



Spread of *Sporobolus neglectus* and *S. vaginiflorus* (Poaceae) in Slovenia and neighbouring countries

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ABSTRACT: Systematic field sampling revealed that within 50 years since the first records in Slovenia, *Sporobolus neglectus* and *S. vaginiflorus* became widespread. They are two superficially similar N American annual grass species with cleistogamous spikelets and similar ecology that are confined to dry ruderal places in their European secondary range, especially along roads. The oldest records of naturalised populations of both species in Europe date back to the 1950s, when both were found for the first time in the Vipava valley (SW Slovenia). They spread slowly in the next decades to NE Italy, N Croatia, and S Austria until recently, when an explosive expansion has been observed along almost all the main roads in lowland and montane Slovenia. In addition to that, one or both of them have recently been recorded scattered in SE Europe (Hungary, Serbia, B&H, Montenegro) and W Europe (France, Switzerland). *Sporobolus vaginiflorus* is herein reported for the first time for Serbia, Herzegovina (in B&H), and Slavonia (in Croatia).

KEYWORDS: invasive species, neophytes, *Sporobolus neglectus*, *Sporobolus vaginiflorus*, road banks, Slovenia, Europe

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INTRODUCTION

Among naturalised neophytes, some inconspicuous grasses quite often remain neglected, especially if their flowering time is late in autumn and, in addition to that, their inflorescences are mostly cleistogamous, hidden in leaf sheaths. This has been the case with two annual species of dropseeds (*Sporobolus* R. Br.), originating from N America, which became locally naturalised in Europe just after the end of WW2, but whose occurrence, although locally they can develop dense “grass-lines” along roads, is still rarely recorded.

Sporobolus is a genus of grasses, subfamily *Chloridoideae* Kunth ex Beilschm. (CLAYTON & RENVOIZE 1986; WATSON 1986), a C_4 -photosynthesis subfamily with only a few taxa (genera *Crypsis*, *Cleistogenes*, *Eragrostis*, *Cynodon*, *Spartina*) native to Europe (VALDES & SCHOLZ 2009). The genus comprises about 160 species with worldwide distribution in tropical

to warm temperate regions, of which 27 are native to N America (PETERSON *et al.* 2003) and only *Sporobolus pungens* (Schreb.) Kunth. is native to Europe (HANSEN 1980; VALDÉS & SCHOLZ 2009). The name “*Sporobolus*” refers to an unusual type of fruit, which is not a typical caryopsis, but instead a one-seeded capsule, as the pericarp is not adherent to the seed and in ripe fruits in contact with water, the inner layer of pericarp swells and ejects the seed.

In addition to native *S. pungens*, several other *Sporobolus* taxa are naturalised in Europe: *S. indicus* (L.) R. Br., widespread in Mediterranean regions (CONERT 1983); *S. cryptandrus* (Torrey) A. M. Gray in Slovakia, Germany, and Italy (HOLUB & JEHLIK 1987; WISSKIRCHEN & HAEUPLER 1998; RAAB-STRAUBE & RAUS 2015); and the discussed two species, *S. neglectus* and *S. vaginiflorus* (see details below), which are locally to regionally established in S Europe. Several more taxa are reported as casuals (CONERT 1983; RYVES *et al.* 1996).

MATERIAL AND METHODS

Mapping of the flora of Slovenia is following the Central-European scheme using the so-called MTB grid for stratified sampling (NIKLFELD 1971). The standard mapping unit is the “quadrant”, which represents one fourth of the so-called base-field and in Slovenia covers about 35 km². Easily recognisable taxa are just recorded in a field-list, which was also the case with systematic recording of the two mentioned species, where only some vouchers were collected and deposited in the LJU herbarium (THIERS 2016).

Specificity of mapping of the discussed *Sporobolus* taxa is linked to their late flowering and narrow ecological niche: they are strictly linked to dry (semi-) ruderal places, especially road banks, so focused field work has to be conducted in autumn. Field research was conducted in 2013 between the end of August and end of October on about 100 sampling plots distributed all over lowland Slovenia. In addition to that, *Sporobolus* material has been revised when available in regional herbaria (KL, GZU, W, WU, ZA, TSB).

Unfortunately, the discussed two species are very rarely collected randomly, so revision of material in herbarium collections, which is normally the key method when analysing the history of spreading of certain neophytic taxa, gave a very limited amount of information.

