

Method to fight against insects including the use of hydrocarbon compounds

The present invention relates to a method to fight against insects comprising
5 the use of hydrocarbon compounds, as well as an insecticide composition comprising
a mixture of such hydrocarbon compounds and a method of treatment of insects by
using these insecticide compositions.

Insects, and more particularly gregarious, social, and sub-social insects, use
10 the hydrocarbons that cover their exoskeleton for recognition between species, but
also between members of the same specie. These hydrocarbon compounds are
perceived on contact by the insects and affect their behavior. They constitute their
chemical signature and induce various social behaviors such as, for example,
gathering in colonies or transportation of eggs and young larvae.

15 The role played by the hydrocarbon compounds covering the exoskeleton of
insects in mechanisms of interspecies and intraspecies recognition is described in a
1991 article taken from the *Journal of Chemical Ecology*, vol. 17, 1191, pages 2397
to 2419, especially in the first two paragraphs on page 2398. The use of lures covered
with different extracts of hydrocarbon compounds to study the reactions and the
20 behaviors of the species is disclosed. This document does not disclose any
association of hydrocarbon compounds with insecticide active ingredients neither it
discloses the use of hydrocarbon compounds for fighting against insects.

The use of certain toxins, in the form of baits for example, to fight against
social or sub-social insects is well known to the specialists. For example, patent
25 applications EP 0203413 and US 4,205,066 disclose the use of bait comprising
hydrocarbon derivatives to attract and fight respectively against wasps and flies.
Nests of wasps and flies are small and contain only a few individuals. The spread of
the toxin between the different members of the colony, including the members living
in the nest, is generally not a problem for such species. Nevertheless, nests of
30 termites, ants, cockroaches, earwigs and locusts are different : they can contain
several thousands and sometime even several millions of individuals and are
generally very extensive. This is for example the case of subterranean termite nests
which can contain several thousand of individuals, sometime several millions. The

nest is generally diffused and can also contain several satellite nests with secondary reproductive. Links between parts of the nest are made by galleries being able to length several dozen of meters in which contacts occur between congeners. The use of the type of bait as described in patent applications EP 0203413 and US 4,205,066 to fight against termites, ants, cockroaches, earwigs and locusts therefore presents the drawback in that it is impossible to affect the entire colony, and especially the part of the colony living in the nest. The toxin generally affects only part of the target insect population that consumes the bait and thus directly ingests the toxin.

Surprisingly, it has now been discovered that the use of particular hydrocarbon compounds or a mixture of them can considerably improve the efficacy of the toxins used to combat social, sub-social or gregarious insects chosen from the group comprising termites, ants, cockroaches, earwigs and locusts, since they allow better absorption and adsorption of the toxin by the insects that consume it directly, as well as its good diffusion among the various members of the colony, including the members of the colony living in the nest. The use of such compounds also reduces the quantity of toxin used and, if bait is used, the number of baits placed, which represents, among other advantages, a reduction in treatment cost, as well as a reduction in the spreading of the materials in the environment.

Consequently, the object of this invention is a method of fighting against social, sub-social or gregarious insects chosen from the group comprising termites, ants, cockroaches, earwigs and locusts comprising the use of a mixture of hydrocarbon compounds chosen among alkanes and alkenes comprising from 20 to 40 carbon atoms.

In the context of the present invention, the terms alkanes and alkenes cover linear as well as branched compounds.

In the context of the present invention "social insects" means insects living in hierarchical societies with division of labor between different castes and an overlap between different generations.

In the context of the present invention "sub-social insects" means insects living in groups or family groups where parents take care of their young at least for part of their development.

In the context of the present invention "gregarious insects" means insects
5 tending to stay in clusters and herd together.

The use of hydrocarbon compound mixtures according to this invention allows obtaining an "arresting" effect on the insects, meaning that when the mixture of hydrocarbon compounds is perceived on contact or at a short distance by the
10 insect, the insect is attracted by the mixture which induces an arresting behavior in the insect or limits its movements to the place where the mixture was deposited. An insect which has perceived a hydrocarbon compound mixture according to this invention will have the tendency to remain in contact with said mixture for a long time. In addition, an insect which has consumed or transported such a mixture will
15 see its contacts with other insects of the same species increase, thus improving the distribution of the mixture between the different members of the colony.

This invention relates to a method of fighting against social, sub-social or gregarious insects chosen from the group comprising termites, ants, cockroaches,
20 earwigs and locusts comprising the use of alkanes or alkenes comprising from 20 to 40 carbon atoms. Preferably, the alkanes or alkenes used comprise from 23 to 35 carbon atoms. More preferably, the alkanes and alkenes used comprise from 25 to 27 carbon atoms. Even more preferably, the alkanes and alkenes used are chosen from the group comprising 11-methyltetracosane, 5-methylpentacosane, 11-
25 methylpentacosane, (Z)-9-pentacosene, n-pentacosane, n-hexacosane, 5,17-dimethylpentacosane, and 5-methyltetracosane.

A preferred hydrocarbon compound mixture according to the present invention comprises 11-methylpentacosane, (Z)-9-pentacosene, and n-pentacosane (mixture A). More preferably, the following mixture is used (mixture A-1) :

- 30
- 11-methylpentacosane in a proportion ranging from 36 to 51% in weight;
 - (Z)-9-pentacosene in a proportion ranging from 16 to 31% in weight; and
 - n-pentacosane in a proportion ranging from 26 to 41% in weight.

Even more preferably, the following mixture is used (mixture A-2) :

- 11-methylpentacosane in a proportion ranging from 41 to 46% in weight;
- (Z)-9-pentacosene in a proportion ranging from 21 to 26% in weight; and
- n-pentacosane in a proportion ranging from 31 to 35% in weight.

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Another preferred hydrocarbon mixture according to the present invention comprises 5-methylpentacosane, 11-methylpentacosane, (Z)-9-pentacosene, n-pentacosane, and n-hexacosane (mixture B). More preferably, the following mixture is used (mixture B-1) :

- 10 - 5-methylpentacosane in a proportion ranging from 4 to 19% in weight;
- 11-methylpentacosane in a proportion ranging from 29 to 43% in weight;
- (Z)-9-pentacosene in a proportion ranging from 12 to 27% in weight;
- n-pentacosane in a proportion ranging from 20 to 35% in weight; and
- n-hexacosane in a proportion ranging from 1 to 10% in weight.

- 15 Even more preferably, the following mixture is used (mixture B-2) :

- 5-methylpentacosane in a proportion ranging from 9 to 14% in weight;
- 11-methylpentacosane in a proportion ranging from 34 to 38% in weight;
- (Z)-9-pentacosene in a proportion ranging from 17 to 22% in weight;
- n-pentacosane in a proportion ranging from 25 to 30% in weight; and
- 20 - n-hexacosane in a proportion ranging from 3 to 7% in weight.

Another preferred hydrocarbon mixture according to the present invention comprises 11-methyltetracosane, 5-methylpentacosane, 11-methylpentacosane, (Z)-9-pentacosene, n-pentacosane, n-hexacosane, 5,17-dimethylpentacosane, and 5-methyltetracosane (mixture C). More preferably, the following mixture is used (mixture C-1) :

- 11-methyltetracosane in a proportion ranging from 0.1 to 10% in weight;
- 5-methylpentacosane in a proportion ranging from 3 to 18% in weight;
- 11-methylpentacosane in a proportion ranging from 27 to 41% in weight;
- 30 - (Z)-9-pentacosene in a proportion ranging from 11 to 26% in weight;
- n-pentacosane in a proportion ranging from 19 to 33% in weight;
- n-hexacosane in a proportion ranging from 1 to 10% in weight.

