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EXPLORING SUSTAINABLE CONTROL OF *Takahashia japonica* WITH NATURAL PREDATORS IN URBAN GREEN SPACES

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Abstract *Takahashia japonica* (Hemiptera, Coccidae) is a scale insect species native to South and East Asia, that was first detected in Europe in the North of Italy in 2017. It can be identifiable by the long white loop-shaped ovisacs hanging from the tree twing and branches and can cause substantial damage to urban greenery, especially on the ornamental deciduous trees *Liquidambar styraciflua* L. (sweetgum) and *Morus alba* L. (white mulberry). In this study the efficacy of the biological control of *Takahashia japonica* with the two natural predators (Coleoptera, Coccinellidae) *Exochomus quadripustulatus* and *Cryptolaemus montrouzieri* was evaluated in comparison to the chemical control and against the untreated. 42 trees of the two species, sited in 3 municipalities of the province of Milan, in the North of Italy, were tested. Biological control was performed on n. 4 *Liquidambar styraciflua* L. and n. 10 *Morus alba* L. with the release of 40 *E. quadripustulatus* and 50 *C. montrouzieri* at adult stage. One cardboard bucket, containing the insects and a sugar supply, was hung on one branch of each infested tree. Chemical treatments consisting in the application of cypermethrin (appl. rate 0,2%) on the canopy of a set of 14 host plants. Predators' release and chemical treatment were repeated in 3 applications (5 weeks apart) and followed by 6 monitoring assessments. The effect of the treatments on *T. japonica* individuals was evaluated by the observation of the vegetative vigor recovery of the trees, ranked in 4 levels (0, 1, 2, 3). Per each assessment date and treatment group the mean value of vigor recovery was calculated and data were analysed using one-way ANOVA ($P<0.05$) and Tukey HSD test. The treatment of *T. japonica* infestation with natural predators resulted in a vigor recovery extent significatively different from that observed in the untreated trees for both the species tested. The mean vigor of trees subjected to biological control was 1,55 for *Liquidambar styraciflua* L. and 1,33 for *Morus alba* L., while in the untreated was 0,60 and 0,37 ($p=0.016$ and $p=0.0010$) respectively. There was no significant difference between trees treated with biological control and which treated with cypermethrin, that showed a vigor recovery of 1,12 for *Liquidambar styraciflua* L. and 1,30 for *Morus alba* L. ($p=0.1278$ and $p=0.9206$). The biological control conducted with *E. quadripustulatus* and *C. montrouzieri* on *Liquidambar styraciflua* L. and *Morus alba* L. infested by *T. japonica* was effective in promoting the recovery of the plants vigor, with results similar to those obtained by using chemical products. In this study the vitality of the scale insects was measured by assessing the vigor of the trees, but the efficacy of the treatment should be verified by counting the new ovisacs on tree branches the following oviposition period. Results of the biological control were influenced by the unusually rainy weather occurred during the test, the replication in different years and climatic conditions is suggested.

Key words *Takahashia japonica*, scale insects, biological control, ornamental trees, plant vigor