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New records of the invasive alien plant pest *Halyomorpha halys* (Stål, 1855) in the Iberian Peninsula (Heteroptera: Pentatomidae)

Marcos Roca-Cusachs*, Diego Fernandez**, Lucía Adriana Escudero Colomar*** & Marta Goula****

* Department of Evolutionary Biology, Ecology and Environmental Sciences and IRBio. Faculty of Biology. University of Barcelona. Av. Diagonal, 643. 08028 Barcelona. Spain. A/e: marcosroca-cusachs@gmail.com** Av. Pompeu i Fabra 85 1º 2º. 08906 Prat de Llobregat. Barcelona. Spain. A/e: diego.fernandez.25@gmail.com

*** IRTA. Protecció Vegetal Sostenible (Entomologia). Estació Experimental Agrícola Mas Badia. 17134 La Tallada d'Empordà. Girona.

**** Department of Evolutionary Biology, Ecology and Environmental Sciences and Institut de Recerca de la Biodiversitat (IRBio). Faculty of Biology. University of Barcelona. Av. Diagonal, 643. 08028 Barcelona. Spain. A/e: mgoula@ub.eduCorresponding author: Marcos Roca-Cusachs. A/e: marcosroca-cusachs@gmail.com

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Abstract

The brown marmorated stink bug *Halyomorpha halys* (Stål, 1855) is reported in the province of Barcelona for the first time. Now locations are a hundred kilometer southwards from the first report in the Iberian Peninsula. An alert is made due to the economic importance that this plant pest species has on field, fruit and vegetable crops. Nuisance to people when insects congregate inside buildings to overwinter is not negligible either.

Key words: Plant Pest, Invasive alien species, brown marmorated stink bug, faunistics, Iberian Peninsula.

Resum**Nous registres de la plaga exòtica invasora *Halyomorpha halys* (Stål, 1855) a la península Ibèrica (Heteroptera: Pentatomidae)**

Se cita per primera vegada l'espècie invasora *Halyomorpha halys* (Stål, 1855) a la província de Barcelona. Les noves localitats són a un centenar de kilòmetres més al sud de la primera troballa de l'espècie a la península Ibèrica. S'alerta de la importància econòmica que comporta aquesta plaga en cultius extensius, de fruiters o d'horta. No cal menysprear les molèsties per a la població quan l'insecte es congrega en els edificis per a hibernar-hi.

Paraules clau: Plaga agrícola, espècies exòtiques invasores, xinxa, faunística, península Ibèrica.

Introduction

The brown marmorated stink bug *Halyomorpha halys* (Stål, 1855) is a medium-sized species that ranges from 12 to 17 mm. It is easy to recognize among other native European Pentatomidae (particularly *Rhaphigaster nebulosa* (Poda, 1761) and *Arma custos* (Fabricius, 1794), but also *Pentatoma rufipes* (Linnaeus, 1758), *Dolycoris baccarum* (Linnaeus, 1758) or *Nezara viridula* (Linnaeus, (1758)) after the examination with a simple magnifying glass, of the wing membrane, provided with dark longitudinal lines, the whitish calluses of the pronotal disc part and scutellum base, the last ivory-white tarsi, and the lack of any ventral spine projecting from the abdomen forwards (Wyniger & Kment, 2010). Appropriately guided, even general interested public may be a good help to give alert of new localities, in an exercise of citizen science (Maistrello *et al.*, 2016b). The first European citation came in fact through a hobby photographer shot taken in Switzerland in 2004, and sent for consultation to

specialists (Wermelinger *et al.*, 2008). Also in 2004, another alert came from Lichtenstein (Arnold, 2009).