- 5,17-dimethylpentacosane in a proportion ranging from 0.1 to 5% in weight;
and

- 5-methyltetracosane in a proportion ranging from 0.1 to 5% in weight.

Even more preferably, the following mixture is used (mixture C-2) :

- 5 - 11-methyltetracosane in a proportion ranging from 1 to 5% in weight;
 - 5-methylpentacosane in a proportion ranging from 8 to 13% in weight;
 - 11-methylpentacosane in a proportion ranging from 32 to 36% in weight;
 - (Z)-9-pentacosene in a proportion ranging from 16 to 21% in weight;
 - n-pentacosane in a proportion ranging from 24 to 28% in weight;
10 - n-hexacosane in a proportion ranging from 2 to 7% in weight.
 - 5,17-dimethylpentacosane in a proportion ranging from 0.5 to 3% in weight;
and
 - 5-methyltetracosane in a proportion ranging from 0.5 to 3% in weight.

15 In order for the effects of hydrocarbon compound mixtures according to the present invention to be significant, the mixture quantity to be used may vary according to the insect species targeted and the intensity of the effect sought. Preferably, 0.000001 to 1 g/m² of hydrocarbon compound mixture according to the present invention will be used. More preferably, 0.00001 to 0.5 g/m² of hydrocarbon
20 compound mixture according to the present invention will be used. Even more preferably 0.0001 to 0.2 g/m² of hydrocarbon compound mixture according to the present invention will be used. These quantities are equivalent, from a practical point of view, to a quantity of hydrocarbon compound mixture according to the present invention used ranging from 0.0001 to 100 µg/cm², preferably from 0.001 to 50
25 µg/cm², even more preferably from 0.01 to 20 µg/cm².

The object of the present invention is therefore a method of fighting against social, sub-social or gregarious insects chosen from the group comprising termites, ants, cockroaches, earwigs and locusts comprising comprising the use of a
30 hydrocarbon compound mixture as defined above. Preferably, the insects treated according to the method described above are termites or ants. Even more preferably, the insects treated according to the method described above are termites.

Certain hydrocarbon compounds mixtures according to the present invention are novel. Consequently, the present invention also relates to a hydrocarbon compound mixture comprising 11-methylpentacosane, (Z)-9-pentacosene, and n-pentacosane (mixture A). Preferably, the present invention relates to the following mixture (mixture A-1) :

- 11-methylpentacosane in a proportion ranging from 36 to 51% in weight;
- (Z)-9-pentacosene in a proportion ranging from 16 to 31% in weight; and
- 10 - n-pentacosane in a proportion ranging from 26 to 41% in weight.

Even more preferably, the present invention relates to the following mixture (mixture (A-2) :

- 11-methylpentacosane in a proportion ranging from 41 to 46% in weight;
- (Z)-9-pentacosene in a proportion ranging from 21 to 26% in weight; and
- 15 - n-pentacosane in a proportion ranging from 31 to 35% in weight.

Another mixture which is the object of the present invention is a hydrocarbon compounds mixture comprising 5-methylpentacosane, 11-methylpentacosane, (Z)-9-pentacosene, n-pentacosane, and n-hexacosane (mixture B). Preferably, the present invention relates to the following mixture (mixture B-1) :

- 5-methylpentacosane in a proportion ranging from 4 to 19% in weight;
- 11-methylpentacosane in a proportion ranging from 29 to 43% in weight;
- (Z)-9-pentacosene in a proportion ranging from 12 to 27% in weight;
- n-pentacosane in a proportion ranging from 30 to 35% in weight; and
- 25 - n-hexacosane in a proportion ranging from 1 to 10% in weight.

Even more preferably, the present invention relates to the following mixture (mixture (B-2) :

- 5-methylpentacosane in a proportion ranging from 9 to 14% in weight;
- 11-methylpentacosane in a proportion ranging from 34 to 38% in weight;
- 30 - (Z)-9-pentacosene in a proportion ranging from 17 to 22% in weight;
- n-pentacosane in a proportion ranging from 25 to 30% in weight; and
- n-hexacosane in a proportion ranging from 3 to 7% in weight.

Another mixture which is the object of the present invention is a hydrocarbon compounds mixture comprising 11-methyltetracosane, 5-methylpentacosane, 11-methylpentacosane, (Z)-9-pentacosene, n-pentacosane, n-hexacosane, 5,17-dimethylpentacosane, and 5-methyltetracosane (mixture C). Preferably, the present invention relates to the following mixture (mixture C-1) :

- 11-methyltetracosane in a proportion ranging from 0.1 to 10% in weight;
 - 5-methylpentacosane in a proportion ranging from 3 to 8% in weight;
 - 11-methylpentacosane in a proportion ranging from 27 to 31% in weight;
 - 10 - (Z)-9-pentacosene in a proportion ranging from 11 to 26% in weight;
 - n-pentacosane in a proportion ranging from 19 to 23% in weight;
 - n-hexacosane in a proportion ranging from 1 to 10% in weight;
 - 5,17-dimethylpentacosane in a proportion ranging from 0.1 to 5% in weight;
- and
- 15 - 5-methyltetracosane in a proportion ranging from 0.1 to 5%.

Even more preferably, the present invention relates to the following mixture (mixture (C-2) :

- 11-methyltetracosane in a proportion ranging from 1 to 5% in weight;
 - 5-methylpentacosane in a proportion ranging from 8 to 13% in weight;
 - 20 - 11-methylpentacosane in a proportion ranging from 32 to 36% in weight;
 - (Z)-9-pentacosene in a proportion ranging from 16 to 21% in weight;
 - n-pentacosane in a proportion ranging from 24 to 28% in weight;
 - n-hexacosane in a proportion ranging from 2 to 7% in weight;
 - 5,17-dimethylpentacosane in a proportion ranging from 0.5 to 3% in weight;
- 25 and
- 5-methyltetracosane in a proportion ranging from 0.5 to 3%.

Another object of the present invention is an insecticide composition including a hydrocarbon compound mixture as defined above and one or several insecticide compounds.

