grosuplje, Radensko polje (45,92171334°N, 14,67989451°E). Det. Jana Kus Venvliet, 8. 6. 2013 (results of Thuja 2 project)
- 0054/3 vicinity of Ljubljana, Zagradec pri Grosupljem, individual shrubs in ruderal places. Det. B. Dolinar, 8. 9. 2012 (results of Thuja 2 project)
- 0058/1 Posavje, at river Sava between Log and Blanca, many shrubs. Photo »tama«, 27. 7. 2011 [<http://galerija.foto-narava.com/>]
- 0058/1 Posavje, Leskovec pri Krškem, Nova pot, may be also cultivated, 2013 [data from publicly accessible application in Geopedia]
- 0250/3 Primorska, Senožče, in the bushes. Det. S. Behrič, 24 8 2013 (results of Thuja 2 project)
- 0256/2 Dolenjska, Novo mesto, Brod. Det. J. Čuš, 3. 10. 2013 (results of Thuja 2 project)
- 0355/1 Dolenjska, Kočevje, Stara Cerkev, individual shrubs in ruderal places. Det. H. Lesar, 3. 9. 2013 (results of Thuja 2 project)
- 0355/3 Dolenjska, Kočevje, Mestni Log, individual shrubs in ruderal places. Det. T. Potočnik, 31. 7. 2013 (results of Thuja 2 project)
- 0357/1 Bela krajina, Semič, individual shrubs in ruderal places. 2013? (no author name, results of Thuja 2 project)
- 0457/1 Bela krajina, Črnomelj, ulica pod Gozdom, may be only cultivated. 2013 [no author name, data from publicly accessible application in Geopedia]
- 0557/2 Zilje, individual shrubs in ruderal places, scattered, probably naturalized. Det. B. Dolinar, 1. 9. 2013 (results of Thuja 2 project)
- 9262/1 Prekmurje, Krašči, individual shrubs in ruderal places. Det. R. Šturm, 22. 9. 2012 (results of Thuja 2 project)
- 9361/2 Štajerska, Prlekija, Črešnjevci. Det. J. Čuš, 6. 9. 2013 (results of Thuja 2 project)
- 9455/2 Koroška, SW of Vič pri Dravogradu, individual shrubs in ruderal places. Det. H. Lesar, 27. 8. 2013 (results of Thuja 2 project)
- 9457/1 Štajerska, Vuhred, individual shrubs in ruderal places. Det. M. Cojzer, 14. 9. 2012 (results of Thuja 2 project)
- 9459/2 Štajerska, Maribor, Tabor, abandoned park area along railway. Det. N. Jogan, 2014 (46°33'5,73" N 15°38'40,28" E)
- 9459/4 Štajerska, Maribor, Tezno, dry ruderal places along Tržaška cesta. Det. N. Jogan, 2016 (46°31'58,63" N 15°38'44,24" E)
- 9462/4 Štajerska, Prlekija, Precetinci-Gajševsko lake. Det. J. Čuš, 7. 9. 2013 (results of Thuja 2 project)
- 9464/4 Prekmurje, Petišovci, individual shrubs in ruderal places. Det. J. Čuš, 5. 9. 2013 (results of Thuja 2 project)

