(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
01 June 2023 (01.06.2023)

WIPO | PCT

(10) International Publication Number
WO 2023/097341 A2

(51) International Patent Classification:
C07D 319/14 (2006.01) *A01N 43/32* (2006.01)
C07D 307/77 (2006.01)

(21) International Application Number:
PCT/US2023/015652

(22) International Filing Date:
20 March 2023 (20.03.2023)

(25) Filing Language: English

(26) Publication Language: English

(71) Applicant: **FMC CORPORATION** [US/US]; 2929 Walnut Street, Philadelphia, Pennsylvania 19104 (US).

(72) Inventors: **DEANGELIS, Andrew Jon**; c/o FMC Corporation-Patent Dept., 2929 Walnut Street, Philadelphia, Pennsylvania 19104 (US). **LAHM, George Philip**; c/o FMC Corporation-Patent Dept., 2929 Walnut Street, Philadelphia, Pennsylvania 19104 (US).

(74) Agent: **TRAVIS, David Andrew**; FMC Corporation-Patent Dept., 2929 Walnut Street, Philadelphia, Pennsylvania 19104 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CV, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, MG, MK, MN, MU, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

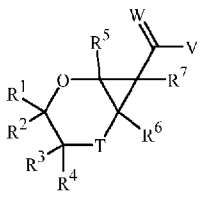
(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, CV, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, ME, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:
— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

Published:
— *upon request of the applicant, before the expiration of the time limit referred to in Article 21(2)(a)*
— *without international search report and to be republished upon receipt of that report (Rule 48.2(g))*

WO 2023/097341 A2

(54) Title: BICYCLIC AMIDES AND ESTERS FOR CONTROLLING INVERTEBRATE PESTS



1

(57) Abstract: Disclosed are compounds of Formula 1, including all geometric and stereoisomers, *N*-oxides, and salts thereof, wherein T, R^1, R^2, R^3, R^4, R^5, R^6, R^7, W and V 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

BICYCLIC AMIDES AND ESTERS FOR CONTROLLING INVERTEBRATE PESTS

FIELD

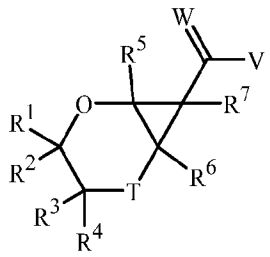
This disclosure relates to certain bicyclic amides and esters, their *N*-oxides, salts and compositions suitable for agronomic and nonagronomic uses, and methods of their use for controlling invertebrate pests such as arthropods in both agronomic and nonagronomic environments.

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 stereoisomers), *N*-oxides, and salts thereof, compositions containing them and their use for controlling invertebrate pests:



1

wherein

T is a direct bond, and V is O-L-J^1; or

T is O, and V is O-L-J^1 or N(Y)-L-J^2;

L is a direct bond or $(CR^{LA}R^{LB})_m$;

each R^{LA} and R^{LB} is independently hydrogen, halogen, C_1-C_3 alkyl or C_1-C_3 haloalkyl;

m is 1, 2 or 3;

R^1, R^2, R^3 and R^4 are each independently hydrogen, halogen, cyano, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy, C_1-C_4 haloalkoxy, C_1-C_4 alkylthio, C_1-C_4 haloalkylthio, C_1-C_4 alkylsulfinyl, C_1-C_4 haloalkylsulfinyl, C_1-C_4 alkylsulfonyl, C_1-C_4 haloalkylsulfonyl or Q^1;

R^5, R^6 and R^7 are each independently hydrogen, halogen, cyano, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy, C_1-C_4 haloalkoxy, C_1-C_4 alkylthio, C_1-C_4 haloalkylthio, C_1-C_4 alkylsulfinyl, C_1-C_4 haloalkylsulfinyl, C_1-C_4 alkylsulfonyl, C_1-C_4 haloalkylsulfonyl or Q^1;

Q^1 is a 6- to 14-membered carbocyclic ring or ring system, each ring or ring system optionally substituted with one or more substituents independently selected from halogen, cyano, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy, C_1-C_4 haloalkoxy, C_1-C_4 alkylthio, C_1-C_4 haloalkylthio, C_1-C_4 alkylsulfinyl, C_1-C_4 haloalkylsulfinyl, C_1-C_4 alkylsulfonyl and C_1-C_4 haloalkylsulfonyl;

W is O or S;

Y is hydrogen, $C(=O)R^8$, $S(=O)_nR^9$, CO_2R^{10}, $C(=O)NR^{11}R^{12}$, $S(=O)_nNR^{11}R^{12}$, $NR^{11}R^{12}$, C_3-C_{15} trialkylsilyl or C_3-C_{15} halotrialkylsilyl; or benzyl optionally substituted by R^{13} on ring members; or C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, C_3-C_8 cycloalkyl, C_3-C_8 halocycloalkyl, C_3-C_8 cycloalkenyl, C_3-C_8 halocycloalkenyl, C_4-C_{10} alkylcycloalkyl, C_4-C_{10} cycloalkylalkyl, C_4-C_{10} halocycloalkylalkyl, C_6-C_{14} cycloalkylcycloalkyl, C_5-C_{10} alkylcycloalkylalkyl, C_2-C_8 alkoxyalkyl, C_2-C_8 haloalkoxyalkyl, C_4-C_{10} cycloalkoxyalkyl, C_3-C_8 alkoxyalkoxyalkyl, C_2-C_6 alkylthioalkyl, C_2-C_6 alkylsulfinylalkyl, C_2-C_6 alkylsulfonylalkyl, C_2-C_6 alkylaminoalkyl, C_2-C_6 haloalkylaminoalkyl, C_3-C_8 dialkylaminoalkyl, C_4-C_{10} cycloalkylaminoalkyl or C_3-C_5 alkoxycarbonylalkyl, each optionally substituted with up to 1 substituent selected from cyano, hydroxy, nitro, C_2-C_4 alkylcarbonyl, C_2-C_4 alkoxycarbonyl, C_3-C_{15} trialkylsilyl and C_3-C_{15} halotrialkylsilyl;

R^8, R^9 and R^{10} are each independently C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_3-C_6 cycloalkyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, C_2-C_7 alkoxyalkyl or C_4-C_7 cycloalkylalkyl; or phenyl optionally substituted by R^{13}; or benzyl optionally substituted by R^{13} on ring members; or pyridyl optionally substituted by R^{13};

R^{11} and R^{12} are each independently hydrogen, hydroxy, cyano, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_3-C_7 cycloalkyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl,

C_2-C_6 haloalkynyl, C_1-C_4 alkoxy, C_1-C_4 haloalkoxy, C_2-C_7 alkoxyalkyl C_4-C_7 cycloalkylalkyl, C_2-C_4 alkylthioalkyl, C_1-C_4 alkylsulfonyl, C_1-C_4 haloalkylsulfonyl, C_2-C_4 alkylsulfinylalkyl, C_2-C_4 alkylsulfonylalkyl, C_2-C_4 alkylcarbonyl, C_2-C_4 haloalkylcarbonyl, C_2-C_5 alkoxycarbonyl, C_3-C_5 alkoxycarbonylalkyl, C_2-C_5 alkylaminocarbonyl, C_3-C_5 dialkylaminocarbonyl, C_3-C_7 alkylaminocarbonylalkyl or C_4-C_7 dialkylaminocarbonylalkyl; or phenyl optionally substituted by R^{13}; or benzyl optionally substituted by R^{13} on ring members; or pyridyl optionally substituted by R^{13}; or

R^{11} and R^{12} are taken together with the nitrogen to which they are attached to form a 3- to 6-membered ring containing ring members selected from carbon atoms and up to two additional atoms independently selected from nitrogen, sulfur and oxygen, wherein the sulfur atom ring member is selected from S, S(=O) and $S(=O)_2$, said ring optionally substituted with 1 to 4 substituents independently selected from halogen, C_1-C_2 alkyl, C_1-C_2 haloalkyl, C_1-C_2 alkoxy, C_1-C_2 haloalkoxy, cyano and nitro;

R^{13} is halogen, C_1-C_3 alkyl, C_1-C_3 haloalkyl, C_1-C_3 alkoxy, C_1-C_3 haloalkoxy, cyano, or nitro;

J^1 is phenyl or naphthalenyl, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{JC}; or a 4-, 5- or 6-membered heterocyclic ring or an 8-, 9- or 10-membered bicyclic ring system, each ring or ring system containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 1 boron, up to 2 oxygen, up to 2 sulfur and up to 4 nitrogen atoms, wherein up to 2 carbon ring members are optionally selected from C(=O) and C(=S), each ring system optionally substituted with up to 5 substituents independently selected from R^{JC} on carbon atom ring members; R^{JN} on nitrogen atom ring members and R^{JB} on boron atom ring members;

J^2 is phenyl or naphthalenyl, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{JC}; or a 4-, 5- or 6-membered heterocyclic ring or an 8-, 9- or 10-membered bicyclic ring system, each ring or ring system containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 1 boron, up to 2 oxygen, up to 2 sulfur and up to 4 nitrogen atoms, wherein up to 2 carbon ring members are optionally selected from C(=O) and C(=S), each ring system optionally substituted with up to 5 substituents independently selected from R^{JC} on carbon

atom ring members; R^{JN} on nitrogen atom ring members and R^{JB} on boron atom ring members;

each R^{JC} is independently hydrogen, halogen, hydroxy, cyano, nitro, OR^{14}, $C(=O)R^{15}$, CO_2H, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $C(=NR^{19})R^{20}$, $NR^{17}R^{18}$, $S(=O)_nR^{21}$ or Q^2; or C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl or C_3-C_6 cycloalkyl, each optionally substituted with one or more substituents independently selected from halogen, cyano, nitro, OR^{14}, $C(=O)R^{15}$, CO_2H, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $C(=NR^{19})R^{20}$, $NR^{17}R^{18}$, $S(=O)_nR^{21}$ or Q^2;

each R^{JN} is independently hydrogen, hydroxy, cyano, OR^{14}, $C(=O)R^{15}$, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $C(=NR^{19})R^{20}$, $NR^{17}R^{18}$, $S(=O)_nR^{21}$ or Q^2; or C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl or C_3-C_6 cycloalkyl, each optionally substituted with one or more substituents independently selected from halogen, cyano, nitro, OR^{14}, $C(=O)R^{15}$, CO_2H, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $C(=NR^{19})R^{20}$, $NR^{17}R^{18}$, $S(=O)_nR^{21}$ or Q^2;

each R^{JB} is independently hydroxy, C_1-C_6 alkoxy, C_1-C_6 haloalkoxy; or phenoxy optionally substituted with up to five substituents independently selected from R^{13};

each R^{14} is independently C_1-C_6 alkyl, C_3-C_7 cycloalkyl, C_1-C_6 haloalkyl or C_3-C_7 halocycloalkyl; or phenyl optionally substituted by halogen, cyano, nitro, C_1-C_3 alkyl, C_1-C_3 haloalkyl, C_3-C_7 cycloalkyl, C_1-C_3 alkoxy or C_1-C_3 haloalkoxy;

each R^{15} is independently C_1-C_6 alkyl, C_3-C_7 cycloalkyl, C_1-C_6 haloalkyl or C_3-C_7 halocycloalkyl; or phenyl optionally substituted by halogen, cyano, nitro, C_1-C_3 alkyl, C_1-C_3 haloalkyl, C_3-C_7 cycloalkyl, C_1-C_3 alkoxy or C_1-C_3 haloalkoxy;

each R^{16} is independently C_1-C_6 alkyl, C_3-C_7 cycloalkyl, C_1-C_6 haloalkyl or C_3-C_7 halocycloalkyl; or phenyl optionally substituted by halogen, cyano, nitro, C_1-C_3 alkyl, C_1-C_3 haloalkyl, C_3-C_7 cycloalkyl, C_1-C_3 alkoxy or C_1-C_3 haloalkoxy;

each Z is independenty O or S;

each R^{17} is independently hydrogen, hydroxy, OR^{22}, $C(=O)R^{23}$, $C(=O)OR^{24}$, $C(=O)NR^{25}R^{26}$, $C(=NR^{19})R^{20}$, $NR^{25}R^{26}$, $S(=O)_nR^{21}$ or Q^2; or C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl or C_3-C_6 cycloalkyl, each optionally substituted with one or more substituents independently selected from R^x;

each R^{18} is independently hydrogen or Q^2; or C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_3-C_7 cycloalkyl, C_2-C_7 alkylcarbonyl or C_2-C_7 alkoxycarbonyl, each optionally substituted by R^x; or

R^{17} and R^{18} are taken together with the nitrogen to which they are attached to form a 3- to 6-membered ring containing ring members selected from carbon atoms and up to two additional atoms independently selected from nitrogen, sulfur and oxygen, wherein the sulfur atom ring member is selected from S, S(=O) and $S(=O)_2$, said ring optionally substituted with 1 to 4 substituents independently selected from halogen, C_1-C_2 alkyl, C_1-C_2 haloalkyl, C_1-C_2 alkoxy, C_1-C_2 haloalkoxy cyano and nitro; or

R^{17} and R^{18} are taken together as $=S(=O)_uR^{27}R^{28}$ or $=S(=NR^{29})R^{27}R^{28}$;

each R^x is independently halogen, hydroxy, cyano, nitro, C_1-C_6 alkyl, C_1-C_6 haloalkyl, C_3-C_6 cycloalkyl, C_1-C_6 alkoxy, C_1-C_6 haloalkoxy, C_3-C_6 cycloalkoxy, $OC(=O)R^{23}$, $C(=O)R^{23}$, $C(=O)OR^{24}$, $C(=O)NR^{25}R^{26}$, $C(=NR^{19})R^{25}$, $NR^{25}R^{26}$, $S(=O)_nR^{30}$, $Si(R^{31})_3$, $OSi(R^{31})_3$ or Q^2;

each R^{19} is independently OR^{22}, $S(O)_nR^{30}$ or NHR^{32};

each R^{20} is independently hydrogen; or C_1-C_6 alkyl, C_3-C_6 cycloalkyl, C_2-C_6 alkenyl or C_2-C_6 alkynyl, each optionally substituted with one or more R^x; or C_1-C_6 alkoxy, C_1-C_6 haloalkoxy, C_3-C_6 cycloalkoxy, $C(=O)R^{23}$, $C(=O)OR^{24}$, $C(=O)NR^{25}R^{26}$, $NR^{25}R^{26}$ or Q^2;

each R^{21} is independently amino, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3-C_6 cycloalkyl, C_3-C_6 halocycloalkyl, C_1-C_6 alkylamino, C_2-C_6 dialkylamino, C_3-C_6 cycloalkylalkyl or C_3-C_6 halocycloalkylalkyl; or phenyl, optionally substituted with up to 5 substituents independently selected from the group consisting of halogen, cyano, nitro, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy;

each R^{22} is independently C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, $C(=O)R^{23}$, $S(=O)_nR^{30}$ or Q^2;

each R^{23} is independently C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3-C_6 cycloalkyl, C_3-C_6 halocycloalkyl, C_4-C_7 cycloalkylalkyl or C_4-C_7 halocycloalkylalkyl; or phenyl, optionally substituted with up to 5 substituents independently selected from the group consisting of halogen, cyano, nitro, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy;

each R^{24} is independently C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3-C_6 cycloalkyl or C_3-C_6 halocycloalkyl; or phenyl, optionally substituted with up to 5 substituents independently selected from the group consisting of halogen, cyano, nitro, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy;

each R^{25} is independently hydrogen, C_1-C_6 alkyl, C_1-C_6 haloalkyl, $C(=O)R^{33}$ or $S(=O)_nR^{33}$; or phenyl or a 5- or 6-membered heterocyclic aromatic ring, each ring optionally substituted with up to 5 substituents independently selected from the group consisting of halogen, cyano, nitro, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy;

each R^{26} is independently hydrogen, C_1-C_6 alkyl or C_1-C_6 haloalkyl; or

R^{25} and R^{26} are taken together with the nitrogen atom to which they are attached to form a 3- to 7-membered ring containing ring members selected from carbon atoms and up to 2 heteroatoms independently selected from one oxygen atom, one sulfur atom, and up to 2 nitrogen atoms, said ring optionally substituted with 1 to 4 substituents independently selected from the group consisting of halogen, cyano, nitro, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy;

each R^{27} is independently C_1-C_4 alkyl or C_1-C_4 haloalkyl; or phenyl, optionally substituted with up to 5 substituents independently selected from the group consisting of halogen, cyano, nitro, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy;

each R^{28} is independently C_1-C_4 alkyl or C_1-C_4 haloalkyl; or phenyl, optionally substituted with up to 5 substituents independently selected from the group consisting of halogen, cyano, nitro, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy; or

R^{27} and R^{28} are taken together with the sulfur atom to which they are attached to form a 3- to 6-membered ring containing ring members selected from carbon atoms;

R^{29} is hydrogen, cyano, C_1-C_4 alkyl, C_1-C_4 haloalkyl or $C(=O)R^{23}$; or phenyl, optionally substituted with up to 5 substituents independently selected from the group consisting of halogen, cyano, nitro, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy;

each R^{30} is independently C_1-C_4 alkyl or C_1-C_4 haloalkyl;

each R^{31} is independently C_1-C_6 alkyl, C_3-C_6 cycloalkyl or phenyl;

each R^{32} is C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, $C(=O)R^{23}$ or $C(=O)OR^{24}$; or phenyl, optionally substituted with up to 5 substituents independently selected from the group consisting of halogen, cyano, nitro, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy;

each R^{33} is independently C_1-C_6 alkyl, C_1-C_6 haloalkyl, C_1-C_6 alkoxy, C_1-C_6 haloalkoxy or $NR^{34}R^{35}$; or phenyl or a 5- or 6-membered heterocyclic aromatic

ring, each ring optionally substituted with up to 5 substituents independently selected from the group consisting of halogen, cyano, nitro, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy;

each R^{34} is independently hydrogen or Q^2; or C_1-C_6 alkyl, C_3-C_6 cycloalkyl, C_2-C_6 alkenyl or C_2-C_6 alkynyl, each optionally substituted with one or more substituents independently selected from the group consisting of halogen, cyano, nitro, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy;

each R^{35} is independently hydrogen or Q^2; or C_1-C_6 alkyl, C_3-C_6 cycloalkyl, C_2-C_6 alkenyl or C_2-C_6 alkynyl, each optionally substituted with one or more substituents independently selected from the group consisting of halogen, cyano, nitro, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy; or

R^{34} and R^{35} are taken together with the nitrogen atom to which they are attached to form a 3- to 10-membered ring containing ring members selected from carbon atoms and up to 2 heteroatoms independently selected from one oxygen atom, one sulfur atom, and up to 2 nitrogen atoms, wherein up to 2 carbon atom ring members are independently selected from C(=O) and C(=S) and the sulfur atom ring member is selected from S, S(=O) or $S(=O)_2$, said ring optionally substituted with up to 4 substituents independently selected from the group consisting of halogen, cyano, nitro, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy;

each Q^2 is independently phenyl, optionally substituted with one or more substituents independently selected from the group consisting of halogen, cyano, nitro, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy; or a 5- or 6-membered heterocyclic aromatic ring or a 3- to 6-membered heterocyclic non-aromatic ring, each ring containing ring members selected from carbon atoms and up to 2 heteroatoms independently selected from one oxygen atom, one sulfur atom, and up to 2 nitrogen atoms, wherein up to 2 carbon atom ring members are independently selected from C(=O) and C(=S) and the sulfur atom ring member is selected from S, S(=O) or $S(=O)_2$, each ring optionally substituted with one or more substituents independently selected from the group consisting of halogen, cyano, nitro, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy;

each n is independently 0, 1 or 2; and

each u is 0 or 1.

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.

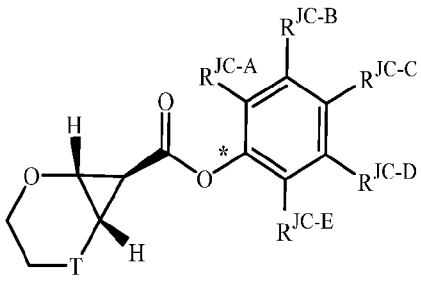
The term "crop vigor" refers to rate of growth or biomass accumulation of a crop plant. An "increase in vigor" refers to an increase in growth or biomass accumulation in a crop plant relative to an untreated control crop plant. The term "crop yield" refers to the return on crop material, in terms of 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.

A wavy line in a structure fragment denotes the attachment point of the fragment to the remainder of the molecule. For example, when the variable Z in the structure shown in Table 1 is defined as Z-7, the wavy line bisecting the bond in Z-7 means that Z-7 is attached to the remainder of the Table 1 structure at said position, as shown below.



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.

"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 another alkoxy moiety. Examples of "alkoxyalkoxy" include CH_3OCH_2O, $CH_3OCH_2CH_2O$, $CH_3CH_2OCH_2O$, $CH_3CH_2CH_2OCH_2O$, and $CH_3CH_2OCH_2CH_2O$. "Alkoxyalkoxyalkyl" denotes alkoxyalkoxy substitution on alkyl. Examples of "alkoxyalkoxyalkyl" include $CH_3OCH_2OCH_2$ $CH_3OCH_2OCH_2CH_2$ and $CH_3CH_2OCH_2OCH_2$.

"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, $CH_3SCH_2CH_2$, $CH_3CH_2SCH_2$, $CH_3CH_2CH_2SCH_2$ and $CH_3CH_2SCH_2CH_2$; "alkylsulfinylalkyl" and "alkylsulfonylalkyl" include the corresponding sulfoxides and sulfones, respectively.

"Alkylamino" includes an NH radical substituted with a straight-chain or branched alkyl group. Examples of "alkylamino" include CH_3CH_2NH, $CH_3CH_2CH_2NH$, and $(CH_3)_2CHCH_2NH$. Examples of "dialkylamino" include $(CH_3)_2N$, $(CH_3CH_2CH_2)_2N$ and $CH_3CH_2(CH_3)N$. "Alkylaminoalkyl" denotes alkylamino substitution on alkyl. Examples of "alkylaminoalkyl" include CH_3NHCH_2, $CH_3NHCH_2CH_2$, $CH_3CH_2NHCH_2$, $CH_3CH_2CH_2CH_2NHCH_2$ and $CH_3CH_2NHCH_2CH_2$. Examples of "dialkylaminoalkyl" include $(CH_3)_2NCH_2$, $(CH_3CH_2CH_2)_2NCH_2CH_2$ and $CH_3CH_2(CH_3)NCH_2$.

"Alkylcarbonyl" denotes a straight-chain or branched alkyl group 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- and pentoxycarbonyl isomers. Examples of "alkylaminocarbonyl" include $CH_3NHC(=O)$, $CH_3CH_2NHC(=O)$, $CH_3CH_2CH_2NHC(=O)$, $(CH_3)_2CHNHC(=O)$, and the different butylamino-, pentylamino- and hexylaminocarbonyl isomers. Examples of "dialkylaminocarbonyl" include

$(CH_3)_2NC(=O)$, $(CH_3CH_2)_2NC(=O)$, $CH_3CH_2(CH_3)NC(=O)$, $(CH_3)_2CH(CH_3)NC(=O)$ and $CH_3CH_2CH_2(CH_3)NC(=O)$.

The term "alkoxycarbonylalkyl" denotes alkoxycarbonyl substitution on alkyl. Examples of "alkoxycarbonylalkyl" include $CH_3CH_2OC(=O)CH_2$, $(CH_3)_2CHOC(=O)CH_2$ and $CH_3OC(=O)CH_2CH_2$. The term "alkylcarbonylamino" denotes alkyl bonded to a C(=O)NH moiety. Examples of "alkylcarbonylamino" include $CH_3CH_2C(=O)NH$ and $CH_3CH_2CH_2C(=O)NH$. The term "alkoxycarbonylamino" denotes alkoxy bonded to a C(=O)NH moiety. Examples of "alkoxycarbonylamino" include $CH_3OC(=O)NH$ and $CH_3CH_2OC(=O)NH$.

The term "alkylaminocarbonylalkyl" denotes a straight-chain or branched alkylaminocarbonyl attached to alkyl. Examples of "alkylaminocarbonylalkyl" include $(CH_3)_2CHCH_2NHC(=O)CH_2$ and $CH_3CH_2NHC(=O)CH_2$. Examples of "dialkylaminocarbonylalkyl" include $CH_3CH_2CH_2(CH_3)NC(=O)CH_2$ and $(CH_3)_2NC(=O)CH_2$.

"Cycloalkyl" includes, for example, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl and cyclooctyl. The term "cycloalkylalkyl" denotes cycloalkyl substitution on an alkyl moiety. Examples of "cycloalkylalkyl" include cyclopropylmethyl, cyclopentylethyl, and other cycloalkyl moieties bonded to a straight-chain or branched alkyl group. The term "alkylcycloalkyl" denotes alkyl substitution on a cycloalkyl moiety and includes, for example, ethylcyclopropyl, *i*-propylcyclobutyl, methylcyclopentyl and methylcyclohexyl. "Alkylcycloalkylalkyl" denotes an alkyl group substituted with alkylcycloalkyl. Examples of "alkylcycloalkylalkyl" include methylcyclohexylmethyl and ethylcycloproylmethyl. "Cycloalkenyl" includes groups such as cyclopentenyl and cyclohexenyl as well as groups with more than one double bond such as 1,3- or 1,4-cyclohexadienyl. The term "cycloalkylcycloalkyl" denotes cycloalkyl substitution on another cycloalkyl ring, wherein each cycloalkyl ring independently has from 3 to 7 carbon atom ring members. Examples of cycloalkylcycloalkyl include cyclopropylcyclopropyl (such as 1,1'-bicyclopropyl-1-yl, 1,1'-bicyclopropyl-2-yl), cyclohexylcyclopentyl (such as 4-cyclopentylcyclohexyl) and cyclohexylcyclohexyl (such as 1,1'-bicyclohexyl-1-yl), and the different *cis*- and *trans*-cycloalkylcycloalkyl isomers, (such as (1*R*,2*S*)-1,1'-bicyclopropyl-2-yl and (1*R*,2*R*)-1,1'-bicyclopropyl-2-yl).

The term "cycloalkoxy" denotes cycloalkyl attached to and linked through an oxygen atom including, for example, cyclopentyloxy and cyclohexyloxy. The term "cycloalkoxyalkyl" denotes cycloalkoxy substitution on an alkyl moiety. Examples of "cycloalkoxyalkyl" include cyclopropyloxymethyl, cyclopentyloxyethyl, and other cycloalkoxy groups bonded to a straight-chain or branched alkyl moiety.

The term "cycloalkylaminoalkyl" denotes cycloalkylamino substitution on an alkyl group. Examples of "cycloalkylaminoalkyl" include cyclopropylaminomethyl, cyclopentylaminoethyl, and other cycloalkylamino moieties bonded to a straight-chain or branched alkyl group.

"Trialkylsilyl" includes 3 branched and/or straight-chain alkyl radicals attached to and linked through a silicon atom, such as trimethylsilyl, triethylsilyl and *tert*-butyldimethylsilyl.

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", "haloalkylsulfinyl", "haloalkylsulfonyl", "haloalkenyl", "haloalkynyl", "haloalkoxyalkoxy" and the like, are defined analogously to the term "haloalkyl". Examples of "halocycloalkyl" include 2-chlorocyclopropyl, 2-fluorocyclobutyl, 3-bromocyclopentyl and 4-chorocyclohexyl. 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.

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.

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 15. 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 vary (e.g., $(R^v)_r$ in Exhibit 1 wherein r is 1, 2, 3 or 4), then said substituents are independently selected from the group of defined substituents, unless otherwise indicated. Further, when the subscript indicates a range, e.g. $(R)_{i-j}$, then the number of substituents may be selected from the integers between i and j inclusive. When a group contains a substituent which can be hydrogen, for example R^1, then when this substituent is taken as hydrogen, it is recognized that this is equivalent to said group being unsubstituted. When a variable group is shown to be optionally attached to a position, for example $(R^v)_r$ in Exhibit 1 wherein r may be 0, then hydrogen may be at the position even if not recited in the definition of the variable group. 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.

The number of optional substituents may be restricted by an expressed limitation. For example, the phrase "optionally substituted with up to 5 substituents independently selected from R^{JC}" means that 0, 1, 2, 3, 4 or 5 substituents can be present (if the number of potential connection points allows). When a range specified for the number of substituents (e.g., r being an integer from 0 to 4 in Exhibit 1) exceeds the number of positions available for substituents on a ring (e.g., in Exhibit 1 only 2 positions are available for $(R^v)_r$ on U-9), the actual higher end of the range is recognized to be the number of available positions.

Naming of substituents in the present disclosure uses recognized terminology providing conciseness in precisely conveying to those skilled in the art the chemical structure. For sake of conciseness, locant descriptors may be omitted.

Unless otherwise indicated, a "ring" or "ring system" as a component of Formula **1** is carbocyclic or heterocyclic. The term "ring system" denotes two or more connected rings. The term "bicyclic ring system" denotes a ring system consisting of two rings sharing one or more common atoms. A "bicyclic ring system" can be "ortho-fused", "bridged bicyclic" or "spirobicyclic". In an "ortho-fused bicyclic ring system" the common atoms are adjacent, and therefore the rings share two adjacent atoms and a bond connecting them. A "bridged bicyclic ring system" is formed by bonding a segment of one or more atoms to nonadjacent ring members of a ring. A "spirobicyclic ring system" is formed by bonding a segment of two or more atoms to the same ring member of a ring. The term "fused heterobicyclic ring system" denotes a fused bicyclic ring system in which at least one ring atom is not carbon. The term "ring member" refers to an atom (e.g., C, O, N, B or S) or other moiety (e.g., C(=O), C(=S), S(=O) or $S(=O)_2$) forming the backbone of a ring or ring system.

The terms "carbocyclic ring", "carbocycle" or "carbocyclic ring system" denote a ring or ring system wherein the atoms forming the ring backbone are selected only from carbon. The terms "heterocyclic ring", "heterocycle" or "heterocyclic ring system" denote a ring or ring system in which at least one atom forming the ring backbone is not carbon, e.g., nitrogen, oxygen, sulfur or boron. Typically a heterocyclic ring contains no more than 4 nitrogens, no more than 2 oxygens, no more than 2 sulfurs and no more than 1 boron. 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 and ring systems can be attached through any available carbon or nitrogen by replacement of a hydrogen on said carbon or nitrogen.

The term "aromatic" indicates that each of the ring atoms of a fully unsaturated ring are essentially in the same plane and have a *p*-orbital perpendicular to the ring plane, and that (4n + 2) π electrons, where n is a positive integer, are associated with the ring to comply with Hückel's rule.

The term "aromatic ring system" denotes a carbocyclic or heterocyclic ring system in which at least one ring of the ring system is aromatic. When a fully unsaturated carbocyclic ring satisfies Hückel's rule, then said ring is also called an "aromatic ring" or "aromatic carbocyclic ring". The term "aromatic carbocyclic ring system" denotes a carbocyclic ring system in which at least one ring of the ring system is aromatic. 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 "aromatic heterocyclic ring system" denotes a heterocyclic ring system in which at least one ring of the ring system is aromatic.

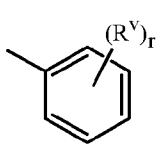
The term "nonaromatic ring system" denotes a carbocyclic or heterocyclic ring system that may be fully saturated, as well as partially or fully unsaturated, provided that none of the rings in the ring system are aromatic. The term "nonaromatic carbocyclic ring system" denotes a carbocyclic ring in which no ring in the ring system is aromatic. The term "nonaromatic heterocyclic ring system" denotes a heterocyclic ring system in which no ring in the ring system is aromatic.

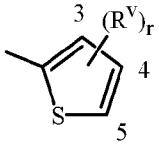
The term "optionally substituted" in connection with the heterocyclic rings refers to groups which are unsubstituted or have at least one non-hydrogen substituent that does not extinguish the biological activity possessed by the unsubstituted analog. As used herein, the following definitions shall apply 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.

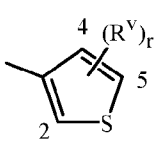
When J^1 or J^2 is a 5- or 6-membered nitrogen-containing heteroaromatic ring, it may be attached to the remainder of Formula **1** though any available carbon or nitrogen ring atom, unless otherwise described. As noted above, J^1 and J^2 can be (among others) phenyl optionally substituted with one or more substituents selected from a group of substituents as defined in the Summary. An example of phenyl optionally substituted with one to five substituents is the ring illustrated as U-1 in Exhibit 1, wherein R^v is R^{JC} as defined in the Summary for J^1 and J^2, and r is an integer from 0 to 5.

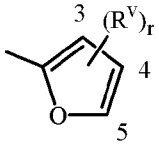
As noted above, J^1 and J^2 can be (among others) 5- or 6-membered heteroaromatic ring, which may be saturated or unsaturated, optionally substituted with one or more substituents selected from a group of substituents as defined in the Summary. Examples of a 5- or 6-membered unsaturated aromatic heterocyclic 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 for J^1 or J^2 (i.e. R^{JC} or R^{JN}) and r is an integer from 0 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 integers 0 or 1, and r being 0 means that the U group is unsubstituted, and a hydrogen is present at the position indicated by $(R^v)_r$.

