



First Records of the Brown Marmorated Stink Bug *Halyomorpha halys* (Stål, 1855) (Hemiptera: Pentatomidae) in Republic of North Macedonia

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Abstract: The brown marmorated stink bug *Halyomorpha halys* is one of the most harmful invasive insect species worldwide. Originating from Asia, this species invaded first North America and later the European continent, where it has soon become widely spread. There have been no official data of the presence of *H. halys* on territory of the Republic of North Macedonia, although the species was recorded in the neighbouring countries: Serbia, Bulgaria, Greece and most recently in Albania. This paper reports the first record of *H. halys* in two regions of R. North Macedonia: in the town of Gevgelija, situated close to the Greek border and in the capital Skopje. The transport as a stowaway and natural dispersal across borders are discussed as potential pathways of introduction of the pest species in this country. The establishment and further spread of *H. halys* in R. North Macedonia could be expected in the future.

Key words: Invasive species, occurrence, citizen's report, pathway of introduction, Balkan Peninsula.

Introduction

The brown marmorated stink bug *Halyomorpha halys* (Stål, 1855) (Hemiptera, Pentatomidae) is an extremely polyphagous species that can feed on numerous wild and cultivated plants (NIELSEN & HAMILTON 2009). This species is native to East Asia, specifically to China, Japan, Korea, Myanmar, Vietnam and Taiwan (JOSIFOV & KERŽHNER 1978, RIDER et al. 2002). Since its first records in the USA during the late 1990s (HOEBEKE & CARTER 2003) and in Europe in 2007 (WERMELINGER et al. 2008) it has become widely distributed throughout these regions. Currently, it is considered a global invasive pest spreading in many countries of North America, Europe, Eurasia, with recent findings in South America as well (FAÚNDEZ & RIDER 2017).

The first records of *H. halys* in Europe date back to 2004 when the specimens were observed

in Liechtenstein and Switzerland (WERMELINGER et al. 2008, ARNOLD 2009, HAYE et al. 2014). Since then, *H. halys* has been spreading continuously all over the continent and, to date, it has been recorded in many countries, such as: Germany in 2011 (HECKMANN 2012), France and Italy in 2012 (CALLOT & BRUA 2013, MAISTRELLO et al. 2014) and Hungary and Romania in 2014 (VÉTEK et al. 2014, MACAVEI et al. 2015). In the Balkan Peninsula, the species was recorded for the first time in Greece in 2011 (MILONAS & PARTSINEVELOU 2014), in the urban zone of Athens. The second finding in the region was from Serbia, in October 2015, at two independent places, in Vršac, at the Romanian-Serbian border, and in Belgrade, in a botanical garden, from where the invasion started and the species has soon become established in the country (ŠEAT 2015, MUSOLIN et al. 2018). The species was recorded in Bulgaria in 2016 (SIMOV 2016), then in Slovenia and Croatia in

2017 (ROT et al. 2018, ŠAPINA & ŠERIĆ JELASKA 2018), as well as in Bosnia and Herzegovina and Albania in 2018 (CLAEREBOUT et al. 2019, cited in EPPO 2019, ZOVKO et al. 2019). All those findings confirm the presence of *H. halys* in the Balkan countries, including the ones neighbouring the Republic of North Macedonia, with a lack of official information whether it is present in this latter country or not.

With this communication the first records of *H. halys* in the Republic of North Macedonia are reported based on field data and data from citizens.

Materials and Methods

The material was collected at light between 7 and 10 p.m. on 27 July 2019, on the wall of a house in Gevgelija Town (N 41.142217, E 22.503331), approximately 7 km far from Evzoni Station, at the R. North Macedonian – Greek border (Fig. 1).

Five adult specimens of sting bugs were observed to land on the wall near a light lamp placed above the front door of a detached house located about 2 km far from the highway A1/E75 in Gevgelija Town. The specimens were collected to be identified later at the laboratory. The owners of the house and their neighbours (five people in total) were interviewed and asked about the presence and/or possible disturbance by the bugs, as well as whether they noticed any damage, which these insects can cause to cultivated plants.

The collected adult insects were determined at the Entomology Laboratory of the Department

of Plant and Environmental Protection at the Faculty of Agriculture, University of Novi Sad, Serbia. The identification was done based on their morphological features, by using the identification key of WYNIĞER & KMENT (2010). The specimens were also compared to Serbian voucher specimens deposited in the collection of the laboratory.

During the investigation of published data on *H. halys* in R. North Macedonia, one photo of a nymph was found posted on 24 July 2018 in the Facebook Public Group Insekti Srbije (Insects of Serbia), as the picture of an ‘unknown insect species found in the urban area of Skopje (the capital of R. North Macedonia)’ (citation translated) (https://www.facebook.com/groups/insectserbia/?post_id=1048476555355423). The picture was taken on 23 July 2018.