Among the insecticide compounds which may be used in the context of the present invention, for the followings may be cited as examples : abamectin, acephate,

acetamiprid, acrinathrin, alanycarb, aldicarb, allethrin, alpha-cypermethrin, aluminium phosphide, amitraz, azadirachtin, azamethiphos, azinphos-ethyl, azinphos-methyl, bendiocarb, benfuracarb, bensultap, beta-cyfluthrin, beta-cypermethrin, bifenthrin, bioallethrin, bioallethrin S-cyclopentenyl isomer, bioresmethrin, bistrifluron, borax, 5 buprofezin, butocarboxim, butoxycarboxim, cadusafos, calcium cyanide, calcium polysulfide, carbaryl, carbofuran, carbosulfan, cartap, chlordane, chlorethoxyfos, chlorfenapyr, chlorfenvinphos, chlorfluazuron, chlormephos, chloropicrin, chlorpyrifos, chlorpyrifos-methyl, chromafenozide, clothianidin, coumaphos, cryolite, cyanophos, cycloprothrin, cyfluthrin, cyhalothrin, cypermethrin, 10 cyphenothrin, cyromazine, dazomet, deltamethrin, demeton-S-methyl, diafenthiuron, diazinon, dichlorvos, dicrotophos, dicyclanil, diflubenzuron, dimethoate, dimethylvinphos, dinotefuran, disulfoton, emamectin, emamectin benzoate, empenthrin, endosulfan, esfenvalerate, ethiofencarb, ethion, ethiprole, ethoprophos, ethylene dibromide, etofenprox, etoxazole, famphur, fenitrothion, fenobucarb, 15 fenoxycarb, fenpropathrin, fenthion, fenvalerate, fipronil, flonicamid, flucycloxuron, flucythrinate, flufenoxuron, flumethrin, formetanate, formetanate hydrochloride, fosthiazate, furathiocarb, halofenozide, heptachlor, heptenophos, hexaflumuron, hydramethylnon, hydroprene, imidacloprid, imiprothrin, indoxacarb, isofenphos, isoprocarb, isopropyl O-(methoxyaminothiophosphoryl) salicylate, isoxathion, 20 lambda-cyhalothrin, lithium perfluorooctane sulfonate, lufenuron, magnesium phosphide, malathion, mecarbam, mercurous chloride, metam, metam-sodium, methamidophos, methidathion, methiocarb, methomyl, methoprene, methothrin, methoxychlor, methoxyfenozide, methyl isothiocyanate, metolcarb, mevinphos, milbemectin, monocrotophos, naled, naphthalenic compounds, nicotine, nitenpyram, 25 nithiazine, novaluron, noviflumuron, omethoate, oxamyl, oxydemeton-methyl, parathion, parathion-methyl, pentachlorophenol, pentachlorophenyl laurate, permethrin, petroleum oils, phenothrin, phenthoate, phorate, phosalone, phosmet, phosphamidon, phosphine, phoxim, pirimicarb, pirimiphos-methyl, prallethrin, profenofos, propaphos, propetamphos, propoxur, prothiofos, pymetrozine, 30 pyraclofos, pyrethrins, pyrethrins, pyrethrins, pyridaben, pyridaphenthion, pyrimidifen, pyriproxyfen, quinalphos, resmethrin, rotenone, sabadilla, silafluofen, sodium cyanide, sodium pentachloro-phenoxide, spinosad, sulcofuron, sulcofuron-

sodium, sulfluramid, sulfotep, sulfuryl fluoride, sulprofos, tau-fluvalinate, tebufenozide, tebupirimfos, teblubenzuron, tefluthrin, temephos, terbufos, tetrachlorvinphos, tetramethrin, tetramethrin, theta-cypermethrin, thiacloprid, thiamethoxam, thiodicarb, thiofanox, thiometon, thiosultap-sodium, tolfenpyrad, 5 tralomethrin, transfluthrin, triazamate, triazophos, trichlorfon, triblumuron, trimethacarb, vamidothion, xylylcarb, zeta-cypermethrin, and zinc phosphide.

Among these compounds fipronil, chlorfenapyr, spinosad, thiamethoxam, imidacloprid, indoxacarb, clothianidin, acetamiprid, dinotefuran, flonicamid, nitenpyram, nithiazine, hexaflumuron, lufenuron, noviflumuron, triflumuron, or 10 ethiprole are preferably used. More preferably, fipronil, chlorfenapyr, spinosad, thiamethoxam, imidacloprid, or ethiprole are used. Even more preferably, imidacloprid or fipronil are used.

Among the insecticide compositions preferred according to the invention the 15 following compositions can be cited as examples but without limitation thereto :

Insecticide composition according to invention	Hydrocarbon compound mixture	Insecticide compound
1	Mixture A	Imidacloprid
2	Mixture A-1	Imidacloprid
3	Mixture A-2	Imidacloprid
4	Mixture B	Imidacloprid
5	Mixture B-1	Imidacloprid
6	Mixture B-2	Imidacloprid
7	Mixture C	Imidacloprid
8	Mixture C-1	Imidacloprid
9	Mixture C-2	Imidacloprid
10	Mixture A	Fipronil
11	Mixture A-1	Fipronil
12	Mixture A-2	Fipronil
13	Mixture B	Fipronil
14	Mixture B-1	Fipronil
15	Mixture B-2	Fipronil
16	Mixture C	Fipronil
17	Mixture C-1	Fipronil

18	Mixture C-2	Fipronil
19	Mixture A	Chlorfenapyr
20	Mixture A-1	Chlorfenapyr
21	Mixture A-2	Chlorfenapyr
22	Mixture B	Chlorfenapyr
23	Mixture B-1	Chlorfenapyr
24	Mixture B-2	Chlorfenapyr
25	Mixture C	Chlorfenapyr
26	Mixture C-1	Chlorfenapyr
27	Mixture C-2	Chlorfenapyr
28	Mixture A	Spinosad
29	Mixture A-1	Spinosad
30	Mixture A-2	Spinosad
31	Mixture B	Spinosad
32	Mixture B-1	Spinosad
33	Mixture B-2	Spinosad
34	Mixture C	Spinosad
35	Mixture C-1	Spinosad
36	Mixture C-2	Spinosad
37	Mixture A	Thiamethoxam
38	Mixture A-1	Thiamethoxam
39	Mixture A-2	Thiamethoxam
40	Mixture B	Thiamethoxam
41	Mixture B-1	Thiamethoxam
42	Mixture B-2	Thiamethoxam
43	Mixture C	Thiamethoxam
44	Mixture C-1	Thiamethoxam
45	Mixture C-2	Thiamethoxam
46	Mixture A	Ethiprole
47	Mixture A-1	Ethiprole
48	Mixture A-2	Ethiprole
49	Mixture B	Ethiprole
50	Mixture B-1	Ethiprole
51	Mixture B-2	Ethiprole
52	Mixture C	Ethiprole
53	Mixture C-1	Ethiprole
54	Mixture C-2	Ethiprole

55	Mixture A	Indoxacarb
56	Mixture A-1	Indoxacarb
57	Mixture A-2	Indoxacarb
58	Mixture B	Indoxacarb
59	Mixture B-1	Indoxacarb
60	Mixture B-2	Indoxacarb
61	Mixture C	Indoxacarb
62	Mixture C-1	Indoxacarb
63	Mixture C-2	Indoxacarb
64	Mixture A	Chlothianidin
65	Mixture A-1	Chlothianidin
66	Mixture A-2	Chlothianidin
67	Mixture B	Chlothianidin
68	Mixture B-1	Chlothianidin
69	Mixture B-2	Chlothianidin
70	Mixture C	Chlothianidin
71	Mixture C-1	Chlothianidin
72	Mixture C-2	Chlothianidin
73	Mixture A	Hexaflumuron
74	Mixture A-1	Hexaflumuron
75	Mixture A-2	Hexaflumuron
76	Mixture B	Hexaflumuron
77	Mixture B-1	Hexaflumuron
78	Mixture B-2	Hexaflumuron
79	Mixture C	Hexaflumuron
80	Mixture C-1	Hexaflumuron
81	Mixture C-2	Hexaflumuron
82	Mixture A	Lufenuron
83	Mixture A-1	Lufenuron
84	Mixture A-2	Lufenuron
85	Mixture B	Lufenuron
86	Mixture B-1	Lufenuron
87	Mixture B-2	Lufenuron
88	Mixture C	Lufenuron
89	Mixture C-1	Lufenuron
90	Mixture C-2	Lufenuron
91	Mixture A	Noviflumuron

92	Mixture A-1	Noviflumuron
93	Mixture A-2	Noviflumuron
94	Mixture B	Noviflumuron
95	Mixture B-1	Noviflumuron
96	Mixture B-2	Noviflumuron
97	Mixture C	Noviflumuron
98	Mixture C-1	Noviflumuron
99	Mixture C-2	Noviflumuron
100	Mixture A	Triflumuron
101	Mixture A-1	Triflumuron
102	Mixture A-2	Triflumuron
103	Mixture B	Triflumuron
104	Mixture B-1	Triflumuron
105	Mixture B-2	Triflumuron
106	Mixture C	Triflumuron
107	Mixture C-1	Triflumuron
108	Mixture C-2	Triflumuron

The insecticide composition according to the present invention may optionally contain one or several tensioactive agents as well as one or several supports.

