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## (54) Title: PEST CONTROL COMPOSITIONS AND METHODS



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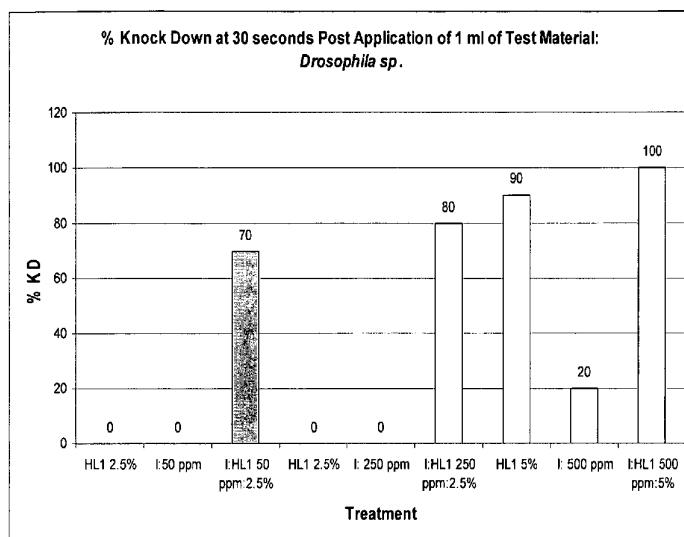


Figure 4D

(57) **Abstract:** Embodiments of the present invention provide compositions for controlling a target pest including a pest control product and at least one active agent, wherein: the active agent can be capable of interacting with a receptor in the target pest; the pest control product can have a first activity against the target pest when applied without the active agent and the compositions can have a second activity against the target pest; and the second activity can be greater than the first activity.



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## PEST CONTROL COMPOSITIONS AND METHODS

### CROSS-REFERENCE TO RELATED APPLICATIONS

**[0001]** This application claims priority from U.S. Provisional Application Serial Nos. 60/885,214 filed January 16, 2007, 60/885,403 filed January 17, 2007, and 60/889,259 filed February 9, 2007, each of which is hereby incorporated by reference in its entirety.

### FIELD OF THE INVENTION

**[0002]** The present invention relates to compositions and methods related to controlling insects.

### BACKGROUND OF THE INVENTION

**[0003]** While the first recorded use of chemicals to control pests dates back to 2500 BC, only in the last 60 years has chemical control has been widely used. Early pesticides included hellebore to control body lice, nicotine to control aphids, and pyrithrin to control a wide variety of insects. Lead arsenate was first used in 1892 as an orchard spray, while at the same time it was discovered that a mixture of lime and copper sulphate (Bordeaux mixture) controlled downy mildew, a fungal disease of grapes.

**[0004]** The modern era of chemical pest control commenced during World War II. For example, DDT played a major role in maintaining the health and welfare of soldiers who used it to control body lice and mosquitoes. Further developments of pesticides followed, and with their relatively low cost, ease of use, and effectiveness, they became the primary means of pest control. Protection of crops, produce, animals, and humans over extended periods became possible with corresponding increases in food production and improved standards of living.

**[0005]** Some modern pesticides are sophisticated compounds that are carefully researched to ensure they are effective against target organisms, generally safe to the environment, and can be used without undue hazard to users or consumers. Many of these have been developed to target specific biochemical reactions within the target organism, e.g. an enzyme necessary for photosynthesis within a plant or a hormone required for normal development in an insect. Thus, some modern chemicals are safer, more specific, and friendlier to the environment than the older products they have replaced.

#### SUMMARY

**[0006]** Embodiments of the present invention provide compositions for controlling a target pest including a pest control product and at least one active agent, wherein: the active agent can be capable of interacting with a receptor in the target pest; the pest control product can have a first activity against the target pest when applied without the active agent and the compositions can have a second activity against the target pest; and the second activity can be greater than the first activity. The first and second activities can be quantified by measuring concentration of the pest control product effective to control the target pest, and a concentration corresponding to the first activity can be higher than a concentration corresponding to the second activity. The first and second activities can be quantified by measuring disablement effect of the target pest at a standard concentration of pest control product, and the compositions exhibit a greater disablement effect than the pest control product applied without the active agent. The first activity can persist for a first period, the second activity can persist for a second period, and the second period can be longer than the first period. The active agent can include a synergistic combination of at least two receptor ligands. The second activity can reflect a synergistic interaction of the active agent and the pest control product.

**[0007]** The target pest can be selected from the group consisting of a fungus, a plant, an animal, a moneran, and a protist. The target pest can be an arthropod species, such as, for example, an insect, an arachnid, or an arachnoid. The target pest can be a species belonging to an animal order selected from: Acari, Anoplura, Araneae, Blattodea, Coleoptera, Collembola, Diptera, Grylloptera, Heteroptera, Homoptera, Hymenoptera, Isopoda, Isoptera, Lepidoptera, Mantodea, Mallophaga, Neuroptera, Odonata, Orthoptera, Psocoptera, Siphonaptera, Symphyla, Thysanura, and Thysanoptera.

**[0008]** The pest control product can be a chlorphenoxy compound such as, for example, 2,4-D Amine and/or 2,4D IBE. Likewise, the pest control product can be a carbamate such as, for example, methomyl, carbofuran, carbaryl, BPMC, carbendazim, carbosulfan, captan hydrochloride, and/or cartap. The pest control product can be an organophosphate such as, for example, acephate, malathion, diazinon, chlorpyfiros, fenoxycab, edifenphos, febuconazole, chlorphenapyr, magnesium phosphide, metamidophos, and/or fenitrothion. The pest control product can be an organochlorine such as, for example, DDT, DDE, and/or heptachlorepoxyde. The pest control product can be a pyrethroid such as, for example, cypermethrin, cynmethylin +2,4-D IBE, lambdacyhalothrin, dazomet, cyfluthrin, betacypermethrin, pendimethlin, permethrin, deltamethrin, bifenethrin, alphacypermethrin, fenvalerate, propanil, and/or esfenvalerate. The pest control product can be a neonicotinoid such as, for example, thiomethoxam, fipronil, clothianidin, and/or imidacloprid. The pest control product can include at least one of an avermectin, abamectin, spinosad, fluxastrobin, and/or indoxacarb. The pest control product can be a botanical product such as, for example, rotenone, nicotine, caffeine, a pyrethrum, an essential oil, and/or a fixed oil. The pest control product can be a fungicide, a nematicide, an insecticide, an acaricide, and/or a bactericide.

**[0009]** The receptor can be a G protein-coupled receptor (GPCR), such as a GPCR of the insect olfactory cascade, such as, for example, a tyramine receptor, an olfactory receptor Or43a, an olfactory receptor Or83b and/or an octopamine receptor. Binding of the receptor by an ingredient of the compositions can result in a change in intracellular level of cAMP and/or calcium, wherein the change can be sufficient to permit control of the target pest.

**[0010]** Control can include a condition such as, for example, killing, knockdown, repellency, interference with reproduction, interference with feeding, and interference with a stage of a life cycle of the target pest.

**[0011]** Embodiments of the invention also include a crop protected by the compositions disclosed herein.

**[0012]** In addition, embodiments of the invention can include compositions for controlling a target pest including a pest control product and at least one active agent, wherein: the active agent can include a ligand of a GPCR of a target pest, wherein binding of the ligand to the GPCR can cause a change in a level of cAMP or calcium that can permit control of the target pest; the pest control product can have a first activity against the target pest, the active agent can have a second activity against the target pest, and the compositions can have a third activity against the target pest; and the third activity can be greater than the first activity or the second activity. The active agent can include a synergistic combination of at least two GPCR ligands. The third activity can be indicative of synergy between the active agent and the pest control product. In some embodiments, compositions can include at least two active ingredients, wherein at least one active ingredient interacts with a G protein-coupled receptor (GPCR) of the pest and wherein at least one active ingredient does not interact with the GPCR, and wherein the at least two active ingredients in combination have a synergistic pest-control activity. The pest

can be an insect and the GPCR can be associated with olfaction, and further the GPCR preferably can be absent from vertebrate animals. The synergistic pest-control activity can have a coefficient of synergy in excess of 1.5. The synergistic pest-control activity can exceed additive effects of the active ingredients, as measured by the Colby calculation of synergy. The GPCR can have a high affinity for the active ingredient in a target organism and the GPCR can be absent or can have a low affinity for the active ingredient in a non-target organism. The non-target organism can be a vertebrate animal. In some embodiments, the target organism can be a plant, an animal, a fungus, a protist, or a moneran, and the non-target organism can be selected from a crop plant, a vertebrate animal, and a non-pest invertebrate.

**[0013]** In some embodiments, the invention provides low-resistance pest-control compositions, including at least a first active ingredient and a second active ingredient, wherein the first active ingredient interacts with a first molecular target under genetic control within a selected pest, and wherein the second active ingredient interacts with a second molecular target under genetic control within the selected pest, and wherein the ingredients in the compositions act together in a complementary manner upon the target pest, and wherein resistance to the compositions in an individual target pest requires two separate genetic lesions divergent from a non-resistant population of the pest. The first and second molecular targets can include two separate molecules encoded or controlled by separate genetic elements. The complementary manner can include an additive effect of each agent acting separately, or the complementary manner can include a synergistic effect as compared with each agent acting separately. The first molecular target can be a GPCR, and the second molecular target is preferably not the same as the first molecular target.

**[0014]** Also provided in some embodiments are pest-control compositions exhibiting high potency against an invertebrate target pest and low toxicity against a vertebrate animal, the compositions including a synergistic combination of active agents, wherein each active agent interacts with a molecular target with high affinity in the target pest and that can be absent from, or present with low affinity, from the vertebrate. The at least one active agent can be a ligand of a selected GPCR, and the at least one active agent is preferably not a ligand of the selected GPCR. The high target potency and low vertebrate toxicity can be expressed as a ratio of LD50(target) versus LD50(vertebrate animal), and wherein the ratio can be less than 100:1.

**[0015]** In some embodiments, the invention provides methods of pest control including contacting a target pest with a composition as described herein, resulting in control of the pest. The methods can include applying a composition to a target pest or to a substrate associated with a target pest, wherein the compositions can include a pesticide and an active agent including at least one receptor ligand, and wherein the pest control can include affecting a physiological condition of the pest associated with a function of the pesticide while also affecting a function of the receptor associated with the receptor ligand. The binding of the receptor by an ingredient of the compositions can result in a change in intracellular level of cAMP and/or calcium, and wherein the change can be sufficient to permit control of the target pest. The pesticide can be selected from a chlorphenoxy compound, a carbamate, an organophosphate, an organochlorine, a pyrethroid, a neonicotinoid, a botanical product, a fungicide, a nematicide, and insecticide, and acaricide, a bactericide, and an avermectin. The substrate can be, for example, a crop plant and/or a soil. The target pest can be, for example, a fungus, a plant, an animal, a moneran, or a protist. The use of the compositions can permit an improvement of control of the pest as compared with use of the pesticide alone or the active agent alone. The improvement can

include a synergistic interaction of the pest control product with the active agent. The improvement can include an improved result with use of a substantially similar amount of the pest control product. The improved result can be at least one of: increased killing of the target pest; increased interference with reproduction by the target pest; and prolonged effectiveness of the pest control product. The improvement can include a substantially similar result with use of a substantially lower amount of the pest control product and/or the active agent. Use of the compositions permits an agricultural improvement such as, for example, increased crop yield; reduced frequency of application of pest control product; reduced phytotoxicity associated with the pesticide; and reduced cost or increased value associated with at least one environmental factor. The environmental factor can include, for example, air quality, water quality, soil quality, detectable pesticide residue, safety or comfort of workers; and a collateral effect on a non-target organism.

**[0016]** Also provided are methods of developing a compositions for pest control, including: providing a cell line expressing at least one of: a tyramine receptor, an olfactory receptor Or43a, or an olfactory receptor Or83b, wherein binding of a ligand to any of the receptors causes a change in a level of intracellular cAMP or calcium, and the change can be indicative of a potential for invertebrate pest control; contacting the cell with a candidate ligand; detecting a change in the level of cAMP and/or calcium in the cell; identifying the candidate ligand as an active compound for control of an invertebrate pest; and combining the active compound with a pesticide to form a composition for pest control, wherein the pesticide does not bind to a receptor bound by the active compound, and wherein a combined effect of the active compound and the pesticide can include an effect against a target pest that can be greater than the effect of either the active compound alone or the pesticide alone. The compositions further can

include a second active compound capable of binding at least one of the receptors. The active compounds can cooperate to cause a synergistic change in the level of cAMP and/or calcium in the cell line and/or in a target pest. The combined effect of the active compound and the pesticide can be synergistic. The combined effect can be determined by at least one condition selected from the group consisting of: killing, knockdown, repellency, interference with reproduction, interference with feeding, and interference with a stage of a life cycle of the target pest.

**[0017]** Also provided are further methods of pest control, including, providing a composition including at a first and a second active ingredient, wherein the first active ingredient interacts with a receptor of a target pest, and wherein the second active ingredient can be a pesticide that does not interact with the receptor of the first active ingredient; and contacting the pest with the compositions, wherein the contacting results in synergistic pest control. The compositions further can include a third active ingredient, wherein the third active ingredient interacts with a receptor of the target pest, and wherein at least the first and third active ingredients in combination synergistically interact to permit control of the target pest. The first and third active ingredients can optionally bind the same receptor; in other embodiments, the first and third active ingredients do not bind the same receptor. The first, second, and third active ingredients in combination can have a synergistic effect that can be greater than the effect of any single ingredient and can be also greater than the synergistic effect of the first and third ingredients in combination. The receptor can be a GPCR such as, for example, a tyramine receptor, an olfactory receptor Or43a, and an olfactory receptor Or83b. The pest control can be associated with a receptor-activated alteration in a level of cAMP and/or calcium within the pest. The alteration can persist for at least about 60 seconds.

**[0018]** Also provided are other methods of pest control, including: providing a composition including at least two active ingredients, wherein at least one active ingredient interacts with a GPCR of a target pest, the composition produces a first level of at least one of intracellular calcium and cyclic AMP in a cell expressing the GPCR on exposure to the cell, and the first level can be higher than a second level produced when the cell can be contacted with any single active ingredient; and contacting the pest with the compositions, wherein the contacting results in synergistic pest control. Other embodiments provide methods for controlling a target pest including use of a pest control compositions, the compositions including a pest control product and at least one active agent, wherein: the active agent can include a ligand of a GPCR of a target pest, wherein binding of the ligand to the GPCR causes a change in a level of cAMP or calcium that permits control of the target pest; the pest control product can have a first activity against the target pest, the active agent can have a second activity against the target pest, and the compositions can have a third activity against the target pest; and the third activity can be greater than the first activity or the second activity. A further method of pest control can include use of a pest control composition, wherein the composition can include at least two active ingredients, wherein at least one active ingredient interacts with a G protein-coupled receptor (GPCR) of the pest and wherein at least one active ingredient does not interact with the GPCR, and wherein the at least two active ingredients in combination have a synergistic pest-control activity. Other methods of pest control can permit low-resistance in a target pest, including administering a pest-control composition, the composition including at least a first active ingredient and a second active ingredient, wherein the first active ingredient interacts with a first molecular target under genetic control within a selected pest, and wherein the second active ingredient interacts with a second molecular target under genetic control within the selected pest, and wherein the

ingredients in the composition act together in a complementary manner upon the target pest, and wherein resistance to the composition in an individual target pest requires two separate genetic lesions divergent from a non-resistant population of the pest.

**[0019]** Still other embodiments provide pest control compositions exemplified by the following: in combination, a blend of lilac flower oil (LFO), d-limonene, thyme oil, and further including a pesticide. The pesticide can be, for example, clothianidin. The blend can include 10-80% LFO, 5-60% d-limonene, and 10-80% thyme oil. In other embodiments, the blend can include 20-60% LFO, 10-45% d-limonene, and 20-60% thyme oil. In other embodiments, blend can include 42.6% w/w LFO, 27.35% w/w d-limonene, and 30.08% w/w thyme oil white.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0020]** Figure 1 shows a screening method using a transfected cell lines expressing a receptor of interest, for example, a biogenic amine receptor, such as, a TyR or an octopamine receptor;

**[0021]** Figure 2 shows the binding of a ligand to a biogenic amine receptor, resulting in downstream signaling affecting certain physiological responses;

**[0022]** Figure 3 shows an insect control chemical, deltamethrin (DM), affecting downstream signaling;

**[0023]** Figure 4A shows a pesticidal effect against *Aedes aegypti* caused by 1) a test composition; 2) clothianidin; and 3) a combination of a test composition and clothianidin;

**[0024]** Figure 4B shows a pesticidal effect against *Aedes aegypti* caused by 1) a test composition; 2) clothianidin; and 3) a combination of a test composition and clothianidin;

[0025] Figure 4C shows a pesticidal effect against *Aedes aegypti* caused by 1) a test composition; 2) imidacloprid; and 3) a combination of a test composition and imidacloprid;

[0026] Figure 4D shows a pesticidal effect against *Drosophila sp.* caused by 1) a test composition; 2) imidacloprid; and 3) a combination of a test composition and imidacloprid;

[0027] Figure 5 shows a pesticidal effect against *Aedes aegypti* caused by 1) a test composition; 2) imidacloprid; and 3) a combination of a test composition and imidacloprid;

[0028] Figure 6A shows a pesticidal effect against *Periplaneta americana* caused by 1) a test composition; 2) clothianidin; and 3) a combination of a test composition and clothianidin;

[0029] Figure 6B shows a pesticidal effect against *Periplaneta americana* caused by 1) a test composition; 2) imidacloprid; and 3) a combination of a test composition and imidacloprid;

[0030] Figure 7 shows a pesticidal effect against bed bugs caused by 1) a test composition; 2) pyrethrum; and 3) a combination of a test composition and pyrethrum;

[0031] Figure 8A shows the nucleic acid sequence and the peptide sequence of a Tyramine receptor;

[0032] Figure 8B shows the nucleic acid sequence and the peptide sequence of a Tyramine receptor;

[0033] Figure 9 shows fluorescence intensity curves corresponding to intracellular calcium ion concentrations, with the curve corresponding to the composition containing the mixture of imidacloprid and thyme oil indicated by triangles, the curve corresponding to the composition containing the thyme oil alone indicated by circles, and the curve corresponding to the composition containing imidacloprid alone indicated by squares;

[0034] Figure 10 shows fluorescence intensity curves corresponding to intracellular calcium ion concentrations, with the curve corresponding to the composition containing the mixture of fluoxastrobin and thyme oil indicated by triangles, the curve corresponding to the composition containing the thyme oil alone indicated by squares, and the curve corresponding to the composition containing fluoxastrobin alone indicated by circles.

#### DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0035] Many previously known and commercialized products having sufficient pesticidal activity to be useful also have toxic or deleterious effects on mammals, fish, fowl, or other non-target species. For example, common insecticides such as organophosphorus compounds and carbamates inhibit the activity of acetylcholinesterase in all classes of animals. Chlordimeform and related formamidines are known to act on insect octopamine receptors, but have been removed from the market because of cardiotoxic potential in vertebrates and carcinogenicity in animals and a varied effect on different insects.

[0036] However, the deleterious effects of many pesticides can be mitigated by reducing the amount of pesticide that can be applied to a given area to achieve the desired result. This reduction can be achieved by combining the pesticidal compound or product with selected active ingredients. These active ingredients can comprise, for example, plant essential oils, and the like. Combinations of selected active ingredients with selected pesticidal compounds or products can reduce the concentration of pesticide needed to achieve a net efficiency, and extend the useful life of existing synthetic pesticides.

[0037] The details of one or more embodiments of the invention are provided. Modifications to embodiments described in this document, and other embodiments, will be evident to those of ordinary skill in the art after a study of the information provided in this

document. The information provided in this document, and particularly the specific details of the described exemplary embodiments, is provided primarily for clearness of understanding and no unnecessary limitations are to be understood therefrom.

**[0038]** Embodiments of the invention are directed to methods of screening compositions for pest-control potential, compositions for controlling pests, and methods for using these compositions.

**[0039]** As used herein, “pests” can mean any organism whose existence it can be desirable to control. Pests can include, for example, bacteria, cestodes, fungi, insects, nematodes, parasites, plants, and the like.

**[0040]** As used herein, “pesticidal” can mean, for example, antibacterial, antifungal, antiparasitic, herbicidal, insecticidal, and the like.

**[0041]** *Screening of compositions*

**[0042]** In some embodiments of the invention, the screening method for pest control potential can target a molecule of an insect olfactory receptor protein. In some embodiments of the invention, the screening method for pest control potential can target an insect olfactory receptor protein. The insect olfactory system includes more than 60 identified olfactory receptors. These receptors are generally members of a large family of G protein coupled receptors (GPCRs).

**[0043]** As used herein, a “receptor” is an entity on the cell membrane or within the cell, cytoplasm, or cell nucleus that can bind to a specific molecule (a ligand), such as, for example, a neurotransmitter, hormone, or the like, and initiates the cellular response to the ligand. Ligand-

induced changes in the behavior of receptor proteins can result in physiological changes that constitute the biological actions of the ligands.

**[0044]** In accordance with the present disclosure, receptors such as G protein-coupled receptors may be classified on the basis of binding affinity of the receptor to an active ingredient. This may also be expressed as the binding affinity of the active ingredient for the receptor. The binding affinity of an active ingredient for a receptor, or the binding affinity of a receptor for an active ingredient, may be measured in accordance with methods disclosed herein or methods known to those of skill in the art. As used in the present disclosure, a "low" affinity indicates that a high concentration of the active ingredient relative to the receptor is required to maximally occupy the binding site of the receptor and trigger a physiological response, while a "high" affinity indicates that a low concentration of the active ingredient relative to the receptor is adequate to maximally occupy the binding site of the receptor and trigger a physiological response. A "high" affinity may correspond to, for example, an active ingredient concentration of two or more orders of magnitude less than the concentration of the receptor that is effective to trigger the physiological response, while a "low" affinity may correspond to an active ingredient concentration of one or more orders of magnitude greater than the concentration of the receptor that is effective to trigger the physiological response.

**[0045]** In *Drosophila melanogaster*, the olfactory receptors are located in two pairs of appendages located on the head of the fly. The family of *Drosophila* chemoreceptors includes approximately 62 odorant receptor (Or) and 68 gustatory receptor (Gr) proteins, encoded by families of approximately 60 Or and 60 Gr genes through alternative splicing. Some of these receptor proteins have been functionally characterized, while others have been identified by

sequence homology to other sequences but have not been fully characterized. Other insects have similar olfactory receptor proteins.

**[0046]** In certain embodiments, the insect olfactory receptor protein targeted by the screening or insect control method of the invention is the tyramine receptor (TyR). In additional embodiments, the insect olfactory receptor protein is the insect olfactory receptor protein Or83b or Or43a. In additional embodiments, the targeted protein can be any of the insect olfactory protein receptors.

**[0047]** Additionally, other components of the insect olfactory receptor cascade can be targeted using the method of the invention in order to identify useful insect control compounds. Exemplary insect olfactory cascade components that can be targeted by methods of the invention include but are not limited to serotonin receptor, Or22a, Or22b, Gr5a, Gr21a, Gr61a,  $\beta$ -arrestin receptor, GRK2 receptor, and tyramine  $\beta$ -hydroxylase receptor, and the like.

**[0048]** With reference to Figure 1, an exemplary screening method for identifying effective pestcontrol compositions can make use of one or more transfected cell lines expressing a receptor of interest, for example, a biogenic amine receptor, such as, a TyR or an octopamine receptor.

**[0049]** In some embodiments of the invention, isolated cell membranes expressing the receptor of interest can be used in competitive binding assays. Whole cells can be used to study changes in signaling down-stream to the receptor, in response to treatment with a test composition.

**[0050]** Embodiments of the invention can utilize prokaryotic and eukaryotic cells including, for example, bacterial cells, yeast cells, fungal cells, insect cells, nematode cells, plant

cells, animal cells, and the like. Suitable animal cells can include, for example, HEK cells, HeLa cells, COS cells, U20S cells, CHO-K1 cells, various primary mammalian cells, and the like. An animal model expressing one or more conjugates of an arrestin and a marker molecule, for example, throughout its tissues, within a particular organ or tissue type, or the like, can be used.

**[0051]** The potential for insect control activity can be identified by measuring the affinity of the test compositions for the receptor in the cell lines expressing a TyrR, Or83b, and/or Or43a. The potential for insect control activity can also be identified by measuring the change in intracellular cAMP and/or  $\text{Ca}^{2+}$  in the cell lines expressing TyrR, Or83b, and/or Or43a following treatment with the test compositions. The gene sequences of the TyrR, the Or 83b receptor and the Or 43a receptor have substantial similarity between various insect species. As such, the *Drosophila* Schneider cell lines expressing these receptors can be used to screen for compositions having insect control activity in various insect species.

**[0052]** In some embodiments, a method of selecting a composition for pesticidal use can include the following. A cell expressing a TyR is provided and is contacted with test compounds. The receptor binding affinity of the compounds is measured. At least one parameter selected from the following parameters is measured: intracellular cAMP level, and intracellular  $\text{Ca}^{2+}$  level. A first compound for the composition is identified, that is capable of altering at least one of the parameters, and that has a high receptor binding affinity for the TyR; and a second compound for the composition is identified, that is capable of altering at least one of the parameters, and that has a low receptor binding affinity for the TyR. A composition is selected that includes the first and second compounds. In some embodiments, a composition is selected that includes the first and second compounds and demonstrates an anti-parasitic effect that exceeds the anti-parasitic effect of any of the compounds when used alone.

**[0053]** In some embodiments of the invention, the cell used can be any cell capable of being transfected with and express a TyrR. Examples of cells include, but are not limited to: insect cells, such as *Drosophila* Schneider cells, *Drosophila* Schneider 2 cells (S2 cells), and *Spodoptera frugiperda* cells (e.g., Sf9 or Sf21); or mammalian cells, such as Human Embryonic Kidney cells (HEK-293 cells), African green monkey kidney fibroblast cells (COS-7 cells), HeLa Cells, and Human Keratinocyte cells (HaCaT cells).

**[0054]** The TyrR can be a full-length TyrR, a functional fragment of a TyrR, or a functional variant of a TyrR. A functional fragment of a TyrR is a TyrR in which amino acid residues are deleted as compared to the reference polypeptide, i.e., full-length TyrR, but where the remaining amino acid sequence retains the binding affinity of the reference polypeptide for tyramine. A functional variant of a TyrR is a TyrR with amino acid insertions, amino acid deletions, or conservative amino acid substitutions, that retains the binding affinity of the reference polypeptide for tyramine. A “conservative amino acid substitution” is a substitution of an amino acid residue with a functionally similar residue. Examples of conservative substitutions can include, for example, the substitution of one non-polar (hydrophobic) residue such as isoleucine, valine, leucine or methionine for another; the substitution of one polar (hydrophilic) residue for another such as between arginine and lysine, between glutamine and asparagine, between glycine and serine; the substitution of one basic residue such as lysine, arginine or histidine for another; the substitution of one acidic residue, such as aspartic acid or glutamic acid for another, and the like. A conservative amino acid substitution can also include replacing a residue with a chemically derivatized residue, provided that the resulting polypeptide retains the binding affinity of the reference polypeptide for tyramine. Examples of TyrRs can include, for example: TyrRs, such as, *Drosophila melanogaster* TyrR (GENBANK® accession

number (GAN) CAA38565), *Locusta migratoria* TyrR (GAN: Q25321), TyrRs of other invertebrates, TyrRs of nematodes, and the like.

**[0055]** Exemplary screening methods can include “positive” screening, where, for example, compositions that bind a receptor of interest are selected. Exemplary screening methods can include “negative” screening, where, for example, compositions that bind a receptor of interest are rejected. An exemplary method can include: selecting a composition that binds a TyR. Another exemplary method can include: selecting a composition that binds a TyRand does not bind an octopamine receptor.

**[0056]** In some embodiments of the invention, the efficacy of a test composition can be determined by conducting studies with insects. For example, the efficacy of a test composition for repelling an insect can be studied using controlled experiments wherein insects are exposed to the test composition. In some embodiments, the toxicity of a test composition against an insect can be studied using controlled experiments wherein insects are exposed to the test composition.

**[0057]** Methods of screening compositions for insect control activity are set forth in the following applications, each of which is incorporated in its entirety herein by reference: U.S. Application 10/832,022, entitled COMPOSITIONS AND METHODS FOR CONTROLLING INSECTS; U.S. Application 11/086,615, entitled COMPOSITIONS AND METHODS FOR CONTROLLING INSECTS RELATED TO THE OCTOPAMINE RECEPTOR; U.S. Application 11/365,426, entitled COMPOSITIONS AND METHODS FOR CONTROLLING INSECTS INVOLVING THE TYRAMINE RECEPTOR; and U.S. Application 11/870,385, entitled COMPOSITIONS AND METHODS FOR CONTROLLING INSECTS.

**[0058]** Compositions for pest control

**[0059]** Embodiments of the invention can include a composition for controlling pests.

Embodiments of the invention that include a composition for controlling pests can include an pest control chemical or product. Embodiments of the invention that include a composition for controlling pests can include an active agent.

**[0060]** In embodiments of the invention that include an active agent, the active agent can be, for example, an agent that can have a biogocal impact on an insect, such as, for example, a chemical, a compound, or the like. In embodiments of the invention that include an active agent, the active agent can be, for example, one or more plant essential oils, or the like. The plant essential oils, when combined, can have a synergistic effect. Embodiments can also can include a fixed oil, which is typically a non-volatile, non-scented plant oil. Additionally, in some embodiments, these compositions can be made up of generally regarded as safe (GRAS) compounds.

**[0061]** In embodiments of the invention that include at least one pest control chemical, the at least one pest control chemical can be selected from, for example, the pest control chemicals set forth in Table 1, or the like.

**TABLE 1: PEST CONTROL CHEMICALS**

Pest Control Chemical	CAS Registry Number
ABAMECTIN	71751-41-2
ACEPHATE	30560-19-1
ACETAMIPRID	135410-20-7
ACETOCHLOR	34256-82-1
ACEQUINOCYL	57960-19-7
ACIBENZOLAR-S-METHYL	

<b><u>TABLE 1: PEST CONTROL CHEMICALS</u></b>	
<b>Pest Control Chemical</b>	<b>CAS Registry Number</b>
ALACHLOR	15972-60-8
ALDICARB	116-06-3
ALDIMORPH	
ALLETHRIN	584-79-2
AMISULBROM	
AMITRAZ	33089-61-1
ANILAZINE	
AZACONAZOLE	
AZOXYSTROBIN	
BIFENTHRIN	82657-04-3
BENALAXYL	
BENDIOCARB	22781-23-3
BENTHIAVALICARB	
BENODANIL	
BENOMYL	
BIFENTHRIN	82657-04-3
BINAPACRYL	
BIORESMETHRIN	28434-01-7
BIPHENYL	
BITERTANOL	
BLASTICIDIN-S	
BOSCALID	

<b><u>TABLE 1: PEST CONTROL CHEMICALS</u></b>	
<b>Pest Control Chemical</b>	<b>CAS Registry Number</b>
BROMUCONAZOLE	
BUPIRIMATE	
CAPTAFOL	
CAPTAN	
CARBENDAZIM	1563-66-2
CARBOFURAN	
CARBARYL	63-25-2
CARBENDAZIM	
CARBOXIN	
CARPROPAMID	
CHLORDIMEFORM	6164-98-3
CHLORFENVINFOS	470-90-6
CHLORONEB	
CHLOROTHALONIL	1897-45-6
CHLOROXURON	1982-47-4
CHLORPYRIFOS	2921-88-2
CHLOZOLINATE	
CLOTHIANIDIN	
COPPER (DIFFERENT SALTS)	
COPPER FUNGICIDES	
CYAZOFAMID	
CYCLOPROPANECARBOXYLIC ACID, 2,2-	39515-40-7

**TABLE 1: PEST CONTROL CHEMICALS**

Pest Control Chemical	CAS Registry Number
DIMETHYL-3-(2-METHYL-1-PROPYNYL)-, CYANO(3-PHOXYPHENYL)METHYL ESTER	
CYFLUFENAMID	
CYFLUTHRIN	68359-37-5
CYHALOPOP BUTYL	122008-85-9
CYHALOTHRIN K	91465-08-6
CYHALOTHRIN ( $\lambda$ )	
CYMOXANIL	
CYPERMETHRIN	52315-07-8
CYPROCONAZOLE	
CYPRODINIL	
CYROMAZINE	66215-27-8
D-TRANS-ALLETHRIN	28057-48-9
DELTAMETHRIN (DECA-)	52918-63-5
DIAFENTHIURON	80060-09-0
DIAZINON	333-41-5
DICHLOFENTHION	97-17-6
DICHLOFLUANID	
DICLOCYMET	
DICLOMEZINE	
DICLORAN	

<b><u>TABLE 1: PEST CONTROL CHEMICALS</u></b>	
<b>Pest Control Chemical</b>	<b>CAS Registry Number</b>
DIFENOCONAZOLE	
DIETHOFENCARB	
DIFLUBENZURON	35367-38-5
DIFLUMETORIM	
DIFENOCONAZOLE	
DIMETHIRIMOL	
DIMETHOATE	60-51-5
DIMETHOMORPH	
DIMOXYSTROBIN	
DINICONAZOLE	
DINOCAP	
DISULFOTON	298-04-4
DITHIANON	
DODEMORPH	
DODINE	
EDFINPHOS	
ENDOSULFAN	115-29-7
ENEESTROBIN	
EPOXICONAZOLE	
ESFENVALERATE	66230-04-4
ETHABOXAM	
ETHIRIMOL	

<b><u>TABLE 1: PEST CONTROL CHEMICALS</u></b>	
<b>Pest Control Chemical</b>	<b>CAS Registry Number</b>
ETRIDIAZOLE	
FAMOXADONE	
FENBUCONAZOLE	
FENFURAM	
FENITROTHION	122-14-5
FENOXYCARB	72490-01-8
ENPROPATHRIN	39515-41-8
FENAMIDONE	
FENARIMOL	
FENHEXAMID	
FENOXANIL	
FENPICLONIL	
FENPROPIDIN	
FENPROPIMORPH	
FENTIN ACETATE	
FENTIN CHLORIDE	
FENTIN HYDROXIDE	
FENVALERATE	51630-58-1
FERBAM	
FERIMZONE	
FIPRONIL	120068-37-3
FLUAZINAM	

**TABLE 1: PEST CONTROL CHEMICALS**

Pest Control Chemical	CAS Registry Number
FLUDIOXONIL	
FLUMORPH	
FLUSILAZOLE	
FLUSULFAMIDE	
FLUTRIAFOL	
FLUOPICOLIDE	
FLUOXASTROBIN	
FLUQUINCONAZOLE	
FLUTOLANIL	
FOSETYL-AL	
FOLPET	
FTHALIDE	
FUBERIDAZOLE	
FURAMETPYR	
FURALAXYL	
GUAZATINE	
HEXACONAZOLE	
HYDRAMETHYLNON	67485-29-4
HYMEXAZOLE	
IMAZALIL	
IMIBENCONAZOLE	
IMIDACLOPRID	105827-78-9

**TABLE 1: PEST CONTROL CHEMICALS**

<b>Pest Control Chemical</b>	<b>CAS Registry Number</b>
IMINOCTADINE	
INDOXACARB	
IODOCARB	
IPCONAZOLE	
IPROBENFOS (IBP)	
IPRODINE	
ISOPROTHIOLANE	
ISOTIANIL	
KASUGAMYCIN	
KRESOXIM-METHYL	
LAMBDA-CYHALOTHRIN	91465-08-6
LUFENURON	103055-07-8
MALATHION	121-75-5
MANCOZEB	
MANDIPROPAMID	
MANEB	
MEPANIPYRIM	
MEPRONIL	
METALAXYL	
METALAXYL-M (=MEFENOXM)	
METCONAZOLE	
METHIDATHION	950-37-8

**TABLE 1: PEST CONTROL CHEMICALS**

Pest Control Chemical	CAS Registry Number
METHAMIDAPHOS (O,S-Dimethylphosphoramidothiolate)	10265-92-6
METHASULFOCARB	
METHOMYL	16752-77-5
METHYL PARATHION	298-00-0
METIRAM	
METOMINOSTROBIN	
METRAFENONE	
MINERAL OILS, ORGANIC OILS, POTASSIUM BICARBONATE, MATERIAL OF BIOLOGICAL ORIGIN	
MYCLOBUTANIL	
NAFTIFINE	
NALED	300-76-5
NUARIMOL	
OCTHILINONE	
OFURACE	
ORYSASTROBIN	
OXADIXYL	
OXAMYL	23135-22-0
OXOLINIC ACID	
OXPOCONAZOLE	

**TABLE 1: PEST CONTROL CHEMICALS**

Pest Control Chemical	CAS Registry Number
OXYCARBOXIN	
OXYDEMETON METHYL	301-12-2
OXYTETRACYCLINE	
PEFURAZOATE	
PENCONAZOLE	
PENCYCURON	
PENTHIOPYRAD	
PERMETHRIN	52645-53-1
PHENOTHRIN	26002-80-2
PHOPHOROUS ACID AND SALTS	
PHORATE	52645-53-1
PHOSMET	298-02-2
PICOXYSTROBIN	
PIPERALIN	
POLYOXIN	
PRALLETHRIN (ETOC)	23031-36-9
PROBENAZOLE (ALSO ANTIBACTERIAL AND ANTIFUNGAL ACTIVITY)	
PROCHLORAZ	
PROCYMIDONE	
PROFENOFOS	41198-08-7
PROPAMOCARB	

**TABLE 1: PEST CONTROL CHEMICALS**

Pest Control Chemical	CAS Registry Number
PROPICONAZOLE	
PROPINEB	
PROQUINAZID	
PROTHiocarb	
PROTHIOCONAZOLE	
PYRACLOSTROBIN	
PYRAZOPHOS	
PYRETHRUM	8003-34-7
PYRIBUTICARB	
PYRIFENOX	
PYRIMETHANIL	
PYRIBENCARB	
PYROQUILON	
QUINTOZENE (PCNB)	
QUINOXYFEN	
RESMETHRIN	10453-86-8
SILITHIOFAM	
SIMECONAZOLE	
SPINOSAD	131929-60-7
SPIROXAMINE	
STREPTOMYCIN	
SULPHUR	

**TABLE 1: PEST CONTROL CHEMICALS**

<b>Pest Control Chemical</b>	<b>CAS Registry Number</b>
TEBUCONAZOLE	
TEBUFENOZIDE	112410-23-8
TECLOFTHALAM (BACTERICIDE)	
TECNAZENE (TCNB)	
TEFLUTHRIN	79538-32-2
TERBINAFINE	
TETRACONAZOLE	
THIABENDAZOLE	
TIADINIL	
THIFLUZAMIDE	
THIOCYCLAM	31895-21-3
THIODICARB	59669-26-0
THIOPHANATE	
THIOPHANATE-METHYL	
THIAMETHOXAM	153719-23-4
THIRAM	
TOLCLOFOS-METHYL	
TOLYFLUANID	
TRALOMETHRIN	66841-25-6
TRIADIMEFON	
TRIADIMENOL	
TRIAZOXIDE	

<b><u>TABLE 1: PEST CONTROL CHEMICALS</u></b>	
<b>Pest Control Chemical</b>	<b>CAS Registry Number</b>
TRICYCLAZOLE	
TRIDEMORPH	
TRIFLOXYSTROBIN	
TRIFLUMIZOLE	
TRIFORINE	
TRITICONAZOLE	
VALIDAMYCIN	
VALIPHENAL	
VINCLOZOLIN	
N,N-DIETHYL-3-METHYLBENZAMIDE (DEET)	134-62-3
ZINEB	
ZIRAM	
ZOXAMIDE	

**[0062]** Embodiments of the invention can include compounds such as, for example, abamectin, allethrin, citronella oil, IR3535® (3-[*N*-butyl-*N*-acetyl]-aminopropionic acid ethyl ester), methyl nonyl ketone, metofluthrin, neem oil, nepetalactone, oil of lemon eucalyptus, permethrin, picaridin, p-menthane 3, 8 diol, and the like.

**[0063]** Embodiments of the present invention can include at least one insect control chemical, and at least one compound of a plant origin, or at least one blend of compounds of a plant origin. With reference to Figure 2, compounds of plant origin, such as plant essential oils,

can bind certain biogenic amine receptors, resulting in downstream signaling affecting certain physiological responses. With reference to Figure 3, insect control chemicals, such as deltamethrin (DM), can also affect downstream signaling. As depicted in Figures 2 and 3, the compounds or blends of plant origin and the insect control chemicals activate signaling in different manners.

**[0064]** In embodiments that include an insect control chemical, the insect control chemical can include, for example, any insect control chemical from the classes listed in the following table:

TABLE 2: CLASSIFICATION OF INSECT CONTROL COMPOSITIONS				
Group	Subgroup	Primary target site of action	Chemical subgroup or exemplifying active ingredient	Active ingredients
1*	1A	Acetylcholine esterase inhibitors	Carbamates	Aldicarb Bendiocarb Carbaryl Carbofuran Methiocarb Methomyl Oxamyl Propoxur Thiodicarb
	1B			Acephate Azinphos-methyl Chlorpyrifos Chlorpyrifos-methyl Coumaphos Diazinon Dichlorvos

				Dicrotophos
				Dimethoate
				Disulfoton
				Ethoprop
				Fenamiphos
				Fenthion
				Isofenphos
				Malathion
				Methamidophos
				Methidathion
				Methyl parathion
				Naled
				Oxydemeton-methyl
				Phorate
				Profenofos
				Propetamphos
				Temephos
				Terbufos
				Tetrachlorvinphos
				Trichlorfon
2*	2A	GABA-gated chloride channel antagonists	Cyclodiene organochlorines	Endosulfan
	2B		Fipronil (phenylpyrazoles)	Lindane
3		Sodium channel modulators	Pyrethroids	Fipronil
				Allethrin
				d-cis-trans Allethrin
				d-trans Allethrin
				Bifenthrin
				Bioallethrin S-cyclopentenyl
				Cyfluthrin
				Beta-Cyfluthrin
				Cypermethrin

				zeta-Cypermethrin
				Cyphenothrin [(1R)-trans-isomers]
				Deltamethrin
				Esfenvalerate
				Fenpropathrin
				Fenvalerate
				Imiprothrin
				Permethrin
				Phenothrin [(1R)-trans-isomer]
				Prallethrin
				Resmethrin
				Tefluthrin
				Tetramethrin
				Tralomethrin
			Pyrethrins	Pyrethrins (pyrethrum)
			Methoxychlor	Methoxychlor
4*	4A	Nicotinic acetylcholine receptor agonists/antagonists	Neonicotinoids	Acetamiprid
	4B			Imidacloprid
6		Chloride channel activators	Avermectins, Milbemycins	Thiamethoxam
				Nicotine
7*	7A	Juvenile hormone mimics	Juvenile hormone analogues	Nicotine
	7B			Hydroprene
8*	8A	Compounds of unknown or non-specific mode of action (fumigants)	Methyl bromide	Kinoprene
	8B			Methoprene
	8C		Fenoxy carb	Fenoxy carb
				Methyl bromide and other alkyl halides
				Chloropicrin
				Sulfuryl fluoride
				Sulfuryl fluoride

9*	9A	Compounds of unknown or non-specific mode of action (selective feeding blockers)	Cryolite	Cryolite
10*	10A	Compounds of unknown or non-specific mode of action (mite growth inhibitors)	Clofentezine	Clofentezine
	10B		Hexythiazox	Hexythiazox
			Etoxazole	Etoxazole
11*	11A1	Microbial disruptors of insect midgut membranes (includes transgenic crops expressing <i>B.t.</i> toxins)	<i>B.t.</i> var. <i>israelensis</i>	<i>B.t.</i> var. <i>israelensis</i>
	11B1		<i>B.t.</i> var. <i>aizawai</i>	<i>B.t.</i> var. <i>aizawai</i>
	11B2		<i>B.t.</i> var. <i>kurstaki</i>	<i>B.t.</i> var. <i>kurstaki</i>
12*	12B	Inhibitors of oxidative phosphorylation, disruptors of ATP formation (inhibitors of ATP synthase)	Organotin miticides	Fentutatin oxide
	12C		Propargite	Propargite
15		Inhibitors of chitin biosynthesis, type 0, Lepidopteran	Benzoylureas	Diflubenzuron
17		Moult disruptor, Dipteron		Hexaflumuron
				Novaluron
18*	18A	Ecdysone agonists/moult disruptors	Diacylhydrazines	Halofenozide
	18B			Methoxyfenozide
				Tebufenozide
19		Octopaminergic agonists	Amitraz	Amitraz
20*	20A	Mitochondrial complex III electron transport inhibitors (Coupling site II)	Hydramethylnon	Hydramethylnon
21		Mitochondrial complex I electron transport inhibitors	METI acaricides, Rotenone	Rotenone
22		Voltage-dependent sodium channel blockers	Indoxacarb	Indoxacarb
24*	24A	Mitochondrial complex IV electron transport inhibitors	Aluminum phosphide	Aluminum phosphide
	24C		Phosphine	Phosphine
25		Neuronal inhibitors (unknown mode of action)	Bifenazate	Bifenazate
27*	27A	Synergists	P450 monooxygenase inhibitors	Piperonyl butoxide

UN	UNC	Compounds with unknown mode of action**	Dicofol	Dicofol
	UND		Pyridalyl	Pyridalyl
NS	NSA	Miscellaneous non-specific (multi-site) inhibitors <sup>†</sup>	Borax	Borax

**[0065]** In some embodiments of the invention, the insect control chemical can include at least one of, for example, an organophosphate compound, a carbamate compound, a carbazate compound, a neonicotinoid compound, an organochlorine compound, an organotin compound, an oxadiazine compound, a pyridazinone compound, a pyrethroid, a tetrazine compound, or the like.

**[0066]** In embodiments of the invention that include at least one organophosphate compound, the organophosphate compound can be, for example, azinphos-methyl, chlorpyrifos, diazinon, dimethoate, methidathion, phosmet, or the like.

**[0067]** In embodiments of the invention that include at least one carbamate compound, the carbamate compound can be, for example, methomyl, oxamyl, carbaryl, formetanate, hexythiazox, or the like.

**[0068]** In embodiments of the invention that include at least one carbazate compound, the carbazate compound can be, for example, bifenazate, or the like.

**[0069]** In embodiments of the invention that include at least one neonicotinoid compound, the neonicotinoid compound can be acetamiprid, imidacloprid, thiacloprid, thiomethoxam, or the like.

**[0070]** In embodiments of the invention that include at least one organochlorine compound, the organochlorine compound can be, for example, endosulfan, dicofol, or the like.

**[0071]** In embodiments of the invention that include at least one organotin compound, the organotin compound can be, for example, hexakis, or the like.

**[0072]** In embodiments of the invention that include at least one oxadiazine compound, the oxadiazine compound can be, for example, indoxacarb, or the like.

**[0073]** In embodiments of the invention that include at least one pyridazinone compound, the pyridazinone compound can be, for example, pyridaben, or the like.

**[0074]** In embodiments of the invention that include at least one pyrethroid, the pyrethroid can be, for example, esfenvalerate, fenpropathrin, permethrin, or the like.

**[0075]** In embodiments of the invention that include at least one tetrazine compound, the tetrazine compound can be, for example, clofentezine, or the like.

**[0076]** Embodiments of the invention can include at least one insect control product; and at least one compound of a plant origin, or at least one blend of compounds of a plant origin. The at least one insect control product can be selected from, for example, the insect control products set forth in Table 4, or the like.

<b><u>TABLE 3: INSECT CONTROL PRODUCTS</u></b>		
<b>Brand Name</b>	<b>Generic name</b>	<b>Classification</b>
ARCHER 50 WP	NICLOSAMIDE	
2,4 - D AMINE 6 LBS/USG	2,4-D AMINE	CHLOROPHENOXY COMPOUND
2,4-D AMINE 3.34 LBS/USG	2,4-D AMINE	CHLOROPHENOXY COMPOUND
2,4-D AMINE EC	2,4-D AMINE	CHLOROPHENOXY COMPOUND
2,4-D ESTER	2,4-D IBE	CHLOROPHENOXY COMPOUND
2,4-D ESTER	2,4-D IBE	CHLOROPHENOXY COMPOUND

2,4-D ESTER	2,4-D IBE	CHLOROPHENOXY COMPOUND
2,4-D ESTER	2,4-D IBE	CHLOROPHENOXY COMPOUND
2,4-D ESTER	2,4-D IBE	CHLOROPHENOXY COMPOUND
2,4-D GRANULES	2,4-D IBE	CHLOROPHENOXY COMPOUND
2,4-D GRANULES	2,4-D IBE	CHLOROPHENOXY COMPOUND
5 Star GENERAL	ISOPROTHIOLANE	
ABATE 500 E	TEBUFENOZIDE	
ABATE SG	TEMEPHOS	
Access 2,4-d ESTER	2,4-D IBE	CHLOROPHENOXY COMPOUND
ACETAM 75 SP	ACEPHATE	ORGANOPHOSPHATE
ACROBAT 50 WP	DIMETHOMORPH	
ACROBAT MZ	DIMETHOMORPH + MANCOZEB	
ACTARA 25 WG	THIABENDAZOLE+0- PHENOL	
ACTELLIC 25 EC	PIPEROPHOS + 2,4-D IBE	
ACTIVO 22 SC	ANILOFOS+ETHOYSUL FRON	
ADER 5 EC	CYPERMETHRIN	PYRETHROID
ADMIRE 5 WP	IMAZAQUIN	
ADVANCE EC	BUTACHLOR + PROPANIL	MISCELLANEOUS
ADVANTAGE 5 G	CARBOFURAN	CARBAMATE
ADVANTAGE 5 G	CARBOFURAN	CARBAMATE
AFALON 50 WP	LINDANE	
AGRI MEK 1.8 EC	AVERMECTIN	CHLORIDE CHANNEL ACTIVATOR
AGRICOTE MZ 80 WP	MANCOZEB	DITHIOCARBAMATE

AGRISOL A-150 K	POLYOXYETHYLENE DODECYL ETHER	
AGRISOL A-150K	POLYOXYETHYLENE SORBITAN FATTY ACIDS	
AGRO CYPERMETHRIN 5 EC	CYPERMETHRIN	PYRETHROID
AGROPOINT CARTAP 50 SP	CARTAP HYDROCHLORIDE	
AGROZEB 80 WP	MANCOZEB	DITHIOCARBAMATE
AL-100 TS	SETHOXYDIM	
ALAKDAN 300	BPMC +CHLOPYRIFOS	
ALIETTE 80 WP	FOSETHYL- AL	
ALIETTE 800 WG	FOSETHYL- AL	
ALMIX 20 WP	METRIBUZIN	
AMBUSH 5 EC	CYPERMETHRIN	PYRETHROID
AMDRO ANT BAIT	HEXYTHIAZOX	
AMETREX 80 WP	AMETRYNE	MISCELLANEOUS
AMETREX 80 WP	AMETRYNE	MISCELLANEOUS
AMETRYNE 80 WP	AMETRYNE	MISCELLANEOUS
AMISTAR 25 SC	AZOXYSTROBIN	
AMMO 5 EC	CYPERMETHRIN	PYRETHROID
AMWAY APSA 80	ALKYL ARYL ALKOXYLATE+TALL OIL FATTY AC	
ANCOM BUTACHLOR 60 EC	BUTACHLOR	MISCELLANEOUS
ANCOM CYPERMETHRIN 5 EC	CYPERMETHRIN	PYRETHROID
ANTRACOL 70 WG	PROPICONAZOLE	

ANTRACOL 70 WP	PROPINEB	
ANVIL 5 SC	HALOXYFOP-R-METHYL ESTER	
APACHE 10 G	CADUSAFOS	
APACHE 100 ME	CADUSAFOS	
APACHE 100 ME	CADUSAFOS	
APPLAUD 10 WP	BUPROFESIN	
APRON 35 SD	MCPA	
AQUADIN 25 EC	NICLOSAMIDE	
AQUADIN 70 WP	NICLOSAMIDE	
ARGOLD 10 EC	CINMETHYLIN	
ARGOLD PLUS	CYNMETHYLIN +2,4-D IBE	PYRETHROID
ARIES SUPER METHRIN 5 EC	CYPERMETHRIN	PYRETHROID
ARMOR	THIOPHANATE METHYL	
ARMURE 300 EC	DIFECONAZOLE + PROPICONAZOLE	
ARNIS 2.5 EC	LAMBDA CYHALOTHRIN	PYRETHROID
ARRIVO 5 EC	CYPERMETHRIN	PYRETHROID
ARROW 5 EC	CYPERMETHRIN	PYRETHROID
ASCEND 50 SC	FIPRONIL	
ASSET 48 SL	GLYPHOSATE MONOETHALONAMINE SALT	
ASSURE II EC	PYRIMETHANIL	
ATABRON 5 E	CHLORFLUAZURON	
ATRAMET COMBI 80	AMETRYNE +	MISCELLANEOUS

WP	ATRAZINE	
ATRAZINE 80 WP	ATRAZINE	MISCELLANEOUS
ATTACK 5R	CYPERMETHRIN	PYRETHROID
ATTAIN M-80	MALATHION	ORGANOPHOSPHATE
AVANTEC EC	BUTACHLOR + PROPANIL	MISCELLANEOUS
AVID	AVERMECTIN	CHLORIDE CHANNEL ACTIVATOR
AX 5 EC	CYPERMETHRIN	PYRETHROID
BALEAR 500 SC	CHLOROTHALONIL	CHLORONITRILE
BANKIT	AZOXYSTROBIN	
BANKO 720 SC	CHLOROTHALONIL	MISCELLANEOUS
BANKO 720 SC	CHLOROTHALONIL	MISCELLANEOUS
BANKO 75 WP	CHLOROTHALONIL	MISCELLANEOUS
BANNER 60 EC	BUTACHLOR	MISCELLANEOUS
BANOLE OIL	PARAFFIN OIL	
BANOLE OIL 60	PARAFFINIC MINERAL OIL	
BASAGRAN 48 EC	BENTAZONE	
BASAMID G	DAZOMET	PYRETHROID
BASTA 15 SL	GIBBERRELIC ACID	
BASUDIN 40 WP	DIAZINON	ORGANOPHOSPHATE
BASUDIN 400 EC	DIAZINON	ORGANOPHOSPHATE
BASUDIN 600 EC	DIAZINON	ORGANOPHOSPHATE
BAVISTIN 50 DF	CARBARYL	CARBAMATE
BAYCOR 300 EC	BITERTANOL	
BAYLETON 25 WP	THIOPHANATE METHYL	
BAYLUSCIDE 250 EC	NICLOSAMIDE	

BAYLUSCIDE 50 WP	NICLOSAMIDE ETHANOLAMINE SALT	
BAYLUSCIDE 70 WP	NICLOSAMIDE ETHANOLAMINE SALT	
BAYONET 6% PELLETS	METALDEHYDE	
BAYTHROID 0125 EC	CYFLUTHRIN	Pyrethroid
BAYTHROID 050 EC	CYFLUTHRIN	Pyrethroid
BAZZOKA	CHLORPYFIROS + BPMC	Organophosphate+Carbamate
BELEREX TABLET	GIBBERRELIC ACID	
BELORAN 400 SL	BENZOXONIUM CHLORIDE	
BENLATE 50 WP/OD	BENOMYL	
BENSUL 10 WP	BENSULFURON METHYL	
BERDUGO 50 WP	NICLOSAMIDE ETHANOLAMINE SALT	
BERELEX TABLET	GENERIC NAME	
BIDA 2.5 EC	LAMBACYHALOTHRIN	PYRETHROID
BIFLEX 10 TC	BIFENTHRIN	
BIFLEX 10 TC	BIFENTHRIN	
BIFLEX 2.5 TC	BIFENTHRIN	
BIFLEX TC	BIFENTHRIN	
BIOACT WG	PACLOBUTRAZOL	
BIODAN 3 G	CARBUFORAN	CARBAMATE
BIOZEB	MANCOZEB	DITHiocarbamate
BIOZEB 80 WP	MANCOZEB	DITHiocarbamate
BLADE 60 EC	BUTACHLOR	MISCELLANEOUS

BLINK 275 EC	CHLORPYFIROS + CYPERMETHRIN	ORGANOPHOSPHATE
BLOCKADE 480 SL	BENTAZONE	
BLUE COP 770 WP	COPPER HYDROXIDE	MISCELLANEOUS
BOLT 50 SP	CARTAP	CARBAMATE
BOOST 500 SC	ACIBENZOLAR-S-METHYL	
BOXER 5 EC	CYPERMETHRIN	PYRETHROID
BRAVO 720 FLO	CHLOROTHALONIL	MISCELLANEOUS
BREAK -THRU	POLYCARBOXYLIC ACID	
BRODAN 31.5 EC	CHLORPYFIROS + BPMC	Organophosphate+Carbamate
BROMO GAS	METHOMYL	
BRONCHO	GLYPHOSATE AMMONIUM SALT	
BUGBUSTER 5 EC	CYPERMETHRIN	PYRETHROID
BULLDOZER 50 WP	NICLOSAMIDE	
BULLET 5 EC	CYPERMETHRIN	PYRETHROID
BULL'S EYE INSECTICIDE	CYPERMETHRIN	PYRETHROID
BUMPER 25 EC	PROPICONAZOLE	
BURNDOWN 160 AS	GLYPHOSATE DI-AMMONIUM SALT	
BURNDOWN 160 AS	GLYPHOSATE IPA	
BUSHWHACK 5 EC	CYPERMETHRIN	PYRETHROID
BUTACHLOR 600 EC	BUTACHLOR	MISCELLANEOUS
BUTATAF 60 E	BUTACHLOR	MISCELLANEOUS
CALIBER 70 WP	NICLOSAMIDE	

CALIBER 70 WP	NICLOSAMIDE	
CALIXIN 75 EC	TRICLOPYR	
CAPTAN 50 WP	CAPTAN	MISCELLANEOUS
CAPTAN 50 WP	CAPTAN	MISCELLANEOUS
CAPTURE 5 EC	CYPERMETHRIN	PYRETHROID
CARANCHO 2.5 EC	ETHOFENPROX	
CARBARYL 85 S	CARBARYL	CARBAMATE
CARVIL 50 EC	BPMC	CARBAMATE
CASCADE 10 WDC	FLUFENOXURON	
CELCURE A(P) WOOD PRESERVE	COPPER,CHROME,ARSENIC (CCA)	
CHAKU 2.5 EC	LAMBDA CYHALOTHRIN	
CHAMP DP	COPPER HYDROXIDE	COPPER
CHAMPION WP	CUPRIC HYDROXIDE	COPPER
CHESS 25 WP	PROPINEB	
CHESS 50 WG	PYMETROZINE	
CHIX 2.5 EC	BETACYPERMETHRIN	PYRETHROID
CHLORMITE TC	CHLOROPYFIROS	ORGANOPHOSPHATE
CHOPPER 85 S	CARBARYL	CARBAMATE
CITRUS LUSTER 213	THIABENDAZOLE	
CIVIL 75 WP	CHLOROTHALONIL	MISCELLANEOUS
CLEANFIELD EC	BUTACHLOR+PROPANIL	MISCELLANEOUS
CLEAR OUT 41	GLYPHOSPHATE IPA	
CLEAR OUT 41 PLUS	GLYPHOSPHATE IPA	
CLINCHER 100 EC	CYHALOFOP BUTYL	

COBRA 20 EC	CHLORPYFIROS	ORGANOPHOSPHATE
COMBAT 5 EC	CYPERMETHRIN	PYRETHROID
COMMAND 3 ME	CLOMAZONE	
COMMAND 3 ME	CLOMAZONE	
COMMAND PLUS 600 EC	CLOMAZONE +PROPANIL	
COMPETE 75 SP	ACEPHATE	ORGANOPHOSPHATE
COMPRO 600 EC	CLOMAZONE+PROPANIL	
CONFIDOR 100 SL	IMIDACLOPRID	
CONFIDOR 200 SL	IMIDACLOPRID	
CONTRAZINE 80 WP	ATRAZINE	MISCELLANEOUS
CONTRAZINE 80 WP	ATRAZINE	MISCELLANEOUS
CONTROL 250 EC	NICLOSAMIDE	
CONTROL 70 WP	NICLOSAMIDE ETHANOLAMINE SALT	
CORSAIR 5 EC	PENDIMETHLIN	PYRETHROID
CORSAIR 5 EC	PERMETHRIN	PYRETHROID
COSAVET DF	SULFUR	
COTRIN 5 EC	CYPERMETHRIN	PYRETHROID
COTRIN 5 EC	CYPERMETHRIN	PYRETHROID
COUNTER 10 G	TEMEPHOS	
COZEB 80 WP	MANCOZEB	DITHiocarbamate
CRUSHER 250 EC	NICLOSAMIDE	
CRUSHER 50 WP	NICLOSAMIDE ETHANOLAMINE SALT	
CRUSHER 70 WP	NICLOSAMIDE	
CULTAR 25 SC	OXYFLUORFEN	

CUPRAVIT OB 21	COPPER OXYCHLORIDE	COPPER
CURZATE M FUNGICIDE	MANCOZEB	DITHiocarbamate
CYBEST 5 EC	CYPERMETHRIN	PYRETHROID
CYCLONE 5 EC	CYPERMETHRIN	PYRETHROID
CYMBUSH 5 EC	CYPERMETHRIN	PYRETHROID
CYPER-5	CYPERMETHRIN	PYRETHROID
CYPERMETHRIN 5 EC	CYPERMETHRIN	PYRETHROID
CYPERTHRIN 5 EC	CYPERMETHRIN	PYRETHROID
CYPEX 50 EC	CYPERMETHRIN	PYRETHROID
CYPRO 5 EC	CYPERMETHRIN	PYRETHROID
CYREN 300 EC	CHLORPYFIROS	ORGANOPHOSPHATE
DACINOL 2787 50 WP	CHLOROTHALONIL	MISCELLANEOUS
DACINOL 2787 75 WP	CHLOROTHALONIL	MISCELLANEOUS
DACONIL 720 SC	CHLOROTHALONIL	MISCELLANEOUS
DEADBOL	NICLOSAMIDE	
DECIDE 2.5 EC	DELTAMETHRIN	PYRETHROID
DECIS 1% SC	DELTAMETHRIN	PYRETHROID
DECIS 2.5 EC	DELTAMETHRIN	PYRETHROID
DECIS M 2.5 EC	DELTAMETHRIN	PYRETHROID
DECIS R	DELTAMETHRIN	PYRETHROID
DECIS TAB	DELTAMETHRIN	PYRETHROID
DEFENSA 5 EC	CYPERMETHRIN	PYRETHROID
DEGESCH MAGTOXIN	LUFENURON	
DEGESCH PLATES/STRIPS	MAGNESIUM PHOSPHIDE	

DEGESH PHOSTOXIN	ALUMINUM PHOSPHIDE	RODENTICIDE
DELMARK 2.5 EC	DELTAMETHRIN	PYRETHROID
DETIA GAS EX-B	ALUMINUM PHOSPHIDE	RODENTICIDE
DETIA GAS EX-T	ALUMINUM PHOSPHIDE	RODENTICIDE
DETIA PHOSPHINE PELLETS	ALUMINUM PHOSPHIDE	RODENTICIDE
DIACARB 50 EC	BPMC	CARBAMATE
DIAFURAN 10 G	CARBOFURAN	CARBAMATE
DIAFURAN 3 G	CARBOFURAN	CARBAMATE
DIAFURAN 5 G	CARBOFURAN	CARBAMATE
DIAGRAN 5 G	DIAZINON	ORGANOPHOSPHATE
DIAGRAN 5 G	DIAZINON	ORGANOPHOSPHATE
DIAZINON 40 EC	DIAZINON	ORGANOPHOSPHATE
DIAZINON 60 EC	DIAZINON	ORGANOPHOSPHATE
DIAZINON 60 EC	DIAZINON	ORGANOPHOSPHATE
DIAZINON 60 EC	DIAZINON	ORGANOPHOSPHATE
DIAZINON 600 EC	DIAZINON	ORGANOPHOSPHATE
DIAZOL 40 EC	DIAZINON	ORGANOPHOSPHATE
DIAZOL 40 EC	DIAZINON	ORGANOPHOSPHATE
DIAZOL 60 EC	DIAZINON	ORGANOPHOSPHATE
DIAZOL 60 EC	DIAZINON	ORGANOPHOSPHATE
DICARE 37.5 WG	DIAFENTHIURON + FENOXYCAB	ORGANOPHOSPHATE
DICARZOL 20 SP	FORMETHANATE HCL	
DIMO 50 SP	CARTAP HYDROCHLORIDE	

DIPEL WP	BACILLUS THURINGIENSIS	PLANT ORIGIN
DIPTEREX 95 SP	TRIBUTYLPOLYGLYCO ETHER	
DIREK 800	BUTACHLOR + SAFENER	
DITHANE F-448	MANCOZEB	DITHiocarbamate
DITHANE F-448	MANCOZEB	DITHiocarbamate
DITHANE M-45	MANCOZEB	DITHiocarbamate
DITHANE M-45	MANCOZEB	DITHiocarbamate
DITHANE M-45 WP	MANCOZEB	DITHiocarbamate
DITHANE OS 600	MANCOZEB	DITHiocarbamate
DITHANE OS-600	MANCOZEB	DITHiocarbamate
DIUREX 80 WP	DIURON	UREA
DIUREX 80 WP	DIURON	UREA
DIURON 80 WP	DIURON	UREA
DIURON 80 WP	DIURON	UREA
DMA 3.34 LBS/USG	2,4-D AMINE	CHLOROPHOXY COMPOUND
DRAGO 60 WP	FLUFENACET	
DREXEL DIURON 80 DF	DIURON	UREA
DREXEL MALATHION 57 EC	MALATHION	ORGANOPHOSPHATE
DREXEL SULFA 80 W	SULFUR	
DURSBAN	CHLORPYRIFOS	ORGANOPHOSPHATE
DYNAMEC	AVERMECTIN	CHLORIDE CHANNEL ACTIVATOR
EASY 5 EC	CYPERMETHRIN	PYRETHROID

ELTRA 200 SC	CARBOFURAN	CARBAMATE
EQUATION PRO 52.5 DF	CYMOXANIL + FAMOXADONE	
ERASER 70 EC	BUTACHLOR + PROPANIL	MISCELLANEOUS
ETHREL 10 SL	ETHEPHON	
ETHREL PGR 48%	ETHEPHON	
ETROFOLAN 50 WP	ISAZOFOS	
EXPERT 20 EC	CHLORPYFIROS	ORGANOPHOSPHATE
EXTREME 50 SP	CARTAP HYDROCHLORIDE	
FASTAC 15 WDG	ALPHACYPERMETHRIN	PYRETHROID
FASTAC 250 SC	ALPHACYPERMETHRIN	PYRETHROID
FASTAC R	ALPHACYPERMETHRIN +BPMC	PYRETHROID+CARBAMATE
FENOM D 225 EC	DIAZINON + CYPERMETHRIN	Organophosphate+Pyrethroid
FLASH 5 EC	CYPERMETHRIN	PYRETHROID
FLIP 500 WP	NICLOSAMIDE	
FLIP 700 WP	NICLOSAMIDE ETHANOLAMINE SALT	
FOLICUR 250 EC	SULPHUR	
FOLICUR 430 SC	TEBUCONAZOLE	
FORWARD 700 EC	BUTACHLOR + PROPANIL	MISCELLANEOUS
FROWNCIDE 50 SC	FLUAZINAM	
FRUITONE CPA	CHLOROPHOXY PROPIONIC ACID	
FUJI-ONE 40 EC	ISOPROCARB	
FUMITOXIN	ALUMINUM	RODENTICIDE

	PHOSPHIDE	
FUNGAFLOR 50 L	HYDRAMETHYLNON	
FUNGAFLOR 75 SP	IMAZALIL	
FUNGITOX 70 WP	THIOPHANATE METHYL	
FUNGURAN-OH	COPPER HYDROXIDE	MISCELLANEOUS
FURADAN 10G	CARBARYL	CARBAMATE
FURADAN 3 G	CARBENDAZIM	CARBAMATE
FURADAN 3G	CARBOFURAN	CARBAMATE
FURADAN 5 G	CARBARYL	CARBAMATE
FURADAN 5 G	CARBOFURAN	CARBAMATE
FURUDAN 10 G	CARBOSULFAN	CARBAMATE
FURUDAN 3 G	CARBOSULFAN	CARBAMATE
FURUDAN 5 G	CARBUFORAN	CARBAMATE
GALLANT SUPER	HALOSULFURON METHYL	
GARLON 4	TRICHLOROFON	
GAROTE EC	CHLORPYRIFOS+BPMC	Organophosphate+Carbamate
GAS 250 EC	NICLOSAMIDE	
GAUCHO 70 WS	IMIDACLOPRID	
GEM 2,4-D AMINE	2,4-D AMINE	CHLOROPHOXY COMPOUND
GEM 2,4-D ESTER	2,4-D IBE	CHLOROPHOXY COMPOUND
GEM ATRAZINE	ATRAZINE	MISCELLANEOUS
GEM MALATHION 57 EC	MALATHION	ORGANOPHOSPHATE
GEMTRAK 50 SP	CARTAP HYDROCHLORIDE	
GESAPAX 500 FW	AMETRYNE	MISCELLANEOUS

GESAPAX 80 WP	AMETRYNE	MISCELLANEOUS
GESAPAX COMBI 80 WP	AMETRYNE + ATRAZINE	MISCELLANEOUS
GESAPRIM 80 WP	ATRAZINE	MISCELLANEOUS
GLADIATOR 75 WDG	CHLORPYRIFOS	ORGANOPHOSPHATE
GLYPHOMAX	GLYPHOSATE IPA	
GOAL 24 EC	OXADIAZON	
GOAL 24 EC	OXYFLOURFEN	
GRAMOXONE 20 AS	PARAFINIC MINERAL OIL	
GRASSEDGE	THIOBENCARB	
GRASSEDGE 800 EC	THIOBENCARB + 2,4-D	
GUARDIAN 5 EC	CYPERMETHRIN	PYRETHROID
HALT	BACILLUS THURINGIENSIS	PLANT ORIGIN
HEDONAL LIQ. SL 400	2,4-D AMINE	CHLOROPHOXY COMPOUND
HERBADOX 33 EC	PENDIMETHALIN	
HERBIMAX	PIRIMIPHOS METHYL	
HERCULES 20 EC	TRIADIMEFON	
HI-CONFIL F 75 WP	CHLOROTHALONIL	MISCELLANEOUS
HIDROCOB 77 WP	COPPER HYDROXIDE	MISCELLANEOUS
HINOSAN 300 EC	EDIFENPHOS	Organophosphate
HINOSAN 50 EC	EDIFENPHOS	Organophosphate
HI-PER 5 EC	CYPERMETHRIN	PYRETHROID
HIT 250 EC	NICLOSAMIDE	
HIT WP	NICLOSAMIDE	
HOESTICK	TRIAZOPHOS	

HOPCIDE 50 EC	BPMC	CARBAMATE
HOPCN 50 EC	BPMC	CARBAMATE
HOPKILL 50 EC	BPMC	CARBAMATE
HOSTATHION 20 EC	TRIAZOPHOS	
HYDROX 77 WP	COPPER HYDROXIDE	COPPER
HYDROXIDE SUPER 77 WP	COPPER HYDROXIDE	COPPER
HYDROXIDE SUPER 77 WP	COPPER HYDROXIDE	COPPER
HYTOX 50 WP	MICP	
HYVAR X WEEDKILLER	BROMACIL	
IMAGE 1.5 LC	IMAZALIL	
IMPACT 2.5 EC	DELTAMETHRIN	PYRETHROID
INDAR 2F	FENBUCONAZOLE	ORGANOPHOSPHATE
INDAR 2F	FENBUCONAZOLE	ORGANOPHOSPHATE
INSECT PRO 50 SP	CARTAP HYDOCLORIDE	
INSECT PRO 50 SP	CARTAP HYDOCLORIDE	
INSTAR	CARTAP HYDROCHLORIDE	
INVEST 10 WP	CYCLOSULFAMURON	
IVA DIURON 80 WP	DIURON	MISCELLANEOUS
IVA PYRITILINE 20 PE M/B	CHLORPYFIROS	ORGANOPHOSPHATE
IVAZEB 80 WP	MANCOZEB	DITHIOCARBAMATE
KARATE 2.5 EC	LAMBDA CYHALOTHRI N	PYRETHROID
KARATE w/ ZEON	LAMBDA CYHALOTHRI	PYRETHROID

TECHNOLOGY	N	
KARET 40	MANEB W/ ZINC	
KARMEX WEEDKILLER	DIURON	MISCELLANEOUS
KHOLUSCIDE 70 WP	NICLOSAMIDE ETHANOLAMINE SALT	
KICK 25 EC	NICLOSAMIDE	
KICK 70 WP	NICLOSAMIDE	
KILLER 5 EC	CYPERMETHRIN	PYRETHROID
KILPES 3 EC	FENVALERATE	PYRETHROID
KING 5 EC	CYPERMETHRIN	PYRETHROID
KITAL ATRAZINE	ATRAZINE	MISCELLANEOUS
KITAL MANCOZEB	MANCOZEB	DITHiocarbamate
KITAL STRYKER 5 EC	CYPERMETHRIN	PYRETHROID
KLEEN UP 480 AS	GLYPHOSATE IPA	
KLEN UP 480 AS	GLYPHOSATE IPA	
KLERAT WITH BITREX	BRODIFACOUM	COUMARIN
KLIK 700 EC	BUTACHLOR + PROPANIL	MISCELLANEOUS
KNOCK OUT 5 EC	CYPERMETHRIN	PYRETHROID
KOCIDE 101	CUPRIC HYDROXIDE	MISCELLANEOUS
KOCIDE DF	CUPRIC HYDROXIDE	MISCELLANEOUS
KOCIDE DF 2000	COPPER HYDROXIDE	MISCELLANEOUS
KOP-HYDROXIDE 50 WP	COPPER HYDROXIDE	MISCELLANEOUS
KOTETSU 10 SC	CHLORPHENAPYR	ORGANOPHOSPHATE
KRISS EC	LAMBDA CYHALOTHRI N	PYRETHROID

KUHZAK 25 EC	NICLOSAMIDE	
KUHZAK 70 WP	NICLOSAMIDE	
KUMULUS DF	ELEMENTAL SULFUR	
LANNATE 40 SP	METHIOCARB	
LARVIN 350 FS	THIOBENCARB + 2,4-D IBE	
LATRON B-1956	PHENTHOATE+ BPMC	
LEAD CORP. 2,4-D AMINE	2,4-D AMINE	CHLOROPHENOXY COMPOUND
LEADCORP CARTAP	CARTAP HYDROCHLORIDE	
LEADCORP MALATHION 57 EC	MALATHION	ORGANOPHOSPHATE
LEADMARK 3 EC	FENVALERATE	PYRETHROID
LEADONIL 500 SC	CHLOROTHALONIL	MISCELLANEOUS
LEADREX TC	CHLORPYFIROS	ORGANOPHOSPHATE
LEADTHREL 480 SL	ETHEPON	
LEBAYCID 50 EC	FENTHION	
LECSPRO 44 WP	FENTRAZAMIDE + PROPANIL	PYRETHROID
LENTREK TC	CHLORPYRIFOS	ORGANOPHOSPHATE
LENTREK TC	CHLORPYRIFOS	ORGANOPHOSPHATE
LINDAFOR 75 F	LAMBDA CYHALOTHRI N	ORGANOCHLORINE
LONDAX WP	BENSULFURON METHYL	
LORSBAN 3E	CHLORPYRIFOS	ORGANOPHOSPHATE
LORSBAN 40 EC	CHLORPYRIFOS	ORGANOPHOSPHATE
LUTENSOL A8	ALKYL POLYETHYLENE	

	GLYSOL ETHER	
LUV 2,4-D ESTER	2,4-D IBE	CHLOROPHOXY COMPOUND
LUV MALATHION 57 EC	MALATHION	ORGANOPHOSPHATE
MACHETE 5 G	BUTACHLOR	MISCELLANEOUS
MACHETE EC	BUTACHLOR	MISCELLANEOUS
MACHETE EXPRESS	BUTACHLOR	MISCELLANEOUS
MACHO	BUTACHLOR	MISCELLANEOUS
MAGIK 5% EC	CYPERMETHRIN	PYRETHROID
MAGNUM 5 EC	CYPERMETHRIN	PYRETHROID
MAITHREL 10 PGR	ETHEPON	
MAITHREL 48 PGR	ETHEPON	
MALATHION 57 E PREMIUM	MAGNESSIUM PHOSPHIDE	ORGANOPHOSPHATE
MALATHION 57 EC	MALATHION	ORGANOPHOSPHATE
MALATHION 57 EC	MALATHION	ORGANOPHOSPHATE
MANAGER 80 WP	MANCOZEB	DITHiocarbamate
MANZATE 200 FUNGICIDE	MANCOZEB	DITHiocarbamate
MANZATE 75 DF	MANCOZEB	DITHiocarbamate
MANZEB 80 WP	MIPC	
MARSBYL 85 WP	CARBARYL	CARBAMATE
MARVEL 5 EC	CYPERMETHRIN	PYRETHROID
MASO 70 WP	NICLOSAMIDE	
MASTER 2.5 EC	LAMBDA CYHALOTHRIN	PYRETHROID
MASTRA DIURON 80 WP	DIURON	MISCELLANEOUS
MATADOR 60 SC	METAMIDOPHOS	ORGANOPHOSPHATE

MATCH 050 EC	LINURON	UREA
MATON 5 EC	CYPERMETHRIN	PYRETHROID
MEBROM	METHYL BROMIDE + CHLOROPICRIN	
MEGARIFOS 20 EC	CHLORPYFIROS	ORGANOPHOSPHATE
MEGATHRIN 5 EC	CYPERMETHRIN	PYRETHROID
MELODY DUO	IPRODIONE	
MESUROL 50 WP	METHAMIDOPHOS	
META BAIT	METALDEHYDE	
META BAIT 6% PELLETS	METALAXYL -m + MANCOZEB	
METABROM	METHYL BROMIDE + CHLOROPICRIN	
MICROTHIOL DF	SPINOSAD	
MIMIC 20 F	TEBUCONAZOLE	
MIMIC 20 F	TEBUFENOZIDE	
MINER 50 SP	CARTAP HYDROCHLORIDE	
MIPCIN 50 WP	METSULFURON METHYL + CHLORIMURON ETH	
MIRACLE AMINE	2,4-D AMINE	CHLOROPHOXY COMPOUND
MIRAL 3 G	IPROVALICARB + PROPINEB	
MOCAP 10 G	ETHOPROP	
MODEL 5 EC	CYPERMETHRIN	PYRETHROID
MOLUXIDE 250 EC	NICLOSAMIDE	
MOSPHILAN 3 EC	ACETAMIPRID	
NABU-S	QUIZALOFOP-P-ETHYL	

NEMACUR 10 G	PERMETHRIN + Zn	
NEMACUR 400 EC	PHENAMIPHOS	
NEMATHORIN 10 G	FOZTHIAZATE	
NET 50 WP	NICLOSAMIDE ETHANOLAMINE SALT	
NICLOS M	NICLOSAMIDE	
NISSORUN 5 EC	HEXAFLUMURON	
NOBLITE 60 WG	FENAMIDONE+MANCO ZEB	
NOMINEE 100 SC	BISPYRIBAC SODIUM	
NOMINEE 100 SC	BISPYRIBAC SODIUM	
NORDOX 50 WP	COPPER OXIDE	COPPER
NURELLE D	CHLORPYFIROS + CYPERMETHRIN	ORGANOPHOSPHATE
NUVACRON 300 SCW	Mn-Zn ETHYLENE BISDITHIOCARBAMAT E	
NYDREL 100	ETHEPHON	
NYDREL 480	ETHEPHON	
OCHO 5 WP	CARBARYL	CARBAMATE
OMEGA 45 EC	PRETILACHLOR + FENCLORIM	
ONECIDE 15 EC	FLUAZIFOP-P-BUTYL	
ORTHENE / ACETAM 75 SP	ACEPHATE	ORGANOPHOSPHATE
ORTHENE 75 SP	ACEPHATE	ORGANOPHOSPHATE
OXYCHLOR 85 WP	COPPER OXYCHLORIDE	
PADAN 50 SP	CAPTAN HYDROCHLORIDE	CARBAMATE