This species is original from East Asia (China, Korea, Japan, Eastern Russia and Taiwan) (Lee *et al.*, 2013; Rider, 2006). It is an extremely invasive species and after being accidentally introduced, it has quickly colonized new territories and is now established with active populations in the USA (including Hawai and Alaska), Canada and Europe (Haye *et al.*, 2015). First findings in South America happened in Chile (Faúndez & Rider, 2017). Records in Oceania seem sporadic, and the only African report via and Egyptian sample needs confirmation (Cianferoni *et al.*, 2018). In Europe, it has already been stated from France (Callot & Brua, 2013; Maurel *et al.*, 2016), Germany (Heckmann, 2012), Great Britain (Malumphy, 2014), Greece (Milonas & Partsinevelos, 2014), Hungary (Vétek *et al.*, 2014), Italy (Maistrello *et al.*, 2014; Maistrello & Dioli, 2014), Lichtenstein (Arnold, 2009), Romania (Macavei *et al.*, 2015), European Russia (Mityushev, 2016), Sicily (Carapezza & Lo Verde, 2017), Switzerland

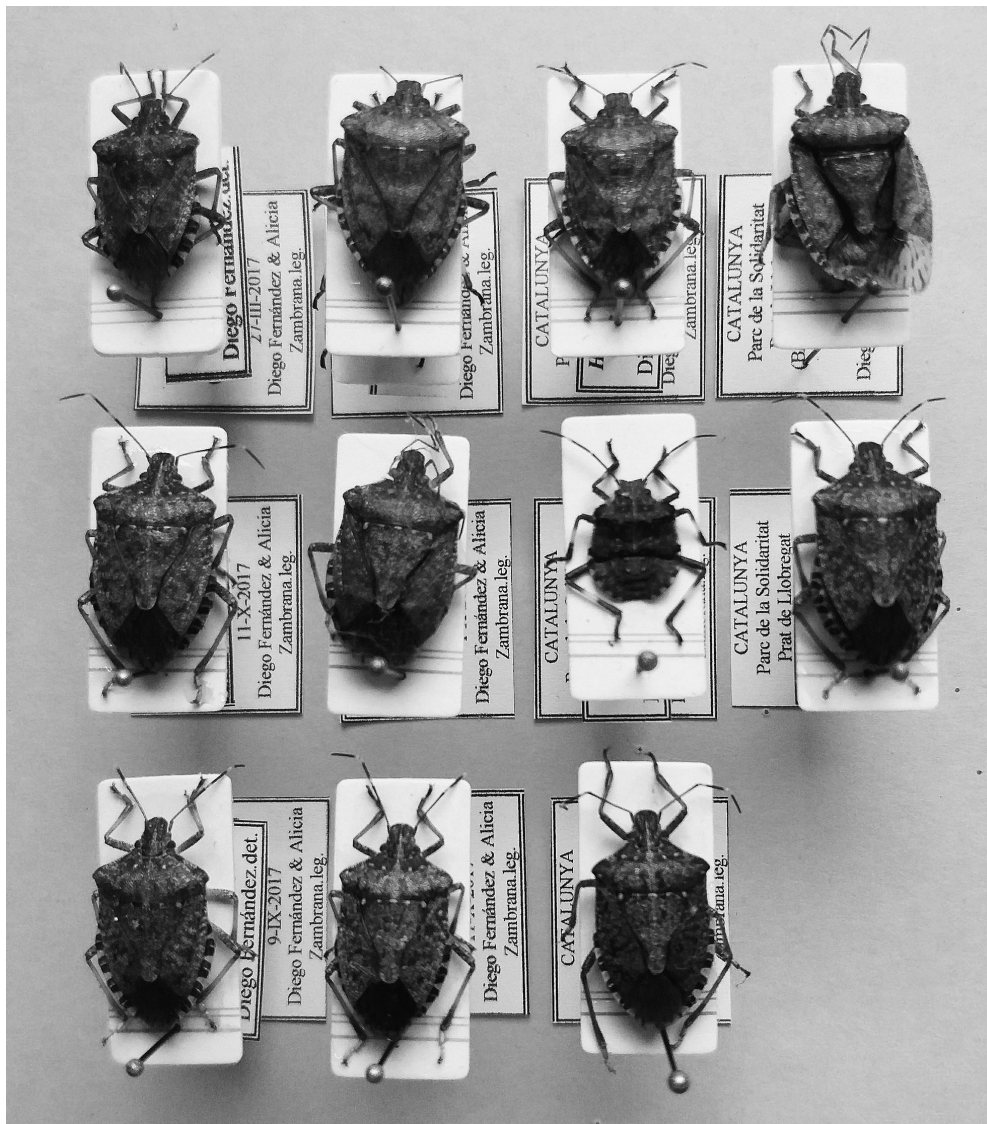


Figure 1. *Halyomorpha halys*, showing a variety of male and female adult specimens, a nymph (Photo: Diego Fernández).

(Wermelinger *et al.*, 2008). Cianferoni *et al.* (2018) provide a good and detailed review, and permanent actualization may be found in CABI (2018). This quick expansion is the result of a variety of factors, some of them intrinsic to biology of the species (Cesari *et al.*, 2015), and other related to the modern way of life, in which globalization is the core concept (Valentin *et al.*, 2017). Due to its tremendous invading capacity, the brown marmorated stink bug was in the EPPO alert list from 2008 to 2013.