- 5 According to the present invention, tensioactive agent means any ionic or non-ionic emulsifying, dispersing, or wetting agent or a mixture of such tensioactive agents. We can cite, for example, polyacrylic acid salts, lignosulfonic acid salts, phenolsulfonic or naphthalenesulfonic acid salts, ethylene oxide polycondensates on fatty alcohols or on fatty acids or on fatty amines, substituted phenols (especially
- 10 alkylphenols or arylphenols), sulfosuccinic acid ester salts, taurine derivatives (especially alkyltaurates), phosphoric esters of alcohols or of polyoxyethylated phenols, fatty acid and polyol esters, sulfate function derivatives, sulfonates and phosphates of the above compounds. The presence of at least one tensioactive agent is generally indispensable when the active matter and/or the inert support are not
- 15 soluble in water and the application vector agent is water.

The insecticide composition according to the present invention may contain the hydrocarbon compound mixture in very varied proportions depending on the efficacy sought and the insects targeted. Preferably, the composition according to this

invention may contain from 0.000001% to 99.99% in weight of the hydrocarbon compound mixture according to the present invention, preferably from 0.0001% to 99.99% in weight, more preferably from 0.01 to 99.99% in weight of the hydrocarbon compound mixture according to the present invention.

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The insecticide composition according to the present invention may be used in various forms among which can be cited oily solutions, emulsifiable concentrates, wettable powders, fluid formulations, and specifically aqueous suspensions or aqueous emulsions, granules, powders, pastes, emulsions, concentrated suspensions,
10 as well as possible mixtures, associations, or combinations of these various forms.

The insecticide composition according to the present invention may take the form of numerous formulation types. Therefore, these compositions can be used in the form of water soluble package; in the form of bait such as ready-to-use bait, concentrate for bait preparation, baits in stock, baits on grain, granulated bait, bait in
15 plates, or bait on chips; in the form of fumigant, such as smoke candle, smoke cartridge, smoke granules, smoke stick, smoke tablet, or smoke box; in the form of granules such as encapsulated granules, fine granules, macrogranules, microgranules, granules or tablets dispersible in water, or granules or tablets soluble in water; in the form of powder such as soluble powder, track powder, wettable powder, powder for
20 powdering, wettable powder for moist treatment, soluble powder for seed treatment or powder to be dispersed in oil; in the form of concentrated suspension also called liquefiable concentrate; in the form of concentrated suspension dilutable in oil; in the form of suspension for very low volume application; in the form of emulsion such as an aqueous emulsion or an oily/inverse emulsion; in the form of gel; in the form of
25 compressed gas; in the form of gas generating product; in the form of liquid miscible in oil; in the form of paste; in the form of soluble concentrate; in the form of liquid for seed treatment; in the form of capsule suspension; in the form of emulsifiable concentrate; in the form of liquid for very low volume application; in the form of steam spreading product; in the form of aerosol generator; in the form of product for
30 cold nebulization; or in the form of product for hot nebulization.

Preferably, the insecticides according to the invention may take the form of water soluble package, concentrated suspension, granules, bait, or fumigant.

The use of a hydrocarbon compound mixture according to the present invention in mixture with one or several of the aforementioned insecticide compounds considerably increases the efficacy of the toxins on the members of the colony that are in contact with the composition and/or consume it, since, due to the arresting effect of the hydrocarbon compound mixture, they remain in contact with the insecticide composition for a longer time and/or consume more of it. In addition, the use of a hydrocarbon compound mixture according to this invention in mixture with one or several of the insecticide compounds mentioned above also considerably increases the efficacy of the toxins on the other members of the colony, including the members in the nest, since, always due to the arresting effect of the hydrocarbon compound mixture, the insects that have consumed the insecticide composition according to this invention will transmit a much larger quantity to the other members of the colony.

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The compositions according to the present invention may be used in the fight against social, sub-social or gregarious insects chosen from the group comprising termites, ants, cockroaches, earwigs and locusts. Thus, the object of this invention is also a method of treatment against social, sub-social or gregarious insects chosen from the group comprising termites, ants, cockroaches, earwigs and locusts using an efficacious quantity of an insecticide composition described above.

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In the context of the present invention, "efficacious quantity" means a quantity of composition according to the invention sufficient to reduce the number of social or sub-social insects or eliminate them. Advantageously, such a quantity will completely destroy the colony.

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Preferably, the present invention relates to a method of treatment against termites or ants. More preferably, the present invention relates to a method of treatment against termites.

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The following examples are mentioned in order to illustrate in a non-limiting manner the invention.

Example 1 : Demonstration of the “arresting” effect on a population of termites from a mixture according to the invention including 5-methylpentacosane, 11-methylpentacosane, (Z)-9-pentacosene, n-pentacosane, and n-hexacosane (mixture B)

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20 termite workers of type *Reticulitermes santonensis - flavipes* are placed in a 5-cm Petri dish containing :

- 2 mm Fontainebleau wet sand on the bottom;
- a 1 cm² square of filter paper treated with 50 µl of a hydrocarbon compound mixture containing 11.4% in weight of 5-methylpentacosane; 36.3% in weight of 11-methylpentacosane; 19.6% in weight of (Z)-9-pentacosene; 27.7% in weight of n-pentacosane, and 5% in weight of n-hexacosane. This hydrocarbon compound mixture is dissolved in pentane and deposited on filter paper. The termites are placed in contact with the treated paper after complete evaporation of the pentane;
- a 1 cm² square of filter paper, untreated.

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The termites found under each of the two sheets of filter paper are then counted after 1 hour, 2 hours, and 4 hours.

This test is repeated identically 5 times.

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A control test conducted under the same condition with non-treated filter paper and filter paper treated with pentane used to dissolve the hydrocarbon compound mixture tested, with the termites coming in contact with the treated paper only after the complete evaporation of pentane, is also done 5 times.

25

The results obtained are then analyzed statistically according to the X² (Chi-square) method : the observed distribution is compared to the theoretical distribution (10 termites under each filter paper). For a significance threshold α equal to 5%, the values obtained are significantly different from reference values, thus proving the arresting effect of the mixture tested, for a $X^2 > 9.48$.

