

DISTRIBUTION OF “SPANISH SLUG” *ARION LUSITANICUS* AUCT. NON MABILLE 1868 (OR *ARION VULGARIS* MOQUIN-TANDON, 1855) (GASTROPODA: ARIONIDAE) IN LATVIA

Iveta Jakubāne, Digna Pilāte, Edgars Dreijers, Maksims Zolovs

Jakubāne I., Pilāte D., Dreijers E., Zolovs M. 2016. Distribution of “Spanish slug” *Arion lusitanicus* auct. non Mabilille 1868 (or *Arion vulgaris* Moquin-Tandon, 1855) (Gastropoda: Arionidae) in Latvia. *Acta Biol. Univ. Daugavp.*, 16 (2): 175– 180.

The paper presents data on the distribution of *Arion lusitanicus* auct./ *vulgaris* in Latvia. The main result shows that “Spanish slug” is mainly spread in the central part of Latvia where we recorded 14 new localities confirmed on November, 2016. We established that *A. lusitanicus* occurs in dense populations almost in all localities nearby human.

Key words: Arionidae, *Arion lusitanicus*, *Arion vulgaris*, Latvia, distribution.

Iveta Jakubāne, Digna Pilāte, Maksims Zolovs. Daugavpils University, Institute of Life Science and Tehnology, Parādes iela 1a. Daugavpils, LV-5401, Latvia, E-mail: iveta.jakubane@biology.lv, digna.pilate@biology.lv, maksims.zolovs@biology.lv

Edgars Dreijers. The Latvian Museum of Natural History, K. Barona iela 4, Rīga, LV-1050, Latvia, E-mail: malakologs@gmail.com

Digna Pilāte. Latvian State Forest Research Institute “Silava”, Rīgas str. 1111, LV 2169, Salaspils, Latvia, E-mail: digna.pilate@silava.lv

INTRODUCTION

Most of *Arion* species cannot be determined only on external morphology, reproductive system characteristics should also be used (Noble 1992, Сверлова & Гураль 2011, Kozłowski 2007, Păpureanu et al. 2014). In total, seven *Arion* species have been reported in Latvia by Rudzīte et al. (2010): *Arion fuscus* (Müller, 1774), *A. fasciatus* (Nilsson, 1822), *A. silvaticus* Lohmander, 1937, *A. circumscriptus* Johnston, 1828, *A. distinctus* Mabilille, 1868, *A. rufus* (Linnaeus, 1758) and *A. lusitanicus* J. Mabilille, 1868, whereas Stalažs & Dreijers (2016) reported five species (*A. rufus*, *A. distinctus*, *A.*

fuscus, *A. fasciatus* and *A. lusitanicus* auct. non J. Mabilille, 1868).

There are two species in *Arion* genus (*A. vulgaris* and *A. lusitanicus* J. Mabilille, 1868) that differ in its distribution: *A. lusitanicus* is described as endemic for Iberian Peninsula (Portugal) (Pfenninger et al. 2014, Slotsbo 2014,) whereas *A. vulgaris* is natively distributed in Spain (i.e. Iberian Peninsula) (Chevallier, 1981), southern France (Moquin-Tandon 1855, Chevallier, 1981) and it is invasive in others parts of Europe (Slotsbo 2014). In Europe those species are often hardly distinguishable and *A. vulgaris* is often referred as the “Spanish slug” (*A. lusitanicus*

auct. non J. Mabille 1868) due to its natural range that coincide with endemic *A. lusitanicus* (Pfenninger et al. 2014). In Latvia territory “Spanish slug” for the first time was found in 2009 and was defined as *A. lusitanicus* (Rudzīte et al. 2010). The further studies of “Spanish slug” distribution in Latvia territory also refer this slug as *A. lusitanicus* auct. non J. Mabille 1868 (Stalažs & Dreijers 2016). In the present study, we identified slugs only by morphological and anatomical features (reproductive system characteristics) and referred it as *A. lusitanicus* auct. non J. Mabille 1868.

The distribution of “Spanish slug” in Latvia territory is purely investigated. Until 2013, only two localities of slugs were known: Pastende (Rudzīte et al. 2010) and Jelgava (Stalažs et al. 2014). Moreover, molecular genetic studies should be conducted to prove slugs belonging to the *A. lusitanicus*.

In many European countries “Spanish slug” is regarded as one of the most destructive agricultural crop pest (Slotsbo 2014). It is considered an alien species for Latvia territory (Nature Conservation Agency: Nr. 7.7/103/2105-P). Moreover, agricultural land area of Latvia has grown and became significant source for economic development (Raubena 2016). Thus, the territory of Latvia should be surveyed to record area of slug introduction.