Finally, many published floristic records for the whole territory of Europe have been checked and the data compiled to analyse the pattern of secondary spreading.

RESULTS AND DISCUSSION

Description of species. The two discussed species share similar appearance and are ecologically similar. They are both annuals, 10 to sometimes over 50 cm tall, with stem branched at the base, shoots distinctly nodial, nodes quite equidistant to the top of the culm, leaf sheaths somewhat shorter than internodes, and leaf blades narrowly linear, shorter than sheaths, and involute when dry. Leaf ligule replaced by a dense rim of short hairs, some longer hairs at the margin of the bottom of the leaf blade. Narrow simple chasmogamous panicle developed terminally (Fig. 1a), protruding from leaf sheath only partially in suitable environmental conditions (a long warm autumn). Cleistogamous panicles develop covered with upper leaf sheaths, exposed only after seeds are completely ripe and the plant is already dead (Fig. 1b). Spikelets 1-flowered (Fig. 1a), slightly laterally compressed, glumes narrow, only weakly covering floret, slightly shorter than spikelet length, lemma and palea similar in structure, both visible, palea wider and longer than lemma. Fruit a special kind of caryopsis, seed not adherent to pericarp and when ripe extruded from pericarp due to inner layers of pericarp swelling

in contact with water, so after an autumn rain, bare somewhat sticky seeds extruded above the leaf sheaths, which had been covering the cleistogamous spikelets. Seed heteromorphism distinct, bigger seeds germinable the first spring, smaller ones need after-ripening over at least one more winter (MCGREGOR 1990), specifically in the case of heterocarpy, which is rather common in annuals and plants of semiarid regions (MANDAK 1997). Flowering: September.

Although both species share many common traits and at the same time are easily distinguishable from all other grasses of the Slovenian flora, there are several stable differences that can be easily presented in the form of a determination key (see also Fig. 1a, 1b):

1 Spikelets 2-3 mm long, cleistogamous silvery white, chasmogamous tinged red to violet, lemma and palea glabrous, abruptly pointed to a short beak, palea with longitudinally folded back, often split, anthers in chasmogamous spikelets 1-1.5 mm long, caryopses 0.8-2 mm long, ripe seeds extruded in wet conditions due to swelling of inner layers of pericarp, at which time sheaths virtually inflated and naked sticky seeds presented at the back of each spikelet. Dry leaves also quite persistent after seed set*S. neglectus* Nash.

* Spikelets (3) 4-6 (7) mm long, lemma and palea with dark transverse stripes, lemma and palea appressed and hairy, hairs 0.2-0.4 mm long, hygroscopic, obliquely erect when wet, appressed when dry, lemma and palea gradually tapering into a narrow peak resembling an awn, palea back not folded, never split, anthers in chasmogamous spikelets 2-3 mm long, caryopses 1.3-3.2 mm long, normal, seeds not extruded, diaspore a whole ripe floret; due to hygroscopic hairs, ripe florets slowly moving the sheaths, which are detached at the bottom and soon fall down after seed set*S. vaginiflorus* (Torr. ex A. Gray) Wood

Such striking differences between these two allegedly closely related species even seem to fit the descriptions of two related genera, which was the reason for the proposed segregation of *S. vaginiflorus* with “normal” caryopses to the genus *Muhlenbergia* Schreb. as *M. vaginiflora* (Torr. ex A. Gray) Jogan (JOGAN 1992a). If that were to be accepted, only *S. neglectus* of the discussed pair would remain within the genus *Sporobolus*, where the peculiar type of caryopses, which are in fact one-seeded capsulae, is typically also present in other taxa.