PADAN 50 SP	CARTAP HYDROCHLORIDE	
PARAFUNGUS 80 WP	MANCOZEB	DITHIOCARBAMATE
PARAKUHOL 250 EC	NICLOSAMIDE	
PARAPEST D 400 EC	DIAZINON	ORGANOPHOSPHATE
PARAULOD 300 EC	CHLORPYFIROS	ORGANOPHOSPHATE
PARTNER 40 DF	CARFENTRAZONE - ETHYL	
PARTNER 40 DF	CARFENTRAZONE-ETHYL	
PASSPORT 500 SC	CHLOROTHALONIL	MISCELLANEOUS
PENNANT	PHENAMIPHOS	
PERFEK 31.5 EC	CHLORPYRIFOS + BPMC	Organophosphate+Carbamate
PERFEKTHON 40 EC	DIMETHOATE	
PERMIT 10 WP	GLYSOPHATE IPA	
PESTMASTER	CYPERMETHRIN	PYRETHROID
PILARICH 500 G/L FP	CHLOROTHALONIL	MISCELLANEOUS
PILARZEB 80 WP	MANCOZEB	DITHIOCARBAMATE
PIPSET 35 WP	CINOSULFURON + PIPEROPHOS	
PISTOL 50 WP	NICLOSAMIDE ETHANOLAMINE	
PISTOL 50 WP	NICLOSAMIDE ETHANOLAMINE SALT	
PLANTERS MALATHION 57 EC	MALATHION	ORGANOPHOSPHATE
POLIDO 2.5 EC	ETHOFENPROX	
PORSANAIL	METALDEHYDE	
POSSE 200 SC	CARBOSULFAN	CARBAMATE

POWER	GLYPHOSATE IPA	
POWER SUPRATECH	GLYPHOSATE DI-AMMONIUM SALT	
PREDATOR EC	CHLORPYFIROS	ORGANOPHOSPHATE
PREDATOR PLUS	CHLORPYFIROS + CYPERMETHRIN	ORGANOPHOSPHATE
PREKILL 330	PARAQUAT DICHLORIDE	
PREMISE 200 SC	IMIDACLOPRID	
PREMIUM 5 EC	CYPERMETHRIN	PYRETHROID
PREVENT 77 WP	COPPER HYDROXIDE	COPPER
PREVICUR - N	PROFENOFOS	
PROCIN 25 WP	BUFROFESIN	
PROCURE 50 WP	BENOMYL	
PROPLANT	PROPAMOCARB	
PROVADO SUPRA 050 EC	IMIDACLOPRID	
PROVIN 85 WP	CARBARYL	CARBAMATE
PUNISH 5.5 EC	CYPERMETHRIN	PYRETHROID
PYRITILENE 20 PE M/B	CHLOPYFIROS	ORGANOPHOSPHATE
PYTOX 10 EC	PERMETHRIN	PYRETHROID
QUICKPHOS (ROUND TAB)	ALUMINUM PHOSPHIDE	RODENTICIDE
RACUMIN DUST	COUMATETRALYL	
RADISSON MANCOZEB 80 WP	MANCOZEB	DITHiocarbamate
RADOR 262.5 EC	CHLORPYFIROS + BETACYFLUTHRIN	Organophosphate+Pyrethroid
RAFT 800 WG	NICLOSAMIDE	

	ETHANOLAMINE SALT	
RAPIDO 5 EC	CYPERMETHRIN	PYRETHROID
RATKIL ZINC PHOSPHIDE80% BAIT	WARFARIN	
RATOXIN P	TRISILOXANE ALKOXYLATE +ALLYL ETHOXYLA	
RECRUIT II	HEXAACONAZOLE	
REDEEM 80 WP	MANCOZEB	DITHiocarbamate
RED-OUT 80 WP	MANCOZEB	DITHiocarbamate
REGENT 0.3 GR	FIPRONIL	
REV 800 WP	MANCOZEB	DITHiocarbamate
RICESTAR EC	FENOXAPOP P-ETHYL	
RIDOMIL GOLD MZ 68 WP	METALAXYL + MANCOZEB	
RIDOMIL MZ 58 WP	METALAXYL	
RILOF 500 EC	PICLORAM + 2,4-D	
RIPCORD 2.5 EC	CYPERMETHRIN	PYRETHROID
ROBODAX 25 EC	NICLOSAMIDE	
ROGUE EC	BUTACHLOR + 2,4-D	
RONSTAR 25 EC	OXADIARGYL	
RONSTAR 2G	OXADIAZON	
ROUND-UP BIOSORB	GLYPHOSATE ISOPROPYLAMINE SALT	
ROUNDUP EW	GLYPHOSATE IPA	
ROUND-UP MAX	GLUFOSINATE AMMONIUM	
ROVER	CHLOROTHALONIL	MISCELLANEOUS

ROVRAL 50 WP	INDOXACARB	
ROVRAL AQUAFLO 50 SC	IPRODIONE	
ROYAL CARTAP	CARTAP	CARBAMATE
ROYANIL 75 WP	CHLOROTHALONIL	MISCELLANEOUS
SABEDONG 5 EC	CYPERMETHRIN	PYRETHROID
SAMURAI 60EC	BUTACHLOR	MISCELLANEOUS
SANAFURAN 3 G	CARBOSULFAN	CARBAMATE
SANAZOLE 250 EC	PROPICONAZOLE	
SAPROL EC	TRIFLUMIZOLE	
SATURN 60 EC	THIAMETOXAM	
SATURN D	THIOBENCARB + 2,4-D	
SATURN S	THIOBENCARB	THiocarbamate
SAVIOR 80 WP	MANCOZEB	DITHiocarbamate
SCOPE 70 WP	THIOPHANATE METHYL	
SCORE 250 EC	DIFENOCONAZOLE	
SELECRON 500 EC	PROCHLORAZ MN	
SELECT 120 EC	CLETHODIM	
SELECT 120 EC	CLETHODIM	
SENCOR 70 WP	METHYL BROMIDE + CHLOROPICRIN	
SENTINEL 75 WP	CHLOROTHALONIL	MISCELLANEOUS
SERVWEL 2,4-D AMINE	2,4-D AMINE	CHLOROPHOXY COMPOUND
SERVWEL MALATHION 57 EC	MALATHION	ORGANOPHOSPHATE
SERVWEL MANCOZEB 80 WP	MANCOZEB	DITHiocarbamate

SERVWEL TKO 50 EC	CYPERMETHRIN	PYRETHROID
SERVWEL 2,4-D GRANULES	2,4-D IBE	CHLOROPHENOXY COMPOUND
SEVIN 50 WP	CARBUFORAN	CARBAMATE
SEVIN 85 WP	CARBUFORAN	CARBAMATE
SHERPA 5 EC	CYPERMETHRIN	PYRETHROID
SHIELD	CHLOROTHALONIL	MISCELLANEOUS
SHOTGUN M	MANCOZEB	DITHIOCARBAMATE
SICO 250 EC	DIFENOCONAZOLE	
SIGA 300 EC	CHLORPYRIFOS	ORGANOPHOSPHATE
SIGANEX 600 SC	PYMETROZINE	
SIGMA	GLYPHOSPHATE IPA	
SILWET 408	TRISILOXANE ALKOXYLATE + ALLYL ETHOXYLA	
SILWET 408	TRIFORINE	
SLASH	GLYPHOSATE IPA	
SMART 480	GLYPHOSATE IPA	
SMART 480	GLYPHOSATE IPA	
SMASH 5 EC	CYPERMETHRIN	PYRETHROID
SNAIL CHAMP 25 EC	NICLOSAMIDE	
SNAIL OUT 50 WP	NICLOSAMIDE	
SNAILKIL 6% P	METALDEHYDE	
SNIPER 5 EC	CYPERMETHRIN	PYRETHROID
SOFIT 300 EC	POLYOXYETHYLENE SORBITANT FATTY ACIDS +	
SOLIGNUM BROWN	PERMETHRIN	PYRETHROID

SOLIGNUM COLORLESS	PERMETHRIN	PYRETHROID
SOLNET 500 EC	PRETILACHLOR	
SONIC 60 EC	BUTACHLOR	MISCELLANEOUS
SPECTRA 5 EC	CYPERMETHRIN	PYRETHROID
SPEED 25 EC	MONOCROTOPHOS	
SPEED 50 WP	NICLOSAMIDE	
SPEEDEX	POLYETHER:POLYMET HYLSILOXANE COPOLYME	
STAM LV-10	PROPAMOCARB HCL	
STAR 5 EC	CYPERMETHRIN	PYRETHROID
STEADFAST TC	ALPHACYPERMETHRIN	PYRETHROID
STEWARD WDG	IMIDACLOPRID +CYFLUTHRIN	
STIMUKIL FLY BAIT	METHOMYL	
STINGRAY 5.625	DELTAMETHRIN+BUPR OFEZIN	
STIX 480 EC	CARBUFORAN	CARBAMATE
STOP 6% PELLETS	METALDEHYDE	
STORM WAX W/ BITREX	FLOCOUMAFEN	
SUCCESS NATURALYTE 25 SC	SORBITAN MONOOLATE(SB),POLY OXYETHYL	
SUMI-ALPHA 2.5 EC	ESFENVALERATE	PYRETHROID
SUMI-ALPHA 2.5 EC	ESFENVALERATE	PYRETHROID
SUMI-ALPHA 2.5 EC	ESFENVALERATE	PYRETHROID
SUMICIDIN	FENVALERATE	PYRETHROID
SUMICIDIN 3 EC	FENVALERATE	PYRETHROID

SUMICIDIN 3 EC	FENVALERATE	PYRETHROID
SUMI-EIGHT	DINICONAZOLE	
SUMITHION 40 WDP	FENITROTHION	ORGANOPHOSPHATE
SUMITHION 50 EC	FENITROTHION	ORGANOPHOSPHATE
SUMITHION 50 EC	FENITHROTHION	ORGANOPHOSPHATE
SUMITHION 50 EC	FENITROTHION	ORGANOPHOSPHATE
SUNRICE 15 WDG	ETHOXYSULFURON	
SUNSPRAY 8N	PAECILOMYCES LILACINUS STRAIN 251	
SUPER BLUE 85 WP	COPPER OXYCHLORIDE	COPPER
SUPREME 5 EC	CYPERMETHRIN	PYRETHROID
SUPREMO EC	BPMC +CHLORPYFIROS	
SURE 250 EC	NICLOSAMIDE	
SUREKILL 70 WP	NICLOSAMIDE	
SURFACTANT A-100	POLYETHER- POLYMETHYLSILOXANE COPOLYM	
SURFACTANT A-100	POLYOXYETHYLENE DODECYL ETHER	
SURFIX	BETA PINENE POLYMER	
SWEEP	THIOPHANATE METHYL	
SWIPE 25 EC	NICLOSAMIDE	
SWIPE 50 WP	NICLOSAMIDE	
TAMARON 600 SL	METALDEHYDE	
TAMEX 360 EC	BUTRALIN	
TARGET 2.5 EC	NICLOSAMIDE	

TARGET 25 EC	NICLOSAMIDE	
TECTO 45 FW	TETRAMETHYLTHIURAM DISULPHIDE	
TEGA 075 EC	TRIDEMORPH	
TELONE II	DICHCHLOROPROPENE	
TERMEX 48 EC	CHLORPYFIROS	ORGANOPHOSPHATE
TERMIDOR 2.5 EC	FIPRONIL	
TERMINATOR 2.5 EC	LAMBDA CYHALOTHRIN	PYRETHROID
TERMITE-X	CHLORPYFIROS	ORGANOPHOSPHATE
TERRAGUARD 48 EC	CHLORPYFIROS	ORGANOPHOSPHATE
THESIS 2.5 EC	DELTAMETHRIN	PYRETHROID
THIRAM 80 WG	TETRAMETHYLTHIURAM DISULPHIDE	
THYLATE 80 WG	TERBUFOS	
TIGER 25 SC	NICLOSAMIDE	
TILT 250 EC	PROPANIL	
TIMBER GUARD CLEAR	PERMETHRIN + Zn	
TIMBER GUARD MEDIUM BROWN	PERMETHRIN	PYRETHROID
TOP 70 WP	THIOPHANATE METHYL	
TOPNOTCH	THIODICARB	
TOPSIN-M 70 WP	THIOPHANATE METHYL	
TOPSTAR 60 EC	OXADIARGYL	
TORDON 101 MIXTURE	PHTHALIC GLYCEROL ALKYL	
TORNADO 60 EC	BUTACHLOR+PROPANI	MISCELLANEOUS

	L	
TORNADO 60 EC	BUTACHLOR + PROPANIL	MISCELLANEOUS
TORO	BUTACHLOR + PROPANIL	MISCELLANEOUS
TORPEDO 5 EC	CYPERMETHRIN	PYRETHROID
TRAMEX COMBI 80 WP	AMETRYNE + ATRAZINE	MISCELLANEOUS
TRANZEB 455 FC	MANCOZEB	DITHiocarbamate
TRANZEB 80 WP	MANCOZEB	DITHiocarbamate
TRAP 70 WP	NICLOSAMIDE	
TREBON 10 EC	ETHOFENPROX	
TREBON 10 EC	ETHOFENPROX	
TREBON 10 EW	ETHOFENPROX	
TREFIC 20 WP	ETHOFENPROX	
TRIFMINE 30 WP	TRIFLOXYSTROBIN	
TRIGARD 75 WP	CYROMAZINE	
TRIM 50 WP	LINURON	
TRINEB 80 WP	MANCOZEB + CYMOXANIL	
TRIO 50 WP	PROCHLORAZ	
TRIPLEX 50 EC	CYPERMETHRIN	PYRETHROID
TROJAN 31.5 EC	CHLORPYFIROS +BPMC	
TWISTER 70 EC	BUTACHLOR + PROPANIL	MISCELLANEOUS
TWISTER EC	BUTACHLOR+PROPANIL	MISCELLANEOUS
ULTIMO EC 200	NICLOSAMIDE	
ULTIMO EC 225	NICLOSAMIDE	

UPROOT 60 EC	BUTACHLOR	MISCELLANEOUS
VECTRON 10 EW	ETHOFENPROX	
VECTRON 20 WP	ETHOFENPROX	
VEGETOX 50 SP	CARTAP	CARBAMATE
VERTIMEC	AVERMECTIN	CHLORIDE CHANNEL ACTIVATOR
VEXTER 300 EC	CHLORPYFIROS	ORGANOPHOSPHATE
VINDEX PLUS	PHENTHOATE	
VISOCOL 50 WP	NICLOSAMIDE	
VITAL BLUE 85 WP	COPPER OXYCHLORIDE	COPPER
VITIGRAN BLUE 58 WP	COPPER OXYCHLORIDE	COPPER
VITIGRAN BLUE 58 WP	COPPER OXYCHLORIDE	COPPER
VONDOZEB 42 SC	MANCOZEB	DITHiocarbamate
VONDOZEB 75 DF	MANCOZEB	DITHiocarbamate
VONDOZEB L	MANEB	
VONDOZEB PLUS	MANCOZEB	DITHiocarbamate
WALLOP 70 WP	NICLOSAMIDE	
WARRIOR 31.5	CHLORPYRIFOS + BPMC	ORGANOPHOSPHATE+CARBAMATE
WAZARY 10 FL	FENVALERATE	PYRETHROID
WAZARY 10 FL	FENVALERATE	PYRETHROID
WEAPON 5 EC	CYPERMETHRIN	PYRETHROID
WEDKILL 2,4-D	2,4-D IBE	CHLOROPHENOXY COMPOUND
WEEDER 60 EC	BUTACHLOR	MISCELLANEOUS
WEEDTROL 40 EC	2,4-D IBE	CHLOROPHENOXY COMPOUND
WEISER ATRAZINE 80	ATRAZINE	1,3,5-TRIAZINE

WP		
WEISSE ATRAZINE 80 WP	ATRAZINE	1,3,5-TRIAZINE
WEISSE CYPERMETHRIN 5 EC	CYPERMETHRIN	PYRETHROID
WHIP-S 120 EW	FENOXAPOP P-ETHYL	
WHIP-S 75 EW	FENOXAPOP P-ETHYL	
WINNER 5 EC	CYPERMETHRIN	PYRETHROID
WIPERS EC	CYPERMETHRIN	PYRETHROID
WOLMAN CCA-C	COPPER,CHROME,ARSENIC(CCA)	
XENTARI WDG	BACILLUS THURINGIENSIS	PLANT ORIGIN
X-PHOS 20 EC	CHLORPYFIROS	ORGANOPHOSPHATE
X-PHOS 40 EC	CHLORPYFIROS	ORGANOPHOSPHATE
X-RAT 1% P	WARFARIN	
XTRAGRO 10 LS	ETHEPHON	
XTRAGRO 240 PGR	ETHEPHON	
XTRAGRO 480 PGR	ETHEPHON	
ZACARB 85 WP	CARBARYL	CARBAMATE
ZACK 50 WP	MIPC	
ZECTRIC 6% PELLETS	METALDEHYDE	
ZEPHYR	AVERMECTIN	CHLORIDE CHANNEL ACTIVATOR
ZINC PHOSPHIDE 80 DP	ZINC PHOSPHIDE	
ZOOM 5 EC	CYPERMETHRIN	PYRETHROID

**[0077]** Embodiments of the invention can include at least one biologically-based insecticide, such as, for example, abamectin, proteins and / or spores derived from *Bacillus thuringiensis*, spinosad, or the like.

**[0078]** Embodiments of the invention can include at least one insect growth regulator, such as, for example, etoxazol, methoxyfenozide, pyriproxyfen, or the like.

**[0079]** Embodiments of the invention can include at least one oil, such as, for example, “Superior oil,” highly-refined oils, and the like.

**[0080]** Embodiments of the invention can include at least one pheromone, such as, for example, Codling moth pheromone, Oriental fruit moth pheromone, and the like.

**[0081]** Embodiments of the invention can include a herbicidal chemical or product. In some embodiments, these herbicidal chemicals can include, for example, amide herbicides, anilide herbicides, arylalanine herbicides, chloroacetanilide herbicides, sulfonanilide herbicides, sulfonamide herbicides, thioamide herbicides, antibiotic herbicides, aromatic acid herbicides, benzoic acid herbicides, pyrimidinyloxybenzoic acid herbicides, pyrimidinylthiobenzoic acid herbicides, phthalic acid herbicides, picolinic acid herbicides, quinolinecarboxylic acid herbicides, arsenical herbicides, benzoylcyclohexanedione herbicides, benzofuranyl alkylsulfonate herbicides, benzothiazole herbicides, carbamate herbicides, carbanilate herbicides, cyclohexene oxime herbicides, cyclopropylisoxazole herbicides, dicarboximide herbicides, dinitroaniline herbicides, dinitrophenol herbicides, diphenyl ether herbicides, nitrophenyl ether herbicides, dithiocarbamate herbicides, halogenated aliphatic herbicides, imidazolinone herbicides, inorganic herbicides, nitrile herbicides, organophosphorus herbicides, oxadiazolone herbicides, phenoxy herbicides, phenoxyacetic herbicides, phenoxybutyric herbicides, phenoxypropionic herbicides, aryloxyphenoxypropionic herbicides, phenylenediamine

herbicides, pyrazole herbicides, benzoylpyrazole herbicides, phenylpyrazole herbicides, pyridazine herbicides, pyridazinone herbicides, pyridine herbicides, pyrimidinediamine herbicides, quaternary ammonium herbicides, thiocarbamate herbicides, thiocarbonate herbicides, thiourea herbicides, triazine herbicides, chlorotriazine herbicides, methoxytriazine herbicides, methylthiotriazine herbicides, triazinone herbicides, triazole herbicides, triazolopyrimidine herbicides, uracil herbicides, urea herbicides, phenylurea herbicides, sulfonylurea herbicides, pyrimidinylsulfonylurea herbicides, triazinylsulfonylurea herbicides, thiadiazolylurea herbicides, unclassified herbicides, and the like.

**[0082]** Embodiments of the invention can include a fungicidal chemical or product. In some embodiments, these fungicidal chemicals can include, for example, aliphatic nitrogen fungicides, amide fungicides, acylamino acid fungicides, anilide fungicides, benzanilide fungicides, furanilide fungicides sulfonanilide fungicides, benzamide fungicides, furamide fungicides, phenylsulfamide fungicides, sulfonamide fungicides, valinamide fungicides, antibiotic fungicides, strobilurin fungicides, aromatic fungicides, benzimidazole fungicides, benzimidazole precursor fungicides, benzothiazole fungicides, bridged diphenyl fungicides, carbamate fungicides, benzimidazolylcarbamate fungicides, carbanilate fungicides, conazole fungicides, copper fungicides, dicarboximide fungicides, dichlorophenyl dicarboximide fungicides, phthalimide fungicides, dinitrophenol fungicides, dithiocarbamate fungicides, imidazole fungicides, inorganic fungicides, mercury fungicides, morpholine fungicides, organophosphorus fungicides, organotin fungicides, oxathin fungicides, oxazole fungicides, polysulfide fungicides, pyrazole fungicides, pyridine fungicides, pyrimidine fungicides, pyrrole fungicides, quinoline fungicides, quinone fungicides, quinoxaline fungicides, thiazole fungicides,

thiazolidine fungicides, thiocarbamate fungicides, thiophene fungicides, triazine fungicides, triazole fungicides, urea fungicides, unclassified fungicides, and the like.

**[0083]** In embodiments of the invention that include at least one compound or chemical of a plant origin, the at least one compound or chemical of a plant origin can include, for example, any of the compounds or chemicals listed in table 4, or the like:

**TABLE 4: COMPOUNDS OF PLANT ORIGIN**

T-ANETHOLE	CORN OIL	LILAC FLOWER OIL (LFO)	PIPERONAL
ALLYL SULFIDE	B-COSTOL	LIME OIL	PIPERONYL
ALLYL TRISULFIDE	CRYPTONE	D-LIMONENE	PIPERONYL
ALLYL-DISULFIDE	CUMIN OIL	LINALOOL	ACETATE
ARTEMISIA	CURZERENONE	LINALYL	PIPERONYL
ALCOHOL ACETATE	P-CYMENE	ACETATE	ALCOHOL
BENZALDEHYDE	DAVANONE	LINALYL	PIPERONYL
BENZOIC ACID	DIALYL	ANTHRANILATE	AMINE
BENZYL ACETATE	TETRASULFIDE	LINDESTRENE	PRENAL
BENZYL ALCOHOL	DIETHYL	LINDENOL	PULEGONE
BERGAMOTENE	PHTHALATE	LINSEED OIL	QUININE
B-BISABOLENE	DIHYDROPYROCURZERENONE	METHYL-ALLYL-TRISULFIDE	ROSEMARY OIL
BISABOLENE OXIDE	DIHYDROTAGENTONE	MENTHOL	SABINENE
A-BISABOLOL	BETA-ELEMENE	MENTHONE	SABINYL
BISABOLOL OXIDE	GAMMA-ELEMENE	2-METHOXYFURANODIENE	ACETATE
BISOBOLOL OXIDE	ELMOL	MENTHYL	SAFFLOWER OIL
B	ESTRAGOLE	ACETATE	A-SANTALENE
BORNYL ACETATE	2-ETHYL-2-HEXEN-1-OL	METHYL	SANTALOL
B-BOURBONENE	EUGENOL	CINNAMATE	SATIVEN
BLACK SEED OIL (BSO)	EUGENOL	METHYL CITRATE	Δ-SELINENE
A-CADINOL	ACETATE	METHYL DI-HYDROJASMONATE	SESAME OIL
CAMPHENE	A-FARNESENE	MENTHYL	B-SESQUPHELANDRENE
A-CAMPHOLENE			SILICONE FLUID
A-CAMPHOLENE			SODIUM LAURYL

ALDEHYDE	(Z,E)-A-FARNESENE	SALICYLATE	SULFATE
CAMPHOR	E-B-FARNESENE	MINERAL OIL	SOYBEAN OIL
CARVACROL	FENCHONE	MUSK AMBRETTE	SPATHULENOL
D-CARVONE	FURANODIENE	MYRCENE	TAGETONE
L-CARVONE	FURANOEUDESM	MYRTENAL	TANGERINE OIL
CARYOPHYLLENE OXIDE	A-1,3-DIENE	NERALDIMETHYL ACETATE	A-TERPINENE
TRANS-CARYOPHYLLENE	FURANOEUDESM	NEROLIDOL	TERPINENE 900
CASTOR OIL	A-1,4-DIENE	NONANONE	A-TERPINEOL
CEDAR OIL	FURANO GERMACRA	GAMMA-NONALACTONE	A-TERPINOLENE
CHAMAZULENE	1,10(15)-DIENE-6-ONE	OIL OF PENNYROYAL	GAMMA-TERPNEOL
1,8-CINEOLE	FURANOSESQUITERPENE	OLIVE OIL	A-TERPINYL ACETATE
CINNAMALDEHYDE	GARLIC OIL	ORANGE SWEET OIL	2-TERT-BUTYL-P-QUINONE
CINNAMYL ALCOHOL	GERANIOL	1-OCTANOL	A-THUJONE
CINNAMON OIL	GERANIOL ACETATE	E OCIMENONE	THYME OIL
CITRAL A	GERMACRENE D	Z OCIMENONE	THYMOL
CITRAL B	GERMACRENE B	3-OCTANONE	THYMYL METHYL ETHER
ISOPROPYL CITRATE	GRAPEFRUIT OIL	OCIMENE	GAMMA-UNDECALACTONE
CITRONELLAL	A-GURJUNENE	OCTYL ACETATE	VALERIC ANHYDRIDE
CITRONELLA OIL	A-HUMULENE	PEANUT OIL	VANILLIN
CITRONELLOL	A-IONONE	PERILLYL ALCOHOL	TRANS-VERBENOL
CITRONELLYL ACETATE	B-IONONE	PEPPERMINT OIL	CIS-VERBENOL
CITRONELLYL FORMATE	ISOBORNEOL	A-PHELLANDRENE	VERBENONE
CLOVE OIL	ISOFURANOGERMACRENE	B-PHELLANDRENE	WHITE MINERAL OIL
A-COPAENE	ISO-MENTHONE	PHENETHYL PROPRIONATE	YOMOGI ALCOHOL
CORNmint OIL	ISO-PULEGONE	PHENYL ACETALDEHYDE	ZINGIBERENE
	JASMONE	A-PINENE	
	LECITHIN		
	LEMON OIL		
	LEMON GRASS OIL		

		B-PINENE PINE OIL TRANS- PINOCARVEOL	
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**[0084]** Additional compounds and chemicals of a plant origin that can be used in accordance with embodiments of the present invention are set forth in the following applications, each of which is incorporated in its entirety herein by reference: U.S. Application 10/832,022, entitled COMPOSITIONS AND METHODS FOR CONTROLLING INSECTS; U.S. Application 11/086,615, entitled COMPOSITIONS AND METHODS FOR CONTROLLING INSECTS RELATED TO THE OCTOPAMINE RECEPTOR; U.S. Application 11/365,426, entitled COMPOSITIONS AND METHODS FOR CONTROLLING INSECTS INVOLVING THE TYRAMINE RECEPTOR; and U.S. Application 11/870,385, entitled COMPOSITIONS AND METHODS FOR CONTROLLING INSECTS.

**[0085]** In certain embodiments, it can be desirable to include a naturally-occurring version or a synthetic version of a compound. For example, in certain embodiments it can be desirable to include Lime Oil 410, a synthetic lime oil that can be obtained, for example, from Millennium Chemicals, Inc. In certain exemplary compositions, it can be desirable to include a compound that is designated as meeting Food Chemical Codex (FCC), for example, Geraniol Fine FCC or Tetrahydrolinalool FCC, which compounds can be obtained, for example, from Millennium Chemicals, Inc.

**[0086]** In embodiments of the invention that include at least one blend of compounds of a plant origin, the compounds of plant origin can be tested for their precise chemical composition

using, for example, High-Pressure Liquid Chromatography (HPLC), Mass Spectrometry (MS), gas chromatography, or the like.

**[0087]** The term "about" or "approximately" means within an acceptable error range for the particular value as determined by one of ordinary skill in the art, which will depend in part on how the value is measured or determined, i.e., the limitations of the measurement system, i.e., the degree of precision required for a particular purpose, such as a pharmaceutical formulation. For example, "about" can mean within 1 or more than 1 standard deviations, per the practice in the art. Alternatively, "about" can mean a range of up to 20%, preferably up to 10%, more preferably up to 5%, and more preferably still up to 1% of a given value. Alternatively, particularly with respect to biological systems or processes, the term can mean within an order of magnitude, preferably within 5-fold, and more preferably within 2-fold, of a value. Where particular values are described in the application and claims, unless otherwise stated the term "about" meaning within an acceptable error range for the particular value should be assumed.

**[0088]** The term "substantially," as used herein, means at least about 80%, preferably at least about 90%, more preferably at least about 99%, for example at least about 99.9%. In some embodiments, the term "substantially" can mean completely, or about 100%.

**[0089]** In embodiments of the invention that include at least one blend of compounds of a plant origin, the at least one blend of compounds can include at least two compounds. For example, in an exemplary embodiment, the at least one blend of compounds can include LFO and Black Seed Oil (BSO).

**[0090]** In another exemplary embodiments, the at least one blend of compounds can include LFO, D-limonene, Thyme Oil White, and Lime Oil.

**[0091]** In another exemplary embodiment, the at least one blend of compounds can include Tetrahydrolinalool, Isopropyl Myristate, Piperonal (aldehyde), Triethyl Citrate, Linalool, Geraniol, Vanillin, D-limonene, Lime Oil, and Thyme Oil White.

**[0092]** In another exemplary embodiment, the at least one blend of compounds can include Isopropyl myristate, Tetrahydrolinalool, Linalool, Geraniol, Piperonal (aldehyde), Vanillin, and BSO.

**[0093]** In another exemplary embodiment, the at least one blend of compounds can include Isopropyl myristate, Tetrahydrolinalool, Linalool Synthetic, Geraniol Fine, Piperonal (aldehyde), Vanillin, BSO, Methyl Salicylate, and D-limonene.

**[0094]** In another exemplary embodiment, the at least one blend of compounds can include Thyme Oil White, Wintergreen Oil, Isopropyl Myristate, and Vanillin.

**[0095]** In another exemplary embodiment, the at least one blend of compounds can include D-limonene, Thyme Oil White, and Wintergreen Oil.

**[0096]** In another exemplary embodiment, the at least one blend of compounds can include Thyme Oil White, Wintergreen Oil, and Isopropyl Myristate.

**[0097]** In another exemplary embodiment, the at least one blend of compounds can include D-limonene, Linalool, Geraniol, Tetrahydrolinalool, Isopropyl Myristate, Piperonal, and Vanillin.

**[0098]** In another exemplary embodiment, the at least one blend of compounds can include Methyl Salicylate, Linalool, Geraniol, Tetrahydrolinalool, Isopropyl Myristate, Piperonal (aldehyde), Vanillin, BSO, and D-limonene.

**[0099]** In another exemplary embodiment, the at least one blend of compounds can include Isopropyl myristate, Tetrahydrolinalool, Linalool, Geraniol, Piperonal (aldehyde), Vanillin, Mineral Oil, BSO, and D-limonene.

**[00100]** In another exemplary embodiment, the at least one blend of compounds can include Linalool, Thymol (crystal), Alpha-Pinene, Para-Cymene, and trans-Anethole.

**[00101]** In another exemplary embodiment, the at least one blend of compounds can include Isopropyl Myristate, Tetrahydrolinalool, Linalool, Geraniol, Piperonal (aldehyde), Vanillin, and BSO.

**[00102]** In another exemplary embodiment, the at least one blend of compounds can include Thyme Oil White, Methyl Salicylate, Isopropyl Myristate, and Vanillin.

**[00103]** In another exemplary embodiment, the at least one blend of compounds can include D-limonene, Thyme Oil White, and Methyl Salicylate.

**[00104]** In another exemplary embodiment, the at least one blend of compounds can include Methyl Salicylate, Thymol, Geraniol, Isopropyl Myristate, and Vanillin.

**[00105]** In some embodiments, the blend of compounds can include between 4 and 5% Lilace Flower Oil (LFO), between 75 and 90% D-Limonene, between 3 and 4% Thyme Oil White, and between 8 and 12% Lime Oil 410.

**[00106]** In some embodiments, the blend of compounds can include 4.40% LFO, 82.3% D-Limonene, 3.3% Thyme Oil White, and 10.0% Lime Oil 410.

**[00107]** In some embodiments, the blend of compounds can include between 75 and 90% D-Limonene, between 2.5 and 4% Thyme Oil White, between 0.5 and 0.65% Linalool Coeur, between 0.7 and 0.9% Tetrahydrolinalool, between 0.04 and 0.06% Vanillin, between 0.7

and 0.9% Isopropyl myristate, between 0.7 and 0.9% Piperonal (aldehyde), between 9 and 11% Lime Oil Minus, between 0.35 and 0.5% Geraniol 60, and between 0.7 and 0.9% Triethyl Citrate.

**[00108]** In some embodiments, the blend of compounds can include 82.52% D-Limonene, 3.28% Thyme Oil White, 0.57% Linalool Coeur, 0.78% Tetrahydrolinalool, 0.05% Vanillin, 0.80% Isopropyl myristate, 0.80% Piperonal (aldehyde), 9.99% Lime Oil Minus, 0.41% Geraniol 60, and 0.80% Triethyl Citrate.

**[00109]** In some embodiments, the blend of compounds can include between 18 and 24% BSO, between 14 and 17% Linalool Coeur, between 17 and 21% Tetrahydrolinalool, between 1.6 and 2% Vanillin, between 21 and 26% Isopropyl myristate, between 7 and 9% Piperonal (aldehyde), and between 9 and 12% Geraniol Fine FCC.

**[00110]** In some embodiments, the blend of compounds can include 21.50% BSO, 15.90% Linalool Coeur, 19.00% Tetrahydrolinalool, 1.80% Vanillin, 23.50% Isopropyl myristate, 7.80% Piperonal (aldehyde), and 10.50% Geraniol Fine FCC.

**[00111]** In some embodiments, the blend of compounds can include between 8 and 10% D-Limonene, 24 and 28.5% BSO, 5.5 and 7.0% Linalool Coeur, between 7 and 9% Tetrahydrolinalool, between 0.7 and 0.9% Vanillin, between 8.5 and 10.5% Isopropyl myristate, between 2.8 and 3.6% Piperonal (aldehyde), between 3.8 and 5% Geraniol Fine FCC, and between 29 and 37% Methyl Salicylate 98% Nat.

**[00112]** In some embodiments, the blend of compounds can include 8.80% D-Limonene, 26.20% BSO, 6.40% Linalool Coeur, 7.80% Tetrahydrolinalool, 0.80% Vanillin, 9.50%

Isopropyl myristate, 3.20% Piperonal (aldehyde), 4.30% Geraniol Fine FCC, and 33.00% Methyl Salicylate 98% Nat.

**[00113]** In some embodiments, the blend of compounds can include between 18 and 23% Thyme Oil White, between 40 and 50% Wintergreen Oil, between 1 and 1.2% Vanillin, and between 30 and 37% Isopropyl myristate.

**[00114]** In some embodiments, the blend of compounds can include 20.50% Thyme Oil White, 45.00% Wintergreen Oil, 1.10% Vanillin, and 33.40% Isopropyl myristate.

**[00115]** In some embodiments, the blend of compounds can include between 50 and 62% D-Limonene, between 10.5 and 13.5% Thyme Oil White, and between 28 and 35% Wintergreen Oil.

**[00116]** In some embodiments, the blend of compounds can include 56.30% D-Limonene, 12.38% Thyme Oil White, and 31.32% Wintergreen Oil.

**[00117]** In some embodiments, the blend of compounds can include between 50 and 62% D-Limonene, between 10.5 and 13.5% Thyme Oil White, and between 28 and 35% Wintergreen Oil Technical.

**[00118]** In some embodiments, the blend of compounds can include 56.30% D-Limonene, 12.38% Thyme Oil White, and 31.32% Wintergreen Oil Technical.

**[00119]** In some embodiments, the blend of compounds can include between 11.5 and 14.5% LFO, between 7.9 and 9.5% D-Limonene, between 8.5 and 10.6% Thyme Oil White, and between 61 and 76% Lime Oil 410.

**[00120]** In some embodiments, the blend of compounds can include 12.94% LFO, 8.72% D-Limonene, 9.58% Thyme Oil White, and 68.76% Lime Oil 410.

**[00121]** In some embodiments, the blend of compounds can include between 11.5 and 14.5% LFO, between 38 and 46.5% D-Limonene, between 8.5 and 10.6% Thyme Oil White, between 0.76 and 0.92% Linalool Coeur, between 6 and 8% Citral, between 6.5 and 8% gamma-terpinene, between 1.1 and 1.5% Alpha-Pinene (98%), between 4.1 and 5.2% Alpha-Terpineol, between 3.8 and 5% Terpinolene, between 1 and 1.25% Para-Cymene, between 1.6 and 2% Linalyl Acetate, between 1.7 and 2.1% Beta Pinene, between 0.08 and 0.1% Camphor Dextro, between 0.07 and 0.09% Terpinene 4 OL, between 1.7 and 2.1% Alpha Terpinene, between 0.8 and 1.0% Borneol L, between 0.3 and 0.45% Camphene, between 0.10 and 0.14% Decanal, between 0.09 and 0.11% Dodecanal, between 0.005 and 0.015% Fenchol Alpha, between 0.1 and 0.14% Geranyl Acetate, between 0.2 and 0.35% Isoborneol, between 0.24 and 0.28% 2-Methyl 1,3-cyclohexadiene, between 0.7 and 0.85% Myrcene, between 0.015 and 0.025% Nonanal, between 0.03 and 0.05% Octanal, and between 0.015 and 0.025% Tocopherol Gamma Tenox.

**[00122]** In some embodiments, the blend of compounds can include 12.94% LFO, 42.2% D-Limonene, 9.58% Thyme Oil White, 0.84% Linalool Coeur, 7.02% Citral, 7.23% gamma-terpinene, 1.33% Alpha-Pinene (98%), 4.68% Alpha-Terpineol, 4.33% Terpinolene, 1.11% Para-Cymene, 1.79% Linalyl Acetate, 1.93% Beta Pinene, 0.09% Camphor Dextro, 0.08% Terpinene 4 OL, 1.93% Alpha Terpinene, 0.89% Borneol L, 0.37% Camphene, 0.12% Decanal, 0.10% Dodecanal, 0.01% Fenchol Alpha, 0.12% Geranyl Acetate, 0.28% Isoborneol, 0.26% 2-Methyl 1,3-cyclohexadiene, 0.78% Myrcene, 0.02% Nonanal, 0.04% Octanal, and 0.02% Tocopherol Gamma Tenox.

**[00123]** In some embodiments, the blend of compounds can include between 8.7 and 10.8% D-Limonene, between 7.7 and 9.4% Thyme Oil White, between 62 and 76% Lime Oil 410, between 1.4 and 1.9% Linalool Coeur, between 2 and 2.5% Tetrahydrolinalool, between

0.13 and 0.17% Vanillin, between 2.1 and 2.55% Isopropyl myristate, between 2.1 and 2.55% Piperonal (aldehyde), between 1.08 and 1.35% Geraniol 60, and between 2.1 and 2.55% Triethyl Citrate.

**[00124]** In some embodiments, the blend of compounds can include 9.70% D-Limonene, 8.54% Thyme Oil White, 69.41% Lime Oil 410, 1.66% Linalool Coeur, 2.29% Tetrahydrolinalool, 0.15% Vanillin, 2.35% Isopropyl myristate, 2.35% Piperonal (aldehyde), 1.21% Geraniol 60, and 2.35% Triethyl Citrate.

**[00125]** In some embodiments, the blend of compounds can include between 72 and 89% LFO and between 18 and 22% Black Seed Oil (BSO).

**[00126]** In some embodiments, the blend of compounds can include 80.09% LFO and 19.91% BSO.

**[00127]** In some embodiments, the blend of compounds can include between 45 and 56% LFO and between 45 and 55% BSO.

**[00128]** In some embodiments, the blend of compounds can include 50.13% LFO and 49.87% BSO.

**[00129]** In some embodiments, the blend of compounds can include between 4.1 and 5.2% Thyme Oil White, between 52 and 64% Wintergreen Oil, and between 33 and 42% Isopropyl myristate.

**[00130]** In some embodiments, the blend of compounds can include 4.60% Thyme Oil White, 57.80% Wintergreen Oil, and 37.60% Isopropyl myristate.

**[00131]** In some embodiments, the blend of compounds can include between 25 and 31% D-Limonene, between 4 and 5% Thyme Oil White, and between 60 and 72% Wintergreen Oil.

**[00132]** In some embodiments, the blend of compounds can include 28.24% D-Limonene, 4.44% Thyme Oil White, and 67.32% Wintergreen Oil.

**[00133]** In some embodiments, the blend of compounds can include between 8.9 and 11% D-Limonene, between 12.5 and 16% Linalool Coeur, between 21.5 and 27% Tetrahydrolinalool, between 2.2 and 2.7% Vanillin, between 25 and 32% Isopropyl myristate, between 9 and 11% Piperonal (aldehyde), and between 9 and 11.4% Geraniol 60.

**[00134]** In some embodiments, the blend of compounds can include 9.90% D-Limonene, 14.14% Linalool Coeur, 24.29% Tetrahydrolinalool, 2.48% Vanillin, 28.92% Isopropyl myristate, 9.97% Piperonal (aldehyde), and 10.30% Geraniol 60.

**[00135]** In some embodiments, the blend of compounds can include between 8.4 and 10.2% D-Limonene, between 29 and 35% Black Seed Oil, between 8.5 and 10.6% Linalool Coeur, between 10 and 12.8% Tetrahydrolinalool, between 1 and 1.35% Vanillin, between 12.5 and 15.5% Isopropyl myristate, between 4.2 and 5.3% Piperonal (aldehyde), between 5.7 and 6.9% Geraniol Fine FCC, and between 10.5 and 13% Methyl Salicylate 98% Nat.

**[00136]** In some embodiments, the blend of compounds can include 9.30% D-Limonene, 31.92% Black Seed Oil, 9.48% Linalool Coeur, 11.40% Tetrahydrolinalool, 1.16% Vanillin, 14.04% Isopropyl myristate, 4.68% Piperonal (aldehyde), 6.29% Geraniol Fine FCC, and 11.72% Methyl Salicylate 98% Nat.

**[00137]** In some embodiments, the blend of compounds can include between 8.7 and 10.4% D-Limonene, between 23 and 30% Black Seed Oil, between 8.9 and 10.8% Linalool Coeur, between 10.7 and 12.9% Tetrahydrolinalool, between 1.05 and 1.35% Vanillin, between 13.4 and 16.5% Mineral Oil White (USP), between 13 and 16% Isopropyl myristate, between 4.4 and 5.4% Piperonal (aldehyde), and between 5.9 and 7.2% Geraniol Fine FCC.

**[00138]** In some embodiments, the blend of compounds can include 9.63% D-Limonene, 26.66% BSO, 9.82% Linalool Coeur, 11.81% Tetrahydrolinalool, 1.20% Vanillin, 14.97% Mineral Oil White (USP), 14.54% Isopropyl myristate, 4.85% Piperonal (aldehyde), and 6.51% Geraniol Fine FCC.

**[00139]** In some embodiments, the blend of compounds can include between 47 and 58% BSO, between 8.7 and 10.5% Linalool Coeur, between 10 and 13% Tetrahydrolinalool, between 1.0 and 1.25% Vanillin, between 12.8 and 15.3% Isopropyl myristate, between 4.3 and 5.2% Piperonal (aldehyde), and between 5.7 and 7% Geraniol Fine FCC.

**[00140]** In some embodiments, the blend of compounds can include 52.28% BSO, 9.63% Linalool Coeur, 11.57% Tetrahydrolinalool, 1.12% Vanillin, 14.26% Isopropyl myristate, 4.75% Piperonal (aldehyde), and 6.38% Geraniol Fine FCC.

**[00141]** In some embodiments, the blend of compounds can include between 34 and 42.5% Thyme Oil White, between 22 and 27.5% Wintergreen Oil, between 1.0 and 1.22% Vanillin, and between 32 and 40% Isopropyl myristate.

**[00142]** In some embodiments, the blend of compounds can include 38.21% Thyme Oil White, 24.79% Wintergreen Oil, 1.11% Vanillin, and 35.89% Isopropyl myristate.

**[00143]** In some embodiments, the blend of compounds can include between 35 and 44% Thyme Oil White, between 22 and 27.2% Wintergreen Oil, and between 32 and 40% Isopropyl myristate.

**[00144]** In some embodiments, the blend of compounds can include 39.24% Thyme Oil White, 24.82% Wintergreen Oil, and 35.94% Isopropyl myristate.

**[00145]** In some embodiments, the blend of compounds can include between 35 and 44% Thyme Oil White, between 32 and 40% Isopropyl myristate, and between 22 and 27.2% Wintergreen Oil Technical.

**[00146]** In some embodiments, the blend of compounds can include 39.24% Thyme Oil White, 35.94% Isopropyl myristate, and 24.82% Wintergreen Oil Technical.

**[00147]** In some embodiments, the blend of compounds can include between 13.3 and 16.3% D-Limonene, between 2.6 and 3.2% Linalool Coeur, between 3.15 and 3.85% Tetrahydrolinalool, between 0.18 and 0.22% Vanillin, between 3.05 and 3.75% Isopropyl myristate, between 3.2 and 4.0% Piperonal (aldehyde), between 1.25 and 1.55% Piperonyl Alcohol, and between 63 and 78% Lime Oil Minus.

**[00148]** In some embodiments, the blend of compounds can include 14.8% D-Limonene, 2.9% Linalool Coeur, 3.5% Tetrahydrolinalool, 0.2% Vanillin, 3.4% Isopropyl myristate, 3.6% Piperonal (aldehyde), 1.4% Piperonyl Alcohol, and 70.2% Lime Oil Minus.

**[00149]** In some embodiments, the blend of compounds can include between 62 and 77% D-Limonene, between 2.6 and 3.2% Linalool Coeur, between 3.15 and 3.85% Tetrahydrolinalool, between 0.18 and 0.22% Vanillin, between 3.05 and 3.75% Isopropyl

myristate, between 3.25 and 3.95% Piperonal (aldehyde), between 1.25 and 1.55% Piperonyl Alcohol, and between 13.5 and 16.7% Lime Oil Minus.

**[00150]** In some embodiments, the blend of compounds can include 69.8% D-Limonene, 2.9% Linalool Coeur, 3.5% Tetrahydrolinalool, 0.2% Vanillin, 3.4% Isopropyl myristate, 3.6% Piperonal (aldehyde), 1.4% Piperonyl Alcohol, and 15.2% Lime Oil Minus.

**[00151]** In some embodiments, the blend of compounds can include between 5.1 and 6.3% Linalool Coeur, between 6.2 and 7.6% Tetrahydrolinalool, between 0.36 and 0.44% Vanillin, between 6.1 and 7.5% Isopropyl myristate, between 6.4 and 7.9% Piperonal (aldehyde), between 2.6 and 3.2% Piperonyl Alcohol, and between 63 and 78% Lime Oil Minus.

**[00152]** In some embodiments, the blend of compounds can include 5.7% Linalool Coeur, 6.9% Tetrahydrolinalool, 0.4% Vanillin, 6.8% Isopropyl myristate, 7.1% Piperonal (aldehyde), 2.9% Piperonyl Alcohol, and 70.2% Lime Oil Minus.

**[00153]** In some embodiments, the blend of compounds can include between 37 and 45.5% LFO, between 25 and 31% D-Limonene, and between 27.5 and 34% Thyme Oil White.

**[00154]** In some embodiments, the blend of compounds can include 41.4% LFO, 27.9% D-Limonene, and 30.7% Thyme Oil White.

**[00155]** In some embodiments, the blend of compounds can include between 24 and 30% D-Limonene, between 27 and 33% Thyme Oil White, and between 38 and 47% Blend C-4003 (13.5% Linalool Coeur, 18.5% Tetradyrdolinalool, 1.2% Vanillin, 19.0% Isopropyl myristate, 19.0% Piperonal [aldehyde], 9.8% Geraniol 60, 19.1% Triethyl Citrate).

**[00156]** In some embodiments, the blend of compounds can include 27.35% D-Limonene, 30.08% Thyme Oil White, and 42.57% Blend C-4003 (13.5% Linalool Coeur, 18.5%

Tetradydrolinalool, 1.2% Vanillin, 19.0% Isopropyl myristate, 19.0% Piperonal [aldehyde], 9.8% Geraniol 60, 19.1% Triethyl Citrate).

**[00157]** In some embodiments, the blend of compounds can include between 24 and 31% D-Limonene, between 27 and 33% Thyme Oil White, between 5.1 and 6.3% Linalool Coeur, between 7.1 and 8.8% Tetrahydrolinalool, between 0.45 and 0.55% Vanillin, between 7.3 and 8.9% Isopropyl myristate, between 7.3 and 8.9% Piperonal (aldehyde), between 3.8 and 4.6% Geraniol 60, and between 7.3 and 8.9% Triethyl Citrate.

**[00158]** In some embodiments, the blend of compounds can include 27.4% D-Limonene, 30.1% Thyme Oil White, 5.7% Linalool Coeur, 7.9% Tetrahydrolinalool, 0.5% Vanillin, 8.1% Isopropyl myristate, 8.1% Piperonal (aldehyde), 4.2% Geraniol 60, and 8.1% Triethyl Citrate.

**[00159]** In some embodiments, the blend of compounds can include between 38 and 47% LFO, between 24 and 31% D-Limonene, between 27 and 33% Thyme Oil White.

**[00160]** In some embodiments, the blend of compounds can include 42.6% LFO, 27.35% D-Limonene, 30.08% Thyme Oil White.

**[00161]** In some embodiments, the blend of compounds can include between 3.6 and 4.45% D-Limonene, between 4 and 4.9% Thyme Oil White, between 15 and 18.4% Benzyl Alcohol, between 18 and 23.5% Isopar M, between 41 and 49% Water, between 5.7 and 7% C-4003 (13.5% Linalool Coeur, 18.5% Tetradydrolinalool, 1.2% Vanillin, 19.0% Isopropyl myristate, 19.0% Piperonal [aldehyde], 9.8% Geraniol 60, and 19.1% Triethyl Citrate), and between 2.8.5 and 3.5% Solution S-3002 (Stock 10% SLS Solution; 10% Sodium Lauryl Sulfate, 90.00% Water).

**[00162]** In some embodiments, the blend of compounds can include 4.03% D-Limonene, 4.43% Thyme Oil White, 16.61% Benzyl Alcohol, 20.95% Isopar M, 44.53% Water, 6.27% Blend C-4003 (13.5% Linalool Coeur, 18.5% Tetradyrdolinalool, 1.2% Vanillin, 19.0% Isopropyl myristate, 19.0% Piperonal (aldehyde), 9.8% Geraniol 60, 19.1% Triethyl Citrate), and 3.18% Solution S-3002 (Stock 10% SLS Solution; 10% Sodium Lauryl Sulfate, 90.00% Water).

**[00163]** In some embodiments, the blend of compounds can include between 3.6 and 4.45% D-Limonene, 4.0 and 4.75% Thyme Oil White, between 0.76 and 0.92% Linalool Coeur, between 1.05 and 1.27% Tetrahydrolinalool, between 0.063 and 0.077% Vanillin, between 1.05 and 1.33% Isopropyl myristate, between 1.05 and 1.33% Piperonal (aldehyde), between 0.56 and 0.68% Geraniol 60, between 1.05 and 1.33% Triethyl Citrate, between 15 and 18% Benzyl Alcohol, between 18 and 24.2% Isopar M, between 40 and 49% Water, and between 2.85 and 3.5% Solution S-3002 (Stock 10% SLS Solution; 10% Sodium Lauryl Sulfate, 90.00% Water).

**[00164]** In some embodiments, the blend of compounds can include 4.03% D-Limonene, 4.43% Thyme Oil White, 0.84% Linalool Coeur, 1.16% Tetrahydrolinalool, 0.07% Vanillin, 1.19% Isopropyl myristate, 1.19% Piperonal (aldehyde), 0.62% Geraniol 60, 1.19% Triethyl Citrate, 16.61% Benzyl Alcohol, 20.95% Isopar M, 44.53% Water, and 3.18% Solution S-3002 (Stock 10% SLS Solution; 10% Sodium Lauryl Sulfate, 90.00% Water).

**[00165]** In some embodiments, the blend of compounds can include between 24 and 31% D-Limonene, between 27 and 33% Thyme Oil White, and between 38 and 47% Blend C-4003 (13.5% Linalool Coeur, 18.5% Tetradyrdolinalool, 1.2% Vanillin, 19.0% Isopropyl myristate, 19.0% Piperonal [aldehyde], 9.8% Geraniol 60, and 19.1% Triethyl Citrate).

**[00166]** In some embodiments, the blend of compounds can include 27.35% D-Limonene, 30.08% Thyme Oil White, and 42.57% Blend C-4003 (13.5% Linalool Coeur, 18.5%

Tetradyrdolinalool, 1.2% Vanillin, 19.0% Isopropyl myristate, 19.0% Piperonal [aldehyde], 9.8% Geraniol 60, and 19.1% Triethyl Citrate).

**[00167]** In some embodiments, the blend of compounds can include between 24 and 31% D-Limonene, between 27 and 33% Thyme Oil White, between 5.2 and 6.4% Linalool Coeur, between 7 and 8.8% Tetrahydrolinalool, between 0.45 and 0.55% Vanillin, between 7.2 and 8.9% Isopropyl myristate, between 7.2 and 8.9% Piperonal (aldehyde), between 3.7 and 4.6% Geraniol 60, and between 7.3 and 9.0% Triethyl Citrate.

**[00168]** In some embodiments, the blend of compounds can include 27.35% D-Limonene, 30.08% Thyme Oil White, 5.73% Linalool Coeur, 7.88% Tetrahydrolinalool, 0.50% Vanillin, 8.08% Isopropyl myristate, 8.09% Piperonal (aldehyde), 4.18% Geraniol 60, and 8.11% Triethyl Citrate.

**[00169]** In some embodiments, the blend of compounds can include between 4 and 4.9% Lilac Flower Oil, between 7.6 and 9.1% D-Limonene, 2.9 and 3.65% Thyme Oil White, and between 9 and 11% Lime Oil Minus.

**[00170]** In some embodiments, the blend of compounds can include 4.4% Lilac Flower Oil, 82.3% D-Limonene, 3.3% Thyme Oil White, and 10.0% Lime Oil Minus.

**[00171]** In some embodiments, the blend of compounds can include between 11.7 and 14.2% Lilac Flower Oil, between 7.9 and 9.6% D-Limonene, between 8.7 and 10.6% Thyme Oil White, and between 61 and 76% Lime Oil Minus.

**[00172]** In some embodiments, the blend of compounds can include 12.94% Lilac Flower Oil, 8.72% D-Limonene, 9.58% Thyme Oil White, and 68.76% Lime Oil Minus.

**[00173]** In some embodiments, the blend of compounds can include between 8.8 and 10.8% D-Limonene, between 7.7 and 9.5% Thyme Oil White, between 1.53 and 1.87% Linalool Coeur, between 2.1 and 2.5% Tetrahydrolinalool, between 0.09 and 0.11% Vanillin, between 2.15 and 2.65% Piperonal (aldehyde), between 62 and 77% Lime Oil Minus, between 1.05 and 1.35% Geraniol 60, and between 2.15 and 2.55% Triethyl Citrate.

**[00174]** In some embodiments, the blend of compounds can include 9.8% D-Limonene, 8.6% Thyme Oil White, 1.7% Linalool Coeur, 2.3% Tetrahydrolinalool, 0.1% Vanillin, 2.4% Piperonal (aldehyde), 69.3% Lime Oil Minus, 1.2% Geraniol 60, and 2.4% Triethyl Citrate.

**[00175]** In some embodiments, the blend of compounds can include between 18 and 23% Thyme Oil White, between 40 and 50% Wintergreen Oil, and between 31 and 38% Isopropyl myristate.

**[00176]** In some embodiments, the blend of compounds can include 20.6% Thyme Oil White, 45.1% Wintergreen Oil, and 34.3% Isopropyl myristate.

**[00177]** In some embodiments, the blend of compounds can include between 19 and 24% Black Seed Oil, between 14 and 17.5% Linalool Coeur, between 17 and 21% Tetrahydrolinalool, between 1.7 and 2.1% Vanillin, between 21 and 26% Isopropyl myristate, between 7 and 8.6% Piperonal (aldehyde), and between 9.5 and 11.6% Geraniol Fine FCC.

**[00178]** In some embodiments, the blend of compounds can include 21.5% Black Seed Oil, 15.8% Linalool Coeur, 19.0% Tetrahydrolinalool, 1.9% Vanillin, 23.4% Isopropyl myristate, 7.8% Piperonal (aldehyde), and 10.5% Geraniol Fine FCC.

**[00179]** In some embodiments, the blend of compounds can include between 6 and 7.4% Linalool Coeur, between 22 and 26% Soy Bean Oil, between 33 and 41% Thymol (crystal), and between 3.3 and 4.2% Alpha-Pinene (98%).

**[00180]** In some embodiments, the blend of compounds can include 6.63% Linalool Coeur, 24.03% Soy Bean Oil, 37.17% Thymol (crystal), and 3.78% Alpha-Pinene (98%).

**[00181]** In some embodiments, the blend of compounds can include between 7.9 and 9.6% Linalool Coeur, between 43 and 53% Thymol (crystal), between 4.5 and 5.5% Alpha-Pinene (98%), and between 33 and 42% Para-Cymene.

**[00182]** In some embodiments, the blend of compounds can include 8.73% Linalool Coeur, 48.93% Thymol (crystal), 4.97% Alpha-Pinene (98%), and 37.37% Para-Cymene.

**[00183]** In some embodiments, the blend of compounds can include between 7.9 and 9.5% D-Limonene, between 8.6 and 10.5% Thyme Oil White, between 61 and 76% Lime Oil 410, between 2.3 and 2.9% Linalool Coeur, between 2.8 and 3.4% Tetrahydrolinalool, between 0.29 and 0.35% Vanillin, between 3.4 and 4.3% Isopropyl myristate, between 1.16 and 1.42% Piperonal (aldehyde), and between 1.5 and 1.9% Geraniol Fine FCC.

**[00184]** In some embodiments, the blend of compounds can include 8.72% D-Limonene, 9.58% Thyme Oil White, 68.76% Lime Oil 410, 2.61% Linalool Coeur, 3.13% Tetrahydrolinalool, 0.32% Vanillin, 3.86% Isopropyl myristate, 1.29% Piperonal (aldehyde), and 1.73% Geraniol Fine FCC.

**[00185]** In some embodiments, the blend of compounds can include between 25 and 31% D-Limonene, between 4 and 4.9% Thyme Oil White, and between 60 and 74% Methyl Salicylate (Synth.).

**[00186]** In some embodiments, the blend of compounds can include 28.24% D-Limonene, 4.44% Thyme Oil White, and 67.32% Methyl Salicylate (Synth.).

**[00187]** In some embodiments, the blend of compounds can include between 18 and 23% Thyme Oil White, between 31 and 37.8% Isopropyl Myristate, and between 40 and 50% Wintergreen Oil (Technical).

**[00188]** In some embodiments, the blend of compounds can include 20.6% Thyme Oil White, 34.3% Isopropyl Myristate, and 45.1% Wintergreen Oil (Technical).

**[00189]** In some embodiments, the blend of compounds can include between 49 and 60% Castor Oil hydrogenated (PEO40), between 20.7 and 25% Lemon Grass Oil (India), and between 20 and 24.6% Blend B-5006 (12.94% Lilac Flower Oil, 8.72% D-Limonene, 9.58% Thyme Oil White, 68.76% Lime Oil 410).

**[00190]** In some embodiments, the blend of compounds can include 54.63% Castor Oil hydrogenated - PEO40, 22.93% Lemon Grass Oil - India, and 22.44% Blend B-5006 (12.94% Lilac Flower Oil, 8.72% D-Limonene, 9.58% Thyme Oil White, 68.76% Lime Oil 410).

**[00191]** In some embodiments, the blend of compounds can include between 14.5 and 17.8% Lilac Flower Oil, between 60 and 75% D-Limonene, between 10 and 12.4% Thyme Oil White, and between 4.4 and 5.4% Black Seed Oil.

**[00192]** In some embodiments, the blend of compounds can include 16.18% Lilac Flower Oil, 67.81% D-Limonene, 11.18% Thyme Oil White, and 4.83% Black Seed Oil.

**[00193]** In some embodiments, the blend of compounds can include between 14.4 and 17.6% Lilac Flower Oil (LFO), between 60 and 75% D-Limonene, between 10.4 and 12.7% Thyme Oil White, and between 4.8 and 5.8% Black Seed Oil (BSO).

**[00194]** In some embodiments, the blend of compounds can include 16.01% LFO, 67.09% D-Limonene, 11.59% Thyme Oil White, 5.31% BSO.

**[00195]** In some embodiments, the blend of compounds can include between 8 and 9.6% D-Limonene, between 8.8 and 10.6% Thyme Oil White, between 50 and 60% Lime Oil 410, between 1.5 and 1.85% Linalool Coeur, between 2.1 and 2.5% Tetrahydrolinalool, between 0.135 and 0.165% Vanillin, between 2.1 and 2.5% Isopropyl myristate, between 2.1 and 2.6% Piperonal (aldehyde), between 1.1 and 1.35% Geraniol 60, between 2.1 and 2.6% Triethyl Citrate, and between 12.5 and 15.3% Isopar M.

**[00196]** In some embodiments, the blend of compounds can include 8.83% D-Limonene, 9.71% Thyme Oil White, 55.17% Lime Oil 410, 1.68% Linalool Coeur, 2.31% Tetrahydrolinalool, 0.15% Vanillin, 2.37% Isopropyl myristate, 2.37% Piperonal (aldehyde), 1.23% Geraniol 60, 2.38% Triethyl Citrate, and 13.80% Isopar M.

**[00197]** In some embodiments, the blend of compounds can include between 7.9 and 9.5% D-Limonene, between 8.6 and 10.5% Thyme Oil White, between 62 and 76% Lime Oil 410, between 1.5 and 1.82% Linalool Coeur, between 2 and 2.5% Tetrahydrolinalool, between 0.14 and 0.16% Vanillin, between 2.1 and 2.6% Isopropyl myristate, between 2.1 and 2.6% Piperonal (aldehyde), between 1.1 and 1.32% Geraniol 60, and between 2.1 and 2.6% Triethyl Citrate.

**[00198]** In some embodiments, the blend of compounds can include 8.72% D-Limonene, 9.59% Thyme Oil White, 69.35% Lime Oil 410, 1.66% Linalool Coeur, 2.28% Tetrahydrolinalool, 0.15% Vanillin, 2.34% Isopropyl myristate, 2.34% Piperonal (aldehyde), 1.21% Geraniol 60, and 2.35% Triethyl Citrate.

**[00199]** In some embodiments, the blend of compounds can include between 14.7 and 18% LFO, between 61 and 76% D-Limonene, between 4.8 and 5.9% Thyme Oil White, and between 9 and 11% Lime Oil 410.

**[00200]** In some embodiments, the blend of compounds can include 16.31% LFO, 68.34% D-Limonene, 5.37% Thyme Oil White, and 9.98% Lime Oil 410.

**[00201]** In some embodiments, the blend of compounds can include between 4.2 and 5.2% Linalool Coeur, between 36 and 45% Thymol (crystal), between 1.7 and 2.1% Alpha-Pinene (98%), between 31 and 38% Para-Cymene, and between 16 and 20% Trans-anethole.

**[00202]** In some embodiments, the blend of compounds can include 4.7% Linalool Coeur, 40.8% Thymol (crystal), 1.9% Alpha-Pinene (98%), 34.49% Para-Cymene, and 18.2% Trans-anethole.

**[00203]** In some embodiments, the blend of compounds can include between 6 and 7.4% Linalool Coeur, between 21.5 and 26.5% Soy Bean Oil, between 33 and 41% Thymol (crystal), between 3.4 and 4.2% Alpha-Pinene (98%), and between 25 and 31% Para-Cymene.

**[00204]** In some embodiments, the blend of compounds can include 6.6% Linalool Coeur, 24.0% Soy Bean Oil, 37.2% Thymol (crystal), 3.8% Alpha-Pinene (98%), and 28.39% Para-Cymene.

**[00205]** In some embodiments, the blend of compounds can include between 36 and 45% Linalool Coeur, between 31 and 37.5% Thymol (crystal), between 4.2 and 5.2% Alpha-Pinene (98%), between 1.7 and 2.1% Para-Cymene, and between 16.5 and 20% Trans-anethole.

**[00206]** In some embodiments, the blend of compounds can include 40.8% Linalool Coeur, 34.4% Thymol (crystal), 4.7% Alpha-Pinene (98%), 1.9% Para-Cymene, and 18.20% Trans-anethole.

**[00207]** In some embodiments, the blend of compounds can include between 8.5 and 10.5% Linalool Coeur, between 42 and 53% Thymol (crystal), between 8.5 and 10.4% Alpha-Pinene (98%), and between 30 and 36.5% Para-Cymene.

**[00208]** In some embodiments, the blend of compounds can include 9.49% Linalool Coeur, 47.87% Thymol (crystal), 9.46% Alpha-Pinene (98%), and 33.18% Para-Cymene.

**[00209]** In some embodiments, the blend of compounds can include between 18 and 22.3% Linalool Coeur, between 22 and 27% Tetrahydrolinalool, between 2.2 and 2.7% Vanillin, between 26 and 33% Isopropyl myristate, between 9 and 11% Piperonal (aldehyde), and between 12 and 14.6% Geraniol Fine FCC.

**[00210]** In some embodiments, the blend of compounds can include 20.15% Linalool Coeur, 24.23% Tetrahydrolinalool, 2.47% Vanillin, 29.84% Isopropyl myristate, 9.95% Piperonal (aldehyde), and 13.36% Geraniol Fine FCC.

**[00211]** In some embodiments, the blend of compounds can include between 20 and 26% Tetrahydrolinalool, between 1.0 and 1.4% Vanillin, between 4 and 4.9% Hercolyn D, between 13.5 and 16.6% Isopropyl myristate, between 6.8 and 8.3% Piperonal (aldehyde), between 20 and 25.2% Ethyl Linalool, between 6 and 7.3% Hedione, between 9 and 11.2% Triethyl Citrate, and between 8.1 and 10% Dipropylene glycol (DPG).

**[00212]** In some embodiments, the blend of compounds can include 22.98% Tetrahydrolinalool, 1.17% Vanillin, 4.44% Hercolyn D, 15.10% Isopropyl myristate, 7.55%

Piperonal (aldehyde), 22.91% Ethyl Linalool, 6.67% Hedione, 10.10% Triethyl Citrate, and 9.09% Dipropylene glycol (DPG).

**[00213]** In some embodiments, the blend of compounds can include between 12.2 and 14.8% Linalool Coeur, between 16.9 and 20.1% Tetrahydrolinalool, 1.08 and 1.32% Vanillin, between 17 and 21% Isopropyl myristate, between 17 and 21% Piperonal (aldehyde), between 8.8 and 10.8% Geraniol 60, and between 17 and 21% Triethyl Citrate.

**[00214]** In some embodiments, the blend of compounds can include 13.5% Linalool Coeur, 18.5% Tetrahydrolinalool, 1.2% Vanillin, 19.0% Isopropyl myristate, 19.0% Piperonal (aldehyde), 9.8% Geraniol 60, and 19.1% Triethyl Citrate.

**[00215]** In some embodiments, the blend of compounds can include between 17 and 21% Linalool Coeur, between 21 and 25.5% Tetrahydrolinalool, between 1.08 and 1.32% Vanillin, between 20.6 and 25.2% Isopropyl myristate, between 21 and 26% Piperonal (aldehyde), and between 8.6 and 10.5% Piperonyl Alcohol.

**[00216]** In some embodiments, the blend of compounds can include 19.2% Linalool Coeur, 23.2% Tetrahydrolinalool, 1.2% Vanillin, 22.9% Isopropyl myristate, 23.8% Piperonal (aldehyde), and 9.6% Piperonyl Alcohol.

**[00217]** In some embodiments, the blend of compounds can include between 43 and 54% D-Limonene, between 1.1 and 1.34% Linalool Coeur, between 9.2 and 11.3% Citral, between 9.4 and 11.6% gamma-terpinene, between 1.7 and 2.13% Alpha-Pinene (98%), between 6.1 and 7.5% Alpha-Terpineol, between 5.6 and 7.0% Terpinolene, between 1.45 and 1.76% Para-Cymene, between 2.34 and 2.86% Linalyl Acetate, between 2.5 and 3.1% Beta Pinene, between 0.12 and 0.14% Camphor Dextro, between 0.1 and 0.12% Terpinene 4 OL, between 2.5

and 3.1% Alpha Terpinene, between 1.17 and 1.43% Borneol L, between 0.49 and 0.61% Camphene, between 0.155 and 0.185% Decanal, between 0.13 and 0.15% Dodecanal, between 0.009 and 0.011% Fenchol Alpha, between 0.16 and 0.20% Geranyl Acetate, between 0.37 and 0.45% Isoborneol, between 0.34 and 0.42% 2-Methyl 1,3-cyclohexadiene, between 1.03 and 1.25% Myrcene, between 0.027 and 0.033% Nonanal, between 0.054 and 0.066% Octanal, and between 0.027 and 0.033% Tocopherol Gamma Tenox.

**[00218]** In some embodiments, the blend of compounds can include 48.58% D-Limonene, 1.22% Linalool Coeur, 10.21% Citral, 10.51% gamma-terpinene, 1.94% Alpha-Pinene (98%), 6.80% Alpha-Terpineol, 6.30% Terpinolene, 1.61% Para-Cymene, 2.60% Linalyl Acetate, 2.80% Beta Pinene, 0.13% Camphor Dextro, 0.11% Terpinene 4 OL, 2.80% Alpha Terpinene, 1.30% Borneol L, 0.54% Camphene, 0.17% Decanal, 0.14% Dodecanal, 0.01% Fenchol Alpha, 0.18% Geranyl Acetate, 0.41% Isoborneol, 0.38% 2-Methyl 1,3-cyclohexadiene, 1.14% Myrcene, 0.03% Nonanal, 0.06% Octanal, and 0.03% Tocopherol Gamma Tenox.

**[00219]** In some embodiments, the blend of compounds can include between 52 and 65% D-Limonene, between 1.3 and 1.61% Linalool Coeur, between 11.4 and 13.9% gamma-terpinene, between 2.1 and 2.6% Alpha-Pinene (98%), between 6.8 and 8.5% Terpinolene, between 1.7 and 2.2% Para-Cymene, between 2.8 and 2.45% Linalyl Acetate, between 3 and 3.7% Beta Pinene, between 0.145 and 0.176% Camphor Dextro, between 0.12 and 0.14% Terpinene 4 OL, between 3 and 3.7% Alpha Terpinene, between 1.42 and 1.72% Borneol L, between 0.59 and 0.71% Camphene, between 0.18 and 0.22% Decanal, between 0.155 and 0.185% Dodecanal, between 0.009 and 0.011% Fenchol Alpha, 0.2 and 0.24% Geranyl Acetate, between 0.44 and 0.54% Isoborneol, between 0.42 and 0.5% 2-Methyl 1,3-cyclohexadiene,

between 1.24 and 1.5% Myrcene, between 0.036 and 0.044% Nonanal, between 0.06 and 0.08% Octanal, and between 0.036 and 0.044% Tocopherol Gamma Tenox.

**[00220]** In some embodiments, the blend of compounds can include 58.54% D-Limonene, 1.47% Linalool Coeur, 12.66% gamma-terpinene, 2.34% Alpha-Pinene (98%), 7.59% Terpinolene, 1.94% Para-Cymene, 3.13% Linalyl Acetate, 3.37% Beta Pinene, 0.16% Camphor Dextro, 0.13% Terpinene 4 OL, 3.37% Alpha Terpinene, 1.57% Borneol L, 0.65% Camphene, 0.20% Decanal, 0.17% Dodecanal, 0.01% Fenchol Alpha, 0.22% Geranyl Acetate, 0.49% Isoborneol, 0.46% 2-Methyl 1,3-cyclohexadiene, 1.37% Myrcene, 0.04% Nonanal, 0.07% Octanal, and 0.04% Tocopherol Gamma Tenox.

**[00221]** In some embodiments, the blend of compounds can include between 31 and 38% D-Limonene, between 9 and 11.1% Linalool Coeur, between 4.5 and 5.5% Alpha-Pinene (98%), between 9 and 11.2% Terpinolene, between 9 and 11.1% Para-Cymene, between 2.8 and 5.9% Linalyl Acetate, between 4.5 and 5.8% Beta Pinene, between 4.3 and 5.4% Alpha Terpinene, between 5.2 and 6.4% Camphene, and between 8.3 and 10.2% Myrcene.

**[00222]** In some embodiments, the blend of compounds can include 34.50% D-Limonene, 10.05% Linalool Coeur, 5.01% Alpha-Pinene (98%), 10.10% Terpinolene, 10.04% Para-Cymene, 5.30% Linalyl Acetate, 5.02% Beta Pinene, 4.88% Alpha Terpinene, 5.84% Camphene, and 9.26% Myrcene.

**[00223]** In some embodiments, the blend of compounds can include between 81 and 99% B-5028 (20.6% Thyme Oil White, 45.1% Wintergreen Oil, and 34.3% Isopropyl myristate) and between 9 and 11% Solution S-3002 (Stock 10% SLS Solution; 10% Sodium Lauryl Sulfate, 90.00% Water).

**[00224]** In some embodiments, the blend of compounds can include 90% B-5028 (20.6% Thyme Oil White, 45.1% Wintergreen Oil, and 34.3% Isopropyl myristate) and 10% Solution S-3002 (Stock 10% SLS Solution; 10% Sodium Lauryl Sulfate, 90.00% Water).

**[00225]** In some embodiments, the blend of compounds can include between 0.8 and 1.0% Polyglycerol-4-oleate, between 0.18 and 0.22% Lecithin, between 8.8 and 10.8% Water, and between 80 and 98% Blend B-5028 (20.6% Thyme Oil White, 45.1% Wintergreen Oil, 34.3% Isopropyl myristate).

**[00226]** In some embodiments, the blend of compounds can include 0.90% Polyglycerol-4-oleate, 0.20% Lecithin, 9.8% Water, and 89.1% Blend B-5028 (20.6% Thyme Oil White, 45.1% Wintergreen Oil, 34.3% Isopropyl myristate).

**[00227]** In some embodiments, the blend of compounds can include between 0.9 and 1.1% Potassium sorbate, between 0.25 and 0.31% Xanthan Gum, between 73 and 89% Water, and between 15.3 and 18.4% Blend F-4001 (0.90% Polyglycerol-4-oleate, 0.20% Lecithin, 9.8% Water, 89.1% Blend B-5028 [20.6% Thyme Oil White, 45.1% Wintergreen Oil, 34.3% Isopropyl myristate]).

**[00228]** In some embodiments, the blend of compounds can include 1.00% Potassium sorbate, 0.28% Xanthan Gum, 81.82% Water, and 16.90% Blend F-4001 (0.90% Polyglycerol-4-oleate, 0.20% Lecithin, 9.8% Water, 89.1% Blend B-5028 [20.6% Thyme Oil White, 45.1% Wintergreen Oil, 34.3% Isopropyl myristate]).

**[00229]** In some embodiments, the blend of compounds can include between 0.10 and 0.12% Potassium sorbate, between 0.135 and 0.165% Polyglycerol-4-oleate, between 0.25 and 0.31% Xanthan Gum, between 0.030 and 0.038% Lecithin, between 76 and 92% Water, and

between 13.5 and 16.5% Blend B-5028 (20.6% Thyme Oil White, 45.1% Wintergreen Oil, 34.3% Isopropyl myristate).

**[00230]** In some embodiments, the blend of compounds can include 0.11% Potassium sorbate, 0.15% Polyglycerol-4-oleate, 0.28% Xanthan Gum, 0.034% Lecithin, 84.4% Water, and 15% Blend B-5028 (20.6% Thyme Oil White, 45.1% Wintergreen Oil, 34.3% Isopropyl myristate).

**[00231]** In some embodiments, the blend of compounds can include between 2.7 and 3.4% Thyme Oil White, between 6 and 7.5% Wintergreen Oil, between 4.5 and 5.7% Isopropyl myristate, between 0.1 and 0.12% Potassium sorbate, between 0.135 and 0.165% Polyglycerol-4-oleate, between 0.25 and 0.31% Xanthan Gum, between 0.027 and 0.033% Lecithin, and between 76 and 91% Water.

**[00232]** In some embodiments, the blend of compounds can include 3.09% Thyme Oil White, 6.77% Wintergreen Oil, 5.15% Isopropyl myristate, 0.11% Potassium sorbate, 0.15% Polyglycerol-4-oleate, 0.28% Xanthan Gum, 0.03% Lecithin, and 84.41% Water.

**[00233]** In some embodiments, the blend of compounds can include between 0.8 and 1.0% Polyglycerol-4-oleate, between 0.18 and 0.22% Lecithin, between 9 and 11% Water, and between 80 and 98% Blend B-5016 (39.24% Thyme Oil White, 24.82% Wintergreen Oil, 35.94% Isopropyl myristate).

**[00234]** In some embodiments, the blend of compounds can include 0.90% Polyglycerol-4-oleate, 0.20% Lecithin, 9.8% Water, and 89.10% Blend B-5016 (39.24% Thyme Oil White, 24.82% Wintergreen Oil, 35.94% Isopropyl myristate).

**[00235]** In some embodiments, the blend of compounds can include between 2.7 and 3.4% Water, between 76 and 92% Blend F-4001 (0.90% Polyglycerol-4-oleate, 0.20% Lecithin, 9.8% Water, 89.1% Blend B-5028 [20.6% Thyme Oil White, 45.1% Wintergreen Oil, 34.3% Isopropyl myristate]), and between 11.5 and 14% Solution S-3001 (Stock 2.5% Xanthan-1% K sorbate; 1% Potassium Sorbate, 2.50% Xanthan Gum, 96.50% Water).

**[00236]** In some embodiments, the blend of compounds can include 3.1% Water, 84.2% Blend F-4001 (0.90% Polyglycerol-4-oleate, 0.20% Lecithin, 9.8% Water, 89.1% Blend B-5028 [20.6% Thyme Oil White, 45.1% Wintergreen Oil, 34.3% Isopropyl myristate]), and 12.7% Solution S-3001 (Stock 2.5% Xanthan-1% K sorbate; 1% Potassium Sorbate, 2.50% Xanthan Gum, 96.50% Water).

**[00237]** In some embodiments, the blend of compounds can include between 14 and 17% Thyme Oil White, between 30 and 37% Wintergreen Oil, between 23 and 27.5% Isopropyl myristate, between 0.115 and 0.145% Potassium sorbate, between 0.7 and 0.83% Polyglycerol-4-oleate, between 0.29 and 0.36% Xanthan Gum, between 0.15 and 0.19% Lecithin, and between 21 and 26% Water.

**[00238]** In some embodiments, the blend of compounds can include 15.5% Thyme Oil White, 33.8% Wintergreen Oil, 25.7% Isopropyl myristate, 0.13% Potassium sorbate, 0.76% Polyglycerol-4-oleate, 0.32% Xanthan Gum, 0.17% Lecithin, and 23.6% Water.

**[00239]** In some embodiments, the blend of compounds can include between 9.2% Water, between 70 and 88% Blend F-4001(0.90% Polyglycerol-4-oleate, 0.20% Lecithin, 9.8% Water, 89.1% Blend B-5028 [20.6% Thyme Oil White, 45.1% Wintergreen Oil, 34.3% Isopropyl myristate]), and between 10.5 and 13.2% Solution S-3001 (Stock 2.5% Xanthan-1% K sorbate; 1% Potassium Sorbate, 2.50% Xanthan Gum, 96.50% Water).

**[00240]** In some embodiments, the blend of compounds can include 9.2% Water, 78.87% Blend F-4001(0.90% Polyglycerol-4-oleate, 0.20% Lecithin, 9.8% Water, 89.1% Blend B-5028 [20.6% Thyme Oil White, 45.1% Wintergreen Oil, 34.3% Isopropyl myristate]), and 11.90% Solution S-3001 (Stock 2.5% Xanthan-1% K sorbate; 1% Potassium Sorbate, 2.50% Xanthan Gum, 96.50% Water).

