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Authors: Scheffrahn, Rudolf H., and Scherer, Clay W.

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EFFICACY OF ALTRISET® ON THE TROPICAL ARBOREAL TERMITE, *NASUTITERMES CORNIGER* (ISOPTERA: TERMITIDAE: NASUTITERMITINAE)

Rudolf H. Scheffrahn[1] and Clay W. Scherer[2]
[1]University of Florida, Fort Lauderdale Research and Education Center, 3205 College Avenue, Davie, FL 33314

[2]DuPont Crop Protection, Wilmington, DE 19880-0705

Corresponding author; E-mail: rhsc@ufl.edu

Nasutitermes corniger (Motschulsky), a member of the termite family Termitidae, is an important structural pest over much of Central and South America (Constantino 2002; Torales 2002) and the West Indies including Puerto Rico and the U.S. Virgin Islands (Scheffrahn et al. 2003). This termite has now invaded South Florida (Scheffrahn et al. 2002), the Bahamas (Scheffrahn et al. 2006), and New Guinea (Scheffrahn et al. 2005). DuPont™ Altriset® is a newly registered termiticide containing the active ingredient, chlorantraniliprole, which is characterized by its extremely low mammalian toxicity (Lahm et al. 2007) and its high efficacy against subterranean termites (family Rhinotermitidae e.g., Mao et al. 2011; Neoh et al. 2012; Spomer & Kamble 2011). The efficacy of Altriset® against higher termites (Termitidae) has not been evaluated. Given the toxicity of Altriset® against conordinals, the purpose of this study was to assess the efficacy of residual and spray treatments of Altriset® on *N. corniger* workers using laboratory bioassays.

Soil Exposures

Altriset® (18.4% chlorantraniliprole AI, DuPont Professional Products), was applied to sand (natural play sand, Sakrete, Bonsal America, Charlotte, North Carolina) in aqueous solutions and thoroughly mixed by hand for final dry concentrations (wt AI/wt sand) of 100 ppm, 50 ppm, and 0 ppm water only). The 50 ppm concentration is approximately the conventional soil application rate. For each treatment, 9 g of the dry treated sand was poured into an 8.2 cm ID plastic Petri dish bottom to which 6 mL of water was added. Twenty five (25) workers of *N. corniger* were then placed on top of the damp sand and a matching lid was used to close each bioassay unit. Each treatment was replicated 8 times. Termites were taken from a single large colony collected in Dania Beach, FL, in Dec 2011 and maintained in the laboratory under ambient conditions in a 148-liter aquarium. Termites were fed dead *Schinus* wood and damp cellulose sponges. The 24 units were placed in a laboratory incubator at 22 ± 0.5 °C and 90% RH. Termite mortality and moribundity were recorded once or twice per day for 7 days.

Spray Applications

A 4.6-cm-diam, 1-mm-thick cellulose pad (Gelman Inc.) was placed inside a 5.5 cm plastic Petri dish bottom and moistened with 1.25 mL of water. Twenty-five workers of *N. corniger*, as obtained above, were placed on top of the pad. The termites were taken from a whole field-collected colony that was maintained in the laboratory in a 40 gallon (148 L) aquarium tank. Eight replicates were sprayed with 500 ppm aqueous Altriset® and eight control replicates were sprayed with water. The liquid spray concentration of 500 ppm (0.05%) is the current label application rate for the commercial product. The sprays were deposited from a distance of 35 cm using a hand sprayer set to deliver medium/fine droplets. For each treatment (Altriset® or water) 4 pumps (6 mL total) were applied. About 2 mL actually landed inside all the replicates of each treatment. Within five minutes, the sprayed termites were transferred to identical clean, unsprayed, Petri dishes containing damp pads. Lids were placed on the pads and the 16 dishes were placed in a laboratory incubator at 22 °C and 90% RH. Termite mortality and moribundity were recorded once or twice per day, as time allowed, for 7 days.

Table 1 and Fig. 1 summarize time versus mortality for the five treatments prepared for this study. In all Altriset® exposures, locomotion of *N. corniger* workers slowed markedly, followed by moribundity. Moribundity preceded mortality by about 0.5-2 days. The 500 ppm Altriset® spray treatment yielded 44% mortality by 65 hours and reached 100% mortality in 161 hours post-exposure compared to 4% mortality for the water-only spray treatment. The 100 ppm Altriset® sand treatment produced 100% mortality by 25 h while the 50 ppm treatment yielded 1% mortality over this time period. However by 73 h, the 50 ppm sand exposure produced 45% mortality and by 161 h, mortality rose to 99%. At 161 h, the mortality in the water-only sand treatment was less than 4%.

This laboratory study attempts to represent typical routes of field exposure to *N. corniger*. During a commercial application of liquid termiticide (surface spray and injection), most termites will be exposed to the liquid termiticide through

TABLE 1. MEAN PERCENT MORTALITY (±SD) OF *NASUTITERMES CORNIGER* WORKERS AFTER 6 TO 161 HOURS EXPOSURE TO FIVE ALTRISET (CHLORANTRANILIPROLE) TREATMENTS[a].

