

Effects of soil treated with a nonrepellent insecticide, fipronil at low concentrations on subterranean termites

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Chemicals that do not repel termites from penetrating into treated soil but rather successfully kill them are called nonrepellent termiticides, and they have been accepted worldwide as new-generation alternatives to conventional soil-poisoning repellent termiticides. The success in termite management depends on the lack of a repellent effect and the slow-acting characteristics of these termiticides may allow transfer of toxicants between exposed and unexposed termites through their social behaviors such as trophallaxis and grooming. The transfer of a toxicant (fipronil) is thought to cause the elimination of termite colonies. The main aim of the present research was to determine the effect of treatment concentrations and presence of dead termites on the tunneling of subterranean termites in the laboratory. Termite bioassay was conducted at concentrations of fipronil [0-50 ppm (w/w soil)] lower than manufacturer's specifications.

Materials and methods

Soil-penetration test: A glass tube filled with treated and untreated soil (or 20 dead termite bodies), agar was used as a test device. Termites (50 workers + 5 soldiers of *Coptotermes formosanus* Shiraki) were placed at the bottom of the tube, and were forced to penetrate up to a wood piece (Fig. 1). Test soil was treated with fipronil (a commercial product) at 0 ~50 ppm. Penetration distance, wood consumption and termite mortality were determined after one-week bioassay at 28 ± 2 °C and 80% RH. Repellency to dead bodies was tested, when 20 dead bodies that were prepared by freezing, exposure to the toxicant or microbial degradation were placed beneath the treated soil.

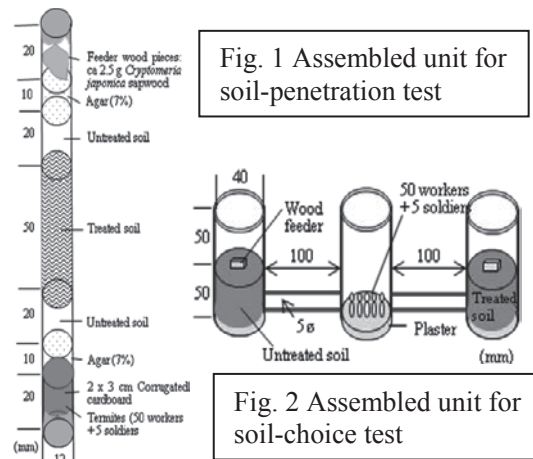


Fig. 1 Assembled unit for soil-penetration test

Fig. 2 Assembled unit for soil-choice test

Soil-choice test: An acrylic pipe was used as a test chamber (Fig. 2). Fipronil concentrations in the treated soil ranged from 0 to 50 ppm. The effect of accumulation and occurrence of dead bodies was tested when 50 dead termites were mixed with untreated soil and 10 bodies prepared by freezing process were placed around a wood feeder on the treated soil, respectively. Fifty workers and 5 soldiers were released in the central chamber. Test units were maintained for two weeks under the same condition of soil-penetration test. Measurement items were the same as well.

Results and discussion

Soil-penetration test: Penetration distances at 5 and 50 ppm were significantly shorter than 0 and 0.1 ppm. Worker termites succeeded in passing through the zone with dead bodies, regardless of preparatory processes of dead bodies.

Soil-choice test: Termites could not reach wood feeders at any treatment concentration (>0.1 ppm). Termites aggregated in the central chamber within one day after the initiation of bioassay, and they would not move afterwards. This was regarded as repellency of termite to dead bodies.

In both tests to determine the effect of accumulation and occurrence of dead bodies, repellency was observed, although termites penetrated through the treated soil zone. When a group of termite once aggregated in the treated chambers, and microbial growth on the dead bodies was subsequently seen, they moved towards the central chamber and finally were dead within a few days. Since the test design did not allow termites to clean up dead termites outside their foraging territory, further simulation tests should be done.