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***Halyomorpha halys* (Stål, 1855) (Insecta: Heteroptera) in Valtellina and Northern Lake of Como (Lombardy, Italy)**

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ABSTRACT - The Asiatic brown marmorated stink bug, *Halyomorpha halys* (Stål, 1855), in the last decade infested North America and, recently, Europe and Italy, where it was recorded in Lombardy. Until 2014, it was not recorded in Valtellina, and, in 2015, fourteen pheromone-baited traps were placed in vineyards and apple orchards. Captures indicated that *H. halys* climbed rapidly the valley, by flight along “Costiera dei Cech”, Northern Morbegno, and by commercial transports. In one locality (Northern Lake of Como - Sorico) feeding activity caused deformity on pears. The species was recorded also on pomegranate, quince, and pepper. In 2016 the catch of several specimens in Sondrio and Ponte in Valtellina confirmed that the species established in this area.

Key Words: *Halyomorpha halys*, Brown marmorated stink bug, pheromone traps, Sondrio province, Northern Lake of Como, Lombardy, Italy.

RIASSUNTO – *Halyomorpha halys* (Stål, 1855) (Insecta, Heteroptera) in Valtellina e a nord del Lago di Como (Lombardia, Italia) La cimice asiatica bruna marmorizzata *Halyomorpha halys* (Stål, 1855), ha infestato, nell’ultima decade, il Nord America e, recentemente, è arrivata anche in Europa e, quindi, in Italia. La specie è stata trovata in diverse zone della Lombardia, ma non ancora in Valtellina. Quattordici trappole a feromoni sono state disposte in altrettanti vigneti e meleti: le catture effettuate con il presente lavoro, dimostrano che *H. halys* ha risalito rapidamente la valle in volo attraverso la “Costiera dei Cech”, versante a nord di Morbegno, e per mezzo di trasporti commerciali. In una località dell’Alto Lario (Sorico), gli attacchi a scopo nutrizionale hanno causato notevoli deformazioni sulle pere. La specie è stata rinvenuta anche su melograno, melo cotogno e peperone. Nel 2016 la cattura di parecchi esemplari a Sondrio e a Ponte in Valtellina ha confermato che la specie è ormai insediata in quest’area.

Parole chiave: *Halyomorpha halys*, cimice bruno-marmorizzata, trappole a feromoni, Sondrio, Alto Lario, Lombardia, Italia.

Introduction

The Brown marmorated stink bug, *Halyomorpha halys* (Stål), recently recorded in Italy (MAISTRELLO et al., 2014), is considered a key pest of fruit orchards and legume crops in native countries, China, Korea, Japan and Taiwan (Lee et al., 2013a).

It was accidentally introduced in 1996 in the USA (HOEBEKE & CARTER, 2003) and, after few years from the first record in Pennsylvania, it spread in 40 States, and caused an economic loss valued at 21 billion dollars (USDA-NIFA SCRI, 2013). It replaced the key pest tortrix moth in fruit orchards and caused farmers to quadruplicate insecticide treatments (LESKEY et al., 2012). This species is currently recorded in the USA (Northeastern IPM Center, 2016), in Canada and in Central and Southern America (HAYE et al., 2015), and it is actively expanding in Switzerland, France, Germany, Italy, Greece, Hungary, Liechtenstein, Romania, Austria, Serbia (HAYE et al., 2015), Russia, Abkhazia and Georgia (GAPON, 2016; MITYUSHEV, 2016). It is also reported in Britain (<https://www.Britishbugs.org.uk/>) (MALUMPHY, 2014) and Spain (DIOLI et al., 2016).

H. halys, like most pentatomids, is extremely polyphagous, and, up to now, 120 plants are known as hosts, mainly trees and shrubs (LEE, 2015). Adults and nymphs are extremely active, and move from different host plants, cultivated and ornamental, neutralizing the effect of treatment (LEE et al., 2013b). Adults overwinter and, in April-May, they move from recoveries to vegetation where they feed and mate. From June, females lay clusters of 28 eggs on the underside of leaves (HOEBEKE & CARTER, 2003). In the coldest area, the species is univoltine, in the temperate area, it is bivoltine while, in the subtropical areas, it presents from 4 to 6 generations per year (HOEBEKE & CARTER, 2003). Overwintering adults clusters in plant litter and natural crevices, or inside buildings, in this case causing concern, as hundreds or even thousands of specimen enter in houses and release an unpleasant odour (HOEBEKE & CARTER, 2003). *H. halys* was recorded, for the first time in Europe, in Switzerland in 2007 (WERMELINGER et al., 2008), while in Italy was observed in Emilia-Romagna region, Modena province, in September 2012, and it was identified by Dioli (MAISTRELLO et al., 2013). Emilia-Romagna has a high-value fruit production and the presence of this invasive alien species causes concern; since May 2013, a citizen science survey started and revealed that *H. halys* has spread out in this Region. Economic damages

