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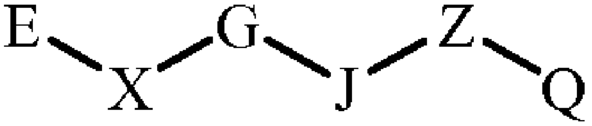
(54) **Title**: FUNGICIDAL AZOCYCLIC AMIDES



(I)

(57) **Abstract**: Disclosed are compounds of Formula 1, including all stereoisomers, *N* oxides, and salts thereof, wherein E, X, G, J, Z, and Q are as defined in the disclosure. Also disclosed are compositions containing the compounds of Formula 1 and methods for controlling plant disease caused by a fungal pathogen comprising applying an effective amount of a compound or a composition of the invention.

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TITLE

FUNGICIDAL AZOCYCLIC AMIDES

FIELD OF THE INVENTION

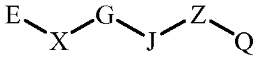
This invention relates to certain azocyclic amides, their *N*-oxides, salts and compositions, and methods of their use as fungicides.

BACKGROUND OF THE INVENTION

The control of plant diseases caused by fungal plant pathogens is extremely important in achieving high crop efficiency. Plant disease damage to ornamental, vegetable, field, cereal, and fruit crops can cause significant reduction in productivity and thereby result in increased costs to the consumer. Many products are commercially available for these purposes, but the need continues for new compounds which are more effective, less costly, less toxic, environmentally safer or have different sites of action.

SUMMARY OF THE INVENTION

This invention is directed to compounds of Formula **1** (including all stereoisomers), *N*-oxides, and salts thereof, agricultural compositions containing them and their use as fungicides:



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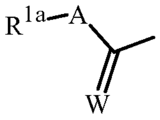
wherein

E is a radical selected from the group consisting of



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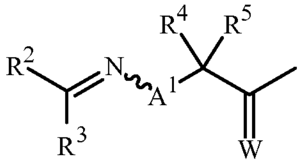

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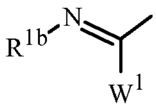

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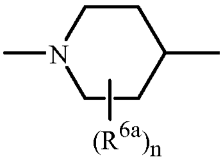
E-1 E-2 E-3

X is a radical selected from the group consisting of



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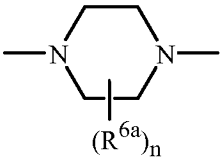

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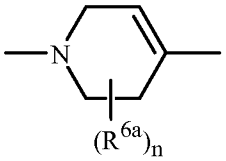
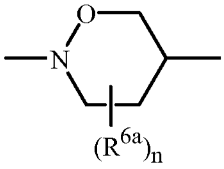


X-1 X-2 X-3



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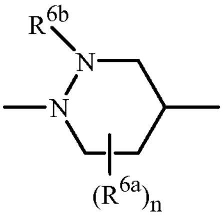
X-4



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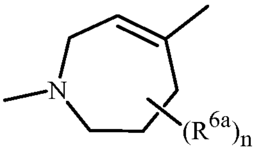
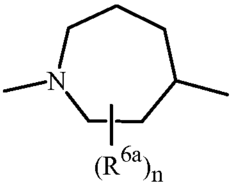
X-5



X-6



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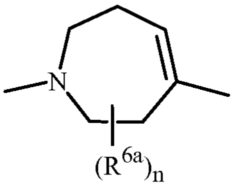
X-7



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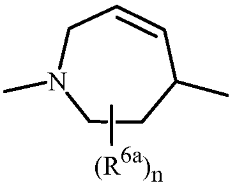
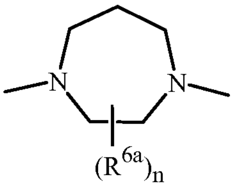
X-8



and

X-9



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X-10

wherein the orientation of the X group is such that the bond extending to the left is attached to E in Formula **1** and the bond extending to the right is attached to G in Formula **1**;

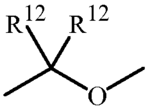
G is a 5-membered heterocyclic ring optionally substituted with up to 3 substituents independently selected from R^{29a} on carbon atom ring members and R^{30a} on nitrogen atom ring members;

J is a 5-, 6- or 7-membered ring, a 8- to 11-membered bicyclic ring system or a 7- to 11-membered spirocyclic ring system, each ring or ring system containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S, up to 4 N and up to 2 Si atoms, wherein up to 3 carbon atom ring members are independently selected from C(=O) and C(=S), the sulfur atom ring members are independently selected from $S(=O)_s(=NR^{17})_f$, and the silicon atom ring members are independently selected from $SiR^{10}R^{11}$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{23};

Z is Z^1; or

a 4-, 5- or 6-membered saturated or unsaturated chain containing chain members selected from carbon atoms and up to 2 heteroatoms independently selected from up to 2 O, up to 2 S, up to 2 N and up to 1 Si atoms, wherein up to 2 carbon atom chain members are independently selected from C(=O), C(=S) and C(=NOH), the sulfur atom chain members are independently selected from $S(=O)_s(=NR^{17})_f$, and the silicon atom chain members are independently selected from $SiR^{10}R^{11}$, each chain optionally substituted with up to 4 substituents independently selected from R^{12} on carbon atom chain members and R^{13} on nitrogen atom chain members;

Z^1 is a radical selected from the group consisting of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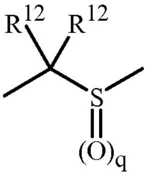
Z^1-1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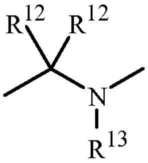
Z^1-2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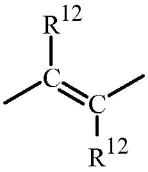
Z^1-3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Z^1-4


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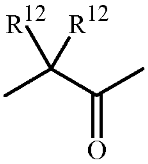
Z^1-5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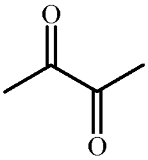
Z^1-6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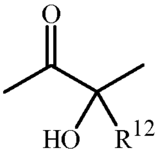
Z^1-7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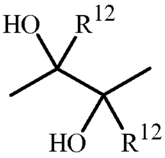
Z^1-8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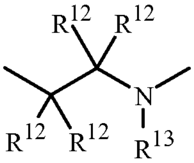
Z^1-9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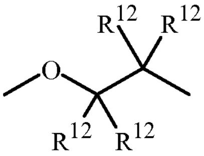
Z^1-10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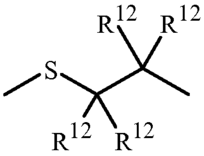
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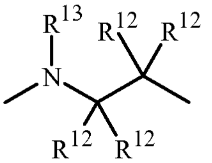
Z^1-12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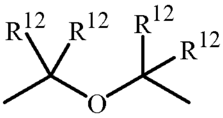
Z^1-13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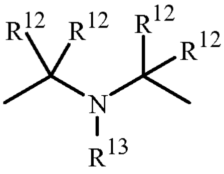
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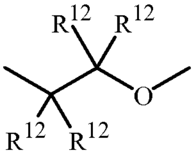
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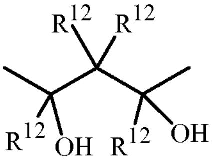
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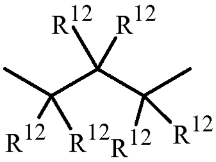
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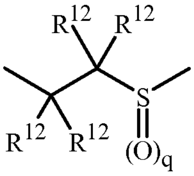

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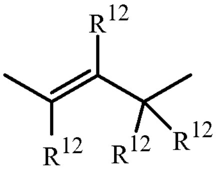

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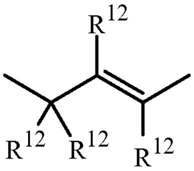

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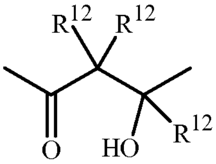

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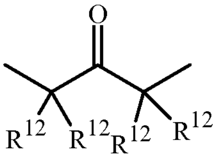

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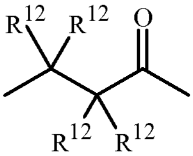

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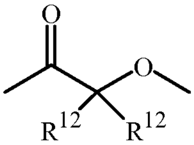

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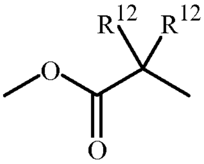

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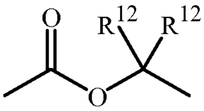

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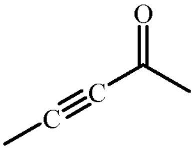

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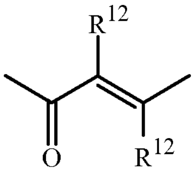

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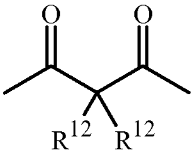

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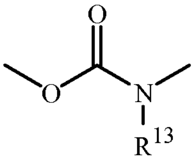

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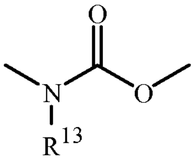

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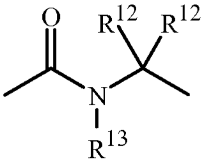

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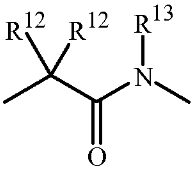

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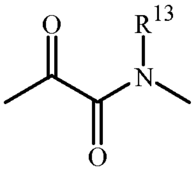

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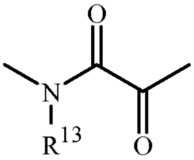

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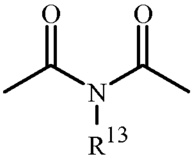

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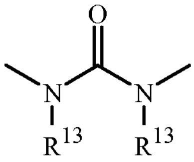

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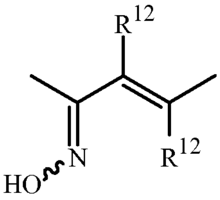

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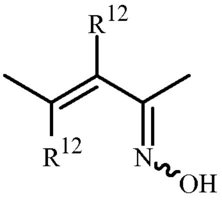

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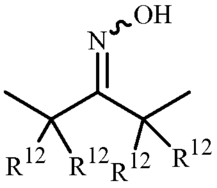

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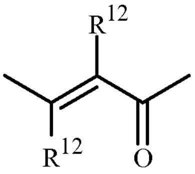


Z^1-42

;

wherein the orientation of the Z^1 group is such that the bond extending to the left is attached to J in Formula **1** and the bond extending to the right is attached to Q in Formula **1**;

Q is phenyl or naphthalenyl each optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^{9a}; or

a 5- to 6-membered heteroaromatic ring or an 8- to 11-membered heteroaromatic bicyclic ring system containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, and optionally substituted with up to 5 substituents independently selected from R^{9a} on carbon atom ring members and R^{9b} on nitrogen atom ring members; or

a 3- to 7-membered nonaromatic carbocyclic ring, a 5- to 7-membered nonaromatic heterocyclic ring or an 8- to 11-membered nonaromatic bicyclic ring system, each ring or ring system containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S, up to 4 N and up to 2 Si atoms, wherein up to 3 carbon atom ring members are independently selected from C(=O) and C(=S), the sulfur atom ring members are independently selected from $S(=O)_s(=NR^{17})_f$, and the silicon atom ring members are independently selected from $SiR^{10}R^{11}$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{9a} on carbon atom ring members and R^{9b} on nitrogen atom ring members;

A is CHR^{15}, NR^{16} or C(=O);

A^1 is -O-, -S-, $-N(R^7)-$, $-C(R^8)_2-$, $-OC(R^8)_2-$, $-SC(R^8)_2-$ or $-N(R^7)C(R^8)_2-$, wherein the bond projecting to the left is connected to $-N=C(R^2)(R^3)$, and the bond projecting to the right is connected to $-C(R^4)(R^5)-$;

W is O or S;

W^1 is OR^{18}, SR^{19}, $NR^{20}R^{21}$ or R^{22};

R^{1a} and R^{1b} independently are an optionally substituted phenyl, an optionally substituted naphthalenyl or an optionally substituted 5- to 6-membered heteroaromatic ring; or cyano, $C_1–C_8$ alkyl, $C_2–C_8$ alkenyl, $C_2–C_8$ alkynyl, $C_1–C_8$ haloalkyl, $C_2–C_8$ haloalkenyl, $C_2–C_8$ haloalkynyl, $C_3–C_8$ cycloalkyl, $C_3–C_8$ halocycloalkyl, $C_4–C_{10}$ alkylcycloalkyl, $C_4–C_{10}$ cycloalkylalkyl, $C_4–C_{10}$

halocycloalkylalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_4–C_{10} cycloalkoxyalkyl, C_3–C_{10} alkoxyalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 haloalkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_3–C_8 alkoxycarbonylalkyl, C_3–C_8 haloalkoxycarbonylalkyl, C_2–C_8 alkylaminoalkyl, C_3–C_{10} dialkylaminoalkyl, C_2–C_8 haloalkylaminoalkyl, C_4–C_{10} cycloalkylaminoalkyl, C_1–C_8 alkoxy, C_1–C_8 haloalkoxy, C_3–C_8 cycloalkoxy, C_3–C_8 halocycloalkoxy, C_4–C_{10} cycloalkylalkoxy, C_2–C_8 alkenyloxy, C_2–C_8 haloalkenyloxy, C_2–C_8 alkynyloxy, C_3–C_8 haloalkynyloxy, C_2–C_8 alkoxyalkoxy, C_2–C_8 alkylcarbonyloxy, C_2–C_8 haloalkylcarbonyloxy, C_1–C_8 alkylthio, C_1–C_8 haloalkylthio, C_3–C_8 cycloalkylthio, C_3–C_{10} trialkylsilyl, C_1–C_8 alkylamino, C_2–C_8 dialkylamino, C_1–C_8 haloalkylamino, C_2–C_8 halodialkylamino, C_3–C_8 cycloalkylamino, C_2–C_8 alkylcarbonylamino, C_2–C_8 haloalkylcarbonylamino, C_1–C_8 alkylsulfonylamino, C_1–C_8 haloalkylsulfonylamino, pyrrolidinyl, piperidinyl or morpholinyl;

R^2 is hydrogen, halogen, cyano, amino, -CHO, -C(=O)OH, -C(=O)NH_2, 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_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_4–C_6 alkylcycloalkyl, C_4–C_6 cycloalkylalkyl, C_4–C_6 halocycloalkylalkyl, C_3–C_6 cycloalkenyl, C_3–C_6 halocycloalkenyl, C_2–C_6 alkoxyalkyl, C_2–C_6 alkylthioalkyl, C_2–C_6 alkylsulfinylalkyl, C_2–C_6 alkylsulfonylalkyl, C_2–C_6 alkylaminoalkyl, C_3–C_6 dialkylaminoalkyl, C_2–C_6 haloalkylaminoalkyl, C_2–C_6 alkylcarbonyl, C_2–C_6 haloalkylcarbonyl, C_4–C_6 cycloalkylcarbonyl, C_2–C_6 alkoxycarbonyl, C_4–C_6 cycloalkoxycarbonyl, C_5–C_6 cycloalkylalkoxycarbonyl, C_2–C_6 alkylaminocarbonyl, C_3–C_6 dialkylaminocarbonyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_3–C_6 cycloalkoxy, C_3–C_6 halocycloalkoxy, C_2–C_6 alkenyloxy, C_2–C_6 haloalkenyloxy, C_2–C_6 alkynyloxy, C_3–C_6 haloalkynyloxy, C_2–C_6 alkoxyalkoxy, C_2–C_6 alkylcarbonyloxy, C_2–C_6 haloalkylcarbonyloxy, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio, C_3–C_6 cycloalkylthio, C_1–C_6 alkylamino, C_2–C_6 dialkylamino, C_1–C_6 haloalkylamino, C_2–C_6 halodialkylamino, C_3–C_6 cycloalkylamino, C_2–C_6 alkylcarbonylamino, C_2–C_6 haloalkylcarbonylamino, C_1–C_6 alkylsulfonylamino or C_1–C_6 haloalkylsulfonylamino;

R^3 is hydrogen, halogen, cyano, hydroxy, C_1–C_3 alkyl, C_1–C_3 haloalkyl, C_1–C_3 alkoxy or C_1–C_3 haloalkoxy; or

R^2 and R^3 are taken together with the carbon atom to which they are attached to form a 3- to 7-membered ring containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S, up to 2 N and up to 2 Si atoms, wherein up to 3 carbon atom ring members are independently selected from C(=O) and C(=S), the sulfur atom ring members are independently selected from $S(=O)_s(=NR^{17})_f$, and the silicon atom ring members are independently selected from $SiR^{10}R^{11}$, the ring optionally substituted with up to 4 substituents independently selected from halogen, cyano, C_1–C_2 alkyl, C_1–C_2 haloalkyl, C_1–C_2 alkoxy and C_1–C_2 haloalkoxy on carbon atom ring members and cyano, C_1–C_2 alkyl and C_1–C_2 alkoxy on nitrogen atom ring members;

R^4 is optionally substituted phenyl, optionally substituted naphthalenyl or an optionally substituted 5- to 6-membered heteroaromatic ring; or hydrogen, halogen, cyano, hydroxy, -CHO, C_1–C_4 alkyl, C_2–C_4 alkenyl, C_2–C_4 alkynyl, C_1–C_4 haloalkyl, C_2–C_4 haloalkenyl, C_2–C_4 haloalkynyl, C_2–C_4 alkoxyalkyl, C_2–C_4 alkylthioalkyl, 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_2–C_5 alkylaminocarbonyl, C_3–C_5 dialkylaminocarbonyl, 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, C_2–C_4 alkylcarbonyloxy, C_2–C_4 haloalkylcarbonyloxy, C_2–C_5 alkoxycarbonyloxy, C_2–C_5 alkylaminocarbonyloxy or C_3–C_5 dialkylaminocarbonyloxy;

R^5 is hydrogen, C_1–C_3 alkyl or C_1–C_3 haloalkyl;

each R^{6a} is independently C_1–C_4 alkyl, C_1–C_4 alkenyl, C_1–C_4 haloalkyl, C_1–C_4 alkoxy, halogen, cyano or hydroxy; or

two R^{6a} are taken together as C_1–C_4 alkylene or C_2–C_4 alkenylene to form a bridged bicyclic or fused bicyclic ring system; or

two R^{6a} attached to adjacent ring carbon atoms joined by a double bond are taken together as –CH=CH–CH=CH– optionally substituted with up to 3 substituents selected from C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_1–C_4 alkoxy, C_1–C_4 haloalkoxy, halogen, hydroxy, amino, cyano and nitro;