Treatment	6 hours	19 hours	25 hours	29 hours	43 hours	49 hours
Altriset 100 ppm Sand	0 ± 0 A	24.4 ±7.55 A	100 ± 0 A	100 ± 0 A	100 ± 0 A	100 ± 0 A
Altriset 50 ppm Sand	0 ± 0 A	0.5 ± 1.41 B	1.0 ± 2.83 C	3.5 ± 3.96 C	3.5 ± 3.96 C	10.4 ± 5.56 C
Altriset 0 ppm Sand Control	0 ± 0 A	0 ± 0 B	0 ± 0 C	0 ± 0 C	0 ± 0 C	0.6 ± 1.61 C
Altriset Spray 500 ppm	0 ± 0 A	0 ± 0 B	5.0 ± 6.52 B	10.1 ± 7.25 B	17.4 ± 8.21 B	28.1 ± 14.23 B
Altriset Spray 0 ppm	0 ± 0 A	0 ± 0 B	0 ± 0 C	0.5 ± 1.31 C	0.5 ± 1.31 C	0.9 ± 2.62 C
Treatment Effects Statistics:						
F	0	79.98	1539.24	1074.49	869.58	287.39
P	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Treatment	65 hours	73 hours	96 hours	116 hours	144 hours	161 hours
Altriset 100 ppm Sand	100 ± 0 A	100 ± 0 A	100 ± 0 A	100 ± 0 A	100 ± 0 A	100 ± 0 A
Altriset 50 ppm Sand	22.7 ± 10.04 C	44.6 ± 18.79 C	67.3 ± 13.66 C	86.1 ± 13.41 B	97.1 ± 4.04 A	99.0 ± 1.78 A
Altriset 0 ppm Sand	0.6 ± 1.61 D	0.6 ± 1.61 D	0.6 ± 1.61 D	0.6 ± 1.61 C	2.1 ± 2.22 B	2.1 ± 2.22 B
Altriset Spray 500 ppm	43.7 ± 15.89 B	66.7 ± 8.80 B	84.3 ± 6.78 B	93.6 ± 2.98 A	99.0 ± 2.95 A	100 ± 0 A
Altriset Spray 0 ppm	1.85 ± 5.24 D	2.3 ± 6.55 D	2.8 ± 6.50 D	3.3 ± 7.78 C	3.7 ± 9.07 B	3.7 ± 9.07 B
Treatment Effects Statistics:						
F	175.51	152.72	311.57	401.10	980.89	1250.60
P	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

[a]Means of 8 replicates, 25 workers per replicate. Means within a column followed by the same letter are not significantly different Student-Newman-Keuls test; (treatment degrees of freedom 4, 35).

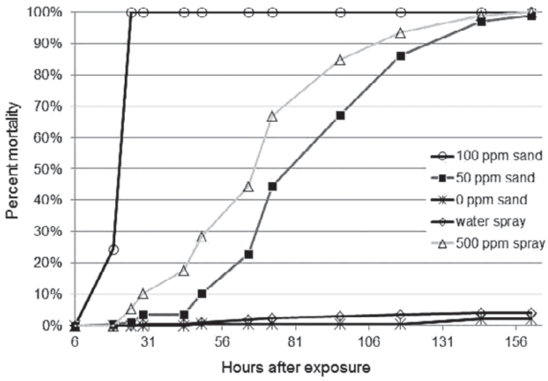

Fig. 1. *Nasutitermes corniger* worker mortality over time for Altriset spray and sand exposure bioassays and water controls.

direct contact which is represented here by the topical direct spray bioassay. Additional contact by termites to treated carton (nest material) or foraging substrata is fairly represented by the sand exposure bioassay. Field trials must still be conducted to address the variables that could affect efficacy in the outdoor environment.

Summary

Altriset® (chlorantraniliprole) was toxic to the higher termite, *Nasutitermes corniger*, in exposures to 500 ppm aqueous spray and to 50 or 100 ppm forced exposures on treated sand. Depending on the treatment, complete mortality occurred between 25 and 161 hours post-treatment with sand treatments causing faster mortality than spray applications. Although this species does not exhibit the same soil tunneling/excavating behavior as subterranean termites, the direct spray and treated sand results provide a realistic estimation of Altriset efficacy after direct treatment to nest sites or *Nasutitermes* spp. foraging areas.

Key Words: chlorantraniliprole, sand exposure bioassay, spray application, soil exposure

Resumen

Altriset® (clorantraniliprole) fue tóxico para la termita, *Nasutitermes corniger*, expuestas a 500 ppm de asperacion acuosa y de 50 o 100 ppm de expuesta forzada en arena tratada. Dependiendo del tratamiento, la mortalidad total ocurrió entre 25 y 161 horas después del tratamiento con los tratamientos de arena causando mortalidad más rápida que las aplicaciones de asperación. Aunque esta especie no presenta el mismo comportamiento de suelo túnel /excavación de las termitas subterráneas, los resultados de las asperaciones directas y de arena tratada proveen una estimación realista de la eficacia de Altriset después del tratamiento directo a los nidos o áreas de alimentación de *Nasutitermes* spp.

Palabras clave: clorantraniliprole, bioensayo de exposición de arena, aplicación por asperación, exposición del suelo

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