Basic and Applied Studies in Pest Management

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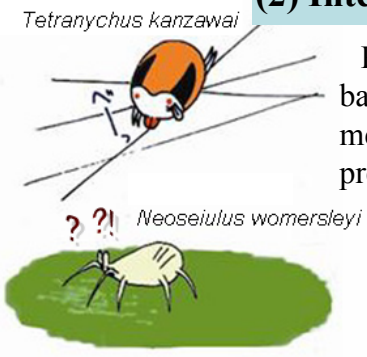
In the wild, there are seldom outbreaks of herbivorous arthropods, due to the antiherbivore defenses in plants and the action of natural enemies that regulate herbivore density. To prevent outbreaks of pest herbivores while minimizing chemical control, we must understand and apply the interactions between plants and herbivores and those between herbivores and their natural enemies both natural and agro-ecosystems, namely. In our laboratory, we have engaged in both basic and applied research using mites and insects as experimental organisms.

(1) Interactions Between Plants and Pest Herbivores

In interactions between plants and herbivores, a balance exists between the antiherbivore defenses in plants, which help to prevent or overcome attack by herbivores, and counter-defense mechanisms in herbivores. We are examining plant defense systems and counter-defense mechanisms in herbivores to elucidate why each spider mite species prefers a particular host plant species, and why each plant is used by a particular mite species.

An adult female *Panonychus citri* and her eggs—This mite lives on citrus trees, and we are examining how the mite circumvents the defensive chemicals of citrus plants.

(2) Interactions Between Pest Herbivores and Their Natural Enemies

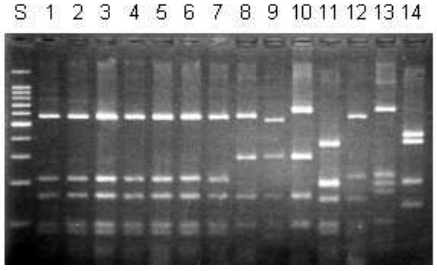


Predator-prey interactions between herbivores and their natural enemies are balanced by predator avoidance in herbivores and the efficient search mechanisms of predators. We are investigating these interactions in order to use predatory mites as biological control agents against spider mites.

Behaviors of predator and prey—Predatory mites (bottom) use the silk thread produced by spider mites as a prey-searching cue. When they become aware of the predators, spider mites (top) take refuge within their webs.

(3) Molecular Ecology for Investigating Population Dynamics and Gene Flow

Because mites are small, they are useful for laboratory experiments. In field observations, however, it is difficult to distinguish individuals and to identify species. Using DNA markers, we are investigating variation in the mites' adaptive traits (e.g., sympatric speciation, diapause and host selection), metapopulation structure, and development of acaricide resistance.



Discrimination of Japanese *Tetranychus* species using PCR-RFLP of internal transcribed spacer region of nuclear ribosomal DNA—We are able to discriminate each mite species by comparing the banding patterns (S: standard size marker; 1–13: mites belonging to genus *Tetranychus*; 14: mite of genus *Amphitetranychus*)

Keywords

Spider mite, Phytoseiid mite, DNA, Diapause, Interspecific interaction, Adaptive evolution, Population ecology, Ethology, Molecular ecology, Biological control, Pest management, Ecological management

Recent Publications

Using high relative humidity and low air temperature as a long-term storage strategy for the predatory mite *Neoseiulus californicus* (Gamasida: Phytoseiidae). Ghazy, N. A., T. Suzuki, M. Shah, H. Amano and K. Ohyama (2012) Biological Control 60:241-246

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Seasonal changes in the deleterious effects of solar ultraviolet-B radiation on eggs of the twospotted spider mite, *Tetranychus urticae* (Acari: Tetranychidae). Sakai, Y., M. Sudo and Mh. Osakabe (2012) Appl. Entomol. Zool.47: 67-73

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Cooperative web sharing against predators promotes group living in spider mites. Yano, S. (2012) Behav. Ecol. Sociobiol. 66: 845-853.

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Comparison of genetic diversity among three phytoseiid mite species in Japan by mitochondrial DNA sequence analysis. Hinomoto, N., T. Shintaku and H. Amano (2010) J. Acarol. Soc. Jpn. 19: 9-14

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