Even though “Spanish slug” was initially reported in Latvia in 2009, the first complaints about problems with this species were received from citizens only in 2016, that led to the involvement of citizens in research on the distribution of this species in 2016. In this paper we present data on the distribution of this species in Latvia (all confirmed localities till November 2016).

MATERIAL AND METHODS

The investigation was carried out in the period from 2014 to 2016. Information on the

distribution of slugs was obtained in two ways: Firstly, we visited sites where slugs could be potentially introduced, e. g. plant nurseries of companies which are known as importers of plants. Secondly, data were collected from citizens. A public information campaign was initiated in 2016 by publishing information on “Spanish slug” in various popular and popular-scientific magazines. Published information contained photographs of different slug species, especially the largest and most common ones, and contact details for reporting the presence of slugs in gardens or agriculture fields. Responses from citizens were received via phone or email. Based on the received reports, a total of 33 potential “Spanish slug” localities were surveyed. In survey localities, the focus was made on species distribution corridors.

All the reports were confirmed with collecting material of slug specimens by authors. Identification of slugs was done on the base of differences in anatomical features for particular slug species according Noble (1992).

RESULTS AND DISCUSSION

Localities and habitats of *A. lusitanicus* auct. non J. Mabille 1868

Until 2013, “Spanish slug” was known only from two localities: Pastende, confirmed in 2009 (Rudzīte et al. 2010) and Jelgava, confirmed in June of 2010 (Stalažs et al. 2014). During 2014 and 2015 we confirmed six new localities. They were under humanly-influenced environment close to home gardens or plant nurseries with imported seedlings. The number of known sites with “Spanish slug” increased by eight after informative campaign provided for citizens in 2016 (Fig. 1, Table 1).

In all sites slugs was found in dense populations. According to information received from citizens, rapid increase of each population occurred over more than five years. It should be taken into account that recognition of the presence

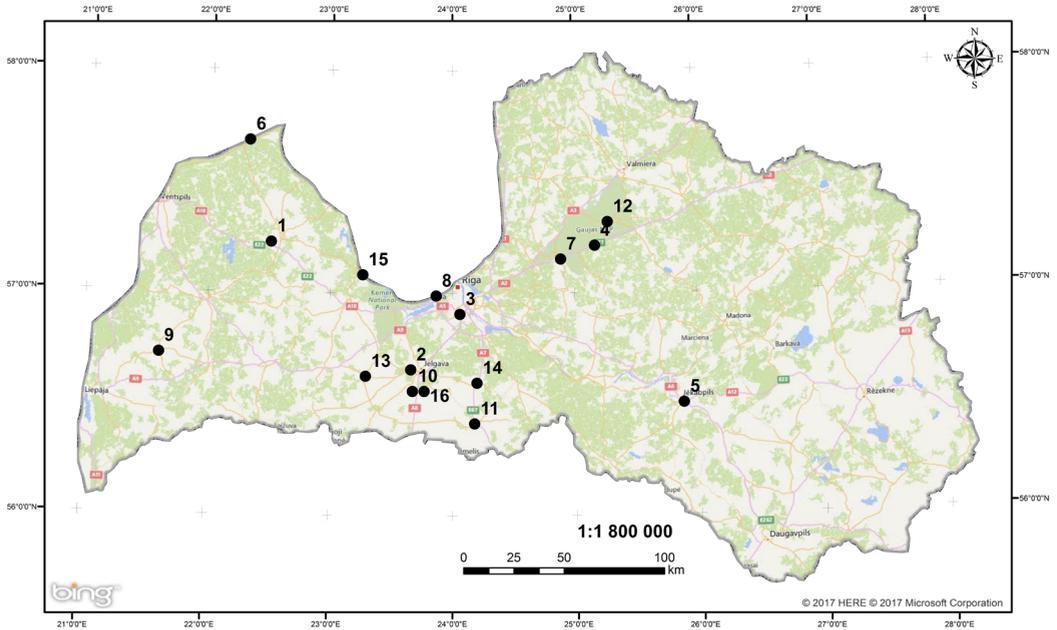


Fig. 1. Confirmed localities of *Arion lusitanicus* auct. non J. Mabille 1868 in Latvia during 2009 - 2016 (map drawn by M. Nitcis). Full name of places are given in Table 1.