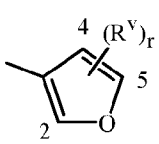
Exhibit 1

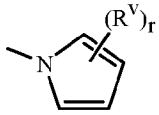

U-1

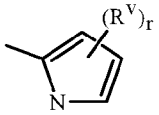

U-2

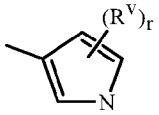

U-3

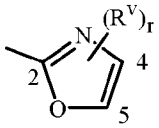

U-4

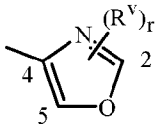

U-5

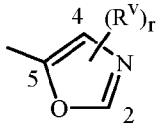

U-6

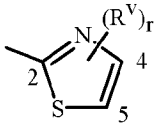

U-7

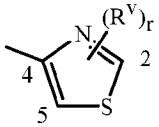

U-8

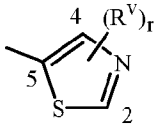

U-9

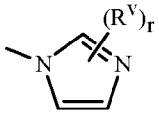

U-10

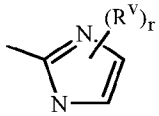

U-11

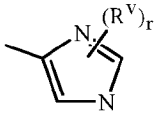

U-12

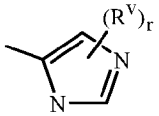

U-13

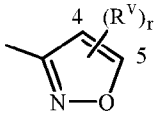

U-14

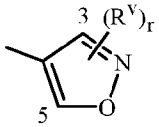

U-15

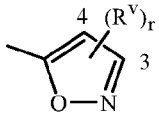

U-16

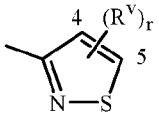

U-17

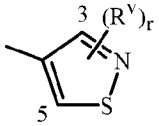

U-18

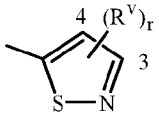

U-19

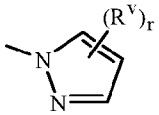

U-20

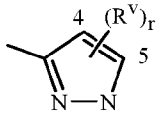

U-21

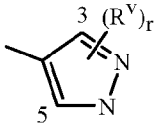

U-22

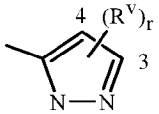

U-23

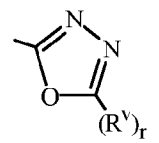

U-24

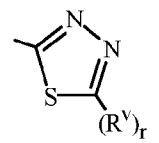

U-25

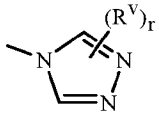

U-26

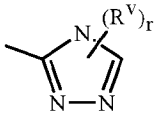

U-27

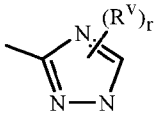

U-28

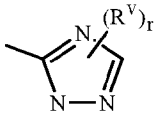

U-29

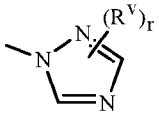

U-30

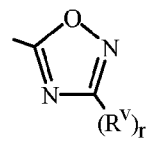

U-31


U-32

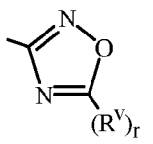

U-33


U-34

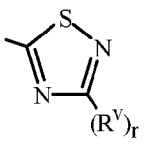

U-35



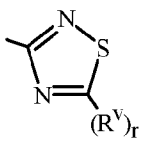
U-36 ,



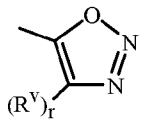
U-37 ,



U-38 ,



U-39 ,



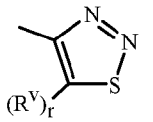
U-40 ,



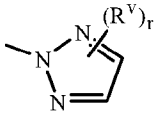
U-41 ,



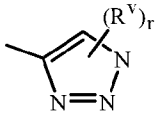
U-42 ,



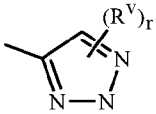
U-43 ,



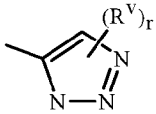
U-44 ,



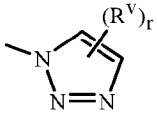
U-45 ,



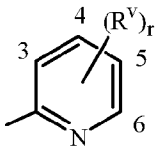
U-46 ,



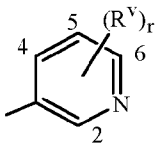
U-47 ,



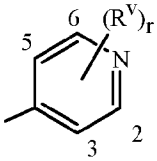
U-48 ,



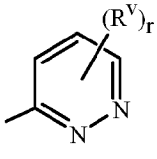
U-49 ,



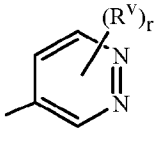
U-50 ,



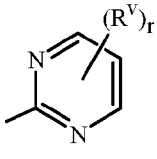
U-51 ,



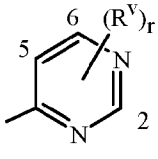
U-52 ,



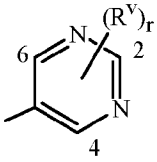
U-53 ,



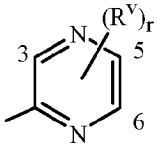
U-54 ,



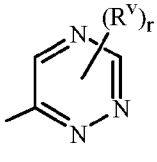
U-55 ,



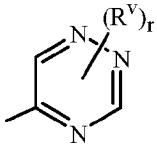
U-56 ,



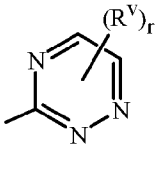
U-57 ,



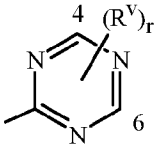
U-58 ,



U-59 ,



U-60 and



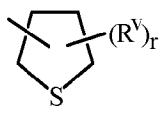
U-61 .

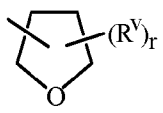
Note that when J^1 or J^2 is a 4-, 5- or 6-membered saturated or unsaturated non-aromatic heterocyclic ring optionally substituted with one or more substituents selected from the group of substituents as defined in the Summary for R^{JC}, one or two carbon ring members of the heterocycle can optionally be in the oxidized form of a carbonyl moiety.

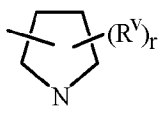
Examples of a 4-, 5- or 6-membered saturated or non-aromatic unsaturated heterocyclic ring include the rings G-1 through G-40 as illustrated in Exhibit 2. Note that when the attachment point on the G group is illustrated as floating, the G group can be attached to the remainder of Formula **1** through 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, r is typically an integer from 0 to 4, limited by the number of available positions on each G group.

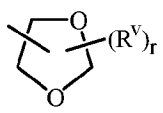
Note that when J^1 or J^2 is a ring selected from G-28 through G-35, G^2 is selected from O, S or N. Note that when G^2 is N, the nitrogen atom can complete its valence by substitution with either H or the substituents corresponding to R^V as defined in the Summary for J^1 and J^2 (i.e. R^{JC} or R^{JN}).

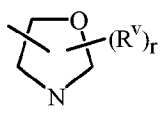
Exhibit 2

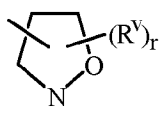

G-1

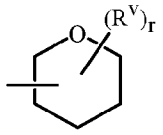

G-2

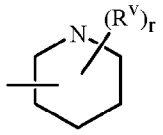

G-3

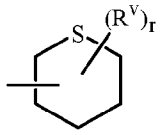

G-4

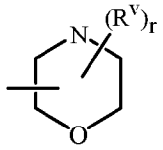

G-5

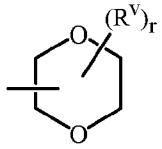

G-6

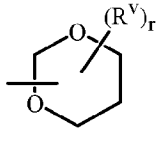

G-7

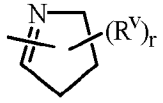

G-8

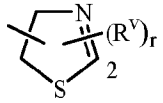

G-9

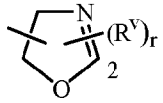

G-10

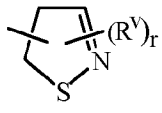

G-11

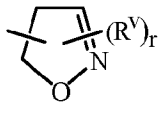

G-12

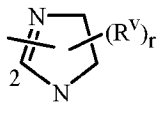

G-13

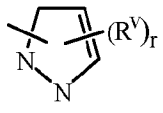

G-14

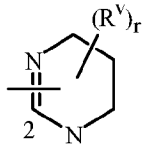

G-15

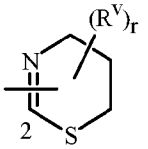
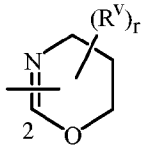
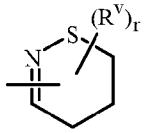
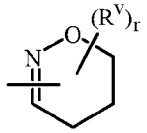
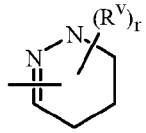

G-16

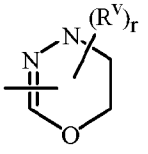
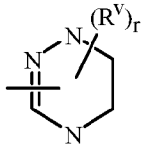
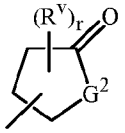
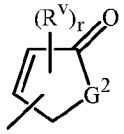
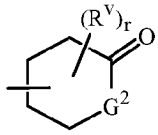

G-17

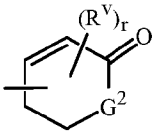
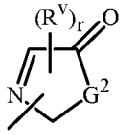
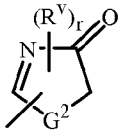
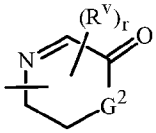
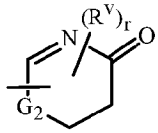

G-18

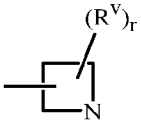
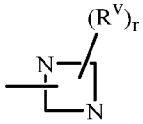
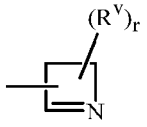
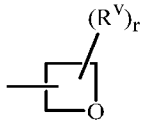
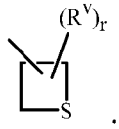

G-19


G-20


G-21 ,

G-22 ,

G-23 ,

G-24 ,

G-25 ,

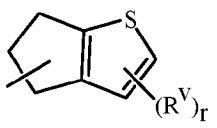
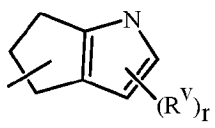
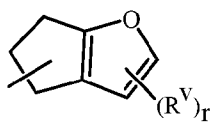
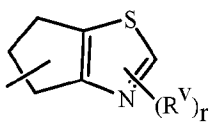

G-26 ,

G-27 ,

G-28 ,

G-29 ,

G-30 ,

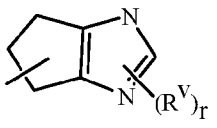
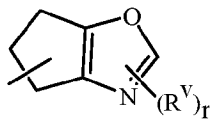
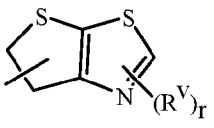
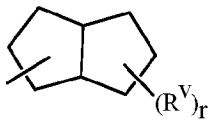

G-31 ,

G-32 ,

G-33 ,

G-34 ,

G-35 ,

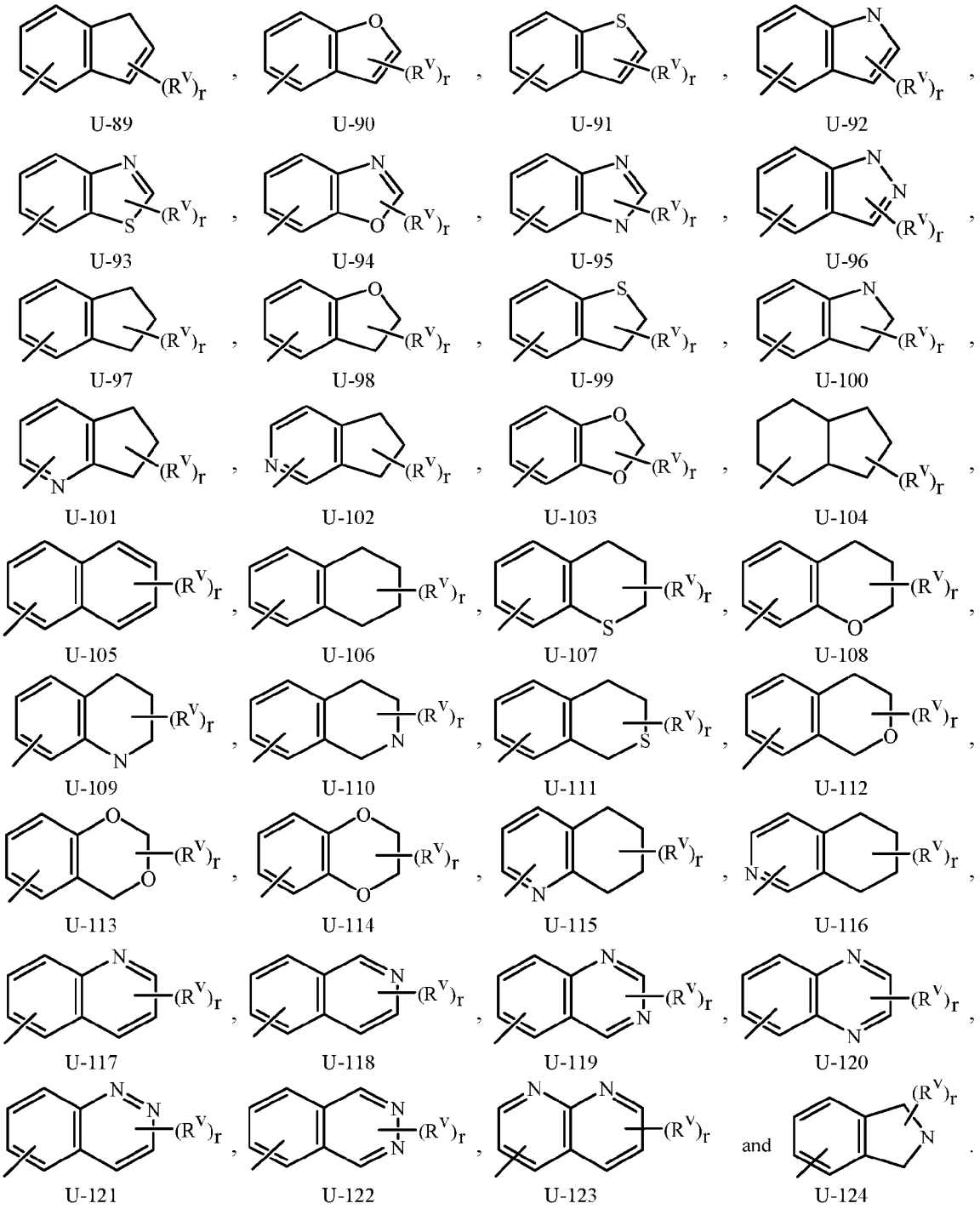

G-36 ,

G-37 ,

G-38 ,

G-39 and

G-40 .

As noted above, J^1 and J^2 can be (among others) an 8-, 9- or 10-membered bicyclic ring system optionally substituted with one or more substituents selected from a group of substituents as defined in the Summary (i.e. R^{JC} or R^{JN}). Examples of 8-, 9- or 10-membered ortho-fused bicyclic ring system optionally substituted with from one or more substituents include the rings U-81 through U-124 illustrated in Exhibit 3 wherein R^v is any substituent as defined in the Summary for J^1 and J^2 (i.e. R^{JC} or R^{JN}), and r is typically an integer from 0 to 4.

Exhibit 3


U-81 ,

U-82 ,

U-83 ,

U-84 ,


U-85 ,

U-86 ,

U-87 ,

U-88 ,



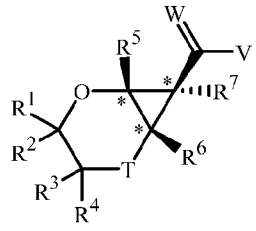
Although R^V groups are shown in the structures U-1 through U-124, it is noted that they do not need to be present since they are optional substituents. Note that when R^V is H when attached to an atom, this is the same as if said atom is unsubstituted. The nitrogen atoms that

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 group is illustrated as floating, $(R^v)_r$ can be attached to any available carbon atom or nitrogen atom of the U group. Note that when the attachment point on the U group 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 groups can only be substituted with less than 4 R^v groups (e.g., U-2 through U-5, U-7 through U-48, and U-52 through U-61).

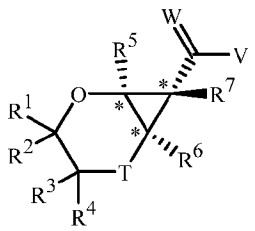
A wide variety of synthetic methods are known in the art to enable preparation of aromatic and nonaromatic heterocyclic rings and ring systems; for extensive reviews see the eight-volume set of *Comprehensive Heterocyclic Chemistry*, A. R. Katritzky and C. W. Rees editors-in-chief, Pergamon Press, Oxford,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

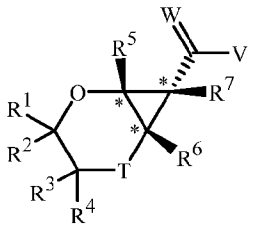
The compounds of the disclosure may be present as a mixture of stereoisomers or individual stereoisomers. For example, four possible stereoisomers of Formula **1** are depicted as Formula $\mathbf{1^i}$, $\mathbf{1^{ii}}$, $\mathbf{1^{iii}}$, and Formula $\mathbf{1^{iv}}$, involving the three cyclopropane chiral centers identified with asterisks (*). Analogously, other chiral centers are possible at, for example, R^1. One skilled in the art will appreciate that when T is O; and R^1, R^2, R^3 and R^4 are each substituted with the same substituent; and R^5 and R^6 are each substituted with the same substituent, then Formula $\mathbf{1^i}$ and Formula $\mathbf{1^{ii}}$ will be equivalent. Likewise, when T is O; and R^1, R^2, R^3 and R^4 are each substituted with the same substituent; and R^5 and R^6 are each substituted with the same substituent then Formula $\mathbf{1^{iii}}$ and Formula $\mathbf{1^{iv}}$ will also be equivalent.



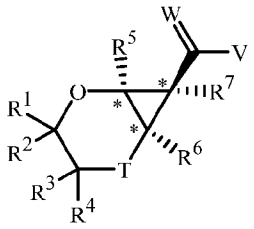
1^{i}



1^{ii}



1^{iii}



1^{iv}

Molecular depictions drawn herein follow standard conventions for depicting stereochemistry. To indicate stereoconfiguration, 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**.

This disclosure comprises racemic mixtures of equal amounts of the enantiomers of Formulae $\mathbf{1}^{i}$ and $\mathbf{1}^{ii}$. In addition, this disclosure includes mixtures that are enriched in the Formula $\mathbf{1}^{i}$ enantiomer compared to the racemic mixture of Formulae $\mathbf{1}^{i}$ and $\mathbf{1}^{ii}$. This disclosure also comprises the essentially pure enantiomer of Formula $\mathbf{1}^{i}$.

An embodiment of this disclosure comprises mixtures of stereoisomers of the compounds of Formula $\mathbf{1}^{i}$ and Formula $\mathbf{1}^{ii}$, wherein the ratio of $\mathbf{1}^{i}$ to $\mathbf{1}^{ii}$ is at least 75:25 (a 50% enantiomeric excess of $\mathbf{1}^{i}$).

An embodiment of this disclosure comprises mixtures of stereoisomers of the compounds of Formula $\mathbf{1}^{i}$ and Formula $\mathbf{1}^{ii}$, wherein the ratio of $\mathbf{1}^{i}$ to $\mathbf{1}^{ii}$ is at least 90:10 (an 80% enantiomeric excess of $\mathbf{1}^{i}$).

An embodiment of this disclosure comprises mixtures of stereoisomers of the compounds of Formula $\mathbf{1^i}$ and Formula $\mathbf{1^{ii}}$, wherein the ratio of $\mathbf{1^i}$ to $\mathbf{1^{ii}}$ is at least 95:5 (a 90% enantiomeric excess of $\mathbf{1^i}$).

An embodiment of this disclosure comprises mixtures of stereoisomers of the compounds of Formula $\mathbf{1^i}$ and Formula $\mathbf{1^{ii}}$, wherein the ratio of $\mathbf{1^i}$ to $\mathbf{1^{ii}}$ is at least 98:2 (a 96% enantiomeric excess of $\mathbf{1^i}$).

An embodiment of this disclosure comprises mixtures of stereoisomers of the compounds of Formula $\mathbf{1^i}$ and Formula $\mathbf{1^{ii}}$, wherein the ratio of $\mathbf{1^i}$ to $\mathbf{1^{ii}}$ is at least 99:1 (a 98% enantiomeric excess of $\mathbf{1^i}$).

An embodiment of this disclosure comprises mixtures of stereoisomers of the compounds of Formula $\mathbf{1^i}$ and Formula $\mathbf{1^{ii}}$, wherein the ratio of $\mathbf{1^i}$ to $\mathbf{1^{ii}}$ is essentially 100:0.

An embodiment of this disclosure comprises the compounds of Formula $\mathbf{1^i}$.

In addition, this disclosure includes mixtures that are enriched in the Formula $\mathbf{1^{ii}}$ enantiomer compared to the racemic mixture of Formulae $\mathbf{1^{ii}}$ and $\mathbf{1^i}$. This disclosure also comprises the essentially pure enantiomer of Formula $\mathbf{1^{ii}}$.

An embodiment of this disclosure comprises mixtures of stereoisomers of the compounds of Formula $\mathbf{1^{ii}}$ and Formula $\mathbf{1^i}$, wherein the ratio of $\mathbf{1^{ii}}$ to $\mathbf{1^i}$ is at least 75:25 (a 50% enantiomeric excess of $\mathbf{1^{ii}}$).

An embodiment of this disclosure comprises mixtures of stereoisomers of the compounds of Formula $\mathbf{1^{ii}}$ and Formula $\mathbf{1^i}$, wherein the ratio of $\mathbf{1^{ii}}$ to $\mathbf{1^i}$ is at least 90:10 (an 80% enantiomeric excess of $\mathbf{1^{ii}}$).

An embodiment of this disclosure comprises mixtures of stereoisomers of the compounds of Formula $\mathbf{1^{ii}}$ and Formula $\mathbf{1^i}$, wherein the ratio of $\mathbf{1^{ii}}$ to $\mathbf{1^i}$ is at least 95:5 (a 90% enantiomeric excess of $\mathbf{1^{ii}}$).

An embodiment of this disclosure comprises mixtures of stereoisomers of the compounds of Formula $\mathbf{1^{ii}}$ and Formula $\mathbf{1^i}$, wherein the ratio of $\mathbf{1^{ii}}$ to $\mathbf{1^i}$ is at least 98:2 (a 96% enantiomeric excess of $\mathbf{1^{ii}}$).

An embodiment of this disclosure comprises mixtures of stereoisomers of the compounds of Formula $\mathbf{1^{ii}}$ and Formula $\mathbf{1^i}$, wherein the ratio of $\mathbf{1^{ii}}$ to $\mathbf{1^i}$ is at least 99:1 (a 98% enantiomeric excess of $\mathbf{1^{ii}}$).

An embodiment of this disclosure comprises mixtures of stereoisomers of the compounds of Formula $\mathbf{1^{ii}}$ and Formula $\mathbf{1^i}$, wherein the ratio of $\mathbf{1^{ii}}$ to $\mathbf{1^i}$ is essentially 100:0.

An embodiment of this disclosure comprises the compounds of Formula $\mathbf{1^{ii}}$.

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

Compounds of this disclosure can exist as one or more conformational isomers due to restricted rotation about an amide bond (e.g., C(=O)–N) 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.

This disclosure comprises all stereoisomers, conformational isomers and mixtures thereof in all proportions as well as isotopic forms such as deuterated compounds.

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 T is a direct bond, and V is O-L-J^1.

Embodiment 1a. A compound of Formula **1** wherein T is O, and V is O-L-J^1 or N(Y)-L-J^2.

Embodiment 1b. A compound of Formula **1** or Embodiment 1a wherein T is O, and V is O-L-J^1.

Embodiment 1c. A compound of Formula **1** or Embodiment 1a wherein T is O, and V is N(Y)-L-J^2.

Embodiment 1d. A compound of Formula **1** or any of the preceding Embodiments wherein L is a direct bond, CH_2, $CH(CH_3)$ or CH_2CH_2.

Embodiment 1e. A compound of Formula **1** or any of the preceding Embodiments wherein L is a direct bond or CH_2.

Embodiment 1f. A compound of Formula **1** or any of the preceding Embodiments wherein L is a direct bond.

Embodiment 2. A compound of Formula **1** wherein R^1, R^2, R^3 and R^4 are each independently hydrogen, halogen, cyano, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy, C_1-C_4 haloalkoxy, C_1-C_4 alkylthio, C_1-C_4 haloalkylthio, C_1-C_4 alkylsulfinyl, C_1-C_4 haloalkylsulfinyl, C_1-C_4 alkylsulfonyl or C_1-C_4 haloalkylsulfonyl.

Embodiment 2a. A compound of Embodiment 2 wherein R^1, R^2, R^3 and R^4 are each independently hydrogen, halogen, cyano, C_1-C_3 alkyl, C_1-C_2 haloalkyl, C_1-C_2 alkoxy, C_1-C_2 haloalkoxy, C_1-C_2 alkylthio, C_1-C_2 haloalkylthio, C_1-C_2 alkylsulfinyl, C_1-C_2 haloalkylsulfinyl, C_1-C_2 alkylsulfonyl or C_1-C_2 haloalkylsulfonyl.

Embodiment 2b. A compound of Embodiment 2a wherein R^1, R^2, R^3 and R^4 are each independently hydrogen, halogen, C_1-C_4 alkyl or C_1-C_4 haloalkyl.

Embodiment 2c. A compound of Embodiment 2b wherein R^1, R^2, R^3 and R^4 are each independently hydrogen, halogen, methyl, ethyl, isopropyl or C_1-C_2 haloalkyl.

Embodiment 2d. A compound of Formula **1** or any of the preceding Embodiments wherein R^1, R^2, R^3 and R^4 are each independently hydrogen, halogen or methyl.

Embodiment 2e. A compound of Formula **1** or any of the preceding Embodiments wherein R^1, R^2, R^3 and R^4 are each independently hydrogen or methyl.

Embodiment 2f. A compound of Formula **1** or any of the preceding Embodiments wherein R^1, R^2, R^3 and R^4 are each hydrogen.

Embodiment 3a. A compound of Formula **1** or any of the preceding Embodiments wherein R^5, R^6 and R^7 are each independently hydrogen, halogen, cyano, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy, C_1-C_4 haloalkoxy, C_1-C_4 alkylthio, C_1-C_4 haloalkylthio, C_1-C_4 alkylsulfinyl, C_1-C_4 haloalkylsulfinyl, C_1-C_4 alkylsulfonyl or C_1-C_4 haloalkylsulfonyl.

Embodiment 3a1. A compound of Formula **1** or any one of Embodiments 1 through 2a wherein R^5, R^6 and R^7 are each independently hydrogen, halogen, cyano, C_1-C_3 alkyl, C_1-C_2 haloalkyl, C_1-C_2 alkoxy, C_1-C_2 haloalkoxy, C_1-C_2 alkylthio, C_1-C_2 haloalkylthio, C_1-C_2 alkylsulfinyl, C_1-C_2 haloalkylsulfinyl, C_1-C_2 alkylsulfonyl, C_1-C_2 haloalkylsulfonyl or Q^1.

Embodiment 3b. A compound of Embodiment 3a or 3a1 wherein R^5, R^6 and R^7 are each independently hydrogen, halogen, cyano, C_1-C_3 alkyl, C_1-C_2 haloalkyl, C_1-C_2 alkoxy, C_1-C_2 haloalkoxy, C_1-C_2 alkylthio, C_1-C_2 haloalkylthio, C_1-C_2 alkylsulfinyl, C_1-C_2 haloalkylsulfinyl, C_1-C_2 alkylsulfonyl or C_1-C_2 haloalkylsulfonyl.

Embodiment 3c. A compound of Embodiment 3a wherein R^5, R^6 and R^7 are each independently hydrogen, halogen, C_1-C_4 alkyl or C_1-C_4 haloalkyl.

Embodiment 3d. A compound of Embodiment 3c wherein R^5, R^6 and R^7 are each independently hydrogen, halogen, methyl, ethyl, isopropyl or C_1-C_2 haloalkyl.

Embodiment 3e. A compound of Formula **1** or any of the preceding Embodiments wherein R^5, R^6 and R^7 are each independently hydrogen, halogen or methyl.

Embodiment 3f. A compound of Formula **1** or any of the preceding Embodiments wherein R^5, R^6 and R^7 are each hydrogen.

Embodiment 4a. A compound of Formula **1** or any of the preceding Embodiments wherein Q^1 is a 6- to 10-membered carbocyclic ring or ring system, each ring or ring system optionally substituted with one or more substituents independently selected from halogen, cyano, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy, C_1-C_4 haloalkoxy, C_1-C_4 alkylthio, C_1-C_4 haloalkylthio, C_1-C_4 alkylsulfinyl, C_1-C_4 haloalkylsulfinyl, C_1-C_4 alkylsulfonyl and C_1-C_4 haloalkylsulfonyl.

Embodiment 4b. A compound of Embodiment 4a wherein Q^1 is a 6- to 8-membered aromatic carbocyclic ring, each ring optionally substituted with one or more substituents independently selected from halogen, cyano, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy, C_1-C_4 haloalkoxy, C_1-C_4 alkylthio, C_1-C_4 haloalkylthio, C_1-C_4 alkylsulfinyl, C_1-C_4 haloalkylsulfinyl, C_1-C_4 alkylsulfonyl and C_1-C_4 haloalkylsulfonyl.

Embodiment 4c. A compound of Formula **1** or any one of Embodiments 1 through 3f wherein Q^1 is a 6- to 14-membered carbocyclic ring or ring system, each ring or ring system optionally substituted with one or more substituents independently selected from halogen, cyano, C_1-C_4 alkyl, C_1-C_2 haloalkyl, C_1-C_2 alkoxy, C_1-C_2 haloalkoxy.

Embodiment 4d. A compound of Embodiment 4c wherein Q^1 is a 6- to 10-membered carbocyclic ring or ring system, each ring or ring system optionally substituted with one or more substituents independently selected from halogen, cyano, C_1-C_4 alkyl, C_1-C_2 haloalkyl, C_1-C_2 alkoxy, C_1-C_2 haloalkoxy.

Embodiment 4e. A compound of Embodiment 4d wherein Q^1 is a 6- to 8-membered aromatic carbocyclic ring, each ring optionally substituted with one or more substituents independently selected from halogen, cyano, C_1-C_4 alkyl, C_1-C_2 haloalkyl, C_1-C_2 alkoxy, C_1-C_2 haloalkoxy.

Embodiment 5a. A compound of Formula **1** or any one of Embodiments 1 through 4e wherein W is O.

Embodiment 5b. A compound of Formula **1** or any one of Embodiments 1 through 4e wherein W is S.

Embodiment 6a. A compound of Formula **1** or any of the preceding Embodiments wherein Y is hydrogen, $C(=O)R^8$, $S(=O)_nR^9$, CO_2R^{10}, $C(=O)NR^{11}R^{12}$, $S(=O)_nNR^{11}R^{12}$, $NR^{11}R^{12}$, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, C_3-C_8 cycloalkyl, C_3-C_8 halocycloalkyl, C_3-C_8 cycloalkenyl, C_3-C_8 halocycloalkenyl, C_4-C_{10} alkylcycloalkyl, C_4-C_{10} cycloalkylalkyl, C_4-C_{10} halocycloalkylalkyl, C_6-C_{14} cycloalkylcycloalkyl, C_5-C_{10} alkylcycloalkylalkyl, C_2-C_8 alkoxyalkyl, C_2-C_8 haloalkoxyalkyl, C_4-C_{10} cycloalkoxyalkyl, C_3-C_8 alkoxyalkoxyalkyl, C_2-C_6 alkylthioalkyl, C_2-C_6 alkylsulfinylalkyl, C_2-C_6 alkylsulfonylalkyl, C_2-C_6 alkylaminoalkyl, C_2-C_6 haloalkylaminoalkyl, C_3-C_8 dialkylaminoalkyl, C_4-C_{10} cycloalkylaminoalkyl or C_3-C_5 alkoxycarbonylalkyl.

