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Short communication

Harmonia axyridis (Pallas, 1773) (Coleoptera: Coccinellidae) – expansion to the north: first records of invasion species in Yaroslavl and Novgorod Regions

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Abstract. The paper gives information on the invasion of *Harmonia axyridis* (Pallas, 1773) (Coleoptera: Coccinellidae) into the north of the European part of Russia. The Asian ladybird is recorded for the first time from the Novgorod and Yaroslavl Regions. All records of this alien species from European Russia and the Northern Caucasus are listed.

Keywords: invasion, Asian ladybird, alien species, fauna, beetles.

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Introduction

The Asian ladybird, or harlequin ladybird – *Harmonia axyridis* (Pallas, 1773) (Coleoptera: Coccinellidae) (Fig. 1), which has a native range in northeastern Kazakhstan, China, Mongolia, Korea, Japan and the Asian regions of Russia (South Siberia and the Far East, including its insular part) (Andrianov et al., 2018), has recently been actively spreading within the European part of Russia, which to a large extent poses a risk for native species of Coccinellidae.

In European Russia, *Harmonia axyridis* was first discovered in 2004 in the Belgorod Region (Orlova-Bienkowskaja, 2013), then this species was recorded in a number of regions of the European part of Russia from Kaliningrad and Moscow to the southern regions of the Chernozem Region and the republics of the Caucasus (Orlova-Bienkowskaja, 2013, 2014), and in recent years (2018–2020) has quickly spread across the the Volga Region and the center of European Russia (Egorov et al., 2019; Ruchin et al., 2020; Sazhnev et al., 2020). Judging by the findings, the distribution of *Harmonia axyridis* goes from south to north (donor regions, probably the Krasnodar Region and the Caucasus) and from west to east, i.e., from the European countries bordering Russia, where the

species was introduced back in the early 2000s and spread widely (Roy et al., 2016).

Materials and methods

On the territory of the Yaroslavl Region, the alien species *Harmonia axyridis* was first discovered in 2020. During expeditionary studies in 2021 in different areas of the Yaroslavl Region, the authors also collected last instar (L4) larvae preparing for pupation, pupae and adults. In total, more than 70 specimens were collected. The material is kept in the collection of the Institute of Biology of Inland Waters (IBIW RAS, collections of A.S. Sazhnev), the Zoological Museum Yaroslavl State University named after P.G. Demidov (ZMYarSU, collections of A.A. Rusinov), private collections of D.V. Vlasov (CV) and V.D. Titov (CT). The data for the Novgorod region were kindly provided by colleagues. Some of the distribution points were obtained thanks to the "iNaturalist" project (https://www.inaturalist.org/).

Material:

Novgorod Region: Veliky Novgorod, 08.08.2021, larva L4 (1 specimen), E. Chausova (photo).

Yaroslavl region: Rostov, center, Sovetskaya ploshad, 23.09.2020, imago f. *succinea* (1 specimen), CT; in the same place, ul. Marshala Alekseeva, 23.08.2021, adult f. *succinea* (1 specimen), CT; the same place, 08.09.2021, imago f. *succinea* (3 specimens), CT; the same place, 13.09.2021, imago f. *spectabilis* (1 specimen), CT.

Rostov District, village Spirtsovo, on leaves of white dogwood (*Cornus alba* Linnaeus, 1767), 19.09.2021, pupa (3 specimens), growing to imago f. *succinea* 24.09.2021 (1 specimen) and 26.09.2021 (1 specimen), CT.

Nekouz District, Borok village, 28.07.2021, larva L4 (1 specimen), IBIW RAS; the same place, 30.07.2021, pupa (1 specimen), imago f. *succinea* (19 specimens), IBIW RAS; the same place, 02.08.2021, L4 larva (2 specimens), pupa (1 specimen), imago f. *succinea* (15 specimens), IBIW RAS; the same place, 03.08.2021, imago f. *succinea* (1 specimen), IBIW RAS; the same place, 14.08.2021, imago f. *succinea* (1 specimen), IBIW RAS; the same place, 22.08.2021, imago f. *succinea* (1 specimen), IBIW RAS.

