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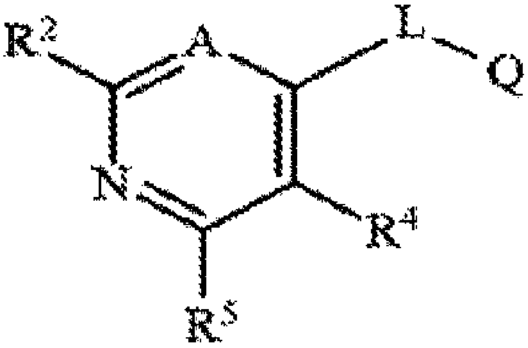
(54) **Titre : COMPOSES AZOLE POUR LUTTER CONTRE DES INVERTEBRES NUISIBLES**
(54) **Title: AZOLE COMPOUNDS FOR CONTROLLING INVERTEBRATE PESTS**



(57) **Abrégé/Abstract:**

Disclosed are compounds of Formula (1), including all geometric and stereoisomers, N-oxides, and salts thereof, wherein R^1, A, R^2, R^4, R^5, L and Q are as defined in the disclosure. Also disclosed are compositions containing the compounds of Formula (1) and methods for controlling an invertebrate pest comprising contacting the invertebrate pest or its environment with a biologically effective amount of a compound or a composition of the disclosure.

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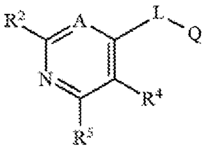
(54) Title: AZOLE COMPOUNDS FOR CONTROLLING INVERTEBRATE PESTS



(1)

(57) Abstract: Disclosed are compounds of Formula (1), including all geometric and stereoisomers, *N*-oxides, and salts thereof, wherein R^1, A, R^2, R^4, R^5, L and Q are as defined in the disclosure. Also disclosed are compositions containing the compounds of Formula (1) and methods for controlling an invertebrate pest comprising contacting the invertebrate pest or its environment with a biologically effective amount of a compound or a composition of the disclosure.

TITLE

AZOLE COMPOUNDS FOR CONTROLLING INVERTEBRATE PESTS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Application No. 63/214420 filed June 24, 2021.

FIELD

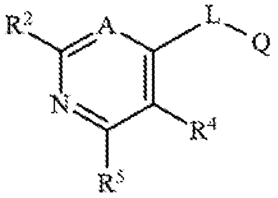
This disclosure relates to certain azole compounds, their *N*-oxides, salts and compositions suitable for agronomic and nonagronomic uses, and methods of their use for controlling invertebrate pests such as arthropods in both agronomic and nonagronomic environments.

BACKGROUND

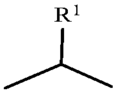
The control of invertebrate pests is extremely important in achieving high crop efficiency. Damage by invertebrate pests to growing and stored agronomic crops can cause significant reduction in productivity and thereby result in increased costs to the consumer. The control of invertebrate pests in forestry, greenhouse crops, ornamentals, nursery crops, stored food and fiber products, livestock, household, turf, wood products, and public and animal health is also important. Many products are commercially available for these purposes, but the need continues for new compounds that are more effective, less costly, less toxic, environmentally safer or have different sites of action.

SUMMARY

This disclosure is directed to compounds of Formula **1** (including all geometric and stereoisomers), *N*-oxides, and salts thereof, and compositions containing them and their use for controlling invertebrate pests:



wherein

L is 

wherein the bond projecting to the left is bonded to the aromatic ring containing A and the bond projecting to the right is bonded to Q;

R^1 is H, CN, $OCOR^6$, C_1-C_6 alkyl, C_1-C_6 haloalkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, C_3–C_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_3–C_5 cycloalkylalkyl or C_3–C_5 halocycloalkylalkyl;

A is N or CR^3;

R^2 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3-C_4 cycloalkyl, C_3-C_4 halocycloalkyl, C_1–C_4 alkoxy or C_1–C_4 haloalkoxy;

R^3 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3-C_4 cycloalkyl, C_3-C_4 halocycloalkyl, C_1–C_4 alkoxy or C_1–C_4 haloalkoxy;

R^4 is a 5- to 6-membered heterocyclic ring, each ring containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, wherein up to 2 ring members are independently selected from C(=O), C(=S), S(=O) and $S(=O)_2$, each ring optionally substituted with up to 5 substituents independently selected from R^v, and r is the number of the substituents.

each R^v is independently H, cyano, halogen, C_1-C_6 alkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_1-C_6 haloalkyl, C_2-C_6 alkenyl, C_2-C_6 haloalkenyl, C_2-C_6 alkynyl, C_2-C_6 haloalkynyl, C_3-C_6 cycloalkyl, C_3-C_6 halocycloalkyl, C_2-C_6 cyanoalkyl, C_1-C_6 hydroxyalkyl, C_4-C_{10} alkylcycloalkyl, C_4-C_{10} cycloalkylalkyl, C_3-C_6 cycloalkenyl, C_3-C_6 halocycloalkenyl, C_2-C_6 alkoxyalkyl, C_4-C_{10} cycloalkoxyalkyl, C_3-C_{10} alkoxyalkoxyalkyl, C_2-C_6 alkylthioalkyl, C_2-C_6 alkylsulfinylalkyl, C_3-C_6 cycloalkoxy, C_3-C_6 halocycloalkoxy, C_4-C_{10} cycloalkylalkoxy, C_2-C_6 alkenyloxy, C_2-C_6 haloalkenyloxy, C_2-C_6 alkoxyalkoxy, C_2-C_6 alkylcarbonyloxy, C_1-C_6 alkylthio, C_1-C_6 haloalkylthio, C_3-C_6 cycloalkylthio, C_1-C_6 alkylsulfinyl, C_1-C_6 haloalkylsulfinyl, C_1-C_6 alkylsulfonyl, C_1-C_6 haloalkylsulfonyl, C_3-C_6 cycloalkylsulfonyl, C_1-C_6 alkylamino, C_2-C_6 dialkylamino, C_1-C_6 haloalkylamino, C_2-C_6 halodialkylamino or C_3-C_6 cycloalkylamino;

r is 1, 2, 3, 4 or 5;

R^5 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl, C_3–C_4 halocycloalkyl, C_1–C_4 alkoxy or C_1–C_4 haloalkoxy;

R^6 is C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl or C_3–C_4 halocycloalkyl;

Q is a five or six membered aromatic ring containing ring members selected from carbon atoms and up to 1 oxygen atom, 1 sulfur atom, 2 nitrogen atoms, each ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w; and s is the number of the substituents; two R^w on adjacent carbon atoms together can form a 5-membered or 6-membered ring, such as -OCF_2O-, -OCH_2O-, -OCF_2S-, -OCH_2CH_2-, OCF_2CF_2O-, -OCR^5=N-, -SCR^5=N-, -CH=CR^5-CH=CH-, or-CH=N-CR^5=CH-;

R^w is independently H, cyano, halogen, , SF_5, SCl, SO_2Cl, SO_2F, C_1-C_6 alkyl, C_1-C_6 haloalkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_2-C_6 alkenyl, C_2-C_6 haloalkenyl, C_2-C_6 alkynyl, C_2-C_6 haloalkynyl, C_3-C_6 cycloalkyl, C_3-C_6 halocycloalkyl, C_2-C_6 cyanoalkyl, C_1-C_6 hydroxyalkyl, C_4-C_{10} alkylcycloalkyl, C_4-C_{10} cycloalkylalkyl, C_3-C_6 cycloalkenyl, C_3-C_6 halocycloalkenyl, C_2-C_6 alkoxyalkyl, C_4-C_{10} cycloalkoxyalkyl, C_3-C_{10} alkoxyalkoxyalkyl, C_2-C_6 alkylthioalkyl, C_2-C_6 alkylsulfinylalkyl, C_1-C_6 alkoxy, C_1-C_6 haloalkoxy, C_3-C_6 cycloalkoxy, C_3-C_6 halocycloalkoxy, C_4-C_{10} cycloalkylalkoxy, C_2-C_6 alkenyloxy, C_2-C_6 haloalkenyloxy, C_2-C_6 alkoxyalkoxy, C_2-C_6 alkylcarbonyloxy, C_1-C_6 alkylthio, C_1-C_6 haloalkylthio, C_3-C_6 cycloalkylthio, C_1-C_6 alkylsulfinyl, C_1-C_6 haloalkylsulfinyl, C_3-C_6 cycloalkylsulfinyl, C_1-C_6 alkylsulfonyl, C_1-C_6 haloalkylsulfonyl, C_3-C_6 cycloalkylsulfonyl, C_1-C_6 alkylamino, C_2-C_6 dialkylamino, C_1-C_6 haloalkylamino, C_2-C_6 halodialkylamino or C_3-C_6 cycloalkylamino;

s is 1, 2, 3, 4 or 5;

n is 0, 1 or 2.

This disclosure also provides a composition comprising a compound of Formula **1**, an *N*-oxide or a salt thereof, and at least one additional component selected from the group consisting of surfactants, solid diluents and liquid diluents. In one embodiment, this disclosure also provides a composition for controlling an invertebrate pest comprising a compound of Formula **1**, an *N*-oxide or a salt thereof, and at least one additional component selected from the group consisting of surfactants, solid diluents and liquid diluents, said composition optionally further comprising at least one additional biologically active compound or agent.

This disclosure also provides a method for controlling an invertebrate pest comprising contacting the invertebrate pest or its environment with a biologically effective amount of a compound of Formula **1**, an *N*-oxide or a salt thereof, (e.g., as a composition described herein). This disclosure also relates to such method wherein the invertebrate pest or its environment is contacted with a composition comprising a biologically effective amount of a compound of Formula **1**, an *N*-oxide or a salt thereof, and at least one additional component selected from the group consisting of surfactants, solid diluents and liquid diluents, said composition optionally further comprising a biologically effective amount of at least one additional biologically active compound or agent.

This disclosure also provides a method for controlling an invertebrate pest comprising contacting the invertebrate pest or its environment with a biologically effective amount of any of the aforesaid compositions wherein the environment is a plant.

This disclosure also provides a method for controlling an invertebrate pest comprising contacting the invertebrate pest or its environment with a biologically effective amount of any of the aforesaid compositions wherein the environment is an animal.

This disclosure also provides a method for controlling an invertebrate pest comprising contacting the invertebrate pest or its environment with a biologically effective amount of any of the aforesaid compositions wherein the environment is a seed.

This disclosure also provides a method for protecting a seed from an invertebrate pest comprising contacting the seed with a biologically effective amount of a compound of Formula **1**, an *N*-oxide or a salt thereof, (e.g., as a composition described herein). This disclosure also relates to the treated seed (i.e. seed contacted with a compound of Formula **1**).

This disclosure also provides a method for increasing vigor of a crop plant comprising contacting the crop plant, the seed from which the crop plant is grown or the locus (e.g., growth medium) of the crop plant with a biologically effective amount of a compound of Formula **1** (e.g., as a composition described herein).

This disclosure further provides a method for protecting an animal from an invertebrate parasitic pest comprising administering to the animal a parasiticidally effective amount of a compound of Formula **1**, an *N*-oxide or a salt thereof, (e.g., as a composition described herein). This disclosure also provides for the use of a compound of Formula **1**, an *N*-oxide or a salt thereof, (e.g., as a composition described herein) in protecting an animal from an invertebrate pest.

DETAILED DESCRIPTION

As used herein, the terms “comprises,” “comprising,” “includes,” “including,” “has,” “having,” “contains”, “containing,” “characterized by” or any other variation thereof, are intended to cover a non-exclusive inclusion, subject to any limitation explicitly indicated. For example, a composition, mixture, process or method that comprises a list of elements is not necessarily limited to only those elements but may include other elements not expressly listed or inherent to such composition, mixture, process or method.

The transitional phrase “consisting of” excludes any element, step, or ingredient not specified. If in the claim, such would close the claim to the inclusion of materials other than those recited except for impurities ordinarily associated therewith. When the phrase “consisting of” appears in a clause of the body of a claim, rather than immediately following the preamble, it limits only the element set forth in that clause; other elements are not excluded from the claim as a whole.

The transitional phrase “consisting essentially of” is used to define a composition or method that includes materials, steps, features, components, or elements, in addition to those literally disclosed, provided that these additional materials, steps, features, components, or elements do not materially affect the basic and novel characteristic(s) of the claimed disclosure. The term “consisting essentially of” occupies a middle ground between “comprising” and “consisting of”.

Where applicants have defined an embodiment or a portion thereof with an open-ended term such as “comprising,” it should be readily understood that (unless otherwise stated) the description should be interpreted to also describe such an embodiment using the terms “consisting essentially of” or “consisting of.”

Further, unless expressly stated to the contrary, “or” refers to an inclusive or and not to an exclusive or. For example, a condition A or B is satisfied by any one of the following: A is true (or present) and B is false (or not present), A is false (or not present) and B is true (or present), and both A and B are true (or present).

Also, the indefinite articles “a” and “an” preceding an element or component of the disclosure are intended to be nonrestrictive regarding the number of instances (i.e. occurrences) of the element or component. Therefore “a” or “an” should be read to include one or at least one, and the singular word form of the element or component also includes the plural unless the number is obviously meant to be singular.

As referred to in this disclosure, the term “invertebrate pest” includes arthropods, gastropods, nematodes and helminths of economic importance as pests. The term “arthropod” includes insects, mites, spiders, scorpions, centipedes, millipedes, pill bugs and symphylans. The term “gastropod” includes snails, slugs and other Stylommatophora. The term “nematode” includes members of the phylum Nematoda, such as phytophagous nematodes and helminth nematodes parasitizing animals. The term “helminth” includes all of the parasitic worms, such as roundworms (phylum Nematoda), heartworms (phylum Nematoda, class Secernentea), flukes (phylum Platyhelminthes, class Tematoda), acanthocephalans (phylum Acanthocephala), and tapeworms (phylum Platyhelminthes, class Cestoda).

In the context of this disclosure “invertebrate pest control” means inhibition of invertebrate pest development (including mortality, feeding reduction, and/or mating disruption), and related expressions are defined analogously.

The term “agronomic” refers to the production of field; crops such as for food and fiber and includes the growth of maize or corn, soybeans and other legumes, rice, cereal (e.g., wheat, oats, barley, rye and rice), leafy vegetables (e.g., lettuce, cabbage, and other cole crops), fruiting vegetables (e.g., tomatoes, pepper, eggplant, crucifers and cucurbits), potatoes, sweet potatoes, grapes, cotton, tree fruits (e.g., pome, stone and citrus), small fruit (e.g., berries and cherries) and other specialty crops (e.g., canola, sunflower and olives).

The term “nonagronomic” refers to other than field crops, such as horticultural crops (e.g., greenhouse, nursery or ornamental plants not grown in a field), residential, agricultural, commercial and industrial structures, turf (e.g., sod farm, pasture, golf course, lawn, sports field, etc.), wood products, stored product, agro-forestry and vegetation management, public health (i.e. human) and animal health (e.g., domesticated animals such as pets, livestock and poultry, undomesticated animals such as wildlife) applications.

The term “crop vigor” refers to rate of growth or biomass accumulation of a crop plant. An “increase in vigor” refers to an increase in growth or biomass accumulation in a crop plant relative to an untreated control crop plant. The term “crop yield” refers to the return on crop material, in terms of both quantity and quality, obtained after harvesting a crop plant. An “increase in crop yield” refers to an increase in crop yield relative to an untreated control crop plant.

The term “biologically effective amount” refers to the amount of a biologically active compound (e.g., a compound of Formula **1**) sufficient to produce the desired biological effect when applied to (i.e. contacted with) an invertebrate pest to be controlled or its environment, or to a plant, the seed from which the plant is grown, or the locus of the plant (e.g., growth medium) to protect the plant from injury by the invertebrate pest or for other desired effect (e.g., increasing plant vigor).

Nonagronomic applications include protecting an animal from an invertebrate parasitic pest by administering a parasiticidally effective (i.e. biologically effective) amount of a compound of the disclosure, typically in the form of a composition formulated for veterinary use, to the animal to be protected. As referred to in the present disclosure and claims, the terms “parasiticidal” and “parasiticidally” refers to observable effects on an invertebrate parasite pest to provide protection of an animal from the pest. Parasiticidal effects typically relate to diminishing the occurrence or activity of the target invertebrate parasitic pest. Such effects on the pest include necrosis, death, retarded growth, diminished mobility or lessened ability to remain on or in the host animal, reduced feeding and inhibition of reproduction. These effects on invertebrate parasite pests provide control (including prevention, reduction or elimination) of parasitic infestation or infection of the animal.

In the above recitations, the term “alkyl”, used either alone or in compound words such as “alkylthio” or “haloalkyl” includes straight-chain or branched alkyl, such as, methyl, ethyl, *n*-propyl, *i*-propyl, or the different butyl, pentyl or hexyl isomers. “Alkenyl” includes straight-chain or branched alkenes such as ethenyl, 1-propenyl, 2-propenyl, and the different butenyl, pentenyl and hexenyl isomers. “Alkenyl” also includes polyenes such as 1,2-propadienyl and 2,4-hexadienyl. “Alkynyl” includes straight-chain or branched alkynes such as ethynyl, 1-propynyl, 2-propynyl and the different butynyl, pentynyl and hexynyl isomers. “Alkynyl” can also include moieties comprised of multiple triple bonds such as 2,5-hexadiynyl. “Alkylene” denotes a straight-chain or branched alkanediyl. Examples of “alkylene” include CH_2, CH_2CH_2, $CH(CH_3)$, $CH_2CH_2CH_2$, $CH_2CH(CH_3)$ and the different butylene isomers. “Alkenylene” denotes a straight-chain or branched alkenediyl containing one olefinic bond. Examples of “alkenylene” include $CH{=}CH$, $CH_2CH{=}CH$, $CH{=}C(CH_3)$

and the different butenylene isomers. “Alkynylene” denotes a straight-chain or branched alkynediyl containing one triple bond. Examples of “alkynylene” include $C{\equiv}C$, $CH_2C{\equiv}C$, $C{\equiv}CCH_2$ and the different butynylene isomers.

“Alkoxy” includes, for example, methoxy, ethoxy, *n*-propyloxy, isopropyloxy and the different butoxy, pentoxy and hexyloxy isomers. “Alkoxyalkyl” denotes alkoxy substitution on alkyl. Examples of “alkoxyalkyl” include CH_3OCH_2, $CH_3OCH_2CH_2$, $CH_3CH_2OCH_2$, $CH_3CH_2CH_2CH_2OCH_2$ and $CH_3CH_2OCH_2CH_2$. “Alkoxyalkoxy” denotes alkoxy substitution on alkoxy. “Alkenyloxy” includes straight-chain or branched alkenyloxy moieties. Examples of “alkenyloxy” include $H_2C{=}CHCH_2O$, $(CH_3)_2C{=}CHCH_2O$, $(CH_3)CH{=}CHCH_2O$, $(CH_3)CH{=}C(CH_3)CH_2O$ and $CH_2{=}CHCH_2CH_2O$. “Alkynyloxy” includes straight-chain or branched alkynyloxy moieties. Examples of “alkynyloxy” include $HC{\equiv}CCH_2O$, $CH_3C{\equiv}CCH_2O$ and $CH_3C{\equiv}CCH_2CH_2O$. “Alkylthio” includes branched or straight-chain alkylthio moieties such as methylthio, ethylthio, and the different propylthio, butylthio, pentylthio and hexylthio isomers. “Alkylsulfinyl” includes both enantiomers of an alkylsulfinyl group. Examples of “alkylsulfinyl” include $CH_3S(O)$-, $CH_3CH_2S(O)$-, $CH_3CH_2CH_2S(O)$-, $(CH_3)_2CHS(O)$- and the different butylsulfinyl, pentylsulfinyl and hexylsulfinyl isomers. Examples of “alkylsulfonyl” include $CH_3S(O)_2$-, $CH_3CH_2S(O)_2$-, $CH_3CH_2CH_2S(O)_2$-, $(CH_3)_2CHS(O)_2$-, and the different butylsulfonyl, pentylsulfonyl and hexylsulfonyl isomers. “Alkylthioalkyl” denotes alkylthio substitution on alkyl. Examples of “alkylthioalkyl” include CH_3SCH_2, $CH_3SCH_2CH_2$, $CH_3CH_2SCH_2$, $CH_3CH_2CH_2CH_2SCH_2$ and $CH_3CH_2SCH_2CH_2$. “Alkylthioalkoxy” denotes alkylthio substitution on alkoxy. “Alkyldithio” denotes branched or straight-chain alkyldithio moieties. Examples of “alkyldithio” include CH_3SS-, CH_3CH_2SS-, $CH_3CH_2CH_2SS$-, $(CH_3)_2CHSS$- and the different butyldithio and pentyldithio isomers. “Cyanoalkyl” denotes an alkyl group substituted with one cyano group. Examples of “cyanoalkyl” include $NCCH_2$, $NCCH_2CH_2$ and $CH_3CH(CN)CH_2$. “Alkylamino”, “dialkylamino”, “alkenylthio”, “alkenylsulfinyl”, “alkenylsulfonyl”, “alkynylthio”, “alkynylsulfinyl”, “alkynylsulfonyl”, and the like, are defined analogously to the above examples.

“Cycloalkyl” includes, for example, cyclopropyl, cyclobutyl, cyclopentyl and cyclohexyl. The term “alkylcycloalkyl” denotes alkyl substitution on a cycloalkyl moiety and includes, for example, ethylcyclopropyl, *i*-propylcyclobutyl, 3-methylcyclopentyl and 4-methylcyclohexyl. The term “cycloalkylalkyl” denotes cycloalkyl substitution on an alkyl moiety. Examples of “cycloalkylalkyl” include cyclopropylmethyl, cyclopentylethyl, and other cycloalkyl moieties bonded to straight-chain or branched alkyl groups. The term “cycloalkoxy” denotes cycloalkyl linked through an oxygen atom such as cyclopentyloxy and cyclohexyloxy. “Cycloalkylalkoxy” denotes cycloalkylalkyl linked through an oxygen atom attached to the alkyl chain. Examples of “cycloalkylalkoxy” include cyclopropylmethoxy, cyclopentylethoxy, and other cycloalkyl moieties bonded to straight-chain or branched alkoxy groups. “Cyanocycloalkyl” denotes a cycloalkyl group substituted with one cyano group. Examples of “cyanocycloalkyl” include 4-cyanocyclohexyl and 3-cyanocyclopentyl. “Cycloalkenyl” includes groups such as cyclopentenyl and cyclohexenyl as well as groups with more than one double bond such as 1,3- and 1,4-cyclohexadienyl.

The term “halogen”, either alone or in compound words such as “haloalkyl”, or when used in descriptions such as “alkyl substituted with halogen” includes fluorine, chlorine, bromine or iodine. Further, when used in compound words such as “haloalkyl”, or when used in descriptions such as “alkyl substituted with halogen” said alkyl may be partially or fully substituted with halogen atoms which may be the same or different. Examples of “haloalkyl” or “alkyl substituted with halogen” include F_3C-, $ClCH_2$-, CF_3CH_2- and CF_3CCl_2-. The terms “halocycloalkyl”, “haloalkoxy”, “haloalkylthio”, “haloalkenyl”, “haloalkynyl”, and the like, are defined analogously to the term “haloalkyl”. Examples of “haloalkoxy” include CF_3O-, CCl_3CH_2O-, $HCF_2CH_2CH_2O$- and CF_3CH_2O-. Examples of “haloalkylthio” include CCl_3S-, CF_3S-, CCl_3CH_2S- and $ClCH_2CH_2CH_2S$-. Examples of “haloalkylsulfinyl” include $CF_3S(O)$-, $CCl_3S(O)$-, $CF_3CH_2S(O)$- and $CF_3CF_2S(O)$-. Examples of “haloalkylsulfonyl” include $CF_3S(O)_2$-, $CCl_3S(O)_2$-, $CF_3CH_2S(O)_2$- and $CF_3CF_2S(O)_2$-. Examples of “haloalkenyl” include $(Cl)_2C{=}CHCH_2$- and $CF_3CH_2CH{=}CHCH_2$-. Examples of “haloalkynyl” include $HC{\equiv}CCHCl$-, $CF_3C{\equiv}C$-, $CCl_3C{\equiv}C$- and $FCH_2C{\equiv}CCH_2$-. Examples of “haloalkoxyalkoxy” include CF_3OCH_2O-, $ClCH_2CH_2OCH_2CH_2O$-, $Cl_3CCH_2OCH_2O$- as well as branched alkyl derivatives.

“Alkylcarbonyl” denotes a straight-chain or branched alkyl moieties bonded to a C(=O) moiety. Examples of “alkylcarbonyl” include $CH_3C(=O)$-, $CH_3CH_2CH_2C(=O)$- and $(CH_3)_2CHC(=O)$-. Examples of “alkoxycarbonyl” include $CH_3OC(=O)$-, $CH_3CH_2OC(=O)$-, $CH_3CH_2CH_2OC(=O)$-, $(CH_3)_2CHOC(=O)$- and the different butoxy- or pentoxycarbonyl isomers.

The chemical abbreviations S(O) and S(=O) as used herein represent a sulfinyl moiety. The chemical abbreviations SO_2, $S(O)_2$ and $S(=O)_2$ as used herein represent a sulfonyl moiety. The chemical abbreviations C(O) and C(=O) as used herein represent a carbonyl moiety. The chemical abbreviations CO_2, C(O)O and C(=O)O as used herein represent an oxycarbonyl moiety. “CHO” means formyl.

When R^4 is a 5- to 6-membered heterocyclic ring substituted with up to 5 substituents independently selected from R^v, the substituents R^v may be attached to the remainder of the compound of Formula **1** through any available ring member of the heterocyclic ring.

When Q is a six membered aromatic ring substituted with up to 5 substituents independently selected from R^w, the substituents R^w may be attached to the remainder of the compound of Formula **1** through any available ring member of the six membered aromatic ring.

The total number of carbon atoms in a substituent group is indicated by the "C_i–C_j" prefix where i and j are numbers from 1 to 10. For example, C_1–C_4 alkylsulfonyl designates methylsulfonyl through butylsulfonyl; C_2 alkoxyalkyl designates CH_3OCH_2-; C_3 alkoxyalkyl designates, for example, $CH_3CH(OCH_3)$-, $CH_3OCH_2CH_2$- or $CH_3CH_2OCH_2$-; and C_4 alkoxyalkyl designates the various isomers of an alkyl group substituted with an alkoxy group containing a total of four carbon atoms, examples including $CH_3CH_2CH_2OCH_2$- and $CH_3CH_2OCH_2CH_2$-.

When a compound is substituted with a substituent bearing a subscript that indicates the number of said substituents can exceed 1, said substituents (when they exceed 1) are independently selected from the group of defined substituents, e.g., $[(R^v)_r]$, r is 1, 2, 3, 4 or 5; and $[(R^w)_s]$, s is 1, 2, 3, 4 or 5. When a group contains a substituent which can be hydrogen, for example R^v or R^w, then when this substituent is taken as hydrogen, it is recognized that this is equivalent to said group being unsubstituted. When one or more positions on a group are said to be "not substituted" or "unsubstituted", then hydrogen atoms are attached to take up any free valency.

Unless otherwise indicated, a "ring" as a component of Formula **1** (e.g., substituent R^4) is carbocyclic or heterocyclic. The term "ring member" refers to an atom or other moiety (e.g., C(=O), C(=S), S(O) or $S(O)_2$) forming the backbone of a ring.

The term "carbocyclic ring" or "carbocycle" denotes a ring wherein the atoms forming the ring backbone are selected only from carbon. The term "heterocyclic ring" or "heterocycle" denotes a ring in which at least one atom forming the ring backbone is not carbon, e.g., nitrogen, oxygen or sulfur. Typically, a heterocyclic ring contains no more than 4 nitrogens, no more than 2 oxygens and no more than 2 sulfurs. Unless otherwise indicated, a carbocyclic ring or heterocyclic ring can be a saturated or unsaturated ring. "Saturated" refers to a ring having a backbone consisting of atoms linked to one another by single bonds; unless otherwise specified, the remaining atom valences are occupied by hydrogen atoms. Unless otherwise stated, an "unsaturated ring" may be partially unsaturated or fully unsaturated. The expression "fully unsaturated ring" means a ring of atoms in which the bonds between atoms in the ring are single or double bonds according to valence bond theory and furthermore the bonds between atoms in the ring include as many double bonds as possible without double bonds being cumulative (i.e. no C=C=C or C=C=N). The term "partially unsaturated ring" denotes a ring comprising at least one ring member bonded to an adjacent ring member through a double bond and which conceptually potentially accommodates a number of non-cumulated double bonds between adjacent ring members (i.e. in its fully unsaturated counterpart form) greater than the number of double bonds present (i.e. in its partially unsaturated form).

Unless otherwise indicated, heterocyclic rings can be attached through any available carbon or nitrogen by replacement of a hydrogen on said carbon or nitrogen.

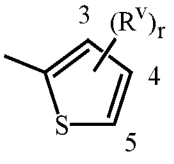
"Aromatic" indicates that each of the ring atoms is essentially in the same plane and has a *p*-orbital perpendicular to the ring plane, and in which $(4n + 2)\ \pi$ electrons, where n is a positive integer, are associated with the ring to comply with Hückel's rule. When a fully unsaturated carbocyclic ring satisfies Hückel's rule, then said ring is also called an "aromatic ring" or "aromatic carbocyclic ring". When a fully unsaturated heterocyclic ring satisfies Hückel's rule, then said ring is also called a "heteroaromatic ring" or "aromatic heterocyclic ring".

The term "optionally substituted" in connection with the heterocyclic rings refers to groups which are unsubstituted or have at least one non-hydrogen substituent that does not extinguish the biological activity possessed by the unsubstituted analog. As used herein, the following definitions shall apply unless otherwise indicated. The term "optionally substituted" is used interchangeably with the phrase "substituted or unsubstituted" or with the term "(un)substituted." Unless otherwise indicated, an optionally substituted group may have a substituent at each substitutable position of the group, and each substitution is independent of the other.

When R^4 is a 5- or 6-membered nitrogen-containing heterocyclic ring, it may be attached to the remainder of Formula **1** though any available carbon or nitrogen ring atom, unless otherwise described.

As noted above, R^4 can be a 5- or 6-membered heterocyclic ring, which may be saturated or unsaturated, optionally substituted with one or more substituents selected from a group of substituents as defined in the Summary. Examples of a 5- or 6-membered unsaturated aromatic heterocyclic ring optionally substituted with from one or more substituents include the rings U-2 through U-61 illustrated in Exhibit 1 wherein R^v is any substituent as defined in the Summary and r is an integer from 1 to 4, limited by the number of available positions on each U group. As U-29, U-30, U-36, U-37, U-38, U-39, U-40, U-41, U-42 and U-43 have only one available position, for these U groups r is limited to the integer 1, and when R^v being H and r being 1 means that the U group is unsubstituted and a hydrogen is present at the position indicated by $(R^v)_r$.

Exhibit 1



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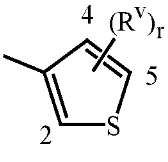

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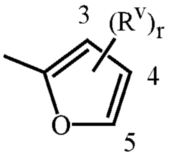

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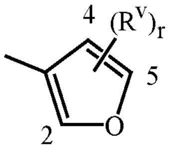

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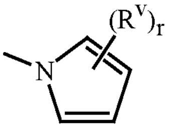

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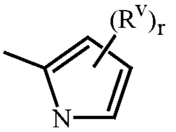

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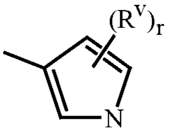

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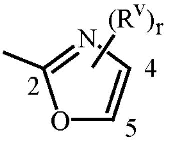

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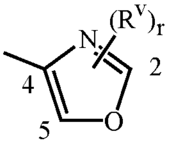

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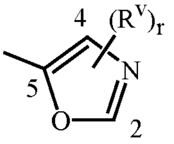

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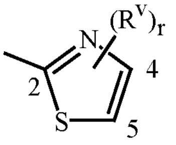

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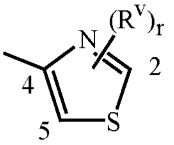

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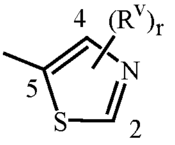

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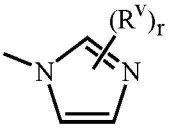

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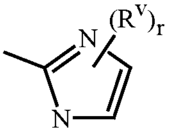

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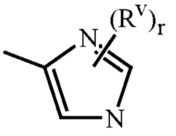

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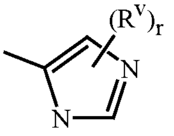

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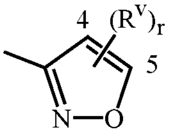

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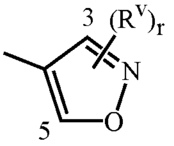

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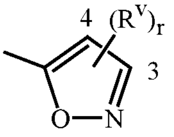

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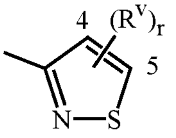

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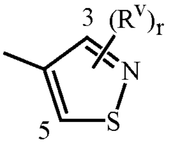

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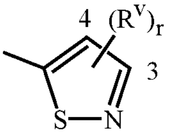

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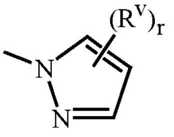

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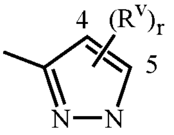

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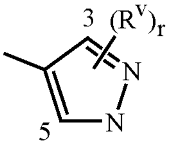

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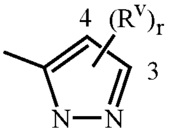

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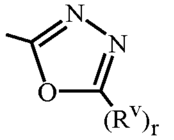

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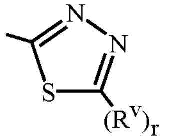

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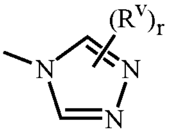

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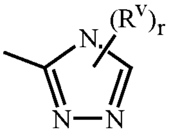

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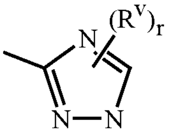

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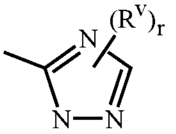

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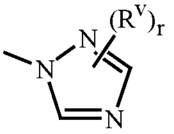

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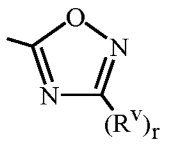

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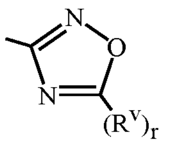

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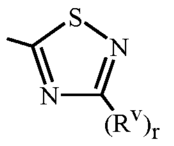

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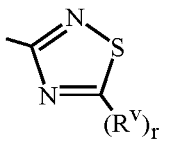

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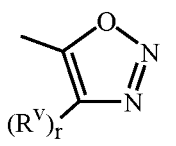

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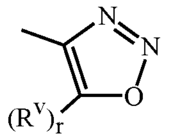

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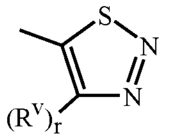

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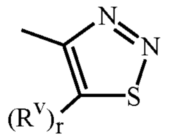
U-42



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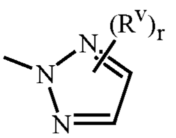

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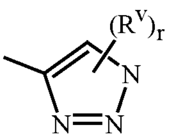

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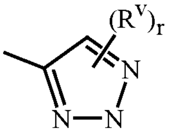
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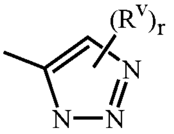
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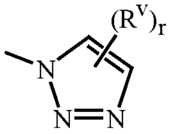
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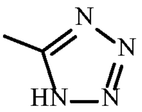
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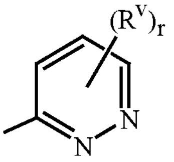
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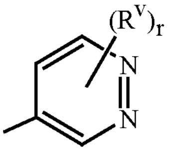
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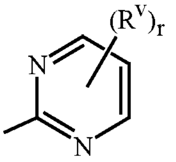
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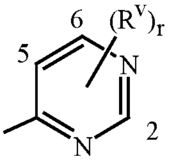
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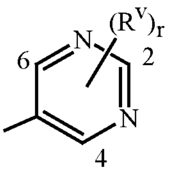
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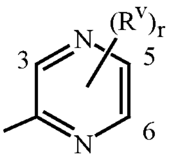
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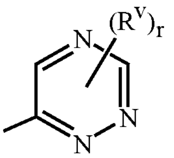
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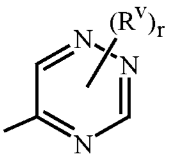
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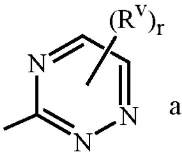
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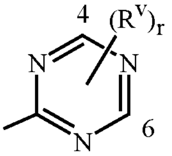
U-61

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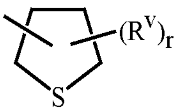
Note that when R^4 is a 5- or 6-membered saturated or unsaturated non-aromatic heterocyclic ring optionally substituted with one or more substituents selected from the group of substituents as defined in the Summary, one or two carbon ring members of the heterocycle can optionally be in the oxidized form of a carbonyl moiety.

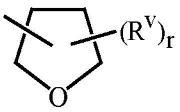
Examples of a 5- or 6-membered saturated or non-aromatic unsaturated heterocyclic ring include the rings G-1 through G-35 as illustrated in Exhibit 2. Note that when the attachment point on the G group is illustrated as floating, the G group can be attached to the remainder of Formula **1** through any available carbon or nitrogen of the G group by replacement of a hydrogen atom. The optional substituents corresponding to R^v can be attached to any available carbon or nitrogen by replacing a hydrogen atom. For these G rings, s is typically an integer from 1 to 5, limited by the number of available positions on each G group.

Note that when R^4 comprises a ring selected from G-28 through G-35, G^2 is selected from O, S or N. Note that when G^2 is N, the nitrogen atom can complete its valence by substitution with the substituents corresponding to R^w as defined in the Summary.

Exhibit 2



G-1



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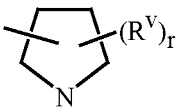

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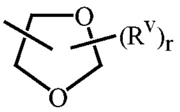
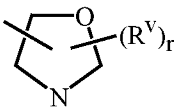


G-4



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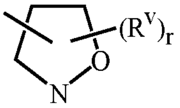

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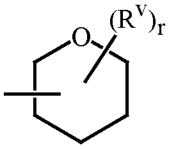

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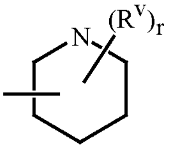

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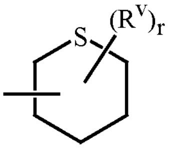

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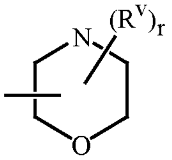

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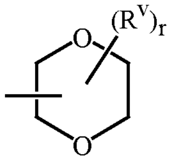

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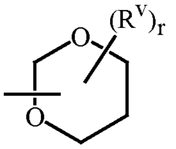

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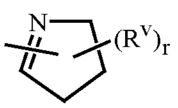

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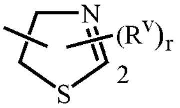

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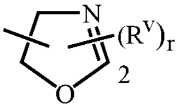

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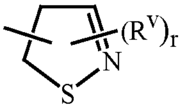

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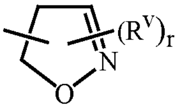

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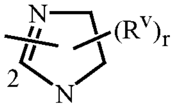

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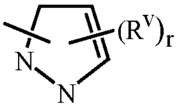

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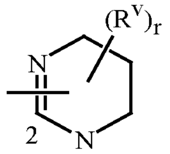

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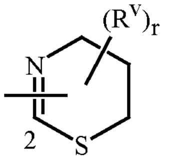

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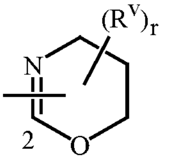

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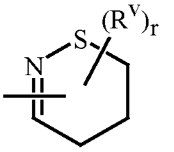

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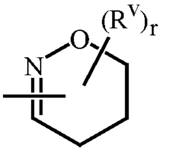

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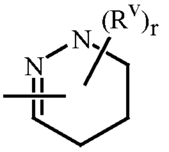

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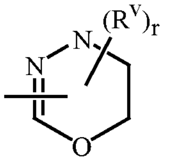

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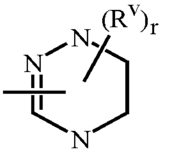

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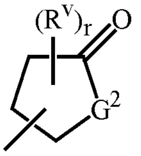

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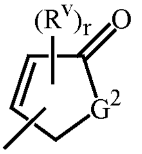

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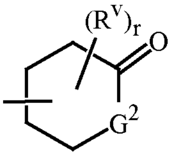

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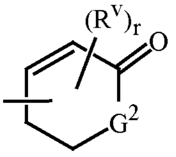

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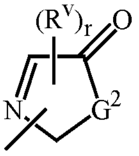

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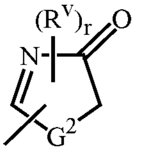

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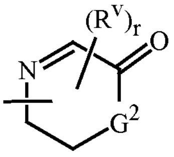

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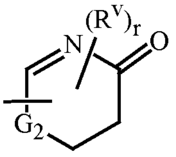


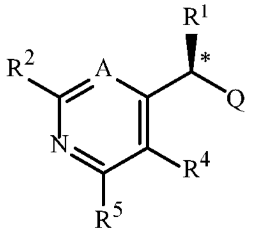
G-34 G-35

Although R^V groups are shown in the structures U-2 through U-61, it is noted that they do not need to be present since they are optional substituents. Note that when R^V is H attached to an atom, this is the same as if said atom is unsubstituted. The nitrogen atoms that require substitution to fill their valence are substituted with H or R^V. Note that when the attachment point between $(R^V)_r$ and the U ring is illustrated as floating, $(R^V)_r$ can be attached to any available carbon atom or nitrogen atom of the U ring. Note that when the attachment point on the U ring is illustrated as floating, the U group can be attached to the remainder of Formula **1** through any available carbon or nitrogen of the U group by replacement of a hydrogen atom. Note that some U rings can only be substituted with less than 4 R^V groups (e.g., U-2 through U-5, U-7 through U-49, and U-52 through U-61).

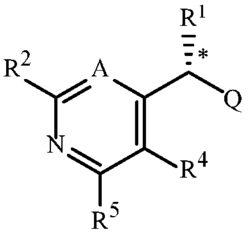
A wide variety of synthetic methods are known in the art to enable preparation of aromatic and nonaromatic heterocyclic rings and ring systems; for extensive reviews see the eight volume set of *Comprehensive Heterocyclic Chemistry*, A. R. Katritzky and C. W. Rees editors-in-chief, Pergamon Press, Oxford, 1984 and the twelve volume set of *Comprehensive Heterocyclic Chemistry II*, A. R. Katritzky, C. W. Rees and E. F. V. Scriven editors-in-chief, Pergamon Press, Oxford, 1996.