30

The mixture was tested with various concentrations (10⁻¹ g/ml, 10⁻² g/ml, 10⁻³ g/ml, and 10⁻⁴ g/ml) and the results obtained are summarised in the table below :

Survey done at t + 1 hour

Samples	Trial number	Number of termites under untreated filter paper (N ⁻)	Number of termites under treated (with pentane evaporated or the mixture to be tested) filter paper (N ⁺)	Δ (= N ⁺ - N ⁻)	X ²
Test	Trial 1	16	4	-12	-
	Trial 2	0	20	20	-
	Trial 3	10	10	0	-
	Trial 4	2	18	16	-
	Trial 5	20	0	20	-
	Average	9.6	10.4	0.8	2
Mixture with 10 ⁻¹ g/ml	Trial 1	5	15	10	-
	Trial 2	10	10	0	-
	Trial 3	8	12	4	-
	Trial 4	6	14	8	-
	Trial 5	9	11	2	-
	Average	7.6	12.4	4.8	4.6
Mixture with 10 ⁻² g/ml	Trial 1	6	14	8	-
	Trial 2	8	12	4	-
	Trial 3	11	9	-2	-
	Trial 4	5	15	10	-
	Trial 5	7	13	6	-
	Average	7.4	12.6	5.2	6.5

Mixture with 10^{-3} g/ml	Trial 1	17	3	-14	-
	Trial 2	8	12	4	-
	Trial 3	10	10	0	-
	Trial 4	7	13	6	-
	Trial 5	4	16	12	-
	Average	9.2	10.8	1.6	9.8
Mixture with 10^{-4} g/ml	Trial 1	8	12	4	-
	Trial 2	12	8	-4	-
	Trial 3	5	15	10	-
	Trial 4	6	14	8	-
	Trial 5	11	9	-2	-
	Average	8.4	11.6	3.2	5

Survey done at t + 2 hours

Samples	Trial number	Number of termites under untreated filter paper (N)	Number of termites under treated (with pentane evaporated or the mixture to be tested) filter paper (N ⁺)	Δ (= N ⁺ - N)	X ²
Test	Trial 1	7	13	6	-
	Trial 2	8	12	4	-
	Trial 3	6	14	14	-
	Trial 4	7	13	6	-
	Trial 5	16	4	-12	-
	Average	8.8	11.2	3.6	5.4

Mixture with 10^{-1} g/ml	Trial 1	10	10	0	-
	Trial 2	3	17	14	-
	Trial 3	5	15	10	-
	Trial 4	4	16	12	-
	Trial 5	6	14	8	-
	Average	5.6	14.4	8.8	12.6
Mixture with 10^{-2} g/ml	Trial 1	3	17	14	-
	Trial 2	12	8	-4	-
	Trial 3	11	9	-2	-
	Trial 4	10	10	0	-
	Trial 5	8	12	4	-
	Average	8.8	11.2	2.4	5.8
Mixture with 10^{-3} g/ml	Trial 1	0	20	20	-
	Trial 2	3	17	14	-
	Trial 3	11	9	-2	-
	Trial 4	14	6	-8	-
	Trial 5	10	10	0	-
	Average	7.6	12.4	4.8	16.6
Mixture with 10^{-4} g/ml	Trial 1	10	10	0	-
	Trial 2	7	13	6	-
	Trial 3	0	20	20	-
	Trial 4	14	6	-8	-
	Trial 5	10	10	0	-
	Average	8.2	11.8	3.6	12.5

Survey done at t + 4 hours

Samples	Trial number	Number of termites under untreated filter paper (N⁻)	Number of termites under treated (with pentane evaporated or the mixture to be tested) filter paper (N⁺)	Δ (= N⁺ - N⁻)	X²
Test	Trial 1	12	8	-4	-
	Trial 2	8	12	4	-
	Trial 3	16	4	-12	-
	Trial 4	8	12	4	-
	Trial 5	8	12	4	-
	Average	10.4	9.6	-0.8	0.6
Mixture with 10⁻¹ g/ml	Trial 1	7	13	6	-
	Trial 2	10	10	0	-
	Trial 3	3	17	14	-
	Trial 4	2	18	16	-
	Trial 5	10	10	0	-
	Average	6.4	13.6	7.2	12.2
Mixture with 10⁻² g/ml	Trial 1	10	10	0	-
	Trial 2	13	7	-6	-
	Trial 3	10	10	0	-
	Trial 4	9	11	2	-
	Trial 5	4	16	12	-
	Average	9.2	10.8	1.6	4.6

Mixture with 10^{-3} g/ml	Trial 1	15	5	-10	-
	Trial 2	10	10	0	-
	Trial 3	8	12	4	-
	Trial 4	7	13	6	-
	Trial 5	5	15	10	-
	Average	9	11	2	6.3
Mixture with 10^{-4} g/ml	Trial 1	8	12	4	-
	Trial 2	15	5	-10	-
	Trial 3	2	18	16	-
	Trial 4	3	17	14	-
	Trial 5	10	10	0	-
	Average	7.6	12.4	4.8	14.2

As shown by these results, a significant arresting effect (confirmed by X^2 test) is observed for the hydrocarbon compound mixture tested, at all concentrations tested. The higher the concentrations of the hydrocarbon mixtures, the more quickly the arresting effect of these mixtures is noticed.

Example 2 : Demonstration of the “arresting” effect on a termite population according to the invention including 11-methyltetracosane, 5-methylpentacosane, 11-methylpentacosane, (Z)-9-pentacosene, n-pentacosane, n-hexacosane, 5,17-dimethylpentacosane, and 5-methyltetracosane (mixture C)

20 worker termites of *Reticulitermes santonensis* type are placed in a Petri dish with a diameter of 5 cm containing :

- 2 mm wet Fontainebleau sand on the bottom;
- a 1 cm² square of filter paper treated with 50 µl of a hydrocarbon compound mixture including 3.3% 11-methyltetracosane, 10.7% in weight of 5-methylpentacosane; 34.2% in weight of 11-methyltetracosane; 18.5% in weight of (Z)-9-pentacosene; 26.1% in weight of n-pentacosane, 4.7% in weight of n-hexacosane, 1.1% of 5,17-dimethylpentacosane, and 1.4% of 5-methyltetracosane.

This hydrocarbon compound mixture is dissolved in pentane and deposited on the filter paper. The termites are placed in contact with the treated paper after complete evaporation of the pentane;

- a 1 cm² square of filter paper, untreated.

5 The termites found under each of the two sheets of filter paper are then counted after 1 hour, 2 hours, and 4 hours.

This test is repeated identically 5 times.

10 A control test conducted under the same condition with untreated filter paper and filter paper treated with pentane used to dissolve the hydrocarbon compound mixture tested, the termites being in contact with the treated paper only after the complete evaporation of pentane, is also done 5 times.

15 The results obtained are then analyzed statistically by the X² (Chi-square) method : the distribution observed is compared to the theoretical distribution (10 termites under each filter paper). For a significance threshold α equal to 5%, the values obtained are significantly different from reference values, thus proving the arresting effect of the mixture tested, for a X² > 9.48.