Yaroslavl, Zavolzhsky District, entering apartment on the 5th floor, 15.08.2021, imago f. *succinea* (1 specimen), ZMYarSU; Yaroslavl, Dzerzhinsky District, on poplar bushes, 19.08.2021, adult f. *succinea* (1 specimen), CV; the same place, trunk of linden, 14.09.2021, larva L4 (1 specimen), pupa (2 specimens taken for hatching, f. *succinea* emerged, 24.09.2012, CV); Yaroslavl, Kirovsky District, 12.09.2021, larva L4 (1 specimen), pupa (1 specimen), A. Stolbovsky (photo); the same place, 24.09.2021, on *Sedum* flowers, imago f. *succinea* (1 specimen), CV; Yaroslavl, on the walls of buildings and on a fence on the Volga and Kotorosl river embankment, 06–16.10.2021, imago, (> 20 specimens), CV.

Pereslavl District, vicinity of village of Glebovskoe, on ruderal grasses, 10.08.2021, imago f. *succinea* (7 specimens), CV; Pereslavl-Zalessky, on a pine, imago f. *spectabilis*, 24.08.2021 (1 specimen), A.D. Gorbunov (photo).

Most of the adults collected during the study were assigned to the color form f. *succinea*; f. *spectabilis* was recorded in Pereslavl-Zalessky, in Rostov and the village of Spirtsovo (Rostov district). Mass pupa-

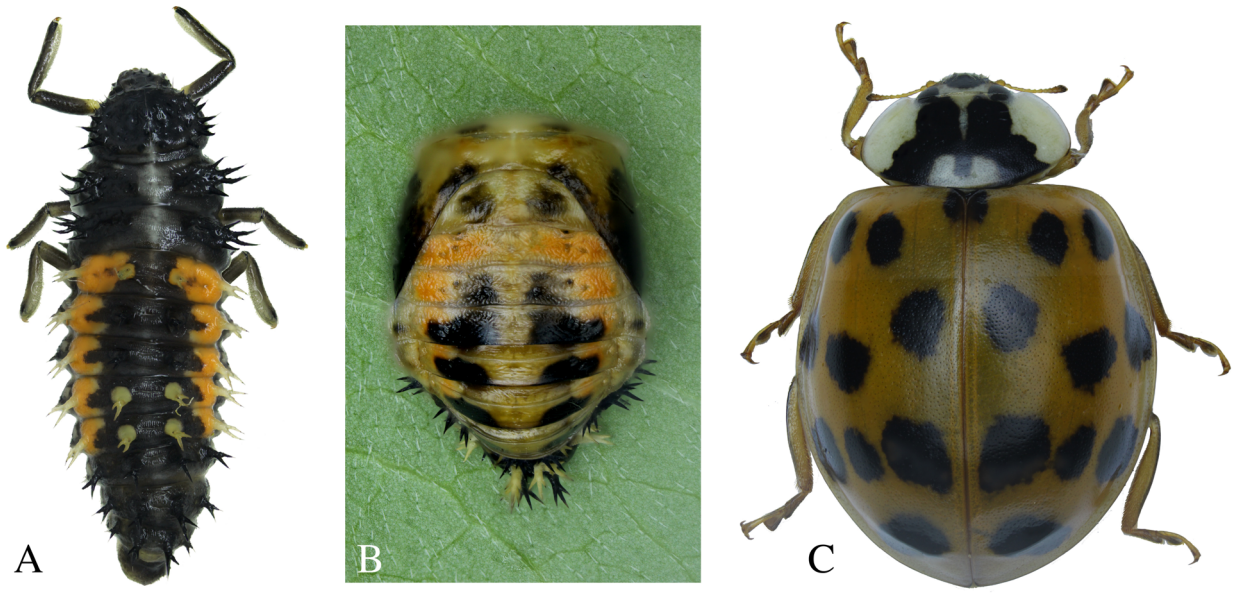

Fig. 1. *Harmonia axyridis* (Yaroslavl Region, Borok village). **A** – larva L4, **B** – pupa, **C** – adult f. *succinea* (photographs by A.S. Sazhnev).