Compounds of this disclosure can exist as one or more stereoisomers. Stereoisomers are isomers of identical constitution but differing in the arrangement of their atoms in space and include enantiomers, diastereomers, cis-trans isomers (also known as geometric isomers) and atropisomers. Atropisomers result from restricted rotation about single bonds where the rotational barrier is high enough to permit isolation of the isomeric species. One skilled in the art will appreciate that one stereoisomer may be more active and/or may exhibit beneficial effects when enriched relative to the other stereoisomer(s) or when separated from the other stereoisomer(s). Additionally, the skilled artisan knows how to separate, enrich, and/or to selectively prepare said stereoisomers. For a comprehensive discussion of all aspects of stereoisomerism, see Ernest L. Eliel and Samuel H. Wilen, *Stereochemistry of Organic Compounds*, John Wiley & Sons, 1994.

The compounds of the disclosure may be present as a mixture of stereoisomers or individual stereoisomers. For example, two possible enantiomers of Formula **1** are depicted as Formula **1a** and Formula **1a′** involving a chiral carbon center identified with an asterisk (*). Analogously, other chiral centers are possible at, for example, R^4.



1a



1a'

Molecular depictions drawn herein follow standard conventions for depicting stereochemistry. To indicate stereo configuration, bonds rising from the plane of the drawing and towards the viewer are denoted by solid wedges wherein the broad end of the wedge is attached to the atom rising from the plane of the drawing towards the viewer. Bonds going below the plane of the drawing and away from the viewer are denoted by dashed wedges wherein the broad end of the wedge is attached to the atom further away from the viewer.

The compounds of the disclosure can exist as stereoisomers due to the possible chiral carbon atoms present in Formula **1**. Thus, this disclosure comprises the individual stereoisomers of the compounds of Formula **1**, as well as mixtures of stereoisomers of the compounds of Formula **1**.

Compounds of Formula **1** can comprise additional chiral centers. For example, substituents and other molecular constituents such as R^4 may themselves contain chiral centers. This disclosure comprises racemic mixtures as well as enriched and essentially pure stereo configurations at these additional chiral centers.

Compounds of this disclosure can exist as one or more conformational isomers due to restricted rotation about any bonds in Formula **1**. This disclosure comprises mixtures of conformational isomers. In addition, this disclosure includes compounds that are enriched in one conformer relative to others.

The more biologically active enantiomer is believed to be Formula **1a** (the R-enantiomer of Formula **1**.

This disclosure comprises racemic mixtures of equal amounts of the enantiomers of Formulae **1a** (the R-enantiomer of Formula **1**) and **1a' (**the S-enantiomer of Formula **1**). In addition, this disclosure includes mixtures that are enriched in the Formula **1a** enantiomer compared to the racemic mixture of Formulae **1a** and **1a'**. This disclosure also comprises the essentially pure enantiomer of Formula **1a**.

An embodiment of this disclosure comprises mixtures of stereoisomers of the compounds of Formula **1a** and Formula **1a'**, wherein the ratio of **1a** to **1a'** is at least 75:25 (a 50% enantiomeric excess).

An embodiment of this disclosure comprises mixtures of stereoisomers of the compounds of Formula **1a** and Formula **1a'**, wherein the ratio of **1a** to **1a'** is at least 90:10 (an 80% enantiomeric excess of **1a**).

An embodiment of this disclosure comprises mixtures of stereoisomers of the compounds of Formula **1a** and Formula **1a'**, wherein the ratio of **1a** to **1a'** is at least 95:5 (a 90% enantiomeric excess of **1a**).

An embodiment of this disclosure comprises mixtures of stereoisomers of the compounds of Formula **1a** and Formula **1a'**, wherein the ratio of **1a** to **1a'** is at least 98:2 (a 96% enantiomeric excess of **1a**).

An embodiment of this disclosure comprises mixtures of stereoisomers of the compounds of Formula **1a** and Formula **1a'**, wherein the ratio of **1a** to **1a'** is at least 99:1 (a 98% enantiomeric excess of **1a**).

An embodiment of this disclosure comprises mixtures of stereoisomers of the compounds of Formula **1a** and Formula **1a'**, wherein the ratio of **1a** to **1a'** is essentially 100:0.

An embodiment of this disclosure comprises the compounds of Formula **1a**.

One skilled in the art will appreciate that not all nitrogen-containing heterocycles can form *N*-oxides since the nitrogen requires an available lone pair for oxidation to the oxide; one skilled in the art will recognize those nitrogen-containing heterocycles which can form *N*-oxides. One skilled in the art will also recognize that tertiary amines can form *N*-oxides. Synthetic methods for the preparation of *N*-oxides of heterocycles and tertiary amines are very well known by one skilled in the art including the oxidation of heterocycles and tertiary amines with peroxy acids such as peracetic and 3-chloroperbenzoic acid (MCPBA), hydrogen peroxide, alkyl hydroperoxides such as *t*-butyl hydroperoxide, sodium perborate, and dioxiranes such as dimethyldioxirane. These methods for the preparation of *N*-oxides have been extensively described and reviewed in the literature, see for example: T. L. Gilchrist in *Comprehensive Organic Synthesis*, vol. 7, pp 748–750, S. V. Ley, Ed., Pergamon Press; M. Tisler and B. Stanovnik in *Comprehensive Heterocyclic Chemistry*, vol. 3, pp 18–20, A. J. Boulton and A. McKillop, Eds., Pergamon Press; M. R. Grimmett and B. R. T. Keene in *Advances in Heterocyclic Chemistry*, vol. 43, pp 149–161, A. R. Katritzky, Ed., Academic Press; M. Tisler and B. Stanovnik in *Advances in Heterocyclic Chemistry*, vol. 9, pp 285–291, A. R. Katritzky and A. J. Boulton, Eds., Academic Press; and G. W. H. Cheeseman and E. S. G. Werstiuk in *Advances in Heterocyclic Chemistry*, vol. 22, pp 390–392, A. R. Katritzky and A. J. Boulton, Eds., Academic Press.

One skilled in the art recognizes that because in the environment and under physiological conditions salts of chemical compounds are in equilibrium with their corresponding nonsalt forms, salts share the biological utility of the nonsalt forms. Thus a wide variety of salts of the compounds of Formula **1** are useful for control of invertebrate pests. The salts of the compounds of Formula **1** include acid-addition salts with inorganic or organic acids such as hydrobromic, hydrochloric, nitric, phosphoric, sulfuric, acetic, butyric, fumaric, lactic, maleic, malonic, oxalic, propionic, salicylic, tartaric, 4-toluenesulfonic or valeric acids. When a compound of Formula **1** contains an acidic moiety such as a carboxylic acid or phenol, salts also include those formed with organic or inorganic bases such as pyridine, triethylamine or ammonia, or amides, hydrides, hydroxides or carbonates of sodium, potassium, lithium, calcium, magnesium or barium. Accordingly, the present disclosure comprises compounds selected from Formula **1**, *N*-oxides and suitable salts thereof.

Compounds selected from Formula **1**, stereoisomers, tautomers, *N*-oxides, and salts thereof, typically exist in more than one form, and Formula **1** thus includes all crystalline and non-crystalline forms of the compounds that Formula **1** represents. Non-crystalline forms include embodiments which are solids such as waxes and gums as well as embodiments which are liquids such as solutions and melts. Crystalline forms include embodiments which represent essentially a single crystal type and embodiments which represent a mixture of polymorphs (i.e. different crystalline types). The term "polymorph" refers to a particular crystalline form of a chemical compound that can crystallize in different crystalline forms, these forms having different arrangements and/or conformations of the molecules in the crystal lattice. Although polymorphs can have the same chemical composition, they can also differ in composition due to the presence or absence of co-crystallized water or other molecules, which can be weakly or strongly bound in the lattice. Polymorphs can differ in such chemical, physical and biological properties as crystal shape, density, hardness, color, chemical stability, melting point, hygroscopicity, suspensibility, dissolution rate and biological availability. One skilled in the art will appreciate that a polymorph of a compound represented by Formula **1** can exhibit beneficial effects (e.g., suitability for preparation of useful formulations, improved biological performance) relative to another polymorph or a mixture of polymorphs of the same compound represented by Formula **1**. Preparation and isolation of a particular polymorph of a compound represented by Formula **1** can be achieved by methods known to those skilled in the art including, for example, crystallization using selected solvents and temperatures. Compounds of this disclosure may exist as one or more crystalline polymorphs. This disclosure comprises both individual polymorphs and mixtures of polymorphs, including mixtures enriched in one polymorph relative to others. For a comprehensive discussion of polymorphism see R. Hilfiker, Ed., *Polymorphism in the Pharmaceutical Industry*, Wiley-VCH, Weinheim, 2006.

Embodiments of the present disclosure as described in the Summary include those described below. In the following Embodiments, Formula **1** includes stereoisomers, *N*-oxides and salts thereof, and reference to "a compound of Formula **1**" includes the definitions of substituents specified in the Summary unless further defined in the Embodiments.

Embodiment 1. A compound of Formula **1** wherein R^1 is H, CN, $OCOR^6$, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, C_1-C_6 haloalkyl, C_3-C_6 cycloalkyl, C_3-C_6 halocycloalkyl or C_3-C_5 cycloalkylalkyl.

Embodiment 1a. A compound of Formula **1** wherein R^1 is H, CN, $OCOR^6$, C_1-C_6 alkyl, C_1-C_6 haloalkyl, C_3-C_6 cycloalkyl, C_3-C_6 halocycloalkyl or C_3-C_5 cycloalkylalkyl.

Embodiment 1b. A compound of Embodiment 1a wherein R^1 is H, CN, $OCOR^6$, C_1-C_6 alkyl, C_1-C_6 haloalkyl, C_3-C_6 cycloalkyl or C_3-C_6 halocycloalkyl.

Embodiment 1c. A compound of Embodiment 1b wherein R^1 is H, CN, $OCOR^6$, C_1-C_6 alkyl, C_1-C_6 haloalkyl or C_3-C_6 cycloalkyl.

Embodiment 1d. A compound of Embodiment 1c wherein R^1 is H, CN, $OCOR^6$, C_1-C_6 alkyl or C_1-C_6 haloalkyl.

Embodiment 1e. A compound of Embodiment 1d wherein R^1 is H, CN, $OCOR^6$ or C_1-C_6 alkyl.

Embodiment 1f. A compound of Embodiment 1e wherein R^1 is H, CN or C_1-C_6 alkyl.

Embodiemtn 1g. A compound of Embodiment 1f wherein R^1 is H or C_1-C_6 alkyl.

Embodiment 2. A compound of Formula **1** or any one of the preceding Embodiments wherein A is N or CR^3.

Embodiment 2a. A compound of Embodiment 2 wherein A is CR^3.

Embodiment 3. A compound of Formula **1** or any of the preceding Embodiments wherein R^2 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl, C_3–C_4 halocycloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy.

Embodiment 3a. A compound of Embodiment 3 wherein R^2 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl, C_3–C_4 halocycloalkyl or C_1-C_4 alkoxy.

Embodiment 3b. A compound of Embodiment 3a wherein R^2 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl or C_3–C_4 halocycloalkyl.

Embodiment 3c. A compound of Embodiment 3b wherein R^2 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl or C_3–C_4 cycloalkyl.

Embodiment 3d. A compound of Embodiment 3c wherein R^2 is H, halogen, CN, C_1-C_4 alkyl or C_1-C_4 haloalkyl.

Embodiment 3e. A compound of Embodiment 3d wherein R^2 is H, halogen, CN or C_1-C_4 alkyl.

Embodiment 3f. A compound of Embodiment 3e wherein R^2 is H, halogen or C_1-C_4 alkyl.

Embodiment 3g. A compound of Embodiment 3f wherein R^2 is H.

Embodiment 3h. A compound of Embodiment 3e wherein R^2 is halogen.

Embodiment 3i. A compound of Embodiment 3e wherein R^2 is C_1-C_4 alkyl.

Embodiment 4. A compound of Formula **1** or any of the preceding Embodiments wherein R^3 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl, C_3–C_4 halocycloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy.

Embodiment 4a. A compound of Embodiment 4 wherein R^3 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl, C_3–C_4 halocycloalkyl or C_1-C_4 alkoxy.

Embodiment 4b. A compound of Embodiment 4a wherein R^3 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl or C_3–C_4 halocycloalkyl.

Embodiment 4c. A compound of Embodiment 4b wherein R^3 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl or C_3–C_4 cycloalkyl.

Embodiment 4d. A compound of Embodiment 4c wherein R^3 is H, halogen, CN, C_1-C_4 alkyl or C_1-C_4 haloalkyl.

Embodiment 4e. A compound of Embodiment 4d wherein R^3 is H, halogen, CN or C_1-C_4 alkyl.

Embodiment 4f. A compound of Embodiment 4e wherein R^3 is H, halogen or C_1-C_4 alkyl.

Embodiment 4g. A compound of Embodiment 4f wherein R^3 is H.

Embodiment 4h. A compound of Embodiment 4g wherein R^3 is C_1-C_4 alkyl.

Embodiment 4i. A compound of Embodiment 4h wherein R^3 is halogen.

Embodiment 4j. A compound of Embodiment 4i wherein R^3 is F, Br or Cl.

Embodiment 4k. A compound of Embodiment 4j wherein R^3 is F or Cl.

Embodiment 4l. A compound of Embodiment 4k wherein R^3 is F.

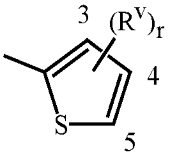
Embodiment 4m. A compound of Embodiment 4k wherein R^3 is Cl.

Embodiment 4n. A compound of Embodiment 4j wherein R^3 is Br.

Embodiment 5. A compound of Formula **1** or any of the preceding Embodiments wherein R^4 is a 5- to 6-membered heterocyclic ring, each ring containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, wherein up to 2 ring members are independently selected from C(=O), C(=S), S(=O) and $S(=O)_2$, each ring optionally substituted with up to 5 substituents independently selected from R^v, and r is the number of the substituents.

Embodiment 5a. A compound of Embodiment 5 wherein R^4 is selected from from U-2 to U-49 or U52 to U61 as shown in Exhibit 1.

Exhibit 1



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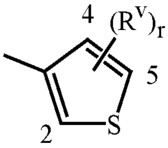

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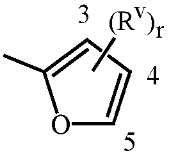

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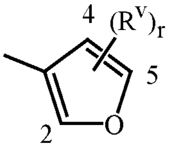

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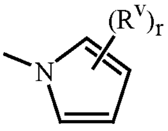

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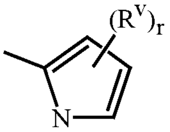

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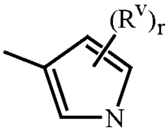

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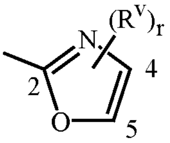

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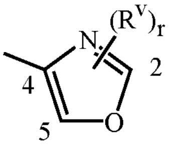

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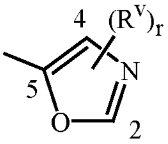

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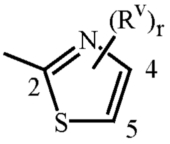

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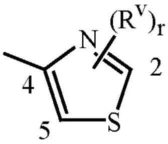

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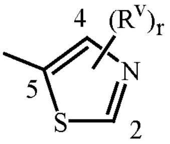

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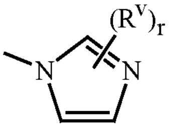

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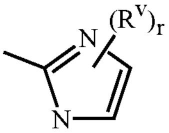

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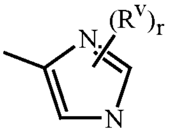

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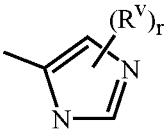

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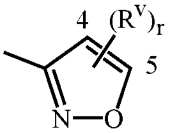

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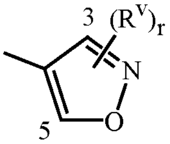

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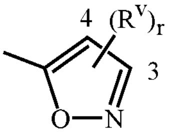

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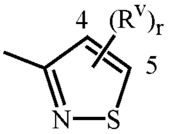

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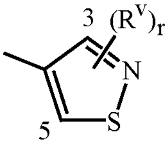

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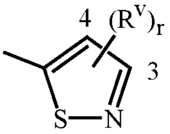

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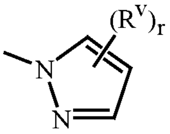

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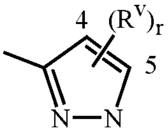

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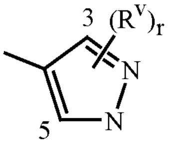

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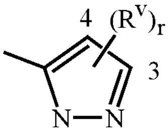

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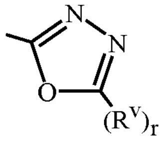

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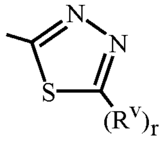

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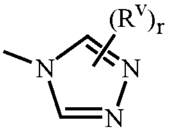

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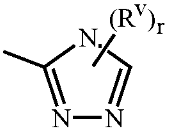

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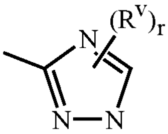

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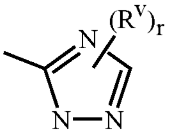

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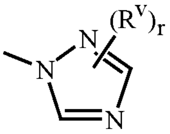

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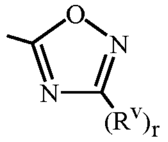

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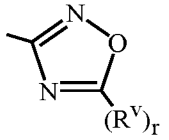

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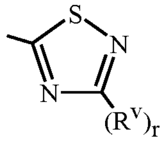

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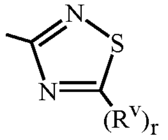

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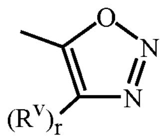

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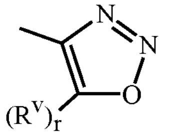 ,

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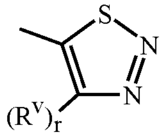 ,

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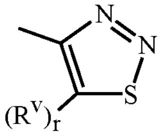 ,

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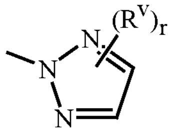 ,

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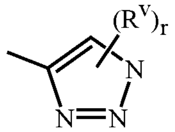 ,

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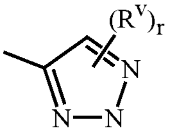 ,

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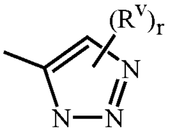 ,

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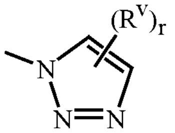 ,

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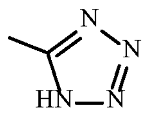 ,

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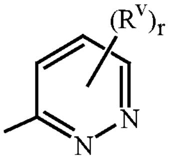 ,

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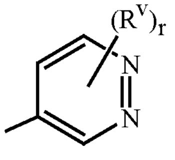 ,

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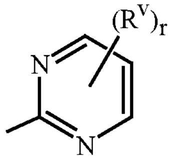 ,

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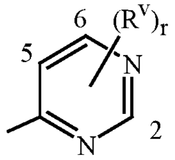 ,

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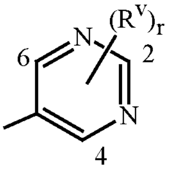 ,

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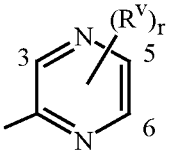 ,

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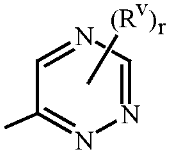 ,

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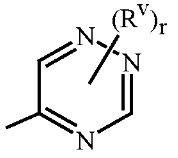 ,

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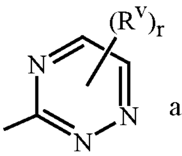 and

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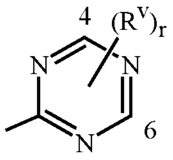
 .

U-61

Embodiment 5b. A compound of Embodiment 5a wherein R^4 is selected from U-2 to U-49.

Embodiment 5c. A compound of Embodiment 5b wherein R^4 is selected from U-2, U-3, U-4, U-5, U-7, U-9, U-11, U-12, U-13, U-16, U-21, U-25, U-26, U-27, U-28, U-29, U-31, U-32, U-35, U-36, U-37, U-44, U-48 and U-49.

Embodiment 5d. A compound of Embodiment 5c wherein R^4 is selected from U-9, U-11, U-32, U-36, U-44, U-48 and U-49.

Embodiment 5e. A compound of Embodiment 5d wherein R^4 is selected from U-9, U-11, U-32, U-36, U-48 and U-44.

Embodiment 5f. A compound of Embodiment 5e wherein R^4 is selected from U-9, U-32, U-44 and U-48.

Embodiment 5g. A compound of Embodiment 5f wherein R^4 is U-9.

Embodiment 5h. A compound of Embodiment 5g wherein R^4 is U-11.

Embodiment 5i. A compound of Embodiment 5h wherein R^4 is U-32.

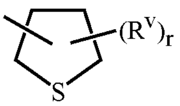
Embodiment 5j. A compound of Embodiment 5i wherein R^4 is U-36.

Embodiment 5k. A compound of Embodiment 5j wherein R^4 is U-44.

Embodiment 5l. A compound of Embodiment 5k wherein R^4 is U-48.

Embodiment 5l. A compound of Embodiment 5 wherein R^4 is selected from G-1 to G-37 as shown in Exhibit 2.

Exhibit 2



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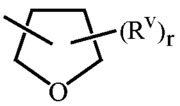
G-1



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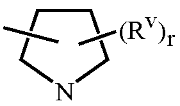
G-2



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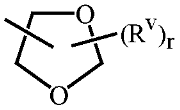
G-3



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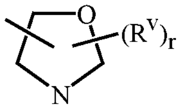
G-4



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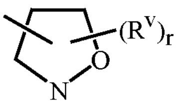

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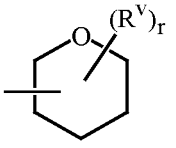

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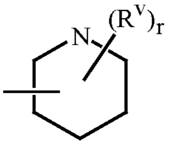

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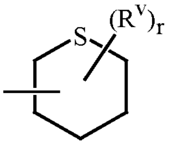

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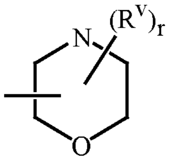
G-9



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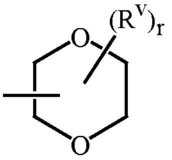
G-10



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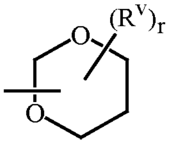

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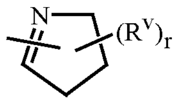

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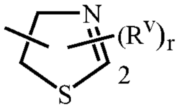

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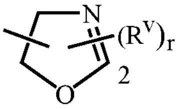

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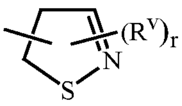

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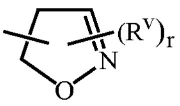

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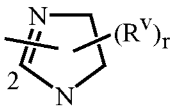

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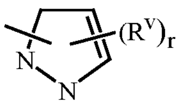

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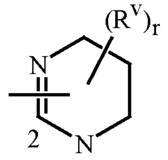

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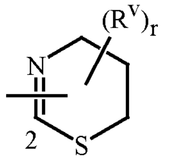

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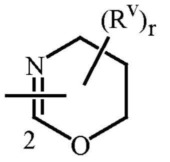

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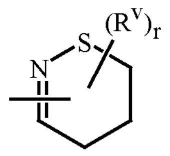

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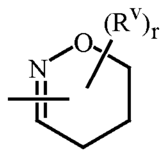

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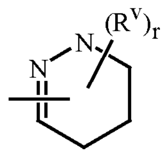

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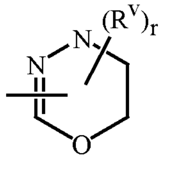

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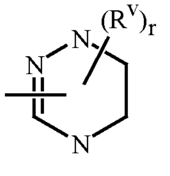

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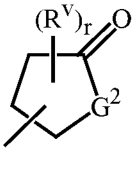

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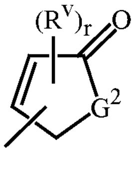

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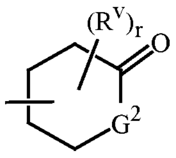

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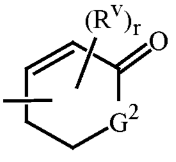

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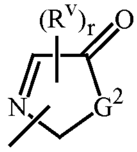

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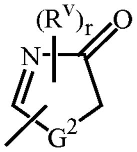

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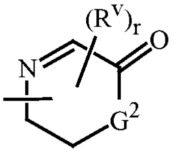

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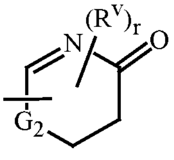

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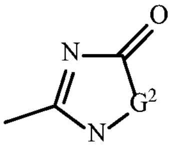

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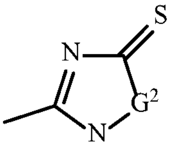


G-37

Embodiment 5l. A compound of Embodiment 5k wherein G-2 is O, S or N.

Embodiment 5m. A compound of Embodiment 5l wherein G-2 is O.

Embodiment 5n. A compound of Embodiment 5l wherein G-2 is S.

Embodiment 5o. A compound of Embodiment 5l wherein G-2 is N.

Embodiment 6. A compound of Formula 1 or any one of the preceding Embodiments wherein R^V is independently H, halogen, C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_1–C_6 alkoxy or C_1–C_6 haloalkoxy.

Embodiment 6a. A compound of Embodiment 6 wherein R^V is H.

Embodiment 6b. A compound of Embodiment 6 wherein R^V is halogen.

Embodiment 6c. A compound of Embodiment 6 wherein R^V is C_1–C_6 alkyl.

Embodiment 6d. A compound of Embodiment 6c wherein R^V is Me.

Embodiment 7. A compound of Formula 1 or any one of Embodiments 5 to 6d wherein r is 1, 2, 3, 4 or 5.

Embodiment 7a. A compound of Embodiment 7 wherein r is 1 or 2.

Embodiment 7b. A compound of Embodiment 7 wherein r is 1.

Embodiment 7c. A compound of Embodiment 7 wherein r is 2.

Embodiment 7d. A compound of Embodiment 7 wherein r is 3.

Embodiment 7e. A compound of Embodiment 7 wherein r is 4.

Embodiment 7f. A compound of Embodiment 7 wherein r is 5.

Embodiment 8. A compound of Formula 1 or any one of the preceding Embodiments wherein R^5 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl, C_3–C_4 halocycloalkyl, C_1–C_4 alkoxy or C_1–C_4 haloalkoxy.

Embodiment 8a. A compound of Embodiment 8 wherein R^5 is H, halogen, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1–C_4 alkoxy or C_1–C_4 haloalkoxy.

Embodiment 8b. A compound of Embodiment 8a wherein R^5 is H or halogen.

Embodiment 8c. A compound of Embodiment 8b wherein R^5 is H.

Embodiment 8d. A compound of Embodiment 8b wherein R^5 is halogen.

Embodiment 8e. A compound of Embodiment 8d wherein R^5 is F.

Embodiment 8e. A compound of Embodiment 8d wherein R^5 is Cl.

Embodiment 8e. A compound of Embodiment 8d wherein R^5 is Br.

Embodiment 8e. A compound of Embodiment 8a wherein R^5 is C_1–C_4 alkyl.

Embodiment 9. A compound of Formula 1 or any one of the preceding Embodiments wherein R^6 is C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_3–C_4 cycloalkyl or C_3–C_4 halocycloalkyl.

Embodiment 9a. A compound of Embodiment 9 wherein R^6 is C_1-C_4 alkyl or C_1-C_4 haloalkyl.

Embodiment 9b. A compound of Embodiment 9a wherein R^6 is C_1-C_4 alkyl.

Embodiment 9c. A compound of Embodiment 9b wherein R^6 is Me;

Embodiment 9d. A compound of Embodiment 9a wherein R^6 is C_1-C_4 haloalkyl.

Embodiment 9e. A compound of Embodiment 9b wherein R^6 is CF_3.

Embodiment 10. A compound of Formula 1 or any one of the preceding Embodiments wherein Q is a six membered aromatic ring with 0 to 2 N on the ring, each ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w.

Embodiment 10a. A compound of Embodiment 10 wherein Q is a phenyl, pyridinyl, pyrimidinyl or pyrazinyl ring, each ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w.

Embodiment 10b. A compound of Embodiment 10a wherein Q is a phenyl ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w.

Embodiment 10c. A compound of Embodiment 10a wherein Q is a pyridinyl ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w.

Embodiment 10d. A compound of Embodiment 10a wherein Q is a pyrimidinyl ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w.

Embodiment 10e. A compound of Embodiment 10a wherein Q is a pyrazinyl ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w.

Embodiment 11. A compound of Formula 1 or any one of Embodiments 10 through 10e wherein R^w is independently H, cyano, halogen, SF_5, SCl, SO_2Cl, SO_2F, C_1-C_6 alkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_1–C_6 haloalkyl, C_2-C_6 alkenyl, C_2-C_6 haloalkenyl, C_2-C_6 alkynyl, C_2-C_6 haloalkynyl, C_2-C_6 alkoxyalkoxy, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio, C_3-

C_6 cycloalkylthio, C_1–C_6 alkylsulfinyl, C_1–C_6 haloalkylsulfinyl, C_1–C_6 alkylsulfonyl, C_1–C_6 haloalkylsulfonyl or C_3-C_6 cycloalkylsulfonyl;

Embodiment 11a. A compound of Embodiment 11 wherein R^w is cyano, halogen, C_1–C_6 alkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_1–C_6 haloalkyl, C_2-C_6 alkenyl, C_2-C_6 haloalkenyl, C_2-C_6 alkynyl, C_2-C_6 haloalkynyl, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio, C_1–C_6 alkylsulfinyl, C_1–C_6 haloalkylsulfinyl, C_1–C_6 alkylsulfonyl or C_1–C_6 haloalkylsulfonyl.

Embodiment 11b. A compound of Embodiment 11a wherein Rw is C_1–C_6 haloalkoxy, C_1–C_6 haloalkyl, C_2-C_6 alkenyl, C_2-C_6 haloalkenyl, C_2-C_6 alkynyl, C_2-C_6 haloalkynyl, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio, C_1–C_6 alkylsulfinyl, C_1–C_6 haloalkylsulfinyl, C_1–C_6 alkylsulfonyl, C_1–C_6 haloalkylsulfonyl.

Embodiment 11c. A compound of Embodiment 11b wherein R^w is C_1–C_6 haloalkoxy, C_1–C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, C_1–C_6 haloalkylthio, C_1–C_6 haloalkylsulfinyl, C_1–C_6 haloalkylsulfonyl.

Embodiment 11d. A compound of Embodiment 11c wherein R^w is OCF_3, SCF_3, OCF_2CFCF_3, CF_3, $SOCF_3$ or SO_2CF_3.

Embodiment 11e. A compound of Embodiment 11d wherein R^w is OCF_3.

Embodiment 11f. A compound of Embodiment 11d wherein R^w is SCF_3.

Embodiment 11g. A compound of Embodiment 11d wherein R^w is CF_3.

Embodiment 11h. A compound of Embodiment 11d wherein R^w is $SOCF_3$ or SO_2CF_3.

Embodiment 11i. A compound of Embodiment 11h wherein R^w is OCF_2CFCF_3.

Embodiment 12. A compound of Formula 1 or any one of the preceding Embodiments wherein s is 1, 2, 3, 4 or 5.

Embodiment 12a. A compound of Embodiment 12 wherein r is 1 or 2.

Embodiment 12b. A compound of Embodiment 12 wherein r is 1.

Embodiment 12c. A compound of Embodiment 12 wherein r is 2.

Embodiment 12d. A compound of Embodiment 12 wherein r is 3.

Embodiment 12e. A compound of Embodiment 12 wherein r is 4.

Embodiment 12f. A compound of Embodiment 12 wherein r is 5.

Embodiment 13. A compound of Formula 1 or any one of the preceding Embodiments wherein n is 0, 1 or 2.

Embodiment 13a. A compound of Embodiment 13 wherein n is 0.

Embodiment 13b. A compound of Embodiment 13 wherein n is 1.

Embodiment 13c. A compound of Embodiment 13 wherein n is 2.

Embodiment A1. A compound of any one of Embodiments 1-13c wherein the compound of Formula 1 is a compound of Formula 1a.

Embodiment A2. A compound of any one of Embodiments 1-13c wherein the compound of Formula 1 is a compound of Formula 1a’.

Embodiment A3. A composition comprising a compound of Formula 1a and a compound of Formula 1a'.

Embodiment A3a. A composition of Embodiment A3 wherein the ratio of the compound of Formula 1a to the compound of Formula 1a' is greater than 60:40.

Embodiment A3b. A composition of Embodiment A3a wherein the ratio of the compound of Formula 1a to the compound of Formula 1a' is greater than 80:20.

Embodiment A3c. A composition of Embodiment A3a wherein the ratio of the compound of Formula 1a to the compound of Formula 1a' is greater than 90:10.

Embodiment A3d. A composition of Embodiment A3a wherein the ratio of the compound of Formula 1a to the compound of Formula 1a' is greater than 99:1.

Embodiment A4. A composition comprising a compound of Formula 1a' and a compound of Formula 1a.

Embodiment A4a. A composition of Embodiment A4 wherein the ratio of the compound of Formula 1a' to the compound of Formula 1a is greater than 60:40.

Embodiment A4b. A composition of Embodiment A4 wherein the ratio of the compound of Formula 1a' to the compound of Formula 1a is greater than 80:20.

Embodiment A4c. A composition of Embodiment A4 wherein the ratio of the compound of Formula 1a' to the compound of Formula 1a is greater than 90:10.

Embodiment A4d. A composition of Embodiment A4 wherein the ratio of the compound of Formula 1a' to the compound of Formula 1a is greater than 99:1.

Embodiment X. A method for controlling an invertebrate pest comprising contacting the invertebrate pest or its environment with a biologically effective amount of a compound of Formula 1.

Embodiment X1. A method of Embodiment X wherein the invertebrate pest is a member of Hemiptera.

Embodiment X2. A method of Embodiment X1 wherein the member of Hemipteran is a member of the suborder Homoptera.

Embodiment X2a. A method of Embodiment X2 wherein the suborder Homoptera comprises planthoppers from the families Cicadellidae and Delphacidae.

Embodiment X2b. A method of Embodiment X2 wherein the suborder Homoptera comprises aphids from the family Aphididae.

Embodiment X2c. A method of Embodiment X2 wherein the suborder Homoptera comprises whiteflies from the family Aleyrodidae.

Embodiment X3. A method of Embodiment X2 wherein the suborder Homoptera comprises CPH, CMA, GPA and WF.

Embodiment X4. A method of Embodiment X2 wherein the suborder Homoptera comprises Aphis fabae Scopoli (black bean aphid), Aphis gossypii Glover (cotton aphid or melon aphid), Bemisia tabaci Gennadius (tobacco whitefly, sweetpotato whitefly), Bemisia argentifolii Bellows & Perring (silverleaf whitefly), Dialeurodes citri Ashmead (citrus whitefly) and Trialeurodes vaporariorum Westwood (greenhouse whitefly); Empoasca fabae Harris (potato leafhopper), Laodelphax striatellus Fallen (smaller brown planthopper), Macrosteles quadrilineatus Forbes (aster leafhopper), Myzus persicae (Sulzer), Nephotettix cincticeps Uhler (green rice leafhopper), Nephotettix nigropictus Stål (rice leafhopper), Nilaparvata lugens Stål (brown planthopper), Peregrinus maidis Ashmead (corn planthopper), Sogatella furcifera Horvath (white-backed planthopper), Tagosodes orizicolus Muir (rice delphacid), Typhlocyba pomaria McAtee (white apple leafhopper) or Erythroneura spp. (grape leafhoppers).

Embodiment X5. A method of Embodiment X1 wherein the Hemipteran is a member of the suborder Heteroptera.

Embodiment X5a. A method of Embodiment X5 wherein the suborder Heteroptera comprises Acrosternum hilare Say (green stink bug), Anasa tristis De Geer (squash bug), Blissus leucopterus leucopterus Say (chinch bug), Cimex lectularius Llinnaeus (bed bug) Corythucha gossypii Fabricius (cotton lace bug), Cyrtopeltis modesta Distant (tomato bug), Dichelops melacanthus Dallas (green belly Stink bug), Dysdercus suturellus Herrich-Schäffer (cotton stainer), Euschistus heros Fabricius (Neotropical Brown Stink Bug), Euschistus servus Say (brown stink bug), Euschistus variolarius Palisot de Beauvois (one-spotted stink bug), Graptostethus spp. (complex of seed bugs), Halyomorpha halys Stål (brown marmorated stink bug), Leptoglossus corculus Say (leaf-footed pine seed bug), Lygus lineolaris Palisot de Beauvois (tarnished plant bug), Nezara viridula Linnaeus (southern green stink bug), Oebalus pugnax Fabricius (rice stink bug), Oncopeltus fasciatus Dallas (large milkweed bug), Pseudatomoscelis seriatus Reuter (cotton fleahopper).

Embodiment X6. A method of Embodiment X5 wherein the suborder Heteroptera comprises stink bugs from the family Pentatomidae.

Embodiment X7. A method of Embodiment X6 wherein the suborder Heteroptera comprises Acrosternum hilare Say (green stink bug), Dichelops melacanthus Dallas (green belly Stink bug), Euschistus heros Fabricius (Neotropical Brown Stink Bug), Euschistus servus Say (brown stink bug), Euschistus variolarius Palisot de Beauvois (one-spotted stink bug), Halymorpha halys Stål (brown marmorated stink bug), Nezara viridula Linnaeus (southern green stink bug), Oebalus pugnax Fabricius (rice stink bug).

Embodiment X8. A method of Embodiment X5 wherein the suborder Heteroptera comprises Anasa tristis De Geer (squash bug), Blissus leucopterus Say (chinch bug), Cimex lectularius Linnaeus (bed bug), Corythuca gossypii Fabricius (cotton lace bug), Cyrtopeltis modesta Distant (tomato bug), Dysdercus suturellus Herrich-Schaffer (cotton stainer), Graptosthetus spp. (complex of seed bugs), Leptoglossus corculus Say (leaf-footed pine seed bug), Lygus lineolaris Palisot de Beauvois (tarnished plant bug), Oncopeltus fasciatus Dallas (large milkweed bug), or Pseudatomoscelis seriatus Reuter (cotton fleahopper).

Embodiments of this disclosure, including Embodiments 1–X8 above as well as any other embodiments described herein, can be combined in any manner, and the descriptions of variables in the embodiments pertain not only to the compounds of Formula 1 but also to the starting compounds and intermediate compounds useful for preparing the compounds of Formula 1. In addition, embodiments of this disclosure, including Embodiments 1-X8 above as well as any other embodiments described herein, and any combination thereof, pertain to the compositions and methods of the present disclosure.

Combinations of Embodiments 1–X8 are illustrated by:

Embodiment A1. A compound of Formula 1 wherein

R^1 is H;

A is CR^3;

R^2 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl, C_3–C_4 halocycloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;

R^3 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl, C_3–C_4 halocycloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;

R^4 is a 5- to 6-membered heterocyclic ring, each ring containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, wherein up to 2 ring members are independently selected from C(=O), C(=S), S(=O) and $S(=O)_2$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^v, and r is the number of the substituents.

each R^v is independently H, halogen, C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_1–C_6 alkoxy or C_1–C_6 haloalkoxy;

r is 1, 2, 3, 4 or 5;

R^5 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl, C_3–C_4 halocycloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;

Q is a six membered aromatic ring with 0 to 2 N on the ring, each ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w;

R^w is independently cyano, halogen, C_1-C_6 alkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_1–C_6 haloalkyl, C_2-C_6 alkenyl, C_2-C_6 haloalkenyl, C_2-C_6 alkynyl, C_2-C_6 haloalkynyl, C_1-C_6 alkylthio, C_1-C_6 haloalkylthio, C_1-C_6 alkylsulfinyl, C_1-C_6 haloalkylsulfinyl, C_1-C_6 alkylsulfonyl or C_1-C_6 haloalkylsulfonyl;

s is 1, 2, 3, 4 or 5;

n is 0, 1 or 2.

Embodiment B1. A compound of Embodiment A1 wherein

R^2 is H, halogen or C_1-C_4 alkyl;

R^3 is H, halogen C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;

R^4 is selected from U-2 to U-49 or U52 to U61 as shown in Exhibit 1;
r is 1 or 2;
R^5 is H, halogen, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;
R^w is C_1–C_6 haloalkoxy, C_1–C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, C_1–C_6 haloalkylthio, C_1–C_6 haloalkylsulfinyl, C_1–C_6 haloalkylsulfonyl.
s is 1 or 2.

Embodiment C1. A compound of Embodiment B1 wherein
R^2 is H;
R^3 is H or halogen;
R^4 is selected from U-2 to U-49;
R^v is H;
R^5 is H or halogen;
Q is a phenyl, pyridinyl, pyrimidinyl or pyrazinyl ring, each ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w;
R^w is OCF_3, SCF_3, OCF_2CFCF_3, CF_3, $SOCF_3$ or SO_2CF_3.

Embodiment D1. A compound of Embodiment B1 wherein
R^2 is H;
R^3 is H or halogen;
R^4 is selected from U-2 to U-49;
R^v is C_1-C_6 alkyl;
R^5 is H;
Q is a phenyl, pyridinyl, pyrimidinyl or pyrazinyl ring, each ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w;

Embodiment E1. A compound of Embodiment C1 wherein
R^3 is halogen;
R^4 is selected from U-2, U-3, U-4, U-5, U-7, U-9, U-11, U-12, U-13, U-16, U-21, U-25, U-26, U-27, U-28, U-29, U-31, U-32, U-35, U-36, U-37, U-44, U-48 and U-49;
R^5 is H;
Q is a phenyl, pyridinyl, pyrimidinyl or pyrazinyl ring, each ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w.

Embodiment F1. A compound of Embodiment E1 wherein
R^3 is F;
R^4 is selected from U-9, U-11, U-32, U-36, U-44 and U-48;

Q is a phenyl ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w.

Embodiment G1. A compound of Embodiment F1 wherein
R^4 is selected from U-44 and U-48.

Embodiment H1. A compound of Embodiment G1 wherein
R^4 is selected from the group of U-44.

Embodiment I1. A compound of Embodiment G1 wherein
R^4 is selected from the group of U-48.

