

# Development of Augmentative Biological Control of Aphids Using Flightless *Harmonia axyridis*

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Aphids are economically important pests with a worldwide distribution. In addition, aphid control has become less effective due to the evolution of insecticide resistance in natural populations. Hence, alternative control methods, such as biological control, are desirable.

Ladybirds have been widely used to control aphids through augmentation by translocation or mass rearing and release. The use of ladybirds in augmentative biological control has been hampered by the tendency of adults to disperse. The coccinellid *Harmonia axyridis* Pallas has been utilized in augmentative biological control in Asia, Europe, and North America. However, even in greenhouses, adult beetles tend to fly away from the crop soon after release and, consequently, they are viewed as unreliable biological control agents. Marples et al. (1993) suggested that if ladybirds were poor flyers they would remain in a crop for longer and provide the potential for more long-term control [1]. Tourniaire et al. (2000) produced a homozygous flightless strain by artificial selection from a laboratory [2].

In the Western Region Agricultural Research Center of National Agriculture and Food Research Organization (NARO), a flightless strain of *H. axyridis* was established by artificial selection for reduced flight ability of adults in a laboratory population. Both adults and larvae of the flightless *H. axyridis* were observed to be effective biocontrol agents, markedly decreasing the numbers of aphids.

A project for practical application of the flightless strain had been conducted from 2008 to 2010 with Okayama University, Agri-Soken Inc., Hyogo Prefectural Agriculture, Forestry and Fishery Technology General Center, Osaka Prefectural Research Institute of Environment, Agriculture and Fisheries, Nara Prefectural Agricultural Research and Development Center, Wakayama Prefectural Agricultural Experiment Station, and Tokushima Agriculture, Forestry and Fisheries Technology Support Center. This project contributed to develop mass-rearing system including quality control and proper method and timing of agent releases in the flightless *H. axyridis*. The efficacy of releasing the flightless strain against aphids had been evaluated on many vegetable plants.

The flightless strain is available commercially from Agrisect Inc.. The product name is 'Ten-top' [3]. Farmers are able to use Ten-top easily after reading the user manual<sup>3)</sup>. This research has been introduced on TV programs and newspapers. It was also selected for Ten Outstanding Topics from Research Results in Agriculture, Forestry and Fisheries 2014 [3]. At the current time efforts are underway to spread their use for vegetables grown in greenhouse and to register their use for open field.

## References

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