- 9556/2 Koroška, Mislinjska Dobrava, individual shrubs in ruderal places. Det. I. Čede, 4. 9. 2013 (results of Thuja 2 project)
- 9647/2 Triglav National Park, rocky outcrops at Kluže fortress (46°21'26" N 13°35'16" E) 9. 9. 2010 (results of Thuja 2 project)
- 9659/1 Štajerska, Slovenska Bistrica, dry ruderal places at Žolgarjeva ulica. Det. N. Jogan, 8. 2017 (46°23'16" N 15°34'11" E)
- 9747/2 Posočje, rocky slopes above the road N of Kobarid. Det. N. Jogan, 26. 8. 2017 (46°14'59" N 13°35'7" E)
- 9747/4 Posočje, Kobarid, slopes at »Napoleonov bridge« [»...pri Kobaridu ... nad mostom, kjer cesta proti Ladri prečka Sočo ... kaže, da je prešla v proces naturalizacije ...«]. N. Jogan & A. Podobnik 1993 (Jogan & Podobnik 1995), locality previously mistakenly interpreted as Kobarid or Smast
- 9756/4 Štajerska, vicinity of Celje, Migojnice. Det. Jan Gojznikar, 18. 9. 2013 (46,23303748 °N, 15,16169261°E) (results of Thuja 2 project)
- 9757/4 Štajerska, Celje, ob Savinji. Det. J. Markovič, 20. 9. 2013 (46,22511036 °N, 15,26665992 °E) (results of Thuja 2 project)
- 9757/4 Štajerska, Celje, Oblakova ulica. Det. Jan Gojznikar, 19. 9. 2013 (46,23446908 °N, 15,26264733 °E) (results of Thuja 2 project)
- 9757/4 Štajerska, Celje, Trubarjeva ulica. Det. Jan Gojznikar, 16. 9. 2013 (46,23236177 °N, 15,25412234 °E) (results of Thuja 2 project)
- 9759/4 Štajerska, Rogaška Slatina, Zdraviliški trg, supporting wall behind hotel Strossmajer (46°14'12" N 15°38'23" E). Photo N. Jogan, 18. 2. 2006
- 9848/2 Posočje, Klavže, individual shrubs in ruderal places. Det. R. Šturm, 29. 8. 2013 (results of Thuja 2 project)
- 9848/2 Posočje, Most na Soči, few shrubs at the left bank of Soča lake. Det. N. Jogan, 14. 1. 2018 (46°9'17" N 13°44'47" E)
- 9853/2 Gorenjska, Prevoje pri Šentvidu, ruderal places at Hofer shop. 315 m s. m., 20. 9. 2013. Leg. Vreš B. (FloVegSi database).
- 9854/1 Gorenjska, Lukovica pri Domžalah, Podpeč, Lukovica quarry. 340 m s. m., 27. 8. 2014. Leg. Vreš B. (FloVegSi database).
- 9855/2 Štajerska, Podlipovica, individual shrubs in ruderal places. Det. D. Cenčič 3. 9. 2013 (results of Thuja 2 project)
- 9857/3 Štajerska, Rimske Toplice, Šmarjeta, individual shrubs in ruderal places. Det. I. Čede, 19. 8. 2013 (results of Thuja 2 project)
- 9859/3 Štajerska, Lesično, individual shrubs in ruderal places. Det. I. Čede, 30. 8. 2013 (results of Thuja 2 project)
- 9947/2 Posočje, Morsko pri Kanalu, individual shrubs in ruderal places. Det. T. Potočnik, 4. 10. 2013 (results of Thuja 2 project)
- 9950/3 between Idrija and Spodnja Idrija. 2010? (published in Dakskobler et al. 2011)
- 9953/2 vicinity of Ljubljana, Spodnji Kašelj, individual shrubs in ruderal places. Det. D. Cenčič, 9. 10. 2012 (results of Thuja 2 project)
- 9954/2 vicinity of Ljubljana, Litija, Gradec, young plants in asphalt cracks on Graška cesta. Det. N. Jogan, 2013 (46°3'48" N 14°49'2" E)
- 9954/2 vicinity of Ljubljana, Veliki vrh pri Litiji, individual shrubs in ruderal places. Det. B. Dolinar, 12. 10. 2012 (results of Thuja 2 project)
- 9956/2 Posavje, Radeče, Njivice, southern slopes of abandoned quarry. Det. N. Jogan, 2013 (46°3'57,14" N 15°8'44,14" E)

9960/3 Štajerska, Bizeljsko-Trnje, individual shrubs in ruderal places, one shrub in the bushes.
Det. R. Šturm, 13. 9. 2013 (results of Thuja 2 project)

