

COMPOSITION FOR CONTROL OF COCKROACHES

This application claims the benefit of U.S. Provisional Application No.
5 60/569,796, filed May 10, 2004.

FIELD OF THE INVENTION

The present invention relates generally to insecticidal compositions. In
particular, it pertains to compositions of insecticides useful for control of
10 cockroaches.

BACKGROUND OF THE INVENTION

Cockroaches have the potential to cause nuisance or harm to persons and
property. Cockroaches can appear in people's living environment at any place and
15 at any time. They contaminate food and articles by way of contact and fecal
droppings subjecting people to threats of bacteria and viruses. There are many types
of cockroaches that require control; some examples are the German cockroach,
American cockroach, Australian cockroach, Smokey-Brown cockroach and Oriental
cockroach.

20 Insecticidal compositions have commonly been used to control cockroaches.
Insecticidal compositions for the control of cockroaches may be broadly categorized
as contact treatments (dusts, sprays, fogs, etc...) or bait treatments that require
ingestion of the active ingredient (baits, gels, etc...). Of primary concern in
developing an insecticidal composition that requires ingestion to control
25 cockroaches are 'direct mortality' rates as well as 'secondary mortality' rates. Direct
mortality occurs when ingestion of the composition kills the cockroach. Secondary
mortality occurs when the cockroach eats fecal deposits (coprophagy), a cockroach
corpse (necrophagy), a live cockroach (cannibalism), reproductive remains
(oothecae, unhatched eggs, or embryonic membranes), cockroach saliva or other
30 cockroach emanations containing the insecticidal composition, all of which in turn
kill the cockroach. A limited number of traditional insecticidal compositions used to
control cockroaches have the ability to cause secondary mortality in any form.
Some traditional insecticidal compositions cause secondary mortality mainly

through coprophagy. Other traditional insecticidal compositions cause secondary mortality mainly through saliva transfer. No traditional insecticidal compositions cause multiple forms of secondary mortality. An insecticidal composition causing multiple forms of secondary mortality would have a significant advantage by increasing translocation of the insecticidal composition and its resultant effect on the cockroach population.

SUMMARY OF THE INVENTION

The composition of the present invention causes high direct mortality rates along with high secondary mortality rates through coprophagy, necrophagy, and cannibalism resulting in a very wide range of effect in controlling the cockroach population. The present invention is directed to a composition suitable for use in controlling cockroaches comprising a mixture of a bait matrix and acetamiprid. Other aspects of the present invention will also be apparent.

DETAILED DESCRIPTION OF THE INVENTION

The present invention is directed to a composition suitable for use in controlling cockroaches comprising a mixture of a bait matrix and acetamiprid. A preferred composition of the present invention is one wherein the amount of acetamiprid present is in the range of 0.05% by weight to 1.0% by weight based on the weight of all components in the total composition, even more preferred is the range of 0.05% by weight to 0.5% by weight of all components in the total composition. Another preferred composition of the present invention is wherein the bait matrix is selected for the group consisting of a sweet bait, a protein bait and a combination of a sweet bait and a protein bait.

Another embodiment of the present invention is a method for controlling cockroaches comprising applying the composition of the present invention to a locus where cockroach control is needed or expected to be needed. Cockroaches may be selected from the genera consisting of *Periplaneta*, *Blattella* and *Blatta*. Preferably, cockroaches are selected from the group consisting of German cockroach, American cockroach, Australian cockroach, Smokey-Brown cockroach and Oriental cockroach. The locus is selected from the group consisting of a cockroach-infested

structure, a structure that is expected to be or become cockroach-infested and a location adjacent to such structures.

The compositions of the present invention may be derived either from technical grade or commercially available formulations of insecticides. For example, formulations of acetamiprid that are particularly useful in the context of the present invention include, without limitation, acetamiprid (sold under the names and trademarks of INTRUDER and ASSAIL), sold as a 70% wettable powder. Using methods known to one skilled in the art, the above-mentioned technical grade or commercially available formulations of insecticides can be dispersed in a bait matrix to provide a composition containing an insecticidally effective amount of the insecticide.