Embodiment J1. A compound of Embodiment B1 wherein
R^2 is C_1-C_4 alkyl;
R^3 is H or halogen;
R^4 is selected from U-2 to U-49;
R^v is H;
r is 2;
R^5 is H;
Q is a phenyl, pyridinyl, pyrimidinyl or pyrazinyl ring, each ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w;
R^w is OCF_3, SCF_3, OCF_2CFCF_3, CF_3, $SOCF_3$ or SO_2CF_3.

Embodiment A2. A compound of Formula 1 wherein
R^1 is CN;
A is CR^3;
R^2 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl, C_3–C_4 halocycloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;
R^3 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl, C_3–C_4 halocycloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;
R^4 is a 5- to 6-membered heterocyclic ring, each ring containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, wherein up to 2 ring members are independently selected from C(=O), C(=S), S(=O) and S(=O)2, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^v, and r is the number of the substituents.
each R^v is independently H, halogen, C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_1–C_6 alkoxy or C_1–C_6 haloalkoxy;
r is 1, 2, 3, 4 or 5;

R^5 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl, C_3–C_4 halocycloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;

Q is a six membered aromatic ring with 0 to 2 N on the ring, each ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w;
R^w is independently cyano, halogen, C_1–C_6 alkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_1–C_6 haloalkyl, C_2-C_6 alkenyl, C_2-C_6 haloalkenyl, C_2-C_6 alkynyl, C_2-C_6 haloalkynyl, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio, C_1–C_6 alkylsulfinyl, C_1–C_6 haloalkylsulfinyl, C_1–C_6 alkylsulfonyl or C_1–C_6 haloalkylsulfonyl;
s is 1, 2, 3, 4 or 5;
n is 0, 1 or 2.

Embodiment B2. A compound of Embodiment A2 wherein
R^2 is H, halogen or C_1-C_4 alkyl;
R^3 is H, halogen, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;
R^4 is selected from U-2 to U-49 or U52 to U61 as shown in Exhibit 1;
r is 1 or 2;
R^5 is H, halogen, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;
Rw is C_1-C_6 haloalkoxy, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, C_1-C_6 haloalkylthio, C_1-C_6 haloalkylsulfinyl, C_1-C_6 haloalkylsulfonyl.
s is 1 or 2.

Embodiment C2. A compound of Embodiment B2 wherein
R^2 is H;
R^3 is H or halogen;
R^4 is selected from U-2 to U-49;
R^v is H;
r is 2;
R^5 is H or halogen;
Q is a phenyl, pyridinyl, pyrimidinyl or pyrazinyl ring, each ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w;
R^w is OCF_3, SCF_3, OCF_2CFCF_3, CF_3, $SOCF_3$ or SO_2CF_3.

Embodiment D2. A compound of Embodiment B2 wherein
R^2 is H;
R^3 is H or halogen;
R^4 is selected from U-2 to U-49;

R^v is C_1-C_6 alkyl;
R^5 is H;
Q is a phenyl, pyridinyl, pyrimidinyl or pyrazinyl ring, each ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w.

Embodiment E2. A compound of Embodiment C2 wherein
R^3 is halogen;
R^4 is selected from U-2, U-3, U-4, U-5, U-7, U-9, U-11, U-12, U-13, U-16, U-21, U-25, U-26, U-27, U-28, U-29, U-31, U-32, U-35, U-36, U-37, U-44, U-48 and U-49;
R^5 is H;
Q is a phenyl, pyridinyl, pyrimidinyl or pyrazinyl ring, each ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w.

Embodiment F2. A compound of Embodiment E2 wherein
R^3 is F;
R^4 is selected from U-9 and U-44;
Q is a phenyl ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w.

Embodiment G2. A compound of Embodiment F2 wherein
R^4 is U-44.

Embodiment H2. A compound of Embodiment F2 wherein
R^4 is U-48.

Embodiment A3. A compound of Formula 1 wherein
R^1 is $OCOR^6$;
A is CR^3;
R^2 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl, C_3–C_4 halocycloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;
R^3 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl, C_3–C_4 halocycloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;
R^4 is a 5- to 6-membered heterocyclic ring, each ring containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, wherein up to 2 ring members are independently selected from C(=O), C(=S), S(=O) and S(=O)2, each ring or ring system optionally substituted with up to 5 substituents independently selected from Rv, and r is the number of the substituents.

each R^v is independently H, halogen, $C_1–C_6$ alkyl, $C_1–C_6$ haloalkyl, $C_1–C_6$ alkoxy or $C_1–C_6$ haloalkoxy;
r is 1, 2, 3, 4 or 5;
R^5 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, $C_3–C_4$ cycloalkyl, $C_3–C_4$ halocycloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;
R^6 is C_1-C_4 alkyl;
Q is a six membered aromatic ring with 0 to 2 N on the ring, each ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w;
R^w is independently cyano, halogen, $C_1–C_6$ alkyl, $C_1–C_6$ alkoxy, $C_1–C_6$ haloalkoxy, $C_1–C_6$ haloalkyl, C_2-C_6 alkenyl, C_2-C_6 haloalkenyl, C_2-C_6 alkynyl, C_2-C_6 haloalkynyl, $C_1–C_6$ alkylthio, $C_1–C_6$ haloalkylthio, $C_1–C_6$ alkylsulfinyl, $C_1–C_6$ haloalkylsulfinyl, $C_1–C_6$ alkylsulfonyl or $C_1–C_6$ haloalkylsulfonyl;
s is 1, 2, 3, 4 or 5;
n is 0, 1 or 2.

Embodiment B3. A compound of Embodiment A3 wherein
R^2 is H, halogen or C_1-C_4 alkyl;
R^3 is H, halogen, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;
R^4 is selected from U-2 to U-49 or U52 to U61 as shown in Exhibit 1;
r is 1 or 2;
R^5 is H, halogen, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;
R^6 is Me;
R^w is $C_1–C_6$ haloalkoxy, $C_1–C_6$ haloalkyl, $C_1–C_6$ haloalkenyl, C_2-C_6 haloalkynyl, $C_1–C_6$ haloalkylthio, $C_1–C_6$ haloalkylsulfinyl, $C_1–C_6$ haloalkylsulfonyl.
s is 1 or 2.

Embodiment C3. A compound of Embodiment B3 wherein
R^2 is H;
R^3 is H or halogen;
R^4 is selected from U-2 to U-49;
R^v is H;
r is 2;
R^5 is H;
Q is a phenyl, pyridinyl, pyrimidinyl or pyrazinyl ring, each ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w;
R^w is OCF_3, SCF_3, OCF_2CFCF_3, CF_3, $SOCF_3$ or SO_2CF_3.

Embodiment D3. A compound of Embodiment B3 wherein

R^2 is H;
R^3 is H or halogen;
R^4 is selected from U-2 to U-49;
R^v is C_1-C_6 alkyl;
R^5 is H;
Q is a phenyl, pyridinyl, pyrimidinyl or pyrazinyl ring, each ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w;

Embodiment E3. A compound of Embodiment C3 wherein
R^3 is halogen;
R^4 is selected from U-2, U-3, U-4, U-5, U-7, U-9, U-11, U-12, U-13, U-16, U-21, U-25, U-26, U-27, U-28, U-29, U-31, U-32, U-35, U-36, U-37, U-44, U-48 and U-49;
R^5 is H;
Q is a phenyl, pyridinyl, pyrimidinyl or pyrazinyl ring, each ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w.

Embodiment F3. A compound of Embodiment E3 wherein
R^3 is F;
R^4 is U-44 or U-48;
Q is a phenyl ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w.

Embodiment G3. A compound of Embodiment F3 wherein
R^4 is selected from the group of U-44.

Embodiment H3. A compound of Embodiment F3 wherein
R^4 is selected from the group of U-48.

Embodiment A4. A compound of Formula 1 wherein
R^1 is C_1-C_6 alkyl;
A is CR^3;
R^2 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl, C_3–C_4 halocycloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;
R^3 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl, C_3–C_4 halocycloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;
R^4 is a 5- to 6-membered heterocyclic ring, each ring containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, wherein up to 2 ring members are independently selected from C(=O), C(=S),

$S(=O)$ and $S(=O)_2$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^v, and r is the number of the substituents.

each R^v is independently H, halogen, $C_1–C_6$ alkyl, $C_1–C_6$ haloalkyl, $C_1–C_6$ alkoxy or $C_1–C_6$ haloalkoxy;

r is 1, 2, 3, 4 or 5;

R^5 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, $C_3–C_4$ cycloalkyl, $C_3–C_4$ halocycloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;

Q is a six membered aromatic ring with 0 to 2 N on the ring, each ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w;

R^w is independently cyano, halogen, $C_1–C_6$ alkyl, $C_1–C_6$ alkoxy, $C_1–C_6$ haloalkoxy, $C_1–C_6$ haloalkyl, C_2-C_6 alkenyl, C_2-C_6 haloalkenyl, C_2-C_6 alkynyl, C_2-C_6 haloalkynyl, $C_1–C_6$ alkylthio, $C_1–C_6$ haloalkylthio, $C_1–C_6$ alkylsulfinyl, $C_1–C_6$ haloalkylsulfinyl, $C_1–C_6$ alkylsulfonyl or $C_1–C_6$ haloalkylsulfonyl;

s is 1, 2, 3, 4 or 5;

n is 0, 1 or 2.

Embodiment B4. A compound of Embodiment A4 wherein

R^2 is H, halogen or C_1-C_4 alkyl;

R^3 is H, halogen, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;

R^4 is selected from U-2 to U-49 or U52 to U61 as shown in Exhibit 1;

r is 1 or 2;

R^5 is H, halogen, C1-C4 alkyl, C1-C4 haloalkyl, C1-C4 alkoxy or C1-C4 haloalkoxy;

R^w is $C_1–C_6$ haloalkoxy, $C_1–C_6$ haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, $C_1–C_6$ haloalkylthio, $C_1–C_6$ haloalkylsulfinyl, $C_1–C_6$ haloalkylsulfonyl.

s is 1 or 2.

Embodiment C4. A compound of Embodiment B4 wherein

R^2 is H;

R^3 is H or halogen;

R^4 is selected from U-2 to U-49;

R^v is H;

R^5 is H or halogen;

Q is a phenyl, pyridinyl, pyrimidinyl or pyrazinyl ring, each ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w;

R^w is OCF_3, SCF_3, OCF_2CFCF_3, CF_3, $SOCF_3$ or SO_2CF_3.

Embodiment D4. A compound of Embodiment B4 wherein

R^2 is H;
R^3 is H or halogen;
R^4 is selected from U-2 to U-49;
R^v is C_1-C_6 alkyl;
R^5 is H;
Q is a phenyl, pyridinyl, pyrimidinyl or pyrazinyl ring, each ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w;

Embodiment E4. A compound of Embodiment C4 wherein
R^3 is halogen;
R^4 is selected from U-2, U-3, U-4, U-5, U-7, U-9, U-11, U-12, U-13, U-16, U-21, U-25, U-26, U-27, U-28, U-29, U-31, U-32, U-35, U-36, U-37, U-44, U-48 and U-49;
R^5 is H;
Q is a phenyl, pyridinyl, pyrimidinyl or pyrazinyl ring, each ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w.

Embodiment D4. A compound of Embodiment E4 wherein
R^3 is F;
R^4 is selected from U-9, U-11, U-32, U-36, U-44 and U-48;
Q is a phenyl ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w.

Embodiment E4. A compound of Embodiment D4 wherein
R^4 is selected from U-44 and U-48.

Embodiment F4. A compound of Embodiment E4 wherein
R^4 is selected from the group of U-44.

Embodiment G4. A compound of Embodiment F4 wherein
R^4 is selected from the group of U-48.

Embodiment H4. A compound of Embodiment B4 wherein
R^2 is C_1-C_4 alkyl;
R^3 is H or halogen;
R^4 is selected from U-2 to U-49;
R^v is H;
r is 2;
R^5 is H;

Q is a phenyl, pyridinyl, pyrimidinyl or pyrazinyl ring, each ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w;

R^w is OCF_3, SCF_3, OCF_2CFCF_3, CF_3, $SOCF_3$ or SO_2CF_3.

Embodiment I4. A compound of any one of Embodiments A4 through H4 wherein R^1 is Me.

Embodiment A5. A compound of Formula 1 wherein

R^1 is C_2-C_6 alkenyl;

A is CR^3;

R^2 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl, C_3–C_4 halocycloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;

R^3 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl, C_3–C_4 halocycloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;

R^4 is a 5- to 6-membered heterocyclic ring, each ring containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, wherein up to 2 ring members are independently selected from C(=O), C(=S), S(=O) and $S(=O)_2$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^v, and r is the number of the substituents.

each R^v is independently H, halogen, C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_1–C_6 alkoxy or C_1–C_6 haloalkoxy;

r is 1, 2, 3, 4 or 5;

R^5 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl, C_3–C_4 halocycloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;

Q is a six membered aromatic ring with 0 to 2 N on the ring, each ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w;

R^w is independently cyano, halogen, C_1–C_6 alkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_1–C_6 haloalkyl, C_2-C_6 alkenyl, C_2-C_6 haloalkenyl, C_2-C_6 alkynyl, C_2-C_6 haloalkynyl, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio, C_1–C_6 alkylsulfinyl, C_1–C_6 haloalkylsulfinyl, C_1–C_6 alkylsulfonyl or C_1–C_6 haloalkylsulfonyl;

s is 1, 2, 3, 4 or 5;

n is 0, 1 or 2.

Embodiment B5. A compound of Embodiment A5 wherein

R^2 is H, halogen or C_1-C_4 alkyl;

R^3 is H, halogen, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;

R^4 is selected from U-2 to U-49 or U52 to U61 as shown in Exhibit 1;

r is 1 or 2;

R^5 is H, halogen, C1-C4 alkyl, C1-C4 haloalkyl, C1-C4 alkoxy or C1-C4 haloalkoxy;

R^w is C_1–C_6 haloalkoxy, C_1–C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, C_1–C_6 haloalkylthio, C_1–C_6 haloalkylsulfinyl, C_1–C_6 haloalkylsulfonyl.
s is 1 or 2.

Embodiment C5. A compound of Embodiment B5 wherein
R^2 is H;
R^3 is H or halogen;
R^4 is selected from U-2 to U-49;
R^v is H;
R^5 is H or halogen;
Q is a phenyl, pyridinyl, pyrimidinyl or pyrazinyl ring, each ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w;
R^w is OCF_3, SCF_3, OCF_2CFCF_3, CF_3, $SOCF_3$ or SO_2CF_3.

Embodiment D5. A compound of Embodiment B5 wherein
R^2 is H;
R^3 is H or halogen;
R^4 is selected from U-2 to U-49;
R^v is C_1-C_6 alkyl;
R^5 is H;
Q is a phenyl, pyridinyl, pyrimidinyl or pyrazinyl ring, each ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w;

Specific embodiments include one or more compounds of Formula 1 selected from the group consisting of:
3-fluoro-5-(2H-1,2,3-triazol-2-yl)-4-[[4-(trifluoromethoxy)phenyl]methyl]pyridine;
3-fluoro-5-(2H-1,2,3-triazol-2-yl)-4-[[4-[(trifluoromethyl)thio]phenyl]methyl]pyridine;
3-fluoro-5-(2H-1,2,3-triazol-2-yl)-4-[1-[4-(trifluoromethoxy)phenyl]ethyl]pyridine;
3-fluoro-5-(2H-1,2,3-triazol-2-yl)-4-[1-[4-[(trifluoromethyl)thio]phenyl]ethyl]pyridine;
3-chloro-5-(2H-1,2,3-triazol-2-yl)-4-[[4-(trifluoromethoxy)phenyl]methyl]pyridine;
3-chloro-5-(2H-1,2,3-triazol-2-yl)-4-[[4-[(trifluoromethyl)thio]phenyl]methyl]pyridine;
3-chloro-5-(2H-1,2,3-triazol-2-yl)-4-[1-[4-(trifluoromethoxy)phenyl]ethyl]pyridine;
3-chloro-5-(2H-1,2,3-triazol-2-yl)-4-[1-[4-[(trifluoromethyl)thio]phenyl]ethyl]pyridine;
3-bromo-5-(2H-1,2,3-triazol-2-yl)-4-[[4-[(trifluoromethyl)thio]phenyl]methyl]pyridine;
3-bromo-5-(2H-1,2,3-triazol-2-yl)-4-[[4-(trifluoromethoxy)phenyl]methyl]pyridine;

3-fluoro-5-(1H-1-pyrazol-1-yl)-4-[[4-(trifluoromethoxy)phenyl]methyl]pyridine;
3-chloro-5-(1H-1-pyrazol-1-yl)-4-[[4-(trifluoromethoxy)phenyl]methyl]pyridine;
3-bromo-5-(1H-pyrazol-1-yl)-4-[[4-(trifluoromethoxy)phenyl]methyl]pyridine;
3-fluoro-5-(1H-pyrazol-1-yl)-4-[[4-[(trifluoromethyl)thio]phenyl]methyl]pyridine;
3-chloro-5-(1H-pyrazol-1-yl)-4-[[4-[(trifluoromethyl)thio]phenyl]methyl]pyridine;
3-bromo-5-(1H-pyrazol-1-yl)-4-[[4-[(trifluoromethyl)thio]phenyl]methyl]pyridine;
3-fluoro-5-(2H-1,2,3-triazol-2-yl)-4-[[4-(trifluoromethyl)phenyl]methyl]pyridine;
3-chloro-5-(2H-1,2,3-triazol-2-yl)-4-[[4-(trifluoromethyl)phenyl]methyl]pyridine;
3-bromo-5-(2H-1,2,3-triazol-2-yl)-4-[[4-(trifluoromethyl)phenyl]methyl]pyridine;
3-fluoro-4-[[4-(1,1,2,2,2-pentafluoroethyl)phenyl]methyl]-5-(2H-1,2,3-triazol-2-yl)pyridine;
3-chloro-4-[[4-(1,1,2,2,2-pentafluoroethyl)phenyl]methyl]-5-(2H-1,2,3-triazol-2-yl)pyridine;
3-bromo-4-[[4-(1,1,2,2,2-pentafluoroethyl)phenyl]methyl]-5-(2H-1,2,3-triazol-2-yl)pyridine;
4-[[4-(difluoromethoxy)phenyl]methyl]-3-fluoro-5-(2H-1,2,3-triazol-2-yl)pyridine;
3-chloro-4-[[4-(difluoromethoxy)phenyl]methyl]- 5-(2H-1,2,3-triazol-2-yl)pyridine;
3-bromo-4-[[4-(difluoromethoxy)phenyl]methyl]- 5-(2H-1,2,3-triazol-2-yl)pyridine;
3-fluoro-5-(1H-pyrazol-1-yl)-4-[[4-(trifluoromethyl)phenyl]methyl]pyridine;
3-chloro-5-(1H-pyrazol-1-yl)-4-[[4-(trifluoromethyl)phenyl]methyl]pyridine;
3-bromo-5-(1H-pyrazol-1-yl)-4-[[4-(trifluoromethyl)phenyl]methyl]pyridine;
3-fluoro-4-[[4-(1,1,2,2,2-pentafluoroethyl)phenyl]methyl]-5-(1H-pyrazol-1-yl)pyridine;
3-chloro-4-[[4-(1,1,2,2,2-pentafluoroethyl)phenyl]methyl]-5-(1H-pyrazol-1-yl)pyridine;
3-bromo-4-[[4-(1,1,2,2,2-pentafluoroethyl)phenyl]methyl]-5-(1H-pyrazol-1-yl)pyridine;
4-[[4-(difluoromethoxy)phenyl]methyl]-3-fluoro-5-(1H-pyrazol-1-yl)pyridine;
3-chloro-4-[[4-(difluoromethoxy)phenyl]methyl]-5-(1H-pyrazol-1-yl)pyridine; and
3-bromo-4-[[4-(difluoromethoxy)phenyl]methyl]-5-(1H-pyrazol-1-yl)pyridine.

Embodiment Y1. A composition comprising a compound of Formula 1 or any one of the preceding embodiments and at least one additional component selected from the group consisting of surfactants, solid diluents and liquid diluents, said composition optionally further comprising at least one additional biologically active compound or agent.

Embodiment Y2. The composition of embodiment Y1 wherein the at least one additional biologically active compound or agent is selected from the group consisting of abamectin, acephate, acequinocyl, acetamiprid, acrinathrin, afidopyropen, amidoflumet, amitraz, avermectin, azadirachtin, azinphos-methyl, benfuracarb, bensultap, bifenthrin, bifenazate, bistrifluron, borate, bromantraniliprole, buprofezin, carbaryl, carbofuran, cartap, carzol, chlorantraniliprole, chlorfenapyr, chlorfluazuron, chlorpyrifos, chlorpyrifos-methyl, chromafenozide, clofentezin, clothianidin, cyantraniliprole, cyclaniliprole, cycloprothrin, cycloxaprid, cyflumetofen, cyfluthrin, beta-cyfluthrin, cyhalodiamide, cyhalothrin, gamma-cyhalothrin, lambda-cyhalothrin, cypermethrin, alpha-cypermethrin, zeta-cypermethrin, cyromazine, deltamethrin, diafenthiuron, diazinon, dichlorantraniliprole, dieldrin, diflubenzuron, dimefluthrin, dimehypo, dimethoate, dinotefuran, diofenolan, emamectin, endosulfan, esfenvalerate, ethiprole, etofenprox, etoxazole, fenbutatin oxide, fenitrothion, fenothiocarb, fenoxycarb, fenpropathrin, fenvalerate, fipronil, flometoquin, flonicamid, flubendiamide, flucythrinate, flufenerim, flufenoxuron, flufenoxystrobin, fluensulfone, fluopyram, flupyradifurone, fluvalinate, tau-fluvalinate, fonophos, formetanate, fosthiazate, halofenozide, heptafluthrin, hexaflumuron, hexythiazox, hydramethylnon, imidacloprid, indoxacarb, insecticidal soaps, isofenphos, lufenuron, malathion, meperfluthrin, metaflumizone, metaldehyde, methamidophos, methidathion, methiocarb, methomyl, methoprene, methoxychlor, methoxyfenozide, metofluthrin, monocrotophos, monofluorothrin, nicotine, N-[1,1-dimethyl-2-(methylthio)ethyl]-7-fluoro-2-(3-pyridinyl)-2H-indazole-4-carboxamide, N-[1,1-dimethyl-2-(methylsulfinyl)ethyl]-7-fluoro-2-(3-pyridinyl)-2H-indazole-4-carboxamide, N-[1,1-dimethyl-2-(methylsulfonyl)ethyl]-7-fluoro-2-(3-pyridinyl)-2H-indazole-4-carboxamide, N-(1-methylcyclopropyl)-2-(3-pyridinyl)-2H-indazole-4-carboxamide, N-[1-(difluoromethyl)cyclopropyl]-2-(3-pyridinyl)-2H-indazole-4-carboxamide, nitenpyram, nithiazine, novaluron, noviflumuron, oxamyl, parathion, parathion-methyl, permethrin, phorate, phosalone, phosmet, phosphamidon, pirimicarb, profenofos, profluthrin, propargite, protrifenbute, pyflubumide, pymetrozine, pyrafluprole, pyrethrin, pyridaben, pyridalyl, pyrifluquinazon, pyriminostrobin, pyriprole, pyriproxyfen, rotenone, ryanodine, silafluofen, spinetoram, spinosad, spirodiclofen, spiromesifen, spirotetramat, sulprofos, sulfoxaflor, tebufenozide, tebufenpyrad, teflubenzuron, tefluthrin, tetrachlorantraniliprole, tetrachlorvinphos, tetramethrin, tetramethylfluthrin, thiacloprid, thiamethoxam, thiodicarb, thiosultap-sodium, tioxazafen, tolfenpyrad, tralomethrin, triazamate, trichlorfon, triflumezopyrim, triflumuron, Bacillus thuringiensis delta-endotoxins, entomopathogenic bacteria, entomopathogenic viruses and entomopathogenic fungi.

Embodiment Y3. The composition of embodiment Y2 wherein the at least one additional biologically active compound or agent is selected from the group consisting of abamectin, acetamiprid, acrinathrin, afidopyropen, amitraz, avermectin, azadirachtin, benfuracarb, bensultap, bifenthrin, buprofezin, carbaryl, cartap, chlorantraniliprole, chlorfenapyr, chlorpyrifos, clothianidin, cyantraniliprole, cyclaniliprole, cycloprothrin, cyfluthrin, beta-cyfluthrin, cyhalothrin, gamma-cyhalothrin, lambda-cyhalothrin, cypermethrin, alpha-cypermethrin, zeta-cypermethrin, cyromazine, deltamethrin, dieldrin, dinotefuran, diofenolan, emamectin, endosulfan, esfenvalerate, ethiprole, etofenprox, etoxazole, fenitrothion, fenothiocarb, fenoxycarb, fenvalerate, fipronil, flometoquin, flonicamid, flubendiamide, flufenoxuron, flufenoxystrobin, fluensulfone, flupiprole, flupyradifurone, fluvalinate, formetanate, fosthiazate, heptafluthrin, hexaflumuron, hydramethylnon, imidacloprid, indoxacarb, lufenuron, meperfluthrin, metaflumizone, methiocarb, methomyl, methoprene, methoxyfenozide, metofluthrin, monofluorothrin, nitenpyram, nithiazine, novaluron, oxamyl, pyflubumide, pymetrozine, pyrethrin, pyridaben, pyridalyl, pyriminostrobin, pyriproxyfen, ryanodine, spinetoram, spinosad, spirodiclofen, spiromesifen, spirotetramat, sulfoxaflor, tebufenozide, tetramethrin, tetramethylfluthrin, thiacloprid, thiamethoxam, thiodicarb, thiosultap-sodium, tralomethrin, triazamate, triflumezopyrim, triflumuron, Bacillus thuringiensis delta-endotoxins, all strains of Bacillus thuringiensis and all strains of nuclear polyhedrosis viruses.

Embodiment Y4. The composition of any one of embodiments Y1-Y3 further comprising a liquid fertilizer.

Embodiment Y5. The composition of Embodiment Y4 wherein the liquid fertilizer is aqueous-based.

Embodiment Y6. A soil drench formulation comprising the composition of any one of embodiments Y1-Y3.

Embodiment Y7. A spray composition comprising the composition of any one of embodiments Y1-Y3 and a propellant.

Embodiment Y8. A bait composition, comprising the composition of any one of embodiments Y1-Y3, one or more food materials, optionally an attractant, and optionally a humectant.

Embodiment Y9. A trap device for controlling an invertebrate pest, comprising: the bait composition of Embodiment Y8 and a housing adapted to receive said bait composition, wherein the housing has at least one opening sized to permit the invertebrate pest to pass through the opening so the invertebrate pest can gain access to said bait composition from a location outside the housing, and wherein the housing is further adapted to be placed in or near a locus of potential or known activity for the invertebrate pest.

Embodiment Y10. A composition comprising the composition of any of Embodiments Y1-Y3 wherein the composition is a solid composition selected from dusts, powders, granules, pellets, prills, pastilles, tablets, and filled films.

Embodiment Y11. The composition of Embodiment Y10 wherein the composition is water-dispersible or water-soluble.

Embodiment Y12. A liquid or dry formulation comprising the composition of any one of Embodiments Y1-Y3 for use in a drip irrigation system, furrow during planting, handheld sprayer, backpack sprayer, boom sprayer, ground sprayer, aerial application, unmanned aerial vehicle, or a seed treatment.

Embodiment Y13. The liquid or dry formulation of Embodiment Y12 wherein said formulation is sprayed at an ultra-low volume.

Of note is that compounds of this disclosure are characterized by favorable metabolic and/or soil residual patterns and exhibit activity controlling a spectrum of agronomic and nonagronomic invertebrate pests.

Of particular note, for reasons of invertebrate pest control spectrum and economic importance, protection of agronomic crops from damage or injury caused by invertebrate pests by controlling invertebrate pests are embodiments of the disclosure. Compounds of this disclosure because of their favorable translocation properties or systemicity in plants also protect foliar or other plant parts which are not directly contacted with a compound of Formula **1** or a composition comprising the compound.

Also noteworthy as embodiments of the present disclosure are compositions comprising a compound of any of the preceding Embodiments, as well as any other embodiments described herein, and any combinations thereof, and at least one additional component selected from the group consisting of a surfactant, a solid diluent and a liquid diluent, said compositions optionally further comprising at least one additional biologically active compound or agent.

Further noteworthy as embodiments of the present disclosure are compositions for controlling an invertebrate pest comprising a compound of any of the preceding Embodiments, as well as any other embodiments described herein, and any combinations thereof, and at least one additional component selected from the group consisting of a surfactant, a solid diluent and a liquid diluent, said compositions optionally further comprising at least one additional biologically active compound or agent. Embodiments of the disclosure further include methods for controlling an invertebrate pest comprising contacting the invertebrate pest or its environment with a biologically effective amount of a compound of any of the preceding Embodiments (e.g., as a composition described herein).

Embodiments of the disclosure also include a composition comprising a compound of any of the preceding Embodiments, in the form of a soil drench liquid formulation. Embodiments of the disclosure further include methods for controlling an invertebrate pest comprising contacting the soil with a liquid composition as a soil drench comprising a biologically effective amount of a compound of any of the preceding Embodiments.

Embodiments of the disclosure also include a spray composition for controlling an invertebrate pest comprising a biologically effective amount of a compound of any of the preceding Embodiments and a propellant. Embodiments of the disclosure further include a bait composition for controlling an invertebrate pest comprising a biologically effective amount of a compound of any of the preceding Embodiments, one or more food materials, optionally an attractant, and optionally a humectant. Embodiments of the disclosure also include a device for controlling an invertebrate pest comprising said bait composition and a housing adapted to receive said bait composition, wherein the housing has at least one opening sized to permit the invertebrate pest to pass through the opening so the invertebrate pest can gain access to said bait composition from a location outside the housing, and wherein the housing is further adapted to be placed in or near a locus of potential or known activity for the invertebrate pest.

Embodiments of the disclosure also include methods for protecting a seed from an invertebrate pest comprising contacting the seed with a biologically effective amount of a compound of any of the preceding Embodiments.

Embodiments of the disclosure also include methods for protecting an animal from an invertebrate parasitic pest comprising administering to the animal a parasiticidally effective amount of a compound of any of the preceding Embodiments.

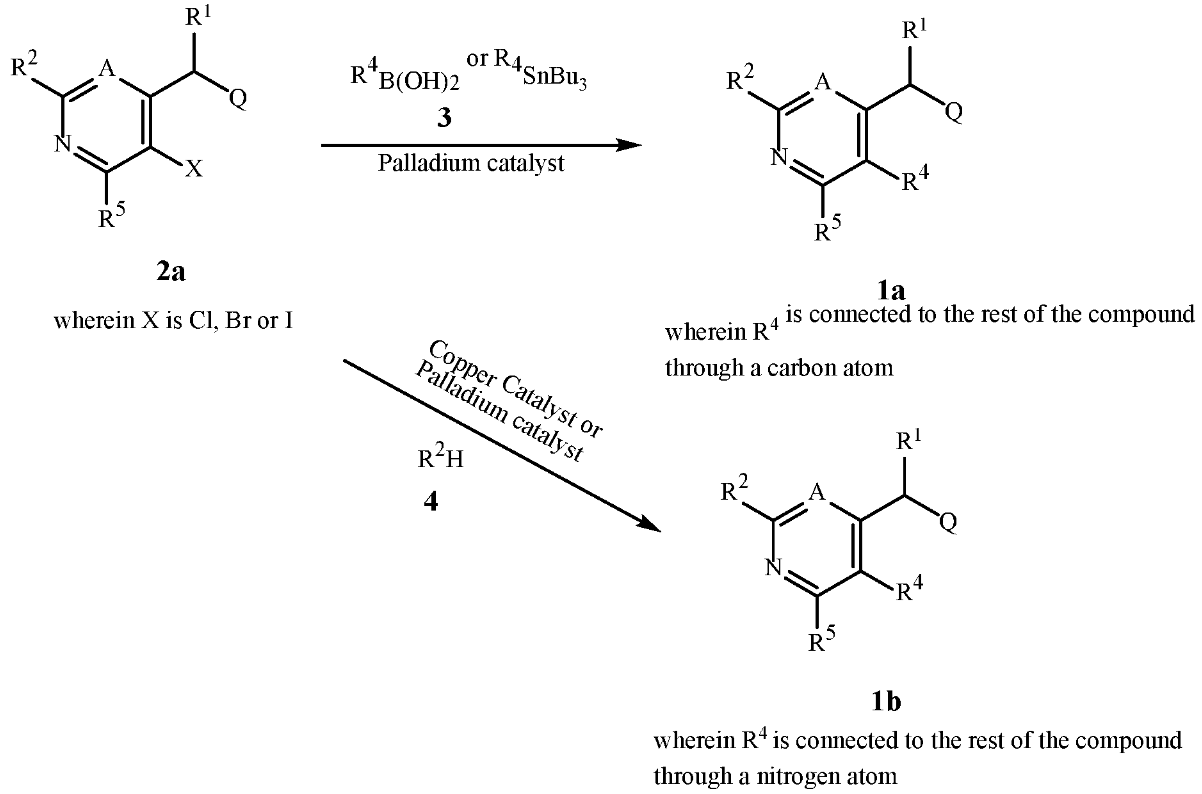
Embodiments of the disclosure also include methods for controlling an invertebrate pest comprising contacting the invertebrate pest or its environment with a biologically effective amount of a compound of Formula **1**, an *N*-oxide or a salt thereof, (e.g., as a composition described herein), provided that the methods are not methods of medical treatment of a human or animal body by therapy.

This disclosure also relates to such methods wherein the invertebrate pest or its environment is contacted with a composition comprising a biologically effective amount of a compound of Formula **1**, an *N*-oxide or a salt thereof, and at least one additional component selected from the group consisting of surfactants, solid diluents and liquid diluents, said composition optionally further comprising a biologically effective amount of at least one additional biologically active compound or agent, provided that the methods are not methods of medical treatment of a human or animal body by therapy.

One or more of the following methods and variations as described in Schemes 1–11 can be used to prepare the compounds of Formula **1**. The definitions of R^1, R^2, R^3, R^4, R^5, A and Q in the compounds of Formulae **1**–**18** below are as defined above in the Summary of the Disclosure unless otherwise noted. Compounds of Formulae **1a**–**1d** are various subsets of the compounds of Formula **1**, and all substituents for Formulae **1a**–**1d** are as defined above for Formula **1** unless otherwise indicated. Ambient or room temperature is defined as about 20–25 °C.

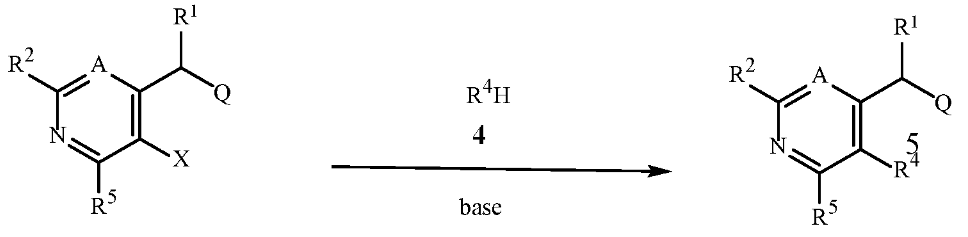
As shown in Scheme 1, compounds of Formula **1a** (compounds of Formula **1** wherein R^4 is attached to the rest of the molecule through a carbon atom) can be prepared by contacting compounds of Formula **2a** wherein X is Cl, Br or I with boronic acids or organotin compounds of Formula **3** in the presence of a palladium catalyst. A wide variety of palladium-containing compounds and complexes are useful as catalysts for the present method. Examples of palladium-containing compounds and complexes useful as catalysts in the method of Scheme 1 include $Pd(OAc)_2$ (palladium(II) acetate), $PdCl_2$ (palladium(II) chloride), $PdCl_2(PPh_3)_2$ bis(triphenylphosphine)palladium(II) dichloride, $Pd(PPh_3)_4$ (tetrakis(triphenylphosphine)palladium(0), $Pd(C_5H_7O_2)_2$ (palladium(II) acetylacetonate) and $Pd_2(dba)_3$ tris (dibenzylideneacetone)dipalladium(0). Also as shown in Scheme 1, compounds of Formula **1b** (compounds of Formula **1** wherein R^4 is attached to the rest of the molecule through a nitrogen atom) can be prepared by contacting compounds of Formula **2a** (wherein X is Cl, Br or I) with compounds of Formula **4** (a heterocyclic compound with an NH as a ring member wherein the H can be replaced by another functional group during a chemical reaction) in the presence of a copper catalyst or a palladium catalyst. For recent review articles and books about this type of functional group transformation; see, for example, F. Bellina et al., *Synthesis* **2004**, *15*, 2419–2440; P. Espinet and A. M. Echavarren, *Angewandte Chemie, International Edition* **2004**, *43*, 4704–4734; and J. J. Li, G. W. Gribble, editors, Palladium in Heterocyclic Chemistry: A Guide for the Synthetic Chemist. 2000. K. W. Anderson et al., *Angewandte Chemie, International Edition* **2006**, *45*, 6523–6527.

Scheme 1



As shown in Scheme 2, compounds of Formula **1b** can also be prepared by contacting compounds of Formula **2b** (wherein X is F or Cl) with compounds of Formula **4** in the presence of a base, such as K_2CO_3 or Cs_2CO_3. A wide variety of known general procedures are reasonably believed to be readily adaptable by one skilled in the art to the method of Scheme 2, for example, see, J. D. Culshaw et al., *Synlett* **2012**, *23*, 1816–1820. The method of Scheme 2 is illustrated by Synthesis Example 1, Step C and Synthesis Example 2, Step B.

Scheme 2



2b

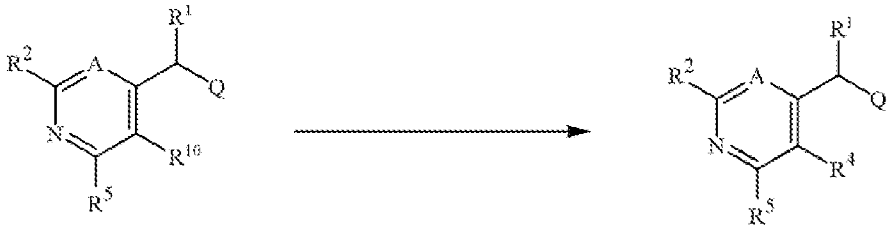
wherein X is F or Cl

1b

wherein R^4 is connected to the rest of the compound through a nitrogen atom

Alternatively, as shown in Scheme 3, compounds of Formula **1a** can be prepared by constructing a heterocyclic ring via compounds of Formula **5** wherein R^{10} is CN, $COCH_3$, NH_2NH_2 or CHO. The methods to form a heterocyclic ring through these functional groups are known in the literature. A variety of known general procedures are reasonably believed to be readily adaptable by one skilled in the art to the method of Scheme 3, for example, see, World Patent Publication WO 2012/002577; World Patent Publication WO 2012/087938; World Patent Publication WO 2013/078468; M. H. Gezginci et al.; *J. Med. Chem.* **2001**, *44*, 1560-1563; K. Gobbis, *J. Heterocyclic Chem.* **2009**, *46*, 1271-1279. The method of Scheme 3 is illustrated by Synthesis Example 3, Steps B, C and D

Scheme 3

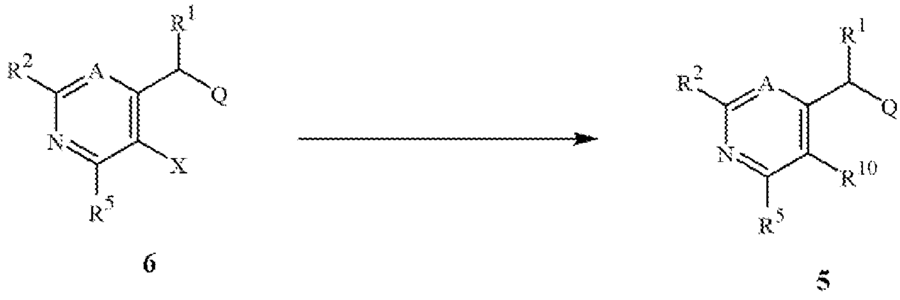


5

1a

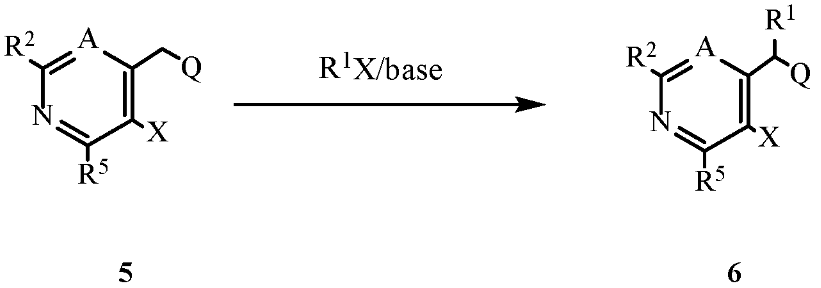
As shown in Scheme 4, a compound of Formula **5** can be prepared by converting the X group in a compound of Formula **6** to the R^{10} group in a compound of Formula **5** via functional group transformation reactions. A variety of general procedures are well known in the literature, for example, see, M. Hatsuda, M. Seki, *Tetrahedron*, **2005**, *61*, 9908-9917; D. Xu et al., *Tetrahedron Letters*, **2008**, 6104-6107; A. Brennfuehrer, et al., *Tetrahedron*, **2007**, *63*, 6252-6258, World Patent Publication WO 2012/050159. The method of Scheme 4 is illustrated by synthesis Example 3, Step A.

Scheme 4



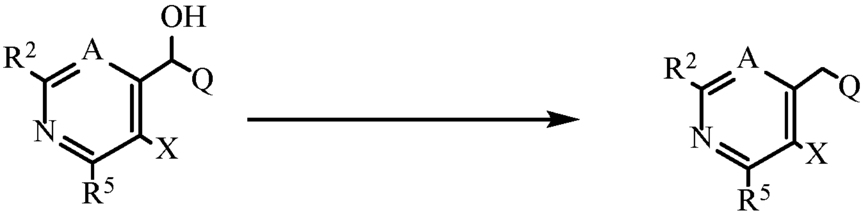
As shown in Scheme 5, a compound of Formula **6** can be prepared by treating the compound of Formula 7 with R^1X in the presence of a base, such as LHMDS, KHMDS, LDA, NaH, etc. A variety of general procedures are well known in the literature, for example, see, Sheng-Chun Sha, et al., *J. Am. Chem. Soc.*, **2013**, 17602-17609; World Patent Publication WO 2001/087839. The method of Scheme 4 is illustrated by synthesis Example 2, Step A.