Comparison of three older published distribution maps with current database showed that all available data in certain period (2001, 2012 and 2017) were not taken into consideration and that discrepancy is as high as 1:2 (Fig. 2). The reasons for incompleteness of given distribution maps are different, quite often there is a temporal gap between record in the field and reporting information to any public interface (classical printed publication, public herbarium voucher, databasing, publishing on internet), but it is also not easy to bear in mind all the complex information network of potentially available records. And there is a sad situation particularly in Slovenia that some research results of projects financed from public financial mechanisms are simply not available to the public. Even more, after an explicit request to one of these public institutions, where they are in possession of more than 20 additional records of *B. davidii* especially from western Slovenia, only three records were provided. Fortunately, the overall distribution pattern published here would not change much by adding the mentioned unavailable records. So also our results will definitely prove incomplete in the following years.

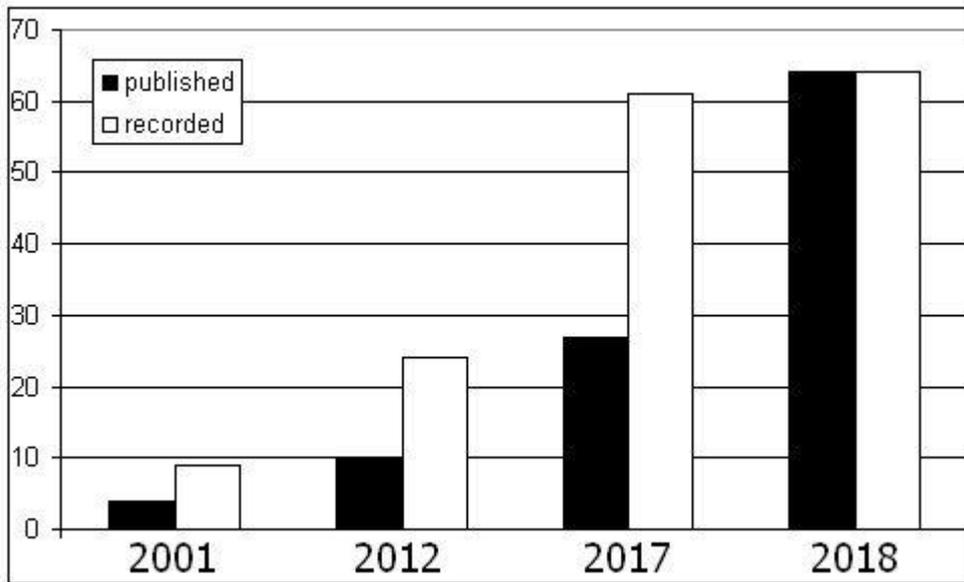


Figure 2. Comparison of compiled (in a map presented in Fig. 1; black columns) and available at the time of published compilation (white columns) records of *B. davidii* in certain period based on quadrant occurrences.

Slika 2. Primerjava zbranih (in predstavljenih z zemljevidom na Sl. 1) podatkov o razširjenosti *B. davidii* v posameznih predhodnih objavah s številom sočasno razpoložljivih podatkov. Podatki agregirani na nivoju kvadranta.

Discussion

It is hard to trace the first occurrence of *B. davidii* in horticulture in the territory of modern-day Slovenia, but definitely as early as 1930 it was reported as escaping from cultivation at Lovrenc na Pohorju (NE Slovenia) (Fritsch 1933). This is obviously one of the first records on *B. davidii* escape from cultivation in entire Europe. Also in a wider European garden practice, the species had not been introduced before 1890 (Tallent-Halsell & Watt 2009), since it was discovered and described as a new species only slightly earlier. It is reported that in the territory of the present-day Czech Republic it appeared as an ornamental in 1911 (Skalicka 2000), and we have to bear in mind that in those times it was part of the Austro-Hungarian Empire that also included the bigger part of modern-day Slovenia (Krain, Untersteiermark, partly Küstenland). Lovrenc na Pohorju was part of Steiermark with Graz as its capital and one of the most important towns in Austria, so we can assume that *B. davidii* appeared in garden practice at approximately the same time as in Czechia, i.e. in the last few years before WW I. So the reported escapes from Lovrenc in 1930 might have been a result of less than 2 decades (!) of cultivation. These reported escapes were as old as the first assumed escapes in Great Britain (Tallent-Halsell & Watt 2009). Further records of escapes in Austria were reported for the town area of Salzburg (Janchen 1956), later Wien and Deutsch Altenburg (Janchen 1966).