Halyomorpha halys feeds on a wide variety of cultivated and spontaneous plants (currently known about three hundred) with a preference for Rosaceae and Fabaceae, and is potentially very dangerous because of the damage it can cause to many cultivated plants, in particular all fruit trees (Maistrello *et al.*, 2013), vines, almost all vegetables, legumes and cereals (maize, sorghum), and also many ornamentals (Leskey *et al.*, 2012; Haye *et al.*, 2015; Maistrello *et al.*, 2016a). Both juveniles and adults prefer to feed on fruits and seeds by sucking bites, but can also attack any epigeal part of the host plants,

causing atrophied developmental damage, early fruit abscission, deformities and abnormal colourings (Hoebeke & Carter, 2003; Nielsen & Hamilton, 2009). The brown marmorated stink bug has replaced tortridic lepidoptera as «key phytophagous» of fruit trees, causing damage severe enough to oblige farmers to quadruple non-selective insecticide interventions with severe ecological and environmental consequences (Leskey *et al.*, 2012). In northern Europe *H. halys* is univoltin (Haye *et al.*, 2014), while in northern Italy (Po valley) it has been observed to be bivoltin (Maistrello *et al.*, 2016a), with severe damage to pear crops (Maistrello *et al.*, 2016b), and consistent attacks on peaches, apples, plums, apricots, kaki and tomato (Maistrello *et al.*, 2014; Bariselli *et al.*, 2016; Dioli *et al.* 2016). Prior to hibernation, the species congregates in great numbers in protected refuges, as for example buildings of any type, including dwellings. Large, stinking insects inside homes is no doubt a nuisance, and originates citizen complaints (Mueller *et al.*, 2011; Haye *et al.*, 2015), regardless of the recognized incoquity of brown marmorated stink bug, leaving aside