20 The mixture was tested with various concentrations (10⁻¹ g/ml, 10⁻² g/ml, 10⁻³ g/ml, and 10⁻⁴ g/ml) and the results obtained are summarised in the table below :

Survey done at t + 1 hours

Samples	Trial number	Number of termites under untreated filter paper (N ⁻)	Number of termites under treated (with pentane evaporated or the mixture to be tested) filter paper (N ⁺)	Δ (= N ⁺ - N ⁻)	X ²
Test	Trial 1	10	10	0	-
	Trial 2	6	14	8	-
	Trial 3	16	4	-12	-
	Trial 4	13	7	-6	-
	Trial 5	8	12	4	-
	Average	10.6	9.4	-1.2	6.5
Mixture with 10 ⁻¹ g/ml	Trial 1	3	17	14	-
	Trial 2	0	20	20	-
	Trial 3	3	17	14	-
	Trial 4	4	16	12	-
	Trial 5	1	19	18	-
	Average	2.2	17.8	15.6	31.5
Mixture with 10 ⁻² g/ml	Trial 1	13	7	-6	-
	Trial 2	4	16	12	-
	Trial 3	6	14	8	-
	Trial 4	2	18	16	-
	Trial 5	0	20	20	-
	Average	5	15	10	22.5

Mixture with 10^{-3} g/ml	Trial 1	18	2	-16	-
	Trial 2	15	5	-10	-
	Trial 3	1	19	18	-
	Trial 4	16	4	-12	-
	Trial 5	12	8	-4	-
	Average	12.4	7.6	-4.8	-
Mixture with 10^{-4} g/ml	Trial 1	18	2	-16	-
	Trial 2	10	10	0	-
	Trial 3	18	2	-16	-
	Trial 4	10	10	0	-
	Trial 5	12	8	-4	-
	Average	13.6	6.4	-7.2	-
Mixture with 10^{-5} g/ml	Trial 1	18	2	-16	-
	Trial 2	10	10	0	-
	Trial 3	10	10	0	-
	Trial 4	4	16	12	-
	Trial 5	15	5	-10	-
	Average	11.4	8.6	-2.8	-

Survey done at t + 2 hours

Samples	Trial number	Number of termites under untreated filter paper (N ⁻)	Number of termites under the treated (with pentane evaporated or the mixture to be tested) filter paper (N ⁺)	Δ (= N ⁺ - N ⁻)	X ²
Test	Trial 1	10	10	0	-
	Trial 2	13	7	-6	-
	Trial 3	16	4	-12	-
	Trial 4	5	15	10	-
	Trial 5	10	10	0	-
	Average	10.8	9.2	-1.6	7
Mixture with 10 ⁻¹ g/ml	Trial 1	10	10	0	-
	Trial 2	2	18	16	-
	Trial 3	2	18	16	-
	Trial 4	11	9	-2	-
	Trial 5	4	16	12	-
	Average	5.8	14.2	8.4	16.5
Mixture with 10 ⁻² g/ml	Trial 1	10	10	0	-
	Trial 2	0	20	20	-
	Trial 3	1	19	18	-
	Trial 4	7	13	6	-
	Trial 5	1	19	18	-
	Average	3.8	16.2	12.4	27.1

Mixture with 10^{-3} g/ml	Trial 1	10	10	0	-
	Trial 2	16	4	-12	-
	Trial 3	6	14	8	-
	Trial 4	12	8	-4	-
	Trial 5	6	14	8	-
	Average	10	10	0	7.2
Mixture with 10^{-4} g/ml	Trial 1	1	19	18	-
	Trial 2	6	14	8	-
	Trial 3	16	4	-12	-
	Trial 4	10	10	0	-
	Trial 5	12	8	-4	-
	Average	9	11	2	13.7
Mixture with 10^{-5} g/ml	Trial 1	2	18	16	-
	Trial 2	8	12	4	-
	Trial 3	10	10	0	-
	Trial 4	4	16	12	-
	Trial 5	10	10	0	-
	Average	6.8	13.2	6.4	10.4

Survey done at t + 4 hours

Samples	Trial number	Number of termites under untreated filter paper (N ⁻)	Number of termites under the treated (with pentane evaporated or the mixture to be tested) filter paper (N ⁺)	Δ (= N ⁺ - N ⁻)	X ²
Test	Trial 1	10	10	0	-
	Trial 2	15	5	-10	-
	Trial 3	16	4	-12	-
	Trial 4	2	18	16	-
	Trial 5	10	10	0	-
	Average	10.6	9.4	-1.2	12.5
Mixture with 10 ⁻¹ g/ml	Trial 1	8	12	4	-
	Trial 2	12	8	-4	-
	Trial 3	2	18	16	-
	Trial 4	6	14	8	-
	Trial 5	1	19	18	-
	Average	5.8	14.2	8.4	16.9
Mixture with 10 ⁻² g/ml	Trial 1	10	10	0	-
	Trial 2	0	20	20	-
	Trial 3	2	18	16	-
	Trial 4	6	14	8	-
	Trial 5	2	18	16	-
	Average	4	16	12	24.4

Mixture with 10^{-3} g/ml	Trial 1	10	10	0	-
	Trial 2	12	8	-4	-
	Trial 3	6	14	8	-
	Trial 4	12	8	-4	-
	Trial 5	2	18	16	-
	Average	8.4	11.6	3.2	8.8
Mixture with 10^{-4} g/ml	Trial 1	16	4	-12	-
	Trial 2	5	15	10	-
	Trial 3	3	17	14	-
	Trial 4	3	17	14	-
	Trial 5	4	16	12	-
	Average	6.2	13.8	7.6	19.5
Mixture with 10^{-5} g/ml	Trial 1	1	19	18	-
	Trial 2	2	18	16	-
	Trial 3	10	10	0	-
	Trial 4	7	13	6	-
	Trial 5	15	5	-10	-
	Average	7	13	6	17.9

As shown by these results, a significant “arresting” effect (confirmed by X^2 test) is observed for the hydrocarbon compound mixture tested. The higher the concentrations of the hydrocarbon mixtures, the more quickly the arresting effect of these mixtures is noticed.

Example 3 : Demonstration of the improvement in the transmission of a biocide between the various members of a termite population thanks to addition of a mixture including 5-methylpentacosane, 11-methylpentacosane, (Z)-9-pentacosene, n-pentacosane, and n-hexacosane (mixture B)

5

The experiment is conducted in a LAB test box (36 cm x 24 cm) containing on the bottom 5 mm of wet Fontainebleau sand and is repeated three times. In the box, a matrix is placed, consisting of a foam cube in which holes are made with a diameter of 5 mm, over which a small piece of poplar wood is placed (1 cm x 2 cm x 2 cm).

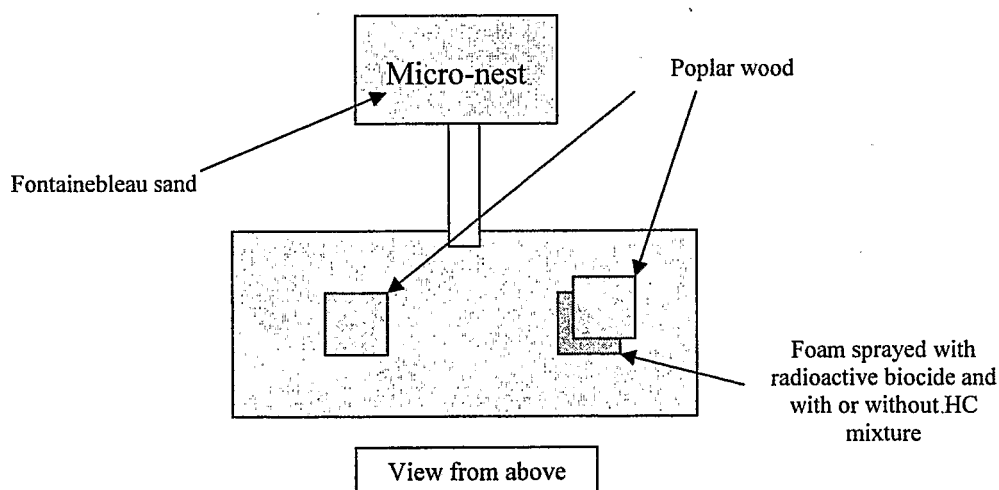
The biocide used for this experiment is fipronil.

