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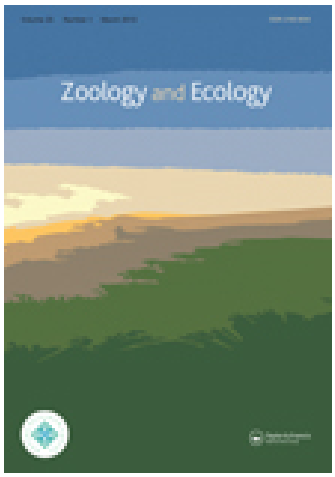

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The first record of the invasive lady beetle *Harmonia axyridis* (Pallas, 1773) (Coleoptera: Coccinellidae) in Turkey

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The morphologically variable multicoloured Asian lady beetle, *Harmonia axyridis*, is reported for the first time from Turkey. A single specimen of this invasive species was recorded in Cappadocia (Central Turkey). General information on the bionomy and distribution of *H. axyridis* is given.

Aprašomas pirmas morfologiškai kintančios daugiaspalvės azijinės boružės (*Harmonia axyridis*) aptikimo atvejis Turkijoje. Vienintelis šios invazinės rūšies egzempliorius buvo užregistruotas Kapadokijoje (Turkijos centrinė dalis). Pateikiama bendra informacija apie *H. axyridis* bionomiją ir paplitimą.

Keywords: *Harmonia axyridis*; Turkey; first record; invasive

Introduction

The multicoloured Asian lady beetle, *Harmonia axyridis* (Pallas, 1773) has a long history of use as a biological control agent of aphids and coccids from the early twentieth century (Gordon 1985; Majerus 1994). The species has been widely used for pest control on various crops in Europe, North and South America, and Africa. *H. axyridis* has been used to control pest species on apples (Brown and Miller 1998), citrus fruits (Michaud 2002) and in other crop systems, e.g. alfalfa, cotton, maize, soybean, tobacco, winter wheat, etc. (Koch 2003; Koch and Galvan 2008). Over many decades, hundreds of papers on faunistics, morphology, behaviour and activity, natural enemies, genetic, population trends, predation, competition, habitat preferences, etc. have been dedicated to this species.

From its native range in Asia, *H. axyridis* has spread to five continents at a very fast rate during the last 23 years (Brown et al. 2011). The multicoloured Asian lady beetle is the most invasive of all alien coccinellids in Europe as well as worldwide (Roy and Majerus 2010). This species causes negative ecological and economic consequences (Koch and Galvan 2008; Roy et al. 2012), and possible negative impacts of *H. axyridis* on native species have been of particular concern (Brown et al. 2008; Pell et al. 2008; Roy and Wajnberg 2008; Verizhnikova 2011).

In the present paper, a first record of *H. axyridis* from Turkey is provided and general information on this invasive species is given.

Materials and methods

The examined material is deposited in the private collection of the second author (Riga, Latvia).

The specimen was studied using a Leica S6D stereomicroscope. Specimen photographs were taken using a Canon EOS 450D SLR camera attached to the microscope, and CombineZP (© Alan Hadley) software was used for image stacking.

Results and discussion

Harmonia axyridis (Pallas, 1773) is reported here for the first time from Turkey and the Middle East. The recorded specimen belongs to the colour morph "*succinea*".

Material examined

Original label: Türkei, Kappadokien, Umg. Göreme, 21–26.vii.2013, leg. Steffen Schellhorn (1 specimen) Figures 1 and 2.

Distribution

The geographic range of *H. axyridis* is expanding rapidly. This species is considered native to southern Siberia, north Kazakhstan, Mongolia, Russian Far East, Japan, Korea and China (with a range extending to the south of the country – Provinces of Yunnan and Guangxi) (Dobzhansky 1933; Iablokoff-Khnzorian 1983; Kuznetsov 1992, 1997; Sasaji 1971). However, its entire

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Figure 1. *H. axyridis*, morph "*succinea*", habitus, dorsal view (specimen from Göreme env., central Turkey).

native distribution range is still not clearly understood (Brown et al. 2011).

The multicoloured Asian lady beetle is currently also known from North America (Canada, the USA and Mexico), South America (Argentina, Brazil, Chile, Colombia, Paraguay, Peru and Uruguay), Africa (Egypt, Kenya, Lesotho, South African Republic and Tunisia) and Australia (Brown et al. 2011). In Europe, *H. axyridis* has spread very rapidly, particularly since 2002 (Kulijer 2010). According to Brown et al. (2011), in Europe, this species was registered in 33 countries. Later, *H. axyridis* was also recorded from Lithuania (Nagrockaitė, Tamutė, and Tamutis 2011), Moldova (Iazlovețchii and Sumencova 2013) as well as the European part of Russia [Kaliningrad Region (Alekseev and Bukejs 2014; Alekseev, Bukejs, and Balalaikins 2012), Krasnodar Region and North Caucasus (Ukrainsky 2013), Belgorod Oblast (Orlova-Bienkowskaja 2013), Lipetsk Oblast (Ukrainsky and Orlova-Bienkowskaja 2014)].