were observed in peach orchards in Piedmont (Pansa et al., 2013) and in Lombardy, the species was recorded in parks and tree-lined roads of Milan and Monza Brianza Provinces. In fact, the species can rapidly spread in new areas by human transport and movement of goods as already observed for other bug species (DIOLI & GRAZIOLI, 2012). A single specimen was recently found in Colico, province of Lecco (MAISTRELLO & DIOLI, 2014). Valtellina is an important fruit and wine production area, and the economic impact of this species, not recorded till 2014, must be considered. For this reason, a monitoring plan, with pheromones traps and sweep net, was carried out to verify the eventual presence of *H. halys*.

Material and methods

Since the end of April 2015, thirteen pheromone-baited traps (Stink Bug Trap, Rescue) were placed in the lower Valtellina (Sorico, Dubino, Traona, Morbegno, Talamona), in the mid valley (Sondrio: loc. Castellina, Ponchiera), and in the higher valley, (Tresivio, Ponte in Valtellina, Villa di Tirano, Bianzone, Tovo Sant'Agata). Pheromone traps were hung from a branch in the orchards or from bordering wild vegetation at 1.5-2 m height and controlled weekly.

Additionally, from July till the end of October, sweep net, beating tray, sieve for debris, and sight search were employed in plant nurseries, vineyards, and natural vegetation. Reports from researchers and private citizens were recorded in 2015 and 2016. The survey was carried out in Sondrio and Como Provinces (tab. 1).

Results

The first record of *H. halys* was in May 2015, some adults were collected close to a building in Sorico and delivered to Fondazione Fojanini in Sondrio. Even if until the beginning of September the traps were empty, damages were observed on pears (fig. 1) in Sorico; therefore bugs were actively surveyed by sweep net, beating tray and direct observation (tab. 2). Two adults on pear tree and two nymphs on pomegranate tree were collected. The pheromone trap was moved from the balcony, where the first specimen was recorded, to the pear tree. After

a week the trap was filled with adults and nymphs (fig. 2). Individuals were present also on quince tree and pepper. One adult, outside the trap, was observed on the same day in the Nature reserve “Pian di Spagna”. In the same period two nymphs in Dubino, outside the trap, and one adult in Tresivio, inside the trap, were found. Several nymphs and adults were trapped in Dubino and Tresivio in the following weeks; in Sorico the trap was full with adults. On October, 12th, two adults were collected in Sondrio and in Morbegno (fig. 3).

In 2016, from February to May, few adults, coming from overwintering sites, were detected in Sondrio (loc. Castellina and suburb Mossini); from September to November several specimens were recorded in different sites.

Site	Position	Elevation m a.s.l.	Vegetation
Sorico (*), Via Antica Regina	46°10'20"N 9°22'53"E	201	Private garden with pear trees
Sorico (*), Seat Riserva naturale Pian di Spagna	46°10'48"N 9°25'48"E	201	Nature reserve
Sorico, Riserva naturale Pian di Spagna. Stalle Poncetta	46°18'74"N 9°42'60"E	201	Nature reserve
Dubino (*)	46°09'00"N 9°27'00"E	223	Fruit trees, vineyards, vegetable gardens
Delebio	46°8'13"N 09°27'42"E		Private garden
Traona (*)	46°09'00"N 9°31'00"E	252	Vineyards
Morbegno (*)	46°08'00"N 9°34'00"E	262	Public garden
Talamona (*)	46°08'00"N 9°37'00"E	285	Apple orchards, brambles

Castione Andevenno	46°09'00"N 9°51'00"E	468	Vineyards
Albosaggia, loc. Porto	46°09'00"N 9°51'00"E	490	Vineyards, vegetable gardens
Sondrio, suburb Mossini and Sant'Anna	46°10'41"N 9°51'46"E	453	Vineyards, fruit orchards, wood
Sondrio, suburb Triasso loc. Paiosa	46°10'26"N 9°51'11"E	547	Mainly spontaneous vegetation
Sondrio, loc. Sassella / loc. Castellina (*)	46°9'45"N 9°50'4" E	306	Vineyards, vegetable gardens
Sondrio, loc. Dossi Salati (*)	46°17'01"N 9°87'31"	500	Vineyards
Montagna in Valtellina, loc. Castel Grumello	46°17'49"N 9°89'92"E	480	Vineyards
Tresivio (*)	46°10'00"N 9°57'00"E	520	Vineyards, apple orchards, wood
Ponte in Valtellina (*)	46°17'89"N 9°96'90"E	550	Apple orchards
Bianzone (*)	46°11'20"N 10°6'37"E	444	Vineyards, apple orchards
Villa di Tirano (*)	46°12'00"N 10°08'00"E	406	Vineyards, apple orchards
Tovo di Sant'Agata (*)	46°15'00"N 10°15'00"E	531	Apple orchards

Table 1 Sites of the survey. Pheromone traps were placed in sites marked with an asterisk (*).