The ecology of both species is quite similar, a new neophytic community having been described as *Poo-Sporoboletum vaginiflori* (HORVATIĆ & GOSPODARIĆ 1960), and they can be found in dry ruderal places, especially along main roads and railways, in trampled ground with little plant coverage, and in more natural

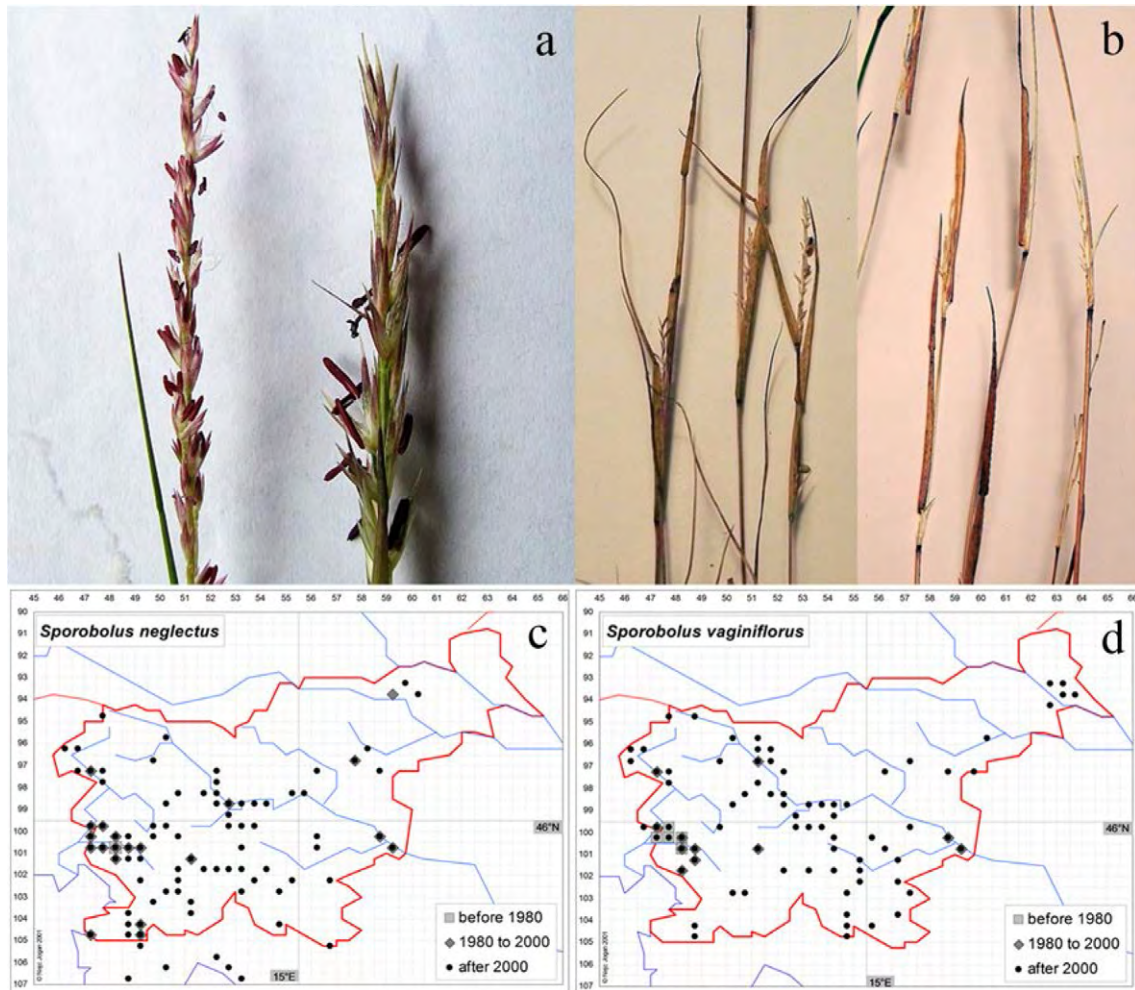


Fig. 1. a) Chasmogamous panicles of *S. neglectus* (left) and *S. vaginiflorus* (right); b) dying plants *S. neglectus* (left) and *S. vaginiflorus* (right) in late autumn: note the persistent vs. detached leaf-sheaths; c) known distribution of *S. neglectus* on the territory of Slovenia; d) known distribution of *S. vaginiflorus* on the territory of Slovenia. Squares: recorded before 1980; diamonds: recorded between 1980 and 2000; dots: recorded after 2000.

habitat types, mainly in pioneer communities on sandy and gravelly dry river banks.

