



Managing *Halyomorpha halys* by means of exclusion netting: trials 2016-2018

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Extended Abstract: The invasive polyphagous crop pest *Halyomorpha halys*, also known as a brown marmorated stink bug (BMSB), is rapidly spreading in Italy and other European countries. In order to cope with its high harmfulness in fruit orchards, in Emilia-Romagna Region, Northern Italy, farmers have increased the use of broad-spectrum insecticides, resulting in disruption of the most innovative IPM strategies, such as mating disruption (MD) or the use of microbiological products (e. g. CpGV), with serious agro-environmental risks (Maistrello et al., 2017). Several investigations are underway in order to identify more sustainable control strategies against BMSB that include “IPM-CPR” (Blaauw et al., 2014), “attract and kill”, trap crop (Morrison III et al., 2015), and exclusion netting. The latest method, designed by the French extension services in 2005 (Severac and Romet, 2007) to control the codling moth, has been tested also in Italy. In both countries, it has been proved that exclusion netting represents one of the most readily available tools for crop protection and an environmentally friendly alternative to pesticides (Alaphilippe et.al., 2016). As a matter of fact, this method is currently applied on several thousand hectares of orchards in both countries (Caruso et al., 2017) and other applications are currently being carried out in different parts of the world (Chouinard et al., 2016). The present study aimed at investigating exclusion nets as a potential strategy to prevent BMSB damage in pear orchards. The experiments performed during 2016-18 included:

1. A laboratory trial was performed to evaluate the effectiveness of different net’s mesh size (2.2×2.2 mm, 4.0×2.5 mm, 5.0×1.3 mm, 7.0×3.0 mm), against different instars (II, III, IV, V and adults).
2. Field trials, conducted in commercial orchards in the province of Modena, using different types of net as follows:
 - a. eight IPM orchards with “anti-hail nets” (mesh size of 7.0×3.0 mm) in comparison with 8 uncovered orchards;
 - b. eight IPM orchards with “whole orchard-nets” (made of an anti-hail net at the top with mesh size of 7.0×3.0 mm, and the net whit mesh size of 4.5×2.0 mm on the perimeter), in comparison with 8 uncovered orchards;
 - c. eight organic orchards with single-row nets (mesh size of 4.5×2.0 mm) in comparison with 8 uncovered orchards.

The results of laboratory trials show that 4.0×2.5 and 5.0×1.3 mm mesh size net, are able to exclude the most damaging instars, such as adults and older nymphs (IV-V instars). Nets with smaller mesh size (2.2×2.2 mm) exclude also third instar nymphs, with no significant efficiency gains. Therefore, the nets 4.0×2.5 and 5.0×1.3 mm, commonly used

in exclusion netting and already widespread in the field, could be considered as reliable for this type of application. The results of field trials indicated that:

- “anti-hail net” alone reduced damage on pears about 50% compared to un-netted orchards but no differences were detected in the number of applied insecticide treatments (i. e., average of 6.5 treatments/year);
- in “whole orchard-net” damage on pears was reduced about 80% compared to un-netted orchards and insecticide treatments were reduced about 35%;
- in “single-row net” fruit damage was reduced by almost 90% compared to un-netted orchard in organic farms, where no effective insecticides are available/authorized.

These results demonstrated that exclusion netting systems are an efficient and sustainable tool in the framework of IMP and Organic programs for BMSB. However, this species being a very mobile insect (Lee and Leskey, 2015), with five instars of different size able to move in narrow spaces, the efficacy of exclusion netting is not always close to 100%, and some additional insecticide treatments might be necessary. These observed positive results induced the Regional administrations of Northern Italian Regions to contribute financing the installation of exclusion netting with either whole or single-row nets in fruit orchard farms.

Key words: Brown marmorated stink bug, exclusion netting, integrated pest management, pear orchards, invasive insect

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References

- Alaphilippe, A., Capowiez, Y., Severac, G., Simon, S., Sandreau, M., Caruso, S., and Vergnani, S. 2016. Codling moth exclusion netting: an overview of French and Italian experiences. IOBC-WPRS Bull. 112: 31-35.
- Blaauw, B. R., Polk, D., and Nielsen, A. L. 2014. “IPM-CPR for Peaches: Incorporating Behaviorally-Based Methods to Manage *Halyomorpha halys* and Key Pests in Peach. Pest Management Science 71(11): 1513-1522. doi:10.1002/ps.3955.
- Caruso, S., Vaccari, G., Vergnani, S., Raguzzoni, F., and Maistrello, L. 2017. Nuove opportunità di impiego di reti multifunzionali. L’Informatore Agrario n. 15: 57:60.
- Chouinard, G., Firlej, A., and Cormier, D. 2016. Going beyond sprays and killing agents: exclusion, sterilization and disruption for insect pest control in pome and stone fruit orchards. Scientia Horticulturae 208: 13-27.
- Lee, D. H., and Leskey, T. C. 2015. Flight behavior of foraging and overwintering brown marmorated stink bug, *Halyomorpha halys* (Hemiptera: Pentatomidae). Bulletin of Entomological Research 105(59): 566-573.

- Maistrello, L., Vaccari, G., Caruso, S., Costi, E., Bortolini, S., Macavei, L., Foca, G., Ulrici, A., Bortolotti, P. P., Nannini, R., Casoli, L., Fornaciari, M., Mazzoli, G. L., Dioli, P. 2017. Monitoring of the invasive *Halyomorpha halys*, a new key pest of fruit orchards in Northern Italy. *Journal of Pest Science* 88(1): 37-47. DOI 10.1007/s10340-017-0896-2.
- Morrison, W. R., Lee, D. H., Short, B. D., Khimian, A. and Leskey, T. C. 2016. Establishing the Behavioral Basis for an Attract-and-Kill Strategy to Manage the Invasive *Halyomorpha halys* in Apple Orchards. *Journal of Pest Science* 89(1): 81-96. doi:10.1007/s10340-015-0679-6.
- Severac, G., and Romet, L. 2007. Alt'Carpo, contre la carpocapse travailler avec filets. *Phytoma* 601: 10-14.