Present Status and Future Prospects of Biological Control in Japan

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Biological control is the most important control method in integrated pest management (IPM). To establish scientific bases of biological control, we must investigate ecological relationship between pests and their natural enemies in natural- and agro-ecosystem. There are three basic approaches to biological control: (1) classical biological control (2) augmentative biological control (3) conservational biological control. The first attempt for classical biological control was the introduction of the Vedalia beetle into Japan to control the cottony cushion scale. This attempt was very quickly carried out and was successful. After this success, we introduced several foreign natural enemies especially for biological control of accidentally introduced fruit tree pests. The most drastic successes in classical biological control in Japan were those of the red wax scale, the arrowhead scale and the chestnut gall wasp. More recent attemptof introduction of foreign natural enemies was for biological control of the alfalfa weevil. Of the 4 parasitoids introduced from USA, *Bathyplectes anurus* was recently recovered in Kyushu. Twelve species of insect natural enemies, 4 species of predatory mites, 2 species of nematodes and 8 species of microorganisms including BT are now available as commercial bio-pesticides for augmentative biological control in Japan. Not all of them are widely used by farmers because they are more expensive than chemical pesticide. More recently, however, increasing demand by consumers for food safety made farers to try to reduce chemical insecticide applications. Some farmer groups began to apply biological control based IPM. Improve of effectiveness of natural enemies is very important for biological control. Many different approaches are now studying as the efforts of conservational biological control, including application of banker plants, combination of selective insecticide uses and physical control etc. These efforts will surely diffuse biological control based IPM near future in Japan.