In Slovenia, the occurrence at Lovrenc has not been confirmed after its first report. The old graveyard, from the walls of which the first escaped population was reported in 1930 (Fritsch 1933), had been abandoned and the area around the church changed. The new graveyard is situated about 300 m away, and despite the quite intense floristic activity around Lovrenc in the last few decades, the occurrence of *B. davidii* has not been confirmed. It is interesting to mention that in horticultural handbook from 1974 (Strgar in Hay & Synge 1974) it is explicitly stated that *B. davidii* shrubs are not well adapted to continental Slovenia as their shoots are destroyed by winter frost. Obviously the situation changed at least in the 1990s, probably due to new and better adapted cultivars.

The situation comparable to Slovenia and Austria is also in the neighbouring Friuli Venezia Giulia region (Italy), where in 1991 the presence of butterfly-bush was reported in 12 mapping units and only a decade later in 39 units covering more than half of the regional territory (Poldini 1991, 2002). And most probably we share with Friuli Venezia Giulia the oldest regional record and source of later spread of *B. davidii* that escaped from cultivation in Gorizia. This record is important for understanding its spreading in W Slovenia along the Soča river. C. Zirnich collected a butterfly-bush in 1945 beyond a public garden above the Koren stream in Gorizia (Italy, Mezzena 1986), which is just about a km from the Slovenian border and about 2 km from the localities in Solkan above the river Soča. It is interesting that the oldest herbarium record for this part of Italy mentioned by Poldini (2009) is 20 years younger: Trieste, M. Valerio 1965. In Slovenia, the oldest records with confirmed continuous presence of *B. davidii* are exactly from the Soča valley and also from Ljubljana in the first half of the 1990s (Turk 1988, Jogan & Podobnik 1995). From the area along the Soča valley, the first records came from natural or semi-natural habitat types on rocky limestone outcrops above the river and the river banks. In this part of Slovenia, *B. davidii* has obviously been spreading since then (and most probably already after 1945) and today its occurrence is reported from

Kluže at about 500 m a.s.l. to Solkan 400 m lower and about 70 km further to the south. Here, *B. davidii* has larger populations in some abandoned limestone/dolomite quarries or similar rocky localities with little vegetation cover.

The species' occurrence in dry ruderal localities in Ljubljana is similar to the situation in the oldest Austrian records from towns. *B. davidii* has been spontaneously spreading for 3 decades, and today about 20 localities are known (15 of them recorded during the floristic mapping of the Ljubljana Municipality in 2015; Jogan et al. 2015). Its occurrence in Ljubljana is mostly linked to dry ruderal places, especially open gravelly or pebbly areas at the abandoned building sites; no population has been recorded in semi-natural habitat types. The oldest occurrence of cultivated butterfly-bush in Ljubljana is not known, but as early as 1933 instructions for its maintenance were given by the chief city gardener A. Lap («Pomladanska dela na vrtu», Slovenski narod, 18. 3. 1933, p. 7).

In the last two decades, the number of recorded localities of *B. davidii* in Slovenia has been growing almost exponentially, and today its presence in more than 60 quadrants is known in all parts of Slovenia below 500 m a.s.l. Especially alarming are the results of systematic mapping of invasive alien plants in 100 randomly (!) chosen 1 km² squares that took place in 2012 and 2013 within the framework of Thuja 2 project (Jogan et al. 2013). Specifically, *B. davidii* was recorded in more than 20% of the mapping units, mostly as individual plants in dry ruderal places, but these localities can function as a stepping stone to rocky/gravelly habitat types in the vicinity. Particularly so, if we bear in mind the extreme spreading potential of *B. davidii* with enormous production of tiny seeds dispersed by wind.

