

Technologies

Liquid learning

A new study compares how liquid termiticides affect termite behavior

By Dr. Gregg Henderson Contributor

The newest tools in fighting termites are products that cause colony mortality away from the treatment site. To be effective, these products must be nonrepellent and slow-acting enough to allow intoxicated termites to leave the treatment site. This is important, because large numbers of dead termites around the treatment zone repel healthy termites (Su et al., 1991).

Fipronil (Termidor) and imidacloprid (Premise) are both nonrepellent, slow-acting insecticides that can affect termites through direct contact. They are more toxic to insects than to mammals because of differences in the insect central nervous system (CNS). Fipronil and imidacloprid kill insects through hyperexcitation of the central nervous system. However, because they act on different

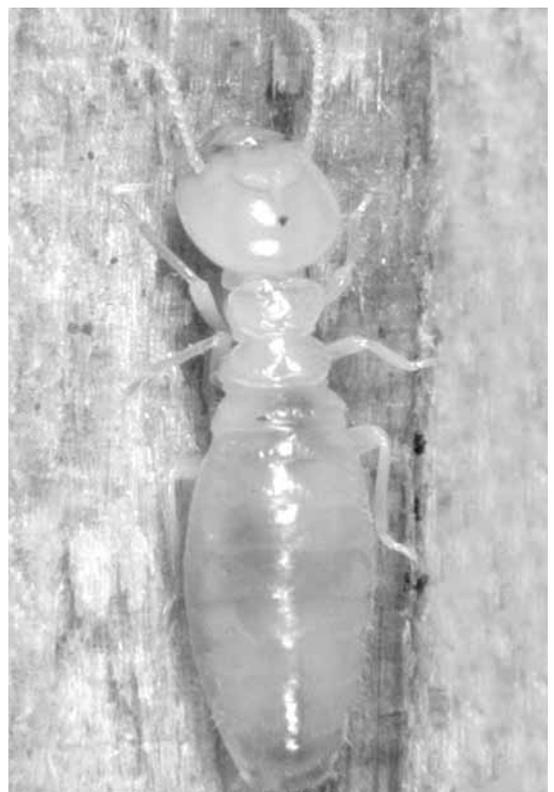
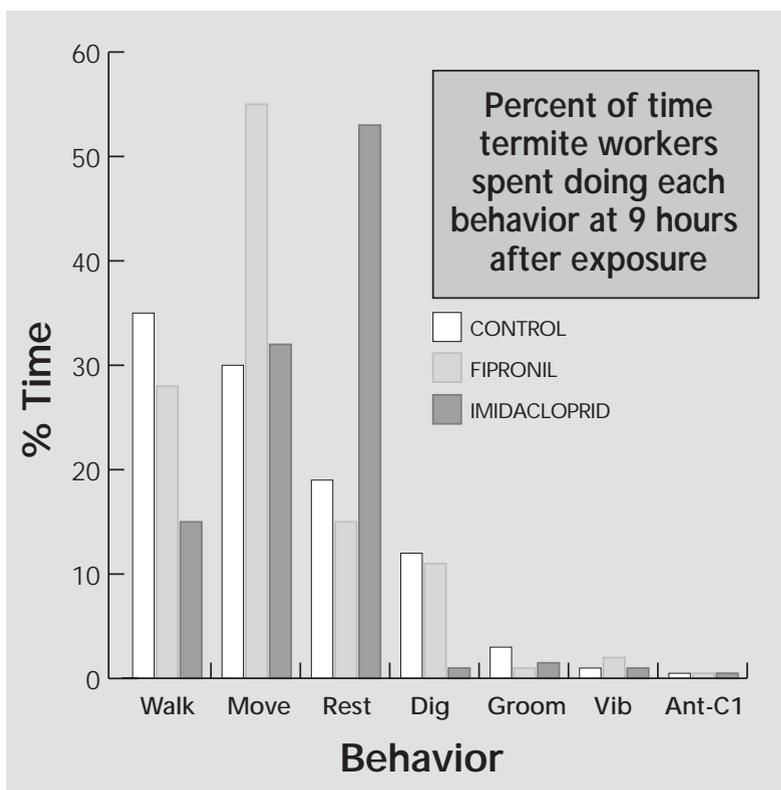
parts of the insect CNS, their effects may become visible at different times.