Scheme 5



As shown in Scheme 6, a compound of Formula 7 can be easily obtained by treating the compound of Formula **8** with reduced agents, such as HI/HOAc, Zn/HCOOH, CF_3COOH/Et_3SiH, PBr_3 etc.. A variety of general procedures are well known in the literature, for example, see, Y. Nishigaya, et al., *Tetrahedron*, **2016**, *72*, 1566-1572; S. Efange, et al. *J. Med. Chem.*, **1990**, 3133-3138; World Patent Publication WO 2020/180624. The method of Scheme 6 is illustrated by synthesis Example 1, Step B.

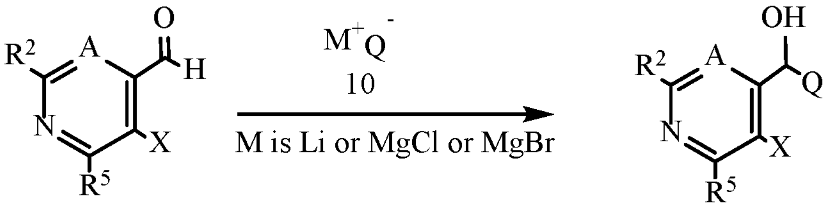
Scheme 6



8 **7**

As shown in Scheme 7, compounds of Formula **8** are readily available from nucleophilic addition of compounds of Formula **10** with the aldehydes of Formula **9**. The nucleophiles of Formula **10** can be generated by various chemical approaches. For example, the metal–halogen exchange reaction of a haloaromatic compound QX′ (wherein X′ is preferred to be Br or I) with *n*-butyllithium or *i*-propylmagnesium bromide, typically at a temperature between about –100 and about –20 °C, can generate the nucleophiles of Formula **10** *in situ*. A wide variety of general procedures for conducting metal halogen exchange followed by reaction with electrophiles are known in the art and can be readily adapted for the present method. For related general procedures see, for example, M. Schlosser, *Angew. Chem. Int. Ed.* **2004**, *43*, 2 and P. Knochel et al., *Synthesis*, **2002**, 565. In addition, the nucleophiles of Formula **10** can be prepared via Grignard reaction of the corresponding bromide or iodide QBr or QI with magnesium. Some of the nucleophiles of Formula **10** are commercially available, for example, 4-tert-butylphenylmagnesium bromide or 4-(trifluoromethoxy)phenylmagnesium bromide. Most of the aldehydes of Formula **9** are commercially available or known compounds in the chemical literature.

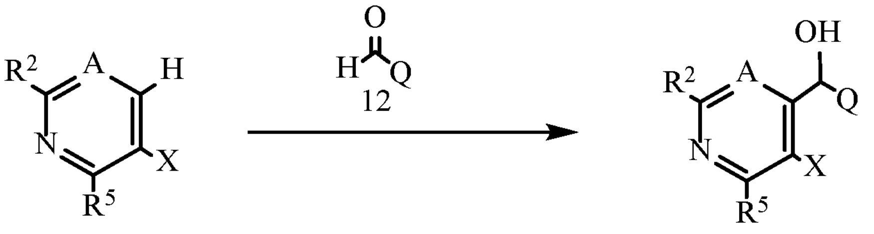
Scheme 7



9 **8**

As shown in Scheme 8, treating compounds of Formula **11** (wherein X is F or Cl) with a base, such as lithium diisopropylamide, 2,2,6,6-tetramethylpiperidinyl magnesium chloride lithium chloride complex etc. in ether solvents, such as THF, diethyl ether or dioxanes at a temperature between -100 °C to -10 °C will generate the desired anions *in situ*. By quenching the above anions with aldehydes of Formula **12**, compounds of Formula **8** can be prepared. This method is well known in literature, see for example, R. J. Mattson, et al. *J. Org. Chem.*, **1990,** *55*, 3410. The method of Scheme 8 is illustrated by synthesis Examples 1, Step A.

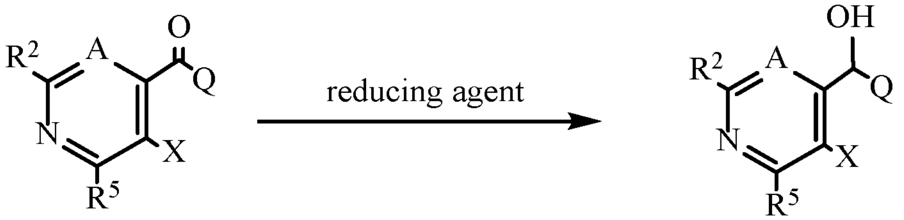
Scheme 8



11 **8**

As shown in Scheme 9, compounds of Formula **8** can also be prepared by reduction of the corresponding carbonyl compounds of Formula **13**. By treating compounds of Formula **13** in solvents, such as methanol, ethanol or ethers (such as tetrahydrofuran) with a variety of reducing agents, such as sodium borohydride, borane-dimethylsulfide, compounds of Formula **8** can be prepared. Alternatively, the reduction of the carbonyl compounds of Formula **13** can be accomplished by catalytic hydrogenation. Several general procedures of these transformations are known in the art; see, for example, D. Douglas, et al., *J. Med. Chem* **2009**, *52*, 4694; M. Moriyasu, et al., *Synlett* **1997**, *3*, 273.

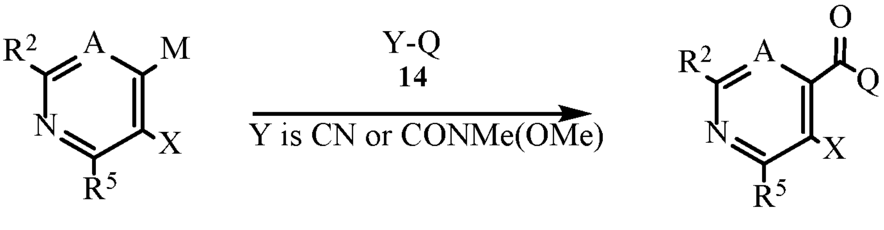
Scheme 9



13 **8**

As shown in Scheme 10, compounds of Formula **13** can be prepared from CN substituted aromatic compounds of Formula **14** (wherein Y is CN) or Weinreb amides of Formula **14** (wherein Y is CONMeOMe). Reactions of compounds of Formula **15** with compounds of Formula **14** can provide carbonyl compounds of Formula **13**. Compounds of Formula **15** can be prepared using a similar chemistry which generates the corresponding anions *in situ* as described in Scheme 8. For related references see, for example: U.S. Patent Application Publication US 2008/280891 and Bela. et al. European J. Org. Chem. 2004 17, 3623-3632. Many of the compounds of Formula **14** and **15** are commercially available or readily available from literature synthetic methods.

Scheme 10



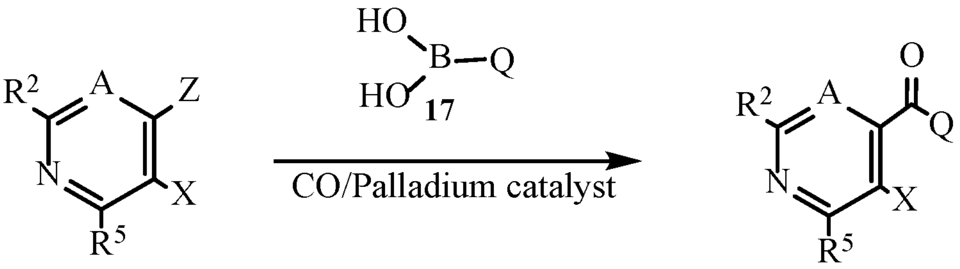
15

wherein M is Li or MgX

13

Alternatively, as shown in Scheme 11, compounds of Formula **13** can also be prepared from 4-halopyridine or pyrimidine compounds of Formula **16** (wherein Z is Br or I and X is other than Br or I). The palladium-catalyzed cross-coupling reaction of the compounds of Formula **16**, carbon monoxide and boronic acids of Formula **17** can provide an alternative way to prepare compounds of Formula **13**. Treating a mixture of 4-halopyridine or pyrimidine compounds of Formula **16** and boronic acids of Formula **17** in the presence of palladium catalyst (such as bis(triphenylphosphine)palladium(II) dichloride, or tetrakis(triphenylphosphine)-palladium(0)) with a base (such as potassium carbonate, sodium carbonate or cesium carbonate) at a temperature of about 80 to 150 °C in ethereal solvents (such as tetrahydrofuran or dioxane) under pressurized carbon monoxide atmosphere from 1 to 50 bar will provide the desired carbonyl compounds of Formula **13**. A detailed experimental procedure is given in Couve-Bonnair et. al., *Tetrahedron Lett.* **2001**, *42*, 3689-3691. Most of the compounds of Formula **16** and boronic acids of Formula **17** are commercially available or readily available from the chemical literature.

Scheme 11



16

13

wherein Z is Br or I; and X is other than Br or I

It is recognized that some reagents and reaction conditions described above for preparing compounds of Formula **1** may not be compatible with certain functionalities present in the intermediates. In these instances, the incorporation of protection/deprotection sequences or functional group interconversions into the synthesis will aid in obtaining the desired products.

The use and choice of the protecting groups will be apparent to one skilled in chemical synthesis (see, for example, Greene, T. W.; Wuts, P. G. M. *Protective Groups in Organic Synthesis*, 2nd ed.; Wiley: New York, 1991). One skilled in the art will recognize that, in some cases, after the introduction of a given reagent as it is depicted in any individual scheme, it may be necessary to perform additional routine synthetic steps not described in detail to complete the synthesis of compounds of Formula **1**. One skilled in the art will also recognize that it may be necessary to perform a combination of the steps illustrated in the above schemes in an order other than that implied by the particular sequence presented to prepare the compounds of Formula **1**.

One skilled in the art will also recognize that compounds of Formula **1** and the intermediates described herein can be subjected to various electrophilic, nucleophilic, radical, organometallic, oxidation, and reduction reactions to add substituents or modify existing substituents.

Without further elaboration, it is believed that one skilled in the art using the preceding description can utilize the present disclosure to its fullest extent. The following Synthesis Examples are, therefore, to be construed as merely illustrative, and not limiting of the disclosure in any way whatsoever. Steps in the following Synthesis Examples illustrate a procedure for each step in an overall synthetic transformation, and the starting material for each step may not have necessarily been prepared by a particular preparative run whose procedure is described in other Examples or Steps. Ambient or room temperature is defined as about 20–25 °C. Percentages are by weight except for chromatographic solvent mixtures or where otherwise indicated. Parts and percentages for chromatographic solvent mixtures are by volume unless otherwise indicated. MPLC refers to medium pressure liquid chromatography on silica gel. ^{1}H NMR spectra are reported in ppm downfield from tetramethylsilane; “s” means singlet, “d” means doublet, “dd” means doublet of doublets, “ddd” means doublet of doublet of doublets, “t” means triplet, “m” means multiplet, and “br s” means broad singlet. For mass spectral data, the numerical value reported is the molecular weight of the parent molecular ion (M) formed by addition of H^+ (molecular weight of 1) to the molecule to give a M+1 peak observed by mass spectrometry using atmospheric pressure chemical ionization (AP^+).

Schemes 1 through 11 illustrate methods to prepare compounds of Formula **1** having a variety of substituents. Compounds of Formula **1** having substituents other than those particularly noted for Schemes 1 through 11 can be prepared by general methods known in the art of synthetic organic chemistry, including methods analogous to those described for Schemes 1 to 11.

SYNTHESIS EXAMPLE 1

Preparation of 3-fluoro-5-(triazol-2-yl)-4-[[4(trifluoromethoxy)phenyl]methyl]pyridine (Compound 1)

Step A: Preparation of (3,5-difluoro-4-pyridyl)-[4-(trifluoromethoxy)phenyl]methanol

To a stirred solution of 3,5-difluoropyridine (5 g, 0.043 mol, 1.0 eq.) in THF (50 ml) was added 2.0 M LDA in THF (26.0 mL, 0.052 mol, 1.2 eq.), slowly at -78°C under N_2 atmosphere. Then the reaction mixture was stirred for 30 min and added 4-(trifluoromethoxy)benzaldehyde (8.25 g, 0.043 mol, 1.0 eq) (dissolved in 30 ml of THF) at -78 °C and stirred for 90 min at same temperature. Reaction monitored by TLC. The reaction mixture was quenched with saturated NH_4Cl aqueous solution and extracted with EtOAc (3x 500 ml) then dried over anhydrous Na_2SO_4 and concentrated under reduced pressure to get crude. The obtained crude was purified by combi flash chromatography using 100-200 silica gel, eluted with 0-30% ethyl acetate in petroleum ether to afford the title product as an off white solid (9.0 g, 69% yield).

^1H NMR ($CDCl_3$) δ 8.38 (s, 2H), 7.43 (d, 2H), 7.22 (d, 2H), 6.26 (d, 1H), 2.75 (d, 1H).

Step B: Preparation of 3,5-difluoro-4-[[4-(trifluoromethoxy)phenyl]methyl]pyridine

To a stirred solution of (3,5-difluoro-4-pyridyl)-[4-(trifluoromethoxy)phenyl]methanol (2.0 g, 0.0065 mol, 1.0 eq) in AcOH (20 ml) was added 50% HI in H_2O (2 x 8.3 g (100%), 0.065 mol, 10.0 eq) at rt, under N_2 atmosphere then stirred for 16 h with oil batch at 140°C. Reaction monitored by TLC, the reaction mixture was diluted with water (20 ml) and extracted with EtOAc (3x 100 mL) then organic layer washed with saturated aqueous $NaHCO_3$ solution (2x 100 mL) and water (1x 100 mL). Then dried over anhydrous Na_2SO_4 and concentrated under reduced pressure to get crude. The obtained crude was purified by combiflash chromatography using 100-200 silica gel, eluted with 0-10% ethyl acetate in petroleum ether to get the title product as light yellow liquid (1.8 g, 94% yield).

^1H NMR ($CDCl_3$) δ 8.33 (s, 2H), 7.28 (d, 2H), 7.14 (d, 2H), 4.05 (s, 2H).

Step C: Preparation of 3-fluoro-5-(triazol-2-yl)-4-[[4-(trifluoromethoxy)phenyl] methyl]pyridine and 3-fluoro-5-(triazol-1-yl)-4-[[4-(trifluoromethoxy)phenyl] methyl]pyridine

To a stirred solution of 3,5-difluoro-4-[[4-(trifluoromethoxy)phenyl]methyl]pyridine (1.5 g, 0.0051 mol, 1.0 eq) in DMF (15 ml) was added K_2CO_3 (1.8 g, 0.0129 mol, 2.5 eq) and 1,2,3-triazole (0.45 mL, 0.0077 mol, 1.5 eq) in sealed tube at rt under N_2 atmosphere. The reaction mixture was stirred for 16 h at 80° C and monitored by TLC. The reaction mixture was cooled to rt and was poured into ice cold water (150 ml) and extracted with EtOAc (2x 100 ml). Then the organic layer was washed with brine (2x 100 ml) & ice water (100 ml), dried over anhydrous Na_2SO_4 and concentrated under reduced pressure to get crude. The obtained crude was purified by combi flash chromatography using 100-200 silica gel, eluted with 0-10% ethyl acetate in petroleum ether to afford the title products of 3-fluoro-5-(triazol-2-yl)-4-[[4-(trifluoromethoxy)phenyl]methyl]pyridine (0.2 g, 11% yield) as an off white solid and 3-fluoro-5-(triazol-1-yl)-4-[[4-(trifluoromethoxy)phenyl]methyl]pyridine (0.05 g, 3% yield).

^{1}H NMR (d6-DMSO) δ 8.79 (s, 1H), 8.77 (s, 1H), 8.22 (s, 2H), 7.22 (d, 2H), 7.14 (d, 2H), 4.27 (s, 2H); and 8.85 (s, 1H), 8.65 (s, 1H), 8.58 (d, 1H), 8.01 (d, 1H), 4.04 (s, 2H).(Compound 1)

SYNTHESIS EXAMPLE 2

Preparation of 3-fluoro-5-(triazol-2-yl)-4-[1-[4-(trifluoromethoxy)phenyl]ethyl]pyridine and 3-fluoro-5-(triazol-1-yl)-4-[1-[4-(trifluoromethoxy)phenyl]ethyl]pyridine (Compound 9)

Step A: Preparation of 3,5-difluoro-4-[1-[4-(trifluoromethoxy)phenyl]ethyl]pyridine

To a stirred solution of 3,5-difluoro-4-[[4-(trifluoromethoxy)phenyl]methyl]pyridine (1.5 g, 0.0051 mol, 1.0 eq, product from Step B of Synthesis Example 1) in THF (15 ml) was added 1.0 M LiHMDS in THF (10.3 mL, 0.0103 mol, 2.0 eq) at 0°C temperature and allow to stir for 15 mints. Then MeI (0.48 mL, 0.0077 mol, 1.5 eq) was added to the reaction mixture at 0°C under N_2 atmosphere and allowed to stir at rt for 2 h. Reaction was monitored by TLC. After completion, reaction mixture quenched with an ice-cold water and extracted with ethyl acetate (2x 200 mL). The organic layer was dried over anhydrous Na_2SO_4 and concentrated under reduced pressure to get crude. The obtained crude was purified by combi flash chromatography using 100-200 silica gel, eluted with 0-10% ethyl acetate in petroleum ether to afford the title product (1.2 g, 80% yield) as a colourless liquid.

^{1}H NMR (d6-DMSO) δ 8.49 (s, 2H), 7.41 (d, 2H), 7.32 (d, 2H), 7.64 (q, 1H), 1.70 (d, 3H).

Step B: Preparation of 3-fluoro-5-(triazol-2-yl)-4-[1-[4-(trifluoromethoxy)phenyl] ethyl]pyridine and 3-fluoro-5-(triazol-1-yl)-4-[1-[4-(trifluoromethoxy)phenyl]ethyl]pyridine

To a stirred solution of 3,5-difluoro-4-[1-[4-(trifluoromethoxy)phenyl]ethyl]pyridine (1.1 g, 0.0036 mol, 1.0 eq) in DMF (15 ml) was added K_2CO_3 (1.0 g, 0.0072 mol, 2.0 eq) and 1,2,3-triazole (0.31 mL, 0.0054 mol, 1.5 eq) in sealed tube at rt under N_2 atmosphere. The reaction mixture was stirred for 16 h at 80° C and the reaction was monitored by TLC. The reaction mixture was cooled to rt and was poured into an ice-cold water (150 mL) and extracted with EtOAc (2x 100 mL). Then the organic layer was washed with brine (2x 100 mL) and ice water (100 ml) then dried over anhydrous Na_2SO_4 and concentrated under reduced pressure to get crude. The obtained crude was purified by combi flash chromatography using 100-200 silica gel, eluted with 0-10% ethyl acetate in pet ether to afford the title products of 3-fluoro-

5-(triazol-2-yl)-4-[1-[4-(trifluoromethoxy)phenyl]ethyl]pyridine (0.18 g, 15% yield) as an off white solid and 3-fluoro-5-(triazol-1-yl)-4-[1-[4-(trifluoromethoxy)phenyl]ethyl]pyridine (36 mg, 3% yield).

^{1}H NMR (d6-DMSO) δ 8.71 (s, 1H), 8.69 (s, 1H), 8.25 (s, 2H), 7.32 (d, 2H), 7.28 (d, 2H), 4.39 (q, 1H), 1.66 (d, 3H); and 8.58 (s, 1H), 8.39 (s, 1H), 7.84 (d, 1H), 7.58 (d, 1H), 7.16 (d, 2H), 7.09 (d, 2H), 4.19 (q, 1H), 1.74 (d, 3H). (Compound 9)

SYNTHESIS EXAMPLE 3

Preparation of 3-fluoro-5-(4-methyltriazol-2-yl)-4-[[4-(trifluoromethoxy)phenyl]methyl] pyridine (Compound 3)

Step A: Preparation of [5-fluoro-4-[[4-(trifluoromethoxy)phenyl]methyl]-3-pyridyl]hydrazine

To a stirred solution of 3,5-difluoro-4-[[4-(trifluoromethoxy)phenyl]methyl]pyridine (1.5 g, 0.0051 mol, 1.0 eq, product from Step B of Synthesis Example 1) in DMF (15 ml) was added K_2CO_3 (1.8 g, 0.0129 mol, 2.5 eq) and $N_2H_4.H_2O$ (2.5 g, 0.051 mol, 10 eq) in a sealed tube at rt under N_2 atmosphere then heated to 140° C. The reaction mixture was stirred for 9 h at 140° C. The reaction was monitored by TLC. The reaction mixture was cooled to rt and was poured into ice cold water (150 ml) and extracted with EtOAc (3x 100 ml). Then the organic layer was washed with brine (2x 50 ml) and ice water (50 ml) then dried over anhydrous Na_2SO_4 and concentrated under reduced pressure to get crude. The obtained crude title product (1.3 g crude) was confirmed by LCMS (56.6 %) and used for the next step without purification.

Step B: Preparation of 2-[[5-fluoro-4-[[4-(trifluoromethoxy)phenyl]methyl]-3-pyridyl]hydrazono]propanal oxime

To a stirred solution of the above crude product from Step A (1.3 g, 0.0043 mol, 1.0 eq) in EtOH (13 ml) was added 2-oxopropanal oxime (0.45 g, 0.0051 mol, 1.2 eq) at rt under N_2 atmosphere and heated to reflux for 3 h, reaction monitored by TLC. Then cooled to rt and concentrated at reduced pressure to get crude. The obtained crude was triturated with MTBE (1 ml) and then petroleum ether (2X 2ml) to get solid compound 7 (0.8 g, 50% yield in two steps)

^{1}H NMR (d6-DMSO) δ 11.36 (s, 1H), 8.71 (s, 1H), 8.50 (s, 1H), 8.12 (s, 1H), 7.29 (s, 4H), 4.25 (s, 2H), 1.99 (s, 3H).

Step C: Preparation of 2-[5-fluoro-4-[[4-(trifluoromethoxy)phenyl]methyl]-3-pyridyl]-4-methyl-1lambda5,2,3-triazacyclopenta-3,5-diene 1-oxide

To a stirred solution of 2-[[5-fluoro-4-[[4-(trifluoromethoxy)phenyl]methyl]-3-pyridyl]hydrazono]propanal oxime (250 mg, 0.675 m.mol, 1.0 eq) in 15% aq. pyridine solution (10 mL) at rt was heated to 100° C, then added $CuSO_4$ (253 mg, 1.013 m.mol, 1.5 eq, dissolved in 2.5 ml of water) and stirred for 1 h at 100° C. Reaction monitored by TLC. The reaction mixture was cooled to rt and acidified with 1N HCl solution up to PH=2, then extracted with ethyl acetate (2x 50 ml). The organic layer was dried over anhydrous Na_2SO_4 and concentrated under reduced pressure to get crude compd. The obtained crude was purified by combiflash chromatography using 100-200 silica gel, eluted with 50% ethyl acetate/ petroleum ether to get the title product (180 mg 72% yield).

^{1}H NMR (d6-DMSO) δ 8.85 (s, 1H), 8.60 (s, 1H), 7.88 (s, 1H), 7.22 (d, 2H), 7.12 (d, 2H), 4.03 (s, 2H), 2.21 (s, 3H).

Step D: Preparation of 3-fluoro-5-(4-methyltriazol-2-yl)-4-[[4-(trifluoromethoxy) phenyl]methyl]pyridine

To a stirred solution of 2-[5-fluoro-4-[[4-(trifluoromethoxy)phenyl]methyl]-3-pyridyl]-4-methyl-1lambda5,2,3-triazacyclopenta-3,5-diene 1-oxide

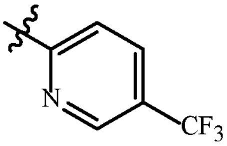
(180 mg, 0.489 m.mol, 1.0 eq) in chloroform was added PCl_3 (201.4 mg, 1.467 m.mol, 3.0 eq) at rt under N_2 atmosphere, then heated to reflux and stirred for 15 h. Reaction monitored by TLC. The reaction mixture was cooled to 0° C, then quenched with saturated aqueous $NaHCO_3$ solution and extracted with ethyl acetate (2x 50 ml). Then the organic layer was dried over anhydrous Na_2SO_4 and concentrated under reduced pressure to get crude. The obtained crude was purified by combiflash chromatography using 100-200 silica gel, eluted with 30% ethyl acetate/petroleum ether to get the title product as a brown liquid (78 mg, 45% yield).

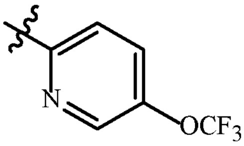
^{1}H NMR (d6-DMSO) δ 8.75 (s, 1H), 8.73 (s, 1H), 7.98 (s, 1H), 7.23 (d, 2H), 7.15 (d, 2H), 4.30 (s, 2H), 2.35 (s, 3H).

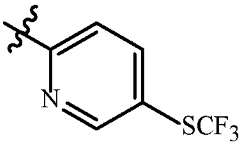
By the procedures described herein together with methods known in the art, the following compounds of Tables 1 to 42N can be prepared. The following abbreviations are used in the Tables which follow: *t* means tertiary, *s* means secondary, *n* means normal, *i* means iso, *c* means cyclo, Me means methyl, Et means ethyl, Pr means propyl, *i*-Pr means isopropyl, Bu means butyl, Ph means phenyl, OMe means methoxy, OEt means ethoxy, SMe means methylthio, SEt means ethylthio, -CN means cyano, Ph means phenyl, Py means pyridinyl, $-NO_2$ means nitro, TMS means trimethylsilyl, S(O)Me means methylsulfinyl, and $S(O)_2Me$ means methylsulfonyl.

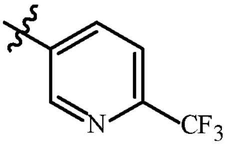
Fragments Q-1 through Q-19 shown below are referred to in Tables 1A to 98I. The structures of fragments Q-1 through Q-19 are illustrated in Exhibit 3. The wavy line denotes the attachment point of the fragment to the remainder of the molecule.

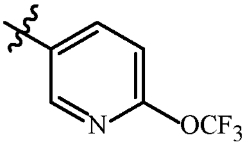
Exhibit 3

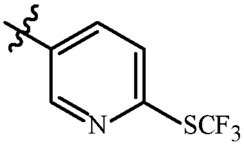

Q-1


Q-2


Q-3


Q-4


Q-5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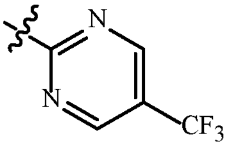
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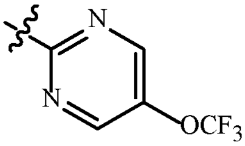
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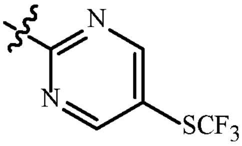
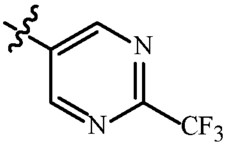

Q-9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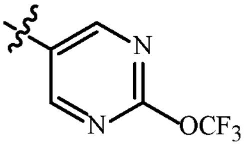
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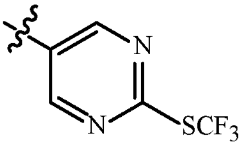
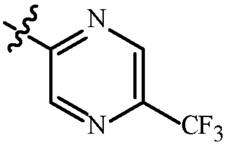
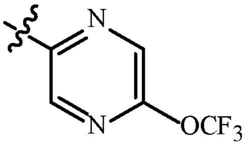
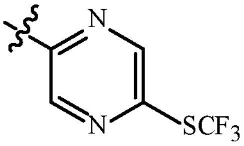
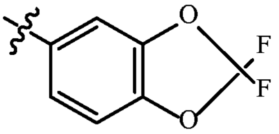

Q-12

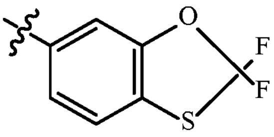

Q-13


Q-14

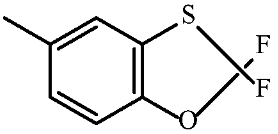

Q-15



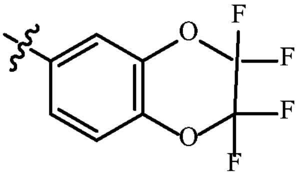
Q-16



Q-17



Q-18



Q-19

Tables 1A–70. A pertain to the structure shown below.

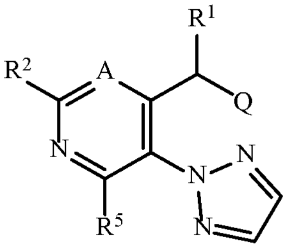


TABLE 1A

R^1 is H, A is CH, R^2 is H and R^5 is H.

Q	Q	Q
4-chlorophenyl	3-(CF_3)phenyl	3-Cl, 4-(CF_3)phenyl
4-bromophenyl	3-(OCF_3)phenyl	3-Br, 4-(CF_3)phenyl
4-iodophenyl	3-(*s*-Bu)phenyl	3-Me, 4-(CF_3)phenyl
4-nitrophenyl	3-(*t*-Bu)phenyl	2,6-diF, 4-(CF_3)phenyl
4-cyanophenyl	3-($CMe_2CH_2CH_3$)phenyl	2,6-diCl, 4-(CF_3)phenyl
4-(CF_3)phenyl	3-(S-*i*-Pr)phenyl	2-F, 4-(OCF_3)phenyl
4-(OCF_3)phenyl	3-(SCH_2CF_3)phenyl	2-Cl, 4-(OCF_3)phenyl
4-(*s*-Bu)phenyl	3-($CF(CF_3)_2$)phenyl	2-Me, 4-(OCF_3)phenyl
4-(*t*-Bu)phenyl	2-F, 4-(*t*-Bu)phenyl	3-F, 4-(OCF_3)phenyl
4-($CMe_2CH_2CH_3$)phenyl	2-Cl, 4-(*t*-Bu)phenyl	3-Cl, 4-(OCF_3)phenyl
4-(S-*i*-Pr)phenyl	2-Me, 4-(*t*-Bu)phenyl	3-Br, 4-(OCF_3)phenyl
4-(SCH_2CF_3)phenyl	3-F, 4-(*t*-Bu)phenyl	3-Me, 4-(OCF_3)phenyl
4-($SCHF_2$)phenyl	3-Cl, 4-(*t*-Bu)phenyl	2,6-diF, 4-(OCF_3)phenyl
4-($S(O)CHF_2$)phenyl	3-Br, 4-(*t*-Bu)phenyl	2,6-diCl, 4-(OCF_3)phenyl
4-(SO_2CHF_2)phenyl	3-Me, 4-(*t*-Bu)phenyl	2-F, 4-(CF_2CF_3)phenyl
4-($CF(CF_3)_2$)phenyl	2,6-diF, 4-(*t*-Bu)phenyl	2-Cl, 4-(CF_2CF_3)phenyl
3-chlorophenyl	2,6-diCl, 4-(*t*-Bu)phenyl	2-Me, 4-(CF_2CF_3)phenyl
3-bromophenyl	2-F, 4-(CF_3)phenyl	3-F, 4-(CF_2CF_3)phenyl
3-iodophenyl	2-Cl, 4-(CF_3)phenyl	3-Cl, 4-(CF_2CF_3)phenyl
3-nitrophenyl	2-Me, 4-(CF_3)phenyl	3-Br, 4-(CF_2CF_3)phenyl
3-cyanophenyl	3-(SCF_3)phenyl	3-Me, 4-(CF_2CF_3)phenyl
4-(SCF_3)phenyl	3-($S(O)CF_3$)phenyl	Q-1
4-($S(O)CF_3$)phenyl	3-(SO_2CF_3)phenyl	Q-2
4-(SO_2CF_3)phenyl	3-(CF_2CF_3)phenyl	Q-3
4-(CF_2CF_3)phenyl	3-($CF_2CF_2CF_3$)phenyl	Q-4
4-($CF_2CF_2CF_3$)phenyl	3-(OCF_2CF_3)phenyl	Q-5

Q	Q	Q
4-(OCF_2CF_3)phenyl	2-F, 4-(OCF_2CF_3)phenyl	Q-6
2-F, 4-(SCF_3)phenyl	2-Cl, 4-(OCF_2CF_3)phenyl	Q-7
2-Cl, 4-(SCF_3)phenyl	2-Me, 4-(OCF_2CF_3)phenyl	Q-8
2-Me, 4-(SCF_3)phenyl	3-F, 4-(OCF_2CF_3)phenyl	Q-9
3-F, 4-(SCF_3)phenyl	3-Cl, 4-(OCF_2CF_3)phenyl	Q-10
3-Cl, 4-(SCF_3)phenyl	3-Br, 4-(OCF_2CF_3)phenyl	Q-11
3-Br, 4-(SCF_3)phenyl	3-Me, 4-(OCF_2CF_3)phenyl	Q-12
3-Me, 4-(SCF_3)phenyl	2,6-diF, 4-(OCF_2CF_3)phenyl	Q-13
2,6-diF, 4-(SCF_3)phenyl	2,6-diCl, 4-(OCF_2CF_3)phenyl	Q-14
2,6-diCl, 4-(SCF_3)phenyl	3-F, 4-(CF_3)phenyl	Q-15
		Q-16
		Q-17
		Q-18
		Q-19

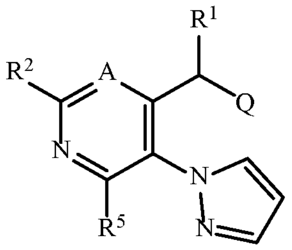
The present disclosure also includes Tables 2A through 70A, each of which is constructed the same as Table 1A above except that the row heading in Table 1A (i.e. "A is CH, R^4 is H and R^5 is H.") below the Markush structure is replaced with the respective row heading shown below. For example, in Table 2A the row heading is "R^1 is H, A is CF, R^4 is H and R^5 is H, and Q is as defined in Table 1A above. Thus, the first entry in Table 2A specifically discloses 4-[(4-chlorophenyl)methyl]-3-fluoro-5-(triazol-2-yl) pyridine.

Table	Table Headings	Table	Table Headings
2A	R^1 is H, A is CF	23A	R^1 is CH_3, A is C-*i*-Pr
3A	R^1 is H, A is CCl	24A	R^1 is CH_3, A is C-*c*-Pr
4A	R^1 is H, A is CBr	25A	R^1 is CH_3, A is C-CF_3
5A	R^1 is H, A is CI	26A	R^1 is CH_3, A is C-OMe
6A	R^1 is H, A is CMe	27A	R^1 is CH_3, A is C-OEt
7A	R^1 is H, A is CEt	28A	R^1 is CH_3, A is N
8A	R^1 is H, A is C-*n*-Pr	29A	R1 is CH_2CH_3, A is CH
9A	R^1 is H, A is C-*i*-Pr	30A	R1 is CH_2CH_3, A is CF
10A	R^1 is H, A is C-*c*-Pr	31A	R1 is CH_2CH_3, A is CCl
11A	R1 is H, A is CCF_3	32A	R1 is CH_2CH_3, A is CBr
12A	R1 is H, A is COMe	33A	R1 is CH_2CH_3, A is CI
13A	R1 is H, A is C-OEt	34A	R1 is CH_2CH_3, A is CMe

Table	Table Headings	Table	Table Headings
14A	R1 is H, A is N	35A	R1 is CH_2CH_3, A is CEt
15A	R1 is CH_3, A is CH	36A	R1 is CH_2CH_3, A is C-*n*-Pr
16A	R1 is CH_3, A is CF	37A	R1 is CH_2CH_3, A is C-*i*-Pr
17A	R1 is CH_3, A is CCl	38A	R1 is CH_2CH_3, A is C-*c*-Pr
18A	R1 is CH_3, A is CBr	39A	R1 is CH_2CH_3, A is C-CF_3
19A	R1 is CH_3, A is CI	40A	R1 is CH_2CH_3, A is C-OMe
20A	R1 is CH_3, A is CMe	41A	R1 is CH_2CH_3, A is C-OEt
21A	R1 is CH_3, A is CEt	42A	R1 is CH_2CH_3, A is N
22A	R1 is CH_3, A is C-*n*-Pr		
43A	R1 is CF_3, A is CH	57A	R1 is CN, A is CH
44A	R1 is CF_3, A is CF	58A	R1 is CN, A is CF
45A	R1 is CF_3, A is CCl	59A	R1 is CN, A is CCl
46A	R1 is CF_3, A is CBr	60A	R1 is CN, A is CBr
47A	R1 is CF_3, A is CI	61A	R1 is CN_3, A is CI
48A	R1 is CF_3, A is CMe	62A	R1 is CN, A is CMe
49A	R1 is CF_3, A is CEt	63A	R1 is CN, A is CEt
50A	R1 is CF_3, A is C-n-Pr	64A	R1 is CN, A is C-n-Pr
51A	R1 is CF_3, A is C-i-Pr	65A	R1 is CN, A is C-i-Pr
52A	R1 is CF_3, A is C-c-Pr	66A	R1 is CN, A is C-c-Pr
53A	R1 is CF_3, A is C-CF_3	67A	R1 is CN, A is C-CF_3
54A	R1 is CF_3, A is C-OMe	68A	R1 is CN, A is C-OMe
55A	R1 is CF_3, A is C-OEt	69A	R1 is CN, A is C-OEt
56A	R1 is CF_3, A is N	70A	R1 is CN, A is N

TABLE 1B

Table 1B is identical to Table 1A, except that the chemical structure in the Table 1B heading is replaced with the following structure:



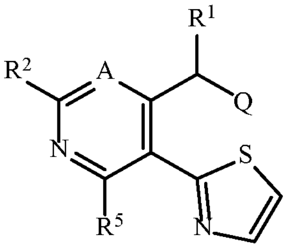
For example, the first compound in Table 1B is the structure shown immediately above wherein R^1 is H, A is CH, R^2 is H, R^5 is H, and Q is 4-chlorophenyl.

TABLES 2B-70B

Tables 2B through 70B are constructed in a similar manner as Tables 2A through 70A.

TABLE 1C

Table 1C is identical to Table 1A, except that the chemical structure in the Table 1B heading is replaced with the following structure:



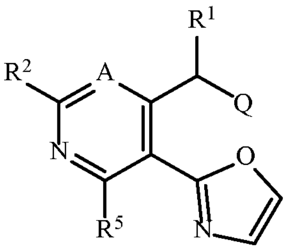
For example, the first compound in Table 1C is the structure shown immediately above wherein R^1 is H, A is CH, R^2 is H, R^5 is H, and Q is 4-chlorophenyl.

TABLES 2C-70C

Tables 2C through 70C are constructed in a similar manner as Tables 2A through 70A.

TABLE 1D

Table 1D is identical to Table 1A, except that the chemical structure in the Table 1D heading is replaced with the following structure:



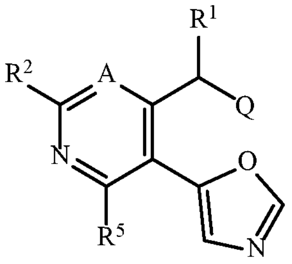
For example, the first compound in Table 1D is the structure shown immediately above wherein R^1 is H, A is CH, R^2 is H, R^5 is H, and Q is 4-chlorophenyl.

TABLES 2D-70D

Tables 2D through 70D are constructed in a similar manner as Tables 2A through 70A.

TABLE 1E

Table 1E is identical to Table 1A, except that the chemical structure in the Table 1E heading is replaced with the following structure:



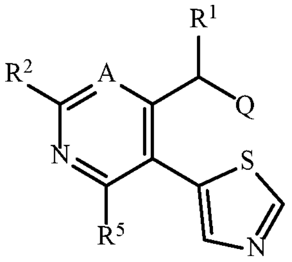
For example, the first compound in Table 1D is the structure shown immediately above wherein R^1 is H, A is CH, R^2 is H, R^5 is H, and Q is 4-chlorophenyl.

TABLES 2E-70E

Tables 2E through 70E are constructed in a similar manner as Tables 2A through 70A.

TABLE 1F

Table 1F is identical to Table 1A, except that the chemical structure in the Table 1F heading is replaced with the following structure:



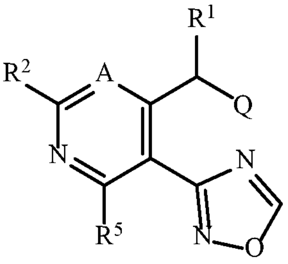
For example, the first compound in Table 1F is the structure shown immediately above wherein R^1 is H, A is CH, R^2 is H, R^5 is H, and Q is 4-chlorophenyl.

TABLES 2F-70F

Tables 2F through 70F are constructed in a similar manner as Tables 2A through 70A.

TABLE 1G

Table 1G is identical to Table 1A, except that the chemical structure in the Table 1G heading is replaced with the following structure:



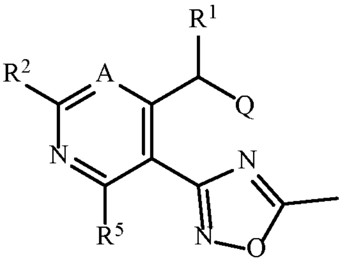
For example, the first compound in Table 1G is the structure shown immediately above wherein R^1 is H, A is CH, R^2 is H, R^5 is H, and Q is 4-chlorophenyl.

TABLES 2G-70G

Tables 2G through 70G are constructed in a similar manner as Tables 2A through 70A.

TABLE 1H

Table 1H is identical to Table 1A, except that the chemical structure in the Table 1H heading is replaced with the following structure:



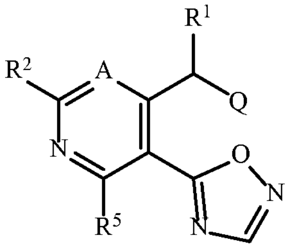
For example, the first compound in Table 1H is the structure shown immediately above wherein R^1 is H, A is CH, R^2 is H, R^5 is H, and Q is 4-chlorophenyl.

TABLES 2H-70H

Tables 2H through 70H are constructed in a similar manner as Tables 2A through 70A.

TABLE 1I

Table 1I is identical to Table 1A, except that the chemical structure in the Table 1H heading is replaced with the following structure:



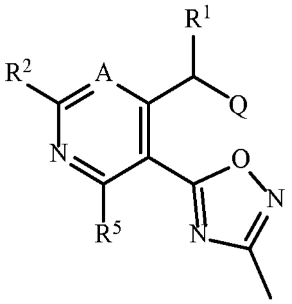
For example, the first compound in Table 1I is the structure shown immediately above wherein R^1 is H, A is CH, R^2 is H, R^5 is H, and Q is 4-chlorophenyl.