Invasion of *B. davidii* populations in semi-natural rocky habitat types similar to the already mentioned situation along the Soča valley has been recorded especially in some abandoned dolomite quarries in the vicinity of Radeče (9956/2), Litija (Sava, 9955/1) and Zreče (Brinjeva gora, 9658/2), as well as in gravelly or pebbly river banks of the Drava, Sava and Mura rivers.

So when did *B. davidii* become invasive in Slovenia? Definitely not in 1930, and it is definitely invasive today. If we analyze records per decades, the number of new records and the number of completely new localities has unquestionably risen in the last decade, hence the switch to invasiveness must have occurred in the first decade of this century. So butterfly-bush occurrence in Slovenia can be interpreted as probably ephemeral in the first decades after the 1930s, then undoubtedly locally naturalized since 1990s (Jogan & Podobnik 1995), whereas about 20 years later it definitely became an invasive alien species quickly spreading into semi-natural habitat types and changed their structure/function. Today we can confirm its already recognized invasive status (Jogan et al. 2012) based on results presented herewith.

Povzetek

Metuljnik (*Buddleja davidii*) je po vsem svetu razširjena invazivna rastlina, ki izvira s Kitajske. Opisana je bila šele konec 19. stoletja in kmalu zatem se je kot okrasna rastlina pojavila v hortikulturi. Na evropske razmere je bila očitno dobro prilagojena, tako da o prvem podivjanem uspevanju poročajo že v 1930. letih, ko je bila zabeležena v Lovrencu na Pohorju in ponekod v Z Evropi. Pojavljanje v Lovrencu kasneje ni bilo potrjeno, s konca druge svetovne vojne pa je podatek o podivjanem uspevanju v bližini kasnejše Nove Gorice, kjer so naturalizirane populacije metuljnika še danes in prvič zanesljivo zabeležene že pred skoraj tremi desetletji. Danes ima metuljnik več popolnoma naturaliziranih populacij vse od Gorice do gornje doline Soče (trdnjava Kluže), pojavljajo pa se predvsem po skalovju in v opuščeni kamnolomih. Drugod po Sloveniji spremljamo pojavljanje posameznih rastlin raztreseno vse od 1990. let, kontinuirano je vrsta razširjena v Ljubljani, vendar brez podatkov o popolni naturalizaciji v naravnih rastiščih, na več mestih v vzhodnejših predelih Slovenije pa se poleg številnih razpršenih podatkov o morda še efemernem uspevanju vrsta z naturaliziranimi populacijami širi na območjih opuščeni kamnolomov (npr. pri Radečah, Zrečah, Litiji). V Sloveniji je do prehoda iz neškodljive naturaliziranosti v invazivnost prišlo šele nedavno, na podlagi zbranih podatkov lahko sklepamo, da po letu 2000, medtem ko predhodne faze postopnega prilagajanja lahko časovno umestimo nekako takole: od 1930. let dalje pojavljanje efemerno, v 1990. letih že lokalno naturalizirano in v zadnjem desetletju zanesljivo invazivno z več smermi širjenja v geografskem in ekološkem smislu. Za širjenje v (pol)naravne rastiščne razmere so primerni predvsem opuščeni kamnolomi in prodišča ter skalnata obrežja rek. Novi podatki, predstavljeni v članku, več kot podvojijo vednost o razširjenosti metuljnika v Sloveniji, primerjava treh predhodno objavljenih kompilacij podatkov o razširjenosti vrste v Sloveniji pa je pokazala, da vedno obstaja razkorak med trenutno zbranim in na zemljevidih razširjenosti upoštevanim znanjem. Glede na to lahko ocenimo, da je naturaliziranih populacij tudi danes v Sloveniji že precej več, kot nam jih je uspelo zabeležiti, kar zahteva tudi odgovorno ukrepanje.

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