R^{6b} is hydrogen, cyano, C_1–C_3 alkyl, C_1–C_3 haloalkyl, C_1–C_3 alkoxy, C_2–C_3 alkylcarbonyl, C_2–C_3 alkoxycarbonyl or C_3–C_6 cycloalkyl;

R^7 is hydrogen, cyano, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_2–C_4 alkoxyalkyl, C_2–C_4 alkylthioalkyl, C_2–C_4 alkylcarbonyl, C_2–C_4 haloalkylcarbonyl, C_2–C_4 alkoxycarbonyl, C_2–C_4 alkylaminocarbonyl, C_3–C_5 dialkylaminocarbonyl, C_1–C_4 alkylsulfonyl or C_1–C_4 haloalkylsulfonyl; or

R^3 and R^7 are taken together with the linking atoms to which they are attached to form a 5- to 7-membered partially saturated ring containing ring members, in addition to the linking atoms, selected from carbon atoms and up to 3 heteroatoms independently selected from up to 1 O, up to 1 S and up to 1 N atom, the ring optionally substituted with up to 3 substituents independently selected from halogen, cyano, nitro, C_1–C_2 alkyl, C_1–C_2 haloalkyl, C_1–C_2 alkoxy and C_1–C_2

haloalkoxy on carbon atom ring members and cyano, C_1–C_2 alkyl and C_1–C_2 alkoxy on nitrogen atom ring members;

each R^8 is independently hydrogen, C_1–C_3 alkyl or C_1–C_3 haloalkyl;

each R^{9a} is independently halogen, hydroxy, amino, cyano, nitro, C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_6 cycloalkyl, C_4–C_{10} cycloalkylalkyl, C_4–C_{10} alkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_6–C_{14} cycloalkylcycloalkyl, C_1–C_6 haloalkyl, C_2–C_6 haloalkenyl, C_2–C_6 haloalkynyl, C_3–C_6 halocycloalkyl, C_1–C_4 alkoxy, C_1–C_4 haloalkoxy, C_1–C_4 alkylthio, C_1–C_4 alkylsulfinyl, C_1–C_4 alkylsulfonyl, C_1–C_4 haloalkylthio, C_1–C_4 haloalkylsulfinyl, C_1–C_4 haloalkylsulfonyl, C_1–C_4 alkylamino, C_2–C_8 dialkylamino, C_3–C_6 cycloalkylamino, C_2–C_4 alkoxyalkyl, C_1–C_4 hydroxyalkyl, C_2–C_4 alkylcarbonyl, C_2–C_6 alkoxycarbonyl, C_2–C_6 alkylcarbonyloxy, C_2–C_6 alkylcarbonylthio, C_2–C_6 alkylaminocarbonyl, C_3–C_8 dialkylaminocarbonyl or C_3–C_6 trialkylsilyl; or

phenyl or naphthalenyl optionally substituted with up to 3 substituents independently selected from halogen, cyano, C_1–C_2 alkyl, C_1–C_2 haloalkyl, C_1–C_2 alkoxy and C_1–C_2 haloalkoxy; or

a 5- to 6-membered heteroaromatic ring containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, and optionally substituted with up to 3 substituents independently selected from halogen, cyano, C_1–C_2 alkyl, C_1–C_2 haloalkyl, C_1–C_2 alkoxy and C_1–C_2 haloalkoxy on carbon atom ring members and cyano, C_1–C_2 alkyl and C_1–C_2 alkoxy on nitrogen atom ring members; or

a 3- to 7-membered nonaromatic ring containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, wherein up to 3 carbon atom ring members are independently selected from C(=O) and C(=S), the ring optionally substituted with up to 3 substituents independently selected from halogen, cyano, C_1–C_2 alkyl, C_1–C_2 haloalkyl, C_1–C_2 alkoxy and C_1–C_2 haloalkoxy on carbon atom ring members and cyano, C_1–C_2 alkyl and C_1–C_2 alkoxy on nitrogen atom ring members;

each R^{9b} is independently hydrogen, cyano, C_1–C_3 alkyl, C_1–C_3 haloalkyl, C_1–C_3 alkoxy, C_2–C_3 alkylcarbonyl, C_2–C_3 alkoxycarbonyl or C_3–C_6 cycloalkyl;

each R^{10} and R^{11} is independently C_1–C_5 alkyl, C_2–C_5 alkenyl, C_2–C_5 alkynyl, C_3–C_5 cycloalkyl, C_3–C_6 halocycloalkyl, C_4–C_{10} cycloalkylalkyl, C_4–C_7 alkylcycloalkyl, C_5–C_7 alkylcycloalkylalkyl, C_1–C_5 haloalkyl, C_1–C_5 alkoxy or C_1–C_5 haloalkoxy;

each R^{12} is independently hydrogen, halogen, hydroxy, cyano, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_1–C_4 alkoxy, C_1–C_4 haloalkoxy, C_2–C_4 alkoxyalkyl, C_2–C_4 alkylcarbonyl, C_2–C_4 alkoxycarbonyl or C_3–C_6 cycloalkyl;

each R^{13} is independently hydrogen, cyano, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_1–C_4 alkoxy, C_2–C_4 alkylcarbonyl, C_2–C_4 alkoxycarbonyl or C_3–C_6 cycloalkyl;

R^{15} is hydrogen, halogen, cyano, hydroxy, -CHO, C_1–C_4 alkyl, C_2–C_4 alkenyl, C_2–C_4 alkynyl, C_1–C_4 haloalkyl, C_2–C_4 haloalkenyl, C_2–C_4 haloalkynyl, C_2–C_4 alkoxyalkyl, C_2–C_4 alkylthioalkyl, C_2–C_4 alkylsulfinylalkyl, C_2–C_4 alkylsulfonylalkyl, C_3–C_5 alkoxycarbonylalkyl, C_2–C_4 alkylcarbonyl, C_2–C_4 haloalkylcarbonyl, C_2–C_5 alkoxycarbonyl, C_2–C_5 alkylaminocarbonyl, C_3–C_5 dialkylaminocarbonyl, 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; provided that when R^{15} is hydroxy, then R^{1a} is bonded through a carbon atom to A in Formula **1**;

R^{16} is hydrogen, C_1–C_4 alkyl, C_2–C_4 alkenyl, C_3–C_4 alkynyl, C_1–C_4 haloalkyl, C_2–C_4 haloalkenyl, C_2–C_4 haloalkynyl, C_2–C_4 alkoxyalkyl, C_2–C_4 alkylthioalkyl, 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_1–C_4 alkylsulfonyl or C_1–C_4 haloalkylsulfonyl;

each R^{17} is independently hydrogen, cyano, C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_3–C_8 cycloalkyl, C_3–C_8 halocycloalkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_1–C_6 alkylamino, C_2–C_8 dialkylamino, C_1–C_6 haloalkylamino or phenyl;

R^{18} and R^{19} independently are C_1–C_6 alkyl, C_3–C_6 alkenyl, C_3–C_6 alkynyl, C_1–C_6 haloalkyl, C_3–C_6 haloalkenyl, C_3–C_6 haloalkynyl, C_3–C_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_4–C_8 halocycloalkylalkyl, C_5–C_8 alkylcycloalkylalkyl, C_2–C_6 alkoxyalkyl, C_4–C_8 cycloalkoxyalkyl, C_3–C_6 alkoxyalkoxyalkyl, C_2–C_6 alkylthioalkyl, C_2–C_6 alkylsulfinylalkyl, C_2–C_6 alkylsulfonylalkyl, C_2–C_6 alkylaminoalkyl, C_3–C_6 dialkylaminoalkyl, C_2–C_6 haloalkylaminoalkyl, C_4–C_8 cycloalkylaminoalkyl, C_2–C_6 alkylcarbonyl, C_2–C_6 haloalkylcarbonyl, C_4–C_8 cycloalkylcarbonyl, C_2–C_6 alkoxycarbonyl, C_2–C_6 alkylaminocarbonyl, C_3–C_8 dialkylaminocarbonyl or C_4–C_8 cycloalkylaminocarbonyl;

R^{20} is hydrogen, cyano, hydroxy, amino, C_1–C_6 alkyl, C_3–C_6 alkenyl, C_3–C_6 alkynyl, C_1–C_6 haloalkyl, C_3–C_6 haloalkenyl, C_3–C_6 haloalkynyl, C_3–C_6 cycloalkyl, C_4–C_8 cycloalkylalkyl, C_2–C_6 alkoxyalkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_1–C_6 alkylsulfonyl, C_1–C_6 haloalkylsulfonyl, C_2–C_6 alkylcarbonyl, C_2–C_6

haloalkylcarbonyl, C_1–C_6 alkylamino, C_2–C_8 dialkylamino, C_1–C_6 haloalkylamino or C_2–C_8 halodialkylamino;

R^{21} is hydrogen, C_1–C_6 alkyl, C_3–C_6 alkenyl, C_3–C_6 alkynyl, C_1–C_6 haloalkyl or C_3–C_6 cycloalkyl; or

R^{20} and R^{21} are taken together as $-(CH_2)_4-$, $-(CH_2)_5-$ or $-(CH_2)_2O(CH_2)_2-$;

R^{22} is hydrogen, halogen, cyano, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_2–C_4 alkoxyalkyl, C_2–C_4 alkylcarbonyl, C_2–C_4 alkoxycarbonyl, C_2–C_3 alkylaminocarbonyl or C_3–C_6 dialkylaminocarbonyl;

each R^{23} is independently selected from R^{23a} on carbon atom ring members and independently selected from R^{23b} on nitrogen atom ring members;

R^{23a} is halogen, hydroxy, cyano, C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_1–C_4 alkoxy, C_1–C_4 haloalkoxy, C_2–C_6 alkoxyalkyl, C_2–C_4 alkylcarbonyl, C_2–C_6 alkoxycarbonyl or C_3–C_6 cycloalkyl;

R^{23b} is cyano, C_1–C_3 alkyl, C_1–C_3 haloalkyl, C_1–C_3 alkoxy, C_2–C_3 alkylcarbonyl, C_2–C_3 alkoxycarbonyl or C_3–C_6 cycloalkyl;

each R^{29a} is independently hydrogen, halogen, C_1–C_3 alkyl or C_1–C_3 haloalkyl;

each R^{30a} is independently hydrogen or C_1–C_3 alkyl;

n is 0, 1 or 2;

q is 0, 1 or 2; and

s and f are independently 0, 1 or 2 in each instance of $S(=O)_s(=NR^{17})_f$, provided that the sum of s and f is 0, 1 or 2;

provided that when Z is Z^1-13, then Q is other than unsubstituted phenyl.

More particularly, this invention pertains to a compound of Formula **1** (including all stereoisomers), an *N*-oxide or a salt thereof.

This invention also relates to a fungicidal composition comprising (a) a compound of the invention (i.e. in a fungicidally effective amount); and (b) at least one additional component selected from the group consisting of surfactants, solid diluents and liquid diluents.

This invention also relates to a fungicidal composition comprising (a) a compound of the invention; and (b) at least one other fungicide (e.g., at least one other fungicide having a different site of action).

This invention further relates to a method for controlling plant diseases caused by fungal plant pathogens comprising applying to the plant or portion thereof, or to the plant seed, a fungicidally effective amount of a compound of the invention (e.g., as a composition described herein).

DETAILS OF THE INVENTION

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, method, article, or apparatus 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, method, article, or apparatus.

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, method or apparatus 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 invention. The term "consisting essentially of" occupies a middle ground between "comprising" and "consisting of".

Where applicants have defined an invention 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 invention 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 invention 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 the present disclosure and claims, "plant" includes members of Kingdom Plantae, particularly seed plants (Spermatopsida), at all life stages, including young plants (e.g., germinating seeds developing into seedlings) and mature, reproductive stages (e.g., plants producing flowers and seeds). Portions of plants include geotropic members typically growing beneath the surface of the growing medium (e.g., soil), such as roots, tubers, bulbs and corms, and also members growing above the growing medium, such as foliage (including stems and leaves), flowers, fruits and seeds.

As referred to herein, the term “seedling”, used either alone or in a combination of words means a young plant developing from the embryo of a seed.

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” also includes moieties comprised of multiple triple bonds such as 2,5-hexadiynyl. “Alkylene” denotes a straight-chain or branched alkanediyl. Examples of “alkylene” include CH_2, CH_2CH_2, $CH(CH_3)$, $CH_2CH_2CH_2$, $CH_2CH(CH_3)$, and the different butylene isomers. “Alkenylene” denotes a straight-chain or branched alkenediyl containing one olefinic bond. Examples of “alkenylene” include $CH{=}CH$, $CH_2CH{=}CH$, $CH{=}C(CH_3)$ and the different butenylene isomers. “Alkynylene” denotes a straight-chain or branched alkynediyl containing one triple bond. Examples of “alkynylene” include $C{\equiv}C$, $CH_2C{\equiv}C$, $C{\equiv}CCH_2$, and the different butynylene isomers.

“Alkoxy” includes, for example, methoxy, ethoxy, *n*-propyloxy, isopropyloxy and the different butoxy, pentoxy and hexyloxy isomers. “Alkoxyalkyl” denotes alkoxy substitution on alkyl. Examples of “alkoxyalkyl” include CH_3OCH_2, $CH_3OCH_2CH_2$, $CH_3CH_2OCH_2$, $CH_3CH_2CH_2CH_2OCH_2$ and $CH_3CH_2OCH_2CH_2$. “Alkoxyalkoxy” denotes alkoxy substitution on alkoxy. “Alkenyloxy” includes straight-chain or branched alkenyloxy moieties. Examples of “alkenyloxy” include $H_2C{=}CHCH_2O$, $(CH_3)_2C{=}CHCH_2O$, $(CH_3)CH{=}CHCH_2O$, $(CH_3)CH{=}C(CH_3)CH_2O$ and $CH_2{=}CHCH_2CH_2O$. “Alkynyloxy” includes straight-chain or branched alkynyloxy moieties. Examples of “alkynyloxy” include $HC{\equiv}CCH_2O$, $CH_3C{\equiv}CCH_2O$ and $CH_3C{\equiv}CCH_2CH_2O$. “Alkylthio” includes branched or straight-chain alkylthio moieties such as methylthio, ethylthio, and the different propylthio, butylthio, pentylthio and hexylthio isomers. “Alkylsulfinyl” includes both enantiomers of an alkylsulfinyl group. Examples of “alkylsulfinyl” include $CH_3S(O)$-, $CH_3CH_2S(O)$-, $CH_3CH_2CH_2S(O)$-, $(CH_3)_2CHS(O)$- and the different butylsulfinyl, pentylsulfinyl and hexylsulfinyl isomers. Examples of “alkylsulfonyl” include $CH_3S(O)_2$-, $CH_3CH_2S(O)_2$-, $CH_3CH_2CH_2S(O)_2$-, $(CH_3)_2CHS(O)_2$-, and the different butylsulfonyl, pentylsulfonyl and hexylsulfonyl isomers. “Alkylthioalkyl” denotes alkylthio substitution on alkyl. Examples of “alkylthioalkyl” include CH_3SCH_2, $CH_3SCH_2CH_2$, $CH_3CH_2SCH_2$, $CH_3CH_2CH_2CH_2SCH_2$ and $CH_3CH_2SCH_2CH_2$.

“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.

"Hydroxyalkyl" denotes an alkyl group substituted with one hydroxy group. Examples of "hydroxyalkyl" include $HOCH_2CH_2$, $CH_3CH_2(OH)CH$ and $HOCH_2CH_2CH_2CH_2$.

"Alkylamino", "dialkylamino" and the like, are defined analogously to the above examples. The term "halodialkylamino" denotes a dialkylamino group substituted on at least one alkyl moiety with one or more halogen atoms which may be the same or different. Examples of "halodialkylamino" include $CF_3(CH_3)N$-, $(CF_3)_2N$- and $CH_2Cl(CH_3)N$-. "Cycloalkylamino" means the amino nitrogen atom is attached to a cycloalkyl radical and a hydrogen atom and includes groups such as cyclopropylamino, cyclobutylamino, cyclopentylamino and cyclohexylamino. "Haloalkylaminoalkyl" denotes an alkylaminoalkyl group substituted on the amino nitrogen or either alkyl moiety or a combination thereof with one or more halogen atoms which may be the same or different. "Haloalkylaminoalkyl" includes a halogen group attached to any of the alkyl moieties as well as nitrogen. Examples of "haloalkylaminoalkyl" include $ClCH_2CH_2NHCH_2$- and $CH_3NCH(CH_2CH_2Cl)$-.

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

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

Examples of "alkylcarbonyl" include $CH_3C(O)$, $CH_3CH_2CH_2C(O)$ and $(CH_3)_2CHC(O)$. Examples of "alkoxycarbonyl" include $CH_3OC(=O)$, $CH_3CH_2OC(=O)$, $CH_3CH_2CH_2OC(=O)$, $(CH_3)_2CHOC(=O)$ and the different butoxy- or pentoxycarbonyl isomers. Examples of "alkylaminocarbonyl" include $CH_3NHC(=O)$-, $CH_3CH_2NHC(=O)$-, $CH_3CH_2CH_2NHC(=O)$-, $(CH_3)_2CHNHC(=O)$- and the different butylamino- or pentylaminocarbonyl isomers. Examples of "dialkylaminocarbonyl" include $(CH_3)_2NC(=O)$-, $(CH_3CH_2)_2NC(=O)$-, $CH_3CH_2(CH_3)NC(=O)$-, $(CH_3)_2CHN(CH_3)C(=O)$- and $CH_3CH_2CH_2(CH_3)NC(=O)$-. The term "alkylcarbonyloxy" denotes straight-chain or branched alkyl bonded to a $C(=O)O$ moiety. Examples of "alkylcarbonyloxy" include $CH_3CH_2C(=O)O$ and $(CH_3)_2CHC(=O)O$.

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

When a compound is substituted with a substituent bearing a subscript that indicates the number of said substituents can exceed 1, said substituents (when they exceed 1) are independently selected from the group of defined substituents, e.g., $(R^{9a})_p$, p is 1, 2, 3, 4 or 5. 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^{6b}, 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 $(R^{6a})_n$ wherein n may be 0, then hydrogen may be at the position even if not recited in the variable group definition. 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.

A "chain" is an acyclic string of atoms bonded in a single line with single (saturated) or multiple bonds (unsaturated) between atoms (chain members). The term "chain" is used to define group Z in Formula **1** and connects to group J on one end and group Q on the other end. A "chain" as a component of Formula **1** may contain carbon or heteroatom chain members. The chain itself is unbranched, but chain members may also be further substituted with other functional groups as indicated in variables R^{12} and R^{13}. The chain length can vary from two to six chain members as described in the Summary of the Invention.