**[00241]** In some embodiments, the blend of compounds can include between 0.11 and 0.15% Potassium sorbate, between 0.7 and 0.84% Polyglycerol-4-oleate, between 0.29 and 0.36% Xanthan gum, between 0.15 and 0.19% Lecithin, between 25 and 32% Water, and between 63 and 77% Blend B-5028 (20.6% Thyme Oil White, 45.1% Wintergreen Oil, 34.3% Isopropyl myristate).

**[00242]** In some embodiments, the blend of compounds can include 0.13% Potassium sorbate, 0.76% Polyglycerol-4-oleate, 0.32% Xanthan gum, 0.17% Lecithin, 28.6% Water, and 70% Blend B-5028 (20.6% Thyme Oil White, 45.1% Wintergreen Oil, 34.3% Isopropyl myristate).

**[00243]** In some embodiments, the blend of compounds can include between 2.8 and 3.4% Water, between 76 and 92% Blend F-4003 (0.90% Polyglycerol-4-oleate, 0.20% Lecithin, 9.8% Water, 89.10% Blend B-5016 [39.24% Thyme Oil White, 24.82% Wintergreen Oil, 35.94% Isopropyl Myristate]), and between 11.5 and 14% Solution S-3001 (Stock 2.5% Xanthan-1% K sorbate; 1% Potassium Sorbate, 2.50% Xanthan Gum, 96.50% Water).

**[00244]** In some embodiments, the blend of compounds can include 3.1% Water, 84.2% Cationic formulation-Hi residual (F-4003; 0.90% Polyglycerol-4-oleate, 0.20% Lecithin, 9.8% Water, 89.10% Blend B-5016 [39.24% Thyme Oil White, 24.82% Wintergreen Oil, 35.94%

Isopropyl Myristate]), and 12.7% Solution S-3001 (Stock 2.5% Xanthan-1% K sorbate; 1% Potassium Sorbate, 2.50% Xanthan Gum, 96.50% Water).

**[00245]** In some embodiments, the blend of compounds can include between 0.9 and 1.1% Potassium sorbate, between 0.25 and 0.31% Xanthan gum, between 73 and 90% Water, and between 15.3 and 18.5% Blend F-4003 (0.90% Polyglycerol-4-oleate, 0.20% Lecithin, 9.8% Water, 89.10% Blend B-5016 [39.24% Thyme Oil White, 24.82% Wintergreen Oil, 35.94% Isopropyl Myristate]).

**[00246]** In some embodiments, the blend of compounds can include 1% Potassium sorbate, 0.28% Xanthan gum, 81.8% Water, and 16.9% Blend F-4003 (0.90% Polyglycerol-4-oleate, 0.20% Lecithin, 9.8% Water, 89.10% Blend B-5016 [39.24% Thyme Oil White, 24.82% Wintergreen Oil, 35.94% Isopropyl Myristate]).

**[00247]** In some embodiments, the blend of compounds can include between 0.8 and 1.0% Polyglycerol-4-oleate, between 0.18 and 0.22% Lecithin, between 8.9 and 11% Water, and between 80 and 98% Blend B-5034 (20.6% Thyme Oil White, 34.3% Isopropyl Myristate, 45.1% Wintergreen Oil Technical).

**[00248]** In some embodiments, the blend of compounds can include 0.90% Polyglycerol-4-oleate, 0.20% Lecithin, 9.8% Water, and 89.10% Blend B-5034 (20.6% Thyme Oil White, 34.3% Isopropyl Myristate, 45.1% Wintergreen Oil Technical).

**[00249]** In some embodiments, the blend of compounds can include between 0.9 and 1.1% Potassium sorbate, between 0.25 and 0.31% Xanthan gum, between 73 and 90% Water, and between 15.3 and 17.5% Formulation F-4009 (0.90% Polyglycerol-4-oleate, 0.20% Lecithin,

9.8% Water, 89.10% Blend B-5034 [24B-4a for Institutions with Methyl Sal; 20.6% Thyme Oil White, 34.3% Isopropyl Myristate, 45.1% Wintergreen Oil Technical]).

**[00250]** In some embodiments, the blend of compounds can include 1.00% Potassium sorbate, 0.28% Xanthan gum, 81.82% Water, and 16.9% Formulation F-4009 (0.90% Polyglycerol-4-oleate, 0.20% Lecithin, 9.8% Water, 89.10% Blend B-5034 [24B-4a for Institutions with Methyl Sal; 20.6% Thyme Oil White, 34.3% Isopropyl Myristate, 45.1% Wintergreen Oil Technical]).

**[00251]** In some embodiments, the blend of compounds can include between 0.18 and 0.22% Citronella Oil, between 0.18 and 0.22% Carbopol 940, between 0.9 and 0.11% BHT, between 54 and 66% Water, between 12.5 and 16% Emulsifying Wax, between 3.6 and 4.4% Light liquid paraffin, between 8.1 and 9.9% White Soft Paraffin, between 0.22 and 0.28% Sodium metabisulfate, between 1.8 and 2.2% Propylene glycol, between 0.13 and 0.17% Methyl parabin, between 0.045 and 0.055% Propyl parabin, between 4.5 and 5.5% Cresmer RH40 hydrogenated, between 0.13 and 0.17% Triethanolamine, between 0.018 and 0.022% Vitamin E acetate, between 0.045 and 0.055% Disodium EDTA, and between 4.5 and 5.5% Blend B-5006 (12.94% Lilac Flower Oil, 8.72% D-Limonene, 9.58% Thyme Oil White, 68.76% Lime Oil 410).

**[00252]** In some embodiments, the blend of compounds can include 0.20% Citronella Oil, 0.20% Carbopol 940, 0.10% BHT, 59.83% Water, 14.00% Emulsifying Wax, 4.00% Light liquid paraffin, 9.00% White Soft Paraffin, 0.25% Sodium metabisulfate, 2.00% Propylene glycol, 0.15% Methyl parabin, 0.05% Propyl parabin, 5.00% Cresmer RH40 hydrogenated, 0.15% Triethanolamine, 0.02% Vitamin E acetate, 0.05% Disodium EDTA, and 5.00% Blend B-5006 (12.94% Lilac Flower Oil, 8.72% D-Limonene, 9.58% Thyme Oil White, 68.76% Lime Oil 410).

**[00253]** In some embodiments, the blend of compounds can include between 0.045 and 0.055% Span 80, between 0.18 and 0.22% Sodium benzoate, between 26 and 32% Isopar M, between 13 and 16% A46 Propellant, between 38 and 46% Water, between 1.3 and 1.7% Isopropyl alcohol, and between 11.2 and 13.7% Blend B-5005 (56.30% D-Limonene, 12.38% Thyme Oil White, 31.32% Wintergreen Oil).

**[00254]** In some embodiments, the blend of compounds can include 0.05% Span 80, 0.20% Sodium benzoate, 29% Isopar M, 14.5% A46 Propellant, 42.25% Water, 1.50% Isopropyl alcohol, and 12.5% Blend B-5005 (56.30% D-Limonene, 12.38% Thyme Oil White, 31.32% Wintergreen Oil).

**[00255]** In some embodiments, the blend of compounds can include between 46 and 56% Isopar M, between 36 and 44% A46 propellant, between 2.7 and 3.3% Isopropyl alcohol, and between 5.4 and 6.6% B-5024 (TT-7; 27.35% D-Limonene, 30.08% Thyme Oil White, 42.57% Blend C-4003 [13.5% Linalool Coeur, 18.5% Tetradyrdolinalool, 1.2% Vanillin, 19.0% Isopropyl myristate, 19.0% Piperonal (aldehyde), 9.8% Geraniol 60, 19.1% Triethyl Citrate]).

**[00256]** In some embodiments, the blend of compounds can include 51.0% Isopar M, 40.0% A46 propellant, 3.0% Isopropyl alcohol, and 6.0% B-5024 (TT-7; 27.35% D-Limonene, 30.08% Thyme Oil White, 42.57% Blend C-4003 [13.5% Linalool Coeur, 18.5% Tetradyrdolinalool, 1.2% Vanillin, 19.0% Isopropyl myristate, 19.0% Piperonal (aldehyde), 9.8% Geraniol 60, 19.1% Triethyl Citrate]).

**[00257]** In some embodiments, the blend of compounds can include between 46 and 56% Isopar M, between 36 and 44% A46 propellant, between 0.045 and 0.055% Bifenthrin, between 2.7 and 3.3% Isopropyl alcohol, and between 5.4 and 6.6% Blend B-5024 (TT-7; 27.35% D-Limonene, 30.08% Thyme Oil White, 42.57% Blend C-4003 [13.5% Linalool Coeur,

18.5% Tetradyrdolinalool, 1.2% Vanillin, 19.0% Isopropyl myristate, 19.0% Piperonal (aldehyde), 9.8% Geraniol 60, 19.1% Triethyl Citrate]).

**[00258]** In some embodiments, the blend of compounds can include 51.0% Isopar M, 40.0% A46 propellant, 0.05% Bifenthrin, 3.0% Isopropyl alcohol, and 6.0% Blend B-5024 (TT-7; 27.35% D-Limonene, 30.08% Thyme Oil White, 42.57% Blend C-4003 [13.5% Linalool Coeur, 18.5% Tetradyrdolinalool, 1.2% Vanillin, 19.0% Isopropyl myristate, 19.0% Piperonal (aldehyde), 9.8% Geraniol 60, 19.1% Triethyl Citrate]).

**[00259]** In some embodiments, the blend of compounds can include between 49 and 60% Isopar M, between 36 and 44% A46 propellant, and between 5.4 and 6.6% Blend B-5021 (HL1; 27.35% D-Limonene, 30.08% Thyme Oil White, 42.57% Blend C-4003 [13.5% Linalool Coeur, 18.5% Tetradyrdolinalool, 1.2% Vanillin, 19.0% Isopropyl myristate, 19.0% Piperonal (aldehyde), 9.8% Geraniol 60, 19.1% Triethyl Citrate]).

**[00260]** In some embodiments, the blend of compounds can include 54.0% Isopar M, 40.0% A46 propellant, and 6.0% Blend B-5021 (HL1; 27.35% D-Limonene, 30.08% Thyme Oil White, 42.57% Blend C-4003 [13.5% Linalool Coeur, 18.5% Tetradyrdolinalool, 1.2% Vanillin, 19.0% Isopropyl myristate, 19.0% Piperonal (aldehyde), 9.8% Geraniol 60, 19.1% Triethyl Citrate]).

**[00261]** In some embodiments, the blend of compounds can include between 1.8 and 2.3% Thyme Oil White, between 4 and 5% Wintergreen Oil, between 3.1 and 3.75% Isopropyl myristate, between 0.10 and 0.12% Potassium Sorbate, between 0.135 and 0.165% Polyclycerol-4-oleate, between 0.25 and 0.31% Xanthan Gum, between 0.027 and 0.033% Lecithin, and between 80 and 98% Water.

**[00262]** In some embodiments, the blend of compounds can include 2.06% Thyme Oil White, 4.51% Wintergreen Oil, 3.43% Isopropyl myristate, 0.11% Potassium Sorbate, 0.15% Polyclycerol-4-oleate, 0.28% Xanthan Gum, 0.03% Lecithin, and 89.42% Water.

**[00263]** In some embodiments, the blend of compounds can include between 0.9 and 1.15% Thyme Oil White, between 2 and 2.5% Wintergreen Oil, between 1.55 and 1.89% Isopropyl myristate, between 0.1 and 0.12% Potassium Sorbate, between 0.13 and 0.17% Polyglycerol-4-oleate, between 0.25 and 0.31% Xanthan Gum, between 0.027 and 0.033% Lecithin, and between 85 and 100% Water.

**[00264]** In some embodiments, the blend of compounds can include 1.03% Thyme Oil White, 2.26% Wintergreen Oil, 1.72% Isopropyl myristate, 0.11% Potassium Sorbate, 0.15% Polyglycerol-4-oleate, 0.28% Xanthan Gum, 0.03% Lecithin, and 94.43% Water.

**[00265]** In some embodiments, the blend of compounds can include between 0.18 and 0.22% Soya Lecithin, between 0.8 and 1.0% Polyglycerol-4-oleate, between 8.8 and 10.8% Water, and between 80 and 98% Blend B-5016 (39.24% Thyme Oil White, 24.82% Wintergreen Oil, 35.94% Isopropyl Myristate).

**[00266]** In some embodiments, the blend of compounds can include 0.20% Soya Lecithin, 0.90% Polyglycerol-4-oleate, 9.80% Water, and 89.10% Blend B-5016 (39.24% Thyme Oil White, 24.82% Wintergreen Oil, 35.94% Isopropyl Myristate).

**[00267]** In some embodiments, the blend of compounds can include between 32 and 38% Thyme Oil White, between 29 and 35% Isopropyl myristate, between 0.18 and 0.22% Soya Lecithin, between 0.8 and 1.0% Polyglycerol-4-oleate, between 8.8 and 10.8% Water, and between 20 and 24% Wintergreen Oil Technical.

**[00268]** In some embodiments, the blend of compounds can include 35.0% Thyme Oil White, 32.0% Isopropyl myristate, 0.20% Soya Lecithin, 0.90% Polyglycerol-4-oleate, 9.80% Water, and 22.1% Wintergreen Oil Technical.

**[00269]** In some embodiments, the blend of compounds can include between 0.09 and 0.11% Soya Lecithin, between 0.8 and 1.0% Polyglycerol-4-oleate, between 8.9 and 10.9% Water, and between 80 and 98% Blend B-5004 (20.50% Thyme Oil White, 45.00% Wintergreen Oil, 1.10% Vanillin, 33.40% Isopropyl myristate).

**[00270]** In some embodiments, the blend of compounds can include 0.10% Soya Lecithin, 0.90% Polyglycerol-4-oleate, 9.90% Water, and 89.1% Blend B-5004 (20.50% Thyme Oil White, 45.00% Wintergreen Oil, 1.10% Vanillin, 33.40% Isopropyl myristate).

**[00271]** In some embodiments, the blend of compounds can include between 16 and 20.5% Thyme Oil White, between 36 and 44% Wintergreen Oil, between 0.89 and 1.08% Vanillin, between 26.5 and 33% Isopropyl myristate, between 0.09 and 0.11% Soya Lecithin, between 0.8 and 1.0% Polyglycerol-4-oleate, and between 8.9 and 10.9% Water.

**[00272]** In some embodiments, the blend of compounds can include 18.27% Thyme Oil White, 40.10% Wintergreen Oil, 0.98% Vanillin, 29.76% Isopropyl myristate, 0.10% Soya Lecithin, 0.90% Polyglycerol-4-oleate, and 9.90% Water.

**[00273]** In some embodiments, the blend of compounds can include between 1.7 and 2.1% Polyglycerol-4-oleate, between 8 and 10% Water, and between 80 and 98% Blend B-5016 (39.24% Thyme Oil White, 24.82% Wintergreen Oil, 35.94% Isopropyl Myristate).

**[00274]** In some embodiments, the blend of compounds can include 1.90% Polyglycerol-4-oleate, 9.00% Water, and 89.10% Blend B-5016 (39.24% Thyme Oil White, 24.82% Wintergreen Oil, 35.94% Isopropyl Myristate).

**[00275]** In some embodiments, the blend of compounds can include between 31.5 and 38.5% Thyme Oil White, between 29 and 35% Isopropyl myristate, between 1.7 and 2.1% Polyglycerol-4-oleate, between 8 and 10% Water, and between 20 and 24% Wintergreen Oil (Technical).

**[00276]** In some embodiments, the blend of compounds can include 35.0% Thyme Oil White, 32.0% Isopropyl myristate, 1.90% Polyglycerol-4-oleate, 9.00% Water, and 22.1% Wintergreen Oil (Technical).

**[00277]** In some embodiments, the blend of compounds can include between 0.10 and 0.12% Potassium Sorbate, between 1.7 and 2.1% Polyglycerol-4-oleate, between 0.24 and 0.31% Xanthan Gum, between 78 and 94% Water, and between 10 and 12.5% Blend P-1010 (0.10% Soya Lecithin, 0.90% Polyglycerol-4-oleate, 9.90% Water, 89.1% Blend B-5004 [20.50% Thyme Oil White, 45.00% Wintergreen Oil, 1.10% Vanillin, 33.40% Isopropyl myristate]).

**[00278]** In some embodiments, the blend of compounds can include 0.11% Potassium Sorbate, 1.90% Polyglycerol-4-oleate, 0.275% Xanthan Gum, 86.410% Water, and 11.30% Blend P-1010 (0.10% Soya Lecithin, 0.90% Polyglycerol-4-oleate, 9.90% Water, 89.1% Blend B-5004 [20.50% Thyme Oil White, 45.00% Wintergreen Oil, 1.10% Vanillin, 33.40% Isopropyl myristate]).

**[00279]** In some embodiments, the blend of compounds can include between 5.0 and 6.3% D-Limonene, between 1.1 and 1.4% Thyme Oil White, between 0.010 and 0.012% Soya

Lecithin, between 0.1 and 0.12% Potassium Sorbate, between 1.8 and 2.2% Polyglycerol-4-oleate, between 0.24 and 0.31% Xanthan Gum, between 79 and 96.5% Water, and between 2.8 and 3.45% Wintergreen Oil (Technical).

**[00280]** In some embodiments, the blend of compounds can include 5.67% D-Limonene, 1.25% Thyme Oil White, 0.011% Soya Lecithin, 0.11% Potassium Sorbate, 2.002% Polyglycerol-4-oleate, 0.275% Xanthan Gum, 87.529% Water, and 3.15% Wintergreen Oil (Technical).

**[00281]** In some embodiments, the blend of compounds can include between 0.1 and 0.12% Potassium Sorbate, between 0.24 and 0.31% Xanthan Gum, between 80 and 97% Water, and between 10 and 12.6% Blend P-1000 (0.20% Soya Lecithin, 0.90% Polyglycerol-4-oleate, 9.80% Water, 89.10% Blend B-5016 [39.24% Thyme Oil White, 24.82% Wintergreen Oil, 35.94% Isopropyl Myristate]).

**[00282]** In some embodiments, the blend of compounds can include 0.11% Potassium Sorbate, 0.275% Xanthan Gum, 88.315% Water, and 11.30% Blend P-1000 (0.20% Soya Lecithin, 0.90% Polyglycerol-4-oleate, 9.80% Water, 89.10% Blend B-5016 [39.24% Thyme Oil White, 24.82% Wintergreen Oil, 35.94% Isopropyl Myristate]).

**[00283]** In some embodiments, the blend of compounds can include between 3.5 and 4.4% Thyme Oil White, between 3.2 and 4% Isopropyl myristate, between 0.02 and 0.025% Soya Lecithin, between 0.1 and 0.12% Potassium Sorbate, between 0.9 and 0.115% Polyglycerol-4-oleate, between 0.25 and 0.30% Xanthan Gum, between 80 and 98% Water, and between 2.2 and 2.8% Wintergreen Oil (Technical).

**[00284]** In some embodiments, the blend of compounds can include 3.95% Thyme Oil White, 3.62% Isopropyl myristate, 0.023% Soya Lecithin, 0.11% Potassium Sorbate, 0.102% Polyglycerol-4-oleate, 0.275% Xanthan Gum, 89.422% Water, 2.50% Wintergreen Oil (Technical).

**[00285]** In some embodiments, the blend of compounds can include between 0.1 and 0.12% Potassium Sorbate, between 0.25 and 0.30% Xanthan Gum, between 80 and 98% Water, and between 10 and 12.6% Blend P-1020 (1.90% Polyglycerol-4-oleate, 9.00% Water, 89.10% Blend B-5016 [39.24% Thyme Oil White, 24.82% Wintergreen Oil, 35.94% Isopropyl Myristate]).

**[00286]** In some embodiments, the blend of compounds can include 0.11% Potassium Sorbate, 0.275% Xanthan Gum, 88.315% Water, and 11.30% Blend P-1020 (1.90% Polyglycerol-4-oleate, 9.00% Water, 89.10% Blend B-5016 [39.24% Thyme Oil White, 24.82% Wintergreen Oil, 35.94% Isopropyl Myristate]).

**[00287]** In some embodiments, the blend of compounds can include between 3.5 and 4.4% Thyme Oil White, between 2.2 and 2.8% Wintergreen Oil, between 3.3 and 40% Isopropyl myristate, between 0.1 and 0.12% Potassium Sorbate, between 0.18 and 0.23% Polyglycerol-4-oleate, between 0.25 and 0.30% Xanthan Gum, and between 80 and 98% Water.

**[00288]** In some embodiments, the blend of compounds can include 3.95% Thyme Oil White, 2.50% Wintergreen Oil, 3.62% Isopropyl myristate, 0.11% Potassium Sorbate, 0.21% Polyglycerol-4-oleate, 0.275% Xanthan Gum, and 89.332% Water.

**[00289]** In some embodiments, the blend of compounds can include between 0.9 and 1.1% Potassium Sorbate, between 2.2 and 2.8% Xanthan Gum, and between 87 and 100% Water.

**[00290]** In some embodiments, the blend of compounds can include 1.00% Potassium Sorbate, 2.500% Xanthan Gum, and 96.500% Water.

**[00291]** In some embodiments, the blend of compounds can include between 1.8 and 2.2% Sodium Benzoate and between 89 and 100% Water.

**[00292]** In some embodiments, the blend of compounds can include 2% Sodium Benzoate and 98% Water.

**[00293]** In some embodiments, the blend of compounds can include between 1.05 and 1.32% Span 80, between 1.5 and 1.8% Tween 80, between 13 and 15.4% Isopar M, between 60 and 76% Water, between 2.5 and 3.2% Blend B-5005 (25B-4b blend; 56.30% D-Limonene, 12.38% Thyme Oil White, 31.32% Wintergreen Oil), and between 10 and 12.5% Solution P-1100 (2% Sodium Benzoate; 2% Sodium Benzoate, 98% Water).

**[00294]** In some embodiments, the blend of compounds can include 1.20% Span 80, 1.65% Tween 80, 14.20% Isopar M, 68.75% Water, 2.84% Blend B-5005 (25B-4b blend; 56.30% D-Limonene, 12.38% Thyme Oil White, 31.32% Wintergreen Oil), and 11.36% Solution P-1100 (2% Sodium Benzoate; 2% Sodium Benzoate, 98% Water).

**[00295]** In some embodiments, the blend of compounds can include between 1.4 and 1.8% D-Limonene, between 0.32 and 0.38% Thyme Oil White, between 0.8 and 0.98% Wintergreen Oil, between 1.1 and 1.3% Span 80, between 1.5 and 1.8% Tween 80, between 0.2 and 0.26% Sodium Benzoate, between 13 and 15.4% Isopar M, and between 71 and 88% Water.

**[00296]** In some embodiments, the blend of compounds can include 1.60% D-Limonene, 0.35% Thyme Oil White, 0.89% Wintergreen Oil, 1.20% Span 80, 1.65% Tween 80, 0.23% Sodium Benzoate, 14.20% Isopar M, and 79.88% Water.

**[00297]** In some embodiments, the blend of compounds can include between 20 and 24% Propellant A70 and between 70 and 86% Blend P-1110 (1.20% Span 80, 1.65% Tween 80, 14.20% Isopar M, 68.75% Water, 2.84% Blend B-5005 [56.30% D-Limonene, 12.38% Thyme Oil White, 31.32% Wintergreen Oil], 11.36% Solution P-1100 [2% Sodium Benzoate; 2% Sodium Benzoate, 98% Water]).

**[00298]** In some embodiments, the blend of compounds can include 22% Propellant A70 and 78% Blend P-1110 (1.20% Span 80, 1.65% Tween 80, 14.20% Isopar M, 68.75% Water, 2.84% Blend B-5005 [56.30% D-Limonene, 12.38% Thyme Oil White, 31.32% Wintergreen Oil], 11.36% Solution P-1100 [2% Sodium Benzoate; 2% Sodium Benzoate, 98% Water]).

**[00299]** In some embodiments, the blend of compounds can include between 1.1 and 1.4% D-Limonene, between 0.24 and 0.3% Thyme Oil White, between 0.62 and 0.76% Wintergreen Oil, between 0.85 and 1.04% Span 80, between 1.1 and 1.48% Tween 80, between 0.16 and 0.20% Sodium Benzoate, between 10 and 12.2% Isopar M, between 56 and 69% Water, and between 20 and 24% Propellant A70.

**[00300]** In some embodiments, the blend of compounds can include 1.25% D-Limonene, 0.27% Thyme Oil White, 0.69% Wintergreen Oil, 0.94% Span 80, 1.29% Tween 80, 0.18% Sodium Benzoate, 11.08% Isopar M, 62.31% Water, and 22.0% Propellant A70.

**[00301]** In some embodiments, the blend of compounds can include between 0.9 and 1.1% Potassium Sorbate, between 0.13 and 0.17% Polyglycerol-4-oleate, between 0.25 and 0.31% Xanthan Gum, between 0.030 and 0.037% Lecithin, between 75 and 91% Water, and between 13.5 and 16.6% Blend B-5028 (20.6% Thyme Oil White, 45.1% Wintergreen Oil, 34.3% Isopropyl myristate).

**[00302]** In some embodiments, the blend of compounds can include 1.0% Potassium Sorbate, 0.15% Polyglycerol-4-oleate, 0.28% Xanthan Gum, 0.034% Lecithin, 83.5% Water, and 15.1% Blend B-5028 (20.6% Thyme Oil White, 45.1% Wintergreen Oil, 34.3% Isopropyl myristate).

**[00303]** In some embodiments, the blend of compounds can include between 30 and 37% Water and between 59 and 74% Formulation F-4002 (1.00% Potassium sorbate, 0.28% Xanthan Gum, 81.82% Water, 16.90% Formulation F-4001 [0.90% Polyglycerol-4-oleate, 0.20% Lecithin, 9.8% Water, 89.1% Blend B-5028 (20.6% Thyme Oil White, 45.1% Wintergreen Oil, 34.3% Isopropyl myristate)]).

**[00304]** In some embodiments, the blend of compounds can include 33.40% Water and 66.60% Formulation F-4002 (1.00% Potassium sorbate, 0.28% Xanthan Gum, 81.82% Water, 16.90% Formulation F-4001 [0.90% Polyglycerol-4-oleate, 0.20% Lecithin, 9.8% Water, 89.1% Blend B-5028 (20.6% Thyme Oil White, 45.1% Wintergreen Oil, 34.3% Isopropyl myristate)]).

**[00305]** In some embodiments, the blend of compounds can include between 3.6 and 4.5% D-Limonene, between 4 and 4.9% Thyme Oil White, between 15 and 18.2% Benzyl Alcohol, between 18 and 23.5% Isopar M, between 44 and 49% Water, between 5.6 and 7.0% Blend C-4003 (3.18% Solution S-3002 (Stock 10% SLS Solution; 10% Sodium Lauryl Sulfate, 90% Water).

**[00306]** In some embodiments, the blend of compounds can include 4.03% D-Limonene, 4.43% Thyme Oil White, 16.61% Benzyl Alcohol, 20.95% Isopar M, 44.53% Water, 6.27% Blend C-4003 (3.18% Solution S-3002 (Stock 10% SLS Solution; 10% Sodium Lauryl Sulfate, 90% Water).

**[00307]** In some embodiments, the blend of compounds can include between 3.6 and 4.45% D-Limonene, between 4.0 and 4.9% Thyme Oil White, between 15 and 18.4% Benzyl Alcohol, between 18 and 23.4% Isopar M, between 40 and 49% Water, between 0.045 and 0.055% Bifenthrin, between 5.6 and 7.0% Blend C-4003 (3.178% Solution S-3002 (Stock 10% SLS Solution; 10% Sodium Lauryl Sulfate, 90% Water).

**[00308]** In some embodiments, the blend of compounds can include 4.028% D-Limonene, 4.428% Thyme Oil White, 16.60% Benzyl Alcohol, 20.94% Isopar M, 44.51% Water, 0.05% Bifenthrin, 6.267% Blend C-4003 (3.178% Solution S-3002 (Stock 10% SLS Solution; 10% Sodium Lauryl Sulfate, 90% Water).

**[00309]** In some embodiments, the blend of compounds can include between 1.8 and 2.3% Thyme Oil White, between 4.0 and 5.0% Wintergreen Oil, between 3.1 and 3.8% Isopropyl myristate, between 0.45 and 0.55% Span 80, between 13.5 and 16.5% Isopar M, between 67 and 82% Water, and between 0.045 and 0.055% Bifenthrin.

**[00310]** In some embodiments, the blend of compounds can include 2.06% Thyme Oil White, 4.51% Wintergreen Oil, 3.43% Isopropyl myristate, 0.50% Span 80, 15% Isopar M, 74.45% Water, 0.05% Bifenthrin.

**[00311]** In some embodiments, the blend of compounds can include between 0.36 and 0.45% Thyme Oil White, between 0.8 and 1.0% Wintergreen Oil, between 0.6 and 0.76% Isopropyl myristate, between 0.018 and 0.022% Sodium Lauryl Sulfate, and between 88 and 100% Water.

**[00312]** In some embodiments, the blend of compounds can include 0.41% Thyme Oil White, 0.90% Wintergreen Oil, 0.69% Isopropyl myristate, 0.02% Sodium Lauryl Sulfate, and 97.98% Water.

**[00313]** In some embodiments, the blend of compounds can include between 0.9 and 1.15% Thyme Oil White, between 2.0 and 2.5% Wintergreen Oil, between 1.5 and 1.9% Isopropyl myristate, and between 85 and 100% AgSorb.

**[00314]** In some embodiments, the blend of compounds can include 1.03% Thyme Oil White, 2.26% Wintergreen Oil, 1.71% Isopropyl myristate, 95.00% AgSorb.

**[00315]** In some embodiments, the blend of compounds can include between 0.9 and 1.16% Thyme Oil White, between 2.0 and 2.5% Wintergreen Oil, between 1.5 and 1.9% Isopropyl myristate, and between 85 and 100% DG Light.

**[00316]** In some embodiments, the blend of compounds can include 1.03% Thyme Oil White, 2.26% Wintergreen Oil, 1.71% Isopropyl myristate, 95.0% DG Light.

**[00317]** In some embodiments, the blend of compounds can include between 0.36 and 0.45% Thyme Oil White, between 0.8 and 1.0% Wintergreen Oil, between 0.6 and 0.78% Isopropyl myristate, between 0.018 and 0.022% Sodium Lauryl Sulfate, and between 87 and 100% Water.

**[00318]** In some embodiments, the blend of compounds can include 0.41% Thyme Oil White, 0.90% Wintergreen Oil, 0.69% Isopropyl myristate, 0.02% Sodium Lauryl Sulfate, 97.98% Water.

**[00319]** In some embodiments, the blend of compounds can include between 22 and 27% D-Limonene, between 0.89 and 1.1% Thyme Oil White, between 0.15 and 0.19% Linalool

Coeur, between 0.2 and 0.26% Tetrahydrolinalool, between 0.018 and 0.022% Vanillin, between 0.22 and 0.26% Isopropyl myristate, between 0.215 and 0.265% Piperonal (aldehyde), between 2.7 and 3.3% Lime Oil Minus, between 0.11 and 0.13% Geraniol 60, between 0.22 and 0.26% Triethyl Citrate, between 60 and 74% Water, and between 2.7 and 3.3% Solution S-3002 (Stock 10% SLS Solution; 10% Sodium Lauryl Sulfate; 90% Water).

**[00320]** In some embodiments, the blend of compounds can include 24.76% D-Limonene, 0.98% Thyme Oil White, 0.17% Linalool Coeur, 0.23% Tetrahydrolinalool, 0.02% Vanillin, 0.24% Isopropyl myristate, 0.24% Piperonal (aldehyde), 3.00% Lime Oil Minus, 0.12% Geraniol 60, 0.24% Triethyl Citrate, 67% Water, 3% Solution S-3002 (Stock 10% SLS Solution; 10% Sodium Lauryl Sulfate; 90% Water).

**[00321]** In some embodiments, the blend of compounds can include between 18 and 23% Thyme Oil White, between 40 and 50% Wintergreen Oil, between 31 and 38% Isopropyl myristate, between 0.9 and 1.1% Potassium Sorbate, between 0.25 and 0.31% Xanthan Gum, between 72 and 89% Water, between 15 and 17.6% Blend F-4001 (0.90% Polyglycerol-4-oleate, 0.20% Lecithin, 9.8% Water, 89.1% Blend B-5028 [20.6% Thyme Oil White, 45.1% Wintergreen Oil, 34.3% Isopropyl myristate]).

**[00322]** In some embodiments, the blend of compounds can include 20.6% Thyme Oil White, 45.1% Wintergreen Oil, 34.3% Isopropyl myristate, 1% Potassium Sorbate, 0.28% Xanthan Gum, 81.82% Water, 16.90% Blend F-4001 ({Cationic Formulation; }0.90% Polyglycerol-4-oleate, 0.20% Lecithin, 9.8% Water, 89.1% Blend B-5028 [20.6% Thyme Oil White, 45.1% Wintergreen Oil, 34.3% Isopropyl myristate]).

**[00323]** In some embodiments, the blend of compounds can include between 85 and 100% Miracle Gro (Sterile), and between 4.5 and 5.5% Blend B-5028 (20.6% Thyme Oil White, 45.1% Wintergreen Oil, 34.3% Isopropyl myristate).

**[00324]** In some embodiments, the blend of compounds can include 95% Miracle Gro (Sterile), 5% Blend B-5028 (25B-4A for Institutions; 20.6% Thyme Oil White, 45.1% Wintergreen Oil, 34.3% Isopropyl myristate).

**[00325]** In some embodiments, the blend of compounds can include between 0.45 and 0.56% Thyme Oil White, between 1.0 and 1.3% Wintergreen Oil, between 0.78 and 0.95% Isopropyl myristate, between 0.45 and 0.55% Span 80, between 13.5 and 16.5% Isopar M, between 73 and 90% Water, and between 0.045 and 0.55% Bifenthrin.

**[00326]** In some embodiments, the blend of compounds can include 0.51% Thyme Oil White, 1.13% Wintergreen Oil, 0.86% Isopropyl myristate, 0.50% Span 80, 15% Isopar M, 81.95% Water, and 0.05% Bifenthrin.

**[00327]** In certain embodiments wherein the composition includes LFO, one or more of the following compounds can be substituted for the LFO: Tetrahydrolinalool, Ethyl Linalool, Heliotropine, Hedion, Hercolyn D, and Triethyl Citrate. In certain embodiments wherein the composition includes LFO, a blend of the following compounds can be substituted for the LFO: Isopropyl myristate, Tetrahydrolinalool FCC, Linalool, Geraniol Fine FCC, Piperonal (aldehyde), and Vanillin.

**[00328]** In certain embodiments wherein the composition includes LFO, a blend of the following compounds can be substituted for the LFO: Isopropyl myristate, Tetrahydrolinalool, Linalool, Geraniol, Piperonal (aldehyde), Vanillin, Methyl Salicylate, and D-limonene.

**[00329]** In certain embodiments wherein the composition includes BSO, one or more of the following compounds can be substituted for the BSO: alpha-thujene; alpha-pinene; beta-pinene; p-cymene; limonene; and tert-butyl-p-benzoquinone.

**[00330]** In certain exemplary embodiments wherein the composition includes Thyme Oil, one or more of the following compounds can be substituted for the Thyme Oil: thymol,  $\alpha$ -thujone;  $\alpha$ -pinene, camphene,  $\beta$ -pinene, p-cymene,  $\alpha$ -terpinene, linalool, borneol,  $\beta$ -caryophyllene, and carvacrol.

**[00331]** Compounds used to prepare the exemplary compositions of the present invention can be obtained, for example, from the following sources: Millennium Chemicals, Inc. (Jacksonville, FL), Ungerer Company (Lincoln Park, NJ), SAFC (Milwaukee, WI), and IFF Inc. (Hazlet, NJ).

**[00332]** In some embodiments of the compositions, it can be desirable to include compounds each having a purity of about 60%, 65%, 70%, 75%, 80%, 85%, 90%, or 95%. For example, in some embodiments of the compositions that include geraniol, it can be desirable to include a geraniol that is at least about 60%, 85% or 95% pure. In some embodiments, it can be desirable to include a specific type of geraniol. For example, in some embodiments, the compositions can include: geraniol 60, geraniol 85, or geraniol 95. When geraniol is obtained as geraniol 60, geraniol 85, or geraniol 95, then forty percent, fifteen percent, or five percent of the oil can be Nerol. Nerol is a monoterpene ( $C_{10}H_{18}O$ ), that can be extracted from attar of roses, oil of orange blossoms and oil of lavender.

**[00333]** Embodiments of the present invention can include art-recognised ingredients normally used in such formulations. These ingredients can include, for example, antifoaming agents, anti-microbial agents, anti-oxidants, anti-redeposition agents, bleaches, colorants,

emulsifiers, enzymes, fats, fluorescent materials, fungicides, hydrotropes, moisturisers, optical brighteners, perfume carriers, perfume, preservatives, proteins, silicones, soil release agents, solubilisers, sugar derivatives, sun screens, surfactants, vitamins waxes, and the like.

**[00334]** In certain embodiments, embodiments of the present invention can also contain other adjuvants or modifiers such as one or more therapeutically or cosmetically active ingredients. Exemplary therapeutic or cosmetically active ingredients useful in the compositions of the invention can include, for example, fungicides, sun screening agents, sunblocking agents, vitamins, tanning agents, plant extracts, anti-inflammatory agents, anti-oxidants, radical scavenging agents, retinoids, alpha-hydroxy acids, emollients, antiseptics, antibiotics, antibacterial agents, antihistamines, and the like, and can be present in an amount effective for achieving the therapeutic or cosmetic result desired.

**[00335]** In some embodiments, compositions of this invention can include one or more materials that can function as an antioxidant, such as reducing agents and free radical scavengers. Suitable materials that can function as an antioxidant can include, for example: acetyl cysteine, ascorbic acid, t-butyl hydroquinone, cysteine, diamylhydroquinone, erythorbic acid, ferulic acid, hydroquinone, p-hydroxyanisole, hydroxylamine sulfate, magnesium ascorbate, magnesium ascorbyl phosphate, octocrylene, phloroglucinol, potassium ascorbyl tocopheryl phosphate, potassium sulfite, rutin, sodium ascorbate, sodium sulfite, sodium thoglycolate, thiodiglycol, thiodiglycolamide, thioglycolic acid, thiosalicylic acid, tocopherol, tocopheryl acetate, tocopheryl linoleate, tris(nonylphenyl)phosphite, and the like.

**[00336]** Embodiments of the invention can also include one or more materials that can function as a chelating agent to complex with metallic ions. This action can help to inactivate the metallic ions for the purpose of preventing their adverse effects on the stability or appearance

of a formulated composition. Chelating agents suitable for use in an embodiment of this invention can include, for example, aminotrimethylene phosphonic acid, beta-alanine diacetic acid, calcium disodium EDTA, citric acid, cyclodextrin, cyclohexanediamine tetraacetic acid, diammonium citrate, diammonium EDTA, dipotassium EDTA, disodium azacycloheptane diphosphonate, disodium EDTA, disodium pyrophosphate, EDTA (ethylene diamine tetra acetic acid), gluconic acid, HEDTA (hydroxyethyl ethylene diamine triacetic acid), methyl cyclodextrin, pentapotassium triphosphate, pentasodium aminotrimethylene phosphonate, pentasodium triphosphate, pentetic acid, phytic acid, potassium citrate, potassium gluconate, sodium citrate, sodium diethylenetriamine pentamethylene phosphonate, sodium dihydroxyethylglycinate, sodium gluconate, sodium metaphosphate, sodium metasilicate, sodium phytate, triethanolamine ("TEA")-EDTA, TEA-polyphosphate, tetrahydroxypropyl ethylenediamine, tetrapotassium pyrophosphate, tetrasodium EDTA, tetrasodium pyrophosphate, tripotassium EDTA, trisodium EDTA, trisodium HEDTA, trisodium phosphate, and the like.

**[00337]** Embodiments of the invention can also include one or more materials that can function as a humectant. A humectant is added to a composition to retard moisture loss during use, which effect is accomplished, in general, by the presence therein of hygroscopic materials.

**[00338]** In some embodiments, each compound can make up between about 1% to about 99%, by weight (wt/wt %) or by volume (vol/vol %), of the composition. For example, one composition of the present invention comprises about 2% alpha-Pinene and about 98% D-limonene. As used herein, percent amounts, by weight or by volume, of compounds are to be understood as referring to relative amounts of the compounds. As such, for example, a composition including 7% linalool, 35% thymol, 4% alpha-pinene, 30% para-cymene, and 24% soy bean oil (vol/vol %) can be said to include a ratio of 7 to 35 to 4 to 30 to 24 linalool, thymol,

alpha-pinene, para-cymene, and soy bean oil, respectively (by volume). As such, if one compound is removed from the composition, or additional compounds or other ingredients are added to the composition, it is contemplated that the remaining compounds can be provided in the same relative amounts. For example, if soy bean oil were removed from the exemplary composition, the resulting composition would include 7 to 35 to 4 to 40 linalool, thymol, alpha-pinene, and para-cymene, respectively (by volume). This resulting composition would include 9.21% linalool, 46.05% thymol, 5.26% alpha-pinene, and 39.48% para-cymene (vol/vol %). For another example, if safflower oil were added to the original composition to yield a final composition containing 40% (vol/vol) safflower oil, then the resulting composition would include 4.2% linalool, 21% thymol, 2.4% alpha-pinene, 18% para-cymene, 14.4% soy bean oil, and 40% safflower oil (vol/vol %). One having ordinary skill in the art would understand that volume percentages are easily converted to weight percentages based the known or measured specific gravity of the substance.

**[00339]** Surprisingly, by combining certain insect control chemicals, and compounds or blends of the present invention, insect control activity of the resulting compositions can be enhanced, i.e., a synergistic effect on insect control activity is achieved when a certain chemical or chemicals, and a certain compound or compounds are combined. In other words, the compositions including certain combinations of at least one chemical, and at least one compound or at least one blend of compounds can have an enhanced ability to control insects, as compared to each of the chemicals or compounds taken alone.

**[00340]** In embodiments of the present invention, “synergy” can refer to any substantial enhancement, in a combination of at least two ingredients, of a measurable effect, when compared with the effect of one active ingredient alone, or when compared with the effect of the

complete combination minus at least one ingredient. Synergy is a specific feature of a combination of ingredients, and is above any background level of enhancement that would be due solely to, e.g., additive effects of any random combination of ingredients. Effects include but are not limited to: repellent effect of the composition; pesticidal effect of the composition; perturbation of a cell message or cell signal such as, e.g., calcium, cyclic-AMP, and the like; and diminution of activity or downstream effects of a molecular target.

**[00341]** In various embodiments, a substantial enhancement can be expressed as a coefficient of synergy, wherein the coefficient is a ratio of the measured effect of the complete blend, divided by the effect of a comparison composition, typically a single ingredient or a subset of ingredients found in the complete blend. In some embodiments, the synergy coefficient can be adjusted for differences in concentration of the complete blend and the comparison composition.

**[00342]** In some embodiments of the invention, a coefficient of synergy of 1.1, 1.2, 1.3, 1.4, or 1.5 can be substantial and commercially desirable. In other embodiments, the coefficient of synergy can be from about 1.6 to about 5, including but not limited to 1.8, 2.0, 2.5, 3.0, 3.5, 4.0, and 4.5. In other embodiments, the coefficient of synergy can be from about 5 to 50, including but not limited to 10, 15, 20, 25, 30, 35, 40, and 45. In other embodiments, the coefficient of synergy can be from about 50 to about 500, or more, including but not limited to 50, 75, 100, 125, 150, 200, 250, 300, 350, 400, and 450. Any coefficient of synergy above 500 is also contemplated within embodiments of the present invention.

**[00343]** Given that a broad range of synergies can be found in various embodiments of the invention, it is expressly noted that a coefficient of synergy can be described as being “greater than” a given number and therefore not necessarily limited to being within the bounds of

a range having a lower and an upper numerical limit. Likewise, in some embodiments of the invention, certain low synergy coefficients, or lower ends of ranges, are expressly excluded. Accordingly, in some embodiments, synergy can be expressed as being “greater than” a given number that constitutes a lower limit of synergy for such an embodiment. For example, in some embodiments, the synergy coefficient is equal to or greater than 25; in such an embodiment, all synergy coefficients below 25, even though substantial, are expressly excluded.

**[00344]** Compositions containing combinations of certain chemicals and compounds can be tested for synergistic effect on insect control activity by comparing the effect of a particular combination of at least one chemical, and at least one compound or at least one blend of compounds, to the effect of the individual chemical(s) and compound(s). Additional information related to making a synergy determination can be found in the Examples set forth in this document.

**[00345]** Exemplary methods that can be used to determine the synergistic effect of a particular composition are set forth in the following applications, each of which is incorporated in its entirety herein by reference: U.S. Application 10/832,022, entitled COMPOSITIONS AND METHODS FOR CONTROLLING INSECTS; U.S. Application 11/086,615, entitled COMPOSITIONS AND METHODS FOR CONTROLLING INSECTS RELATED TO THE OCTOPAMINE RECEPTOR; U.S. Application 11/365,426, entitled COMPOSITIONS AND METHODS FOR CONTROLLING INSECTS INVOLVING THE TYRAMINE RECEPTOR; and U.S. Application 11/870,385, entitled COMPOSITIONS AND METHODS FOR CONTROLLING INSECTS.

**[00346]** Controlling pests

[00347] Embodiments of the invention can be used to control insect species belonging to orders Acari, Anoplura, Araneae, Blattodea, Coleoptera, Collembola, Diptera, Grylloptera, Heteroptera, Homoptera, Hymenoptera, Isopoda, Isoptera, Lepidoptera, Mantodea, Mallophaga, Neuroptera, Odonata, Orthoptera, Psocoptera, Siphonaptera, Symphyla, Thysanura, and Thysanoptera.

[00348] Embodiments of the present invention can be used to control, for example, the insects set forth in Table 5, or the like.

**TABLE 5: INSECTS SUBJECT TO CONTROL BY EMBODIMENTS OF THE INVENTION**

Scientific Name	English Common Name	Order	Family
<i>Abgrallaspis ithacae</i> (Ferris)	hemlock scale	Homoptera	Diaspididae
<i>Acalitus essigi</i> (Hassan)	redberry mite	Acari	Eriophyidae
<i>Acalitus rudis</i> (Can.)	birch budgall mite	Acari	Eriophyidae
<i>Acalitus vaccinii</i> (Keif.)	blueberry bud mite	Acari	Eriophyidae
<i>Acalymma vittatum</i> (F.)	striped cucumber beetle	Coleoptera	Chrysomelidae
<i>Acantholyda erythrocephala</i> (L.)	pine false webworm	Hymenoptera	Pamphiliidae
<i>Acantholyda zappei</i> (Roh.)	nesting pine sawfly	Hymenoptera	Pamphiliidae
<i>Acanthomyops interjectus</i> (Mayr)	larger yellow ant	Hymenoptera	Formicidae
<i>Acanthoscelides obtectus</i> (Say)	bean weevil	Coleoptera	Bruchidae
<i>Acarus siro</i> L.	grain mite	Acari	Acaridae
<i>Aceria campestricola</i> (Frauen.)	elm leafgall mite	Acari	Eriophyidae
<i>Aceria dispar</i> (Nal.)	aspen leaf mite	Acari	Eriophyidae
<i>Aceria elongatus</i> (Hodg.)	crimson erineum mite	Acari	Eriophyidae

<i>Aceria fraxiniflora</i> (Felt)	ash flower gall mite	Acari	Eriophyidae
<i>Aceria parapopuli</i> (Keif.)	poplar budgall mite	Acari	Eriophyidae
<i>Aceria tosicella</i> Keif.	wheat curl mite	Acari	Eriophyidae
<i>Acericecis ocellaris</i> (O.S.)	ocellate gall midge	Diptera	Cecidomyiidae
<i>Achaearanea tepidariorum</i> (Koch)	European house spider	Araneae	Theridiidae
<i>Acheta domesticus</i> (L.)	house cricket	Grylloptera	Gryllidae
<i>Achyra rantalis</i> (Gn.)	garden webworm	Lepidoptera	Pyralidae
<i>Acleris chalybeana</i> (Fern.)	lesser maple leafroller	Lepidoptera	Tortricidae
<i>Acleris comariana</i> (Zell.)	strawberry tortrix	Lepidoptera	Tortricidae
<i>Acleris fuscana</i> (B. & Bsk.)	small aspen leaftier	Lepidoptera	Tortricidae
<i>Acleris gloverana</i> (Wlsm.)	western blackheaded budworm	Lepidoptera	Tortricidae
<i>Acleris logiana</i> (Cl.)	blackheaded birch leaffolder	Lepidoptera	Tortricidae
<i>Acleris minuta</i> (Rob.)	yellowheaded fireworm	Lepidoptera	Tortricidae
<i>Acleris variana</i> (Fern.)	eastern blackheaded budworm	Lepidoptera	Tortricidae
<i>Acossus centerensis</i> (Lint.)	poplar carpenterworm	Lepidoptera	Cossidae
<i>Acossus populi</i> (Wlk.)	aspen carpenterworm	Lepidoptera	Cossidae
<i>Acrobasis betulella</i> Hulst	birch tubemaker	Lepidoptera	Pyralidae
<i>Acrobasis caryae</i> Grt.	hickory shoot borer	Lepidoptera	Pyralidae
<i>Acrobasis comptoniella</i> Hulst	sweetfern leaf casebearer	Lepidoptera	Pyralidae
<i>Acrobasis juglandis</i> (LeB.)	pecan leaf casebearer	Lepidoptera	Pyralidae
<i>Acrobasis rubrifasciella</i> Pack.	alder tubemaker	Lepidoptera	Pyralidae
<i>Acrobasis sylviella</i> Ely	ironwood tubemaker	Lepidoptera	Pyralidae
<i>Acrobasis vaccinii</i> Riley	cranberry fruitworm	Lepidoptera	Pyralidae

<i>Acronicta americana</i> (Harr.)	American dagger moth	Lepidoptera	Noctuidae
<i>Acronicta dactylina</i> Grt.	alder dagger moth	Lepidoptera	Noctuidae
<i>Acronicta fragilis</i> (Gn.)	fragile dagger moth	Lepidoptera	Noctuidae
<i>Acronicta funeralis</i> G. & R.	paddle caterpillar	Lepidoptera	Noctuidae
<i>Acronicta furcifera</i> Gn.	forked dagger moth	Lepidoptera	Noctuidae
<i>Acronicta grisea</i> Wlk.	gray dagger moth	Lepidoptera	Noctuidae
<i>Acronicta hasta</i> Gn.	cherry dagger moth	Lepidoptera	Noctuidae
<i>Acronicta impressa</i> Wlk.	willow dagger moth	Lepidoptera	Noctuidae
<i>Acronicta innotata</i> Gn.	birch dagger moth	Lepidoptera	Noctuidae
<i>Acronicta leporina</i> (L.)	poplar dagger moth	Lepidoptera	Noctuidae
<i>Acronicta lepusculina</i> Gn.	cottonwood dagger moth	Lepidoptera	Noctuidae
<i>Acronicta oblinita</i> (J.E. Smith)	smeared dagger moth	Lepidoptera	Noctuidae
<i>Acronicta tristis</i> Sm.	sad dagger moth	Lepidoptera	Noctuidae
<i>Acronicta vinnula</i> (Grt.)	elm dagger moth	Lepidoptera	Noctuidae
<i>Actebia fennica</i> (Tausch.)	black army cutworm	Lepidoptera	Noctuidae
<i>Actias luna</i> (L.)	luna moth	Lepidoptera	Saturniidae
<i>Aculops lycopersici</i> (Tryon)	tomato russet mite	Acari	Eriophyidae
<i>Aculus fockeui</i> (Nal. & Tr.)	plum rust mite	Acari	Eriophyidae
<i>Aculus schlechtendali</i> (Nal.)	apple rust mite	Acari	Eriophyidae
<i>Acyrtosiphon caraganae</i> (Cholodk.)	caragana aphid	Homoptera	Aphididae
<i>Acyrtosiphon pisum</i> (Harr.)	pea aphid	Homoptera	Aphididae
<i>Adalia bipunctata</i> (L.)	twospotted lady beetle	Coleoptera	Coccinellidae
<i>Adelges abietis</i> (L.)	eastern spruce gall adelgid	Homoptera	Adelgidae

<i>Adelges cooleyi</i> (Gill.)	Cooley spruce gall adelgid	Homoptera	Adelgidae
<i>Adelges lariciatus</i> (Patch)	spruce gall adelgid	Homoptera	Adelgidae
<i>Adelges laricis</i> Vallot	pale spruce gall adelgid	Homoptera	Adelgidae
<i>Adelges piceae</i> (Ratz.)	balsam woolly adelgid	Homoptera	Adelgidae
<i>Adelges tsugae</i> Ann.	hemlock woolly adelgid	Homoptera	Adelgidae
<i>Adelphocoris lineolatus</i> (Goeze)	alfalfa plant bug	Heteroptera	Miridae
<i>Adelphocoris rapidus</i> (Say)	rapid plant bug	Heteroptera	Miridae
<i>Adelphocoris superbus</i> (Uhl.)	superb plant bug	Heteroptera	Miridae
<i>Aedes aegypti</i> (L.)	yellowfever mosquito	Diptera	Culicidae
<i>Aellopos titan</i> (Cram.)	whitebanded day sphinx	Lepidoptera	Sphingidae
<i>Aeshna canadensis</i> Wlk.	Canada darner	Odonata	Aeshnidae
<i>Aeshna umbrosa</i> Wlk.	shadow darner	Odonata	Aeshnidae
<i>Aglais milberti</i> (Godt.)	Milbert tortoiseshell	Lepidoptera	Nymphalidae
<i>Agrilus anxius</i> Gory	bronze birch borer	Coleoptera	Buprestidae
<i>Agrilus aurichalceus</i> Redt.	rose stem girdler	Coleoptera	Buprestidae
<i>Agrilus bilineatus</i> (Weber)	twolined chestnut borer	Coleoptera	Buprestidae
<i>Agrilus liragus</i> B. & B.	bronze poplar borer	Coleoptera	Buprestidae
<i>Agrilus politus</i> (Say)	willow gall limb borer	Coleoptera	Buprestidae
<i>Agrilus ruficollis</i> (F.)	rednecked cane borer	Coleoptera	Buprestidae
<i>Agriopodes fallax</i> (H.-S.)	green marvel	Lepidoptera	Noctuidae
<i>Agriotes limosus</i> (LeC.)	little brown click beetle	Coleoptera	Elateridae
<i>Agriotes lineatus</i> (L.)	lined click beetle	Coleoptera	Elateridae

<i>Agriotes mancus</i> (Say)	wheat wireworm	Coleoptera	Elateridae
<i>Agriotes obscurus</i> (L.)	dusky wireworm	Coleoptera	Elateridae
<i>Agriotes sparsus</i> LeC.	western wireworm	Coleoptera	Elateridae
<i>Agriphila vulgivagella</i> (Clem.)	vagabond crambus	Lepidoptera	Pyralidae
<i>Agrius cingulata</i> (F.)	pinkspotted hawkmoth	Lepidoptera	Sphingidae
<i>Agromyza aristata</i> Malloch	elm agromyzid leafminer	Diptera	Agromyzidae
<i>Agromyza frontella</i> (Rond.)	alfalfa blotch leafminer	Diptera	Agromyzidae
<i>Agromyza melampyga</i> (Loew)	mockorange leafminer	Diptera	Agromyzidae
<i>Agrotis gladiaria</i> Morr.	claybacked cutworm	Lepidoptera	Noctuidae
<i>Agrotis ipsilon</i> (Hufn.)	black cutworm	Lepidoptera	Noctuidae
<i>Agrotis orthogonia</i> Morr.	pale western cutworm	Lepidoptera	Noctuidae
<i>Ahasverus advena</i> (Waltl)	foreign grain beetle	Coleoptera	Cucujidae
<i>Alabama argillacea</i> (Hbn.)	cotton leafworm	Lepidoptera	Noctuidae
<i>Alaus myops</i> (F.)	smalleyed click beetle	Coleoptera	Elateridae
<i>Alaus oculatus</i> (L.)	eyed click beetle	Coleoptera	Elateridae
<i>Aleuroglyphus ovatus</i> (Troup.)	brownlegged grain mite	Acari	Acaridae
<i>Allantus cinctus</i> (L.)	curled rose sawfly	Hymenoptera	Tenthredinidae
<i>Alniphagus aspericollis</i> (LeC.)	alder bark beetle	Coleoptera	Scolytidae
<i>Alphitobius diaperinus</i> (Panz.)	lesser mealworm	Coleoptera	Tenebrionidae
<i>Alphitobius laevigatus</i> (F.)	black fungus beetle	Coleoptera	Tenebrionidae
<i>Alphitophagus bifasciatus</i> (Say)	twobanded fungus beetle	Coleoptera	Tenebrionidae
<i>Alsophila pometaria</i> (Harr.)	fall cankerworm	Lepidoptera	Geometridae
<i>Altica ambiens</i> LeC.	alder flea beetle	Coleoptera	Chrysomelidae

<i>Altica canadensis</i> Gent.	prairie flea beetle	Coleoptera	Chrysomelidae
<i>Altica chalybaea</i> Ill.	grape flea beetle	Coleoptera	Chrysomelidae
<i>Altica prasina</i> LeC.	poplar flea beetle	Coleoptera	Chrysomelidae
<i>Altica rosae</i> Woods	rose flea beetle	Coleoptera	Chrysomelidae
<i>Altica sylvia</i> Malloch	blueberry flea beetle	Coleoptera	Chrysomelidae
<i>Altica ulmi</i> Woods	elm flea beetle	Coleoptera	Chrysomelidae
<i>Alypia langtoni</i> Couper	fireweed caterpillar	Lepidoptera	Noctuidae
<i>Alypia octomaculata</i> (F.)	eightspotted forester	Lepidoptera	Noctuidae
<i>Amblyscirtes vialis</i> (Edw.)	roadside skipper	Lepidoptera	Hesperiidae
<i>Amphibolips confluenta</i> (Harr.)	spongy oakapple gall	Hymenoptera	Cynipidae
<i>Amphibolips quercusinanis</i> (O.S.)	large oakapple gall	Hymenoptera	Cynipidae
<i>Amphicerus bicaudatus</i> (Say)	apple twig borer	Coleoptera	Bostrichidae
<i>Amphimallon majalis</i> (Raz.)	European chafer	Coleoptera	Scarabaeidae
<i>Amphion floridensis</i> B.P.Clark	nessus sphinx	Lepidoptera	Sphingidae
<i>Amphipoea interoceanica</i> (Sm.)	strawberry cutworm	Lepidoptera	Noctuidae
<i>Amphipyra pyramidoides</i> Gn.	copper underwing	Lepidoptera	Noctuidae
<i>Amphipyra pyramidoides</i> Gn.	rearhumped caterpillar	Lepidoptera	Noctuidae
<i>Amplicephalus inimicus</i> (Say)	painted leafhopper	Homoptera	Cicadellidae
<i>Anabrus simplex</i> Hald.	Mormon cricket	Orthoptera	Tettigoniidae
<i>Anacampsis innocuella</i> (Zell.)	darkheaded aspen leafroller	Lepidoptera	Gelechiidae
<i>Anacampsis niveopulvella</i> (Cham.)	paleheaded aspen leafroller	Lepidoptera	Gelechiidae
<i>Anagrapha falcifera</i> (Kby.)	celery looper	Lepidoptera	Noctuidae
<i>Anaphothrips obscurus</i> (Müll.)	grass thrips	Thysanoptera	Thripidae
<i>Anarsia lineatella</i> Zell.	peach twig borer	Lepidoptera	Gelechiidae

<i>Anasa tristis</i> (DeG.)	squash bug	Heteroptera	Coreidae
<i>Anathix puta</i> (G. & R.)	poplar catkin moth	Lepidoptera	Noctuidae
<i>Anatis labiculata</i> (Say)	fifteenspotted lady beetle	Coleoptera	Coccinellidae
<i>Anatis mali</i> (Say)	eyespotted lady beetle	Coleoptera	Coccinellidae
<i>Ancistronycha bilineata</i> (Say)	twolined cantharid	Coleoptera	Cantharidae
<i>Ancylis burgessiana</i> (Zell.)	oak leaffolder	Lepidoptera	Tortricidae
<i>Ancylis comptana</i> (Frö.)	strawberry leafroller	Lepidoptera	Tortricidae
<i>Ancylis discigerana</i> (Wlk.)	yellow birch leaffolder	Lepidoptera	Tortricidae
<i>Anelaphus parallelus</i> (Newm.)	hickory twig pruner	Coleoptera	Cerambycidae
<i>Anelaphus villosus</i> (F.)	twig pruner	Coleoptera	Cerambycidae
<i>Anisota finlaysoni</i> Riotte	shorthorned oakworm	Lepidoptera	Saturniidae
<i>Anisota senatoria</i> (J.E.Smith)	orangestriped oakworm	Lepidoptera	Saturniidae
<i>Anisota stigma</i> (F.)	spiny oakworm	Lepidoptera	Saturniidae
<i>Anisota virginiensis</i> (Drury)	pinkstriped oakworm	Lepidoptera	Saturniidae
<i>Anobium punctatum</i> (DeG.)	furniture beetle	Coleoptera	Anobiidae
<i>Anomoea laticlavia</i> (Först.)	claycoloured leaf beetle	Coleoptera	Chrysomelidae
<i>Anoplonyx canadensis</i> Hgtn.	onelined larch sawfly	Hymenoptera	Tenthredinidae
<i>Anoplonyx luteipes</i> (Cress.)	threelined larch sawfly	Hymenoptera	Tenthredinidae
<i>Antheraea polyphemus</i> (Cram.)	polyphemus moth	Lepidoptera	Saturniidae
<i>Anthonomus musculus</i> Say	cranberry weevil	Coleoptera	Curculionidae
<i>Anthonomus quadrigibbus</i> (Say)	apple curculio	Coleoptera	Curculionidae
<i>Anthonomus signatus</i> Say	strawberry bud weevil	Coleoptera	Curculionidae
<i>Anthonomus signatus</i> Say	strawberry clipper weevil	Coleoptera	Curculionidae

<i>Anthophylax attenuatus</i> (Hald.)	mottled longhorned beetle	Coleoptera	Cerambycidae
<i>Anthrenus flavipes</i> LeC.	furniture carpet beetle*	Coleoptera	Dermestidae
<i>Anthrenus museorum</i> (L.)	museum beetle	Coleoptera	Dermestidae
<i>Anthrenus scrophulariae</i> (L.)	carpet beetle	Coleoptera	Dermestidae
<i>Anthrenus verbasci</i> (L.)	varied carpet beetle	Coleoptera	Dermestidae
<i>Antispila nysaefoliella</i> Clem.	tupelo leafminer	Lepidoptera	Heliozelidae
<i>Apamea amputatrix</i> (Fitch)	yellowheaded cutworm	Lepidoptera	Noctuidae
<i>Apamea devastator</i> (Brace)	glassy cutworm	Lepidoptera	Noctuidae
<i>Aphis craccivora</i> Koch	cowpea aphid	Homoptera	Aphididae
<i>Aphis fabae</i> Scop.	black bean aphid	Homoptera	Aphididae
<i>Aphis fabae</i> Scop.	bean aphid	Homoptera	Aphididae
<i>Aphis gossypii</i> Glov.	melon aphid	Homoptera	Aphididae
<i>Aphis maculatae</i> Oestl.	spotted poplar aphid	Homoptera	Aphididae
<i>Aphis nasturtii</i> Kltb.	buckthorn aphid	Homoptera	Aphididae
<i>Aphis pomi</i> DeG.	apple aphid	Homoptera	Aphididae
<i>Aphis rubicola</i> Oest.	raspberry aphid	Homoptera	Aphididae
<i>Aphomia gularis</i> (Zell.)	stored nut moth	Lepidoptera	Pyralidae
<i>Aphrophora cibrata</i> (Wlk.)	pine spittlebug	Homoptera	Cercopidae
<i>Aphrophora fulva</i> Doering	western pine spittlebug	Homoptera	Cercopidae
<i>Aphrophora parallelia</i> (Say)	spruce spittlebug	Homoptera	Cercopidae
<i>Aphrophora permutata</i> Uhl.	Douglas-fir spittlebug	Homoptera	Cercopidae
<i>Aphrophora saratogensis</i> (Fitch)	Saratoga spittlebug	Homoptera	Cercopidae
<i>Apion longirostre</i> Oliv.	hollyhock weevil	Coleoptera	Apionidae
<i>Apion nigrum</i> Hbst.	black locust seed	Coleoptera	Apionidae

	weevil*		
<i>Apion simile</i> Kby.	birch catkin weevil	Coleoptera	Apionidae
<i>Apis mellifera</i> L.	honey bee	Hymenoptera	Apidae
<i>Apotomis dextrana</i> (McD.)	green aspen leafroller	Lepidoptera	Tortricidae
<i>Aradus kormileri</i> Heiss	pine flat bug	Heteroptera	Aradidae
<i>Araecerus fasciculatus</i> (DeG.)	coffee bean weevil	Coleoptera	Anthribidae
<i>Araneus trifolium</i> (Hentz)	shamrock spider	Araneae	Araneidae
<i>Archips argyrospila</i> (Wlk.)	fruittree leafroller	Lepidoptera	Tortricidae
<i>Archips cerasivorana</i> (Fitch)	uglynest caterpillar	Lepidoptera	Tortricidae
<i>Archips fervidana</i> (Clem.)	oak webworm	Lepidoptera	Tortricidae
<i>Archips mortuana</i> Kft.	duskyback leafroller	Lepidoptera	Tortricidae
<i>Archips negundana</i> (Dyar)	larger boxelder leafroller	Lepidoptera	Tortricidae
<i>Archips packardiana</i> (Fern.)	spring spruce needle moth	Lepidoptera	Tortricidae
<i>Archips purpurana</i> (Clem.)	omnivorous leafroller	Lepidoptera	Tortricidae
<i>Archips rosana</i> (L.)	European leafroller	Lepidoptera	Tortricidae
<i>Archips semiferana</i> (Wlk.)	oak leafroller	Lepidoptera	Tortricidae
<i>Arctia caja</i> (L.)	great tiger moth	Lepidoptera	Arctiidae
<i>Argas persicus</i> (Oken)	fowl tick	Acari	Argasidae
<i>Argyresthia conjugella</i> Zell.	apple fruit moth	Lepidoptera	Argyresthiidae
<i>Argyresthia laricella</i> Kft.	larch shoot moth	Lepidoptera	Argyresthiidae
<i>Argyresthia oreasella</i> Clem.	cherry shoot borer	Lepidoptera	Argyresthiidae
<i>Argyresthia thuiella</i> (Pack.)	arborvitae leafminer	Lepidoptera	Argyresthiidae
<i>Argyrotaenia citrana</i> (Fern.)	orange tortrix	Lepidoptera	Tortricidae
<i>Argyrotaenia mariana</i> (Fern.)	graybanded leafroller	Lepidoptera	Tortricidae
<i>Argyrotaenia occultana</i> Free.	fall spruce needle moth	Lepidoptera	Tortricidae

<i>Argyrotaenia pinatubana</i> (Kft.)	pine tube moth	Lepidoptera	Tortricidae
<i>Argyrotaenia quadrifasciana</i> (Fern.)	fourlined leafroller	Lepidoptera	Tortricidae
<i>Argyrotaenia quercifoliana</i> (Fitch)	tortricid oakworm	Lepidoptera	Tortricidae
<i>Argyrotaenia tabulana</i> Free.	jack pine tube moth	Lepidoptera	Tortricidae
<i>Argyrotaenia velutinana</i> (Wlk.)	redbanded leafroller	Lepidoptera	Tortricidae
<i>Arhopalus foveicollis</i> (Hald.)	pitted longhorned beetle	Coleoptera	Cerambycidae
<i>Arhopalus productus</i> (LeC.)	new house borer	Coleoptera	Cerambycidae
<i>Armadillidium vulgare</i> (Latr.)	pillbug	Isopoda	Armadillidae
<i>Aroga trialbamaculella</i> (Cham.)	redstriped fireworm	Lepidoptera	Gelechiidae
<i>Arrhenodes minutus</i> (Drury)	oak timberworm	Coleoptera	Brentidae
<i>Asemum striatum</i> (L.)	opaque sawyer	Coleoptera	Cerambycidae
<i>Aspidiottus nerii</i> Bouch.	oleander scale	Homoptera	Diaspididae
<i>Asterodiapsis variolosa</i> (Ratz.)	golden oak scale	Homoptera	Asterolecaniida
<i>Asynapta hopkinsi</i> Felt	cone resin midge	Diptera	Cecidomyiidae
<i>Asynonychus cervinus</i> (Boh.)	Fuller rose beetle	Coleoptera	Curculionidae
<i>Attagenus pellio</i> (L.)	fur beetle	Coleoptera	Dermestidae
<i>Attagenus unicolor</i> (Brahm)	black carpet beetle	Coleoptera	Dermestidae
<i>Aulacaspis rosae</i> (Bouch.)	rose scale	Homoptera	Diaspididae
<i>Aulacorthum solani</i> (Kltb.)	foxglove aphid	Homoptera	Aphididae
<i>Aulocara elliotti</i> (Thos.)	bigheaded grasshopper	Orthoptera	Acrididae
<i>Autographa biloba</i> (Steph.)	bilobed looper	Lepidoptera	Noctuidae
<i>Autographa californica</i> (Speyer)	alfalfa looper	Lepidoptera	Noctuidae
<i>Automeris io</i> (F.)	io moth	Lepidoptera	Saturniidae
<i>Bactrocera oleae</i> (Gmel.)	olive fruit fly	Diptera	Tephritidae

<i>Baliosus nervosus</i> (Panz.)	basswood leafminer	Coleoptera	Chrysomelidae
<i>Banasa dimiata</i> (Say)	banasa stink bug	Heteroptera	Pentatomidae
<i>Barbara colfaxiana</i> (Kft.)	Douglas-fir cone moth	Lepidoptera	Tortricidae
<i>Battus philenor</i> (L.)	pipevine swallowtail	Lepidoptera	Papilionidae
<i>Bemisia tabaci</i> (Genn.)	sweetpotato whitefly	Homoptera	Aleyrodidae
<i>Biston betularia cognataria</i> (Gn.)	pepper-and-salt moth	Lepidoptera	Geometridae
<i>Blastobasis glandulella</i> (Riley)	acorn moth	Lepidoptera	Blastobasidae
<i>Blatta orientalis</i> L.	oriental cockroach	Blattodea	Blattellidae
<i>Blattella germanica</i> (L.)	German cockroach	Blattodea	Blattellidae
<i>Blissus l. leucopterus</i> (Say)	chinch bug	Heteroptera	Lygaeidae
<i>Blissus leucopterus hirtus</i> Montd.	hairy chinch bug	Heteroptera	Lygaeidae
<i>Blissus occiduus</i> Barber	western chinch bug	Heteroptera	Lygaeidae
<i>Boisea rubrolineata</i> (Barber)	western boxelder bug	Heteroptera	Rhopalidae
<i>Boisea trivittata</i> (Say)	boxelder bug	Heteroptera	Rhopalidae
<i>Boloria bellona</i> (F.)	meadow fritillary	Lepidoptera	Nymphalidae
<i>Boloria eunomia</i> (Esp.)	bog fritillary	Lepidoptera	Nymphalidae
<i>Boloria selene</i> (D. & S.)	silverbordered fritillary	Lepidoptera	Nymphalidae
<i>Bombyx mori</i> (L.)	silkworm	Lepidoptera	Bombycidae
<i>Bomolocha deceptalis</i> (Wlk.)	basswood owlet moth	Lepidoptera	Noctuidae
<i>Bourletiella hortensis</i> (Fitch)	garden springtail	Collembola	Sminthuridae
<i>Bovicola bovis</i> (L.)	cattle biting louse	Mallophaga	Trichodectidae
<i>Bovicola caprae</i> (Gurlt)	goat biting louse	Mallophaga	Trichodectidae
<i>Bovicola equi</i> (Denny)	horse biting louse	Mallophaga	Trichodectidae
<i>Bovicola ovis</i> (Schr.)	sheep biting louse	Mallophaga	Trichodectidae
<i>Brachycaudus persicae</i> (Pass.)	black peach aphid	Homoptera	Aphididae

<i>Brachycorynella asparagi</i> (Mord.)	asparagus aphid	Homoptera	Aphididae
<i>Brevicoryne brassicae</i> (L.)	cabbage aphid	Homoptera	Aphididae
<i>Brochymena quadripustulata</i> (F.)	fourhumped stink bug	Heteroptera	Pentatomidae
<i>Bromius obscurus</i> (L.)	western grape rootworm	Coleoptera	Chrysomelidae
<i>Bruchophagus platypterus</i> (Wlk.)	clover seed chalcid	Hymenoptera	Eurytomidae
<i>Bruchophagus roddi</i> (Guss.)	alfalfa seed chalcid	Hymenoptera	Eurytomidae
<i>Bruchus brachialis</i> Fähr.	vetch bruchid	Coleoptera	Bruchidae
<i>Bruchus pisorum</i> (L.)	pea weevil	Coleoptera	Bruchidae
<i>Bruchus rufimanus</i> Boh.	broadbean weevil	Coleoptera	Bruchidae
<i>Bryobia praetiosa</i> Koch	clover mite	Acari	Tetranychidae
<i>Bryobia rubrioculus</i> (Scheut.)	brown mite	Acari	Tetranychidae
<i>Bucculatrix ainsliella</i> Murt.	oak skeletonizer	Lepidoptera	Lyonetiidae
<i>Bucculatrix canadensisella</i> Cham.	birch skeletonizer	Lepidoptera	Lyonetiidae
<i>Buprestis aurulenta</i> L.	golden buprestid	Coleoptera	Buprestidae
<i>Buprestis maculativentris</i> Say	ventrally-spotted buprestid	Coleoptera	Buprestidae
<i>Byturus unicolor</i> Say	raspberry fruitworm	Coleoptera	Byturidae
<i>Cacopsylla buxi</i> (L.)	boxwood psyllid	Homoptera	Psyllidae
<i>Cacopsylla mali</i> (Schmdbl.)	apple sucker	Homoptera	Psyllidae
<i>Cacopsylla negundinis</i> Mally	boxelder psyllid	Homoptera	Psyllidae
<i>Cacopsylla pyricola</i> Först.	pear psylla	Homoptera	Psyllidae
<i>Cadra cautella</i> (Wlk.)	almond moth	Lepidoptera	Pyralidae
<i>Cadra figulilella</i> (Greg.)	raisin moth	Lepidoptera	Pyralidae
<i>Caenurgina crassiuscula</i> (Haw.)	clover looper	Lepidoptera	Noctuidae
<i>Caliroa cerasi</i> (L.)	pear sawfly	Hymenoptera	Tenthredinidae
<i>Caliroa cerasi</i> (L.)	pearslug	Hymenoptera	Tenthredinidae

<i>Caliroa fasciata</i> (Nort.)	oakslug	Hymenoptera	Tenthredinidae
<i>Caliroa fasciata</i> (Nort.)	oak sawfly	Hymenoptera	Tenthredinidae
<i>Callidium antennatum hesperum</i> Casey	blackhorned pine borer	Coleoptera	Cerambycidae
<i>Calligrapha alni</i> Schaeff.	russet alder leaf beetle	Coleoptera	Chrysomelidae
<i>Calligrapha philadelphica</i> (L.)	dogwood leaf beetle	Coleoptera	Chrysomelidae
<i>Calligrapha scalaris</i> (LeC.)	elm calligrapha	Coleoptera	Chrysomelidae
<i>Callirhytis cornigera</i> (O.S.)	horned oak gall wasp	Hymenoptera	Cynipidae
<i>Callirhytis quercuspunctata</i> (Bass.)	gouty oak gall wasp	Hymenoptera	Cynipidae
<i>Callosamia promethea</i> (Drury)	promethea moth	Lepidoptera	Saturniidae
<i>Calocoris norvegicus</i> Gmel.	strawberry bug	Heteroptera	Miridae
<i>Calopteryx maculata</i> (Beauv.)	ebony jewelwing	Odonata	Calopterygidae
<i>Caloptilia alnivorella</i> (Cham.)	alder leafminer	Lepidoptera	Gracillariidae
<i>Caloptilia invariabilis</i> (Braun)	cherry leafcone caterpillar	Lepidoptera	Gracillariidae
<i>Caloptilia negundella</i> (Cham.)	boxelder leafroller	Lepidoptera	Gracillariidae
<i>Caloptilia syringella</i> (F.)	lilac leafminer	Lepidoptera	Gracillariidae
<i>Calosoma calidum</i> (F.)	fiery hunter	Coleoptera	Carabidae
<i>Calvia quatuordecimguttata</i> (L.)	fourteenspotted lady beetle	Coleoptera	Coccinellidae
<i>Cameraria aceriella</i> (Clem.)	maple leafblotch miner	Lepidoptera	Gracillariidae
<i>Cameraria betulivora</i> (Wlsm.)	birch leafblotch miner	Lepidoptera	Gracillariidae
<i>Cameraria cincinnatiella</i> (Cham.)	gregarious oak leafminer	Lepidoptera	Gracillariidae
<i>Cameraria hamadryadella</i> (Clem.)	solitary oak leafminer	Lepidoptera	Gracillariidae
<i>Camnula pellucida</i> (Scudd.)	clearwinged grasshopper	Orthoptera	Acrididae

<i>Campaea perlata</i> (Gn.)	fringed looper	Lepidoptera	Geometridae
<i>Camponotus ferrugineus</i> (F.)	red carpenter ant	Hymenoptera	Formicidae
<i>Camponotus herculeanus</i> (L.)	boreal carpenter ant	Hymenoptera	Formicidae
<i>Camponotus pennsylvanicus</i> (DeG.)	black carpenter ant	Hymenoptera	Formicidae
<i>Campylomma verbasci</i> (Meyer)	mullein bug	Heteroptera	Miridae
<i>Canarsia ulmiarrosorella</i> (Clem.)	elm leaf tier	Lepidoptera	Pyralidae
<i>Caripeta angustiorata</i> Wlk.	brown pine looper	Lepidoptera	Geometridae
<i>Caripeta divisata</i> Wlk.	gray spruce looper	Lepidoptera	Geometridae
<i>Carpoglyphus lactis</i> (L.)	driedfruit mite	Acari	Carpoglyphidae
<i>Carpophilus hemipterus</i> (L.)	driedfruit beetle	Coleoptera	Nitidulidae
<i>Carterocephalus palaemon</i> (Pallas)	Arctic skipper	Lepidoptera	Hesperiidae
<i>Cartodere constricta</i> (Gyll.)	plaster beetle	Coleoptera	Lathridiidae
<i>Carulaspis juniperi</i> (Bouch.)	juniper scale	Homoptera	Diaspididae
<i>Catastega aceriella</i> Clem.	maple trumpet skeletonizer	Lepidoptera	Tortricidae
<i>Catocala blandula</i> Hulst	gray-blue underwing	Lepidoptera	Noctuidae
<i>Catocala briseis</i> Edw.	briseis underwing	Lepidoptera	Noctuidae
<i>Catocala cerogama</i> Gn.	yellowbanded underwing	Lepidoptera	Noctuidae
<i>Catocala concumbens</i> Wlk.	pink underwing	Lepidoptera	Noctuidae
<i>Catocala gracilis</i> Edw.	graceful underwing	Lepidoptera	Noctuidae
<i>Catocala habilis</i> Grt.	hickory underwing	Lepidoptera	Noctuidae
<i>Catocala ilia</i> (Cram.)	ilia underwing	Lepidoptera	Noctuidae
<i>Catocala relicta</i> Wlk.	white underwing	Lepidoptera	Noctuidae
<i>Catocala sordida</i> Grt.	blueberry underwing	Lepidoptera	Noctuidae
<i>Catocala ultronia</i> (Hbn.)	plum tree underwing	Lepidoptera	Noctuidae