Embodiment 6b. A compound of Formula **1** or any one of Embodiments 1 through 5b wherein Y is hydrogen, $C(=O)R^8$, $S(=O)_nR^9$, CO_2R^{10}, $C(=O)NR^{11}R^{12}$, $S(=O)_nNR^{11}R^{12}$ or $NR^{11}R^{12}$; or benzyl optionally substituted by R^{13} on ring members; or C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, C_3-C_8 cycloalkyl, C_2-C_8 alkoxyalkyl, C_2-C_8 haloalkoxyalkyl, C_2-C_6 alkylthioalkyl, C_2-C_6 alkylsulfinylalkyl, C_2-C_6 alkylsulfonylalkyl, C_2-C_6 alkylaminoalkyl, C_2-C_6 haloalkylaminoalkyl, C_3-C_8

dialkylaminoalkyl, C_4-C_{10} cycloalkylaminoalkyl or C_3-C_5 alkoxycarbonylalkyl, each optionally substituted with up to 1 substituent selected from cyano, hydroxy, nitro, C_2-C_4 alkylcarbonyl, C_2-C_4 alkoxycarbonyl.

Embodiment 6c. A compound of Embodiment 6a or 6b wherein Y is hydrogen, $C(=O)R^8$, $S(=O)_nR^9$, CO_2R^{10}, $C(=O)NR^{11}R^{12}$, $S(=O)_nNR^{11}R^{12}$, $NR^{11}R^{12}$, C_1-C_6 alkyl, C_2-C_4 alkenyl, C_2-C_4 alkynyl, C_1-C_6 haloalkyl, C_2-C_4 haloalkenyl, C_2-C_4 haloalkynyl, C_3-C_6 cycloalkyl, C_2-C_4 alkoxyalkyl, C_2-C_4 haloalkoxyalkyl, C_2-C_4 alkylthioalkyl, C_2-C_4 alkylsulfinylalkyl, C_2-C_4 alkylsulfonylalkyl, C_2-C_4 alkylaminoalkyl, C_2-C_4 haloalkylaminoalkyl, C_3-C_5 dialkylaminoalkyl, C_4-C_7 cycloalkylaminoalkyl or C_3-C_5 alkoxycarbonylalkyl.

Embodiment 6d. A compound of Embodiment 6c wherein Y is hydrogen, $C(=O)R^8$, $S(=O)_nR^9$, CO_2R^{10}, $C(=O)NR^{11}R^{12}$, $S(=O)_nNR^{11}R^{12}$, $NR^{11}R^{12}$ or C_1-C_6 alkyl.

Embodiment 6e. A compound of Embodiment 6c wherein Y is hydrogen, C_1-C_6 alkyl, C_2-C_4 alkenyl, C_2-C_4 alkynyl, C_1-C_6 haloalkyl, C_2-C_4 haloalkenyl, C_2-C_4 haloalkynyl, C_3-C_6 cycloalkyl.

Embodiment 6f. A compound of Formula **1** or any of the preceding Embodiments wherein Y is hydrogen or C_1-C_6 alkyl.

Embodiment 6g. A compound of Embodiment 6f wherein Y is hydrogen or C_1-C_4 alkyl.

Embodiment 6h. A compound of Embodiment 6g wherein Y is hydrogen, methyl, ethyl or isopropyl.

Embodiment 6i. A compound of Embodiment 6h wherein Y is hydrogen or methyl.

Embodiment 6j. A compound of Embodiment 6i wherein Y is hydrogen.

Embodiment 7a. A compound of Formula **1** or any of the preceding Embodiments wherein R^8, R^9 and R^{10} are each independently C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_3-C_6 cycloalkyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, C_2-C_7 alkoxyalkyl or C_4-C_7 cycloalkylalkyl; or phenyl optionally substituted by R^{13}.

Embodiment 7b. A compound of Embodiment 7a wherein R^8, R^9 and R^{10} are each independently C_1-C_3 alkyl, C_2-C_3 alkenyl, C_2-C_3 alkynyl, C_3-C_6 cycloalkyl or C_1-C_3 haloalkyl.

Embodiment 7c. A compound of Embodiment 7b wherein R^8, R^9 and R^{10} are each independently C_1-C_3 alkyl or C_1-C_2 haloalkyl.

Embodiment 8a. A compound of Formula **1** or any of the preceding Embodiments wherein R^{11} is hydrogen, C_1-C_6 alkyl, C_2-C_4 alkenyl, C_2-C_4 alkynyl, C_3-C_6

cycloalkyl, C_1-C_6 haloalkyl, C_2-C_4 haloalkenyl, C_2-C_4 haloalkynyl, C_1-C_4 alkoxy, C_1-C_4 haloalkoxy, C_2-C_7 alkoxyalkyl C_4-C_7 cycloalkylalkyl, C_2-C_4 alkylthioalkyl, C_1-C_4 alkylsulfonyl, C_1-C_4 haloalkylsulfonyl, C_2-C_4 alkylsulfinylalkyl, C_2-C_4 alkylsulfonylalkyl, C_2-C_4 alkylcarbonyl, C_2-C_4 haloalkylcarbonyl, C_2-C_5 alkoxycarbonyl, C_3-C_5 alkoxycarbonylalkyl, C_2-C_5 alkylaminocarbonyl, C_3-C_5 dialkylaminocarbonyl, C_3-C_7 alkylaminocarbonylalkyl or C_4-C_7 dialkylaminocarbonylalkyl; or phenyl optionally substituted by R^{13}; or benzyl optionally substituted by R^{13} on ring members; or pyridyl optionally substituted by R^{13}.

Embodiment 8b. A compound of Embodiment 8a wherein R^{11} is hydrogen, C_1-C_6 alkyl, C_2-C_4 alkenyl, C_2-C_4 alkynyl, C_3-C_6 cycloalkyl, C_1-C_6 haloalkyl, C_2-C_4 haloalkenyl, C_2-C_4 haloalkynyl, C_1-C_4 alkoxy, C_1-C_4 haloalkoxy, C_2-C_7 alkoxyalkyl C_4-C_7 cycloalkylalkyl, C_2-C_4 alkylthioalkyl, C_1-C_4 alkylsulfonyl, C_1-C_4 haloalkylsulfonyl, C_2-C_4 alkylsulfinylalkyl, C_2-C_4 alkylsulfonylalkyl, C_2-C_4 alkylcarbonyl, C_2-C_4 haloalkylcarbonyl, C_2-C_5 alkoxycarbonyl, C_3-C_5 alkoxycarbonylalkyl, C_2-C_5 alkylaminocarbonyl, C_3-C_5 dialkylaminocarbonyl, C_3-C_7 alkylaminocarbonylalkyl or C_4-C_7 dialkylaminocarbonylalkyl.

Embodiment 8c. A compound of Embodiment 8b wherein R^{11} is hydrogen, C_1-C_6 alkyl, C_2-C_4 alkenyl, C_2-C_4 alkynyl, C_3-C_6 cycloalkyl, C_1-C_6 haloalkyl, C_2-C_4 haloalkenyl, C_2-C_4 haloalkynyl, C_1-C_4 alkoxy, C_1-C_4 haloalkoxy, C_2-C_7 alkoxyalkyl C_4-C_7 cycloalkylalkyl, C_2-C_4 alkylthioalkyl, C_1-C_4 alkylsulfonyl, C_1-C_4 haloalkylsulfonyl, C_2-C_4 alkylsulfinylalkyl or C_2-C_4 alkylsulfonylalkyl.

Embodiment 8d. A compound of Embodiment 8c wherein R^{11} is hydrogen, C_1-C_4 alkyl, C_2-C_4 alkenyl, C_2-C_4 alkynyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_2-C_4 haloalkenyl, C_2-C_4 haloalkynyl, C_1-C_4 alkoxy, C_1-C_4 haloalkoxy, C_2-C_7 alkoxyalkyl or C_4-C_7 cycloalkylalkyl.

Embodiment 8e. A compound of Embodiment 8d wherein R^{11} is hydrogen, C_1-C_4 alkyl, C_2-C_4 alkenyl, C_2-C_4 alkynyl, C_3-C_6 cycloalkyl or C_4-C_7 cycloalkylalkyl.

Embodiment 8f. A compound of Embodiment 8e wherein R^{11} is hydrogen, C_1-C_4 alkyl, C_3-C_6 cycloalkyl or C_4-C_7 cycloalkylalkyl.

Embodiment 8g. A compound of Embodiment 8f wherein R^{11} is C_1-C_4 alkyl, C_3-C_6 cycloalkyl or C_4-C_7 cycloalkylalkyl.

Embodiment 9a. A compound of Formula **1** or any of the preceding Embodiments wherein R^{12} is hydrogen, C_1-C_6 alkyl, C_2-C_4 alkenyl, C_2-C_4 alkynyl, C_3-C_6 cycloalkyl, C_1-C_6 haloalkyl, C_2-C_4 haloalkenyl, C_2-C_4 haloalkynyl, C_1-C_4

alkoxy, C_1-C_4 haloalkoxy, C_2-C_7 alkoxyalkyl C_4-C_7 cycloalkylalkyl, C_2-C_4 alkylthioalkyl, C_1-C_4 alkylsulfonyl, C_1-C_4 haloalkylsulfonyl, C_2-C_4 alkylsulfinylalkyl, C_2-C_4 alkylsulfonylalkyl, C_2-C_4 alkylcarbonyl, C_2-C_4 haloalkylcarbonyl, C_2-C_5 alkoxycarbonyl, C_3-C_5 alkoxycarbonylalkyl, C_2-C_5 alkylaminocarbonyl, C_3-C_5 dialkylaminocarbonyl, C_3-C_7 alkylaminocarbonylalkyl or C_4-C_7 dialkylaminocarbonylalkyl; or phenyl optionally substituted by R^{13}; or benzyl optionally substituted by R^{13} on ring members; or pyridyl optionally substituted by R^{13}.

Embodiment 9b. A compound of Embodiment 9a wherein R^{12} is hydrogen, C_1-C_6 alkyl, C_2-C_4 alkenyl, C_2-C_4 alkynyl, C_3-C_6 cycloalkyl, C_1-C_6 haloalkyl, C_2-C_4 haloalkenyl, C_2-C_4 haloalkynyl, C_1-C_4 alkoxy, C_1-C_4 haloalkoxy, C_2-C_7 alkoxyalkyl C_4-C_7 cycloalkylalkyl, C_2-C_4 alkylthioalkyl, C_1-C_4 alkylsulfonyl, C_1-C_4 haloalkylsulfonyl, C_2-C_4 alkylsulfinylalkyl, C_2-C_4 alkylsulfonylalkyl, C_2-C_4 alkylcarbonyl, C_2-C_4 haloalkylcarbonyl, C_2-C_5 alkoxycarbonyl, C_3-C_5 alkoxycarbonylalkyl, C_2-C_5 alkylaminocarbonyl, C_3-C_5 dialkylaminocarbonyl, C_3-C_7 alkylaminocarbonylalkyl or C_4-C_7 dialkylaminocarbonylalkyl.

Embodiment 9c. A compound of Embodiment 9b wherein R^{12} is hydrogen, C_1-C_6 alkyl, C_2-C_4 alkenyl, C_2-C_4 alkynyl, C_3-C_6 cycloalkyl, C_1-C_6 haloalkyl, C_4-C_7 cycloalkylalkyl, C_1-C_4 alkylsulfonyl, C_2-C_4 alkylcarbonyl or C_2-C_5 alkoxycarbonyl.

Embodiment 9d. A compound of Embodiment 9c wherein R^{12} is hydrogen, C_1-C_4 alkyl, C_2-C_4 alkylcarbonyl or C_2-C_5 alkoxycarbonyl.

Embodiment 9e. A compound of Embodiment 9c wherein R^{12} is C_1-C_4 alkyl, C_2-C_4 alkylcarbonyl or C_2-C_5 alkoxycarbonyl.

Embodiment 9f. A compound of Embodiment 9c wherein R^{12} is hydrogen, C_2-C_4 alkylcarbonyl or C_2-C_5 alkoxycarbonyl.

Embodiment 10a. A compound of Formula **1** or any of the preceding Embodiments wherein R^{11} and R^{12} are taken together with the nitrogen to which they are attached to form a 3- to 6-membered ring containing ring members selected from carbon atoms and up to two additional atoms independently selected from nitrogen, sulfur and oxygen, said ring optionally substituted with 1 to 2 substituents independently selected from halogen, C_1-C_2 alkyl, C_1-C_2 haloalkyl, C_1-C_2 alkoxy, C_1-C_2 haloalkoxy, cyano and nitro.

Embodiment 10b. A compound of Embodiment 10a wherein R^{11} and R^{12} are taken together with the nitrogen to which they are attached to form a 3- to 6-membered

ring containing ring members selected from carbon atoms and up to two additional atoms independently selected from nitrogen, sulfur and oxygen, said ring optionally substituted with 1 to 2 substituents independently selected from halogen, C_1-C_2 alkyl and C_1-C_2 haloalkyl.

Embodiment 10c. A compound of Embodiment 10b wherein R^{11} and R^{12} are taken together with the nitrogen to which they are attached to form a 3- to 5-membered ring containing ring members selected from carbon atoms and up to one additional atom independently selected from nitrogen, sulfur and oxygen, said ring optionally substituted with 1 to 2 substituents independently selected from halogen, C_1-C_2 alkyl and C_1-C_2 haloalkyl.

Embodiment 11a. A compound of Formula **1** or any of the preceding Embodiments wherein R^{13} is halogen, C_1-C_3 alkyl, C_1-C_3 haloalkyl C_1-C_3 alkoxy or C_1-C_3 haloalkoxy.

Embodiment 11b. A compound of Embodiment 11a wherein R^{13} is halogen, C_1-C_3 alkyl, C_1-C_3 haloalkyl.

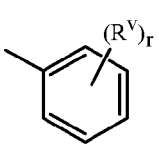
Embodiment 11c. A compound of Embodiment 11b wherein R^{13} is halogen.

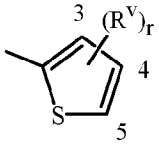
Embodiment 12a. A compound of Formula **1** or any of the preceding Embodiments wherein J^1 is phenyl or naphthalenyl, each ring or ring system optionally substituted with up to 4 substituents independently selected from R^{JC}; or a 4-, 5- or 6-membered heterocyclic ring or an 8-, 9- or 10-membered bicyclic ring system, each ring or ring system containing ring members selected from carbon atoms and 1 to 3 heteroatoms independently selected from up to 1 boron, up to 2 oxygen, up to 1 sulfur and up to 3 nitrogen atoms, wherein up to 1 carbon ring members are optionally selected from C(=O) and C(=S), each ring system optionally substituted with up to 4 substituents independently selected from R^{JC} on carbon atom ring members; R^{JN} on nitrogen atom ring members and R^{JB} on boron atom ring members.

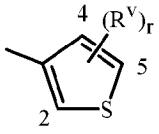
Embodiment 12b. A compound of Embodiment 12a wherein J^1 is phenyl, each ring optionally substituted with up to 4 substituents independently selected from R^{JC}; or a 4-, 5- or 6-membered heterocyclic ring, each ring containing ring members selected from carbon atoms and 1 to 3 heteroatoms independently selected from up to 2 oxygen, up to 1 sulfur and up to 3 nitrogen atoms, wherein up to 1 carbon ring members are optionally selected from C(=O) and C(=S), each ring system optionally substituted with up to 4 substituents independently selected from R^{JC} on carbon atom ring members and R^{JN} on nitrogen atom ring members.

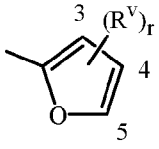
Embodiment 12c. A compound of Formula **1** or any of the preceding Embodiments wherein J^1 is selected from U-1 through U-61 as shown in Exhibit 1

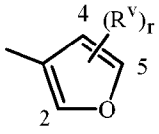
Exhibit 1

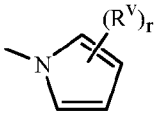

U-1

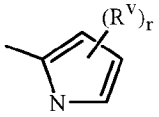

U-2

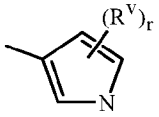

U-3

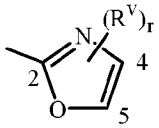

U-4

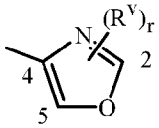

U-5

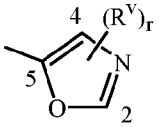

U-6

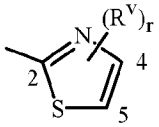

U-7

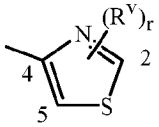

U-8

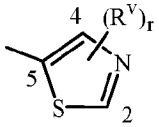

U-9

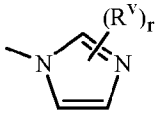

U-10

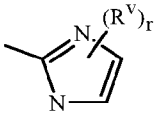

U-11

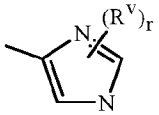

U-12

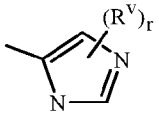

U-13

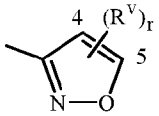

U-14

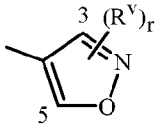

U-15

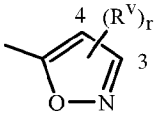

U-16

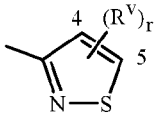

U-17

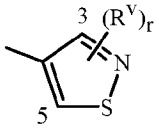

U-18

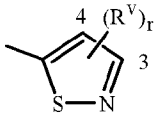

U-19

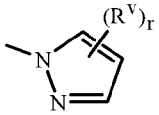

U-20

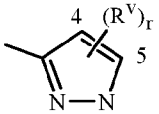

U-21

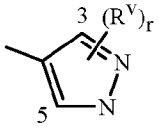

U-22

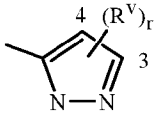

U-23

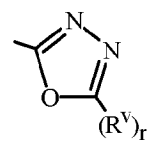

U-24

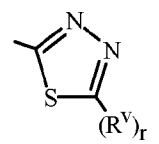

U-25

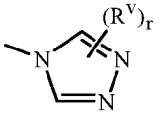

U-26

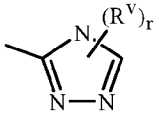

U-27

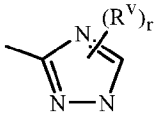

U-28

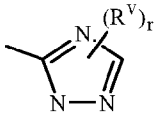

U-29

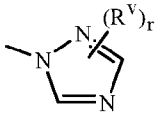

U-30

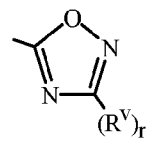
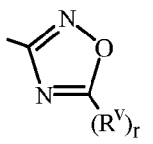
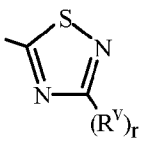
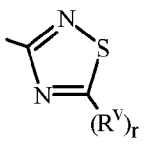
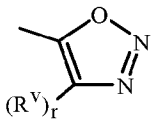
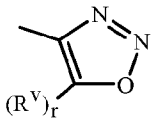
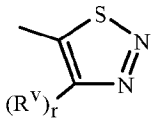

U-31

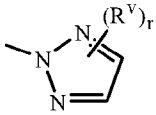
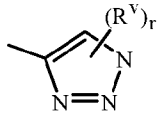
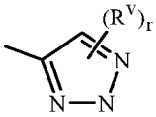
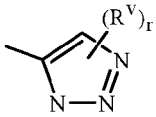
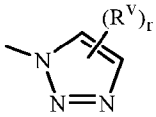
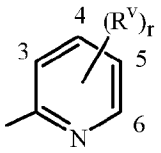
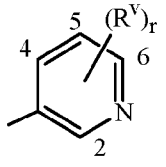
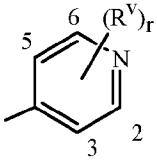
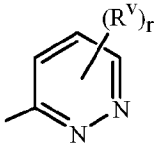
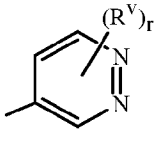
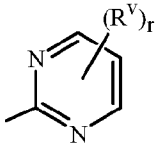
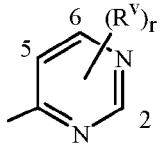
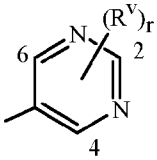
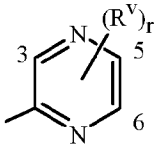
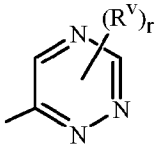
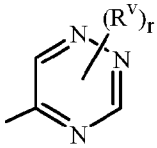
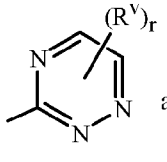
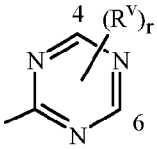

U-32


U-33


U-34


U-35


U-36 ,

U-37 ,

U-38 ,

U-39 ,

U-40 ,

U-41 ,

U-42 ,

U-43 ,

U-44 ,

U-45 ,

U-46 ,

U-47 ,

U-48 ,

U-49 ,

U-50 ,

U-51 ,

U-52 ,

U-53 ,

U-54 ,

U-55 ,

U-56 ,

U-57 ,

U-58 ,

U-59 ,

U-60 and

U-61 ;

wherein up to 1 carbon ring member is optionally selected from C(=O); and when R^v is attached to a carbon ring member, said R^v is selected from R^{JC}, and when R^v is attached to a nitrogen ring member, said R^v is selected from R^{JN}; and r is 0, 1, 2, 3 or 4.

Embodiment 12d. A compound of Embodiment 12c wherein J^1 is selected from U-2 through U-61.

Embodiment 12d1. A compound of Embodiment 12c wherein J^1 is selected from U-49 through U-61.

Embodiment 12d2. A compound of Embodiment 12c wherein J^1 is selected from U-49 through U-61, wherein 1 carbon ring member is C(=O).

Embodiment 12e. A compound of Embodiment 12c wherein J^1 is selected from U-1, U-2, U-4, U-26, U-28, U-37, U-38, U-39, U-49, U-50, U-51, U-53 or U-56.

Embodiment 12f. A compound of Formula **1** or any of the preceding Embodiments wherein J^1 is selected from U-1, U-2, U-4, U-26, U-37, U-38, U-39, U-49, U-50 or U-51.

Embodiment 12g. A compound of Formula **1** or any of the preceding Embodiments wherein J^1 is selected from U-1 or U-26; or U-50 wherein up to 1 carbon ring member is optionally selected from C(=O).

Embodiment 12h. A compound of Embodiment 12g wherein J^1 is U-1.

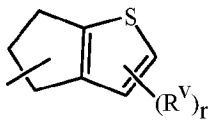
Embodiment 12i. A compound of Embodiment 12g wherein J^1 is U-26.

Embodiment 12j. A compound of Embodiment 12g wherein J^1 is U-50.

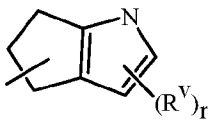
Embodiment 12k. A compound of Embodiment 12g wherein J^1 is U-50, wherein 1 carbon ring member is C(=O).

Embodiment 12h. A compound of Formula **1** or any one of Embodiments 1 through 12a wherein J^1 is selected from U-81 through U-124 as shown in Exhibit 3

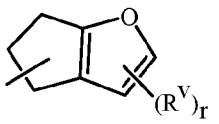
Exhibit 3



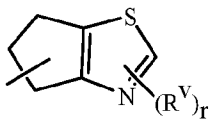
U-81 ,



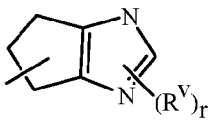
U-82 ,



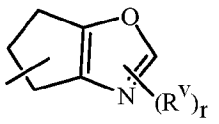
U-83 ,



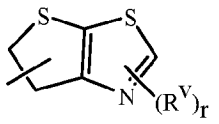
U-84 ,



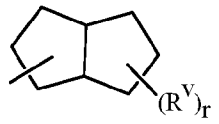
U-85 ,



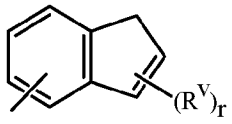
U-86 ,



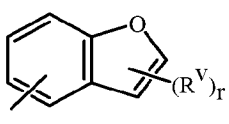
U-87 ,



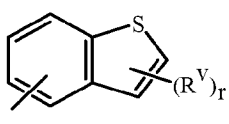
U-88 ,



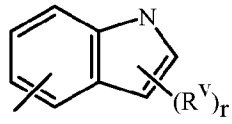
U-89 ,



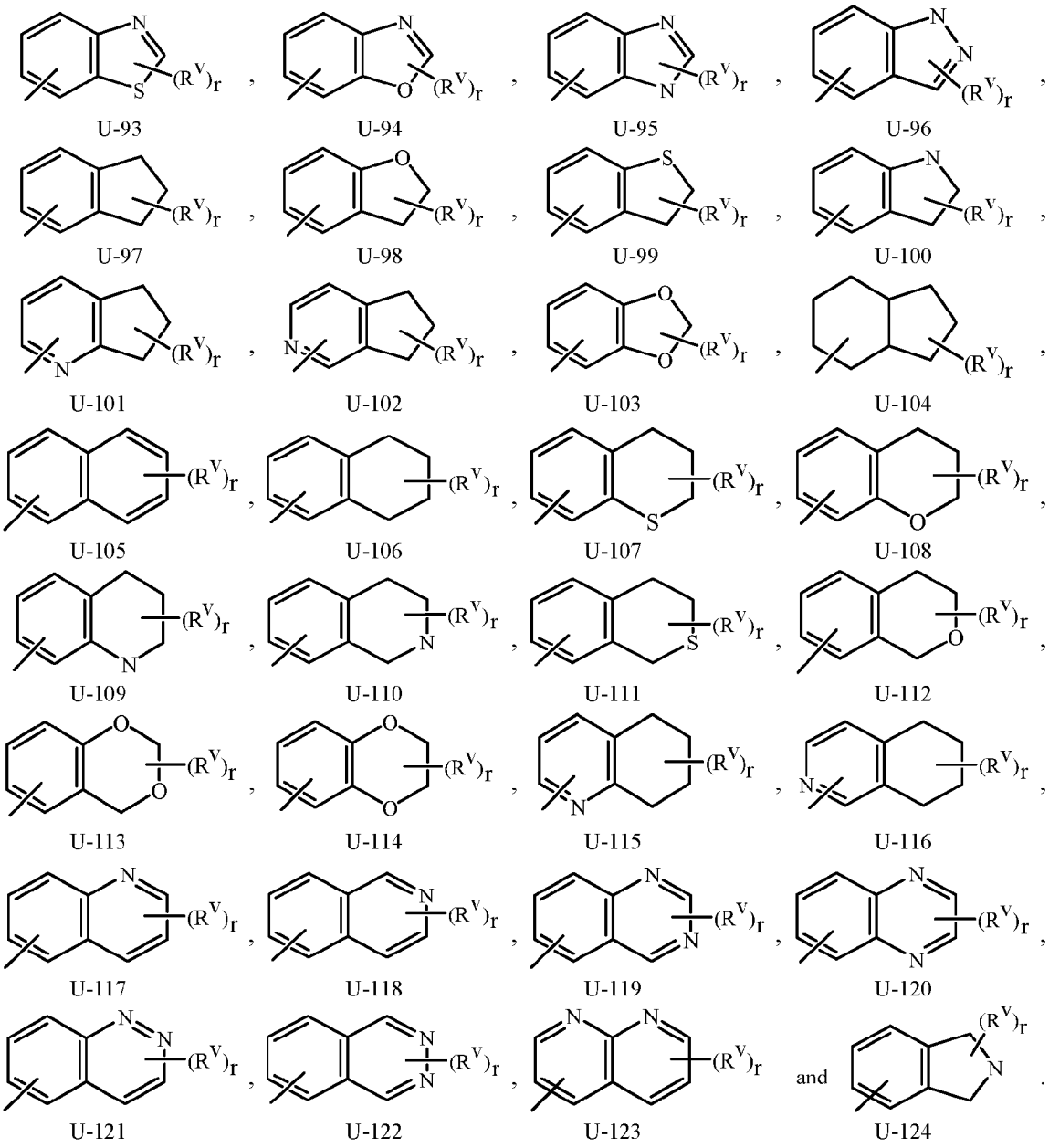
U-90 ,



U-91 ,



U-92 ,



wherein up to 1 carbon ring member is optionally selected from C(=O); and when R^v is attached to a carbon ring member, said R^v is selected from R^{JC}, and when R^v is attached to a nitrogen ring member, said R^v is selected from R^{JN}; and r is 0, 1, 2, 3 or 4.

Embodiment 12i. A compound of Embodiment 12h wherein J^1 is selected from U-90 through U-96, U-105, U-110 or U-117 through U-124.

Embodiment 12j. A compound of Embodiment 12h wherein J^1 is U-105.

Embodiment 12k. A compound of Embodiment 12h wherein J^1 is selected from U-91, U-94, U-95, U-96, U-110, U-117, U-118 or U-124.

Embodiment 12l. A compound of Embodiment 12h wherein J^1 is selected from U-91.

Embodiment 13a. A compound of Formula **1** or any of the preceding Embodiments wherein J^2 is phenyl or naphthalenyl, each ring or ring system optionally substituted with up to 4 substituents independently selected from R^{JC}; or a 4-, 5- or 6-membered heterocyclic ring or an 8-, 9- or 10-membered bicyclic ring system, each ring or ring system containing ring members selected from carbon atoms and 1 to 3 heteroatoms independently selected from up to 1 boron, up to 2 oxygen, up to 1 sulfur and up to 3 nitrogen atoms, wherein up to 1 carbon ring members are optionally selected from C(=O) and C(=S), each ring system optionally substituted with up to 4 substituents independently selected from R^{JC} on carbon atom ring members; R^{JN} on nitrogen atom ring members and R^{JB} on boron atom ring members.

Embodiment 13b. A compound of Embodiment 13a wherein J^2 is phenyl, each ring optionally substituted with up to 4 substituents independently selected from R^{JC}; or a 4-, 5- or 6-membered heterocyclic ring, each ring containing ring members selected from carbon atoms and 1 to 3 heteroatoms independently selected from up to 2 oxygen, up to 1 sulfur and up to 3 nitrogen atoms, wherein up to 1 carbon ring members are optionally selected from C(=O) and C(=S), each ring system optionally substituted with up to 4 substituents independently selected from R^{JC} on carbon atom ring members and R^{JN} on nitrogen atom ring members.

Embodiment 13c. A compound of Formula **1** or any of the preceding Embodiments wherein J^2 is selected from U-1 through U-61 as shown in Exhibit 1 wherein up to 1 carbon ring member is optionally selected from C(=O); and when R^v is attached to a carbon ring member, said R^v is selected from R^{JC}, and when R^v is attached to a nitrogen ring member, said R^v is selected from R^{JN}; and r is 0, 1, 2, 3 or 4.

Embodiment 13d. A compound of Embodiment 13c wherein J^2 is selected from U-2 through U-61.

Embodiment 13d1. A compound of Embodiment 13c wherein J^2 is selected from U-49 through U-61.

Embodiment 13d2. A compound of Embodiment 13c wherein J^2 is selected from U-49 through U-61, wherein 1 carbon ring member is C(=O).

Embodiment 13e. A compound of Embodiment 13c wherein J^2 is selected from U-1, U-2, U-4, U-26, U-28, U-37, U-38, U-39, U-49, U-50, U-51, U-53 or U-56.

Embodiment 13f. A compound of Formula **1** or any of the preceding Embodiments wherein J^2 is selected from U-1, U-2, U-4, U-26, U-37, U-38, U-39, U-49, U-50 or U-51.

Embodiment 13g. A compound of Formula **1** or any of the preceding Embodiments wherein J^2 is selected from U-1 or U-26; or U-50 wherein up to 1 carbon ring member is optionally selected from C(=O).

Embodiment 13h. A compound of Embodiment 13g wherein J^2 is U-1.

Embodiment 13i. A compound of Embodiment 13g wherein J^2 is U-26.

Embodiment 13j. A compound of Embodiment 13g wherein J^2 is U-50.

Embodiment 13k. A compound of Embodiment 13g wherein J^2 is U-50, wherein 1 carbon ring member is C(=O).

Embodiment 13h. A compound of Formula **1** or any one of Embodiments 1 through 13a wherein J^2 is selected from U-81 through U-124 as shown in Exhibit 3 wherein up to 1 carbon ring member is optionally selected from C(=O); and when R^v is attached to a carbon ring member, said R^v is selected from R^{JC}, and when R^v is attached to a nitrogen ring member, said R^v is selected from R^{JN}; and r is 0, 1, 2, 3 or 4.

Embodiment 13i. A compound of Embodiment 13h wherein J^2 is selected from U-90 through U-96, U-105, U-110 or U-117 through U-124.

Embodiment 13j. A compound of Embodiment 13h wherein J^2 is U-105.

Embodiment 13k. A compound of Embodiment 13h wherein J^2 is selected from U-91, U-94, U-95, U-96, U-110, U-117, U-118 or U-124.

Embodiment 13l. A compound of Embodiment 13h wherein J^2 is selected from U-91.

Embodiment 14a. A compound of Formula **1** or any of the preceding Embodiments wherein r is 1 or 2.

Embodiment 14b. A compound of Embodiment 14a wherein r is 1.

Embodiment 14c. A compound of Embodiment 14a wherein r is 2.

Embodiment 14d. A compound of Formula **1** or any one of Embodiments 1 through 13d wherein r is 3.