This study was undertaken by myself and associate researchers Rebecca Cross and Lara Maistrello to determine the difference in the speed of behavioral modification between fipronil- and imidacloprid-treated termites. Behavioral pattern charts, or ethograms, were constructed that recorded all relevant social behaviors of the termites under study. We hypothesize that a slower-acting nonrepellent termiticide will increase transmission and thus have a greater impact on the targeted colony.

STUDY SPECIFICS

Both termiticides we tested work by causing tetanus in the termite — seizures caused by rapid firing of the nervous system. In Formosan subterranean termites (*Coptotermes formosanus*), this results in horizontal antennae, uncontrollable shaking and fluid secretion.

Fipronil works by blocking a neurological transmission



responder in the termite's nervous system, thus making it impossible for the insect to tell its nervous system to stop firing (Bloomquist, 1999).

Imidacloprid works similarly. It is also similar to acetylcholine, a major excitatory neurotransmitter in the insect CNS. However, imidacloprid is unaffected by acetylcholinesterase, an enzyme that breaks down acetylcholine. This means that when imidacloprid binds to the acetylcholine receptor, it is able to continuously activate this receptor and the insect is unable to turn it off (Bloomquist, 1999).

Behavioral changes in Formosans exposed to nonlabel, low concentrations of imidacloprid- or fipronil-treated sand at 80.6° F were recorded at 15 minutes, 4 hours, 9 hours and 24 hours after exposure. Results showed that after 4 hours, imidacloprid-treated termites walked significantly less and rested significantly more than fipronil-treated or untreated termites.

After 9 hours, a significant number of imidacloprid-treated termites had their antennae stuck at right angles to the head and were unable to show normal searching patterns. After 24 hours, imidacloprid-treated termites continued to act sickly and behave abnormally. Moreover, the sickly termites would not travel very far, reducing their ability to transfer the toxicant.

Fipronil-treated termites did not show any significant behavioral changes until 24 hours after exposure, when nearly all were upside down with horizontal antennae — dying or already dead. Thus, fipronil may allow for longer transmission periods via termites grooming one another and other interactions.

Many behaviors were recorded during the study. Among the more prevalent ones:

- ▶ Walking — lifting legs; changing location or orientation
- ▶ Moving — moving body but not legs
- ▶ Resting — no movement in either body or legs
- ▶ Digging — tunneling or digging in the sand
- ▶ Grooming — cleaning other termites
- ▶ Vibrating — rapid shaking of the entire body (termite defense/danger signal)
- ▶ Antennae cleaning — cleaning its own antennae

The presence or absence of horizontal antennae was also noted.

CONCLUSIONS

Ethogram analyses showed that fipronil-treated termites are not affected as quickly as imidacloprid-treated termites. This is the first study to examine and compare behavioral changes in fipronil-treated and imidacloprid-treated termites.

Imidacloprid's effects were visible 4 hours after exposure, while fipronil-treated termites remained relatively similar to controls up to 24 hours after exposure. This delayed behavioral affect may allow healthy nestmates to come in contact with fipronil-treated termites more often. This increases horizontal



This study looked specifically at Formosan termite behavior.

transmission of fipronil, thus increasing colony mortality.

This behavioral assay was undertaken because of the numerous comments from pest management professionals that Termidor appeared to kill more termites away from the site of application than did Premise. From my own observations in the field, I noticed that Premise-treated termites bubbled out of the site of treatment very quickly after application. If behavior is important for transfer, this can be a critical observation.

It's important to note that these products, as good as they are, are not silver bullets. Placing the liquids as close to as many termites as possible is key to gaining success. This means finding and targeting the termites as best as possible. Knowing where the termites like to enter structures can help in this regard. PC

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References:

Su, N., P.M. Ban, R.H. Scheffrahn. (1991) Suppression of Foraging Populations of the Formosan Subterranean Termite (Isoptera: Rhinotermitidae) by Field Applications of a Slow-Acting Toxicant Bait. J. Econ. Entomol. 84(5): 1525-1531

Bloomquist J.R., (1999) Insecticides: Chemistries and Characteristics. In E. B. Radcliffe and W. D. Hutchison [eds.], Radcliffe's IPM World Textbook, URL: <http://ipmworld.umn.edu>, University of Minnesota, St. Paul, MN

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