Unless otherwise indicated, a "ring" or "ring system" as a component of Formula **1** (e.g., substituent Q) is carbocyclic or heterocyclic. The term "ring system" denotes two or more fused rings. The terms "bicyclic ring system" and "fused bicyclic ring system" denote a ring system consisting of two fused rings, in which either ring can be saturated, partially unsaturated, or fully unsaturated unless otherwise indicated. The term "fused heterobicyclic ring system" denotes a fused bicyclic ring system in which at least one ring atom is not carbon. A "bridged bicyclic ring system" is formed by bonding a segment of one or more atoms to nonadjacent ring members of a ring. The term "ring member" refers to an atom or other moiety (e.g., C(=O), C(=S), $SiR^{10}R^{11}$ or $S(=O)_s(=NR^{17})_f)$ forming the backbone of a ring or ring system.

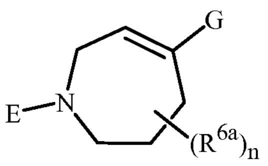
The terms "carbocyclic ring", "carbocycle" or "carbocyclic ring system" denote a ring or ring system wherein the atoms forming the ring backbone are selected only from carbon. Unless otherwise indicated, a carbocyclic ring can be a saturated, partially unsaturated, or fully unsaturated ring. When a fully unsaturated carbocyclic ring satisfies Hückel's rule, then said ring is also called an "aromatic ring". "Saturated carbocyclic" refers to a ring having a backbone consisting of carbon atoms linked to one another by single bonds; unless otherwise specified, the remaining carbon valences are occupied by hydrogen atoms.

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 or sulfur. Typically a heterocyclic ring contains no more than 4 nitrogens, no more than 2 oxygens and no more than 2 sulfurs. Unless otherwise indicated, a heterocyclic ring can be a saturated, partially unsaturated, or fully unsaturated ring. When a fully unsaturated heterocyclic ring satisfies Hückel's rule, then said ring is also called a "heteroaromatic ring" or "aromatic heterocyclic ring". 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.

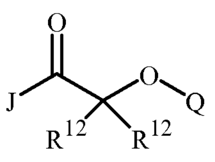
"Aromatic" indicates that each of the ring atoms is essentially in the same plane and has a *p*-orbital perpendicular to the ring plane, and that $(4n + 2)$ π electrons, where n is a positive integer, are associated with the ring to comply with Hückel's rule. The term "aromatic ring system" denotes a carbocyclic or heterocyclic ring system in which at least one ring of the ring system is aromatic. The term "aromatic carbocyclic ring system" denotes a carbocyclic ring system in which at least one ring of the ring system is aromatic. 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” 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.

The statement " wherein the orientation of the X group is such that the bond extending to the left is attached to E in Formula **1** and the bond extending to the right is attached to G in Formula **1**" is demonstrated for the X-6 group below. The statement " wherein the orientation of the Z^1 group is such that the bond extending to the left is attached to J in Formula **1** and the bond extending to the right is attached to Q in Formula **1**" is demonstrated for the Z^1-25 group below.



X-6



Z^1-25

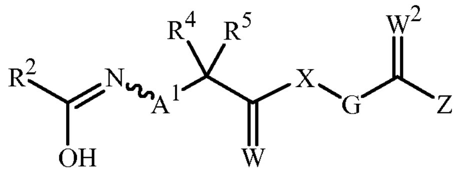
The wavy bond between the nitrogen atom and the atom represented by A^1 in Formula **1**, and in other rings depicted in the present description, indicates a single bond and the geometry about the adjacent double (i.e. the bond linking the nitrogen atom to the substituents R^2 and R^3) is either *cis*- (*E*), *trans*- (*Z*), or a mixture thereof.

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.

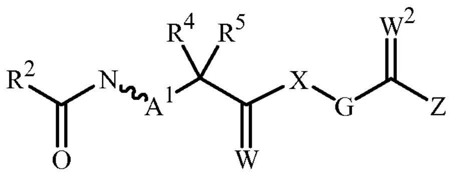
Compounds of this invention can exist as one or more stereoisomers. The various stereoisomers include enantiomers, diastereomers, atropisomers and geometric isomers. One skilled in the art will appreciate that one stereoisomer may be more active and/or may exhibit beneficial effects when enriched relative 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. The compounds of the invention may be present as a mixture of stereoisomers, individual stereoisomers or as an optically active form. Compounds of Formula **1** can comprise one or more chiral centers by virtue of their substituents and other molecular constituents (for example X, Q or Z) containing chiral centers. This invention comprises racemic mixtures as well as enriched and essentially pure stereoconfigurations at all possible chiral centers.

Compounds of this invention can exist as one or more conformational isomers due to restricted rotation about the amide bond (e.g., C(=W)–N) in Formula **1**. This invention comprises mixtures of conformational isomers. In addition, this invention includes compounds that are enriched in one conformer relative to others.

One skilled in the art recognizes that compounds of Formula **1** can exist in equilibrium with one or more of its respective tautomeric counterparts. Unless otherwise indicated, reference to a compound by one tautomer description is to be considered to include all tautomers. For example, in Formula **1** when E is E-2 and R^3 is hydroxy, then reference to the tautomeric form depicted by Formula $\mathbf{1}^1$ also includes the tautomic form depicted by Formula $\mathbf{1}^2$.



$\mathbf{1}^1$



$\mathbf{1}^2$

Additionally, some of the unsaturated rings and ring systems depicted in Exhibits 1, 4 and 5 can have an arrangement of single and double bonds between ring members different from that depicted. Such differing arrangements of bonds for a particular arrangement of ring atoms correspond to different tautomers. For these unsaturated rings and ring systems, the particular tautomer depicted is to be considered representative of all the tautomers possible for the arrangement of ring atoms shown.

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 *m*-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 plant diseases caused by fungal plant pathogens (i.e. are agriculturally suitable). 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 invention comprises compounds selected from Formula **1**, *N*-oxides and agriculturally 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 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.

Embodiments of the present invention as described in the Summary of the Invention include (where Formula **1** as used in the following Embodiments includes *N*-oxides and salts thereof):

Embodiment 1. A compound of Formula **1** wherein E is E-3.

Embodiment 2. A compound of Formula **1** wherein E is E-1 or E-2.

Embodiment 3. A compound of Formula **1** or Embodiment 2 wherein E is E-1.

Embodiment 4. A compound of Formula **1** or Embodiment 2 wherein E is E-2.

Embodiment 5. A compound of Formula **1** or Embodiments 2 or 3, either taken alone or in combination, wherein A is CHR^{15} or NR^{16}.

Embodiment 6. A compound of Embodiment 5 wherein A is CHR^{15}.

Embodiment 7. A compound of Embodiment 5 wherein A is NR^{16}.

Embodiment 8. A compound of Formula **1** or Embodiments 5 or 6, either taken alone or in combination, wherein R^{15} is H, halogen, cyano, hydroxy, -CHO, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_2-C_5 alkoxycarbonyl or C_1-C_4 alkoxy.

Embodiment 9. A compound of Embodiment 8 wherein R^{15} is H, halogen, cyano, hydroxy, methyl or methoxy.

Embodiment 10. A compound of Embodiment 9 wherein R^{15} is H.

Embodiment 11. A compound of of Formula **1** or Embodiments 5 or 7, either taken alone or in combination, wherein R^{16} is H, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_2-C_4 alkylcarbonyl, C_2-C_4 haloalkylcarbonyl or C_2-C_4 alkoxycarbonyl.

Embodiment 12. A compound of Embodiment 11 wherein R^{16} is H, methyl, methylcarbonyl or methoxycarbonyl.

Embodiment 13. A compound of Embodiment 12 wherein R^{16} is H.

Embodiment 14. A compound of Formula **1** or Embodiments 2 or 4, either taken alone or in combination, wherein A^1 is -O-, -S-, -N(R^7)-, -C(R^8)$_2$- or -OC(R^8)$_2$.

Embodiment 15. A compound of Embodiment 14 wherein A^1 is -O-, -S- or -N(R^7)-.

Embodiment 16. A compound of Embodiment 15 wherein A^1 is -O- or -N(R^7)-.

Embodiment 17. A compound of Formula **1** or any one of Embodiments 14 through 16, either taken alone or in combination, wherein R^7 when taken alone (i.e. not taken together with R^3) is H, C_1-C_2 alkyl, C_1-C_2 haloalkyl, $CH_3C(=O)$, $CF_3C(=O)$ or $CH_3OC(=O)$.

Embodiment 18. A compound of Embodiment 17 wherein R^7 when taken alone is H or C_1-C_2 alkyl.

Embodiment 19. A compound of Embodiment 18 wherein R^7 when taken alone is H or methyl.

Embodiment 20. A compound of Formula **1** or any of Embodiments 2 through 19, either taken alone or in combination, wherein W is O.

Embodiment 21. A compound of Formula **1** or Embodiment 1, either taken alone or in combination, wherein W^1 is OR^{18}, SR^{19} or $NR^{20}R^{21}$.

Embodiment 22. A compound of Embodiment 21 wherein W^1 is OR^{18}.

Embodiment 23. A compound of Embodiment 21 wherein W^1 is SR^{19}.

Embodiment 24. A compound of Embodiment 21 wherein W^1 is $NR^{20}R^{21}$.

Embodiment 25. A compound of Formula **1** or any one of Embodiments 1 and 21, either taken alone or in combination, through 23 wherein each R^{18} and R^{19} independently is selected from C_1-C_6 alkyl, C_3-C_4 alkenyl, C_3-C_4 alkynyl, C_1-C_4 haloalkyl, C_3-C_6 haloalkenyl, C_3-C_6 haloalkynyl, C_2-C_6 alkoxyalkyl and C_3-C_6 cycloalkyl.

Embodiment 26. A compound of Embodiment 25 wherein each R^{18} and R^{19} independently is selected from C_1-C_6 alkyl, C_3-C_4 alkenyl, C_3-C_4 alkynyl and C_1-C_4 haloalkyl.

Embodiment 27. A compound of Embodiment 26 wherein each R^{18} and R^{19} independently is C_1-C_4 alkyl.

Embodiment 28. A compound of Formula **1** or Embodiments 1 or 24, either taken alone or in combination, wherein R^{20} is selected from H, cyano, hydroxy, amino and C_1-C_6 alkyl.

Embodiment 29. A compound of Formula **1** or Embodiments 1 or 24, either taken alone or in combination, wherein R^{21} is selected from H and C_1-C_6 alkyl.

Embodiment 30. A compound of Formula **1** or Embodiment 24, either taken alone or in combination, wherein R^{20} and R^{21} are taken together as $-(CH_2)_4-$, $-(CH_2)_5-$ or $-(CH_2)_2O(CH_2)_2-$.

Embodiment 31. A compound of Embodiment 30 wherein R^{20} and R^{21} are taken together as $-(CH_2)_4-$ or $-(CH_2)_2O(CH_2)_2-$.

Embodiment 32. A compound of Embodiment 31 wherein R^{20} and R^{21} are taken together as $-(CH_2)_4-$.

Embodiment 33. A compound of Formula **1** or any one of Embodiments 1 through 32, either taken alone or in combination, wherein R^{1a} and R^{1b} independently are an optionally substituted phenyl, an optionally substituted naphthalenyl or an optionally substituted 5- to 6-membered heteroaromatic ring; or cyano, C_1-C_8 alkyl, C_2-C_8 alkenyl, C_2-C_8 alkynyl, C_1-C_8 haloalkyl, C_2-C_8 haloalkenyl, C_2-C_8 haloalkynyl, C_3-C_8 cycloalkyl, C_2-C_8 alkoxyalkyl, C_2-C_8 haloalkoxyalkyl, C_2-C_8 alkylthioalkyl, C_2-C_8 haloalkylthioalkyl, C_2-C_8 alkylsulfinylalkyl, C_2-C_8 alkylsulfonylalkyl, C_3-C_8 alkoxycarbonylalkyl, C_3-C_8 haloalkoxycarbonylalkyl, C_2-C_8 alkylaminoalkyl, C_3-C_{10} dialkylaminoalkyl, C_2-C_8 haloalkylaminoalkyl,

C_4-C_{10} cycloalkylaminoalkyl, C_1-C_8 alkoxy, C_1-C_8 haloalkoxy, C_3-C_8 cycloalkoxy, C_3-C_8 halocycloalkoxy, C_4-C_{10} cycloalkylalkoxy, C_2-C_8 alkenyloxy, C_2-C_8 haloalkenyloxy, C_2-C_8 alkynyloxy, C_3-C_8 haloalkynyloxy, C_2-C_8 alkoxyalkoxy, C_2-C_8 alkylcarbonyloxy, C_2-C_8 haloalkylcarbonyloxy, C_1-C_8 alkylthio, C_1-C_8 haloalkylthio, C_3-C_8 cycloalkylthio, C_3-C_{10} trialkylsilyl, C_1-C_8 alkylamino, C_2-C_8 dialkylamino, C_2-C_8 alkylcarbonylamino, pyrrolidinyl, piperidinyl or morpholinyl.

Embodiment 34. A compound of Embodiment 33 wherein independently when R^{1a}, and R^{1b} are other than optionally substituted phenyl, optionally substituted naphthalenyl or an optionally substituted 5- or 6-membered heteroaromatic ring then R^{1a} and R^{1b} are independently cyano, C_1-C_8 alkyl, C_2-C_8 alkenyl, C_2-C_8 alkynyl, C_1-C_8 haloalkyl, C_2-C_8 haloalkenyl, C_2-C_8 haloalkynyl, C_3-C_8 cycloalkyl, C_2-C_8 alkoxyalkyl, C_2-C_8 alkylthioalkyl, C_2-C_8 alkylsulfinylalkyl, C_2-C_8 alkylsulfonylalkyl, C_2-C_8 alkylaminoalkyl, C_3-C_{10} dialkylaminoalkyl, C_1-C_8 alkoxy, C_1-C_8 haloalkoxy, C_1-C_8 alkylthio, C_3-C_{10} trialkylsilyl, C_1-C_8 alkylamino, C_2-C_8 dialkylamino, C_2-C_8 alkylcarbonylamino, pyrrolidinyl, piperidinyl or morpholinyl.

Embodiment 35. A compound of Embodiment 34 wherein independently when R^{1a} and R^{1b} are other than optionally substituted phenyl, optionally substituted naphthalenyl or an optionally substituted 5- or 6-membered heteroaromatic ring then R^{1a} and R^{1b} are independently C_2-C_5 alkyl, C_2-C_5 alkenyl, C_2-C_5 haloalkyl, C_2-C_5 haloalkenyl, C_2-C_5 haloalkylthioalkyl, C_2-C_5 alkoxyalkyl, C_2-C_5 haloalkoxyalkyl, C_2-C_5 alkylthioalkyl, C_2-C_5 alkylaminoalkyl, C_2-C_5 alkylcarbonyloxy, C_2-C_5 haloalkylcarbonyloxy, C_2-C_5 alkoxy, C_2-C_5 haloalkoxy, C_2-C_5 alkylthio, C_2-C_5 alkylamino or C_2-C_5 alkylcarbonylamino.

Embodiment 36. A compound of Embodiment 35 wherein independently when R^{1a} and R^{1b} are other than optionally substituted phenyl, optionally substituted naphthalenyl or an optionally substituted 5- or 6-membered heteroaromatic ring then R^{1a} and R^{1b} are independently C_3-C_5 alkyl, C_3-C_5 alkenyl, C_3-C_5 haloalkyl, C_3-C_5 haloalkenyl, C_2-C_4 haloalkylthioalkyl, C_2-C_4 alkoxyalkyl, C_2-C_4 haloalkoxyalkyl, C_2-C_4 alkylthioalkyl, C_2-C_4 alkylaminoalkyl, C_2-C_3 alkylcarbonyloxy, C_2-C_3 haloalkylcarbonyloxy, C_2-C_4 alkoxy, C_2-C_4 haloalkoxy, C_2-C_4 alkylthio, C_2-C_4 alkylamino or C_2-C_3 alkylcarbonylamino.

Embodiment 37. A compound of Embodiment 36 wherein independently when R^{1a} and R^{1b} are other than optionally substituted phenyl, optionally substituted naphthalenyl or an optionally substituted 5- or 6-membered heteroaromatic ring then R^{1a} and R^{1b} are independently C_3-C_5 haloalkyl, C_3-C_5 haloalkenyl, C_3-C_5

haloalkylthioalkyl, C_3-C_5 haloalkoxyalkyl, C_2-C_3 haloalkylcarbonyloxy or C_2-C_4 haloalkoxy.

Embodiment 38. A compound of Embodiment 37 wherein independently when R^{1a} and R^{1b} are other than optionally substituted phenyl, optionally substituted naphthalenyl or an optionally substituted 5- or 6-membered heteroaromatic ring then R^{1a} and R^{1b} are independently C_4 haloalkyl, C_4 haloalkenyl, C_3 haloalkoxyalkyl or C_3 haloalkoxy.

Embodiment 39. A compound of Formula **1** or any one of Embodiments 1 through 33, either taken alone or in combination, wherein independently when R^{1a} and R^{1b} are optionally substituted phenyl, optionally substituted naphthalenyl or an optionally substituted 5- or 6-membered heteroaromatic ring, the optionally substituted phenyl, optionally substituted naphthalenyl or optionally substituted 5- or 6-membered heteroaromatic ring is optionally substituted with up to 3 independently selected substituents.

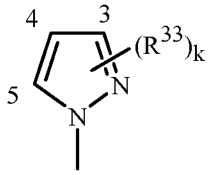
Embodiment 40. A compound of Embodiment 39 wherein independently when R^{1a} and R^{1b} are optionally substituted phenyl, optionally substituted naphthalenyl or an optionally substituted 5- or 6-membered heteroaromatic ring, the optionally substituted phenyl, optionally substituted naphthalenyl or optionally substituted 5- or 6-membered heteroaromatic ring is optionally substituted with up to 2 independently selected substituents.

