



The invasive *Halyomorpha halys* in Europe: a challenge for integrated fruit production

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Extended Abstract: The Brown Marmorated Stink Bug (BMSB), *Halyomorpha halys* Stal (Heteroptera: Pentatomidae), is a highly polyphagous insect native to eastern Asia, rapidly spreading as a serious pest of global importance of many agricultural crops (Haye and Weber, 2017). It is also a household nuisance, due to the large overwintering aggregations inside man-made structures. It has successfully invaded and established in large areas of North America, in many central, eastern and southern European countries and, most recently, also in Chile (Leskey and Nielsen, 2018). BMSB caused millions of dollars losses in fruit orchards and horticultural crops in the USA, and it rapidly became a key pest of fruit orchards in Northern Italy with severe losses especially on pear (Maistrello et al., 2017). BMSB is also a serious pest of hazelnuts grown in Piedmont and in the countries along the Black Sea (Bosco et al., 2017).

The sneaking behaviour of BMSB makes its worldwide invasion virtually unstoppable. In fact, the propensity to aggregate in narrow, hidden microhabitats (e. g. slots of vehicles, packaging materials, suitcases, clothes etc.) exhibited particularly during overwintering phase, allows these bugs to “hitchhike” unnoticed on practically any type of goods, facilitating human assisted spread all over the world (Maistrello et al., 2018). Interceptions of BMSB are increasingly reported at transitional facilities in many countries, and models highlight the potential for further spread and establishment, threatening horticultural productions of areas with suitable climate in both hemispheres (Kriticos et al., 2017).

BMSB is currently rapidly spreading in European countries causing increasing damage in fruit orchards and other horticultural crops. In northern Italy a BMSB life table calculations performed under outdoor conditions demonstrated a high growth potential for BMSB bivoltine populations with high reproductive rates for both generations ($R_0 = 24.04$ and 5.44 respectively) (Costi et al., 2017). A 3-year field survey in the same area showed that the biocontrol potential by native antagonists is presently very limited (Costi et al., 2018).

In the attempt to counteract the fast spread and high damage levels caused by BMSB, farmers intensify treatments with broad-spectrum insecticides, resulting in disruption of the existing Integrated Pest Management (IPM) programs (Leskey et al., 2012; Maistrello et al., 2017), with increasing negative environmental impact. Management of BMSB is particularly challenging. Chemical control proved to be scarcely effective due to the general robustness, as well as to the high polyphagy combined with high mobility of all instars, that results in continuous movements of the bugs between different host plants (Lee and Leskey, 2015). More sustainable approaches to manage BMSB in fruit orchards include the use of exclusion netting systems (Caruso et al., 2017) and behaviour-based strategies such as IPM-CPR (Blaauw et al., 2015). Evaluation of mass rearing of efficient native antagonists for inundative release is also being considered.

Field monitoring of BMSB presently relies on traps baited with aggregation pheromones that showed scarce efficiency and increased damage on the plants surrounding the installation point. The use of substrate-borne vibrational stimuli might favour the development of innovative multi-modal trapping devices as well as behavioural manipulation approaches (Mazzoni et al., 2017).

Key words: brown marmorated stink bug, biological invasions, human assisted spread, fruit orchards, IPM

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