Distribution. Both of the discussed species have their primary distribution in the eastern part of N America, at elevations ranging from lowland up to 1300 m (HITCHCOCK & CHASE 1971; PETERSON *et al.* 2003). Secondly there are some populations in western N America. In the primary range, *S. vaginiflorus* seems to be more common and is frequently linked to disturbed habitat types. On the other hand, *S. neglectus* is regarded as declining and even threatened in some of the northeastern states of the USA, e.g., Maine, Maryland, Connecticut, Massachusetts, New Hampshire, and New Jersey (PETERSON *et al.* 2003; BARKWORTH *et al.* 2007). Both species prefer open, often disturbed habitats with sandy to gravelly soils and thrive in various plant communities. Although native, *S. vaginiflorus* behaves as an invasive species spreading quickly along roads

and in other disturbed areas (CHEPLICK 1993), with ripe cleistogamous spikelets remaining closed inside leaf sheaths until the next spring (*ibid.*).

It seems that the oldest record in Europe indicating subsequent naturalisation and spread of the two discussed taxa was in W Slovenia, in the region adjacent to Italy, a sub-Mediterranean region (COHRS 1953, 1963; MEZZENA 1986; JOGAN 1990). Dropseeds were probably brought there unintentionally by American military forces, which were present in the region from the end of WW2 until 1947. In the 1950s, there are several records of *S. vaginiflorus* collected mainly by A. Filipič and/or K. Zirnich in the lower Vipava valley (COHRS 1963; MEZZENA 1986), where obviously vital populations of both taxa already became established, although the occurrence of *S. neglectus* remained ignored and was only revealed 30 years later in a mixed herbarium sample collected by A. Filipič in 1958. Both species probably

established a population in the Krško basin along the lower Sava river in the 1960s, as *S. vaginiflorus* was recorded already in 1954 in adjacent Croatia (HORVATÍĆ & GOSPODARIĆ 1960) on the river's gravelly banks, while *S. neglectus* was ignored until 1970 (MARKOVIĆ 1973). In the 1970s and 1980s, only a couple of records from the already known parts of Slovenia were gathered, i.e., both taxa in the sub-Mediterranean region of the lower Soča valley (MELZER 1985), and *S. neglectus* in the warmest parts of the extreme SW of the country adjacent to the Adriatic coast (JOGAN 1992b). In the 1990s, new localities scattered all over lowland Slovenia were recorded (JOGAN 1992b), and *S. neglectus* was registered for the first time in central Slovenia in pre-Alpine and sub-Pannonian phytogeographic regions (division following WRABER 1969). In the first years of the new millennium, a number of scattered records slowly increased our knowledge about the distribution of these species, but in the last few years (between 2010 and 2016) it seems that almost all of the main road network in lowland Slovenia has experienced constant spreading of both species (Fig. 1c, 1d).

During systematic sampling in Slovenia in 2013, a great majority of sampling sites scattered all over Slovenia in the lowland and lower montane belts were positive for at least one of the discussed species (see Appendix for details, available online).

Over the last four decades, both taxa also appeared in Austria (MELZER 1978, 1986; WALTER 2002; FISCHER *et al.* 2008), and they spread further in Croatia (HORVATÍĆ & GOSPODARIĆ 1960; MARKOVIĆ 1973; MELZER 1985; MELZER & BREGANT 1990), Italy (PIGNATTI 1982; MELZER 1983; POLDINI 2002; CELESTI GRAPOW 2010), and W Hungary (KIRALY & HOHLA 2015). Later on, sporadic sampling in the countries neighbouring Slovenia revealed the presence of both taxa in more regions of Croatia (e.g., Slavonia, Istria, Gorski Kotar), while *S. vaginiflorus* alone was also found in Montenegro (Podgorica, STEŠEVIĆ & JOGAN 2006) and Bosnia (NOBIS *et al.* 2016). In addition, the first records of *S. vaginiflorus* for Serbia (Srem) and Herzegovina are herein reported.

In Austria, the spread of *Sporobolus* obviously started from the south: thus, *S. vaginiflorus* was recorded for the first time in the 1990s (unpublished record from Melzer's herbarium from Kaernten; WALTER *et al.* 2002) and *S. neglectus* in 1993, already with established populations in the vicinity of Villach just few kilometres from the Slovenian border (MELZER 1994). In the last edition of Exkursionsflora (FISCHER *et al.* 2008), both species are mentioned for Kaernten and *S. neglectus* for Salzburg as well. Quotations for South Tirol refer to Italian territory, but from there its spread to Austrian parts of the Tirol can be expected in the years to come. The occurrence of *S. vaginiflorus* is recognised as naturalised and that of *S. neglectus* as casual to locally established (*ibid.*).