TABLES 2I-70I

Tables 2I through 70I are constructed in a similar manner as Tables 2A through 70A.

TABLE 1J

Table 1J is identical to Table 1A, except that the chemical structure in the Table 1J heading is replaced with the following structure:



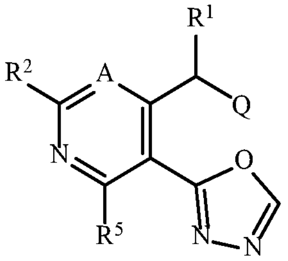
For example, the first compound in Table 1J is the structure shown immediately above wherein R^1 is H, A is CH, R^2 is H, R^5 is H, and Q is 4-chlorophenyl.

TABLES 2J-70J

Tables 2J through 70J are constructed in a similar manner as Tables 2A through 70A.

TABLE 1K

Table 1K is identical to Table 1A, except that the chemical structure in the Table 1K heading is replaced with the following structure:



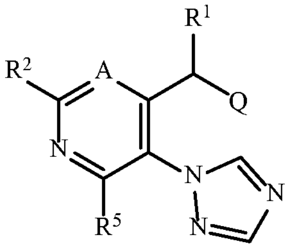
For example, the first compound in Table 1K is the structure shown immediately above wherein R^1 is H, A is CH, R^2 is H, R^5 is H, and Q is 4-chlorophenyl.

TABLES 2K-70K

Tables 2K through 70K are constructed in a similar manner as Tables 2A through 70A.

TABLE 1L

Table 1L is identical to Table 1A, except that the chemical structure in the Table 1L heading is replaced with the following structure:



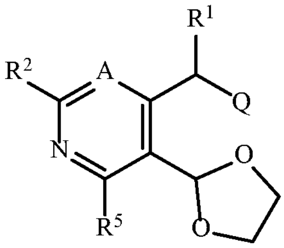
For example, the first compound in Table 1L is the structure shown immediately above wherein R^1 is H, A is CH, R^2 is H, R^5 is H, and Q is 4-chlorophenyl.

TABLES 2L-70L

Tables 2L through 70L are constructed in a similar manner as Tables 2A through 70A.

TABLE 1M

Table 1M is identical to Table 1A, except that the chemical structure in the Table 1M heading is replaced with the following structure:



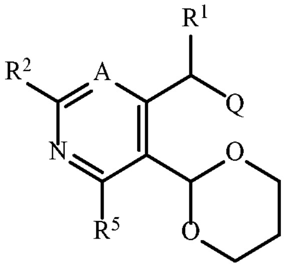
For example, the first compound in Table 1M is the structure shown immediately above wherein R^1 is H, A is CH, R^2 is H, R^5 is H, and Q is 4-chlorophenyl.

TABLES 2M-70M

Tables 2M through 70M are constructed in a similar manner as Tables 2A through 70A.

TABLE 1N

Table 1N is identical to Table 1A, except that the chemical structure in the Table 1N heading is replaced with the following structure:



For example, the first compound in Table 1N is the structure shown immediately above wherein R1 is H, A is CH, R^2 is H, R5 is H, and Q is 4-chlorophenyl.

TABLES 2N-70N

Tables 2N through 70N are constructed in a similar manner as Tables 2A through 70A.

A compound of this disclosure will generally be used as an invertebrate pest control active ingredient in a composition, i.e. formulation, with at least one additional component selected from the group consisting of surfactants, solid diluents and liquid diluents, which serves as a carrier. The formulation or composition ingredients are selected to be consistent with the physical properties of the active ingredient, mode of application and environmental factors such as soil type, moisture and temperature.

Useful formulations include both liquid and solid compositions. Liquid compositions include solutions (including emulsifiable concentrates), suspensions, emulsions (including microemulsions, oil in water emulsions, flowable concentrates and/or suspoemulsions) and the like, which optionally can be thickened into gels. The general types of aqueous liquid compositions are soluble concentrate, suspension concentrate, capsule suspension, concentrated emulsion, microemulsion, oil in water emulsion, flowable concentrate and suspoemulsion. The general types of nonaqueous liquid compositions are emulsifiable concentrate, microemulsifiable concentrate, dispersible concentrate and oil dispersion.

The general types of solid compositions are dusts, powders, granules, pellets, prills, pastilles, tablets, filled films (including seed coatings) and the like, which can be water-dispersible ("wettable") or water-soluble. Films and coatings formed from film-forming solutions or flowable suspensions are particularly useful for seed treatment. Active ingredient can be (micro)encapsulated and further formed into a suspension or solid formulation; alternatively, the entire formulation of active ingredient can be encapsulated (or "overcoated"). Encapsulation can control or delay release of the active ingredient. An emulsifiable granule combines the advantages of both an emulsifiable concentrate formulation and a dry granular formulation. High-strength compositions are primarily used as intermediates for further formulation.

Sprayable formulations are typically extended in a suitable medium before spraying. Such liquid and solid formulations are formulated to be readily diluted in the spray medium, usually water, but occasionally another suitable medium like an aromatic or paraffinic hydrocarbon or vegetable oil. Spray volumes can range from about one to several thousand liters per hectare, but more typically are in the range from about ten to several hundred liters per hectare. Sprayable formulations can be tank mixed with water or another suitable medium for foliar treatment by aerial or ground application, or for application to the growing medium of the plant. Liquid and dry formulations can be metered directly into drip irrigation systems or metered into the furrow during planting. Liquid and solid formulations can be applied onto seeds of crops and other desirable vegetation as seed treatments before planting to protect developing roots and other subterranean plant parts and/or foliage through systemic uptake.

The formulations will typically contain effective amounts of active ingredient, diluent and surfactant within the following approximate ranges which add up to 100 percent by weight.

	Weight Percent		
	Active Ingredient	Diluent	Surfactant
Water-Dispersible and Water-soluble Granules, Tablets and Powders	0.001–90	0–99.999	0–15
Oil Dispersions, Suspensions, Emulsions, Solutions (including Emulsifiable Concentrates)	1–50	40–99	0–50
Dusts	1–25	70–99	0–5
Granules and Pellets	0.001–99	5–99.999	0–15
High Strength Compositions	90–99	0–10	0–2

Solid diluents include, for example, clays such as bentonite, montmorillonite, attapulgite and kaolin, gypsum, cellulose, titanium dioxide, zinc oxide, starch, dextrin, sugars (e.g., lactose, sucrose), silica, talc, mica, diatomaceous earth, urea, calcium carbonate, sodium carbonate and bicarbonate, and sodium sulfate. Typical solid diluents are described in Watkins et al., *Handbook of Insecticide Dust Diluents and Carriers*, 2nd Ed., Dorland Books, Caldwell, New Jersey.

Liquid diluents include, for example, water, *N*,*N*-dimethylalkanamides (e.g., *N*,*N*-dimethylformamide), limonene, dimethyl sulfoxide, *N*-alkylpyrrolidones (e.g., *N*-methylpyrrolidinone), alkyl phosphates (e.g., triethylphosphate), ethylene glycol, triethylene glycol, propylene glycol, dipropylene glycol, polypropylene glycol, propylene carbonate, butylene carbonate, paraffins (e.g., white mineral oils, normal paraffins, isoparaffins), alkylbenzenes, alkylnaphthalenes, glycerine, glycerol triacetate, sorbitol, aromatic hydrocarbons, dearomatized aliphatics, alkylbenzenes, alkylnaphthalenes, ketones such as cyclohexanone, 2-heptanone, isophorone and 4-hydroxy-4-methyl-2-pentanone, acetates such as isoamyl acetate, hexyl acetate, heptyl acetate, octyl acetate, nonyl acetate, tridecyl acetate and isobornyl acetate, other esters such as alkylated lactate esters, dibasic esters alkyl and aryl benzoates, γ-butyrolactone, and alcohols, which can be linear, branched, saturated or unsaturated, such as methanol, ethanol, *n*-propanol, isopropyl alcohol, *n*-butanol, isobutyl alcohol, *n*-hexanol, 2-ethylhexanol, *n*-octanol, decanol, isodecyl alcohol, isooctadecanol, cetyl alcohol, lauryl alcohol, tridecyl alcohol, oleyl alcohol, cyclohexanol, tetrahydrofurfuryl alcohol, diacetone alcohol, cresol and benzyl alcohol. Liquid diluents also include glycerol esters of saturated and unsaturated fatty acids (typically C_6–C_{22}), such as plant seed and fruit oils (e.g., oils of olive, castor, linseed, sesame, corn (maize), peanut, sunflower, grapeseed, safflower, cottonseed, soybean, rapeseed, coconut and palm kernel), animal-sourced fats (e.g., beef tallow, pork tallow, lard, cod liver oil, fish oil), and mixtures thereof. Liquid diluents also include alkylated fatty acids (e.g., methylated, ethylated, butylated) wherein the fatty acids may be obtained by hydrolysis of glycerol esters from plant and animal sources, and can be purified by distillation. Typical liquid diluents are described in Marsden, *Solvents Guide*, 2nd Ed., Interscience, New York, 1950.

The solid and liquid compositions of the present disclosure often include one or more surfactants. When added to a liquid, surfactants (also known as "surface-active agents") generally modify, most often reduce, the surface tension of the liquid. Depending on the nature of the hydrophilic and lipophilic groups in a surfactant molecule, surfactants can be useful as wetting agents, dispersants, emulsifiers or defoaming agents.

Surfactants can be classified as nonionic, anionic or cationic. Nonionic surfactants useful for the present compositions include, but are not limited to: alcohol alkoxylates such as alcohol alkoxylates based on natural and synthetic alcohols (which may be branched or linear) and prepared from the alcohols and ethylene oxide, propylene oxide, butylene oxide or mixtures thereof; amine ethoxylates, alkanolamides and ethoxylated alkanolamides; alkoxylated triglycerides such as ethoxylated soybean, castor and rapeseed oils; alkylphenol alkoxylates such as octylphenol ethoxylates, nonylphenol ethoxylates, dinonyl phenol ethoxylates and dodecyl phenol ethoxylates (prepared from the phenols and ethylene oxide, propylene oxide, butylene oxide or mixtures thereof); block polymers prepared from ethylene oxide or propylene oxide and reverse block polymers where the terminal blocks are prepared from propylene oxide; ethoxylated fatty acids; ethoxylated fatty esters and oils; ethoxylated methyl esters; ethoxylated tristyrylphenol (including those prepared from ethylene oxide, propylene oxide, butylene oxide or mixtures thereof); fatty acid esters, glycerol esters, lanolinbased derivatives, polyethoxylate esters such as polyethoxylated sorbitan fatty acid esters, polyethoxylated sorbitol fatty acid esters and polyethoxylated glycerol fatty acid esters; other sorbitan derivatives such as sorbitan esters; polymeric surfactants such as random copolymers, block copolymers, alkyd peg (polyethylene glycol) resins, graft or comb polymers and star polymers; polyethylene glycols (pegs); polyethylene glycol fatty acid esters; silicone-based surfactants; and sugar-derivatives such as sucrose esters, alkyl polyglycosides and alkyl polysaccharides.

Useful anionic surfactants include, but are not limited to: alkylaryl sulfonic acids and their salts; carboxylated alcohol or alkylphenol ethoxylates; diphenyl sulfonate derivatives; lignin and lignin derivatives such as lignosulfonates; maleic or succinic acids or their anhydrides; olefin sulfonates; phosphate esters such as phosphate esters of alcohol alkoxylates, phosphate esters of alkylphenol alkoxylates and phosphate esters of styryl phenol ethoxylates; protein-based surfactants; sarcosine derivatives; styryl phenol ether sulfate; sulfates and sulfonates of oils and fatty acids; sulfates and sulfonates of ethoxylated alkylphenols; sulfates of alcohols; sulfates of ethoxylated alcohols; sulfonates of amines and amides such as *N*,*N*-alkyltaurates; sulfonates of benzene, cumene, toluene, xylene, and dodecyl and tridecylbenzenes; sulfonates of condensed naphthalenes; sulfonates of naphthalene and alkyl naphthalene; sulfonates of fractionated petroleum; sulfosuccinamates; and sulfosuccinates and their derivatives such as dialkyl sulfosuccinate salts.

Useful cationic surfactants include, but are not limited to: amides and ethoxylated amides; amines such as *N*-alkyl propanediamines, tripropylenetriamines and dipropylenetetramines, and ethoxylated amines, ethoxylated diamines and propoxylated amines (prepared from the amines and ethylene oxide, propylene oxide, butylene oxide or mixtures thereof); amine salts such as amine acetates and diamine salts; quaternary ammonium salts such as quaternary salts, ethoxylated quaternary salts and diquaternary salts; and amine oxides such as alkyldimethylamine oxides and bis-(2-hydroxyethyl)-alkylamine oxides.

Also useful for the present compositions are mixtures of nonionic and anionic surfactants or mixtures of nonionic and cationic surfactants. Nonionic, anionic and cationic surfactants and their recommended uses are disclosed in a variety of published references including *McCutcheon's Emulsifiers and Detergents*, annual American and International Editions published by McCutcheon's Division, The Manufacturing Confectioner Publishing Co.; Sisely and Wood, *Encyclopedia of Surface Active Agents*, Chemical Publ. Co., Inc., New York, 1964; and A. S. Davidson and B. Milwidsky, *Synthetic Detergents*, Seventh Edition, John Wiley and Sons, New York, 1987.

Compositions of this disclosure may also contain formulation auxiliaries and additives, known to those skilled in the art as formulation aids (some of which may be considered to also function as solid diluents, liquid diluents or surfactants). Such formulation auxiliaries and additives may control: pH (buffers), foaming during processing (antifoams such polyorganosiloxanes), sedimentation of active ingredients (suspending agents), viscosity (thixotropic thickeners), in-container microbial growth (antimicrobials), product freezing (antifreezes), color (dyes/pigment dispersions), wash-off (film formers or stickers), evaporation (evaporation retardants), and other formulation attributes. Film formers include, for example, polyvinyl acetates, polyvinyl acetate copolymers, polyvinylpyrrolidone-vinyl acetate copolymer, polyvinyl alcohols, polyvinyl alcohol copolymers and waxes. Examples of formulation auxiliaries and additives include those listed in *McCutcheon's Volume 2: Functional Materials*, annual International and North American editions published by McCutcheon's Division, The Manufacturing Confectioner Publishing Co.; and PCT Publication WO 03/024222.

The compound of Formula **1** and any other active ingredients are typically incorporated into the present compositions by dissolving the active ingredient in a solvent or by grinding in a liquid or dry diluent. Solutions, including emulsifiable concentrates, can be prepared by simply mixing the ingredients. If the solvent of a liquid composition intended for use as an emulsifiable concentrate is water-immiscible, an emulsifier is typically added to emulsify the active-containing solvent upon dilution with water. Active ingredient slurries, with particle diameters of up to 2,000 μm can be wet milled using media mills to obtain particles with average diameters below 3 μm. Aqueous slurries can be made into finished suspension concentrates (see, for example, U.S. 3,060,084) or further processed by spray drying to form water-dispersible granules. Dry formulations usually require dry milling processes, which produce average particle diameters in the 2 to 10 μm range. Dusts and powders can be prepared by blending and usually grinding (such as with a hammer mill or fluid-energy mill). Granules and pellets can be prepared by spraying the active material upon preformed granular carriers or by agglomeration techniques. See Browning, "Agglomeration", *Chemical Engineering*, December 4, 1967, pp 147–48, *Perry's Chemical Engineer's Handbook*, 4th Ed., McGraw-Hill, New York, 1963, pages 8–57 and following, and WO 91/13546. Pellets can be prepared as described in U.S. 4,172,714. Water-dispersible and water-soluble granules can be prepared as taught in U.S. 4,144,050, U.S. 3,920,442 and DE 3,246,493. Tablets can be prepared as taught in U.S. 5,180,587, U.S. 5,232,701 and U.S. 5,208,030. Films can be prepared as taught in GB 2,095,558 and U.S. 3,299,566.

For further information regarding the art of formulation, see T. S. Woods, "The Formulator's Toolbox – Product Forms for Modern Agriculture" in *Pesticide Chemistry and Bioscience, The Food–Environment Challenge*, T. Brooks and T. R. Roberts, Eds., Proceedings of the 9th International Congress on Pesticide Chemistry, The Royal Society of Chemistry, Cambridge, 1999, pp. 120–133. See also U.S. 3,235,361, Col. 6, line 16 through Col. 7, line 19 and Examples 10–41; U.S. 3,309,192, Col. 5, line 43 through Col. 7, line 62 and Examples 8, 12, 15, 39, 41, 52, 53, 58, 132, 138–140, 162–164, 166, 167 and 169–182; U.S. 2,891,855, Col. 3, line 66 through Col. 5, line 17 and Examples 1–4; Klingman, *Weed*

Control as a Science, John Wiley and Sons, Inc., New York, 1961, pp 81–96; Hance et al., *Weed Control Handbook*, 8th Ed., Blackwell Scientific Publications, Oxford, 1989; and *Developments in formulation technology*, PJB Publications, Richmond, UK, 2000.

In the following Examples, all formulations are prepared in conventional ways. Compound numbers refer to compounds in Index Tables A–B. Without further elaboration, it is believed that one skilled in the art using the preceding description can utilize the present disclosure to its fullest extent. The following Examples are, therefore, to be construed as merely illustrative, and not limiting of the disclosure in any way whatsoever. Percentages are by weight except where otherwise indicated.

Example A

High Strength Concentrate

compound **8**	98.5%
silica aerogel	0.5%
synthetic amorphous fine silica	1.0%

Example B

Wettable Powder

compound **9**	65.0%
dodecylphenol polyethylene glycol ether	2.0%
sodium ligninsulfonate	4.0%
sodium silicoaluminate	6.0%
montmorillonite (calcined)	23.0%

Example C

Granule

compound **2**	10.0%
attapulgite granules (low volatile matter, 0.71/0.30 mm; U.S.S. No. 25–50 sieves)	90.0%

Example D

Extruded Pellet

compound **4**	25.0%
anhydrous sodium sulfate	10.0%
crude calcium ligninsulfonate	5.0%
sodium alkylnaphthalenesulfonate	1.0%
calcium/magnesium bentonite	59.0%

Example E

Emulsifiable Concentrate

compound **6**	10.0%
polyoxyethylene sorbitol hexoleate	20.0%
C_6–C_{10} fatty acid methyl ester	70.0%

Example F

Microemulsion

compound **11**	5.0%
polyvinylpyrrolidone-vinyl acetate copolymer	30.0%
alkylpolyglycoside	30.0%
glyceryl monooleate	15.0%
water	20.0%

Example G

Seed Treatment

compound **1**	20.00%
polyvinylpyrrolidone-vinyl acetate copolymer	5.00%
montan acid wax	5.00%
calcium ligninsulfonate	1.00%
polyoxyethylene/polyoxypropylene block copolymers	1.00%
stearyl alcohol (POE 20)	2.00%
polyorganosilane	0.20%
colorant red dye	0.05%
water	65.75%

Example H

Fertilizer Stick

compound **5**	2.5%
pyrrolidone-styrene copolymer	4.8%
tristyrylphenyl 16-ethoxylate	2.3%
talc	0.8%
corn starch	5.0%
slow-release fertilizer	36.0%
kaolin	38.0%
water	10.6%

Example I

Suspension Concentrate

compound **7**	35%
butyl polyoxyethylene/polypropylene block copolymer	4.0%

stearic acid/polyethylene glycol copolymer	1.0%
styrene acrylic polymer	1.0%
xanthan gum	0.1%
propylene glycol	5.0%
silicone based defoamer	0.1%
1,2-benzisothiazolin-3-one	0.1%
water	53.7%

Example J

Emulsion in Water

compound **3**	10.0%
butyl polyoxyethylene/polypropylene block copolymer	4.0%
stearic acid/polyethylene glycol copolymer	1.0%
styrene acrylic polymer	1.0%
xanthan gum	0.1%
propylene glycol	5.0%
silicone based defoamer	0.1%
1,2-benzisothiazolin-3-one	0.1%
aromatic petroleum based hydrocarbon	20.0
water	58.7%

Example K

Oil Dispersion

compound **1**	25%
polyoxyethylene sorbitol hexaoleate	15%
organically modified bentonite clay	2.5%
fatty acid methyl ester	57.5%

Example L

Suspoemulsion

compound **9**	10.0%
imidacloprid	5.0%
butyl polyoxyethylene/polypropylene block copolymer	4.0%
stearic acid/polyethylene glycol copolymer	1.0%
styrene acrylic polymer	1.0%
xanthan gum	0.1%
propylene glycol	5.0%
silicone based defoamer	0.1%
1,2-benzisothiazolin-3-one	0.1%
aromatic petroleum based hydrocarbon	20.0%

water	53.7%

Compounds of this disclosure exhibit activity against a wide spectrum of invertebrate pests. These pests include invertebrates inhabiting a variety of environments such as, for example, plant foliage, roots, soil, harvested crops or other foodstuffs, building structures or animal integuments. These pests include, for example, invertebrates feeding on foliage (including leaves, stems, flowers and fruits), seeds, wood, textile fibers or animal blood or tissues, and thereby causing injury or damage to, for example, growing or stored agronomic crops, forests, greenhouse crops, ornamentals, nursery crops, stored foodstuffs or fiber products, or houses or other structures or their contents, or being harmful to animal health or public health. Those skilled in the art will appreciate that not all compounds are equally effective against all growth stages of all pests.

These present compounds and compositions are thus useful agronomically for protecting field crops from phytophagous invertebrate pests, and also nonagronomically for protecting other horticultural crops and plants from phytophagous invertebrate pests. This utility includes protecting crops and other plants (i.e. both agronomic and nonagronomic) that contain genetic material introduced by genetic engineering (i.e. transgenic) or modified by mutagenesis to provide advantageous traits. Examples of such traits include tolerance to herbicides, resistance to phytophagous pests (e.g., insects, mites, aphids, spiders, nematodes, snails, plant-pathogenic fungi, bacteria and viruses), improved plant growth, increased tolerance of adverse growing conditions such as high or low temperatures, low or high soil moisture, and high salinity, increased flowering or fruiting, greater harvest yields, more rapid maturation, higher quality and/or nutritional value of the harvested product, or improved storage or process properties of the harvested products. Transgenic plants can be modified to express multiple traits. Examples of plants containing traits provided by genetic engineering or mutagenesis include varieties of corn, cotton, soybean and potato expressing an insecticidal *Bacillus thuringiensis* toxin such as YIELD GARD®, KNOCKOUT®, STARLINK®, BOLLGARD®, NuCOTN® and NEWLEAF®, INVICTA RR2 PRO™, and herbicide-tolerant varieties of corn, cotton, soybean and rapeseed such as ROUNDUP READY®, LIBERTY LINK®, IMI®, STS® and CLEARFIELD®, as well as crops expressing *N*-acetyltransferase (GAT) to provide resistance to glyphosate herbicide, or crops containing the HRA gene providing resistance to herbicides inhibiting acetolactate synthase (ALS). The present compounds and compositions may exhibit enhanced effects with traits introduced by genetic engineering or modified by mutagenesis, thus enhancing phenotypic expression or effectiveness of the traits or increasing the invertebrate pest control effectiveness of the present compounds and compositions. In particular, the present compounds and compositions may exhibit enhanced effects with the phenotypic expression of proteins or other natural products toxic to invertebrate pests to provide greater-than-additive control of these pests.

Compositions of this disclosure can also optionally comprise plant nutrients, e.g., a fertilizer composition comprising at least one plant nutrient selected from nitrogen, phosphorus, potassium, sulfur, calcium, magnesium, iron, copper, boron, manganese, zinc, and molybdenum. Of note are compositions comprising at least one fertilizer composition comprising at least one plant nutrient selected from nitrogen, phosphorus, potassium, sulfur, calcium and magnesium. Compositions of the present disclosure which further comprise at least one plant nutrient can be in the form of liquids or solids. Of note are solid formulations in the form of granules, small sticks or tablets. Solid formulations comprising a fertilizer composition can be prepared by mixing the compound or composition of the present disclosure with the fertilizer composition together with formulating ingredients and then preparing the formulation by methods such as granulation or extrusion. Alternatively solid formulations can be prepared by spraying a solution or suspension of a compound or composition of the present disclosure in a volatile solvent onto a previous prepared fertilizer composition in the form of dimensionally stable mixtures, e.g., granules, small sticks or tablets, and then evaporating the solvent.

Nonagronomic uses refer to invertebrate pest control in the areas other than fields of crop plants. Nonagronomic uses of the present compounds and compositions include control of invertebrate pests in stored grains, beans and other foodstuffs, and in textiles such as clothing and carpets. Nonagronomic uses of the present compounds and compositions also include invertebrate pest control in ornamental plants, forests, in yards, along roadsides and railroad rights of way, and on turf such as lawns, golf courses and pastures. Nonagronomic uses of the present compounds and compositions also include invertebrate pest control in houses and other buildings which may be occupied by humans and/or companion, farm, ranch, zoo or other animals. Nonagronomic uses of the present compounds and compositions also include the control of pests such as termites that can damage wood or other structural materials used in buildings.

Nonagronomic uses of the present compounds and compositions also include protecting human and animal health by controlling invertebrate pests that are parasitic or transmit infectious diseases. The controlling of animal parasites includes controlling external parasites that are parasitic to the surface of the body of the host animal (e.g., shoulders, armpits, abdomen, inner part of the thighs) and internal parasites that are parasitic to the inside of the body of the host animal (e.g., stomach, intestine, lung, veins, under the skin, lymphatic tissue). External parasitic or disease transmitting pests include, for example, chiggers, ticks, lice, mosquitoes, flies, mites and fleas. Internal parasites include heartworms, hookworms and helminths. Compounds and compositions of the present disclosure are suitable for systemic and/or non-systemic control of infestation or infection by parasites on animals. Compounds and compositions of the present disclosure are particularly suitable for combating external parasitic or disease transmitting pests. Compounds and compositions of the present disclosure are suitable for combating parasites that infest agricultural working animals, such as cattle, sheep, goats, horses, pigs, donkeys, camels, buffalos, rabbits, hens, turkeys, ducks, geese and bees; pet animals and domestic animals such as dogs, cats, pet birds and aquarium fish; as well as so-called experimental animals, such as hamsters, guinea pigs, rats and mice. By combating these parasites, fatalities and performance reduction (in terms of meat, milk, wool, skins, eggs, honey, etc.) are reduced, so that applying a composition comprising a compound of the present disclosure allows more economic and simple husbandry of animals.

Examples of agronomic or nonagronomic invertebrate pests include eggs, larvae and adults of the order Lepidoptera, such as armyworms, cutworms, loopers, and heliothines in the family Noctuidae (e.g., pink stem borer (*Sesamia inferens* Walker), corn stalk borer (*Sesamia nonagrioides* Lefebvre), southern armyworm (*Spodoptera eridania* Cramer), fall armyworm (*Spodoptera frugiperda* J. E. Smith), beet armyworm (*Spodoptera exigua* Hübner), cotton leafworm (*Spodoptera littoralis* Boisduval), yellowstriped armyworm (*Spodoptera ornithogalli* Guenée), black cutworm (*Agrotis ipsilon* Hufnagel), velvetbean caterpillar (*Anticarsia gemmatalis* Hübner), green fruitworm (*Lithophane antennata* Walker), cabbage armyworm (*Barathra brassicae* Linnaeus), soybean looper (*Pseudoplusia includens* Walker), cabbage looper (*Trichoplusia ni* Hübner), tobacco budworm (*Heliothis virescens* Fabricius)); borers, casebearers, webworms, coneworms, cabbageworms and skeletonizers from the family Pyralidae (e.g., European corn borer (*Ostrinia nubilalis* Hübner), navel orangeworm (*Amyelois transitella* Walker), corn root webworm (*Crambus caliginosellus* Clemens), sod webworms (Pyralidae: *Crambinae*) such as sod worm (*Herpetogramma licarsisalis* Walker), sugarcane stem borer (*Chilo infuscatellus* Snellen), tomato small borer (*Neoleucinodes elegantalis* Guenée), green leafroller (*Cnaphalocrocis medinalis* Guenée), grape leaffolder (*Desmia funeralis* Hübner), pickleworm (*Diaphania nitidalis* Stoll), cabbage center grub (*Hellula hydralis* Guenée), yellow stem borer (*Scirpophaga incertulas* Walker), white stem borer (*Scirpophaga innotata* Walker), top shoot borer (*Scirpophaga nivella* Fabricius), dark-headed rice borer (*Chilo polychrysus* Meyrick), striped riceborer (*Chilo suppressalis* Walker), cabbage cluster caterpillar (*Crocidolomia binotalis* Zeller)); leafrollers, budworms, seed worms, and fruit worms in the family Tortricidae (e.g., codling moth (*Cydia pomonella* Linnaeus), grape berry moth (*Paralobesia viteana* Clemens), oriental fruit moth (*Grapholita molesta* Busck), citrus false codling moth (*Cryptophlebia leucotreta* Meyrick), citrus borer (*Gymnandrosoma aurantianum* Lima), redbanded leafroller (*Argyrotaenia velutinana* Walker), obliquebanded leafroller (*Choristoneura rosaceana* Harris), light brown apple moth (*Epiphyas postvittana* Walker), European grape berry moth (*Eupoecilia ambiguella* Hübner), apple bud moth (*Pandemis pyrusana* Kearfott), omnivorous leafroller (*Platynota stultana* Walsingham), barred fruit-tree tortrix (*Pandemis cerasana* Hübner), apple brown tortrix (*Pandemis heparana* Denis & Schiffermüller)); and many other economically important lepidoptera (e.g., diamondback moth (*Plutella xylostella* Linnaeus), pink bollworm

(*Pectinophora gossypiella* Saunders), gypsy moth (*Lymantria dispar* Linnaeus), peach fruit borer (*Carposina niponensis* Walsingham), peach twig borer (*Anarsia lineatella* Zeller), potato tuberworm (*Phthorimaea operculella* Zeller), spotted teniform leafminer (*Phyllonorycter blancardella* Fabricius), Asiatic apple leafminer (*Lithocolletis ringoniella* Matsumura), rice leaffolder (*Lerodea eufala* Edwards), apple leafminer (*Leucoptera scitella* Zeller)); eggs, nymphs and adults of the order Blattodea including cockroaches from the families Blattellidae and Blattidae (e.g., oriental cockroach (*Blatta orientalis* Linnaeus), Asian cockroach (*Blatella asahinai* Mizukubo), German cockroach (*Blattella germanica* Linnaeus), brownbanded cockroach (*Supella longipalpa* Fabricius), American cockroach (*Periplaneta americana* Linnaeus), brown cockroach (*Periplaneta brunnea* Burmeister), Madeira cockroach (*Leucophaea maderae* Fabricius)), smoky brown cockroach (*Periplaneta fuliginosa* Serville), Australian Cockroach (*Periplaneta australasiae* Fabr.), lobster cockroach (*Nauphoeta cinerea* Olivier) and smooth cockroach (*Symploce pallens* Stephens)); eggs, foliar feeding, fruit feeding, root feeding, seed feeding and vesicular tissue feeding larvae and adults of the order Coleoptera including weevils from the families Anthribidae, Bruchidae, and Curculionidae (e.g., boll weevil (*Anthonomus grandis* Boheman), rice water weevil (*Lissorhoptrus oryzophilus* Kuschel), granary weevil (*Sitophilus granarius* Linnaeus), rice weevil (*Sitophilus oryzae* Linnaeus)), annual bluegrass weevil (*Listronotus maculicollis* Dietz), bluegrass billbug (*Sphenophorus parvulus* Gyllenhal), hunting billbug (*Sphenophorus venatus vestitus* Chittenden), Rocky Mountain billbug (*Sphenophorus cicatristriatus* Fahraeus)); flea beetles, cucumber beetles, rootworms, leaf beetles, potato beetles, and leafminers in the family Chrysomelidae (e.g., Colorado potato beetle (*Leptinotarsa decemlineata* Say), western corn rootworm (*Diabrotica virgifera* LeConte)); chafers and other beetles from the family Scarabaeidae (e.g., Japanese beetle (*Popillia japonica* Newman), oriental beetle (*Anomala orientalis* Waterhouse, northern masked chafer (*Cyclocephala borealis* Arrow), southern masked chafer (*Cyclocephala immaculata* Olivier or *C. lurida* Bland), dung beetle and white grub (*Aphodius* spp.), black turfgrass ataenius (*Ataenius spretulus* Haldeman), green June beetle (*Cotinis nitida* Linnaeus), Asiatic garden beetle (*Maladera castanea* Arrow), May/June beetles (*Phyllophaga* spp.) and European chafer (*Rhizotrogus majalis* Razoumowsky)); carpet beetles from the family Dermestidae; wireworms from the family Elateridae; bark beetles from the family Scolytidae and flour beetles from the family Tenebrionidae.

In addition, agronomic and nonagronomic pests include: eggs, adults and larvae of the order Dermaptera including earwigs from the family Forficulidae (e.g., European earwig (*Forficula auricularia* Linnaeus), black earwig (*Chelisoches morio* Fabricius)); eggs, immatures, adults and nymphs of the order Hemiptera such as, plant bugs from the family Miridae, cicadas from the family Cicadidae, leafhoppers (e.g. *Empoasca* spp.) from the family Cicadellidae, bed bugs (e.g., *Cimex lectularius* Linnaeus) from the family Cimicidae, planthoppers from the families Fulgoridae and Delphacidae, treehoppers from the family Membracidae, psyllids from the families Liviidae, Psyllidae, and Triozidae, whiteflies from the family Aleyrodidae, aphids from the family Aphididae, phylloxera from the family Phylloxeridae, mealybugs from the family Pseudococcidae, scales from the families Coccidae, Diaspididae and Margarodidae, lace bugs from the family Tingidae, stink bugs from the family Pentatomidae, chinch bugs (e.g., hairy chinch bug (*Blissus leucopterus hirtus* Montandon) and southern chinch bug (*Blissus insularis* Barber)) and other seed bugs from the family Lygaeidae, spittlebugs from the family Cercopidae squash bugs from the family Coreidae, and red bugs and cotton stainers from the family Pyrrhocoridae.

Agronomic and nonagronomic pests also include : eggs, larvae, nymphs and adults of the order Acari (mites) such as spider mites and red mites in the family Tetranychidae (e.g., European red mite (*Panonychus ulmi* Koch), twospotted spider mite (*Tetranychus urticae* Koch), McDaniel spider mite (*Tetranychus mcdanieli* McGregor)); flat mites in the family Tenuipalpidae (e.g., citrus flat mite (*Brevipalpus lewisi* McGregor)); rust and bud mites in the family Eriophyidae and other foliar feeding mites and mites important in human and animal health, i.e. dust mites in the family Epidermoptidae, follicle mites in the family Demodecidae, grain mites in the family Glycyphagidae; ticks in the family Ixodidae, commonly known as hard ticks (e.g., deer tick (*Ixodes scapularis* Say), Australian paralysis tick (*Ixodes holocyclus* Neumann), American dog tick (*Dermacentor variabilis* Say), lone star tick (*Amblyomma americanum* Linnaeus)) and ticks in the family Argasidae, commonly known as soft ticks (e.g., relapsing fever tick (*Ornithodoros turicata* Duges), common fowl tick (*Argas radiatus* Raillet)); scab and itch mites in the families Psoroptidae, Pyemotidae, and Sarcoptidae; eggs, adults and immatures of the order Orthoptera including grasshoppers, locusts and crickets (e.g., migratory grasshoppers (e.g., *Melanoplus sanguinipes* Fabricius, *M. differentialis* Thomas), American grasshoppers (e.g., *Schistocerca americana* Drury), desert locust (*Schistocerca gregaria* Forsskål), migratory locust (*Locusta migratoria* Linnaeus), bush locust (*Zonocerus* spp.), house cricket (*Acheta domesticus* Linnaeus), mole crickets (e.g., tawny mole cricket (*Scapteriscus vicinus* Scudder) and southern mole cricket (*Scapteriscus borellii* Giglio-Tos)); eggs, adults and immatures of the order Diptera including leafminers (e.g., *Liriomyza* spp. such as serpentine vegetable leafminer (*Liriomyza sativae* Blanchard)), midges, fruit flies (Tephritidae), frit flies (e.g., *Oscinella frit* Linnaeus), soil maggots, house flies (e.g., *Musca domestica* Linnaeus), lesser house flies (e.g., *Fannia canicularis* Linnaeus, *F. femoralis* Stein), stable flies (e.g., *Stomoxys calcitrans* Linnaeus), face flies, horn flies, blow flies (e.g., *Chrysomya* spp., *Phormia* spp.), and other muscoid fly pests, horse flies (e.g., *Tabanus* spp.), bot flies (e.g., *Gasterophilus* spp., *Oestrus* spp.), cattle grubs (e.g., *Hypoderma* spp.), deer flies (e.g., *Chrysops* spp.), keds (e.g., *Melophagus ovinus* Linnaeus) and other Brachycera, mosquitoes (e.g., *Aedes* spp., *Anopheles* spp., *Culex* spp.), black flies (e.g., *Prosimulium* spp., *Simulium* spp.), biting midges, sand flies, sciarids, and other Nematocera; eggs, adults and immatures of the order Thysanoptera including onion thrips (*Thrips tabaci* Lindeman), flower thrips (*Frankliniella* spp.), and other foliar feeding thrips; insect pests of the order Hymenoptera including ants of the Family Formicidae including the Florida carpenter ant (*Camponotus floridanus* Buckley), red carpenter ant (*Camponotus ferrugineus* Fabricius), black carpenter ant (*Camponotus pennsylvanicus* De Geer), white-footed ant (*Technomyrmex albipes* F. Smith), big headed ants (*Pheidole* sp.), ghost ant (*Tapinoma melanocephalum* Fabricius); Pharaoh ant (*Monomorium pharaonis* Linnaeus), little fire ant (*Wasmannia auropunctata* Roger), fire ant (*Solenopsis geminata* Fabricius), red imported fire ant (*Solenopsis invicta* Buren), Argentine ant (*Iridomyrmex humilis* Mayr), crazy ant (*Paratrechina longicornis* Latreille), pavement ant (*Tetramorium caespitum* Linnaeus), cornfield ant (*Lasius alienus* Förster) and odorous house ant (*Tapinoma sessile* Say). Other Hymenoptera including bees (including carpenter bees), hornets, yellow jackets, wasps, and sawflies (*Neodiprion* spp.; *Cephus* spp.); insect pests of the order Isoptera including termites in the Termitidae (e.g., *Macrotermes* sp., *Odontotermes obesus* Rambur), Kalotermitidae (e.g., *Cryptotermes* sp.), and Rhinotermitidae (e.g., *Reticulitermes* sp., *Coptotermes* sp., *Heterotermes tenuis* Hagen) families, the eastern subterranean termite (*Reticulitermes flavipes* Kollar), western subterranean termite (*Reticulitermes hesperus* Banks), Formosan subterranean termite (*Coptotermes formosanus* Shiraki), West Indian drywood termite (*Incisitermes immigrans* Snyder), powder post termite (*Cryptotermes brevis* Walker), drywood termite (*Incisitermes snyderi* Light), southeastern subterranean termite (*Reticulitermes virginicus* Banks), western drywood termite (*Incisitermes minor* Hagen), arboreal termites such as *Nasutitermes* sp. and other termites of economic importance; insect pests of the order Thysanura such as silverfish (*Lepisma saccharina* Linnaeus) and firebrat (*Thermobia domestica* Packard); insect pests of the orders Mallophaga and Phthiraptera, and including the head louse (*Pediculus humanus capitis* De Geer), body louse (*Pediculus humanus* Linnaeus), chicken body louse (*Menacanthus stramineus* Nitzsch), dog biting louse (*Trichodectes canis* De Geer), fluff louse (*Goniocotes gallinae* De Geer), sheep body louse (*Bovicola ovis* Schrank), short-nosed cattle louse (*Haematopinus eurysternus* Nitzsch), long-nosed cattle louse (*Linognathus vituli* Linnaeus) and other sucking and chewing parasitic lice that attack man and animals; insect pests of the order Siphonoptera including the oriental rat flea (*Xenopsylla cheopis* Rothschild), cat flea (*Ctenocephalides felis* Bouché), dog flea (*Ctenocephalides canis* Curtis), hen flea (*Ceratophyllus gallinae* Schrank), sticktight flea (*Echidnophaga gallinacea* Westwood), human flea (*Pulex irritans* Linnaeus) and other fleas afflicting mammals and birds. Additional arthropod pests covered include: spiders in the order Araneae such as the brown recluse spider (*Loxosceles reclusa* Gertsch & Mulaik) and the black widow spider (*Latrodectus mactans* Fabricius), and centipedes in the order Scutigeromorpha such as the house centipede (*Scutigera coleoptrata* Linnaeus).

Examples of invertebrate pests of stored grain include larger grain borer (*Prostephanus truncatus* Horn), lesser grain borer (*Rhyzopertha dominica* Fabricius), rice weevil (*Sitophilus oryzae* Linnaeus), maize weevil (*Sitophilus zeamais* Motschulsky), cowpea weevil (*Callosobruchus maculatus* Fabricius), red flour beetle (*Tribolium castaneum* Herbst), granary weevil (*Sitophilus granarius* Linnaeus), Indian meal moth (*Plodia interpunctella* Hübner), Mediterranean flour beetle (*Ephestia kuehniella* Zeller) and flat or rusty grain beetle (*Cryptolestes ferrugineus* Stephens).

Compounds of the present disclosure may have activity on members of the Classes Nematoda, Cestoda, Trematoda, and Acanthocephala including economically important members of the orders Strongylida, Ascaridida, Oxyurida, Rhabditida, Spirurida, and Enoplida such as but not limited to economically important agricultural pests (i.e. root knot nematodes in the genus *Meloidogyne*, lesion nematodes in the genus *Pratylenchus*, stubby root nematodes in the genus *Trichodorus*, etc.) and animal and human health pests (i.e. all economically important flukes, tapeworms, and roundworms, such as *Strongylus vulgaris* in horses, *Toxocara canis* in dogs, *Haemonchus contortus* in sheep, *Dirofilaria immitis* Leidy in dogs, *Anoplocephala perfoliata* in horses, *Fasciola hepatica* Linnaeus in ruminants, etc.).