<i>Catocala unijuga</i> Wlk.	oncemarried underwing	Lepidoptera	Noctuidae
<i>Caulocampus acericaulis</i> (MacG.)	maple petiole borer	Hymenoptera	Tenthredinidae
<i>Cavariella aegopodii</i> (Scop.)	carrot-willow aphid	Homoptera	Aphididae
<i>Cecidomyia pellea</i> O.S.	ash bulletgall midge	Diptera	Cecidomyiidae
<i>Cecidomyia piniinopis</i> O.S.	jack pine midge	Diptera	Cecidomyiidae
<i>Cecidomyia resinicola</i> (O.S.)	jack pine resin midge	Diptera	Cecidomyiidae
<i>Cecidomyia verrucicola</i> O.S.	linden wart gall midge	Diptera	Cecidomyiidae
<i>Cecidophyopsis ribis</i> (Westw.)	currant bud mite	Acari	Eriophyidae
<i>Cecidophyopsis ribis</i> (Westw.)	blackcurrant big bud mite	Acari	Eriophyidae
<i>Celastrina argiolus</i> (Cram.)	spring azure	Lepidoptera	Lycaenidae
<i>Cephalcia fascipennis</i> (Cress.)	spruce webspinning sawfly	Hymenoptera	Pamphiliidae
<i>Cephalcia marginata</i> Middk.	red pine webspinning sawfly	Hymenoptera	Pamphiliidae
<i>Cephaloon lepturoides</i> Newm.	false leptura beetle	Coleoptera	Cephaloidea
<i>Cephus cinctus</i> Nort.	wheat stem sawfly	Hymenoptera	Cephidae
<i>Cephus pygmaeus</i> (L.)	European wheat stem sawfly	Hymenoptera	Cephidae
<i>Cerapteryx graminis</i> L.	antler moth	Lepidoptera	Noctuidae
<i>Ceratomia amyntor</i> (Gey.)	elm sphinx	Lepidoptera	Sphingidae
<i>Ceratomia undulosa</i> (Wlk.)	waved sphinx	Lepidoptera	Sphingidae
<i>Ceratophyllus gallinae</i> (Schr.)	European chicken flea	Siphonaptera	Ceratophyllidae
<i>Ceratophyllus niger</i> Fox	western chicken flea	Siphonaptera	Ceratophyllidae
<i>Cercyonis pegala</i> (F.)	common wood nymph	Lepidoptera	Satyridae
<i>Cerotoma trifurcata</i> (Först.)	bean leaf beetle	Coleoptera	Chrysomelidae

<i>Ceutorhynchus assimilis</i> (Payk.)	cabbage seedpod weevil	Coleoptera	Curculionidae
<i>Ceutorhynchus rapae</i> Gyll.	cabbage curculio	Coleoptera	Curculionidae
<i>Chaetocnema pulicaria</i> Melsh.	corn flea beetle	Coleoptera	Chrysomelidae
<i>Chaetophloeus heterodoxus</i> (Casey)	mountain mahogany bark beetle	Coleoptera	Scolytidae
<i>Chaetosiphon fragaefolii</i> (Ckll.)	strawberry aphid	Homoptera	Aphididae
<i>Chaitophorus populincola</i> Thos.	smokywinged poplar aphid	Homoptera	Aphididae
<i>Chalcophora virginiensis</i> (Drury)	sculptured pine borer	Coleoptera	Buprestidae
<i>Charidotella sexpunctata bicolor</i> (F.)	golden tortoise beetle	Coleoptera	Chrysomelidae
<i>Charidryas harrisii</i> (Scudd.)	Harris checkerspot	Lepidoptera	Nymphalidae
<i>Charidryas nycteis</i> (Dblly.)	silvery checkerspot	Lepidoptera	Nymphalidae
<i>Cheimophila salicella</i> (Hbn.)	blueberry flagleaf webworm	Lepidoptera	Oecophoridae
<i>Chelopistes meleagridis</i> (L.)	large turkey louse	Mallophaga	Philopteridae
<i>Chelymorpha cassidea</i> (F.)	argus tortoise beetle	Coleoptera	Chrysomelidae
<i>Chilocorus stigma</i> (Say)	twicestabbed lady beetle	Coleoptera	Coccinellidae
<i>Chionaspis americana</i> Johns.	elm surfy scale	Homoptera	Diaspididae
<i>Chionaspis corni</i> Cooley	dogwood scale	Homoptera	Diaspididae
<i>Chionaspis furfura</i> (Fitch)	scurfy scale	Homoptera	Diaspididae
<i>Chionaspis lintneri</i> Comst.	Lintner scale	Homoptera	Diaspididae
<i>Chionaspis pinifoliae</i> (Fitch)	pine needle scale	Homoptera	Diaspididae
<i>Chionaspis salicisnigrae</i> (Walsh)	willow surfy scale	Homoptera	Diaspididae
<i>Chionodes formosella</i> (Murt.)	spring oak leafroller	Lepidoptera	Gelechiidae
<i>Chionodes obscurusella</i> (Cham.)	boxelder leafworm	Lepidoptera	Gelechiidae
<i>Chlorochlamys chloroleucaria</i>	blackberry looper	Lepidoptera	Geometridae

(Gn.)			
<i>Chlorochroa sayi</i> (Stål)	Say stink bug	Heteroptera	Pentatomidae
<i>Choreutis pariana</i> (Cl.)	apple-and-thorn skeletonizer	Lepidoptera	Choreutidae
<i>Chorioptes bovis</i> (Gerl.)	chorioptic mange mite	Acari	Psoroptidae
<i>Choristoneura biennis</i> Free.	two-year-cycle budworm	Lepidoptera	Tortricidae
<i>Choristoneura conflictana</i> (Wlk.)	large aspen tortrix	Lepidoptera	Tortricidae
<i>Choristoneura fractivittana</i> (Clem.)	brokenbanded leafroller	Lepidoptera	Tortricidae
<i>Choristoneura fumiferana</i> (Clem.)	spruce budworm	Lepidoptera	Tortricidae
<i>Choristoneura occidentalis</i> Free.	western spruce budworm	Lepidoptera	Tortricidae
<i>Choristoneura p. pinus</i> Free.	jack pine budworm	Lepidoptera	Tortricidae
<i>Choristoneura parallela</i> (Rob.)	spotted fireworm	Lepidoptera	Tortricidae
<i>Choristoneura rosaceana</i> (Harr.)	obliquebanded leafroller	Lepidoptera	Tortricidae
<i>Chortippus c. curtipennis</i> (Harr.)	marsh meadow grasshopper	Orthoptera	Acrididae
<i>Chromatomyia syngenesiae</i> Hdy.	chrysanthemum leafminer	Diptera	Agromyzidae
<i>Chrysobothris femorata</i> (Oliv.)	flatheaded appletree borer	Coleoptera	Buprestidae
<i>Chrysochus auratus</i> (F.)	dogbane beetle	Coleoptera	Chrysomelidae
<i>Chrysomela crotchi</i> Brown	aspen leaf beetle	Coleoptera	Chrysomelidae
<i>Chrysomela scripta</i> F.	cottonwood leaf beetle	Coleoptera	Chrysomelidae
<i>Chrysomela walshi</i> Brown	balsam poplar leaf beetle	Coleoptera	Chrysomelidae
<i>Chrysopa oculata</i> Say	goldeneyed lacewing	Neuroptera	Chrysopidae

<i>Chrysoperla carnea</i> (Steph.)	common green lacewing	Neuroptera	Chrysopidae
<i>Chrysoteuchia topiaria</i> (Zell.)	cranberry girdler	Lepidoptera	Pyralidae
<i>Cimbex americana</i> Leach	elm sawfly	Hymenoptera	Cimbicidae
<i>Cimex lectularius</i> L.	bed bug	Heteroptera	Cimicidae
<i>Cimex pilosellus</i> (Horv.)	bat bug	Heteroptera	Cimicidae
<i>Cinara banksiana</i> P. & T.	jack pine aphid	Homoptera	Aphididae
<i>Cinara curvipes</i> (Patch)	balsam fir aphid	Homoptera	Aphididae
<i>Cinara fornacula</i> Hottes	green spruce aphid	Homoptera	Aphididae
<i>Cinara laricifex</i> (Fitch)	black larch aphid	Homoptera	Aphididae
<i>Cinara laricis</i> (Htg.)	larch aphid	Homoptera	Aphididae
<i>Cinara pinea</i> (Mord.)	pine aphid	Homoptera	Aphididae
<i>Cinara strobi</i> (Fitch)	white pine aphid	Homoptera	Aphididae
<i>Cingilia catenaria</i> (Drury)	chainspotted geometer	Lepidoptera	Geometridae
<i>Circulifer tenellus</i> (Baker)	beet leafhopper	Homoptera	Cicadellidae
<i>Citheronia regalis</i> (F.)	hickory horned devil	Lepidoptera	Saturniidae
<i>Citheronia regalis</i> (F.)	regal moth	Lepidoptera	Saturniidae
<i>Clastoptera obtusa</i> (Say)	alder spittlebug	Homoptera	Cercopidae
<i>Clastoptera proteus</i> Fitch	dogwood spittlebug	Homoptera	Cercopidae
<i>Clepsis persicana</i> (Fitch)	whitetriangle leafroller	Lepidoptera	Tortricidae
<i>Clossiana titania grandis</i> (B. & McD.)	purple lesser fritillary	Lepidoptera	Nymphalidae
<i>Closteria albosigma</i> Fitch	rustylined leaftier	Lepidoptera	Notodontidae
<i>Closteria apicalis</i> (Wlk.)	redmarked tentmaker	Lepidoptera	Notodontidae
<i>Closteria inclusa</i> (Hbn.)	poplar tentmaker	Lepidoptera	Notodontidae
<i>Cnephacia longana</i> (Haw.)	omnivorous leaftier	Lepidoptera	Tortricidae

<i>Coccinella novemnotata</i> Hbst.	ninespotted lady beetle	Coleoptera	Coccinellidae
<i>Coccinella septempunctata</i> L.	sevenspotted lady beetle	Coleoptera	Coccinellidae
<i>Coccinella transversoguttata richardsoni</i> Brown	transverse lady beetle	Coleoptera	Coccinellidae
<i>Coccinella undecimpunctata</i> L.	elevenspotted lady beetle	Coleoptera	Coccinellidae
<i>Cochliomyia macellaria</i> (F.)	secondary screwworm	Diptera	Calliphoridae
<i>Coenonympha inornata</i> Edw.	inornate ringlet	Lepidoptera	Satyridae
<i>Coleophora laricella</i> (Hbn.)	larch casebearer	Lepidoptera	Coleophoridae
<i>Coleophora laticornella</i> Clem.	pecan cigar casebearer	Lepidoptera	Coleophoridae
<i>Coleophora limosipennella</i> (Dup.)	elm casebearer	Lepidoptera	Coleophoridae
<i>Coleophora malivorella</i> Riley	pistol casebearer	Lepidoptera	Coleophoridae
<i>Coleophora pruniella</i> Clem.	cherry casebearer	Lepidoptera	Coleophoridae
<i>Coleophora serratella</i> (L.)	cigar casebearer	Lepidoptera	Coleophoridae
<i>Coleophora serratella</i> (L.)	birch casebearer	Lepidoptera	Coleophoridae
<i>Coleotechnites apicitripunctella</i> (Clem.)	green hemlock needleminer	Lepidoptera	Gelechiidae
<i>Coleotechnites canusella</i> (Free.)	banded jack pine needleminer	Lepidoptera	Gelechiidae
<i>Coleotechnites laricis</i> (Free.)	orange larch tubemaker	Lepidoptera	Gelechiidae
<i>Coleotechnites macleodi</i> (Free.)	brown hemlock needleminer	Lepidoptera	Gelechiidae
<i>Coleotechnites milleri</i> (Bsk.)	lodgepole needleminer	Lepidoptera	Gelechiidae
<i>Coleotechnites piceaella</i> (Kft.)	orange spruce needleminer	Lepidoptera	Gelechiidae

<i>Coleotechnites resinosae</i> (Free.)	red pine needleminer	Lepidoptera	Gelechiidae
<i>Coleotechnites thujaella</i> (Kft.)	brown cedar leafminer	Lepidoptera	Gelechiidae
<i>Colias eurytheme</i> Bdv.	alfalfa caterpillar	Lepidoptera	Pieridae
<i>Colias interior</i> Scudd.	pinkedged sulphur	Lepidoptera	Pieridae
<i>Colias philodice</i> Godt.	clouded sulphur	Lepidoptera	Pieridae
<i>Colomerus vitis</i> (Pgst.)	grape erineum mite	Acari	Eriophyidae
<i>Colopha ulmicola</i> (Fitch)	elm cockscombgall aphid	Homoptera	Aphididae
<i>Coloradia pandora</i> Blake	pandora moth	Lepidoptera	Saturniidae
<i>Conophthorus coniperda</i> (Schw.)	white pine cone beetle	Coleoptera	Scolytidae
<i>Conophthorus ponderosae</i> Hopk.	ponderosa pine cone beetle	Coleoptera	Scolytidae
<i>Conophthorus ponderosae</i> Hopk.	lodgepole cone beetle	Coleoptera	Scolytidae
<i>Conophthorus resinosae</i> Hopk.	red pine cone beetle	Coleoptera	Scolytidae
<i>Conotrachelus juglandis</i> LeC.	butternut curculio	Coleoptera	Curculionidae
<i>Conotrachelus nenuphar</i> (Hbst.)	plum curculio	Coleoptera	Curculionidae
<i>Contarinia baeri</i> (Prell)	European pineneedle midge	Diptera	Cecidomyiidae
<i>Contarinia bromicola</i> (M. & A.)	bromegrass seed midge	Diptera	Cecidomyiidae
<i>Contarinia canadensis</i> Felt	ash midribgall midge	Diptera	Cecidomyiidae
<i>Contarinia johnsoni</i> Felt	grape blossom midge	Diptera	Cecidomyiidae
<i>Contarinia negundifolia</i> Felt	boxelder leaf gall midge	Diptera	Cecidomyiidae
<i>Contarinia negundinis</i> (Gill.)	boxelder budgall midge	Diptera	Cecidomyiidae
<i>Contarinia oregonensis</i> Foote	Douglas-fir cone gall midge	Diptera	Cecidomyiidae

<i>Contarinia pyrivora</i> (Riley)	pear midge	Diptera	Cecidomyiidae
<i>Contarinia schulzi</i> Gagn.	sunflower midge	Diptera	Cecidomyiidae
<i>Contarinia virginianae</i> (Felt)	chokecherry midge	Diptera	Cecidomyiidae
<i>Contarinia washingtonensis</i> Johns.	Douglas-fir cone scale midge	Diptera	Cecidomyiidae
<i>Corcyra cephalonica</i> (Staint.)	rice moth	Lepidoptera	Pyralidae
<i>Corthylus punctatissimus</i> (Zimm.)	pitted ambrosia beetle	Coleoptera	Scolytidae
<i>Corydalus cornutus</i> (L.)	dobsonfly	Neuroptera	Corydalidae
<i>Corydalus cornutus</i> (L.)	hellgrammite	Neuroptera	Corydalidae
<i>Corythucha arcuata</i> (Say)	oak lace bug	Heteroptera	Tingidae
<i>Corythucha ciliata</i> (Say)	sycamore lace bug	Heteroptera	Tingidae
<i>Corythucha elegans</i> Drake	willow lace bug	Heteroptera	Tingidae
<i>Corythucha heidemanni</i> Drake	alder lace bug	Heteroptera	Tingidae
<i>Corythucha juglandis</i> (Fitch)	walnut lace bug	Heteroptera	Tingidae
<i>Corythucha pallipes</i> Parsh.	birch lace bug	Heteroptera	Tingidae
<i>Corythucha ulmi</i> O. & D.	elm lace bug	Heteroptera	Tingidae
<i>Cotalpa lanigera</i> (L.)	goldsmith beetle	Coleoptera	Scarabaeidae
<i>Craponius inaequalis</i> (Say)	grape curculio	Coleoptera	Curculionidae
<i>Creophilus maxillosus</i> (L.)	hairy rove beetle	Coleoptera	Staphylinidae
<i>Crepidodera nana</i> (Say)	tiny aspen flea beetle	Coleoptera	Chrysomelidae
<i>Crioceris asparagi</i> (L.)	asparagus beetle	Coleoptera	Chrysomelidae
<i>Crioceris duodecimpunctata</i> (L.)	spotted asparagus beetle	Coleoptera	Chrysomelidae
<i>Crocigrapha normani</i> (Grt.)	climbing cherry cutworm	Lepidoptera	Noctuidae
<i>Croesia curvalana</i> (Kft.)	blueberry leaftier	Lepidoptera	Tortricidae
<i>Croesia semipurpurana</i> (Kft.)	oak leafshredder	Lepidoptera	Tortricidae

<i>Croesus latitarsus</i> Nort.	dusky birch sawfly	Hymenoptera	Tenthredinidae
<i>Cryptocala acadiensis</i> (Bethune)	catocaline dart	Lepidoptera	Noctuidae
<i>Cryptococcus fagisuga</i> Lind.	beech scale	Homoptera	Eriococcidae
<i>Cryptolestes ferrugineus</i> (Steph.)	rusty grain beetle	Coleoptera	Cucujidae
<i>Cryptolestes pusillus</i> (Schonh.)	flat grain beetle	Coleoptera	Cucujidae
<i>Cryptolestes turcicus</i> (Grouv.)	flourmill beetle	Coleoptera	Cucujidae
<i>Cryptomyzus ribis</i> (L.)	currant aphid	Homoptera	Aphididae
<i>Cryptophagus varus</i> W. & C.	sigmoid fungus beetle	Coleoptera	Cryptophagidae
<i>Cryptorhynchus lapathi</i> (L.)	poplar-and-willow borer	Coleoptera	Curculionidae
<i>Ctenicera aeripennis</i> (Kby.)	Puget Sound wireworm	Coleoptera	Elateridae
<i>Ctenicera destructor</i> (Brown)	prairie grain wireworm	Coleoptera	Elateridae
<i>Ctenicera propola propola</i> LeC.	twospotted click beetle	Coleoptera	Elateridae
<i>Ctenicera pruinina</i> (Horn)	Great Basin wireworm	Coleoptera	Elateridae
<i>Ctenicera r. resplendens</i> (Esch.)	green click beetle	Coleoptera	Elateridae
<i>Ctenicera triundulata</i> (Rand.)	threespotted click beetle	Coleoptera	Elateridae
<i>Ctenocephalides canis</i> (Curt.)	dog flea	Siphonaptera	Pulicidae
<i>Ctenocephalides felis</i> (Bouch.)	cat flea	Siphonaptera	Pulicidae
<i>Cucullia intermedia</i> Speyer	goldenrod cutworm	Lepidoptera	Noctuidae
<i>Culex pipiens</i> L.	northern house mosquito	Diptera	Culicidae
<i>Curculio uniformis</i> (LeC.)	filbert weevil	Coleoptera	Curculionidae
<i>Cuterebra tenebrosa</i> Coq.	rodent bot fly	Diptera	Oestridae
<i>Cydia caryana</i> (Fitch)	hickory shuckworm	Lepidoptera	Tortricidae

<i>Cydia latiferreana</i> (Wlsm.)	filbertworm	Lepidoptera	Tortricidae
<i>Cydia nigricana</i> (F.)	pea moth	Lepidoptera	Tortricidae
<i>Cydia piperana</i> Kft.	ponderosa pine seedworm	Lepidoptera	Tortricidae
<i>Cydia pomonella</i> (L.)	codling moth	Lepidoptera	Tortricidae
<i>Cydia strobilella</i> (L.)	spruce seed moth	Lepidoptera	Tortricidae
<i>Cydia toreuta</i> (Grt.)	eastern pine seedworm	Lepidoptera	Tortricidae
<i>Cynaeus angustus</i> (LeC.)	larger black flour beetle	Coleoptera	Tenebrionidae
<i>Cytodites nudus</i> (Vizioli)	airsac mite	Acari	Cytoditidae
<i>Daktulosphaira vitifoliae</i> (Fitch)	grape phylloxera	Homoptera	Phylloxeridae
<i>Danaus plexippus</i> (L.)	monarch butterfly	Lepidoptera	Danaidae
<i>Darapsa myron</i> (Cram.)	Virginiacreeper sphinx	Lepidoptera	Sphingidae
<i>Darapsa versicolor</i> (Harr.)	hydrangea sphinx	Lepidoptera	Sphingidae
<i>Dasineura balsamicola</i> (Lint.)	introduced false balsam gall midge	Diptera	Cecidomyiidae
<i>Dasineura communis</i> Felt	gouty vein midge	Diptera	Cecidomyiidae
<i>Dasineura gleditchiae</i> O.S.	honeylocust podgall midge	Diptera	Cecidomyiidae
<i>Dasineura leguminicola</i> (Lint.)	clover seed midge	Diptera	Cecidomyiidae
<i>Dasineura mali</i> (Keif.)	apple leaf midge	Diptera	Cecidomyiidae
<i>Dasineura rhodophaga</i> (Coq.)	rose midge	Diptera	Cecidomyiidae
<i>Dasineura swainei</i> (Felt)	spruce bud midge	Diptera	Cecidomyiidae
<i>Dasychira dorsipennata</i> (B. & McD.)	hardwood tussock moth	Lepidoptera	Lymantriidae
<i>Dasychira pinicola</i> (Dyar)	pine tussock moth	Lepidoptera	Lymantriidae
<i>Dasychira plagiata</i> (Wlk.)	northern pine tussock moth	Lepidoptera	Lymantriidae

<i>Dasylophia thyatiroides</i> (Wlk.)	beech caterpillar	Lepidoptera	Notodontidae
<i>Datana integerrima</i> G. & R.	walnut caterpillar	Lepidoptera	Notodontidae
<i>Datana ministra</i> (Drury)	yellownecked caterpillar	Lepidoptera	Notodontidae
<i>Deidamia inscripta</i> (Harr.)	lettered sphinx	Lepidoptera	Sphingidae
<i>Delia antiqua</i> (Meig.)	onion maggot	Diptera	Anthomyiidae
<i>Delia floralis</i> (Fall.)	turnip maggot	Diptera	Anthomyiidae
<i>Delia platura</i> (Meig.)	seedcorn maggot	Diptera	Anthomyiidae
<i>Delia radicum</i> (L.)	cabbage maggot	Diptera	Anthomyiidae
<i>Demodex bovis</i> Stiles	cattle follicle mite	Acari	Demodicidae
<i>Demodex cati</i> M. gn.	cat follicle mite	Acari	Demodicidae
<i>Demodex equi</i> Raill.	horse follicle mite	Acari	Demodicidae
<i>Demodex ovis</i> Raill.	sheep follicle mite	Acari	Demodicidae
<i>Demodex phylloides</i> Csokor	hog follicle mite	Acari	Demodicidae
<i>Dendroctonus brevicomis</i> LeC.	western pine beetle	Coleoptera	Scolytidae
<i>Dendroctonus frontalis</i> Zimm.	southern pine beetle*	Coleoptera	Scolytidae
<i>Dendroctonus murrayanae</i> Hopk.	lodgepole pine beetle	Coleoptera	Scolytidae
<i>Dendroctonus ponderosae</i> Hopk.	mountain pine beetle	Coleoptera	Scolytidae
<i>Dendroctonus pseudotsugae</i> Hopk.	Douglas-fir beetle	Coleoptera	Scolytidae
<i>Dendroctonus punctatus</i> LeC.	boreal spruce beetle	Coleoptera	Scolytidae
<i>Dendroctonus rufipennis</i> (Kby.)	spruce beetle	Coleoptera	Scolytidae
<i>Dendroctonus simplex</i> LeC.	eastern larch beetle	Coleoptera	Scolytidae
<i>Dendroctonus valens</i> LeC.	red turpentine beetle	Coleoptera	Scolytidae
<i>Depressaria pastinacella</i> (Dup.)	parsnip webworm	Lepidoptera	Oecophoridae
<i>Dermacentor albipictus</i> (Pack.)	winter tick	Acari	Ixodidae
<i>Dermacentor andersoni</i> Stiles	Rocky Mountain wood tick	Acari	Ixodidae

<i>Dermacentor variabilis</i> (Say)	American dog tick	Acari	Ixodidae
<i>Dermanyssus gallinae</i> (DeG.)	chicken mite	Acari	Dermanyssidae
<i>Dermatophagoides farinae</i> Hughes	American house dust mite	Acari	Epidermoptidae
<i>Dermatophagoides pteronyssinus</i> (Troues.)	European house dust mite	Acari	Epidermoptidae
<i>Dermestes ater</i> DeG.	black larder beetle	Coleoptera	Dermestidae
<i>Dermestes lardarius</i> L.	larder beetle	Coleoptera	Dermestidae
<i>Dermestes maculatus</i> DeG.	hide beetle	Coleoptera	Dermestidae
<i>Desmia funeralis</i> (Hbn.)	grape leaffolder	Lepidoptera	Pyralidae
<i>Desmocerus palliatus</i> (Först.)	elder borer	Coleoptera	Cerambycidae
<i>Diabrotica barberi</i> S. & L.	northern corn rootworm	Coleoptera	Chrysomelidae
<i>Diabrotica undecimpunctata howardi</i> Barber	spotted cucumber beetle	Coleoptera	Chrysomelidae
<i>Diabrotica v. virgifera</i> LeC.	western corn rootworm	Coleoptera	Chrysomelidae
<i>Diapheromera femorata</i> (Say)	walkingstick	Phasmatodea	Heteronemiidae
<i>Diaspidiotus aenatus</i> (Putn.)	Putnam scale	Homoptera	Diaspididae
<i>Dicerca divaricata</i> (Say)	flatheaded hardwood borer	Coleoptera	Buprestidae
<i>Dicerca tenebrica</i> (Kby.)	flatheaded poplar borer	Coleoptera	Buprestidae
<i>Dicerca tenebrosa</i> (Kby.)	flatheaded conifer borer	Coleoptera	Buprestidae
<i>Dichelonyx backii</i> (Kby.)	green rose chafer	Coleoptera	Scarabaeidae
<i>Dichomeris ligulella</i> Hbn.	palmerworm	Lepidoptera	Gelechiidae
<i>Dichomeris marginella</i> (F.)	juniper webworm	Lepidoptera	Gelechiidae
<i>Dimorphopteryx melanognathus</i> Roh.	fringed birch sawfly	Hymenoptera	Tenthredinidae

<i>Dioryctria abietivorella</i> (Grt.)	fir coneworm	Lepidoptera	Pyralidae
<i>Dioryctria auranticella</i> (Grt.)	ponderosa pine coneworm	Lepidoptera	Pyralidae
<i>Dioryctria disclusa</i> Heinr.	webbing coneworm	Lepidoptera	Pyralidae
<i>Dioryctria reniculelloides</i> Mut. & Mun.	spruce coneworm	Lepidoptera	Pyralidae
<i>Dioryctria resinosella</i> Mut.	red pine shoot moth	Lepidoptera	Pyralidae
<i>Dioryctria zimmermani</i> (Grt.)	Zimmerman pine moth	Lepidoptera	Pyralidae
<i>Diplolepis radicum</i> (O.S.)	rose root gall wasp	Hymenoptera	Cynipidae
<i>Diplolepis rosae</i> (L.)	mossyrose gall wasp	Hymenoptera	Cynipidae
<i>Diprion similis</i> (Htg.)	introduced pine sawfly	Hymenoptera	Diprionidae
<i>Diptacus gigantorhynchus</i> (Nal.)	bigbeaked plum mite	Acari	Diptilomiopidae
<i>Discestra trifolii</i> (Hufn.)	clover cutworm	Lepidoptera	Noctuidae
<i>Disonycha alternata</i> (Ill.)	striped willow leaf beetle	Coleoptera	Chrysomelidae
<i>Disonycha triangularis</i> (Say)	threespotted flea beetle	Coleoptera	Chrysomelidae
<i>Disonycha xanthomelas</i> (Dalm.)	spinach flea beetle	Coleoptera	Chrysomelidae
<i>Dissosteira carolina</i> (L.)	Carolina grasshopper	Orthoptera	Acrididae
<i>Diuraphis noxia</i> (Mordv.)	Russian wheat aphid	Homoptera	Aphididae
<i>Diuraphis tritici</i> (Gill.)	western wheat aphid	Homoptera	Aphididae
<i>Dolichovespula arenaria</i> (F.)	aerial yellowjacket	Hymenoptera	Vespidae
<i>Dolichovespula maculata</i> (L.)	baldfaced hornet	Hymenoptera	Vespidae
<i>Drepana arcuata</i> Wlk.	masked birch caterpillar	Lepidoptera	Drepanidae
<i>Drepana bilineata</i> (Pack.)	warty birch caterpillar	Lepidoptera	Drepanidae
<i>Drepanaphis acerifoliae</i> (Thos.)	painted maple aphid	Homoptera	Aphididae

<i>Dryocampa rubicunda</i> (F.)	greenstriped mapleworm	Lepidoptera	Saturniidae
<i>Dryocoetes betulae</i> Hopk.	birch bark beetle	Coleoptera	Scolytidae
<i>Dryocoetes confusus</i> Swaine	western balsam bark beetle	Coleoptera	Scolytidae
<i>Dysaphis plantaginea</i> (Pass.)	rosy apple aphid	Homoptera	Aphididae
<i>Dysstroma citrata</i> (L.)	dark marbled carpet	Lepidoptera	Geometridae
<i>Eacles imperialis</i> pini Mich.	pine imperial moth	Lepidoptera	Saturniidae
<i>Earomyia abietum</i> McAlp.	fir seed maggot	Diptera	Lonchaeidae
<i>Ecdytolopha insiticiana</i> Zell.	locust twig borer	Lepidoptera	Tortricidae
<i>Ectoedemia lindquisti</i> (Free.)	small birch leafminer	Lepidoptera	Nepticulidae
<i>Ectropis crepuscularia</i> (D. & S.)	saddleback looper	Lepidoptera	Geometridae
<i>Eilema bicolor</i> (Grt.)	smoky moth	Lepidoptera	Arctiidae
<i>Elaphria versicolor</i> (Grt.)	fir harlequin	Lepidoptera	Noctuidae
<i>Elasmostethus cruciatus</i> Say	redcrossed stink bug	Heteroptera	Acanthosomatida
<i>Elatobium abietinum</i> (Wlk.)	spruce aphid	Homoptera	Aphididae
<i>Empoasca fabae</i> (Harr.)	potato leafhopper	Homoptera	Cicadellidae
<i>Empoasca maligna</i> (Walsh)	apple leafhopper	Homoptera	Cicadellidae
<i>Enargia decolor</i> (Wlk.)	aspen twoleaf tier	Lepidoptera	Noctuidae
<i>Enchenopa binotata</i> (Say)	twomarked treehopper	Homoptera	Membracidae
<i>Endelomyia aethiops</i> (F.)	roseslug	Hymenoptera	Tenthredinidae
<i>Endopiza viteana</i> Clem.	grape berry moth	Lepidoptera	Tortricidae
<i>Endothenia albolineana</i> (Kft.)	spruce needleminer	Lepidoptera	Tortricidae
<i>Endrosis sarcitrella</i> (L.)	whiteshouldered house moth	Lepidoptera	Oecophoridae
<i>Ennomos magnaria</i> Gn.	maple spanworm	Lepidoptera	Geometridae
<i>Ennomos subsignaria</i> (Hbn.)	elm spanworm	Lepidoptera	Geometridae

<i>Enodia anthonedon</i> Clark	northern pearly eye	Lepidoptera	Satyridae
<i>Entomoscelis americana</i> Brown	red turnip beetle	Coleoptera	Chrysomelidae
<i>Epargyreus clarus</i> (Cram.)	silverspotted skipper	Lepidoptera	Hesperiidae
<i>Epeorus elutella</i> (Hbn.)	tobacco moth	Lepidoptera	Pyralidae
<i>Epeorus kuehniella</i> Zell.	Mediterranean flour moth	Lepidoptera	Pyralidae
<i>Epicauta fabricii</i> (LeC.)	ashgray blister beetle	Coleoptera	Meloidae
<i>Epicauta maculata</i> (Say)	spotted blister beetle	Coleoptera	Meloidae
<i>Epicauta murina</i> (LeC.)	dark blister beetle	Coleoptera	Meloidae
<i>Epicauta pennsylvanica</i> (DeG.)	black blister beetle	Coleoptera	Meloidae
<i>Epicauta pestifera</i> Werner	margined blister beetle*	Coleoptera	Meloidae
<i>Epicauta subglabra</i> (Fall)	caragana blister beetle	Coleoptera	Meloidae
<i>Epicauta vittata</i> (F.)	striped blister beetle	Coleoptera	Meloidae
<i>Epilachna varivestis</i> Muls.	Mexican bean beetle	Coleoptera	Coccinellidae
<i>Epinotia meritana</i> Heinr.	white fir needleminer	Lepidoptera	Tortricidae
<i>Epinotia nanana</i> (Treit.)	European spruce needleminer	Lepidoptera	Tortricidae
<i>Epinotia nisella</i> (Cl.)	yellowheaded aspen leaftier	Lepidoptera	Tortricidae
<i>Epinotia radicana</i> (Heinr.)	redstriped needleworm	Lepidoptera	Tortricidae
<i>Epinotia solandriana</i> (L.)	birch-aspen leafroller	Lepidoptera	Tortricidae
<i>Epinotia solicitana</i> (Wlk.)	birch shootworm	Lepidoptera	Tortricidae
<i>Epinotia timidella</i> (Clem.)	oak trumpet skeletonizer	Lepidoptera	Tortricidae
<i>Epinotia tsugana</i> Free.	hemlock needleminer	Lepidoptera	Tortricidae
<i>Epirrita autumnata</i> henshawi (Swett)	November moth	Lepidoptera	Geometridae

<i>Epitrimerus pyri</i> (Nal.)	pear rust mite	Acari	Eriophyidae
<i>Epitrix cucumeris</i> (Harr.)	potato flea beetle	Coleoptera	Chrysomelidae
<i>Epitrix hirtipennis</i> (Melsh.)	tobacco flea beetle	Coleoptera	Chrysomelidae
<i>Epitrix subcrinita</i> (LeC.)	western potato flea beetle	Coleoptera	Chrysomelidae
<i>Epitrix tuberis</i> Gent.	tuber flea beetle	Coleoptera	Chrysomelidae
<i>Erannis tiliaria</i> (Harr.)	linden looper	Lepidoptera	Geometridae
<i>Erannis tiliaria vancouverensis</i> Hulst	western winter moth	Lepidoptera	Geometridae
<i>Ergates spiculatus</i> (LeC.)	ponderous borer	Coleoptera	Cerambycidae
<i>Eriocampa juglandis</i> (Fitch)	woolly butternut sawfly	Hymenoptera	Tenthredinidae
<i>Eriocampa ovata</i> (L.)	woolly alder sawfly	Hymenoptera	Tenthredinidae
<i>Eriophyes betulae</i> (Nal.)	birch witches broom mite	Acari	Eriophyidae
<i>Eriophyes pyri</i> (Pgst.)	pearleaf blister mite	Acari	Eriophyidae
<i>Eriosoma americanum</i> (Riley)	woolly elm aphid	Homoptera	Aphididae
<i>Eriosoma crataegi</i> (Oestl.)	woolly hawthorn aphid	Homoptera	Aphididae
<i>Eriosoma lanigerum</i> (Haust.)	woolly apple aphid	Homoptera	Aphididae
<i>Eristalis tenax</i> (L.)	drone fly	Diptera	Syrphidae
<i>Eristalis tenax</i> (L.)	rattailed maggot	Diptera	Syrphidae
<i>Erynnis icelus</i> (Scudd. & Burg.)	dreamy dusky wing	Lepidoptera	Hesperiidae
<i>Erynnis juvenalis</i> (F.)	Juvenal dusky wing	Lepidoptera	Hesperiidae
<i>Erythroneura comes</i> (Say)	grape leafhopper	Homoptera	Cicadellidae
<i>Erythroneura tricincta</i> Fitch	threebanded leafhopper	Homoptera	Cicadellidae
<i>Erythroneura vitis</i> (Harr.)	grapevine leafhopper	Homoptera	Cicadellidae
<i>Erythroneura ziczac</i> Walsh	Virginiacreeper	Homoptera	Cicadellidae

	leafhopper		
<i>Estigmene acrea</i> (Drury)	saltmarsh caterpillar	Lepidoptera	Arctiidae
<i>Euceraphis punctipennis</i> (Zett.)	European birch aphid	Homoptera	Aphididae
<i>Euchaetes egle</i> (Drury)	milkweed tussock moth	Lepidoptera	Arctiidae
<i>Euclea delphinii</i> (Bdv.)	spiny slug caterpillar	Lepidoptera	Limacodidae
<i>Eucosma gloriola</i> Heinr.	eastern pine shoot borer	Lepidoptera	Tortricidae
<i>Eucosma monitorana</i> Heinr.	red pine cone borer	Lepidoptera	Tortricidae
<i>Eucosma recissoriana</i> Heinr.	lodgepole pine cone borer	Lepidoptera	Tortricidae
<i>Eucosma siskiyouana</i> (Kft.)	fir cone borer	Lepidoptera	Tortricidae
<i>Eucosma sonomana</i> Kft.	western pine shoot borer	Lepidoptera	Tortricidae
<i>Eucosma tocullionana</i> Heinr.	white pine cone borer	Lepidoptera	Tortricidae
<i>Eudryas grata</i> (F.)	beautiful wood nymph	Lepidoptera	Noctuidae
<i>Eudryas unio</i> (Hbn.)	pearly wood nymph	Lepidoptera	Noctuidae
<i>Eulachnus agilis</i> (Kltb.)	spotted pineneedle aphid	Homoptera	Aphididae
<i>Eulithis diversilineata</i> (Hbn.)	grapevine looper	Lepidoptera	Geometridae
<i>Eumerus strigatus</i> (Fall.)	onion bulb fly	Diptera	Syrphidae
<i>Eumerus tuberculatus</i> Rond.	lesser bulb fly	Diptera	Syrphidae
<i>Eumorpha achemon</i> (Drury)	achemon sphinx	Lepidoptera	Sphingidae
<i>Eumorpha pandorus</i> (Hbn.)	pandora sphinx	Lepidoptera	Sphingidae
<i>Eupareophora parca</i> (Cress.)	spiny ash sawfly	Hymenoptera	Tenthredinidae
<i>Euparthenos nubilis</i> (Hbn.)	locust underwing	Lepidoptera	Noctuidae
<i>Euphoria inda</i> (L.)	bumble flower beetle	Coleoptera	Scarabaeidae
<i>Euphranta canadensis</i> (Loew)	currant fruit fly	Diptera	Tephritidae

<i>Euphydryas phaeton</i> (Drury)	Baltimore	Lepidoptera	Nymphalidae
<i>Euphyes vestris</i> (Bdv.)	dun skipper	Lepidoptera	Hesperiidae
<i>Eupithecia filmata</i> Pears.	early brown looper	Lepidoptera	Geometridae
<i>Eupithecia luteata</i> Pack.	fir needle inchworm	Lepidoptera	Geometridae
<i>Eupithecia mutata</i> Pears.	spruce cone looper	Lepidoptera	Geometridae
<i>Eupithecia palpata</i> Pack.	small pine looper	Lepidoptera	Geometridae
<i>Eupithecia spermaphaga</i> (Dyar)	fir cone looper	Lepidoptera	Geometridae
<i>Eupithecia transcanadata</i> MacK.	small conifer looper	Lepidoptera	Geometridae
<i>Euproctis chrysorrhoea</i> (L.)	browntail moth	Lepidoptera	Lymantriidae
<i>Eupsilia tristigmata</i> (Grt.)	brown fruitworm	Lepidoptera	Noctuidae
<i>Euptoieta claudia</i> (Cram.)	variegated fritillary	Lepidoptera	Nymphalidae
<i>Eurema lisa</i> Bdv. & LeC.	little sulphur	Lepidoptera	Pieridae
<i>Eurema nicippe</i> (Cram.)	sleepy orange	Lepidoptera	Pieridae
<i>Euschistus tristigmus</i> (Say)	dusky stink bug	Heteroptera	Pentatomidae
<i>Euschistus variolarius</i> (P. de B.)	onespotted stink bug	Heteroptera	Pentatomidae
<i>Eutrapela clemataria</i> (J.E.Smith)	purplishbrown looper	Lepidoptera	Geometridae
<i>Eutrombidium trigonum</i> (Herm.)	red grasshopper mite	Acari	Trombidiidae
<i>Euura atra</i> (Jur.)	smaller willow shoot sawfly	Hymenoptera	Tenthredinidae
<i>Euxoa auxiliaris</i> (Grt.)	army cutworm	Lepidoptera	Noctuidae
<i>Euxoa detersa</i> (Wlk.)	sand cutworm	Lepidoptera	Noctuidae
<i>Euxoa messoria</i> (Harr.)	darksided cutworm	Lepidoptera	Noctuidae
<i>Euxoa ochrogaster</i> (Gn.)	redbacked cutworm	Lepidoptera	Noctuidae
<i>Euxoa scandens</i> (Riley)	white cutworm	Lepidoptera	Noctuidae
<i>Euxoa tessellata</i> (Harr.)	striped cutworm	Lepidoptera	Noctuidae
<i>Euxoa tristicula</i> (Morr.)	early cutworm	Lepidoptera	Noctuidae
<i>Euzophera semifuneralis</i> (Wlk.)	American plum borer	Lepidoptera	Pyralidae

<i>Everes amyntula</i> (Bdv.)	western tailed blue	Lepidoptera	Lycaenidae
<i>Everes comyntas</i> (Godt.)	eastern tailed blue	Lepidoptera	Lycaenidae
<i>Evergestis pallidata</i> (Hufn.)	purplebacked cabbageworm	Lepidoptera	Pyralidae
<i>Evergestis rimosalis</i> (Gn.)	cross-striped cabbageworm	Lepidoptera	Pyralidae
<i>Evora hemidesma</i> (Zell.)	spirea leaftier	Lepidoptera	Tortricidae
<i>Exoteleia dodecella</i> (L.)	pine bud moth	Lepidoptera	Gelechiidae
<i>Exoteleia nepheos</i> Free.	pine candle moth	Lepidoptera	Gelechiidae
<i>Fannia canicularis</i> (L.)	little house fly	Diptera	Muscidae
<i>Fannia scalaris</i> (F.)	latrine fly	Diptera	Muscidae
<i>Faronta diffusa</i> (Wlk.)	wheat head armyworm	Lepidoptera	Noctuidae
<i>Felicola subrostratus</i> (Burm.)	cat louse	Mallophaga	Trichodectidae
<i>Feltia jaculifera</i> (Gn.)	dingy cutworm	Lepidoptera	Noctuidae
<i>Feniseca tarquinius</i> (F.)	harvester	Lepidoptera	Lycaenidae
<i>Fenusia dohrnii</i> (Tisch.)	European alder leafminer	Hymenoptera	Tenthredinidae
<i>Fenusia pusilla</i> (Lep.)	birch leafminer	Hymenoptera	Tenthredinidae
<i>Fidia viticida</i> Walsh	grape rootworm	Coleoptera	Chrysomelidae
<i>Fishia discors</i> (Grt.)	garden cutworm	Lepidoptera	Noctuidae
<i>Forficula auricularia</i> L.	European earwig	Dermoptera	Forficulidae
<i>Formica exsectoides</i> Forel	Allegheny mound ant	Hymenoptera	Formicidae
<i>Formica fusca</i> L.	silky ant	Hymenoptera	Formicidae
<i>Formica obscuripes</i> Forel	western thatching ant	Hymenoptera	Formicidae
<i>Frankliniella occidentalis</i> (Perg.)	western flower thrips	Thysanoptera	Thripidae
<i>Frankliniella tritici</i> (Fitch)	flower thrips	Thysanoptera	Thripidae
<i>Frankliniella vaccinii</i> Morg.	blueberry thrips	Thysanoptera	Thripidae

<i>Galeruca browni</i> Blake	peppergrass beetle	Coleoptera	Chrysomelidae
<i>Galerucella nymphaea</i> (L.)	waterlily leaf beetle	Coleoptera	Chrysomelidae
<i>Galleria mellonella</i> (L.)	greater wax moth	Lepidoptera	Pyralidae
<i>Galleria mellonella</i> (L.)	waxworm	Lepidoptera	Pyralidae
<i>Gargaphia tiliae</i> (Walsh)	basswood lace bug	Heteroptera	Tingidae
<i>Gasterophilus haemorrhoidalis</i> (L.)	nose bot fly	Diptera	Oestridae
<i>Gasterophilus intestinalis</i> (DeG.)	horse bot fly	Diptera	Oestridae
<i>Gasterophilus nasalis</i> (L.)	throat bot fly	Diptera	Oestridae
<i>Gilpinia frutetorum</i> (F.)	nursery pine sawfly	Hymenoptera	Diprionidae
<i>Gilpinia hercyniae</i> (Htg.)	European spruce sawfly	Hymenoptera	Diprionidae
<i>Givira lotta</i> B. & McD.	pine carpenterworm	Lepidoptera	Cossidae
<i>Glauopsyche lygdamus</i> (Dbl.)	silvery blue	Lepidoptera	Lycaenidae
<i>Glischrochilus quadrisignatus</i> (Say)	fourspotted sap beetle	Coleoptera	Nitidulidae
<i>Glycobius speciosus</i> (Say)	sugar maple borer	Coleoptera	Cerambycidae
<i>Glyptipteryx linneella</i> (Cl.)	linden bark borer	Lepidoptera	Glyptipterigidae
<i>Glyptoscelis pubescens</i> (F.)	hairy leaf beetle	Coleoptera	Chrysomelidae
<i>Gnatocerus cornutus</i> (F.)	broadhorned flour beetle	Coleoptera	Tenebrionidae
<i>Goes tesselatus</i> (Hald.)	oak sapling borer*	Coleoptera	Cerambycidae
<i>Gonioctena americana</i> (Schaeff.)	American aspen beetle	Coleoptera	Chrysomelidae
<i>Goniodes gigas</i> (Tasch.)	large chicken louse	Mallophaga	Philopteridae
<i>Gossyparia spuria</i> (Mod.)	European elm scale	Homoptera	Eriococcidae
<i>Grammia virguncula</i> (Kby.)	little virgin tiger moth	Lepidoptera	Arctiidae
<i>Grapholita interstinctana</i> (Clem.)	clover head caterpillar	Lepidoptera	Tortricidae

<i>Grapholita molesta</i> (Bsk.)	oriental fruit moth	Lepidoptera	Tortricidae
<i>Grapholita packardi</i> Zell.	cherry fruitworm	Lepidoptera	Tortricidae
<i>Grapholita prunivora</i> (Walsh)	lesser appleworm	Lepidoptera	Tortricidae
<i>Gretchena delicatana</i> Heinr.	ironwood fruitworm	Lepidoptera	Tortricidae
<i>Grylloprociphilus imbricator</i> (Fitch)	beech blight aphid	Homoptera	Aphididae
<i>Gryllus pennsylvanicus</i> Burm.	fall field cricket	Grylloptera	Gryllidae
<i>Gryllus veletis</i> (Alex. & Big.)	spring field cricket	Grylloptera	Gryllidae
<i>Gypsonoma haimbachiana</i> (Kft.)	cottonwood twig borer	Lepidoptera	Tortricidae
<i>Haemaphysalis chordeilis</i> (Pack.)	bird tick	Acari	Ixodidae
<i>Haemaphysalis leporispalustris</i> (Pack.)	rabbit tick	Acari	Ixodidae
<i>Haematobia irritans</i> (L.)	horn fly	Diptera	Muscidae
<i>Haematopinus asini</i> (L.)	horse sucking louse	Anoplura	Haematopinidae
<i>Haematopinus eurysternus</i> (Nitz.)	shortnosed cattle louse	Anoplura	Haematopinidae
<i>Haematopinus suis</i> (L.)	hog louse	Anoplura	Haematopinidae
<i>Haemodipsus ventricosus</i> (Denny)	rabbit louse	Anoplura	Hoplopleuridae
<i>Halysidota harrisii</i> Walsh	sycamore tussock moth	Lepidoptera	Arctiidae
<i>Halysidota tessellaris</i> (J.E.Smith)	pale tussock moth	Lepidoptera	Arctiidae
<i>Hamamelistes spinosus</i> Shimer	witch hazel gall aphid	Homoptera	Aphididae
<i>Haploa confusa</i> (Lyman)	Lyman haploa	Lepidoptera	Arctiidae
<i>Haploa lecontei</i> (G.-M.)	Leconte haploa	Lepidoptera	Arctiidae
<i>Haplothrips leucanthemi</i> Schr.	clover thrips	Thysanoptera	Phlaeothripidae
<i>Harkenclenus titus</i> (F.)	coral hairstreak	Lepidoptera	Lycaenidae
<i>Harrisimemna trisignata</i> (Wlk.)	Harris threespot	Lepidoptera	Zygaenidae

<i>Hedya nubiferana</i> (Haw.)	green budworm	Lepidoptera	Tortricidae
<i>Helicoverpa zea</i> (Boddie)	tomato fruitworm	Lepidoptera	Noctuidae
<i>Helicoverpa zea</i> (Boddie)	corn earworm	Lepidoptera	Noctuidae
<i>Heliothis ononis</i> (D. & S.)	flax bollworm	Lepidoptera	Noctuidae
<i>Heliothis virescens</i> (F.)	tobacco budworm	Lepidoptera	Noctuidae
<i>Heliothrips haemorrhoidalis</i> (Bouch.)	greenhouse thrips	Thysanoptera	Thripidae
<i>Hemaris diffinis</i> (Bdv.)	snowberry clearwing	Lepidoptera	Sphingidae
<i>Hemaris thysbe</i> (F.)	hummingbird moth	Lepidoptera	Sphingidae
<i>Hemicroa crocea</i> (Geoff.)	striped alder sawfly	Hymenoptera	Tenthredinidae
<i>Henricus fuscodorsanus</i> (Kft.)	cone cochylid	Lepidoptera	Cochylidae
<i>Hepialus gracilis</i> Grt.	graceful ghost moth	Lepidoptera	Hepialidae
<i>Hercinothrips femoralis</i> (Reut.)	banded greenhouse thrips	Thysanoptera	Thripidae
<i>Herculia thymetusalis</i> (Wlk.)	spruce needleworm	Lepidoptera	Pyralidae
<i>Hesperia comma borealis</i> Linds.	Labrador skipper	Lepidoptera	Hesperiidae
<i>Hesperia comma laurentina</i> (Lyman)	Laurentian skipper	Lepidoptera	Hesperiidae
<i>Heterarthrus nemoratus</i> (Fall.)	late birch leaf edgeminer	Hymenoptera	Tenthredinidae
<i>Heterocampa guttivitta</i> (Wlk.)	saddled prominent	Lepidoptera	Notodontidae
<i>Hippodamia convergens</i> G.-M.	convergent lady beetle	Coleoptera	Coccinellidae
<i>Hippodamia tredecimpunctata tibialis</i> (Say)	thirteen-spotted lady beetle	Coleoptera	Coccinellidae
<i>Hofmannophila pseudospretella</i> (Staint.)	brown house moth	Lepidoptera	Oecophoridae
<i>Homadaula anisocentra</i> Meyr.	mimosa webworm	Lepidoptera	Plutellidae
<i>Homoeosoma electellum</i> (Hulst)	sunflower moth	Lepidoptera	Pyralidae

<i>Homoglaea hircina</i> Morr.	goat sallow	Lepidoptera	Noctuidae
<i>Homohadena badistriga</i> (Grt.)	honeysuckle budworm	Lepidoptera	Noctuidae
<i>Hoplocampa halcyon</i> (Nort.)	shadbush sawfly	Hymenoptera	Tenthredinidae
<i>Hoplocampa testudinea</i> (Klug)	European apple sawfly	Hymenoptera	Tenthredinidae
<i>Hyalophora cecropia</i> (L.)	cecropia moth	Lepidoptera	Saturniidae
<i>Hyalophora columbia</i> (S.I.Smith)	Columbian silk moth	Lepidoptera	Saturniidae
<i>Hyalophora columbia</i> (S.I.Smith)	larch silkworm	Lepidoptera	Saturniidae
<i>Hyalopterus pruni</i> (Geoff.)	mealy plum aphid	Homoptera	Aphididae
<i>Hydraecia immanis</i> Gn.	hop vine borer	Lepidoptera	Noctuidae
<i>Hydraecia micacea</i> (Esp.)	potato stem borer	Lepidoptera	Noctuidae
<i>Hydria prunivora</i> (Fgn.)	cherry scallophshell moth	Lepidoptera	Geometridae
<i>Hydriomena divisaria</i> (Wlk.)	transversebanded looper	Lepidoptera	Geometridae
<i>Hylastinus obscurus</i> (Marsh.)	clover root borer	Coleoptera	Scolytidae
<i>Hyles gallii</i> (Rott.)	bedstraw hawkmoth	Lepidoptera	Sphingidae
<i>Hyles lineata</i> (F.)	whitelined sphinx	Lepidoptera	Sphingidae
<i>Hylesinus aculeatus</i> Say	eastern ash bark beetle	Coleoptera	Scolytidae
<i>Hylesinus californicus</i> (Swaine)	western ash bark beetle	Coleoptera	Scolytidae
<i>Hyllolycaena hyllus</i> (Cram.)	bronze copper	Lepidoptera	Lycaenidae
<i>Hylobius congener</i> D.T., S. & M.	seedling debarking weevil	Coleoptera	Curculionidae
<i>Hylobius pales</i> (Hbst.)	pales weevil	Coleoptera	Curculionidae
<i>Hylobius piceus</i> (DeG.)	large spruce weevil*	Coleoptera	Curculionidae
<i>Hylobius pinicola</i> (Couper)	Couper collar weevil	Coleoptera	Curculionidae

<i>Hylobius radicis</i> Buch.	pine root collar weevil	Coleoptera	Curculionidae
<i>Hylobius warreni</i> Wood	Warren root collar weevil	Coleoptera	Curculionidae
<i>Hylotrupes bajulus</i> (L.)	old house borer	Coleoptera	Cerambycidae
<i>Hylurgopinus rufipes</i> (Eichh.)	native elm bark beetle	Coleoptera	Scolytidae
<i>Hypagyrtis unipunctata</i> (Haw.)	onespotted variant	Lepidoptera	Geometridae
<i>Hypena scabra</i> (F.)	green cloverworm	Lepidoptera	Noctuidae
<i>Hypera meles</i> (F.)	clover head weevil	Coleoptera	Curculionidae
<i>Hypera nigrirostris</i> (F.)	lesser clover leaf weevil	Coleoptera	Curculionidae
<i>Hypera postica</i> (Gyll.)	alfalfa weevil	Coleoptera	Curculionidae
<i>Hypera punctata</i> (F.)	clover leaf weevil	Coleoptera	Curculionidae
<i>Hyphantria cunea</i> (Drury)	fall webworm	Lepidoptera	Arctiidae
<i>Hypnoidus abbreviatus</i> (Say)	abbreviated wireworm	Coleoptera	Elateridae
<i>Hypoderma bovis</i> (L.)	northern cattle grub	Diptera	Oestridae
<i>Hypoderma lineatum</i> (DeVill.)	common cattle grub	Diptera	Oestridae
<i>Hypoderma tarandi</i> (L.)	caribou warble fly	Diptera	Oestridae
<i>Hypogastrura nivicola</i> (Fitch)	snow flea	Collembola	Hypogastruridae
<i>Hypoprepia fucosa</i> Hbn.	Painted lichen moth	Lepidoptera	Arctiidae
<i>Hypoprepia miniata</i> (Kby.)	scarletwinged lichen moth	Lepidoptera	Arctiidae
<i>Hyppa xylinoides</i> (Gn.)	cranberry cutworm	Lepidoptera	Noctuidae
<i>Incisalia augustinus</i> (Westw.)	brown elfin	Lepidoptera	Lycaenidae
<i>Incisalia henrici</i> (G. & R.)	Henry elfin	Lepidoptera	Lycaenidae
<i>Incisalia irus</i> (Godt.)	frosted elfin	Lepidoptera	Lycaenidae
<i>Incisalia lanoraieensis</i> Shep.	bog elfin	Lepidoptera	Lycaenidae

<i>Incisalia niphon clarki</i> Free.	pine elfin	Lepidoptera	Lycaenidae
<i>Incisalia polia</i> C. & W.	hoary elfin	Lepidoptera	Lycaenidae
<i>Ipimorpha pleonectusa</i> Grt.	blackcheeked aspen caterpillar	Lepidoptera	Noctuidae
<i>Ips borealis</i> Swaine	northern engraver	Coleoptera	Scolytidae
<i>Ips calligraphus</i> (Germ.)	coarsewriting engraver	Coleoptera	Scolytidae
<i>Ips grandicollis</i> (Eichh.)	southern pine engraver	Coleoptera	Scolytidae
<i>Ips perturbatus</i> (Eichh.)	northern spruce engraver	Coleoptera	Scolytidae
<i>Ips pini</i> (Say)	pine engraver	Coleoptera	Scolytidae
<i>Isochnus rufipes</i> (LeC.)	willow flea weevil	Coleoptera	Curculionidae
<i>Itame loricaria</i> (Evers.)	false bruce spanworm	Lepidoptera	Geometridae
<i>Itame pustularia</i> (Gn.)	lesser maple spanworm	Lepidoptera	Geometridae
<i>Itame ribearia</i> (Fitch)	currant spanworm	Lepidoptera	Geometridae
<i>Ithycerus noveboracensis</i> (Först.)	New York weevil	Coleoptera	Ithyceridae
<i>Ixodes pacificus</i> Cooley & Kohls	western blacklegged tick	Acari	Ixodidae
<i>Janus abbreviatus</i> (Say)	willow shoot sawfly	Hymenoptera	Cephidae
<i>Janus integer</i> (Nort.)	currant stem girdler	Hymenoptera	Cephidae
<i>Junonia coenia</i> (Hbn.)	buckeye	Lepidoptera	Nymphalidae
<i>Kaliofenusula ulmi</i> (Sund.)	elm leafminer	Hymenoptera	Tenthredinidae
<i>Kaltenbachiella ulmifusa</i> (W. & R.)	elm pouchgall aphid	Homoptera	Aphididae
<i>Kaltenbachiola canadensis</i> (Felt)	spruce cone gall midge	Diptera	Cecidomyiidae
<i>Kaltenbachiola rachiphaga</i> (Tripp)	spruce cone axis midge	Diptera	Cecidomyiidae

<i>Keiferia lycopersicella</i> (Wlsm.)	tomato pinworm	Lepidoptera	Gelechiidae
<i>Kleidocerys resedae geminatus</i> Say	birch catkin bug	Heteroptera	Lygaeidae
<i>Labidomera clivicollis</i> (Kby.)	milkweed leaf beetle	Coleoptera	Chrysomelidae
<i>Labops hesperius</i> Uhl.	black grass bug	Heteroptera	Miridae
<i>Lacinipolia meditata</i> (Grt.)	pinkbacked cutworm	Lepidoptera	Noctuidae
<i>Lacinipolia renigera</i> (Steph.)	bristly cutworm	Lepidoptera	Noctuidae
<i>Lambdina f. fiscellaria</i> (Gn.)	hemlock looper	Lepidoptera	Geometridae
<i>Lambdina fiscellaria lugubrosa</i> (Hulst)	western hemlock looper	Lepidoptera	Geometridae
<i>Lambdina fiscellaria somniaria</i> (Hulst)	western oak looper	Lepidoptera	Geometridae
<i>Lampronia rubiella</i> (Bjerk.)	raspberry bud moth	Lepidoptera	Incurvariidae
<i>Laothoe juglandis</i> (J.E.Smith)	walnut sphinx	Lepidoptera	Sphingidae
<i>Lapara bombycoides</i> Wlk.	pine tree sphinx	Lepidoptera	Sphingidae
<i>Lasioderma serricorne</i> (F.)	cigarette beetle	Coleoptera	Anobiidae
<i>Latheticus oryzae</i> Waterh.	longheaded flour beetle	Coleoptera	Tenebrionidae
<i>Lathridius minutus</i> (L.)	squarenosed fungus beetle	Coleoptera	Lathridiidae
<i>Latrodectus variolus</i> Walck.	northern widow spider	Araneae	Theridiidae
<i>Lema t. trilinea</i> White	threelined potato beetle	Coleoptera	Chrysomelidae
<i>Lepidosaphes ulmi</i> (L.)	oystershell scale	Homoptera	Diaspididae
<i>Lepisma saccharina</i> L.	silverfish	Thysanura	Lepismatidae
<i>Leptinotarsa decemlineata</i> (Say)	Colorado potato beetle	Coleoptera	Chrysomelidae
<i>Leptoglossus occidentalis</i> Heid.	western conifer-seed bug	Heteroptera	Coreidae
<i>Leptopterna dolabrata</i> (L.)	meadow plant bug	Heteroptera	Miridae

<i>Lepyrus nordenskioeldi canadensis</i> Casey	poplar-willow leaf weevil	Coleoptera	Curculionidae
<i>Lethocerus americanus</i> (Leidy)	giant water bug	Heteroptera	Belostomatidae
<i>Leucoma salicis</i> (L.)	satin moth	Lepidoptera	Lymantriidae
<i>Ligyrus gibbosus</i> (DeG.)	carrot beetle	Coleoptera	Scarabaeidae
<i>Lilioceris lilii</i> (Scop.)	lily leaf beetle	Coleoptera	Chrysomelidae
<i>Limenitis a. arthemis</i> (Drury)	white admiral	Lepidoptera	Nymphalidae
<i>Limenitis archippus</i> (Cram.)	viceroy	Lepidoptera	Nymphalidae
<i>Limenitis arthemis astyanax</i> (F.)	redspotted purple	Lepidoptera	Nymphalidae
<i>Limonius agonus</i> (Say)	eastern field wireworm	Coleoptera	Elateridae
<i>Limonius californicus</i> (Man.)	sugarbeet wireworm	Coleoptera	Elateridae
<i>Limonius canus</i> LeC.	Pacific Coast wireworm	Coleoptera	Elateridae
<i>Limonius infuscatus</i> Mots.	western field wireworm	Coleoptera	Elateridae
<i>Limothrips denticornis</i> Hal.	barley thrips	Thysanoptera	Thripidae
<i>Linognathus ovillus</i> (Nm.)	sheep sucking louse	Anoplura	Linognathidae
<i>Linognathus pedalis</i> (Osb.)	sheep foot louse	Anoplura	Linognathidae
<i>Linognathus setosus</i> (Olf.)	dog sucking louse	Anoplura	Linognathidae
<i>Linognathus stenopsis</i> (Burm.)	goat sucking louse	Anoplura	Linognathidae
<i>Linognathus vituli</i> (L.)	longnosed cattle louse	Anoplura	Linognathidae
<i>Linsleya sphaericollis</i> (Say)	ash blister beetle	Coleoptera	Meloidae
<i>Lipaphis erysimi</i> (Kltb.)	turnip aphid	Homoptera	Aphididae
<i>Lipeurus caponis</i> (L.)	wing louse	Mallophaga	Philopteridae
<i>Liriomyza sativae</i> Blanch.	vegetable leafminer	Diptera	Agromyzidae
<i>Listronotus oregonensis</i> (LeC.)	carrot weevil	Coleoptera	Curculionidae
<i>Lithophane antennata</i> (Wlk.)	green fruitworm	Lepidoptera	Noctuidae

<i>Lixus concavus</i> Say	rhubarb curculio	Coleoptera	Curculionidae
<i>Lobophora nivigerata</i> Wlk.	twolined aspen looper	Lepidoptera	Geometridae
<i>Lochmaeus bilineata</i> (Pack.)	elm prominent	Lepidoptera	Notodontidae
<i>Lochmaeus manteo</i> Dbly.	variable oakleaf caterpillar	Lepidoptera	Notodontidae
<i>Lomographa semiclarata</i> (Wlk.)	wild cherry looper	Lepidoptera	Geometridae
<i>Lophocampa caryae</i> Harr.	hickory tussock moth	Lepidoptera	Arctiidae
<i>Lophocampa maculata</i> Harr.	spotted tussock moth	Lepidoptera	Arctiidae
<i>Loxostege cereralis</i> (Zell.)	alfalfa webworm	Lepidoptera	Pyralidae
<i>Loxostege sticticalis</i> (L.)	beet webworm	Lepidoptera	Pyralidae
<i>Lucilia sericata</i> (Meig.)	sheep blow fly	Diptera	Calliphoridae
<i>Lycaeides idas</i> (L.)	northern blue	Lepidoptera	Lycaenidae
<i>Lycaena dorcas</i> (Kby.)	dorcas copper	Lepidoptera	Lycaenidae
<i>Lycaena epixanthe</i> (Bdv. & LeC.)	bog copper	Lepidoptera	Lycaenidae
<i>Lycaena phlaeas americana</i> Harr.	American copper	Lepidoptera	Lycaenidae
<i>Lycia ursaria</i> (Wlk.)	stout spanworm	Lepidoptera	Geometridae
<i>Lyctus linearis</i> (Goeze)	cosmopolitan powderpost beetle	Coleoptera	Lyctidae
<i>Lyctus planicollis</i> LeC.	southern lyctus beetle	Coleoptera	Lyctidae
<i>Lygidea mendax</i> Reut.	apple red bug	Heteroptera	Miridae
<i>Lygocoris caryae</i> (Knight)	hickory plant bug	Heteroptera	Miridae
<i>Lygocoris communis</i> (Knight)	green apple bug	Heteroptera	Miridae
<i>Lygocoris communis</i> (Knight)	pear plant bug	Heteroptera	Miridae
<i>Lygocoris quercalbae</i> (Knight)	oak plant bug	Heteroptera	Miridae
<i>Lygus elisus</i> Van D.	lucerne plant bug	Heteroptera	Miridae
<i>Lygus elisus</i> Van D.	pale legume bug	Heteroptera	Miridae
<i>Lygus hesperus</i> Knight	western tarnished	Heteroptera	Miridae

	plant bug		
<i>Lygus lineolaris</i> (P. de B.)	tarnished plant bug	Heteroptera	Miridae
<i>Lymantria dispar</i> (L.)	gypsy moth	Lepidoptera	Lymantriidae
<i>Lytta nuttalli</i> Say	Nuttall blister beetle	Coleoptera	Meloidae
<i>Macrodactylus subspinosus</i> (F.)	rose chafer	Coleoptera	Scarabaeidae
<i>Macronoctua onusta</i> Grt.	iris borer	Lepidoptera	Noctuidae
<i>Macropsis trimaculata</i> (Fitch)	plum leafhopper	Homoptera	Cicadellidae
<i>Macrosiphoniella sanborni</i> (Gill.)	chrysanthemum aphid	Homoptera	Aphididae
<i>Macrosiphum euphorbiae</i> (Thos.)	potato aphid	Homoptera	Aphididae
<i>Macrosiphum rosae</i> (L.)	rose aphid	Homoptera	Aphididae
<i>Macrosteles quadrilineatus</i> Fbs.	aster leafhopper	Homoptera	Cicadellidae
<i>Magdalis armicollis</i> (Say)	red elm bark weevil	Coleoptera	Curculionidae
<i>Magdalis barbita</i> (Say)	black elm bark weevil	Coleoptera	Curculionidae
<i>Magicicada septendecim</i> (L.)	periodical cicada	Homoptera	Cicadidae
<i>Malacosoma americanum</i> (F.)	eastern tent caterpillar	Lepidoptera	Lasiocampidae
<i>Malacosoma californicum lutescens</i> (N. & D.)	prairie tent caterpillar	Lepidoptera	Lasiocampidae
<i>Malacosoma californicum pluviale</i> (Dyar)	northern tent caterpillar	Lepidoptera	Lasiocampidae
<i>Malacosoma disstria</i> Hbn.	forest tent caterpillar	Lepidoptera	Lasiocampidae
<i>Mamestra configurata</i> Wlk.	bertha armyworm	Lepidoptera	Noctuidae
<i>Manduca quinquemaculata</i> (Haw.)	tomato hornworm	Lepidoptera	Sphingidae
<i>Manduca sexta</i> (L.)	tobacco hornworm	Lepidoptera	Sphingidae
<i>Mantis religiosa</i> L.	praying mantis	Mantodea	Mantidae
<i>Mantis religiosa</i> L.	European mantid	Mantodea	Mantidae
<i>Marmara elotella</i> (Bsk.)	apple barkminer	Lepidoptera	Gracillariidae
<i>Marmara fasciella</i> (Cham.)	white pine barkminer	Lepidoptera	Gracillariidae

<i>Marmara pomonella</i> Bsk.	apple fruitminer	Lepidoptera	Gracillariidae
<i>Matsucoccus macrocicatrices</i> Rich.	white pine fungus scale	Homoptera	Margarodidae
<i>Matsucoccus resinosae</i> B. & God.	red pine scale	Homoptera	Margarodidae
<i>Mayetiola carpophaga</i> (Tripp)	spruce seed midge	Diptera	Cecidomyiidae
<i>Mayetiola destructor</i> (Say)	Hessian fly	Diptera	Cecidomyiidae
<i>Mayetiola piceae</i> (Felt)	spruce gall midge	Diptera	Cecidomyiidae
<i>Mayetiola thujae</i> (Hed.)	western red cedar cone midge	Diptera	Cecidomyiidae
<i>Mecas confusa</i> C. & L.	poplar gall borer*	Coleoptera	Cerambycidae
<i>Megachile rotundata</i> (F.)	alfalfa leafcutting bee	Hymenoptera	Megachilidae
<i>Megacyllene robiniae</i> (Först.)	locust borer	Coleoptera	Cerambycidae
<i>Megastigmus atedius</i> Wlk.	spruce seed chalcid	Hymenoptera	Torymidae
<i>Megastigmus laricis</i> Marc.	larch seed chalcid	Hymenoptera	Torymidae
<i>Megastigmus pinus</i> Parf.	fir seed chalcid	Hymenoptera	Torymidae
<i>Megastigmus specularis</i> Walley	balsam fir seed chalcid	Hymenoptera	Torymidae
<i>Megastigmus spermotrophus</i> Wachtl	Douglas-fir seed chalcid	Hymenoptera	Torymidae
<i>Megisto cymela</i> (Cram.)	little wood satyr	Lepidoptera	Satyridae
<i>Melanchra picta</i> (Harr.)	zebra caterpillar	Lepidoptera	Noctuidae
<i>Melanolophia canadaria</i> (Gn.)	variable redmarked looper	Lepidoptera	Geometridae
<i>Melanolophia imitata</i> (Wlk.)	greenstriped forest looper	Lepidoptera	Geometridae
<i>Melanophila acuminata</i> (DeG.)	black fire beetle	Coleoptera	Buprestidae
<i>Melanoplus bivittatus</i> (Say)	twostriped grasshopper	Orthoptera	Acrididae
<i>Melanoplus borealis</i> (Fieb.)	northern grasshopper	Orthoptera	Acrididae

<i>Melanoplus femur-rubrum</i> (DeG.)	redlegged grasshopper	Orthoptera	Acrididae
<i>Melanoplus packardii</i> Scudd.	Packard grasshopper	Orthoptera	Acrididae
<i>Melanoplus sanguinipes</i> (F.)	migratory grasshopper	Orthoptera	Acrididae
<i>Melanoplus spretus</i> (Walsh)	Rocky Mountain grasshopper	Orthoptera	Acrididae
<i>Melittia cucurbitae</i> (Harr.)	squash vine borer	Lepidoptera	Sesiidae
<i>Meloe americanus</i> Leach	buttercup oil beetle	Coleoptera	Meloidae
<i>Melophagus ovinus</i> (L.)	sheep ked	Diptera	Hippoboscidae
<i>Menacanthus stramineus</i> (Nitz.)	chicken body louse	Mallophaga	Menoponidae
<i>Menopon gallinae</i> (L.)	shaft louse	Mallophaga	Menoponidae
<i>Merhynchites bicolor</i> (F.)	rose curculio	Coleoptera	Rhynchitidae
<i>Merodon equestris</i> (F.)	narcissus bulb fly	Diptera	Syrphidae
<i>Meromyza americana</i> Fitch	wheat stem maggot	Diptera	Chloropidae
<i>Meroptera pravella</i> (Grt.)	lesser aspen webworm	Lepidoptera	Pyralidae
<i>Mesolecanium nigrofasciatum</i> (Perg.)	terrapin scale	Homoptera	Coccidae
<i>Messa nana</i> (Klug)	early birch leaf edgeminer	Hymenoptera	Tenthredinidae
<i>Messa populifoliella</i> (Towns.)	poplar leafmining sawfly	Hymenoptera	Tenthredinidae
<i>Metopolophium dirhodum</i> (Wlk.)	rose-grass aphid	Homoptera	Aphididae
<i>Micrurapteryx salicifoliella</i> (Cham.)	willow leafminer	Coleoptera	Cerambycidae
<i>Mindarus abietinus</i> Koch	balsam twig aphid	Homoptera	Aphididae
<i>Monochamus marmorator</i> Kby.	balsam fir sawyer	Coleoptera	Cerambycidae
<i>Monochamus mutator</i> LeC.	spotted pine sawyer	Coleoptera	Cerambycidae
<i>Monochamus notatus</i> (Drury)	northeastern sawyer	Coleoptera	Cerambycidae

<i>Monochamus s. scutellatus</i> (Say)	whitespotted sawyer	Coleoptera	Cerambycidae
<i>Monochamus scutellatus oregonensis</i> (LeC.)	Oregon fir sawyer	Coleoptera	Cerambycidae
<i>Monochroa fragariae</i> (Bsk.)	strawberry crownminer	Lepidoptera	Gelechiidae
<i>Monocetus fulvus</i> (Nort.)	cedar sawfly	Hymenoptera	Diprionidae
<i>Monoctenus suffusus</i> (Cress.)	arborvitae sawfly	Hymenoptera	Diprionidae
<i>Monomorium minimum</i> (Buckl.)	little black ant	Hymenoptera	Formicidae
<i>Monomorium pharaonis</i> (L.)	pharaoh ant	Hymenoptera	Formicidae
<i>Mononychus vulpeculus</i> (F.)	iris weevil	Coleoptera	Curculionidae
<i>Monophadnoides geniculatus</i> (Htg.)	raspberry sawfly	Hymenoptera	Tenthredinidae
<i>Mordwilkoja vagabunda</i> (Walsh)	poplar vagabond aphid	Homoptera	Aphididae
<i>Mulsantina picta</i> (Rand.)	pine lady beetle	Coleoptera	Coccinellidae
<i>Murgantia histrionica</i> (Hahn)	harlequin bug	Heteroptera	Pentatomidae
<i>Musca autumnalis</i> DeG.	face fly	Diptera	Muscidae
<i>Musca domestica</i> L.	house fly	Diptera	Muscidae
<i>Muscina stabulans</i> (Fall.)	false stable fly	Diptera	Muscidae
<i>Mycetophagus quadriguttatus</i> Müll.	spotted hairy fungus beetle	Coleoptera	Mycetophagidae
<i>Myzus ascalonicus</i> Doncaster	shallot aphid	Homoptera	Aphididae
<i>Myzus cerasi</i> (F.)	black cherry aphid	Homoptera	Aphididae
<i>Myzus persicae</i> (Sulz.)	green peach aphid	Homoptera	Aphididae
<i>Nacerdes melanura</i> (L.)	wharf borer	Coleoptera	Oedemeridae
<i>Nacophora quernaria</i> (J.E.Smith)	oak beauty	Lepidoptera	Geometridae
<i>Nadata gibbosa</i> (J.E.Smith)	yellowlined caterpillar	Lepidoptera	Notodontidae
<i>Nearctaphis bakeri</i> (Cowen)	clover aphid	Homoptera	Aphididae

<i>Necrobia ruficollis</i> (F.)	redshouldered ham beetle	Coleoptera	Cleridae
<i>Necrobia rufipes</i> (DeG.)	redlegged ham beetle	Coleoptera	Cleridae
<i>Nemapogon granella</i> (L.)	European grain moth	Lepidoptera	Tineidae
<i>Nematocampa resistaria</i> (H.-S.)	filament bearer	Lepidoptera	Geometridae
<i>Nematus ribesii</i> (Scop.)	imported currantworm	Hymenoptera	Tenthredinidae
<i>Nemocestes incomptus</i> (Horn)	woods weevil	Coleoptera	Curculionidae
<i>Nemoria mimosaria</i> (Gn.)	flanged looper	Lepidoptera	Geometridae
<i>Neochlamisus cribripennis</i> (LeC.)	blueberry case beetle	Coleoptera	Chrysomelidae
<i>Neoclytus acuminatus</i> (F.)	redheaded ash borer	Coleoptera	Cerambycidae
<i>Neoclytus caprea</i> (Say)	banded ash borer	Coleoptera	Cerambycidae
<i>Neodiprion abietis</i> (Harr.)	balsam fir sawfly	Hymenoptera	Diprionidae
<i>Neodiprion burkei</i> Midd.	lodgepole sawfly	Hymenoptera	Diprionidae
<i>Neodiprion lecontei</i> (Fitch)	redheaded pine sawfly	Hymenoptera	Diprionidae
<i>Neodiprion n. nanulus</i> Schedl	red pine sawfly	Hymenoptera	Diprionidae
<i>Neodiprion pinetum</i> (Nort.)	white pine sawfly	Hymenoptera	Diprionidae
<i>Neodiprion pratti banksianae</i> Roh.	jack pine sawfly	Hymenoptera	Diprionidae
<i>Neodiprion rugifrons</i> Midd.	redheaded jack pine sawfly	Hymenoptera	Diprionidae
<i>Neodiprion sertifer</i> (Geoff.)	European pine sawfly	Hymenoptera	Diprionidae
<i>Neodiprion swainei</i> Midd.	Swaine jack pine sawfly	Hymenoptera	Diprionidae
<i>Neodiprion tsugae</i> Midd.	hemlock sawfly	Hymenoptera	Diprionidae
<i>Neohydatothrips tiliae</i> (Hood)	basswood thrips	Thysanoptera	Thripidae
<i>Neophasia menapia</i> (C. & R.F.)	pine white	Lepidoptera	Pieridae
<i>Nephelodes minians</i> Gn.	bronzed cutworm	Lepidoptera	Noctuidae

<i>Nephopterix subcaesiella</i> (Clem.)	locust leafroller	Lepidoptera	Pyralidae
<i>Nephopterix subfuscella</i> (Rag.)	striped sumac leafroller	Lepidoptera	Pyralidae
<i>Nepytia canosaria</i> (Wlk.)	false hemlock looper	Lepidoptera	Geometridae
<i>Nepytia freemani</i> Mun.	western false hemlock looper	Lepidoptera	Geometridae
<i>Nepytia phantasmaria</i> (Stkr.)	phantom hemlock looper	Lepidoptera	Geometridae
<i>Neurotoma inconspicua</i> (Nort.)	plum webspinning sawfly	Hymenoptera	Pamphiliidae
<i>Niptus hololeucus</i> (Fald.)	golden spider beetle	Coleoptera	Ptinidae
<i>Nites betulella</i> (Bsk.)	blackdotted birch leaftier	Lepidoptera	Oecophoridae
<i>Nites grotella</i> (Rob.)	hazel leaftier	Lepidoptera	Oecophoridae
<i>Nodonota puncticollis</i> (Say)	rose leaf beetle	Coleoptera	Chrysomelidae
<i>Nomia melanderi</i> Ckll.	alkali bee	Hymenoptera	Halictidae
<i>Nomius pygmaeus</i> (Dej.)	stink beetle	Coleoptera	Carabidae
<i>Nomophila nearctica</i> Mun.	celery stalkworm	Lepidoptera	Pyralidae
<i>Nosopsyllus fasciatus</i> (Bosc)	northern rat flea	Siphonaptera	Ceratophyllidae
<i>Nymphalis antiopa</i> (L.)	mourningcloak butterfly	Lepidoptera	Nymphalidae
<i>Nymphalis antiopa</i> (L.)	spiny elm caterpillar	Lepidoptera	Nymphalidae
<i>Nymphalis californica</i> (Bdv.)	California tortoiseshell	Lepidoptera	Nymphalidae
<i>Nymphalis vau-album</i> (D. & S.)	Compton tortoise-shell	Lepidoptera	Nymphalidae
<i>Nysius niger</i> Baker	northern false chinch bug	Heteroptera	Lygaeidae
<i>Oberea bimaculata</i> (Oliv.)	raspberry cane borer	Coleoptera	Cerambycidae
<i>Oberea schaumii</i> LeC.	poplar branch borer	Coleoptera	Cerambycidae