In Italy, the oldest records were geographically not far from the oldest Slovenian records. *Sporobolus*

vaginiflorus was collected for the first time in 1955, in the vicinity of Villesse (along the Torre river, leg. Zirnich, his herbarium published by MEZZENA 1986), just about 20 km west of the oldest Slovenian localities recorded by the same author four years earlier. In 1982 both taxa were already reported in the flora of Italy (PIGNATTI 1982), *S. vaginiflorus* with more localities in close proximity to the first discovered one and *S. neglectus* as a casual at only one locality in Veneto along the river Tagliamento's estuary (cf. MELZER 1981). In the 1991 edition of a distribution atlas (POLDINI 1991) for Friuli-Venezia Giulia, both taxa were reported at more than 15 localities each, scattered in the lowland; 10 years later (POLDINI 2002), both almost completely covered the lowland parts of Friuli. Today *S. vaginiflorus* is reported throughout the entire territory of N Italy (Schede di botanica, <http://luirig.altervista.org/flora/taxa>), while *S. neglectus* is reported in Veneto, but obviously the database is not complete.

The occurrence of *S. vaginiflorus* in western parts of N Italy can be linked to its spread from France, as is probably the case with records in SW Switzerland on the banks of Lake Geneva (CIARDO & DELARZE 2005). On the other hand, at approximately the same time both species were also observed in SE Switzerland, to which populations probably spread from NE Italy (TINNER 2013). However, the discovery of both taxa in NE Switzerland (St. Galler, Rheintal; TINNER 2013) very close to the border with Liechtenstein and Germany cannot be unambiguously linked to already known records, but nevertheless shows an important potential to spread further north, where ecological conditions are quite suitable, especially in the wine-making Rheintal region.

In Croatia, in addition to continental records dating back to the 1950s and 1960s (HORVATÍĆ & GOSPODARIĆ 1960), when both species were found along the Sava river in NE Croatia and subsequently spread into the surrounding lowland areas (including Slavonia, the first records from which are published herein), their spread into the country's sub-Mediterranean part was recorded for the first time in Istria (MELZER 1983, 1985). If recent records of *S. vaginiflorus* in Montenegro (STEŠEVIĆ & JOGAN 2006), Bosnia (NOBIS 2016), and Herzegovina (reported herein) are linked to the Croatian populations, we can expect its occurrence all along the E Adriatic coast.

In more distant W European countries, there are only a handful of secondary records of *S. neglectus* or *S. vaginiflorus*. The occurrence of *S. neglectus* (l'Ain; PROST 1990) and *S. vaginiflorus* (Rhône-Alpes, l'Isère; CHOLER & DUTARTRE 1996) was reported in France, and both were estimated as naturalised and spreading, which is also shown by the interactively produced recent rough distribution map (<http://www.tela-botanica.org>). *Sporobolus vaginiflorus* has also been recorded along a

highway in adjacent W Switzerland (CIARDO & DELARZE 2005).

Outside Europe, there are some records from Japan dating from 1986 on (published in Vascular Plant Specimen Database of the Kanagawa Prefectural Museum of Natural History, accessed via <http://www.gbif.org>), but the degree of naturalisation there is not reported.

Further discussion. A great majority of sampling sites scattered all over Slovenia in its lowland and lower montane belts were positive for at least one of the discussed species. The main cause of seed dispersal is human activity, and the spread of populations can be fast and without any recognisable pattern, so the absence of *Sporobolus* from several plots in the Prekmurje region (extreme E Slovenia) and adjacent Hungary (around Lenti) does not necessarily mean that the discussed taxa (either or both!) are not scattered in these areas as well.

