METHOD FOR CONTROLLING TERMITES USING LIQUID TERMITICIDES IN A BAIT FORMULATION

This application claims the benefit of U.S. Provisional Application No. 60/649513, filed February 3, 2005.

FIELD OF THE INVENTION

The present invention relates to the field of controlling termites.

BACKGROUND OF THE INVENTION

Termites are undisputedly the most destructive of all structural insects. Termites are estimated to cause 1.5 billion dollars of damage to structures annually, and that an additional one billion dollars is spent on treatment. Depending on the type of termite, a colony can cover as much as 22,000 square feet. These industrious insects work 24 hours a day, gradually eating wood and any other cellulose containing material in their environment. Since they remain hidden within the wood in which they are feeding, in mud tubes, or in the soil, they typically wreak havoc undetected. There are two types of termites, described as i) dry wood termites, and ii) subterranean termites. Of these two types, the subterranean termites usually live in the soil (i.e., soil-borne), in which they build tunnels and from which they build mud tubes to structural wood where they then feed.

Traditionally, control of soil-borne termites has been accomplished by many different methods. One method involves the strategic application of at least one termiticide in an aqueous formulation to the soil where there is a termite infestation. Termiticides used in this method include, but are not limited to, chlorfenapyr, indoxacarb, finpronil, pyrethroids such as bifenthrin and neonicotinoids such as imidacloprid and acetamiprid. These are moderate to fast acting, very effective termaticides. A problem with this method is that the final distribution of a termiticide in soil is the result of a whole series of variables: soil moisture, soil type, solubility of the active ingredient in water, formulation type, and application variables such as volume applied, pressure, nozzle type. As a result of these

variables, problems occur causing gaps, or thinly treated areas in the soil. Termites, therefore, can gain access via tunnels and mud tubes to food sources/structures through those gaps and thinly treated areas in the chemical barrier. This method is also labor intensive and raises issues about soil contamination.

Another method to control termites involves the insertion of wooden stakes or some other suitable termite bait material (one such composition is disclosed in U.S. Patent No. 5,573,760 to Thorne, et al., the disclosure of which is incorporated herein by reference in its entirety) into the soil around the periphery of the structure to be protected, monitoring of the bait for infestation, and then switching the bait with a bait containing toxicant in those areas in which infestation is observed. This approach minimizes use of chemicals in the soil, yet presents other problems. The bait stakes, for example, do not provide a continuous barrier around the structure, as they typically occupy a limited area and, moreover, are separated from one another by a distance on the order of feet or even yards. Termite populations located in the soil can have difficulty locating the bait stakes, especially if the bait stakes are widely spaced and located on a pre-determined interval irrespective of conditions around a structure conducive to termite attack, such as moist areas around the structure. Also, removal of the bait stakes (to switch with bait containing the toxicant) can disrupt the system of passageways leading to the stakes that termites may have constructed and, in turn, can disrupt the flow of termites to a stake upon stake reinsertion. These problems are said to be addressed by U.S. Patents 5,329,726 and 5,555,672 both in the name of Thorne, et al., which disclose insertion into the ground of a stationery housing that not only contains a removable bait cartridge but also possesses a plurality of extensions which are said to intercept or obstruct the path of termites in the vicinity of the housing.

Traditionally, the toxicants used in the bait stake method described above include slow-acting toxicants such as hydramethylnon, insect growth regulators and pathogens. The toxicants used in baits of this method traditionally did not include the liquid termiticides used in direct treatment of soil (as described above) since termites did not prefer or consume those termiticides in traditional bait form.

SUMMARY OF THE INVENTION

It has been unexpectedly found that when liquid termiticides used in soil treatment are combined with a cellulosic material derived from decayed birch (Betula sp.), termites prefer and remain in close association with the bait composition. Specifically, the present invention relates to a method of controlling termites, said method comprising placing at a locus where termite control is needed or expected to be needed, a composition comprising a cellulosic material derived from birch (Betula sp.), a binder, and a termiticide selected from the group consisting of chlorfenapyr, indoxacarb, fipronil, a pyrethroid and a neonicotinoid. Other aspects of the present invention will also be apparent.

DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to a method of controlling termites, said method comprising placing at a locus where termite control is needed or expected to be needed, a composition comprising a cellulosic material derived from birch (Betula sp.), a binder, and a termiticide selected from the group consisting of chlorfenapyr, indoxacarb, fipronil, a pyrethroid and a neonicotinoid. The chlorfenapyr can be present in a concentration of from 1 part per million to 600 parts per million, preferably from 50 parts per million to 600 parts per million. The indoxacarb can be present in a concentration of from 1 part per million to 1,000 parts per million, preferably from 100 parts per million to 1,000 parts per million. The fipronil can be present in a concentration of from 1 part per million to 1,500 parts per million, preferably from 90 parts per million to 1,500 parts per million.

The neonicotinoid can be selected from imidacloprid, acetamiprid, nithiazine, thiamethoxam, dinotefuran, nitenpyram, thiacloprid and clothianadin. Preferably, the neonicotinoid is selected from imidacloprid and acetamiprid. The acetamiprid can be present in a concentration of from 1 part per million to 1,100 parts per million, preferably from 10 parts per million to 1,100 parts per million.

The pyrethroid can be selected from bifenthrin, cypermethrin, zeta cypermethrin, lambdacyhalothrin, betacyhalothrin, alphacypermethrin, tralomethrin, deltamethrin, cyfluthrin, beta-cyfluthrin, esfenvalerate, fluvalinate, etofenprox or permethrin. Preferably, the pyrethroid is selected from bifenthrin, cypermethrin, zeta

cypermethrin and permethrin. More preferably, the pyrethroid is bifenthrin. The bifenthrin can be present in a concentration of from 1 part per million to 80 parts per million, preferably from 7 parts per million to 80 parts per million. Combinations of multiple termiticides, such as bifenthrin with acetamiprid, can be used in the present invention.

The locus can be a location adjacent to a termite-infested structure, a location adjacent to a structure that is expected to be termite-infested, a location that is termite-infested, a location that is expected to be termite-infested, a location with an active termite monitor station or any area where termite detection or control are desired.

Binders can be selected from any material capable of holding the cellulosic material together in a shaped form. The binders can be hydrocolloids selected from carrageenan, Terra-Control SC 823 soil stabilizer, polyacrylamide soil stabilizer, micro crystalline cellulose, walpole sticker, sodium silicate, alginate, agar, glues, dental impression matrix, hardeners, and combinations thereof. Preferably, binders are iota carrageenan or kappa carrageenan. Any amount of binder can be utilized as long as it is sufficient to hold the cellulosic material together and to allow it to be shaped and dried into a preferred configuration. These preferred configurations include, without limitation, disks, pellets and elongated blocks. Compositions containing cellulosic material and binder are useful in monitoring and detecting termites.

The compositions used in the method may contain other components such as volatile attractants, compression agents, anti-microbial agents, starches and other fillers.

The compositions of the present invention are prepared by combining the cellulosic material, binder, water and the termiticide (as technical material or from formulated products). The termiticide may be combined with the cellulosic material or with the water before the composition is prepared.

Shaped articles prepared from the compositions of the present invention can be used in conjunction with any monitoring/baiting system including those sold

under the trademarks Firstline™ and Defender™ from FMC; Sentricon™ from Dow and any similar configuration. The compositions described herein can be used as the entire monitor member in such systems or disks prepared from the composition can be used in combination with conventional wood monitors, or used without any station at all.

The compositions used in the present invention may be derived from commercially available formulations of termiticides. For example, bifenthrin, sold by FMC Corporation under the names and trademarks of TALSTAR® GC FLOWABLE INSECTICIDE/MITICIDE, or TalstarOne™ Multi-Insecticide, to name a few, find utility in the present invention. Formulations of acetamiprid that are particularly useful in the context of the present invention include, without limitation, acetamiprid (sold under the name and trademark of INTRUDER™), sold as a 70% wettable powder. Using methods known to one skilled in the art, the above-mentioned formulations of termiticides can be dispersed in an aqueous medium to provide a composition containing a termiticidally effective amount of a termiticide and mixed into the bait.

The following examples further illustrate the present invention, but, of course, should not be construed as in any way limiting its scope.