The matrix is sprayed with 5 ml of radioactive biocide. Only 4 faces are sprayed. The top and the bottom of the matrix are not treated.

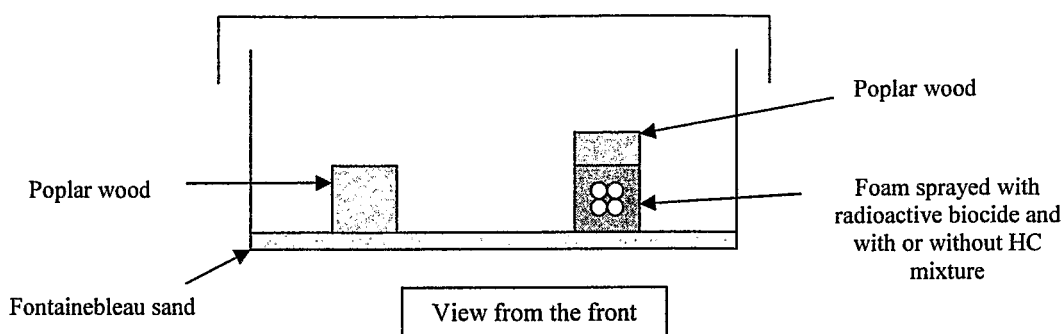
In the box, an untreated piece of poplar wood is also placed in order to recreate a natural situation as exactly as possible.

The box is connected to a micro-nest also made up of an LAB test box (12 cm x 9 cm) containing on the bottom 5 cm of wet Fontainebleau sand.

The experimental arrangement may be diagrammed as follows :



20



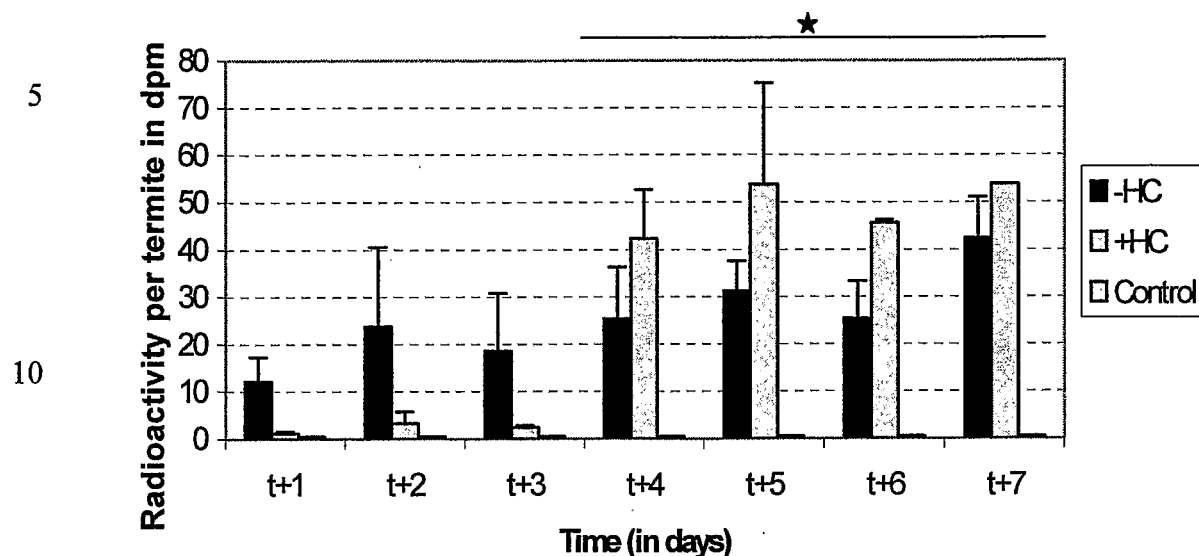
Six experiments have been conducted in total :

- 3 experiments are conducted without spraying the matrix, in addition to the radioactive biocidal product, with the hydrocarbon compound mixture; and

- 3 experiments are conducted by spraying on the matrix, in addition to the radioactive biocidal product, a mixture of hydrocarbon compounds including 11.4% in weight of 5-methylpentacosane, 36.3% in weight of 11-methylpentacosane, 19.6% in weight of (Z)-9-pentacosene, 27.7% in weight of n-pentacosane and 5% in weight of n-hexacosane.

1,000 worker termites of the *Reticulitermes santonensis* type are placed in the micro-nest which is closed for 5 days in order to deprive the termites of food and make them used to the artificial environment of the micro-nest. Then the micro-nest is opened and the termites have access to the box containing the matrix. During these experiments, 50 termites are taken from the micro-nest every 24 hours (from the opening of the micro-nest) and are crushed directly into the scintillation liquid. The radioactivity of the solution obtained is then measured.

The results obtained are summarised in the graph below (where -HC means that radioactivity was measured in the tests in which the matrix was not sprayed with the mixture of hydrocarbon compounds to be tested and +HC means that the radioactivity was measured in the tests in which the matrix was sprayed with the hydrocarbon compound mixture to be tested). The higher the radioactivity observed, the more biocidal material was absorbed by the termites and the better the transmission was to the other members of the colony.



★ : Significant difference

These results show a spreading of the biocide material between the various members of the termite colony clearly improved by the addition of the hydrocarbon compound mixture tested starting 4 days after the opening of the micro-nest.

Example 4 : Demonstration of the insecticidal activity of a composition including a hydrocarbon compound mixture (11.4% in weight of 5-methylpentacosane; 36.3% in weight of 11-methylpentacosane; 19.6% in weight of (Z)-9-pentacosene; 27.7% in weight of n-pentacosane, and 5% in weight of n-hexacosane) and an insecticide compound (fipronil)

The experiment is conducted in a LAB test box (6 cm x 9 cm) containing on the bottom 2 mm of wet Fontainebleau sand and is repeated five times. In the box, a matrix is placed, consisting of a foam cube in which holes are made with a diameter of 5 mm, over which a small piece of poplar wood is placed (1 cm x 2 cm x 2 cm). The foam is impregnated with cold fipronil. The matrix is sprayed with a hydrocarbon compound mixture including 11.4% of 5-methylpentacosane; 36.3% of 11-methylpentacosane; 19.6% of (Z)-9-pentacosene; 27.7% of n-pentacosane, and

5% of n-hexacosane. Only 4 faces are sprayed. The top and the bottom of the matrix are not treated.

In the box, an untreated piece of poplar wood is also placed in order to recreate a natural situation as exactly as possible.

