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***Halyomorpha halys* in Italy: first results of field monitoring in fruit orchards**

Lara Maistrello¹, Elena Costi¹, Stefano Caruso², Giacomo Vaccari^{1,2}, Paolo Bortolotti², Roberta Nannini², Luca Casoli³, Anselmo Montermini^{2,3}, Massimo Bariselli⁴, Roberto Guidetti¹

¹*Department of Life Sciences, University of Modena and Reggio Emilia, Via G. Amendola 2, 42122 Reggio-Emilia, Italy;* ²*Plant Protection Service of Modena, Via Santi 14, 41123 Modena, Italy;* ³*Plant Protection Service of Reggio Emilia, Via Gualerzi 32, 42124 Reggio Emilia, Plant Protection Service - Emilia Romagna Region, Via di Corticella 133, 40128 Bologna, Italy*

E-mail: lara.maistrello@unimore.it

Abstract: The invasive pest brown marmorated stink bug (BMSB) *Halyomorpha halys* (Heteroptera, Pentatomidae) was detected for the first time in Italy in September 2012 in Modena province (Northern Italy) during an insect collection for educational purposes. A survey performed in 2013 allowed to detect its presence in Emilia Romagna, Lombardy and Piedmont regions. In 2014, in the provinces of Modena, Reggio Emilia and Bologna a periodical active field monitoring was performed using tree beating, sweep-net and visual observations in selected orchards and vineyards, recording numbers of BMSB adults and nymphs, and of other Heteroptera. Besides, fruit injury and crop loss were recorded at harvest. Partial results from field data obtained between April and July 2014 are presented, indicating that BMSB is already becoming an important pest of fruit orchards and that special attention should be directed to monitor its spread all over the region and the whole Italian country.

Key words: introduced pest, invasive species, tree beating, brown marmorated stink bug

Introduction

The brown marmorated stink bug (BMSB) *Halyomorpha halys* (Stål, 1855) is an extremely polyphagous species native to eastern Asia, with an extremely high potential as an invasive pest of agricultural crops worldwide. It feeds on a wide host range that includes a variety of fruit, vegetable and row crops, and many ornamental plants that are attacked by adults and nymphs by piercing and sucking on the leaves, fruits and seeds. The feeding activity of the BMSB causes injuries that include fruit abscission, fruit deformities and discolorations, scars, depressions, black spots, and brown flesh. The first occurrence of *H. halys* in Italy was recorded during an insect collection for educational purposes in September 2012 in the province of Modena (Emilia Romagna region, Northern Italy) (Maistrello *et al.*, 2014). This territory has extended areas with high value fruit orchards and vineyards, and is one of the most important for fruit production both at the Italian and at the European level, and is therefore potentially at serious risk for the impact that BMSB might have on its economy. The prompt activation of a survey that combined active search and citizen science during April-November 2013, allowed to detect BMSB presence in different locations in Emilia Romagna, Lombardy and Piedmont regions (Northern Italy) and also in Canton Ticino (Southern Switzerland) (Cesari *et al.*, submitted; Maistrello *et al.*, submitted). In the provinces of

Modena and Reggio Emilia an increasing problem with deformed fruits, especially pears, had been reported in the last 7-8 years by farmers, especially in the orchard edges, with a damage percentage on harvested fruits varying between 1-5% up to 37% (Bortolotti *et al.*, 2012). Considering the type of damage, the problem was attributed to mirids (*Calocoris* spp., *Lygus* spp., *Adelphocoris* spp.; Heteroptera, Miridae) and an appropriate monitoring program had been activated to verify their presence and abundance with periodical sweep-net sampling on herbaceous plants on the orchards boundaries (Casoli *et al.*, 2012). However, the same kind of injuries could be induced also by *H. halys* feeding activities.

To verify the real presence of *H. halys* in the field crops and its damage potential, a periodical active monitoring was undertaken in the Province of Modena and nearby areas, sampling in the sites of the mirid monitoring program and including also the sites that had shown the highest BMSB overwintering density.