Embodiment 14d. A compound of Formula **1** or any one of Embodiments 1 through 13d wherein r is 4.

Embodiment 15a. A compound of Formula **1** or any of the preceding Embodiments wherein each R^{JC} is independently hydrogen, halogen, hydroxy, cyano, OR^{14},

$C(=O)R^{15}$, CO_2H, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $C(=NR^{19})R^{20}$, $NR^{17}R^{18}$, $S(=O)_nR^{21}$ or Q^2; or C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl or C_3-C_6 cycloalkyl, each optionally substituted with one or more substituents independently selected from halogen, cyano, nitro, OR^{14}, $C(=O)R^{15}$, CO_2H, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $C(=NR^{19})R^{20}$, $NR^{17}R^{18}$, $S(=O)_nR^{21}$ or Q^2.

Embodiment 15b. A compound of Embodiment 15a wherein ach R^{JC} is independently hydrogen, halogen, hydroxy, cyano, OR^{14}, $C(=O)R^{15}$, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $C(=NR^{19})R^{20}$, $NR^{17}R^{18}$, $S(=O)_nR^{21}$ or Q^2; or C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl or C_3-C_6 cycloalkyl, each optionally substituted with one or more substituents independently selected from halogen, cyano, $C(=O)R^{15}$, CO_2H, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $C(=NR^{19})R^{20}$, $NR^{17}R^{18}$ or $S(=O)_nR^{21}$.

Embodiment 15c. A compound of Embodiment 15b wherein each R^{JC} is independently hydrogen, halogen, hydroxy, cyano, OR^{14}, $C(=O)R^{15}$, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $NR^{17}R^{18}$, $S(=O)_nR^{21}$ or Q^2; or C_1-C_6 alkyl or C_3-C_6 cycloalkyl, each optionally substituted with one or more substituents independently selected from halogen, cyano, CO_2H, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $NR^{17}R^{18}$ or $S(=O)_nR^{21}$.

Embodiment 15d. A compound of Embodiment 15c wherein each R^{JC} is independently hydrogen, halogen, hydroxy, cyano, OR^{14}, $C(=O)R^{15}$, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $NR^{17}R^{18}$, $S(=O)_nR^{21}$ or Q^2; or C_1-C_6 alkyl or C_3-C_6 cycloalkyl, each optionally substituted with one or more substituents independently selected from halogen, cyano, $C(=O)OR^{16}$ or $C(=Z)NR^{17}R^{18}$.

Embodiment 16a. A compound of Formula **1** or any of the preceding Embodiments wherein each R^{JN} is independently hydrogen, hydroxy, cyano, OR^{14}, $C(=O)R^{15}$, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $C(=NR^{19})R^{20}$, $NR^{17}R^{18}$, $S(=O)_nR^{21}$ or Q^2; or C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl or C_3-C_6 cycloalkyl, each optionally substituted with one or more substituents independently selected from halogen, cyano, $C(=O)R^{15}$, CO_2H, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $C(=NR^{19})R^{20}$, $NR^{17}R^{18}$ or $S(=O)_nR^{21}$.

Embodiment 16b. A compound of Embodiment 16a wherein each R^{JN} is independently hydrogen, hydroxy, OR^{14}, $C(=O)R^{15}$, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $NR^{17}R^{18}$, $S(=O)_nR^{21}$ or Q^2; or C_1-C_6 alkyl or C_3-C_6 cycloalkyl, each optionally substituted with one or more substituents

independently selected from halogen, cyano, C(=O)R^{15}, CO_2H, C(=O)OR^{16}, C(=Z)$NR^{17}R^{18}$ or S(=O)$_n R^{21}$.

Embodiment 16c. A compound of Embodiment 16b wherein each R^{JN} is independently hydrogen, hydroxy, C(=O)R^{15}, C(=O)OR^{16}, C(=Z)$NR^{17}R^{18}$, $NR^{17}R^{18}$ or Q^2; or C_1-C_6 alkyl or C_3-C_6 cycloalkyl, each optionally substituted with one or more substituents independently selected from halogen, cyano, C(=O)R^{15}, CO_2H, C(=O)OR^{16} or C(=Z)$NR^{17}R^{18}$.

Embodiment 16d. A compound of Embodiment 16c wherein each R^{JN} is independently hydrogen, C(=O)R^{15}, C(=O)OR^{16}, C(=Z)$NR^{17}R^{18}$ or $NR^{17}R^{18}$; or C_1-C_6 alkyl, optionally substituted with one or more substituents independently selected from halogen, cyano, C(=O)R^{15}, C(=O)OR^{16} or C(=Z)$NR^{17}R^{18}$.

Embodiment 17. A compound of Formula **1** or any of the preceding Embodiments wherein each R^{JB} is independently hydroxy or C_1-C_6 alkoxy.

Embodiment 18a. A compound of Formula **1** or any of the preceding Embodiments wherein each R^{14} is independently C_1-C_6 alkyl, C_3-C_7 cycloalkyl, C_1-C_6 haloalkyl or C_3-C_7 halocycloalkyl.

Embodiment 18a1. A compound of Embodiment 18a wherein each R^{14} is independently C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl or C_3-C_6 halocycloalkyl.

Embodiment 18a2. A compound of Embodiment 18a1 wherein each R^{14} is independently C_1-C_4 alkyl, C_3-C_6 cycloalkyl or C_1-C_4 haloalkyl.

Embodiment 18b. A compound of Formula **1** or any of the preceding Embodiments wherein each R^{15} is independently C_1-C_6 alkyl, C_3-C_7 cycloalkyl, C_1-C_6 haloalkyl or C_3-C_6 halocycloalkyl.

Embodiment 18b1. A compound of Embodiment 18b wherein each R^{15} is independently C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl or C_3-C_6 halocycloalkyl.

Embodiment 18b2. A compound of Embodiment 18b1 wherein each R^{15} is independently C_1-C_4 alkyl, C_3-C_6 cycloalkyl or C_1-C_4 haloalkyl.

Embodiment 18c. A compound of Formula **1** or any of the preceding Embodiments wherein each R^{16} is independently C_1-C_6 alkyl, C_3-C_7 cycloalkyl or C_1-C_6 haloalkyl.

Embodiment 18c1. A compound of Embodiment 18c wherein each R^{16} is independently C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl or C_3-C_6 halocycloalkyl.

Embodiment 18c2. A compound of Embodiment 18c1 wherein each R^{16} is independently C_1-C_4 alkyl, C_3-C_6 cycloalkyl or C_1-C_4 haloalkyl.

Embodiment 18d1. A compound of Formula **1** or any one of the preceding Embodiments wherein Z is O.

Embodiment 18d2. A compound of Formula **1** or any one of Embodiments 1 through 18c2 wherein Z is S.

Embodiment 19. A compound of Formula **1** or any of the preceding Embodiments wherein each R^{17} is independently hydrogen, hydroxy, OR^{22}, $C(=O)R^{23}$, $C(=O)OR^{24}$, $C(=O)NR^{25}R^{26}$, $NR^{25}R^{26}$ or $S(=O)_nR^{21}$; or C_1-C_6 alkyl or C_3-C_6 cycloalkyl, each optionally substituted with 1 to 3 substituents independently selected from R^x.

Embodiment 19a. A compound of Embodiment 19 wherein each R^{17} is independently hydrogen, $C(=O)R^{23}$, $C(=O)OR^{24}$, $C(=O)NR^{25}R^{26}$ or $S(=O)_nR^{21}$; or C_1-C_6 alkyl or C_3-C_6 cycloalkyl, each optionally substituted with 1 to 3 substituents independently selected from R^x.

Embodiment 19b. A compound of Embodiment 19a wherein each R^{17} is independently hydrogen, $C(=O)R^{23}$, $C(=O)OR^{24}$ or $C(=O)NR^{25}R^{26}$; or C_1-C_4 alkyl, optionally substituted with 1 to 3 substituents independently selected from R^x.

Embodiment 19c. A compound of Embodiment 19a wherein each R^{17} is independently hydrogen, $C(=O)R^{23}$, $C(=O)OR^{24}$ or $C(=O)NR^{25}R^{26}$; or C_1-C_4 alkyl or C_3-C_5 cycloalkyl, each optionally substituted with 1 to 3 substituents independently selected from R^x.

Embodiment 19d. A compound of Embodiment 19c wherein each R^{17} is independently hydrogen; or C_1-C_4 alkyl or C_3-C_5 cycloalkyl, each optionally substituted with 1 to 3 substituents independently selected from R^x.

Embodiment 19e. A compound of Embodiment 19d wherein each R^{17} is independently C_1-C_4 alkyl or C_3-C_5 cycloalkyl, each optionally substituted with 1 to 3 substituents independently selected from R^x.

Embodiment 20. A compound of Formula **1** or any of the preceding Embodiments wherein each R^{18} is independently hydrogen or Q^2; or C_1-C_6 alkyl, C_3-C_7

cycloalkyl, C_2-C_7 alkylcarbonyl or C_2-C_7 alkoxycarbonyl, each optionally substituted by R^x.

Embodiment 20a. A compound of Embodiment 20 wherein each R^{18} is independently hydrogen; or C_1-C_6 alkyl, C_3-C_7 cycloalkyl, C_2-C_7 alkylcarbonyl or C_2-C_7 alkoxycarbonyl, each optionally substituted with 1 to 3 substituents independently selected from R^x.

Embodiment 20b. A compound of Embodiment 20a wherein each R^{18} is independently hydrogen, C_1-C_4 alkyl, C_3-C_5 cycloalkyl, C_2-C_5 alkylcarbonyl or C_2-C_5 alkoxycarbonyl.

Embodiment 20c. A compound of Embodiment 20b wherein each R^{18} is independently hydrogen or C_1-C_4 alkyl.

Embodiment 20d. A compound of Embodiment 20c wherein R^{18} is hydrogen.

Embodiment 21a. A compound of Formula **1** or any of the preceding Embodiments wherein R^{17} and R^{18} are taken together with the nitrogen to which they are attached to form a 3- to 5-membered ring containing ring members selected from carbon atoms and up to two additional atoms independently selected from nitrogen, sulfur and oxygen, wherein the sulfur atom ring member is selected from S, S(=O) and $S(=O)_2$, said ring optionally substituted with 1 to 3 substituents independently selected from halogen, C_1-C_2 alkyl, C_1-C_2 haloalkyl, C_1-C_2 alkoxy, C_1-C_2 haloalkoxy cyano and nitro.

Embodiment 21b. A compound of Formula **1** or any of the preceding Embodiments wherein R^{17} and R^{18} are taken together as $=S(=O)_uR^{27}R^{28}$.

Embodiment 21c. A compound of Formula **1** or any of the preceding Embodiments wherein R^{17} and R^{18} are taken together as $=S(=NR^{29})R^{27}R^{28}$.

Embodiment 22. A compound of Formula **1** or any of the preceding Embodiments wherein each R^x is independently halogen, cyano, C_1-C_6 alkyl, C_1-C_6 haloalkyl, C_3-C_6 cycloalkyl, C_1-C_6 alkoxy, C_1-C_6 haloalkoxy, C_3-C_6 cycloalkoxy, $OC(=O)R^{23}$, $C(=O)R^{23}$, $C(=O)OR^{24}$, $C(=O)NR^{25}R^{26}$, $C(=NR^{19})R^{25}$, $NR^{25}R^{26}$, $S(=O)_nR^{30}$, $Si(R^{31})_3$, $OSi(R^{31})_3$ or Q^2.

Embodiment 22a. A compound of Embodiment 22 wherein each R^x is independently halogen, cyano, C_1-C_6 alkyl, C_1-C_6 haloalkyl, C_3-C_6 cycloalkyl, C_1-C_6 alkoxy, C_1-C_6 haloalkoxy, C_3-C_6 cycloalkoxy, $OC(=O)R^{23}$, $C(=O)R^{23}$, $C(=O)OR^{24}$, $C(=O)NR^{25}R^{26}$, $NR^{25}R^{26}$ or $S(=O)_nR^{30}$.

Embodiment 22b. A compound of Embodiment 22a wherein each R^x is independently halogen, cyano, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3-C_5 cycloalkyl, C_1-C_4 alkoxy,

C_1-C_4 haloalkoxy, C(=O)R^{23}, C(=O)OR^{24}, C(=O)N$R^{25}R^{26}$, N$R^{25}R^{26}$ or S(=O)$_n$$R^{30}$.

Embodiment 22c. A compound of Embodiment 22b wherein each R^x is independently halogen, cyano, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3-C_5 cycloalkyl, C_1-C_4 alkoxy, C_1-C_4 haloalkoxy, C(=O)R^{23}, C(=O)OR^{24} or C(=O)N$R^{25}R^{26}$.

Embodiment 22d. A compound of Embodiment 22c wherein each R^x is independently halogen, C_1-C_4 alkyl or C_1-C_4 haloalkyl.

Embodiment 23. A compound of Formula **1** or any of the preceding Embodiments wherein each R^{19} is independently OR^{22} or NHR^{32}.

Embodiment 24. A compound of Formula **1** or any of the preceding Embodiments wherein each R^{20} is independently hydrogen; or C_1-C_6 alkyl or C_3-C_6 cycloalkyl, each optionally substituted with 1 to 3 R^x.

Embodiment 25. A compound of Formula **1** or any of the preceding Embodiments wherein each R^{21} is independently amino, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3-C_6 cycloalkyl or phenyl.

Embodiment 26. A compound of Formula **1** or any of the preceding Embodiments wherein each R^{22} is independently C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl or Q^2.

Embodiment 26a. A compound of Embodiment 26 wherein each R^{22} is independently C_1-C_4 alkyl, C_3-C_6 cycloalkyl or C_1-C_4 haloalkyl.

Embodiment 26b. A compound of Embodiment 26a wherein each R^{22} is independently C_1-C_4 alkyl.

Embodiment 27. A compound of Formula **1** or any of the preceding Embodiments wherein each R^{23} is independently C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3-C_6 cycloalkyl, C_3-C_6 halocycloalkyl, C_4-C_7 cycloalkylalkyl or C_4-C_7 halocycloalkylalkyl.

Embodiment 27a. A compound of Embodiment 27 wherein each R^{23} is independently C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3-C_6 cycloalkyl or C_3-C_6 halocycloalkyl.

Embodiment 27b. A compound of Embodiment 27a wherein each R^{23} is independently C_1-C_4 alkyl, C_1-C_4 haloalkyl or C_3-C_6 cycloalkyl.

Embodiment 28. A compound of Formula **1** or any of the preceding Embodiments wherein each R^{24} is independently C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3-C_6 cycloalkyl or C_3-C_6 halocycloalkyl.

Embodiment 29. A compound of Formula **1** or any of the preceding Embodiments wherein each R^{25} is independently hydrogen, C_1-C_6 alkyl, C_1-C_6 haloalkyl, $C(=O)R^{33}$ or $S(=O)_nR^{33}$.

Embodiment 30. A compound of Formula **1** or any of the preceding Embodiments wherein each R^{26} is independently hydrogen or C_1-C_6 alkyl.

Embodiment 31. A compound of Formula **1** or any of the preceding Embodiments wherein R^{25} and R^{26} are taken together with the nitrogen atom to which they are attached to form a 3- to 6-membered ring containing ring members selected from carbon atoms and up to 2 heteroatoms independently selected from one oxygen atom, one sulfur atom, and up to 2 nitrogen atoms, said ring optionally substituted with 1 to 3 substituents independently selected from the group consisting of halogen, cyano, C_1-C_4 alkyl, C_3-C_6 cycloalkyl and C_1-C_4 haloalkyl.

Embodiment 32. A compound of Formula **1** or any of the preceding Embodiments wherein each R^{27} is independently C_1-C_4 alkyl or C_1-C_4 haloalkyl.

Embodiment 33. A compound of Formula **1** or any of the preceding Embodiments wherein each R^{28} is independently C_1-C_4 alkyl or C_1-C_4 haloalkyl.

Embodiment 34. A compound of Formula **1** or any of the preceding Embodiments wherein each R^{29} is independently hydrogen, cyano, C_1-C_4 alkyl, C_1-C_4 haloalkyl or $C(=O)R^{23}$.

Embodiment 34a. A compound of Embodiment 34 wherein each R^{29} is independently hydrogen or C_1-C_4 alkyl.

Embodiment 35. A compound of Formula **1** or any of the preceding Embodiments wherein each Q^2 is independently phenyl, optionally substituted with one or more substituents independently selected from the group consisting of halogen, cyano, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy; or a 5- or 6-membered heterocyclic aromatic ring, each ring containing ring members selected from carbon atoms and up to 2 heteroatoms independently selected from one oxygen atom, one sulfur atom, and up to 2 nitrogen atoms, each ring optionally substituted with one or more substituents independently selected from the group consisting of halogen, cyano, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy.

Embodiment 35a. A compound of Formula **1** or any of the preceding Embodiments wherein each Q^2 is independently phenyl, optionally substituted with one or more substituents independently selected from the group consisting of halogen,

cyano, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy.

Embodiment 36a. A compound of Formula **1** or any of the preceding Embodiments wherein n is 0.

Embodiment 36b. A compound of Formula **1** or any one of Embodiments 1 through 35 wherein n is 1 or 2.

Embodiment 36c. A compound of Embodiment 36b wherein n is 1.

Embodiment 36d. A compound of Embodiment 36b wherein n is 2.

Embodiment 37a. A compound of Formula **1** or any of the preceding Embodiments wherein u is 0.

Embodiment 37b. A compound of Formula **1** or any one of Embodiments 1 through 36d wherein u is 1.

Embodiment S1. A compound of any one of Embodiments 1-37b wherein the compound of Formula **1** is a compound of Formula $\mathbf{1^i}$.

Embodiment S2. A compound of any one of Embodiments 1-37b wherein the compound of Formula **1** is a compound of Formula $\mathbf{1^{ii}}$.

Embodiment S3. A composition consisting of a compound of Formula $\mathbf{1^i}$ and a compound of Formula $\mathbf{1^{ii}}$ wherein the ratio of the compound of Formula $\mathbf{1^i}$ to the compound of Formula $\mathbf{1^{ii}}$ is greater than 60:40.

Embodiment S3a. A composition of Embodiment S3 wherein the ratio of the compound of Formula $\mathbf{1^i}$ to the compound of Formula $\mathbf{1^{ii}}$ is greater than 80:20.

Embodiment S3b. A composition of Embodiment S3 wherein the ratio of the compound of Formula $\mathbf{1^i}$ to the compound of Formula $\mathbf{1^{ii}}$ is greater than 90:10.

Embodiment S3c. A composition of Embodiment S3 wherein the ratio of the compound of Formula $\mathbf{1^i}$ to the compound of Formula $\mathbf{1^{ii}}$ is greater than 99:1.

Embodiment S4. A composition consisting of a compound of Formula $\mathbf{1^{ii}}$ and a compound of Formula $\mathbf{1^i}$ wherein the ratio of the compound of Formula $\mathbf{1^{ii}}$ to the compound of Formula $\mathbf{1^i}$ is greater than 60:40.

Embodiment S4a. A composition of Embodiment S4 wherein the ratio of the compound of Formula $\mathbf{1^{ii}}$ to the compound of Formula $\mathbf{1^i}$ is greater than 80:20.

Embodiment S4b. A composition of Embodiment S4 wherein the ratio of the compound of Formula $\mathbf{1^{ii}}$ to the compound of Formula $\mathbf{1^i}$ is greater than 90:10.

Embodiment S4c. A composition of Embodiment S4 wherein the ratio of the compound of Formula $\mathbf{1^{ii}}$ to the compound of Formula $\mathbf{1^i}$ is greater than 99:1.

Embodiment S5. A compound of any one of Embodiments 1-37b wherein the compound of Formula **1** is a compound of Formula $\mathbf{1}^{iii}$.

Embodiment S6. A compound of any one of Embodiments 1-37b wherein the compound of Formula **1** is a compound of Formula $\mathbf{1}^{iv}$.

Embodiments of this disclosure, including Embodiments 1-S6 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-S6 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-S6 are illustrated by:

Embodiment A. A compound of Formula **1** wherein

R^1, R^2, R^3 and R^4 are each independently hydrogen, halogen, cyano, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy, C_1-C_4 haloalkoxy, C_1-C_4 alkylthio, C_1-C_4 haloalkylthio, C_1-C_4 alkylsulfinyl, C_1-C_4 haloalkylsulfinyl, C_1-C_4 alkylsulfonyl or C_1-C_4 haloalkylsulfonyl;

R^5, R^6 and R^7 are each independently hydrogen, halogen, cyano, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy, C_1-C_4 haloalkoxy, C_1-C_4 alkylthio, C1-C4 haloalkylthio, C_1-C_4 alkylsulfinyl, C_1-C_4 haloalkylsulfinyl, C_1-C_4 alkylsulfonyl or C_1-C_4 haloalkylsulfonyl;

W is O;

Y is hydrogen, $C(=O)R^8$, $S(=O)_nR^9$, CO_2R^{10}, $C(=O)NR^{11}R^{12}$, $S(=O)_nNR^{11}R^{12}$, $NR^{11}R^{12}$, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, C_3-C_8 cycloalkyl, C_3-C_8 halocycloalkyl, C_3-C_8 cycloalkenyl, C_3-C_8 halocycloalkenyl, C_4-C_{10} alkylcycloalkyl, C_4-C_{10} cycloalkylalkyl, C_4-C_{10} halocycloalkylalkyl, C_6-C_{14} cycloalkylcycloalkyl, C_5-C_{10} alkylcycloalkylalkyl, C_2-C_8 alkoxyalkyl, C_2-C_8 haloalkoxyalkyl, C_4-C_{10} cycloalkoxyalkyl, C_3-C_8 alkoxyalkoxyalkyl, C_2-C_6 alkylthioalkyl, C_2-C_6 alkylsulfinylalkyl, C_2-C_6 alkylsulfonylalkyl, C_2-C_6 alkylaminoalkyl, C_2-C_6 haloalkylaminoalkyl, C_3-C_8 dialkylaminoalkyl, C_4-C_{10} cycloalkylaminoalkyl or C_3-C_5 alkoxycarbonylalkyl;

J^1 is phenyl or naphthalenyl, each ring or ring system optionally substituted with up to 4 substituents independently selected from R^{JC}; or a 4-, 5- or 6-membered heterocyclic ring or an 8-, 9- or 10-membered bicyclic ring system, each ring or ring system containing ring members selected from carbon atoms and 1 to 3 heteroatoms independently selected from up to 1 boron, up to 2 oxygen, up to 1 sulfur and up to 3 nitrogen atoms, wherein up to 1 carbon ring members are optionally selected from C(=O) and C(=S), each ring system optionally substituted with up to 4 substituents independently selected from R^{JC} on carbon atom ring members; R^{JN} on nitrogen atom ring members and R^{JB} on boron atom ring members; and

J^2 is phenyl or naphthalenyl, each ring or ring system optionally substituted with up to 4 substituents independently selected from R^{JC}; or a 4-, 5- or 6-membered heterocyclic ring or an 8-, 9- or 10-membered bicyclic ring system, each ring or ring system containing ring members selected from carbon atoms and 1 to 3 heteroatoms independently selected from up to 1 boron, up to 2 oxygen, up to 1 sulfur and up to 3 nitrogen atoms, wherein up to 1 carbon ring members are optionally selected from C(=O) and C(=S), each ring system optionally substituted with up to 4 substituents independently selected from R^{JC} on carbon atom ring members; R^{JN} on nitrogen atom ring members and R^{JB} on boron atom ring members.

Embodiment B. A compound of Formula **1** or Embodiment A wherein

J^1 and J^2 are independently selected from U-1 through U-61 as shown in Exhibit 1, wherein up to 1 carbon ring member is optionally selected from C(=O); and when R^v is attached to a carbon ring member, said R^v is selected from R^{JC}, and when R^v is attached to a nitrogen ring member, said R^v is selected from R^{JN}; and r is 0, 1, 2 or 3; or

J^1 and J^2 are independently selected from U-81 through U-124 as shown in Exhibit 3, wherein up to 1 carbon ring member is optionally selected from C(=O); and when R^v is attached to a carbon ring member, said R^v is selected from R^{JC}, and when R^v is attached to a nitrogen ring member, said R^v is selected from R^{JN}; and r is 0, 1, 2 or 3.

Embodiment C. A compound of Embodiment B wherein

R^1, R^2, R^3 and R^4 are each independently hydrogen, halogen, C_1-C_4 alkyl or C_1-C_4 haloalkyl;

R^5, R^6 and R^7 are each independently hydrogen, halogen, C_1-C_4 alkyl or C_1-C_4 haloalkyl;

Y is hydrogen or C_1-C_6 alkyl;

R^{13} is halogen;

each R^{JC} is independently hydrogen, halogen, hydroxy, cyano, OR^{14}, $C(=O)R^{15}$, CO_2H, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $C(=NR^{19})R^{20}$, $NR^{17}R^{18}$, $S(=O)_nR^{21}$ or Q^2; or C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl or C_3-C_6 cycloalkyl, each optionally substituted with one or more substituents independently selected from halogen, cyano, nitro, OR^{14}, $C(=O)R^{15}$, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $C(=NR^{19})R^{20}$, $NR^{17}R^{18}$, $S(=O)_nR^{21}$ or Q^2;

each R^{JN} is independently hydrogen, hydroxy, cyano, OR^{14}, $C(=O)R^{15}$, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $C(=NR^{19})R^{20}$, $NR^{17}R^{18}$, $S(=O)_nR^{21}$ or Q^2; or C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl or C_3-C_6 cycloalkyl, each optionally substituted with one or more substituents independently selected from halogen, cyano, $C(=O)R^{15}$, CO_2H, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $C(=NR^{19})R^{20}$, $NR^{17}R^{18}$ or $S(=O)_nR^{21}$;

each R^{17} is independently hydrogen, $C(=O)R^{23}$, $C(=O)OR^{24}$, $C(=O)NR^{25}R^{26}$ or $S(=O)_nR^{21}$; or C_1-C_6 alkyl or C_3-C_6 cycloalkyl, each optionally substituted with 1 to 3 substituents independently selected from R^x; and

each R^{18} is independently hydrogen; or C_1-C_6 alkyl, C_3-C_7 cycloalkyl, C_2-C_7 alkylcarbonyl or C_2-C_7 alkoxycarbonyl, each optionally substituted with 1 to 3 substituents independently selected from R^x; or

R^{17} and R^{18} are taken together with the nitrogen to which they are attached to form a 3- to 5-membered ring containing ring members selected from carbon atoms and up to two additional atoms independently selected from nitrogen, sulfur and oxygen, wherein the sulfur atom ring member is selected from S, S(=O) and $S(=O)_2$, said ring optionally substituted with 1 to 3 substituents independently selected from halogen, C_1-C_2 alkyl, C_1-C_2 haloalkyl, C_1-C_2 alkoxy, C_1-C_2 haloalkoxy cyano and nitro.

Embodiment D. A compound of Embodiment C wherein

R^1, R^2, R^3 and R^4 are each hydrogen;

R^5, R^6 and R^7 are each hydrogen;

J^1 and J^2 are independently selected from U-1 through U-61, U-90 through U-96, U-105, U-110 or U-117 through U-124, wherein up to 1 carbon ring member is optionally selected from C(=O); and when R^v is attached to a carbon ring member, said R^v is selected from R^{JC}, and when R^v is attached to a nitrogen ring member, said R^v is selected from R^{JN}; and r is 0, 1, 2 or 3;

each R^{JC} is independently hydrogen, halogen, hydroxy, cyano, OR^{14}, $C(=O)R^{15}$, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $C(=NR^{19})R^{20}$, $NR^{17}R^{18}$, $S(=O)_nR^{21}$ or Q^2; or C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl or C_3-C_6 cycloalkyl, each optionally substituted with one or more substituents independently selected from halogen, cyano, $C(=O)R^{15}$, CO_2H, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $C(=NR^{19})R^{20}$, $NR^{17}R^{18}$ or $S(=O)_nR^{21}$;

each R^{JN} is independently hydrogen, hydroxy, OR^{14}, $C(=O)R^{15}$, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $NR^{17}R^{18}$, $S(=O)_nR^{21}$ or Q^2; or C_1-C_6 alkyl or C_3-C_6 cycloalkyl, each optionally substituted with one or more substituents independently selected from halogen, cyano, $C(=O)R^{15}$, CO_2H, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$ or $S(=O)_nR^{21}$;

each R^{17} is independently hydrogen, $C(=O)R^{23}$, $C(=O)OR^{24}$ or $C(=O)NR^{25}R^{26}$; or C_1-C_4 alkyl, optionally substituted with 1 to 3 substituents independently selected from R^x; and

each R^{18} is independently hydrogen, C_1-C_4 alkyl, C_3-C_5 cycloalkyl, C_2-C_5 alkylcarbonyl or C_2-C_5 alkoxycarbonyl.

Embodiment E. A compound of Embodiment D wherein

Y is hydrogen or methyl;

J^1 and J^2 are independently selected from U-1, U-2, U-4, U-26, U-28, U-37, U-38, U-39, U-49, U-50, U-51, U-53, U-56, U-91, U-94, U-95, U-96, U-110, U-117, U-118 or U-124, wherein up to 1 carbon ring member is optionally selected from C(=O); and when R^v is attached to a carbon ring member, said R^v is selected from R^{JC}, and when R^v is attached to a nitrogen ring member, said R^v is selected from R^{JN}; and r is 0, 1, 2 or 3;

each R^{17} is independently hydrogen, $C(=O)R^{23}$, $C(=O)OR^{24}$ or $C(=O)NR^{25}R^{26}$; or C_1-C_4 alkyl or C_3-C_5 cycloalkyl, each optionally substituted with 1 to 3 substituents independently selected from R^x; and

each R^{18} is independently hydrogen or C_1-C_4 alkyl.

Embodiment F. A compound of Formula **1** or Embodiment E wherein

Y is hydrogen;

J^1 and J^2 are independently selected from U-1, U-2, U-4, U-26, U-37, U-38, U-39, U-49, U-50, U-51 or U-91, wherein up to 1 carbon ring member is optionally selected from C(=O); and when R^v is attached to a carbon ring member, said R^v is selected from R^{JC}, and when R^v is attached to a nitrogen ring member, said R^v is selected from R^{JN}; and r is 0, 1, 2 or 3;

each R^{JC} is independently hydrogen, halogen, hydroxy, cyano, OR^{14}, $C(=O)R^{15}$, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $NR^{17}R^{18}$, $S(=O)_nR^{21}$ or Q^2; or C_1-C_6 alkyl or C_3-C_6 cycloalkyl, each optionally substituted with one or more substituents independently selected from halogen, cyano, CO_2H, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $NR^{17}R^{18}$ or $S(=O)_nR^{21}$;

each R^{JN} is independently hydrogen, hydroxy, $C(=O)R^{15}$, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $NR^{17}R^{18}$ or Q^2; or C_1-C_6 alkyl or C_3-C_6 cycloalkyl, each optionally substituted with one or more substituents independently selected from halogen, cyano, $C(=O)R^{15}$, CO_2H, $C(=O)OR^{16}$ or $C(=Z)NR^{17}R^{18}$;

each R^{17} is independently hydrogen; or C_1-C_4 alkyl or C_3-C_5 cycloalkyl, each optionally substituted with 1 to 3 substituents independently selected from R^x; and

each R^{18} is hydrogen.

Embodiment G. A compound of Embodiment F wherein

J^1 and J^2 are independently selected from U-1 or U-26; or U-50 wherein up to 1 carbon ring member is optionally selected from C(=O);

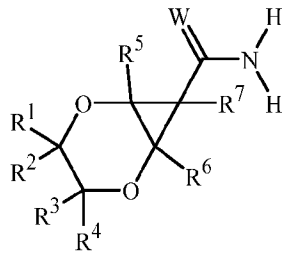
each R^{JC} is independently hydrogen, halogen, hydroxy, cyano, OR^{14}, $C(=O)R^{15}$, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $NR^{17}R^{18}$, $S(=O)_nR^{21}$ or Q^2; or C_1-C_6 alkyl or C_3-C_6 cycloalkyl, each optionally substituted with one or more substituents independently selected from halogen, cyano, $C(=O)OR^{16}$ or $C(=Z)NR^{17}R^{18}$;

each R^{JN} is independently hydrogen, $C(=O)R^{15}$, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$ or $NR^{17}R^{18}$; or C_1-C_6 alkyl, optionally substituted with one or more substituents independently selected from halogen, cyano, $C(=O)R^{15}$, $C(=O)OR^{16}$ or $C(=Z)NR^{17}R^{18}$; and

R^{17} is independently C_1-C_4 alkyl or C_3-C_5 cycloalkyl, each optionally substituted with 1 to 3 substituents independently selected from R^x.