<i>Obolodiplosis robiniae</i> (Hald.)	locust gall midge	Diptera	Cecidomyiidae
<i>Obrussa ochrefasciella</i> (Cham.)	hard maple budminer	Lepidoptera	Nepticulidae
<i>Odontopus calceatus</i> (Say)	tuliptree leafminer	Coleoptera	Curculionidae
<i>Odontota dorsalis</i> (Thunb.)	locust leafminer	Coleoptera	Chrysomelidae
<i>Oecanthus fultoni</i> T.J. Wlk.	snowy tree cricket	Grylloptera	Gryllidae
<i>Oecanthus nigricornis</i> Wlk.	blackhorned tree cricket	Grylloptera	Gryllidae
<i>Oecanthus quadripunctatus</i> Beut.	fourspotted tree cricket	Grylloptera	Gryllidae
<i>Oeciacus vicarius</i> Horv.	swallow bug	Heteroptera	Cimicidae
<i>Oeneis chryxus</i> (Dbl. & Hew.)	chryxus arctic	Lepidoptera	Satyridae
<i>Oeneis jutta</i> (Hbn.)	jutta arctic	Lepidoptera	Satyridae
<i>Oeneis macounii</i> (Edw.)	Macoun arctic	Lepidoptera	Satyridae
<i>Oeneis polixenes</i> (F.)	polixenes arctic	Lepidoptera	Satyridae
<i>Oeneis taygete</i> Gey.	whiteveined arctic	Lepidoptera	Satyridae
<i>Oenensis melissa</i> (F.)	melissa arctic	Lepidoptera	Satyridae
<i>Oestrus ovis</i> L.	sheep bot fly	Diptera	Oestridae
<i>Olethreutes permundana</i> (Clem.)	raspberry leafroller	Lepidoptera	Tortricidae
<i>Oligocentria lignicolor</i> (Wlk.)	lacecapped caterpillar	Lepidoptera	Notodontidae
<i>Oligonychus pratensis</i> (Banks)	Banks grass mite	Acari	Tetranychidae
<i>Oligonychus ununguis</i> (Jac.)	spruce spider mite	Acari	Tetranychidae
<i>Omanodus floralis</i> (L.)	narrownecked grain beetle	Coleoptera	Anthicidae
<i>Omias saccatus</i> (LeC.)	sagebrush weevil	Coleoptera	Curculionidae
<i>Oncideres cingulata</i> (Say)	twig girdler	Coleoptera	Cerambycidae
<i>Oncopeltus fasciatus</i> (Dall.)	large milkweed bug	Heteroptera	Lygaeidae
<i>Operophtera bruceata</i> (Hulst)	Bruce spanworm	Lepidoptera	Geometridae

<i>Operophtera brumata</i> (L.)	winter moth	Lepidoptera	Geometridae
<i>Orgyia antiqua</i> (L.)	rusty tussock moth	Lepidoptera	Lymantriidae
<i>Orgyia leucostigma</i> (J.E. Smith)	whitemarked tussock moth	Lepidoptera	Lymantriidae
<i>Orgyia pseudotsugata</i> (McD.)	Douglas-fir tussock moth	Lepidoptera	Lymantriidae
<i>Ornithonyssus bacoti</i> (Hirst)	tropical rat mite	Acari	Macronyssidae
<i>Ornithonyssus sylviarum</i> (C. & F.)	northern fowl mite	Acari	Macronyssidae
<i>Ortholepis pasadamia</i> (Dyar)	striped birch pyralid	Lepidoptera	Pyralidae
<i>Orthosia hibisci</i> (Gn.)	speckled green fruitworm	Lepidoptera	Noctuidae
<i>Orthosia revicta</i> (Morr.)	rusty whitesided caterpillar	Lepidoptera	Noctuidae
<i>Oryzaephilus mercator</i> (Fauvel)	merchant grain beetle	Coleoptera	Cucujidae
<i>Oryzaephilus surinamensis</i> (L.)	sawtoothed grain beetle	Coleoptera	Cucujidae
<i>Oscinella frit</i> (L.)	frit fly	Diptera	Chloropidae
<i>Ostrinia nubilalis</i> (Hbn.)	European corn borer	Lepidoptera	Pyralidae
<i>Ostrinia obumbratalis</i> (Led.)	smartweed borer	Lepidoptera	Pyralidae
<i>Otiorhynchus ligustici</i> (L.)	alfalfa snout beetle	Coleoptera	Curculionidae
<i>Otiorhynchus ovatus</i> (L.)	strawberry root weevil	Coleoptera	Curculionidae
<i>Otiorhynchus rugosostriatus</i> (Goeze)	rough strawberry weevil	Coleoptera	Curculionidae
<i>Otiorhynchus sulcatus</i> (F.)	black vine weevil	Coleoptera	Curculionidae
<i>Otobius megnini</i> (Dugès)	ear tick	Acari	Argasidae
<i>Otodectes cynotis</i> (Her.)	ear mite	Acari	Psoroptidae
<i>Oulema melanopus</i> (L.)	cereal leaf beetle	Coleoptera	Chrysomelidae
<i>Pachypsylla celtidismamma</i> (Fletcher)	hackberry nipplegall maker	Homoptera	Psyllidae

<i>Pachyrhinus ferrugineus</i> (Casey)	rusty pineneedle weevil	Coleoptera	Curculionidae
<i>Pachysphinx modesta</i> (Harr.)	big poplar sphinx	Lepidoptera	Sphingidae
<i>Paleacrita vernata</i> (Peck)	spring cankerworm	Lepidoptera	Geometridae
<i>Palorus ratzeburgii</i> (Wissm.)	smalleyed flour beetle	Coleoptera	Tenebrionidae
<i>Palorus subdepressus</i> (Woll.)	depressed flour beetle	Coleoptera	Tenebrionidae
<i>Palpita magniferalis</i> (Wlk.)	ash leafroller	Lepidoptera	Pyralidae
<i>Palthis angulalis</i> (Hbn.)	spruce harlequin	Lepidoptera	Noctuidae
<i>Pamphilius ochreipes</i> (Cress.)	viburnum webspinning sawfly	Hymenoptera	Pamphiliidae
<i>Pandemis canadana</i> Kft.	green aspen leaftier	Lepidoptera	Tortricidae
<i>Pandemis limitata</i> (Rob.)	threelined leafroller	Lepidoptera	Tortricidae
<i>Panonychus ulmi</i> (Koch)	European red mite	Acari	Tetranychidae
<i>Panthea acronyctoides</i> (Wlk.)	tufted spruce caterpillar	Lepidoptera	Noctuidae
<i>Panthea furcilla</i> (Pack.)	tufted white pine caterpillar	Lepidoptera	Noctuidae
<i>Paonias excaecatus</i> (J.E. Smith)	blinneyed sphinx	Lepidoptera	Sphingidae
<i>Paonias myops</i> (J.E. Smith)	smalleyed sphinx	Lepidoptera	Sphingidae
<i>Papaipema cataphracta</i> (Grt.)	burdock borer	Lepidoptera	Noctuidae
<i>Papaipema nebris</i> (Gn.)	stalk borer	Lepidoptera	Noctuidae
<i>Papilio brevicauda</i> Saund.	shorttailed swallowtail	Lepidoptera	Papilionidae
<i>Papilio canadensis</i> (R. & J.)	Canadian tiger swallowtail	Lepidoptera	Papilionidae
<i>Papilio cresphontes</i> Cram.	giant swallowtail	Lepidoptera	Papilionidae
<i>Papilio cresphontes</i> Cram.	orangedog	Lepidoptera	Papilionidae
<i>Papilio glaucus</i> L.	tiger swallowtail	Lepidoptera	Papilionidae
<i>Papilio polyxenes asterias</i> Stoll	parsleyworm	Lepidoptera	Papilionidae

<i>Papilio polyxenes asterias</i> Stoll	celeryworm	Lepidoptera	Papilionidae
<i>Papilio polyxenes asterias</i> Stoll	black swallowtail	Lepidoptera	Papilionidae
<i>Papilio troilus</i> L.	spicebush swallowtail	Lepidoptera	Papilionidae
<i>Paraclemensia acerifoliella</i> (Fitch)	maple leafcutter	Lepidoptera	Incurvariidae
<i>Paradiplosis tumifex</i> Gagn.	balsam gall midge	Diptera	Cecidomyiidae
<i>Paraleucoptera albella</i> (Cham.)	cottonwood leafminer	Lepidoptera	Lyonetiidae
<i>Parandra brunnea brunnea</i> (F.)	pole borer	Coleoptera	Cerambycidae
<i>Paraphytomyza populincola</i> (Wlk.)	Lombardy leafminer	Diptera	Agromyzidae
<i>Paraprociphilus tessellatus</i> (Fitch)	woolly alder aphid	Homoptera	Aphididae
<i>Paratriozza cockerelli</i> (Sulc)	tomato psyllid	Homoptera	Psyllidae
<i>Paratriozza cockerelli</i> (Sulc)	potato psyllid	Homoptera	Psyllidae
<i>Parcoblatta pennsylvanica</i> (DeG.)	Pennsylvania wood cockroach	Blattodea	Blattellidae
<i>Parectopa robinella</i> Clem.	locust digitate leafminer	Lepidoptera	Gracillariidae
<i>Paria fragariae</i> Wilcox	strawberry rootworm	Coleoptera	Chrysomelidae
<i>Parornix geminatella</i> Pack.	unspotted tentiform leafminer	Lepidoptera	Gracillariidae
<i>Parthenolecanium corni</i> (Bouch.)	European fruit lecanium	Homoptera	Coccidae
<i>Parthenolecanium persicae</i> (F.)	European peach scale	Homoptera	Coccidae
<i>Parthenolecanium quercifex</i> (Fitch)	oak lecanium	Homoptera	Coccidae
<i>Pediculus humanus capitis</i> DeG.	head louse	Anoplura	Pediculidae
<i>Pediculus humanus humanus</i> L.	body louse	Anoplura	Pediculidae
<i>Pegomya hyoscyami</i> (Panz.)	spinach leafminer	Diptera	Anthomyiidae
<i>Pegomya rubivora</i> (Coq.)	raspberry cane maggot	Diptera	Anthomyiidae
<i>Pegomya</i> spp.	beet leafminer	Diptera	Anthomyiidae

<i>Pemphigus bursarius</i> (L.)	lettuce aphid	Homoptera	Aphididae
<i>Pemphigus populitransversus</i> Riley	poplar petiolegall aphid	Homoptera	Aphididae
<i>Pemphigus populiveneae</i> Fitch	sugarbeet root aphid	Homoptera	Aphididae
<i>Pennisetia marginata</i> (Harr.)	raspberry crown borer	Lepidoptera	Sesiidae
<i>Peranabrus scabricollis</i> (Thos.)	coulee cricket	Grylloptera	Tettigoniidae
<i>Peridroma saucia</i> (Hbn.)	variegated cutworm	Lepidoptera	Noctuidae
<i>Perillus bioculatus</i> (F.)	twospotted stink bug	Heteroptera	Pentatomidae
<i>Periphyllus lyropictus</i> (Kess.)	Norway maple aphid	Homoptera	Aphididae
<i>Periphyllus negundinis</i> (Thos.)	boxelder aphid	Homoptera	Aphididae
<i>Periplaneta americana</i> (L.)	American cockroach	Blattodea	Blattidae
<i>Periplaneta australasiae</i> (F.)	Australian cockroach	Blattodea	Blattidae
<i>Periplaneta brunnea</i> Burm.	brown cockroach	Blattodea	Blattidae
<i>Petrobia latens</i> (Müll.)	brown wheat mite	Acari	Tetranychidae
<i>Petrova albicapitana</i> (Bsk.)	northern pitch twig moth	Lepidoptera	Tortricidae
<i>Petrova comstockiana</i> (Fern.)	pitch twig moth	Lepidoptera	Tortricidae
<i>Phenacoccus aceris</i> (Sign.)	apple mealybug	Homoptera	Pseudococcidae
<i>Phenacoccus gossypii</i> T. & C.	Mexican mealybug	Homoptera	Pseudococcidae
<i>Pheosia rimosa</i> Pack.	false hornworm	Lepidoptera	Notodontidae
<i>Phigalia titea</i> (Cram.)	spiny looper	Lepidoptera	Geometridae
<i>Philaenus spumarius</i> (L.)	meadow spittlebug	Homoptera	Cercopidae
<i>Phloeosinus canadensis</i> Swaine	northern cedar bark beetle	Coleoptera	Scolytidae
<i>Phloeosinus punctatus</i> LeC.	western cedar bark beetle	Coleoptera	Scolytidae
<i>Phloeotribus liminaris</i> (Harr.)	peach bark beetle	Coleoptera	Scolytidae
<i>Phobetron pitheciun</i> (J.E.Smith)	hag moth	Lepidoptera	Limacodidae

<i>Pholisora catullus</i> (F.)	common sooty wing	Lepidoptera	Hesperiidae
<i>Phormia regina</i> (Meig.)	black blow fly	Diptera	Calliphoridae
<i>Phorodon humuli</i> (Schr.)	hop aphid	Homoptera	Aphididae
<i>Phragmatobia assimilans</i> Wlk.	dusky red tiger moth	Lepidoptera	Arctiidae
<i>Phragmatobia fuliginosa rubricosa</i> (Harr.)	ruby tiger moth	Lepidoptera	Arctiidae
<i>Phratora p. purpurea</i> Brown	aspen skeletonizer	Coleoptera	Chrysomelidae
<i>Phthorimaea operculella</i> (Zell.)	potato tuberworm	Lepidoptera	Gelechiidae
<i>Phyciodes batesii</i> (Reak.)	tawny crescent	Lepidoptera	Nymphalidae
<i>Phyciodes selenis</i> (Kby.)	northern pearl crescent	Lepidoptera	Nymphalidae
<i>Phyllobius intrusus</i> Kono	arborvitae weevil	Coleoptera	Curculionidae
<i>Phyllobius oblongus</i> (L.)	European snout beetle	Coleoptera	Curculionidae
<i>Phyllocnistis populiella</i> Cham.	aspen serpentine leafminer	Lepidoptera	Lyonetiidae
<i>Phyllocolpa bozemani</i> (Cooley)	poplar leaffolding sawfly	Hymenoptera	Tenthredinidae
<i>Phyllocolpa popuella</i> (Ross)	poplar edgefolding sawfly	Hymenoptera	Tenthredinidae
<i>Phyllodesma americana</i> (Harr.)	lappet moth	Lepidoptera	Lasiocampidae
<i>Phyllonorycter apparella</i> (H.-S.)	aspen leafblotch miner	Lepidoptera	Gracillariidae
<i>Phyllonorycter blancardella</i> (F.)	spotted tentiform leafminer	Lepidoptera	Gracillariidae
<i>Phyllonorycter crataegella</i> (Clem.)	apple blotch leafminer	Lepidoptera	Gracillariidae
<i>Phyllonorycter lucetiella</i> (Clem.)	basswood squareblotch miner	Lepidoptera	Gracillariidae
<i>Phyllonorycter lucidicostella</i> (Clem.)	lesser maple leafblotch miner	Lepidoptera	Gracillariidae

<i>Phyllonorycter nipigon</i> (Free.)	balsam poplar leafblotch miner	Lepidoptera	Gracillariidae
<i>Phyllonorycter populiella</i> (Cham.)	poplar leafminer	Lepidoptera	Gracillariidae
<i>Phyllonorycter propinquella</i> (Braun)	cherry blotchminer	Lepidoptera	Gracillariidae
<i>Phyllonorycter salicifoliella</i> (Cham.)	willow leafblotch miner	Lepidoptera	Gracillariidae
<i>Phyllonorycter tiliacella</i> (Cham.)	basswood roundblotch miner	Lepidoptera	Gracillariidae
<i>Phyllonorycter tremuloidiella</i> (Braun)	aspen blotchminer	Lepidoptera	Gracillariidae
<i>Phyllophaga fusca</i> (Frö.)	northern June beetle	Coleoptera	Scarabaeidae
<i>Phyllophaga futilis</i> (LeC.)	lesser June beetle	Coleoptera	Scarabaeidae
<i>Phyllophaga rugosa</i> (Melsh.)	rugose June beetle	Coleoptera	Scarabaeidae
<i>Phyllotreta albionica</i> (LeC.)	cabbage flea beetle	Coleoptera	Chrysomelidae
<i>Phyllotreta armoraciae</i> (Koch)	horseradish flea beetle	Coleoptera	Chrysomelidae
<i>Phyllotreta cruciferae</i> (Goeze)	crucifer flea beetle	Coleoptera	Chrysomelidae
<i>Phyllotreta pusilla</i> Horn	western black flea beetle	Coleoptera	Chrysomelidae
<i>Phyllotreta robusta</i> LeC.	garden flea beetle	Coleoptera	Chrysomelidae
<i>Phyllotreta striolata</i> (F.)	striped flea beetle	Coleoptera	Chrysomelidae
<i>Physokermes piceae</i> (Schr.)	spruce bud scale	Homoptera	Coccidae
<i>Phytobia amelanchieris</i> (Greene)	amelanchier twig borer	Diptera	Agromyzidae
<i>Phytobia betulivora</i> Spencer	birch cambium miner	Diptera	Agromyzidae
<i>Phytobia setosa</i> (Loew)	red maple cambium borer	Diptera	Agromyzidae
<i>Phytomyza ilicis</i> Curt.	holly leafminer	Diptera	Agromyzidae
<i>Phytonemus pallidus</i> (Banks)	cyclamen mite	Acari	Tarsonemidae

<i>Pieris napi</i> (L.)	mustard white	Lepidoptera	Pieridae
<i>Pieris rapae</i> (L.)	cabbage butterfly	Lepidoptera	Pieridae
<i>Pieris rapae</i> (L.)	imported cabbageworm	Lepidoptera	Pieridae
<i>Pieris virginiana</i> (Edw.)	West Virginia white	Lepidoptera	Pieridae
<i>Pikonema alaskensis</i> (Roh.)	yellowheaded spruce sawfly	Hymenoptera	Tenthredinidae
<i>Pikonema dimmockii</i> (Cress.)	greenheaded spruce sawfly	Hymenoptera	Tenthredinidae
<i>Pineus floccus</i> (Patch)	red spruce adelgid	Homoptera	Adelgidae
<i>Pineus pinifoliae</i> (Fitch)	pine leaf adelgid	Homoptera	Adelgidae
<i>Pineus similis</i> (Gill.)	ragged spruce gall adelgid	Homoptera	Adelgidae
<i>Pineus strobi</i> (Htg.)	pine bark adelgid	Homoptera	Adelgidae
<i>Piophila casei</i> (L.)	cheese skipper	Diptera	Piophilidae
<i>Pissodes nemorensis</i> Germ.	northern pine weevil	Coleoptera	Curculionidae
<i>Pissodes rotundatus</i> LeC.	small spruce weevil	Coleoptera	Curculionidae
<i>Pissodes striatulus</i> (F.)	balsam bark weevil	Coleoptera	Curculionidae
<i>Pissodes strobi</i> (Peck)	white pine weevil	Coleoptera	Curculionidae
<i>Pissodes terminalis</i> Hopping	lodgepole terminal weevil	Coleoptera	Curculionidae
<i>Pityokteines sparsus</i> (LeC.)	balsam fir bark beetle	Coleoptera	Scolytidae
<i>Plagiodera versicolora</i> (Laich.)	imported willow leaf beetle	Coleoptera	Chrysomelidae
<i>Plagiognathus obscurus</i> Uhl.	obscure plant bug	Heteroptera	Miridae
<i>Planococcus citri</i> (Risso)	citrus mealybug	Homoptera	Pseudococcidae
<i>Platycotis vittata</i> (F.)	oak treehopper	Homoptera	Membracidae
<i>Plebejus saepiolus</i> (Bdv.)	greenish blue	Lepidoptera	Lycaenidae
<i>Pleroneura brunneicornis</i> Roh.	balsam shootboring	Hymenoptera	Xyelidae

	sawfly		
<i>Plodia interpunctella</i> (Hbn.)	Indianmeal moth	Lepidoptera	Pyralidae
<i>Plutella xylostella</i> (L.)	diamondback moth	Lepidoptera	Plutellidae
<i>Pnyxia scabiei</i> (Hopk.)	potato scab gnat	Diptera	Sciaridae
<i>Poanes hobomok</i> (Harr.)	Hobomok skipper	Lepidoptera	Hesperiidae
<i>Poanes viator</i> (Edw.)	broadwinged skipper	Lepidoptera	Hesperiidae
<i>Pococera aplastella</i> (Hulst)	aspen webworm	Lepidoptera	Pyralidae
<i>Pococera asperatella</i> (Clem.)	maple webworm	Lepidoptera	Pyralidae
<i>Pococera expandens</i> (Wlk.)	striped oak webworm	Lepidoptera	Pyralidae
<i>Pococera militella</i> (Zell.)	sycamore webworm	Lepidoptera	Pyralidae
<i>Pococera robustella</i> (Zell.)	pine webworm	Lepidoptera	Pyralidae
<i>Podapion gallicola</i> Riley	pine gall weevil	Coleoptera	Apionidae
<i>Podisus maculiventris</i> (Say)	spined soldier bug	Heteroptera	Pentatomidae
<i>Podosesia syringae</i> (Harr.)	lilac borer	Lepidoptera	Sesiidae
<i>Podosesia syringae</i> (Harr.)	ash borer	Lepidoptera	Sesiidae
<i>Poecilocapsus lineatus</i> (F.)	fourlined plant bug	Heteroptera	Miridae
<i>Pogonomyrmex occidentalis</i> (Cress.)	western harvester ant	Hymenoptera	Formicidae
<i>Polites mystic</i> (Edw.)	long dash	Lepidoptera	Hesperiidae
<i>Polites peckius</i> (Kby.)	Peck skipper	Lepidoptera	Hesperiidae
<i>Polites themistocles</i> (Latr.)	tawnyedged skipper	Lepidoptera	Hesperiidae
<i>Pollenia rudis</i> (F.)	cluster fly	Diptera	Calliphoridae
<i>Polychrysia moneta</i> (F.)	delphinium cutworm	Lepidoptera	Noctuidae
<i>Polydrusus impressifrons</i> (Gyll.)	pale green weevil	Coleoptera	Curculionidae
<i>Polygonia comma</i> (Harr.)	hop merchant	Lepidoptera	Nymphalidae
<i>Polygonia faunus</i> (Edw.)	green comma	Lepidoptera	Nymphalidae
<i>Polygonia gracilis</i> (G. & R.)	hoary comma	Lepidoptera	Nymphalidae

<i>Polygonia interrogationis</i> (F.)	question mark	Lepidoptera	Nymphalidae
<i>Polygonia progne</i> (Cram.)	gray comma	Lepidoptera	Nymphalidae
<i>Polygonia satyrus</i> (Edw.)	satyr anglewing	Lepidoptera	Nymphalidae
<i>Polygraphus rufipennis</i> (Kby.)	four-eyed spruce bark beetle	Coleoptera	Scolytidae
<i>Polyphylla decemlineata</i> (Say)	ten-lined June beetle	Coleoptera	Scarabaeidae
<i>Pontania proxima</i> (Lep.)	willow redgall sawfly	Hymenoptera	Tenthredinidae
<i>Pontania s-pomum</i> (Walsh)	willow applegall sawfly	Hymenoptera	Tenthredinidae
<i>Pontia occidentalis</i> (Reak.)	checkered white cabbageworm	Lepidoptera	Pieridae
<i>Pontia occidentalis</i> (Reak.)	western checkered white	Lepidoptera	Pieridae
<i>Pontia protodice</i> (Bdv. & LeC.)	checkered white	Lepidoptera	Pieridae
<i>Popillia japonica</i> Newm.	Japanese beetle	Coleoptera	Scarabaeidae
<i>Prionoxystus macmurtrei</i> (Guér.)	little carpenterworm	Lepidoptera	Cossidae
<i>Prionoxystus robiniae</i> (Peck)	carpenterworm	Lepidoptera	Cossidae
<i>Prionus laticollis</i> (Drury)	broad-necked root borer	Coleoptera	Cerambycidae
<i>Pristiphora erichsonii</i> (Htg.)	larch sawfly	Hymenoptera	Tenthredinidae
<i>Pristiphora geniculata</i> (Htg.)	mountain-ash sawfly	Hymenoptera	Tenthredinidae
<i>Pristiphora lena</i> Kinc.	little spruce sawfly	Hymenoptera	Tenthredinidae
<i>Probola amicaria</i> (H.-S.)	red-cheeked looper	Lepidoptera	Geometridae
<i>Prochoerodes transversata</i> (Drury)	large maple spanworm	Lepidoptera	Geometridae
<i>Prodiplosis morrisi</i> Gagn.	leafcurl midge	Diptera	Cecidomyiidae
<i>Profenusia canadensis</i> (Marl.)	hawthorn leafmining sawfly	Hymenoptera	Tenthredinidae
<i>Profenusia lucifex</i> (Ross)	oak leafmining sawfly	Hymenoptera	Tenthredinidae

<i>Profenus a thomsoni</i> (Konow)	ambermarked birch leafminer	Hymenoptera	Tenthredinidae
<i>Proserpinus flavofasciata</i> (Wlk.)	yellowbanded day sphinx	Lepidoptera	Sphingidae
<i>Proteoteras aesculana</i> Riley	maple twig borer	Lepidoptera	Tortricidae
<i>Proteoteras moffatiana</i> Fern.	maple shoot borer	Lepidoptera	Tortricidae
<i>Proteoteras willingana</i> (Kft.)	boxelder twig borer	Lepidoptera	Tortricidae
<i>Protopoarmia porcelaria indicataria</i> (Wlk.)	dashlined looper	Lepidoptera	Geometridae
<i>Protophormia terraenovae</i> (Rob.-Desv.)	northern blow fly	Diptera	Calliphoridae
<i>Pseudaleitia unipuncta</i> (Haw.)	armyworm	Lepidoptera	Noctuidae
<i>Pseudexentera cressoniana</i> (Clem.)	oak olethreutid leafroller	Lepidoptera	Tortricidae
<i>Pseudexentera malii</i> Free.	pale apple leafroller	Lepidoptera	Tortricidae
<i>Pseudococcus comstocki</i> (Kuw.)	Comstock mealybug	Homoptera	Pseudococcidae
<i>Pseudococcus longispinus</i> (Targ.)	longtailed mealybug	Homoptera	Pseudococcidae
<i>Pseudococcus maritimus</i> (Ehrh.)	grape mealybug	Homoptera	Pseudococcidae
<i>Pseudopityophthorus minutissimus</i> (Zimm.)	oak bark beetle	Coleoptera	Scolytidae
<i>Pseudopityophthorus pubipennis</i> (LeC.)	western oak bark beetle	Coleoptera	Scolytidae
<i>Pseudosciaphila duplex</i> (Wlsm.)	poplar leafroller	Lepidoptera	Tortricidae
<i>Psila rosae</i> (F.)	carrot rust fly	Diptera	Psilidae
<i>Psilocorsis cryptolechiella</i> (Cham.)	twoleaf tier	Lepidoptera	Oecophoridae
<i>Psilocorsis quercicella</i> Clem.	oak leaffier	Lepidoptera	Oecophoridae
<i>Psilocorsis reflexella</i> Clem.	flat leaffier	Lepidoptera	Oecophoridae
<i>Psinidia f. fenestralis</i> (Aud.-Serv.)	longhorned grasshopper	Orthoptera	Acrididae

<i>Psoroptes equi</i> (Rasp.)	scab mite	Acari	Psoroptidae
<i>Psoroptes ovis</i> (Her.)	sheep scab mite	Acari	Psoroptidae
<i>Psorosina hammondi</i> (Riley)	appleleaf skeletonizer	Lepidoptera	Pyralidae
<i>Psylla striata</i> Patch	birch psyllid	Homoptera	Psyllidae
<i>Psylliodes punctulata</i> Melsh.	hop flea beetle	Coleoptera	Chrysomelidae
<i>Pterocomma smithiae</i> (Monell)	black willow aphid	Homoptera	Aphididae
<i>Pthirus pubis</i> (L.)	crab louse	Anoplura	Pediculidae
<i>Ptinus claviger</i> Panz.	brown spider beetle	Coleoptera	Ptinidae
<i>Ptinus fur</i> (L.)	whitemarked spider beetle	Coleoptera	Ptinidae
<i>Ptinus ocellus</i> Brown	Australian spider beetle	Coleoptera	Ptinidae
<i>Ptinus raptor</i> Sturm	eastern spider beetle	Coleoptera	Ptinidae
<i>Ptinus villiger</i> (Reitter)	hairy spider beetle	Coleoptera	Ptinidae
<i>Ptycholoma peritana</i> (Clem.)	garden tortrix	Lepidoptera	Tortricidae
<i>Pulex irritans</i> (L.)	human flea	Siphonaptera	Pulicidae
<i>Pulvinaria amygdali</i> Ckll.	cottony peach scale	Homoptera	Coccidae
<i>Pulvinaria innumerabilis</i> (Rathv.)	cottony maple scale	Homoptera	Coccidae
<i>Puto cupressi</i> (Colm.)	fir mealybug	Homoptera	Pseudococcidae
<i>Puto sandini</i> Wash.	spruce mealybug	Homoptera	Pseudococcidae
<i>Pyemotes tritici</i> (L.-F. & M.)	straw itch mite	Acari	Pyemotidae
<i>Pyralis farinalis</i> L.	meal moth	Lepidoptera	Pyralidae
<i>Pyrgus centaureae</i> (Rambur)	grizzled skipper	Lepidoptera	Hesperiidae
<i>Pyrrharctia isabella</i> (J.E. Smith)	banded woollybear	Lepidoptera	Arctiidae
<i>Pyrrhia umbra</i> (Hufn.)	rose budworm	Lepidoptera	Noctuidae
<i>Quadraspidiotus juglansregiae</i> (Comst.)	walnut scale	Homoptera	Diaspididae

<i>Quadraspidiotus ostreaeformis</i> (Curt.)	European fruit scale	Homoptera	Diaspididae
<i>Quadraspidiotus perniciosus</i> (Comst.)	San Jose scale	Homoptera	Diaspididae
<i>Rabdophaga rigidae</i> (O.S.)	willow beakedgall midge	Diptera	Cecidomyiidae
<i>Rabdophaga salicisbatatas</i> (O.S.)	willow potatogall midge	Diptera	Cecidomyiidae
<i>Rabdophaga salicisbrassicoides</i> (Pack.)	willow cabbagegall midge	Diptera	Cecidomyiidae
<i>Rabdophaga strobiloides</i> (O.S.)	willow pinecone gall midge	Diptera	Cecidomyiidae
<i>Raphia frater</i> Grt.	yellowmarked caterpillar	Lepidoptera	Noctuidae
<i>Recurvaria nanella</i> (D. & S.)	lesser bud moth	Lepidoptera	Gelechiidae
<i>Reduvius personatus</i> (L.)	masked hunter	Heteroptera	Reduviidae
<i>Reticulitermes flavipes</i> (Koll.)	eastern subterranean termite	Isoptera	Rhinotermitidae
<i>Reticulitermes hesperus</i> Banks	western subterranean termite	Isoptera	Rhinotermitidae
<i>Rhabdopterus picipes</i> (Oliv.)	cranberry rootworm	Coleoptera	Chrysomelidae
<i>Rhagoletis cingulata</i> (Loew)	cherry fruit fly	Diptera	Tephritidae
<i>Rhagoletis cingulata</i> (Loew)	cherry maggot	Diptera	Tephritidae
<i>Rhagoletis completa</i> Cress.	husk maggot	Diptera	Tephritidae
<i>Rhagoletis completa</i> Cress.	walnut husk fly	Diptera	Tephritidae
<i>Rhagoletis fausta</i> (O.S.)	black cherry fruit fly	Diptera	Tephritidae
<i>Rhagoletis indifferens</i> Curran	western cherry fruit fly	Diptera	Tephritidae
<i>Rhagoletis mendax</i> Curran	blueberry maggot	Diptera	Tephritidae
<i>Rhagoletis pomonella</i> (Walsh)	apple maggot	Diptera	Tephritidae

<i>Rhaxonycha carolina</i> (F.)	Carolina cantharid	Coleoptera	Cantharidae
<i>Rheumaptera hastata</i> (L.)	spearmarked black moth	Lepidoptera	Geometridae
<i>Rhipicephalus sanguineus</i> (Latr.)	brown dog tick	Acari	Ixodidae
<i>Rhizoglyphus echinopus</i> (F. & R.)	bulb mite	Acari	Acaridae
<i>Rhopalomyia chrysanthemi</i> (Ahlb.)	chrysanthemum gall midge	Diptera	Cecidomyiidae
<i>Rhopalosiphum fitchii</i> (Sand.)	apple grain aphid	Homoptera	Aphididae
<i>Rhopalosiphum maidis</i> (Fitch)	corn leaf aphid	Homoptera	Aphididae
<i>Rhopalosiphum padi</i> (L.)	oat-birdcherry aphid	Homoptera	Aphididae
<i>Rhopobota naevana</i> (Hbn.)	blackheaded fireworm	Lepidoptera	Tortricidae
<i>Rhyacionia buoliana</i> (D. & S.)	European pine shoot moth	Lepidoptera	Tortricidae
<i>Rhyacionia busckana</i> Heinr.	red pine shoot borer	Lepidoptera	Tortricidae
<i>Rhyacionia frustrana</i> (Comst.)	Nantucket pine tip moth	Lepidoptera	Tortricidae
<i>Rhyacionia granti</i> Miller	jack pine shoot borer	Lepidoptera	Tortricidae
<i>Rhyacionia rigidana</i> (Fern.)	pitch pine tip moth	Lepidoptera	Tortricidae
<i>Rhyacionia sonia</i> Miller	yellow jack pine shoot borer	Lepidoptera	Tortricidae
<i>Rhynchaenus pallicornis</i> (Say)	apple flea weevil	Coleoptera	Curculionidae
<i>Rhynchaenus testaceus</i> (Mull.)	birch and alder flea weevil	Coleoptera	Curculionidae
<i>Rhyzopertha dominica</i> (F.)	lesser grain borer	Coleoptera	Bostrichidae
<i>Ribautiana tenerrima</i> (H.-S.)	bramble leafhopper	Homoptera	Cicadellidae
<i>Saissetia coffeae</i> (Wlk.)	hemispherical scale	Homoptera	Coccidae
<i>Saperda calcarata</i> Say	poplar borer	Coleoptera	Cerambycidae
<i>Saperda candida</i> F.	Saskatoon borer	Coleoptera	Cerambycidae

<i>Saperda candida</i> F.	roundheaded apple tree borer	Coleoptera	Cerambycidae
<i>Saperda tridentata</i> Oliv.	elm borer	Coleoptera	Cerambycidae
<i>Saperda vestita</i> Say	linden borer	Coleoptera	Cerambycidae
<i>Sarcophaga aldrichi</i> Park.	large flesh fly	Diptera	Sarcophagidae
<i>Sarcoptes scabiei</i> (DeG.)	itch mite	Acari	Sarcoptidae
<i>Satyrium acadicum</i> (Edw.)	Acadian hairstreak	Lepidoptera	Lycaenidae
<i>Satyrium calanus</i> (Hbn.)	banded hairstreak	Lepidoptera	Lycaenidae
<i>Satyrium caryaevorum</i> (McD.)	hickory hairstreak	Lepidoptera	Lycaenidae
<i>Satyrium edwardsii</i> (G. & R.)	Edwards hairstreak	Lepidoptera	Lycaenidae
<i>Satyrium liparops</i> (LeC.)	striped hairstreak	Lepidoptera	Lycaenidae
<i>Satyrodes eurydice</i> (Johan.)	eyed brown	Lepidoptera	Satyridae
<i>Schinia florida</i> (Gn.)	primrose moth	Lepidoptera	Noctuidae
<i>Schizaphis graminum</i> (Rond.)	greenbug	Homoptera	Aphididae
<i>Schizolachnus piniradiatae</i> (Dav.)	woolly pine needle aphid	Homoptera	Aphididae
<i>Schizura concinna</i> (J.E. Smith)	redhumped caterpillar	Lepidoptera	Notodontidae
<i>Schizura ipomoeae</i> Dbly.	oak-maple humped caterpillar	Lepidoptera	Notodontidae
<i>Schizura unicornis</i> (J.E. Smith)	unicorn caterpillar	Lepidoptera	Notodontidae
<i>Sciopithes obscurus</i> Horn	obscure root weevil	Coleoptera	Curculionidae
<i>Scoliopteryx libatrix</i> (L.)	herald moth	Lepidoptera	Noctuidae
<i>Scolytus mali</i> (Bech.)	larger shothole borer	Coleoptera	Scolytidae
<i>Scolytus multistriatus</i> (Marsh.)	European elm bark beetle	Coleoptera	Scolytidae
<i>Scolytus quadrispinosus</i> Say	hickory bark beetle	Coleoptera	Scolytidae
<i>Scolytus rugulosus</i> (Müll.)	shothole borer	Coleoptera	Scolytidae
<i>Scolytus tsugae</i> (Swaine)	hemlock engraver	Coleoptera	Scolytidae

<i>Scolytus unispinosus</i> LeC.	Douglas-fir engraver	Coleoptera	Scolytidae
<i>Scolytus ventralis</i> LeC.	fir engraver	Coleoptera	Scolytidae
<i>Scudderia furcata</i> B. von W.	forktailed bush katydid	Grylloptera	Tettigoniidae
<i>Scutigerella immaculata</i> (Newp.)	garden symphylan	Sympyla	Scutigerellidae
<i>Semanotus ligneus</i> (F.)	cedartree borer	Coleoptera	Cerambycidae
<i>Semanotus litigiosus</i> (Casey)	firtree borer	Coleoptera	Cerambycidae
<i>Semiothisa granitata</i> (Gn.)	green spruce looper	Lepidoptera	Geometridae
<i>Semiothisa ocellinata</i> (Gn.)	locust looper	Lepidoptera	Geometridae
<i>Semiothisa sexmaculata</i> (Pack.)	green larch looper	Lepidoptera	Geometridae
<i>Semiothisa signaria dispuncta</i> (Wlk.)	spruce-fir looper	Lepidoptera	Geometridae
<i>Sesia tibialis</i> (Harr.)	cottonwood crown borer	Lepidoptera	Sesiidae
<i>Setoptus jonesi</i> (Keif.)	red pine needle mite	Acari	Phytoptidae
<i>Sicya macularia</i> (Harr.)	twopronged looper	Lepidoptera	Geometridae
<i>Simulium arcticum</i> Malloch	northern black fly	Diptera	Simuliidae
<i>Simulium venustum</i> Say	whitestockinged black fly	Diptera	Simuliidae
<i>Simulium vittatum</i> Zett.	striped black fly	Diptera	Simuliidae
<i>Sinea diadema</i> (F.)	spined assassin bug	Heteroptera	Reduviidae
<i>Sirex cyaneus</i> F.	blue horntail	Hymenoptera	Siricidae
<i>Sirex juvencus juvencus</i> (L.)	European blue horntail	Hymenoptera	Siricidae
<i>Sitobion avenae</i> (F.)	English grain aphid	Homoptera	Aphididae
<i>Sitodiplosis mosellana</i> (Gehin)	wheat midge	Diptera	Cecidomyiidae
<i>Sitona cylindricollis</i> (Fåhr.)	sweetclover weevil	Coleoptera	Curculionidae
<i>Sitona hispidulus</i> (F.)	clover root curculio	Coleoptera	Curculionidae

<i>Sitona lineatus</i> (L.)	pea leaf weevil	Coleoptera	Curculionidae
<i>Sitophilus granarius</i> (L.)	granary weevil	Coleoptera	Curculionidae
<i>Sitophilus oryzae</i> (L.)	rice weevil	Coleoptera	Curculionidae
<i>Sitotroga cerealella</i> (Oliv.)	Angoumois grain moth	Lepidoptera	Gelechiidae
<i>Smerinthus cerisyi</i> Kby.	willow sphinx	Lepidoptera	Sphingidae
<i>Smerinthus jamaicensis</i> (Drury)	twinspot sphinx	Lepidoptera	Sphingidae
<i>Solenopsis molesta</i> (Say)	thief ant	Hymenoptera	Formicidae
<i>Solenoptes capillatus</i> End.	little blue cattle louse	Anoplura	Linognathidae
<i>Spaelotis clandestina</i> (Harr.)	w-marked cutworm	Lepidoptera	Noctuidae
<i>Spaelotis havilae</i> (Grt.)	western w-marked cutworm	Lepidoptera	Noctuidae
<i>Sparganothis acerivorana</i> MacK.	maple leafroller	Lepidoptera	Tortricidae
<i>Sparganothis directana</i> (Wlk.)	chokecherry leafroller	Lepidoptera	Tortricidae
<i>Sparganothis pectinana</i> (Rob.)	maple-basswood leafroller	Lepidoptera	Tortricidae
<i>Speyeria aphrodite</i> (F.)	aphrodite fritillary	Lepidoptera	Nymphalidae
<i>Speyeria atlantis</i> (Edw.)	Atlantis fritillary	Lepidoptera	Nymphalidae
<i>Speyeria cybele</i> (F.)	great spangled fritillary	Lepidoptera	Nymphalidae
<i>Sphaerolecanium prunastri</i> (Fonsc.)	globose scale	Homoptera	Coccidae
<i>Spharagemon collare</i> (Scudd.)	mottled sand grasshopper	Orthoptera	Acrididae
<i>Sphinx canadensis</i> Bdv.	northern ash sphinx	Lepidoptera	Sphingidae
<i>Sphinx chersis</i> (Hbn.)	great ash sphinx	Lepidoptera	Sphingidae
<i>Sphinx drupiferarum</i> J.E.Smith	wild cherry sphinx	Lepidoptera	Sphingidae
<i>Sphinx drupiferarum</i> J.E.Smith	plum sphinx	Lepidoptera	Sphingidae
<i>Sphinx eremita</i> (Hbn.)	hermit sphinx	Lepidoptera	Sphingidae

<i>Sphinx gordius</i> Cram.	apple sphinx	Lepidoptera	Sphingidae
<i>Sphinx kalmiae</i> J.E.Smith	laurel sphinx	Lepidoptera	Sphingidae
<i>Sphinx luscitiosa</i> Clem.	poplar-and-willow sphinx	Lepidoptera	Sphingidae
<i>Sphinx vashti</i> Stkr.	snowberry sphinx	Lepidoptera	Sphingidae
<i>Spilonota ocellana</i> (D. & S.)	eyespotted bud moth	Lepidoptera	Tortricidae
<i>Spilosoma virginica</i> (F.)	yellow woollybear	Lepidoptera	Arctiidae
<i>Spodoptera exigua</i> (Hbn.)	beet armyworm	Lepidoptera	Noctuidae
<i>Spodoptera frugiperda</i> (J.E.Smith)	fall armyworm	Lepidoptera	Noctuidae
<i>Spodoptera ornithogalli</i> (Gn.)	yellowstriped armyworm	Lepidoptera	Noctuidae
<i>Spodoptera praefica</i> (Grt.)	western yellowstriped armyworm	Lepidoptera	Noctuidae
<i>Stegobium paniceum</i> (L.)	drugstore beetle	Coleoptera	Anobiidae
<i>Stenolophus lecontei</i> (Chaud.)	seedcorn beetle	Coleoptera	Carabidae
<i>Steremnius carinatus</i> (Boh.)	conifer seedling weevil	Coleoptera	Curculionidae
<i>Stethophyma lineatum</i> (Scudd.)	striped sedge grasshopper	Orthoptera	Acrididae
<i>Sthenopis argenteomaculatus</i> (Harr.)	alder root borer	Lepidoptera	Hepialidae
<i>Stictocephala bisonia</i> K. & Y.	buffalo treehopper	Homoptera	Membracidae
<i>Stictoleptura canadensis</i> Oliv.	redshouldered pine borer	Coleoptera	Cerambycidae
<i>Stilbosis ostryaella</i> (Cham.)	ironwood leafminer	Lepidoptera	Cosmopterigidae
<i>Stomoxyx calcitrans</i> (L.)	stable fly	Diptera	Muscidae
<i>Strauzia longipennis</i> (Wied.)	sunflower maggot	Diptera	Tephritidae
<i>Strobilomyia appalachensis</i> Michelsen	black spruce cone maggot	Diptera	Anthomyiidae
<i>Strobilomyia laricis</i> Michelsen	larch cone maggot	Diptera	Anthomyiidae

<i>Strobilomyia neanthracina</i> Michelsen	white spruce cone maggot	Diptera	Anthomyiidae
<i>Strobilomyia varia</i> (Huckett)	tamarack cone maggot	Diptera	Anthomyiidae
<i>Strymon melinus</i> Hbn.	gray hairstreak	Lepidoptera	Lycaenidae
<i>Supella longipalpa</i> (F.)	brownbanded cockroach	Blattodea	Blattellidae
<i>Symmerista albifrons</i> (J.E.Smith)	orangehumped oakworm	Lepidoptera	Notodontidae
<i>Symmerista canicosta</i> Franc.	redhumped oakworm	Lepidoptera	Notodontidae
<i>Symmerista leucitys</i> Franc.	orangehumped mapleworm	Lepidoptera	Notodontidae
<i>Symydobius americanus</i> Baker	dark birch aphid	Homoptera	Aphididae
<i>Synanthedon acerni</i> (Clem.)	maple callus borer	Lepidoptera	Sesiidae
<i>Synanthedon albicornis</i> (Hy. Edw.)	willow stem borer	Lepidoptera	Sesiidae
<i>Synanthedon bibionipennis</i> (Bdv.)	strawberry crown moth	Lepidoptera	Sesiidae
<i>Synanthedon decipiens</i> (Hy. Edw.)	oak gall borer	Lepidoptera	Sesiidae
<i>Synanthedon exitiosa</i> (Say)	peachtree borer	Lepidoptera	Sesiidae
<i>Synanthedon pictipes</i> (G. & R.)	lesser peachtree borer	Lepidoptera	Sesiidae
<i>Synanthedon pini</i> (Kell.)	pitch mass borer	Lepidoptera	Sesiidae
<i>Synanthedon pyri</i> (Harr.)	apple bark borer	Lepidoptera	Sesiidae
<i>Synanthedon scitula</i> (Harr.)	dogwood borer	Lepidoptera	Sesiidae
<i>Synanthedon sequoiae</i> (Hy. Edw.)	sequoia pitch moth	Lepidoptera	Sesiidae
<i>Synanthedon tipuliformis</i> (Cl.)	currant borer	Lepidoptera	Sesiidae
<i>Syneta ferruginea</i> (Germ.)	rusty leaf beetle	Coleoptera	Chrysomelidae
<i>Sygrapha alias</i> (Ottol.)	spruce climbing cutworm	Lepidoptera	Noctuidae
<i>Sygrapha rectangula</i> (Kby.)	angulated cutworm	Lepidoptera	Noctuidae

<i>Syngrapha selecta</i> (Wlk.)	spruce false looper	Lepidoptera	Noctuidae
<i>Systema blanda</i> (Melsh.)	palestriped flea beetle	Coleoptera	Chrysomelidae
<i>Systema frontalis</i> (F.)	redheaded flea beetle	Coleoptera	Chrysomelidae
<i>Tabanus lineola</i> F.	striped horse fly	Diptera	Tabanidae
<i>Tachycines asynamorus</i> Adel.	greenhouse stone cricket	Grylloptera	Gryllacrididae
<i>Taeniothrips inconsequens</i> (Uzel)	pear thrips	Thysanoptera	Thripidae
<i>Tapinoma sessile</i> (Say)	odorous house ant	Hymenoptera	Formicidae
<i>Tarsonemus granarius</i> Lindquist	glossy grain mite	Acari	Tarsonemidae
<i>Telamona tremulata</i> Ball	aspen treehopper	Homoptera	Membracidae
<i>Tenebrio molitor</i> L.	yellow mealworm	Coleoptera	Tenebrionidae
<i>Tenebrio obscurus</i> F.	dark mealworm	Coleoptera	Tenebrionidae
<i>Tenebroides mauritanicus</i> (L.)	cadelle	Coleoptera	Trogositidae
<i>Tenodera aridifolia sinensis</i> Sauss.	Chinese mantid	Mantodea	Mantidae
<i>Tetanops myopaeformis</i> (Roder)	sugarbeet root maggot	Diptera	Otitidae
<i>Tethida cordigera</i> (Beauv.)	blackheaded ash sawfly	Hymenoptera	Tenthredinidae
<i>Tetramesa hordei</i> (Harr.)	barley jointworm	Hymenoptera	Eurytomidae
<i>Tetramesa secale</i> (Fitch)	rye jointworm	Hymenoptera	Eurytomidae
<i>Tetramesa tritici</i> (Fitch)	wheat jointworm	Hymenoptera	Eurytomidae
<i>Tetranychus canadensis</i> (McG.)	fourspotted spider mite	Acari	Tetranychidae
<i>Tetranychus mcdanieli</i> McG.	McDaniel spider mite	Acari	Tetranychidae
<i>Tetranychus urticae</i> Koch	twospotted spider mite	Acari	Tetranychidae
<i>Tetraopes tetraphthalmus</i> (Först.)	red milkweed beetle	Coleoptera	Cerambycidae
<i>Tetropium cinnamopterum</i> Kby.	eastern larch borer	Coleoptera	Cerambycidae
<i>Tetropium parvulum</i> Casey	northern spruce borer	Coleoptera	Cerambycidae

<i>Tetropium velutinum</i> LeC.	western larch borer	Coleoptera	Cerambycidae
<i>Tetyra bipunctata</i> (H.-S.)	shieldbacked pine seed bug	Heteroptera	Pentatomidae
<i>Thecodiplosis piniresinosae</i> Kearby	red pine needle midge	Diptera	Cecidomyiidae
<i>Therioaphis riehmi</i> (Börner)	sweetclover aphid	Homoptera	Aphididae
<i>Thermobia domestica</i> (Pack.)	firebrat	Thysanura	Lepismatidae
<i>Thorybes pylades</i> (Scudd.)	northern cloudy wing	Lepidoptera	Hesperiidae
<i>Thrips nigropilosus</i> Uzel	chrysanthemum thrips	Thysanoptera	Thripidae
<i>Thrips simplex</i> (Mor.)	gladiolus thrips	Thysanoptera	Thripidae
<i>Thrips tabaci</i> Lind.	onion thrips	Thysanoptera	Thripidae
<i>Thylodrias contractus</i> Mots.	odd beetle	Coleoptera	Dermestidae
<i>Thymelicus lineola</i> (Ochs.)	European skipper	Lepidoptera	Hesperiidae
<i>Thyridopteryx ephemeraeformis</i> (Haw.)	bagworm	Lepidoptera	Psychidae
<i>Tibicen pruinosa</i> (Say)	dogday cicada	Homoptera	Cicadidae
<i>Tinea pellionella</i> L.	casemaking clothes moth	Lepidoptera	Tineidae
<i>Tineola bisselliella</i> (Hum.)	webbing clothes moth	Lepidoptera	Tineidae
<i>Tipula paludosa</i> Meig.	European crane fly	Diptera	Tipulidae
<i>Tischeria malifoliella</i> Clem.	appleleaf trumpet miner	Lepidoptera	Tischeriidae
<i>Tischeria quercitella</i> Clem.	oak blotchminer	Lepidoptera	Tischeriidae
<i>Tolype laricis</i> (Fitch)	larch lappet moth	Lepidoptera	Lasiocampidae
<i>Tolype velleda</i> (Stoll)	velleda lappet moth	Lepidoptera	Lasiocampidae
<i>Tomostethus multicinctus</i> (Roh.)	brownheaded ash sawfly	Hymenoptera	Tenthredinidae
<i>Torymus varians</i> (Wlk.)	apple seed chalcid	Hymenoptera	Torymidae
<i>Toumeyella liriodendri</i> (Gmel.)	tuliptree scale	Homoptera	Coccidae

<i>Toumeyella parvicornis</i> (Ckll.)	pine tortoise scale	Homoptera	Coccidae
<i>Trachykele blondeli</i> Marseul	western cedar borer	Coleoptera	Buprestidae
<i>Tremex columba</i> (L.)	pigeon tremex	Hymenoptera	Siricidae
<i>Trialeurodes vaporariorum</i> (Westw.)	greenhouse whitefly	Homoptera	Aleyrodidae
<i>Tribolium audax</i> Halst.	American black flour beetle	Coleoptera	Tenebrionidae
<i>Tribolium castaneum</i> (Hbst.)	red flour beetle	Coleoptera	Tenebrionidae
<i>Tribolium confusum</i> Duv.	confused flour beetle	Coleoptera	Tenebrionidae
<i>Tribolium destructor</i> Uytt.	large flour beetle	Coleoptera	Tenebrionidae
<i>Tribolium madens</i> (Charp.)	European black flour beetle	Coleoptera	Tenebrionidae
<i>Trichiocampus simplicicornis</i> (Nort.)	hairy willow sawfly	Hymenoptera	Tenthredinidae
<i>Trichiocampus viminalis</i> (Fall.)	hairy poplar sawfly	Hymenoptera	Tenthredinidae
<i>Trichiosoma triangulum</i> Kby.	giant birch sawfly	Hymenoptera	Cimbicidae
<i>Trichobaris trinotata</i> (Say)	potato stalk borer	Coleoptera	Curculionidae
<i>Trichodectes canis</i> (DeG.)	dog biting louse	Mallophaga	Trichodectidae
<i>Trichogramma minutum</i> Riley	minute egg parasite	Hymenoptera	Trichogrammatid
<i>Tricholochmaea d. decora</i> (Say)	gray willow leaf beetle	Coleoptera	Chrysomelidae
<i>Tricholochmaea decora carbo</i> (LeC.)	Pacific willow leaf beetle	Coleoptera	Chrysomelidae
<i>Tricholochmaea vaccinii</i> (Fall)	blueberry leaf beetle	Coleoptera	Chrysomelidae
<i>Trichophaga tapetzella</i> (L.)	carpet moth	Lepidoptera	Tineidae
<i>Trichoplusia ni</i> (Hbn.)	cabbage looper	Lepidoptera	Noctuidae
<i>Trichordestra legitima</i> (Grt.)	striped garden caterpillar	Lepidoptera	Noctuidae
<i>Trigonogenius globulus</i> Sol.	globular spider beetle	Coleoptera	Ptinidae

<i>Trisetacus ehmanni</i> Keif.	pine needle mite	Acari	Phytoptidae
<i>Trisetacus grosmanni</i> Keif.	spruce bud mite	Acari	Phytoptidae
<i>Trisetacus grosmanni</i> Keif.	fir bud mite	Acari	Phytoptidae
<i>Trogium pulsatorium</i> (L.)	larger pale booklouse	Psocoptera	Trogiidae
<i>Trogium pulsatorium</i> (L.)	deathwatch	Psocoptera	Trogiidae
<i>Trogoderma granarium</i> Everts	khapra beetle	Coleoptera	Dermestidae
<i>Trogoderma inclusum</i> LeC.	larger cabinet beetle	Coleoptera	Dermestidae
<i>Trogoderma variabile</i> Ballion	warehouse beetle	Coleoptera	Dermestidae
<i>Tropidosteptes amoenus</i> Reut.	ash plant bug	Heteroptera	Miridae
<i>Trypodendron betulae</i> Swaine	birch ambrosia beetle	Coleoptera	Scolytidae
<i>Trypodendron lineatum</i> (Oliv.)	striped ambrosia beetle	Coleoptera	Scolytidae
<i>Trypodendron retusum</i> (LeC.)	poplar ambrosia beetle	Coleoptera	Scolytidae
<i>Tuberolachnus salignus</i> (Gmel.)	giant willow aphid	Homoptera	Aphididae
<i>Tychius picirostris</i> (F.)	clover seed weevil	Coleoptera	Curculionidae
<i>Tychius stephensi</i> Schonh.	red clover seed weevil	Coleoptera	Curculionidae
<i>Typhaea stercorea</i> (L.)	hairy fungus beetle	Coleoptera	Mycetophagidae
<i>Typhlocyba froggatti</i> Baker	yellow apple leafhopper	Homoptera	Cicadellidae
<i>Typhlocyba pomaria</i> McA.	white apple leafhopper	Homoptera	Cicadellidae
<i>Tyria jacobaeae</i> (L.)	cinnabar moth	Lepidoptera	Arctiidae
<i>Tyrolichus casei</i> Oud.	cheese mite	Acari	Acaridae
<i>Tyrophagus putrescentiae</i> (Schr.)	mold mite	Acari	Acaridae
<i>Udea rubigalis</i> (Gn.)	celery leaffier	Lepidoptera	Pyralidae
<i>Udea rubigalis</i> (Gn.)	greenhouse leaffier	Lepidoptera	Pyralidae

<i>Unaspis euonymi</i> (Comst.)	euonymus scale	Homoptera	Diaspididae
<i>Upis ceramboides</i> (L.)	roughened darkling beetle	Coleoptera	Tenebrionidae
<i>Urocerus albicornis</i> (F.)	black horntail	Hymenoptera	Siricidae
<i>Urocerus cressoni</i> Nort.	black and red horntail	Hymenoptera	Siricidae
<i>Urocerus gigas flavicornis</i> (F.)	banded horntail	Hymenoptera	Siricidae
<i>Utetheisa bella</i> (L.)	bella moth	Lepidoptera	Arctiidae
<i>Vanessa atalanta</i> (L.)	red admiral	Lepidoptera	Nymphalidae
<i>Vanessa cardui</i> (L.)	painted lady	Lepidoptera	Nymphalidae
<i>Vanessa virginensis</i> (Drury)	American painted lady	Lepidoptera	Nymphalidae
<i>Vasates quadripedes</i> Shimer	maple bladdergall mite	Acari	Eriophyidae
<i>Vespa crabro germana</i> Christ	European hornet	Hymenoptera	Vespidae
<i>Vespa crabro germana</i> Christ	giant hornet	Hymenoptera	Vespidae
<i>Vespula germanica</i> (F.)	German yellowjacket	Hymenoptera	Vespidae
<i>Vespula maculifrons</i> (Buys.)	eastern yellowjacket	Hymenoptera	Vespidae
<i>Vespula pensylvanica</i> (Sauss.)	western yellowjacket	Hymenoptera	Vespidae
<i>Wohlfahrtia vigil</i> (Wlk.)	myiasis fly	Diptera	Sarcophagidae
<i>Wyeomyia smithii</i> (Coq.)	pitcherplant mosquito	Diptera	Culicidae
<i>Xanthia togata</i> (Esp.)	pinkbarred sallow	Lepidoptera	Noctuidae
<i>Xanthogaleruca luteola</i> (Müll.)	elm leaf beetle	Coleoptera	Chrysomelidae
<i>Xanthonia decemnotata</i> (Say)	tenspotted leaf beetle	Coleoptera	Chrysomelidae
<i>Xanthoteras quercusforticorne</i> (Walsh)	oak figgall wasp	Hymenoptera	Cynipidae
<i>Xanthotype sospeta</i> (Drury)	crocus geometer	Lepidoptera	Geometridae
<i>Xenopsylla cheopis</i> (Roths.)	oriental rat flea	Siphonaptera	Pulicidae
<i>Xestia perquiritata</i> (Morr.)	gray spruce cutworm	Lepidoptera	Noctuidae

<i>Xestia spp.</i>	spotted cutworm	Lepidoptera	Noctuidae
<i>Xestobium rufovillosum (DeG.)</i>	deathwatch beetle*	Coleoptera	Anobiidae
<i>Xestobium rufovillosum (DeG.)</i>	knock beetle*	Coleoptera	Anobiidae
<i>Xyela minor Nort.</i>	pine flower sawfly	Hymenoptera	Xyelidae
<i>Xylotrechus aceris Fisher</i>	gallmaking maple borer	Coleoptera	Cerambycidae
<i>Xylotrechus colonus (F.)</i>	rustic borer	Coleoptera	Cerambycidae
<i>Xylotrechus obliteratus LeC.</i>	poplar butt borer*	Coleoptera	Cerambycidae
<i>Xylotrechus undulatus (Say)</i>	spruce zebra beetle	Coleoptera	Cerambycidae
<i>Yponomeuta cognatella Hbn.</i>	euonymus webworm	Lepidoptera	Yponomeutidae
<i>Yponomeuta malinella Zell.</i>	apple ermine moth	Lepidoptera	Yponomeutidae
<i>Ypsolopha dentella (F.)</i>	European honeysuckle leafroller	Lepidoptera	Plutellidae
<i>Zale helata (Sm.)</i>	white pine false looper	Lepidoptera	Noctuidae
<i>Zale lunifera (Hbn.)</i>	pine false looper	Lepidoptera	Noctuidae
<i>Zale metatoides McD.</i>	jack pine false looper	Lepidoptera	Noctuidae
<i>Zale minerea (Gn.)</i>	large false looper	Lepidoptera	Noctuidae
<i>Zale undularis (Drury)</i>	locust false looper	Lepidoptera	Noctuidae
<i>Zaraea inflata Nort.</i>	honeysuckle sawfly	Hymenoptera	Cimbicidae
<i>Zeiraphera canadensis Mut. &amp; Free.</i>	spruce bud moth	Lepidoptera	Tortricidae
<i>Zeiraphera fortunana (Kft.)</i>	yellow spruce budworm	Lepidoptera	Tortricidae
<i>Zeiraphera improbana (Wlk.)</i>	larch needleworm	Lepidoptera	Tortricidae
<i>Zeiraphera unfortunana Powell</i>	purplestriped shootworm	Lepidoptera	Tortricidae
<i>Zelleria haimbachi Bsk.</i>	pine needle sheathminer	Lepidoptera	Yponomeutidae

<i>Zeugophora scutellaris</i> Suffr.	cottonwood leafmining beetle	Coleoptera	Chrysomelidae
<i>Zeuzera pyrina</i> (L.)	leopard moth	Lepidoptera	Cossidae
<i>Zonosemata electa</i> (Say)	pepper maggot	Diptera	Tephritidae
<i>Zootermopsis angusticollis</i> (Hagen)	Pacific dampwood termite	Isoptera	Termopsidae
<i>Zophodia grossulariella</i> (Hbn.)	gooseberry fruitworm	Lepidoptera	Pyralidae
<i>Zygogramma exclamationis</i> (F.)	sunflower beetle	Coleoptera	Chrysomelidae

[00349] For purposes of simplicity, the term “insect” shall be used through out this application; however, it should be understood that the term “insect” refers, not only to insects, but also to arachnids, larvae, and like invertebrates. Also for purposes of this application, the term “insect control” shall refer to having a repellent effect, a pesticidal effect, or both.

[00350] “Target pest” refers to the organism that is the subject of the insect control effort.

[00351] “Repellant effect” is an effect wherein more insects are repelled away from a host or area that has been treated with the composition than a control host or area that has not been treated with the composition. In some embodiments, repellant effect is an effect wherein at least about 75% of insects are repelled away from a host or area that has been treated with the composition. In some embodiments, repellant effect is an effect wherein at least about 90% of insects are repelled away from a host or area that has been treated with the composition.

[00352] “Pesticidal effect” is an effect wherein treatment with a composition causes at least about 1% of the insects to die. In this regard, an LC<sub>1</sub> to LC<sub>100</sub> (lethal concentration) or an LD<sub>1</sub> to LD<sub>100</sub> (lethal dose) of a composition will cause a pesticidal effect. In some embodiments,

the pesticidal effect is an effect wherein treatment with a composition causes at least about 5% of the exposed insects to die. In some embodiments, the pesticidal effect is an effect wherein treatment with a composition causes at least about 10% of the exposed insects to die. In some embodiments, the pesticidal effect is an effect wherein treatment with a composition causes at least about 25% of the insects to die. In some embodiments the pesticidal effect is an effect wherein treatment with a composition causes at least about 50% of the exposed insects to die. In some embodiments the pesticidal effect is an effect wherein treatment with a composition causes at least about 75% of the exposed insects to die. In some embodiments the pesticidal effect is an effect wherein treatment with a composition causes at least about 90% of the exposed insects to die.

**[00353]** “Disablement” is an effect wherein insects are mobility-impaired such that their mobility is reduced as compared to insects that have not been exposed to the composition. In some embodiments, disablement is an effect wherein at least about 75% of insects are mobility-impaired such that their mobility is reduced as compared to insects that have not been exposed to the composition. In some embodiments, disablement is an effect wherein at least about 90% of insects are mobility-impaired such that their mobility is reduced as compared to insects that have not been exposed to the composition. In some embodiments, disablement can be caused by a disabling effect at the cellular or whole-organism level.

**[00354]** Embodiments of the invention can be used to control parasites. As used herein, the term “parasite” includes parasites, such as but not limited to, protozoa, including intestinal protozoa, tissue protozoa, and blood protozoa. Examples of intestinal protozoa include, but are not limited to: *Entamoeba histolytica*, *Giardia lamblia*, *Cryptosporidium muris*, and *Cryptosporidium parvum*. Examples of tissue protozoa include, but are not limited to:

*Trypanosomatida gambiense*, *Trypanosomatida rhodesiense*, *Trypanosomatida crusi*, *Leishmania mexicana*, *Leishmania braziliensis*, *Leishmania tropica*, *Leishmania donovani*, *Toxoplasma gondii*, and *Trichomonas vaginalis*. Examples of blood protozoa include, but are not limited to *Plasmodium vivax*, *Plasmodium ovale*, *Plasmodium malariae*, and *Plasmodium falciparum*. *Histomonas meleagridis* is yet another example of a protozoan parasite.

[00355] As used herein, the term “parasite” further includes, but is not limited to: helminthes or parasitic worms, including nematodes (round worms) and platyhelminthes (flat worms). Examples of nematodes include, but are not limited to: animal and plant nematodes of the adenophorea class, such as the intestinal nematode *Trichuris trichiura* (whipworm) and the plant nematode *Trichodorus obtusus* (stubby-root nematode); intestinal nematodes of the secementea class, such as *Ascaris lumbricoides*, *Enterobius vermicularis* (pinworm), *Ancylostoma duodenale* (hookworm), *Necator americanus* (hookworm), and *Strongyloides stercoralis*; and tissue nematodes of the secementea class, such as *Wuchereria bancrofti* (Filaria bancrofti) and *Dracunculus medinensis* (Guinea worm). Examples of plathyhelminthes include, but are not limited to: Trematodes (flukes), including blood flukes, such as *Schistosoma mansoni* (intestinal Schistosomiasis), *Schistosoma haematobium*, and *Schistosoma japonicum*; liver flukes, such as *Fasciola hepatica*, and *Fasciola gigantica*; intestinal flukes, such as *Heterophyes heterophyes*; and lung flukes such as *Paragonimus westermani*. Examples of platheminthes further include, but are not limited to: Cestodes (tapeworms), including *Taenia solium*, *Taenia saginata*, *Hymenolepis nana*, and *Echinococcus granulosus*.

[00356] Furthermore, the term “parasite” further includes, but is not limited to those organisms and classes of organisms listed in the following table:

**TABLE 6: PARASITES SUBJECT TO CONTROL BY EMBODIMENTS OF THE INVENTION**

**Protozoa** (sub-groups: rhizopods, flagellates, ciliate, sporozoans)

Parasite (Genus)	(Species)	Context
<i>Entamoeba</i>	<i>coli</i> <i>dispar</i> <i>histolytica</i> <i>gingivalis</i>	Example of gut rhizopod that can switch from commensal to parasite depending on circumstances. Several species are found in humans. <i>E. histolytica</i> is the pathogen responsible for <u>amoebiasis</u> (which includes amoebic <u>dysentery</u> and amoebic liver abscesses).
<i>Balantidium</i>	<i>coli</i>	Example of parasitic ciliate and zoonosis
<i>Giardia</i>	<i>intenstinalis</i> <i>lamblia</i>	Example of water-borne flagellate and zoonosis
<i>Trichomonas</i>	<i>vaginalis</i>	Example of gut flagellate in birds. Venereally transmitted flagellate causing abortion & infertility
<i>Histomonas</i>	<i>meleagridis</i>	Example of a parasite transmitted by another parasite – Heterakis
<i>Trypanosoma</i>	<i>avium</i> <i>brucei</i> <i>cruzi</i> <i>equiperdum</i> <i>evansi</i> <i>vivax</i>	Example of a venerally transmitted flagellate
<i>Eimeria</i>	<u><i>acerulina</i></u> <u><i>brunetti</i></u> <i>jemezi</i> <u><i>maxima</i></u> <i>nextrix</i> <i>tenella</i> <i>stiedae</i> <i>meleagridis</i>	A picomplexan parasite responsible for the poultry disease coccidiosis. Used to illustrate the basic characteristics of the coccidian direct lifecycle. Ovine, bovine & rabbit coccidiosis mentioned but not by species.
<i>Isospora</i>	<i>belli</i> <i>felis</i> <i>canis</i>	Mentioned as the dog/cat/pig equivalent of Eimeria

<i>Cyclospora</i>	<i>cayetanensis</i>	Traveler's Diarrhea.
<i>Cryptosporidium</i>	<i>parvum</i> <i>hominis</i> <i>canis</i> <i>felis</i> <i>hominis</i> <i>meleagridis</i> <i>muris</i>	Of the Phylum <u>Apicomplexa</u> and causes a <u>diarrheal</u> illness called <u>cryptosporidiosis</u> . Example of an important water borne zoonosis.
<i>Sarcocystis</i>	<i>cruzi</i> <i>hominis</i> <i>muris</i>	Used to illustrate the basic characteristics of the coccidian indirect lifecycle. Can happen when undercooked <u>meat</u> is ingested. Symptoms include <u>diarrhea</u> , which may be mild and transient or severe and life threatening.
<i>Toxoplasma</i>	<i>gondii</i>	The definitive <u>host</u> is the <u>cat</u> , but the parasite can be carried by the vast majority of warm-blooded animals, including <u>humans</u> . The causative agent of <u>toxoplasmosis</u> .
<i>Neospora</i>	<i>caninum</i>	Important pathogen in cattle and dogs. Highly transmissible with some herds having up to 90% prevalence. Causes abortions.
<i>Babesia</i>	<i>major</i> <i>microti</i> <i>divergens</i> <i>duncani</i> <i>gibsoni</i>	Example of tick-borne protozoa, responsible for causing Texas Fever.
<i>Plasmodium</i>	<i>falciparum</i> <i>vivax</i> <i>ovale</i> <i>malariae</i> <i>knowlesi</i> <i>gigliolii</i>	Example of an endemic insect borne protozoan. Causative agent of malaria.
<i>Leishmania</i>	<i>aethiopica</i> <i>donovani</i> <i>major</i> <i>mexicana</i> <i>tropica</i> <i>braziliensis</i>	Example of insect borne protozoan that lives inside host macrophages

### Trematodes

Parasite (Genus)	(Species)	Context
<i>Fasciola</i>	<i>hepatica</i> <i>magna</i> <i>gigantica</i> <i>jacksoni</i>	Also known as the <b>common liver fluke</b> it is a <u>parasitic</u> flatworm of <u>phylum Platyhelminthes</u> that infects liver of a various <u>mammals</u> , including man. The disease caused by the fluke is called <u>fascioliasis</u> (also known as fasciolosis). <i>F. hepatica</i> is world-wide distributed and causes great economic losses in sheep and cattle.
<i>Dicrocoelium</i>	<i>dendriticum</i>	The <b>Lancet liver fluke</b> is a <u>parasite fluke</u> that tends to live in <u>cattle</u> or other grazing mammals.
<i>Schistosoma</i>	<i>mansonii</i> <i>japonicum</i> <i>mekongi</i> <i>intercalatum</i> <i>haematobium</i>	Commonly known as <b>blood-flukes</b> and <b>bilharzia</b> , cause the most significant infection of humans by <u>flatworms</u> . Considered by the <u>World Health Organization</u> as second in importance only to <u>malaria</u> .

### Cestodes

Parasite (Genus)	(Species)	Context
<i>Taenia</i>	<i>crassiceps</i> <i>pisiformis</i> <i>saginata</i> <i>solium</i>	Example of tapeworms with humans as natural definite hosts but with implications for zoonoses and meat inspection
<i>Dipylidium</i>	<i>caninum</i>	Also called the <b>cucumber tapeworm</b> or the <b>double-pore</b> tapeworm, it infects organisms afflicted with <u>fleas</u> , including <u>canids</u> , <u>felids</u> , and pet-owners, especially children.
<i>Echinococcus</i>	<i>granulosus</i> <i>multilocularis</i> <i>shiquicus</i>	Includes six species of <u>cyclophyllid</u> tapeworms. Infection with <i>Echinococcus</i> results in <u>hydatid disease</u> , also known as <i>echinococcosis</i> .

Nematodes		
Parasite (Genus)	(Species)	Context
<i>Aphelenchoides</i>	<i>fragariae</i> <i>ritzemabosi</i> <i>besseyi</i> .	Foliar nematodes are plant parasitic roundworms which are a widespread problem for the ornamental and nursery industries.
<i>Heterodera</i>		Soybean cyst nematode.
<i>Globodera</i>	<i>solanacearum</i> <i>virginiae</i> <i>tabacum</i>	<b>Potato cyst nematode.</b>
<i>Nacobbus</i>	<i>dorsalis</i>	<b>False Root-knot.</b>
<i>Pratylenchus</i>	<i>brachurus</i> <i>penetrans</i>	<b>Brown root rot.</b>
<i>Ditylenchus</i>	<i>dipsaci</i>	Plant pathogenic nematode which infects the bud and stem.
<i>Xiphinema</i>	<i>americanum</i>	<b>American dagger nematode;</b> plant pathogen.
<i>Longidorus</i>	<i>sylphus</i>	Attacks mint.
<i>Paratrichodorus</i>	<i>minor</i>	<b>Christie's stubby root nematode.</b>
<i>Dioctophyma</i>	<i>renale</i>	<b>Giant kidney worm;</b> common parasitic worm found in carnivorous animals.
<i>Meloidogyne</i>	<i>hapla</i> <i>incognita</i> <i>javanica</i>	<b>Root-knot</b> nematodes infect plant roots and are one of the three most economically damaging genera of nematodes on horticultural and field crops.
<i>Trichostrongylus</i>	<i>tenius</i>	Used as a basic nematode lifecycle
<i>Ostertagia</i> or <i>Teladorsagia</i>		Highlights impact of larval development in abomasum wall, differences between type I & II, example of seasonally-induced hypobiosis
<i>Nematodirus</i>		Example of nematode developing in the gut lumen, example of nematode with critical hatching

		conditions
<i>Haemonchus</i>		Example of blood-feeding nematode
<i>Cooperia</i>		Distinctive coiled nematode of ruminants
<i>Trichuris</i>		Distinctive whip-like nematode of ruminants
<i>Ascaris</i>		Example of hepato-trachael migratory nematode
<i>Parascaris</i>		Important equine nematode
<i>Oxyuris</i>		Distinctive pin-worm of equines
<i>Toxascaris</i>		Example of non-migratory ascarid of dogs & cats referred forward to the migratory <i>Toxocara</i> sp
<i>Toxocara</i>		Example of complex migratory nematode with hypobiotic larval stages, complex biochemical interactions between host & parasite, congenital infections, vertical transmission, zoonosis, reproductive-related hypobiosis, Comparison with <i>T.catti</i> , refs back to non-migratory <i>Toxascaris</i>
<i>Trichinella</i>		Example of hypobiotic larvae, no external stages, zoonosis
<i>Oesophagostomum</i>		Example of strongyle of ruminants with extensive cuticular ornamentation and nodule formation on gut wall
<i>Chabertia</i>		Example of strongyle of ruminants with large buccal capsule as adaptation to tissue feeding
<i>Cyathostomes</i> or <i>Trichonemes</i>		Horse colic.
<i>Strongylus</i>	<i>vulgaris</i>	<b>Blood worm</b> ; common horse parasite.
<i>Bunostomum</i>		Example of hookworm of ruminants
<i>Uncinaria</i>		Example of canine/feline "northern" hookworm
<i>Ancylostoma</i>		Example of potential emerging hookworm related to climate change/behaviour
<i>Dictyocaulus</i>		Basic lungworm direct lifecycle, vaccination using

		irradiated larvae
<i>Metastrengylus</i>		Lungworm with indirect lifecycle, used to reinforce concepts of transport, paratenic & intermediate host using earthworm as example
<i>Parafilaria</i>		Example of filarial worm, example of insect-borne parasite that does not involve a blood-feeding vector
<i>Dirofilaria</i>		Example of filarial worm transmitted by blood-feeding vector, distribution limited by that of vector, potential impact of climate change on distribution

### Fungi

Parasite (Genus)	(Species)	Context
<i>Cercospora</i>	<i>zeae-maydis</i>	Etiological agent of <b>grey leaf spot</b> in cereal plants.
<i>Ustilago</i>	<i>maydis</i>	Etiological agent of <b>corn smut</b> disease of maize.
<i>Magnaporthe</i>	<i>grisea</i>	Most significant disease affecting rice cultivation; <b>rice blast</b> .
<i>Bipolaris</i>	<i>oryzae</i>	<b>Brown spot</b> can infect both seedlings and mature plants.

### Acarina - Mites and Ticks

Parasite	Context
Psoroptic mites - <i>Psoroptes ovis</i> , <i>Chorioptes</i>	Sheep scab aetiology and control. Topology of infestation in relation to skin histology.
Sarcoptic mites - <i>Sarcoptes</i> , <i>Knemidocoptes</i>	Causation of mange, hypersensitivity and pruritus. Topology of infestation in relation to skin histology.

Demodectic mites - <i>Demodex</i> , <i>Trombicula</i> , <i>Cheyletiella</i>	Causation of demodicosis. Topology of infestation in relation to histology of skin. Aesthetic and zoonotic problems with <i>Cheyletiella</i> .
Dermanyssid mites - <i>Dermanyssus</i> , <i>Ornithonyssus</i>	Nature of infestation as micro-predator. Importance to poultry industry. Control by hygiene and pesticides.
<i>Ixodes ricinus</i>	Vector of agents of babesiosis, tick borne fever, louping ill and Lyme disease.

Lice and Fleas	
Parasite (Genus)	Context
<i>Linognathus</i> and <i>Haematopinus</i> sp.	Example of sessile ectoparasites with incomplete metamorphosis causing stress and hide damage. Example of blood feeding anopluran lice.
<i>Trichodectes</i> and <i>Felicola</i>	Lice problems in small companion animals caused by chewing lice. Role as intermediate host of <i>Dipylidium</i> tapeworm.
<i>Lipeurus</i> , <i>Cuclotogaster</i> , <i>Menopon</i>	Two families of chewing lice on birds. All bird lice are chewing lice causing irritation and production losses.
<i>Ctenocephalides felis</i> and <i>C.canis</i>	Cat/Dog flea; one of the most abundant and widespread fleas in the world.
<i>Ceratophyllus</i> and <i>Echidnophaga</i>	Parasitizes mainly rodents and birds.

Flies	
Parasite	Context
Muscid flies	Importance of flies with sponging mouthparts a nuisance leading to production losses in dairy cattle and as mechanical vectors of pathogens such as <i>Moraxella</i> bacteria.

<i>Haematobia</i> and <i>Stomoxys</i>	<b>Horn fly;</b> <i>H. irritans</i> is a bloodsucking fly dangerous to livestock.
Tabanid flies	Examples of biting stress caused by flies with complex slashing and sponging blood feeding mouthparts. Example of life cycle of flies with complete metamorphosis.
<i>Melophagus ovinus</i>	<b>Louse flies or keds;</b> obligate parasite of mammals and birds - can serve as the vector of pigeon malaria.
Culicoides midges	Example of how flies act as vectors.
Mosquitoes	Vectors of viral, protozoal and nematode pathogens.
Phlebotomus sand flies	Vector of Leishmania protozoa.
Lucilia cuprina blowfly	Example of facultative myiasis - blowfly strike.
Hypoderma bovis	Example of obligate myiasis - warble fly. Example of low reproduction / high survival system.
Gasterophilus and Oestrus bots	Illustration of these forms of myiasis.