Material and methods

Periodical active field monitoring was performed on 37 selected farms from 15 localities in the province of Modena, and in two sites in the nearby provinces of Reggio Emilia and Bologna, using tree-beating (frappage) on trees and shrubs (10 plants per site, tapping 5 times on each limb at 1.5-3.0 m), sweep-netting on herbaceous plants (20 beats on 5 areas 10 m long), and visual observations (10 observations of one minute on 10 randomly selected points of the monitoring site) to detect egg-masses and adult and nymphal stages. For some localities monitoring was performed weekly, for other every two weeks and in some sites only occasionally. Monitored sites included fruit orchards (35% of the sites), untreated “domestic” orchards (10%), vineyards (4%), herbaceous crops (18%), hedges (18%), small woods (7%), and grass uncultivated areas (7%). Among fruit orchards, pear represented 66% of cases, followed by peach/nectarine (19%), plum (10%), hazelnut (3%) and other (1%). Herbaceous crops were represented by alfalfa (68%), strawberry (13%), mixed horticultural crops (9%), tomato (7%) and sorghum (3%). Besides, damage percentage was recorded at harvest. Data, in form of number of individuals per sampling unit (as described above), were analysed by means of non parametric tests using Statistica 7.0 software (Statsoft).

Results and discussion

Preliminary results obtained from 1263 monitoring records performed during 15 weeks (April-July 2014) showed significant differences in the number of *H. halys* detected according to the period of time, locality, sampling method and type of sampled site. Highest presence of BMSB occurred in the fields of the farms close to the sites of higher overwintering density, whereas no specimens were detected in the northern areas of Modena province where the bug had not previously been recorded (Maistrello *et al.*, submitted). The first adult specimens were detected in the second half of April, the first egg-masses in the second half of May and early juvenile instars in the first half of June. Presence of BMSB was significantly higher in untreated “domestic” orchards, followed by fruit orchards and hedges (Figure 1), whereas the highest presence of other heteropterans, occurred in herbaceous crops and grass (Figure 2). *H. halys* was mainly detected by mean of visual sampling and tree beating whereas the other heteropterans were detected mostly with sweep-netting.

Our results confirm that BMSB is typically an arboreal species (Nielsen and Hamilton, 2009), which is easier to catch in active sampling using tree-beating rather than sweep net

(Lee *et al.*, 2013; Nielsen *et al.*, 2011), whereas the other collected heteropterans were represented mostly by species belonging to the Miridae family, typically related to herbaceous plants, and easy to catch with the sweep-net. Among the other Heteroptera, native species of Pentatomidae (mainly *Nezara viridula*) and Coreidae (*Gonocerus acuteangulatus*) were also detected (a more detailed analysis is currently being performed).