In the context of the present invention, the term "insecticide" refers to the active chemical compound or ingredient, such as acetamiprid, that kills insects such as cockroaches. The term "locus" refers to any locations where control of insects, such as cockroaches, is needed or expected to be needed. The term "direct mortality" refers to death of the insects, such as cockroaches, resulting from ingestion of the insecticide. The term "secondary mortality" refers to death of the insects, such as cockroaches, resulting from ingestion of fecal deposits (coprophagy), a cockroach corpse (necrophagy), a live cockroach (cannibalism), reproductive remains (oothecae, unhatched eggs, or embryonic membranes), or cockroach saliva containing an insecticide. The term "% by weight" refers to the weight of the insecticide or specified component as a percent of the total weight of the composition (e.g. including the bait matrix, other insecticides, surfactants, wetting agents, freeze/thaw agents and combinations thereof). The term "bait" or "bait matrix" refers to any edible or palatable substance that may contain a toxicant. The term "sweet bait" refers to any carbohydrate source such as sucrose, glucose or fructose that may contain a toxicant. The term "protein bait" refers to a plant protein source, such as peanut or soy, or an animal protein source, such as liver powder, that may contain a toxicant. The terms "mortality", "percent mortality", "control", "controlling" or "percent control" may be used interchangeably, and refer to the killing of cockroaches.

The following examples further illustrate the present invention, but, of course, should not be construed as in any way limiting its scope. The examples set forth certain biological data illustrating the efficacy of the compositions of the present invention in controlling cockroaches. Unless otherwise indicated, all parts, percentages, and the like are by weight.

In the examples the following materials were used:

- 70% wettable powder of acetamiprid; commercially available as Intruder from Dupont;
- Sweet bait refers to a carbohydrate source such as sucrose, glucose or fructose;
- Protein bait refers to a plant protein source, such as peanut or soy, or a animal protein source such as liver powder;
- MAXFORCE FC fipronil and hydramethylnon is available from Bayer Environmental Science;
- Blank Matrix refers to cat food.

EXAMPLE 1

Direct Mortality Rates of German and American Cockroaches Exposed to a Sweet Bait and Acetamiprid Composition

The compositions of the present invention were prepared and tested for German cockroach and American cockroach activity in the following manner:

Test compositions made up of sweet bait matrix and a 70% wettable powder of acetamiprid in distilled water were prepared that provided appropriate rates of sweet bait and acetamiprid.

All cockroaches were laboratory-reared and starved for 24 hours before testing. Ten German cockroaches or 5 American cockroaches were added to plastic cups (12 oz with lids) coated with liquid Teflon to prevent escape. Four replicates of each treatment were tested. Bait was added to each cup along with water. Sweet baits containing 0% to 0.3% acetamiprid were evaluated. Cockroaches were held at 75° to 80°F under ambient light regime throughout the duration of the test. Mortality was recorded through one week. The following results were obtained:

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Table 1
Direct Mortality Rates of German and American Cockroaches Exposed to a Sweet Bait and Acetamiprid Composition

Sweet Bait + %Acetamiprid	Percent Mortality					
	German (n=40)			American (n=20)		
	1 Day	2 Days	7 Days	1 Day	2 Days	7 Days
0%	0	0	3	0	0	0
0.005%	0	0	10	0	6	50
0.05%	0	20	68	10	36	90
0.10%	25	73	100	10	56	90
0.15%	35	95	100	30	46	96
0.20%	68	73	100	40	70	100
0.30%	68	83	100	46	80	100

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EXAMPLE 2
Direct Mortality Rates of German Cockroaches Exposed to a Protein Bait and Acetamiprid Composition

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The compositions of the present invention were prepared and tested for German cockroach activity in the following manner:

Test compositions made up of protein bait and a 70% wettable powder of acetamiprid in distilled water were prepared that provided appropriate rates of protein bait and acetamiprid.

All cockroaches were laboratory-reared and starved for 24 hours before testing. Ten cockroaches were added to plastic cups (12 oz, with lids) coated with liquid Teflon to prevent escape. Three replicates of each treatment were tested. Bait was added to each cup along with water. Protein baits containing 0.15% to 0.5% acetamiprid were evaluated and compared to Maxforce FC fipronil (0.01%) and hydramethylnon (2.15%) cockroach baits and blank screening matrix (Blank Matrix A). Cockroaches were held at 75° to 80°F under ambient light regime throughout the

duration of the test. Mortality was recorded through four days. The following results were obtained:

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Table 2
Direct Mortality Rates of German Cockroaches

Protein Bait + % Acetamiprid	Mean % Mortality $\pm$ SEM*	
	1 day	2 days
0.15%	33.3 $\pm$ 3.3	63.3 $\pm$ 12.0
0.20%	58.7 $\pm$ 11.3	81.0 $\pm$ 4.9
0.25%	39.3 $\pm$ 5.8	77.7 $\pm$ 7.9
0.30%	70.0 $\pm$ 5.8	83.3 $\pm$ 3.3
0.35%	80.0 $\pm$ 7.8	96.7 $\pm$ 3.3
0.40%	53.3 $\pm$ 3.3	93.3 $\pm$ 6.7
0.45%	61.0 $\pm$ 5.9	79.3 $\pm$ 9.7
0.50%	73.3 $\pm$ 8.8	100
Maxforce fipronil	83.3 $\pm$ 8.8	93.3 $\pm$ 6.7
Maxforce hydramethylnon	0.0	0.0
Blank Matrix A	0.0	0.0