Embodiment 41. A compound of Formula **1** or any one of Embodiments 1 through 33, and 39 through 40, either taken alone or in combination, wherein independently when R^{1a} and R^{1b} are optionally substituted phenyl, optionally substituted naphthalenyl or an optionally substituted 5- or 6-membered heteroaromatic ring, then the optional substituents on the phenyl, naphthalenyl or 5- or 6-membered heteroaromatic ring are independently selected from R^{33a} on carbon ring members and R^{33b} on nitrogen ring members;

each R^{33a} is independently halogen, cyano, hydroxy, amino, nitro, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_3-C_6 cycloalkyl, C_4-C_{10} cycloalkylalkyl, C_4-C_{10} alkylcycloalkyl, C_5-C_{10} alkylcycloalkylalkyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, C_3-C_6 halocycloalkyl, C_1-C_4 alkoxy, C_1-C_4 haloalkoxy, C_1-C_4 alkylthio, C_1-C_4 alkylsulfinyl, C_1-C_4 alkylsulfonyl, C_1-C_4 haloalkylthio, C_1-C_4 haloalkylsulfinyl, C_1-C_4 haloalkylsulfonyl, C_1-C_4 alkylamino, C_2-C_8 dialkylamino, C_3-C_6 cycloalkylamino, C_2-C_4 alkoxyalkyl, C_1-C_4 hydroxyalkyl, C_2-C_4 alkylcarbonyl, C_2-C_6 alkoxycarbonyl, C_2-C_6 alkylcarbonyloxy, C_2-C_6 alkylcarbonylthio, C_2-C_6 alkylaminocarbonyl, C_3-C_8 dialkylaminocarbonyl or C_3-C_6 trialkylsilyl; and each R^{33b} is independently C_1-C_6 alkyl, C_3-C_6 alkenyl, C_3-C_6 alkynyl, C_3-C_6 cycloalkyl, C_1-C_6 haloalkyl, C_3-C_6 haloalkenyl, C_3-C_6 haloalkynyl, C_3-C_6 halocycloalkyl or C_2-C_4 alkoxyalkyl.

Embodiment 42. A compound of Formula **1** or any one of Embodiments 1 through 33, and 39 through 41, either taken alone or in combination, wherein independently R^{1a} and R^{1b} are selected from U-1 through U-50 depicted in Exhibit 1;

Exhibit 1



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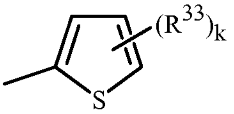

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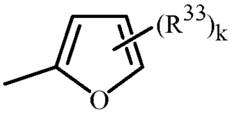

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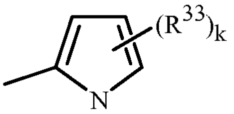

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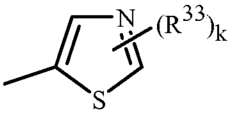

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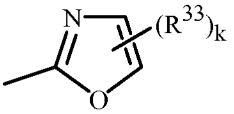

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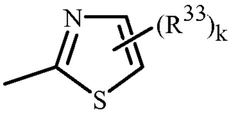

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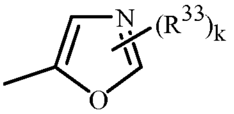

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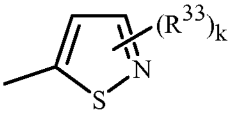

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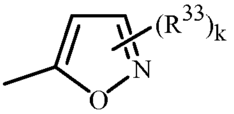

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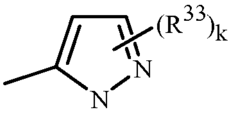

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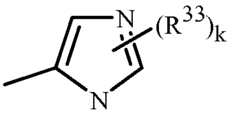

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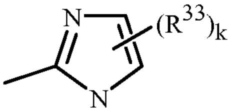

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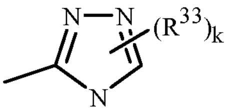

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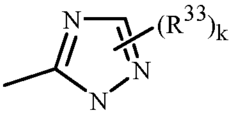

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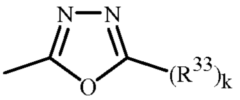

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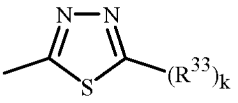

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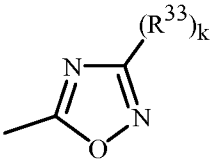

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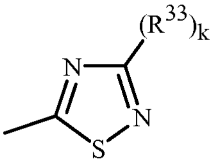

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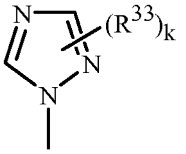

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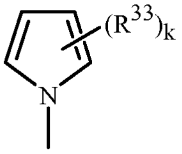

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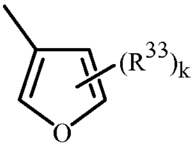

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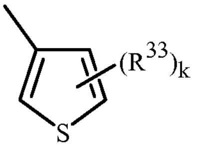

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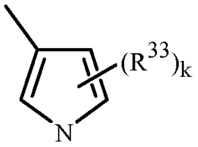

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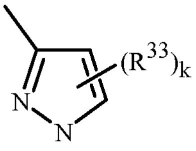

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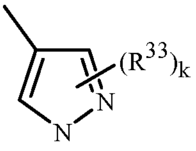

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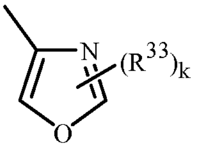

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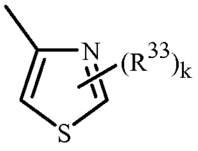

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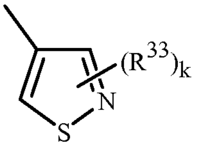 ,

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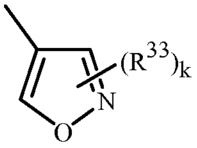 ,

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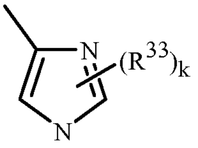 ,

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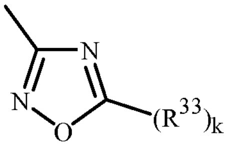 ,

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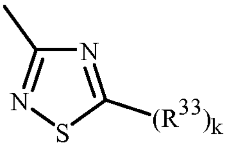 ,

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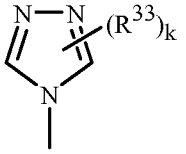 ,

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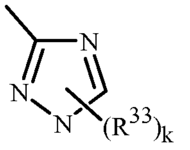 ,

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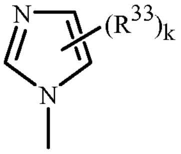 ,

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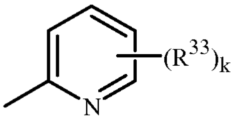 ,

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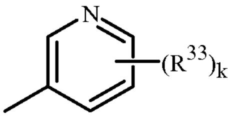 ,

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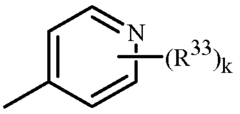 ,

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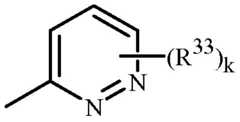 ,

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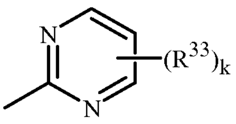 ,

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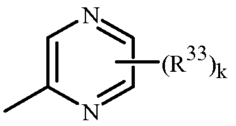 ,

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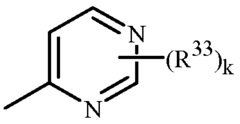 ,

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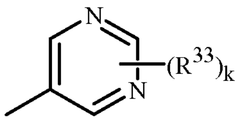 ,

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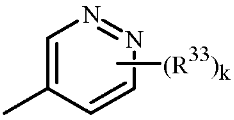 ,

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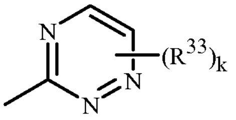 ,

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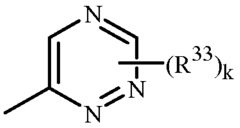 ,

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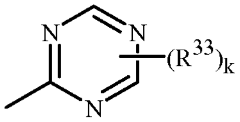 ,

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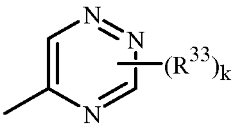 and

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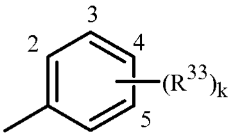
 ;

U-50

wherein when R^{33} is attached to a carbon ring member, said R^{33} is selected from R^{33a}, and when R^{33} is attached to a nitrogen ring member (e.g., in U-4, U-11 through U-15, U-24 through U-26, U-31 or U-35), said R^{33} is selected from R^{33b}; and k is 0, 1, 2 or 3.

Embodiment 43. A compound of Embodiments 41 or 42, either taken alone or in combination, wherein independently R^{1a} and R^{1b} are selected from U-1 through U-5, U-8, U-11, U-13, U-15, U-20 through U-28, U-31, U-36 through U-39 and U-50.

Embodiment 44. A compound of Embodiment 43 wherein independently R^{1a} and R^{1b} are selected from U-1 through U-3, U-5, U-8, U-11, U-13, U-20, U-22, U-23, U-25 through U-28, U-36 through U-39 and U-50.

Embodiment 45. A compound of Embodiment 44 wherein independently R^{1a} and R^{1b} are selected from U-1 through U-3, U-11, U-13, U-20, U-22, U-23, U-36 through U-39 and U-50.

Embodiment 46. A compound of Embodiment 45 wherein independently R^{1a} and R^{1b} are U-1, U-20 and U-50.

Embodiment 47. A compound of Embodiment 46 wherein independently wherein R^{1a} and R^{1b} are U-1.

Embodiment 48. A compound of Embodiment 46 wherein independently R^{1a} and R^{1b} are U-20.

Embodiment 49. A compound of Embodiment 46 wherein independently R^{1a} and R^{1b} are U-50.

Embodiment 50. A compound of Formula **1** or any one of Embodiments 1 through 49, either taken alone or in combination, wherein each R^{33a} is independently halogen, C_1-C_6 alkyl, C_1-C_6 haloalkyl or C_2-C_4 alkoxyalkyl.

Embodiment 51. A compound of Embodiment 50 wherein each R^{33a} is independently halogen, C_1-C_3 alkyl, C_1-C_3 haloalkyl or C_2-C_3 alkoxyalkyl.

Embodiment 51a. A compound of Embodiment 50 wherein each R^{33} is independently halogen, C_1-C_3 alkyl, C_1-C_3 haloalkyl or C_2-C_3 alkoxyalkyl. (simplified language for when only carbon ring members can be substituted)

Embodiment 52. A compound of Formula **1** or any one of Embodiments 1 through 51, either taken alone or in combination, wherein each R^{33b} is independently C_1-C_6 alkyl.

Embodiment 53. A compound of Formula **1** or any one of Embodiments 2 through 52, either taken alone or in combination, wherein R^2 when taken alone (i.e. not taken together with R^3) is H, cyano, C_1-C_4 alkyl, C_2-C_4 alkenyl, C_2-C_4 alkynyl, C_1-C_4 haloalkyl, C_2-C_4 haloalkenyl, C_2-C_4 haloalkynyl, C_2-C_4 alkoxyalkyl, C_2-C_4 alkylthioalkyl, C_2-C_4 alkylcarbonyl, C_2-C_4 haloalkylcarbonyl, C_2-C_4 alkoxycarbonyl, C_1-C_4 alkoxy, C_1-C_4 haloalkoxy, C_2-C_4 alkenyloxy, C_2-C_4 haloalkenyloxy, C_2-C_4 alkynyloxy, C_3-C_4 haloalkynyloxy, C_2-C_4 alkoxyalkoxy, C_1-C_4 alkylthio, C_1-C_4 haloalkylthio, C_1-C_4 alkylamino, C_2-C_4 dialkylamino, C_1-C_4 haloalkylamino or C_2-C_4 halodialkylamino.

Embodiment 54. A compound of Embodiment 53 wherein R^2 when taken alone is H, cyano, C_1-C_3 alkyl, C_2-C_3 alkenyl, C_2-C_3 alkynyl, C_1-C_3 haloalkyl, C_2-C_3 haloalkenyl, C_2-C_3 haloalkynyl, C_1-C_3 alkoxy or C_1-C_3 haloalkoxy.

Embodiment 55. A compound of Embodiment 54 wherein R^2 when taken alone is H, C_1-C_3 alkyl or C_1-C_3 haloalkyl.

Embodiment 56. A compound of Embodiment 55 wherein R^2 when taken alone is H, C_1-C_3 alkyl or C_1-C_3 fluoroalkyl.

Embodiment 57. A compound of Embodiment 56 wherein R^2 is methyl, trifluoromethyl or CF_3CH_2.

Embodiment 58. A compound of Formula **1** or any one of Embodiments 2 through 57, either taken alone or in combination, wherein R^2 is taken alone.

Embodiment 59. A compound of Formula **1** or any one of Embodiments 2 through 58, either taken alone or in combination, wherein R^3 when taken alone (i.e. not taken together with R^2 or R^7) is H, C_1-C_3 alkyl, C_1-C_3 alkoxy or C_1-C_3 haloalkyl.

Embodiment 60. A compound of Embodiment 59 wherein R^3 when taken alone is H, C_1-C_3 alkyl or C_1-C_3 haloalkyl.

Embodiment 61. A compound of Embodiment 60 wherein R^3 when taken alone is H, C_1-C_2 alkyl or C_1-C_3 fluoroalkyl.

Embodiment 62. A compound of Embodiment 61 wherein R^3 is H, methyl or trifluoromethyl.

Embodiment 63. A compound of Formula **1** or any one of Embodiments 2 through 62, either taken alone or in combination, wherein R^3 is taken alone.

Embodiment 64. A compound of Formula **1** or any one of Embodiments 2 through 52, either taken alone or in combination, wherein when R^2 and R^3 are taken together with the carbon atom to which they are attached to form a ring, the ring is 3- to 6-membered and contains ring members selected from carbon atoms and up to 2 heteroatoms independently selected from up to 2 O, up to 2 S and up to 2 N, wherein up to 1 carbon atom ring member is C(=O) or C(=S) and the ring is optionally substituted with up to 3 substituents independently selected from halogen, cyano, C_1-C_2 alkyl, C_1-C_2 haloalkyl, C_1-C_2 alkoxy and C_1-C_2 haloalkoxy on carbon atom ring members and cyano, C_1-C_2 alkyl and C_1-C_2 alkoxy on nitrogen atom ring members.

Embodiment 65. A compound of Formula **1** or any one of Embodiments 2 through 64, either taken alone or in combination, wherein R^4 is optionally substituted phenyl, optionally substituted naphthalenyl or an optionally substituted 5- or 6-membered heteroaromatic ring; or hydrogen, cyano, hydroxy, C_1-C_3 alkyl, C_2-C_3 alkenyl, C_2-C_3 alkynyl, C_1-C_3 haloalkyl, C_2-C_3 haloalkenyl, C_2-C_3 haloalkynyl, C_2-C_3 alkylcarbonyl, C_2-C_3 haloalkylcarbonyl, C_1-C_3 alkoxy, C_1-C_3 haloalkoxy, C_1-C_3 alkylthio, C_1-C_3 haloalkylthio, C_2-C_3 alkylcarbonyloxy or C_2-C_3 haloalkylcarbonyloxy.

Embodiment 66. A compound of Embodiment 65 wherein when R^4 is other than optionally substituted phenyl, optionally substituted naphthalenyl or an optionally substituted 5- or 6-membered heteroaromatic ring then R^4 is hydrogen, cyano, hydroxy, C_1-C_3 alkyl, C_2-C_3 alkenyl, C_2-C_3 alkynyl, C_1-C_3 haloalkyl, C_2-C_3 haloalkenyl, C_2-C_3 haloalkynyl, C_2-C_3 alkylcarbonyl, C_2-C_3

haloalkylcarbonyl, C_1-C_3 alkoxy, C_1-C_3 haloalkoxy, C_1-C_3 alkylthio, C_1-C_3 haloalkylthio, C_2-C_3 alkylcarbonyloxy or C_2-C_3 haloalkylcarbonyloxy.

Embodiment 67. A compound of Embodiment 66 wherein when R^4 is other than optionally substituted phenyl, optionally substituted naphthalenyl or an optionally substituted 5- or 6-membered heteroaromatic ring then R^4 is hydrogen, cyano, hydroxy, C_1-C_3 alkyl, C_1-C_3 haloalkyl, C_1-C_3 alkoxy, C_1-C_3 haloalkoxy, C_1-C_3 alkylthio, C_1-C_3 haloalkylthio, C_2-C_3 alkylcarbonyloxy or C_2-C_3 haloalkylcarbonyloxy.

Embodiment 68. A compound of Embodiment 67 wherein R^4 is hydrogen, cyano, methyl, methoxy or $CH_3C(=O)O$-.

Embodiment 69. A compound of Embodiment 68 wherein R^4 is hydrogen or methyl.

Embodiment 70. A compound of Embodiment 69 wherein R^4 is hydrogen.

Embodiment 71. A compound of Formula **1** or any one of Embodiments 2 through 65, either taken alone or in combination, wherein when R^4 is optionally substituted phenyl, optionally substituted naphthalenyl or an optionally substituted 5- or 6-membered heteroaromatic ring, the optionally substituted phenyl, optionally substituted naphthalenyl or optionally substituted 5- or 6-membered heteroaromatic ring is substituted with up to 3 optional substituents.

Embodiment 72. A compound of Embodiment 71 wherein when R^4 is optionally substituted phenyl, optionally substituted naphthalenyl or an optionally substituted 5- or 6-membered heteroaromatic ring, the optionally substituted phenyl, optionally substituted naphthalenyl or optionally substituted 5- or 6-membered heteroaromatic ring is substituted with up to 2 optional substituents.

Embodiment 73. A compound of Formula **1** or any one of Embodiments 2 through 72, either taken alone or in combination, when R^4 is optionally substituted phenyl, optionally substituted naphthalenyl or an optionally substituted 5- or 6-membered heteroaromatic ring, then the optional substituents on the phenyl, naphthalenyl or 5- or 6-membered heteroaromatic ring are independently selected from R^{32a} on carbon ring members and R^{32b} on nitrogen ring members;

each R^{32a} is independently halogen, cyano, hydroxy, amino, nitro, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_3-C_6 cycloalkyl, C_4-C_{10} cycloalkylalkyl, C_4-C_{10} alkylcycloalkyl, C_5-C_{10} alkylcycloalkylalkyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, C_3-C_6 halocycloalkyl, C_1-C_4 alkoxy, C_1-C_4 haloalkoxy, C_1-C_4 alkylthio, C_1-C_4 alkylsulfinyl, C_1-C_4 alkylsulfonyl, C_1-C_4 haloalkylthio, C_1-C_4 haloalkylsulfinyl, C_1-C_4 haloalkylsulfonyl, C_1-C_4 alkylamino, C_2-C_8 dialkylamino, C_3-C_6 cycloalkylamino, C_2-C_4 alkoxyalkyl, C_1-C_4 hydroxyalkyl, C_2-C_4 alkylcarbonyl, C_2-C_6

alkoxycarbonyl, C_2-C_6 alkylcarbonyloxy, C_2-C_6 alkylcarbonylthio, C_2-C_6 alkylaminocarbonyl, C_3-C_8 dialkylaminocarbonyl or C_3-C_6 trialkylsilyl; and

each R^{32b} is independently C_1-C_6 alkyl, C_3-C_6 alkenyl, C_3-C_6 alkynyl, C_3-C_6 cycloalkyl, C_1-C_6 haloalkyl, C_3-C_6 haloalkenyl, C_3-C_6 haloalkynyl, C_3-C_6 halocycloalkyl or C_2-C_4 alkoxyalkyl.