Embodiment H. An insecticidal composition comprising:

at least one compound selected from the compounds of Formula **9b**, *N*-oxides, and salts thereof:



9b

wherein

R^1, R^2, R^3 and R^4 are each independently hydrogen, halogen, cyano, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy, C_1-C_4 haloalkoxy, C_1-C_4 alkylthio, C_1-C_4 haloalkylthio, C_1-C_4 alkylsulfinyl, C_1-C_4 haloalkylsulfinyl, C_1-C_4 alkylsulfonyl, C_1-C_4 haloalkylsulfonyl or Q^1;

R^5, R^6 and R^7 are each independently hydrogen, halogen, cyano, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy, C_1-C_4 haloalkoxy, C_1-C_4 alkylthio, C_1-C_4 haloalkylthio, C_1-C_4 alkylsulfinyl, C_1-C_4 haloalkylsulfinyl, C_1-C_4 alkylsulfonyl, C_1-C_4 haloalkylsulfonyl or Q^1;

$Q^1$is a 6- to 14-membered carbocyclic ring or ring system, each ring or ring system optionally substituted with one or more substituents independently selected from halogen, cyano, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy, C_1-C_4 haloalkoxy, C_1-C_4 alkylthio, C_1-C_4 haloalkylthio, C_1-C_4 alkylsulfinyl, C_1-C_4 haloalkylsulfinyl, C_1-C_4 alkylsulfonyl and C_1-C_4 haloalkylsulfonyl; and

W is O or S.

Embodiment I. An insecticidal composition of Embodiment H wherein

R^1, R^2, R^3 and R^4 are each independently hydrogen, halogen, C_1-C_4 alkyl or C_1-C_4 haloalkyl;

R^5, R^6 and R^7 are each independently hydrogen, halogen, C_1-C_4 alkyl or C_1-C_4 haloalkyl; and

W is O.

Embodiment J. An insecticidal composition of Embodiment I wherein R^1, R^2, R^3, R^4, R^5, R^6 and R^7 are each hydrogen.

Embodiment K. An insecticidal composition of Embodiment H wherein the compound of Formula **9b** is (1α,6α,7α)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxamide.

Specific embodiments include compounds of Formula **1** selected from the group consisting of:

(1α,5α,7α)-*N*-[2-[(methylamino)carbonyl]phenyl]-2,5-dioxabicyclo[4.1.0]-heptane-7-carboxamide;

(1α,5α,7α)-*N*-phenyl-2,5-dioxabicyclo[4.1.0]heptane-7-carboxamide;

(1α,5α,7α)-*N*-(3-methylphenyl)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxamide;

(1α,5α,7α)-*N*-(2-fluorophenyl)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxamide;

(1α,5α,7α)-*N*-(2-fluoro-4-methylphenyl)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxamide;

(1α,5α,7α)-*N*-(3,4-dimethylphenyl)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxamide;

(1α,5α,7α)-*N*-(1,2-dihydro-1-methyl-2-oxo-3-pyridinyl)- 2,5-dioxabicyclo[4.1.0]heptane-7-carboxamide;

(1α,5α,7α)-*N*-(1-methyl-1*H*-pyrazol-3-yl)- 2,5-dioxabicyclo[4.1.0]heptane-7-carboxamide;

2-[(methylamino)carbonyl]phenyl (1α,5α,7α)-2,5-dioxabicyclo[4.1.0]-heptane-7-carboxylate;

phenyl (1α,5α,7α)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxylate;

3-methylphenyl (1α,5α,7α)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxylate;

2-fluorophenyl (1α,5α,7α)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxylate;

2-fluoro-4-methylphenyl (1α,5α,7α)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxylate;

3,4-dimethylphenyl (1α,5α,7α)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxylate;

1,2-dihydro-1-methyl-2-oxo-3-pyridinyl (1α,5α,7α)-2,5-dioxabicyclo-[4.1.0]heptane-7-carboxylate;

1-methyl-1*H*-pyrazol-3-yl (1α,5α,7α)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxylate;

2-[(methylamino)carbonyl]phenyl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate;

2-[(methylamino)carbonyl]phenyl (1*S*,5*S*,6*S*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate;

rel-2-[(methylamino)carbonyl]phenyl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]-hexane-6-carboxylate;

phenyl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate;

phenyl (1*S*,5*S*,6*S*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate;

rel-phenyl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate;

3-methylphenyl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate;

3-methylphenyl (1*S*,5*S*,6*S*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate;

rel-3-methylphenyl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate;

2-fluorophenyl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate;

2-fluorophenyl (1*S*,5*S*,6*S*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate;

rel-2-fluorophenyl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate;

2-fluoro-4-methylphenyl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate;

2-fluoro-4-methylphenyl (1*S*,5*S*,6*S*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate;

rel-2-fluoro-4-methylphenyl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate;

3,4-dimethylphenyl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate;

3,4-dimethylphenyl (1*S*,5*S*,6*S*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate;

rel-3,4-dimethylphenyl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate;

1,2-dihydro-1-methyl-2-oxo-3-pyridinyl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]-hexane-6-carboxylate;

1,2-dihydro-1-methyl-2-oxo-3-pyridinyl (1*S*,5*S*,6*S*)-2-oxabicyclo[3.1.0]-hexane-6-carboxylate;

rel-1,2-dihydro-1-methyl-2-oxo-3-pyridinyl (1*R*,5*R*,6*R*)-2-oxabicyclo-[3.1.0]hexane-6-carboxylate;

1-methyl-1*H*-pyrazol-3-yl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate;

1-methyl-1*H*-pyrazol-3-yl (1*S*,5*S*,6*S*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate;

rel-1-methyl-1*H*-pyrazol-3-yl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate, and combinations thereof.

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.

Embodiments of this disclosure also include use of an unmanned aerial vehicle (UAV) for the dispersion of the compositions disclosed herein over a planted area. In some embodiments the planted area is a crop-containing area. In some embodiments, the crop is selected from a monocot or dicot. In some embodiments, the crop is selected form rice, corn, barley, soybean, wheat, vegetable, tobacco, tea tree, fruit tree and sugar cane. In some embodiments, the compositions disclosed herein are formulated for spraying at an ultra-low volume. Products applied by drones may use water or oil as the spray carrier. Typical spray volume (including product) used for drone applications globally is 5.0 liters/ha – 100 liters/ha

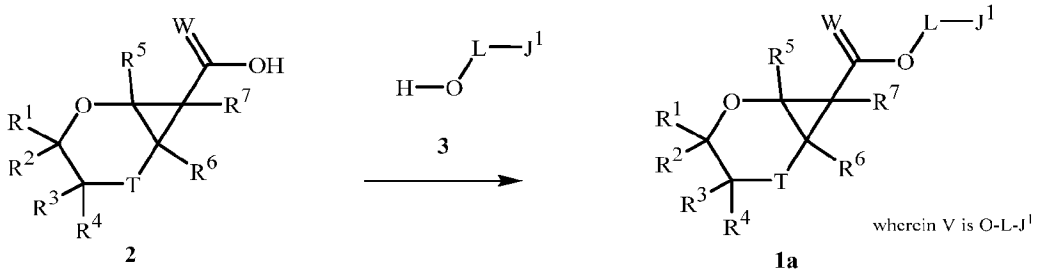
(approximately 0.5-10 gpa). This includes the range of ultra-low spray volume (ULV) to low spray volume (LV). Although not common there may be situations where even lower spray volumes could be used as low as 1.0 liter/ha (0.1 gpa).

The compounds of Formula **1** can be prepared by one or more of the following methods and variations as described in Schemes 1–13. The definitions of substituents in the compounds of Formulae **1–12** below are as defined above in the Summary unless otherwise noted. Compounds of Formulae **1a**, **1b**, **1c** and 1d are subsets of the compounds of Formula **1**. Formula **8a** is a subset of Formula **8**; Formula **9a** is a subset of Formula **9**; Formula **10a** is a subset of Formula **10**. Substituents for each subset formula are as defined for its parent formula unless otherwise noted. Ambient or room temperature is defined as about 20–25 °C.

Enantioenriched compounds of Formulae $\mathbf{1^i}$ and $\mathbf{1^{ii}}$ can be obtained from a racemic mixture of compounds of Formulae $\mathbf{1^i}$ and $\mathbf{1^{ii}}$ through the utilization of well-known chiral chromatography separation methods. Enantioenriched compounds of Formulae $\mathbf{1^{iii}}$ and $\mathbf{1^{iv}}$ can also be obtained from a racemic mixture of compounds of Formulae $\mathbf{1^{iii}}$ and $\mathbf{1^{iv}}$ using these well-known chiral chromatography separation methods. For extensive reviews of chiral separation methods see the *Chiral Separations: Methods and Protocols* (Methods in Molecular Biology), 2nd ed., 2013 Edition, by Gerhard K. E. Scriba (Editor).

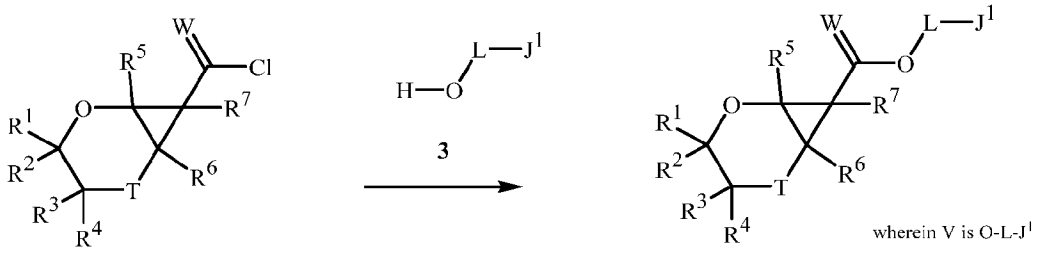
As shown in Scheme 1 compounds of Formula **1a** (wherein V is O-L-J^1) can be prepared by the reaction of acids of Formula **2** with alcohols of Formula **3** in the presence of a dehydrative coupling reagent such as *N,N'*-dicyclohexylcarbodiimide (DCC), 1-(3-dimethylaminopropyl)-3-ethylcarbodiimide (EDC), *N,N'*-carbonyldiimidazole. Further coupling reagents useful in this method include propylphosphonic anhydride (T3P), 2-chloro-1,3-dimethylimidazolium chloride, 2-chloro-l-methylpyridinium iodide, and uronium-type couping reagents such as *O*-(7-azabenzotriazol-1-yl)-*N,N,N',N'*-tetramethyluronium hexafluorophosphate (HATU). Polymer-supported reagents, such as polymer-supported cyclohexylcarbodiimide, are also suitable. These reactions are typically run at temperatures ranging from 0–60 °C in an anhydrous aprotic solvent such as dichloromethane, acetonitrile, *N,N*-dimethylformamide, tetrahydrofuran or ethyl acetate in the presence of a base such as triethylamine, pyridine, 4-(dimethylamino)pyridine, *N,N*-diisopropylamine, or 1,8-diaza-bicyclo[5.4.0]undec-7-ene. For reaction conditions useful in the method of Scheme 1, as well as other well-established coupling conditions see, for example, *Organic letters* **2011**, *13*(12), 2988-2991, and *Tetrahedron Letters* **1984**, *25*(43), 4943-4946; and references cited therein. Also present Example 1, Step C and Example 2, Step C illustrate the method of Scheme 1. Alcohols of Formula **3** are commercially available or can be prepared by methods well established in the art.

Scheme 1



Alternatively, as shown in Scheme 2, compounds of Formula **1a** can be prepared by reacting an acid chloride of Formula **4** with an alcohol of Formula **3** in the presence of an acid scavenger. Typical acid scavengers include amine bases such as triethylamine, *N*,*N*-diisopropylethylamine and pyridine. Other scavengers include hydroxides such as sodium hydroxide and potassium hydroxide, or carbonates such as sodium carbonate and potassium carbonate. Typical reaction conditions include an organic solvent such as ethyl acetate, dichloromethane, tetrahydrofuran or *N*,*N*-dimethylformamide, and a reaction temperature between room temperature and 80 °C. In certain instances it is useful to use polymer-supported acid scavengers such as polymer-bound *N*,*N*-diisopropylethylamine and polymer-bound 4-(dimethylamino)pyridine.

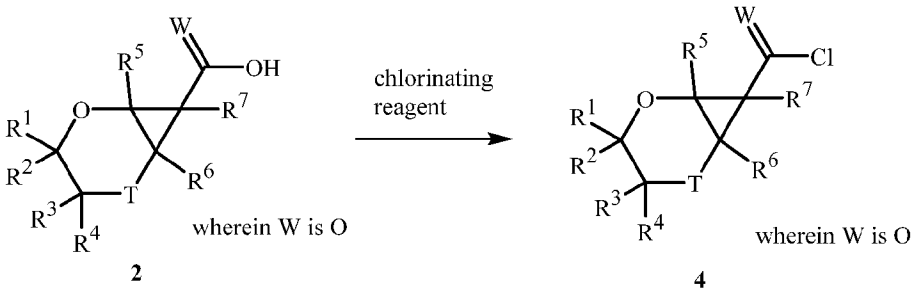
Scheme 2



As shown in Scheme 3, acid chlorides of Formula **4** wherein W is O are easily prepared from carboxylic acids of Formula **2** by numerous well-known methods. For example, reacting the carboxylic acid with a chlorinating reagent such as thionyl chloride, oxalyl chloride or phosphorus oxychloride in a solvent such as dichloromethane or toluene and optionally in the presence of a catalytic amount of *N*,*N*-dimethylformamide can provide the corresponding acid chloride of Formula **4**.

60

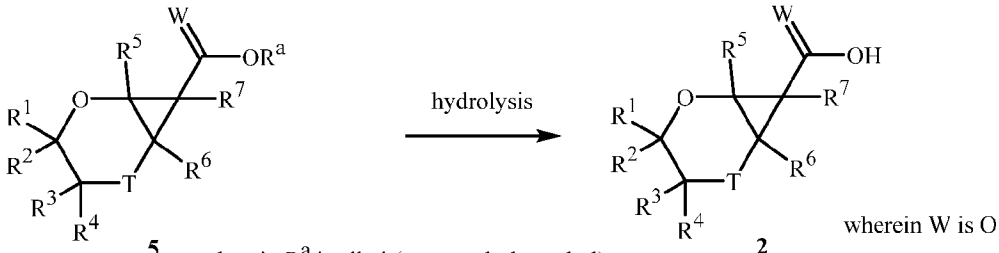
Scheme 3



2 4

As shown in Scheme 4, carboxylic acids of Formula **2** wherein W is O can be prepared according to well-known methods of basic or acidic hydrolysis of the corresponding compounds of Formula **5**, preferably using a slight excess of a hydroxide base (e.g. lithium hydroxide, sodium hydroxide, or potassium hydroxide) in a water-miscible solvent such as methanol, ethanol, tetrahydrofuran or 1,4-dioxane with or without water at a temperature between 0 and 80 °C. The product can be isolated by adjusting the pH to about 1 to 3 and then filtering or extracting, optionally after removal of the organic solvent by evaporation (see, for example, US 2015/0023913). Also present Example 1, Step B and Example 2, Step B illustrate the method of Scheme 4.

Scheme 4

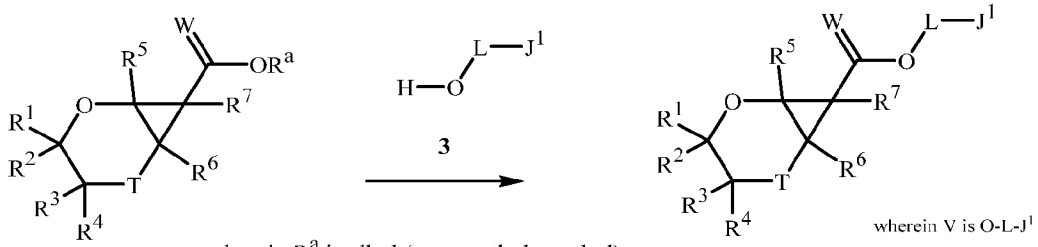


5 2

wherein R^a is alkyl (e.g., methyl or ethyl)

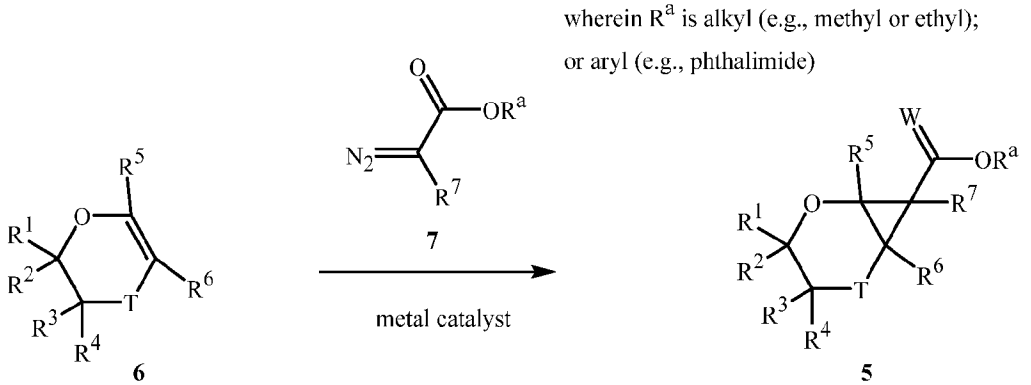
Compounds of Formula **1a** can also be prepared by reacting an ester of Formula **5** with an alcohol of Formula **3** in the presence of a base such as sodium hydride. Typical reaction conditions include an organic solvent such as dichloromethane, tetrahydrofuran or *N*,*N*-dimethylformamide, and a reaction temperature between 0 °C and 80 °C. Also present Example 4, Step B illustrates the method of Scheme 5.

Scheme 5



As shown in Scheme 6, compounds of Formula **5** can be prepared by the cyclopropanation of an olefin of Formula **6** with a diazoester of Formula **7** in the presence of a transition metal catalyst such as Rh_2OAc_4 (i.e. rhodium(II) acetate dimer), Rh_2oct_4 (i.e. rhodium(II) octanoate dimer), Rh_2esp_2 (i.e. bis[rhodium(α,α,α′,α′-tetramethyl-1,3-benzenedipropionic acid)]), [(Ph-Pheox)Ru(NCMe)$_4$]PF_6, [(*p*-cymene)Ru((S)-Pheox)-(NCMe)]PF_6 or copper(II) sulfate. The reaction can optionally be carried out without solvent other than the compounds of Formulae **6** and **7**. More typically the reaction is conducted in a liquid phase with a solvent such as methylene chloride, hexanes, or toluene, and a reaction temperature between -78 and 110 °C. General procedures for cyclopropanation of diazoesters with olefins are well documented in the chemical literature, see for example WO 1998/057968. The method of Scheme 6 is also illustrated by present Example 1, Step A and Example 2, Step A using a rhodium catalyst, and present Example 4, Step A using a ruthenium catalyst. Compounds of Formula **7** are commercially available or can be prepared by methods well known in the art.

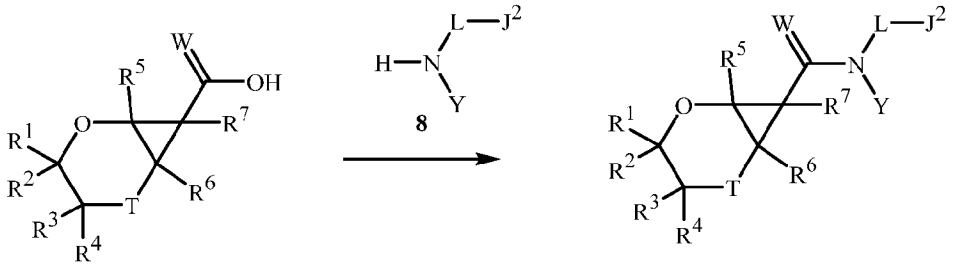
Scheme 6



As shown in Scheme 7, compounds of Formula **1b** (wherein V is N(Y)-L-J^2) can be prepared by reacting an acid of Formula **2** with amines of Formula **8** in the presence of a coupling reagent. Useful coupling reagents include, for example, dicyclohexyl carbodiimide,

1-(3-dimethylaminopropyl)-3-ethylcarbodiimide (EDC) and carbonyl diimidazole. Further coupling reagents useful in this method include *O*-(7-azabenzotriazol-1-yl)-*N,N,N',N'*-tetramethyluronium hexafluorophosphate (HATU), propylphosphonic anhydride (T3P), *O*-(7-azabenzotriazol-1-yl)-*N,N,N',N'*-tetramethyluronium tetrafluoroborate (TATU) and 2-(1*H*-benzotriazol-1-yl)-1,1,3,3-tetramethyluronium hexafluorophosphate (HBTU). These coupling reagents are generally used in the presence of a base such as triethylamine, pyridine, 4-(dimethylamino)pyridine or *N,N*-diisopropylethylamine. Typical reaction conditions include an anhydrous aprotic solvent such as ethyl acetate, dichloromethane, tetrahydrofuran or *N,N*-dimethylformamide, and a reaction temperature between room temperature and 80 °C. For reaction conditions useful in the method of Scheme 1, as well as other well-established coupling conditions see, for example, *Bioorganic & Medicinal Chemistry*, **2015**, *23*(3), 564, *Journal of Organic Chemistry* **2008**, *73*(7), 2731-2737; *Tetrahedron Letters* **2009**, *50*(45), 6200-6202; and *Organic letters* **2011**, *13*(12), 2988-91. Also present Example 1, Step A illustrates the method of Scheme 7. Amines of Formula **8** are commercially available or can be prepared by methods well established in the art.

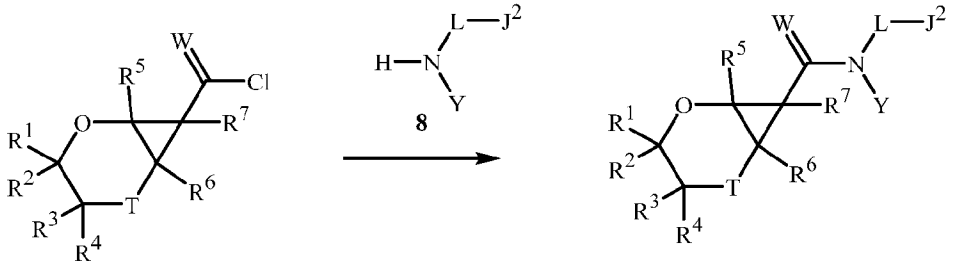
Scheme 7



2 **1b**

Alternatively, as shown in Scheme 8, compounds of Formula **1b** can be prepared by reacting an acid chloride of Formula **4** with an amine of Formula **8** in the presence of an acid scavenger. Typical acid scavengers include amine bases such as triethylamine, *N,N*-diisopropylethylamine and pyridine. Other scavengers include hydroxides such as sodium hydroxide and potassium hydroxide, or carbonates such as sodium carbonate and potassium carbonate. Typical reaction conditions include an organic solvent such as ethyl acetate, dichloromethane, tetrahydrofuran or *N,N*-dimethylformamide, and a reaction temperature between room temperature and 80 °C. In certain instances it is useful to use polymer-supported acid scavengers such as polymer-bound *N,N*-diisopropylethylamine and polymer-bound 4-(dimethylamino)pyridine.

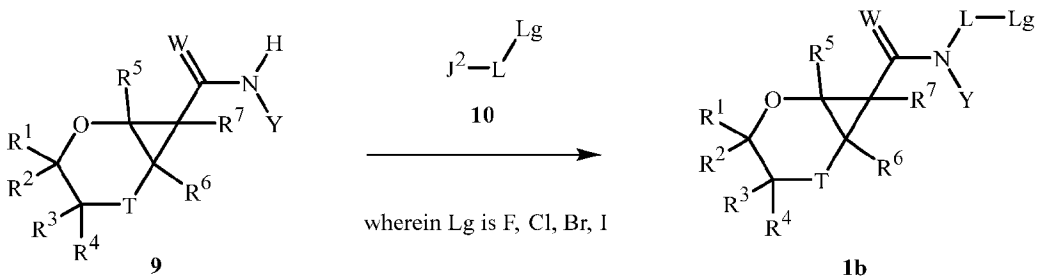
Scheme 8



4 1b

As shown in Scheme 9, compounds of Formula **1b** can be prepared from an amide of Formula **9** by reacting with a compound of Formula **10** wherein Lg is a leaving group such as a halide (e.g., Cl, Br, I) in the presence of a base such as sodium hydride or in the presence of a dilute acid such as hydrochloric acid. Reactions of this type are typically carried out in a solvent such as dimethyl sulfoxide, *N*,*N*-dimethylformamide, or *tert*-butanol, at a temperature ranging from about room temperature to the reflux temperature of the reaction mixture (see, for example, US 2003119829A1). Compounds of Formula **10** are commercially available or can be prepared by methods well established in the art.

Scheme 9

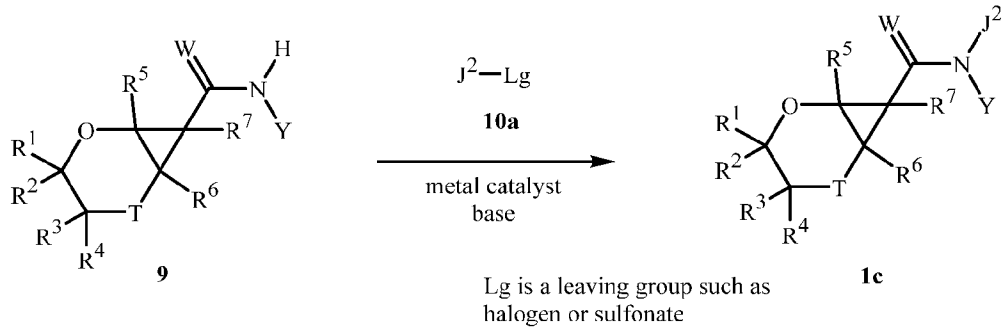


9 1b

As shown in Scheme 10, compounds of Formula **1c** (i.e. compounds of Formula **1b** wherein L is a direct bond) can also be prepared by a transition-metal-catalyzed cross coupling of a compound of Formula **9** with a compound of Formula **10a** wherein L is a direct bond and Lg is a leaving group such as halide (e.g., Cl, Br, I) or sulfonate (e.g., mesylate, triflate, *p*-toluenesulfonate), and the like. Reactions of this type are typically carried out using a palladium catalyst such as palladium(II) acetate with a phosphine ligand such as *t*-BuBrettPhos (i.e., 2-(di-*tert*-butylphosphino)-2′,4′,6′-triisopropyl-3,6-dimethoxy-1,1′-biphenyl), or a copper catalyst such as copper (I) iodide with a diamine ligand such as *trans*-*N*,*N*′-dimethylcyclohexane-1,2-diamine. These reactions traditionally require the presence of a base, such as a potassium carbonate or potassium phosphate in an organic solvent such as *tert*-

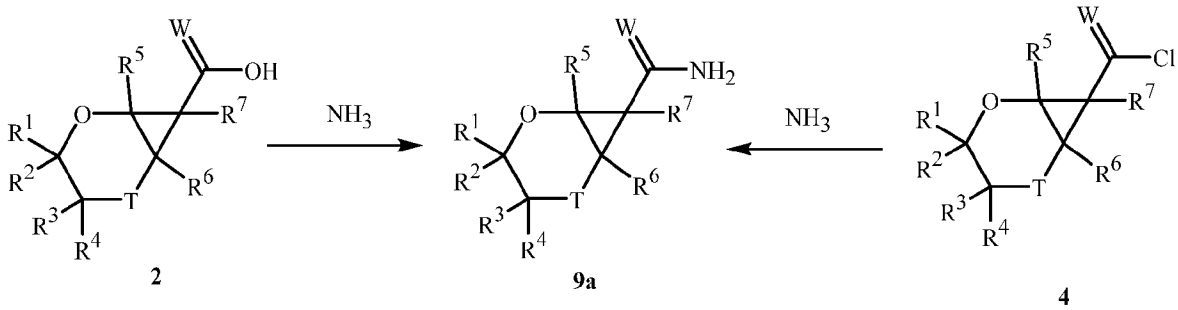
butanol, toluene, or dioxane and a reaction temperature between 80 and 110 °C (see, for example, *Tetrahedron*, **2009**, *65*, 6576). Compounds of Formula **10a** are commercially available or can be prepared by methods well established in the art.

Scheme 10



As shown in Scheme 11, ammonia can be substituted for the compound of Formula **8** in the reactions of Schemes 6 and 7 to yield amides of Formula **9a** (Formula **9** wherein Y is H). An acid chloride of Formula **4** can also be generated in situ from a compound of Formula **2** with thionyl chloride prior to the addition of ammonia optionally in the presence a base, such as triethylamine or *N,N*-diisopropylethylamine. For reaction conditions useful in the method of Scheme 11, see, for example, *J. Am. Chem. Soc.* **2015**, *137*, 2042.

Scheme 11

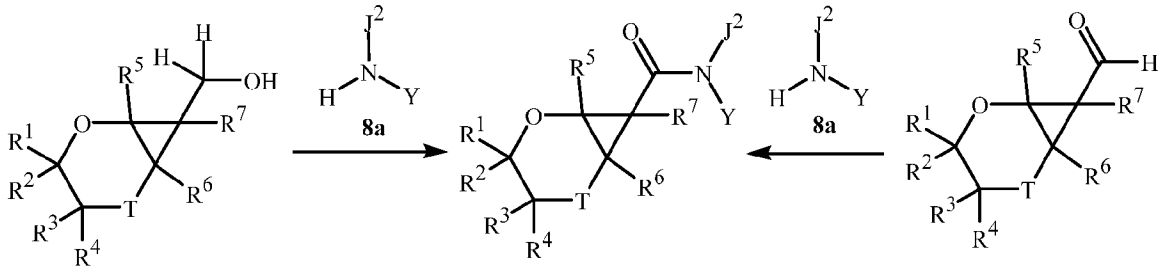


Compounds of Formula **1d** (Formula **1c** wherein W is O) can be prepared by rhodium-catalyzed oxidative amidation of alcohols of Formula **11** with amines of Formula **8a** wherein L is a direct bond, as shown in Scheme 12. This reaction is typically carried out in the presence of a catalyst such as $Rh(COD)_2BF_4$ (i.e., bis(1,5-cyclooctadiene)rhodium(I) tetrafluoroborate), a ligand such as 4,5-bis(diphenylphosphino)-9,9-dimethylxanthene (i.e., Xantphos) or 1,4-bis(diphenylphosphino)butane (i.e., DPPB), a hydrogen acceptor such as trifluoroacetophenone, and a base such as cesium acetate or cesium carbonate. The reaction can be run in an aprotic solvent such as tetrahydrofuran or dioxane with temperatures ranging

between 0 – 100 °C (see, for example, *ACS Catalysis*, **2016**, *6*, 8214). Alternatively, compounds of Formula **1d** can be prepared by coupling alcohols of Formula **11** with amines of Formula **8a** in the presence of a catalyst such as $RuHClCO(AsPh_3)_3$ (i.e., carbonylchlorohydrotris(triphenylarsine) ruthenium(II)) with a suitable thiocarboxamide ligand such as 2-pyridinecarbothioamide. The reaction is typically conducted under aerobic conditions in an organic solvent such as ethanol at a temperature ranging from about room temperature to the reflux temperature of the solvent (see, for example, *Organometallics*, **2014**, *33*, 4269).

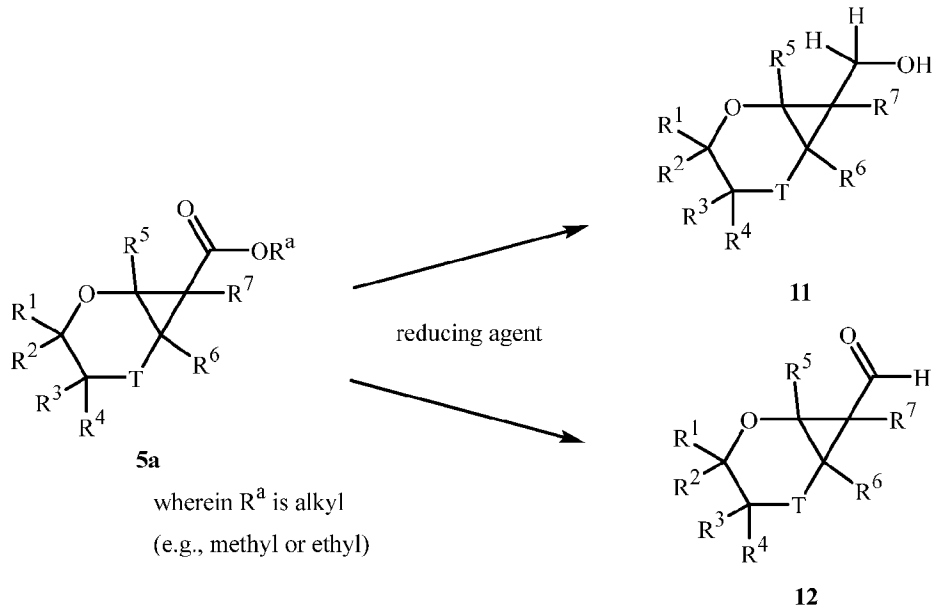
As shown in Scheme 12, compounds of Formula **1d** can also be prepared by rhodium-catalyzed oxidative amidation of aldehydes of Formula **12** with amines of Formula **8a**.