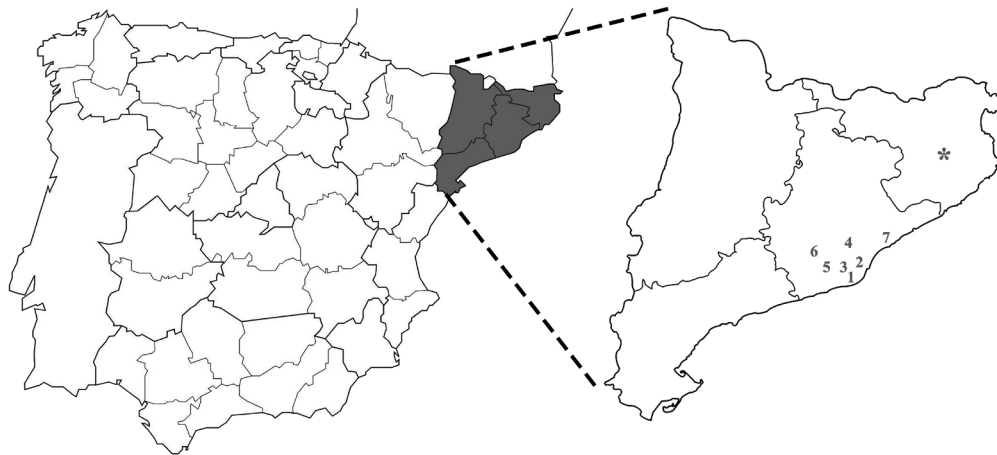


Figure 2. Distribution map of *H. halys* in the Iberian Peninsula: * Girona, first record of the invasive species reported by Dioli *et al.* (2016); new records in this study: 1, El Prat de Llobregat; 2, Barcelona; 3, L'Hospitalet de Llobregat; 4, Sant Cugat; 5, Castellbisbal; 6, Vallirana; 7, Masnou. Numbers are arranged according to chronology of first collection of *H. halys* in each location.

defensive bites. Thus, tracking the spreading of *H. halys* into new areas, especially in the Iberian Peninsula, has a strong impact in ecology, agronomy and social welfare.

The objective of this paper is to inform on new localities in the Iberian Peninsula where *H. halys* has been collected, which apparently state for the species spreading and stablishing in the Westernmost Mediterranean Peninsula.

Methods

Specimens were found by chance, collected by hand and kept dry (Fig. 1), except the specimen collected by J. Pujade-Villar (UB), preserved in absolute ethanol. Other contributions come from personal observations (with no collection), or from shared pictures

Results and discussion

Several individuals were found in the city of Barcelona or at most ca. 50 km around, in urban environments (public parks, street trees) or directly inside buildings. The map of locations may be seen in figure 2. The material examined is the following:

Facultat de Biologia, Avda Diagonal 643, Barcelona, Barcelonès (Barcelona, Catalonia), A. Serra leg., Roca-Cusachs det. (In Centre de Recursos de Biodiversitat Animal (CRBA) coll., Faculty of Biology, University of Barcelona, under code: CRBA-1409). 1.iv.2017: 1 ♂. Parc Joan Miró, Barcelona, Barcelonès (Barcelona, Catalonia), F. Lizana photoleg. and J. Tomàs det., 26.viii.2017: 1 adult, 1 nymph. Two pictures uploaded in [http://www.biodiversidadvirtual.org/insectarium/Halyomorpha-halys-\(St-l-1855\)-img972466.html](http://www.biodiversidadvirtual.org/insectarium/Halyomorpha-halys-(St-l-1855)-img972466.html). Jardins Verdaguer, Montjuïc area, Barcelona, Barcelona, Barcelonès (Barcelona, Catalonia), F. Lizana photoleg. and J. Tomàs det., 18.ix.2017: 1 nymph. Two pictures up-

loaded in [http://www.biodiversidadvirtual.org/insectarium/Halyomorpha-halys-\(St-l-1855\)-img933683.html](http://www.biodiversidadvirtual.org/insectarium/Halyomorpha-halys-(St-l-1855)-img933683.html) (Fig. 3). Raval area, Barcelona, Barcelonès (Barcelona, Catalonia), J. Pujade leg. and M. Roca-Cusachs det. (In M. Roca-Cusachs coll.). 10.i.2018: 1 ♂. Inside apartment, Pedro Pons/Manuel Girona streets, Sarrià-Pedralbes area, Barcelona, Barcelonès (Barcelona, Catalonia), L. Álvarez photoleg. and M. Goula det. 18.iii.2018: 1 ex. A picture uploaded in Facebook. Plaça de Sants, Barcelona, Barcelonès (Barcelona, Catalonia), F. Lizana photoleg. and J. Tomàs det., 19.iv.2018: 1 adult, 1 nymph. Five pictures uploaded in [http://www.biodiversidadvirtual.org/insectarium/Halyomorpha-halys-\(St-l-1855\)-img972465.html](http://www.biodiversidadvirtual.org/insectarium/Halyomorpha-halys-(St-l-1855)-img972465.html). Parc de la Solidaritat, El Prat de Llobregat, Baix Llobregat (Barcelona, Catalonia), D. Fernández & A. Zambrana leg. and det. (In D. Fernández coll.). 27.iii.2017: 1 ♀; 9.ix.2017: 1 ♂ & 1 ♀; 14-IX-2017: 1 ♂; 18.ix.2017: 1 nymph; 20-IX-2017: 1 ♂ & 1 ♀; 11.x.2017: 2 ♀; 29.iii.2018: 1 ♀. Can Comas, El Prat de Llobregat, Baix Llobregat (Barcelona, Catalonia), F. Contreras leg. and L. A. Escudero Colomar det. (In IRTA Mas Badia coll.). 11-X-2017: 1 ♂ &