Embodiment 74. A compound of Embodiment 73 wherein each R^{32a} is independently halogen, C_1-C_2 alkyl, C_1-C_2 haloalkyl or C_1-C_2 alkoxy.

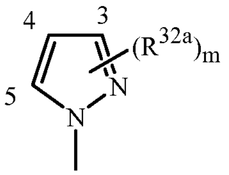
Embodiment 75. A compound of Embodiment 74 wherein each R^{32a} is independently Cl, Br, I, C_1-C_2 alkyl, trifluoromethyl or methoxy.

Embodiment 76. A compound of Embodiment 75 wherein each R^{32a} is independently Cl, Br, C_1-C_2 alkyl or trifluoromethyl.

Embodiment 77. A compound of Formula **1** or any one of Embodiments 2 through 76, either taken alone or in combination, wherein R^4 is other than optionally substituted naphthalenyl.

Embodiment 78. A compound of any one of Embodiments 73 through 76, either taken alone or in combination, wherein when R^4 is an optionally substituted 5- to 6-membered heteroaromatic ring then R^4 is selected from the group consisting of V-1 through V-10, and when R^4 is optionally substituted phenyl then R^4 is selected from V-11, shown below in Exhibit 2

Exhibit 2



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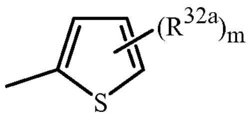
V-1



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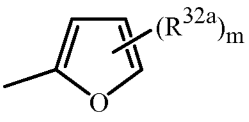
V-2



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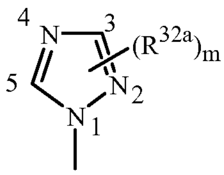
V-3



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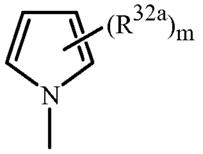
V-4



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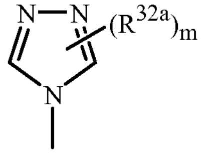
V-5



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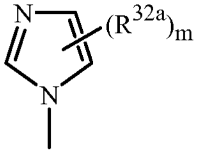
V-6



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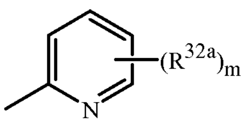
V-7



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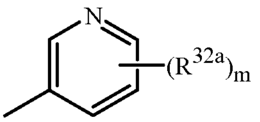
V-8



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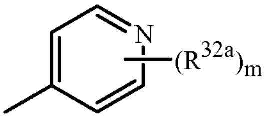
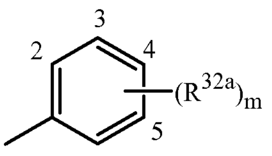
V-9



V-10

and



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V-11

wherein m is 0, 1, 2 or 3.

Embodiment 79. A compound of Embodiment 78 wherein R^4 is selected from the group consisting of V-1 through V-11.

Embodiment 80. A compound of Embodiment 79 wherein R^4 is selected from V-1, V-4 and V-11.

Embodiment 81. A compound of Embodiment 80 wherein R^4 is V-1.

Embodiment 82. A compound of Formula **1** or any one of Embodiments 2 through 81, either taken alone or in combination, wherein R^5 is hydrogen or C_1-C_2 alkyl.

Embodiment 83. A compound of Embodiment 82 wherein R^5 is hydrogen.

Embodiment 84. A compound of Formula **1** or any one of Embodiments 1 through 83, either taken alone or in combination, wherein X is X-1, X-2, X-3, X-4 or X-5.

Embodiment 85. A compound of Embodiment 84 wherein X is X-1, X-2 or X-3.

Embodiment 86. A compound of Embodiment 85 wherein X is X-4 or X-5.

Embodiment 87. A compound of Embodiment 86 wherein X is X-1 or X-2.

Embodiment 88. A compound of Embodiment 87 wherein X is X-2.

Embodiment 89. A compound of Embodiment 87 wherein X is X-1.

Embodiment 90. A compound of Formula **1** or any one of Embodiments 1 through 89, either taken alone or in combination, wherein each R^{6a} is independently C_1–C_2 alkyl, C_1–C_2 haloalkyl, C_1–C_2 alkoxy, halogen, cyano or hydroxy.

Embodiment 91. A compound of Embodiment 90 wherein each R^{6a} is independently methyl, methoxy, cyano or hydroxy.

Embodiment 92. A compound of Embodiment 91 wherein each R^{6a} is methyl.

Embodiment 93. A compound of Formula **1** or any one of Embodiments 1 through 92, either taken alone or in combination, wherein n is 0 or 1.

Embodiment 94. A compound of Embodiment 93 wherein n is 0.

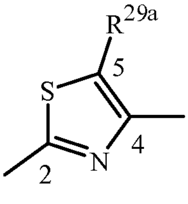
Embodiment 95. A compound of Formula **1** or any one of Embodiments 1 through 94, either taken alone or in combination, wherein each R^{6b} is hydrogen, methyl or ethyl.

Embodiment 96. A compound of Embodiment 95 wherein each R^{6b} is hydrogen.

Embodiment 97. A compound of Formula **1** or any one of Embodiments 1 through 96, either taken alone or in combination, wherein G is a 5-membered heterocyclic ring optionally substituted with up to 2 substituents independently selected from R^{29a} on carbon atom ring members and R^{30a} on nitrogen atom ring members.

Embodiment 98. A compound of Formula **1** or any one of Embodiments 1 through 97, either taken alone or in combination, wherein G is selected from G-1 through G-48 shown in Exhibit 3

Exhibit 3



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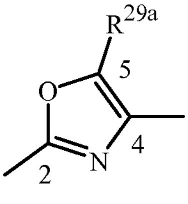
G-1



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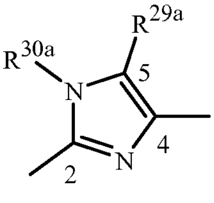
G-2



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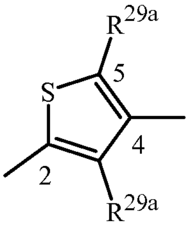
G-3



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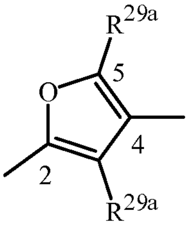
G-4



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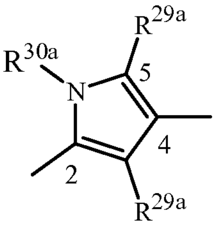
G-5



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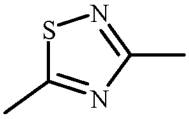
G-6



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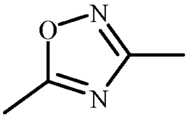
G-7



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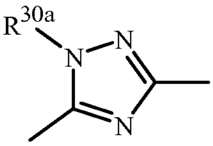
G-8



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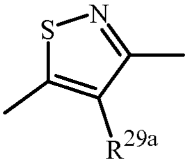
G-9



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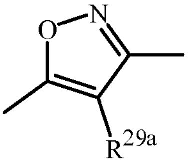
G-10



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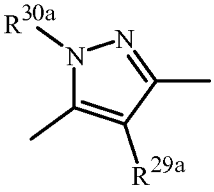
G-11



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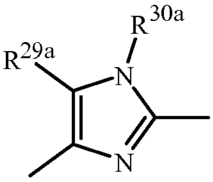

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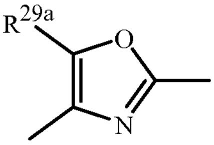

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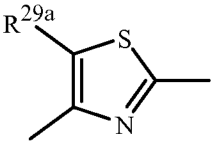
G-14



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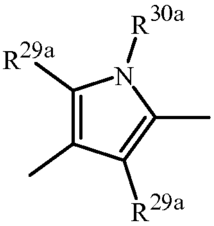
G-15



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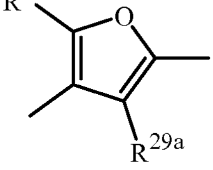
G-16



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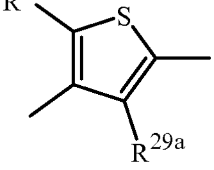
G-17



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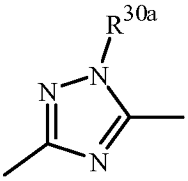
G-18



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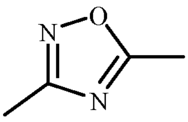
G-19



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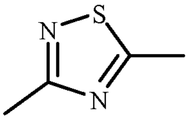

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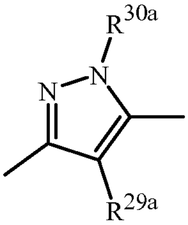
G-21



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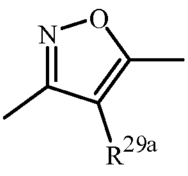
G-22



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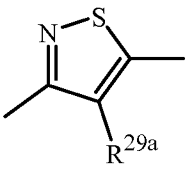

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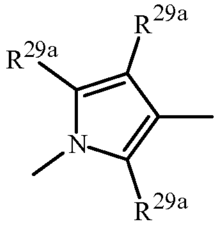
G-24

 ,

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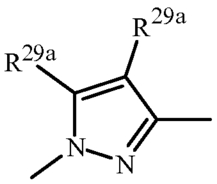 ,

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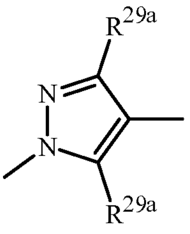 ,

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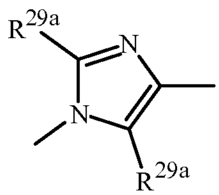 ,

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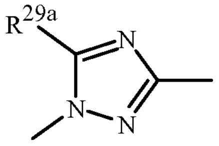 ,

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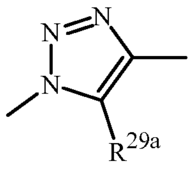 ,

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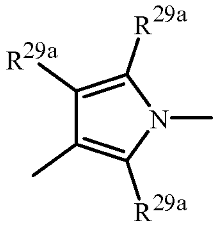 ,

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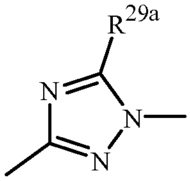 ,

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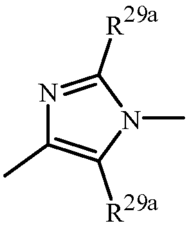 ,

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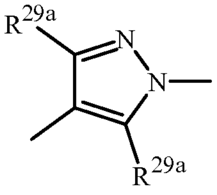 ,

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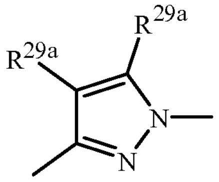 ,

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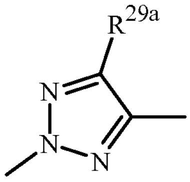 ,

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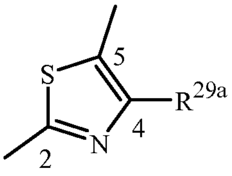 ,

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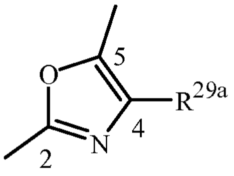 ,

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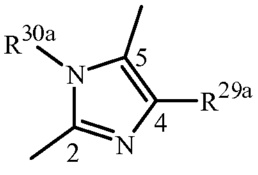
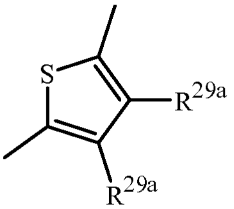
 ,

G-39

 ,

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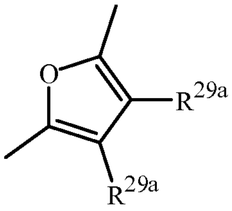 ,

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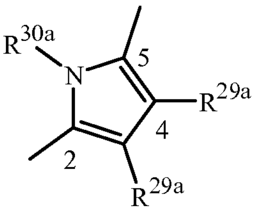
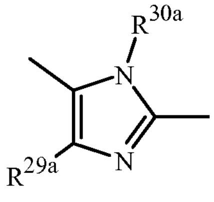
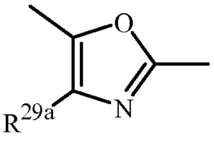
 ,

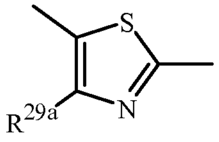
G-42

 ,

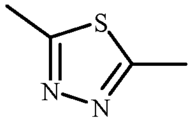
G-43

 ,

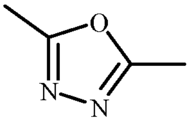
G-44

 ,

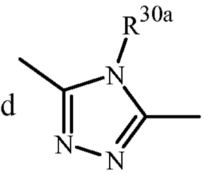
G-45

 ,

G-46

 and

G-47

 ;

G-48

wherein the bond projecting to the left is bonded to X in Formula **1**, and the bond projecting to the right is bonded to J in Formula **1**.

Embodiment 99. A compound of Embodiment 98 wherein G is selected from G-1 through G-3, G-7, G-8, G-10, G-11, G-14, G-15, G-23, G-24, G-26 through G-28, G-30 and G-36 through G-38.

Embodiment 100. A compound of Embodiment 99 wherein G is selected from G-1, G-2, G-7, G-8, G-14, G-15, G-23, G-24, G-26, G-27, G-36, G-37 and G-38.

Embodiment 101. A compound of Embodiment 100 wherein G is selected from G-1, G-2, G-15, G-26, G-27, G-36, G-37 and G-38.

Embodiment 102. A compound of Embodiment 101 wherein G is selected from G-1, G-2, G-15, G-26, G-36 and G-37.

Embodiment 103. A compound of Embodiment 102 wherein G is G-1.

Embodiment 104. A compound of Embodiment 102 wherein G is G-2.

Embodiment 105. A compound of Embodiment 102 wherein G is G-15.

Embodiment 106. A compound of Embodiment 102 wherein G is G-26.

Embodiment 107. A compound of Embodiment 102 wherein G is G-36.

Embodiment 108. A compound of Formula **1** or any one of Embodiments 1 through 107, either taken alone or in combination, wherein each R^{29a} is independently hydrogen, halogen or C_1-C_3 alkyl.

Embodiment 109. A compound of Embodiment 108 wherein each R^{29a} is independently hydrogen or methyl.

Embodiment 110. A compound of Embodiment 109 wherein each R^{29a} is hydrogen.

Embodiment 111. A compound of Formula **1** or any one of Embodiments 1 through 110, either taken alone or in combination, wherein each R^{30a} is independently hydrogen or methyl.

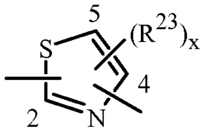
Embodiment 112. A compound of Embodiment 111 wherein each R^{30a} is hydrogen.

Embodiment 113. A compound of Formula **1** or any one of Embodiments 1 through 107, either taken alone or in combination, wherein G is a heterocyclic ring unsubstituted except for its attachments to X and J.

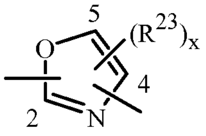
Embodiment 114. A compound of Formula **1** or any one of Embodiments 1 through 113, either taken alone or in combination, wherein J is a 5-, 6- or 7-membered ring, an 8- to 11-membered bicyclic ring system or a 7- to 11-membered spirocyclic ring system, each ring or ring system containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N, wherein up to 3 carbon atom ring members are independently selected from C(=O) and C(=S), and the sulfur atom ring members are independently selected from $S(=O)_s(=NR^{11})_f$, each ring or ring system substituted with up to 2 substituents independently selected from R^{23}.

Embodiment 115. A compound of Embodiment 114 wherein J is a ring selected from the group consisting of J-1 through J-83 in Exhibit 4

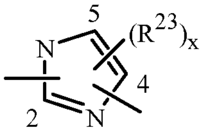
Exhibit 4



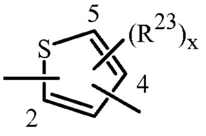
J-1



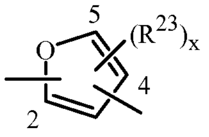
J-2



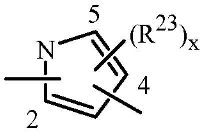
J-3



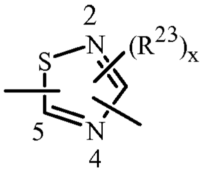
J-4



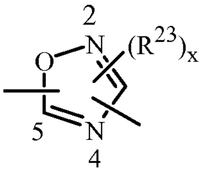
J-5



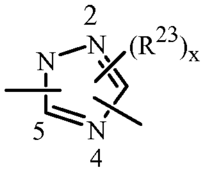
J-6



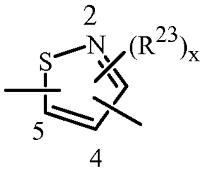
J-7



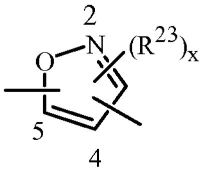
J-8



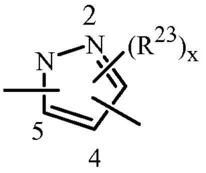
J-9



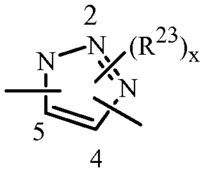
J-10



J-11



J-12



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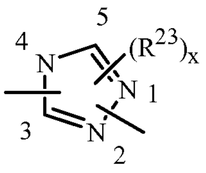
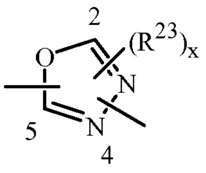
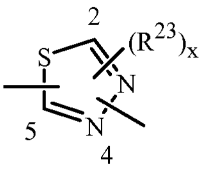


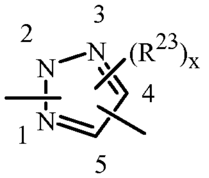
J-14



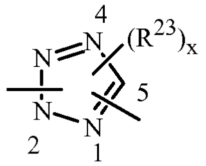
J-15



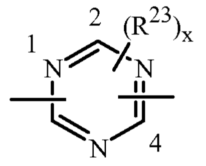
J-16



J-17



J-18



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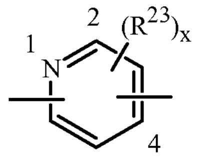
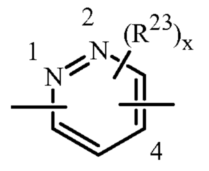


J-20



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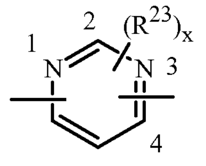
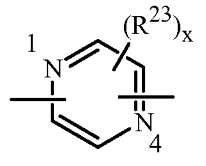
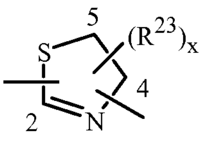


