FIRST DETECTION OF *Halyomorpha halys* Stål, A NEW INVASIVE SPECIES WITH A HIGH POTENTIAL OF DAMAGE ON AGRICULTURAL CROPS IN ROMANIA

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Abstract

The presence of the Brown Marmorated Stink Bug *Halyomorpha halys* Stål (Heteroptera, Pentatomidae) is signaled for the first time in Romania, in the Botanical Garden of Bucarest. This polyphagous bug, native to Asia, is recorded as an extremely invasive pest of many agricultural crops in the countries where it has been introduced (USA, Italy). The current distribution and pest status, morphology and biology are described. Although the majority of individuals were collected from the Botanical Garden, several other *H. halys* were observed in the urban area, several kilometers away, suggesting that this species is already spread out in the city, and that its presence in Romania could date back to at least 1-2 years ago. Considering the potential serious risk for agriculture in Romania, the necessity to develop a monitoring strategy in field crops for early detection is suggested.

Key words: brown marmorated stink bug, monitoring, invasive

With global trade, a lot of organisms are being spread all over the world. Availability of food and adaptability to climate conditions for all development stages will determine the potential degree of colonization of the introduced species in the new areas; absence or low effectiveness of natural antagonists together with high biotic potential will result in turning the alien into an invasive species, disrupting the local ecosystem services, eventually causing economic damages (Pimentel D. *et al,* 2005; Kenis M. *et al,* 2009; Vilà M. *et al*, 2009) *Halyomorpha halys* Stål (Hemiptera, Pentatomidae), also known as the Brown Marmorated Stink Bug (BMSB), is an extremely polyphagous phytophagous bug native to Asia (Lee D.H. *et al*., 2013) that has become an invasive pest of great economic importance in the U.S.A. (Leskey T.C. *et al.*, 2012a, 2012b). Its recent range expansion in Europe (Haye T. *et al*., 2015) increases the concern about the consequences that this insect might have on crop production in this continent. We describe the first detection of *H. halys* in Romania and give basic information on its biology in the view to raise awareness on its damaging potential for agricultural crops and to suggest strategies for early detection.

CURRENT STATUS

As an invasive species, BMSB presence was signaled in U.S.A. (Adams Island, Allentown) since 1996 but confirmed only in 2001 (Hoebeke E.R., Carter M.R., 2003). Presently it is found in 42 U.S. states (www.stopbmsb.org) and in two states from Canada (Fogain R., Graff S., 2011).

In Europe, it was first recorded in Switzerland (Wermelinger B. *et al*., 2008; Gariepy T.D. *et al*., 2014), since in 2004, and is currently present in almost all Cantons as a household pest with occasional damage to backyard fruit and vegetable gardens (Haye T. *et al*., 2015). Afterwards it was reported in Germany (Heckmann R., 2012), France (Callot H., Brua C., 2013) and Greece (Milonas P.G., Partsinevelos G.K., 2014). First record in Italy occurred in 2012 in Emilia Romagna region (EPPO, 2013; Maistrello L. *et al*., 2013), followed by Piedmont (Pansa M.G. *et al*., 2013) and Lombardy (Maistrello L. *et al.*, 2014) and genetic analysis indicate that Italian populations of BMSB are the result of different invasive episodes (Cesari M. *et al.*, 2015). Current investigations that include a public survey and field monitoring performed since 2014, are showing a fast spread in northern Italian regions and damage to fruit crops (Maistrello L. *et al*.,

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unpublished data). Finally in 2013, Vetek G. *et al*., (2014), reported BMSB as present in Hungary, in the Budapest area.

MORPHOLOGY

The adults have a specific brown-marmorated coloration. On antennas, legs and borders of abdomen, white and dark alternating bands are present. Males are usually smaller than females and can be distinguished by a posterior scoop, present on the ventral part (Medal J. *et al*., 2013). Adult's body length can vary in size, usually around 12-17 mm.

The eggs are light green and afterwards become white (Hoebeke E.R., Carter M.R., 2003; Rice K.B. *et al.*, 2014). After emergence, the nymphs go through five distinct instars, which are briefly described by Hoebeke E.R. and Carter M.R. (2003). The neonates have black heads and orange-red abdomens; second instars are dark and have whitish abdomen with reddish spots; spines are present on the sides of head and pronotum of the younger nymphs; on the tibiae of last two instars a white band can be noticed (Rice K.B. *et al*., 2014; Wermelinger B. *et al*., 2008).

BIOLOGY

BMSB is considered a polyphagous species that can develop 1-2 generations per year (Leskey T.C. *et al*., 2012a; Rice K.B. *et al.*, 2014) and overwinters as non-reproductive adults in natural and artificial shelters, such as human dwellings (Funayama K., 2004).