Scheme 12



Alcohols of Formula **11** and aldehydes of Formula **12**, as shown in Scheme 13, can be prepared from esters of Formula **5** according to general methods known to one skilled in the art. In one example, a suitable amount of reducing agent such as diisobutylaluminum hydride, in an aprotic solvent such as dichloromethane or tetrahydrofuran, at a suitable temperature, results in the transformation of a compounds of Formula **5** to compounds of Formulae **11** and **12**.

Scheme 13



5a

wherein R^a is alkyl (e.g., methyl or ethyl)

11

12

Compounds of Formula **1** prepared by the methods described above wherein W is O can be converted to the corresponding thioamides wherein W is S using a variety of standard thiating reagents such as phosphorus pentasulfide or 2,4-bis(4-methoxyphenyl)-1,3-dithia-2,4-diphosphetane-2,4-disulfide (Lawesson's reagent). Reactions of this type are well-known see, for example, *Heterocycles* **1995**, *40*, 271-278; *J. Med. Chem.* **2008**, *51*, 8124-8134; *J. Med. Chem.* **1990**, *33*, 2697-706; *Synthesis* **1989**, (5), 396-3977; *J. Chem. Soc., Perkin Trans. 1*, **1988**, 1663-1668; *Tetrahedron* **1988** *44*, 3025-3036; and *J. Org. Chem.* **1988** *53*(6), 1323-1326.

Schemes 1 through 13 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 13 can be prepared by general methods known in the art of synthetic organic chemistry, including methods analogous to those described for Schemes 1 to 13.

It is recognized by one skilled in the art that various functional groups can be converted into others to provide different compounds of Formula **1**. Compounds of Formula **1**, or intermediates for their preparation, may contain aromatic nitro groups, which can be reduced to amino groups, and then converted via reactions well-known in the art (e.g., Sandmeyer reaction) to various halides. By similar known reactions, aromatic amines (anilines) can be converted via diazonium salts to phenols, which can then be alkylated to prepare compounds

of Formula **1** with alkoxy substituents. Likewise, aromatic halides such as bromides or iodides prepared via the Sandmeyer reaction can react with alcohols under copper-catalyzed conditions, such as the Ullmann reaction or known modifications thereof, to provide compounds of Formula **1** that contain alkoxy substituents. Additionally, some halogen groups, such as fluorine or chlorine, can be displaced with alcohols under basic conditions to provide compounds of Formula **1** containing the corresponding alkoxy substituents. Compounds of Formula **1** or precursors thereof containing a halide, preferably bromide or iodide, are particularly useful intermediates for transition metal-catalyzed cross-coupling reactions to prepare compounds of Formula **1**. These types of reactions are well documented in the literature; see, for example, Tsuji in *Transition Metal Reagents and Catalysts: Innovations in Organic Synthesis*, John Wiley and Sons, Chichester, 2002; Tsuji in *Palladium in Organic Synthesis*, Springer, 2005; and Miyaura and Buchwald in *Cross Coupling Reactions: A Practical Guide*, 2002; and references cited therein.

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 introduction of the reagents depicted in the individual schemes, additional routine synthetic steps not described in detail may be needed 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 invention 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. Steps in the following 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. 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. ^{1}H NMR spectra are reported in ppm downfield from tetramethylsilane; "s" means singlet, "d" means doublet, "t" means triplet, "m" means multiplet, "br s" means broad singlet and "dd" means doublet of doublets.

EXAMPLE 1

Preparation of *rel*-3-methylphenyl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate (Compound 7).

Step A: Preparation of *rel*-ethyl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate.

To a stirred mixture of rhodium(II) acetate dimer (0.16 g, 0.35 mmol) and 2,3-dihydrofuran (8 mL, 106 mmol) in dichloromethane (117 mL) at room temperature was added ethyl diazoacetate (87% in dichloromethane, 4.26 mL, 35.3 mmol) at a rate of 2 mL/hr. The reaction mixture was stirred for 20 min, concentrated under reduced pressure and purified by silica gel column chromatography (eluting with a gradient of 0 to 15% ethyl acetate in hexanes) to yield a 3:1 mixture of diastereomers as a colorless liquid (4.24 g) containing the title compound as the major diastereomer.

^{1}H NMR ($CDCl_3$, 500 MHz) δ 4.24-4.02 (m, 4H), 3.52-3.43 (m, 0.75H), 2.51-2.42 (m, 0.25H), 2.30-2.22 (m, 0.25H), 2.22-2.14 (m, 1.5H), 2.12-2.07 (m, 0.25H), 2.07-2.01 (m, 0.75H), 1.91-1.87 (m, 1H), 1.60-1.55 (m, 0.25H), 1.30-1.21 (m, 3H).

Step B: Preparation of *rel*-(1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]hexane-6-carboxylic acid.

To a solution of *rel*-ethyl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate (i.e. the product of Step A) (4.24 g, 27.2 mmol) in tetrahydrofuran (27 mL) and methanol (13.5 mL) was added a solution of lithium hydroxide monohydrate (1.37 g, 32.6 mmol) in water (13.6 mL) and stirred at room temperature for 4.5 h. The reaction mixture was washed with diethyl ether (1x). The aqueous layer was acidified with hydrochloric acid (1 N aqueous solution) and extracted with ethyl acetate(3x). The extracts were combined, washed with a saturated brine solution, dried over magnesium sulfate, filtered and concentrated under reduced pressure to yield a 9:1 mixture of diastereomers (2.47 g) containing the title compound as the major diastereomer.

^{1}H NMR (DMSO-d_6, 500 MHz) δ 12.82-10.74 (m, 1H), 4.19-4.14 (m, 0.1H), 4.12-4.01 (m, 0.9H), 4.00-3.89 (m, 1H), 3.47-3.40 (m, 1H), 2.37-2.27 (m, 0.2H), 2.22-2.11 (m, 0.2H), 2.10-1.94 (m, 2.6H), 1.90-1.83 (m, 0.9H), 1.55-1.48 (m, 0.1H).

Step C: Preparation of *rel*-3-methylphenyl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate (Compound 7).

To a solution of *rel*-(1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]hexane-6-carboxylic acid (i.e. the product of Step B) (0.50 g, 3.9 mmol) in dichloromethane (20 mL) at 0 °C was added *N*,*N*′-dicyclohexylcarbodiimide (1.21 g, 5.85 mmol) followed by 4-dimethylaminopyridine (95 mg, 0.78 mmol). The reaction mixture was stirred at 0 °C for 10 min. 3-Methylphenol (476 mg, 3.90 mmol) was added to the reaction mixture. The reaction mixture was allowed to warm to room temperature and stirred for 48 h. The reaction mixture was quenched with ice-cold water (60 mL) and extracted with dichloromethane (2 x 50 mL). The organic extracts were combined, dried over anhydrous sodium sulfate, filtered, concentrated under reduced pressure and purified by silica gel column chromatography (eluting with 10% ethyl acetate in petroleum ether) to yield the title compound, a compound of the present invention, as a white solid (0.22 g).

^{1}H NMR (DMSO-d_6, 500 MHz) δ 7.28-7.25 (m, 1H), 7.18-7.14 (m, 1H), 6.95-6.87 (m, 2H), 4.33 (d, 1H), 4.03-3.97 (m, 1H), 3.57-3.48 (m, 1H), 2.30 (s, 3H), 2.29-2.21 (m, 2H), 2.14-2.04 (m, 2H).

LCMS: m/z: 219.1 $[M+H]^+$

EXAMPLE 2

Preparation of 3-methylphenyl (1α,6α,7α)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxylate.

Step A: Preparation of ethyl (1α,6α,7α)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxylate.

To rhodium(II) acetate dimer (86 mg, 0.194 mmol) under a dry nitrogen atmosphere was added dichloromethane (39 mL) and 1,4-dioxene (5.0 g, 58 mmol) at room temperature and stirred vigorously. To the reaction mixture was added ethyl diazoacetate (87% in dichloromethane, 2.54 g, 19.4 mmol) at a rate of 1 mL/hr. The reaction mixture was stirred for 20 min, concentrated under reduced pressure and purified by silica gel column chromatography (eluting with a gradient of 0 to 15% ethyl acetate in hexanes) to yield the title compound, a single diastereomer, as a colorless liquid (1.89 g).

^{1}H NMR ($CDCl_3$, 500 MHz) δ 4.16-4.07 (m, 2H), 3.97-3.92 (m, 2H), 3.74-3.67 (m, 2H), 3.66-3.58 (m, 2H), 2.18-2.13 (m, 1H), 2.29-2.20 (m, 3H).

GCMS: m/z: 172.1 $[M+H]^+$

Step B: Preparation of (1α,6α,7α)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxylic acid.

To a stirred solution of ethyl (1α,6α,7α)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxylate (i.e. the product of Step A) (1.85 g, 10.75 mmol) in tetrahydrofuran (6.7 mL) and methanol (6.7 mL) was added a 1 M aqueous solution of lithium hydroxide (12.9 mL, 12.9 mmol) and stirred vigorously at room temperature for 2 h. The mixture was acidified with hydrochloric acid (1 N aqueous solution) and extracted with ethyl acetate (4x). The extracts were combined, dried over magnesium sulfate, filtered and concentrated under reduced pressure to yield the title compound, a single diastereomer, as a colorless solid (1.41 g).

^{1}H NMR ($CDCl_3$, 500 MHz) δ 12.54-9.68 (br s, 1H), 4.04-3.97 (m, 2H), 3.75-3.68 (m, 2H), 3.67-3.60 (m, 2H), 2.19-2.12 (m, 1H).

Step C: Preparation of 3-methylphenyl (1α,6α,7α)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxylate.

To (1α,6α,7α)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxylic acid (i.e. the product of Step B) (144 mg, 1.0 mmol) and *N,N'*-dicyclohexylcarbodiimide (309 mg, 1.5 mmol) under a dry nitrogen atmosphere at 0 °C was added dichloromethane (4 mL) and stirred at 0 °C for 10 min. 3-Methylphenol (108 mg, 1.0 mmol) was added to the reaction mixture followed by 4-dimethylaminopyridine (122 mg, 1.0 mmol). The reaction mixture was allowed to warm to room temperature and stirred for 16 h. The reaction mixture was concentrated under reduced pressure and subjected to silica gel column chromatography (eluting with a 0 to 12% gradient of ethyl acetate in hexanes) to yield a residue as a 1:1 mixture of the title compound and 3-methylphenol. The residue was dissolved in ethyl acetate and quickly washed with a 1 N aqueous solution of sodium hydroxide, dried over magnesium sulfate, filtered, concentrated under reduced pressure and purified by silica gel column chromatography (eluting with a 0 to 12% gradient of ethyl acetate in hexanes) to yield the title compound, a compound of the present invention, as a colorless oil (62 mg).

^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.25-7.21 (m, 1H), 7.05-7.00 (m, 1H), 6.91-6.84 (m, 2H), 4.13-4.08 (m, 2H), 3.79-3.72 (m, 2H), 3.72-3.65 (m, 2H), 2.41-2.37 (m, 1H), 2.37-2.33 (m, 3H).

LCMS: m/z: 235.6 $[M+H]^+$.

EXAMPLE 3

Preparation of (1α,6α,7α)-*N*-(3-methylphenyl)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxamide (Compound 3).

To (1α,6α,7α)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxylic acid (i.e. the product of Example 2 Step B) (100 mg, 0.694 mmol) under a dry nitrogen atmosphere was added dichloromethane (1.4 mL) followed by diisopropylethylamine (269 mg, 2.08 mmol). The

mixture was stirred at 0 °C and 3-methylbenzenamine (82 mg, 0.763 mmol) was added followed by a dropwise addition of propylphosphonic anhydride (50% solution in ethyl acetate (0.53 g, 0.83 mmol) over a period of 5 min. The resultant mixture was stirred overnight at room temperature, concentrated under reduced pressure and purified by silica gel column chromatography (eluting with a 10 to 60% gradient of ethyl acetate in hexanes) to yield the title compound, a compound of the present invention, as a colorless solid (150 mg).

^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.37-7.28 (m, 1H), 7.25-7.14 (m, 3H), 6.97-6.84 (m, 1H), 4.08-4.02 (m, 2H), 3.79-3.70 (m, 2H), 3.69-3.58 (m, 2H), 2.37-2.28 (m, 3H), 2.09-1.98 (m, 1H).

LCMS: m/z: 234.2 $[M+H]^+$.

EXAMPLE 4

Preparation of 2-[(methylamino)carbonyl]phenyl (1α,6α,7α)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxylate.

Step A: Preparation of 1,3-dioxoisoindol-2-yl (1α,6α,7α)-2,5-dioxabicyclo[4.1.0]-heptane-7-carboxylate.

To ruthenium(1+), tetrakis(acetonitrile)[2-(4,5-dihydro-4-phenyl-2-oxazolyl-κN^3)-phenyl-κC]-, (*OC*-6-23)-, hexafluorophosphate(1-) (1:1) (i.e. CAS 2288845-81-6) (see *Chem. Communications* **2012**, *48*, 7750-7752 for preparation) (50 mg, 0.08 mmol) under a dry nitrogen atmosphere was added dichloromethane (54 mL) and 1,4-dioxene (2.25 g, 26.1 mmol) and cooled to 0 °C. A solution of 1,3-dioxoisoindol-2-yl 2-diazoacetate (see *Angew. Chem. Int. Ed.* **2019**, *58*, 5930 for preparation) (2.01 g, 8.695 mmol) in dichloromethane (28 mL) was added dropwise to the mixture and stirred at 0 °C for 30 min. The reaction mixture was concentrated under reduced pressure and purified by silica gel column chromatography (eluting with a gradient of 10 to 40% ethyl acetate in hexanes) to yield the title compound as white solid (1.35 g) (single diastereomer).

^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.88 (dd, J = 5.52, 2.99 Hz, 2H), 7.80-7.76 (m, 2H), 4.18-4.16 (m, 2H), 4.15-4.09 (m, 3H), 3.81-3.74 (m, 2H), 3.74-3.68 (m, 2H), 2.52-2.48 (m, 1H).

Step B: Preparation of 2-[(methylamino)carbonyl]phenyl (1α,6α,7α)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxylate.

To sodium hydride (60% in mineral oil, 33 mg, 0.83 mmol) under a dry nitrogen atmosphere was added tetrahydrofuran (3.5 mL) and cooled to 0 °C. 2-Hydroxy-*N*-methylbenzamide (125 mg, 0.83 mmol) was added to the cooled mixture and stirred at 0 °C for 30 min. To the reaction mixture was added 1,3-dioxoisoindol-2-yl (1α,6α,7α)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxylate (i.e. the product of Example 4 Step A) (200 mg, 0.691 mmol) and stirred at room temperature for 4 h. The resultant mixture was filtered

through Celite® diatomaceous earth filter aid, concentrated under reduced pressure and purified by silica gel column chromatography (eluting with a gradient of 0 to 50% ethyl acetate in hexanes) to yield the title compound, a compound of the present invention, as a colorless solid (49 mg).

^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.77-7.72 (m, 1H), 7.46-7.41 (m, 1H), 7.32-7.27 (m, 1H), 7.10-7.06 (m, 1H), 6.26-6.07 (m, 1H), 4.13 (d, J = 2.84 Hz, 2H), 3.80-3.73 (m, 2H), 3.73-3.67 (m, 2H), 3.00 (d, J = 4.89 Hz, 3H), 2.42 (t, J = 2.92 Hz, 1H).

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.

By the procedures described herein together with methods known in the art, the following compounds of Tables 1 to 260 can be prepared. The following abbreviations are used in the Tables which follow: Me means methyl, OMe means methoxy, Et means ethyl, OEt means ethoxy, *n*-Pr means *n*-propyl, *i*-Pr means isopropyl, *c*-Pr means cyclopropyl, *n*-Bu means *n*-butyl, *s*-Bu means sec-butyl, *t*-Bu means *tert*-butyl, *c*-Bu means cyclobutyl, Ph means phenyl and CN means cyano. In Tables 1 to 260, Z has the following meaning as defined in Exhibit 4. Of note for values of Z is where Z is selected from Z-2, Z-3, Z-7 and Z-8.

Exhibit 4

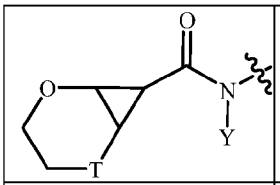
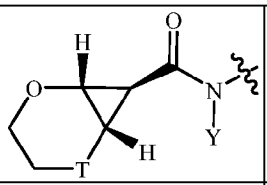
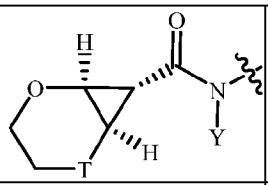
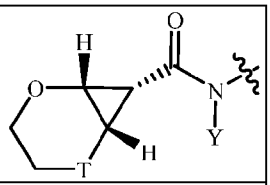
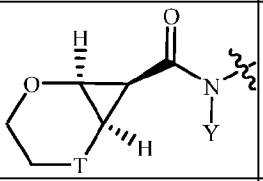
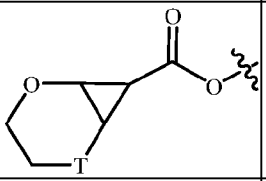
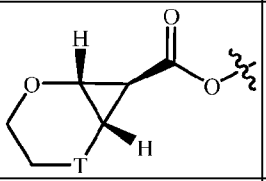
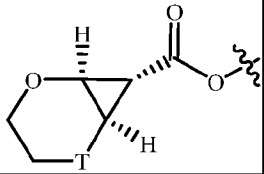
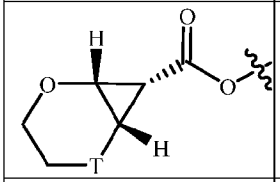
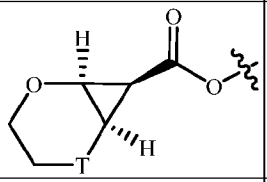
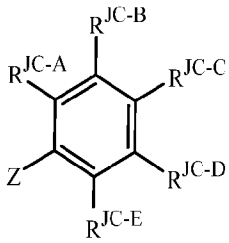
			
Z-1	Z-2	Z-3	Z-4
			
Z-5	Z-6	Z-7	Z-8
			
Z-9	Z-10		

Table 1



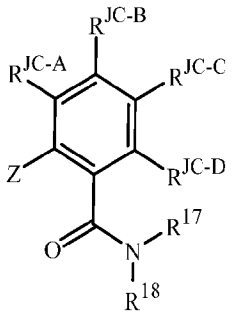
Z is Z-1, T is O and Y is H.

R^{JC-A}	R^{JC-B}	R^{JC-C}	R^{JC-D}	R^{JC-E}
Me	H	H	H	H
H	Me	H	H	H
H	H	Me	H	H
F	H	H	H	H
H	F	H	H	H
H	H	F	H	H
Cl	H	H	H	H
H	Cl	H	H	H
H	H	Cl	H	H
CF_3	H	H	H	H
H	CF_3	H	H	H
H	H	CF_3	H	H
OMe	H	H	H	H
H	OMe	H	H	H
H	H	OMe	H	H
CN	H	H	H	H
H	CN	H	H	H
H	H	CN	H	H
Me	Me	H	H	H
Mc	H	Mc	H	H
Me	H	H	Me	H
Me	H	H	H	Me
H	Me	Me	H	H
H	Me	H	Me	H
H	Me	H	H	Me

The present disclosure also includes Tables 2 through 20, each of which is constructed the same as Table 1 above, except that the row heading in Table 1 (i.e. "Z is Z-1, T is O and Y is H") is replaced with the respective row headings shown below.

Table	Row Heading	Table	Row Heading
2	Z is Z-2, T is O and Y is H.	3	Z is Z-3, T is O and Y is H.
4	Z is Z-4, T is O and Y is H.	5	Z is Z-5, T is O and Y is H.
6	Z is Z-1, T is O and Y is Me.	7	Z is Z-2, T is O and Y is Me.
8	Z is Z-3, T is O and Y is Me.	9	Z is Z-4, T is O and Y is Me.
10	Z is Z-5, T is O and Y is Me.	11	Z is Z-6 and T is O.
12	Z is Z-7 and T is O.	13	Z is Z-8 and T is O.
14	Z is Z-9 and T is O.	15	Z is Z-10 and T is O.
16	Z is Z-6 and T is a direct bond.	17	Z is Z-7 and T is a direct bond.
18	Z is Z-8 and T is a direct bond.	19	Z is Z-9 and T is a direct bond.
20	Z is Z-10 and T is a direct bond.		

Table 21



In Table 21 moieties listed with a dash on each end (i.e., -$CH_2CH_2CH_2CH_2$-) denote a ring wherein R^{17} and R^{18} are taken together with the nitrogen to which they are attached to form a ring with said moiety.

Z is Z-1, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H ; T is O and Y is H.

R^{17}	R^{18}
Me	H
Et	H
n-Pr	H
i-Pr	H
c-Pr	H

Z is Z-1, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H ; T is O and Y is H.

R^{17}	R^{18}
n-Bu	H
c-Bu	H
sec-Bu	H
i-Bu	H
$-CH_2CF_3$	H
$-CH_2OMe$	H
$-CH(CF_3)_2$	H
Ph	H
H	H
OMe	H
OEt	H
$-CH_2CH_2CH_2CH_2-$	
$-CH_2CH_2CH_2CH_2CH_2-$	
$-CH_2CH_2OCH_2CH_2-$	
$-CH_2CH_2NHCH_2CH_2-$	
$-CH_2CH_2N(Me)CH_2CH_2-$	
Me	Me
Et	Me
n-Pr	Me
i-Pr	Me
c-Pr	Me

The present disclosure also includes Tables 22 through 160, each of which is constructed the same as Table 21 above, except that the row heading in Table 21 (i.e. "Z is Z-1, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H, T is O and Y is H. ") is replaced with the respective row headings shown below.

Table	Row Heading
22	Z is Z-2, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H, T is O and Y is H.
23	Z is Z-3, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H, T is O and Y is H.
24	Z is Z-4, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H, T is O and Y is H.
25	Z is Z-5, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H, T is O and Y is H.
26	Z is Z-6, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H and T is O.

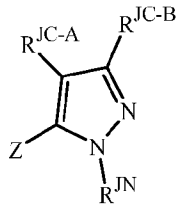
Table	Row Heading
27	Z is Z-7, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H and T is O.
28	Z is Z-8, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H and T is O.
29	Z is Z-9, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H and T is O.
30	Z is Z-10, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H and T is O.
31	Z is Z-6, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H and T is a direct bond.
32	Z is Z-7, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H and T is a direct bond.
33	Z is Z-8, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H and T is a direct bond.
34	Z is Z-9, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H and T is a direct bond.
35	Z is Z-10, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H and T is a direct bond.
36	Z is Z-1, R^{JC-A} is Me, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H, T is O and Y is H.
37	Z is Z-2, R^{JC-A} is Me, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H, T is O and Y is H.
38	Z is Z-3, R^{JC-A} is Me, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H, T is O and Y is H.
39	Z is Z-4, R^{JC-A} is Me, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H, T is O and Y is H.
40	Z is Z-5, R^{JC-A} is Me, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H, T is O and Y is H.
41	Z is Z-6, R^{JC-A} is Me, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H and T is O.
42	Z is Z-7, R^{JC-A} is Me, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H and T is O.
43	Z is Z-8, R^{JC-A} is Me, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H and T is O.
44	Z is Z-9, R^{JC-A} is Me, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H and T is O.
45	Z is Z-10, R^{JC-A} is Me, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H and T is O.
46	Z is Z-6, R^{JC-A} is Me, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H and T is a direct bond.
47	Z is Z-7, R^{JC-A} is Me, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H and T is a direct bond.
48	Z is Z-8, R^{JC-A} is Me, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H and T is a direct bond.
49	Z is Z-9, R^{JC-A} is Me, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H and T is a direct bond.
50	Z is Z-10, R^{JC-A} is Me, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H and T is a direct bond.
51	Z is Z-1, R^{JC-A} is H, R^{JC-B} is Me, R^{JC-C} is H, R^{JC-D} is H, T is O and Y is H.
52	Z is Z-2, R^{JC-A} is H, R^{JC-B} is Me, R^{JC-C} is H, R^{JC-D} is H, T is O and Y is H.
53	Z is Z-3, R^{JC-A} is H, R^{JC-B} is Me, R^{JC-C} is H, R^{JC-D} is H, T is O and Y is H.
54	Z is Z-4, R^{JC-A} is H, R^{JC-B} is Me, R^{JC-C} is H, R^{JC-D} is H, T is O and Y is H.
55	Z is Z-5, R^{JC-A} is H, R^{JC-B} is Me, R^{JC-C} is H, R^{JC-D} is H, T is O and Y is H.
56	Z is Z-6, R^{JC-A} is H, R^{JC-B} is Me, R^{JC-C} is H, R^{JC-D} is H and T is O.
57	Z is Z-7, R^{JC-A} is H, R^{JC-B} is Me, R^{JC-C} is H, R^{JC-D} is H and T is O.
58	Z is Z-8, R^{JC-A} is H, R^{JC-B} is Me, R^{JC-C} is H, R^{JC-D} is H and T is O.
59	Z is Z-9, R^{JC-A} is H, R^{JC-B} is Me, R^{JC-C} is H, R^{JC-D} is H and T is O.
60	Z is Z-10, R^{JC-A} is H, R^{JC-B} is Me, R^{JC-C} is H, R^{JC-D} is H and T is O.

Table	Row Heading
61	Z is Z-6, R^{JC-A} is H, R^{JC-B} is Me, R^{JC-C} is H, R^{JC-D} is H and T is a direct bond.
62	Z is Z-7, R^{JC-A} is H, R^{JC-B} is Me, R^{JC-C} is H, R^{JC-D} is H and T is a direct bond.
63	Z is Z-8, R^{JC-A} is H, R^{JC-B} is Me, R^{JC-C} is H, R^{JC-D} is H and T is a direct bond.
64	Z is Z-9, R^{JC-A} is H, R^{JC-B} is Me, R^{JC-C} is H, R^{JC-D} is H and T is a direct bond.
65	Z is Z-10, R^{JC-A} is H, R^{JC-B} is Me, R^{JC-C} is H, R^{JC-D} is H and T is a direct bond.
66	Z is Z-1, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is Me, R^{JC-D} is H, T is O and Y is H.
67	Z is Z-2, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is Me, R^{JC-D} is H, T is O and Y is H.
68	Z is Z-3, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is Me, R^{JC-D} is H, T is O and Y is H.
69	Z is Z-4, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is Me, R^{JC-D} is H, T is O and Y is H.
70	Z is Z-5, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is Me, R^{JC-D} is H, T is O and Y is H.
71	Z is Z-6, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is Me, R^{JC-D} is H and T is O.
72	Z is Z-7, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is Me, R^{JC-D} is H and T is O.
73	Z is Z-8, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is Me, R^{JC-D} is H and T is O.
74	Z is Z-9, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is Me, R^{JC-D} is H and T is O.
75	Z is Z-10, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is Me, R^{JC-D} is H and T is O.
76	Z is Z-6, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is Me, R^{JC-D} is H and T is a direct bond.
77	Z is Z-7, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is Me, R^{JC-D} is H and T is a direct bond.
78	Z is Z-8, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is Me, R^{JC-D} is H and T is a direct bond.
79	Z is Z-9, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is Me, R^{JC-D} is H and T is a direct bond.
80	Z is Z-10, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is Me, R^{JC-D} is H and T is a direct bond.
81	Z is Z-1, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is Me, T is O and Y is H.
82	Z is Z-2, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is Me, T is O and Y is H.
83	Z is Z-3, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is Me, T is O and Y is H.
84	Z is Z-4, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is Me, T is O and Y is H.
85	Z is Z-5, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is Me, T is O and Y is H.
86	Z is Z-6, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is Me and T is O.
87	Z is Z-7, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is Me and T is O.
88	Z is Z-8, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is Me and T is O.
89	Z is Z-9, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is Me and T is O.
90	Z is Z-10, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is Me and T is O.
91	Z is Z-6, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is Me and T is a direct bond.
92	Z is Z-7, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is Me and T is a direct bond.
93	Z is Z-8, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is Me and T is a direct bond.
94	Z is Z-9, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is Me and T is a direct bond.

Table	Row Heading
95	Z is Z-10, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is Me and T is a direct bond.
96	Z is Z-1, R^{JC-A} is Cl, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H, T is O and Y is H.
97	Z is Z-2, R^{JC-A} is Cl, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H, T is O and Y is H.
98	Z is Z-3, R^{JC-A} is Cl, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H, T is O and Y is H.
99	Z is Z-4, R^{JC-A} is Cl, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H, T is O and Y is H.
100	Z is Z-5, R^{JC-A} is Cl, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H, T is O and Y is H.
101	Z is Z-6, R^{JC-A} is Cl, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H and T is O.
102	Z is Z-7, R^{JC-A} is Cl, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H and T is O.
103	Z is Z-8, R^{JC-A} is Cl, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H and T is O.
104	Z is Z-9, R^{JC-A} is Cl, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H and T is O.
105	Z is Z-10, R^{JC-A} is Cl, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H and T is O.
106	Z is Z-6, R^{JC-A} is Cl, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H and T is a direct bond.
107	Z is Z-7, R^{JC-A} is Cl, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H and T is a direct bond.
108	Z is Z-8, R^{JC-A} is Cl, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H and T is a direct bond.
109	Z is Z-9, R^{JC-A} is Cl, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H and T is a direct bond.
110	Z is Z-10, R^{JC-A} is Cl, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H and T is a direct bond.
111	Z is Z-1, R^{JC-A} is H, R^{JC-B} is Cl, R^{JC-C} is H, R^{JC-D} is H, T is O and Y is H.
112	Z is Z-2, R^{JC-A} is H, R^{JC-B} is Cl, R^{JC-C} is H, R^{JC-D} is H, T is O and Y is H.
113	Z is Z-3, R^{JC-A} is H, R^{JC-B} is Cl, R^{JC-C} is H, R^{JC-D} is H, T is O and Y is H.
114	Z is Z-4, R^{JC-A} is H, R^{JC-B} is Cl, R^{JC-C} is H, R^{JC-D} is H, T is O and Y is H.
115	Z is Z-5, R^{JC-A} is H, R^{JC-B} is Cl, R^{JC-C} is H, R^{JC-D} is H, T is O and Y is H.
116	Z is Z-6, R^{JC-A} is H, R^{JC-B} is Cl, R^{JC-C} is H, R^{JC-D} is H and T is O.
117	Z is Z-7, R^{JC-A} is H, R^{JC-B} is Cl, R^{JC-C} is H, R^{JC-D} is H and T is O.
118	Z is Z-8, R^{JC-A} is H, R^{JC-B} is Cl, R^{JC-C} is H, R^{JC-D} is H and T is O.
119	Z is Z-9, R^{JC-A} is H, R^{JC-B} is Cl, R^{JC-C} is H, R^{JC-D} is H and T is O.
120	Z is Z-10, R^{JC-A} is H, R^{JC-B} is Cl, R^{JC-C} is H, R^{JC-D} is H and T is O.
121	Z is Z-6, R^{JC-A} is H, R^{JC-B} is Cl, R^{JC-C} is H, R^{JC-D} is H and T is a direct bond.
122	Z is Z-7, R^{JC-A} is H, R^{JC-B} is Cl, R^{JC-C} is H, R^{JC-D} is H and T is a direct bond.
123	Z is Z-8, R^{JC-A} is H, R^{JC-B} is Cl, R^{JC-C} is H, R^{JC-D} is H and T is a direct bond.
124	Z is Z-9, R^{JC-A} is H, R^{JC-B} is Cl, R^{JC-C} is H, R^{JC-D} is H and T is a direct bond.
125	Z is Z-10, R^{JC-A} is H, R^{JC-B} is Cl, R^{JC-C} is H, R^{JC-D} is H and T is a direct bond.
126	Z is Z-1, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is Cl, R^{JC-D} is H, T is O and Y is H.
127	Z is Z-2, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is Cl, R^{JC-D} is H, T is O and Y is H.
128	Z is Z-3, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is Cl, R^{JC-D} is H, T is O and Y is H.