Evidently, the dynamics of spread has been similar to that of *Ambrosia artemisiifolia* (JOGAN & VREŠ 1998), *Geranium purpureum* (PLAZAR & JOGAN 2001), or just recently *Dittrichia graveolens* (FRAJMAN & KALIGARIČ 2009), where in all cases after some years or decades of slow spreading (or stability of sub-Mediterranean native populations of *G. purpureum*), an “explosion” occurred in a short period of time, with the result that in less than a decade all phytogeographical regions of Slovenia acquired naturalised populations of the mentioned neophytic taxa. What happened with *A. artemisiifolia* in the 1980s and 1990s and with *D. graveolens* probably in the 2010s occurred to both *Sporobolus* taxa in the first decade of the 3rd millennium. Not only is the pattern of spread similar to that of the four mentioned species, but all of them are also specifically linked to extreme habitat types of road banks, especially those of heavily salted (during the winter) main roads with a lot of traffic. Despite that, it seems that the main factor responsible for the spread is not traffic, but rather regular mechanical mowing of the road banks with machinery capable of mowing several dozen kilometres in a working day, a procedure that is repeated about once a month during the vegetation period. In addition to frequent mowing and winter salting, road bank habitats are also exposed to trampling and extreme temperatures (asphalt!) with consequent drought during the summer. Moreover, due to vehicles speeding just a few metres away, the air is also extremely turbulent, much more so than in any natural habitat type in the area. The soil is structurally very poor, consisting mostly of sands and gravel. In such extreme ecological conditions, very few native plants can thrive, their number including species such as *Juncus compressus*, *Trifolium campestre*, *Potentilla anserina*, and *Digitaria ischaemum*. However, those plants can be outcompeted by aggressive neophytes, so that especially in the late summer and autumn almost

monocultural stands of *Ambrosia* and/or *Sporobolus* spp., sometimes together with *Dittrichia graveolens*, can be found continuously for kilometres along the main roads. Another probable pathway of the spread of *Sporobolus* seeds is the use of seed mixtures, as reported from Austria by MELZER (1994).

Taking a look at sampling dynamics of *Sporobolus* spp., we must bear in mind their already mentioned late flowering and inconspicuousness, which has resulted in very sparse data collected by random or in systematic floristic research activity of other Slovenian botanists. But at least since 1990, when the four-decades-old Slovenian records of both dropseeds were brought to light again and their distribution was reassessed (JOGAN 1992b; MARTINČIČ *et al.* 1999), the present author has been recording localities of both species, especially in the systematic sampling in 2013.

Very interesting is the relationship between declining populations in several countries in the northeastern part of the native range of *S. neglectus* (BARKWORTH *et al.* 2007) and rapid expansion and spread of the same species in its secondary range of distribution. We can assume that marginal and limiting conditions on the border of the range can somehow result in local extinction of populations. That causes natural fluctuation of the range border. But on the other hand, *S. neglectus* in the European part of its range is spreading even to localities above 600 m a.s.l., for example to Bloke (750 m a.s.l., in the Dinaric part of Slovenia) and to Rateče (850 m), and Strmec (950 m), both in the Alpine phytogeographical region.

With respect to a detail in the biology of spreading of *S. vaginiflorus* seeds, the native populations in N America seem to differ from the naturalised ones in Slovenia. It is reported that in N America ripe cleistogamous spikelets remain closed within their leaf sheaths from autumn until the next spring (CHEPLICK 1993). In Slovenia, on the other hand, already in November it is hard to find an intact sheath covering a ripe panicle, sheaths are detached from the node (see Fig. 1, d), and some ripe florets fall together with sheaths while the rest of them are shed, with the result that only the glumes are somehow persistent.

Another interesting detail refers to the existence of forms allegedly transitional between the two mentioned species. Such forms were reported by COLBRY (1957), but never mentioned in more recent accounts. COLBRY (1957) stated that in limestone areas of Arkansas and Missouri, there can be found *S. vaginiflorus* populations which have typical shape of the lemma and palea, but completely glabrous bracts and - even more significantly - a split palea, a trait characteristic of *S. neglectus*. We haven't observed such forms in Europe.

Late and inconspicuous flowering, un-attractive habitat types, and general neglect of grasses are probably the reasons why both of the discussed taxa can remain

unnoticed, especially in regions where they have not been known for a long time, even decades, previously. This fact we have to bear in mind when interpreting the random age of the »first« records. However, among the dense stands of fresh green tiny annual grass that can be observed during the summer in dry ruderal places, it is easy to recognise one of the discussed species because old spikelets are persistent and can be found attached to the base of the plantlets. This is especially the case with *S. vaginiflorus*, as its fruit is a normal caryopsis that is shed enveloped with the lemma and palea.