Starting from April-May, the adults emerge from the overwintering sites and search for host plants (Funayama K., 2002). In order to become reproductively mature, females need a long mating and preoviposition period (Wermelinger B. *et al.*, 2008). During late spring and summer, females of overwintering generation lay clusters of 20-30 eggs on the underside of leave's host (Hoebeke E.R., Carter M.R., 2003;). First instars form aggregations around egg masses further spreading on host plant (Rice K.B. *et al*., 2014). For a complete development, from egg to adult, about 538 DD are required (Nielsen A.L. *et al*., 2008). In Europe (Switzerland), up to 70% of eggs were deposit between June and July (Haye T. *et al*., 2014). Starting from September, the bugs aggregate and seek for overwintering shelters (Toyama M. *et al*., 2006). A certain preference to northern and southern sides of hibernating place was observed (Funayama K., 2015).

HOST PLANTS AND PATTERNS OF DAMAGE

Halyomorpha halys has a wide range of hosts, being reported on more than 100 plants (Lee D.H. *et al.*, 2013).

The damage is made by adults and nymphs that extract fluids from host leaves and fruits, by inserting their proboscis into plant's tissue. Small necrotic areas are formed at the feeding site. Appearance of damage is related to plant species, variety and phenological status (Rice K.B. *et al.*, 2014).

Among preferred plants, various species of fruit trees and shrubs are reported, such as apricot *Prunus armeniaca* L., sweet cherry *Prunus avium* L., peach *Prunus persica* L., plum *Prunus domestica* L., apple *Malus* spp., pear *Pyrus* spp., *Citrus* spp., mulberry *Morus* spp., Japanese Persimmon *Diospyros* spp., berries *Rubus* spp. and grape vine *Vitis vinifera* L.. *H. halys* attack also many hoticultural and row crops such as tomato *Solanum lycopersicum* L., pepper *Capsicum annuum* L., eggplant *Solanum melongena L.,* (Kuhar T.P. *et al.*, 2012), corn *Zea mays* L., sunflower *Helianthus annuus* L., sorghum *Sorghum bicolor* L., wheat *Triticum aestivum* L., cotton *Gossypium hirsutum* L., hops *Humulus lupulus* L., soybean *Glycine max* L., bean *Phaseolus vulgaris* L., pea *Pisum sativum* L.,; trees, ornamental trees and shrubs (maple *Acer* spp., willow *Salix* spp., butterfly bush *Buddleja davidii* L., Paulownia *Paulownia tomentosa* Thunb., Scarlet firethorn *Pyracantha coccinea* M. Roen., honeysuckle *Lonicera* spp., lilac *Syringa* spp., Hibiscus *Hibiscus* spp., *Japanese cedar Cryptomeria* spp., cypress *Cupressus* spp.) Rice K.B. *et al.*, 2014; Wermelinger B. *et al.*, 2008).

FIRST RECORD IN ROMANIA

The first specimens of *H. halys* in Romania were 25 adults and nymphs (3 of seccond instar, 2 of third instar and 4 nymphs for each of forth and fifth instar), that were detected while actively feeding on fruit plants (Cornus spp. and plants from Cucurbitaceae family) and around the main building in the Botanical Garden „Dimitrie Brândză", Bucarest on September 15. Among all observed individuals, 15 specimens were collected and a sample is currently being used for genetic analyses to determine its haplotype. Other specimens (2 adults and 1 nymph of fifth instar) were detected during a survey performed in the beginning of October in other urban green areas of the city (Colentina area) which were 5 km away from the Botanical Gardens.

CONCLUSIONS

The region between latitudes 40u and 50uN in Europe showed high climate suitability for *Halyomorpha halys* (Zhu G. *et al*., 2012). Detection of actively breeding populations of *H. halys* in the Botanical Garden as well as in other parts of Bucarest, in the range of 5 km, suggests that possibly this species is already spread out in the city. It is likely that its first appearance in Romania could date back to at least 1-2 years ago and the pathway of introduction could be international trade of goods with countries where the bug is native (Eastern Asia, especially China) or with countries where it was introduced (either USA or the other countries in Europe, especially Hungary, which is the closest to Romania) and the genetic analyses that are currently being perform will help to elucidate this point.

Early detection is crucial for the management of introduced species, particularly in the case of pests that are recognized for their destructive potential. Tracking the current spread is especially relevant in the case of territories with crops that could suffer serious economic losses by the uncontrolled expansion of the invasive alien pest.

In the year 2014, Romania registered an agricultural output of approximately 15.5 bilion euro with an average of 1.160 euro per hectar (ec.europa.eu/eurostat).

Considering the potential serious risk for agriculture in Romania, the necessity to develop an early detection tool and a field monitoring strategy for crops is suggested. In Italy a citizen-science survey was used to detect the initial spread of BMSB and to obtain valuable information that allowed to perform a focused field monitoring and to obtain data for cultivated crops (Maistrello et al., 2014). A similar strategy could help in early detection and monitoring of *H. halys* in Romania.

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