[00357] Embodiments of the invention can be used to prevent or treat the following parasite hosts:

<b>TABLE 7: PARASITE HOSTS</b>	
<b>Fungal Diseases afflicting Canola (<i>Brassica rapa</i>)</b>	
Alternaria black spot = Dark pod spot (UK)	<i>Alternaria brassicae</i> , <i>Alternaria brassicicola</i> <i>Alternaria japonica</i> = <i>Alternaria raphani</i>
Anthracnose	<i>Colletotrichum gloeosporioides</i> , <i>Glomerella cingulata</i> [teleomorph]

	<i>Colletotrichum higginsianum</i>
Black leg = stem canker (UK)	<i>Leptosphaeria maculans</i> <i>Phoma lingam</i> [anamorph]
Black mold rot	<i>Rhizopus stolonifer</i>
Black root	<i>Aphanomyces raphani</i>
Brown girdling root rot	<i>Rhizoctonia solani</i> <i>Thanatephorus cucumeris</i> [teleomorph]
Cercospora leaf spot	<i>Cercospora brassicicola</i>
Clubroot	<i>Plasmodiophora brassicae</i>
Downy mildew	<i>Peronospora parasitica</i>
Fusarium wilt	<i>Fusarium oxysporum</i> f.sp. <i>conglutinans</i>
Gray mold	<i>Botrytis cinerea</i> <i>Botryotinia fuckeliana</i> [teleomorph]
Head rot	<i>Rhizoctonia solani</i> <i>Thanatephorus cucumeris</i> [teleomorph]
Leaf spot	<i>Alternaria alternata</i> <i>Ascochyta</i> spp.
Light leaf spot	<i>Pyrenopeziza brassicae</i> <i>Cylindrosporium concentricum</i> [anamorph]
Pod rot	<i>Alternaria alternata</i> <i>Cladosporium</i> spp.
Powdery mildew	<i>Erysiphe polygoni</i> <i>Erysiphe cruciferarum</i>
Ring spot	<i>Mycosphaerella brassicicola</i> <i>Asteromella brassicae</i> [anamorph]
Root rot	<i>Alternaria alternata</i> <i>Fusarium</i> spp. <i>Macrophomina phaseolina</i> <i>Phymatotrichopsis omnivora</i> <i>Phytophthora megasperma</i> <i>Pythium debaryanum</i> <i>Pythium irregularare</i>

	<i>Rhizoctonia solani</i> <i>Thanatephorus cucumeris</i> [teleomorph] <i>Sclerotium rolfsii</i> <i>Athelia rolfsii</i> [teleomorph]
Sclerotinia stem rot	<i>Sclerotinia sclerotiorum</i>
Seed rot, damping-off	<i>Alternaria</i> spp. <i>Fusarium</i> spp. <i>Gliocladium roseum</i> <i>Nectria ochroleuca</i> [teleomorph] <i>Pythium</i> spp. <i>Rhizoctonia solani</i> <i>Thanatephorus cucumeris</i> [teleomorph] <i>Rhizopus stolonifer</i> <i>Sclerotium rolfsii</i>
Root gall smut	<i>Urocystis brassicae</i>
Southern blight (leaf, root and seed rot)	<i>Sclerotium rolfsii</i>
Verticillium wilt	<i>Verticillium longisporum</i>
White blight	<i>Rhizoctonia solani</i> <i>Thanatephorus cucumeris</i> [teleomorph]
White leaf spot = grey stem (Canada)	<i>Pseudocercosporella capsellae</i> = <i>Cercosporella brassicae</i> <i>Mycosphaerella capsellae</i> [teleomorph]
White rust = staghead	<i>Albugo candida</i> = <i>Albugo cruciferarum</i> ( <i>Peronospora</i> sp. commonly present in staghead phase)
Yellows	<i>Fusarium oxysporum</i>

### Cat (*Felis catus*)

#### Apicomplexa:

*Besnoitia* sp. (oocysts)

*Isospora felis*

*Isospora rivolta*

*Sarcocystis gigantea* (sporocysts)

*Sarcocystis hirsuta* (sporocysts)

*Sarcocystis medusiformis* (sporocysts)

*Sarcocystis muris* (sporocysts)

*Sarcocystis* sp. (sporocysts)  
*Toxoplasma gondii* (cysts)  
*Toxoplasma gondii* (oocysts)

Sarcomastigophora:  
*Giardia intestinalis*

**Dog (*Canis familiaris*)**

Apicomplexa:  
*Hammondia heydorni* (oocysts)  
*Isospora canis*  
*Isospora ohioensis*  
*Neospora caninum*  
*Sarcocystis arieticanis* (sporocysts)  
*Sarcocystis capracanis* (sporocysts)  
*Sarcocystis cruzi* (sporocysts)  
*Sarcocystis tenella* (sporocysts)  
*Sarcocystis* sp. (sporocysts)  
*Toxoplasma gondii* (cysts)

Sarcomastigophora:  
*Giardia intestinalis*

**Goat (*Capra hircus*)**

Apicomplexa:  
*Cryptosporidium* sp.  
*Eimeria alijevi*  
*Eimeria apsheronica*  
*Eimeria arloingi*  
*Eimeria capralis*  
*Eimeria caprina*  
*Eimeria caprovina*  
*Eimeria charlestoni*  
*Eimeria christensenii*  
*Eimeria hirci*  
*Eimeria jolchejevi*  
*Eimeria masseyensis*  
*Eimeria ninakohlyakimovae*  
*Eimeria punctata*  
*Eimeria tunisiensis*  
*Sarcocystis capracanis* (cysts)  
*Toxoplasma gondii* (cysts)

Sarcomastigophora:  
*Giardia* sp.

**Horse** (*Equus caballus*)

Apicomplexa:  
*Eimeria leuckarti*  
*Klossiella equi*  
*Sarcocystis* sp. (cysts)

**Man** (*Homo sapiens*)

Apicomplexa:  
*Cyptosporidium* sp.  
*Isospora hominis*\*  
*Plasmodium* sp.\*  
*Toxoplasma gondii* (cysts)

Sarcomastigophora:  
*Chilomastix mesnili*  
*Dientamoeba fragilis*  
*Endolimax nana*  
*Entamoeba coli*  
*Entamoeba hartmanni*  
*Entamoeba histolytica*  
*Giardia intestinalis*  
*Iodamoeba buetschlii*  
*Leishmania donovani*\*  
*Trichomonas hominis*  
*Trichomonas vaginalis*

Fungal diseases afflicting Maize ( <i>Zea mays</i> )	
Anthracnose leaf blight	<i>Colletotrichum graminicola</i> <i>Glomerella graminicola</i> <i>Glomerella tucumanensis</i> <i>Glomerella falcatum</i>
Anthracnose stalk rot	
Aspergillus ear and kernel rot	<i>Aspergillus flavus</i>
Banded leaf and sheath spot	<i>Rhizoctonia solani</i> = <i>Rhizoctonia microsclerotia</i>

	<i>Thanatephorus cucumeris</i>
Black bundle disease	<i>Acremonium strictum</i> = <i>Cephalosporium acremonium</i>
Black kernel rot	<i>Lasiodiplodia theobromae</i> = <i>Botryodiplodia theobromae</i>
Borde blanco	<i>Marasmiellus</i> sp.
Brown spot	
Black spot	<i>Physoderma maydis</i>
Stalk rot	
Cephalosporium kernel rot	<i>Acremonium strictum</i> = <i>Cephalosporium acremonium</i>
Charcoal rot	<i>Macrophomina phaseolina</i>
Corticium ear rot	<i>Thanatephorus cucumeris</i> = <i>Corticium sasakii</i>
Curvularia leaf spot	<i>Curvularia clavata</i> <i>C. eragrostidis</i> = <i>C. maculans</i> <i>Cochliobolus eragrostidis</i> <i>Curvularia inaequalis</i> <i>C. intermedia</i> <i>Cochliobolus intermedius</i> <i>Curvularia lunata</i> <i>Cochliobolus lunatus</i> <i>Curvularia pallens</i> <i>Cochliobolus pallens</i> <i>Curvularia senegalensis</i> <i>C. tuberculata</i> <i>Cochliobolus tuberculatus</i>
Didymella leaf spot	<i>Didymella exitalis</i>
Diplodia ear rot and stalk rot	<i>Diplodia frumenti</i> <i>Botryosphaeria festucae</i>
Diplodia ear rot	
Stalk rot	
Seed rot	
Seedling blight	<i>Diplodia maydis</i>
Diplodia leaf spot or leaf streak	<i>Stenocarpella macrospora</i> = <i>Diplodia macrospora</i>
<b>Downy mildews afflicting Maize (<i>Zea mays</i>)</b>	
Brown stripe downy mildew	<i>Sclerotinia rayssiae</i>

Crazy top downy mildew	<i>Sclerophthora macrospora</i> = <i>Sclerospora macrospora</i>
Green ear downy mildew Graminicola downy mildew	<i>Sclerospora graminicola</i>
Java downy mildew	<i>Perenosclerospora maydis</i> = <i>Sclerospora maydis</i>
Philippine downy mildew	<i>Perenosclerospora philippinensis</i> = <i>Sclerospora philippinensis</i>
Sorghum downy mildew	<i>Perenosclerospora sorghi</i> = <i>Sclerospora sorghi</i>
Spontaneum downy mildew	<i>Perenosclerospora spontanea</i> = <i>Sclerospora spontanea</i>
Sugarcane downy mildew	<i>Perenosclerospora sacchari</i> = <i>Sclerospora sacchari</i>
Dry ear rot Cob, kernel and stalk rot	<i>Nigrospora oryzae</i> <i>Khuskia oryzae</i>
Ear rots, minor	<i>Alternaria alternata</i> = <i>A. tenuis</i> <i>Aspergillus glaucus</i> <i>A. niger</i> <i>Aspergillus</i> spp. <i>Botrytis cinerea</i> <i>Botryotinia fuckeliana</i> <i>Cunninghamella</i> sp. <i>Curvularia pallescens</i> <i>Doratomyces stemonitis</i> = <i>Cephalotrichum stemonitis</i> <i>Fusarium culmorum</i> <i>Gonatobotrys simplex</i> <i>Pithomyces maydicus</i> <i>Rhizopus microsporus</i> <i>R. stolonifer</i> = <i>R. nigricans</i> <i>Scopulariopsis brumptii</i>
Ergot	<i>Claviceps gigantea</i>
Horse's tooth	<i>Sphacelia</i> sp.
Eyespot	<i>Aureobasidium zeae</i> = <i>Kabatiella zeae</i>
Fusarium ear and stalk rot	<i>Fusarium subglutinans</i> = <i>F. moniliforme</i>
Fusarium kernel, root and stalk rot, seed rot and seedling blight	<i>Fusarium moniliforme</i> <i>Gibberella fujikuroi</i>

Fusarium stalk rot	<i>Fusarium avenaceum</i>
Seedling root rot	<i>Gibberella avenacea</i>
Gibberella ear and stalk rot	<i>Gibberella zeae</i> <i>Fusarium graminearum</i>
Gray ear rot	<i>Botryosphaeria zeae</i> = <i>Physalospora zeae</i> <i>Macrophoma zeae</i>
Gray leaf spot	<i>Cercospora sorghi</i> = <i>C. sorghi</i>
Cercospora leaf spot	<i>C. zae-maydis</i>
Helminthosporium root rot	<i>Exserohilum pedicellatum</i> = <i>Helminthosporium pedicellatum</i> <i>Setosphaeria pedicellata</i>
Hormodendrum ear rot	<i>Cladosporium cladosporioides</i> = <i>Hormodendrum cladosporioides</i>
Cladosporium rot	<i>C. herbarum</i> <i>Mycosphaerella tassiana</i>
Hyalothyridium leaf spot	<i>Hyalothyridium maydis</i>
Late wilt	<i>Cephalosporium maydis</i>
Leaf spots, minor	<i>Alternaria alternata</i> [[[ <i>Ascochyta maydis</i> ]]] <i>A. tritici</i> <i>A. zeicola</i> <i>Bipolaris victoriae</i> = <i>Helminthosporium victoriae</i> <i>Cochliobolus victoriae</i> <i>C. sativus</i> <i>Bipolaris sorokiniana</i> = <i>H. sorokinianum</i> = <i>H. sativum</i> <i>Epicoccum nigrum</i> <i>Exserohilum prolatum</i> = <i>Drechslera proleta</i> <i>Setosphaeria prolata</i> <i>Graphium penicilliodes</i> <i>Leptosphaeria maydis</i> <i>Leptothyrium zeae</i> <i>Ophiophaerella herpotricha</i> <i>Scolecosporiella</i> sp. <i>Paraphaeosphaeria michotii</i> <i>Phoma</i> sp. <i>Septoria zeae</i>

	<i>S. zeicola</i> <i>S. zeina</i>
Northern corn leaf blight White blast Crown stalk rot Stripe	<i>Setosphaeria turcica</i> <i>Exserohilum turcicum</i> = <i>Helminthosporium turcicum</i>
Northern corn leaf spot Helminthosporium ear rot (race 1)	<i>Cochliobolus carbonum</i> <i>Bipolaris zeicola</i> = <i>Helminthosporium carbonum</i>
Penicillium ear rot Blue eye Blue mold	<i>Penicillium</i> spp. <i>P. chrysogenum</i> <i>P. expansum</i> <i>P. oxalicum</i>
Phaeocytostroma stalk rot and root rot	<i>Phaeocytostroma ambiguum</i> = <i>Phaeocytosporella zaeae</i>
Phaeosphaeria leaf spot	<i>Phaeosphaeria maydis</i> = <i>Sphaerulina maydis</i>
Physalospora ear rot Botryosphaeria ear rot	<i>Botryosphaeria festucae</i> = <i>Physalospora zeicola</i> <i>Diplodia frumenti</i>
Purple leaf sheath	Hemiparasitic bacteria and fungi
Pyrenopeziza stalk rot and root rot	<i>Phoma terrestris</i> = <i>Pyrenopeziza terrestris</i>
Pythium root rot	<i>Pythium</i> spp. <i>P. arrhenomanes</i> <i>P. graminicola</i>
Pythium stalk rot	<i>Pythium aphanidermatum</i> = <i>P. butleri</i>
Red kernel disease Ear mold, leaf and seed rot	<i>Epicoccum nigrum</i>
Rhizoctonia ear rot Sclerotial rot	<i>Rhizoctonia zaeae</i> <i>Waitea circinata</i>
Rhizoctonia root rot and stalk rot	<i>Rhizoctonia solani</i> <i>R. zaeae</i>
Root rots, minor	<i>Alternaria alternata</i> <i>Cercospora sorghi</i> <i>Dictyochaeta fertilis</i> <i>Fusarium acuminatum</i> <i>Gibberella acuminata</i>

	<i>F. equiseti</i> <i>G. intricans</i> <i>F. oxysporum</i> <i>F. pallidoroseum</i> <i>F. poae</i> <i>F. roseum</i> <i>G. cyanogena</i> <i>F. sulphureum</i> <i>Microdochium bolleyi</i> <i>Mucor</i> sp. <i>Periconia circinata</i> <i>Phytophthora cactorum</i> <i>P. drechsleri</i> <i>P. nicotianae</i> <i>Rhizopus arrhizus</i>
Rostratum leaf spot Helminthosporium leaf disease, ear and stalk rot	<i>Setosphaeria rostrata</i> = <i>Helminthosporium rostratum</i>
Rust, common corn	<i>Puccinia sorghi</i>
Rust, southern corn	<i>Puccinia polyspora</i>
Rust, tropical corn	<i>Physopella pallescens</i> <i>P. zae</i> = <i>Angiopsora zae</i>
Sclerotium ear rot Southern blight	<i>Sclerotium rolfsii</i> <i>Athelia rolfsii</i>
Seed rot-seedling blight	<i>Bipolaris sorokiniana</i> <i>B. zeicola</i> = <i>Helminthosporium carbonum</i> <i>Diplodia maydis</i> <i>Exserohilum pedicillatum</i> <i>Exserohilum turcicum</i> = <i>Helminthosporium turcicum</i> <i>Fusarium avenaceum</i> <i>F. culmorum</i> <i>F. moniliforme</i> <i>Gibberella zae</i> <i>F. graminearum</i> <i>Macrophomina phaseolina</i> <i>Penicillium</i> spp. <i>Phomopsis</i> spp. <i>Pythium</i> spp. <i>Rhizoctonia solani</i> [[ <i>Rhizoctonia zae</i> ]  <i>R. zae</i> ]

	<i>Sclerotium rolfsii</i> <i>Spicaria</i> spp.
Selenophoma leaf spot	<i>Selenophoma</i> sp.
Sheath rot	<i>Gaeumannomyces graminis</i>
Shuck rot	<i>Myrothecium gramineum</i>
Silage mold	<i>Monascus purpureus</i> <i>M. ruber</i>
Smut, common	<i>Ustilago zaeae</i> = <i>U. maydis</i>
Smut, false	<i>Ustilaginoidea virens</i>
Smut, head	<i>Sphacelotheca reiliana</i> = <i>Sporisorium holci-sorghii</i>
Southern corn leaf blight and stalk rot	<i>Cochliobolus heterostrophus</i> <i>Bipolaris maydis</i> = <i>Helminthosporium maydis</i>
Southern leaf spot	<i>Stenocarpella macrospora</i> = <i>Diplodia macrospora</i>
Stalk rots, minor	<i>Cercospora sorghi</i> <i>Fusarium episphaeria</i> <i>F. merismoides</i> <i>F. oxysporum</i> <i>F. poae</i> <i>F. roseum</i> <i>F. solani</i> <i>Nectria haematococca</i> <i>F. tricinctum</i> <i>Mariannaea elegans</i> <i>Mucor</i> spp. <i>Rhopographus zaeae</i> <i>Spicaria</i> spp.
Storage rots	<i>Aspergillus</i> spp. <i>Penicillium</i> spp. and other fungi
Tar spot	<i>Phyllachora maydis</i>
Trichoderma ear rot and root rot	<i>Trichoderma viride</i> = <i>T. lignorum</i> <i>Hypocrea</i> sp.
White ear rot, root and stalk rot	<i>Stenocarpella maydis</i> = <i>Diplodia zaeae</i>
Yellow leaf blight	<i>Ascochyta ischaemi</i> <i>Phyllosticta maydis</i>

	<i>Mycosphaerella zae-maydis</i>
Zonate leaf spot	<i>Gloeocercospora sorghi</i>

Nematodes afflicting Maize ( <i>Zea mays</i> )	
Awl	<i>Dolichodorus spp.</i> , <i>D. heterocephalus</i>
Bulb and stem	<i>Ditylenchus dipsaci</i>
Burrowing	<i>Radopholus similis</i>
Cyst	<i>Heterodera avenae</i> <i>H. zae</i> <i>Punctodera chalcoensis</i>
Dagger	<i>Xiphinema spp.</i> <i>X. americanum</i> <i>X. mediterraneum</i>
False root-knot	<i>Nacobbus dorsalis</i>
Lance, Columbia	<i>Hoplolaimus columbus</i>
Lance	<i>Hoplolaimus spp.</i> <i>H. galeatus</i>
Lesion	<i>Pratylenchus spp.</i> , <i>P. brachyurus</i> , <i>P. crenatus</i> , <i>P. hexincisus</i> , <i>P. neglectus</i> <i>P. penetrans</i> , <i>P. scribneri</i> , <i>P. thornei</i> , <i>P. zae</i>
Needle	<i>Longidorus spp.</i> <i>L. brevianulatus</i>
Ring	<i>Criconemella spp.</i> <i>C. ornata</i>
Root-knot	<i>Meloidogyne spp.</i> <i>M. chitwoodi</i> <i>M. incognita</i> <i>M. javanica</i>
Spiral	<i>Helicotylenchus spp.</i>
Sting	<i>Belonolaimus spp.</i>

	<i>B. longicaudatus</i>
Stubby-root	<i>Paratrichodorus</i> spp. <i>P. christiei</i> <i>P. minor</i> <i>Quinisulcius acutus</i> <i>Trichodorus</i> spp.
Stunt	<i>Tylenchorhynchus dubius</i>

**Mouse (*Mus musculus*)**

Apicomplexa:

*Hepatozoon musculi*  
*Sarcocystis muris* (cysts)

Sarcomastigophora:

*Giardia intestinalis*  
*Giardia muris*

**Ox**

(*Bos tarus*)

Apicomplexa:

*Cyptosporidium* sp.  
*Eimeria alabamensis*  
*Eimeria auburnensis*  
*Eimeria bovis*  
*Eimeria brasiliensis*  
*Eimeria bukidnonensis*  
*Eimeria canadensis*  
*Eimeria cylindrica*  
*Eimeria ellipsoidalis*  
*Eimeria subspherica*  
*Eimeria wyomingensis*  
*Eimeria zurnii*  
*Isospora* sp.  
*Neospora caninum*  
*Sarcocystis cruzi* (cysts)  
*Sarcocystis hirsuta* (cysts)  
*Theileria orientalis*

Sarcomastigophora:

*Tritrichomonas foetus*

Ciliophora:  
*Balantidium coli*

**Pig** (*Sus scrofa*)

Apicomplexa:  
*Cyptosporidium* sp.  
*Eimeria cerdonis*  
*Eimeria debbiecki*  
*Eimeria neodebbiecki*  
*Eimeria porci*  
*Eimeria scabra*  
*Eimeria suis*  
*Isospora suis*  
*Sarcocystis* sp. (cysts)  
*Toxoplasma gondii* (cysts)

Ciliophora:  
*Balantidium coli*

**Poultry** (*Gallus gallus*)

Endoparasites:

Protozoa:  
*Histomonas meleagridis*  
*Hexamita meleagridis*  
*Eimeria* spp.  
Helminths:  
*Ascaridia galli*  
*Ascaridia dissimilis*  
*Ascardidia columbae*  
*Capillaria contorta*  
*Capillaria obsingata*  
*Capillaria caudinflata*  
*Heterakis gallinarum*  
*Heterakis isolonche*  
*Syngamus trachea*

Ectoparasites:

Mites:  
*Cnemidocoptes mutans*

*Cnemidocoptes gallinae*

*Dermanyssus gallinae*

*Lamiosioptes cysticola*

*Ornithonyssus slyvarium*

Fleas:

*Ceratophyllus gallinae*

*Echindnophaga gallinacea*

Lice:

*Menacanthus stramineus*

### Rabbit (*Oryctolagus cuniculus*)

Apicomplexa:

*Eimeria jlavescens*

*Eimeria irresidua*

*Eimeria media*

*Eimeria petforans*

*Eimeria pyriformis*

*Eimeria stiedae*

*Hepatozoon cuniculi*

*Sarcocystis* sp. (cysts)

*Toxoplasma gondii* (cysts)

### Rice (*Oryza sativa*)

Fungal diseases afflicting Rice	
Aggregate sheath spot	<i>Ceratobasidium oryzae-sativae</i> <i>Rhizoctonia oryzae-sativae</i>
Black kernel	<i>Curvularia lunata</i> <i>Cochliobolus lunatus</i>
Blast (leaf, neck [rotten neck], nodal and collar)	<i>Pyricularia grisea</i> = <i>Pyricularia oryzae</i> <i>Magnaporthe grisea</i>
Brown spot	<i>Cochliobolus miyabeanus</i> <i>Bipolaris oryzae</i>
Crown sheath rot	<i>Gaeumannomyces graminis</i>

Downy mildew	<i>Sclerophthora macrospora</i>
Eyespot	<i>Drechslera gigantea</i>
False smut	<i>Ustilaginoidea virens</i>
Kernel smut	<i>Tilletia barclayana</i> = <i>Neovossia horrida</i>
Leaf smut	<i>Entyloma oryzae</i>
Leaf scald	<i>Microdochium oryzae</i> = <i>Rhynchosporium oryzae</i>
Narrow brown leaf spot	<i>Cercospora janseana</i> = <i>Cercospora oryzae</i> <i>Sphaerulina oryzina</i>
Pecky rice (kernel spotting)	Damage by many fungi including <i>Cochliobolus miyabeanus</i> <i>Curvularia</i> spp. <i>Fusarium</i> spp. <i>Microdochium oryzae</i> <i>Sarocladium oryzae</i> and other fungi.
Root rots	<i>Fusarium</i> spp. <i>Pythium</i> spp. <i>Pythium dissotocum</i> <i>Pythium spinosum</i>
Seedling blight	<i>Cochliobolus miyabeanus</i> <i>Curvularia</i> spp. <i>Fusarium</i> spp. <i>Rhizoctonia solani</i> <i>Sclerotium rolfsii</i> <i>Athelia rolfsii</i>
Sheath blight	<i>Thanatephorus cucumeris</i> <i>Rhizoctonia solani</i>
Sheath rot	<i>Sarocladium oryzae</i> = <i>Acrocylindrium oryzae</i>
Sheath spot	<i>Rhizoctonia oryzae</i>

Stackburn (Alternaria leaf spot)	<i>Alternaria padwickii</i>
Stem rot	<i>Magnaporthe salvinii</i> <i>Sclerotium oryzae</i>
Water-mold (seed-rot and seedling disease)	<i>Achlya conspicua</i> <i>Achlya klebsiana</i> <i>Fusarium</i> spp. <i>Pythium</i> spp. <i>Pythium dissotocum</i> <i>Pythium spinosum</i>

Nematodes, parasitic	
Crimp nematode, summer	<i>Aphelenchoides besseyi</i>
Root-knot	<i>Meloidogyne</i> spp.
Root nematode, rice	<i>Hirschmanniella oryzae</i>
Stem nematode, rice	<i>Ditylenchus angustus</i>

### Sheep (*Ovis aries*)

#### Apicomplexa:

*Cyptosporidium* sp.  
*Eimeria ahsata*  
*Eimeria crandallis*  
*Eimeria faurei*  
*Eimeria granulosa*  
*Eimeria intricata*  
*Eimeria ovinoidalis*  
*Eimeria ovis*

*Eimeria pallida*  
*Eimeria pama*  
*Eimeria punctata*  
*Eimeria weybridgeensis*  
*Sarcocystis arieticanis* (cysts)  
*Sarcocystis gigantea* (cysts)  
*Sarcocystis medusiformis* (cysts)  
*Sarcocystis tenella* (cysts)  
*Toxoplasma gondii* (cysts)

**Soybean (*Glycine max*)**

<b>Fungal diseases afflicting Soybeans</b>	
Alternaria leaf spot	<i>Alternaria</i> spp.
Anthracnose	<i>Colletotrichum truncatum</i> <i>Colletotrichum dematium</i> f. <i>truncatum</i> <i>Glomerella glycines</i> <i>Colletotrichum destructivum</i>
Black leaf blight	<i>Arkoola nigra</i>
Black root rot	<i>Thielaviopsis basicola</i> <i>Chalara elegans</i> [synanamorph]
Brown spot	<i>Septoria glycines</i> <i>Mycosphaerella usoenskajae</i>
Brown stem rot	<i>Phialophora gregata</i> = <i>Cephalosporium gregatum</i>
Charcoal rot	<i>Macrophomina phaseolina</i>
Choanephora leaf blight	<i>Choanephora infundibulifera</i> <i>Choanephora trispora</i>
Damping-off	<i>Rhizoctonia solani</i> <i>Thanatephorus cucumeris</i> <i>Pythium aphanidermatum</i> <i>Pythium debaryanum</i>

	<i>Pythium irregularare</i> <i>Pythium myriotylum</i> <i>Pythium ultimum</i>
Downy mildew	<i>Peronospora manshurica</i>
Drechslera blight	<i>Drechslera glycines</i>
Frogeye leaf spot	<i>Cercospora sojina</i>
Fusarium root rot	<i>Fusarium</i> spp.
Leptosphaerulina leaf spot	<i>Leptosphaerulina trifolii</i>
Mycoleptodiscus root rot	<i>Mycoleptodiscus terrestris</i>
Neocosmospora stem rot	<i>Neocosmospora vasinfecta</i> <i>Acremonium</i> spp.
Phomopsis seed decay	<i>Phomopsis</i> spp.
Phytophthora root and stem rot	<i>Phytophthora sojae</i>
Phyllosticta leaf spot	<i>Phyllosticta sojaecola</i>
Phymatotrichum root rot = cotton root rot	<i>Phymatotrichopsis omnivora</i> = <i>Phymatotrichum omnivorum</i>
Pod and stem blight	<i>Diaporthe phaseolorum</i> <i>Phomopsis sojae</i>
Powdery mildew	<i>Microsphaera diffusa</i>
Purple seed stain	<i>Cercospora kikuchii</i>
Pyrenopeziza leaf spot	<i>Pyrenopeziza glycines</i>
Pythium rot	<i>Pythium aphanidermatum</i> <i>Pythium debaryanum</i> <i>Pythium irregularare</i> <i>Pythium myriotylum</i> <i>Pythium ultimum</i>
Red crown rot	<i>Cylindrocladium crotalariae</i>

	<i>Calonectria crotalariae</i>
Red leaf blotch = <i>Dactulioiphora</i> leaf spot	<i>Dactuliochaeta glycines</i> = <i>Pyrenochaeta glycines</i> <i>Dactulioiphora glycines</i> [synanamorph]
Rhizoctonia aerial blight	<i>Rhizoctonia solani</i> <i>Thanatephorus cucumeris</i>
Rhizoctonia root and stem rot	<i>Rhizoctonia solani</i>
Rust	<i>Phakopsora pachyrhizi</i>
Scab	<i>Spaceloma glycines</i>
Sclerotinia stem rot	<i>Sclerotinia sclerotiorum</i>
Southern blight (damping-off and stem rot) = Sclerotium blight	<i>Sclerotium rolfsii</i> <i>Athelia rolfsii</i>
Stem canker	<i>Diaporthe phaseolorum</i> <i>Diaporthe phaseolorum</i> var. <i>caulivora</i> <i>Phomopsis phaseoli</i>
Stemphylium leaf blight	<i>Stemphylium botryosum</i> <i>Pleospora tarda</i>
Sudden death syndrome	<i>Fusarium solani</i> f.sp. <i>glycines</i>
Target spot	<i>Corynespora cassiicola</i>
Yeast spot	<i>Nematospora coryli</i>

Nematodes, parasitic	
Lance nematode	<i>Hoplolaimus columbus</i> <i>Hoplolaimus galeatus</i> <i>Hoplolaimus magnistylus</i>
Lesion nematode	<i>Pratylenchus</i> spp.
Pin nematode	<i>Paratylenchus projectus</i>

	<i>Paratylenchus tenuicaudatus</i>
Reniform nematode	<i>Rotylenchulus reniformis</i>
Ring nematode	<i>Criconemella ornata</i>
Root-knot nematode	<i>Meloidogyne arenaria</i> <i>Meloidogyne hapla</i> <i>Meloidogyne incognita</i> <i>Meloidogyne javanica</i>
Sheath nematode	<i>Hemicyclophora</i> spp.
Soybean cyst nematode	<i>Heterodera glycines</i>
Spiral nematode	<i>Helicotylenchus</i> spp.
Sting nematode	<i>Belonolainus gracilis</i> <i>Belonolainus longicaudatus</i>
Stubby root nematode	<i>Paratrichodorus minor</i>
Stunt nematode	<i>Quinisulcius acutus</i> <i>Tylenchorhynchus</i> spp.

**Tobacco (*Nicotiana tabacum*)**

Fungal diseases afflicting Tobacco	
Anthracnose	<i>Colletotrichum destructivum</i> <i>Glomerella glycines</i>
Barn spot	<i>Cercospora nicotianae</i>
Barn rot	Several fungi and bacteria
Black root rot	<i>Thielaviopsis basicola</i>
Black shank	<i>Phytophthora nicotianae</i>
Blue mold (downy)	<i>Peronospora tabacina</i>

mildew)	= <i>Peronospora hyoscyami</i> f.sp. <i>tabacina</i>
Brown spot	<i>Alternaria alternata</i>
Charcoal rot	<i>Macrophomina phaseolina</i>
Collar rot	<i>Sclerotinia sclerotiorum</i>
Damping-off, Pythium	<i>Pythium</i> spp. <i>Pythium aphanidermatum</i> <i>Pythium ultimum</i>
Frogeye leaf spot	<i>Cercospora nicotianae</i>
Fusarium wilt	<i>Fusarium oxysporum</i>
Gray mold	<i>Botrytis cinerea</i> <i>Botryotinia fuckeliana</i>
Mycosphaerella leaf spot	<i>Mycosphaerella nicotianae</i>
Olpidium seedling blight	<i>Olpidium brassicae</i>
Phyllosticta leaf spot	<i>Phyllosticta nicotiana</i>
Powdery mildew	<i>Erysiphe cichoracearum</i>
Ragged leaf spot	<i>Phoma exigua</i> var. <i>exigua</i> = <i>Ascochyta phaseolorum</i>
Scab	<i>Hymenula affinis</i> = <i>Fusarium affine</i>
Sore shin and damping-off	<i>Rhizoctonia solani</i> <i>Thanatephorus cucumeris</i>
Southern stem rot Southern blight	<i>Sclerotium rolfsii</i> <i>Athelia rolfsii</i>
Stem rot of transplants	<i>Pythium</i> spp.
Target spot	<i>Rhizoctonia solani</i>

Verticillium wilt	<i>Verticillium albo-atrum</i> <i>Verticillium dahliae</i>
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Nematodes, parasitic	
Bulb and stem (stem break)	<i>Ditylenchus dipsaci</i>
Cyst	<i>Globodera solanacearum</i> = <i>Globodera virginiae</i> <i>Globodera tabacum</i>
Dagger, American	<i>Xiphinema americanum</i>
Foliar	<i>Aphelenchoides ritzemabosi</i>
Lesion	<i>Pratylenchus brachyurus</i> <i>Pratylenchus penetrans</i> <i>Pratylenchus</i> spp.
Reniform	<i>Rotylenchulus reniformis</i>
Root-knot	<i>Meloidogyne arenaria</i> , <i>Meloidogyne hapla</i> , <i>Meloidogyne incognita</i> , <i>Meloidogyne javanica</i>
Spiral	<i>Helicotylenchus</i> spp.
Stubby-root	<i>Paratrichodorus</i> spp. <i>Trichodorus</i> spp.
Stunt	<i>Merlinius</i> spp. <i>Tylenchorhynchus</i> spp.

### Wheat (*Triticum* spp.)

#### Fungal diseases afflicting Wheat

Alternaria leaf blight	<i>Alternaria triticina</i>
Anthracnose	<i>Colletotrichum graminicola</i> <i>Glomerella graminicola</i>
Ascochyta leaf spot	<i>Ascochyta tritici</i>
Aureobasidium decay	<i>Microdochium bolleyi</i> = <i>Aureobasidium bolleyi</i>
Black head molds = sooty molds	<i>Alternaria</i> spp. <i>Cladosporium</i> spp. <i>Epicoccum</i> spp. <i>Sporobolomyces</i> spp. <i>Stemphylium</i> spp. and other genera
Cephalosporium stripe	<i>Hymenula cerealis</i> = <i>Cephalosporium gramineum</i>
Common bunt = stinking smut	<i>Tilletia tritici</i> = <i>Tilletia caries</i> <i>Tilletia laevis</i> = <i>Tilletia foetida</i>
Common root rot	<i>Cochliobolus sativus</i> <i>Bipolaris sorokiniana</i> = <i>Helminthosporium sativum</i>
Cottony snow mold	<i>Coprinus psychromorbidus</i>
Crown rot = foot rot, seedling blight, dryland root rot	<i>Fusarium</i> spp. <i>Fusarium pseudograminearum</i> <i>Gibberella zaeae</i> <i>Fusarium graminearum</i> Group II <i>Gibberella avenacea</i> <i>Fusarium avenaceum</i> <i>Fusarium culmorum</i>
Dilophospora leaf spot = twist	<i>Dilophospora alopecuri</i>
Downy mildew = crazy top	<i>Sclerotinia macrospora</i>
Dwarf bunt	<i>Tilletia controversa</i>

Ergot	<i>Claviceps purpurea</i> <i>Sphacelia segetum</i>
Eyespot = foot rot, strawbreaker	<i>Tapesia yallundae</i> <i>Ramulispora herpotrichoides</i> = <i>Pseudocercosporella herpotrichoides</i> W-pathotype <i>T. acuformis</i> <i>Ramulispora acuformis</i> = <i>Pseudocercosporella herpotrichoides</i> var. <i>acuformis</i> R-pathotype
False eyespot	<i>Gibellina cerealis</i>
Flag smut	<i>Urocystis agropyri</i>
Foot rot = dryland foot rot	<i>Fusarium</i> spp.
Halo spot	<i>Pseudoseptoria donacis</i> = <i>Selenophoma donacis</i>
Karnal bunt = partial bunt	<i>Tilletia indica</i> = <i>Neovossia indica</i>
Leaf rust = brown rust	<i>Puccinia triticina</i> = <i>Puccinia recondita</i> f.sp. <i>tritici</i> <i>Puccinia tritici-duri</i>
Leptosphaeria leaf spot	<i>Phaeosphaeria herpotrichoides</i> = <i>Leptosphaeria herpotrichoides</i> <i>Stagonospora</i> sp.
Loose smut	<i>Ustilago tritici</i> = <i>Ustilago segetum</i> var. <i>tritici</i> <i>Ustilago segetum</i> var. <i>nuda</i> <i>Ustilago segetum</i> var. <i>avenae</i>
Microscopica leaf spot	<i>Phaeosphaeria microscopica</i> = <i>Leptosphaeria microscopica</i>
Phoma spot	<i>Phoma</i> spp. <i>Phoma glomerata</i> <i>Phoma sorghina</i> = <i>Phoma insidiosa</i>

Pink snow mold = Fusarium patch	<i>Microdochium nivale</i> = <i>Fusarium nivale</i> <i>Monographella nivalis</i>
Platyspora leaf spot	<i>Clathrospora pentamera</i> = <i>Platyspora pentamera</i>
Powdery mildew	<i>Erysiphe graminis f.sp. tritici</i> <i>Blumeria graminis</i> = <i>Erysiphe graminis</i> <i>Oidium monilioides</i>
Pythium root rot	<i>Pythium aphanidermatum</i> <i>Pythium arrhenomanes</i> <i>Pythium graminicola</i> <i>Pythium myriotylum</i> <i>Pythium volutum</i>
Rhizoctonia root rot	<i>Rhizoctonia solani</i> <i>Thanatephorus cucumeris</i>
Ring spot = Wirrega blotch	<i>Pyrenophora seminiperda</i> = <i>Drechslera campanulata</i> <i>Drechslera wirreganensis</i>
Scab = head blight	<i>Fusarium</i> spp. <i>Gibberella zaeae</i> <i>Fusarium graminearum</i> Group II <i>Gibberella avenacea</i> <i>Fusarium avenaceum</i> <i>Fusarium culmorum</i> <i>Microdochium nivale</i> = <i>Fusarium nivale</i> <i>Monographella nivalis</i>
Sclerotinia snow mold = snow scald	<i>Myriosclerotinia borealis</i> = <i>Sclerotinia borealis</i>
Sclerotium wilt (see Southern blight)	<i>Sclerotium rolfsii</i> <i>Athelia rolfsii</i>
Septoria blotch	<i>Septoria tritici</i> <i>Mycosphaerella graminicola</i>

Sharp eyespot	<i>Rhizoctonia cerealis</i> <i>Ceratobasidium cereale</i>
Snow rot	<i>Pythium</i> spp. <i>Pythium aristosporum</i> <i>Pythium iwayamae</i> <i>Pythium okanoganense</i>
Southern blight = Sclerotium base rot	<i>Sclerotium rolfsii</i> <i>Athelia rolfsii</i>
Speckled snow mold = gray snow mold or Typhula blight	<i>Typhula idahoensis</i> <i>Typhula incarnata</i> <i>Typhula ishikariensis</i> <i>Typhula ishikariensis</i> var. <i>canadensis</i>
Spot blotch	<i>Cochliobolus sativus</i> <i>Bipolaris sorokiniana</i> = <i>Helminthosporium sativum</i>
Stagonospora blotch	<i>Phaeosphaeria avenaria</i> f.sp. <i>triticae</i> <i>Stagonospora avenae</i> f.sp. <i>triticae</i> = <i>Septoria avenae</i> f.sp. <i>triticea</i> <i>Phaeosphaeria nodorum</i> <i>Stagonospora nodorum</i> = <i>Septoria nodorum</i>
Stem rust = black rust	<i>Puccinia graminis</i> = <i>Puccinia graminis</i> f.sp. <i>tritici</i>
Storage molds	<i>Aspergillus</i> spp. <i>Penicillium</i> spp. and others
Stripe rust = yellow rust	<i>Puccinia striiformis</i> <i>Uredo glumarum</i>
Take-all	<i>Gaeumannomyces graminis</i> var. <i>tritici</i> <i>Gaeumannomyces graminis</i> var. <i>avenae</i>
Tan spot = yellow leaf spot, red smudge	<i>Pyrenophora tritici-repentis</i> <i>Drechslera tritici-repentis</i>
Tar spot	<i>Phyllachora graminis</i> <i>Linochora graminis</i>

Wheat Blast	<i>Magnaporthe grisea</i>
Zoosporic root rot	<i>Lagena radicicola</i> <i>Ligniera pilorum</i> <i>Olpidium brassicae</i> <i>Rhizophydium graminis</i>

[00358] Embodiments of the invention can be used to treat crops in order to limit or prevent insect infestation. The types of crops that can be treated can include, for example, any of the following, or the like:

<b><u>TABLE 8: CROPS SUITABLE FOR TREATMENT WITH COMPOSITIONS AND METHODS OF THE INVENTION</u></b>	
<b>Crop name</b>	<b>Botanical name</b>
Abaca (Manila hemp)	<i>Musa textilis</i>
Alfalfa for fodder	<i>Medicago sativa</i>
Alfalfa for seed	<i>Medicago sativa</i>
Almond	<i>Prunus dulcis</i>
Anise seeds	<i>Pimpinella anisum</i>
Apple	<i>Malus sylvestris</i>
Apricot	<i>Prunus armeniaca</i>
Areca (betel nut)	<i>Areca catechu</i>
Arracha	<i>Arracacia xanthorrhiza</i>
Arrowroot	<i>Maranta arundinacea</i>
Artichoke	<i>Cynara scolymus</i>
Asparagus	<i>Asparagus officinalis</i>
Avocado	<i>Persea americana</i>
Bajra (Pearl millet)	<i>Pennisetum americanum</i>
Bambara groundnut	<i>Vigna subterranea</i>
Banana	<i>Musa paradisiaca</i>
Barley	<i>Hordeum vulgare</i>
Beans, dry, edible, for grains	<i>Phaseolus vulgaris</i>
Beans, harvested green	<i>Phaseolus and Vigna spp.</i>
Beet, fodder (mangel)	<i>Beta vulgaris</i>
Beet, red	<i>Beta vulgaris</i>
Beet, sugar	<i>Beta vulgaris</i>
Beet, sugar for fodder	<i>Beta vulgaris</i>
Beet, sugar for seeds	<i>Beta vulgaris</i>
Bergamot	<i>Citrus bergamia</i>

Betel nut	<i>Areca catechu</i>
Black pepper	<i>Piper nigrum</i>
Black wattle	<i>Acacia mearnsii</i>
Blackberries of various species	<i>Rubus spp.</i>
Blueberry	<i>Vaccinium spp.</i>
Brazil nut	<i>Bertholletia excelsa</i>
Breadfruit	<i>Artocarpus altilis</i>
Broad bean, dry	<i>Vicia faba</i>
Broad bean, harvested green	<i>Vicia faba</i>
Broccoli	<i>Brassica oleracea var. botrytis</i>
Broom millet	<i>Sorghum bicolor</i>
Broom sorghum	<i>Sorghum bicolor</i>
Brussels sprouts	<i>Brassica oleracea var. gemmifera</i>
Buckwheat	<i>Fagopyrum esculentum</i>
Cabbage (red, white, Savoy)	<i>Brassica oleracea var. capitata</i>
Cabbage, Chinese	<i>Brassica chinensis</i>
Cabbage, for fodder	<i>Brassica spp.</i>
Cacao (cocoa)	<i>Theobroma cacao</i>
Cantaloupe	<i>Cucumis melo</i>
Caraway seeds	<i>Carum carvi</i>
Cardamom	<i>Elettaria cardamomum</i>
Cardoon	<i>Cynara cardunculus</i>
Carob	<i>Ceratonia siliqua</i>
Carrot, edible	<i>Daucus carota ssp. sativa</i>
Carrot, for fodder	<i>Daucus carota ssp. sativa</i>
Cashew nuts	<i>Anacardium occidentale</i>
Cassava (manioc)	<i>Manihot esculenta</i>
Castor bean	<i>Ricinus communis</i>
Cauliflower	<i>Brassica oleracea var. botrytis</i>
Celeriac	<i>Apium graveolens var. rapaceum</i>
Celery	<i>Apium graveolens</i>
Chayote	<i>Sechium edule</i>
Cherry (all varieties)	<i>Prunus spp.</i>
Chestnut	<i>Castanea sativa</i>
Chickpea (gram pea)	<i>Cicer arietinum</i>
Chicory	<i>Cichorium intybus</i>
Chicory for greens	<i>Cichorium intybus</i>
Chili, dry (all varieties)	<i>Capsicum spp. (annuum)</i>
Chili, fresh (all varieties)	<i>Capsicum spp. (annuum)</i>
Cinnamon	<i>Cinnamomum verum</i>
Citron	<i>Citrus medica</i>
Citronella	<i>Cymbopogon citrates/ Cymbopogon nar</i>
Clementine	<i>Citrus reticulata</i>
Clove	<i>Eugenia aromatic (Syzygium aromaticu</i>
Clover for fodder (all varieties)	<i>Trifolium spp.</i>

Clover for seed (all varieties)	<i>Trifolium</i> spp.
Cocoa (cacao)	<i>Theobroma cacao</i>
Coconut	<i>Cocos nucifera</i>
Cocoyam	<i>Colocasia esculenta</i>
Coffee	<i>Coffea</i> spp.
Cola nut (all varieties)	<i>Cola acuminata</i>
Colza (rapeseed)	<i>Brassica napus</i>
Corn (maize), for cereals	<i>Zea mays</i>
Corn (maize), for silage	<i>Zea mays</i>
Corn (sweet), for vegetable	<i>Zea mays</i>
Corn for salad	<i>Valerianella locusta</i>
Cotton (all varieties)	<i>Gossypium</i> spp.
Cottonseed (all varieties)	<i>Gossypium</i> spp.
Cowpea, for grain	<i>Vigna unguiculata</i>
Cowpea, harvested green	<i>Vigna unguiculata</i>
Cranberry	<i>Vaccinium</i> spp.
Cress	<i>Lepidium sativum</i>
Cucumber	<i>Cucumis sativus</i>
Currants (all varieties)	<i>Ribes</i> spp.
Custard apple	<i>Annona reticulata</i>
Dasheen	<i>Colocasia esculenta</i>
Dates	<i>Phoenix dactylifera</i>
Drumstick tree	<i>Moringa oleifera</i>
Durra (sorghum)	<i>Sorghum bicolour</i>
Durum wheat	<i>Triticum durum</i>
Earth pea	<i>Vigna subterranea</i>
Edo (eddoe)	<i>Xanthosoma</i> spp.; <i>Colocasia</i> spp.
Eggplant	<i>Solanum melongena</i>
Endive	<i>Cichorium endivia</i>
Fennel	<i>Foeniculum vulgare</i>
Fenugreek	<i>Trigonella foenum-graecum</i>
Fig	<i>Ficus carica</i>
Filbert (Hazelnut)	<i>Corylus avellana</i>
Fique	<i>Furcraea macrophylla</i>
Flax for fibre	<i>Linum usitatissimum</i>
Flax for oil seed (linseed)	<i>Linum usitatissimum</i>
Formio (New Zealand flax)	<i>Phormium tenax</i>
Garlic, dry	<i>Alium sativum</i>
Garlic, green	<i>Alium sativum</i>
Geranium	<i>Pelargonium</i> spp.; <i>Geranium</i> spp.
Ginger	<i>Zingiber officinale</i>
Gooseberry (all varieties)	<i>Ribes</i> spp.
Gourd	<i>Lagenaria</i> spp.; <i>Cucurbita</i> spp.
Gram pea (chickpea)	<i>Cicer arietinum</i>
Grape	<i>Vitis vinifera</i>

Grapefruit	<i>Citrus paradisi</i>
Grapes for raisins	<i>Vitis vinifera</i>
Grapes for table use	<i>Vitis vinifera</i>
Grapes for wine	<i>Vitis vinifera</i>
Grass esparto	<i>Lygeum spartum</i>
Grass, orchard	<i>Dactylis glomerata</i>
Grass, Sudan	<i>Sorghum bicolor</i> var. <i>sudanense</i>
Groundnut (peanut)	<i>Arachis hypogaea</i>
Guava	<i>Psidium guajava</i>
Guinea corn (sorghum)	<i>Sorghum bicolor</i>
Hazelnut (filbert)	<i>Corylus avellana</i>
Hemp fibre	<i>Cannabis sativa</i> ssp. <i>indica</i>
Hemp, Manila (abaca)	<i>Musa textilis</i>
Hemp, sun	<i>Crotalaria juncea</i>
Hempseed	<i>Cannabis sativa</i> ( <i>marijuana</i> )
Henequen	<i>Agave fourcroydes</i>
Henna	<i>Lawsonia inermis</i>
Hop	<i>Humulus lupulus</i>
Horse bean	<i>Vicia faba</i>
Horseradish	<i>Armoracia rusticana</i>
Hybrid maize	<i>Zea mays</i>
Indigo	<i>Indigofera tinctoria</i>
Jasmine	<i>Jasminum</i> spp.
Jerusalem artichoke	<i>Helianthus tuberosus</i>
Jowar (sorghum)	<i>Sorghum bicolor</i>
Jute	<i>Corchorus</i> spp. (over 30 sp.)
Kale	<i>Brassica oleracea</i> var. <i>acephala</i>
Kapok	<i>Ceiba pentandra</i>
Kenaf	<i>Hibiscus cannabinus</i>
Kohlrabi	<i>Brassica oleracea</i> var. <i>gongylodes</i>
Lavender	<i>Lavandula</i> spp. (over 15 sp.)
Leek	<i>Alium ampeloprasum</i> ; <i>Alium porrum</i>
Lemon	<i>Citrus limon</i>
Lemon grass	<i>Cymbopogon citratus</i>
Lentil	<i>Lens culinaris</i>
Lespedeza (all varieties)	<i>Lespedeza</i> spp.
Lettuce	<i>Lactuca sativa</i> var. <i>capitata</i>
Lime, sour	<i>Citrus aurantiifolia</i>
Lime, sweet	<i>Citrus limetta</i>
Linseed (flax for oil seed)	<i>Linum usitatissimum</i>
Liquorice	<i>Glycyrrhiza glabra</i>
Litchi	<i>Litchi chinensis</i>
Loquat	<i>Eriobotrya japonica</i>
Lupine (all varieties)	<i>Lupinus</i> spp.
Macadamia (Queensland nut)	<i>Macadamia</i> spp. <i>ternifolia</i>

Mace	<i>Myristica fragrans</i>
Maguey	<i>Agave atrovirens</i>
Maize (corn)	<i>Zea mays</i>
Maize (corn) for silage	<i>Zea mays</i>
Maize (hybrid)	<i>Zea mays</i>
Maize, ordinary	<i>Zea mays</i>
Mandarin	<i>Citrus reticulata</i>
Mangel (fodder beet)	<i>Beta vulgaris</i>
Mango	<i>Mangifera indica</i>
Manioc (cassava)	<i>Manihot esculenta</i>
Maslin (mixed cereals)	<i>Mixture of Triticum spp.; Secale cereale</i>
Medlar	<i>Mespilus germanica</i>
Melon (except watermelon)	<i>Cucumis melo</i>
Millet broom	<i>Sorghum bicolor</i>
Millet, bajra	<i>Pennisetum americanum</i>
Millet, bulrush	<i>Pennisetum americanum</i>
Millet, finger	<i>Eleusine coracana</i>
Millet, foxtail	<i>Setaria italica</i>
Millet, Japanese	<i>Echinochloa esculenta</i>
Millet, pearl (bajra, bulrush)	<i>Pennisetum americanum</i>
Millet, proso	<i>Panicum miliaceum</i>
Mint (all varieties)	<i>Mentha spp.</i>
Mulberry for fruit (all varieties)	<i>Morus spp.</i>
Mulberry for silkworms	<i>Morus alba</i>
Mushrooms	<i>Agaricus spp.; Pleurotus spp.; Volvariella</i>
Mustard	<i>Brassica nigra; Sinapis alba</i>
Nectarine	<i>Prunus persica var. nectarina</i>
New Zealand flax (formio)	<i>Phormium tenax</i>
Niger seed	<i>Guizotia abyssinica</i>
Nutmeg	<i>Myristica fragrans</i>
Oats, for fodder	<i>Avena spp. (about 30 sp.)</i>
Oats, for grain	<i>Avena spp. (about 30 sp.)</i>
Oil palm	<i>Elaeis guineensis</i>
Okra	<i>Abelmoschus esculentus</i>
Olive	<i>Olea europaea</i>
Onion seed	<i>Alium cepa</i>
Onion, dry	<i>Alium cepa</i>
Onion, green	<i>Alium cepa</i>
Opium	<i>Papaver somniferum</i>
Orange	<i>Citrus sinensis</i>
Orange, bitter	<i>Citrus aurantium</i>
Ornamental plants	<i>Various</i>
Palm palmyra	<i>Borassus flabellifer</i>
Palm, kernel oil	<i>Elaeis guineensis</i>
Palm, oil	<i>Elaeis guineensis</i>

Palm, sago	<i>Metroxylon sagu</i>
Papaya (pawpaw)	<i>Carica papaya</i>
Parsnip	<i>Pastinaca sativa</i>
Pea, edible dry, for grain	<i>Pisum sativum</i>
Pea, harvested green	<i>Pisum sativum</i>
Peach	<i>Prunus persica</i>
Peanut (groundnut)	<i>Arachis hypogaea</i>
Pear	<i>Pyrus communis</i>
Pecan nut	<i>Carya illinoensis</i>
Pepper, black	<i>Piper nigrum</i>
Pepper, dry	<i>Capsicum spp. (over 30 sp.)</i>
Persimmon	<i>Diospyros kaki; Diospyros virginiana</i>
Pigeon pea	<i>Cajanus cajan</i>
Pineapple	<i>Ananas comosus</i>
Pistachio nut	<i>Pistacia vera</i>
Plantain	<i>Musa sapientum</i>
Plum	<i>Prunus domestica</i>
Pomegranate	<i>Punica granatum</i>
Pomelo	<i>Citrus grandis</i>
Poppy seed	<i>Papaver somniferum</i>
Potato	<i>Solanum tuberosum</i>
Potato, sweet	<i>Ipomoea batatas</i>
Prune	<i>Prunus domestica</i>
Pumpkin, edible	<i>Cucurbita spp. (over 25 sp.)</i>
Pumpkin, for fodder	<i>Cucurbita spp. (over 25 sp.)</i>
Pyrethrum	<i>Chrysanthemum cinerariaefolium</i>
Quebracho	<i>Aspidosperma spp. (more than 3 sp.)</i>
Queensland nut	<i>See Macadamia</i>
Quince	<i>Cydonia oblonga</i>
Quinine	<i>Cinchona spp. (more than 6 sp.)</i>
Quinoa	<i>Chenopodium quinoa</i>
Radish	<i>Raphanus sativus (inc. Cochlearia armoracia)</i>
Ramie	<i>Boehmeria nivea</i>
Rapeseed (colza)	<i>Brassica napus</i>
Raspberry (all varieties)	<i>Rubus spp. (over 360 sp.)</i>
Red beet	<i>Beta vulgaris</i>
Redtop	<i>Agrostis spp.</i>
Rhea	<i>Boehmeria nivea</i>
Rhubarb	<i>Rheum spp.</i>
Rice	<i>Oryza sativa; Oryza glaberrima</i>
Rose	<i>Rose spp.</i>
Rubber	<i>Hevea brasiliensis</i>
Rutabaga (swede)	<i>Brassica napus var. napobrassica</i>
Rye	<i>Secale cereale</i>

Ryegrass seed	<i>Lolium spp. (about 20 sp.)</i>
Safflower	<i>Carthamus tinctorius</i>
Sainfoin	<i>Onobrychis vicifolia</i>
Salsify	<i>Tragopogon porrifolius</i>
Sapodilla	<i>Achras sapota</i>
Satsuma (mandarin/tangerine)	<i>Citrus reticulata</i>
Scorzonera – black salsify	<i>Scorzonera hispanica</i>
Sesame	<i>Sesamum indicum</i>
Shea butter (nut)	<i>Vitellaria paradoxa</i>
Sisal	<i>Agave sisalana</i>
Sorghum	<i>Sorghum bicolor</i>
Sorghum, broom	<i>Sorghum bicolor</i>
Sorghum, durra	<i>Sorghum bicolor</i>
Sorghum, Guinea corn	<i>Sorghum bicolor</i>
Sorghum, jowar	<i>Sorghum bicolor</i>
Sorghum, sweet	<i>Sorghum bicolor</i>
Soybean	<i>Glycine max</i>
Soybean hay	<i>Glycine max</i>
Spelt wheat	<i>Triticum spelta</i>
Spinach	<i>Spinacia oleracea</i>
Squash	<i>Cucurbita spp. (over 25 sp.)</i>
Strawberry	<i>Fragaria spp. (over 30 sp.)</i>
Sugar beet	<i>Beta vulgaris</i>
Sugar beet for fodder	<i>Beta vulgaris</i>
Sugar beet for seed	<i>Beta vulgaris</i>
Sugarcane for fodder	<i>Saccharum officinarum</i>
Sugarcane for sugar or alcohol	<i>Saccharum officinarum</i>
Sugarcane for thatching	<i>Saccharum officinarum</i>
Sunflower for fodder	<i>Helianthus annuus</i>
Sunflower for oil seed	<i>Helianthus annuus</i>
Sunhemp	<i>Crotalaria juncea</i>
Swede	<i>Brassica napus var. napobrassica</i>
Swede for fodder	<i>Brassica napus var. napobrassica</i>
Sweet corn	<i>Zea mays</i>
Sweet lime	<i>Citrus limetta</i>
Sweet pepper	<i>Capsicum annuum</i>
Sweet potato	<i>Lopmoea batatas</i>
Sweet sorghum	<i>Sorghum bicolor</i>
Tangerine	<i>Citrus reticulata</i>
Tannia	<i>Xanthosoma sagittifolium</i>
Tapioca (cassava)	<i>Manihot esculenta</i>
Taro	<i>Colocasia esculenta</i>
Tea	<i>Camelia sinensis</i>
Tef	<i>Eragrostis abyssinica</i>
Timothy	<i>Phleum pratense</i>

Tobacco	<i>Nicotiana tabacum</i>
Tomato	<i>Lycopersicon esculentum</i>
Trefoil	<i>Lotus spp. (about 100 sp.)</i>
Triticale for fodder	<i>Hybrid of Triticum aestivum and Secale cereale</i>
Tung tree	<i>Aleurites spp.; Fordii</i>
Turnip, edible	<i>Brassica rapa</i>
Turnip, for fodder	<i>Brassica rapa</i>
Urena (Congo jute)	<i>Urena lobata</i>
Vanilla	<i>Vanilla planifolia</i>
Vetch for grain	<i>Vicia sativa</i>
Walnut	<i>Juglans spp. (over 20 sp.), ep. regia</i>
Watermelon	<i>Citrulus lanatus</i>
Wheat	<i>Triticum aestivum</i>
Yam	<i>Dioscorea spp. (over 120 sp.)</i>
Yerba mate	<i>Ilex paraguariensis</i>

[00359] In certain embodiments of the invention, an area can be treated with a composition of the present invention, for example, by using a spray formulation, such as an aerosol or a pump spray, or a burning formulation, such as a candle or a piece of incense containing the composition, or the like. In certain embodiments of the invention, an area can be treated, for example, via aerial delivery, by truck-mounted equipment, or the like. Of course, various treatment methods can be used without departing from the spirit and scope of the present invention. For example, compositions can be comprised in household products, for example, hard surface cleaners, and the like.

[00360] An exemplary dispenser of a system of the present invention can deliver an pest control composition to the atmosphere in a continuous manner over a period of time. The exemplary dispenser can include a reservoir for holding a pest control composition, and a wick for drawing the composition from the reservoir and releasing the insect control composition into the atmosphere. The reservoir can be constructed from a material that is impermeable to the pest control composition, for example, appropriate glass, ceramic, or polymeric materials can be

used. The reservoir can include an aperture, which can be sealed or unsealed, as desired. When the exemplary system of the present invention is not in use, the aperture can be sealed to prevent the release of the pest control composition into the atmosphere. It may be desirable, for example, to seal the aperture when the exemplary system is being stored or transported. When the system is in use, the aperture is unsealed, such that the wick can draw the pest control composition from the reservoir, and release the control composition through the aperture into the atmosphere.

**[00361]** In certain embodiments of the invention, the rate of release of the composition can be controlled, for example, by making adjustments to the wick of the dispenser. For example, the surface area of the wick that is exposed to the atmosphere can be altered. Generally, the greater the exposed surface area, the greater the rate of release of the pest control composition. In this regard, in certain embodiments, the dispenser can include multiple wicks and the reservoir can include multiple apertures through which the insect control composition can be released into the atmosphere. As another example, the wick can be constructed from a particular material that draws the pest control composition from the reservoir and releases it into the environment at a desired rate, such as, for example, a wick made of wood, a wick made of a synthetic fiber, or the like.

**[00362]** Another exemplary dispenser of a system of the present invention can deliver an insect control composition to a desired area. The dispenser can include a sealed pouch that can be constructed from a material that is impermeable to the insect control composition, for example, a metallic foil, a polymeric material, or the like. The pouch can define a volume for holding the insect control composition. The composition can be provided in a material disposed within the volume of the pouch, for example, a sponge, a cloth saturated with the material, or the

like. When it becomes desirable to place the exemplary system into use, the pouch can be unsealed, exposing the composition for release into the atmosphere or for application to a desired area.

**[00363]** In certain embodiments the insect control composition is provided in a saturated cloth within the pouch, which can be used to apply the control composition a desired area. For example, a desired area can be an animal, such as a human, a domestic animal, surfaces within a dwelling, an outdoor living area, or the like.

**[00364]** In certain embodiments, the dispenser can further include a hook, allowing the pouch and exposed control composition to be hung in a desired location, such as in a closet or a pantry.

**[00365]** In certain embodiments, a method of the present invention can deliver insect an control composition to a desired area. In certain embodiments, a dispenser used with the method can be constructed from a substantially planar, integral piece of material, having a first side that is coated with control composition, and a second side that is not coated with control composition. The integral piece of material can be folded and sealed such that the side coated with the control composition is contained within the volume defined by the sealed pouch. When the pouch is unsealed, the side that is coated with control composition is exposed. The substantially planar piece of material can be placed in a desired location to deliver control composition to the atmosphere, or to crawling insects that walk across the material.

**[00366]** Another exemplary dispenser of a system of the present invention can deliver an insect control composition to a desired area. The control composition can be incorporated into an appropriate material. In certain embodiments, the composition-containing material can be a material that is capable of controlling the release rate of the control composition, i.e., controlled-

release material, allowing the control composition to be released into the atmosphere at a desired rate that can be adjusted by providing controlled-release material having appropriate specifications. The controlled-release material can be constructed from an appropriate polymer. In other embodiments the composition-containing material does not allow the control composition to be released into the atmosphere, but rather retains the control composition. An optional casing that is impermeable to the insect control composition can be provided to hold the composition-containing material until the system is ready for use. When the system is ready for use, the casing can be peeled away, exposing the composition-containing material. The composition-containing material can be placed in a desired location to deliver control composition to crawling insects that walk across the material, or to deliver the control composition to the atmosphere when a controlled-release material is used, e.g., control flying insects.

**[00367]** In certain embodiments, the composition-containing material can have a substantially planar design, appropriate for positioning adjacent a mattress for controlling bed bugs, e.g., *Cimex lectularius*. A substantially planar design can also be used, for example, as or with a picnic table cloth. In certain embodiments, the composition-containing material can be used as ground cover for a garden bed or adjacent crop plants to control weeds. In certain embodiments, the composition-containing material can take the shape of a bag, and could be used for trash collection, while controlling insect commonly attracted to household garbage or other trash.

**[00368]** Another exemplary dispenser of a system of the present invention can be a substantially dry sheet containing the control composition, which control composition can be applied to a desired location upon exposing the cloth to water or an aqueous liquid, e.g.,

perspiration. In certain embodiments, the dry sheet containing the control composition can dissolve into a cream or gel when exposed to water or an aqueous liquid, which can then be applied to a desired area. For example, a desired area can be an animal, such as a human, a domestic animal, or another animal.

**[00369]** The following references are incorporated herein by this reference: United States Patent No. 6,610,254 to Furner et al., issued August 26, 2003, entitled "Dual Function Dispenser," United States Patent No. 6,360,477 to Flashinski et al., issued March 26, 2002, entitled "Insect Control Pouch," United States Patent No. 5,980,931 to Fowler et al., issued November 9, 1999, entitled "Cleansing Products Having a Substantially Dry Substrate," United States Patent No. 4,320,113 to Kydonieus, issued March 16, 1982, entitled "Process for Controlling Cockroaches and Other Crawling Insects," United States Patent No. 4,943,435 to Baker et al., issued July 24, 1990, entitled "Prolonged Activity Nicotine Patch," United States Patent Publication No. 2004/0185080 to Hojo, et al, entitled "Sustained Release Dispenser Comprising Two or More Sex Pheromone Substances and a Pest Control Method," PCT Publication No. WO/2006/061803 to Firmenich, et al, entitled "A Device for Dispensing a Volatile Liquid and Method for its Activation," and PCT Publication No. WO/2004/006968 to Firmenich, et al., entitled "A Device for Dispensing Active Volatile Liquid."

**[00370]** Treatment can include, for example, use of a oil-based formulation, a water-based formulation, a residual formulation, and the like. In some embodiments, combinations of formulations can be employed to achieve the benefits of different formulation types.

**[00371]** Embodiments of the invention can result in agricultural improvements, such as, for example, increased crop yield, reduced frequency of application of pest control product,

reduced phytotoxicity associated with the pesticide, reduced cost or increased value associated with at least one environmental factor, and the like.

**[00372]** In embodiments of the invention that can reduce the cost of, or increase the value associated with at least one environmental factor, the environmental factor can include, for example, air quality, water quality, soil quality, detectable pesticide residue, safety or comfort of workers, collateral effect on a non-target organism, and the like.

**[00373]** Embodiments of the present invention can be used to control pests by either treating a host directly, or treating an area where the host will be located. For purposes of this application, host is defined as a plant, human or other animal. The host can be treated, for example, directly by using a cream or spray formulation, that can be applied externally or topically, when appropriate in light of the specific composition being used, e.g., to the skin of a human. A composition can be applied to the host, for example, in the case of a human, using formulations of a variety of personal products or cosmetics for use on the skin or hair. For example, any of the following can be used, when appropriate in light of the specific composition being used: fragrances, colorants, pigments, dyes, colognes, skin creams, skin lotions, deodorants, talcs, bath oils, soaps, shampoos, hair conditioners and styling agents.

**[00374]** The present invention is further illustrated by the following examples.

## EXAMPLES

**[00375]** Test compositions are provided, including: a pest control chemical (selected, for example from Table 1), an insect control product (selected, for example, from Table 3), and a blend selected from Table 9 (below).

**TABLE 9: BLENDS OF COMPOUNDS**

	Compounds	CAS Registry Number	Vol/Vol	Wt/Wt
<b>Blend 1</b>	LFO (LFO), (IFF)		4.0%	4%
	D-Limonene (Millennium)	5989-27-5	83.0%	82%
	Thyme Oil White (Ungerer)	8007-46-3	3.0%	3%
	Lime Oil 410		10.0%	10%
<b>Blend 2</b>	Tetrahydrolinalool FCC	78-69-3	0.80%	0.78%
	Isopropyl Myristate	110-27-0	0.80%	0.80%
	Piperonal (aldehyde)	120-57-0	0.80%	0.80%
	Triethyl Citrate	77-93-0	0.60%	0.80%
	Linalool Coeur	78-70-6	0.56%	0.57%
	Geraniol 60	106-24-1	0.40%	0.41%
	Vanillin	121-33-5	0.04%	0.05%
	D-Limonene (Millennium)	5989-27-5	83.0%	85.5%
	Lime Oil 410 Minus		10.0%	10.0%
	Thyme Oil White (Ungerer)	8007-46-3	3.0%	3.3%
<b>Blend 3</b>	Isopropyl myristate	110-27-0	24.0%	23.5%
	Tetrahydrolinalool FCC	78-69-3	20.0%	19.0%
	Linalool Coeur	78-70-6	16.0%	15.9%
	Geraniol Fine FCC	106-24-1	10.4%	10.5%
	Piperonal (aldehyde)	120-57-0	8.0%	7.8%
	Vanillin	121-33-5	1.6%	1.8%
	BSO	8014-13-9	20.0%	21.5%
<b>Blend 4</b>	Isopropyl myristate	110-27-0	10.8%	9.6%
	Tetrahydrolinalool FCC	78-69-3	9.0%	7.8%
	Linalool Synthetic	78-70-6	7.2%	6.5%
	Geraniol Fine FCC	106-24-1	4.7%	4.3%
	Piperonal (aldehyde)	120-57-0	3.6%	3.2%
	Vanillin	121-33-5	0.7%	0.8%
	BSO	8014-13-9	27.0%	26.3%
	Methyl Salicylate 98% Nat	119-36-8	27.0%	33.0%

**TABLE 9: BLENDS OF COMPOUNDS**

	Compounds	CAS Registry Number	Vol/Vol	Wt/Wt
	D-Limonene (Millennium)	5989-27-5	10.0%	8.8%
<b>Blend 5</b>	Thyme Oil White (Ungerer)	8007-46-3	22.0%	20.6%
	Wintergreen Oil	68-917-75-9	38.0%	45.0%
	Isopropyl Myristate	110-27-0	39.0%	33.4%
	Vanillin	121-33-5	1.0%	1.1%
<b>Blend 6</b>	D-Limonene (Millennium)	5989-27-5	62.5%	56.3%
	Thyme Oil White (Ungerer)	8007-46-3	12.5%	12.4%
	Wintergreen Oil	68-917-75-9	25.0%	31.3%
<b>Blend 7</b>	LFO (IFF)		12.0%	12.94%
	D-Limonene (Millennium)	5989-27-5	9.0%	8.72%
	Thyme Oil White (Ungerer)	8007-46-3	9.0%	9.58%
	Lime Oil 410		70.0%	68.76%
<b>Blend 8</b>	Tetrahydrolinalool FCC	78-69-3	2.40%	2.29%
	Isopropyl Myristate	110-27-0	2.40%	2.35%
	Piperonal (aldehyde)	120-57-0	2.40%	2.35%
	Triethyl Citrate	77-93-0	1.80%	2.35%
	Linalool Coeur	78-70-6	1.68%	1.66%
	Geraniol 60	106-24-1	1.20%	1.21%
	Vanillin	121-33-5	0.12%	0.15%
	Lime Oil 410		70.0%	69.4%
	D-Limonene (Millennium)	5989-27-5	10.0%	9.70%
	Thyme Oil White (Ungerer)	8007-46-3	8.0%	8.54%
<b>Blend 9</b>	LFO (IFF)		80.0%	80.09%
	BSO	8014-13-9	20.0%	19.91%

**TABLE 9: BLENDS OF COMPOUNDS**

	Compounds	CAS Registry Number	Vol/Vol	Wt/Wt
<b>Blend 10</b>	LFO (IFF)		50.0%	50.13%
	BSO	8014-13-9	50.0%	49.87%
<b>Blend 11</b>	Thyme Oil White	8007-46-3	5.0%	4.60%
	Wintergreen Oil	68-917-75-9	50.0%	57.80%
	Isopropyl Myristate	110-27-0	45.0%	37.60%
<b>Blend 12</b>	d-Limonene	5989-27-5	35.0%	28.24%
	Thyme Oil White	8007-46-3	5.0%	4.44%
	Wintergreen Oil	68-917-75-9	60.0%	67.33%
<b>Blend 13</b>	d-Limonene	5989-27-5	10.0%	9.90%
	Linalool Coeur	78-70-6	14.0%	14.14%
	Geraniol 60	106-24-1	10.0%	10.30%
	Tetrahydrolinalool	78-69-3	25.0%	24.29%
	Isopropyl Myristate	110-27-0	29.0%	28.92%
	Piperonal	120-57-0	10.0%	9.97%
	Vanillin	121-33-5	2.0%	2.48%
<b>Blend 14</b>	Methyl Salicylate 98% Nat	119-36-8	9.0%	11.73%
	Linalool Coeur	78-70-6	10.0%	9.49%
	Geraniol Fine	106-24-1	6.5%	6.29%
	Tetrahydrolinalool	78-69-3	12.5%	11.40%
	Isopropyl Myristate	110-27-0	15.0%	14.04%
	Piperonal (aldehyde)	120-57-0	5.0%	4.68%
	Vanillin	121-33-5	1.0%	1.16%
	BSO	8014-13-9	31.0%	31.92%
	d-Limonene	5989-27-5	10.0%	9.30%
<b>Blend 15</b>	Isopropyl myristate	110-27-0	15.0%	14.54%
	Tetrahydrolinalool FCC	78-69-3	12.5%	11.81%
	Linalool Coeur	78-70-6	10.0%	9.82%
	Geraniol Fine FCC	106-24-1	6.5%	6.51%
	Piperonal (aldehyde)	120-57-0	5.0%	4.85%
	Vanillin	121-33-5	1.0%	1.20%
	Mineral Oil	8042-47-5	15.0%	14.97%
	BSO	8014-13-9	25.0%	26.66%

<b>TABLE 9: BLENDS OF COMPOUNDS</b>				
	Compounds	CAS Registry Number	Vol/Vol	Wt/Wt
	d-Limonene	5989-27-5	10.0%	9.63%
<b>Blend 16</b>	Isopropyl myristate	110-27-0	15.0%	14.26%
	Tetrahydrolinalool FCC	78-69-3	12.5%	11.57%
	Linalool Synthetic	78-70-6	10.0%	9.63%
	Geraniol Fine FCC	106-24-1	6.5%	6.38%
	Piperonal (aldehyde)	120-57-0	5.0%	4.75%
	Vanillin	121-33-5	1.0%	1.12%
	BSO	8014-13-9	50.0%	52.28%
<b>Blend 17</b>	Thyme Oil White	110-27-0	39.0%	38.21%
	Wintergreen Oil	78-69-3	20.0%	24.79%
	Vanillin	121-33-5	1.0%	1.11%
	Isopropyl Myristate	8014-13-9	40.0%	35.89%
<b>Blend 18</b>	Thyme Oil White	110-27-0	40.0%	39.24%
	Wintergreen Oil	78-69-3	20.0%	24.82%
	Isopropyl Myristate	8014-13-9	40.0%	35.94%
<b>Blend 19</b>	Linalool Coeur	78-70-6	5.0%	4.7%
	Thymol (crystal)	89-83-8	39.0%	40.8%
	Alpha-Pinene, 98%	80-56-8	2.0%	1.9%
	Para-Cymene	99-87-6	37.0%	34.5%
	trans-Anethole	4180-23-8	17.0%	18.2%
<b>Blend 20</b>	Thyme Oil White (Ungerer)	8007-46-3		22%
	Methyl Salicylate Nat Wintergreen extract	68917-75-9		38%
	Isopropyl Myristate	110-27-0		39%
	Vanillin	121-33-5		1.0%
<b>Blend 21</b>	D-Limonene (Millennium)	5989-27-5		62.5%
	Thyme Oil White (Ungerer)	8007-46-3		12.5%
	Methyl Salicylate Nat Wintergreen extract	68917-75-9		25.0%

**TABLE 9: BLENDS OF COMPOUNDS**

	Compounds	CAS Registry Number	Vol/Vol	Wt/Wt
<b>Blend 22</b>	Methyl Salicylate	119-36-8		39%
	Thymol (crystal)	89-83-8		20%
	Geraniol 60	106-24-1		20%
	Isopropyl Myristate	110-27-0		20%
	Vanillin	121-33-5		1%
<b>Blend 23</b>	LFO	5989-27-5		42.6%
	D-Limonene (Millennium)	5989-27-5		27.35%
	Thyme Oil White (Ungerer)	8007-46-3		30.08%
<b>Blend 24</b>	D-Limonene	5989-27-5		82.52%
	Thyme Oil White	8007-46-3		3.28%
	Linalool Coeur	78-70-6		0.57%
	Tetrahydrolinalool	78-69-3		0.78%
	Vanillin	121-33-5		0.05%
	Isopropyl myristate	110-27-0		0.80%
	Piperonal (aldehyde)	120-57-0		0.80%
	Lime Oil Minus			9.99%
	Geraniol 60	106-24-1		0.41%
	Triethyl Citrate	77-93-0		0.80%
<b>Blend 25</b>	Thyme Oil White	8007-46-3		12.38%
	Wintergreen Oil Technical			31.32%
	D-Limonene	5989-27-5		56.30%
<b>Blend 26</b>	Fenchol Alpha	512-13-0		0.01%
	Nonanal	124-19-6		0.02%
	Tocopherol Gamma Tenox	54-28-4		0.02%
	Octanal	124-13-0		0.04%
	Terpinene 4 OL	562-74-3		0.08%
	Camphor Dextro	464-49-3		0.09%
	Dodecanal	112-54-9		0.10%
	Decanal	112-31-2		0.12%
	Geranyl Acetate	105-87-3		0.12%

**TABLE 9: BLENDS OF COMPOUNDS**

	Compounds	CAS Registry Number	Vol/Vol	Wt/Wt
	2-Methyl 1,3-cyclohexadiene	30640-46-1, 1888-90-0		0.26%
	Isoborneol	124-76-5		0.28%
	Camphene	79-92-5		0.37%
	Myrcene	123-35-3		0.78%
	Linalool Coeur	78-70-6		0.84%
	Borneol L	507-70-0		0.89%
	Para-Cymene	99-87-6		1.11%
	Alpha-Pinene, 98%	80-56-8		1.33%
	Linalyl Acetate	115-95-7		1.79%
	Beta Pinene	127-91-3		1.93%
	Alpha Terpinene	99-86-5		1.93%
	Terpinolene	586-62-9		4.33%
	alpha-Terpineol	98-55-5		4.68%
	Citral	5392-40-5		7.02%
	gamma-terpinene	99-85-4		7.23%
	Thyme Oil White	8007-46-3		9.58%
	LFO			12.94%
	D-Limonene	5989-27-5		42.12%
<b>Blend 27</b>	Wintergreen Oil Technical			24.82%
	Isopropyl myristate	110-27-0		35.94%
	Thyme Oil White	8007-46-3		39.24%
<b>Blend 28</b>	Vanillin	121-33-5		0.2%
	Piperonyl Alcohol	495-76-1		1.4%
	Linalool Coeur	78-70-6		2.9%
	Isopropyl myristate	110-27-0		3.4%
	Tetrahydrolinalool	78-69-3		3.5%
	Piperonal (aldehyde)	120-57-0		3.6%
	D-Limonene	5989-27-5		14.8%
	Lime Oil Minus			70.2%
<b>Blend 29</b>	Vanillin	121-33-5		0.2%
	Piperonyl Alcohol	495-76-1		1.4%
	Linalool Coeur	78-70-6		2.9%
	Isopropyl myristate	110-27-0		3.4%
	Tetrahydrolinalool	78-69-3		3.5%

**TABLE 9: BLENDS OF COMPOUNDS**

	Compounds	CAS Registry Number	Vol/Vol	Wt/Wt
	Piperonal (aldehyde)	120-57-0		3.6%
	Lime Oil Minus			15.2%
	D-Limonene	5989-27-5		69.8%
<b>Blend 30</b>	Vanillin	121-33-5		0.4%
	Piperonyl Alcohol	495-76-1		2.9%
	Linalool Coeur	78-70-6		5.7%
	Isopropyl myristate	110-27-0		6.8%
	Tetrahydrolinalool	78-69-3		6.9%
	Piperonal (aldehyde)	120-57-0		7.1%
	Lime Oil Minus			70.2%
<b>Blend 31</b>	D-Limonene	5989-27-5		27.35%
	Thyme Oil White	8007-46-3		30.08%
	LFO3			42.57%
<b>Blend 32</b>	Vanillin	121-33-5		0.5%
	Geraniol 60	106-24-1		4.2%
	Linalool Coeur	78-70-6		5.7%
	Tetrahydrolinalool	78-69-3		7.9%
	Isopropyl myristate	110-27-0		8.1%
	Piperonal (aldehyde)	120-57-0		8.1%
	Triethyl Citrate	77-93-0		8.1%
	D-Limonene	5989-27-5		27.4%
	Thyme Oil White	8007-46-3		30.1%
<b>Blend 33</b>	D-Limonene	5989-27-5		27.35%
	Thyme Oil White	8007-46-3		30.08%
	LFO			42.6%
<b>Blend 34</b>	Stock 10% SLS Solution			3.18%
	D-Limonene	5989-27-5		4.03%
	Thyme Oil White	8007-46-3		4.43%
	LFO3			6.27%
	Benzyl Alcohol	100-51-6		16.61%
	Isopar M	64742-47-8		20.95%
	Water	7732-18-5		44.53%