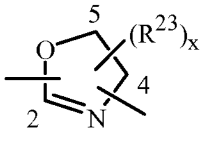
J-22



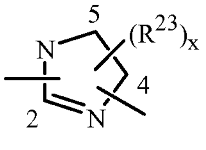
J-23



J-24



J-25



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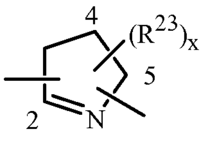

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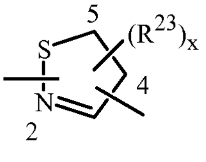

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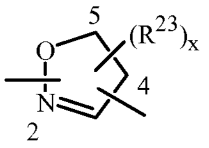
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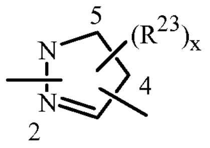
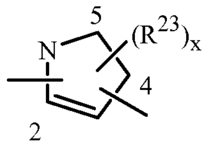
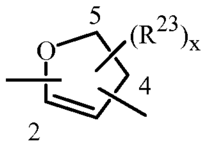
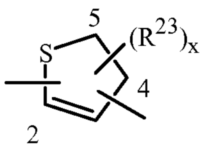

J-30


J-31


J-32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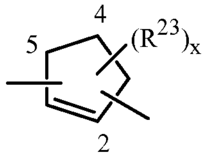
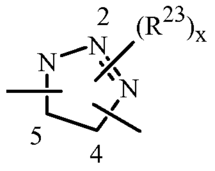

J-34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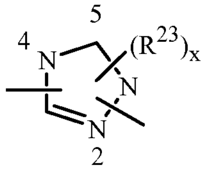
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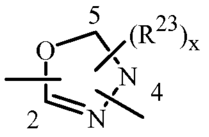
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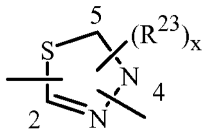
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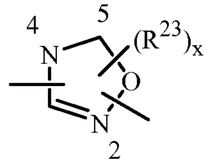
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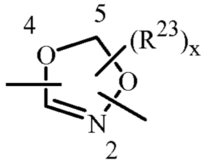
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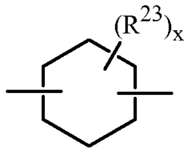
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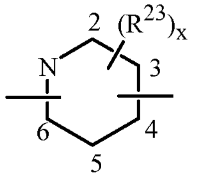
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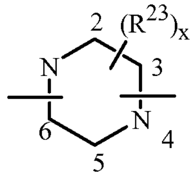
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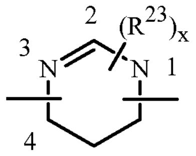
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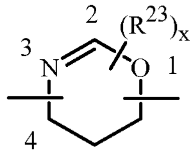
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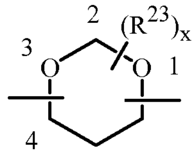
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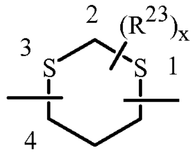
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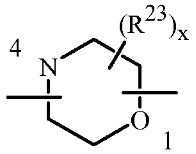
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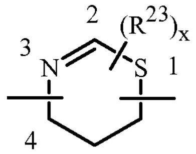
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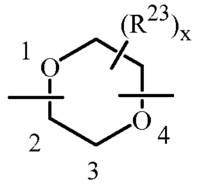
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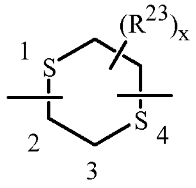
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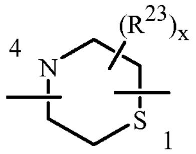
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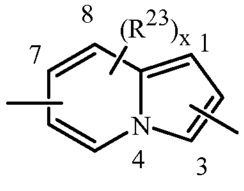
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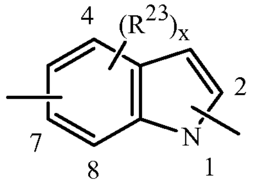
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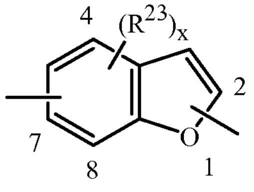
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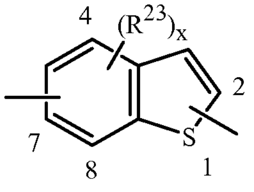
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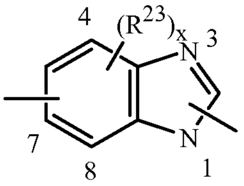

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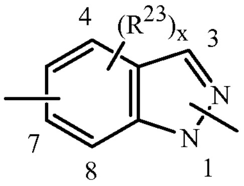

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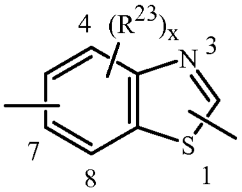

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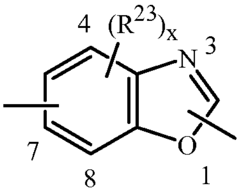

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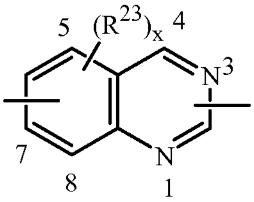

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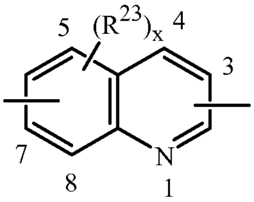

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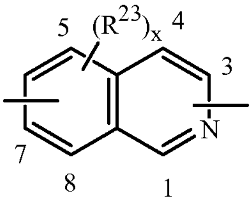

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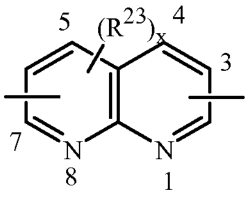

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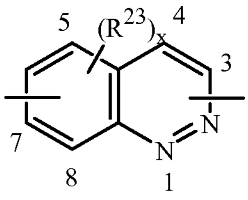

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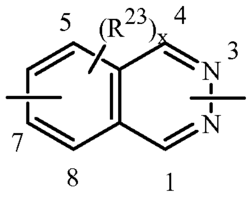

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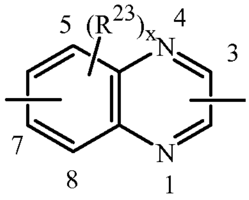

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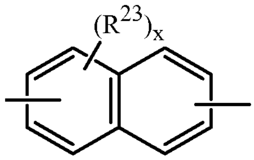

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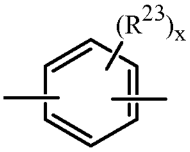

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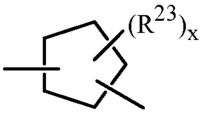

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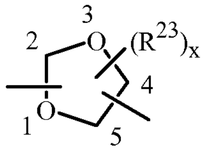

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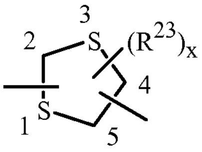

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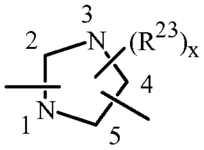

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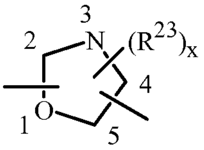

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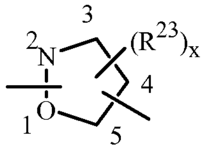

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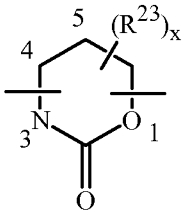

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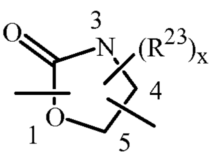

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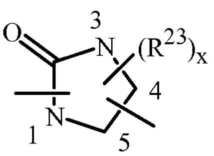

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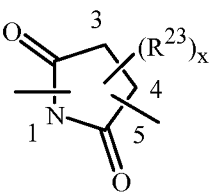

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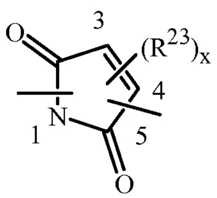

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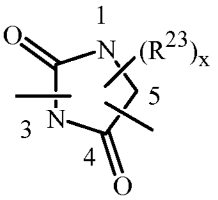

J-81

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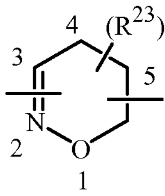
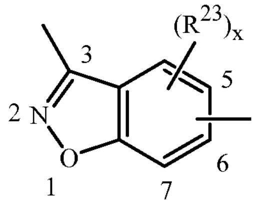


J-82

and



J-83

;

wherein one of the floating bonds is connected to G in Formula **1** through any available carbon or nitrogen atom of the depicted ring or ring system and the other floating bond is connected to Z in Formula **1** through any available carbon or nitrogen atom of the depicted ring or ring system; when R^{23} is attached to a carbon ring member, said R^{23} is selected from R^{23a}, and when R^{23} is attached to a nitrogen ring member, said R^{23} is selected from R^{23b}; and x is an integer from 0 to 5.

Embodiment 116. A compound of Embodiment 115 wherein J is a ring selected from the group consisting of J-1, J-2, J-3, J-4, J-5, J-7, J-8, J-9, J-10, J-11, J-12, J-14, J-15, J-16, J-20, J-24, J-25, J-26, J-29, J-30, J-37, J-38, J-45 and J-69.

Embodiment 117. A compound of Embodiment 116 wherein J is selected from J-4, J-5, J-8, J-11, J-15, J-16, J-20, J-29, J-30, J-37, J-38 and J-69.

Embodiment 118. A compound of Embodiment 117 wherein J is selected from J-4, J-5, J-11, J-20, J-29, J-37, J-38 and J-69.

Embodiment 119. A compound of Embodiment 118 wherein J is J-11.

Embodiment 120. A compound of Embodiment 118 wherein J is J-29.

Embodiment 121. A compound of Embodiment 118 wherein J is J-69.

Embodiment 122. A compound of any one of Embodiments 115 through 121, either taken alone or in combination, wherein x is 0 or 1.

Embodiment 123. A compound of Embodiment 122 wherein x is 0.

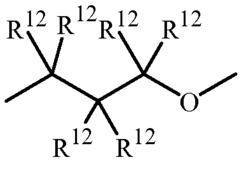
Embodiment 124. A compound of Embodiment 122 wherein x is 1.

Embodiment 124a. A compound of Embodiment 124 wherein R^{23} is cyano or C_1-C_3 alkyl.

Embodiment 125. A compound of Formula **1** or any one of Embodiments 1 through 124, either taken alone or in combination, wherein Z is Z^1.

Embodiment 125A. A compound of Formula **1** or any one of Embodiments 1 through 124, either taken alone or in combination, wherein Z is Z^1-1 through Z^1-41.

Embodiment 126. A compound of Formula **1** or any one of Embodiments 1 through 124, either taken alone or in combination, wherein Z is



Z-1

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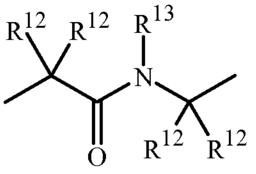
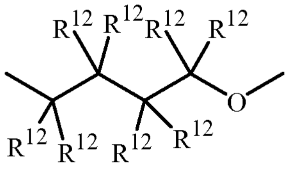


Z-2

or



Z-3

.

wherein the orientation of the Z group is such that the bond extending to the left is attached to J in Formula **1** and the bond extending to the right is attached to Q in Formula **1**.

Embodiment 127. A compound of Embodiment 125 and 126 wherein Z is selected from Z^1-1, Z^1-4, Z^1-14, Z^1-16, Z^1-18, Z-1, Z-2 and Z-3.

Embodiment 128. A compound of Embodiment 127 wherein Z is selected from Z^1-1, Z^1-16, Z^1-18, Z-1 and Z-3.

Embodiment 129. A compound of Embodiment 128 wherein Z is Z^1-1 , Z^1-16 or Z-1.

Embodiment 130. A compound of Embodiment 129 wherein Z is Z^1-1.

Embodiment 131. A compound of Embodiment 129 wherein Z is Z^1-16.

Embodiment 132. A compound of Formula **1** or any one of Embodiments 1 through 131, either taken alone or in combination, wherein each R^{12} is independently hydrogen, halogen, C_1–C_4 alkyl or C_1–C_4 alkoxy.

Embodiment 133. A compound of Embodiment 132 wherein each R^{12} is independently hydrogen or methyl.

Embodiment 134. A compound of Embodiment 133 wherein each R^{12} is independently hydrogen.

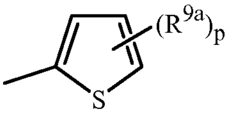
Embodiment 135. A compound of Formula **1** or any one of Embodiments 1 through 134, either taken alone or in combination, wherein Q is phenyl or naphthalenyl each optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^{9a}; or

a 5- to 6-membered heteroaromatic ring or an 8- to 11-membered heteroaromatic bicyclic ring system containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, and optionally substituted with up to 5 substituents independently selected from R^{9a} on carbon atom ring members and R^{9b} on nitrogen atom ring members; or

a 3- to 7-membered nonaromatic carbocyclic ring, a 5- to 7-membered nonaromatic heterocyclic ring or an 8- to 11-membered nonaromatic bicyclic ring system, each ring or ring system containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, wherein up to 3 carbon atom ring members are independently selected from C(=O) and C(=S) and the sulfur atom ring members are independently selected from $S(=O)_s(=NR^{17})_f$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{9a} on carbon atom ring members and R^{9b} on nitrogen atom ring members;

Embodiment 136. A compound of Embodiment 135 wherein Q is a ring selected from Q-1 through Q-102, shown below in Exhibit 5;

Exhibit 5



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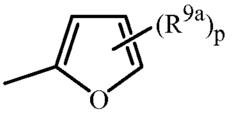
Q-1



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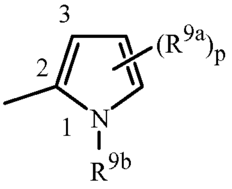
Q-2



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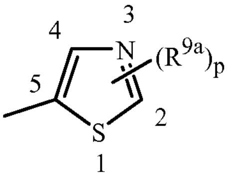
Q-3



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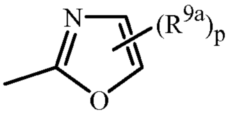
Q-4



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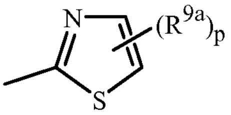
Q-5



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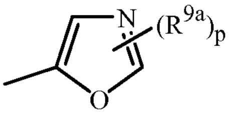
Q-6



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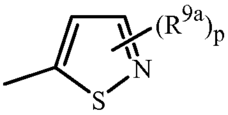
Q-7



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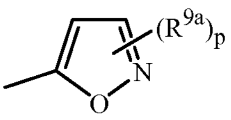
Q-8



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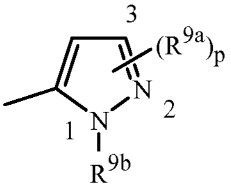

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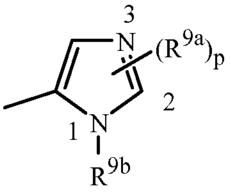
Q-10



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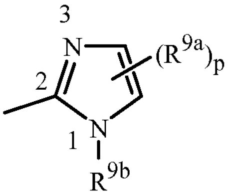

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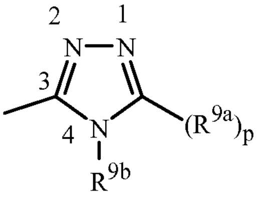
Q-12



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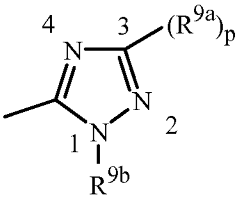
Q-13



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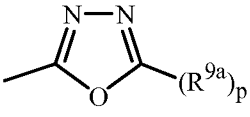

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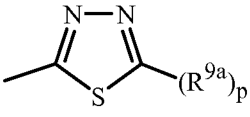

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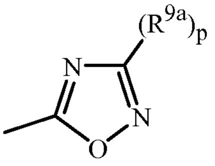

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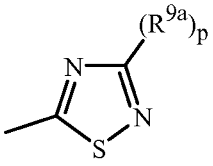

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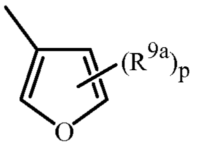

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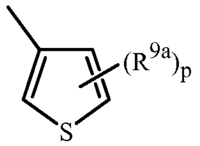

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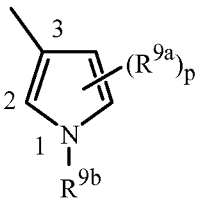

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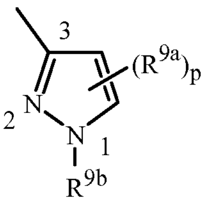

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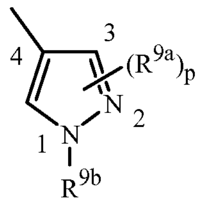

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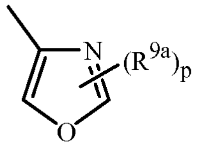

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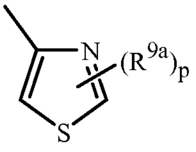

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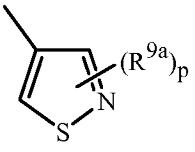

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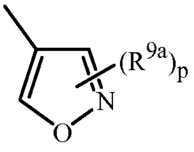

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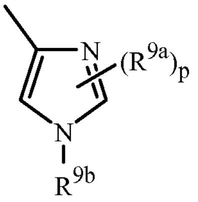

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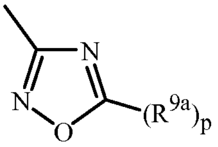

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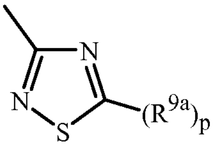

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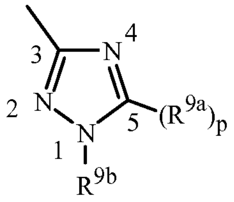

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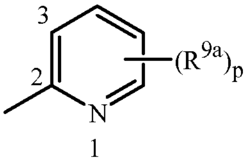

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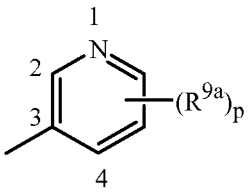

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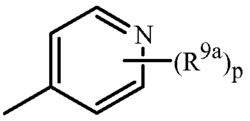

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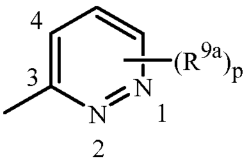