Interestingly, the inconspicuousness and similarity of the two discussed taxa apparently resulted in completely wrong illustrations in two important European floristic monographs. Already in 1985, Melzer recognised that in Flora d'Italia (PIGNATTI 1982) *S. vaginiflorus* is represented by an illustration of a typical spikelet of *S. neglectus*. Even more confusing is the presentation of these two taxa in Flora Alpina (AESCHIMANN *et al.* 2004), where *S. neglectus* seems to be represented by a photo of *S. vaginiflorus*, whereas *S. vaginiflorus* is represented by a photo of a herbarium specimen that quite simply is some other grass species. This must not be forgotten, especially when well established and/or scattered populations are reported.

A question which remains to be resolved is how closely related the mentioned two taxa are. As indicated above, it may even be possible to place *S. vaginiflorus* in the related genus *Muhlenbergia* (JOGAN 1992a; POLDINI 2002; AESCHIMANN *et al.* 2004). A molecular systematic study is needed to elucidate the given relationship.

CONCLUSIONS

To summarize the overall pattern of spread, it can be stated that both taxa established the oldest known European populations in SW Slovenia in the decades after WW2, then remaining in lowland ruderal localities. Intense further spreading took place in the 1990s and first decades of 21st century, with a slightly more expressed tendency of *S. neglectus* and *S. vaginiflorus* to spread towards warmer parts more quickly in the continental regions of E Slovenia. At least one locality of both species has been recorded in each of the six phytogeographical regions of Slovenia, including the Alpine and Dinaric ones. From the Slovenian centre of spread, colonisation also went towards the west, which resulted in the presence of both taxa all over the eastern part of N Italy and from there in SE Switzerland as well. The Adriatic part of Croatia (and Herzegovina and Montenegro further on) probably was indirectly colonised from there also. The S Austrian populations are most likely a result of similar northward spreading via central Slovenia.

An independent centre probably appeared in the 1950s along the Sava river in N Croatia, and invasion of the continental parts of Croatia definitely occurred from

there, possibly extending into SE Slovenia as well, and from Croatia to Serbia and Bosnia.

In E France the third centre appeared without clear connections to the others in the 1980s, and the discussed species spread from that centre to invade some other parts of France, SW Switzerland, and the western part of N Italy.

The fourth centre is located in the border regions of NE Switzerland (in the Rhine basin), from where invasion may have spread further to Lichtenstein and SW Germany. However, it is also possible that this centre is linked to the recently reported occurrence of *S. neglectus* in Salzburg.

At the moment, we can be completely sure that there are several more regions where *Sporobolus* populations are already established, but have not yet been discovered, so in the years to come we will no doubt be able to better fill the gaps in our knowledge about the given invasion.

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REZIME

Širenje *Sporobolus neglectus* i *S. vaginiflorus* (Poaceae) u Sloveniji i okolnim zemljama

Nejc JOGAN

Systematskim terenskim istraživanjima otkriveno je da su vrste *Sporobolus neglectus* i *S. vaginiflorus*, 50 godina nakon prvih podataka za Sloveniju, postale široko rasprostranjene. To su dve slične vrste severnoameričkih jednogodišnjih trava sa klejstogamnim klasićima i slične ekologije, u svom evropskom sekundarnom arealu ograničene na suva ruderalna staništa, posebno duž puteva. Najstariji podaci o naturalizovanim populacijama obe vrste u Evropi datiraju iz 1950-ih godina, kada su obe po prvi put pronađene u dolini Vipave (JZ Slovenija). Polako su se širile u SI Italiju, S Hrvatsku, J Austriju sve do nedavno, kada je uočena eksplozivna ekspanzija duž gotovo svih glavnih puteva u nizijskim i planinskim regionima Slovenije. Dodatno, jedna ili obe vrste su skorije zabeležene sporadično u JI Evropi (Mađarska, Srbija, BiH, Crna Gora) i Z Evropi (Francuska, Švajcarska). *Sporobolus vaginiflorus* je po prvi put zabeležen za Srbiju, Hercegovinu (BiH) i Slavoniju (Hrvatska).

KLJUČNE REČI: invazivne vrste, neofite, *Sporobolus neglectus*, *Sporobolus vaginiflorus*, nasipi pored puta, Slovenija, Evropa