**TABLE 9: BLENDS OF COMPOUNDS**

	Compounds	CAS Registry Number	Vol/Vol	Wt/Wt
<b>Blend 35</b>	Vanillin	121-33-5		0.07%
	Geraniol 60	106-24-1		0.62%
	Linalool Coeur	78-70-6		0.84%
	Tetrahydrolinalool	78-69-3		1.16%
	Isopropyl myristate	110-27-0		1.19%
	Piperonal (aldehyde)	120-57-0		1.19%
	Triethyl Citrate	77-93-0		1.19%
	Stock 10% SLS Solution			3.18%
	D-Limonene	5989-27-5		4.03%
	Thyme Oil White	8007-46-3		4.43%
	Benzyl Alcohol	100-51-6		16.61%
	Isopar M	64742-47-8		20.95%
	Water	7732-18-5		44.53%
<b>Blend 36</b>	D-Limonene	5989-27-5		27.35%
	Thyme Oil White	8007-46-3		30.08%
	LFO3			42.57%
<b>Blend 37</b>	Vanillin	121-33-5		0.50%
	Geraniol 60	106-24-1		4.18%
	Linalool Coeur	78-70-6		5.73%
	Tetrahydrolinalool	78-69-3		7.88%
	Isopropyl myristate	110-27-0		8.08%
	Piperonal (aldehyde)	120-57-0		8.09%
	Triethyl Citrate	77-93-0		8.11%
	D-Limonene	5989-27-5		27.35%
	Thyme Oil White	8007-46-3		30.08%
<b>Blend 38</b>	Thyme Oil White	8007-46-3		3.3%
	LFO			4.4%
	Lime Oil Minus			10.0%
	D-Limonene	5989-27-5		82.3%
<b>Blend 39</b>	D-Limonene	5989-27-5		8.72%
	Thyme Oil White	8007-46-3		9.58%
	LFO			12.94%
	Lime Oil Minus			68.76%

**TABLE 9: BLENDS OF COMPOUNDS**

	Compounds	CAS Registry Number	Vol/Vol	Wt/Wt
<b>Blend 40</b>	Vanillin	121-33-5		0.1%
	Geraniol 60	106-24-1		1.2%
	Linalool Coeur	78-70-6		1.7%
	Tetrahydrolinalool	78-69-3		2.3%
	Piperonal (aldehyde)	120-57-0		2.4%
	Triethyl Citrate	77-93-0		2.4%
	Thyme Oil White	8007-46-3		8.6%
	D-Limonene	5989-27-5		9.8%
	Lime Oil Minus			69.3%
<b>Blend 41</b>	Thyme Oil White	8007-46-3		20.6%
	Isopropyl myristate	110-27-0		34.3%
	Wintergreen Oil	68917-75-9		45.1%
<b>Blend 42</b>	Vanillin	121-33-5		1.9%
	Piperonal (aldehyde)	120-57-0		7.8%
	Geraniol Fine FCC	106-24-1		10.5%
	Linalool Coeur	78-70-6		15.8%
	Tetrahydrolinalool	78-69-3		19.0%
	BSO	977017-84-7		21.5%
	Isopropyl myristate	110-27-0		23.4%
<b>Blend 43</b>	Alpha-Pinene, 98%	80-56-8		3.78%
	Linalool Coeur	78-70-6		6.63%
	Soy Bean Oil	8016-70-4		24.03%
	Para-Cymene	99-87-6		28.39%
	Thymol (crystal)	89-83-8		37.17%
<b>Blend 44</b>	Alpha-Pinene, 98%	80-56-8		4.97%
	Linalool Coeur	78-70-6		8.73%
	Para-Cymene	99-87-6		37.37%
	Thymol (crystal)	89-83-8		48.93%
<b>Blend 45</b>	Vanillin	121-33-5		0.32%
	Piperonal (aldehyde)	120-57-0		1.29%
	Geraniol Fine FCC	106-24-1		1.73%
	Linalool Coeur	78-70-6		2.61%
	Tetrahydrolinalool	78-69-3		3.13%
	Isopropyl myristate	110-27-0		3.86%

**TABLE 9: BLENDS OF COMPOUNDS**

	Compounds	CAS Registry Number	Vol/Vol	Wt/Wt
	D-Limonene	5989-27-5		8.72%
	Thyme Oil White	8007-46-3		9.58%
	Lime Oil 410			68.76%
<b>Blend 46</b>	Thyme Oil White	8007-46-3		4.44%
	D-Limonene	5989-27-5		28.24%
	Methyl Salicylate Synth			67.32%
<b>Blend 47</b>	Thyme Oil White	8007-46-3		20.6%
	Isopropyl myristate	110-27-0		34.3%
	Wintergreen Oil Technical			45.1%
<b>Blend 48</b>	CIK Formula			22.44%
	Lemon Grass Oil - India			22.93%
	Castor Oil hydrogenated - PEO40			54.63%
<b>Blend 49</b>	BSO	977017-84-7		4.83%
	Thyme Oil White	8007-46-3		11.18%
	LFO			16.18%
	D-Limonene	5989-27-5		67.81%
<b>Blend 50</b>	BSO	977017-84-7		5.31%
	Thyme Oil White	8007-46-3		11.59%
	LFO			16.01%
	D-Limonene	5989-27-5		67.09%
<b>Blend 51</b>	Vanillin	121-33-5		0.15%
	Geraniol 60	106-24-1		1.23%
	Linalool Coeur	78-70-6		1.68%
	Tetrahydrolinalool	78-69-3		2.31%
	Isopropyl myristate	110-27-0		2.37%
	Piperonal (aldehyde)	120-57-0		2.37%
	Triethyl Citrate	77-93-0		2.38%
	D-Limonene	5989-27-5		8.83%
	Thyme Oil White	8007-46-3		9.71%

**TABLE 9: BLENDS OF COMPOUNDS**

	Compounds	CAS Registry Number	Vol/Vol	Wt/Wt
	Isopar M	64742-47-8		13.80%
	Lime Oil 410			55.17%
<b>Blend 52</b>	Vanillin	121-33-5		0.15%
	Geraniol 60	106-24-1		1.21%
	Linalool Coeur	78-70-6		1.66%
	Tetrahydrolinalool	78-69-3		2.28%
	Isopropyl myristate	110-27-0		2.34%
	Piperonal (aldehyde)	120-57-0		2.34%
	Triethyl Citrate	77-93-0		2.35%
	D-Limonene	5989-27-5		8.72%
	Thyme Oil White	8007-46-3		9.59%
	Lime Oil 410			69.35%
<b>Blend 53</b>	Thyme Oil White	8007-46-3		5.37%
	Lime Oil 410			9.98%
	LFO			16.31%
	D-Limonene	5989-27-5		68.34%
<b>Blend 54</b>	Alpha-Pinene, 98%	80-56-8		3.8%
	Linalool Coeur	78-70-6		6.6%
	Soy Bean Oil	8016-70-4		24.0%
	Para-Cymene	99-87-6		28.39%
	Thymol (crystal)	89-83-8		37.2%
<b>Blend 55</b>	Para-Cymene	99-87-6		1.90%
	Alpha-Pinene, 98%	80-56-8		4.70%
	Trans-Anethole	4180-23-8		18.20%
	Thymol (crystal)	89-83-8		34.40%
	Linalool Coeur	78-70-6		40.80%
<b>Blend 56</b>	Alpha-Pinene, 98%	80-56-8		9.46%
	Linalool Coeur	78-70-6		9.49%
	Para-Cymene	99-87-6		33.18%
	Thymol (crystal)	89-83-8		47.87%
<b>Blend 57</b>	Vanillin	121-33-5		2.47%
	Piperonal (aldehyde)	120-57-0		9.95%
	Geraniol Fine FCC	106-24-1		13.36%

**TABLE 9: BLENDS OF COMPOUNDS**

	Compounds	CAS Registry Number	Vol/Vol	Wt/Wt
	Linalool Coeur	78-70-6		20.15%
	Tetrahydrolinalool	78-69-3		24.23%
	Isopropyl myristate	110-27-0		29.84%
<b>Blend 58</b>	Vanillin	121-33-5		1.17%
	Hercolyn D	8050-15-5		4.44%
	Hedione	24851-98-7		6.67%
	Piperonal (aldehyde)	120-57-0		7.55%
	Dipropylene glycol (DPG)	246-770-3		9.09%
	Triethyl Citrate	77-93-0		10.10%
	Isopropyl myristate	110-27-0		15.10%
	Ethyl Linalool	10339-55-6		22.91%
	Tetrahydrolinalool	78-69-3		22.98%
<b>Blend 59</b>	Vanillin	121-33-5		1.2%
	Geraniol 60	106-24-1		9.8%
	Linalool Coeur	78-70-6		13.5%
	Tetrahydrolinalool	78-69-3		18.5%
	Isopropyl myristate	110-27-0		19.0%
	Piperonal (aldehyde)	120-57-0		19.0%
	Triethyl Citrate	77-93-0		19.1%
<b>Blend 60</b>	Vanillin	121-33-5		1.2%
	Piperonyl Alcohol	495-76-1		9.6%
	Linalool Coeur	78-70-6		19.2%
	Isopropyl myristate	110-27-0		22.9%
	Tetrahydrolinalool	78-69-3		23.2%
	Piperonal (aldehyde)	120-57-0		23.8%
<b>Blend 61</b>	Fenchol Alpha	512-13-0		0.01%
	Nonanal	124-19-6		0.03%
	Tocopherol Gamma Tenox	54-28-4		0.03%
	Octanal	124-13-0		0.06%
	Terpinene 4 OL	562-74-3		0.11%
	Camphor Dextro	464-49-3		0.13%
	Dodecanal	112-54-9		0.14%
	Decanal	112-31-2		0.17%

**TABLE 9: BLENDS OF COMPOUNDS**

	Compounds	CAS Registry Number	Vol/Vol	Wt/Wt
	Geranyl Acetate	105-87-3		0.18%
	2-Methyl 1,3-cyclohexadiene	30640-46-1, 1888-90-0		0.38%
	Isoborneol	124-76-5		0.41%
	Camphene	79-92-5		0.54%
	Myrcene	123-35-3		1.14%
	Linalool Coeur	78-70-6		1.22%
	Borneol L	507-70-0		1.30%
	Para-Cymene	99-87-6		1.61%
	Alpha-Pinene, 98%	80-56-8		1.94%
	Linalyl Acetate	115-95-7		2.60%
	Beta Pinene	127-91-3		2.80%
	Alpha Terpinene	99-86-5		2.80%
	Terpinolene	586-62-9		6.30%
	alpha-Terpineol	98-55-5		6.80%
	Citral	5392-40-5		10.21%
	gamma-terpinene	99-85-4		10.51%
	D-Limonene	5989-27-5		48.58%
<b>Blend 62</b>	Fenchol Alpha	512-13-0		0.01%
	Nonanal	124-19-6		0.04%
	Tocopherol Gamma Tenox	54-28-4		0.04%
	Octanal	124-13-0		0.07%
	Terpinene 4 OL	562-74-3		0.13%
	Camphor Dextro	464-49-3		0.16%
	Dodecanal	112-54-9		0.17%
	Decanal	112-31-2		0.20%
	Geranyl Acetate	105-87-3		0.22%
	2-Methyl 1,3-cyclohexadiene	30640-46-1, 1888-90-0		0.46%
	Isoborneol	124-76-5		0.49%
	Camphene	79-92-5		0.65%
	Myrcene	123-35-3		1.37%
	Linalool Coeur	78-70-6		1.47%
	Borneol L	507-70-0		1.57%
	Para-Cymene	99-87-6		1.94%
	Alpha-Pinene, 98%	80-56-8		2.34%
	Linalyl Acetate	115-95-7		3.13%

**TABLE 9: BLENDS OF COMPOUNDS**

	Compounds	CAS Registry Number	Vol/Vol	Wt/Wt
	Beta Pinene	127-91-3		3.37%
	Alpha Terpinene	99-86-5		3.37%
	Terpinolene	586-62-9		7.59%
	gamma-terpinene	99-85-4		12.66%
	D-Limonene	5989-27-5		58.54%
<b>Blend 63</b>	Alpha Terpinene	99-86-5		4.88%
	Alpha-Pinene, 98%	80-56-8		5.01%
	Beta Pinene	127-91-3		5.02%
	Linalyl Acetate	115-95-7		5.30%
	Camphene	79-92-5		5.84%
	Myrcene	123-35-3		9.26%
	Para-Cymene	99-87-6		10.04%
	Linalool Coeur	78-70-6		10.05%
	Terpinolene	586-62-9		10.10%
	D-Limonene	5989-27-5		34.50%
<b>Blend 64</b>	Stock 10% SLS Solution			10%
	25B-4A for Institutions			90%
<b>Blend 65</b>	Lecithin	8002-43-5		0.20%
	Polyglycerol-4-oleate	9007-48-1		0.90%
	Water	7732-18-5		9.8%
	25B-4A for Institutions			89.1%
<b>Blend 66</b>	Xanthan Gum	11138-66-2		0.28%
	Potassium Sorbate	590-00-1 or 24634-61-5		1.00%
	Cationic Formulation			16.90%
	Water	7732-18-5		81.82%
<b>Blend 67</b>	Lecithin	8002-43-5		0.034%
	Potassium Sorbate	590-00-1 or 24634-61-5		0.11%
	Polyglycerol-4-oleate	9007-48-1		0.15%
	Xanthan Gum	11138-66-2		0.28%

**TABLE 9: BLENDS OF COMPOUNDS**

	Compounds	CAS Registry Number	Vol/Vol	Wt/Wt
	25B-4A for Institutions			15%
	Water	7732-18-5		84.4%
<b>Blend 68</b>	Lecithin	8002-43-5		0.03%
	Potassium Sorbate	590-00-1 or 24634-61-5		0.11%
	Polyglycerol-4-oleate	9007-48-1		0.15%
	Xanthan Gum	11138-66-2		0.28%
	Thyme Oil White	8007-46-3		3.09%
	Isopropyl myristate	110-27-0		5.15%
	Wintergreen Oil	68917-75-9		6.77%
	Water	7732-18-5		84.41%
<b>Blend 69</b>	Lecithin	8002-43-5		0.20%
	Polyglycerol-4-oleate	9007-48-1		0.90%
	Water	7732-18-5		9.8%
	25B-4A-formula 1a			89.10%
<b>Blend 70</b>	Stock 2.5% Xanthan-1% Ksorbate			12.7%
	Cationic Formulation			84.2%
	Water	7732-18-5		3.1%
<b>Blend 71</b>	Potassium Sorbate	590-00-1 or 24634-61-5		0.13%
	Lecithin	8002-43-5		0.17%
	Xanthan Gum	11138-66-2		0.32%
	Polyglycerol-4-oleate	9007-48-1		0.76%
	Thyme Oil White	8007-46-3		15.5%
	Water	7732-18-5		23.6%
	Isopropyl myristate	110-27-0		25.7%
	Wintergreen Oil	68917-75-9		33.8%
<b>Blend 72</b>	Water	7732-18-5		9.2%
	Stock 2.5% Xanthan-1% Ksorbate			11.90%
	Cationic Formulation			78.87%

**TABLE 9: BLENDS OF COMPOUNDS**

	Compounds	CAS Registry Number	Vol/Vol	Wt/Wt
<b>Blend 73</b>	Potassium Sorbate	590-00-1 or 24634-61-5		0.13%
	Lecithin	8002-43-5		0.17%
	Xanthan Gum	11138-66-2		0.32%
	Polyglycerol-4-oleate	9007-48-1		0.76%
	Water	7732-18-5		28.6%
	25B-4A for Institutions			70%
<b>Blend 74</b>	Water	7732-18-5		3.1%
	Stock 2.5% Xanthan-1% Ksorbate			12.7%
	Cationic Formulation-Hi Residual			84.2%
<b>Blend 75</b>	Xanthan Gum	11138-66-2		0.28%
	Potassium Sorbate	590-00-1 or 24634-61-5		1%
	Cationic Formulation-Hi Residual			16.90%
	Water	7732-18-5		81.8%
<b>Blend 76</b>	CIK Formula			2.50%
<b>Blend 77</b>	Lecithin	8002-43-5		0.20%
	Polyglycerol-4-oleate	9007-48-1		0.90%
	Water	7732-18-5		9.8%
	25B-4A for Institutions w Methyl Sal			89.10%
<b>Blend 78</b>	Xanthan Gum	11138-66-2		0.28%
	Potassium Sorbate	590-00-1 or 24634-61-5		1.00%
	Cationic Formulation w MS			16.90%
	Water	7732-18-5		81.82%
<b>Blend 79</b>	Vitamin E Acetate	[58-95-7]		0.02%
	Propyl Paraben	[94-13-3]		0.05%

**TABLE 9: BLENDS OF COMPOUNDS**

	Compounds	CAS Registry Number	Vol/Vol	Wt/Wt
	Disodium EDTA	[139-33-3]		0.05%
	BHT	128-37-0		0.10%
	Methyl Paraben	[99-76-3]		0.15%
	Triethanolamine	[102-71-6]		0.15%
	Citronella Oil	106-22-9		0.20%
	Carbopol 940	[9003-01-4]		0.20%
	Sodium Metabisulphate	[7681-57-4]		0.25%
	Propylene Glycol	[57-55-6]		2.00%
	Light Liquid Paraffin	8012-95-1		4.00%
	CIK Formula			5.00%
	Cresmer hydrogenated oil	RH40 castor [61791-12-6]		5.00%
	White Soft Paraffin	[8009-03-8]		9.00%
	Emulsifying Wax	67762-27-0, 9005-67-8		14.00%
	Water	7732-18-5		59.83%
<b>Blend 80</b>	Span 80			0.05%
	Sodium Benzoate			0.20%
	Isopropyl alcohol	67-63-0		1.50%
	25B-4b blend			12.50%
	A46 Propellant			14.50%
	Isopar M	64742-47-8		29%
	Water	7732-18-5		42.25%
<b>Blend 81</b>	Isopropyl alcohol	67-63-0		3.0%
	TT-7			6.0%
	A46 Propellant			40.0%
	Isopar M	64742-47-8		51.0%
<b>Blend 82</b>	Isopropyl alcohol	67-63-0		3.0%
	TT-7			6.0%
	A46 Propellant			40.0%
	Isopar M	64742-47-8		51.0%
<b>Blend 83</b>	HL1			6.0%
	A46 Propellant			40.0%

**TABLE 9: BLENDS OF COMPOUNDS**

	Compounds	CAS Registry Number	Vol/Vol	Wt/Wt
	Isopar M	64742-47-8		54.0%
	Bifenthrin	83657-04-3		0.05%
<b>Blend 84</b>	Lecithin	8002-43-5		0.03%
	Potassium Sorbate	590-00-1 or 24634-61-5		0.11%
	Polyglycerol-4-oleate	9007-48-1		0.15%
	Xanthan Gum	11138-66-2		0.28%
	Thyme Oil White	8007-46-3		2.06%
	Isopropyl myristate	110-27-0		3.43%
	Wintergreen Oil	68917-75-9		4.51%
	Water	7732-18-5		89.42%
<b>Blend 85</b>	Lecithin	8002-43-5		0.03%
	Potassium Sorbate	590-00-1 or 24634-61-5		0.11%
	Polyglycerol-4-oleate	9007-48-1		0.15%
	Xanthan Gum	11138-66-2		0.28%
	Thyme Oil White	8007-46-3		1.03%
	Isopropyl myristate	110-27-0		1.72%
	Wintergreen Oil	68917-75-9		2.26%
	Water	7732-18-5		94.43%
<b>Blend 86</b>	Lecithin, Soya	8030-76-0		0.20%
	Polyglycerol-4-oleate	9007-48-1		0.90%
	Water	7732-18-5		9.80%
	25B-4A-formula 1a			89.10%
<b>Blend 87</b>	Lecithin, Soya	8030-76-0		0.20%
	Polyglycerol-4-oleate	9007-48-1		0.90%
	Water	7732-18-5		9.80%
	Wintergreen Oil Technical			22.1%
	Isopropyl myristate	110-27-0		32.0%
	Thyme Oil White	8007-46-3		35.0%
<b>Blend 88</b>	Lecithin, Soya	8030-76-0		0.10%
	Polyglycerol-4-oleate	9007-48-1		0.90%
	Water	7732-18-5		9.90%

**TABLE 9: BLENDS OF COMPOUNDS**

	Compounds	CAS Registry Number	Vol/Vol	Wt/Wt
	25B-4A w vanillin			89.1%
<b>Blend 89</b>	Lecithin, Soya	8030-76-0		0.10%
	Polyglycerol-4-oleate	9007-48-1		0.90%
	Water	7732-18-5		9.90%
	Isopropyl myristate	110-27-0		29.76%
	Thyme Oil White	8007-46-3		18.27%
	Wintergreen Oil	68917-75-9		40.10%
	Vanillin	121-33-5		0.98%
<b>Blend 90</b>	Polyglycerol-4-oleate	9007-48-1		1.90%
	Water	7732-18-5		9.00%
	25B-4A-formula 1a			89.10%
<b>Blend 91</b>	Polyglycerol-4-oleate	9007-48-1		1.90%
	Water	7732-18-5		9.00%
	Wintergreen Oil Technical			22.1%
	Isopropyl myristate	110-27-0		32.0%
	Thyme Oil White	8007-46-3		35.0%
<b>Blend 92</b>	Potassium Sorbate	590-00-1 or 24634-61-5		0.11%
	Xanthan Gum	11138-66-2		0.275%
	Polyglycerol-4-oleate	9007-48-1		1.90%
	Anionic Dispersible Concentrate			11.30%
	Water	7732-18-5		86.410%
<b>Blend 93</b>	Lecithin, Soya	8030-76-0		0.011%
	Potassium Sorbate	590-00-1 or 24634-61-5		0.11%
	Xanthan Gum	11138-66-2		0.275%
	Thyme Oil White	8007-46-3		1.25%
	Polyglycerol-4-oleate	9007-48-1		2.002%
	Wintergreen Oil Technical			3.15%
	D-Limonene	5989-27-5		5.67%
	Water	7732-18-5		87.529%

**TABLE 9: BLENDS OF COMPOUNDS**

	Compounds	CAS Registry Number	Vol/Vol	Wt/Wt
<b>Blend 94</b>	Potassium Sorbate	590-00-1 or 24634-61-5		0.11%
	Xanthan Gum	11138-66-2		0.275%
	Cationic Dispersible Concentrate			11.30%
	Water	7732-18-5		88.315%
<b>Blend 95</b>	Lecithin, Soya	8030-76-0		0.023%
	Polyglycerol-4-oleate	9007-48-1		0.102%
	Potassium Sorbate	590-00-1 or 24634-61-5		0.11%
	Xanthan Gum	11138-66-2		0.275%
	Wintergreen Oil Technical			2.50%
	Isopropyl myristate	110-27-0		3.62%
	Thyme Oil White	8007-46-3		3.95%
	Water	7732-18-5		89.422%
<b>Blend 96</b>	Potassium Sorbate	590-00-1 or 24634-61-5		0.11%
	Xanthan Gum	11138-66-2		0.275%
	Nonionic Dispersible Concentrate			11.30%
	Water	7732-18-5		88.315%
<b>Blend 97</b>	Potassium Sorbate	590-00-1 or 24634-61-5		0.11%
	Polyglycerol-4-oleate	9007-48-1		0.21%
	Xanthan Gum	11138-66-2		0.275%
	Wintergreen Oil	68917-75-9		2.50%
	Isopropyl myristate	110-27-0		3.62%
	Thyme Oil White	8007-46-3		3.95%
	Water	7732-18-5		89.332%
<b>Blend 98</b>	Potassium Sorbate	590-00-1 or 24634-61-5		1.00%
	Xanthan Gum	11138-66-2		2.500%
	Water	7732-18-5		96.500%

**TABLE 9: BLENDS OF COMPOUNDS**

	Compounds	CAS Registry Number	Vol/Vol	Wt/Wt
<b>Blend 99</b>	Sodium Benzoate			2%
	Water	7732-18-5		98%
<b>Blend 100</b>	Span 80			1.20%
	Tween 80			1.65%
	25B-4b blend			2.84%
	2% Sodium Benzoate			11.36%
	Isopar M	64742-47-8		14.20%
	Water	7732-18-5		68.75%
<b>Blend 101</b>	Span 80			1.20%
	Tween 80			1.65%
	Isopar M	64742-47-8		14.20%
	Water	7732-18-5		79.88%
	Sodium Benzoate			0.23%
	Wintergreen Oil	68917-75-9		0.89%
	Thyme Oil White	8007-46-3		0.35%
	D-Limonene	5989-27-5		1.60%
<b>Blend 102</b>	Propellant A70			22%
	8A Intermediate			78%
<b>Blend 103</b>	Propellant A70			22.0%
	Span 80			0.94%
	Tween 80			1.29%
	Isopar M	64742-47-8		11.08%
	Water	7732-18-5		62.31%
	Sodium Benzoate			0.18%
	Wintergreen Oil	68917-75-9		0.69%
	Thyme Oil White	8007-46-3		0.27%
	D-Limonene	5989-27-5		1.25%
<b>Blend 104</b>	Potassium Sorbate	590-00-1 or 24634-61-5		1%
	Xanthan Gum	11138-66-2		2.50%
	Water	7732-18-5		96.50%
<b>Blend 105</b>	Sodium Lauryl Sulfate	151-21-3		10%
	Water	7732-18-5		90.00%

<b>TABLE 9: BLENDS OF COMPOUNDS</b>				
	Compounds	CAS Registry Number	Vol/Vol	Wt/Wt
<b>Blend 106</b>	Water	7732-18-5		83.5%
	Potassium Sorbate	590-00-1 or 24634-61-5		1.0%
	Xanthan Gum	11138-66-2		0.28%
	Polyglycerol-4-oleate	9007-48-1		0.15%
	Lecithin	8002-43-5		0.034%
	25B-4A for Institutions			15.1%
<b>Blend 107</b>	Water	7732-18-5		33.40%
	15% B-5028 RTU in BLF			66.60%
<b>Blend 108</b>	Stock 10% SLS Solution			3.18%
	D-Limonene	5989-27-5		4.03%
	Thyme Oil White	8007-46-3		4.43%
	LFO3			6.27%
	Benzyl Alcohol	100-51-6		16.61%
	Isopar M	64742-47-8		20.95%
	Water	7732-18-5		44.53%
<b>Blend 109</b>	Bifenthrin	83657-04-3		0.05%
	Stock 10% SLS Solution			3.178%
	D-Limonene	5989-27-5		4.028%
	Thyme Oil White	8007-46-3		4.428%
	LFO3			6.267%
	Benzyl Alcohol	100-51-6		16.60%
	Isopar M	64742-47-8		20.94%
<b>Blend 110</b>	Water	7732-18-5		44.51%
	Bifenthrin	83657-04-3		0.05%
	Span 80			0.50%
	Isopar M	64742-47-8		15%
	Water	7732-18-5		74.45%
	Thyme Oil White	8007-46-3		2.06%
	Wintergreen Oil	68917-75-9		4.51%

**TABLE 9: BLENDS OF COMPOUNDS**

	Compounds	CAS Registry Number	Vol/Vol	Wt/Wt
	Isopropyl myristate	110-27-0		3.43%
<b>Blend 111</b>	Sodium Lauryl Sulfate	151-21-3		0.02%
	Water	7732-18-5		97.98%
	Thyme Oil White	8007-46-3		0.41%
	Wintergreen Oil	68917-75-9		0.90%
	Isopropyl myristate	110-27-0		0.69%
<b>Blend 112</b>	AgSorb			95.00%
	Thyme Oil White	8007-46-3		1.03%
	Wintergreen Oil	68917-75-9		2.26%
	Isopropyl myristate	110-27-0		1.71%
<b>Blend 113</b>	DG Light			95.0%
	Thyme Oil White	8007-46-3		1.03%
	Wintergreen Oil	68917-75-9		2.26%
	Isopropyl myristate	110-27-0		1.71%
<b>Blend 114</b>	Sodium Lauryl Sulfate	151-21-3		0.02%
	Thyme Oil White	8007-46-3		0.41%
	Isopropyl myristate	110-27-0		0.69%
	Wintergreen Oil	68917-75-9		0.90%
	Water	7732-18-5		97.98%
<b>Blend 115</b>	Vanillin	121-33-5		0.02%
	Geraniol 60	106-24-1		0.12%
	Linalool Coeur	78-70-6		0.17%
	Tetrahydrolinalool	78-69-3		0.23%
	Isopropyl myristate	110-27-0		0.24%
	Piperonal (aldehyde)	120-57-0		0.24%
	Triethyl Citrate	77-93-0		0.24%
	Thyme Oil White	8007-46-3		0.98%
	Lime Oil Minus			3.00%
	Stock 10% SLS Solution			3%
	D-Limonene	5989-27-5		24.76%
	Water	7732-18-5		67%
<b>Blend 116</b>	Xanthan Gum	11138-66-2		0.28%

<b>TABLE 9: BLENDS OF COMPOUNDS</b>				
	Compounds	CAS Registry Number	Vol/Vol	Wt/Wt
	Potassium Sorbate	590-00-1 or 24634-61-5		1%
	Cationic Formulation			16.90%
	Thyme Oil White	8007-46-3		20.6%
	Isopropyl myristate	110-27-0		34.3%
	Wintergreen Oil	68917-75-9		45.1%
	Water	7732-18-5		81.82%
<b>Blend 117</b>	25B-4A for Institutions			5%
	Miracle Gro (Sterile)			95%
<b>Blend 118</b>	Bifenthrin	83657-04-3		0.05%
	Span 80			0.50%
	Thyme Oil White	8007-46-3		0.51%
	Isopropyl myristate	110-27-0		0.86%
	Wintergreen Oil	68917-75-9		1.13%
	Isopar M	64742-47-8		15%
	Water	7732-18-5		81.95%

[00376] *Example 1- Pesticidal effect on Culex quinquefasciatus*

[00377] The effect of compositions, and their individual ingredients, on the mortality of insects is tested. Multiple plexiglass chambers are used. A treatment chamber is provided for each composition and ingredient that is tested, and the chambers are sprayed (aerosol spray) evenly on all surfaces with the composition or ingredient being tested. A control chamber is provided that is not treated.

[00378] Southern house mosquitoes, *Culex quinquefasciatus*, are obtained as test organisms. Multiple laboratory-cultured, sucrose-fed female mosquitoes aged about 2-5 days are released into the glass chambers prior to the spraying of aerosol. The discharge rate (gm/second)

of each can of aerosol to be tested is predetermined. Based on the dosage required, an estimated time of spray of aerosol is discharged into the glass chamber.

[00379] Knockdown of mosquitoes is observed at indicated intervals up to about 20 minutes. After about 20 minutes, all mosquitoes are collected and placed in cylindrical polyethylene containers with 10% sucrose pads. Mortality is observed 4 hours post-treatment. The mortality value is based on a combination of dead and moribund mosquitoes over the total number of mosquitoes initially released.

[00380] The data from an exemplary study is shown in Table 10. The study tested: (1) a composition comprising Pyrethrum and Blend 9; (2) Pyrethrum; (3) BSO; and (4) LFO (IFF Inc., Hazlet, NJ). The percent mortality of the mosquitoes treated with the composition was 100%, compared to 60% for BSO alone, 80% for LFO alone, 90% for Pyrethrum alone, and 0% for the non-treated control.

		Mosquitoes		% Mortality
		# Added to Chamber	# Dead after 4 hours	
Control	50	0	0	0%
BSO	50	30	30	60%
LFO	50	40	40	80%
Pyrethrum	50	45	45	90%
Composition (Pyrethrum and Blend 9)	50	50	50	100%

[00381] Example 2- Repellency effect against *Culex quinquefasciatus*

[00382] The repellency of exemplary compositions of the present invention are compared to the repellency of their individual ingredients, and to a non-treated control. Southern house mosquitoes, *Culex quinquefasciatus*, are obtained as test organisms. Multiple human

evaluators test each treatment in a replicated experiment. Experimentation is conducted in a laboratory using multiple-chambered, plexiglass modules, each chamber stocked with about 2-10 day-old colony-reared female mosquitoes. The modules are equipped with sliding doors to expose the mosquitoes to the legs of three volunteers. Treatments are applied at about 28.6 $\mu$ l to 12cm<sup>2</sup> rectangular sections of skin located directly beneath the chamber openings. Each volunteer conducts 2-minute biting counts for each treatment at five time intervals: 0, 1, 2, 4 & 6 hours post-treatment. New mosquitoes are stocked into the chamber for each time interval. Ambient temperature and humidity data is recorded with a HOBO datalogger. Percent repellency is determined according to the following formula: Control – Treatment / Control X 100.

[00383] The data from an exemplary study is shown in Table 11. The study tested: (1) a composition comprising 5% DEET and 95% Blend 9; (2) BSO; and (3) LFO (IFF Inc., Hazlet, NJ). The percent repellency for the composition was 100%, as compared to the individual ingredients, that exhibited lower initial percent repellency, and no repellency after about 6 hours.

<b>TABLE 11</b>					
PERCENT REPELLENCE					
	<b>0</b>	<b>1 Hour</b>	<b>2 Hours</b>	<b>4 Hours</b>	<b>6 Hours</b>
Control	0	0	0	0	0
BSO	20	10	5	2	0
LFO	30	15	8	3	0
5% DEET	40	20	10	5	0
Composition (5% DEET and 95% Blend 9)	100.0	100.0	100.0	100.0	100.0

[00384] As indicated by the data above, the composition has a synergistic effect as compared to the individual ingredients of the composition. A coefficient of synergy can be calculated for the blend, relative to each individual ingredient, i.e., comparison composition.

Such synergy coefficients for the composition including Pyrethrum, BSO, and LFO are set forth in Table 12. Such synergy coefficients for the composition including DEET, BSO, and LFO are set forth in Table 13.

TABLE 12

Comparison Composition	Mortality (%)	Activity Ratio	Concentration of Comparison Composition in Blend (% by wt)	Concentration Adjustment Factor	Synergy Coefficient
BSO	60	$(1.00)/(0.60)=$ 1.67	$19.91(0.95)=$ 18.91	$(1.00)/(0.1891)=$ 5.29	8.83
LFO	80	$(1.00)/(0.80)=$ 1.25	$80.09(0.95)=$ 76.09	$(1.00)/(0.7609)=$ 1.31	1.64
Pyrethrum	90	$(1.00)/(0.90)=$ 1.11	5	$(1.00)/(0.05)=$ 20	22.2
Control	00.0	---	---	---	---
Composition	100	$(1.00)/(1.00)=$ 1.00	100	$(1.00)/(1.00)=$ 1.00	1.00

TABLE 13

Comparison Composition	Repelency (%), at 1 Hour	Activity Ratio	Concentration of Comparison Composition in Blend (% by wt)	Concentration Adjustment Factor	Synergy Coefficient
BSO	10	$(1.00)/(0.10)=$ 10	$19.91(0.95)=$ 18.91	$(1.00)/(0.1891)=$ 5.29	52.9
LFO	15	$(1.00)/(0.15)=$ 6.7	$80.09(0.95)=$ 76.09	$(1.00)/(0.7609)=$ 1.31	8.78
DEET	20	$(1.00)/(0.20)=$ 5.0	5	$(1.00)/(0.05)=$ 20	100
Control	00.0	---	---	---	---
Composition	100	$(1.00)/(1.00)=$ 1.00	100	$(1.00)/(1.00)=$ 1.00	1.00

[00385] The synergy coefficients and other data presented in Tables 12 and 13 are calculated as follows. An activity ratio (A) can be calculated by dividing the effect of the blend ( $E_B$ ) by the effect of the comparison composition ( $E_C$ ), as follows:

Formula 1

$$A = E_B/E_C$$

[00386] A concentration adjustment factor (F) can be calculated based on the concentration (X) of the comparison composition in the blend, as follows:

Formula 2

$$F = 1/X$$

[00387] The synergy coefficient (S) can then be calculated by multiplying the activity ratio (A) and the concentration adjustment factor (F), as follows:

Formula 3

$$S = (A)(F)$$

[00388] As such, the synergy coefficient (S) can also be calculated, as follows:

Formula 4

$$S = [E_B/E_C]/X$$

[00389] For example, with reference to Table 12, the activity ratio for BSO is 1.67 because the effect of the composition is a cure rate of 100%, while the effect of BSO alone is 60% [(1.00)/(0.60)=1.67]. The concentration adjustment factor for BSO is 5.29 because the blend contains 95% of a blend that includes 19.91% BSO [19.91(0.95)=18.91], as compared to the 100% *p*-cymene tested alone [(1.00)/(0.1891)=5.29]. The synergy coefficient of the blend, relative to BSO ( $S_{BSO}$ ) is therefore 8.83. With further reference to Table 12, the synergy coefficients for the blend are as follows:  $S_{pyrethrum} = 22.2$ ;  $S_{LFO} = 1.64$ ;  $S_{BSO} = 8.83$ .

[00390] In some embodiments, synergy or synergistic effect associated with a composition can be determined using calculations similar to those described in Colby, S. R., "Calculating synergistic and antagonistic responses of herbicide combinations," Weeds (1967) 15:1, pp. 20-22, which is incorporated herein by this reference. In this regard, the following formula can be used to express an expected percent effect (E) of a composition including two compounds, Compound X and Compound Y:

Formula 5

$$E = X + Y - (X*Y/100)$$

[00391] In Formula 5, X is the measured actual percent effect of Compound X in the composition, and Y is the measured actual percent effect of Compound Y of the composition. The expected percent effect (E) of the composition is then compared to a measured actual percent effect (A) of the composition. If the actual percent effect (A) that is measured differs from the expected percent effect (E) as calculated by the formula, then the difference is due to an interaction of the compounds. Thus, the composition has synergy (a positive interaction of the compounds) when A > E. Further, there is a negative interaction (antagonism) when A < E.

[00392] Formula 5 can be extended to account for any number of compounds in a composition; however it becomes more complex as it is expanded, as is illustrated by the following formula for a composition including three compounds, Compound X, Compound Y, and Compound Z:

Formula 6

$$E = X + Y + Z - ((XY + XZ + YZ)/100) + (X*Y*Z/10000)$$

[00393] An easy-to-use formula that accommodates compositions with any number of compounds can be provided by modifying Formulas 5 and 6. Such a modification of the formula will now be described. When using Formulas 5 and 6, an untreated control value (untreated with composition or compound) is set at 100%, e.g., if the effect being measured is the amount of target insects killed, the control value would be set at 100% survival of target insect. In this regard, if treatment with Compound A results in 80% killing of a target insect, then the treatment with Compound A can be said to result in a 20% survival, or 20% of the control value. The relationship between values expressed as a percent effect and values expressed as a percent-of-control are set forth in the following formulas, where E' is the expected percent of control of the composition, X<sub>n</sub> is the measured actual percent effect of an individual compound (Compound X<sub>n</sub>,

) of the composition,  $X_n'$  is the percent of control of an individual compound of the composition, and  $A'$  is the actual measured percent of control of the composition.

$$\text{Formula 7} \quad E = 100 - E'$$

$$\text{Formula 8} \quad X_n = 100 = X_n'$$

$$\text{Formula 9} \quad A = 100 - A'$$

[00394] By substituting the percent-of-control values for the percent effect values of Formulas 5 and 6, and making modifications to accommodate any number (n) of compounds, the following formula is provided for calculating the expected percent of control (E') of the composition:

$$E' = \left( \prod_{i=1}^n X_i' \right) \div 100^{n-1}$$

Formula 10

[00395] According to Formula 10, the expected percent of control (E') for the composition is calculated by dividing the product of the measured actual percent of control values ( $X_n'$ ) for each compound of the composition by  $100^{n-1}$ . The expected percent of control (E') of the composition is then compared to the measured actual percent of control (A') of the composition. If the actual percent of control (A') that is measured differs from the expected percent of control (E') as calculated by the Formula 10, then the difference is due to an interaction of the compounds. Thus, the composition has synergy (a positive interaction of the compounds) when  $A' < E'$ . Further, there is a negative interaction (antagonism) when  $A' > E'$ .

[00396] Example 3- Synergistic compositions as indicated by TyR binding inhibition

[00397] When the chemical(s) and compound(s) are combined to provide the compositions of the present invention, there is a synergistic effect. The efficacy for insect

control and the synergistic effect of compositions can be predicted and demonstrated in a variety of manners, for example, a competition binding assay can be used. With reference to Table 14, the percent TyrR binding inhibition affected by the following agents was determined using a competition binding assay: the natural ligand, Tyramine(TA); Blend 5; Blend 12; DM; Pyrethrum; 90:1 Blend 5 + DM; 9:1 Blend 5 + Pyrethrum; 90:1 Blend 12 + DM; and 9:1 Blend 12 + Pyrethrum.

<b>Table 14</b>	
Agent	% TyrR Binding Inhibition
Tyramine (TA)	75
Blend 5	30
Blend 12	60
DM	10
Pyrethrum	5
90:1 Blend 5 + DM	50
9:1 Blend 5 + Pyrethrum	60
90:1 Blend 12 + DM	60
9:1 Blend 12 + Pyrethrum	60

[00398] One example of an synergistic effect shown by this study is as follows: the insect control chemical, Pyrethrum, only has a 5% TyrR binding inhibition, and Blend 5 only has a 30% TyrR binding inhibition; however, when Pyrethrum and Blend 5 are combined, the TyrR binding inhibition increases to 60%, approaching that of the natural ligand.

**[00399] Example 4- Pesticidal effect against *Blattella germanica***

[00400] With reference to Table 15, the pesticidal effect against *Blattella germanica* (German cockroaches) was determined for DM, Blend 12, and the composition including DM and Blend 12. Treatment with DM alone resulted in an average knock down (KD) of the insects in 120 sec, and 100% killing of the insects in 15 minutes. Treatment with Blend 12 alone resulted in an average KD of the insects in 20 sec, and 100% killing of the insects in 5 minutes.

A synergistic effect was shown for the combination treatment that resulted in an average KD of the insects in 5 sec, and 100% killing of the insects in 55 seconds. The composition including Blend 12 and DM was shown to be effective and was shown to have a synergistic effect. Additionally, the above-described methods, including competition receptor binding assays, assessments of changes in cAMP, and assessments of changes in  $\text{Ca}^{2+}$ , are confirmed to be effective at predicting and demonstrating the synergistic effect of and the efficacy of the composition.

**TABLE 15: Efficacy of DM and Blend 12 against German cockroaches**

Chemicals	Bioactivity	
	KD	100% Kill
DM (0.037 mg/cm <sup>2</sup> ) (17 $\mu\text{l}$ of 16.99% formulated DM)	120 sec	15 min
Blend 12 (1.9 mg/cm <sup>2</sup> )	20 sec	5 min
Composition (1.9 mg/cm <sup>2</sup> ) (1 part DM: 9 parts Blend 12 (v/v))	5 sec	55 sec

**[00401] Example 5- Pesticidal effect against *Aedes aegypti***

**[00402]** With reference to Figure 4A, the pesticidal effect against *Aedes aegypti* was determined for Blend 23 (labeled “HL1”) and the composition including CL and Blend 23. Treatment with CL alone at 500ppm resulted in no KD of the target insect, however treatment with CL at 167ppm combined with 2.5% Blend 23 resulted in 100% KD. The composition including Blend 23 and CL was shown to be effective and was shown to have a synergistic effect.

**[00403]** Similarly, with reference to Figure 4B, the pesticidal effect against *Aedes aegypti* was determined for Blend 23 (labeled “HL1”) and the composition including CL and Blend 23. Treatment with CL alone at 250ppm resulted in no KD of the target insect, however

treatment with CL at 167ppm combined with 2.5% Blend 23 resulted in 100% KD. The composition including Blend 23 and CL was shown to be effective and was shown to have a synergistic effect.

**[00404]** Similarly, with reference to Figure 4C, the pesticidal effect against *Aedes aegypti* was determined for Blend 23 (labeled “HL1”) and the composition including Imidacloprid and Blend 23. Treatment with Imidacloprid alone at 250ppm resulted in 20% KD of the target insect at 30 seconds post-treatment, while treatment with 2.5% Blend 23 alone resulted in 40% KD of the target insect at 30 seconds post-treatment. However treatment with Imidacloprid at 250ppm combined with 2.5% Blend 23 resulted in 90% KD at 30 seconds post-treatment. The composition including Blend 23 and CL was shown to be effective and was shown to have a synergistic effect.

**[00405]** Similarly, with reference to Figure 4D, the pesticidal effect against *Drosophila sp.* was determined for Blend 23 (labeled “HL1”) and the composition including Imidacloprid and Blend 23. Treatment with Imidacloprid alone at 50ppm resulted in 0% KD of the target insect at 30 seconds post-treatment, while treatment with 2.5% Blend 23 alone also resulted in 0% KD of the target insect at 30 seconds post-treatment. However treatment with Imidacloprid at 50ppm combined with 2.5% Blend 23 resulted in 70% KD at 30 seconds post-treatment. The composition including Blend 23 and CL was shown to be effective and was shown to have a synergistic effect.

**[00406]** Example 6- Pesticidal effect against *Aedes aegypti*

**[00407]** With reference to Figure 5, the pesticidal effect against *Aedes aegypti* was determined for Blend 5 (labeled “B5028”) and the composition including Imidacloprid and B5028. Treatment with Imidacloprid alone at 500ppm resulted in no KD of the target insect, and

treatment with B5028 at 5% showed 10% KD of the target. However treatment with Imidacloprid at 500ppm combined with B5028 at 5% resulted in 100% KD. The composition including B5028 and CL was shown to be effective and was shown to have a synergistic effect.

**[00408] Example 6- Comparison of pesticidal effects**

**[00409]** Similarly, with reference to Table 16, the pesticidal effect against German cockroaches was determined for DM, Blend 5, and the composition including DM and Blend 5. Treatment with DM alone resulted in an average KD of the insects in 140 sec, and 100% killing of the insects in 12 minutes. Treatment with Blend 5 alone resulted in an average KD of the insects in 10 sec, and 100% killing of the insects in 45 seconds. A synergistic effect was shown for the combination treatment that results in an average KD of the insects in 5 sec, and 100% killing of the insects in 17 seconds. The composition including Blend 5 and DM was shown to be effective and was shown to have a synergistic effect. The above-described methods, including competition receptor binding assays, assessments of changes in cAMP, and assessments of changes in  $\text{Ca}^{2+}$ , were confirmed to be effective at predicting and demonstrating the synergistic effect of and the efficacy of the composition.

**TABLE 16: Efficacy of DM and Blend 5 against German cockroaches**

Chemicals	Bioactivity	
	KD	100% Kill
DM (0.037 mg/cm <sup>2</sup> ) (17 $\mu\text{l}$ of 16.99% formulated DM)	140 sec	12 min
Blend 5 (3.8 mg/cm <sup>2</sup> )	10 sec	45 sec
Composition (3.8 mg/cm <sup>2</sup> ) (1 part DM: 99 parts Blend 5 (v/v))	5 sec	17 sec

**[00410] Example 7- Comparison of pesticidal effects**

[00411] With reference to Table 17, the pesticidal effect against Darkling Beetles was determined for Pyrethrum, Blend 12, and the composition including Pyrethrum and Blend 12.

<b>TABLE 17 Efficacy of Pyrethrum and Blend 12 against Darkling Beetles</b>				
Test Material	% Mortality after Application by direct spray to Darkling Beetle			
	Day 1	Day 4	Day 8	Day 12
Vehicle Control (Water)	0 ± 0%	0 ± 0%	5 ± 7%	5 ± 7%
4% Blend 12	15 ± 5%	40 ± 13%	55 ± 10%	80 ± 0%
4% Pyrethrum	0 ± 0%	10 ± 10%	20 ± 19%	30 ± 28%
2% Blend 12 and 2% Pyrethrum	25 ± 13%	45 ± 17%	80 ± 14%	100 ± 0%**

Values displayed are the mean plus or minus the standard deviation for 4 replicates of 10 insects each, except vehicle control-(2 replicates of 10 insects each).

\*\* Significantly greater than all other values for mortality (P<0.001, 2 tail student t Test)

[00412] The synergistic effect can be altered by changing the specific combinations of ingredients or changing the specific ratios of ingredients.

**[00413] *Example 8- Pesticidal effect against Periplaneta americana***

[00414] With reference to Figure 6A, the pesticidal effect against *Periplaneta americana* was determined for Blend 23 (labeled “HL1”) and the composition including CL and Blend 23. Treatment with CL alone at 0.05% resulted in no mortality of the target insect at 30 minutes post-treatment, while treatment with Blend 23 at 5% resulted in 60% target mortality 30 minutes post-treatment. However treatment with CL at 0.05% combined with 5% Blend 23 resulted in 100% mortality 30 minutes post-treatment. The composition including Blend 23 and CL was shown to be effective and was shown to have a synergistic effect.

[00415] With reference to Figure 6B, the pesticidal effect against *Periplaneta americana* was determined for Blend 23 (labeled “HL1”) and the composition including Imidacloprid and Blend 23. Treatment with Imidacloprid alone (at 0.05%, 0.033%, and 0.01%) resulted in no

mortality of the target insect at 30 minutes post-treatment, while treatment with Blend 23 at 5% resulted in 60% target mortality 30 minutes post-treatment. However treatment with Imidacloprid at 0.033% combined with 5% Blend 23 resulted in 90% mortality 30 minutes post-treatment. The composition including Blend 23 and Imidacloprid was shown to be effective and was shown to have a synergistic effect.

**[00416] Example 9- Pesticidal effect against bed bugs**

[00417] Turning now to Figure 7 showing the pesticidal effect against bed bugs expressed as percent mortality as a function of time, the 1:1 ratio composition was shown to have a synergistic effect, when compared to the pesticidal effect of Blend 12 (labeled as "CL-4") or Pyrethrum alone. The pyrethrum alone did not achieve higher than about 30% mortality, and Blend 12 alone did not achieve higher than about 80% mortality. However, the 1:1 ratio composition including Blend 12 and Pyrethrum resulted in 100% mortality, as early as about 30 minutes after treatment, and had a residual effect lasting up to about 24 hours after treatment.

**[00418] Example 10- Synergistic combination of active ingredients with DM and Imidacloprid**

[00419] With reference to Table 18, the pesticidal effect against several insects was determined for Imidacloprid (a commercial pesticide rated as "moderately toxic" by the EPA, and requiring a "Warning" or "Caution" label), DM, Blend 2, Blend 5, and the composition including DM and Blend 2. Treatment with DM alone resulted in an average KD of the insects in 120 sec, and 100% killing of the insects in 15 minutes. The composition including Blend 2 and DM was shown to be effective and was shown to have a synergistic effect.

**TABLE 18: Interim Field Plot Ratings, South Georgia, August 1-6, 2007 (Insect counts)**

		Blend 2 percentage	Blend 5 percentage			
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Pest	Un-treated	0.75	1.5	3.0	0.75	1.5	3.0	DM + Blend 2	DM	Imidacloprid
Whitefly (on zucchini)										
Adult	20	27	30	21	20	21	14	17	18	16
Nymph	282	207	171	162	122	107	74	28	142	5
aphids (on cotton)										
Adults	61	50	25	18	37	23	16	7	15	0.3
Nymph	204	138	105	86	108	78	53	16	26	1.6
Thrips (on cotton)	22	24	18	12	20	13	9	6	13	9
Flower damage (1-5 rating scale; 1=no damage)	3.4	3.3	2.7	2.2	2.6	2.5	1.6	1.9	2.2	2.0
Ratings 1 wk after treatment. No phyto on cotton; dose related phyto on zucchini										

**[00420] Example 11- Repellency of target insects**

**[00421]** Adult insects are randomly selected for testing the repellent effect of test compositions. 5 insects per replicate are used. 3 replicates are used for each treatment. Untreated control tests are included with only solvent application to an equal-sized population/replications, held under identical conditions. Filter paper (about 80cm<sup>2</sup>) is treated with the test composition (about 100mg in 300ml acetone). After about 3 minutes of air drying, the filter paper is placed in a dish and insect repellency is evaluated. Insects are released to the dish, one insect at a time at the far end of the dish. Using one or more stopwatches, the time

spent on either the filter paper or the untreated surface of the dish is recorded up to about 300 seconds. Repellency ratio (RR) is calculated as follows:  $RR = [(time\ on\ control\ surface - time\ on\ treated\ surface)/total\ time\ of\ test]$ . If  $RR > 0$  the composition is considered to have a repellent effect, that is to say, an effect, wherein more insects are repelled away from treated surface than the control surface; if  $RR < 0$  the composition is considered to not have a repellent effect.

**[00422] Example 12- Repellent effect against *Aedes aegypti***

**[00423]** Approximately 250 female *Aedes aegypti* mosquitoes are introduced into a chamber containing 5 wells, each covered by a Baudruche membrane. Wells are filled with bovine blood, containing sodium citrate (to prevent clotting) and ATP (72mg ATP disodium salt per 26ml of blood), and heated to 37C. A volume of 25ul of isopropyl alcohol, containing test compositions is applied to each membrane.

**[00424]** After 5 min, 4 day-old female mosquitoes are added to the chamber. The number of mosquitoes probing the membranes for each treatment is recorded at 2 min intervals over 20 min.

**[00425] Example 13- Pesticidal effect against *Coptotermes formosanus***

**[00426]** Filter paper having a diameter of 80mm is placed in a cylindrical cup made of acrylic resin having a diameter of 80mm and a height of 60mm (i.e. a cup having a hole with a diameter of 10mm formed in the bottom and having hard plaster (Dental Stone) set at the bottom in a thickness of 10mm), and 1ml of a test composition containing a sample compound in a predetermined concentration, is dropped thereon. Nine *Coptotermes formosanus* (termite) workers and one termite soldier are released thereon. The cup is placed in a container having

wet cotton laid over the bottom, and the container is maintained at room temperature of 25C for 7 days, whereupon the mortality of termites in the cup is examined.

**[00427] Example 14- Pesticidal effect against *Coptotermes formosanus***

**[00428]** A solution containing a test compound in a predetermined concentration is coated by a paint brush in an amount of 110mg +/- 10mg on a rectangular wood block of Japanese red pine (20mm X 10mm X 10mm). The treated wood block is naturally dried in a dark room of 25C for 14 days. The treated wood block and a non-treated wood block are dried at a temperature of 60C for 72 hours, their weights (W.sub.1) are measured, and they are used as test specimens. A test specimen is put into a cylindrical cup made of acrylic resin (i.e. a cup having a hole with a diameter of 10mm formed in the bottom and having hard plaster (Dental Stone) set at the bottom in a thickness of 10mm), and 150 termite workers and 10 termite soldiers (*Reticulitermes speratus*) are released thereon. The cup is placed in a container having wet cotton laid over the bottom, and the container is maintained at room temperature of 25C for 24 days, whereupon the mortality of termites in the cup is examined. Further, the test specimen is taken out from the cup, and the deposited substance is removed from the surface of the test specimen. After drying at a temperature of 60C for 72 hours, it is weighed (W.sub.2), whereupon the mean weight loss is calculated.

**[00429] Example 15- Pesticidal effect against *Drosophila***

**[00430]** Two acetonnic solutions (about 1% and 10%) of a test composition are prepared. Test concentrations in acetone are then added to the inside of glass vials (about 5ml) that are marked to about 3cm above the bottom. The vials are rotated such that the inner surfaces of the vials, except the area between the marks to the neck, are left with a film of test composition. All vials are aerated for about 10 seconds to ensure complete evaporation of acetone before

introducing *Drosophila* to the treated vials. After complete evaporation of acetone, about 10 adult sex mixed flies are added to each vial and the vials are stoppered with cotton plugs.

Mortality is observed about 24 hours after exposure.

**[00431] Example 16- Pesticidal effect against ants**

**[00432]** 1g of powdered skim milk is treated with 1ml of test composition at a pre-determined concentration. Then, this composition is put into a cup together with wet cotton, and 15 ants (*Lasius japonicus*) are released. 4 days later, the mortality is examined.

**[00433] Example 17- Pesticidal effect against ants**

**[00434]** The repellent effect of various test compositions is tested by treating a filter paper with the test oils. After five minutes at room temperature, the paper is placed in a dish and ants are introduced one at a time. The repellency is determined as described above. Oils are tested alone and are mixed with pesticidal compounds or products to form compositions that are then tested.

**[00435] Example 18- Repellent effect of test compositions vs. DEET**

**[00436]** For purposes of comparing the repellent effect of various test compositions, the repellency of the commercial repellent 29% DEET, that can be purchased under the name, REPEL® (Wisconsin Pharmacal Company, Inc, Jackson, WY), is measured against Carpenter ants by treating a filter paper with the 29% DEET. After five minutes at room temperature, the paper is placed in a dish and ants are introduced one at a time. The repellency is determined as described above.

**[00437] Example 19- Pesticidal effect against *Pediculus humanus capitus***

[00438] Live adult *Pediculus humanus capitatus* (head lice) are collected from female and male children between the age of about 4 and 11. The insects are collected using fine-toothed louse detector comb and pooled together. The collected lice are kept in dishes and used in the studies within about 30 minutes of their collection.

[00439] Various concentrations of the compositions being tested are prepared in water. To allow the pesticidal effect of these compositions to be compared to that of a commercially available lice-killing agent, ivermectin, is dissolved in water. About 1ml of each concentration of the compositions is applied to a dish, about 1ml of the ivermectin solution is applied to a dish, and about 1ml of water is applied to a control dish. 10 adult head lice are introduced to each dish.

[00440] Treated and control dishes are kept under continuous observation and LT<sub>100</sub> is observed. LT refers to the time required to kill a given percentage of insects; thus, LT<sub>100</sub> refers to the time required to kill 100% of the lice. Head lice is considered dead if no response to a hard object is found.

[00441] Example 20- Pesticidal effect against mosquito larvae

[00442] Four small ponds are used for test locations and floating boom dividers are used to further subdivide the ponds into five test areas. An initial survey of the test areas is conducted for both aquatic insects and vegetation. Insects are sampled using dip nets within two meters of the shore within the emergent vegetation, which produces ideal mosquito habitat. 96% of the mosquito larvae were present within one meter of the shore. Plots are sampled and large numbers of larvae are observed.

[00443] Test plots are treated with compositions comprising the blends listed in Table 7 and commercial pesticide products. After 24 hours the plots are sampled again.

[00444] Example 21- Repellent effect against *Aedes aegypti*

[00445] 0.7 grams of each test composition is applied to the forearms of three male subjects. The subjects then insert their forearms into 25cm X 25cm X 40cm cheesecloth-covered wire cages containing approximately 500 seven-to-ten-day-old mixed sex *Aedes aegypti* mosquitoes. Assessments are conducted for three minutes per arm commencing immediately after the application of the formulation thereto, and every hour thereafter until a confirmed bite is recorded. A confirmed bite is defined as more than one bite in a given exposure period or one bite in each of two consecutive exposure periods. A 15 second pre-treatment exposure of an untreated forearm is conducted for each subject at the beginning of each day of testing.

[00446] The data are analyzed using two-way analysis of variance with treatment means separated using least significant difference techniques.

[00447] Example 22- Repellent effect against Western Black-legged ticks

[00448] To determine the efficacy of test compounds as a tick repellent, a test subject's hands are treated with a test composition while the fingers of the hand are left untreated. As a positive control, Ultrathon™ (3M, Minneapolis, Minn.) is applied to the hand and the fingers are left untreated. An untreated hand is used as a negative control. Unfed nymphal Western Black-legged ticks are placed on the fingers of the hands and observed as they climbed toward the treated or untreated skin of the hand. Ticks crossing onto the treated skin are scored as "crossing." Those not crossing were scored as "repelled." Ticks are removed after a single score is recorded. Repellency is calculated as the proportion of all trials in which a tick is repelled.

For example, 8 repels in 10 trials provides a repellency of 80%. In this study, each subject tests a tick at 15 minute intervals for 2 hours and 15 minutes.

**[00449] Example 23- Repellent effect against *Aedes aegypti***

**[00450]** To determine if test compositions would enhance the mosquito repelling effect of DEET, the repellent activity of test compositions alone and compositions comprising test compositions and DEET were compared to a positive control, Ultrathon™ (3M, Minneapolis, Minn., approximately 31% DEET).

**[00451]** In the first study, three subjects receive applications of test compositions, to one subject is applied Ultrathon™, and two subjects serve as negative controls. Composition applications are evenly divided among leg and arm surfaces. The total area of treated surfaces are calculated for each subject in advance of the application.

**[00452]** Test subjects count and record bites in a series of 10 minute periods. Counts are recorded on data sheets. In this test, the testing period was two hours, with 12 consecutive 10 minute recording periods.

**[00453]** Ambient biting rates are measured throughout the study by the subjects with untreated control limbs. Total bites are recorded.

**[00454] Example 23- Repellent effect against *Ceratopogonid* Biting Flies**

**[00455]** To determine the efficacy of test compositions as biting insect repellents, eight human subjects take part in an experiment wherein three subjects are treated with a test composition. Three other subjects serve as negative controls (untreated skin), while two positive control subjects are treated with two commercially available insect repellents, Ultrathon™, a DEET-based repellent, and Treo™, a plant-based repellent. Testing is conducted at various sites.

[00456] The test materials are applied either to the lower arm or lower leg skin of the study subjects. The areas of treated skin surfaces are calculated for each subject in advance of the application. Applications of the test materials are made at various concentrations. Positive control subjects are treated with Ultrathon™ and Treo™ at the recommended concentrations.

[00457] Each test subject records the number of bites received by ceratopogonid biting flies on treated or control surfaces during sequential sampling periods that begin every 10 minutes, with the overall test duration being approximately 1 hour.

[00458] Example 24- Repellent effect against *Aedes vexans*

[00459] Tests are conducted in the outdoors in an area where the predominant species of mosquito is *Aedes vexans*, an aggressive biting insect. Tests are performed in the summer months in the early afternoon (1430-1630 hours, Test 1) and in the late afternoon/early evening (1515-1915 hours, Test 2). In two separate tests, four subjects in total apply a test composition to one lower arm. The other lower arm of each subject is untreated and serves as a control. Total mosquito bites are counted and the resulting data is analyzed.

[00460] Example 25- Repellent effect against *Musca domestica* L.(Diptera: Muscidae)

[00461] A study is conducted to evaluate the efficacy of candles (designated as "A", "B" and "C") containing test compositions in repelling house flies.

[00462] Candle "A" contains 95% Paraffin Wax and 5% of a test composition.

[00463] Candle "B" contains 90% Paraffin Wax and 10% of a test composition.

[00464] Candle "C" contains only Paraffin Wax.

[00465] The evaluation is conducted in a 28.3 cubic meter chamber with airing ports. A screened cage measuring 15cm X 15cm X 47.5cm is attached inside an upper airing port, and a

screened repellency observation cage measuring 15cm X 15cm X 32.5cm is attached outside the upper airing port. The two cages are held together by a Masonite plate that fits firmly in the airing port. A 4cm hole located in the center of each Masonite plate provides an escape for the test insects. A barrier is used to close the hole.

[00466] A caged mouse is used as an attractant and is placed inside the chamber in the larger section of the repellency cage. *Musca domestica L.* (adult house flies) are used as test insects.

[00467] The candles are allowed to burn for 20 minutes and the number of house flies and mosquitoes repelled is recorded for the next 60 minutes with the following equipment and procedure.

[00468] For each replicate, 75 to 100 adult house flies are removed from the rearing cage by means of a vacuum aspirator, and transferred by carbon dioxide anesthesia to the inner cage containing the mouse. The assembled cage is placed in one of the upper ventilation ports of the chamber. For each experimental situation the test insects are transferred to a clean cage containing the mouse. A house fly candle is placed centrally on the chamber floor and burned for 20 minutes before initiating the repellency counts. The maximum period for the repellency counts is 60 minutes. The first repellency count is made at 10 minutes after the burning ends, and subsequent counts are taken at 5-minute intervals thereafter. The number of house flies repelled are those escaping to the outside cage. For the control, counts are made in a similar manner, but no candle is burned.

[00469] The same three candles are used for all four replicates. Between replicates the chamber is exhausted, the Kraft paper flooring for the chamber is replaced, and the two screened repellency cages are submerged in hot detergent water, rinsed and dried.

**[00470] Example 26- Metamorphosis inhibition effect against *Nilaparvata lugens***

[00471] Test compositions are provided at appropriate concentrations. Compositions are sprayed onto rice plants cultivated in polyethylene cups at a rate of 20ml per every 2 pots on a turning table. After air-drying, the plants are infested with about ten 3rd instar nymphs of *Nilaparvata lugens* (brown rice planthopper). After 10 days, the number of normal adults is counted to obtain an emergence inhibitory rate.

**[00472] Example 27- Reproduction inhibition effect against *Nephrotettix cincticeps***

[00473] Test compositions are provided at appropriate concentrations. Compositions are sprayed onto rice plants (about 20cm in height) cultivated in plastic pots at a rate of 40ml per every 2 pots on a turning table. After air-drying, the pots are covered with wire cages, and 10 male and 10 female adults of *Nephrotettix cincticeps* (green rice leafhopper) are released in each of the cages. After 3 weeks, the number of nymphs is counted to obtain a reproduction inhibitory rate.

**[00474] Example 28- Reproduction inhibition effect against *Nilaparvata lugens***

[00475] Test compositions are provided at appropriate concentrations. Compositions are sprayed onto rice plants (about 20 cm in height) cultivated in plastic pots at a rate of 40ml per every2 pots on a turning table. After air-drying, the pots are covered with wire cages, and each 5 female and male adults of brown rice planthopper (*Nilaparvata lugens*) are released in each of the cages. After 3 weeks, the number of nymphae are counted to obtain a reproduction inhibitory rate.

**[00476] Example 29- Repellent effect against mosquitos**

[00477] The tendency of mosquitoes to rest upon cloth surfaces when not feeding is used to evaluate the insect repellency of test compounds. Lab-bred mosquito pupae are transferred to test chambers prepared from cardboard boxes (45cm X 30cm X 30cm). To permit observation and allow for ventilation, the top of box is removed and covered with mosquito netting. Access to the interior of the chamber is provided by two holes (10cm diameter) cut into the front face of the box and covered with mosquito netting. The inner surface of the chambers is lined with muslin cloth that serves as the resting surface for the mosquitos.

[00478] To measure the repellency of the test compounds and mixture thereof, two opposing walls of the experimental chambers are treated with solvent and the remaining two walls are treated with test compounds or DEET, either alone or as a mixture. The test compounds are applied uniformly over the cardboard surface. After drying for four hours, 100 mosquitoes are introduced into the test chamber. An observer notes at appropriate times the location of the resting mosquitoes. Repellent effect is defined as the length of time before mosquitoes began resting on the repellent treated surface (i.e., days of 100% repellency).

[00479] Example 30- Repellent effect against flies

[00480] To measure the efficacy of the test compositions as fly repellents, vinyl floor tiles (25cm<sup>2</sup>) are treated uniformly with either 2ml solvent or 2ml test composition or mixtures of MNDA or DEET dissolved in isopropyl alcohol to yield a final concentration of 2%. The tiles are placed onto a glass plate located inside test chambers identical to those used to measure mosquito repellency. A food source in a small dish is placed on top of each tile. The experiment is initiated by introducing 100 flies into the test chamber. An observer notes at appropriate times the feeding location of the flies. Repellent effect is defined as the length of time the flies stay away from the tile treated with the repellent compound(s).

**[00481] Example 31- Pesticidal effect against *Spodoptera littoralis*, *Dysdercus fasciatus* and *Heliothis virescens***

**[00482]** Cotton plants are sprayed with appropriate concentrations of a test compound.

After drying of the coating, larvae of the species *Spodoptera littoralis* (L3 stage), *Dysdercus fasciatus* (L4) and *Heliothis virescens* (L3), respectively, are settled on the plants. Two plants are used for each test compound and for each test species, and an assessment of the destruction of larvae is made 2, 4, 24 and 48 hours after commencement of the test. The tests are carried out at 24C with 60% relative humidity. Total insect mortality is recorded.

**[00483] Example 32- Pesticidal effect against *Myzus persicae***

**[00484]** Plants (*Vicia fabae*) grown in water are each infested, before the commencement of the test, with about 200 individuals of the species *Myzus persicae*. Three days later, the plants treated in this manner are sprayed from a distance of 30cm until dripping wet with a solution containing 10 and 1 ppm, respectively, of the compound to be tested. Two plants are used for each test compound and for each concentration, and an evaluation of the attained degree of destruction of the insects is made after a further 24 hours.

**[00485] Example 33- Pesticidal effect against *Aphis craccivora***

**[00486]** Rooted bean plants are transplanted into pots containing 600cc of soil, and subsequently 50ml of a solution of the test composition at an appropriate concentration is poured directly onto the soil. After 24 hours, lice of the species *Aphis craccivora* are settled onto the parts of the plants above the soil, and a plastic cylinder is placed over each plant in order to protect the lice from a possible contact or gas effect of the test composition. Evaluation of the lice viability is made 24 and 48 hours after commencement of the test. Two plants, each in a

separate pot, are used for each concentration dose of test composition. The test is carried out at 25C with 70% relative humidity.

**[00487] Example 34- Pesticidal effect against *Aulocara elliotti***

**[00488]** Grasshoppers (*Aulocara elliotti* (Thomas)) are collected as nymphs and as young adults at a wild population site and divided into groups with three pairs of nymphs maintained per cage until they become adults. The adults are separated, one pair to a cage and are maintained under hot temperatures that fluctuate diurnally from 24C-29.5C. The growing host plant, western wheatgrass, is transplanted from a field site onto tables in a greenhouse where it is maintained under hot temperatures that alternate diurnally from 24C-29.5C.

**[00489]** Twice each week grasshopper pairs are fed the greenhouse grass that is freshly cut on the morning of the feeding day and then treated with a test composition prepared according to the present invention. The feedings are continued until all grasshoppers are dead. The number of eggs laid and the number of viable eggs are recorded throughout the lifetime of each female grasshopper.

**[00490]** The freshly cut greenhouse grass is treated with the test composition by dipping the grass leaves in the composition and then letting the cut ends stand in the same solution for about 4 hours. Individual feeding vials are assembled by wrapping cut grass with a urethane foam strip about one inch in diameter and then fitting the bundle of cut grass into a plastic pill vial. The cut grass is then watered with the test composition, and as this composition evaporates or is taken up by the grass, the vial is rewatered with distilled water. These conditions are maintained throughout the lifetime of each female grasshopper.

**[00491] Example 35- Aerial application of insect control compositions**

**[00492]** Aerial application platforms (helicopters and fixed wing) are used to apply appropriate concentrations of insect control compositions. Applications are made uniformly over the entire crop, ensuring that the aircraft is utilizing the optimum swath width. Areas that cannot be effectively treated by aircraft are not planted. The optimum application height for the composition is determined by methods known in the art and then utilized; turbine aircraft are generally operated with the spray boom 10-12 feet above the crop canopy. Other release heights may reduce pattern uniformity and increase drift potential.

**[00493]** Spraying during the heat of the day is avoided if possible; as more radiant energy is absorbed into the crop canopy, it becomes more difficult to pass the smaller droplets through the strong micro-inversion layer that forms at the top of the crop.

**[00494]** Appropriate spray nozzles are determined by methods known in the art and then utilized; nozzles that make as few droplets as possible below 200 $\mu$  (microns) are often preferred. Droplet spectrums should be targeted in the 285-335 VMD (volumetric median diameter – where ½ of the spray volume is that size or larger and ½ of the spray volume is that size or smaller) range. Droplet spectrum is an important aspect of these applications and should be carefully adjusted with nozzle selection, operating pressure and mounting configuration. Software models are available to help determine the expected droplet spectrum.

**[00495]** Almost all applications can be enhanced with wind, particularly application crosswinds, to help mix the material down into the lower portions of the canopy. Turbine powered, faster aircraft, generally have more uniform patterns, though it may be more difficult for faster aircraft to work around some obstructions. Total spray volume per acre will be somewhat dependent on crop canopy structure. The use of adjuvants and surfactants may be

beneficial as spreaders and stickers. Care should be taken to avoid major droplet spectrum changes when these products are being utilized. If multiple applications are made, utilize different travel lanes or go in the opposite direction to move droplets into the canopy at different angles.

**[00496] Example 36- Composition effect on insect mortality**

**[00497]** A formulation containing 0.75% of Blend 24 (also designated B-5001) and 1.4 ounces of Deltamethrin per gallon (7 ounces of Deltamethrin per planted acre) is prepared (“Combined Formulation A”). Cotton plants of variety DPL555RRBR are planted in an outdoor field in a location suitable for cotton cultivation. The formulation is applied to the plants by spraying, using a backpack system employing TSX-8 cones at a nozzle pressure of 60 psi. Three applications of the formulation are made, at 9, 16, and 23 days post-planting. The temperature during these applications is between 80 and 100 degrees Fahrenheit. 5 gallons of the formulation are applied per acre. For comparison purposes, three other formulations are applied in a similar manner to cotton plants of the same variety planted at the same location and under the same conditions. The first formulation contains, as its active ingredient, only 0.75% of Blend 24 (“Blend 24 Formulation A”), the second formulation contains only 1.4 ounces of Deltamethrin per gallon (i.e., 7 ounces of Deltamethrin per acre) (“Deltamethrin Formulation A”), and the third formulation contains 1.24 ounces per gallon of the commercial insecticide Provado® (i.e., 6.2 ounces of Provado® per acre) (“Provado® Formulation A;” active ingredient: imidacloprid, 1-[(6-Chloro-3-pyridinyl)methyl]-N-nitro-2-imidazolidinimine) available from Bayer CropScience (Research Triangle Park, NC). Furthermore, no formulation is applied to control plants.

[00498] The presence of Western flower thrip (*Frankliniella occidentis*) adults and nymphs on the plant leaves is assessed at, for example, 10 days and 17 days post-planting. Feeding damage is assessed at 10 days post-planting. Tobacco thrips, if also present, are not segregated.

[00499] At any of these points, or after one, two, or three applications of each formulation, plants to which Combined Formulation A was applied exhibit an *F. occidentis* adult or nymph count that is significantly lower than that of plants treated with Blend 24 Formulation A, Deltamethrin Formulation A, or Provado® Formulation A. The feeding damage observed at 10 days after planting is also lower for the plants treated with Combined Formulation A than for those treated with Blend 24 Formulation A, Deltamethrin Formulation A, or Provado® Formulation A.

[00500] Furthermore, the presence of cotton aphid (*Aphis gossypii*) adults or nymphs on the plant leaves is assessed at, for example, 17 days and 24 days post-planting.

[00501] At either of these points, or after one, two, or three applications of each formulation, the plants treated with Combined Formulation A exhibit an *A. gossypii* adult or nymph count that is significantly lower than that of plants treated with Blend 24 Formulation A, Deltamethrin Formulation A, or Provado® Formulation A.

[00502] Example 37-Composition effect on insect mortality

[00503] Combined Formulation A, Blend 24 Formulation A, Deltamethrin Formulation A, and Provado® Formulation A are prepared as described above. Cotton plants of variety DPL555RRBR are planted in an outdoor field in a location suitable for cotton cultivation. The formulations are applied to the plants by spraying, using a backpack system employing TSX-8

cones at a nozzle pressure of 60 psi. Two applications of the formulation are made, at 76 and 84 days post-planting. The temperature during these applications is within a range of 80-100 degrees Fahrenheit. 5 gallons of the formulations are applied per acre.

[00504] The presence of cotton aphids (*Aphis gossypii*) adults and nymphs on the plant leaves is assessed at 84, 91, and 98 days post-planting. At any of these points, or after one or two or more applications of each formulation, plants to which Combined Formulation A was applied exhibit an *A. gossypii* adult or nymph count that is significantly lower than that of plants treated with Blend 24 Formulation A, Deltamethrin Formulation A, or Provado® Formulation A.

[00505] Furthermore, the presence of whitefly (*Bemisia tabaci*) adults and nymphs on the plant leaves is assessed at 91 days and 98 days post-planting. At any of these points, or after one or two or more applications of each formulation, plants to which Combined Formulation A was applied exhibit an *B. tabaci* adult or nymph count that is significantly lower than that of plants treated with Blend 24 Formulation A, Deltamethrin Formulation A, or Provado® Formulation A.

**[00506] Example 38- Composition effect on insect mortality**

[00507] A formulation containing 0.75% of Blend 24 (also designated B-5001) and 0.35 ounces of Deltamethrin per gallon (7 ounces of Deltamethrin per planted acre) is prepared (“Combined Formulation B”). Zucchini plants, variety “Yellow Crook Neck,” are planted in an outdoor field in a location suitable for *zucchini* cultivation. Four replications are undertaken. The formulation is applied to the plants by spraying, using a backpack system employing XR8002 nozzles at a nozzle pressure of 42 psi. Three applications of the formulation are made, at 17, 24, and 31 days post-planting. The temperature during these applications is within a range of 80-100 degrees Fahrenheit. 20 gallons of the formulation are applied per acre. For

comparison purposes, three other formulations are applied in a similar manner to zucchini plants of the same variety planted at the same location and under the same conditions. The first formulation contains, as its active ingredient, only 0.75% of Blend 24 (“Blend 24 Formulation B”), the second formulation contains only 0.35 ounces of Deltamethrin per gallon (i.e., 7 ounces of Deltamethrin per acre) (“Deltamethrin Formulation B”), and the third formulation contains 0.31 ounces per gallon of the commercial insecticide Provado® (i.e., 6.2 ounces of Provado® per acre) (“Provado® Formulation B;” active ingredient: imidacloprid, 1-[(6-Chloro-3-pyridinyl)methyl]-N-nitro-2-imidazolidinimine) available from Bayer CropScience (Research Triangle Park, NC). Furthermore, no formulation is applied to control plants.

**[00508]** None of the formulations show significant phytotoxicity at 24 or 33 days after planting, although formulations containing higher concentrations of either Blend 24 or Blend 5 (1.5% and 3.0%) do show phytotoxicity at these points.

**[00509]** Damage to the plants from leaf miners (*Liriomyza sp.*) is assessed at 24 days and 32 days post-planting. At either of these points, or after one or two or more applications of each formulation, plants treated with Combined Formulation B exhibit significantly less damage from leaf miners than plants treated with Blend 24 Formulation B, Deltamethrin Formulation B, or Provado® Formulation B.

**[00510]** The severity of powdery mildew (*Erysiphe sp.*) in the treated plants is assessed at, for example, 24 days after planting. At this point, or after one or two or more applications of each formulation, the severity is significantly lower in the plants treated with Combined Formulation B than in plants treated with Blend 24 Formulation B, Deltamethrin Formulation B, or Provado® Formulation B.

[00511] The presence of whitefly (*Bemisia tabaci*) adults and nymphs on the plant leaves is assessed at 24 days and 32 days post-planting. At either of these points, or after one or two or more applications of each formulation, the plants treated with Combined Formulation B exhibit a *B. tabaci* adult or nymph count that is significantly lower than that in the plants treated with Blend 24 Formulation B, Deltamethrin Formulation B, or Provado® Formulation B.

[00512] Example 39- Composition effect on insect mortality

[00513] A formulation containing 0.75% of Blend 24 (also designated B-5001) and 0.093 ounces of Deltamethrin per gallon (7 ounces of Deltamethrin per planted acre) is prepared (“Combined Formulation C”). Tomato plants, variety FL-47, are planted in an outdoor field in a location suitable for tomato cultivation. 4 replications are undertaken. The formulation is applied to the plants by spraying, using a backpack system employing a disk cone at a nozzle pressure of 42 psi. Five applications of the formulation are made, at 2 days pre-planting, and 8, 14, 21, and 28 days post-planting. The temperature during these applications is within a range of 80-100 degrees Fahrenheit. 75 gallons of the formulation are applied per acre. For comparison purposes, three other formulations are applied in a similar manner to tomato plants of the same variety planted at the same location and under the same conditions. The first formulation contains, as its active ingredient, only 0.75% of Blend 24 (“Blend 24 Formulation C”), the second contains only 0.093 ounces of Deltamethrin per gallon (i.e., 7 ounces of Deltamethrin per acre) (“Deltamethrin Formulation C”), and the third contains 0.0826 ounces per gallon of the commercial insecticide Provado® (i.e., 6.2 ounces of Provado® per acre) (“Provado® Formulation C;” active ingredient: imidacloprid, 1-[(6-Chloro-3-pyridinyl)methyl]-N-nitro-2-imidazolidinimine) available from Bayer CropScience (Research Triangle Park, NC). Furthermore, no formulation is applied to control plants.

[00514] The presence of Western flower thrip (*Frankliniella occidentis*) adults and nymphs on the plant leaves is assessed at 28 days and 35 days post-planting. At either of these points, or after one or two or more applications of each formulation, the *F. occidentis* adult or nymph counts are significantly lower in the plants treated with Combined Formulation C than in plants treated with Blend 24 Formulation C, Deltamethrin Formulation C, or Provado® Formulation C.