Compounds of the disclosure may have activity against pests in the order Lepidoptera (e.g., *Alabama argillacea* Hübner (cotton leaf worm), *Archips argyrospila* Walker (fruit tree leaf roller), *A. rosana* Linnaeus (European leaf roller) and other *Archips* species, *Chilo suppressalis* Walker (rice stem borer), *Cnaphalocrocis medinalis* Guenée (rice leaf roller), *Crambus caliginosellus* Clemens (corn root webworm), *Crambus teterrellus* Zincken (bluegrass webworm), *Cydia pomonella* Linnaeus (codling moth), *Earias insulana* Boisduval (spiny bollworm), *Earias vittella* Fabricius (spotted bollworm), *Helicoverpa armigera* Hübner (Old World bollworm), *Helicoverpa zea* Boddie (corn earworm), *Heliothis virescens* Fabricius (tobacco budworm), *Herpetogramma licarsisalis* Walker (sod webworm), *Lobesia botrana* Denis & Schiffermüller (grape berry moth), *Pectinophora gossypiella* Saunders (pink bollworm), *Phyllocnistis citrella* Stainton (citrus leafminer), *Pieris brassicae* Linnaeus (large white butterfly), *Pieris rapae* Linnaeus (small white butterfly), *Plutella xylostella* Linnaeus (diamondback moth), *Spodoptera exigua* Hübner (beet armyworm), *Spodoptera litura* Fabricius (tobacco cutworm, cluster caterpillar), *Spodoptera frugiperda* J. E. Smith (fall armyworm), *Trichoplusia ni* Hübner (cabbage looper) and *Tuta absoluta* Meyrick (tomato leafminer)).

Compounds of the disclosure have significant activity on members from the order Hemiptera including: *Acyrthosiphon pisum* Harris (pea aphid), *Aphis craccivora* Koch (cowpea aphid), *Aphis fabae* Scopoli (black bean aphid), *Aphis gossypii* Glover (cotton aphid, melon aphid), *Aphis pomi* De Geer (apple aphid), *Aphis spiraecola* Patch (spirea aphid), *Aulacorthum solani* Kaltenbach (foxglove aphid), *Chaetosiphon fragaefolii* Cockerell (strawberry aphid), *Diuraphis noxia* Kurdjumov/Mordvilko (Russian wheat aphid), *Dysaphis* *plantaginea* Passerini (rosy apple aphid), *Eriosoma lanigerum* Hausmann (woolly apple aphid), *Hyalopterus pruni* Geoffroy (mealy plum aphid), *Lipaphis pseudobrassicae* Davis (turnip aphid), *Metopolophium dirrhodum* Walker (rose-grain aphid), *Macrosiphum euphorbiae* Thomas (potato aphid), *Myzus persicae* Sulzer (peach-potato aphid, green peach aphid), *Nasonovia ribisnigri* Mosley (lettuce aphid), *Pemphigus* spp. (root aphids and gall aphids), *Rhopalosiphum maidis* Fitch (corn leaf aphid), *Rhopalosiphum padi* Linnaeus (bird cherry-oat aphid), *Schizaphis graminum* Rondani (greenbug), *Sitobion avenae* Fabricius (English grain aphid), *Therioaphis maculata* Buckton (spotted alfalfa aphid), *Toxoptera aurantii* Boyer de Fonscolombe (black citrus aphid), and *Toxoptera citricidus* Kirkaldy (brown citrus aphid); *Adelges* spp. (adelgids); *Phylloxera devastatrix* Pergande (pecan phylloxera); *Bemisia tabaci* Gennadius (tobacco whitefly, sweetpotato whitefly), *Bemisia argentifolii* Bellows & Perring (silverleaf whitefly), *Dialeurodes citri* Ashmead (citrus whitefly) and *Trialeurodes vaporariorum* Westwood (greenhouse whitefly); *Empoasca fabae* Harris (potato leafhopper), *Laodelphax striatellus* Fallén (smaller brown planthopper), *Macrosteles quadrilineatus* Forbes (aster leafhopper), *Nephotettix cincticeps* Uhler (green rice leafhopper), *Nephotettix nigropictus* Stål (rice leafhopper), *Nilaparvata lugens* Stål (brown planthopper), *Peregrinus maidis* Ashmead (corn planthopper), *Sogatella furcifera* Horváth (white-backed planthopper), *Tagosodes orizicolus* Muir (rice delphacid), *Typhlocyba pomaria* McAtee (white apple leafhopper), Erythroneura spp. (grape leafhoppers); *Magicidada septendecim* Linnaeus (periodical cicada); *Icerya purchasi* Maskell (cottony cushion scale), *Quadraspidiotus perniciosus* Comstock (San Jose scale); *Planococcus citri* Risso (citrus mealybug); *Pseudococcus* spp. (other mealybug complex); *Cacopsylla pyricola* Foerster (pear psylla), *Trioza diospyri* Ashmead (persimmon psylla).

Compounds of this disclosure also have activity on members from the order Hemiptera including: *Acrosternum hilare* Say (green stink bug), *Anasa tristis* De Geer (squash bug), *Blissus leucopterus leucopterus* Say (chinch bug), *Cimex lectularius* Linnaeus (bed bug) *Corythucha gossypii* Fabricius (cotton lace bug), *Cyrtopeltis modesta* Distant (tomato bug), *Dysdercus suturellus* Herrich-Schäffer (cotton stainer), *Euschistus servus* Say (brown stink bug), *Euschistus variolarius* Palisot de Beauvois (one-spotted stink bug), *Graptostethus* spp. (complex of seed bugs), *Halyomorpha halys* Stål (brown marmorated stink bug), *Leptoglossus corculus* Say (leaf-footed pine seed bug), *Lygus lineolaris* Palisot de Beauvois (tarnished plant bug), *Nezara viridula* Linnaeus (southern green stink bug), *Oebalus pugnax* Fabricius (rice stink bug), *Oncopeltus fasciatus* Dallas (large milkweed bug), *Pseudatomoscelis seriatus* Reuter (cotton fleahopper). Other insect orders controlled by compounds of the disclosure include Thysanoptera (e.g., *Frankliniella occidentalis* Pergande (western flower thrips), *Scirtothrips citri* Moulton (citrus thrips), *Scirtothrips variabilis* Beach (soybean thrips), and *Thrips tabaci* Lindeman (onion thrips); and the order Coleoptera (e.g., *Leptinotarsa* *decemlineata* Say (Colorado potato beetle), *Epilachna varivestis* Mulsant (Mexican bean beetle) and wireworms of the genera *Agriotes*, *Athous* or *Limonius*).

Of note is use of compounds of this disclosure for controlling western flower thrips (*Frankliniella occidentalis*). Of note is use of compounds of this disclosure for controlling potato leafhopper (*Empoasca fabae*). Of note is use of compounds of this disclosure for controlling cotton melon aphid (*Aphis gossypii*). Of note is use of compounds of this disclosure for controlling green peach aphid (*Myzus persicae*). Of note is use of compounds of this disclosure for controlling sweetpotato whitefly (*Bemisia tabaci*).

Compounds of the present disclosure may also be useful for increasing vigor of a crop plant. This method comprises contacting the crop plant (e.g., foliage, flowers, fruit or roots) or the seed from which the crop plant is grown with a compound of Formula **1** in amount sufficient to achieve the desired plant vigor effect (i.e. biologically effective amount). Typically the compound of Formula **1** is applied in a formulated composition. Although the compound of Formula **1** is often applied directly to the crop plant or its seed, it can also be applied to the locus of the crop plant, i.e. the environment of the crop plant, particularly the portion of the environment in close enough proximity to allow the compound of Formula **1** to migrate to the crop plant. The locus relevant to this method most commonly comprises the growth medium (i.e. medium providing nutrients to the plant), typically soil in which the plant is grown. Treatment of a crop plant to increase vigor of the crop plant thus comprises contacting the crop plant, the seed from which the crop plant is grown or the locus of the crop plant with a biologically effective amount of a compound of Formula **1**.

Increased crop vigor can result in one or more of the following observed effects: (a) optimal crop establishment as demonstrated by excellent seed germination, crop emergence and crop stand; (b) enhanced crop growth as demonstrated by rapid and robust leaf growth (e.g., measured by leaf area index), plant height, number of tillers (e.g., for rice), root mass and overall dry weight of vegetative mass of the crop; (c) improved crop yields, as demonstrated by time to flowering, duration of flowering, number of flowers, total biomass accumulation (i.e. yield quantity) and/or fruit or grain grade marketability of produce (i.e. yield quality); (d) enhanced ability of the crop to withstand or prevent plant disease infections and arthropod, nematode or mollusk pest infestations; and (e) increased ability of the crop to withstand environmental stresses such as exposure to thermal extremes, suboptimal moisture or phytotoxic chemicals.

The compounds of the present disclosure may increase the vigor of treated plants compared to untreated plants by killing or otherwise preventing feeding of phytophagous invertebrate pests in the environment of the plants. In the absence of such control of phytophagous invertebrate pests, the pests reduce plant vigor by consuming plant tissues or sap, or transmiting plant pathogens such as viruses. Even in the absence of phytophagous invertebrate pests, the compounds of the disclosure may increase plant vigor by modifying metabolism of plants. Generally, the vigor of a crop plant will be most significantly increased by treating the plant with a compound of the disclosure if the plant is grown in a nonideal environment, i.e. an environment comprising one or more aspects adverse to the plant achieving the full genetic potential it would exhibit in an ideal environment.

Of note is a method for increasing vigor of a crop plant wherein the crop plant is grown in an environment comprising phytophagous invertebrate pests. Also of note is a method for increasing vigor of a crop plant wherein the crop plant is grown in an environment not comprising phytophagous invertebrate pests. Also of note is a method for increasing vigor of a crop plant wherein the crop plant is grown in an environment comprising an amount of moisture less than ideal for supporting growth of the crop plant. Of note is a method for increasing vigor of a crop plant wherein the crop is rice. Also of note is a method for increasing vigor of a crop plant wherein the crop is maize (corn). Also of note is a method for increasing vigor of a crop plant wherein the crop is soybean.

Compounds of this disclosure can also be mixed with one or more other biologically active compounds or agents including insecticides, fungicides, nematocides, bactericides, acaricides, herbicides, herbicide safeners, growth regulators such as insect molting inhibitors and rooting stimulants, chemosterilants, semiochemicals, repellents, attractants, pheromones, feeding stimulants, other biologically active compounds or entomopathogenic bacteria, virus or fungi to form a multi-component pesticide giving an even broader spectrum of agronomic and nonagronomic utility. Thus, the present disclosure also pertains to a composition comprising a biologically effective amount of a compound of Formula **1**, at least one additional component selected from the group consisting of surfactants, solid diluents and liquid diluents, and at least one additional biologically active compound or agent. For mixtures of the present disclosure, the other biologically active compounds or agents can be formulated together with the present compounds, including the compounds of Formula **1**, to form a premix, or the other biologically active compounds or agents can be formulated separately from the present compounds, including the compounds of Formula **1**, and the two formulations combined together before application (e.g., in a spray tank) or, alternatively, applied in succession.

Examples of such biologically active compounds or agents with which compounds of this disclosure can be formulated are insecticides such as abamectin, acephate, acequinocyl, acetamiprid, acrinathrin, afidopyropen ([(3*S*,4*R*,4a*R*,6*S*,6a*S*,12*R*,12a*S*,12b*S*)-3-[(cyclopropylcarbonyl)oxy]-1,3,4,4a,5,6,6a,12,12a,12b-decahydro-6,12-dihydroxy-4,6a,12b-trimethyl-11-oxo-9-(3-pyridinyl)-2*H*,11*H*-naphtho[2,1-*b*]pyrano[3,4-*e*]pyran-4-yl]methyl cyclopropanecarboxylate), amidoflumet, amitraz, avermectin, azadirachtin, azinphos-methyl, benfuracarb, bensultap, bifenthrin, bifenazate, bistrifluron, borate, buprofezin, cadusafos, carbaryl, carbofuran, cartap, carzol, chlorantraniliprole, chlorfenapyr, chlorfluazuron, chlorpyrifos, chlorpyrifos-methyl, chromafenozide, clofentezin, clothianidin, cyantraniliprole (3-bromo-1-(3-chloro-2-pyridinyl)-*N*-[4-cyano-2-methyl-6-[(methylamino)carbonyl]phenyl]-

1*H*-pyrazole-5-carboxamide), cyclaniliprole (3-bromo-*N*-[2-bromo-4-chloro-6-[[(1-cyclopropylethyl)amino]carbonyl]phenyl]-1-(3-chloro-2-pyridinyl)-1*H*-pyrazole-5-carboxamide), cycloprothrin, cycloxaprid ((5*S*,8*R*)-1-[(6-chloro-3-pyridinyl)methyl]-2,3,5,6,7,8-hexahydro-9-nitro-5,8-Epoxy-1*H*-imidazo[1,2-*a*]azepine) cyflumetofen, cyfluthrin, beta-cyfluthrin, cyhalothrin, gamma-cyhalothrin, lambda-cyhalothrin, cypermethrin, alpha-cypermethrin, zeta-cypermethrin, cyromazine, deltamethrin, diafenthiuron, diazinon, dieldrin, diflubenzuron, dimefluthrin, dimehypo, dimethoate, dinotefuran, diofenolan, emamectin, endosulfan, esfenvalerate, ethiprole, etofenprox, etoxazole, fenbutatin oxide, fenitrothion, fenothiocarb, fenoxycarb, fenpropathrin, fenvalerate, fipronil, flometoquin (2-ethyl-3,7-dimethyl-6-[4-(trifluoromethoxy)phenoxy]-4-quinolinyl methyl carbonate), flonicamid, flubendiamide, flucythrinate, flufenerim, flufenoxuron, flufenoxystrobin (methyl (α*E*)-2-[[2-chloro-4-(trifluoromethyl)phenoxy]methyl]-α-(methoxymethylene)benzeneacetate), flufensulfone (5-chloro-2-[(3,4,4-trifluoro-3-buten-1-yl)sulfonyl]thiazole), fluhexafon, fluopyram, flupiprole (1-[2,6-dichloro-4-(trifluoromethyl)phenyl]-5-[(2-methyl-2-propen-1-yl)amino]-4-[(trifluoromethyl)sulfinyl]-1*H*-pyrazole-3-carbonitrile), flupyradifurone (4-[[(6-chloro-3-pyridinyl)methyl](2,2-difluoroethyl)amino]-2(5*H*)-furanone), fluvalinate, tau-fluvalinate, fonophos, formetanate, fosthiazate, halofenozide, heptafluthrin ([2,3,5,6-tetrafluoro-4-(methoxymethyl)phenyl]methyl 2,2-dimethyl-3-[(1*Z*)-3,3,3-trifluoro-1-propen-1-yl]cyclopropanecarboxylate), hexaflumuron, hexythiazox, hydramethylnon, imidacloprid, indoxacarb, insecticidal soaps, isofenphos, lufenuron, malathion, meperfluthrin ([2,3,5,6-tetrafluoro-4-(methoxymethyl)phenyl]methyl (1*R*,3*S*)-3-(2,2-dichloroethenyl)-2,2-dimethylcyclopropanecarboxylate), metaflumizone, metaldehyde, methamidophos, methidathion, methiodicarb, methomyl, methoprene, methoxychlor, metofluthrin, methoxyfenozide, metofluthrin, monocrotophos, monofluorothrin ([2,3,5,6-tetrafluoro-4-(methoxymethyl)phenyl]methyl 3-(2-cyano-1-propen-1-yl)-2,2-dimethylcyclopropanecarboxylate), nicotine, nitenpyram, nithiazine, novaluron, noviflumuron, oxamyl, parathion, parathion-methyl, permethrin, phorate, phosalone, phosmet, phosphamidon, pirimicarb, profenofos, profluthrin, propargite, protrifenbute, pyflubumide (1,3,5-trimethyl-*N*-(2-methyl-1-oxopropyl)-*N*-[3-(2-methylpropyl)-4-[2,2,2-trifluoro-1-methoxy-1-(trifluoromethyl)ethyl]phenyl]-1*H*-pyrazole-4-carboxamide), pymetrozine, pyrafluprole, pyrethrin, pyridaben, pyridalyl, pyrifluquinazon, pyriminostrobin (methyl (α*E*)-2-[[[2-[(2,4-dichlorophenyl)amino]-6-(trifluoromethyl)-4-pyrimidinyl]oxy]methyl]-α-(methoxymethylene)benzeneacetate), pyriprole, pyriproxyfen, rotenone, ryanodine, silafluofen, spinetoram, spinosad, spirodiclofen, spiromesifen, spirotetramat, sulprofos, sulfoxaflor (*N*-[methyloxido[1-[6-(trifluoromethyl)-3-pyridinyl]ethyl]-λ^{4}-sulfanylidene]cyanamide), tebufenozide, tebufenpyrad, teflubenzuron, tefluthrin, terbufos, tetrachlorvinphos, tetramethrin, tetramethylfluthrin ([2,3,5,6-tetrafluoro-4-

(methoxymethyl)phenyl]methyl 2,2,3,3-tetramethylcyclopropanecarboxylate), tetraniliprole, thiacloprid, thiamethoxam, thiodicarb, thiosultap-sodium, tioxazafen (3-phenyl-5-(2-thienyl)-1,2,4-oxadiazole), tolfenpyrad, tralomethrin, triazamate, trichlorfon, triflumezopyrim (2,4-dioxo-1-(5-pyrimidinylmethyl)-3-[3-(trifluoromethyl)phenyl]-2*H*-pyrido[1,2-*a*]pyrimidinium inner salt), triflumuron, *Bacillus thuringiensis* delta-endotoxins, entomopathogenic bacteria, entomopathogenic viruses and entomopathogenic fungi.

Of note are insecticides such as abamectin, acetamiprid, acrinathrin, afidopyropen, amitraz, avermectin, azadirachtin, benfuracarb, bensultap, bifenthrin, buprofezin, cadusafos, carbaryl, cartap, chlorantraniliprole, chlorfenapyr, chlorpyrifos, clothianidin, cyantraniliprole, cyclaniliprole, cycloprothrin, cyfluthrin, beta-cyfluthrin, cyhalothrin, gamma-cyhalothrin, lambda-cyhalothrin, cypermethrin, alpha-cypermethrin, zeta-cypermethrin, cyromazine, deltamethrin, dieldrin, dinotefuran, diofenolan, emamectin, endosulfan, esfenvalerate, ethiprole, etofenprox, etoxazole, fenitrothion, fenothiocarb, fenoxycarb, fenvalerate, fipronil, flometoquin, flonicamid, flubendiamide, flufenoxuron, flufenoxystrobin, flufensulfone, flupiprole, flupyradifurone, fluvalinate, formetanate, fosthiazate, heptafluthrin, hexaflumuron, hydramethylnon, imidacloprid, indoxacarb, lufenuron, meperfluthrin, metaflumizone, methiodicarb, methomyl, methoprene, methoxyfenozide, metofluthrin, monofluorothrin, nitenpyram, nithiazine, novaluron, oxamyl, pyflubumide, pymetrozine, pyrethrin, pyridaben, pyridalyl, pyriminostrobin, pyriproxyfen, ryanodine, spinetoram, spinosad, spirodiclofen, spiromesifen, spirotetramat, sulfoxaflor, tebufenozide, tetramethrin, tetramethylfluthrin, thiacloprid, thiamethoxam, thiodicarb, thiosultap-sodium, tralomethrin, triazamate, triflumezopyrim, triflumuron, *Bacillus thuringiensis* delta-endotoxins, all strains of *Bacillus thuringiensis* and all strains of nucleo polyhedrosis viruses.

One embodiment of biological agents for mixing with compounds of this disclosure include entomopathogenic bacteria such as *Bacillus thuringiensis,* and the encapsulated delta-endotoxins of *Bacillus thuringiensis* such as MVP® and MVPII® bioinsecticides prepared by the CellCap® process (CellCap®, MVP® and MVPII® are trademarks of Mycogen Corporation, Indianapolis, Indiana, USA); entomopathogenic fungi such as green muscardine fungus; and entomopathogenic (both naturally occurring and genetically modified) viruses including baculovirus, nucleopolyhedro virus (NPV) such as *Helicoverpa zea* nucleopolyhedrovirus (HzNPV), *Anagrapha falcifera* nucleopolyhedrovirus (AfNPV); and granulosis virus (GV) such as *Cydia pomonella* granulosis virus (CpGV).

One embodiment of biological agents for mixing with compounds of this disclosure include one or a combination of (i) a bacterium of the genus *Actinomycetes, Agrobacterium, Arthrobacter, Alcaligenes, Aureobacterium, Azobacter, Bacillus, Beijerinckia, Bradyrhizobium, Brevibacillus, Burkholderia, Chromobacterium, Clostridium, Clavibacter, Comamonas, Corynebacterium, Curtobacterium, Enterobacter, Flavobacterium, Gluconobacter*, *Hydrogenophaga, Klebsiella, Methylobacterium, Paenibacillus, Pasteuria,* *Photorhabdus, Phyllobacterium, Pseudomonas, Rhizobium, Serratia, Sphingobacterium, Stenotrophomonas, Streptomyces, Variovorax*, or *Xenorhabdus, for example a bacterium of Bacillus amyloliquefaciens, Bacillus cereus, Bacillus firmus, Bacillus, licheniformis, Bacillus pumilus, Bacillus sphaericus, Bacillus subtilis, Bacillus thuringiensis, Bradyrhizobium japonicum, Chromobacterium subtsugae, Pasteuria nishizawae, Pasteuria penetrans, Pasteuria usage, Pseudomonas fluorescens,* and *Streptomyces lydicus*; (ii) a fungus such as green muscardine fungus; (iii) a virus including baculovirus, nucleopolyhedro virus such as *Helicoverpa zea* nucleopolyhedrovirus, *Anagrapha falcifera* nucleopolyhedrovirus; granulosis virus such as *Cydia pomonella* granulosis virus.

Of particular note is such a combination where the other invertebrate pest control active ingredient belongs to a different chemical class or has a different site of action than the compound of Formula **1**. In certain instances, a combination with at least one other invertebrate pest control active ingredient having a similar spectrum of control but a different site of action will be particularly advantageous for resistance management. Thus, a composition of the present disclosure can further comprise a biologically effective amount of at least one additional invertebrate pest control active ingredient having a similar spectrum of control but belonging to a different chemical class or having a different site of action. These additional biologically active compounds or agents include, but are not limited to, acetylcholinesterase (AChE) inhibitors such as the carbamates methomyl, oxamyl, thiodicarb, triazamate, and the organophosphates chlorpyrifos; GABA-gated chloride channel antagonists such as the cyclodienes dieldrin and endosulfan, and the phenylpyrazoles ethiprole and fipronil; sodium channel modulators such as the pyrethroids bifenthrin, cyfluthrin, *beta*-cyfluthrin, cyhalothrin, *lambda*-cyhalothrin, cypermethrin, deltamethrin, dimefluthrin, esfenvalerate, metofluthrin and profluthrin; nicotinic acetylcholinereceptor (nAChR) agonists such as the neonicotinoids acetamiprid, clothianidin, dinotefuran, imidacloprid, nitenpyram, nithiazine, thiacloprid, and thiamethoxam, the sulfoximine sulfoxaflor, the butenolide flupyradifurone, and the mesoionic triflumezopyrim; nicotinic acetylcholine receptor (nAChR) allosteric activators such as the spinosyns spinetoram and spinosad; chloride channel activators such as the avermectins abamectin and emamectin; juvenile hormone mimics such as diofenolan, methoprene, fenoxycarb and pyriproxyfen; chordotonal organ modulators such as pymetrozine, pyrifluquinazon and flonicamid; mite growth inhibitors such as etoxazole; inhibitors of mitochondrial ATP synthase such as propargite; uncouplers of oxidative phosphorylation via disruption of the proton gradient such as chlorfenapyr; nicotinic acetylcholine receptor (nAChR) channel blockers such as the nereistoxin analogs cartap; inhibitors of chitin biosynthesis such as the benzoylureas flufenoxuron, hexaflumuron, lufenuron, novaluron, noviflumuron and triflumuron, and buprofezin; dipteran moulting disrupters such as cyromazine; ecdysone receptor agonists such as the diacylhydrazines methoxyfenozide and tebufenozide; octopamine receptor agonists such as amitraz;

mitochondrial complex III electron transport inhibitors such as hydramethylnon and bifenazate; mitochondrial complex I electron transport inhibitors such as pyridaben; voltage-dependent sodium channel blockers such as indoxacarb; inhibitors of acetyl CoA carboxylase such as the tetronic and tetramic acids spirodiclofen, spiromesifen and spirotetramat; mitochondrial complex II electron transport inhibitors such as the ß-ketonitriles cyenopyrafen and cyflumetofen; ryanodine receptor modulators such as the anthranilic diamides chlorantraniliprole and cyantraniliprole, diamides such as flubendiamide, and ryanodine receptor ligands such as ryanodine; compounds wherein the target site responsible for biological activity is unknown or uncharacterized such as azadirachtinand pyridalyl; microbial disrupters of insect midgut membranes such as *Bacillus thuringiensis* and the delta-endotoxins they produce and *Bacillus sphaericus*; and biological agents including nuclear polyhedrosis (NPV) and other naturally occurring or genetically modified insecticidal viruses.

Further examples of biologically active compounds or agents with which compounds of this disclosure can be formulated are: fungicides such as acibenzolar-S-methyl, aldimorph, ametoctradin, aminopyrifen, amisulbrom, anilazine, azaconazole, azoxystrobin, benalaxyl (including benalaxyl-M), benodanil, benomyl, benthiavalicarb (including benthiavalicarb-isopropyl), benzovindiflupyr, bethoxazin, binapacryl, biphenyl, bitertanol, bixafen, blasticidin-S, boscalid, bromuconazole, bupirimate, buthiobate, carboxin, carpropamid, captafol, captan, carbendazim, chloroneb, chlorothalonil, chlozolinate, copper hydroxide, copper oxychloride, copper sulfate, coumoxystrobin, cyazofamid, cyflufenamid, cymoxanil, cyproconazole, cyprodinil, dichlobentiazox, dichlofluanid, diclocymet, diclomezine, dicloran, diethofencarb, difenoconazole, diflumetorim, dimethirimol, dimethomorph, dimoxystrobin, diniconazole (including diniconazole-M), dinocap, dipymetitrone, dithianon, dithiolanes, dodemorph, dodine, econazole, etaconazole, edifenphos, enoxastrobin (also known as enestroburin), epoxiconazole, ethaboxam, ethirimol, etridiazole, famoxadone, fenamidone, fenaminstrobin, fenarimol, fenbuconazole, fenfuram, fenhexamide, fenoxanil, fenpiclonil, fenpicoxamid, fenpropidin, fenpropimorph, fenpyrazamine, fentin acetate, fentin hydroxide, ferbam, ferimzone, flometoquin, florylpicoxamid, fluopimomide, fluazinam, fludioxonil, flufenoxystrobin, fluindapyr, flumorph, fluopicolide, fluopyram, fluoxapiprolin, fluoxastrobin, fluquinconazole, flusilazole, flusulfamide, flutianil, flutolanil, flutriafol, fluxapyroxad, folpet, fthalide (also known as phthalide), fuberidazole, furalaxyl, furametpyr, hexaconazole, hymexazole, guazatine, imazalil, imibenconazole, iminoctadine albesilate, iminoctadine triacetate, inpyrfluxam, iodicarb, ipconazole, ipfentrifluconazole, ipflufenoquin, isofetamid, iprobenfos, iprodione, iprovalicarb, isoflucypram, isoprothiolane, isopyrazam, isotianil, kasugamycin, kresoxim-methyl, lancotrione, mancozeb, mandipropamid, mandestrobin, maneb, mapanipyrin, mefentrifluconazole, mepronil, meptyldinocap, metalaxyl (including metalaxyl-M/mefenoxam), metconazole, methasulfocarb, metiram, metominostrobin, metyltetraprole, metrafenone, myclobutanil, naftitine, neo-asozin (ferric methanearsonate), nuarimol, octhilinone, ofurace, orysastrobin, oxadixyl, oxathiapiprolin, oxolinic acid, oxpoconazole, oxycarboxin, oxytetracycline, penconazole, pencycuron, penflufen, penthiopyrad, perfurazoate, phosphorous acid (including salts thereof, e.g., fosetyl-aluminm), picoxystrobin, piperalin, polyoxin, probenazole, prochloraz, procymidone, propamocarb, propiconazole, propineb, proquinazid, prothiocarb, prothioconazole, pydiflumetofen (Adepidyn®), pyraclostrobin, pyrametostrobin, pyrapropoyne, pyraoxystrobin, pyraziflumid, pyrazophos, pyribencarb, pyributacarb, pyridachlometyl, pyrifenox, pyriofenone, perisoxazole, pyrimethanil, pyrifenox, pyrrolnitrin, pyroquilon, quinconazole, quinmethionate, quinofumelin, quinoxyfen, quintozene, silthiofam, sedaxane, simeconazole, spiroxamine, streptomycin, sulfur, tebuconazole, tebufloquin, teclofthalam, tecloftalam, tecnazene, terbinafine, tetraconazole, thiabendazole, thifluzamide, thiophanate, thiophanate-methyl, thiram, tiadinil, tolclofos-methyl, tolprocarb, tolyfluanid, triadimefon, triadimenol, triarimol, triazoxide, tribasic copper sulfate, triclopyricarb, tridemorph, trifloxystrobin, triflumizole, trimoprhamide tricyclazole, trifloxystrobin, triforine, triticonazole, uniconazole, validamycin, valifenalate (also known as valifenal), vinclozolin, zineb, ziram, zoxamide and 1-[4-[4-[5-(2,6-difluorophenyl)-4,5-dihydro-3-isoxazolyl]-2-thiazolyl]-1-piperidinyl]-2-[5-methyl-3-(trifluoromethyl)-1*H*-pyrazol-1-yl]ethanone; nematocides such as fluopyram, spirotetramat, thiodicarb, fosthiazate, abamectin, iprodione, fluensulfone, dimethyl disulfide, tioxazafen, 1,3-dichloropropene (1,3-D), metam (sodium and potassium), dazomet, chloropicrin, fenamiphos, ethoprophos, cadusaphos, terbufos, imicyafos, oxamyl, carbofuran, tioxazafen, *Bacillus firmus* and *Pasteuria nishizawae*; bactericides such as streptomycin; acaricides such as amitraz, chinomethionat, chlorobenzilate, cyhexatin, dicofol, dienochlor, etoxazole, fenazaquin, fenbutatin oxide, fenpropathrin, fenpyroximate, hexythiazox, propargite, pyridaben and tebufenpyrad.

Invertebrate pests are controlled in agronomic and nonagronomic applications by applying one or more compounds of this disclosure, typically in the form of a composition, in a biologically effective amount, to the environment of the pests, including the agronomic and/or nonagronomic locus of infestation, to the area to be protected, or directly on the pests to be controlled.

Thus the present disclosure comprises a method for controlling an invertebrate pest in agronomic and/or nonagronomic applications, comprising contacting the invertebrate pest or its environment with a biologically effective amount of one or more of the compounds of the disclosure, or with a composition comprising at least one such compound or a composition comprising at least one such compound and a biologically effective amount of at least one additional biologically active compound or agent. Examples of suitable compositions comprising a compound of the disclosure and a biologically effective amount of at least one additional biologically active compound or agent include granular compositions wherein the additional active compound is present on the same granule as the compound of the disclosure or on granules separate from those of the compound of the disclosure.

To achieve contact with a compound or composition of the disclosure to protect a field crop from invertebrate pests, the compound or composition is typically applied to the seed of the crop before planting, to the foliage (e.g., leaves, stems, flowers, fruits) of crop plants, or to the soil or other growth medium before or after the crop is planted.

One embodiment of a method of contact is by spraying. Alternatively, a granular composition comprising a compound of the disclosure can be applied to the plant foliage or the soil. Compounds of this disclosure can also be effectively delivered through plant uptake by contacting the plant with a composition comprising a compound of this disclosure applied as a soil drench of a liquid formulation, a granular formulation to the soil, a nursery box treatment or a dip of transplants. Of note is a composition of the present disclosure in the form of a soil drench liquid formulation. Also of note is a method for controlling an invertebrate pest comprising contacting the invertebrate pest or its environment with a biologically effective amount of a compound of the present disclosure or with a composition comprising a biologically effective amount of a compound of the present disclosure. Of further note is this method wherein the environment is soil and the composition is applied to the soil as a soil drench formulation. Of further note is that compounds of this disclosure are also effective by localized application to the locus of infestation. Other methods of contact include application of a compound or a composition of the disclosure by direct and residual sprays, aerial sprays, gels, seed coatings, microencapsulations, systemic uptake, baits, ear tags, boluses, foggers, fumigants, aerosols, dusts and many others. One embodiment of a method of contact is a dimensionally stable fertilizer granule, stick or tablet comprising a compound or composition of the disclosure. The compounds of this disclosure can also be impregnated into materials for fabricating invertebrate control devices (e.g., insect netting).

Compounds of the disclosure are useful in treating all plants, plant parts and seeds. Plant and seed varieties and cultivars can be obtained by conventional propagation and breeding methods or by genetic engineering methods. Genetically modified plants or seeds (transgenic plants or seeds) are those in which a heterologous gene (transgene) has been stably integrated into the plant's or seed’s genome. A transgene that is defined by its particular location in the plant genome is called a transformation or transgenic event.

Genetically modified plant and seed cultivars which can be treated according to the disclosure include those that are resistant against one or more biotic stresses (pests such as nematodes, insects, mites, fungi, etc.) or abiotic stresses (drought, cold temperature, soil salinity, etc.), or that contain other desirable characteristics. Plants and seeds can be genetically modified to exhibit traits of, for example, herbicide tolerance, insect-resistance, modified oil profiles or drought tolerance. Useful genetically modified plants and seeds containing single gene transformation events or combinations of transformation events are listed in Table Z. Additional information for the genetic modifications listed in Table Z can be obtained from the following databases:

OECD BioTrack Product Database [database online]. Retrieved from The Organisation for Economic Co-operation and Development (OECD) using internet <https://biotrackproductdatabase.oecd.org/byidentifier.aspx>

USDA Animal and Plant Health Inspection Service [database online]. Retrieved from the US Department of Agriculture using the internet <http://www.aphis.usda.gov>

Deliberate Release and Placing on the EU Market of GMOs - GMO Register [database online]. Retrieved from the European Commission Joint Research Centre using internet <http://gmoinfo.jrc.ec.europa.eu>

The following abbreviations are used in Table Z which follows: tol. is tolerance, res. is resistance, SU is sulfonylurea, ALS is acetolactate synthase, HPPD is 4-Hydroxyphenylpyruvate Dioxygenase, NA is Not Available.

Table Z

Crop	Event Name	Event Code	Trait(s)	Gene(s)
Alfalfa	J101	MON-00101-8	Glyphosate tol.	cp4 epsps (aroA:CP4)
Alfalfa	J163	MON-00163-7	Glyphosate tol.	cp4 epsps (aroA:CP4)
Canola*	23-18-17 (Event 18)	CGN-89465-2	High lauric acid oil	te
Canola*	23-198 (Event 23)	CGN-89465-2	High lauric acid oil	te
Canola*	61061	DP-061061-7	Glyphosate tol.	gat4621
Canola*	73496	DP-073496-4	Glyphosate tol.	gat4621
Canola*	GT200 (RT200)	MON-89249-2	Glyphosate tol.	cp4 epsps (aroA:CP4); goxv247
Canola*	GT73 (RT73)	MON-00073-7	Glyphosate tol.	cp4 epsps (aroA:CP4); goxv247
Canola*	HCN10 (Topas 19/2)	NA	Glufosinate tol.	bar
Canola*	HCN28 (T45)	ACS-BN008-2	Glufosinate tol.	pat (syn)
Canola*	HCN92 (Topas 19/2)	ACS-BN007-1	Glufosinate tol.	bar
Canola*	MON88302	MON-88302-9	Glyphosate tol.	cp4 epsps (aroA:CP4)
Canola*	MPS961	NA	Phytate breakdown	phyA
Canola*	MPS962	NA	Phytate breakdown	phyA
Canola*	MPS963	NA	Phytate breakdown	phyA
Canola*	MPS964	NA	Phytate breakdown	phyA
Canola*	MPS965	NA	Phytate breakdown	phyA
Canola*	MS1 (B91-4)	ACS-BN004-7	Glufosinate tol.	bar
Canola*	MS8	ACS-BN005-8	Glufosinate tol.	bar
Canola*	OXY-235	ACS-BN011-5	Oxynil tol.	bxn
Canola*	PHY14	NA	Glufosinate tol.	bar

Canola*	PHY23	NA	Glufosinate tol.	bar
Canola*	PHY35	NA	Glufosinate tol.	bar
Canola*	PHY36	NA	Glufosinate tol.	bar
Canola*	RF1 (B93-101)	ACS-BN001-4	Glufosinate tol.	bar
Canola*	RF2 (B94-2)	ACS-BN002-5	Glufosinate tol.	bar
Canola*	RF3	ACS-BN003-6	Glufosinate tol.	bar
Bean	EMBRAPA 5.1	EMB-PV051-1	Disease res.	ac1 (sense and antisense)
Brinjal (Eggplant)	EE-1		Insect res.	cry1Ac
Carnation	11 (7442)	FLO-07442-4	SU tol..; modified flower color	surB; dfr; hfl (f3'5'h)
Carnation	11363 (1363A)	FLO-11363-1	SU tol.; modified flower color	surB; dfr; bp40 (f3'5'h)
Carnation	1226A (11226)	FLO-11226-8	SU tol.; modified flower color	surB; dfr; bp40 (f3'5'h)
Carnation	123.2.2 (40619)	FLO-40619-7	SU tol.; modified flower color	surB; dfr; hfl (f3'5'h)
Carnation	123.2.38 (40644)	FLO-40644-4	SU tol.; modified flower color	surB; dfr; hfl (f3'5'h)
Carnation	123.8.12	FLO-40689-6	SU tol.; modified flower color	surB; dfr; bp40 (f3'5'h)
Carnation	123.8.8 (40685)	FLO-40685-1	SU tol.; modified flower color	surB; dfr; bp40 (f3'5'h)
Carnation	1351A (11351)	FLO-11351-7	SU tol.; modified flower color	surB; dfr; bp40 (f3'5'h)
Carnation	1400A (11400)	FLO-11400-2	SU tol.; modified flower color	surB; dfr; bp40 (f3'5'h)
Carnation	15	FLO-00015-2	SU tol.; modified flower color	surB; dfr; hfl (f3'5'h)
Carnation	16	FLO-00016-3	SU tol.; modified flower color	surB; dfr; hfl (f3'5'h)
Carnation	4	FLO-00004-9	SU tol.; modified flower color	surB; dfr; hfl (f3'5'h)
Carnation	66	FLO-00066-8	SU tol.; delayed senescence	surB; acc
Carnation	959A (11959)	FLO-11959-3	SU tol.; modified flower color	surB; dfr; bp40 (f3'5'h)
Carnation	988A (11988)	FLO-11988-7	SU tol.; modified flower color	surB; dfr; bp40 (f3'5'h)
Carnation	26407	IFD-26497-2	SU tol.; modified flower color	surB; dfr; bp40 (f3'5'h)
Carnation	25958	IFD-25958-3	SU tol.; modified flower color	surB; dfr; bp40 (f3'5'h)
Chicory	RM3-3	NA	Glufosinate tol.	bar
Chicory	RM3-4	NA	Glufosinate tol.	bar
Chicory	RM3-6	NA	Glufosinate tol.	bar
Cotton	19-51a	DD-01951A-7	ALS herbicide tol.	S4-HrA
Cotton	281-24-236	DAS-24236-5	Glufosinate tol.; insect res.	pat (syn); cry1F
Cotton	3006-210-23	DAS-21023-5	Glufosinate tol.; insect res.	pat (syn); cry1Ac
Cotton	31707	NA	Oxynil tol.; insect res.	bxn; cry1Ac
Cotton	31803	NA	Oxynil tol.; insect res.	bxn; cry1Ac
Cotton	31807	NA	Oxynil tol.; insect res.	bxn; cry1Ac
Cotton	31808	NA	Oxynil tol.; insect res.	bxn; cry1Ac

Cotton	42317	NA	Oxynil tol.; insect res.	bxn; cry1Ac
Cotton	BNLA-601	NA	Insect res.	cry1Ac
Cotton	BXN10211	BXN10211-9	Oxynil tol.	bxn; cry1Ac
Cotton	BXN10215	BXN10215-4	Oxynil tol.	bxn; cry1Ac
Cotton	BXN10222	BXN10222-2	Oxynil tol.	bxn; cry1Ac
Cotton	BXN10224	BXN10224-4	Oxynil tol.	bxn; cry1Ac
Cotton	COT102	SYN-IR102-7	Insect res.	vip3A(a)
Cotton	COT67B	SYN-IR67B-1	Insect res.	cry1Ab
Cotton	COT202		Insect res.	vip3A
Cotton	Event 1	NA	Insect res.	cry1Ac
Cotton	GMF Cry1A	GTL-GMF311-7	Insect res.	cry1Ab-Ac
Cotton	GHB119	BCS-GH005-8	Insect res.	cry2Ae
Cotton	GHB614	BCS-GH002-5	Glyphosate tol.	2mepsps
Cotton	GK12	NA	Insect res.	cry1Ab-Ac
Cotton	LLCotton25	ACS-GH001-3	Glufosinate tol.	bar
Cotton	MLS 9124	NA	Insect res.	cry1C
Cotton	MON1076	MON-89924-2	Insect res.	cry1Ac
Cotton	MON1445	MON-01445-2	Glyphosate tol.	cp4 epsps (aroA:CP4)
Cotton	MON15985	MON-15985-7	Insect res.	cry1Ac; cry2Ab2
Cotton	MON1698	MON-89383-1	Glyphosate tol.	cp4 epsps (aroA:CP4)
Cotton	MON531	MON-00531-6	Insect res.	cry1Ac
Cotton	MON757	MON-00757-7	Insect res.	cry1Ac
Cotton	MON88913	MON-88913-8	Glyphosate tol.	cp4 epsps (aroA:CP4)
Cotton	Nqwe Chi 6 Bt	NA	Insect res.	NA?
Cotton	SKG321	NA	Insect res.	cry1A; CpTI
Cotton	T303-3	BCS-GH003-6	Insect res.; glufosinate tol.	cry1Ab; bar
Cotton	T304-40	BCS-GH004-7	Insect res.; glufosinate tol.	cry1Ab; bar
Cotton	CE43-67B		Insect res.	cry1Ab
Cotton	CE46-02A		Insect res.	cry1Ab
Cotton	CE44-69D		Insect res.	cry1Ab
Cotton	1143-14A		Insect res.	cry1Ab
Cotton	1143-51B		Insect res.	cry1Ab
Cotton	T342-142		Insect res.	cry1Ab
Cotton	PV-GHGT07 (1445)		Glyphosate tol.	cp4 epsps (aroA:CP4)
Cotton	EE-GH3		Glyphosate tol.	mepsps
Cotton	EE-GH5		Insect res.	cry1Ab
Cotton	MON88701	MON-88701-3	Dicamba & glufosinate tol.	Modified dmo; bar
Cotton	OsCr11		Anti-allergy	Modified Cry j
Creeping Bentgrass	ASR368	SMG-36800-2	Glyphosate tol.	cp4 epsps (aroA:CP4)
Eucalyptus	20-C		Salt tol.	codA
Eucalyptus	12-5C		Salt tol.	codA