Site	Date	N. of specimen	Caught in the trap
Sorico, Via Antica Regina	1.IX.2015	5 exx. (3 Ad., 2 Juv.)	
	7.IX.2015	97exx. Ad. and Juv.	X
	25.IX.2015	54exx. Ad. and Juv.	X
Sorico, Riserva naturale Pian di Spagna	1.IX.2015	1 ex. Ad.	
	1.X.2015	1 ex. Ad.	
	5.X.2015	3 exx. Ad.	
	10.X.2015	1 ex. Ad.	
Sorico, Riserva naturale Pian di Spagna, Stalle Poncetta.	10.X.2015	1 ex. Ad.	
Dubino	7.IX.2015	2exx. Juv.	
	12.IX.2015	2 exx. Juv.	X
	25.IX.2015	3 exx. Ad.	
Delebio	22.XI.2016	1 ex. Ad.	
Talamona	7.XI.2016	> 50 exx. Ad.	
Morbegno	15.X.2015	1 ex. Ad.	X
Sondrio, loc. Castellina	10.X.2015	1 ex. Ad.	
	21.II.2016	1 ex. Ad.	
	23.IX.2016	1 ex. Ad.	
	23.IX.2016	4 exx. Ad.	X
	23.IX.2016	1 ex. Ad.	
	30.IX.2016	20 exx. Ad.	
	2.IX.2016	11 exx. Ad.	
Sondrio, suburb Mossini	20.IV.2016	1 ex. Ad.	X
	24.V.2016	4 ex. Ad.	X
Tresivio	7.IX.2015	1 ex. Ad.	X
Ponte in Valtellina	19.IX.2015	1 ex. Juv.	X
	20.IX.2015	1 ex. Ad.	
	20.X.2016	1 ex. Ad.	
	25.X.2016	1 ex. Ad.	

Table 2 Captures of *Halyomorpha halys* in Valtellina and Northern Lake of Como.



Figure 1 *Halyomorpha halys* (Stål, 1855), feeding damage to pear in Sorico.



Figure 2 Pheromone trap in Sorico.



Figure 3 Map of Valtellina and Northern Lake of Como. Red stars indicate *Halyomorpha halys* pheromones traps, blue stars indicate sites where the insect was recorded.

Discussion

Halyomorpha halys is established in the area among Colico, Sorico and Dubino since 2015, while in Talamona, Sondrio and Ponte in Valtellina several specimens were recorded in 2016. In these areas, it could cause heavy economic damages to fruit orchards and to horticultural crops if not monitored. In these areas, there are two important industrial zones, Colico/Piantedo and Morbegno/Talamona, and a commercial hub in Castione Andevenno, where goods are continuously delivered from Milan and other places. *H. halys*, as other insects, invades new areas through international transport and, locally, along commercial routes (GARIEPY ET AL., 2013; MAISTRELLO & DIOLI, 2014). In fact, in other sites of Valtellina, from Trevisio to Tovo di Sant'Agata, few individuals were detected, mainly in the fruit district of Tresivio, Ponte in Valtellina and Tovo di Sant'Agata, where a fruit cooperative and a fruit store are present, and a well-known company provides fruit and vegetable from all over Italy.

The insects can spread actively by flight, from the low valley to the middle valley. In this case, insects should be caught by pheromone traps, placed in Traona, Talamona, and Sondrio. Insects can also be accidentally introduced by commerce. This can explain the lack of insects in the pheromone traps and the presence far from the invaded area. The presence of a nymph, in the trap placed in 2015 in Ponte in Valtellina, shows that *H. halys* already settled in this area. In 2016 more specimens were found in Sondrio and Ponte in Valtellina, this fact confirms that the species settled also in this area. It is important to monitor

the insect population and the damages to the fruit as this invasive species has a strong flight capacity (Lee et al., 2013a, b), and can replace *Nezara viridula* (L.), as it was already observed in Sorico (Authors observation).

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