EXAMPLE 1

Lab Trials Demonstrating Mortality from Composition/Bait Containing Liquid Termiticides

A composition was prepared containing 100 grams of ground birch (Betula sp.), 5 grams of iota carrageenan and approximately 228 milliliters of water. Sufficient additional water was included so that the final composition had a dough-like consistency. Various termiticides were combined in the composition as indicated in the tables below. The termiticides were added into the water prior to its addition to the composition. The dough-like composition was rolled out and disks were cut therefrom. The resulting disks were dried (to approximately 5-10%

moisture content) and placed in a petri dish containing moist soil. Populations of termites were placed on the soil and the percent mortality over time was measured to determine the effectiveness of the composition. Effectiveness against populations of both *Reticulitermes flavipes* and *Coptotermes formosanus* termites was determined. In all tests it was observed that the termites preferred to remain in close contact with the disks containing the composition of the present invention (usually by standing on top of them). Mortaility results for various termiticides and concentrations are shown in Tables 1, 2, 3, 4 and 5.

Table 1

Percent Termite Mortality from Composition/Bait Containing Chlorfenapyr

Termite Type	**Chlorfenapyr Conc. (ppm)**	**1 Day**	**2 Days**	**3 Days**	**7 Days**	**15 Days**	**17 Days**
C. formosanus	57	1	0	1	20	99	100
	571	1	17	61	100	100	100
R. flavipes	57	0	1	4	82	100	100
	571	11	89	97	100	100	100

Table 2

Percent Termite Mortality from Composition/Bait Containing Indoxacarb

Termite Type	**Indoxacarb Conc. ppm**	**2 Days**	**7 Days**	**14 Days**	**17 Days**	**24 Days**
C. formosanus	100	18	53	100	100	100
	300	1	35	69	69	100
	1000	0	2	71	100	100
R. flavipes	100	1	99	100	100	100
	300	15	100	100	100	100
	1000	36	100	100	100	100

Table 3

Percent Termite Mortality from Composition/Bait Containing Fipronil

Termite Type	Fipronil Conc. ppm	1 Days	2 Days	3 Days	7 Days
C. formosanus	92	24	44	66	100
	185	26	40	64	100
	369	50	78	96	100
	738	6	16	30	100
	1476	10	42	64	100
R. flavipes	92	46	92	100	100
	185	28	84	100	100
	369	74	96	100	100
	738	80	96	98	100
	1476	80	100	96	100

Table 4

Percent Termite Mortality from Composition/Bait Containing Bifenthrin

Termite Type	Bifenthrin Conc. ppm	2 Days	7 Days	14 Days	22 Days	37 Days
C. formosanus	7.6	0	0	0	1	89
	76	0	3	55	68	100
R. flavipes	7.6	0	0	2	42	100
	76	1	3	38	100	100

Table 5

Percent Termite Mortality from Composition/Bait Containing Acetamiprid

Termite Type	Acetamiprid Conc. ppm	1 Days	2 Days	3 Days	7 Days
C. formosanus	13	2	2	2	4
	133	2	2	14	100
	267	0	2	16	100
	533	4	4	10	36
	1067	6	14	16	50
R. flavipes	13	0	0	4	80
	133	2	6	18	100
	267	0	8	22	100
	533	10	22	44	66
	1067	12	28	58	78

EXAMPLE 2

Trials Demonstrating Selectivity and Mortality from Composition/Bait Containing Liquid Termiticides

A three gallon plastic container was filled with moist sand and used as a test arena. An FMC termite monitor station fitted with a SMARTDISC™ Locator was installed in each arena. Within the monitor station, a toxic test disc (identical to the discs used in Example #1 above) was placed into the bottom of the station and an untreated wood monitor wood placed on top, therefore giving the termites a choice of food source. The toxic test disc had been treated with either 84 ppm of fipronil or 132 ppm of acetamiprid. One thousand termites (Reticulitermes flavipes or Coptotermes formosanus) were poured onto the sand and allowed to tunnel into the sand and infest the monitor station. The stations are checked periodically by removing the cap, removing the wood and inspecting the bottom of the station to

determine if there was any disc consumption or dead termites. Results were recorded during the periodic checks and the notations were as follows: D = entire termite population was dead, LT = live termites found in test arena, DT = dead termites found in test arena. The results are shown in Tables 6 and 7.