Eucalyptus	12-5B		Salt tol.	codA
Eucalyptus	107-1		Salt tol.	codA
Eucalyptus	1/9/2001		Salt tol.	codA
Eucalyptus	2/1/2001		Salt tol.	codA
Eucalyptus			Cold tol.	des9
Flax	FP967	CDC-FL001-2	ALS herbicide tol.	als
Lentil	RH44		Imidazolinone tol.	als
Maize	3272	SYN-E3272-5	Modified alpha-amylase	amy797E
Maize	5307	SYN-05307-1	Insect res.	ecry3.1Ab
Maize	59122	DAS-59122-7	Insect res.; glufosinate tol.	cry34Ab1; cry35Ab1; pat
Maize	676	PH-000676-7	Glufosinate tol.; pollination control	pat; dam
Maize	678	PH-000678-9	Glufosinate tol.; pollination control	pat; dam
Maize	680	PH-000680-2	Glufosinate tol.; pollination control	pat; dam
Maize	98140	DP-098140-6	Glyphosate toll; ALS herbicide tol.	gat4621; zm-hra
Maize	Bt10	NA	Insect res.; glufosinate tol.	cry1Ab; pat
Maize	Bt176 (176)	SYN-EV176-9	Insect res.; glufosinate tol.	cry1Ab; bar
Maize	BVLA430101	NA	Phytate breakdown	phyA2
Maize	CBH-351	ACS-ZM004-3	Insect res.; glufosinate tol.	cry9C; bar
Maize	DAS40278-9	DAS40278-9	2,4-D tol.	aad-1
Maize	DBT418	DKB-89614-9	Insect res.; glufosinate tol.	cry1Ac; pinII; bar
Maize	DLL25 (B16)	DKB-89790-5	Glufosinate tol.	bar
Maize	GA21	MON-00021-9	Glyphosate tol.	mepsps
Maize	GG25		Glyphosate tol.	mepsps
Maize	GJ11		Glyphosate tol.	mepsps
Maize	Fl117		Glyphosate tol.	mepsps
Maize	GAT-ZM1		Glufosinate tol.	pat
Maize	LY038	REN-00038-3	Increased lysine	cordapA
Maize	MIR162	SYN-IR162-4	Insect res.	vip3Aa20
Maize	MIR604	SYN-IR604-5	Insect res.	mcry3A
Maize	MON801 (MON80100)	MON801	Insect res.; glyphosate tol.	cry1Ab; cp4 epsps (aroA:CP4); goxv247
Maize	MON802	MON-80200-7	Insect res.; glyphosate tol.	cry1Ab; cp4 epsps (aroA:CP4); goxv247
Maize	MON809	PH-MON-809-2	Insect res.; glyphosate tol.	cry1Ab; cp4 epsps (aroA:CP4); goxv247
Maize	MON810	MON-00810-6	Insect res.; glyphosate tol.	cry1Ab; cp4 epsps (aroA:CP4); goxv247
Maize	MON832	NA	Glyphosate tol.	cp4 epsps (aroA:CP4); goxv247
Maize	MON863	MON-00863-5	Insect res.	cry3Bb1
Maize	MON87427	MON-87427-7	Glyphosate tol.	cp4 epsps (aroA:CP4)
Maize	MON87460	MON-87460-4	Drought tol.	cspB
Maize	MON88017	MON-88017-3	Insect res.; glyphosate tol.	cry3Bb1; cp4 epsps (aroA:CP4)

Maize	MON89034	MON-89034-3	Insect res.	cry2Ab2; cry1A.105
Maize	MS3	ACS-ZM001-9	Glufosinate tol.; pollination control	bar; barnase
Maize	MS6	ACS-ZM005-4	Glufosinate tol.; pollination control	bar; barnase
Maize	NK603	MON-00603-6	Glyphosate tol.	cp4 epsps (aroA:CP4)
Maize	T14	ACS-ZM002-1	Glufosinate tol.	pat (syn)
Maize	T25	ACS-ZM003-2	Glufosinate tol.	pat (syn)
Maize	TC1507	DAS-01507-1	Insect res.; glufosinate tol.	cry1Fa2; pat
Maize	TC6275	DAS-06275-8	Insect res.; glufosinate tol.	mocry1F; bar
Maize	VIP1034		Insect res.; glufosinate tol.	vip3A; pat
Maize	43A47	DP-043A47-3	Insect res.; glufosinate tol.	cry1F; cry34Ab1; cry35Ab1; pat
Maize	40416	DP-040416-8	Insect res.; glufosinate tol.	cry1F; cry34Ab1; cry35Ab1; pat
Maize	32316	DP-032316-8	Insect res.; glufosinate tol.	cry1F; cry34Ab1; cry35Ab1; pat
Maize	4114	DP-004114-3	Insect res.; glufosinate tol.	cry1F; cry34Ab1; cry35Ab1; pat
Melon	Melon A	NA	Delayed ripening/senescence	sam-k
Melon	Melon B	NA	Delayed ripening/senescence	sam-k
Papaya	55-1	CUH-CP551-8	Disease res.	prsv cp
Papaya	63-1	CUH-CP631-7	Disease res.	prsv cp
Papaya	Huanong No. 1	NA	Disease res.	prsv rep
Papaya	X17-2	UFL-X17CP-6	Disease res.	prsv cp
Petunia	Petunia-CHS	NA	Modified product quality	CHS suppres.sion
Plum	C-5	ARS-PLMC5-6	Disease res.	ppv cp
Canola**	ZSR500	NA	Glyphosate tol.	cp4 epsps (aroA:CP4); goxv247
Canola**	ZSR502	NA	Glyphosate tol.	cp4 epsps (aroA:CP4); goxv247
Canola**	ZSR503	NA	Glyphosate tol.	cp4 epsps (aroA:CP4); goxv247
Poplar	Bt poplar	NA	Insect res.	cry1Ac; API
Poplar	Hybrid poplar clone 741	NA	Insect res.	cry1Ac; API
Poplar	trg300-1		High cellulose	AaXEG2
Poplar	trg300-2		High cellulose	AaXEG2
Potato	1210 amk	NA	Insect res.	cry3A
Potato	2904/1 kgs	NA	Insect res.	cry3A
Canola**	ZSR500	NA	Glyphosate tol.	cp4 epsps (aroA:CP4); goxv247
Canola**	ZSR502	NA	Glyphosate tol.	cp4 epsps (aroA:CP4); goxv247
Potato	ATBT04-27	NMK-89367-8	Insect res.	cry3A
Potato	ATBT04-30	NMK-89613-2	Insect res.	cry3A
Potato	ATBT04-31	NMK-89170-9	Insect res.	cry3A
Potato	ATBT04-36	NMK-89279-1	Insect res.	cry3A
Potato	ATBT04-6	NMK-89761-6	Insect res.	cry3A

Potato	BT06	NMK-89812-3	Insect res.	cry3A
Potato	BT10	NMK-89175-5	Insect res.	cry3A
Potato	BT12	NMK-89601-8	Insect res.	cry3A
Potato	BT16	NMK-89167-6	Insect res.	cry3A
Potato	BT17	NMK-89593-9	Insect res.	cry3A
Potato	BT18	NMK-89906-7	Insect res.	cry3A
Potato	BT23	NMK-89675-1	Insect res.	cry3A
Potato	EH92-527-1	BPS-25271-9	Modified starch/carbohydrate	gbss (antisense)
Potato	HLMT15-15	NA	Insect & disease res.	cry3A; pvy cp
Potato	HLMT15-3	NA	Insect & disease res.	cry3A; pvy cp
Potato	HLMT15-46	NA	Insect & disease res.	cry3A; pvy cp
Potato	RBMT15-101	NMK-89653-6	Insect & disease res.	cry3A; pvy cp
Potato	RBMT21-129	NMK-89684-1	Insect & disease res.	cry3A; plrv orf1; plrv orf2
Potato	RBMT21-152	NA	Insect & disease res.	cry3A; plrv orf1; plrv orf2
Potato	RBMT21-350	NMK-89185-6	Insect & disease res.	cry3A; plrv orf1; plrv orf2
Potato	RBMT22-082	NMK-89896-6	Insect & disease res.; Glyphosate tol.	cry3A; plrv orf1; plrv orf2; cp4 epsps (aroA:CP4)
Potato	RBMT22-186	NA	Insect & disease res.; Glyphosate tol.	cry3A; plrv orf1; plrv orf2; cp4 epsps (aroA:CP4)
Potato	RBMT22-238	NA	Insect & disease res.; Glyphosate tol.	cry3A; plrv orf1; plrv orf2; cp4 epsps (aroA:CP4)
Potato	RBMT22-262	NA	Insect & disease res.; Glyphosate tol.	cry3A; plrv orf1; plrv orf2; cp4 epsps (aroA:CP4)
Potato	SEMT15-02	NMK-89935-9	Insect & disease res.	cry3A; pvy cp
Potato	SEMT15-07	NA	Insect & disease res.	cry3A; pvy cp
Potato	SEMT15-15	NMK-89930-4	Insect & disease res.	cry3A; pvy cp
Potato	SPBT02-5	NMK-89576-1	Insect res.	cry3A
Potato	SPBT02-7	NMK-89724-5	Insect res.	cry3A
Rice	7Crp#242-95-7		Anti-allergy	7crp
Rice	7Crp#10	NA	Anti-allergy	7crp
Rice	GM Shanyou 63	NA	Insect res.	cry1Ab; cry1Ac
Rice	Huahui-1/TT51-1	NA	Insect res.	cry1Ab; cry1Ac
Rice	LLRICE06	ACS-OS001-4	Glufosinate tol.	bar
Rice	LLRICE601	BCS-OS003-7	Glufosinate tol.	bar
Rice	LLRICE62	ACS-OS002-5	Glufosinate tol.	bar
Rice	Tarom molaii + cry1Ab	NA	Insect res.	cry1Ab (truncated)
Rice	GAT-OS2		Glufosinate tol.	bar
Rice	GAT-OS3		Glufosinate tol.	bar
Rice	PE-7		Insect res.	Cry1Ac
Rice	7Crp#10	NA	Anti-allergy	7crp

Rice	KPD627-8		High tryptophan	OASA1D
Rice	KPD722-4		High tryptophan	OASA1D
Rice	KA317		High tryptophan	OASA1D
Rice	HW5		High tryptophan	OASA1D
Rice	HW1		High tryptophan	OASA1D
Rice	B-4-1-18		Erect leaves semidwarf	Δ OsBRI1
Rice	G-3-3-22		Semidwarf	OSGA2ox1
Rice	AD77		Disease res.	DEF
Rice	AD51		Disease res.	DEF
Rice	AD48		Disease res.	DEF
Rice	AD41		Disease res.	DEF
Rice	13pNasNaatAprt1		Low iron tol.	HvNAS1; HvNAAT-A; APRT
Rice	13pAprt1		Low iron tol.	APRT
Rice	gHvNAS1-gHvNAAT-1		Low iron tol.	HvNAS1; HvNAAT-A; HvNAAT-B
Rice	gHvIDS3-1		Low iron tol.	HvIDS3
Rice	gHvNAAT1		Low iron tol.	HvNAAT-A; HvNAAT-B
Rice	gHvNAS1-1		Low iron tol.	HvNAS1
Rice	NIA-OS006-4		Disease res.	WRKY45
Rice	NIA-OS005-3		Disease res.	WRKY45
Rice	NIA-OS004-2		Disease res.	WRKY45
Rice	NIA-OS003-1		Disease res.	WRKY45
Rice	NIA-OS002-9		Disease res.	WRKY45
Rice	NIA-OS001-8		Disease res.	WRKY45
Rice	OsCr11		Anti-allergy	Modified Cry j
Rice	17053		Glyphosate tol.	cp4 epsps (aroA:CP4)
Rice	17314		Glyphosate tol.	cp4 epsps (aroA:CP4)
Rose	WKS82 / 130-4-1	IFD-52401-4	Modified flower color	5AT; bp40 (f3'5'h)
Rose	WKS92 / 130-9-1	IFD-52901-9	Modified flower color	5AT; bp40 (f3'5'h)
Soybean	260-05 (G94-1, G94-19, G168)	NA	Modified oil/fatty acid	gm-fad2-1 (silencing locus)
Soybean	A2704-12	ACS-GM005-3	Glufosinate tol.	pat
Soybean	A2704-21	ACS-GM004-2	Glufosinate tol.	pat
Soybean	A5547-127	ACS-GM006-4	Glufosinate tol.	pat
Soybean	A5547-35	ACS-GM008-6	Glufosinate tol.	pat
Soybean	CV127	BPS-CV127-9	Imidazolinone tol.	csr1-2
Soybean	DAS68416-4	DAS68416-4	Glufosinate tol.	pat
Soybean	DP305423	DP-305423-1	Modified oil/fatty acid; ALS herbicide tol.	gm-fad2-1 (silencing locus); gm-hra
Soybean	DP356043	DP-356043-5	Modified oil/fatty acid; glyphosate tol.	gm-fad2-1 (silencing locus); gat4601
Soybean	FG72	MST-FG072-3	Glyphosate & HPPD tol.	2mepsps; hppdPF W336
Soybean	GTS 40-3-2 (40-3-2)	MON-04032-6	Glyphosate tol.	cp4 epsps (aroA:CP4)

Soybean	GU262	ACS-GM003-1	Glufosinate tol.	pat
Soybean	MON87701	MON-87701-2	Insect res.	cry1Ac
Soybean	MON87705	MON-87705-6	Modified oil/fatty acid; glyphosate tol.	fatb1-A (sense & antisense); fad2-1A (sense & antisense); cp4 epsps (aroA:CP4)
Soybean	MON87708	MON-87708-9	Dicamba & glyphosate tol.	dmo; cp4 epsps (aroA:CP4)
Soybean	MON87769	MON-87769-7	Modified oil/fatty acid; glyphosate tol.	Pj.D6D; Nc.Fad3; cp4 epsps (aroA:CP4)
Soybean	MON89788	MON-89788-1	Glyphosate tol.	cp4 epsps (aroA:CP4)
Soybean	W62	ACS-GM002-9	Glufosinate tol.	bar
Soybean	W98	ACS-GM001-8	Glufosinate tol.	bar
Soybean	MON87754	MON-87754-1	High oil	dgat2A
Soybean	DAS21606	DAS-21606	Aryloxyalkanoate & glufosinate tol.	Modified aad-12; pat
Soybean	DAS44406	DAS-44406-6	Aryloxyalkanoate, glyphosate & glufosinate tol.	Modified aad-12; 2mepsps; pat
Soybean	SYHT04R	SYN-0004R-8	Mesotrione tol.	Modified avhppd
Soybean	9582.814.19.1		Insect res. & glufosinate tol.	cry1Ac, cry1F, PAT
Squash	CZW3	SEM-0CZW3-2	Disease res.	cmv cp, zymv cp, wmv cp
Squash	ZW20	SEM-0ZW20-7	Disease res.	zymv cp, wmv cp
Sugar Beet	GTSB77 (T9100152)	SY-GTSB77-8	Glyphosate tol.	cp4 epsps (aroA:CP4); goxv247
Sugar Beet	H7-1	KM-000H71-4	Glyphosate tol.	cp4 epsps (aroA:CP4)
Sugar Beet	T120-7	ACS-BV001-3	Glufosinate tol.	pat
Sugar Beet	T227-1		Glyphosate tol.	cp4 epsps (aroA:CP4)
Sugarcane	NXI-1T		Drought tol.	EcbetA
Sunflower	X81359		Imidazolinone tol.	als
Sweet Pepper	PK-SP01	NA	Disease res.	cmv cp
Tobacco	C/F/93/08-02	NA	Oxynil tol.	bxn
Tobacco	Vector 21-41	NA	Reduced nicotine	NtQPT1 (antisense)
Tomato	1345-4	NA	Delayed ripening/senescense	acc (truncated)
Tomato	35-1-N	NA	Delayed ripening/senescense	sam-k
Tomato	5345	NA	Insect res.	cry1Ac
Tomato	8338	CGN-89322-3	Delayed ripening/senescense	accd
Tomato	B	SYN-0000B-6	Delayed ripening/senescense	pg (sense or antisense)
Tomato	Da	SYN-0000DA-9	Delayed ripening/senescense	pg (sense or antisense)
Sunflower	X81359		Imidazolinone tol.	als
Tomato	Da Dong No 9	NA	Modified product	NA
Tomato	F (1401F, h38F, 11013F,7913F)	SYN-0000F-1	Delayed ripening/senescense	pg (sense or antisense)
Tomato	FLAVR SAVR™	CGN-89564-2	Delayed ripening/senescense	pg (sense or antisense)
Tomato	Huafan No 1	NA	Delayed ripening/senescense	anti-efe

Tomato	PK-TM8805R (8805R)	NA	Disease res.	cmv cp
Wheat	MON71800	MON-71800-3	Glyphosate tol.	cp4 epsps (aroA:CP4)

* Argentine, ** Polish, # Eggplant

Treatment of genetically modified plants and seeds with compounds of the disclosure may result in enhanced effects. For example, reduction in application rates, broadening of the activity spectrum, increased tolerance to biotic/abiotic stresses or enhanced storage stability may be greater than expected from just simple additive effects of the application of compounds of the disclosure on genetically modified plants and seeds.

Compounds of this disclosure are also useful in seed treatments for protecting seeds from invertebrate pests. In the context of the present disclosure and claims, treating a seed means contacting the seed with a biologically effective amount of a compound of this disclosure, which is typically formulated as a composition of the disclosure. This seed treatment protects the seed from invertebrate soil pests and generally can also protect roots and other plant parts in contact with the soil of the seedling developing from the germinating seed. The seed treatment may also provide protection of foliage by translocation of the compound of this disclosure or a second active ingredient within the developing plant. Seed treatments can be applied to all types of seeds, including those from which plants genetically transformed to express specialized traits will germinate. Representative examples include those expressing proteins toxic to invertebrate pests, such as *Bacillus thuringiensis* toxin or those expressing herbicide resistance such as glyphosate acetyltransferase, which provides resistance to glyphosate. Seed treatments with compounds of this disclosure can also increase vigor of plants growing from the treated seed.

One method of seed treatment is by spraying or dusting the seed with a compound of the disclosure (i.e. as a formulated composition) before sowing the seeds. Compositions formulated for seed treatment generally comprise a film former or adhesive agent. Therefore typically a seed coating composition of the present disclosure comprises a biologically effective amount of a compound of Formula **1**, an *N*-oxide or salt thereof, and a film former or adhesive agent. Seed can be coated by spraying a flowable suspension concentrate directly into a tumbling bed of seeds and then drying the seeds. Alternatively, other formulation types such as wetted powders, solutions, suspoemulsions, emulsifiable concentrates and emulsions in water can be sprayed on the seed. This process is particularly useful for applying film coatings on seeds. Various coating machines and processes are available to one skilled in the art. Suitable processes include those listed in P. Kosters et al., *Seed Treatment: Progress and Prospects*, 1994 BCPC Mongraph No. 57, and references listed therein.

Compounds of Formula **1** and their compositions, both alone and in combination with other insecticides and fungicides, are particularly useful in seed treatment for crops including, but not limited to, maize or corn, soybeans, cotton, cereal (e.g., wheat, oats, barley, rye and rice), potatoes, vegetables and oilseed rape.

Other insecticides with which compounds of Formula **1** can be formulated to provide mixtures useful in seed treatment include abamectin, acetamiprid, acrinathrin, amitraz, avermectin, azadirachtin, bensultap, bifenthrin, buprofezin, carbaryl, carbofuran, cartap, chlorantraniliprole, chlorfenapyr, chlorpyrifos, clothianidin, cyantraniliprole, cyfluthrin, beta-cyfluthrin, cyhalothrin, gamma-cyhalothrin, lambda-cyhalothrin, cypermethrin, alpha-cypermethrin, zeta-cypermethrin, cyromazine, deltamethrin, dieldrin, dinotefuran, diofenolan, emamectin, endosulfan, esfenvalerate, ethiprole, etofenprox, etoxazole, fenothiocarb, fenoxycarb, fenvalerate, fipronil, flonicamid, flubendiamide, flufenoxuron, fluvalinate, formetanate, fosthiazate, hexaflumuron, hydramethylnon, imidacloprid, indoxacarb, lufenuron, metaflumizone, methiocarb, methomyl, methoprene, methoxyfenozide, nitenpyram, nithiazine, novaluron, oxamyl, pymetrozine, pyrethrin, pyridaben, pyridalyl, pyriproxyfen, ryanodine, spinetoram, spinosad, spirodiclofen, spiromesifen, spirotetramat, sulfoxaflor, tebufenozide, tetramethrin, thiacloprid, thiamethoxam, thiodicarb, thiosultap-sodium, tralomethrin, triazamate, triflumuron, *Bacillus thuringiensis* delta-endotoxins, all strains of *Bacillus thuringiensis* and all strains of nuclear polyhedrosis viruses.

Fungicides with which compounds of Formula **1** can be formulated to provide mixtures useful in seed treatment include amisulbrom, azoxystrobin, boscalid, carbendazim, carboxin, cymoxanil, cyproconazole, difenoconazole, dimethomorph, fluazinam, fludioxonil, fluquinconazole, fluopicolide, fluoxastrobin, flutriafol, fluxapyroxad, ipconazole, iprodione, metalaxyl, mefenoxam, metconazole, myclobutanil, paclobutrazole, penflufen, picoxystrobin, prothioconazole, pyraclostrobin, sedaxane, silthiofam, tebuconazole, thiabendazole, thiophanate-methyl, thiram, trifloxystrobin and triticonazole.

Compositions comprising compounds of Formula **1** useful for seed treatment can further comprise bacteria such as *Bacillus pumilus* (e.g., strain GB34) and *Bacillus firmus* (e.g., isolate 1582), rhizobia inoculants/extenders, isoflavonoids and lipo-chitooligosaccharides.

The treated seed typically comprises a compound of the present disclosure in an amount from about 0.1 g to 1 kg per 100 kg of seed (i.e. from about 0.0001 to 1% by weight of the seed before treatment). A flowable suspension formulated for seed treatment typically comprises from about 0.5 to about 70% of the active ingredient, from about 0.5 to about 30% of a film-forming adhesive, from about 0.5 to about 20% of a dispersing agent, from 0 to about 5% of a thickener, from 0 to about 5% of a pigment and/or dye, from 0 to about 2% of an antifoaming agent, from 0 to about 1% of a preservative, and from 0 to about 75% of a volatile liquid diluent.

The compounds of this disclosure can be incorporated into a bait composition that is consumed by an invertebrate pest or used within a device such as a trap, bait station, and the like. Such a bait composition can be in the form of granules which comprise (a) active ingredients, namely a biologically effective amount of a compound of Formula **1**, an *N*-oxide, or salt thereof; (b) one or more food materials; optionally (c) an attractant, and optionally (d) one or more humectants. Of note are granules or bait compositions which comprise between about 0.001-5% active ingredients, about 40-99% food material and/or attractant; and optionally about 0.05-10% humectants, which are effective in controlling soil invertebrate pests at very low application rates, particularly at doses of active ingredient that are lethal by ingestion rather than by direct contact. Some food materials can function both as a food source and an attractant. Food materials include carbohydrates, proteins and lipids. Examples of food materials are vegetable flour, sugar, starches, animal fat, vegetable oil, yeast extracts and milk solids. Examples of attractants are odorants and flavorants, such as fruit or plant extracts, perfume, or other animal or plant component, pheromones or other agents known to attract a target invertebrate pest. Examples of humectants, i.e. moisture retaining agents, are glycols and other polyols, glycerine and sorbitol. Of note is a bait composition (and a method utilizing such a bait composition) used to control at least one invertebrate pest selected from the group consisting of ants, termites and cockroaches. A device for controlling an invertebrate pest can comprise the present bait composition and a housing adapted to receive the bait composition, wherein the housing has at least one opening sized to permit the invertebrate pest to pass through the opening so the invertebrate pest can gain access to the bait composition from a location outside the housing, and wherein the housing is further adapted to be placed in or near a locus of potential or known activity for the invertebrate pest.

The compounds of this disclosure can be applied without other adjuvants, but most often application will be of a formulation comprising one or more active ingredients with suitable carriers, diluents, and surfactants and possibly in combination with a food depending on the contemplated end use. One method of application involves spraying a water dispersion or refined oil solution of a compound of the present disclosure. Combinations with spray oils, spray oil concentrations, spreader stickers, adjuvants, other solvents, and piperonyl butoxide often enhance compound efficacy. For nonagronomic uses such sprays can be applied from spray containers such as a can, a bottle or other container, either by means of a pump or by releasing it from a pressurized container, e.g., a pressurized aerosol spray can. Such spray compositions can take various forms, for example, sprays, mists, foams, fumes or fog. Such spray compositions thus can further comprise propellants, foaming agents, etc. as the case may be. Of note is a spray composition comprising a biologically effective amount of a compound or a composition of the present disclosure and a carrier. One embodiment of such a spray composition comprises a biologically effective amount of a compound or a composition of the present disclosure and a propellant. Representative propellants include, but are not limited to, methane, ethane, propane, butane, isobutane, butene, pentane, isopentane, neopentane, pentene, hydrofluorocarbons, chlorofluorocarbons, dimethyl ether, and mixtures of the foregoing. Of note is a spray composition (and a method utilizing such a spray composition dispensed from a spray container) used to control at least one invertebrate pest selected from the group consisting of mosquitoes, black flies, stable flies, deer flies, horse flies, wasps, yellow jackets, hornets, ticks, spiders, ants, gnats, and the like, including individually or in combinations.

One embodiment of the present disclosure relates to a method for controlling invertebrate pests, comprising diluting the pesticidal composition of the present disclosure (a compound of Formula **1** formulated with surfactants, solid diluents and liquid diluents or a formulated mixture of a compound of Formula **1** and at least one other pesticide) with water, and optionally adding an adjuvant to form a diluted composition, and contacting the invertebrate pest or its environment with an effective amount of said diluted composition.

Although a spray composition formed by diluting with water a sufficient concentration of the present pesticidal composition can provide sufficient efficacy for controlling invertebrate pests, separately formulated adjuvant products can also be added to spray tank mixtures. These additional adjuvants are commonly known as “spray adjuvants” or “tank-mix adjuvants”, and include any substance mixed in a spray tank to improve the performance of a pesticide or alter the physical properties of the spray mixture. Adjuvants can be surfactants, emulsifying agents, petroleum-based crop oils, crop-derived seed oils, acidifiers, buffers, thickeners or defoaming agents. Adjuvants are used to enhancing efficacy (e.g., biological availability, adhesion, penetration, uniformity of coverage and durability of protection), or minimizing or eliminating spray application problems associated with incompatibility, foaming, drift, evaporation, volatilization and degradation. To obtain optimal performance, adjuvants are selected with regard to the properties of the active ingredient, formulation and target (e.g., crops, insect pests).

Among the spray adjuvants, oils including crop oils, crop oil concentrates, vegetable oil concentrates and methylated seed oil concentrates are most commonly used to improve the efficacy of pesticides, possibly by means of promoting more even and uniform spray deposits. In situations where phytotoxicity potentially caused by oils or other water-immiscible liquids are of concern, spray compositions prepared from the composition of the present disclosure will generally not contain oil-based spray adjuvants. However, in situations where phytotoxicity caused by oil-based spray adjuvants is commercially insignificant, spray compositions prepared from the composition of the present composition can also contain oil-based spray adjuvants, which can potentially further increase control of invertebrate pests, as well as rainfastness.

Products identified as “crop oil” typically contain 95 to 98% paraffin or naphtha-based petroleum oil and 1 to 2% of one or more surfactants functioning as emulsifiers. Products identified as “crop oil concentrates” typically consist of 80 to 85% of emulsifiable petroleum-based oil and 15 to 20% of nonionic surfactants. Products correctly identified as “vegetable oil concentrates” typically consist of 80 to 85% of vegetable oil (i.e. seed or fruit oil, most commonly from cotton, linseed, soybean or sunflower) and 15 to 20% of nonionic surfactants. Adjuvant performance can be improved by replacing the vegetable oil with methyl esters of fatty acids that are typically derived from vegetable oils. Examples of methylated seed oil concentrates include MSO® Concentrate (UAP-Loveland Products, Inc.) and Premium MSO Methylated Spray Oil (Helena Chemical Company).

The amount of adjuvants added to spray mixtures generally does not exceed about 2.5% by volume, and more typically the amount is from about 0.1 to about 1% by volume. The application rates of adjuvants added to spray mixtures are typically between about 1 to 5 L per hectare. Representative examples of spray adjuvants include: Adigor® (Syngenta) 47% methylated rapeseed oil in liquid hydrocarbons, Silwet® (Helena Chemical Company) polyalkyleneoxide modified heptamethyltrisiloxane and Assist® (BASF) 17% surfactant blend in 83% paraffin based mineral oil.

Nonagronomic applications include protecting an animal, particularly a vertebrate, more particularly a homeothermic vertebrate (e.g., mammal or bird) and most particularly a mammal, from an invertebrate parasitic pest by administering a parasiticidally effective (i.e. biologically effective) amount of a compound of the disclosure, typically in the form of a composition formulated for veterinary use, to the animal to be protected. Therefore of note is a method for protecting an animal comprising administering to the animal a parasiticidally effective amount of a compound of the disclosure. As referred to in the present disclosure and claims, the terms “parasiticidal” and “parasiticidally” refers to observable effects on an invertebrate parasite pest to provide protection of an animal from the pest. Parasiticidal effects typically relate to diminishing the occurrence or activity of the target invertebrate parasitic pest. Such effects on the pest include necrosis, death, retarded growth, diminished mobility or lessened ability to remain on or in the host animal, reduced feeding and inhibition of reproduction. These effects on invertebrate parasite pests provide control (including prevention, reduction or elimination) of parasitic infestation or infection of the animal. Examples of invertebrate parasitic pests controlled by administering a parasiticidally effective amount of a compound of the disclosure to an animal to be protected include ectoparasites (arthropods, acarines, etc) and endoparasites (helminths, e.g., nematodes, trematodes, cestodes, acanthocephalans, etc.). In particular, the compounds of this disclosure are effective against ectoparasites including: flies such as *Haematobia (Lyperosia) irritans* (horn fly), *Stomoxys calcitrans* (stable fly), *Simulium* spp. (blackfly), *Glossina* spp. (tsetse flies), *Hydrotaea irritans* (head fly), *Musca autumnalis* (face fly), *Musca domestica* (house fly), *Morellia simplex* (sweat fly), *Tabanus* spp. (horse fly), *Hypoderma bovis*, *Hypoderma lineatum*, *Lucilia sericata*, *Lucilia cuprina* (green blowfly), *Calliphora* spp. (blowfly), *Protophormia* spp., *Oestrus ovis* (nasal botfly), *Culicoides* spp. (midges), *Hippobosca equine*, *Gastrophilus instestinalis*, *Gastrophilus haemorrhoidalis* and *Gastrophilus naslis*; lice such as *Bovicola (Damalinia) bovis*, *Bovicola equi*, *Haematopinus asini*, *Felicola subrostratus*, *Heterodoxus spiniger*, *Lignonathus setosus* and *Trichodectes canis*; keds such as *Melophagus ovinus*; mites such as *Psoroptes* spp., *Sarcoptes scabei*, *Chorioptes bovis*, *Demodex equi*, *Cheyletiella* spp., *Notoedres cati*, *Trombicula* spp. and *Otodectes cyanotis* (ear mites); ticks such as *Ixodes* spp., *Boophilus* spp., *Rhipicephalus* spp., *Amblyomma* spp., *Dermacentor* spp., *Hyalomma* spp. and *Haemaphysalis* spp.; and fleas such as *Ctenocephalides felis* (cat flea) and *Ctenocephalides canis* (dog flea).

Nonagronomic applications in the veterinary sector are by conventional means such as by enteral administration in the form of, for example, tablets, capsules, drinks, drenching preparations, granulates, pastes, boli, feed-through procedures, or suppositories; or by parenteral administration, such as by injection (including intramuscular, subcutaneous, intravenous, intraperitoneal) or implants; by nasal administration; by topical administration, for example, in the form of immersion or dipping, spraying, washing, coating with powder, or application to a small area of the animal, and through articles such as neck collars, ear tags, tail bands, limb bands or halters which comprise compounds or compositions of the present disclosure.

Typically a parasiticidal composition according to the present disclosure comprises a mixture of a compound of Formula **1**, an *N*-oxide or a salt thereof, with one or more pharmaceutically or veterinarily acceptable carriers comprising excipients and auxiliaries selected with regard to the intended route of administration (e.g., oral, topical or parenteral administration such as injection) and in accordance with standard practice. In addition, a suitable carrier is selected on the basis of compatibility with the one or more active ingredients in the composition, including such considerations as stability relative to pH and moisture content. Therefore of note is a composition for protecting an animal from an invertebrate parasitic pest comprising a parasitically effective amount of a compound of the disclosure and at least one carrier.

For parenteral administration including intravenous, intramuscular and subcutaneous injection, a compound of the present disclosure can be formulated in suspension, solution or emulsion in oily or aqueous vehicles, and may contain adjuncts such as suspending, stabilizing and/or dispersing agents. Pharmaceutical compositions for injection include aqueous solutions of water-soluble forms of active ingredients (e.g., a salt of an active compound), preferably in physiologically compatible buffers containing other excipients or auxiliaries as are known in the art of pharmaceutical formulation.

For oral administration in the form of solutions (the most readily available form for absorption), emulsions, suspensions, pastes, gels, capsules, tablets, boluses powders, granules, rumen-retention and feed/water/lick blocks, a compound of the present disclosure can be formulated with binders/fillers known in the art to be suitable for oral administration compositions, such as sugars (e.g., lactose, sucrose, mannitol, sorbitol), starch (e.g., maize starch, wheat starch, rice starch, potato starch), cellulose and derivatives (e.g., methylcellulose, carboxymethylcellulose, ethylhydroxycellulose), protein derivatives (e.g., zein, gelatin), and synthetic polymers (e.g., polyvinyl alcohol, polyvinylpyrrolidone). If desired, lubricants (e.g., magnesium stearate), disintegrating agents (e.g., cross-linked polyvinylpyrrolidinone, agar, alginic acid) and dyes or pigments can be added. Pastes and gels often also contain adhesives (e.g., acacia, alginic acid, bentonite, cellulose, xanthan gum, colloidal magnesium aluminum silicate) to aid in keeping the composition in contact with the oral cavity and not being easily ejected.

If the parasiticidal compositions are in the form of feed concentrates, the carrier is typically selected from high-performance feed, feed cereals or protein concentrates. Such feed concentrate-containing compositions can, in addition to the parasiticidal active ingredients, comprise additives promoting animal health or growth, improving quality of meat from animals for slaughter or otherwise useful to animal husbandry. These additives can include, for example, vitamins, antibiotics, chemotherapeutics, bacteriostats, fungistats, coccidiostats and hormones.

Compounds of the present disclosure have been discovered to have favorable pharmacokinetic and pharmacodynamic properties providing systemic availability from oral administration and ingestion. Therefore after ingestion by the animal to be protected, parasiticidally effective concentrations of compounds of the disclosure in the bloodstream protect the treated animal from blood-sucking pests such as fleas, ticks and lice. Therefore of note is a composition for protecting an animal from an invertebrate parasite pest in a form for oral administration (i.e. comprising, in addition to a parasiticidally effective amount of a compound of the disclosure, one or more carriers selected from binders and fillers suitable for oral administration and feed concentrate carriers).

Formulations for topical administration are typically in the form of a powder, cream, suspension, spray, emulsion, foam, paste, aerosol, ointment, salve or gel. More typically a topical formulation is a water-soluble solution, which can be in the form of a concentrate that is diluted before use. Parasiticidal compositions suitable for topical administration typically comprise a compound of the present disclosure and one or more topically suitable carriers. In applications of a parasiticidal composition topically to the exterior of an animal as a line or spot (i.e. “spot-on” treatment), the active ingredient migrates over the surface of the animal to cover most or all of its external surface area. As a result, the treated animal is particularly protected from invertebrate pests that feed off the epidermis of the animal such as ticks, fleas and lice. Therefore formulations for topical localized administration often comprise at least one organic solvent to facilitate transport of the active ingredient over the skin and/or penetration into the epidermis of the animal. Solvents commonly used as carriers in such formulations include propylene glycol, paraffins, aromatics, esters such as isopropyl myristate, glycol ethers, and alcohols such as ethanol and *n*-propanol.

The rate of application required for effective control (i.e. "biologically effective amount") will depend on such factors as the species of invertebrate to be controlled, the pest's life cycle, life stage, its size, location, time of year, host crop or animal, feeding behavior, mating behavior, ambient moisture, temperature, and the like. Under normal circumstances, application rates of about 0.01 to 2 kg of active ingredients per hectare are sufficient to control pests in agronomic ecosystems, but as little as 0.0001 kg/hectare may be sufficient or as much as 8 kg/hectare may be required. For nonagronomic applications, effective use rates will range from about 1.0 to 50 mg/square meter but as little as 0.1 mg/square meter may be sufficient or as much as 150 mg/square meter may be required. One skilled in the art can easily determine the biologically effective amount necessary for the desired level of invertebrate pest control.

In general for veterinary use, a compound of Formula **1**, an *N*-oxide or a salt thereof, is administered in a parasiticidally effective amount to an animal to be protected from invertebrate parasite pests. A parasiticidally effective amount is the amount of active ingredient needed to achieve an observable effect diminishing the occurrence or activity of the target invertebrate parasite pest. One skilled in the art will appreciate that the parasitically effective dose can vary for the various compounds and compositions of the present disclosure, the desired parasitical effect and duration, the target invertebrate pest species, the animal to be protected, the mode of application and the like, and the amount needed to achieve a particular result can be determined through simple experimentation.

For oral administration to homeothermic animals, the daily dosage of a compound of the present disclosure typically ranges from about 0.01 mg/kg to about 100 mg/kg, more typically from about 0.5 mg/kg to about 100 mg/kg, of animal body weight. For topical (e.g., dermal) administration, dips and sprays typically contain from about 0.5 ppm to about 5000 ppm, more typically from about 1 ppm to about 3000 ppm, of a compound of the present disclosure.

Recent advances in the processing power of computers have afforded scientists unprecedented opportunities to leverage in silico tools to predict and investigate potential adverse outcomes associated with xenobiotic exposures, along with the molecular bases for these events. While current computational models cannot solely be used to replace all in vivo or in vitro experimental approaches, they nevertheless provide valuable tools to generate hypotheses, flag compounds of interest, and help prioritize and align chemicals to appropriate *in vitro* or *in vivo* studies.

Computational/predictive toxicology is a rapidly developing discipline that integrates information and data from a variety of sources to develop mathematical and computer-based models to better understand and predict interactions of chemical agents and biological organisms across many scales (e.g., population, individual, cellular, and molecular) and can be considered to encompass two broad areas:

(1) Development and application of 2-dimensional (2D) models via first principles (e.g., structural motifs that drive facile chemical reactivity (Wijeyesakere, S.J. *et al.*cDevelopment

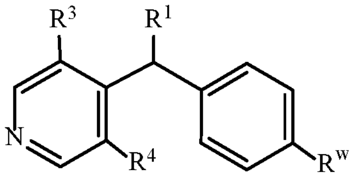
of a Profiler for Facile Chemical Reactivity Using the Open-Source Konstanz Information Miner. *Appl. Vitr. Toxicol.*, **4**, 202–213, 2018). Additionally, to predict the dosimetry for a biological outcome of interest, quantitative structure-activity relationship techniques (QSAR) such as tend-analysis can be undertaken if experimental data from analogous molecules is available (e.g. prediction of the cholinergic potential of a series of related organophosphorus compounds (Makhaeva, G.F. *et al.* Esterase profiles of organophosphorus compounds in vitro predict their behavior in vivo. *Chem. Biol. Interact.*, **259**, 332–342, 2016). Makhaeva, G.F. *et al.* Kinetics and mechanism of inhibition of serine esterases by fluorinated carbethoxy 1-aminophosphonates. *Dokl. Biochem. Biophys.*, **451**, 203–206, 2013).

(2) Use of "big data" approaches that curate all available information on a particular outcome/mode of action (e.g., predictive models to identify mitochondrial inhibitors (Wijeyesakere, S.J. *et al.* Hybrid Machine-Learning/SMARTS Profiling Model for Mitochondrial Inhibition. *Appl. Vitr. Toxicol.*, **5**, 196–204, 2019) or those that can interact with defined neuronal receptors (Wijeyesakere, S.J. *et al.* Prediction of cholinergic compounds by machine-learning. *Comput. Toxicol.*, **13**, 100119, 2020); and extension of these 2D assessments to encompass 3D techniques such as docking and molecular dynamics (MD) simulations to further investigate the molecular basis for interactions between toxicants and known/putative biological targets (Wang, Y. *et al.* Mixed inhibition of adenosine deaminase activity by 1,3-dinitrobenzene: A Model for understanding cell-selective neurotoxicity in chemically-induced energy deprivation syndromes in brain. *Toxicol. Sci.*, **125**, 509–521, 2012; Gonzalez, T.L. *et al.* Metabolites of n-Butylparaben and iso-Butylparaben Exhibit Estrogenic Properties in MCF-7 and T47D Human Breast Cancer Cell Lines. *Toxicol. Sci.*, **164**, 50–59018, 2018).

Specific compounds of Formula **1** prepared by the methods and variations as described in preceding Schemes 1-11 and Synthesis Examples 1-2, are shown in the Index Tables A and B below. See Index Table C for ^{1}H NMR data. For mass spectral (MS) data, the numerical value reported is the molecular weight of the highest isotopic abundance parent ion (M+1) formed by addition of H^+ (molecular weight of 1) to the molecule, observed by mass spectrometry using atmospheric pressure chemical ionization (AP^+). Melting point data (MP) is reported as a temperature range. The alternate molecular ion peaks (e.g., M+2 or M+4) that occur with compounds containing multiple halogens are not reported.