Table 1. Sites where the presence of *Arion lusitanicus* auct. non J. Mabille 1868 has been confirmed in Latvia

No.	Year of species detection	Locality	Geographical coordinates	Habitat
1.	2009	Pastende	57° 13' 39.137" N, 22° 30' 31.767" E	Gardens, fallow field, roadside, field with rape, lakeside
2.	2010	Jelgava	56° 39' 25.012" N, 23° 39' 43.804" E	Gardens, roadside
3.	2014	Bieriņi	56° 54' 23.892" N, 24° 3' 42.548" E	Greenhouse complex
4.	2014	Ieriķi	57° 12' 43.580" N, 25° 10' 17.058" E	Roadside, plant nursery, fallow field, forest, ditches, roadside
5.	2014	Jēkabpils	56° 30' 9.523" N, 25° 52' 38.755" E	Gardens, roadsides, ditches
6.	2014	Mazirbe	57° 41' 2.584" N, 22° 18' 59.167" E	Gardens, roadsides, fallow field
7.	2015	Sigulda	57° 9' 8.574" N, 24° 53' 29.085" E	Gardens, roadsides, ditches
8.	2015	Jūrmala	56° 59' 20.652" N, 23° 52' 4.686" E	Gardens, roadsides, dunes
9.	2016	Aizpute	56° 43' 23.089" N, 21° 36' 35.778" E	Gardens
10.	2016	Atpūta	56° 33' 36.061" N, 23° 40' 35.486" E	Gardens, forest
11.	2016	Jauncode	56° 24' 51.343" N, 24° 10' 50.111" E	Gardens, roadside, ditches
12.	2016	Cēsis	57° 19' 3.587" N, 25° 16' 49.860" E	Gardens
13.	2016	Dobele	56° 37' 35.782" N, 23° 17' 42.223" E	Gardens, forest
14.	2016	Iecava	56° 35' 50.423" N, 24° 11' 59.620" E	Gardens
15.	2016	Plieņciems	57° 4' 56.493" N, 23° 15' 53.652" E	Gardens
16.	2016	Vircava	56° 33' 37.024" N, 23° 46' 16.904" E	Gardens

of “Spanish slug” by citizens was usually delayed until large and dense populations were established.

In the most of the surveyed areas, this species is common in gardens and roadsides, but in some places slugs have already moved to the other habitats (fallow field, dunes, lake side, field with rape) (Table 1). In Latvia, slugs were documented in a rape field only in Pastende in 2009, and there is no further information about its impact as an agricultural pest in this locality. It was found that the slug spread mainly by roadsides and watersides.

Potential impact on *Arion rufus*

Only *A. rufus* may be wrong identified as *A. lusitanicus* auct. non J. Mabille 1868 in Latvia. *Arion rufus* is distributed in the most western part of Latvia - in the Kurzeme region (Rudzīte et al. 2010). In Latvia there is no evidence that *A. rufus* and *A. lusitanicus* auct. non J. Mabille 1868 occur together, as in all sites where particular species have been confirmed, both species occur separately and never together. The nearest locality where *A. lusitanicus* auct. non J. Mabille 1868 have been confirmed is situated about 50 km away from an area where *A. rufus* was found. However, the observed spread of “Spanish slugs” in Latvia could be threat to *A. rufus*. It has been documented that if *A. lusitanicus* contacts *A. rufus* populations, over time, via hybridisation, *A. rufus* disappears and *A. lusitanicus* auct. non J. Mabille 1868 remains (Dreijers et al. 2013).

Distribution of *A. lusitanicus*

We assume that “Spanish slugs” were introduced into Latvia during the last 10-12 years, i.e. after 2004, when Latvia became a member state of European Union (EU). Opening of the borders between member states accelerated plant import from other EU countries that contributed *A. lusitanicus* introduction (Reise et al. 2002; Kozłowski 2007; Soroka et al. 2009; Dreijers et al. 2013).

The fast spread of *A. lusitanicus* in Latvia happened similarly to other countries where this species has been previously studied (e. g. in Poland: Kozłowski 2007; Kozłowski, Kozłowski 2011; in Estonia: Eek, Kukk 2013; in Norway: Hatteland et al. 2013). Similarly to other countries (Noble 1992; Kozłowski 2000; Soroka et al. 2009), *A. lusitanicus* mainly occur in anthropogenic habitats (Slotsbo 2014) (Table 1).

Although the presence of this species in all Baltic countries had been recorded quite recently — initially in Estonia (Eek, Kukk 2008) and in Lithuania in 2008 (Adomaitis, Skujienė 2016), this species rapidly spreads to new territories. In Lithuania, the “Spanish slug” is already included in the List of Invasive Species (Gudžinskas et al. 2014).

ACKNOWLEDGEMENTS

Fieldwork was carried during 2013 out within the framework of the project „Joint resistance to bioinvasions for sustainable agriculture and management of natural resources/ TEAMWORK (LLIV-250) within the Latvia–Lithuania Cross Border Cooperation Programme under the European Territorial Cooperation Objective 2007–2013”, as well as fieldwork was carried out during 2015 within the project of Nature Conservation Agency: Nr. 7.7/103/2105-P “Developing of invasive alien species monitoring program in Latvia”. Authors are grateful to the Arturs Stalažs and Māris Jundzis for material collection.

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Received: 05.10.2016.

Accepted: 01.1.2016.

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