According to published data, the nearest known records of *H. axyridis* to Turkey come from Bulgaria (Tomov et al. 2009), Greece (Kontodimas, Stathas, and Martinou 2008) and Georgia (Brown et al. 2011; Poutsma et al. 2008).

In the last few years, a wide distribution of this invasive species was observed on the Black Sea coast of Krasnodar Region, on the part of the Black Sea coast of Abkhazia, and in the southern and northern foothills of the Greater Caucasus, where it is considered to be a dominant ladybird species (Orlova-Bienkowskaja 2014). Probably, the Transcaucasian population appeared as a result of the intentional introduction in the 1980s. But the Ciscaucasian populations appeared as a result of some later releases of species or as a result of spontaneous expansion of the European invasive range.

Morphology

Imagoes of *H. axyridis* vary from 4.9 to 8.2 mm in the total body length (Kuznetsov 1992, 1997). The body is oval, moderately convex dorsally. Dorsal colouration and maculation are highly variable. The colour of the head can be black, yellowish-orange or black with yellowish markings. The pronotum is yellowish-orange or red with black markings in the centre: these markings can form four black spots, two curved lines, a black M-shaped mark or a solid black trapezoid. The pronotum is black with orange or red markings in the melanic form. Elytral colouration can range from yellow-orange to red with up to 19 black spots; or may be black with or without red spots. The apex of the elytra usually has a transverse fold. The ventral surface can be yellow-orange to uniformly black (Chapin and Brou 1991; Kuznetsov 1992, 1997; Przewoźny, Barłozek, and Bunalski 2007; Sasaji 1971).

Numerous colour morphs of *H. axyridis* are documented (Dobzhansky 1933; Komai 1956). The relative frequencies of various morphs vary geographically. Colour polymorphism has also been shown to vary seasonally within a year (Komai 1956; Osawa and Nishida 1992). European populations of *H. axyridis* generally include a mix of three main colour morphs: "*succinea*", "*spectabilis*" and "*conspicua*", with "*succinea*" being

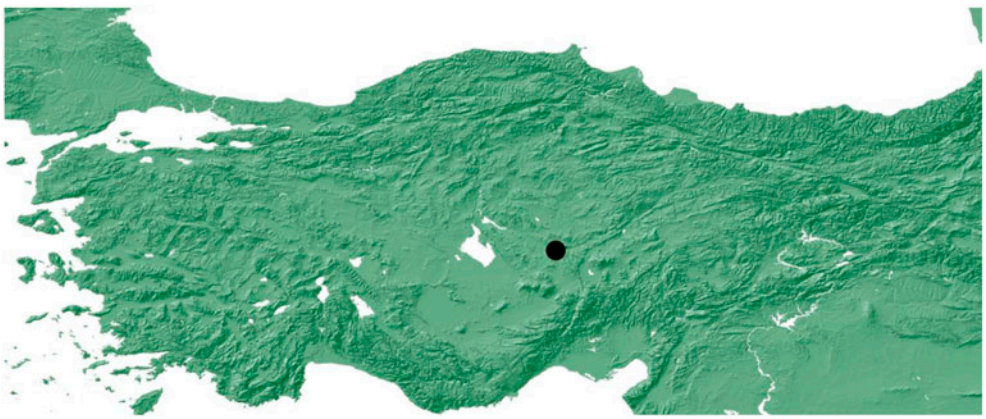

Figure 2. Locality of *H. axyridis* in central Turkey: Göreme environs (prepared using ArcMaps 9.0).

predominant. These morphs do not have any taxonomical value and are informal. According to Koch, Venette, and Hutchison (2006), "*succinea*" is generally associated with boreal forests, temperate broadleaved and mixed forests, temperate coniferous forests and tropical/subtropical moist broadleaved forests. In this morph, elytra are generally yellow, orange or red, and bear 0–21 black spots, partly or completely fused to various degrees (Brown et al. 2008).

Bionomy

Harmonia axyridis is considered to be a semi-arboreal (Hodek 1973) polyphagous species, with a wide prey range. It feeds on aphids, psyllids, adelgids, coccids, and the eggs and larvae of many other insects, including other coccinellids and lepidopterans (Koch 2003; Koch, Venette, and Hutchison 2006; Ware and Majerus 2008). It is able to out-compete and displace native aphidophagous species through predation and competition for food (Koch 2003; Roy and Wajnberg 2008). Imagoes can also damage grapes, apples and pears (Galvan et al. 2007; Galvan, Koch, and Hutchison 2008; Koch et al. 2004).

Because of its large prey-range, *H. axyridis* occurs in a wide variety of natural, semi-natural and anthropogenic habitats (Brown et al. 2011; Koch 2003; Koch, Venette, and Hutchison 2006). The species is documented from woodlands and forest habitats, small anthropogenic woodlands, parks and gardens, agricultural and horticultural habitats as well as from buildings in cities, towns and villages. The locality in Göreme, central Turkey, is an agricultural area.

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