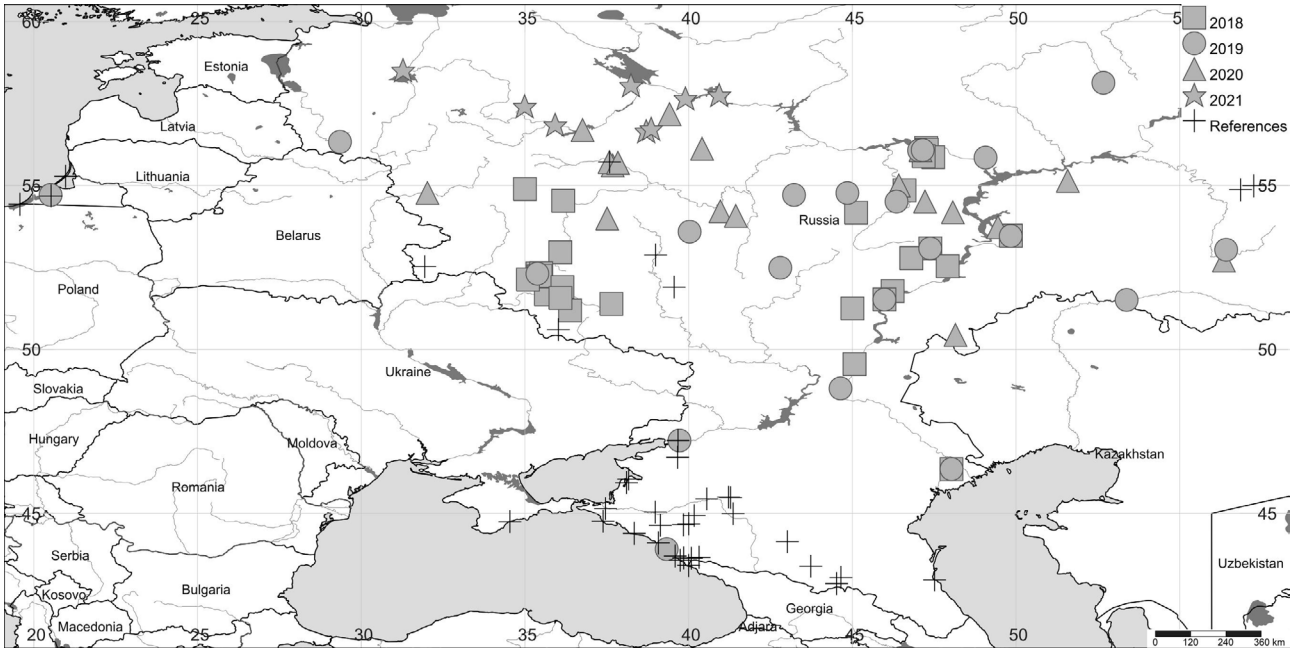

Fig. 2. The modern range of *Harmonia axyridis* in European Russia and the Northern Caucasus (all points on map (except references) – author's data)

tion of larvae was observed in early to mid-August (August 02–14, 2021) in Borka and in the first ten days of September (09.09.2021) in Rostov.

Results and discussion

At present, the record of the Asian ladybird *Harmonia axyridis* in the Novgorod and Yaroslavl regions (as well as the record from the city of Glazov, Udmurt Republic (Sazhnev et al., 2020)) are the northernmost sites for the secondary range of this invasive species within European Russia. Most likely, the distribution of the species to the north will extend beyond these records, and records of the ladybird can be expected in adjoining northern regions, such as the Pskov, Vologda, Leningrad regions, the Republic of Karelia, etc. For instance, at present *Harmonia axyridis* is known in the Baltic Region and Scandinavia: Latvia, Estonia and Finland (Barševskis, 2009; Kallavus, 2018; pers. data).

Undoubtedly, the expansion of many species outside their ranges has an anthropogenic basis. However, modern global processes of climate change contribute to the extension and change of ranges: in particular, an increase in average annual temperatures allows certain species shift their distribution northwards. For *Harmonia axyridis*, the question of the limit of its range and the possibility of successfully overwintering in the northern part remains open, since even in more southern regions, a rather large percentage of individuals of this species died during overwintering (Sazhnev et al., 2020).

Conclusions

Thus, according to the literature (Ruchin et al., 2020; Sazhnev et al., 2020) and our own observations, the modern range of *Harmonia axyridis* in European Russia and the North Caucasus covers the following regions (Fig. 2): Astrakhan, Belgorod, Bryansk, Vladimir, Volgograd, Voronezh, Kaliningrad, Kaluga, Kostroma, Lipetsk, Moscow, Nizhny Novgorod, Novgorod, Orenburg, Oryol, Penza, Pskov, Rostov, Ryazan, Samara, Saratov, Tula, Ulyanovsk and Yaroslavl regions, city of Moscow, Krasnodar, Stavropol, the Republic of Adygea, Bashkiria, Dagestan, Kabardino-Balkaria, Karachay-Cherkessia, Crimea, Mordovia, North Ossetia-Alania, Tatarstan, Udmurt, Chechen and Chuvashia regions.

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