Figure 3. Nymph of *H. halys* observed in Montjuïc area in Barcelona city (Photo: Ferran Lizana).

1 ♀. L'Hospitalet de Llobregat, Baix Llobregat (Barcelona, Catalonia), Outside buildings, L. A. Escudero Colomar. leg. and det. 11.x.2017: 2 ♂; M. Prieto.leg. and D. Fernández det. (In D. Fernández coll.). 4.iii.2018: 1 ♀. Sant Cugat del Vallès, (Barcelona, Catalonia). S. Quintanilla Giménez and L.A. Escudero Colomar leg. 22.II.2018: 2 ♂. Castellbisbal, (Barcelona, Catalonia). D. Fernández & A. Zambrana leg. and det. (In D. Fernández coll.). 20.iii.2018: 1 ♀. El Lledoner, 31TDF08, 400 m, Vallirana, Baix Llobregat (Barcelona, Catalonia) D. Fernández leg. and det. (In D. Fernández coll.). 29.iii.2018: 1 ♀. Masnou, Maresme (Barcelona, Catalonia), T. Alonso photoleg. and J. Tomàs det. 29.iv.2018: 1 adult. One picture uploaded in [http://www.biodiversidad-virtual.org/insectarium/Halyomorpha-halys-\(St-l-1855\)-img976288.html](http://www.biodiversidad-virtual.org/insectarium/Halyomorpha-halys-(St-l-1855)-img976288.html).

First record of the brown marmorated stink bug in the Iberian Peninsula occurred in Northern Catalonia (Dioli *et al.*, 2016), where a nymph was collected (Fig. 3). Ours reports enlarge the Iberian distribution area of the species more than a hundred kilometers southwards.

It is worth to state that in November 2017, the brown marmorated stink bug was news in the L'Hospitalet de Llobregat, a municipality close to El Prat de Llobregat and Barcelona city. The insects congregated in great numbers in buildings to hibernate, provoking citizen complains to local administrators. One of the most affected areas was the city centre of L'Hospitalet (Carrilet Av.), with tall plane trees (*Platanus* sp.) and *Ailanthus* sp., along the streets whose branches were just in front of apartments windows, thus enhancing insect entrance.

Most findings happened in an area relatively close to port of Barcelona, and the international airport of Barcelona El Prat, and it is not to be unaware that it has been the entrance spot of other alien species in the region like the apterous Mantid *Brunneria borealis* Scudder, 1896 (Fernández & Santaeufemia, 2016). Also in Sicily, presence of *H. halys* in the city of Palermo is argued by the active Palermo port (Carapezza & Lo Verde, 2017).

The species is expanding southwards, and most probably its large size and the encounter with people (urban areas, inside buildings) will propitiate an increasing knowledge of localities, helped by social sharing media like specialized nature websites or personal Facebook pages, among others.