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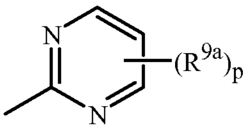

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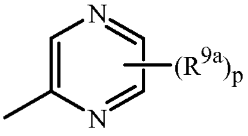

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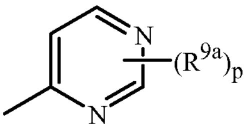

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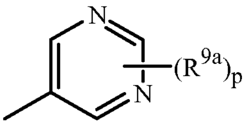

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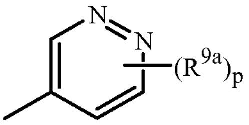

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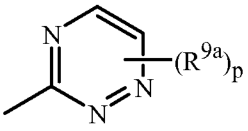

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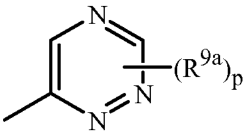

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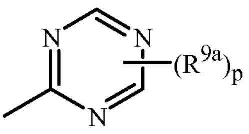

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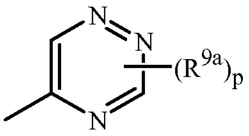

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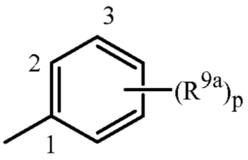

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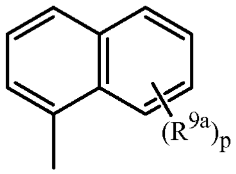

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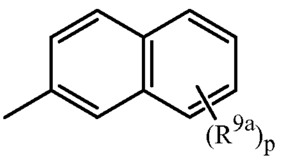

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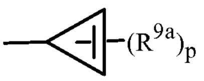

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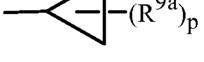

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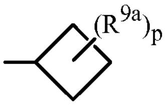

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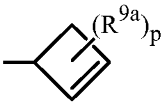

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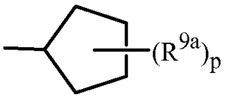

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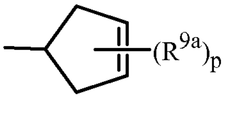

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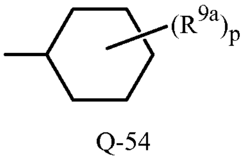

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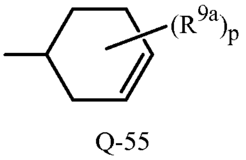

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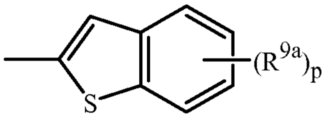

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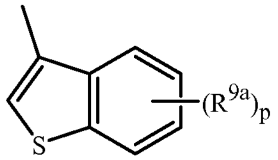

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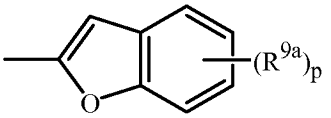

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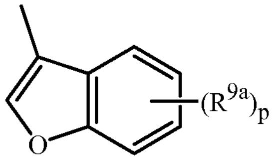

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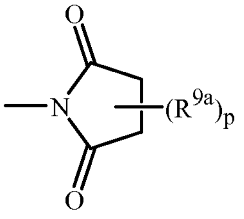

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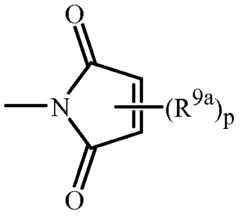

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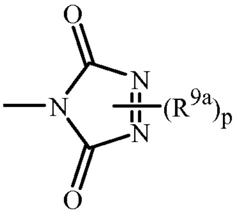

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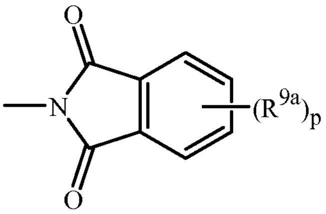

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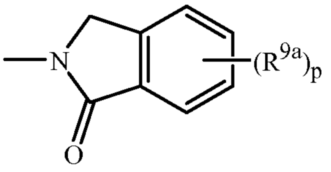

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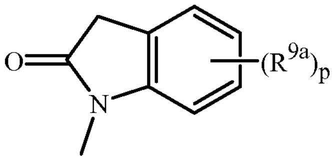

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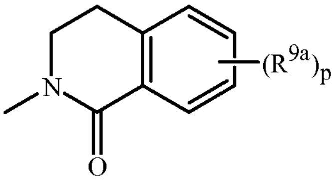

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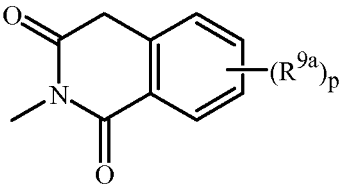

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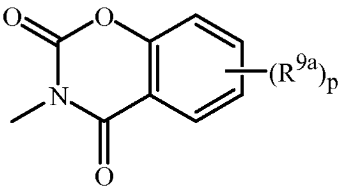

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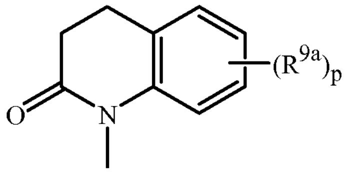

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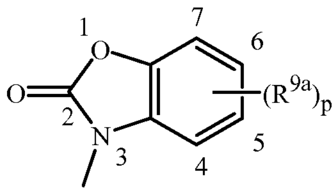

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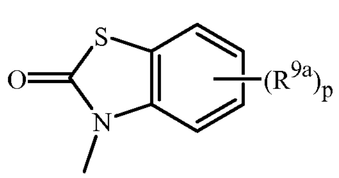

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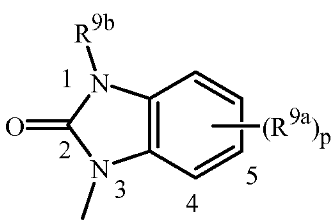

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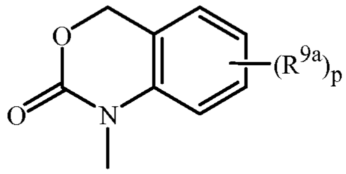

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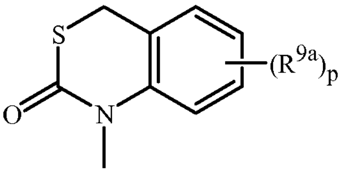

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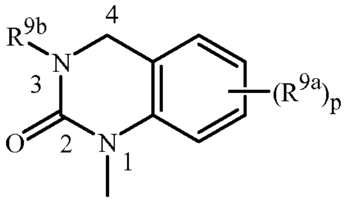

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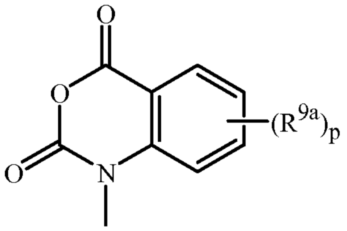

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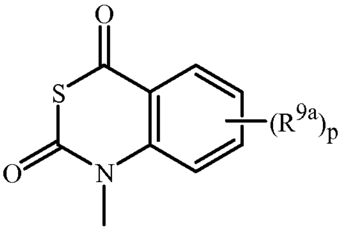

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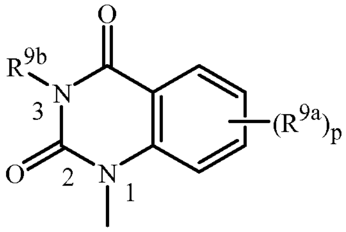

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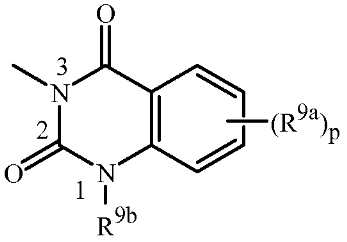

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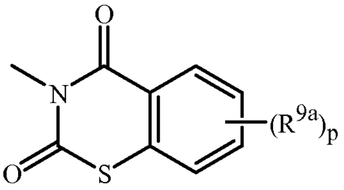

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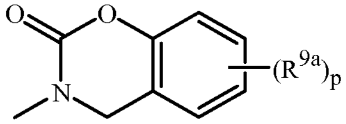

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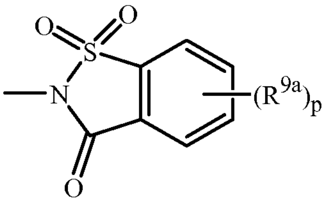

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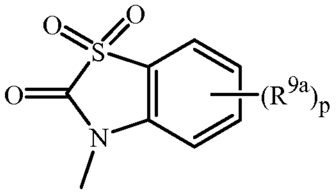

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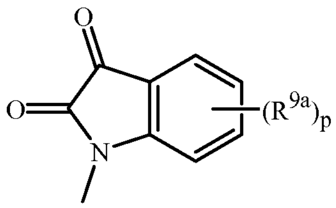

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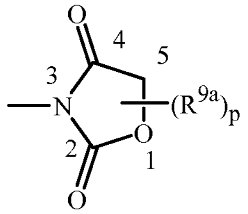
Q-84



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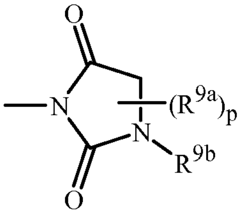
Q-85



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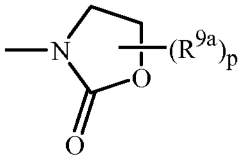

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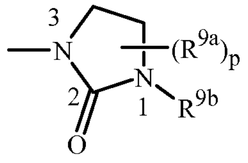
Q-87



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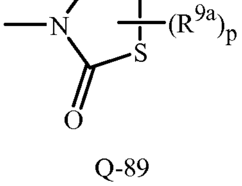

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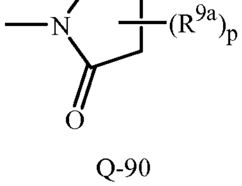

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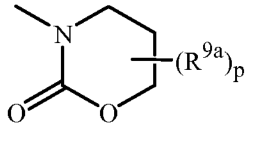
Q-90



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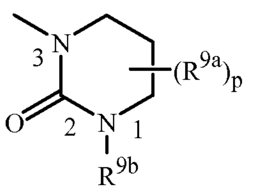

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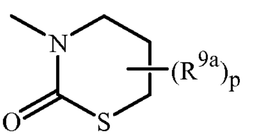

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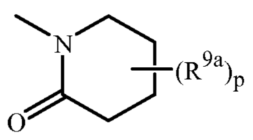

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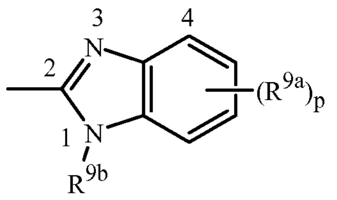

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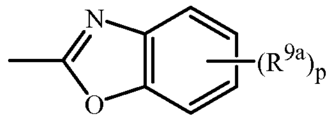

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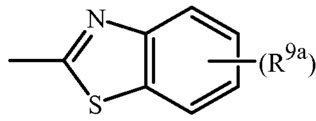

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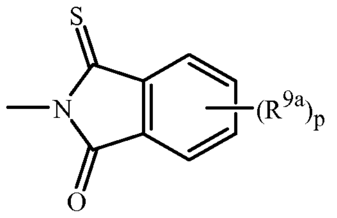

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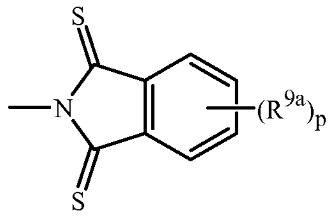

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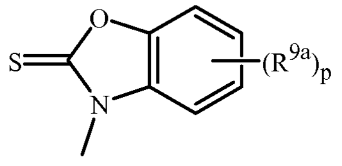

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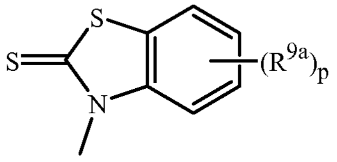
Q-100



and

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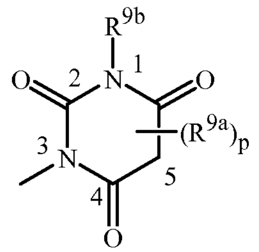


;

Q-102

;

wherein p is 0, 1, 2, 3, 4 or 5.

Embodiment 137. A compound of Embodiment 136 wherein Q is selected from Q-1, Q-20, Q-32 through Q-34, Q-45 through Q-47, Q-60 through Q-73, Q-76 through Q-79, Q-84 through Q-94 and Q-98 through Q-102.

Embodiment 138. A compound of Embodiment 137 wherein Q is selected from Q-1, Q-45, Q-63, Q-64, Q-65, Q-68, Q-69, Q-70, Q-71, Q-72, Q-73, Q-76, Q-78, Q-79, Q-84, Q-85, Q-98, Q-99, Q-100 through Q-102.

Embodiment 139. A compound of Embodiment 138 wherein Q is selected from Q-45, Q-63, Q-64, Q-65, Q-68, Q-69, Q-70, Q-71, Q-72, Q-84 and Q-85.

Embodiment 140. A compound of Embodiment 139 wherein Q is selected from Q-45, Q-63, Q-65, Q-70, Q-71, Q-72, Q-84 and Q-85.

Embodiment 141. A compound of Embodiment 140 wherein Q is selected from Q-45, Q-63, Q-65, Q-70, Q-71, Q-72 and Q-84.

Embodiment 142. A compound of Embodiment 141 wherein Q is selected from Q-45, Q-63, Q-70, Q-71, Q-72 and Q-84.

Embodiment 143. A compound of Embodiment 142 wherein Q is Q-45.

Embodiment 144. A compound of any one of Embodiment 136 through 143, either taken alone or in combination, wherein p is 0, 1, 2 or 3.

Embodiment 145. A compound of Formula **1** or any one of Embodiments 1 through 144, either taken alone or in combination, wherein each R^{9a} is independently halogen, hydroxy, amino, cyano, nitro, C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_6 cycloalkyl, C_4–C_{10} cycloalkylalkyl, C_4–C_{10} alkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_6–C_{14} cycloalkylcycloalkyl, C_1–C_6 haloalkyl, C_2–C_6 haloalkenyl, C_2–C_6 haloalkynyl, C_3–C_6 halocycloalkyl, C_1–C_4 alkoxy, C_1–C_4 haloalkoxy, C_1–C_4 alkylthio, C_1–C_4 alkylsulfinyl, C_1–C_4 alkylsulfonyl, C_1–C_4 haloalkylthio, C_1–C_4 haloalkylsulfinyl, C_1–C_4 haloalkylsulfonyl, C_1–C_4 alkylamino, C_2–C_8 dialkylamino, C_3–C_6 cycloalkylamino, C_2–C_4 alkoxyalkyl, C_1–C_4 hydroxyalkyl, C_2–C_4 alkylcarbonyl, C_2–C_6 alkoxycarbonyl, C_2–C_6 alkylcarbonyloxy, C_2–C_6 alkylcarbonylthio, C_2–C_6 alkylaminocarbonyl, C_3–C_8 dialkylaminocarbonyl or C_3–C_6 trialkylsilyl; or
phenyl optionally substituted with up to 3 substituents independently selected from halogen, C_1–C_2 alkyl, C_1–C_2 haloalkyl and C_1–C_2 alkoxy; or
a 5- to 6-membered heteroaromatic ring containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, and optionally substituted with up to 3 substituents independently selected from halogen, cyano, C_1–C_2 alkyl, C_1–C_2 haloalkyl, C_1–C_2 alkoxy and C_1–C_2 haloalkoxy on carbon atom ring members and cyano, C_1–C_2 alkyl and C_1–C_2 alkoxy on nitrogen atom ring members.

Embodiment 146. A compound of Embodiment 145 wherein each R^{9a} is independently halogen, amino, cyano, C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_6 cycloalkyl, C_4–C_{10} cycloalkylalkyl, C_1–C_6 haloalkyl, C_3–C_6 halocycloalkyl, C_1–C_4 alkoxy, C_1–C_4 haloalkoxy, C_1–C_4 alkylthio, C_1–C_4 alkylsulfonyl, C_1–C_4 alkylamino, C_2–C_8 dialkylamino, C_2–C_4 alkoxyalkyl, C_2–C_4 alkylcarbonyl, C_2–C_6 alkoxycarbonyl, C_2–C_6 alkylcarbonyloxy, C_2–C_6 alkylaminocarbonyl or C_3–C_8 dialkylaminocarbonyl; or
phenyl optionally substituted with up to 3 substituents independently selected from halogen, C_1–C_2 alkyl, C_1–C_2 haloalkyl and C_1–C_2 alkoxy.

Embodiment 147. A compound of Embodiment 146 wherein each R^{9a} is independently halogen, C_1–C_6 alkyl, C_1–C_6 haloalkyl or C_1–C_4 alkoxy.

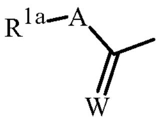
Embodiment 148. A compound of Formula **1** or any one of Embodiments 1 through 147, either taken alone or in combination, wherein each R^{9b} is independently hydrogen, C_1–C_3 alkyl, C_2–C_3 alkylcarbonyl, C_2–C_3 alkoxycarbonyl or C_3–C_6 cycloalkyl.

Embodiments of this invention, including Embodiments 1–148 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 invention, including Embodiments 1–148 above as well as any other embodiments described herein, and any combination thereof, pertain to the compositions and methods of the present invention.