*SEM = Standard Error of the Mean

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EXAMPLE 3

Direct Mortality Rates of Oriental Cockroaches Exposed to Sweet Bait, Protein Bait and Acetamiprid Compositions

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The compositions of the present invention were prepared and tested for Oriental cockroach activity in the following manner:

Test compositions made up of protein or sweet bait and a 70% wettable powder of acetamiprid in distilled water were prepared that provided appropriate rates of acetamiprid.

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All cockroaches were laboratory-reared and starved for 24 hours before testing. Ten cockroaches were added to plastic cups (12 oz, with lids) coated with liquid Teflon to prevent escape. Three replicates of each treatment were tested. Bait was added to each cup along with water. Protein baits containing 0.35% and 0.5% acetamiprid and sweet bait containing 0.15% acetamiprid were evaluated and compared to blanks or controls of sweet bait and protein bait containing no acetamiprid. Cockroaches were held at 75° to 80°F under ambient light regime

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throughout the duration of the test. Mortality was recorded through ten days. The following results were obtained:

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Table 3
Direct Mortality Rates of Oriental Cockroaches

Bait Type	Acetamiprid %	Mortality %					
		1 day	2 days	3 days	4 days	7 days	10 days
Protein Bait	0.5%	100	100	100	100	100	100
Protein Bait	0.35%	50	60	80	80	95	100
Sweet Bait	0.15%	60	70	85	100	100	100
Control Protein Bait	0	0	0	0	0	0	5
Control Sweet Bait	0	0	0	0	0	0	0

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EXAMPLE 4
Secondary Mortality Rates of German Cockroaches Exposed to Fecal Deposits (Coprophagy)

15 The compositions of the present invention were prepared and tested for German cockroach activity in the following manner:

Test compositions made up of bait matrix and a 70% wettable powder of acetamiprid in distilled water were prepared that provided appropriate rates of bait matrix and acetamiprid.

20 All cockroaches were laboratory-reared and starved for 24 hours before testing. Only water and harborage were available during that time. Ten German cockroaches were added to plastic cups (12 oz with lids) coated with liquid Teflon to prevent escape. Six replicates of each treatment were tested. Either Protein Bait containing 0.35% acetamiprid, Sweet Bait containing 0.15% acetamiprid, or a
25 screening matrix (Blank Matrix) was added to each cup along with water. Insects were allowed to feed for five days so that fecal deposits and other emanations accumulated on the harborage and water container. After five days, cockroaches and food were removed from cups and ten naïve male adults were introduced. These new cockroaches were not given fresh food, but had only the fresh water container and
30 harborage used by the previous insects. Six additional replicates of cockroaches in

cups offered either Blank Matrix or Sweet Bait containing 0.15% acetamiprid were used as controls. For insects fed Sweet Bait containing 0.15% acetamiprid, dead individuals were removed daily. Cockroaches were held at 75° to 80°F under ambient light regime throughout the duration of the test. Mortality was recorded through 9 days. The following results were obtained:

Table 4
Secondary Mortality Rates of German Cockroaches Exposed to Fecal Deposits (Coprophagy)

Treatment	Total % Mortality (n=60)				
	1 day	2 days	5 days	7 days	9 days
Acetamiprid Sweet Bait	100	---	---	---	---
Acetamiprid Protein Bait Droppings	36.7	43.3	83.3	90.0	98.3
Acetamiprid Sweet Bait Droppings	85	96.7	100	---	---
Blank Matrix*	0	0	1.7	1.7	8.3
Blank Matrix Droppings	0	0	6.7	13.3	28.3

* Matrix = cat food

EXAMPLE 5
Secondary Mortality Rates of German Cockroaches Exposed to Cockroach Corpses (Necrophagy)

The compositions of the present invention were prepared and tested for German cockroach activity in the following manner:

Test compositions made up of bait matrix and a 70% wettable powder of acetamiprid in distilled water were prepared that provided appropriate rates of bait matrix and acetamiprid.