Conclusions

As stated previously (Dioli *et al.*, 2016) we consider the spreading of the species in Catalonia to be very worrying, having an expansion into the warmer regions of the Iberian Peninsula with high crop production, where the species can cause massive infestations especially to Mediterranean crops such as olive trees, citrus, vines and other edible berries.

Administrations responsible for environment conservation against invasive alien species, plant protection and citizen welfare should plan how to face the arrival of the brown marmorated stink bug, attending to the increasing amount

of information on its biology (Haye *et al.*, 2014; Wallner *et al.*, 2014; Costi *et al.*, 2017). At present, a plan to control the species should be designed, with the main purposes to reduce its expansion and establishment, and to minimize its undesirable impact to the lowest possible levels.

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References

- ARNOLD, K. 2009. *Halyomorpha halys* (Stål, 1855), eine für die europäische Fauna neu nachgewiesene Wanzenart (Insecta: Heteroptera: Pentatomidae: Cappaeini). *Mitteilungen des Thüringer Entomologenverbandes e.V.*, 16: 19.
- BARISELLI, M., BUGIANI, R. & MAISTRELLO, L. 2016. Distribution and damage caused by *Halyomorpha halys* in Italy. *EPPO Bulletin*, 46 (2): 332-334.
- CABI. 2018. Invasive species compendium. Available in: <https://www.cabi.org/isc/datasheet/27377> [Accessed 15 March 2018].
- CALLOT, H. & BRUA, C. 2013. *Halyomorpha halys* (Stål, 1855), la punaise diabolique, nouvelle espèce pour la faune de France (Heteroptera: Pentatomidae). *L'Entomologiste*, 69 (2): 69-71.
- CARAPEZZA, A. & LO VERDE, G. 2017. First record of *Halyomorpha halys* (Stål, 1855) (Hemiptera Pentatomidae) in Sicily. *Naturalista Siciliano*, S.IV, 41 (2): 139-145.
- CESARI, M., MAISTRELLO, L., GANZERLI, F., DIOLI, P., REBECCHI, L. & GUIDETTI, R. 2015. A pest alien invasion in progress: potential pathways of origin of the brown marmorated stink bug *Halyomorpha halys* populations in Italy. *Journal of Pest Science*, 88: 1-7.
- CIANFERONI, F., GRAZINANI, F., DIOLI, P. & CECCOLINI, F. 2018. Review of the occurrence of *Halyomorpha halys* (Hemiptera: Heteroptera: Pentatomidae) in Italy, with an uptake of its European and World distribution. *Biologia*. <https://doi.org/10.2478/s11756-018-0067-9>.
- COSTI, E., HAYE, T. & MAISTRELLO, L. 2017. Biological parameters of the invasive brown marmorated stink bug, *Halyomorpha halys*, in southern Europe. *Journal of Pest Science*, 90 (4): 1059-1067.
- DIOLI, P., LEO, P. & MAISTRELLO, L. 2016. Prime segnalazioni in Spagna e in Sardegna della specie aliena *Halyomorpha halys* (Stål, 1855) e note sulla sua distribuzione in Europa (Hemiptera, Pentatomidae). *Revista gaditana de Entomologia*, 8 (1): 539-548.
- FAÚNDEZ, E. I. & RIDER, D. A. 2017. The vrown marmorated stink bug *Halyomorpha halys* (Stål, 1855)(Heteroptera: Pentatomidae) in Chile. *Arquivos Entomológicos*, 17: 305-307.
- FERNÁNDEZ, D. & SANTAUEFEMIA, X. 2016. Primera cita a Europa d'un pregadéus d'origen americà, *Brunneria borealis* Scudder, 1896 (Insecta: Mantodea: Mantidae). *Butlletí de la Institució Catalana d'Història Natural*, 80: 141-144.
- HAYE, T., ABDALLAH, S., GARIEPY, T. & WYNIGER, D. 2014. Phenology, life table analysis and temperature requirements of

