

Development of technologies for invasive species countermeasures, using ants as a model

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[Abstract]

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This project aimed to develop a scientific management system for invasive species using alien ants as a model. First, as a part of the development of control technology in the initial stage of biological invasions, workshop packages were created and disseminated to the general public in Okinawa as a model area. In addition, the DNA library of invasive alien species that have already established populations in Okinawa Prefecture was created in preparation for the detection of new invasive ants. Furthermore, we established a cross-governmental cooperative system for the detection of new invasions, and applied it to the initial response and control of Argentine ants and Browsing ants that were newly found in Okinawa Prefecture during this project period. Next, as a technique required in the second stage of biological invasion, we expanded the target species of simple diagnostics using the DNA amplification (LAMP) kit, which allows anyone to reliably identify collected alien ants. We also improved its use in collaboration with a pest control company. Furthermore, we confirmed the effectiveness of pyrethroid aerosol agents as a method to control entire containers of alien ants after discovery. Finally, as techniques necessary for control after establishment, we confirmed the effectiveness of fipronil and pyriproxyfen as agents used to control established populations of alien ants, and these agents were used in actual fire ant control conducted by the Ministry of the Environment. We also studied strategies for the effective use of baiting to eradicate established wild colonies. We demonstrated that in polydomous colonies, a common characteristic of invasive alien ants, the entire colony is physiologically integrated through nutrient exchange among member individuals, and each nest tends to specialize in foraging for better quality food resources nearby (the nest-level division of labor). A variety of viral infections, including honeybee pathogenic species, were observed in three exotic ant species collected in Japan: *Solenopsis invicta*, *Anoplolepis gracilipes* and *Pheidole megacephala*. In *S. invicta* and *A. gracilipes*, certain viral infections were found to cause reduced feeding and a tendency to avoid protein content. Considering these factors, we confirmed that simultaneously feeding protein and sugar as separate baits increases the feeding rate of the colony, both in the laboratory and in the field. This baiting strategy was implemented on a trial for the control of *Lepisiota frauenferdi*, which was discovered to have invaded Okinawa during the study period, and has been almost eradicated.

[References]

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