Table	Row Heading
129	Z is Z-4, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is Cl, R^{JC-D} is H, T is O and Y is H.
130	Z is Z-5, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is Cl, R^{JC-D} is H, T is O and Y is H.
131	Z is Z-6, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is Cl, R^{JC-D} is H and T is O.
132	Z is Z-7, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is Cl, R^{JC-D} is H and T is O.
133	Z is Z-8, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is Cl, R^{JC-D} is H and T is O.
134	Z is Z-9, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is Cl, R^{JC-D} is H and T is O.
135	Z is Z-10, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is Cl, R^{JC-D} is H and T is O.
136	Z is Z-6, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is Cl, R^{JC-D} is H and T is a direct bond.
137	Z is Z-7, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is Cl, R^{JC-D} is H and T is a direct bond.
138	Z is Z-8, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is Cl, R^{JC-D} is H and T is a direct bond.
139	Z is Z-9, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is Cl, R^{JC-D} is H and T is a direct bond.
140	Z is Z-10, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is Cl, R^{JC-D} is H and T is a direct bond.
141	Z is Z-1, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is Cl, T is O and Y is H.
142	Z is Z-2, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is Cl, T is O and Y is H.
143	Z is Z-3, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is Cl, T is O and Y is H.
144	Z is Z-4, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is Cl, T is O and Y is H.
145	Z is Z-5, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is Cl, T is O and Y is H.
146	Z is Z-6, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is Cl and T is O.
147	Z is Z-7, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is Cl and T is O.
148	Z is Z-8, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is Cl and T is O.
149	Z is Z-9, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is Cl and T is O.
150	Z is Z-10, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is Cl and T is O.
151	Z is Z-6, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is Cl and T is a direct bond.
152	Z is Z-7, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is Cl and T is a direct bond.
153	Z is Z-8, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is Cl and T is a direct bond.
154	Z is Z-9, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is Cl and T is a direct bond.
155	Z is Z-10, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is Cl and T is a direct bond.
156	Z is Z-1, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H, T is O and Y is Me.
157	Z is Z-2, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H, T is O and Y is Me.
158	Z is Z-3, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H, T is O and Y is Me.
159	Z is Z-4, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H, T is O and Y is Me.
160	Z is Z-5, R^{JC-A} is H, R^{JC-B} is H, R^{JC-C} is H, R^{JC-D} is H, T is O and Y is Me.

Table 161



Z is Z-1 ; T is O and Y is H.

R^{JC-A}	R^{JC-B}	R^{JN}
Me	H	Me
H	Me	Me
Me	Me	Me
Cl	H	Me
H	Cl	Me
CN	H	Me
H	CN	Me
C(=O)NHMe	H	Me
H	C(=O)NHMe	Me
H	H	H
H	H	Me
H	H	Et
H	H	*n*-Pr
H	H	*i*-Pr
H	H	*c*-Pr
H	H	*n*-Bu
H	H	*i*-Bu
H	H	*sec*-Bu
H	H	*c*-Bu
H	H	*c*-pentyl
H	H	hexyl
H	H	CH_2OMe
H	H	CH_2CO_2H
H	H	CH_2CO_2Me
H	H	CH_2CN
H	H	CH_2CF_3

Z is Z-1 ; T is O and Y is H.

R^{JC-A}	R^{JC-B}	R^{JN}
H	H	$CH_2CH_2CF_3$
H	H	CH_2Ph
H	H	CH(Me)Ph
H	H	Ph

The present disclosure also includes Tables 162 through 180, each of which is constructed the same as Table 161 above, except that the row heading in Table 161 (i.e. "Z is Z-1 ; T is O and Y is H") is replaced with the respective row headings shown below.

Table	Row Heading	Table	Row Heading
162	Z is Z-2, T is O and Y is H.	163	Z is Z-3, T is O and Y is H.
164	Z is Z-4, T is O and Y is H.	165	Z is Z-5, T is O and Y is H.
166	Z is Z-1, T is O and Y is Me.	167	Z is Z-2, T is O and Y is Me.
168	Z is Z-3, T is O and Y is Me.	169	Z is Z-4, T is O and Y is Me.
170	Z is Z-5, T is O and Y is Me.	171	Z is Z-6 and T is O.
172	Z is Z-7 and T is O.	173	Z is Z-8 and T is O.
174	Z is Z-9 and T is O.	175	Z is Z-10 and T is O.
176	Z is Z-6 and T is a direct bond.	177	Z is Z-7 and T is a direct bond.
178	Z is Z-8 and T is a direct bond.	179	Z is Z-9 and T is a direct bond.
180	Z is Z-10 and T is a direct bond.		

Table 181

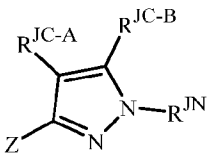
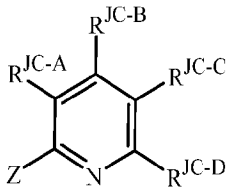


Table 181 is constructed the same as Table 161 except that the structure in Table 161 is replaced with the structure above for Table 181.

Table 182 through Table 200

Table 182 is constructed the same as Table 162 except that the structure in Table 162 is replaced with the structure above for Table 181. Tables 182 through 200 are constructed in the same fashion as Tables 162 through 180.

Table 201



Z is Z-1 ; T is O and Y is H.

R^{JC-A}	R^{JC-B}	R^{JC-C}	R^{JC-D}
Me	H	H	H
H	Me	H	H
H	H	Me	H
H	H	H	Me
F	H	H	H
H	F	H	H
H	H	F	H
H	H	H	F
Cl	H	H	H
H	Cl	H	H
H	H	Cl	H
H	H	H	Cl
CF_3	H	H	H
H	CF_3	H	H
H	H	CF_3	H
H	H	H	CF_3
OMe	H	H	H
H	OMe	H	H
H	H	OMe	H
H	H	H	OMe
CN	H	H	H
H	CN	H	H
H	H	CN	H
H	H	H	CN
Me	Me	H	H
Me	H	Me	H
Me	H	H	Me

Z is Z-1 ; T is O and Y is H.

R^{JC-A}	R^{JC-B}	R^{JC-C}	R^{JC-D}
H	Me	Me	H
H	Me	H	Me
H	H	Me	Me

The present disclosure also includes Tables 202 through 220, each of which is constructed the same as Table 201 above, except that the row heading in Table 201 (i.e. "Z is Z-1 ; T is O and Y is H") is replaced with the respective row headings shown below.

Table	Row Heading	Table	Row Heading
202	Z is Z-2, T is O and Y is H.	203	Z is Z-3, T is O and Y is H.
204	Z is Z-4, T is O and Y is H.	205	Z is Z-5, T is O and Y is H.
206	Z is Z-1, T is O and Y is Me.	207	Z is Z-2, T is O and Y is Me.
208	Z is Z-3, T is O and Y is Me.	209	Z is Z-4, T is O and Y is Me.
210	Z is Z-5, T is O and Y is Me.	211	Z is Z-6 and T is O.
212	Z is Z-7 and T is O.	213	Z is Z-8 and T is O.
214	Z is Z-9 and T is O.	215	Z is Z-10 and T is O.
216	Z is Z-6 and T is a direct bond.	217	Z is Z-7 and T is a direct bond.
218	Z is Z-8 and T is a direct bond.	219	Z is Z-9 and T is a direct bond.
220	Z is Z-10 and T is a direct bond.		

Table 221

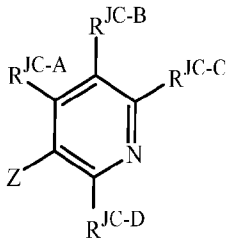
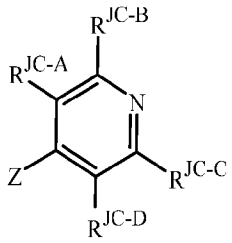


Table 221 is constructed the same as Table 201 except that the structure in Table 201 is replaced with the structure above for Table 221.

Table 222 through Table 240

Table 222 is constructed the same as Table 202 except that the structure in Table 202 is replaced with the structure above for Table 221. Tables 223 through 240 are constructed in the same fashion as Tables 203 through 220.

Table 241



Z is Z-1 ; T is O and Y is H.

R^{JC-A}	R^{JC-B}	R^{JC-C}	R^{JC-D}
Me	H	H	H
H	Me	H	H
F	H	H	H
H	F	H	H
Cl	H	H	H
H	Cl	H	H
CF_3	H	H	H
H	CF_3	H	H
OMe	H	H	H
H	OMe	H	H
CN	H	H	H
H	CN	H	H
Me	Me	H	H
Me	H	Me	H
Me	H	H	Me
H	Me	Me	H

The present disclosure also includes Tables 242 through 260, each of which is constructed the same as Table 241 above, except that the row heading in Table 241 (i.e. "Z is Z-1 ; T is O and Y is H") is replaced with the respective row headings shown below.

Table	Row Heading	Table	Row Heading
242	Z is Z-2, T is O and Y is H.	243	Z is Z-3, T is O and Y is H.
244	Z is Z-4, T is O and Y is H.	245	Z is Z-5, T is O and Y is H.
246	Z is Z-1, T is O and Y is Me.	247	Z is Z-2, T is O and Y is Me.
248	Z is Z-3, T is O and Y is Me.	249	Z is Z-4, T is O and Y is Me.
250	Z is Z-5, T is O and Y is Me.	251	Z is Z-6 and T is O.

Table	Row Heading	Table	Row Heading
252	Z is Z-7 and T is O.	253	Z is Z-8 and T is O.
254	Z is Z-9 and T is O.	255	Z is Z-10 and T is O.
256	Z is Z-6 and T is a direct bond.	257	Z is Z-7 and T is a direct bond.
258	Z is Z-8 and T is a direct bond.	259	Z is Z-9 and T is a direct bond.
260	Z is Z-10 and T is a direct bond.		

Formulation/Utility

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, lanolin-based 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–F. 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 2	98.5%
silica aerogel	0.5%
synthetic amorphous fine silica	1.0%

Example B

Wettable Powder

Compound 4	65.0%
dodecylphenol polyethylene glycol ether	2.0%
sodium ligninsulfonate	4.0%
sodium silicoaluminate	6.0%
montmorillonite (calcined)	23.0%

Example C

Granule

Compound 1	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 5	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 7	10.0%
polyoxyethylene sorbitol hexoleate	20.0%
C_6–C_{10} fatty acid methyl ester	70.0%
Example F	
Microemulsion	
Compound 8	5.0%
polyvinylpyrrolidone-vinyl acetate copolymer	30.0%
alkylpolyglycoside	30.0%
glyceryl monooleate	15.0%
water	20.0%
Example G	
Seed Treatment	
Compound 6	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 3	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 4	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 5	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 2	25%
polyoxyethylene sorbitol hexaoleate	15%
organically modified bentonite clay	2.5%
fatty acid methyl ester	57.5%

Example L

Suspoemulsion

Compound 1	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*), grape leaffolder (*Desmia funeralis* Hübner), melon worm (*Diaphania nitidalis* Stoll), cabbage center grub (*Helluala hydralis* Guenée), yellow stem borer (*Scirpophaga incertulas* Walker), early shoot borer (*Scirpophaga infuscatellus* Snellen), 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* English)); leafrollers, budworms, seed worms, and fruit worms in the family Tortricidae (e.g., codling moth (*Cydia pomonella* Linnaeus), grape berry moth (*Endopiza viteana* Clemens), oriental fruit moth (*Grapholita molesta* Busck), citrus false codling moth (*Cryptophlebia leucotreta* Meyrick), citrus borer (*Ecdytolopha aurantiana* 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 (*Lithocolletis 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* Service), 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*), Denver 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 virgifera* LeConte)); chafers and other beetles from the family Scarabaeidae (e.g., Japanese beetle (*Popillia japonica* Newman), oriental beetle (*Anomala orientalis* Waterhouse, *Exomala orientalis* (Waterhouse) Baraud), 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), two spotted spider mite (*Tetranychus urticae* Koch), McDaniel 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 Demodicidae, 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*), common fowl tick (*Argas radiatus*)); 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* Forskal), 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., *Gastrophilus* 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* fr. 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 order Mallophaga and including the head louse (*Pediculus humanus capitis* De Geer), body louse (*Pediculus humanus* Linnaeus), chicken body louse (*Menacanthus stramineus* Nitszch), 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* Bouche), 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*), lesser grain borer (*Rhyzopertha dominica*), rice weevil (*Stiophilus oryzae*), maize weevil (*Stiophilus zeamais*), cowpea weevil (*Callosobruchus maculatus*), red flour beetle (*Tribolium castaneum*), granary weevil (*Stiophilus granarius*), Indian meal moth (*Plodia interpunctella*), Mediterranean flour beetle (*Ephestia kuhniella*) and flat or rusty grain beetle (*Cryptolestis ferrugineus*).

Compounds of the present disclosure also 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 show particularly high 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), *Cnaphalocrosis 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 (American 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 also 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 dirhodum* 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* Fallen (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* Horvath (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) *Corythuca gossypii* Fabricius (cotton lace bug), *Cyrtopeltis modesta* Distant (tomato bug), *Dysdercus suturellus* Herrich-Schäffer (cotton stainer), *Euchistus servus* Say (brown stink bug), *Euchistus variolarius* Palisot de Beauvois (one-spotted stink bug), *Graptosthetus* spp. (complex of seed bugs), *Halymorpha 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), *Scirthothrips citri* Moulton (citrus thrips), *Sericothrips 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 silverleaf whitefly (*Bemisia argentifolii*). Of note is use of compounds of this invention for controlling western flower thrip (*Frankliniella occidentalis*). Of note is use of compounds of this invention for controlling corn planthopper (*Peregrinus maidis*). 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 diamondback moth (*Plutella xylostella*).

Compounds of the present disclosure are also 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 can 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 the present 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 the present 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 the present 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 the present method for increasing vigor of a crop plant wherein the crop is rice. Also of note is the present method for increasing vigor of a crop plant wherein the crop is maize (corn). Also of note is the present 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, acynonapyr, 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, benzpyrimoxan, bifenthrin, kappa-bifenthrin, bifenazate, bistrifluron, borate, broflanilide, buprofezin, cadusafos, carbaryl, carbofuran, cartap, carzol, chlorantraniliprole, chlorfenapyr, chlorfluazuron, chloroprallethrin, chlorpyrifos, chlorpyrifos-e, chlorpyrifos-methyl, chromafenozide, clofentezin, chloroprallethrin, 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), cyenopyrafen, cyflumetofen, cyfluthrin, beta-cyfluthrin, cyhalodiamide, cyhalothrin, gamma-cyhalothrin, lambda-cyhalothrin, cypermethrin, alpha-cypermethrin, zeta-cypermethrin, cyromazine, deltamethrin, diafenthiuron, diazinon, dicloromesotiaz, dieldrin, diflubenzuron, dimefluthrin, dimehypo, dimethoate, dimpropyridaz, dinotefuran, diofenolan, emamectin, emamectin benzoate, endosulfan, esfenvalerate, ethiprole, etofenprox, epsilon-metofluthrin, etoxazole, fenbutatin oxide, fenitrothion, fenothiocarb, fenoxycarb, fenpropathrin, fenvalerate, fipronil, flometoquin (2-ethyl-3,7-dimethyl-6-[4-(trifluoromethoxy)phenoxy]-4-quinolinyl methyl carbonate), flonicamid, fluazaindolizine, flubendiamide, flucythrinate, flufenerim, flufenoxuron, flufenoxystrobin (methyl (α*E*)-2-[[2-chloro-4-(trifluoromethyl)phenoxy]methyl]-α-(methoxymethylene)benzeneacetate), fluensulfone (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), flupyrimin, fluvalinate, tau-fluvalinate, fluxametamide, fonophos, formetanate, fosthiazate, gamma-cyhalothrin, 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, isocycloseram, kappa-tefluthrin, lambda-cyhalothrin, 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, methiocarb, methomyl, methoprene, methoxychlor, metofluthrin, methoxyfenozide, epsilon-metofluthrin, epsilon-momfluorothrin, monocrotophos, momfluorothrin ([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, oxazosulfyl, 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, spiropidion, spirotetramat, sulprofos, sulfoxaflor (*N*-[methyloxido[1-[6-(trifluoromethyl)-3-pyridinyl]ethyl]-λ^4-sulfanylidene]cyanamide), tebufenozide, tebufenpyrad, teflubenzuron, tefluthrin, kappa-tefluthrin, terbufos, tetrachlorantraniliprole, 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, tyclopyrazoflor, zeta-cypermethrin, *Bacillus thuringiensis* delta-endotoxins, entomopathogenic bacteria, entomopathogenic viruses or entomopathogenic fungi.

Of note are insecticides such as abamectin, acetamiprid, acrinathrin, acynonapyr, afidopyropen, amitraz, avermectin, azadirachtin, benfuracarb, bensultap, bifenthrin, buprofezin, broflanilide, cadusafos, carbaryl, cartap, chlorantraniliprole, chloroprallethrin, 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, epsilon-metofluthrin, esfenvalerate, ethiprole, etofenprox, etoxazole, fenitrothion, fenothiocarb, fenoxycarb, fenvalerate, fipronil, flometoquin, fluxametamide, flonicamid, flubendiamide, fluensulfone, flufenoxuron, flufenoxystrobin, flufensulfone, flupiprole, flupyrimin, flupyradifurone, fluvalinate, formetanate, fosthiazate, gamma-cyhalothrin, heptafluthrin, hexaflumuron, hydramethylnon, imidacloprid, indoxacarb, isocycloseram, kappa-tefluthrin, lambda-cyhalothrin, lufenuron, meperfluthrin, metaflumizone, methiodicarb, methomyl, methoprene, methoxyfenozide, metofluthrin, momfluorothrin, 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, tyclopyrazoflor, zeta-cypermethrin, *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 compounds 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, and sulfoxaflor; 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; selective homopteran feeding blockers such as pymetrozine and flonicamid; mite growth inhibitors such as etoxazole; inhibitors of mitochondrial ATP synthase such as propargite; ucouplers 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; 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; ryanidine receptor modulators such as the anthranilic diamides chlorantraniliprole, cyantraniliprole 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 azadirachtin, bifenazate, pyridalyl, pyrifluquinazon and triflumezopyrim; microbial disrupters of insect midgut membranes such as *Bacillus thuringensis* and the delta-endotoxins they produce and *Bacillus sphaericus*; and biological agents including nucleo polyhedro viruses (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.

In certain instances, combinations of a compound of this disclosure with other biologically active (particularly invertebrate pest control) compounds or agents (i.e. active ingredients) can result in an enhanced effect. Reducing the quantity of active ingredients released in the environment while ensuring effective pest control is always desirable. When enhanced invertebrate pest control occurs at application rates giving agronomically satisfactory levels of invertebrate pest control, such combinations can be advantageous for reducing crop production cost and decreasing environmental load.

Compounds of this disclosure and compositions thereof can be applied to plants genetically transformed to express proteins toxic to invertebrate pests (such as *Bacillus thuringiensis* delta-endotoxins). Such an application may provide a broader spectrum of plant protection and be advantageous for resistance management. The exogenously applied invertebrate pest control compounds of this disclosure in combination with the expressed toxin proteins may provide an enhanced effect.

General references for these agricultural protectants (i.e. insecticides, fungicides, nematocides, acaricides, herbicides and biological agents) include *The Pesticide Manual, 13th Edition*, C. D. S. Tomlin, Ed., British Crop Protection Council, Farnham, Surrey, U.K., 2003 and *The BioPesticide Manual*, *2nd Edition*, L. G. Copping, Ed., British Crop Protection Council, Farnham, Surrey, U.K., 2001.

Compounds of this disclosure can be combined or formulated with polynucleotides including, but not limited to, DNA, RNA, and/or chemically modified nucleotides influencing

the amount of a particular target through down regulation, interference, suppression or silencing of the genetically derived transcript that render an insecticidal effect.

For embodiments where one or more of these various mixing partners are used, the weight ratio of these various mixing partners (in total) to the compound of Formula **1** is typically between about 1:3000 and about 3000:1. Of note are weight ratios between about 1:300 and about 300:1 (for example ratios between about 1:30 and about 30:1). One skilled in the art can easily determine through simple experimentation the biologically effective amounts of active ingredients necessary for the desired spectrum of biological activity. It will be evident that including these additional components can expand the spectrum of invertebrate pests controlled beyond the spectrum controlled by the compound of Formula **1** alone.

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-ØØ163-7	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-Ø61Ø61-7	Glyphosate tol.	gat4621
Canola*	73496	DP-Ø73496-4	Glyphosate tol.	gat4621
Canola*	GT200 (RT200)	MON-89249-2	Glyphosate tol.	cp4 epsps (aroA:CP4); goxv247
Canola*	GT73 (RT73)	MON-ØØØ73-7	Glyphosate tol.	cp4 epsps (aroA:CP4); goxv247
Canola*	HCN10 (Topas 19/2)	NA	Glufosinate tol.	bar
Canola*	HCN28 (T45)	ACS-BNØØ8-2	Glufosinate tol.	pat (syn)
Canola*	HCN92 (Topas 19/2)	ACS-BNØØ7-1	Glufosinate tol.	bar
Canola*	MON88302	MON-883Ø2-9	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-BNØØ4-7	Glufosinate tol.	bar
Canola*	MS8	ACS-BNØØ5-8	Glufosinate tol.	bar
Canola*	OXY-235	ACS-BNØ11-5	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-BNØØ1-4	Glufosinate tol.	bar
Canola*	RF2 (B94-2)	ACS-BNØØ2-5	Glufosinate tol.	bar

Crop	Event Name	Event Code	Trait(s)	Gene(s)
Canola*	RF3	ACS-BNØØ3-6	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-4Ø619-7	SU tol.; modified flower color	surB; dfr; hfl (f3'5'h)
Carnation	123.2.38 (40644)	FLO-4Ø644-4	SU tol.; modified flower color	surB; dfr; hfl (f3'5'h)
Carnation	123.8.12	FLO-4Ø689-6	SU tol.; modified flower color	surB; dfr; bp40 (f3'5'h)
Carnation	123.8.8 (40685)	FLO-4Ø685-1	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-114ØØ-2	SU tol.; modified flower color	surB; dfr; bp40 (f3'5'h)
Carnation	15	FLO-ØØØ15-2	SU tol.; modified flower color	surB; dfr; hfl (f3'5'h)
Carnation	16	FLO-ØØØ16-3	SU tol.; modified flower color	surB; dfr; hfl (f3'5'h)
Carnation	4	FLO-ØØØØ4-9	SU tol.; modified flower color	surB; dfr; hfl (f3'5'h)
Carnation	66	FLO-ØØØ66-8	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-Ø1951A-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-21Ø23-5	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

Crop	Event Name	Event Code	Trait(s)	Gene(s)
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

Crop	Event Name	Event Code	Trait(s)	Gene(s)
Cotton	MON88701	MON-88701-3	Dicamba & glufosinate tol.	Modified dmo; bar
Cotton	OsCr11		Anti-allergy	Modified Cry j
Creeping Bentgrass	ASR368	SMG-368ØØ-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

Crop	Event Name	Event Code	Trait(s)	Gene(s)
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

Crop	Event Name	Event Code	Trait(s)	Gene(s)
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)

Crop	Event Name	Event Code	Trait(s)	Gene(s)
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

Crop	Event Name	Event Code	Trait(s)	Gene(s)
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

Crop	Event Name	Event Code	Trait(s)	Gene(s)
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-ØCZW3-2	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-718ØØ-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.

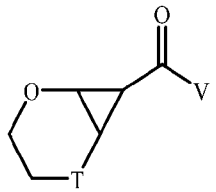
In general for veterinary use, a compound of Formula **1**, an *N*-oxide or a salt thereof, is administered in a parasiticidally effective amount to an animal to be protected from invertebrate parasite pests. A parasiticidally effective amount is the amount of active ingredient needed to achieve an observable 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.

The compounds of this disclosure prepared by the methods described herein are shown in Index Table A. Me means methyl and Ph means phenyl. The abbreviation "Cmpd. No." stands for "Compound Number", and the abbreviation "Ex." stands for "Example" and is followed by a number indicating in which example the compound is prepared. The abbreviation "m.p." stands for melting point. A wavy line or "–" in a structure fragment denotes the attachment point of the fragment to the remainder of the molecule. The numerical value reported in the column "MS" is the molecular weight of the highest isotopic abundance positively charged parent ion (M+1) formed by addition of H^+ (molecular weight of 1) to the molecule having the highest isotopic abundance, or the highest isotopic abundance negatively charged ion (M–1) formed by loss of H^+ (molecular weight of 1). The presence of molecular ions containing one or more higher atomic weight isotopes of lower abundance (e.g., ^{37}Cl, ^{81}Br) is not reported. The reported MS peaks were observed by mass spectrometry using electrospray ionization (ESI) or atmospheric pressure chemical ionization (APCI).

Unless otherwise indicated, the compounds in Index Table A are mixtures of compounds of Formulae **1**$^{\mathbf{i}}$ and **1**$^{\mathbf{ii}}$.

INDEX TABLE A



A dash "–" in the T column means that the T substituent is a direct bond between the two adjacent carbon atoms.

Cmpd. No.	T	V	J	m.p. (°C)	MS
1	O	–N(H)J	1-Me-pyrazol-3-yl		224 (M+1)
2	O	–N(H)J	2-F-4-Me-Ph		252 (M+1)
3 (Ex. 3)	O	–N(H)J	3-Me-Ph		234 (M+1)

Cmpd. No.	T	V	J	m.p. (°C)	MS
4	O	–N(H)J	2-(C(=O)NHMe)Ph		277 (M+1)
5	–	–OJ	2-F-Ph	72-75	
6	–	–OJ	2-F-4-Me-Ph	65-69	
7 (Ex. 1)	–	–OJ	3-Me-Ph		219 (M+1)
8	–	–OJ	3,4-diMe-Ph	61-64	

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 Table A for compound descriptions.

BIOLOGICAL EXAMPLES

Formulation and Spray Methodology for Tests A-F

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 Diamondback Moth (*Plutella xylostella* (L.)) the test unit consisted of a small open container with a 12- to 14-day-old mustard plant inside. The test unit 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 and 50 ppm. After spraying of the formulated test compound, each test unit was allowed to dry for 1 h. A black, screened cap was placed on top of each test unit, and the test units were held for 6 days in a growth chamber at 25 °C and 70% relative humidity. Plant feeding damage was visually assessed based on foliage consumed, and larvae were assessed for mortality.

Of the compounds of Formula **1** tested at 250 ppm, the following provided very good to excellent levels of control efficacy (40% or less feeding damage and/or 100% mortality): 1, 3, 4, 5, 6, 7 and 8.

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): 8.

Test B

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- to 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 50 ppm. 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 to 24 °C and 50 to 70% relative humidity. Each test unit was then visually assessed for insect mortality.

Of the compounds of Formula **1** tested at 250 ppm, the following resulted in at least 80% mortality: 1, 3, 4, 5, 6, 7 and 8.

Of the compounds of Formula **1** tested at 50 ppm, the following resulted in at least 80% mortality: 5, 6, 7 and 8.

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- to 15-day-old radish plant inside. Prior to compound application, each test unit was pre-infested by placing on a leaf of the test plant 30 to 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 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 to 21 °C and 50 to 70% relative humidity. Each test unit was then visually assessed for insect mortality.

Of the compounds of Formula **1** tested at 250 ppm, the following resulted in at least 80% mortality: 1, 2, 3, 4, 5, 6, 7 and 8.

Of the compounds of Formula **1** tested at 50 ppm, the following resulted in at least 80% mortality: 1, 4, 5, 6 and 7.

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 to 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 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 250 ppm, the following resulted in at least 80% mortality: 1, 2, 3, 4, 5, 6, 7 and 8.

Of the compounds of Formula **1** tested at 50 ppm, the following resulted in at least 80% mortality: 1, 4, 5, 6 and 7.

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 6- to 8-day-old soybean plant inside. Adult whiteflies were allowed to lay eggs on the plant and then were removed from the test unit. Plants infested with at least 15 eggs were submitted to the test for spraying.

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

Of the compounds of Formula **1** tested at 250 ppm, the following resulted in at least 50% mortality: 1, 4, 6 and 7.

Of the compounds of Formula **1** tested at 50 ppm, the following resulted in at least 80% mortality: 1, 4, 6 and 7.

Test F

For evaluating control of the Western Flower Thrips (*Franklinielllla occidentalis* (Pergande)) through contact and/or systemic means, the test unit consisted of a small open container with a 5 to 7-day-old Soleil bean plant inside.

Test compounds were formulated and sprayed at 250 ppm. After spraying, the test units were allowed to dry for 1 h, and then about 60 thrips (adults and nymphs) were added to each unit. A black, screened cap was placed on top, and the test units were held for 6 days at 25 °C

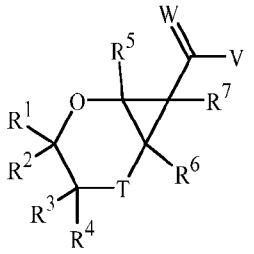
and 45 to 55% relative humidity. Each test unit was then visually assessed for plant damage and insect mortality.

Of the compounds of Formula **1** tested at 250 ppm, the following provided very good to excellent levels of control efficacy (40% or less plant damage and/or 100% mortality): 1, 2, 3 and 4.