- the invasive brown marmorated stink bug, *Halyomorpha halys*, in Europe. *Journal of Pest Science*, 87: 407-418.
- HAYE, T., GARIEPY, T., HOELMER, K., ROSSI, J. P., STREITO, J. P., TASSUS, X. & DESNEUX, N. 2015. Range expansion of the invasive brown marmorated stinkbug, *Halyomorpha halys*: an increasing threat to field, fruit and vegetable crops worldwide. *Journal of Pest Science*, 88: 665-673.
- HECKMANN, R. 2012. Erster Nachweis von *Halyomorpha halys* (Stål, 1855) (Heteroptera: Pentatomidae) für Deutschland. *Heteropteron*, 36: 17-18.
- HOEBEKE, E. R. & CARTER, M. E. 2003. *Halyomorpha halys* (Stål) (Heteroptera: Pentatomidae): a polyphagous plant pest from Asia newly detected in North America. *Proceedings of the Entomological Society of Washington*, 105: 225-237.
- LEE, D.-H., SHORT, B. D., JOSEPH, S. V., BERGH, J. C. & LESKEY, T. C. 2013. Review of the biology, ecology, and management of *Halyomorpha halys* (Hemiptera: Pentatomidae) in China, Japan, and the Republic of Korea. *Environmental Entomology*, 42 (4): 627-641.
- LESKEY, T. C., HAMILTON, G. C., NIELSEN, A. L., POLK, D. F., RODRIGUEZ-SAONA, C., BERGH, J. C., HERBERT, D. A., KUCHAR, T. P., PFEIFFER, D., DIVELY, G. P., HOOKS, C. R., RAUPP, M. J., SHREWSBURY, P. M., KRAWCZYK, G., SHEARER, P. W., WHALEN, J., KOPLINKA-LOEHR, C., MYERS, E., INKLEY, D., HOELMER, K. A., LEE, D.-H. & WRIGHT, S. E. 2012. Pest status of the Brown Marmorated Stink Bug, *Halyomorpha halys* in the USA. *Outlooks on Pest Management*, 23: 218-226.
- MACAVEI, L. I., BĂEȚAN, R., OLTEAN, I., FLORIAN, T., VARGA, M., COSTI, E. & MAISTRELLO, L. 2015. First detection of *Halyomorpha halys* Stål, a new invasive species with a high potential of damage on agricultural crops in Romania. *Lucrări științifice, ser. Agronomie*, 58 (1): 105-108.
- MAISTRELLO, L., DIOLI, P. & BARISELLI, M. 2013. Trovata una cimice esotica dannosa per i frutteti. *Agricoltura, Regione Emilia-Romagna*, 6: 67-68.
- MAISTRELLO, L. & DIOLI, P. 2014. *Halyomorpha halys* Stål 1855, trovata per la prima volta nelle Alpi centrali italiane (Insecta: Heteroptera: Pentatomidae). *Il Naturalista Valtellinese, Atti Museo civico di Storia naturale Morbegno*, 25: 51-57.
- MAISTRELLO, L., DIOLI, P., VACCARI, G., NANNINI, R., BORTOLOTTI, P., CARUSO, S., COSTI, E., MONTERMINI, A., CASOLI, L. & BARISELLI, M. 2014. Primi rinvenimenti in Italia della cimice esotica *Halyomorpha halys*, una nuova minaccia per la frutticoltura. *Atti Giornate Fitopatologiche*, 2014, 1: 283-288.
- MAISTRELLO, L., DIOLI, P., BARISELLI, M., MAZZOLI, G. L. & GIACALONE-FORINI, I. 2016a. Citizen science and early detection of invasive species: phenology of first occurrences of *Halyomorpha halys* in Southern Europe. *Biological Invasions*, 18: 3109-3116.
- MAISTRELLO, L., VACCARI, G., BORTOLINI, S., COSTI, E., GUIDETTI, R., BORTOLOTTI, P., CARUSO, S., NANNINI, R., MONTERMINI, A. & CASOLI, L. 2016b. Monitoraggio in campo e danni della cimice aliena *Halyomorpha halys* in Emilia Romagna: da minaccia a problema concreto. *Atti delle Giornate Fitopatologiche*, 1: 171-178.
