

Application of *Cinnamomum cassia* essential oil by trunk injection as a bio-insecticide in fruit arboriculture.

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Abstract : In conventional agriculture, apple orchards are still treated with numerous phytosanitary products. For several years now, we have been looking for alternatives to these treatments, particularly against the rosy apple aphid (RAA), *Dysaphis plantaginea*. One of the solutions we are currently testing involves injecting essential oil directly into the xylem of the tree, so that the active ingredients can spread rapidly to all the organs. This technique offers several advantages. On the one hand, the quantities injected are very small, which reduces costs compared with spraying essential oil on the tree, and on the other, these oils are natural products that biodegrade rapidly. A first series of trials was carried out in 2020 and 2021 using different concentration of cinnamon essential oil (*Cinnamomum cassia*). Forty and 45 apple trees of the cultivar Jonagold (*Malus domestica*) were monitored respectively during the experiment. These injections were applied as a preventive and curative treatment, as well as a preventive treatment during the vegetative stage and at bud break. Number and dynamic of aphid colonies were monitored, as were populations of other pests and predators after the treatments. In addition, volatile organic compound (VOC) emissions from the trees were sampled to identify the potential impact on aerial biological signals. Tree physiology was assessed visually, and growth and chlorophyll fluorescence were measured. Finally, total and commercial yields were estimated, as well as residues of trans-cinnamaldehyde (EO's main compound) in the fruit, using Stir-bar sorptive extraction methods. A second series of trials was carried out in 2025 in collaboration with the Proefcentrum Fruitteelt in St Truiden. Eighteen apple trees were treated and a further nine served as controls. A trial with 40 apple trees was also set up in Louvain-la-Neuve. The project is funded by the Interreg TransPest program. Initial results show that the treatment had an impact on aphid population dynamics, but did not completely control *D. plantaginea*. Significant differences were observed in terms of VOC emissions from all trees, but these were associated with seasonal variations and not with treatment. Increasing the concentration of the active substance resulted in visual phytotoxicity, reduced performance index and reduced growth of apple trees, allowing the maximum application rate to be established. The treatment showed no residues in fruit and had no impact on yield. Results from 2025 are currently being analyzed. This study examines the practical feasibility of effective laboratory solutions under agronomic conditions and identifies the challenges and limitations to be considered.

Key words : Tree injection, Essential oil, Rosy Apple Aphid, Phytotoxicity