A new concept of termite management by the use of non-repellent termiticides

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We have a long history of combating against termites in Japan since 9th century based on a survey of the literature. Since termites cause considerable economic damage to wooden constructions, they are well recognized as serious urban pests as a result of an increase in the urban population. Among 21 Japanese termite species, *Reticulitermes speratus* (Kolbe) and *Coptotermes formosanus* Shiraki are most economically important subterranean termites.

There are two conventional preventive and control methods to protect wooden houses and structures from termite infestations. One is an industrial/remedial treatment to immunize wood against termite feeding and the other is soil-poisoning to prevent the access of termites to constructions and to control termite infestations as well. Unfortunately, both counterplans are heavily dependent on the use of chemicals. Elimination of the use of chlordane in the 1980's was attributed to an increased public concern about environmental soundness in many countries of the world. Current alternatives generally have a low-mammalian toxicity with a little or negligible environmental impact. Non-repellent termiticides such as imidacloprid, silafluofen, chlorfenapyr, fipronil and other neonicotinoides have been introduced to termiticide-markets. Another development to reduce the risk of soil and water contamination is a physical barrier. Gravels and termite-proof plastic sheeting are good examples of this idea, and were already commercialized in some countries. Although the importance and significance of integrated termite management (ITM) has been often insisted, it has not yet obtained popularity in Japan as in other countries.

The purpose of this short article is to briefly describe the feasibility of a non-repellent termiticide, fipronil in a new concept which is thought to meet requirements as an environmentally sound termite management approach. Non-repellent termiticides may be used as soil-poisoning agents. Nevertheless, we can not expect any favorable environmental contribution accompanied with this application. A bait system would not be applicable to prevention, but enables us to use a small amount of bait toxicants (insect growth regulators instead of termiticides) and to recover residual bait toxicants at the termination of termite management. Characteristics of ecological behavior of termites, grooming and trophallaxis could be taken into consideration in the new concept of termite management with the aid of fipronil.

Transfer of fipronil among workers of Coptotermes formosanus: Laboratory evaluations were conducted at 4 treatment concentrations [0.5-10.0 ppm (m/m)] in sandy loam and two mixing ratios (donors vs. recipients=1:1 and 1:10). After allowing donors (fipronil-exposed workers) to contact with treated sandy loam, they were mixed with recipients (fipronil-unexposed workers) to determine the mortality of both donors and recipients. The final figures for the mortality of donors increased with the treatment concentration and time as expected, and ranged from 30 to 100%, while the mortality of recipients did not vary much with treatment concentrations and mixing ratios with mean figures of 18-36%. The results suggested the possible horizontal transfer of fipronil among nestmates.

Lethal dose of fipronil for workers of Coptotermes formosanus: Lethal dose of fipronil was determined by topical application (0.1, 0.5, 1.0 or 5.0 ng/worker) and contact with treated sandy loam [5 ppm (m/m)]. Topically treated workers of the same dose group were placed in a glass Petri dish (9 cmø) with a water-moistened cotton as a food source for termites to determine LT_{100}s and LT_{50}s based on the change in termite mortality. The LT_{100}/LT_{50} figures were 81/65, 36/24, 27/9, 9/7 hours for 0.1, 0.5, 1.0 and 5.0 ng/worker, respectively. The results clearly supported the dose dependence of fipronil on the termite mortality. The estimated LD_{100}/LD_{50} figures 12 hour-incubation were 2.5 and 2.7 ng/worker. The amount of fipronil recovered from dead termite workers was chemically determined in the contact test for 24 hours. The mean amounts of fipronil recovered were 3.10 and 3.17 ng, respectively from the body exterior and interior with the mean total amount of 6.27 ng fipronil that was much higher than the lethal dose determined by topical application.

Feasibility of a non-repellent termiticide, fipronil in a new concept of termite management: A unit which consists of a container with fipronil-treated soil and termite bait seems applicable to a recoverable, reusable and recyclable devise to eliminate or to suppress foraging activities of subterranean termites in wooden homes and structures. The device requires inspections to confirm whether devices are placed at appropriate sites and to know when the device is renewed, whereas the concept saves labors with an ensured longevity of effectiveness of the device, and should be considered as a part of ITM.