Table 6

Termite Mortality from Test Disk Containing 84 ppm of Fipronil

Termite Type	**Test #**	**Days**							
		7	**8**	**10**	**14**	**15**	**19**	**21**	**22**
C. formosanus	9	**D**							
	11	LT DT			LT DT			**D**	
	16	LT DT			LT DT			**D**	
	25		LT DT			LT DT			**D**
	27		LT DT			LT DT			**D**
	Control	LT			LT			LT	
R. flavipes	10	LT DT				**D**			
	12	**D**							
	15	**D**							
	26	LT DT		**D**					
	28	**D**							
	Control	LT			LT			LT	

Table 7

Termite Mortality from Test Disk Containing 132 ppm of Acetamiprid

Termite Type	**Test Arena #**	**Days**					
		5	**7**	**12**	**14**	**19**	**21**
C. formosanus	17	LT DT		LT DT		LT DT	
	21	LT DT		**D**			
	23	LT DT		LT DT		**D**	
	29		LT DT		**D**		
	31		LT DT		LT DT		**D**
	Control		LT		LT		LT
R. flavipes	18	LT DT		LT DT		LT DT	
	22	LT DT	**D**				
	24	LT DT	**D**				
	30		**D**				
	32		**D**				
	Control		LT		LT		LT

In the context of the present invention, the term "termiticide" refers to the active chemical compound or ingredient, such as chlorfenapyr, indoxacarb, fipronil, pyrethroids and neonicotinoids that quickly (moderate to fast acting) kills or repels termites. The term "toxicant" refers to the active chemical compound or ingredient, such as slow-acting toxicants such as hydramethylnon, insect growth regulators and

pathogens that slowly kills termites. The term "locus" refers to any locations where control of termites is needed or is expected to be needed. Such locations include, without limitation, buildings, trees, posts poles, fences, and locations adjacent to buildings, trees, posts poles, fences, as well as other locations.

Those of ordinary skill in the art will appreciate that variations of the invention may be used and that it is intended that the invention may be practiced otherwise than as specifically described herein. Accordingly, this invention includes all modifications encompassed within the spirit and scope of the invention as defined by the following claims.

What is claimed is:

Claim 1. A method of controlling termites, said method comprising placing at a locus where termite control is needed or expected to be needed, a composition comprising:

(a) a cellulosic material derived from birch (Betula sp.);

(b) a binder; and

(c) a termiticide selected from the group consisting of chlorfenapyr, indoxacarb, fipronil, a pyrethroid and a neonicotinoid.

Claim 2. The method of claim 1, wherein the termiticide is chlorfenapyr present in a concentration of from 1 part per million to 600 parts per million.

Claim 3. The method of claim 1, wherein the termiticide is indoxacarb present in a concentration of from 1 part per million to 1,000 parts per million.

Claim 4. The method of claim 1, wherein the termiticide is fipronil present in a concentration of from 1 part per million to 1,500 parts per million.

Claim 5. The method of claim 1, wherein the neonicotinoid is selected from the group consisting of imidacloprid, acetamiprid, nithiazine, thiamethoxam, dinotefuran, nitenpyram, thiacloprid and clothianadin.

Claim 6. The method of claim 5, wherein the neonicotinoid is imidacloprid or acetamiprid.

Claim 7. The method of claim 6, wherein the neonicotinoid is acetamiprid present in a concentration of from 1 part per million to 1,100 parts per million.

Claim 8. The method of claim 1, wherein said pyrethroid is selected from the group consisting of bifenthrin, cypermethrin, zeta cypermethrin, lambdacyhalothrin, betacyhalothrin, alphacypermethrin, tralomethrin, deltamethrin, cyfluthrin, beta-cyfluthrin, esfenvalerate, fluvalinate, etofenprox and permethrin.

Claim 9. The method of claim 8, wherein the pyrethroid is selected from the group consisting of bifenthrin, cypermethrin, zeta cypermethrin and permethrin.

Claim 10. The method of claim 9, wherein the pyrethroid is bifenthrin.

Claim 11. The method of claim 10, wherein the bifenthrin is present in a concentration of from 1 part per million to 80 parts per million.

Claim 12. The method of claim 1, wherein the binder is selected from the group consisting of carrageenan, Terra-Control SC 823 soil stabilizer, polyacrylamide soil stabilizer, micro crystalline cellulose, walpole sticker, sodium silicate, alginate, agar, glues, dental impression matrix and hardeners.

Claim 13. The method of claim 12, wherein the binder is iota carrageenan or kappa carrageenan.

Claim 14. The method according to claim 1, wherein said locus is a location adjacent to a termite-infested structure, a location adjacent to a structure that is expected to be termite-infested, a location that is termite-infested, a location that is expected to be termite-infested or a location with an active termite monitor station.