All cockroaches were laboratory-reared and starved for 24 hours before testing. Only water and harborage were available during that time. Ten German cockroaches were added to plastic cups (12 oz with lids) coated with liquid Teflon to prevent escape. Six replicates of each treatment were tested. Either Sweet Bait containing 0.15% acetamiprid or a screening matrix (Blank Matrix) was added to each cup along with water. Insects were allowed to feed until those eating Sweet Bait containing 0.15% acetamiprid were moribund. At that time, 10 naïve adult male cockroaches were introduced into cups containing the moribund cockroaches. These new cockroaches were not given fresh food. Also at the same time, insects fed Blank

Matrix were decapitated and introduced to naïve cockroaches. Six additional replicates of cockroaches in cups offered Blank Matrix were used as controls. Cockroaches were held at 75° to 80°F under ambient light regime throughout the duration of the test. Mortality was recorded through 9 days. The following results were obtained:

Table 5
Secondary Mortality Rates of German Cockroaches Exposed to Cockroach Corpses (Necrophagy)

Treatment	Total % Mortality (n=60)				
	1 day	3 days	6 days	8 days	9 days
Acetamiprid Sweet Bait Fed GCR	35	66.7	90	93.3	95
Blank Matrix* Fed GCR	0	3.3	26.7	26.7	30
Blank Matrix*	0	5	5	5	5

* Blank matrix = cat food

EXAMPLE 6
Secondary Mortality Rates of Oriental Cockroaches Exposed to Fecal Deposits (Coprophagy)

The compositions of the present invention were prepared and tested for Oriental cockroach activity in the following manner:

Test compositions made up of bait matrix and technical grade acetamiprid were prepared that provided the appropriate rate of bait matrix and acetamiprid.

All cockroaches were laboratory-reared and starved for 24 hours before testing. Only water and harborage were available during that time. Ten adult cockroaches were added to plastic cups (12 oz with lids) coated with liquid Teflon to prevent escape. Six replicates of each treatment were tested. A Sweet Bait/Protein Bait combination (Bait) containing 0.35% acetamiprid was added to each cup along with water. Insects were allowed to feed for five days so that fecal deposits accumulated on the harborage and water container. After seven days, cockroaches and food were removed from cups and ten naïve nymphs were introduced. These new cockroaches were not given fresh food, but had only the fresh water container and harborage used by the previous insects. Six additional replicates of cockroaches in cups offered either Blank Matrix or Bait containing 0.35% acetamiprid were used

as controls. For insects fed Bait containing 0.35% acetamiprid, dead individuals were removed daily. Cockroaches were held at 75° to 80°F under ambient light regime throughout the duration of the test. Mortality was recorded through 10 days. The following results were obtained:

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Table 6
Secondary Mortality Rates of Oriental Cockroaches Exposed to Fecal Deposits
(Coprophagy)

Treatment	Total % Mortality (n=60)				
	1 day	2 days	3 days	7 days	9 days
Acetamiprid (0.35%) Bait	65	85	100	---	---
Acetamiprid (0.35%) Bait Droppings	0	5	5	10	10
Blank Matrix*	0	0	0	0	0

*Blank Matrix = cat food

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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.

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THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A composition suitable for use in controlling cockroaches comprising a mixture of i) a bait matrix and ii) acetamiprid, wherein the bait matrix is selected from the group consisting of a sweet bait, a protein bait and a combination of a sweet bait and a protein bait, and the amount of acetamiprid is in the range of 0.05% by weight to 1.0% by weight of all components in the total composition.
2. The composition according to claim 1, wherein the amount of acetamiprid is in the range of 0.05% by weight to 0.5% by weight of all components in the total composition.
3. A method for controlling cockroaches comprising applying the composition of claim 1 to a locus where cockroach control is needed or expected to be needed.
4. A method for controlling cockroaches comprising applying the composition of claim 2 to a locus where cockroach control is needed or expected to be needed.
5. The method according to claim 3, wherein said cockroaches are selected from the group consisting of cockroach genera *Periplaneta*, *Blattella* and *Blatta*.
6. The method according to claim 4, wherein said cockroaches are selected from the group consisting of cockroach genera *Periplaneta*, *Blattella* and *Blatta*.
7. The method according to claim 3, wherein said cockroaches are selected from the group consisting of German cockroach, American cockroach, Australian cockroach, Smokey-Brown cockroach and Oriental cockroach.
8. The method according to claim 4, wherein said cockroaches are selected from the group consisting of German cockroach, American cockroach, Australian cockroach, Smokey-Brown cockroach and Oriental cockroach.
9. The method according to claim 3, wherein said locus is selected from the group consisting of a cockroach-infested structure, a structure that is expected to be cockroach-infested and a location adjacent to said structures.

10. The method according to claim 4, wherein said locus is selected from the group consisting of a cockroach-infested structure, a structure that is expected to be cockroach-infested and a location adjacent to said structures.

11. The composition of claim 1, substantially as hereinbefore described with reference to the Examples.

12. The method of claim 3, substantially as hereinbefore described with reference to the Examples.