[00515] Furthermore, the presence of sweet potato whitefly (*Bemisia inconspicua*) adults and nymphs on the plant leaves is assessed at 8, 14, 21, 28, and 35 days post-planting. At one or more of these points, or after one or two or more applications of each formulation, the *B. inconspicua* adult or nymph counts are significantly lower in the plants treated with Combined Formulation C than in plants treated with Blend 24 Formulation C, Deltamethrin Formulation C, or Provado® Formulation C.

**[00516] Example 40- Composition effect on insect mortality**

[00517] Combined Formulation B, Blend 24 Formulation B, Deltamethrin Formulation B, and Provado® Formulation B are prepared as described above. Soybean plants, variety "Pritchard," are planted in an outdoor field in a location suitable for soybean cultivation. 4 replications are conducted. Each formulation is applied to the plants by spraying, using a backpack system employing XR8002 nozzles at a nozzle pressure of 42 psi. Four applications of the formulations are made, at 83, 90, 97, and 111 days post-planting. The temperature during these applications is between 80 and 100 degrees Fahrenheit. 20 gallons of the formulation are applied per acre. The presence of cotton aphids (*Aphis gossypii*) adults and nymphs on the plant leaves is assessed at 90, 97, 111, 118, and 125 days post-planting. At one or more of these points, or after one or two or more applications of each formulation, the *A. gossypii* adult or

nymph counts are significantly lower in the plants treated with Combined Formulation B than in plants treated with Blend 24 Formulation B, Deltamethrin Formulation B, or Provado® Formulation B.

**[00518] Example 41- Composition effect on insect mortality**

**[00519]** A granular formulation containing 1% of Blend 41 (also designated B-5028) and a standard amount of the commercial insecticide Aloft™ (active ingredients: bifenthrin and clothianidin, available from Arysta LifeScience, Cary NC) is prepared (“Combined Formulation D”). Field tests are conducted on turf growing in an outdoor field. The formulation is applied to the turf either by hand sprinkling or by using a disk cone at 131 gpa and a pressure of 25 psi. Irrigation equivalent to one-half inch rain is immediately incorporated after sprinkling. One application of the formulation is made, at a temperature of 94 degrees Fahrenheit, at 50% relative humidity, and at a soil temperature of 88 degrees Fahrenheit. For comparison purposes, three other formulations are applied in a similar manner to turf of the same variety under the same conditions. The first formulation contains, as its active ingredient, only 1% granular Blend 41 (“Blend 41 Formulation D”), the second contains only the standard amount of Aloft™ (“Aloft™ Formulation D”), and the third contains 2 lb/acre of the commercial insecticide Merit® (“Merit® formulation D;” active ingredient: 0.5% imidacloprid, 1-[(6-Chloro-3-pyridinyl)methyl]-N-nitro-2-imidazolidinimine) available from Bayer CropScience (Research Triangle Park, NC). Furthermore, no formulation is applied to control turf.

**[00520]** The presence of Japanese beetles (*Popillia japonica*) is assessed at 51 days after application of the formulations. At one or more of these points, or after one or two or more applications of each formulation, turf treated with Combined Formulation D exhibits a P.

japonica count that is significantly lower than the count obtained from turf treated with Blend 41 Formulation D, Aloft™ Formulation D, or Merit® Formulation D.

**[00521]** Additionally, single active ingredients such as essential oils may be combined with pest control chemicals such as those listed above to produce synergistic or additive effects, as in the following examples.

**[00522]** *Example 42 - Preparation of stably transfected Schneider Cell lines with tyramine receptor (TyrR)*

**[00523]** A. PCR Amplification and Subcloning *Drosophila melanogaster* Tyramine Receptor.

**[00524]** Tyramine receptor is amplified from *Drosophila melanogaster* head cDNA phage library GH that is obtained through the Berkeley Drosophila Genome Project (Baumann, A., 1999, *Drosophila melanogaster* mRNA for octopamine receptor, splice variant 1B NCBI direct submission, Accession AJ007617). The nucleic acid sequence and the peptide sequence of TyrR are set forth in Figures 8A and 8B. Phage DNA is purified from this library using a liquid culture lysate. (Baxter, et al., 1999, *Insect Biochem Mol Biol* 29, 461-467). Briefly, oligonucleotides that are used to amplify the open reading frame of the *Drosophila* tyramine receptor (TyrR) (Han, et al., 1998, *J Neurosci* 18, 3650-3658; von Nickisch-Rosenegk, et al., 1996, *Insect Biochem Mol Biol* 26, 817-827) consist of the 5' oligonucleotide: 5'gccgaattcgccaccATGCCATCGGCAGATCAGATCCTG 3' and 3' oligonucleotide: 5'taatctagaTCAATTCAGGCCAGAAGTCGCTT 3'. Capitalized letters match the tyramine receptor sequence. An added Kozak sequence (Grosmaire, X., Jacquin-Joly, E., 2001 *Mamestra brassicae* putative octopamine receptor (OAR) mRNA, complete cds. NCBI direct submission, Accession AF43878) is indicated by underlined nucleotides. The 5' oligonucleotide also

contains an EcoR I site and the 3' oligonucleotide a Xba I site. The PCR is performed using Vent polymerase (New England Biolabs) with the following conditions: about 95°C., about 5 min for about 1 cycle; about 95°C., about 30 sec; and about 70°C., about 90 sec for about 40 cycles and about 70°C., about 10 min for about 1 cycle.

**[00525]** The PCR product is digested with EcoR I and Xba I, subcloned into pCDNA 3 (Invitrogen) and sequenced on both strands by automated DNA sequencing (Vanderbilt Cancer Center). When this open reading frame is translated to protein, it is found to correctly match the published tyramine receptor sequence (Saudou, et al., The EMBO Journal vol 9 no 1, 6-617). For expression in *Drosophila* Schneider cells, the TyrR ORF is excised from pCDNA3 and inserted into pAC5.1/V5-His(B) [pAc5(B)] using the Eco RI and Xba I restriction sites.

**[00526]** For transfection, *Drosophila* Schneider cells are stably transfected with pAc5(B)-TyrR ORF using the calcium phosphate-DNA coprecipitation protocol as described by Invitrogen Drosophila Expression System (DES) manual. The precipitation protocol is the same for either transient or stable transfection except for the use of an antibiotic resistant plasmid for stable transfection. At least about ten clones of stably transfected cells are selected and separately propagated. Stable clones expressing the receptors are selected by whole cell binding/uptake using <sup>3</sup>H-tyramine. For this assay, cells are washed and collected in insect saline (170 mM NaCl, 6 mM KCl, 2 mM NaHCO<sub>3</sub>, 17mM glucose, 6 mM NaH<sub>2</sub>PO<sub>4</sub>, 2 mM CaCl<sub>2</sub>, and 4 mM MgCl<sub>2</sub>). About 3 million cells in about 1mL insect saline are incubated with about 4 nM <sup>3</sup>H-tyramine at about 23°C. for about 5 minutes. Cells are centrifuged for about 30 seconds and the binding solution is aspirated. The cell pellets are washed with about 500µL insect saline and the cells are resuspended and transferred to scintillation fluid. Nonspecific binding is determined

by including about 50 $\mu$ M unlabeled-tyramine in the reaction. Binding is quantified counting radioactivity using a using a Liquid Scintillation  $\beta$ -counter (Beckman, Model LS1801).

**[00527] B. Selection of Clones Having the Highest Level of Functionally Active Tyramine Receptor Protein.**

**[00528]** Tyramine receptor binding/uptake is performed to determine which of the transfected clones have the highest levels of functionally active tyramine receptor protein. There are about 10 clonal lines for tyramine receptor and about 2 pAc(B) for control.  $^3$ H-tyramine (about 4nM/reaction) is used as a tracer, with and without about 50 $\mu$ M unlabeled tyramine as a specific competitor. For this assay, cells are grown in plates and are collected in about 3ml of medium for cell counting and the number of cells is adjusted to about  $3 \times 10^6$  cells/ml. About two pAcB clones are used in parallel as controls. About 1ml cell suspension is used per reaction. Based on specific binding, about 3 clones express a high level of active tyramine receptor protein. The clone having the highest specific tyramine receptor binding (about 90%), is selected for further studies. The selected clone is propagated and stored in liquid nitrogen. Aliquot of the selected clone are grown for whole cell binding and for plasma membrane preparation for kinetic and screening studies. The control pAcB does not demonstrate any specific binding for the tyramine receptor.

**[00529] C. Efficacy of Schneider Cells Transfected with Tyramine Receptor for Screening Compositions for Tyramine Receptor Interaction.**

**[00530]** Cells transfected with the tyramine receptor (about  $1 \times 10^6$  cells/ml) are cultured in each well of a multi-well plate. About 24 hours after plating the cells, the medium is withdrawn and replaced with about 1ml insect saline (about 23C). Different concentrations of  $^3$ H-tyramine (about 0.1-10 nM) are added with and without about 10 $\mu$ M unlabeled tyramine and

incubated at room temperature (RT). After about a 20 minute incubation, the reaction is stopped by rapid aspiration of the saline and at least one wash with about 2 ml insect saline (about 23C). Cells are solubilized in about 300 $\mu$ l 0.3M NaOH for about 20 min at RT. Solubilized cells are transferred into about 4ml Liquid Scintillation Solution (LSS) and vigorously vortexed for about 30 sec before counting the radioactivity using a Liquid Scintillation  $\beta$ -counter (Beckman, Model LS1801) (LSC).

**[00531]** Receptor specific binding data is expressed as fmol specific binding per 1 $\times$ 10<sup>6</sup> cells and measured as a function of  $^3$ H-tyramine concentration. Specific binding values are calculated as the difference between values in the absence of and values in the presence of about 10 $\mu$ M unlabeled tyramine. The maximum specific binding occurs at about 5nM  $^3$ H-tyramine. Untransfected cells do not respond to tyramine at concentrations as high as about 100 $\mu$ M.

**[00532]** To study the kinetics of the tyramine receptor in stably transfected cells with pAcB-TyrR, crude membrane fractions are prepared from the transfected cells and used to calculate the equilibrium dissociation constant (K<sub>d</sub>), Maximum Binding Capacity (B<sub>max</sub>), equilibrium inhibitor dissociation constant (K<sub>i</sub>) and EC<sub>50</sub> (effective concentration at which binding is inhibited by 50%). A preliminary study to determine the optimum concentration of membrane protein for receptor binding activity is performed. In this study, different concentrations of protein (about 10-50 $\mu$ g/reaction) are incubated in about 1ml binding buffer (50mM Tris, pH 7.4, 5mM MgCl<sub>2</sub> and 2mM ascorbic acid). The reaction is initiated by the addition of about 5nM  $^3$ H-tyramine with and without about 10 $\mu$ M unlabeled tyramine. After about 1 hr incubation at room temperature, reactions are terminated by filtration through GF/C filters (VWR), which have been previously soaked in about 0.3% polyethyleneimine (PEI). The filters are washed one time with about 4ml ice cold Tris buffer and air dried before the retained

radioactivity is measured using LSC. Binding data is analyzed by curve fitting (GraphPad software, Prism). The data demonstrates no differences between about 10, 20, 30 and 50 $\mu$ g protein/reaction in tyramine receptor specific binding. Therefore, about 10 $\mu$ g protein/reaction is used.

**[00533]** To determine  $B_{max}$  and  $K_d$  values for tyramine receptor (TyrR) in membranes expressing TyrR, saturation binding experiments are performed. Briefly, about 10 $\mu$ g protein is incubated with  $^3$ H-tyramine at a range of concentrations (about 0.2-20nM). Binding data is analyzed by curve fitting (GraphPad software, Prism) and the  $K_d$  for tyramine binding to its receptor is determined.

**[00534]** To determine the affinities of several ligands for TyrR, increasing concentration of several compounds are tested for their ability to inhibit binding of about 2nM  $^3$ H-tyramine. For both saturation and inhibition assays total and non-specific binding is determined in the absence and presence of about 10 $\mu$ M unlabeled-tyramine, respectively. Receptor binding reactions are incubated for about 1 hour at room temperature (RT) in restricted light. Reactions are terminated by filtration through GF/C filters (VWR), which have been previously soaked in about 0.3% polyethyleneimine (PEI). The filters are washed one time with about 4ml ice cold Tris buffer and air dried before retained radioactivity is measured using LSC. Binding data is analyzed by curve fitting (GraphPad software, Prism).

**[00535]** In a saturation binding curve of  $^3$ H-tyramine ( $^3$ H-TA) to membranes prepared from Schneider cells expressing tyramine receptor,  $^3$ H-tyramine has a high affinity to tyramine receptor in the stably transfected cells with pAcB-TyrR with  $K_d$  determined to be about 1.257nM and  $B_{max}$  determined to be about 0.679pmol/mg protein.

[00536] In inhibition binding of  $^3\text{H}$ -tyramine ( $^3\text{H}$ -TA) to membranes prepared from Schneider cells expressing tyramine receptor in the presence and absence of various concentrations of unlabeled tyramine (TA), the  $\text{EC}_{50}$  and the  $\text{K}_i$  for tyramine against its receptor in Schneider cells expressing tyramine receptor are about  $0.331\mu\text{M}$  and  $0.127\mu\text{M}$ , respectively.

[00537] In order to determine the pharmacological profile of tyramine receptor (TyrR), the ability of a number of putative *Drosophila* neurotransmitters to displace  $^3\text{H}$ -tyramine ( $^3\text{H}$ -TA) binding from membranes expressing tyramine receptor is tested. In inhibition binding of  $^3\text{H}$ -Tyramine to membranes prepared from Schneider cells expressing tyramine receptor in the presence and absence of different concentrations of unlabeled ligands (including Tyramine (TA), Octopamine (OA), Dopamine (DA), and Serotonin (SE)), tyramine displays the highest affinity ( $\text{K}_i$  of about  $0.127\mu\text{M}$ ,  $\text{EC}_{50}$  of about  $0.305\mu\text{M}$ ) for the *Drosophila* TyrR. Octopamine, dopamine and serotonin were less efficient than tyramine at displacing  $^3\text{H}$ -tyramine binding.

[00538] With respect to the  $\text{K}_i$  and  $\text{EC}_{50}$  of the ligands, the rank order of potency is as follows: tyramine>octopamine>dopamine>serotonin, showing the likelihood that the stably transfected Schneider cells are expressing a functionally active tyramine receptor.

[00539] As such, Schneider cells expressing tyramine receptor are effective as a model for studies and screening for compositions that interact with the tyramine receptor.

[00540] Example 43 - *In vitro* calcium mobilization effects of a combination of thyme oil and imidacloprid

[00541] A Schneider cell line was produced that expressed a cell-surface tyramine receptor of *Drosophila melanogaster*, as described above. Cells of this line were exposed to three different compositions. The first composition contained imidacloprid at  $1\text{mg/ml}$ . The

second solution contained thyme oil at 1mg/ml. The third composition contained an approximately 50/50 mixture of imidacloprid and thyme oil, with the mixture contained at a concentration of 1mg/ml. The results of this screening procedure are shown in Figure 9 as fluorescence intensity curves corresponding to intracellular calcium ion concentrations. In Figure 9, the curve corresponding to the composition containing the mixture of imidacloprid and thyme oil is indicated by triangles, the curve corresponding to the composition containing the thyme oil alone is indicated by circles, and the curve corresponding to the composition containing imidacloprid alone is indicated by squares. These curves may be obtained by the following method.

[00542] Intracellular calcium ion concentrations ( $[Ca^{2+}]_i$ ) are measured by using the acetoxymethyl (AM) ester of the fluorescent indicator fura-2 (Enan, *et al.*, Biochem. Pharmacol. vol 51, 447-454). Cells expressing the tyramine receptor are grown under standard conditions. A cell suspension is prepared in assay buffer (140mM NaCl, 10mM HEPES, 10mM glucose, 5mM KCl, 1mM CaCl<sub>2</sub>, 1mM MgCl<sub>2</sub>) and the cell number is adjusted to about  $2 \times 10^6$  cells per ml. Briefly, about 1.0ml cell suspension (about  $2 \times 10^6$  cells) is incubated with about 5 $\mu$ M fura 2/AM for about 30 min at about 28°C. After incubation, the cells are pelleted at about 3700 rpm for about 10 sec at room temperature and then resuspended in about 1.5ml assay buffer.  $[Ca^{2+}]_i$  changes are analyzed in a spectrofluorometer in the presence and absence of test chemicals. Excitation wave lengths are about 340nm (generated by  $Ca^{2+}$ -bound fura-2) and about 380nm (corresponding to  $Ca^{2+}$ -free fura-2). The fluorescence intensity is monitored at an emission wave length of about 510nm. No absorbance of fluorescence artifacts are observed with any of the compounds used. The ratio of about 340/380nm is calculated and plotted as a function of time.

[00543] As shown in Figure 9, the composition containing the mixture of imidacloprid and thyme oil exhibited a much higher peak intensity and  $V_{max}$  per second than the compositions containing either of the ingredients alone. This demonstrates that imidacloprid and thyme oil act synergistically in this cell system to affect intracellular calcium ion concentrations.

[00544] This combination of ingredients, when applied to a pest expressing the tyramine receptor, also acts synergistically to control the pest.

[00545] Example 44 - In vitro calcium mobilization effects of a combination of thyme oil and fluoxastrobin

[00546] A Schneider cell line was produced that expressed a cell-surface tyramine receptor of *Drosophila melanogaster*, as described above. Cells of this line were exposed to three different compositions. The first composition contained fluoxastrobin at 1mg/ml. The second solution contained thyme oil at 1mg/ml. The third composition contained an approximately 50/50 mixture of fluoxastrobin and thyme oil, with the mixture contained at a concentration of 1mg/ml. The results of this screening procedure are shown in Figure 10 as fluorescence intensity curves corresponding to intracellular calcium ion concentrations. In Figure 10, the curve corresponding to the composition containing the mixture of fluoxastrobin and thyme oil is indicated by triangles, the curve corresponding to the composition containing the thyme oil alone is indicated by squares, and the curve corresponding to the composition containing fluoxastrobin alone is indicated by circles. These curves may be obtained by the method described above.

[00547] As shown in Figure 10, the composition containing the mixture of fluoxastrobin and thyme oil exhibited a much higher peak intensity and  $V_{max}$  per second than the compositions

containing either of the ingredients alone. This demonstrates that fluoxastrobin and thyme oil act synergistically in this cell system to affect intracellular calcium ion concentrations.

**[00548]** This combination of ingredients, when applied to a pest expressing the tyramine receptor, also acts synergistically to control the pest.

**[00549]** One of ordinary skill in the art will recognize that modifications and variations are possible without departing from the teachings of the invention. This description, and particularly the specific details of the exemplary embodiments disclosed, is provided primarily for clearness of understanding and no unnecessary limitations are to be understood therefrom, for modifications and other embodiments will become evident to those skilled in the art upon reading this disclosure and can be made without departing from the spirit or scope of the claimed invention.

WHAT IS CLAIMED IS:

1. A composition for controlling a target pest comprising a pest control product and at least one active agent, wherein:
  - the active agent is capable of interacting with a receptor in the target pest;
  - the pest control product has a first activity against the target pest when applied without the active agent and the composition has a second activity against the target pest; and
  - the second activity is greater than the first activity.
2. The composition of Claim 1, wherein the first and second activities are quantified by measuring concentration of the pest control product effective to control the target pest, and a concentration corresponding to the first activity is higher than a concentration corresponding to the second activity.
3. The composition of Claim 1, wherein the first and second activities are quantified by measuring disablement effect of the target pest at a standard concentration of pest control product, and the composition exhibits a greater disablement effect than the pest control product applied without the active agent.
4. The composition of Claim 1, wherein the first activity persists for a first period, the second activity persists for a second period, and the second period is longer than the first period.
5. The composition of Claim 1, wherein the active agent comprises a synergistic combination of at least two receptor ligands.
6. The composition of Claim 1, wherein the second activity reflects a synergistic interaction of the active agent and the pest control product.

7. The composition of Claim 1, wherein the target pest is selected from the group consisting of a fungus, a plant, an animal, a moneran, and a protist.
8. The composition of Claim 7, wherein the target pest is an arthropod species.
9. The composition of Claim 8, wherein the arthropod is an insect, an arachnid, or an arachnoid.
10. The composition of Claim 7, wherein the target pest is a species belonging to an animal order selected from: Acari, Anoplura, Araneae, Blattodea, Coleoptera, Collembola, Diptera, Grylloptera, Heteroptera, Homoptera, Hymenoptera, Isopoda, Isoptera, Lepidoptera, Mantodea, Mallophaga, Neuroptera, Odonata, Orthoptera, Psocoptera, Siphonaptera, Symphyla, Thysanura, and Thysanoptera.
11. The composition of Claim 1, wherein the pest control product is a chlorphenoxy compound.
12. The composition of Claim 11, wherein the pest control product is selected from the group consisting of 2,4-D Amine and 2,4D IBE.
13. The composition of Claim 1, wherein the pest control product is a carbamate.
14. The composition of Claim 13, wherein the pest control product is selected from the group consisting of methomyl, carbofuran, carbaryl, BPMC, carbendazim, carbosulfan, captan hydrochloride, and cartap.
15. The composition of Claim 1, wherein the pest control product is an organophosphate.
16. The composition of Claim 15, wherein the pest control product is selected from the group consisting of acephate, malathion, diazinon, chlorpyfiros, fenoxycab, edifenphos, febuconazole, chlorphenapyr, magnesium phosphide, metamidophos, and fenitrothion.

17. The composition of Claim 1, wherein the pest control product is an organochlorine.

18. The composition of Claim 17, wherein the pest control product is selected from the group consisting of DDT, DDE, and heptachlorepoxyde.

19. The composition of Claim 1, wherein the pest control product is a pyrethroid.

20. The composition of Claim 17, wherein the pest control product is selected from the group consisting of cypermethrin, cynmethylin +2,4-D IBE, lambdacyhalothrin, dazomet, cyfluthrin, betacypermethrin, pendimethlin, permethrin, deltamethrin, bifenethrin, alphacypermethrin, fenvalerate, propanil, and esfenvalerate.

21. The composition of Claim 1, wherein the pest control product is a neonicotinoid.

22. The composition of Claim 19, wherein the pest control product is thiomethoxam, fipronil, clothianidin, imidacloprid.

23. The composition of Claim 1, wherein the pest control product comprises at least one of an avermectin, abamectin, spinosad, fluxastrobin, and indoxacarb.

24. The composition of Claim 1, wherein the pest control product is a botanical product.

25. The composition of Claim 24, wherein the pest control product is selected from the group consisting of: rotenone, nicotine, caffeine, a pyrethrum, an essential oil, and a fixed oil.

26. The composition of Claim 1, wherein the pest control product is a fungicide, a nematicide, and insecticide, and acaricide, and a bactericide.

27. The composition of Claim 1, wherein the receptor is a G protein-coupled receptor (GPCR).

28. The composition of Claim 27, wherein the GPCR is a receptor of the insect olfactory cascade.

29. The composition of Claim 28, wherein the receptor is selected from a tyramine receptor, an olfactory receptor Or43a, and an olfactory receptor Or83b.

30. The composition of Claim 28, wherein the receptor is an octopamine receptor.

31. The composition of Claim 28, wherein binding of the receptor by an ingredient of the composition results in a change in intracellular level of cAMP and/or calcium, and wherein the change is sufficient to permit control of the target pest.

32. The composition of Claim 1, wherein control comprises a condition selected from the group consisting of: killing, knockdown, repellency, interference with reproduction, interference with feeding, and interference with a stage of a life cycle of the target pest.

33. A crop protected by the composition of Claim 1.

34. A composition for controlling a target pest comprising a pest control product and at least one active agent, wherein:

the active agent comprises a ligand of a GPCR of a target pest, wherein binding of the ligand to the GPCR causes a change in a level of cAMP or calcium that permits control of the target pest;

the pest control product has a first activity against the target pest, the active agent has a second activity against the target pest, and the composition has a third activity against the target pest; and

the third activity is greater than the first activity or the second activity.

35. The composition of Claim 34, wherein the active agent comprises a synergistic combination of at least two GPCR ligands.

36. The composition of Claim 34, wherein the third activity is indicative of synergy between the active agent and the pest control product.

37. A composition for pest control, comprising at least two active ingredients, wherein at least one active ingredient interacts with a G protein-coupled receptor (GPCR) of the pest and wherein at least one active ingredient does not interact with the GPCR, and wherein the at least two active ingredients in combination have a synergistic pest-control activity.

38. The composition of Claim 37, wherein the pest is an insect and the GPCR is associated with olfaction, and further wherein the GPCR is absent from vertebrate animals.

39. The composition of Claim 37, wherein the synergistic pest-control activity has a coefficient of synergy in excess of 1.5.

40. The composition of Claim 37, wherein the synergistic pest-control activity exceeds additive effects of the active ingredients, as measured by the Colby calculation of synergy.

41. The composition of Claim 37, wherein the GPCR has a high affinity for the active ingredient in a target organism and wherein the GPCR is absent or has a low affinity for the active ingredient in a non-target organism.

42. The composition of Claim 41, wherein the non-target organism is a vertebrate animal.

43. The composition of Claim 41, wherein the target organism is selected from a plant, an animal, a fungus, a protist, and a moneran, and the non-target organism is selected from a crop plant, a vertebrate animal, and a non-pest invertebrate.

44. A low-resistance pest-control composition, comprising at least a first active ingredient and a second active ingredient, wherein the first active ingredient interacts with a first

molecular target under genetic control within a selected pest, and wherein the second active ingredient interacts with a second molecular target under genetic control within the selected pest, and wherein the ingredients in the composition act together in a complementary manner upon the target pest, and wherein resistance to the composition in an individual target pest requires two separate genetic lesions divergent from a non-resistant population of the pest.

45. The composition of Claim 44, wherein the first and second molecular targets comprise two separate molecules encoded or controlled by separate genetic elements..

46. The composition of Claim 44, wherein the complementary manner comprises an additive effect of each agent acting separately.

47. The composition of Claim 44, wherein the complementary manner comprises a synergistic effect as compared with each agent acting separately.

48. The composition of Claim 44, wherein the first molecular target is a GPCR, and wherein the second molecular target is not the same as the first molecular target.

49. A pest-control composition exhibiting high potency against an invertebrate target pest and low toxicity against a vertebrate animal, the composition comprising a synergistic combination of active agents, wherein each active agent interacts with a molecular target with high affinity in the target pest and that is absent from, or present with low affinity, from the vertebrate.

50. The pest control composition of Claim 49, wherein at least one active agent is a ligand of a selected GPCR, and wherein at least one active agent is not a ligand of the selected GPCR.

51. The pest-control composition of claim 49, wherein the high target potency and low vertebrate toxicity is expressed as a ratio of LD50(target) versus LD50(vertebrate animal), and wherein the ratio is less than 100:1.

52. A method of pest control comprising contacting a target pest with the composition of Claim 1, resulting in control of the pest.

53. The method of Claim 52, wherein the receptor is a GPCR.

54. The method of Claim 53, wherein the GPCR is a receptor of the insect olfactory cascade.

55. The method of Claim 54, wherein the receptor is selected from a tyramine receptor, an olfactory receptor Or43a, and an olfactory receptor Or83b

56. The method of Claim 54, wherein the receptor is an octopamine receptor.

57. The method of Claim 54, wherein binding of the receptor by an ingredient of the composition results in a change in intracellular level of cAMP and/or calcium, and wherein the change is sufficient to permit control of the target pest.

58. A method of pest control comprising applying a composition to a target pest or to a substrate associated with a target pest, wherein the composition comprises a pesticide and an active agent comprising at least one receptor ligand, and wherein the pest control comprises affecting a physiological condition of the pest associated with a function of the pesticide while also affecting a function of the receptor associated with the receptor ligand.

59. The method of Claim 58, wherein the receptor is a GPCR.

60. The method of Claim 59, wherein the GPCR is a receptor of the insect olfactory cascade.

61. The method of Claim 60, wherein the receptor is selected from a tyramine receptor, an olfactory receptor Or43a, and an olfactory receptor Or83b.
62. The method of Claim 60, wherein the receptor is an octopamine receptor.
63. The method of Claim 60, wherein binding of the receptor by an ingredient of the composition results in a change in intracellular level of cAMP and/or calcium, and wherein the change is sufficient to permit control of the target pest.
64. The method of Claim 58, wherein the pesticide is selected from a chlorphenoxy compound, a carbamate, an organophosphate, an organochlorine, a pyrethroid, a neonicotinoid, a botanical product, a fungicide, a nematicide, and insecticide, and acaricide, a bactericide, and an avermectin.
65. The method of Claim 58, wherein the substrate is a crop plant.
66. The method of Claim 58, wherein the substrate is a soil.
67. The method of Claim 58, wherein the target pest is selected from the group consisting of wherein the target pest is selected from the group consisting of a fungus, a plant, an animal, a moneran, and a protist.
68. The composition of Claim 67, wherein the target pest is an arthropod species.
69. The composition of Claim 68, wherein the arthropod is an insect, an arachnid, or an arachnid.
70. The composition of Claim 69, wherein the target pest is a species belonging to an animal order selected from: Acari, Anoplura, Araneae, Blattodea, Coleoptera, Collembola, Diptera, Grylloptera, Heteroptera, Homoptera, Hymenoptera, Isopoda, Isoptera, Lepidoptera, Mantodea, Mallophaga, Neuroptera, Odonata, Orthoptera, Psocoptera, Siphonaptera, Symphyla, Thysanura, and Thysanoptera.

71. The method of Claim 58, wherein use of the composition permits an improvement of control of the pest as compared with use of the pesticide alone or the active agent alone.

72. The method of claim 71, wherein the improvement comprises a synergistic interaction of the pest control product with the active agent.

73. The method of Claim 71, wherein the improvement comprises an improved result with use of a substantially similar amount of the pest control product.

74. The method of Claim 73, wherein the improved result is at least one of: increased killing of the target pest; increased interference with reproduction by the target pest; and prolonged effectiveness of the pest control product.

75. The method of Claim 71, wherein the improvement comprises a substantially similar result with use of a substantially lower amount of the pest control product and/or the active agent.

76. The method of Claim 75, wherein use of the composition permits an agricultural improvement selected from the group consisting of: increased crop yield; reduced frequency of application of pest control product; reduced phytotoxicity associated with the pesticide; and reduced cost or increased value associated with at least one environmental factor.

77. The method of Claim 76, wherein the environmental factor is selected from: air quality, water quality, soil quality, detectable pesticide residue, safety or comfort of workers; and a collateral effect on a non-target organism.

78. A method of developing a composition for pest control, comprising:  
providing a cell line expressing at least one of: a tyramine receptor, an olfactory receptor Or43a, or an olfactory receptor Or83b, wherein binding of a ligand to any of the receptors causes a change in a level of intracellular cAMP or calcium, and wherein the change is indicative of a

potential for invertebrate pest control;

contacting the cell with a candidate ligand;

detecting a change in the level of cAMP and/or calcium in the cell;

identifying the candidate ligand as an active compound for control of an invertebrate pest; and

combining the active compound with a pesticide to form a composition for pest control, wherein the pesticide does not bind to a receptor bound by the active compound, and wherein a combined effect of the active compound and the pesticide comprises an effect against a target pest that is greater than the effect of either the active compound alone or the pesticide alone.

79. The method of Claim 78, wherein the composition further comprises a second active compound capable of binding at least one of the receptors.

80. The method of Claim 79, wherein the active compounds cooperate to cause a synergistic change in the level of cAMP and/or calcium in the cell line and/or in a target pest.

81. The method of Claim 78, wherein the combined effect of the active compound and the pesticide is synergistic.

82. The method of Claim 78, wherein the combined effect is determined by at least one condition selected from the group consisting of: killing, knockdown, repellency, interference with reproduction, interference with feeding, and interference with a stage of a life cycle of the target pest.

83. A method of pest control, comprising,

providing a composition comprising at a first and a second active ingredient, wherein the first active ingredient interacts with a receptor of a target pest, and wherein the second active ingredient is a pesticide that does not interact with the receptor of the first active ingredient; and

contacting the pest with the composition, wherein the contacting results in synergistic pest control.

84. The method of Claim 83, wherein the composition further comprises a third active ingredient, wherein the third active ingredient interacts with a receptor of the target pest, and wherein at least the first and third active ingredients in combination synergistically interact to permit control of the target pest.

85. The method of Claim 84, wherein the first and third active ingredients bind the same receptor.

86. The method of Claim 84, wherein the first and third active ingredients do not bind the same receptor.

87. The method of Claim 84, wherein the first, second, and third active ingredients in combination have a synergistic effect that is greater than the effect of any single ingredient and is also greater than the synergistic effect of the first and third ingredients in combination.

88. The method of Claim 83, wherein the receptor is a GPCR.

89. The method of Claim 88, wherein the receptor is selected from the group consisting of a tyramine receptor, olfactory receptor Or43a, and olfactory receptor Or83b.

90. The method of Claim 83, wherein pest control is associated with a receptor-activated alteration in a level of cAMP and/or calcium within the pest.

91. The method of Claim 90, wherein the alteration persists for at least about 60 seconds.

92. A method of pest control, comprising:  
providing a composition comprising at least two active ingredients, wherein at least one active ingredient interacts with a GPCR of a target pest, the composition produces a first level of

at least one of intracellular calcium and cyclic AMP in a cell expressing the GPCR on exposure to the cell, and the first level is higher than a second level produced when the cell is contacted with any single active ingredient; and

contacting the pest with the composition, wherein the contacting results in synergistic pest control.

93. A method for controlling a target pest comprising use of a pest control composition, the composition comprising a pest control product and at least one active agent, wherein:

the active agent comprises a ligand of a GPCR of a target pest, wherein binding of the ligand to the GPCR causes a change in a level of cAMP or calcium that permits control of the target pest;

the pest control product has a first activity against the target pest, the active agent has a second activity against the target pest, and the composition has a third activity against the target pest; and

the third activity is greater than the first activity or the second activity.

94. A method of pest control, comprising use of a pest control composition, wherein the composition comprises at least two active ingredients, wherein at least one active ingredient interacts with a G protein-coupled receptor (GPCR) of the pest and wherein at least one active ingredient does not interact with the GPCR, and wherein the at least two active ingredients in combination have a synergistic pest-control activity.

95. A method of pest control permitting low-resistance in a target pest, comprising administering a pest-control composition, the composition comprising at least a first active ingredient and a second active ingredient, wherein the first active ingredient interacts with a first

molecular target under genetic control within a selected pest, and wherein the second active ingredient interacts with a second molecular target under genetic control within the selected pest, and wherein the ingredients in the composition act together in a complementary manner upon the target pest, and wherein resistance to the composition in an individual target pest requires two separate genetic lesions divergent from a non-resistant population of the pest.

96. A pest control composition comprising, in combination, a blend of lilac flower oil, D-limonene, thyme oil, and further comprising a pesticide.

97. The composition of Claim 96, wherein the pesticide is clothianidin.

98. The composition of Claim 96, the blend comprising 10-80% lilac flower oil, 5-60% D-limonene, and 10-80% thyme oil.

99. The composition of Claim 96, the blend comprising 20-60% lilac flower oil, 10-45% D-limonene, and 20-60% thyme oil.

100. The composition of Claim 96, the blend comprising 42.6% w/w lilac flower oil, 27.35% w/w D-limonene, and 30.08% w/w thyme oil white.

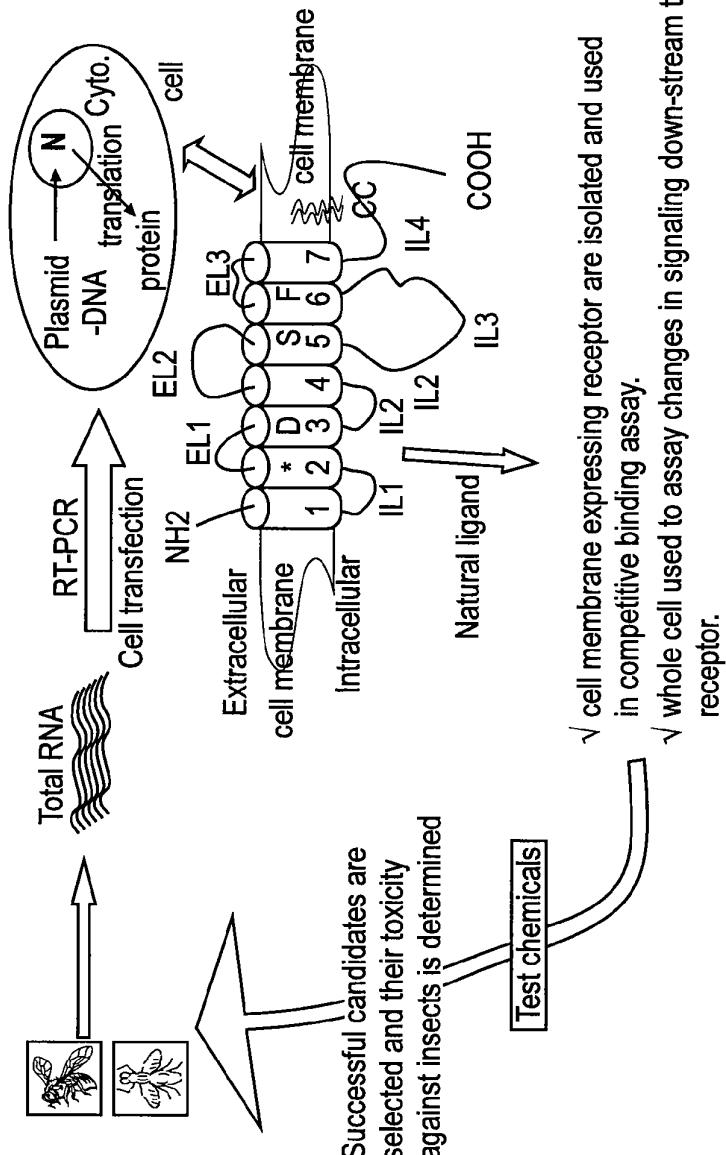
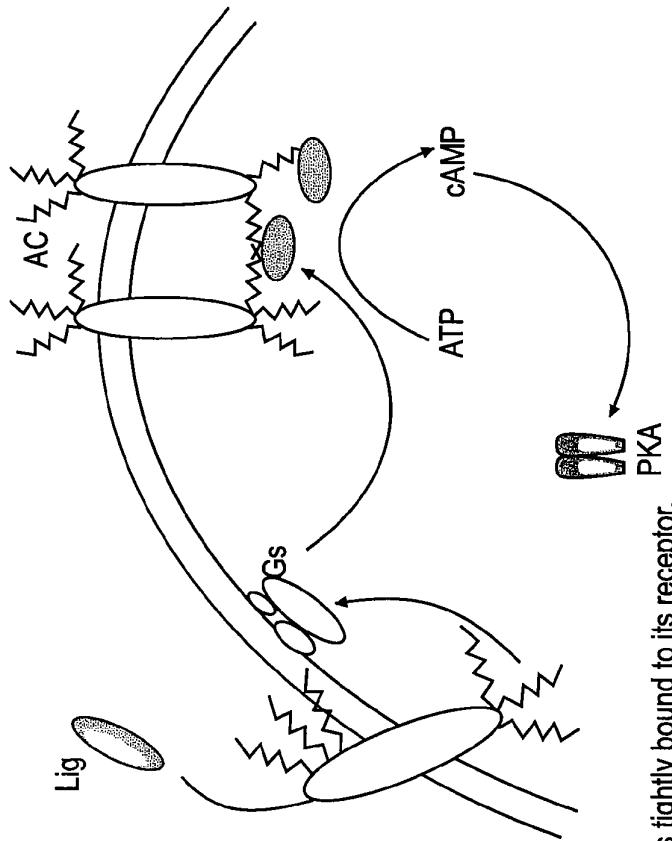


FIG. 1

## Biogenic amine receptors coupled to intracellular cAMP signalling pathways



Once ligand is tightly bound to its receptor,  
the receptor's confirmation will change.  
This structural change is then transferred  
to trimeric G protein.

▲ Physiological responses

FIG. 2

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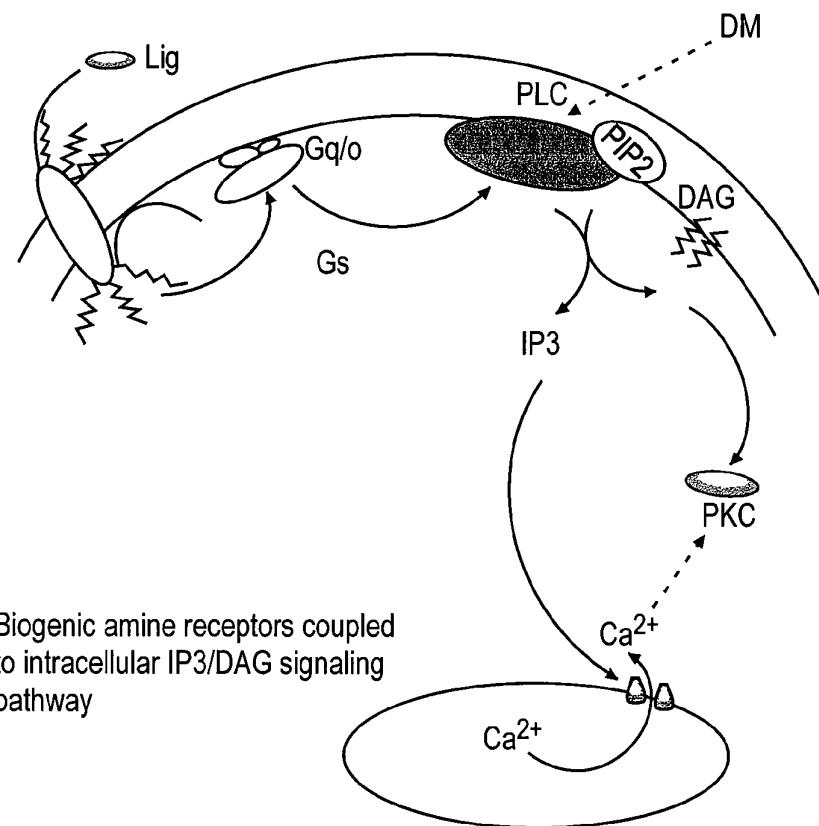


FIG. 3

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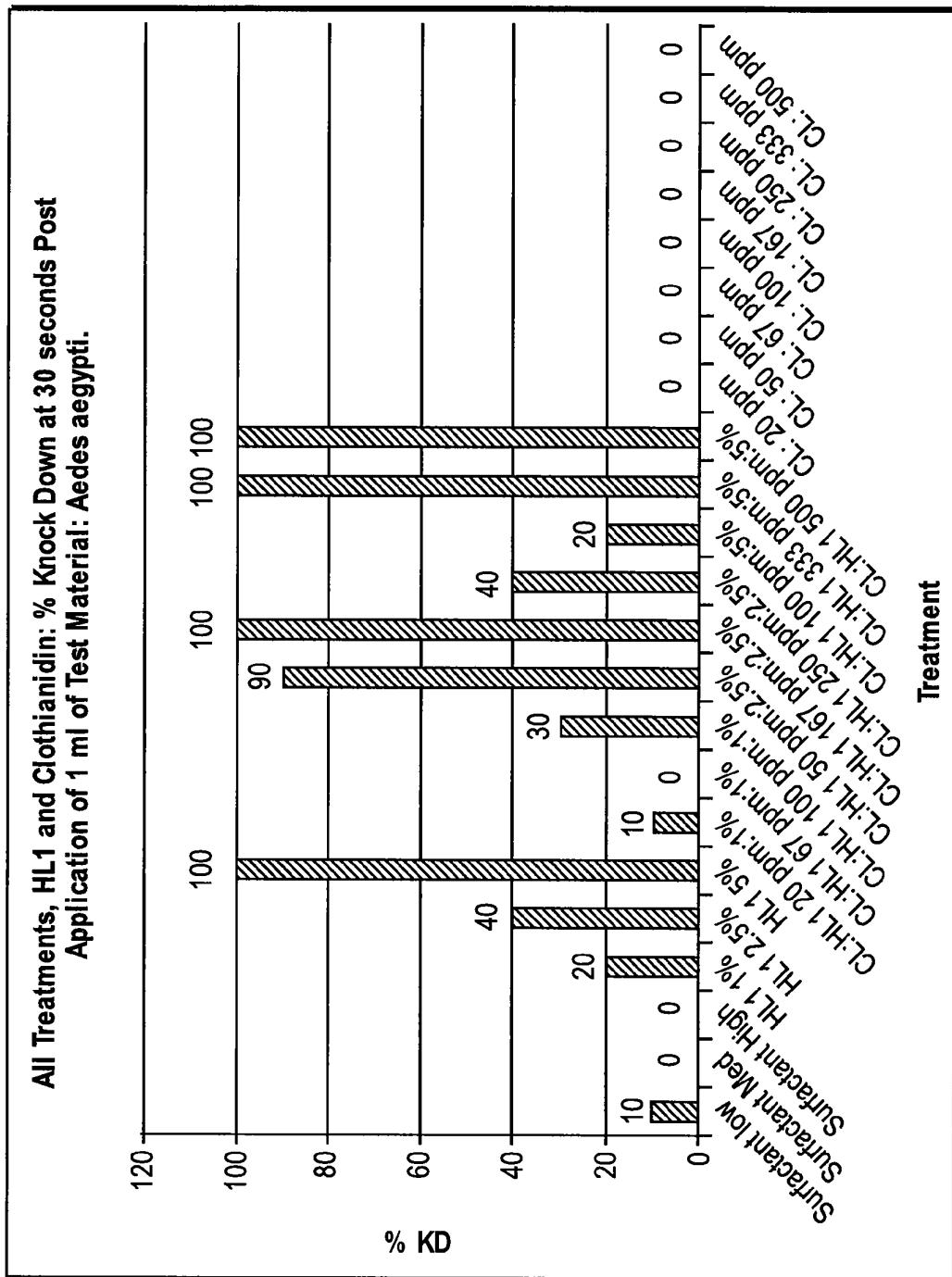


FIG. 4A

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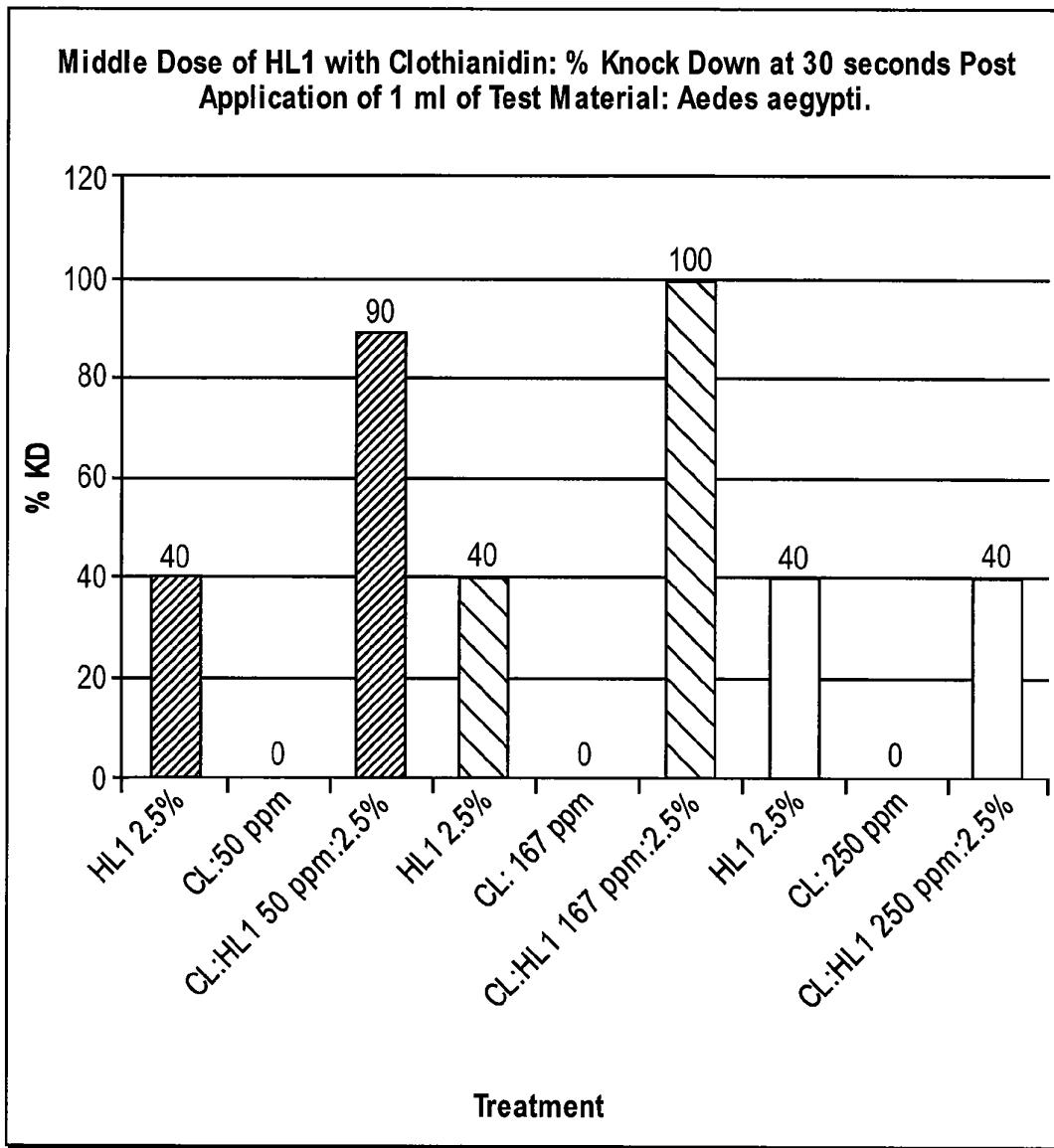


FIG. 4B

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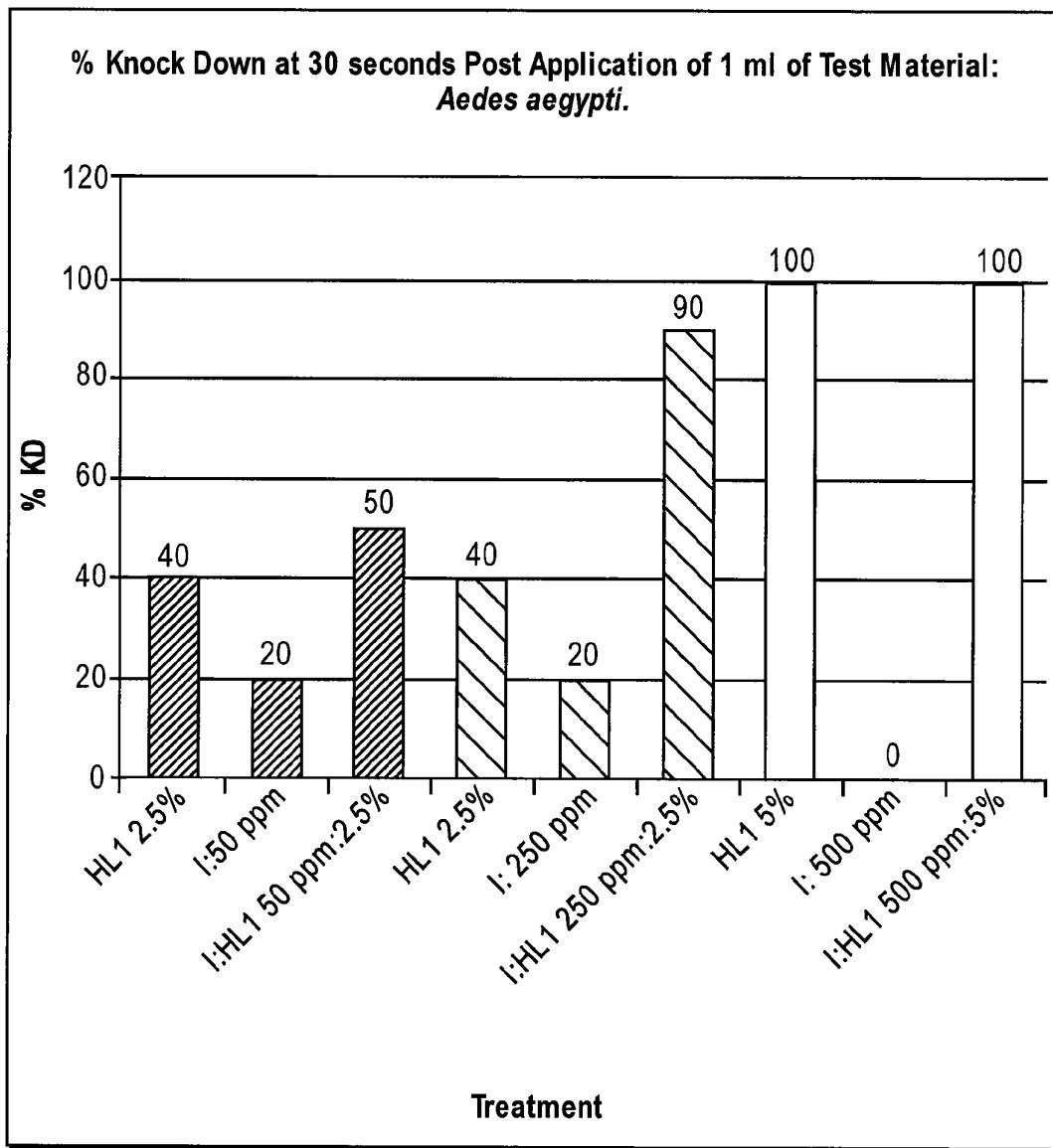


FIG. 4C

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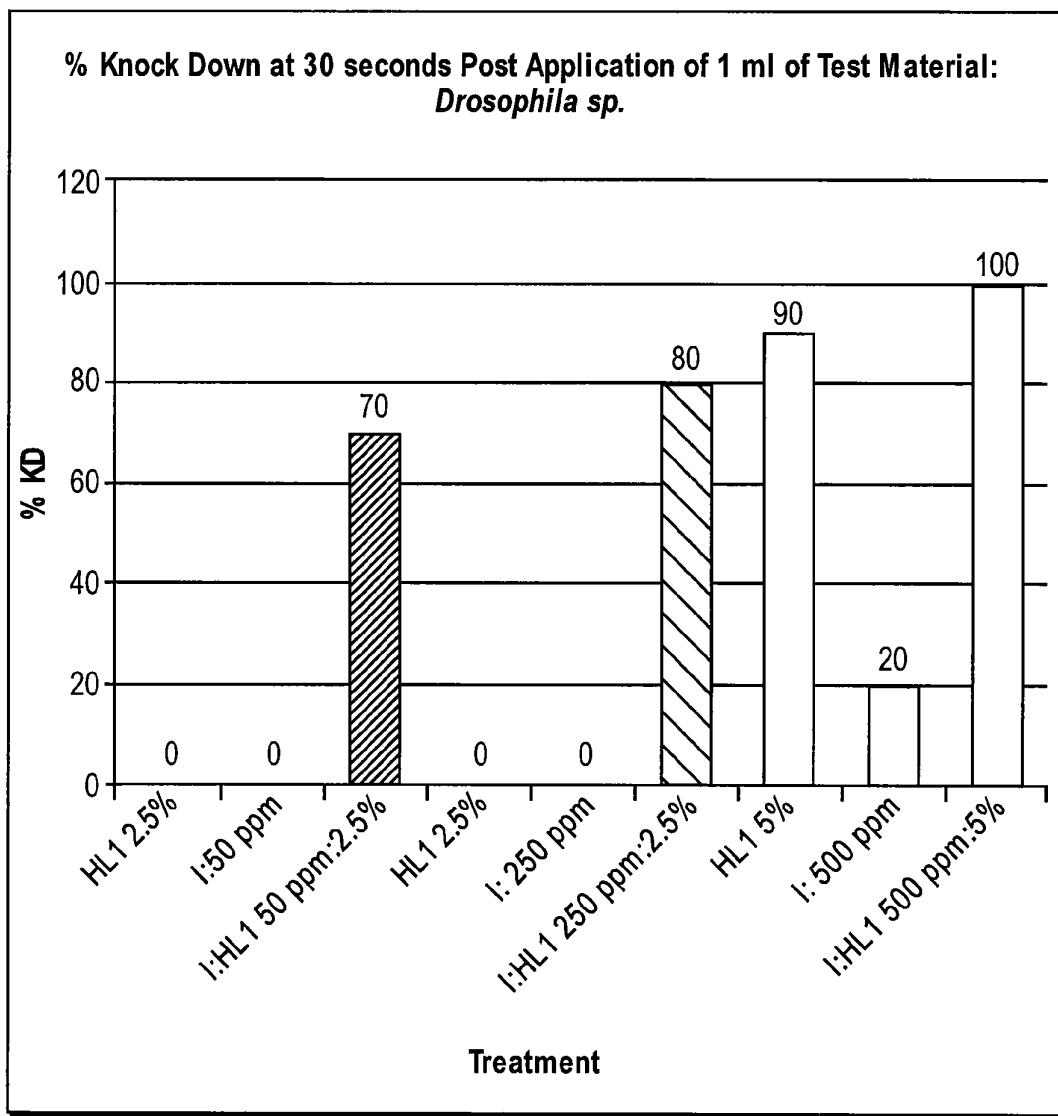


FIG. 4D

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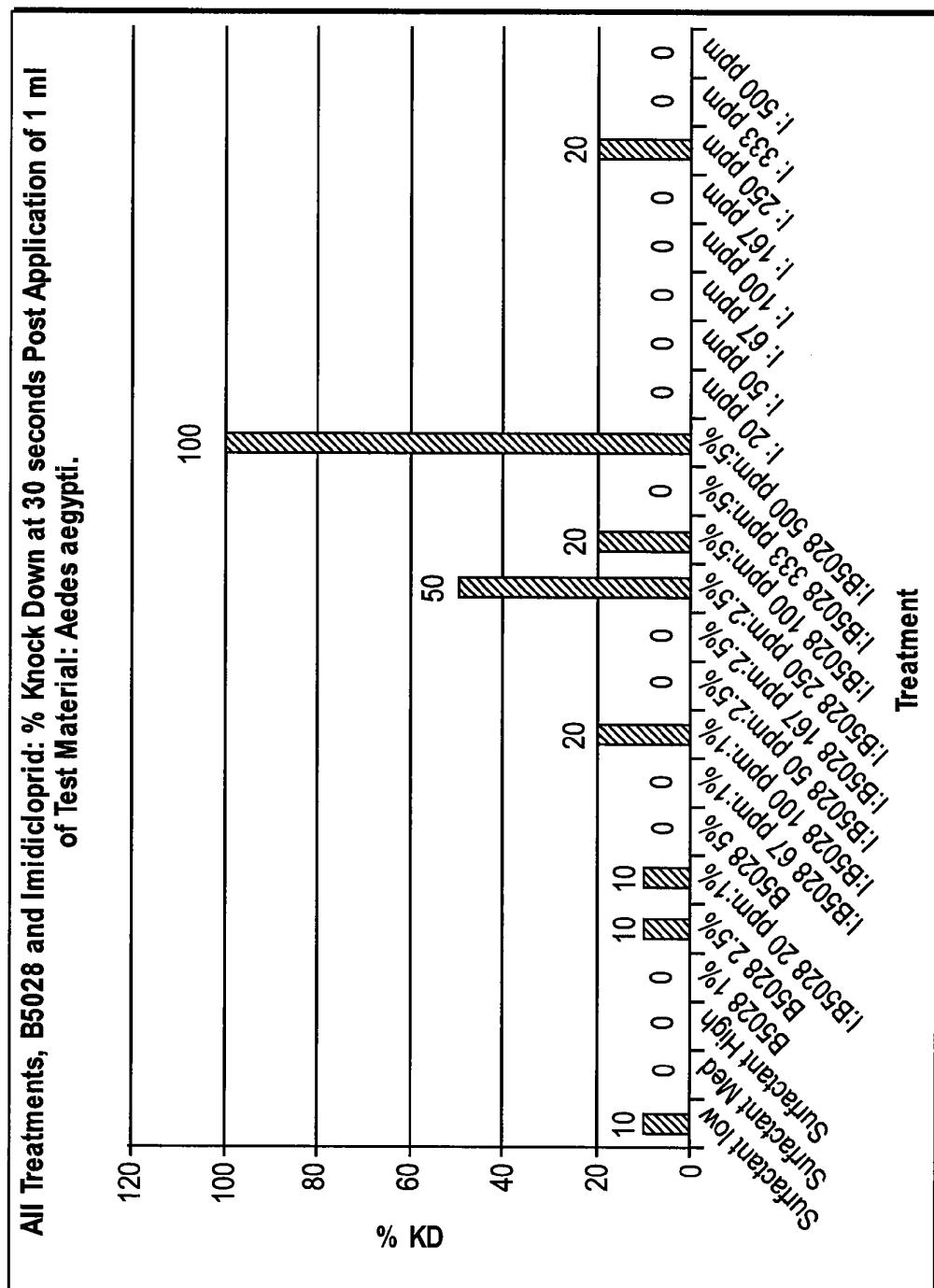


FIG. 5

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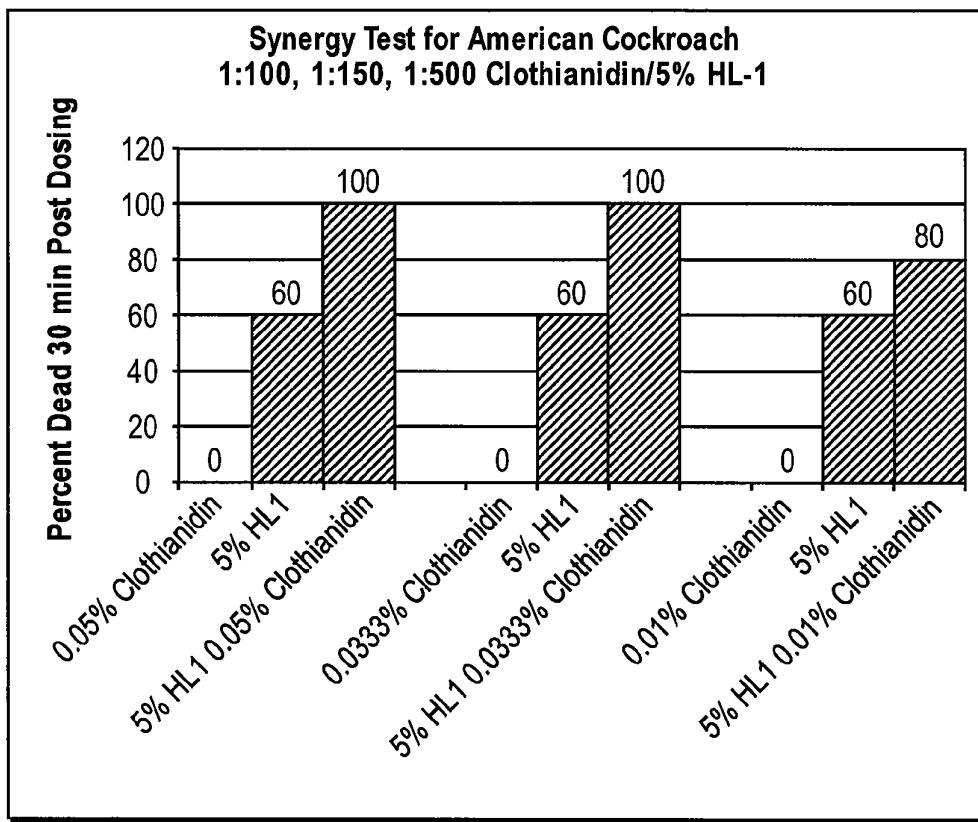


FIG. 6A

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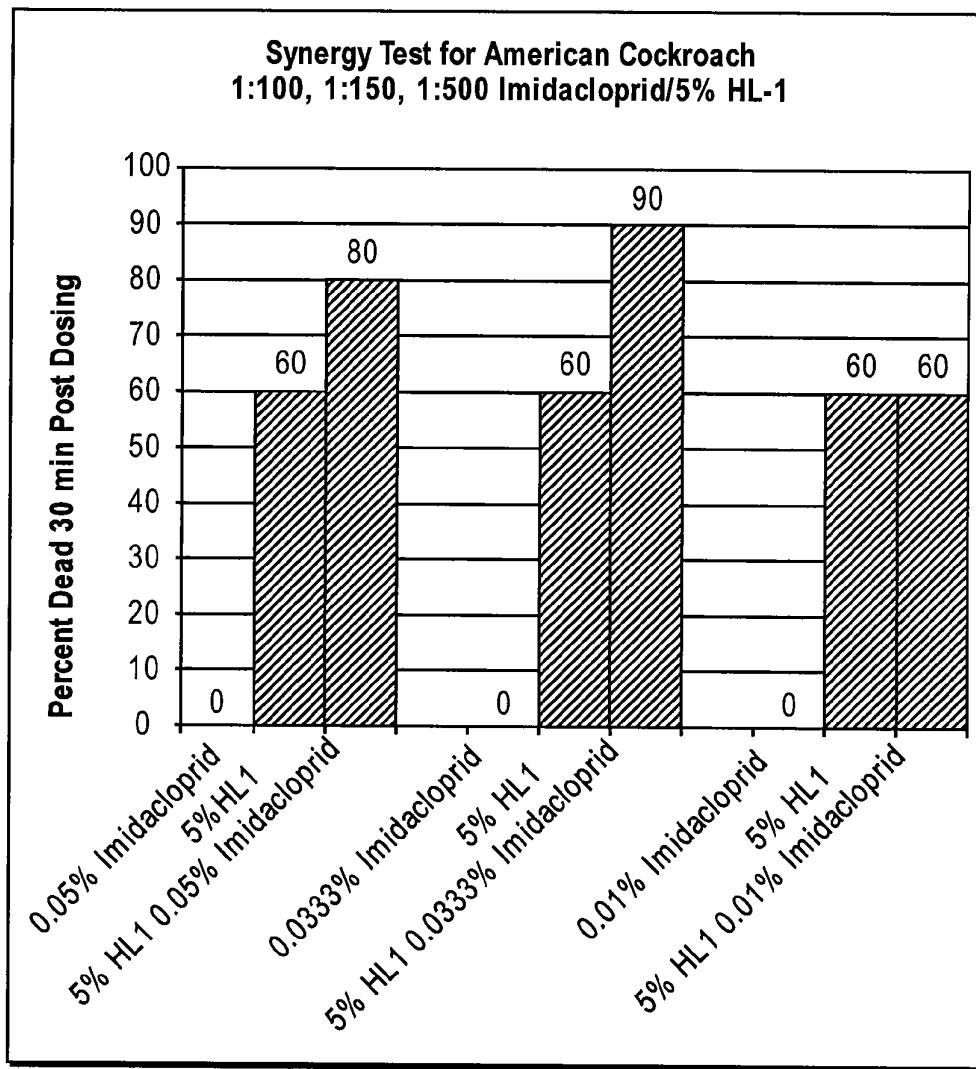


FIG. 6B

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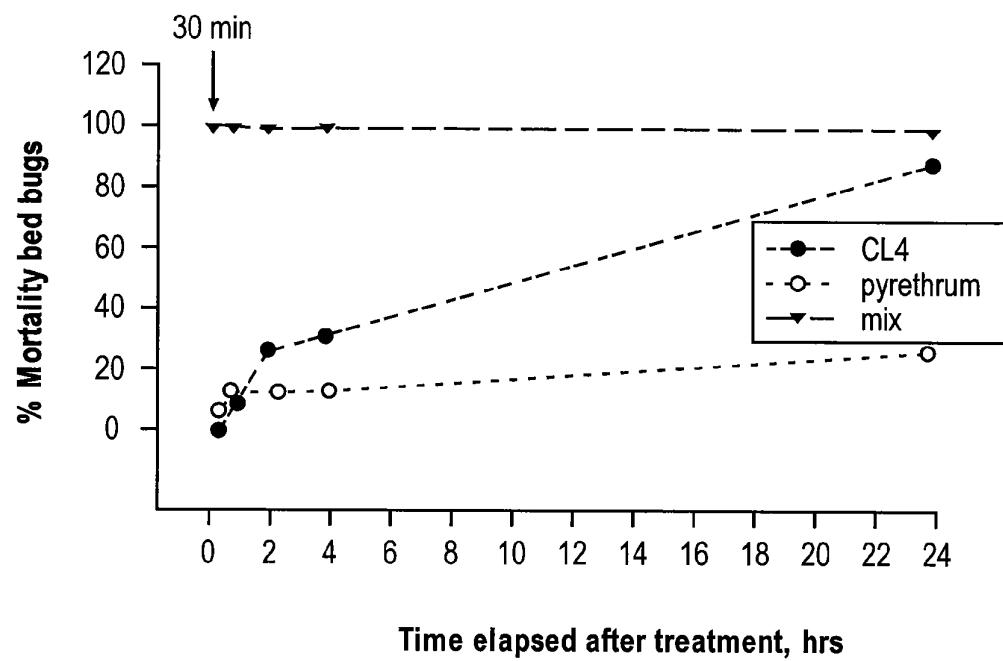


FIG. 7

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ATGCCATCGG CAGATCAGAT CCTGTTGTA AATGTCACCA CAAACGGTGGC GGGGGGGCT CTAACCGGTG CGGCCGGCGT CAGGCCACCA  
 Met Pro Ser Ala Asp Gln Ile Leu Phe Val Asn Val Thr Thr Val Ala Ala Ala Leu Thr Ala Ala Ala Val Ser Thr Thr  
 AAGTCCGAA GCGGAAACGGC CGCACGGGC TACACGGATT CGGATGACGA TGCAGGATG GAAACGGAGG CGGTGGCTAA CATATCCGGC  
 Lys Ser Gly Ser Gly Asn Ala Ala Arg Gly Tyr Thr Asp Ser Asp Asp Ala Gly Met Gly Thr Glu Ala Val Ala Asn Ile Ser Gly  
 TCGCTGGTGG AGGGCTGAC CACCGTACCG GCGGCATTGA GTACGGCTCA GGCGGACAAG GACTCAGCGG GAGAAATGCGA AGGAGCTGTG  
 Ser Leu Val Glu Gly Leu Thr Thr Val Ala Ala Leu Ser Thr Ala Gln Ala Asp Lys Asp Ser Ala Gly Glu Cys Glu Gly Ala Val  
 GAGGAGCTGC ATGCCAGCAT CCTGGCCCTC CAGCTGGCTG TGCGGGACTG GGAGGCCCTT CTCACCGCCC TGGTTCTCTC CGTCATTATC  
 Glu Glu Leu His Ala Ser Ile Leu Gly Leu Gln Leu Ala Val Pro Glu Trp Glu Ala Leu Leu Thr Ala Leu Val Leu Ser Val Ile Ile  
 GTGCTGACCA TCATCGGGAA CATCCCTGGTG ATTCTGAGTGT TGTTTACCTA CAAGCCGCTG CGCATCGTC AGAACCTCTT CATACTTTCG  
 Val Leu Thr Ile Ile Gly Asn Ile Leu Val Ile Leu Ser Val Phe Thr Tyr Lys Pro Leu Arg Ile Val Gln Asn Phe Phe Ile Val Ser  
 CTGGCGGTGG CCGATCTCAC GGTGGCCCTT CTGGTGTGG CCTTCAACGT GGCTTACTCG ATCCTGGGC GCTGGGAGTT CGGCATCCAC  
 Leu Ala Val Ala Asp Leu Thr Val Ala Leu Leu Val Pro Phe Asn Val Ala Tyr Ser Ile Leu Gly Arg Trp Glu Phe Gly Ile His  
 CTGTCGAAGC TGTGGCTCAC CTGGCACGTT CTGGTGTGG CCTAGCTCCAT CCTGAAACCTG TGTGCCATAG CCCTCGACCG GTACTGGGCC  
 Leu Cys Lys Leu Trp Leu Thr Cys Asp Val Leu Cys Thr Ser Ser Ile Leu Asn Leu Cys Ala Ile Ala Leu Asp Arg Tyr Trp Ala  
 ATTACGGACC CCATCAACTA TGCCCCAGAAC AGGACCGTTG GTCGCGTCTCT GCTCCTCATC TCCGGGGTGT GGCTACTTTC GCTGCTGATA  
 Ile Thr Asp Pro Ile Asn Tyr Ala Gln Lys Arg Thr Val Leu Ile Ser Gly Val Leu Ile Ser Gly Val Leu Ile Ser Leu Ile  
 AGTAGTCCGC CGTTGATCGG CTGGAAACGAC TGGCCGGACG AGTTACAAG CGCCACGCC TGCGAGCTGA CCTCGAGCG AGGCTACGTG  
 Ser Ser Pro Pro Leu Ile Gly Trp Asn Asp Trp Pro Asp Glu Phe Thr Ser Ala Thr Pro Cys Glu Leu Thr Ser Gln Arg Gly Tyr Val  
 ATCTACTCT CGCTGGCTC CTTCTTATT CGGTGGCCA TCATGACGAT CGTCTACATC GAGATCTTCG TGGCCACGCG GCGCCGGCTA  
 Ile Tyr Ser Ser Leu Gly Ser Phe Ile Pro Leu Ala Ile Met Thr Ile Val Tyr Ile Glu Ile Phe Val Ala Thr Arg Arg Arg Leu

FIG. 8A

AGGGAGGGAG CCAGGGCCAA CAAGCTAAC ACGATCGCTC TGAAGTCCAC TGAGCTCGAG CCGATGGAA ACTCCTCGCC CGTCGGCC  
 Arg Glu Arg Ala Arg Ala Asn Lys Leu Asn Thr Ile Ala Leu Lys Ser Thr Glu Leu Glu Pro Met Ala Asn Ser Pro Val Ala Ala  
 TCCAACTCG GCTCCAAGTC GCGTCTCCCTA GCGAGCTGGC TTTGCTGGG CCGGGATCGG GCCCAGTTG CCACGCCCTAT GATCCAGAAC  
 Ser Asn Ser Gly Ser Arg Leu Leu Ala Ser Thr Leu Cys Cys Gly Arg Asp Arg Ala Glu Phe Ala Thr Pro Met Ile Glu Asn  
 GACCAAGGAGA GCATCAGGAG TGAACCCAC CAGCCGAGG ATTCTCTCCAA AGCGGGTCCC CATGGCAACA GCGATCCCCA ACAGGAGCAC  
 Asp Glu Ser Ile Ser Ser Glu Thr His Glu Pro Glu Asn Ser Lys Ala Gly Pro His Glu Asn Ser Asp Pro Glu Glu Glu His  
 GTGGTCTGGC TGGTCAAGAA GTCGGCTCGC GCGAAGACCA AGGACTCCAT TAAGCACGGC AAGACCCGTG GTGGCCGCAA GTGCGAGTCC  
 Val Val Val Lys Lys Ser Arg Arg Ala Lys Thr Lys Asp Ser Ile Lys His Glu Lys Thr Arg Gly Arg Lys Ser Glu Ser  
 TCGTCCACAT GCGAGCCCA CGGCGGACCA CAGCTCTAAC CCGCGGGGG GCATGGCCGT ACCTGCCAGC CCGGGGGGG CCAACTCTGGA  
 Ser Ser Thr Cys Glu Pro His Gly Glu Glu Pro Ala Gly Asp Gly Ser Cys Glu Pro Gly Gly Ser His Ser Gly  
 GGGGAAAGT CGGACGCCGA GATCAGCACG GAGAGGGGA GCGATCCAA AGGTGCCATA CAGGTCTGGC TGACTCTAGGC GGACCGAGCAA  
 Gly Lys Ser Asp Ala Glu Ile Ser Thr Glu Ser Gly Ser Pro Lys Gly Cys Ile Glu Val Cys Val Thr Glu Ala Asp Glu Glu Glu  
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 ACGTCCCTAA AGCTGACCC GCGGCAATCC TCGACGGGAG TCGCTGCCGT TTCTGTCACT CCGTTGCCAGA AGAACACTAG TGGGGTTAAC  
 Thr Ser Leu Lys Leu Thr Pro Glu Ser Ser Thr Glu Val Ala Val Ser Val Thr Pro Leu Glu Lys Thr Ser Gly Val Asn  
 CAGTTCAATTG AGGAGAAACA GAAGATCTCG CTTCACCAAGG AGGGGGAGG GGCCTGCAAC CTGGGCATCA TCATGGGGGT GTTCGTCATC  
 Glu Phe Ile Glu Glu Lys Glu Ile Ser Leu Ser Lys Glu Arg Arg Ala Arg Thr Leu Gly Ile Met Gly Val Phe Val Ile  
 TGGCTGGCTGC CCTTCTTCCT CATGTACGTC ATTCTGCCCT TCTGCCAGAC CTGCTGCCCT AGGAACAAGT TCAAGAACTT CATCACCTGG  
 Cys Thr Leu Pro Phe Phe Phe Leu Met Tyr Val Ile Leu Pro Phe Cys Glu Thr Cys Pro Thr Asn Lys Phe Ile Thr Thr  
 CTTGGCTACA TCAACTCGGG CCTGAAATCCG GTCATCTACA CCATCTACA CCTGGACTAC CGCCGGCCCT TCAACGGACT TCTGGGCCTG  
 Leu Gly Tyr Ile Asn Ser Gly Leu Asn Pro Val Ile Tyr Thr Ile Phe Asn Asp Tyr Arg Arg Ala Phe Lys Arg Leu Leu Gly Leu  
 AATGA  
 Asn → 1806 →

FIG. 8B

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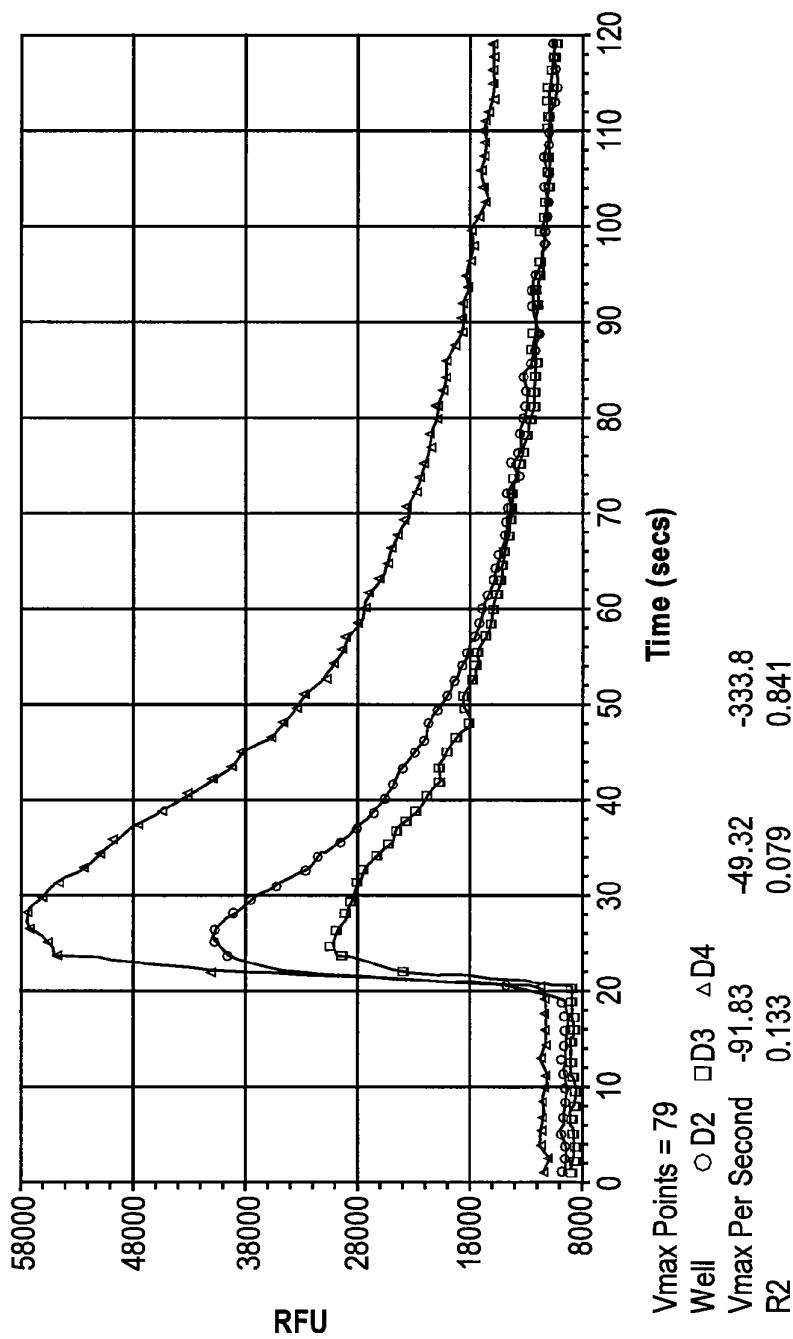


FIG. 9

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