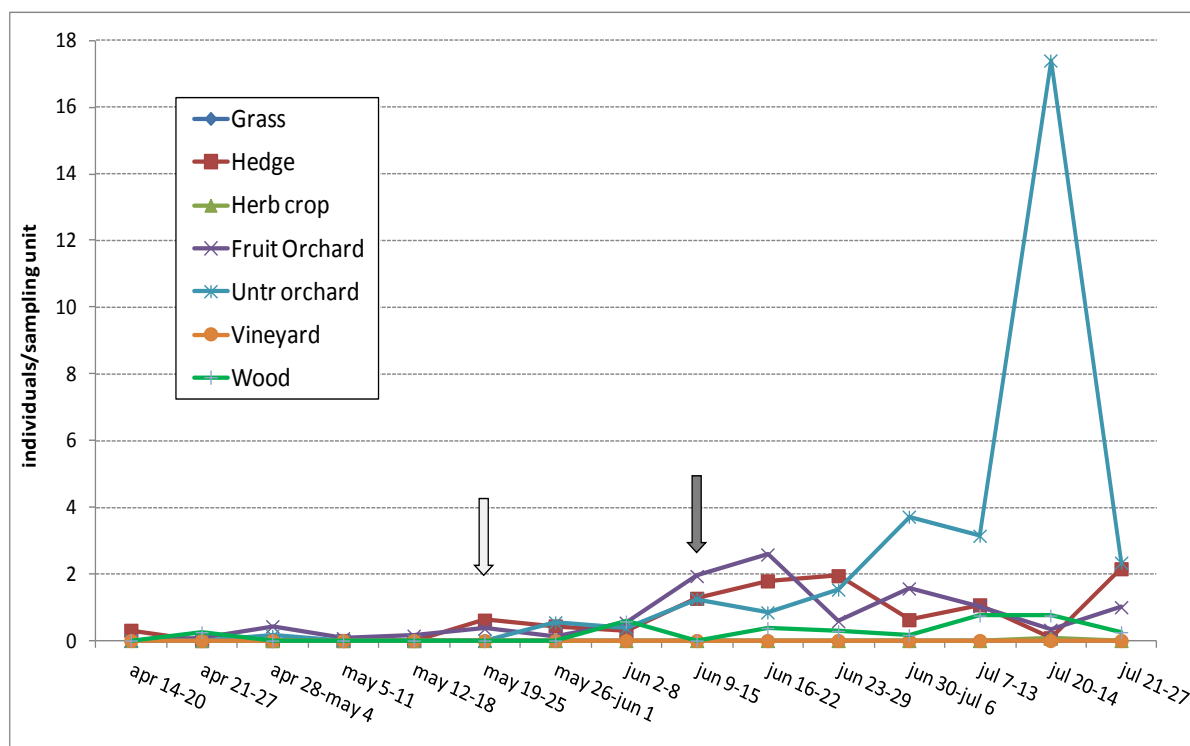


Figure 1. Average number of *H. halys* (adults + nymphs) recorded during 15 weeks, according to the type of sampled site. Light arrow indicate the first detection of an egg-mass, dark arrow indicate first detection of young nymphs (II-III instars). (Herb crop = herbaceous crop, Untr orchards = untreated “domestic” orchards).

In all sites with trees/shrubs, the average abundance per sampling unit was lower than one individual until May and increased in June-July (Figure 1), with isolated cases of up to 30-40 individuals in the untreated “domestic” orchards. From these partial data (at the end of July most fruits were not yet harvested), damage at harvest was on average lower than 10%, although cases of 70% damage occurred in pear and peach orchards, especially in the edge rows close to the houses and barns, and in untreated “domestic” orchards

These first results indicate that *H. halys* is already becoming an important pest of fruit orchards in the western part of Emilia Romagna region and that special attention should be dedicated to monitor its spread all over the region and the whole Italian country.

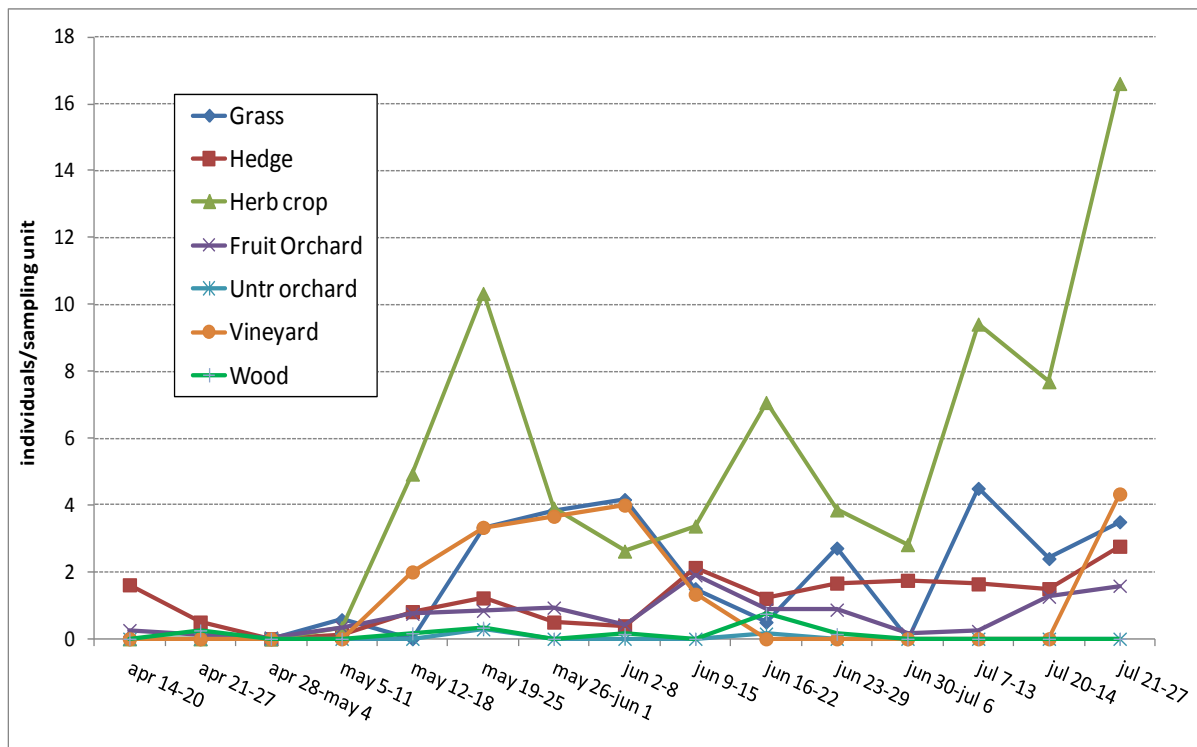


Figure 2. Average number of other Heteroptera (adults + nymphs) recorded during 15 weeks, according to the type of sampled site. (Herb crop = herbaceous crop, Untr orchards = untreated “domestic” orchards).

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