Results

The identification of the five collected specimens in Gevgelija Town confirmed that all of them were adults of *H. halys*, two males and three females. The voucher specimens were deposited at the Entomology Laboratory of the Department of Plant and Environmental Protection, Faculty of Agriculture, University of Novi Sad, Serbia.

The picture taken by the citizen in Skopje, although of low quality, also showed one nymph of *H. halys*.

These records are the first report of the presence of *H. halys* in the Republic of North Macedonia (Fig. 1).

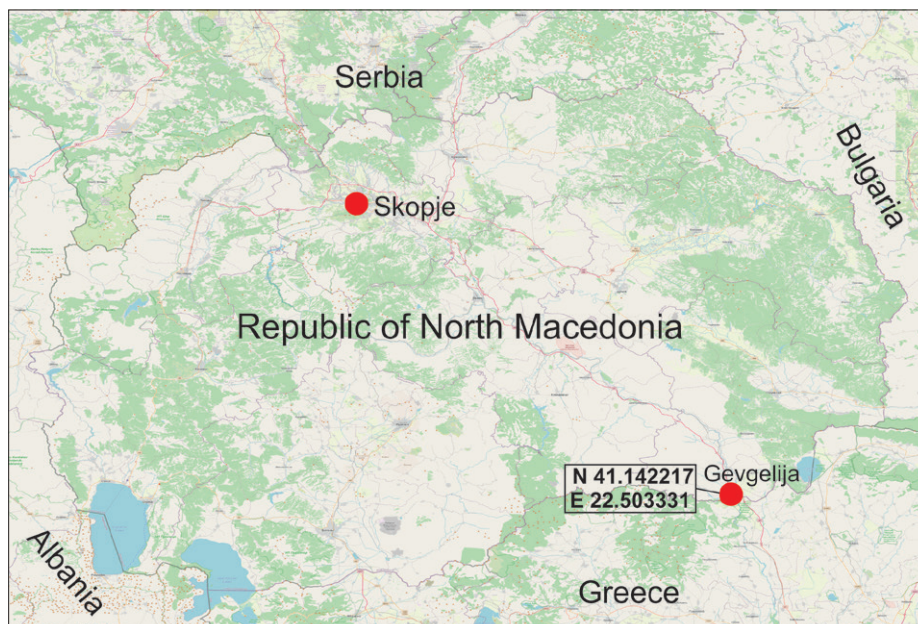


Fig. 1. Map of the Republic of North Macedonia with the sites where *Halyomorpha halys* was recorded.

Discussion

Based on the own records of *H. halys* described above and the record informally published by a citizen from two distant localities in R. North Macedonia, it might be assumed that the first specimens of *H. halys* were introduced and established in R. North Macedonia earlier than these first observations.

The owners of the house and their neighbours who were interviewed about the stink bugs in their urban surroundings were not aware of the alien species to be present in their town or country. During the interviews, they all commented the appearance of the stink bugs as a 'general phenomenon during summer' and they said that they had not noticed any new/different species or a high abundance of pest stink bugs in their gardens. The species was not assessed as a nuisance to local inhabitants and they had no complaints about any damage.

One of the most probable pathways of introduction of *H. halys* in R. North Macedonia is as a stowaway by using trade and/or transportation, which are the most common ways of *H. halys* dispersal (GARIEPY et al. 2014, HAYE et al. 2014, CESARI et al. 2015). The busy highway A1/E75, which connects Central and South Europe, is used intensively during summer for transportation of people and many kinds of goods. In the period of early establishment in European countries, in 2014, it was pointed out that the expansion and increase of *H. halys* populations in many European cities is presumable, especially in large cities located along the main motorways (HAYE et al. 2014). This was based on the fact that the majority of records were independent findings in urban zones, suggesting relatively slow natural spread, which most probably happened also in R. North Macedonia, where only two unconnected findings have been reported so far.

The natural dispersal across borders might be also a possible pathway of introduction of *H. halys*. The good flight abilities of adults and their strong capacity to spontaneously disperse throughout most of the period of their life should not be neglected. As found by WIMAN et al. (2015) 85% of *H. halys* populations are short-distance fliers that fly less than 5 km. Usually, summer generations fly farther and faster than the overwintered adults (WIMAN et al. 2015), which supports the idea of natural spread during summer. The well-established populations in neighbouring Serbia (MUSOLIN et al. 2018), with the southernmost finding in the urban zone of Niš Town (N 43.324719, E 21.903331) (unpublished data) and the established populations in neighbouring Bulgaria, in the urban zone of Sofia City (SIMOV

2016), have the potential to spread naturally to R. North Macedonia.

The records of five adult specimens of *H. halys* in the urban zone in the south of R. North Macedonia and a nymph found in the north indicate a possible invasion of the species to this country. The climate suitability model (CLIMEX Ecoclimatic Index) published by KRITICOS et al. (2017) shows that climatic suitability patterns are consistent throughout Europe (with some exceptions in Switzerland). Therefore, the establishment and further spread of this pest species in the Republic of North Macedonia could be expected in the future.

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