Abstract

[Research Title]

Developing Application Methods for Preventing Fire Ants (Solenopsis spp.) Nesting in Container Yards by Filling Silicone Resin and Its Infestation in Marine Containers by Placing Microencapsulated AITC

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[Abstract]

Solenopsis invicta, one of the most serious invasive alien ant species, has expanded its range to the Pacific Rim in recent years. By the end of 2023, although *S. invicta* had not yet established a stable population in Japan, 111 incursions had been detected, predominantly associated with containers transported from China. Furthermore, since 2019, colonies of *S. invicta* containing new queens have been continuously discovered at major international ports in Japan. Most of these colonies were found nesting in cracks resulting from the deterioration of asphalt pavement in container yards. Given this urgent situation, it is imperative to establish methods to prevent further invasions and the establishment of *S. invicta* in Japan. Therefore, this study aimed to develop novel, effective methods to prevent *S. invicta* from entering containerized cargo and nesting in container yards. A key innovation to prevent *S. invicta* from infiltrating container cargoes is the application of microencapsulated allyl isothiocyanate (mAITC) as a repellent. AITC, a chemical compound derived from Wasabi (*Eutrema japonicum*), is known for its repellent and fumigant properties against various pests. The conventional application of AITC has been limited by its high volatility and intense pungency. Encapsulating AITC, however, facilitates a controlled, sustained release, mitigating irritancy and enhancing efficacy. Our research demonstrated that mAITC maintains a constant concentration of AITC even within a non-airtight cardboard box. Subsequently, we confirmed the repellent efficacy of mAITC against *S. invicta* using actual shipping containers in fields invaded by the ant, and established an effective method for packing mAITC into containerized cargo. To prevent *S. invicta* from establishing nests within container yard cracks, we developed a low-viscosity silicone-modified resin and associated application techniques (JP 2021178809). Characterized by extremely high permeability, an accelerated curing process, and cost-efficiency, this resin facilitates prompt and effective crack repairs without necessitating yard

suspensions. The newly developed silicone resin has been experimentally installed at ten major Japanese ports to verify its usefulness and establish an effective repair method. Additionally, we have initiated the implementation of these two technologies in practical settings. In cooperation with the Ministry of the Environment, we have conducted a model project with container importers to promote the use of mAITC in preventing *S. invicta* from entering imported containerized cargo. The novel silicone resin developed in this study has been marketed under the trade name "Niche" to facilitate its widespread adoption.

[References]

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