- MALUMPHY, C. 2014. Second interception of *Halyomorpha halys* (Stål) (Hemiptera: Pentatomidae) in Britain. *Heteroptera News* (3rd series), 21: 4-5.
- MAUREL, J.-P., BLAYE, G., VALLADARES, L., ROINEL, E., COCHARD, P.-O. 2016. *Halyomorpha halys* (Stål, 1855), la punaise diabolique en France, à Toulouse (Heteroptera ; Pentatomidae). *Carnets natures*, 3: 21-25.
- MILONAS, P. G. & PARTSINEVELOS, G. K. 2014. First report of brown marmorated stink bug *Halyomorpha halys* Stål (Hemiptera: Pentatomidae) in Greece. *EPPO Bulletin*, 44: 183-186.
- MITYUSHEV, I. M. 2016. First record of marmorated bug detection in Russia. *Zashchita i Karantin Rastenii*, 3: 48 (in Russian). Northeastern IPM Center. 2014. Where is BMSB? Available in: <http://www.stopbmsb.org/where-is-bmsb/> [Accessed November 2016].
- MUELLER, G., LUESCHER, I. L. & SCHMIDT, M. 2011. *New data on the incidence of household arthropod pests and new invasive pests in Zurich (Switzerland)*. P. 99-104. In: Robinson, W.H. & Campos, A. E. C. (editors). *Proceedings of the Seventh International Conference on Urban Pests*. Instituto Biológico, São Paulo, SP, Brazil. 423 p.
- NIELSEN, A. L., & HAMILTON, G. C. 2009. Seasonal occurrence and impact of *Halyomorpha halys* (Hemiptera: Pentatomidae) in tree fruit. *Journal of Economic Entomology*, 102(3): 1133-1140.
- RIDER, D. 2006. Pentatomidae, pp. 233-402. In: Aukema, B. & Rieger, Ch. (eds.). *Catalogue of the Heteroptera of the Palaearctic Region*. Pentatomomorpha II. Netherlands Entomological Society, 5. 550 p.
- VALENTIN, R. E., NIELSEN, A. L., WIMAN, N. G., LEE, D.-H. & FONSECA, D. M. 2017. Global invasion network of the brown marmorated stink bug, *Halyomorpha halys*. *Scientific Reports*, 7: 9866.
- VÉTEK, G., PAPP, G., HALTRICH, A. & RÉDEI, D. 2014. First record of the brown marmorated stink bug, *Halyomorpha halys* (Hemiptera: Heteroptera: Pentatomidae), in Hungary, with description of the genitalia of both sexes. *Zootaxa*, 3780 (1): 194-200.
- WALLNER, A. M., HAMILTON, G. C., NIELSEN, A. L., HAHN, N., GREEN E. J. & RODRIGUEZ-SAONA, C. R. 2014. Landscape factors facilitating the invasive dynamics and distribution of the Brown Marmorated Stink Bug, *Halyomorpha halys* (Hemiptera: Pentatomidae), after arrival in the United States. *PLoS ONE*, 9: e95691.
- WERMELINGER, B., WYNIGER, D. & FORSTER, B. 2008. First records of an invasive bug in Europe: *Halyomorpha halys* Stål (Heteroptera: Pentatomidae), a new pest on woody ornamentals and fruit trees? *Mitteilungen der Schweizerischen entomologischen Gesellschaft*, 81: 1-8.
- WYNIGER, D. & KMENT, P. 2010. Key for the separation of *Halyomorpha halys* (Stål) from similar-appearing pentatomids (Insecta: Heteroptera: Pentatomidae) occurring in Central Europe, with new Swiss records. *Mitteilungen der Schweizerischen Entomologischen Gesellschaft*, 83: 261-270.