The following abbreviations are used in the Index Tables which follow: Cmpd means Compound, *t* is tertiary, *c* is cyclo, Me is methyl, Et is ethyl, Pr is propyl, *i*-Pr is isopropyl, Bu is butyl, *c*-Pr is cyclopropyl, *c*-Pn is cyclopentyl, *c*-Hx is cyclohexyl, *t*-Bu is *tertiary*-butyl, Ph is phenyl, OMe is methoxy, SMe is methylthio, and SO_2Me means methylsulfonyl. A wavy line in a structure fragment denotes the attachment point of the fragment to the remainder of the molecule. The abbreviation “Ex.” stands for “Example” and is followed by a number indicating in which Synthesis Example the compound is prepared.

INDEX TABLE A

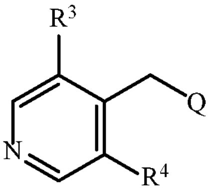


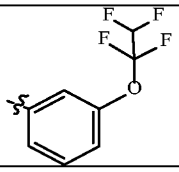
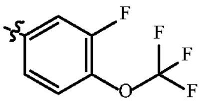
Cmpd. No.	R1	R3	R4	Rw	m.p. (°C)	MS data
1	H	F	2*H*-1,2,3-triazol-2-yl	OCF$_3$	57-60	339.3
2	H	F	2*H*-1,2,3-triazol-2-yl	SCF$_3$	88-91	355.3
3	H	F	4-methyl-2*H*-1,2,3-triazol-2-yl	OCF$_3$		353.4
4	H	F	2*H*-1,2,3-triazol-2-yl	OCF$_2$CHFCF$_3$		421.4
5	H	Cl	2*H*-1,2,3-triazol-2-yl	SCF$_3$		371.2
6	H	Cl	1*H*-1,2,3-triazol-1-yl	SCF$_3$		371.2
7	CH$_2$CH=CH$_2$	F	2*H*-1,2,3-triazol-2-yl	SCF$_3$		395.4
8	Me	F	2*H*-1,2,3-triazol-2-yl	SCF$_3$		369.3
9	Me	F	2*H*-1,2,3-triazol-2-yl	OCF$_3$		353.3
10	CH$_2$CH=CH$_2$	F	2*H*-1,2,3-triazol-2-yl	OCF$_3$		379.4
11	Me	F	1*H*-1,2,3-triazol-1-yl	SCF$_3$		369.3
12	H	Cl	2H-1,2,3-triazol-2-yl	OCF3	53-56	
13	Me	Cl	1H-pyrazol-1-yl	OCF3		384.2
14	Me	Cl	2H-1,2,3-triazol-2-yl	SCF3	92-95	
15	H	Br	2H-1,2,3-triazol-2-yl	OCF3	63-66	
16	H	H	2H-1,2,3-triazol-2-yl	OCF3		321.2
17	H	I	2H-1,2,3-triazol-2-yl	OCF3	66-69	
18	H	F	2H-1,2,3-triazol-2-yl	SOCF3		371.3
19	H	F	1H-pyrazol-1-yl	SCF3		354.2
20	H	Cl	1H-pyrazol-1-yl	SCF3		370.2
21	H	Cl	1,2,4-triazol-1-yl	SCF3		371.3

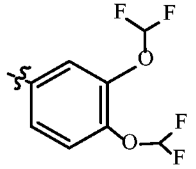
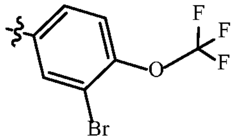
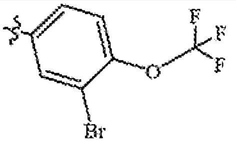
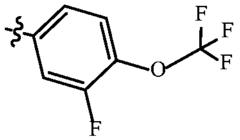
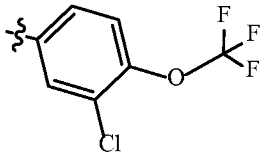
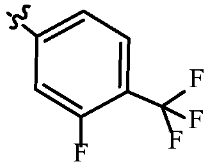
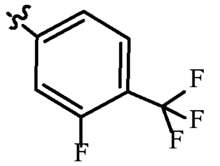
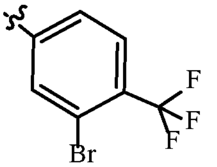
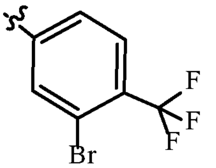
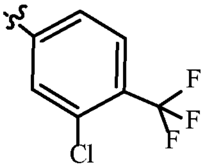
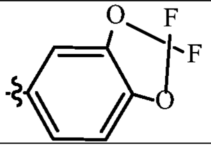
22	H	Cl	2H-1,2,3-triazol-2-yl	SOCF3	86-89	
23	H	H	2H-1,2,3-triazol-2-yl	SCF3	75-78	
24	H	F	1,2,4-triazol-1-yl	SCF3		355.3
25	H	F	3-trifluoromethyl)pyrazol-1-yl	SCF3		422.2
26	H	Br	2H-1,2,3-triazol-2-yl	SCF3	82-85	
27	H	F	2H-1,2,3-triazol-2-yl	OCF2CF2H		371.3
28	H	H	2H-1,2,3-triazol-2-yl	SOCF3	81-84	
29	H	F	1H-pyrazol-1-yl	OCF2CF2H		370.2
30	H	F	1,3-oxazol-2-yl	SCF3	114-117	
31	H	F	2H-1,2,3-triazol-2-yl	Br	80-83	
32	H	Cl	1H-pyrazol-1-yl	OCF2CF2H		386.4
33	H	Cl	2H-1,2,3-triazol-2-yl	OCF2CF2H		387.4
34	H	F	3-methyl-1,2,4-oxadiazol-5-yl	SCF3	111-114	
35	H	Cl	1,3-thiazole-2-yl	SCF3	56-59	
36	H	Cl	3-methyl-1,2,4-oxadiazol-5-yl	SCF3	105-108	
37	H	Cl	1,3-oxazol-2-yl	SCF3		371.3
38	H	F	2H-1,2,3-triazol-2-yl	OCF2CF3		355.3
39	H	F	3-methyl-1,2,4-oxadiazol-5-yl	OCF3	86-89	
40	H	F	1,3-thiazol-2-yl	OCF3		355.2
41	H	F	1,3-oxazol-2-yl	OCF3	63-66	
42	H	Cl	1,3-thiazol-2-yl	OCF3		371.1
43	H	Cl	1,3-oxazol-2-yl	OCF3		355.1
44	H	Cl	2H-1,2,3-triazol-2-yl	OCF2CF3		405.0
45	H	Cl	1H-pyrazol-1-yl	OCF2H		336.1
46	H	Cl	2H-1,2,3-triazol-2-yl	OCF2H		337.2
47	H	Cl	1H-1,2,3-triazol-1-yl	OCF2H		337.2
48	H	Cl	3-methyl-1,2,4-oxadiazol-5-yl	OCF3	89-92	
49	H	F	2H-1,2,3-triazol-2-yl	CF2CF3		373.2
50	Me	F	1H-pyrazol-1-yl	SCF3		368.3

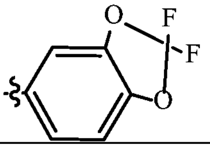
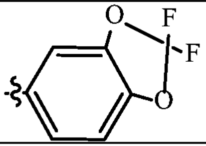
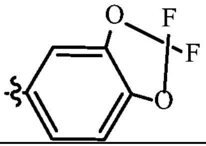
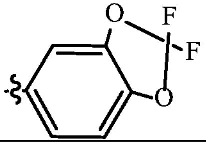
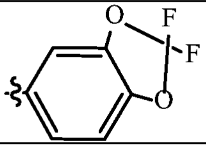
51	Me	Cl	1,2,4-triazol-1-yl	SCF3		385.3
52	Me	F	1,2,4-triazol-1-yl	SCF3		369.2
53	Me	F	3-methyl-1,2,4-oxadiazol-5-yl	SCF3		384.3
54	Me	F	1,3-thiazol-2-yl	SCF3		385.3
55	Me	Cl	1,3-thizaol-2-yl	SCF3		401.2
56	Me	Cl	3-methyl-1,2,4-oxadiazol-5-yl	SCF3		400.3
57	CH2CH3	F	2H-1,2,3-triazol-2-yl	SCF3		383
58	CH2CH3	F	2H-1,2,3-triazol-2-yl	SCF3		383
59	CH(CH3)2	F	2H-1,2,3-triazol-2-yl	SCF3		397
60	CH2CH3	F	2H-1,2,3-triazol-2-yl	OCF3		367
61	CH(CH3)2	F	2H-1,2,3-triazol-2-yl	OCF3		381
62	Me	F	3-methyl-1,2,4-oxadiazol-5-yl	OCF3		368.3
63	Me	F	1,3-thiazol-2-yl	OCF3		369.3
64	Me	Cl	1,3-thiazol-2-yl	OCF3		385.1

INDEX TABLE B



Cmpd. No.	R3	R4	Q	m.p. (°C)	MS data
65	2H-1,2,3-triazol-2-yl	F			371.3
66	2H-1,2,3-triazol-2-yl	F			357.3

67	2H-1,2,3-triazol-2-yl	F			387.3
68	2H-1,2,3-triazol-2-yl	Cl			433.2
69	2H-1,2,3-triazol-2-yl	F			417.2
70	2H-1,2,3-triazol-2-yl	Cl		53-56	
71	2H-1,2,3-triazol-2-yl	Cl			389.3
72	2H-1,2,3-triazol-2-yl	Cl		86-89	
73	2H-1,2,3-triazol-2-yl	F		52-55	
74	2H-1,2,3-triazol-2-yl	Cl			416.9
75	2H-1,2,3-triazol-2-yl	F			401.1
76	2H-1,2,3-triazol-2-yl	F			357.2
77	1H-pyrazol-1yl	F			334.3

78	2H-1,2,3-triazol-2-yl	Cl		97-100	351.3
79	1H-pyrazol-1yl	Cl			350.3
80	2H-1,2,3-triazol-2-yl	F			335.3
81	1H-1,2,3-triazol-1-yl	Cl			351.3
82	1H-1,2,3-triazol-1-yl	F			335.3

The following Tests demonstrate the control efficacy of compounds of this disclosure on specific pests. “Control efficacy” represents inhibition of invertebrate pest development (including mortality) that causes significantly reduced feeding. The pest control protection afforded by the compounds is not limited, however, to these species. See Index Tables A and B for compound descriptions.

BIOLOGICAL EXAMPLES

Formulation and Spray Methodology for Tests A-G

Test compounds were formulated using a solution containing 10% acetone, 90% water and 300 ppm Activator 90® non-ionic surfactant (Loveland Products, Loveland, Colorado, USA). The formulated compounds were applied in 1 mL of liquid through an atomizer nozzle positioned 1.27 cm (0.5 inches) above the top of each test unit. Test compounds were sprayed at the rates indicated, and each test was replicated three times.

Test A

For evaluating control of corn planthopper (*Peregrinus maidis* (Ashmead)) through contact and/or systemic means, the test unit consisted of a small open container with a 3–4-day-old corn (maize) plant inside. White sand was added to the top of the soil prior to application of the test compound.

Test compounds were formulated and sprayed at 250 and/or 50 ppm and/or 10ppm. After spraying of the formulated test compound, the test units were allowed to dry for 1 h before they were post-infested with ~15–20 nymphs (18-to-21-day-old). A black, screened cap was placed on the top of each test unit, and the test units were held for 6 days in a growth chamber at 22–24 °C and 50–70% relative humidity. Each test unit was then visually assessed for insect mortality.

Of the compounds of Formula **1** tested at 50 ppm, the following resulted in at least 80% mortality: 1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 16, 18, 20, 23, 26, 27, 29, 30, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 45, 46, 50, 51, 52, 53, 54, 56, 57, 60, 62, 63, 65, 66, 68, 69, 70, 71, 72, 73, 77.

Of the compounds of Formula **1** tested at 10 ppm, the following resulted in at least 80% mortality: 1, 2, 3, 4, 5, 8, 9, 12, 19, 20, 23, 26, 27, 29, 30, 32, 33, 38, 39, 40, 41, 45, 46, 53, 54, 57, 62, 63, 66, 68, 69, 70, 71, 72, 73, 77.

Test B

For evaluating control of potato leafhopper (*Empoasca fabae* (Harris)) through contact and/or systemic means, the test unit consisted of a small open container with a 5–6-day-old Soleil bean plant (primary leaves emerged) inside. White sand was added to the top of the soil, and one of the primary leaves was excised prior to application of the test compound.

Test compounds were formulated and sprayed at 250 ppm. After spraying of the formulated test compound, the test units were allowed to dry for 1 hour before they were post-infested with 5 potato leafhoppers (18-to-21-day-old adults). A black, screened cap was placed on the top of the test unit, and the test units were held for 6 days in a growth chamber at 20 °C and 70% relative humidity. Each test unit was then visually assessed for insect mortality.

Of the compounds of Formula **1** tested at 50 ppm, the following resulted in at least 80% mortality: 3

Test C

For evaluating control of green peach aphid (*Myzus persicae* (Sulzer)) through contact and/or systemic means, the test unit consisted of a small open container with a 12–15-day-old radish plant inside. This was pre-infested by placing on a leaf of the test plant 30–40 aphids on a piece of leaf excised from a culture plant (cut-leaf method). The aphids moved onto the test plant as the leaf piece desiccated. After pre-infestation, the soil of the test unit was covered with a layer of sand.

Test compounds were formulated and sprayed at 250 and/or 50 ppm. After spraying of the formulated test compound, each test unit was allowed to dry for 1 hour and then a black, screened cap was placed on top. The test units were held for 6 days in a growth chamber at 19–21 °C and 50–70% relative humidity. Each test unit was then visually assessed for insect mortality.

Of the compounds of Formula **1** tested at 50 ppm, the following resulted in at least 80% mortality: 1, 2, 5, 8, 9, 12, 14, 15, 18, 19, 20, 21, 22, 23, 24, 26, 33, 38, 51 ,52, 63, 68, 69, 70, 71, 72.

Of the compounds of Formula **1** tested at 10 ppm, the following resulted in at least 80% mortality: 2, 5, 21, 24, 26, 70.

Test D

For evaluating control of cotton melon aphid (*Aphis gossypii* (Glover)) through contact and/or systemic means, the test unit consisted of a small open container with a 5-day-old okra plant inside. This was pre-infested with 30–40 insects on a piece of leaf according to the cut-leaf method, and the soil of the test unit was covered with a layer of sand.

Test compounds were formulated and sprayed at 250 and/or 50 ppm. After spraying, the test units were maintained in a growth chamber for 6 days at 19 °C and 70% relative humidity. Each test unit was then visually assessed for insect mortality.

Of the compounds of Formula **1** tested at 50 ppm, the following resulted in at least 80% mortality: 2, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 26, 27, 29, 30, 33, 35, 38, 40, 41, 45, 46, 50, 51, 52, 54, 57, 60, 63, 65, 66, 69, 70, 71, 72, 73, 77.

Of the compounds of Formula **1** tested at 10 ppm, the following resulted in at least 80% mortality: 2, 8, 9, 16, 19, 20, 26, 27, 30, 40, 41, 63, 66, 70, 73.

Test E

For evaluating control of the sweetpotato whitefly (*Bemisia tabaci* (Gennadius)) through contact and/or systemic means, the test unit consisted of a small open container with a 12–14-day-old cotton plant inside. Prior to the spray application, both cotyledons were removed from the plant, leaving one true leaf for the assay. Adult whiteflies were allowed to lay eggs on the plant and then were removed from the test unit. Cotton plants infested with at least 15 eggs were submitted to the test for spraying.

Test compounds were formulated and sprayed at 250 and/or 50 ppm. After spraying, the test units were allowed to dry for 1 hour. The cylinders were then removed, and the units were taken to a growth chamber and held for 13 days at 28 °C and 50–70% relative humidity. Each test unit was then visually assessed for insect mortality.

Of the compounds of Formula **1** tested at 50 ppm, the following resulted in at least 70% mortality: 1, 4, 5, 6, 9, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 26, 27, 33, 35, 38, 40, 45, 46, 51, 52, 54, 56, 57, 60, 63, 66, 68, 69, 71, 72, 77.

Of the compounds of Formula **1** tested at 10 ppm, the following resulted in at least 70% mortality: 5, 19, 20, 21, 26, 27, 33, 40, 46, 57, 60, 68, 71.

TEST F

For evaluating control of Brown Planthopper (Nilaparvata lugens (Stål)) through contact and/or systemic means, the test unit consisted of a small open container with 6-10 25-day-old rice stems inside. White sand was added to the top of the soil prior to application of the test compound.

Test compounds were formulated and sprayed at 50 ppm and/or 10ppm. After spraying of the formulated test compound, the test units were allowed to dry for 1 h before they were post-infested with ~15–20 nymphs (15-to-17-day-old). A black, screened cap was placed on the top of each test unit, and the test units were held for 5 days in a growth chamber at 28°C and 65% relative humidity. Each test unit was then visually assessed for insect mortality.

Of the compounds of Formula **1** tested at 10 ppm, the following resulted in at least 80% mortality: 1, 2, 5, 8, 19, 20, 26, 77.

Test G

For evaluating control of diamondback moth (*Plutella xylostella* (L.)) the test unit consisted of a small open container with a 12–14-day-old mustard plant inside. This was pre-infested with ~50 neonate larvae that were dispensed into the test unit via corn cob grits using an inoculator. The larvae moved onto the test plant after being dispensed into the test unit.

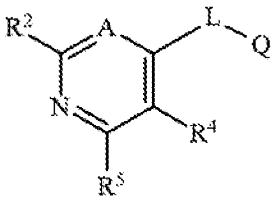
Test compounds were formulated and sprayed at 250 ppm. After spraying of the formulated test compound, each test unit was allowed to dry for 1 hour and then a black, screened cap was placed on top. The test units were held for 6 days in a growth chamber at 25 °C and 70% relative humidity. Plant feeding damage was then visually assessed based on foliage consumed, and larvae were assessed for mortality.

Of the compounds of Formula **1** tested at 50 ppm, the following provided very good to excellent levels of control efficacy (40% or less feeding damage and/or 100% mortality): 11, 15, 25, 68, 70.

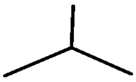
CLAIMS

What is claimed is:

1. A compound selected from Formula **1**, an *N*-oxides or salt thereof,



wherein

L is 

wherein the bond projecting to the left is bonded to the aromatic ring containing A and the bond projecting to the right is bonded to Q;

R^1 is H, CN, $OCOR^6$, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, C_1-C_6 haloalkyl, C_3–C_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_3–C_5 cycloalkylalkyl or C_3–C_5 halocycloalkylalkyl;

A is N or CR^3;

R^2 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl, C_3–C_4 halocycloalkyl, C_1-C_4 alkoxy or C_1–C_4 haloalkoxy;

R^3 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl, C_3–C_4 halocycloalkyl, C_1–C_4 alkoxy or C_1–C_4 haloalkoxy;

R^4 is a 5- to 6-membered heterocyclic ring, each ring containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, wherein up to 2 ring members are independently selected from C(=O), C(=S), S(=O) and $S(=O)_2$, each ring optionally substituted with up to 5 substituents independently selected from R^v, and r is the number of the substituents.

each R^v is independently H, cyano, halogen, C_1-C_6 alkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_1-C_6 haloalkyl, C_2-C_6 alkenyl, C_2-C_6 haloalkenyl, C_2-C_6 alkynyl, C_2-C_6 haloalkynyl, C_3-C_6 cycloalkyl, C_3-C_6 halocycloalkyl, C_2-C_6 cyanoalkyl, C_1-C_6 hydroxyalkyl, C_4-C_{10} alkylcycloalkyl, C_4-C_{10} cycloalkylalkyl, C_3-C_6 cycloalkenyl, C_3-C_6 halocycloalkenyl, C_2-C_6 alkoxyalkyl, C_4-C_{10} cycloalkoxyalkyl, C_3-C_{10} alkoxyalkoxyalkyl, C_2-C_6 alkylthioalkyl, C_2-C_6 alkylsulfinylalkyl, C_3-C_6 cycloalkoxy, C_3-C_6 halocycloalkoxy, C_4-C_{10} cycloalkylalkoxy, C_2-C_6 alkenyloxy, C_2-C_6 haloalkenyloxy, C_2-C_6 alkoxyalkoxy, C_2-C_6 alkylcarbonyloxy, C_1-C_6 alkylthio, C_1-C_6 haloalkylthio,

C_3-C_6 cycloalkylthio, C_1-C_6 alkylsulfinyl, C_1-C_6 haloalkylsulfinyl, C_1-C_6 alkylsulfonyl, C_1-C_6 haloalkylsulfonyl, C_3-C_6 cycloalkylsulfonyl, C_1-C_6 alkylamino, C_2-C_6 dialkylamino, C_1-C_6 haloalkylamino, C_2-C_6 halodialkylamino or C_3-C_6 cycloalkylamino;

r is 1, 2, 3, 4 or 5;

R^5 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl, C_3–C_4 halocycloalkyl, C_1–C_4 alkoxy or C_1–C_4 haloalkoxy;

R^6 is C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl or C_3–C_4 halocycloalkyl;

Q is a five or six membered aromatic ring containing ring members selected from carbon atoms and up to 1 oxygen atom, 1 sulfur atom, 2 nitrogen atoms, each ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w; and s is the number of the substituents; two R^w on adjacent carbon atoms together can form a 5-membered or 6-membered ring, such as $-OCF_2O-$, $-OCH_2O-$, $-OCF_2S-$, $-OCH_2CH_2-$, OCF_2CF_2O-, $-OCR^5{=}N-$, $-SCR^5{=}N-$, $-CH{=}CR^5-CH{=}CH-$, or$-CH{=}N-CR^5{=}CH-$;

R^W is independently H, cyano, halogen, SF_5, SCl, SO_2Cl, SO_2F, C_1-C_6 alkyl, C_1-C_6 haloalkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_2-C_6 alkenyl, C_2-C_6 haloalkenyl, C_2-C_6 alkynyl, C_2-C_6 haloalkynyl, C_3-C_6 cycloalkyl, C_3-C_6 halocycloalkyl, C_2-C_6 cyanoalkyl, C_1-C_6 hydroxyalkyl, C_4-C_{10} alkylcycloalkyl, C_4-C_{10} cycloalkylalkyl, C_3-C_6 cycloalkenyl, C_3-C_6 halocycloalkenyl, C_2-C_6 alkoxyalkyl, C_4-C_{10} cycloalkoxyalkyl, C_3-C_{10} alkoxyalkoxyalkyl, C_2-C_6 alkylthioalkyl, C_2-C_6 alkylsulfinylalkyl, C_1-C_6 alkoxy, C_1-C_6 haloalkoxy, C_3-C_6 cycloalkoxy, C_3-C_6 halocycloalkoxy, C_4-C_{10} cycloalkylalkoxy, C_2-C_6 alkenyloxy, C_2-C_6 haloalkenyloxy, C_2-C_6 alkoxyalkoxy, C_2-C_6 alkylcarbonyloxy, C_1-C_6 alkylthio, C_1-C_6 haloalkylthio, C_3-C_6 cycloalkylthio, C_1-C_6 alkylsulfinyl, C_1-C_6 haloalkylsulfinyl, C_3-C_6 cycloalkylsulfinyl, C_1-C_6 alkylsulfonyl, C_1-C_6 haloalkylsulfonyl, C_3-C_6 cycloalkylsulfonyl, C_1-C_6 alkylamino, C_2-C_6 dialkylamino, C_1-C_6 haloalkylamino, C_2-C_6 halodialkylamino or C_3-C_6 cycloalkylamino;

s is 1, 2, 3, 4 or 5;

n is 0, 1 or 2.

2. The compound of Claim 1 wherein:

wherein

R^1 is H;

A is CR^3;

R^2 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl, C_3–C_4 halocycloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;

R^3 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl, C_3–C_4 halocycloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;

R^4 is a 5- to 6-membered heterocyclic ring, each ring containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, wherein up to 2 ring members are independently selected from C(=O), C(=S), S(=O) and S(=O)2, each ring or ring system optionally substituted with up to 5 substituents independently selected from Rv, and r is the number of the substituents.

each R^v is independently H, halogen, C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_1–C_6 alkoxy or C_1–C_6 haloalkoxy;

r is 1, 2, 3, 4 or 5;

R^5 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl, C_3–C_4 halocycloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;

Q is a six membered aromatic ring with 0 to 2 N on the ring, each ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w;

R^w is independently cyano, halogen, C_1–C_6 alkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_1-C_6 haloalkyl, C_2-C_6 alkenyl, C_2-C_6 haloalkenyl, C_2-C_6 alkynyl, C_2-C_6 haloalkynyl, C_1-C_6 alkylthio, C_1-C_6 haloalkylthio, C_1-C_6 alkylsulfinyl, C_1-C_6 haloalkylsulfinyl, C_1-C_6 alkylsulfonyl or C_1-C_6 haloalkylsulfonyl;

s is 1, 2, 3, 4 or 5;

n is 0, 1 or 2.

3. The compound of Claim 1 or 2 wherein:

R^2 is H, halogen or C_1-C_4 alkyl;

R^3 is H, halogen, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;

R^4 is selected from U-2 to U-49 or U52 to U61 as shown in Exhibit 1;

r is 1 or 2;

R^5 is H, halogen, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;

R^w is C_1–C_6 haloalkoxy, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, C_1–C_6 haloalkylthio, C_1–C_6 haloalkylsulfinyl, C_1–C_6 haloalkylsulfonyl.

s is 1 or 2.

4. The compound of any one of Claims 1-3 wherein:

R^2 is H, halogen or C_1-C_4 alkyl;

R3 is H, halogen, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;

R4 is selected from U-2 to U-49 or U52 to U61 as shown in Exhibit 1;

r is 1 or 2;

R^5 is H, halogen, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;
R^w is C_1–C_6 haloalkoxy, C_1–C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, C_1–C_6 haloalkylthio, C_1–C_6 haloalkylsulfinyl, C_1–C_6 haloalkylsulfonyl.
s is 1 or 2.

5. The compound of Claim 1 wherein:
R^1 is CN;
A is CR^3;
R^2 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl, C_3–C_4 halocycloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;
R^3 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl, C_3–C_4 halocycloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;
R^4 is a 5- to 6-membered heterocyclic ring, each ring containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, wherein up to 2 ring members are independently selected from C(=O), C(=S), S(=O) and S(=O)2, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^v, and r is the number of the substituents.
each R^v is independently H, halogen, C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_1–C_6 alkoxy or C_1–C_6 haloalkoxy;
r is 1, 2, 3, 4 or 5;
R^5 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl, C_3–C_4 halocycloalkyl, C1–C4 alkoxy or C1–C4 haloalkoxy;
Q is a six membered aromatic ring with 0 to 2 N on the ring, each ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w;
R^w is independently cyano, halogen, C_1–C_6 alkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_1–C_6 haloalkyl, C_2-C_6 alkenyl, C_2-C_6 haloalkenyl, C_2-C_6 alkynyl, C_2-C_6 haloalkynyl, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio, C_1–C_6 alkylsulfinyl, C_1–C_6 haloalkylsulfinyl, C_1–C_6 alkylsulfonyl or C_1–C_6 haloalkylsulfonyl;
s is 1, 2, 3, 4 or 5;
n is 0, 1 or 2.

6. The compound of any one of Claims 1-5 wherein:
R^2 is H, halogen or C_1-C_4 alkyl;
R^3 is H, halogen, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;
R^4 is selected from U-2 to U-49 or U52 to U61 as shown in Exhibit 1;
r is 1 or 2;
R^5 is H, halogen, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;

R^w is C_1–C_6 haloalkoxy, C_1–C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, C_1–C_6 haloalkylthio, C_1–C_6 haloalkylsulfinyl, C_1–C_6 haloalkylsulfonyl.
s is 1 or 2.

7. The compound of any one of Claima 1-6 wherein:
R^2 is H;
R^3 is H or halogen;
R^4 is selected from U-2 to U-49;
R^v is H;
r is 2;
R^5 is H or halogen;
Q is a phenyl, pyridinyl, pyrimidinyl or pyrazinyl ring, each ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w;
R^w is OCF_3, SCF_3, OCF_2CFCF_3, CF_3, $SOCF_3$ or SO_2CF_3.

8. The compound of Claim 1 wherein:
R^1 is $OCOR^6$;
A is CR^3;
R^2 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl, C_3–C_4 halocycloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;
R^3 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl, C_3–C_4 halocycloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;
R^4 is a 5- to 6-membered heterocyclic ring, each ring containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, wherein up to 2 ring members are independently selected from C(=O), C(=S), S(=O) and $S(=O)_2$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^v, and r is the number of the substituents.
each R^v is independently H, halogen, C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_1–C_6 alkoxy or C_1–C_6 haloalkoxy;
r is 1, 2, 3, 4 or 5;
R^5 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3–C_4 cycloalkyl, C_3–C_4 halocycloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;
R^6 is C_1-C_4 alkyl;
Q is a six membered aromatic ring with 0 to 2 N on the ring, each ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w;
R^w is independently cyano, halogen, C_1–C_6 alkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_1–C_6 haloalkyl, C_2-C_6 alkenyl, C_2-C_6 haloalkenyl, C_2-C_6 alkynyl, C_2-C_6 haloalkynyl, C_1–C_6

alkylthio, $C_1–C_6$ haloalkylthio, $C_1–C_6$ alkylsulfinyl, $C_1–C_6$ haloalkylsulfinyl, $C_1–C_6$ alkylsulfonyl or $C_1–C_6$ haloalkylsulfonyl;
s is 1, 2, 3, 4 or 5;
n is 0, 1 or 2.

9. The compound of any one of Claims 1-8 wherein:
R^2 is H, halogen or C_1-C_4 alkyl;
R^3 is H, halogen, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;
R^4 is selected from U-2 to U-49 or U52 to U61 as shown in Exhibit 1;
r is 1 or 2;
R^5 is H, halogen, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;
R^6 is Me;
R^w is $C_1–C_6$ haloalkoxy, $C_1–C_6$ haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, $C_1–C_6$ haloalkylthio, $C_1–C_6$ haloalkylsulfinyl, $C_1–C_6$ haloalkylsulfonyl.
s is 1 or 2.

10. The compound of any one of Claims 1- 9 wherein:
R^2 is H;
R^3 is H or halogen;
R^4 is selected from U-2 to U-49;
R^v is H;
r is 2;
R^5 is H;
Q is a phenyl, pyridinyl, pyrimidinyl or pyrazinyl ring, each ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w;
R^w is OCF_3, SCF_3, OCF_2CFCF_3, CF_3, $SOCF_3$ or SO_2CF_3.

11. The compound of Claim 1 wherein
R^1 is C_1-C_6 alkyl;
A is CR^3;
R^2 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, $C_3–C_4$ cycloalkyl, $C_3–C_4$ halocycloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;
R^3 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, $C_3–C_4$ cycloalkyl, $C_3–C_4$ halocycloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;
R^4 is a 5- to 6-membered heterocyclic ring, each ring containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, wherein up to 2 ring members are independently selected from C(=O), C(=S),

S(=O) and $S(=O)_2$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^v, and r is the number of the substituents.

each R^v is independently H, halogen, $C_1–C_6$ alkyl, $C_1–C_6$ haloalkyl, $C_1–C_6$ alkoxy or $C_1–C_6$ haloalkoxy;

r is 1, 2, 3, 4 or 5;

R^5 is H, halogen, CN, C_1-C_4 alkyl, C_1-C_4 haloalkyl, $C_3–C_4$ cycloalkyl, $C_3–C_4$ halocycloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;

Q is a six membered aromatic ring with 0 to 2 N on the ring, each ring optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^w;

R^w is independently cyano, halogen, $C_1–C_6$ alkyl, $C_1–C_6$ alkoxy, $C_1–C_6$ haloalkoxy, $C_1–C_6$ haloalkyl, C_2-C_6 alkenyl, C_2-C_6 haloalkenyl, C_2-C_6 alkynyl, C_2-C_6 haloalkynyl, $C_1–C_6$ alkylthio, $C_1–C_6$ haloalkylthio, $C_1–C_6$ alkylsulfinyl, $C_1–C_6$ haloalkylsulfinyl, $C_1–C_6$ alkylsulfonyl or $C_1–C_6$ haloalkylsulfonyl;

s is 1, 2, 3, 4 or 5;

n is 0, 1 or 2.

12. The comound of any one of Claims 1- 12 wherein

R^2 is H, halogen or C_1-C_4 alkyl;

R^3 is H, halogen, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy or C_1-C_4 haloalkoxy;

R^4 is selected from U-2 to U-49 or U52 to U61 as shown in Exhibit 1;

r is 1 or 2;

R^5 is H, halogen, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy or C1–C4 haloalkoxy;

R^w is $C_1–C_6$ haloalkoxy, $C_1–C_6$ haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, $C_1–C_6$ haloalkylthio, $C_1–C_6$ haloalkylsulfinyl, $C_1–C_6$ haloalkylsulfonyl.

s is 1 or 2.

13. The compound of claim 1, 11 or 12 wherein R^1 is Me.

14. The compound of Claim 1 wherein the compound is selected from one or more compound of the group consisting of:

3-fluoro-5-(2H-1,2,3-triazol-2-yl)-4-[[4-(trifluoromethoxy)phenyl]methyl]pyridine;

3-fluoro-5-(2H-1,2,3-triazol-2-yl)-4-[[4-[(trifluoromethyl)thio]phenyl]methyl]pyridine;

3-fluoro-5-(2H-1,2,3-triazol-2-yl)-4-[1-[4-(trifluoromethoxy)phenyl]ethyl]pyridine;

3-fluoro-5-(2H-1,2,3-triazol-2-yl)-4-[1-[4-[(trifluoromethyl)thio]phenyl]ethyl]pyridine;

3-chloro-5-(2H-1,2,3-triazol-2-yl)-4-[[4-(trifluoromethoxy)phenyl]methyl]pyridine;

3-chloro-5-(2H-1,2,3-triazol-2-yl)-4-[[4-[(trifluoromethyl)thio]phenyl]methyl]pyridine;

3-chloro-5-(2H-1,2,3-triazol-2-yl)-4-[1-[4-(trifluoromethoxy)phenyl]ethyl]pyridine;

3-chloro-5-(2H-1,2,3-triazol-2-yl)-4-[1-[4-[(trifluoromethyl)thio]phenyl]ethyl]pyridine;

3-bromo-5-(2H-1,2,3-triazol-2-yl)-4-[[4-[(trifluoromethyl)thio]phenyl]methyl]pyridine;
3-bromo-5-(2H-1,2,3-triazol-2-yl)-4-[[4-(trifluoromethoxy)phenyl]methyl]pyridine;
3-fluoro-5-(1H-1-pyrazol-1-yl)-4-[[4-(trifluoromethoxy)phenyl]methyl]pyridine;
3-chloro-5-(1H-1-pyrazol-1-yl)-4-[[4-(trifluoromethoxy)phenyl]methyl]pyridine;
3-bromo-5-(1H-pyrazol-1-yl)-4-[[4-(trifluoromethoxy)phenyl]methyl]pyridine;
3-fluoro-5-(1H-pyrazol-1-yl)-4-[[4-[(trifluoromethyl)thio]phenyl]methyl]pyridine;
3-chloro-5-(1H-pyrazol-1-yl)-4-[[4-[(trifluoromethyl)thio]phenyl]methyl]pyridine;
3-bromo-5-(1H-pyrazol-1-yl)-4-[[4-[(trifluoromethyl)thio]phenyl]methyl]pyridine;
3-fluoro-5-(2H-1,2,3-triazol-2-yl)-4-[[4-(trifluoromethyl)phenyl]methyl]pyridine;
3-chloro-5-(2H-1,2,3-triazol-2-yl)-4-[[4-(trifluoromethyl)phenyl]methyl]pyridine;
3-bromo-5-(2H-1,2,3-triazol-2-yl)-4-[[4-(trifluoromethyl)phenyl]methyl]pyridine;
3-fluoro-4-[[4-(1,1,2,2,2-pentafluoroethyl)phenyl]methyl]-5-(2H-1,2,3-triazol-2-yl)pyridine;
3-chloro-4-[[4-(1,1,2,2,2-pentafluoroethyl)phenyl]methyl]-5-(2H-1,2,3-triazol-2-yl)pyridine;
3-bromo-4-[[4-(1,1,2,2,2-pentafluoroethyl)phenyl]methyl]-5-(2H-1,2,3-triazol-2-yl)pyridine;
4-[[4-(difluoromethoxy)phenyl]methyl]-3-fluoro-5-(2H-1,2,3-triazol-2-yl)pyridine;
3-chloro-4-[[4-(difluoromethoxy)phenyl]methyl]- 5-(2H-1,2,3-triazol-2-yl)pyridine;
3-bromo-4-[[4-(difluoromethoxy)phenyl]methyl]- 5-(2H-1,2,3-triazol-2-yl)pyridine;
3-fluoro-5-(1H-pyrazol-1-yl)-4-[[4-(trifluoromethyl)phenyl]methyl]pyridine;
3-chloro-5-(1H-pyrazol-1-yl)-4-[[4-(trifluoromethyl)phenyl]methyl]pyridine;
3-bromo-5-(1H-pyrazol-1-yl)-4-[[4-(trifluoromethyl)phenyl]methyl]pyridine;
3-fluoro-4-[[4-(1,1,2,2,2-pentafluoroethyl)phenyl]methyl]-5-(1H-pyrazol-1-yl)pyridine;
3-chloro-4-[[4-(1,1,2,2,2-pentafluoroethyl)phenyl]methyl]-5-(1H-pyrazol-1-yl)pyridine;
3-bromo-4-[[4-(1,1,2,2,2-pentafluoroethyl)phenyl]methyl]-5-(1H-pyrazol-1-yl)pyridine;
4-[[4-(difluoromethoxy)phenyl]methyl]-3-fluoro-5-(1H-pyrazol-1-yl)pyridine;
3-chloro-4-[[4-(difluoromethoxy)phenyl]methyl]-5-(1H-pyrazol-1-yl)pyridine; and
3-bromo-4-[[4-(difluoromethoxy)phenyl]methyl]-5-(1H-pyrazol-1-yl)pyridine.

15. A composition comprising a compound of any one of Claims 1-14 and at least one additional component selected from the group consisting of surfactants, solid diluents and liquid diluents, said composition optionally further comprising at least one additional biologically active compound or agent.

16. The composition of Claim 15 wherein the at least one additional biologically active compound or agent is selected from the group consisting of abamectin, acephate, acequinocyl, acetamiprid, acrinathrin, afidopyropen, amidoflumet, amitraz, avermectin, azadirachtin, azinphos-methyl, benfuracarb, bensultap, bifenthrin, bifenazate, bistrifluron, borate, bromantraniliprole, buprofezin, carbaryl, carbofuran, cartap, carzol, chlorantraniliprole, chlorfenapyr, chlorfluazuron, chlorpyrifos, chlorpyrifos-methyl,

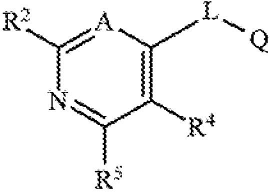
chromafenozide, clofentezin, clothianidin, cyantraniliprole, cyclaniliprole, cycloprothrin, cycloxaprid, cyflumetofen, cyfluthrin, beta-cyfluthrin, cyhalodiamide, cyhalothrin, gamma-cyhalothrin, lambda-cyhalothrin, cypermethrin, alpha-cypermethrin, zeta-cypermethrin, cyromazine, deltamethrin, diafenthiuron, diazinon, dichlorantraniliprole, dieldrin, diflubenzuron, dimefluthrin, dimehypo, dimethoate, dinotefuran, diofenolan, emamectin, endosulfan, esfenvalerate, ethiprole, etofenprox, etoxazole, fenbutatin oxide, fenitrothion, fenothiocarb, fenoxycarb, fenpropathrin, fenvalerate, fipronil, flometoquin, flonicamid, flubendiamide, flucythrinate, flufenerim, flufenoxuron, flufenoxystrobin, fluensulfone, fluopyram, flupyradifurone, fluvalinate, tau-fluvalinate, fonophos, formetanate, fosthiazate, halofenozide, heptafluthrin, hexaflumuron, hexythiazox, hydramethylnon, imidacloprid, indoxacarb, insecticidal soaps, isofenphos, lufenuron, malathion, meperfluthrin, metaflumizone, metaldehyde, methamidophos, methidathion, methiocarb, methomyl, methoprene, methoxychlor, methoxyfenozide, metofluthrin, monocrotophos, monofluorothrin, nicotine, *N*-[1,1-dimethyl-2-(methylthio)ethyl]-7-fluoro-2-(3-pyridinyl)-2*H*-indazole-4-carboxamide, *N*-[1,1-dimethyl-2-(methylsulfinyl)ethyl]-7-fluoro-2-(3-pyridinyl)-2*H*-indazole-4-carboxamide, *N*-[1,1-dimethyl-2-(methylsulfonyl)ethyl]-7-fluoro-2-(3-pyridinyl)-2*H*-indazole-4-carboxamide, N-(1-methylcyclopropyl)-2-(3-pyridinyl)-2H-indazole-4-carboxamide, *N*-[1-(difluoromethyl)cyclopropyl]-2-(3-pyridinyl)-2*H*-indazole-4-carboxamide, nitenpyram, nithiazine, novaluron, noviflumuron, oxamyl, parathion, parathion-methyl, permethrin, phorate, phosalone, phosmet, phosphamidon, pirimicarb, profenofos, profluthrin, propargite, protrifenbute, pyflubumide, pymetrozine, pyrafluprole, pyrethrin, pyridaben, pyridalyl, pyrifluquinazon, pyriminostrobin, pyriprole, pyriproxyfen, rotenone, ryanodine, silafluofen, spinetoram, spinosad, spirodiclofen, spiromesifen, spirotetramat, sulprofos, sulfoxaflor, tebufenozide, tebufenpyrad, teflubenzuron, tefluthrin, tetrachlorantraniliprole, tetrachlorvinphos, tetramethrin, tetramethylfluthrin, thiacloprid, thiamethoxam, thiodicarb, thiosultap-sodium, tioxazafen, tolfenpyrad, tralomethrin, triazamate, trichlorfon, triflumezopyrim, triflumuron, *Bacillus thuringiensis* delta-endotoxins, entomopathogenic bacteria, entomopathogenic viruses and entomopathogenic fungi.

17. A composition for protecting an animal from an invertebrate parasitic pest comprising a parasiticidally effective amount of any one of Claims 1-14 and at least one carrier.

18. A method for controlling an invertebrate pest comprising contacting the invertebrate pest or its environment with a biologically effective amount of a compound, composition, or formulation of any one of claims 1-17.

19. The method of Claim 18 wherein invertebrate pest is a member of Hemiptera.

20. A treated seed comprising a compound of Formula **1** or any one of the preceding claims in an amount of from about 0.0001 to 1 % by weight of the seed before treatment.



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