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HALYOMORPHA HALYS FRUIT INJURY ON PEAR CAN BE REDUCED BY APPLYING KAOLIN AND ZEOLITES

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Abstract: Brown marmorated stink bug (*Halyomorpha halys*, Hemiptera: Pentatomidae), is a key pest of several horticultural crops, challenging to manage due to its high poliphagy and dispersal capacity. In addition, insecticide products have only a limited impact on this species (Kuhar & Kamminga, 2017). The use of geomaterials such as kaolin clays has been investigated for several insect pests, including *H. halys*; for instance, kaolin has been tested in combination with pyrethrin affecting insect mortality and mobility (Lee *et al.*, 2014). Another usage of kaolin reported in the literature is to protect fruiting vegetables from *H. halys* injuries, specifically in organic agriculture (Kuhar *et al.*, 2019). These authors reported a laboratory choice test using tomato fruits placed on a *Paulownia tomentosa* leaf treated or not with kaolin. Significantly fewer *H. halys* individuals occurred on the kaolin-treated leaves; the same study showed also promising results in the field, where kaolin sprays to peppers resulted in significantly lower stink bug-injured fruit compared to the untreated control (Kuhar *et al.*, 2019). Here we present the results of field investigations carried out across 2020-2021 seasons in Emilia-Romagna (Northern Italy) to evaluate the effect of geomaterial sprays on the fruit injury reduction on pear crops within the public project 'Alien.Stop' funded by the Emilia-Romagna region.

Two small-plot trials and four big-plot trials were carried out during 2020-2021 in pear orchards cv Bartlett, either for fresh consumption or for processing (e.g., juice production). Several geomaterials have been investigated within this project, including two types of kaolin clays, three types of zeolites, a volcanic dust and a talcum based-products. Repeated sprays were carried out across the season from fruit set until harvest, testing the products alone (repeated applications of the same geomaterial) or combined (*e.g.*, 4-5 kaolin sprays followed by 4-5 zeolite sprays), with a spray interval of 7-10 days. The growers sprayed all the orchards according to the IPM or organic guidelines and the treated blocks differed from the control blocks only for the additional applications of the geomaterials. Fruit damage assessments were carried out during the season, at harvest and post-harvest, recording the level of pest damage incidence (percentage of injured/deformed fruits) and in some trials, the level of pest damage severity (number of stings per fruit, after cold storage of 6-8 weeks, peeling the fruits). Data analysis was performed using GLM followed by Tukey's test for means (SAS program).The small-plots trials showed an effect of kaolin in reducing the pest damage incidence significantly, while only a trend was recorded in terms of pest damage severity; also, zeolite materials showed some activity in reducing the crop damage when applied alone but to a lesser extent compared to kaolin.

Considering the big-plot trials, in 2020 one experiment was carried out in an organic pear orchard and showed a significant effect of the kaolin/zeolite strategy in reducing the crop damage compared to the control; the second experiment was carried out in a conventional pear orchard and in such experimental condition the contribution of the geomaterial was not significant. In 2021, the big-plot trial was carried out spraying kaolin alone 6-8 times (from the end of April until the end of July) in Bartlett pears used for processed fruit production. The results

showed a significant effect in the fruit injury reduction using kaolin, although the fruit's skin was covered by clay at harvest (not relevant for fruits to be processed).In 2021, a big-plot trial considered a strategy with kaolin sprays until early June, followed by zeolite sprays to prevent fruit staining at harvest. The results showed a significant effect in fruit injury reduction using the geomaterials (compared to the untreated control), with negligible effects on the fruit quality at harvest (pears acceptable for fresh consumption).These studies support the use of kaolin and zeolite for pome fruit crops such as pear to prevent or at least reduce the fruit damage caused by *H. halys*. Nevertheless, the results of these additional sprays may be affected by several factors. The deterrent effect of geomaterials on the *H. halys* feeding depends on the quantity of product sprayed, the sprays interval, the wash-off as an effect of rainfalls, the management program (organic or conventional) and specifically the insecticide spray program, and above all the pest pressure and the agroecological landscape surrounding the orchard. Lastly, the economic evaluation considering the costs of such products (in relation to the dose and the number of applications) has to be carefully considered.

Key words: brown marmorated stink bug, pest control, crop protection, geomaterial, fruit damage.

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