CLAIMS

What is claimed is:

1. A compound selected from Formula 1, *N*-oxides and salts thereof,



1

wherein

T is a direct bond, and V is O-L-J^1; or

T is O, and V is O-L-J^1 or N(Y)-L-J^2;

L is a direct bond or $(CR^{LA}R^{LB})_m$;

each R^{LA} and R^{LB} is independently hydrogen, halogen, C_1-C_3 alkyl or C_1-C_3 haloalkyl;

m is 1, 2 or 3;

R^1, R^2, R^3 and R^4 are each independently hydrogen, halogen, cyano, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy, C_1-C_4 haloalkoxy, C_1-C_4 alkylthio, C_1-C_4 haloalkylthio, C_1-C_4 alkylsulfinyl, C_1-C_4 haloalkylsulfinyl, C_1-C_4 alkylsulfonyl, C_1-C_4 haloalkylsulfonyl or Q^1;

R^5, R^6 and R^7 are each independently hydrogen, halogen, cyano, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy, C_1-C_4 haloalkoxy, C_1-C_4 alkylthio, C_1-C_4 haloalkylthio, C_1-C_4 alkylsulfinyl, C_1-C_4 haloalkylsulfinyl, C_1-C_4 alkylsulfonyl, C_1-C_4 haloalkylsulfonyl or Q^1;

Q^1 is a 6- to 14-membered carbocyclic ring or ring system, each ring or ring system optionally substituted with one or more substituents independently selected from halogen, cyano, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy, C_1-C_4 haloalkoxy, C_1-C_4 alkylthio, C_1-C_4 haloalkylthio, C_1-C_4 alkylsulfinyl, C_1-C_4 haloalkylsulfinyl, C_1-C_4 alkylsulfonyl and C_1-C_4 haloalkylsulfonyl;

W is O or S;

Y is hydrogen, $C(=O)R^8$, $S(=O)_nR^9$, CO_2R^{10}, $C(=O)NR^{11}R^{12}$, $S(=O)_nNR^{11}R^{12}$, $NR^{11}R^{12}$, C_3-C_{15} trialkylsilyl or C_3-C_{15} halotrialkylsilyl; or benzyl optionally substituted by R^{13} on ring members; or C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6

alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, C_3-C_8 cycloalkyl, C_3-C_8 halocycloalkyl, C_3-C_8 cycloalkenyl, C_3-C_8 halocycloalkenyl, C_4-C_{10} alkylcycloalkyl, C_4-C_{10} cycloalkylalkyl, C_4-C_{10} halocycloalkylalkyl, C_6-C_{14} cycloalkylcycloalkyl, C_5-C_{10} alkylcycloalkylalkyl, C_2-C_8 alkoxyalkyl, C_2-C_8 haloalkoxyalkyl, C_4-C_{10} cycloalkoxyalkyl, C_3-C_8 alkoxyalkoxyalkyl, C_2-C_6 alkylthioalkyl, C_2-C_6 alkylsulfinylalkyl, C_2-C_6 alkylsulfonylalkyl, C_2-C_6 alkylaminoalkyl, C_2-C_6 haloalkylaminoalkyl, C_3-C_8 dialkylaminoalkyl, C_4-C_{10} cycloalkylaminoalkyl or C_3-C_5 alkoxycarbonylalkyl, each optionally substituted with up to 1 substituent selected from cyano, hydroxy, nitro, C_2-C_4 alkylcarbonyl, C_2-C_4 alkoxycarbonyl, C_3-C_{15} trialkylsilyl and C_3-C_{15} halotrialkylsilyl;

R^8, R^9 and R^{10} are each independently C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_3-C_6 cycloalkyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, C_2-C_7 alkoxyalkyl or C_4-C_7 cycloalkylalkyl; or phenyl optionally substituted by R^{13}; or benzyl optionally substituted by R^{13} on ring members; or pyridyl optionally substituted by R^{13};

R^{11} and R^{12} are each independently hydrogen, hydroxy, cyano, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_3-C_7 cycloalkyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, C_1-C_4 alkoxy, C_1-C_4 haloalkoxy, C_2-C_7 alkoxyalkyl C_4-C_7 cycloalkylalkyl, C_2-C_4 alkylthioalkyl, C_1-C_4 alkylsulfonyl, C_1-C_4 haloalkylsulfonyl, C_2-C_4 alkylsulfinylalkyl, C_2-C_4 alkylsulfonylalkyl, C_2-C_4 alkylcarbonyl, C_2-C_4 haloalkylcarbonyl, C_2-C_5 alkoxycarbonyl, C_3-C_5 alkoxycarbonylalkyl, C_2-C_5 alkylaminocarbonyl, C_3-C_5 dialkylaminocarbonyl, C_3-C_7 alkylaminocarbonylalkyl or C_4-C_7 dialkylaminocarbonylalkyl; or phenyl optionally substituted by R^{13}; or benzyl optionally substituted by R^{13} on ring members; or pyridyl optionally substituted by R^{13}; or

R^{11} and R^{12} are taken together with the nitrogen to which they are attached to form a 3- to 6-membered ring containing ring members selected from carbon atoms and up to two additional atoms independently selected from nitrogen, sulfur and oxygen, wherein the sulfur atom ring member is selected from S, S(=O) and $S(=O)_2$, said ring optionally substituted with 1 to 4 substituents independently selected from halogen, C_1-C_2 alkyl, C_1-C_2 haloalkyl, C_1-C_2 alkoxy, C_1-C_2 haloalkoxy, cyano and nitro;

R^{13} is halogen, C_1-C_3 alkyl, C_1-C_3 haloalkyl, C_1-C_3 alkoxy, C_1-C_3 haloalkoxy, cyano, or nitro;

J^1 is phenyl or naphthalenyl, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{JC}; or a 4-, 5- or 6-membered heterocyclic ring or an 8-, 9- or 10-membered bicyclic ring system, each ring or ring system containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 1 boron, up to 2 oxygen, up to 2 sulfur and up to 4 nitrogen atoms, wherein up to 2 carbon ring members are optionally selected from C(=O) and C(=S), each ring system optionally substituted with up to 5 substituents independently selected from R^{JC} on carbon atom ring members; R^{JN} on nitrogen atom ring members and R^{JB} on boron atom ring members;

J^2 is phenyl or naphthalenyl, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{JC}; or a 4-, 5- or 6-membered heterocyclic ring or an 8-, 9- or 10-membered bicyclic ring system, each ring or ring system containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 1 boron, up to 2 oxygen, up to 2 sulfur and up to 4 nitrogen atoms, wherein up to 2 carbon ring members are optionally selected from C(=O) and C(=S), each ring system optionally substituted with up to 5 substituents independently selected from R^{JC} on carbon atom ring members; R^{JN} on nitrogen atom ring members and R^{JB} on boron atom ring members;

each R^{JC} is independently hydrogen, halogen, hydroxy, cyano, nitro, OR^{14}, $C(=O)R^{15}$, CO_2H, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $C(=NR^{19})R^{20}$, $NR^{17}R^{18}$, $S(=O)_nR^{21}$ or Q^2; or C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl or C_3-C_6 cycloalkyl, each optionally substituted with one or more substituents independently selected from halogen, cyano, nitro, OR^{14}, $C(=O)R^{15}$, CO_2H, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $C(=NR^{19})R^{20}$, $NR^{17}R^{18}$, $S(=O)_nR^{21}$ or Q^2;

each R^{JN} is independently hydrogen, hydroxy, cyano, OR^{14}, $C(=O)R^{15}$, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $C(=NR^{19})R^{20}$, $NR^{17}R^{18}$, $S(=O)_nR^{21}$ or Q^2; or C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl or C_3-C_6 cycloalkyl, each optionally substituted with one or more substituents independently selected from halogen, cyano, nitro, OR^{14}, $C(=O)R^{15}$, CO_2H, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $C(=NR^{19})R^{20}$, $NR^{17}R^{18}$, $S(=O)_nR^{21}$ or Q^2;

each R^{JB} is independently hydroxy, C_1-C_6 alkoxy, C_1-C_6 haloalkoxy; or phenoxy optionally substituted with up to five substituents independently selected from R^{13};

each R^{14} is independently C_1-C_6 alkyl, C_3-C_7 cycloalkyl, C_1-C_6 haloalkyl or C_3-C_7 halocycloalkyl; or phenyl optionally substituted by halogen, cyano, nitro, C_1-C_3 alkyl, C_1-C_3 haloalkyl, C_3-C_7 cycloalkyl, C_1-C_3 alkoxy or C_1-C_3 haloalkoxy;

each R^{15} is independently C_1-C_6 alkyl, C_3-C_7 cycloalkyl, C_1-C_6 haloalkyl or C_3-C_7 halocycloalkyl; or phenyl optionally substituted by halogen, cyano, nitro, C_1-C_3 alkyl, C_1-C_3 haloalkyl, C_3-C_7 cycloalkyl, C_1-C_3 alkoxy or C_1-C_3 haloalkoxy;

each R^{16} is independently C_1-C_6 alkyl, C_3-C_7 cycloalkyl, C_1-C_6 haloalkyl or C_3-C_7 halocycloalkyl; or phenyl optionally substituted by halogen, cyano, nitro, C_1-C_3 alkyl, C_1-C_3 haloalkyl, C_3-C_7 cycloalkyl, C_1-C_3 alkoxy or C_1-C_3 haloalkoxy;

each Z is independenty O or S;

each R^{17} is independently hydrogen, hydroxy, OR^{22}, $C(=O)R^{23}$, $C(=O)OR^{24}$, $C(=O)NR^{25}R^{26}$, $C(=NR^{19})R^{20}$, $NR^{25}R^{26}$, $S(=O)_nR^{21}$ or Q^2; or C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl or C_3-C_6 cycloalkyl, each optionally substituted with one or more substituents independently selected from R^x;

each R^{18} is independently hydrogen or Q^2; or C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_3-C_7 cycloalkyl, C_2-C_7 alkylcarbonyl or C_2-C_7 alkoxycarbonyl, each optionally substituted by R^x; or

R^{17} and R^{18} are taken together with the nitrogen to which they are attached to form a 3- to 6-membered ring containing ring members selected from carbon atoms and up to two additional atoms independently selected from nitrogen, sulfur and oxygen, wherein the sulfur atom ring member is selected from S, S(=O) and $S(=O)_2$, said ring optionally substituted with 1 to 4 substituents independently selected from halogen, C_1-C_2 alkyl, C_1-C_2 haloalkyl, C_1-C_2 alkoxy, C_1-C_2 haloalkoxy cyano and nitro; or

R^{17} and R^{18} are taken together as $=S(=O)_uR^{27}R^{28}$ or $=S(=NR^{29})R^{27}R^{28}$;

each R^x is independently halogen, hydroxy, cyano, nitro, C_1-C_6 alkyl, C_1-C_6 haloalkyl, C_3-C_6 cycloalkyl, C_1-C_6 alkoxy, C_1-C_6 haloalkoxy, C_3-C_6 cycloalkoxy, $OC(=O)R^{23}$, $C(=O)R^{23}$, $C(=O)OR^{24}$, $C(=O)NR^{25}R^{26}$, $C(=NR^{19})R^{25}$, $NR^{25}R^{26}$, $S(=O)_nR^{30}$, $Si(R^{31})_3$, $OSi(R^{31})_3$ or Q^2;

each R^{19} is independently OR^{22}, $S(O)_nR^{30}$ or NHR^{32};

each R^{20} is independently hydrogen; or C_1-C_6 alkyl, C_3-C_6 cycloalkyl, C_2-C_6 alkenyl or C_2-C_6 alkynyl, each optionally substituted with one or more R^x; or C_1-C_6 alkoxy, C_1-C_6 haloalkoxy, C_3-C_6 cycloalkoxy, $C(=O)R^{23}$, $C(=O)OR^{24}$, $C(=O)NR^{25}R^{26}$, $NR^{25}R^{26}$ or Q^2;

each R^{21} is independently amino, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3-C_6 cycloalkyl, C_3-C_6 halocycloalkyl, C_1-C_6 alkylamino, C_2-C_6 dialkylamino, C_3-C_6

cycloalkylalkyl or C_3-C_6 halocycloalkylalkyl; or phenyl, optionally substituted with up to 5 substituents independently selected from the group consisting of halogen, cyano, nitro, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy;

each R^{22} is independently C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, $C(=O)R^{23}$, $S(=O)_nR^{30}$ or Q^2;

each R^{23} is independently C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3-C_6 cycloalkyl, C_3-C_6 halocycloalkyl, C_4-C_7 cycloalkylalkyl or C_4-C_7 halocycloalkylalkyl; or phenyl, optionally substituted with up to 5 substituents independently selected from the group consisting of halogen, cyano, nitro, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy;

each R^{24} is independently C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_3-C_6 cycloalkyl or C_3-C_6 halocycloalkyl; or phenyl, optionally substituted with up to 5 substituents independently selected from the group consisting of halogen, cyano, nitro, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy;

each R^{25} is independently hydrogen, C_1-C_6 alkyl, C_1-C_6 haloalkyl, $C(=O)R^{33}$ or $S(=O)_nR^{33}$; or phenyl or a 5- or 6-membered heterocyclic aromatic ring, each ring optionally substituted with up to 5 substituents independently selected from the group consisting of halogen, cyano, nitro, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy;

each R^{26} is independently hydrogen, C_1-C_6 alkyl or C_1-C_6 haloalkyl; or

R^{25} and R^{26} are taken together with the nitrogen atom to which they are attached to form a 3- to 7-membered ring containing ring members selected from carbon atoms and up to 2 heteroatoms independently selected from one oxygen atom, one sulfur atom, and up to 2 nitrogen atoms, said ring optionally substituted with 1 to 4 substituents independently selected from the group consisting of halogen, cyano, nitro, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy;

each R^{27} is independently C_1-C_4 alkyl or C_1-C_4 haloalkyl; or phenyl, optionally substituted with up to 5 substituents independently selected from the group consisting of halogen, cyano, nitro, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy;

each R^{28} is independently C_1-C_4 alkyl or C_1-C_4 haloalkyl; or phenyl, optionally substituted with up to 5 substituents independently selected from the group consisting of halogen, cyano, nitro, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy; or

R^{27} and R^{28} are taken together with the sulfur atom to which they are attached to form a 3- to 6-membered ring containing ring members selected from carbon atoms;

R^{29} is hydrogen, cyano, C_1-C_4 alkyl, C_1-C_4 haloalkyl or $C(=O)R^{23}$; or phenyl, optionally substituted with up to 5 substituents independently selected from the group consisting of halogen, cyano, nitro, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy;

each R^{30} is independently C_1-C_4 alkyl or C_1-C_4 haloalkyl;

each R^{31} is independently C_1-C_6 alkyl, C_3-C_6 cycloalkyl or phenyl;

each R^{32} is C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, $C(=O)R^{23}$ or $C(=O)OR^{24}$; or phenyl, optionally substituted with up to 5 substituents independently selected from the group consisting of halogen, cyano, nitro, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy;

each R^{33} is independently C_1-C_6 alkyl, C_1-C_6 haloalkyl, C_1-C_6 alkoxy, C_1-C_6 haloalkoxy or $NR^{34}R^{35}$; or phenyl or a 5- or 6-membered heterocyclic aromatic ring, each ring optionally substituted with up to 5 substituents independently selected from the group consisting of halogen, cyano, nitro, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy;

each R^{34} is independently hydrogen or Q^2; or C_1-C_6 alkyl, C_3-C_6 cycloalkyl, C_2-C_6 alkenyl or C_2-C_6 alkynyl, each optionally substituted with one or more substituents independently selected from the group consisting of halogen, cyano, nitro, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy;

each R^{35} is independently hydrogen or Q^2; or C_1-C_6 alkyl, C_3-C_6 cycloalkyl, C_2-C_6 alkenyl or C_2-C_6 alkynyl, each optionally substituted with one or more substituents independently selected from the group consisting of halogen, cyano, nitro, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy; or

R^{34} and R^{35} are taken together with the nitrogen atom to which they are attached to form a 3- to 10-membered ring containing ring members selected from carbon atoms and up to 2 heteroatoms independently selected from one oxygen atom, one sulfur atom, and up to 2 nitrogen atoms, wherein up to 2 carbon atom ring members are independently selected from C(=O) and C(=S) and the sulfur atom ring member is selected from S, S(=O) or $S(=O)_2$, said ring optionally substituted with up to 4 substituents independently selected from the group consisting of halogen, cyano, nitro, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy;

each Q^2 is independently phenyl, optionally substituted with one or more substituents independently selected from the group consisting of halogen, cyano, nitro, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy; or a 5- or 6-membered heterocyclic aromatic ring or a 3- to 6-membered heterocyclic non-aromatic ring, each ring containing ring members selected from carbon atoms and up to 2 heteroatoms independently selected from one oxygen atom, one sulfur atom, and up to 2 nitrogen atoms, wherein up to 2 carbon atom ring members are independently selected from C(=O) and C(=S) and the sulfur atom ring member is selected from S, S(=O) or $S(=O)_2$, each ring optionally substituted with one or more substituents independently selected from the group consisting of halogen, cyano, nitro, C_1-C_4 alkyl, C_3-C_6 cycloalkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy and C_1-C_4 haloalkoxy;

each n is independently 0, 1 or 2; and

each u is 0 or 1.

2. A compound of Claim 1 wherein:

R^1, R^2, R^3 and R^4 are each independently hydrogen, halogen, cyano, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy, C_1-C_4 haloalkoxy, C_1-C_4 alkylthio, C_1-C_4 haloalkylthio, C_1-C_4 alkylsulfinyl, C_1-C_4 haloalkylsulfinyl, C_1-C_4 alkylsulfonyl or C_1-C_4 haloalkylsulfonyl;

R^5, R^6 and R^7 are each independently hydrogen, halogen, cyano, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy, C_1-C_4 haloalkoxy, C_1-C_4 alkylthio, C1-C4 haloalkylthio, C_1-C_4 alkylsulfinyl, C_1-C_4 haloalkylsulfinyl, C_1-C_4 alkylsulfonyl or C_1-C_4 haloalkylsulfonyl;

W is O;

Y is hydrogen, $C(=O)R^8$, $S(=O)_nR^9$, CO_2R^{10}, $C(=O)NR^{11}R^{12}$, $S(=O)_nNR^{11}R^{12}$, $NR^{11}R^{12}$, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, C_3-C_8 cycloalkyl, C_3-C_8 halocycloalkyl, C_3-C_8 cycloalkenyl, C_3-C_8 halocycloalkenyl, C_4-C_{10} alkylcycloalkyl, C_4-C_{10} cycloalkylalkyl, C_4-C_{10} halocycloalkylalkyl, C_6-C_{14} cycloalkylcycloalkyl, C_5-C_{10} alkylcycloalkylalkyl, C_2-C_8 alkoxyalkyl, C_2-C_8 haloalkoxyalkyl, C_4-C_{10} cycloalkoxyalkyl, C_3-C_8 alkoxyalkoxyalkyl, C_2-C_6 alkylthioalkyl, C_2-C_6 alkylsulfinylalkyl, C_2-C_6 alkylsulfonylalkyl, C_2-C_6 alkylaminoalkyl, C_2-C_6 haloalkylaminoalkyl, C_3-C_8 dialkylaminoalkyl, C_4-C_{10} cycloalkylaminoalkyl or C_3-C_5 alkoxycarbonylalkyl;

J^1 is phenyl or naphthalenyl, each ring or ring system optionally substituted with up to 4 substituents independently selected from R^{JC}; or a 4-, 5- or 6-membered heterocyclic ring or an 8-, 9- or 10-membered bicyclic ring system, each ring or ring system containing ring members selected from carbon atoms and 1 to 3 heteroatoms independently selected from up to 1 boron, up to 2 oxygen, up to 1 sulfur and up to 3 nitrogen atoms, wherein up to 1 carbon ring members are optionally selected from C(=O) and C(=S), each ring system optionally substituted with up to 4 substituents independently selected from R^{JC} on carbon atom ring members; R^{JN} on nitrogen atom ring members and R^{JB} on boron atom ring members; and

J^2 is phenyl or naphthalenyl, each ring or ring system optionally substituted with up to 4 substituents independently selected from R^{JC}; or a 4-, 5- or 6-membered heterocyclic ring or an 8-, 9- or 10-membered bicyclic ring system, each ring or ring system containing ring members selected from carbon atoms and 1 to 3 heteroatoms independently selected from up to 1 boron, up to 2 oxygen, up to 1 sulfur and up to 3 nitrogen atoms, wherein up to 1 carbon ring members are optionally selected from C(=O) and C(=S), each ring system optionally substituted with up to 4 substituents independently selected from R^{JC} on carbon atom ring members; R^{JN} on nitrogen atom ring members and R^{JB} on boron atom ring members.

3. A compound of Claim 2 wherein:

J^1 and J^2 are independently selected from U-1 through U-61 as shown in Exhibit 1,

wherein up to 1 carbon ring member is optionally selected from C(=O); and when R^v is attached to a carbon ring member, said R^v is selected from R^{JC}, and when R^v is attached to a nitrogen ring member, said R^v is selected from R^{JN}; and r is 0, 1, 2 or 3; or

J^1 and J^2 are independently selected from U-81 through U-124 as shown in Exhibit 3,

wherein up to 1 carbon ring member is optionally selected from C(=O); and when R^v is attached to a carbon ring member, said R^v is selected from R^{JC}, and when R^v is attached to a nitrogen ring member, said R^v is selected from R^{JN}; and r is 0, 1, 2 or 3.

4. A compound of Claim 3 wherein:

R^1, R^2, R^3 and R^4 are each independently hydrogen, halogen, C_1-C_4 alkyl or C_1-C_4 haloalkyl;

R^5, R^6 and R^7 are each independently hydrogen, halogen, C_1-C_4 alkyl or C_1-C_4 haloalkyl;

Y is hydrogen or C_1-C_6 alkyl;

R^{13} is halogen;

each R^{JC} is independently hydrogen, halogen, hydroxy, cyano, OR^{14}, $C(=O)R^{15}$, CO_2H, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $C(=NR^{19})R^{20}$, $NR^{17}R^{18}$, $S(=O)_nR^{21}$ or Q^2; or C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl or C_3-C_6 cycloalkyl, each optionally substituted with one or more substituents independently selected from halogen, cyano, nitro, OR^{14}, $C(=O)R^{15}$, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $C(=NR^{19})R^{20}$, $NR^{17}R^{18}$, $S(=O)_nR^{21}$ or Q^2;

each R^{JN} is independently hydrogen, hydroxy, cyano, OR^{14}, $C(=O)R^{15}$, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $C(=NR^{19})R^{20}$, $NR^{17}R^{18}$, $S(=O)_nR^{21}$ or Q^2; or C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl or C_3-C_6 cycloalkyl, each optionally substituted with one or more substituents independently selected from halogen, cyano, $C(=O)R^{15}$, CO_2H, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $C(=NR^{19})R^{20}$, $NR^{17}R^{18}$ or $S(=O)_nR^{21}$;

each R^{17} is independently hydrogen, $C(=O)R^{23}$, $C(=O)OR^{24}$, $C(=O)NR^{25}R^{26}$ or $S(=O)_nR^{21}$; or C_1-C_6 alkyl or C_3-C_6 cycloalkyl, each optionally substituted with 1 to 3 substituents independently selected from R^x; and

each R^{18} is independently hydrogen; or C_1-C_6 alkyl, C_3-C_7 cycloalkyl, C_2-C_7 alkylcarbonyl or C_2-C_7 alkoxycarbonyl, each optionally substituted with 1 to 3 substituents independently selected from R^x; or

R^{17} and R^{18} are taken together with the nitrogen to which they are attached to form a 3- to 5-membered ring containing ring members selected from carbon atoms and up to two additional atoms independently selected from nitrogen, sulfur and oxygen, wherein the sulfur atom ring member is selected from S, S(=O) and $S(=O)_2$, said ring optionally substituted with 1 to 3 substituents independently selected from halogen, C_1-C_2 alkyl, C_1-C_2 haloalkyl, C_1-C_2 alkoxy, C_1-C_2 haloalkoxy cyano and nitro.

5. A compound of Claim 4 wherein:

R^1, R^2, R^3 and R^4 are each hydrogen;

R^5, R^6 and R^7 are each hydrogen;

J^1 and J^2 are independently selected from U-1 through U-61, U-90 through U-96, U-105, U-110 or U-117 through U-124;

each R^{JC} is independently hydrogen, halogen, hydroxy, cyano, OR^{14}, $C(=O)R^{15}$, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $C(=NR^{19})R^{20}$, $NR^{17}R^{18}$, $S(=O)_nR^{21}$ or Q^2; or C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl or C_3-C_6 cycloalkyl, each optionally substituted with one or more substituents independently selected from halogen, cyano, $C(=O)R^{15}$, CO_2H, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $C(=NR^{19})R^{20}$, $NR^{17}R^{18}$ or $S(=O)_nR^{21}$;

each R^{JN} is independently hydrogen, hydroxy, OR^{14}, $C(=O)R^{15}$, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $NR^{17}R^{18}$, $S(=O)_nR^{21}$ or Q^2; or C_1-C_6 alkyl or C_3-C_6 cycloalkyl, each optionally substituted with one or more substituents independently selected from halogen, cyano, $C(=O)R^{15}$, CO_2H, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$ or $S(=O)_nR^{21}$;

each R^{17} is independently hydrogen, $C(=O)R^{23}$, $C(=O)OR^{24}$ or $C(=O)NR^{25}R^{26}$; or C_1-C_4 alkyl, optionally substituted with 1 to 3 substituents independently selected from R^x; and

each R^{18} is independently hydrogen; or C_1-C_4 alkyl, C_3-C_5 cycloalkyl, C_2-C_5 alkylcarbonyl or C_2-C_5 alkoxycarbonyl.

6. A compound of Claim 1 wherein:

Y is hydrogen or methyl;

J^1 and J^2 are independently selected from U-1, U-2, U-4, U-26, U-28, U-37, U-38, U-39, U-49, U-50, U-51, U-53, U-56, U-91, U-94, U-95, U-96, U-110, U-117, U-118 or U-124, wherein up to 1 carbon ring member is optionally selected from C(=O); and when R^v is attached to a carbon ring member, said R^v is selected from R^{JC}, and when R^v is attached to a nitrogen ring member, said R^v is selected from R^{JN}; and r is 0, 1, 2 or 3;

each R^{17} is independently hydrogen, $C(=O)R^{23}$, $C(=O)OR^{24}$ or $C(=O)NR^{25}R^{26}$; or C_1-C_4 alkyl or C_3-C_5 cycloalkyl, each optionally substituted with 1 to 3 substituents independently selected from R^x; and

each R^{18} is independently hydrogen or C_1-C_4 alkyl.

7. A compound of Claim 6 wherein:

Y is hydrogen;

J^1 and J^2 are independently selected from U-1, U-2, U-4, U-26, U-37, U-38, U-39, U-49, U-50, U-51 or U-91, wherein up to 1 carbon ring member is optionally selected from C(=O); and when R^v is attached to a carbon ring member, said R^v is selected from R^{JC}, and when R^v is attached to a nitrogen ring member, said R^v is selected from R^{JN}; and r is 0, 1, 2 or 3;

each R^{JC} is independently hydrogen, halogen, hydroxy, cyano, OR^{14}, $C(=O)R^{15}$, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $NR^{17}R^{18}$, $S(=O)_nR^{21}$ or Q^2; or C_1-C_6 alkyl or C_3-C_6 cycloalkyl, each optionally substituted with one or more substituents independently selected from halogen, cyano, CO_2H, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $NR^{17}R^{18}$ or $S(=O)_nR^{21}$;

each R^{JN} is independently hydrogen, hydroxy, $C(=O)R^{15}$, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $NR^{17}R^{18}$ or Q^2; or C_1-C_6 alkyl or C_3-C_6 cycloalkyl, each optionally substituted with one or more substituents independently selected from halogen, cyano, $C(=O)R^{15}$, CO_2H, $C(=O)OR^{16}$ or $C(=Z)NR^{17}R^{18}$;

each R^{17} is independently hydrogen; or C_1-C_4 alkyl or C_3-C_5 cycloalkyl, each optionally substituted with 1 to 3 substituents independently selected from R^x; and

each R^{18} is hydrogen.

8. A compound of Claim 7 wherein:

J^1 and J^2 are independently selected from U-1 or U-26; or U-50 wherein up to 1 carbon ring member is optionally selected from C(=O);

each R^{JC} is independently hydrogen, halogen, hydroxy, cyano, OR^{14}, $C(=O)R^{15}$, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$, $NR^{17}R^{18}$, $S(=O)_nR^{21}$ or Q^2; or C_1-C_6 alkyl or C_3-C_6 cycloalkyl, each optionally substituted with one or more substituents independently selected from halogen, cyano, $C(=O)OR^{16}$ or $C(=Z)NR^{17}R^{18}$;

each R^{JN} is independently hydrogen, $C(=O)R^{15}$, $C(=O)OR^{16}$, $C(=Z)NR^{17}R^{18}$ or $NR^{17}R^{18}$; or C_1-C_6 alkyl, optionally substituted with one or more substituents independently selected from halogen, cyano, $C(=O)R^{15}$, $C(=O)OR^{16}$ or $C(=Z)NR^{17}R^{18}$; and

R^{17} is independently C_1-C_4 alkyl or C_3-C_5 cycloalkyl, each optionally substituted with 1 to 3 substituents independently selected from R^x.

9. The compound of Claim 1 which is selected from the group:

(1α,5α,7α)-*N*-[2-[(methylamino)carbonyl]phenyl]-2,5-dioxabicyclo[4.1.0]-heptane-7-carboxamide,

(1α,5α,7α)-*N*-phenyl-2,5-dioxabicyclo[4.1.0]heptane-7-carboxamide,

(1α,5α,7α)-*N*-(3-methylphenyl)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxamide,

(1α,5α,7α)-*N*-(2-fluorophenyl)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxamide,

(1α,5α,7α)-*N*-(2-fluoro-4-methylphenyl)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxamide,

(1α,5α,7α)-*N*-(3,4-dimethylphenyl)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxamide,

(1α,5α,7α)-*N*-(1,2-dihydro-1-methyl-2-oxo-3-pyridinyl)- 2,5-dioxabicyclo[4.1.0]heptane-7-carboxamide,

(1α,5α,7α)-*N*-(1-methyl-1*H*-pyrazol-3-yl)- 2,5-dioxabicyclo[4.1.0]heptane-7-carboxamide,

2-[(methylamino)carbonyl]phenyl (1α,5α,7α)-2,5-dioxabicyclo[4.1.0]-heptane-7-carboxylate,

phenyl (1α,5α,7α)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxylate,

3-methylphenyl (1α,5α,7α)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxylate,

2-fluorophenyl (1α,5α,7α)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxylate,

2-fluoro-4-methylphenyl (1α,5α,7α)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxylate,

3,4-dimethylphenyl (1α,5α,7α)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxylate,

1,2-dihydro-1-methyl-2-oxo-3-pyridinyl (1α,5α,7α)-2,5-dioxabicyclo-[4.1.0]heptane-7-carboxylate,

1-methyl-1*H*-pyrazol-3-yl (1α,5α,7α)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxylate,

2-[(methylamino)carbonyl]phenyl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate,

2-[(methylamino)carbonyl]phenyl (1*S*,5*S*,6*S*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate,

rel-2-[(methylamino)carbonyl]phenyl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]-hexane-6-carboxylate,

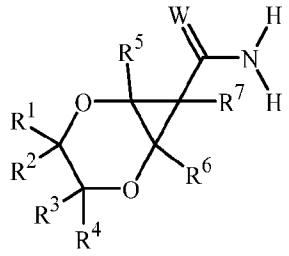
phenyl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate,

phenyl (1*S*,5*S*,6*S*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate,

rel-phenyl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate,
3-methylphenyl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate,
3-methylphenyl (1*S*,5*S*,6*S*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate,
rel-3-methylphenyl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate,
2-fluorophenyl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate,
2-fluorophenyl (1*S*,5*S*,6*S*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate,
rel-2-fluorophenyl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate,
2-fluoro-4-methylphenyl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate,
2-fluoro-4-methylphenyl (1*S*,5*S*,6*S*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate,
rel-2-fluoro-4-methylphenyl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate,
3,4-dimethylphenyl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate,
3,4-dimethylphenyl (1*S*,5*S*,6*S*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate,
rel-3,4-dimethylphenyl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate,
1,2-dihydro-1-methyl-2-oxo-3-pyridinyl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]-hexane-6-carboxylate,
1,2-dihydro-1-methyl-2-oxo-3-pyridinyl (1*S*,5*S*,6*S*)-2-oxabicyclo[3.1.0]-hexane-6-carboxylate,
rel-1,2-dihydro-1-methyl-2-oxo-3-pyridinyl (1*R*,5*R*,6*R*)-2-oxabicyclo-[3.1.0]hexane-6-carboxylate,
1-methyl-1*H*-pyrazol-3-yl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate,
1-methyl-1*H*-pyrazol-3-yl (1*S*,5*S*,6*S*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate,
rel-1-methyl-1*H*-pyrazol-3-yl (1*R*,5*R*,6*R*)-2-oxabicyclo[3.1.0]hexane-6-carboxylate, and combinations thereof.

10. An insecticidal composition comprising:

at least one compound selected from the compounds of Formula **9b**, *N*-oxides, and salts thereof:



9b

wherein

R^1, R^2, R^3 and R^4 are each independently hydrogen, halogen, cyano, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy, C_1-C_4 haloalkoxy, C_1-C_4 alkylthio, C_1-C_4 haloalkylthio, C_1-C_4 alkylsulfinyl, C_1-C_4 haloalkylsulfinyl, C_1-C_4 alkylsulfonyl, C_1-C_4 haloalkylsulfonyl or Q^1;

R^5, R^6 and R^7 are each independently hydrogen, halogen, cyano, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy, C_1-C_4 haloalkoxy, C_1-C_4 alkylthio, C_1-C_4 haloalkylthio, C_1-C_4 alkylsulfinyl, C_1-C_4 haloalkylsulfinyl, C_1-C_4 alkylsulfonyl, C_1-C_4 haloalkylsulfonyl or Q^1;

$Q^1$is a 6- to 14-membered carbocyclic ring or ring system, each ring or ring system optionally substituted with one or more substituents independently selected from halogen, cyano, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy, C_1-C_4 haloalkoxy, C_1-C_4 alkylthio, C_1-C_4 haloalkylthio, C_1-C_4 alkylsulfinyl, C_1-C_4 haloalkylsulfinyl, C_1-C_4 alkylsulfonyl and C_1-C_4 haloalkylsulfonyl; and

W is O or S.

11. An insecticidal composition of Claim 10 wherein:

R^1, R^2, R^3 and R^4 are each independently hydrogen, halogen, C_1-C_4 alkyl or C_1-C_4 haloalkyl;

R^5, R^6 and R^7 are each independently hydrogen, halogen, C_1-C_4 alkyl or C_1-C_4 haloalkyl; and

W is O.

12. An insecticidal composition of Claim 11 wherein:

R^1, R^2, R^3, R^4, R^5, R^6 and R^7 are each hydrogen.

13. An insecticidal composition of Claim 10 wherein the compound of Formula **9b** is (1α,6α,7α)-2,5-dioxabicyclo[4.1.0]heptane-7-carboxamide.

14. A composition comprising a compound of Claim 1 and at least one additional component selected from surfactants, solid diluents and liquid diluents, said composition optionally further comprising at least one additional biologically active compound or agent.

15. The composition of Claim 10 and at least one additional component selected from 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 14 or 15 wherein the at least one additional biologically active compound or agent is selected from the group consisting of abamectin, acetamiprid, acrinathrin, acynonapyr, afidopyropen, amitraz, avermectin, azadirachtin, benfuracarb, bensultap, bifenthrin, buprofezin, broflanilide, cadusafos, carbaryl, cartap, chlorantraniliprole, chloroprallethrin, 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, epsilon-metofluthrin, esfenvalerate, ethiprole, etofenprox, etoxazole, fenitrothion, fenothiocarb, fenoxycarb, fenvalerate, fipronil, flometoquin, fluxametamide, flonicamid, flubendiamide, fluensulfone, flufenoxuron, flufenoxystrobin, flufensulfone, flupiprole, flupyrimin, flupyradifurone, fluvalinate, formetanate, fosthiazate, gamma-cyhalothrin, heptafluthrin, hexaflumuron, hydramethylnon, imidacloprid, indoxacarb, isocycloseram, kappa-tefluthrin, lambda-cyhalothrin, lufenuron, meperfluthrin, metaflumizone, methiodicarb, methomyl, methoprene, methoxyfenozide, metofluthrin, momfluorothrin, 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, tyclopyrazoflor, zeta-cypermethrin, *Bacillus thuringiensis* delta-endotoxins, all strains of *Bacillus thuringiensis* and all strains of nucleo polyhedrosis viruses.

17. The composition of Claim 14, wherein the compound of Claim 1 is present in an amount sufficient to protect an organism from an invertebrate parasitic pest.

18. A soil drench formulation comprising the composition of any one of Claims 10 through 17.

19. A bait composition, comprising: the composition of any one of Claims 10 through 17, one or more food materials, optionally an attractant, and optionally a humectant.

20. A method for controlling an invertebrate pest comprising contacting the invertebrate pest or its environment with a biologically effective amount of a compound of any one of Claims 1 through 9 or a composition of any one of Claims 10 through 19.