5

100 worker termites of *Reticulitermes santonensis* type are placed in the box and their mortality after 3 days is evaluated. Various concentrations of cold fipronil are tested : 0.5 ppm, 1 ppm, 2 ppm, 5 ppm, and 7 ppm. The results obtained are summarised in the table below :

10

Sample tested	Trial number	Number of termites dead after 3 days
Test	Trial 1	0
	Trial 2	0
	Trial 3	0
	Trial 4	0
	Trial 5	0
	Average	0
Fipronil at 0.5 ppm	Trial 1	0
	Trial 2	0
	Trial 3	0
	Trial 4	0
	Trial 5	0
	Average	0
Fipronil at 1 ppm	Trial 1	0
	Trial 2	0
	Trial 3	0
	Trial 4	0
	Trial 5	0
	Average	0

Fipronil at 2 ppm	Trial 1	20
	Trial 2	25
	Trial 3	32
	Trial 4	14
	Trial 5	9
	Average	20
Fipronil at 5 ppm	Trial 1	42
	Trial 2	45
	Trial 3	59
	Trial 4	56
	Trial 5	50
	Average	50.4
Fipronil at 7 ppm	Trial 1	60
	Trial 2	42
	Trial 3	55
	Trial 4	34
	Trial 5	63
	Average	50.8

These results show an insecticidal activity of the composition including fipronil with the hydrocarbon compound mixture (11.4% of 5-methylpentacosane; 34.2% of 11-methylpentacosane; 19.6% of (Z)-9-pentacosene; 27.7% of n-pentacosane, and 5% of n-hexacosane) that, at certain doses, allows destroying more than half of the termite colony in three days.

CLAIMS

1. Method to fight against social, sub-social or gregarious insects chosen from the group comprising termites, ants, cockroaches, earwigs and locusts comprising the
5 use of a hydrocarbon compound mixture chosen among alkanes and alkenes comprising from 20 to 40 carbon atoms.
2. Method according to claim 1, characterised in that the alkanes and alkenes comprise from 23 to 35 carbon atoms.
- 10 3. Method according to claim 2, characterised in that the alkanes and alkenes comprise from 25 to 27 carbon atoms.
4. Method according to claim 3, characterised in that the alkanes and alkenes are
15 chosen from the group comprising 11-methyltetracosane, 5-methylpentacosane, 11-methylpentacosane, (Z)-9-pentacosene, n-pentacosane, n-hexacosane, 5,17-dimethylpentacosane, and 5-methyltetracosane.
5. Method according to claim 4, characterised in that the hydrocarbon
20 compound mixture comprises 11-methylpentacosane, (Z)-9-pentacosene, and n-pentacosane,
6. Method according to claim 5, characterised in that the hydrocarbon compound mixture is as follows :
25
 - 11-methylpentacosane in a proportion ranging from 36 to 51% in weight;
 - (Z)-9-pentacosene in a proportion ranging from 16 to 31% in weight; and
 - n-pentacosane in a proportion ranging from 26 to 41% in weight.
7. Method according to claim 4, characterised in that the hydrocarbon
30 compound mixture comprises 5-methylpentacosane, 11-methylpentacosane, (Z)-9-pentacosene, n-pentacosane, and n-hexacosane.

8. Method according to claim 7, characterised in that the hydrocarbon compound mixture is as follows :

- 5-methylpentacosane in a proportion ranging from 4 to 19% in weight;
- 11-methylpentacosane in a proportion ranging from 29 to 43% in weight;
- 5 - (Z)-9-pentacosene in a proportion ranging from 12 to 27% in weight;
- n-pentacosane in a proportion ranging from 20 to 35% in weight; and
- n-hexacosane in a proportion ranging from 1 to 10% in weight.

9. Method according to claim 4, characterised in that the hydrocarbon compound mixture comprises 11-methyltetracosane, 5-methylpentacosane, 11-methylpentacosane, (Z)-9-pentacosene, n-pentacosane, n-hexacosane, 5,17-dimethylpentacosane, and 5-methyltetracosane.

10. Method according to claim 9, characterised in that the hydrocarbon compound mixture is as follows :

- 11-methyltetracosane in a proportion ranging from 0.1 to 10% in weight;
 - 5-methylpentacosane in a proportion ranging from 3 to 18% in weight;
 - 11-methylpentacosane in a proportion ranging from 27 to 41% in weight;
 - (Z)-9-pentacosene in a proportion ranging from 11 to 26% in weight;
 - 20 - n-pentacosane in a proportion ranging from 19 to 33% in weight;
 - n-hexacosane in a proportion ranging from 1 to 10% in weight;
 - 5,17-dimethylpentacosane in a proportion ranging from 0.1 to 5% in weight;
- and
- 5-methyltetracosane in a proportion ranging from 0.1 to 5% in weight.

25

11. Hydrocarbon compound mixture comprising 11-methylpentacosane, (Z)-9-pentacosene, and n-pentacosane.

12. Mixture according to claim 11, characterised in that the compounds are present in the following proportions :

30

- 11-methylpentacosane in a proportion ranging from 36 to 41% in weight;
- (Z)-9-pentacosene in a proportion ranging from 16 to 31% in weight; and

- n-pentacosane in a proportion ranging from 26 to 41% in weight.

13. Hydrocarbon compound mixture comprising 5-methylpentacosane, 11-methylpentacosane, (Z)-9-pentacosene, n-pentacosane, and n-hexacosane.

5

14. Mixture according to claim 13, characterised in that the compounds are present in the following proportions :

- 5-methylpentacosane in a proportion ranging from 4 to 19% in weight;
- 11-methylpentacosane in a proportion ranging from 29 to 43% in weight;
- 10 - (Z)-9-pentacosene in a proportion ranging from 12 to 27% in weight;
- n-pentacosane in a proportion ranging from 20 to 35% in weight; and
- n-hexacosane in a proportion ranging from 1 to 10% in weight.

15. Hydrocarbon compound mixture comprising 11-methyltetracosane, 5-methylpentacosane, 11-methylpentacosane, (Z)-9-pentacosene, n-pentacosane, n-hexacosane, 5,17-dimethylpentacosane, and 5-methyltetracosane.

15

16. Mixture according to claim 15, characterised in that the compounds are present in the following proportions :

- 20 - 11-methyltetracosane in a proportion ranging from 0.1 to 10% in weight;
- 5-methylpentacosane in a proportion ranging from 3 to 18% in weight;
- 11-methylpentacosane in a proportion ranging from 27 to 41% in weight;
- (Z)-9-pentacosene in a proportion ranging from 11 to 26% in weight;
- n-pentacosane in a proportion ranging from 19 to 33% in weight;
- 25 - n-hexacosane in a proportion ranging from 1 to 10% in weight;
- 5,17-dimethylpentacosane in a proportion ranging from 0.1 to 5% in weight;
- and
- 5-methyltetracosane in a proportion ranging from 0.1 to 5% in weight.

30 17. Insecticide composition comprising a hydrocarbon compound mixture as defined in one of the claims 1 through 10 and one or several insecticide compounds.

18. Composition according to claim 17, characterised in that the insecticide compound is chosen from the group comprising fipronil, chlorfenapyr, spinosad, thiamethoxam, imidacloprid, indoxacarb, clothianidin, hexaflumuron, lufenuron, noviflumuron, triflumuron, and ethiprole.

5

19. Composition according to claim 18, characterised in that the insecticide compound is imidacloprid.

20. Composition according to claim 18, characterised in that the insecticide
10 compound is fipronil.

21. Method of treatment against insects using an efficient quantity of a composition according to one of the claims 18 through 20.

15 22. Method according to claim 21, characterised in that the insects treated are termites.