Combinations of Embodiments 1–148 are illustrated by:

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

E is a radical selected from the group consisting of



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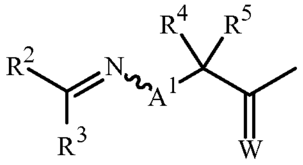

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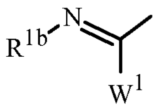

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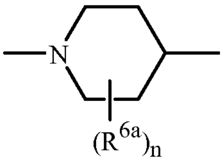
E-1 E-2 E-3

X is a radical selected from the group consisting of



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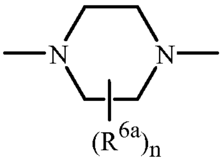

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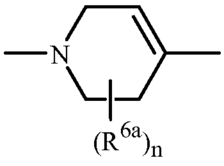
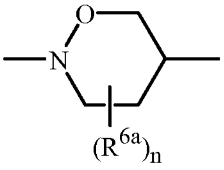


X-1 X-2 X-3



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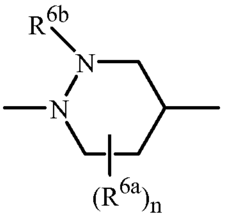

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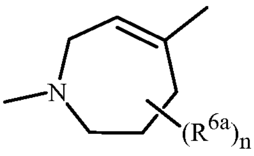
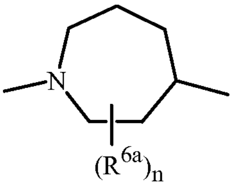


X-4 X-5 X-6



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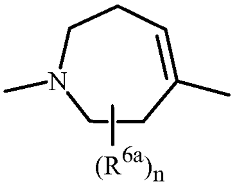

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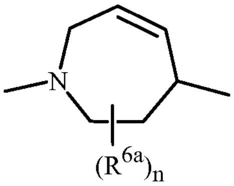
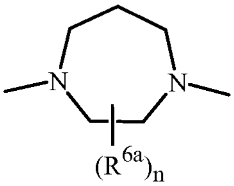


and

X-7 X-8 X-9


;

X-10

wherein the orientation of the X group is such that the bond extending to the left is attached to E in Formula **1** and the bond extending to the right is attached to G in Formula **1**;

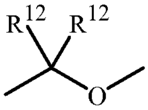
G is a 5-membered heterocyclic ring optionally substituted with up to 3 substituents independently selected from R^{29a} on carbon atom ring members and R^{30a} on nitrogen atom ring members;

J is a 5-, 6- or 7-membered ring, a 8- to 11-membered bicyclic ring system or a 7- to 11-membered spirocyclic ring system, each ring or ring system containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S, up to 4 N and up to 2 Si atoms, wherein up to 3 carbon atom ring members are independently selected from C(=O) and C(=S), the sulfur atom ring members are independently selected from $S(=O)_s(=NR^{17})_f$, and the silicon atom ring members are independently selected from $SiR^{10}R^{11}$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{23};

Z is Z^1; or

a 4-, 5- or 6-membered saturated or unsaturated chain containing chain members selected from carbon atoms and up to 2 heteroatoms independently selected from up to 2 O, up to 2 S, up to 2 N and up to 1 Si atoms, wherein up to 2 carbon atom chain members are independently selected from C(=O), C(=S) and C(=NOH), the sulfur atom chain members are independently selected from $S(=O)_s(=NR^{17})_f$, and the silicon atom chain members are independently selected from $SiR^{10}R^{11}$, each chain optionally substituted with up to 4 substituents independently selected from R^{12} on carbon atom chain members and R^{13} on nitrogen atom chain members;

Z^1 is a radical selected from the group consisting of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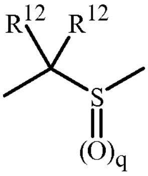
Z^1-1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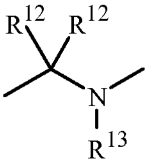
Z^1-2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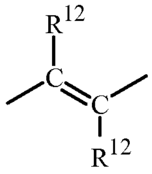
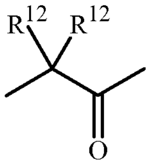
Z^1-3

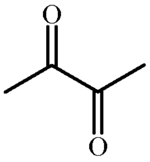


Z^1-4,

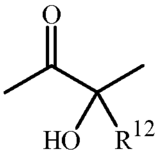
Z^1-5,



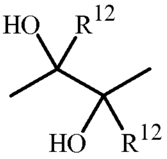
Z^1-6,



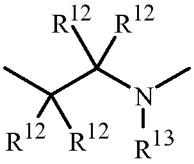
Z^1-7,



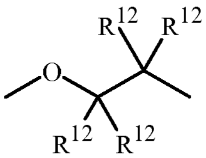
Z^1-8,



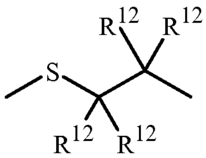
Z^1-9,



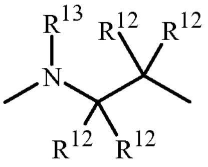
Z^1-10,



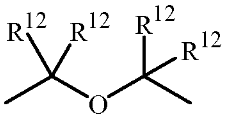
Z^1-11,



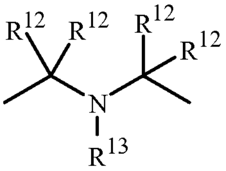
Z^1-12,



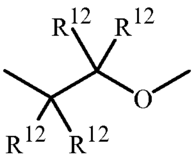
Z^1-13,



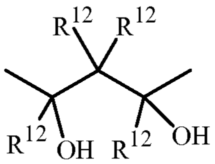
Z^1-14,



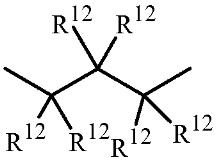
Z^1-15,



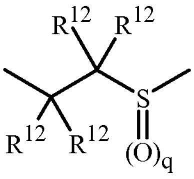
Z^1-16,



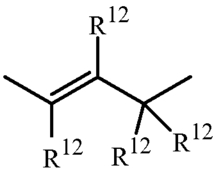
Z^1-17,



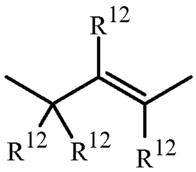
Z^1-18,



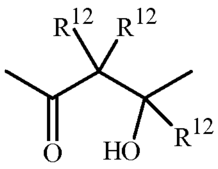
Z^1-19,



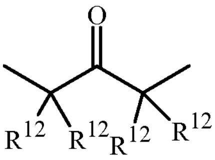
Z^1-20,



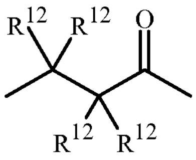
Z^1-21,



Z^1-22,



Z^1-23,



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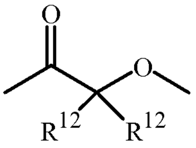
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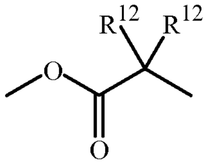
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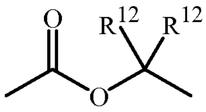
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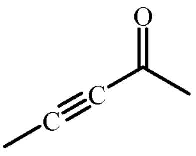
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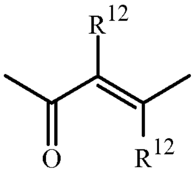
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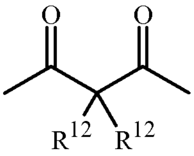
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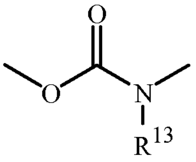
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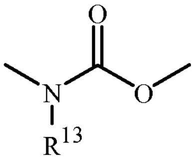
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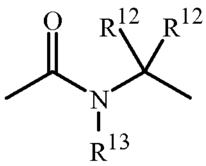
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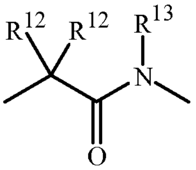
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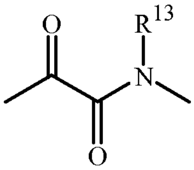
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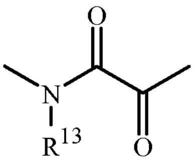
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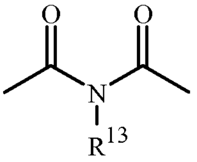
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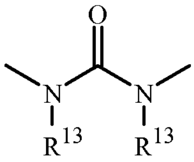
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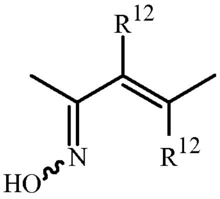
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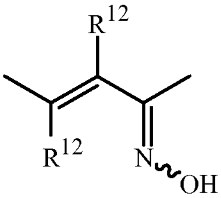
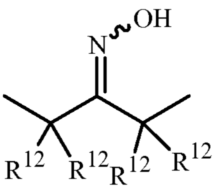

Z^1-40
and


Z^1-41
;

wherein the orientation of the Z^1 group is such that the bond extending to the left is attached to J in Formula **1** and the bond extending to the right is attached to Q in Formula **1**;

Q is phenyl or naphthalenyl each optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^{9a}; or

a 5- to 6-membered heteroaromatic ring or an 8- to 11-membered heteroaromatic bicyclic ring system containing ring members selected from carbon atoms and up

to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, and optionally substituted with up to 5 substituents independently selected from R^{9a} on carbon atom ring members and R^{9b} on nitrogen atom ring members; or

a 3- to 7-membered nonaromatic carbocyclic ring, a 5- to 7-membered nonaromatic heterocyclic ring or an 8- to 11-membered nonaromatic bicyclic ring system, each ring or ring system containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S, up to 4 N and up to 2 Si atoms, wherein up to 3 carbon atom ring members are independently selected from C(=O) and C(=S), the sulfur atom ring members are independently selected from $S(=O)_g(=NR^{17})_f$, and the silicon atom ring members are independently selected from $SiR^{10}R^{11}$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{9a} on carbon atom ring members and R^{9b} on nitrogen atom ring members;

A is CHR^{15}, NR^{16} or C(=O);

A^1 is -O-, -S-, $-N(R^7)-$, $-C(R^8)_2-$, $-OC(R^8)_2-$, $-SC(R^8)_2-$ or $-N(R^7)C(R^8)_2-$, wherein the bond projecting to the left is connected to $-N=C(R^2)(R^3)$, and the bond projecting to the right is connected to $-C(R^4)(R^5)-$;

W is O or S;

W^1 is OR^{18}, SR^{19}, $NR^{20}R^{21}$ or R^{22};

R^{1a} and R^{1b} independently are an optionally substituted phenyl, an optionally substituted naphthalenyl or an optionally substituted 5- to 6-membered heteroaromatic ring; or cyano, C_1–C_8 alkyl, C_2–C_8 alkenyl, C_2–C_8 alkynyl, C_1–C_8 haloalkyl, C_2–C_8 haloalkenyl, C_2–C_8 haloalkynyl, C_3–C_8 cycloalkyl, C_3–C_8 halocycloalkyl, C_4–C_{10} alkylcycloalkyl, C_4–C_{10} cycloalkylalkyl, C_4–C_{10} halocycloalkylalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_4–C_{10} cycloalkoxyalkyl, C_3–C_{10} alkoxyalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 haloalkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_3–C_8 alkoxycarbonylalkyl, C_3–C_8 haloalkoxycarbonylalkyl, C_2–C_8 alkylaminoalkyl, C_3–C_{10} dialkylaminoalkyl, C_2–C_8 haloalkylaminoalkyl, C_4–C_{10} cycloalkylaminoalkyl, C_1–C_8 alkoxy, C_1–C_8 haloalkoxy, C_3–C_8 cycloalkoxy, C_3–C_8 halocycloalkoxy, C_4–C_{10} cycloalkylalkoxy, C_2–C_8 alkenyloxy, C_2–C_8 haloalkenyloxy, C_2–C_8 alkynyloxy, C_3–C_8 haloalkynyloxy, C_2–C_8 alkoxyalkoxy, C_2–C_8 alkylcarbonyloxy, C_2–C_8 haloalkylcarbonyloxy, C_1–C_8 alkylthio, C_1–C_8 haloalkylthio, C_3–C_8 cycloalkylthio, C_3–C_{10} trialkylsilyl, C_1–C_8 alkylamino, C_2–C_8 dialkylamino, C_1–C_8 haloalkylamino, C_2–C_8 halodialkylamino, C_3–C_8 cycloalkylamino, C_2–C_8 alkylcarbonylamino,

C_2–C_8 haloalkylcarbonylamino, C_1–C_8 alkylsulfonylamino, C_1–C_8 haloalkylsulfonylamino, pyrrolidinyl, piperidinyl or morpholinyl;

R^2 is hydrogen, halogen, cyano, amino, -CHO, -C(=O)OH, -C(=O)NH_2, 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_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_4–C_6 alkylcycloalkyl, C_4–C_6 cycloalkylalkyl, C_4–C_6 halocycloalkylalkyl, C_3–C_6 cycloalkenyl, C_3–C_6 halocycloalkenyl, C_2–C_6 alkoxyalkyl, C_2–C_6 alkylthioalkyl, C_2–C_6 alkylsulfinylalkyl, C_2–C_6 alkylsulfonylalkyl, C_2–C_6 alkylaminoalkyl, C_3–C_6 dialkylaminoalkyl, C_2–C_6 haloalkylaminoalkyl, C_2–C_6 alkylcarbonyl, C_2–C_6 haloalkylcarbonyl, C_4–C_6 cycloalkylcarbonyl, C_2–C_6 alkoxycarbonyl, C_4–C_6 cycloalkoxycarbonyl, C_5–C_6 cycloalkylalkoxycarbonyl, C_2–C_6 alkylaminocarbonyl, C_3–C_6 dialkylaminocarbonyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_3–C_6 cycloalkoxy, C_3–C_6 halocycloalkoxy, C_2–C_6 alkenyloxy, C_2–C_6 haloalkenyloxy, C_2–C_6 alkynyloxy, C_3–C_6 haloalkynyloxy, C_2–C_6 alkoxyalkoxy, C_2–C_6 alkylcarbonyloxy, C_2–C_6 haloalkylcarbonyloxy, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio, C_3–C_6 cycloalkylthio, C_1–C_6 alkylamino, C_2–C_6 dialkylamino, C_1–C_6 haloalkylamino, C_2–C_6 halodialkylamino, C_3–C_6 cycloalkylamino, C_2–C_6 alkylcarbonylamino, C_2–C_6 haloalkylcarbonylamino, C_1–C_6 alkylsulfonylamino or C_1–C_6 haloalkylsulfonylamino;

R^3 is hydrogen, halogen, cyano, hydroxy, C_1–C_3 alkyl, C_1–C_3 haloalkyl, C_1–C_3 alkoxy or C_1–C_3 haloalkoxy; or

R^2 and R^3 are taken together with the carbon atom to which they are attached to form a 3- to 7-membered ring containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S, up to 2 N and up to 2 Si atoms, wherein up to 3 carbon atom ring members are independently selected from C(=O) and C(=S), the sulfur atom ring members are independently selected from $S(=O)_s(=NR^{17})_f$, and the silicon atom ring members are independently selected from $SiR^{10}R^{11}$, the ring optionally substituted with up to 4 substituents independently selected from halogen, cyano, C_1–C_2 alkyl, C_1–C_2 haloalkyl, C_1–C_2 alkoxy and C_1–C_2 haloalkoxy on carbon atom ring members and cyano, C_1–C_2 alkyl and C_1–C_2 alkoxy on nitrogen atom ring members;

R^4 is optionally substituted phenyl, optionally substituted naphthalenyl or an optionally substituted 5- to 6-membered heteroaromatic ring; or hydrogen, halogen, cyano, hydroxy, -CHO, C_1–C_4 alkyl, C_2–C_4 alkenyl, C_2–C_4 alkynyl, C_1–C_4 haloalkyl, C_2–C_4 haloalkenyl, C_2–C_4 haloalkynyl, C_2–C_4 alkoxyalkyl, C_2–C_4 alkylthioalkyl, 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_2–C_5

alkylaminocarbonyl, C_3–C_5 dialkylaminocarbonyl, 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, C_2–C_4 alkylcarbonyloxy, C_2–C_4 haloalkylcarbonyloxy, C_2–C_5 alkoxycarbonyloxy, C_2–C_5 alkylaminocarbonyloxy or C_3–C_5 dialkylaminocarbonyloxy;

R^5 is hydrogen, C_1–C_3 alkyl or C_1–C_3 haloalkyl;

each R^{6a} is independently C_1–C_4 alkyl, C_1–C_4 alkenyl, C_1–C_4 haloalkyl, C_1–C_4 alkoxy, halogen, cyano or hydroxy; or

two R^{6a} are taken together as C_1–C_4 alkylene or C_2–C_4 alkenylene to form a bridged bicyclic or fused bicyclic ring system; or

two R^{6a} attached to adjacent ring carbon atoms joined by a double bond are taken together as –CH=CH–CH=CH– optionally substituted with up to 3 substituents selected from C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_1–C_4 alkoxy, C_1–C_4 haloalkoxy, halogen, hydroxy, amino, cyano and nitro;

R^{6b} is hydrogen, cyano, C_1–C_3 alkyl, C_1–C_3 haloalkyl, C_1–C_3 alkoxy, C_2–C_3 alkylcarbonyl, C_2–C_3 alkoxycarbonyl or C_3–C_6 cycloalkyl;

R^7 is hydrogen, cyano, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_2–C_4 alkoxyalkyl, C_2–C_4 alkylthioalkyl, C_2–C_4 alkylcarbonyl, C_2–C_4 haloalkylcarbonyl, C_2–C_4 alkoxycarbonyl, C_2–C_4 alkylaminocarbonyl, C_3–C_5 dialkylaminocarbonyl, C_1–C_4 alkylsulfonyl or C_1–C_4 haloalkylsulfonyl; or

R^3 and R^7 are taken together with the linking atoms to which they are attached to form a 5- to 7-membered partially saturated ring containing ring members, in addition to the linking atoms, selected from carbon atoms and up to 3 heteroatoms independently selected from up to 1 O, up to 1 S and up to 1 N atom, the ring optionally substituted with up to 3 substituents independently selected from halogen, cyano, nitro, C_1–C_2 alkyl, C_1–C_2 haloalkyl, C_1–C_2 alkoxy and C_1–C_2 haloalkoxy on carbon atom ring members and cyano, C_1–C_2 alkyl and C_1–C_2 alkoxy on nitrogen atom ring members;

each R^8 is independently hydrogen, C_1–C_3 alkyl or C_1–C_3 haloalkyl;

each R^{9a} is independently halogen, hydroxy, amino, cyano, nitro, C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_6 cycloalkyl, C_4–C_{10} cycloalkylalkyl, C_4–C_{10} alkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_6–C_{14} cycloalkylcycloalkyl, C_1–C_6 haloalkyl, C_2–C_6 haloalkenyl, C_2–C_6 haloalkynyl, C_3–C_6 halocycloalkyl, C_1–C_4 alkoxy, C_1–C_4 haloalkoxy, C_1–C_4 alkylthio, C_1–C_4 alkylsulfinyl, C_1–C_4 alkylsulfonyl, C_1–C_4 haloalkylthio, C_1–C_4 haloalkylsulfinyl, C_1–C_4 haloalkylsulfonyl, C_1–C_4 alkylamino, C_2–C_8 dialkylamino, C_3–C_6 cycloalkylamino, C_2–C_4 alkoxyalkyl, C_1–C_4 hydroxyalkyl, C_2–C_4 alkylcarbonyl, C_2–C_6 alkoxycarbonyl, C_2–C_6 alkylcarbonyloxy, C_2–C_6

alkylcarbonylthio, C_2–C_6 alkylaminocarbonyl, C_3–C_8 dialkylaminocarbonyl or C_3–C_6 trialkylsilyl; or

phenyl or naphthalenyl optionally substituted with up to 3 substituents independently selected from halogen, cyano, C_1–C_2 alkyl, C_1–C_2 haloalkyl, C_1–C_2 alkoxy and C_1–C_2 haloalkoxy; or

a 5- to 6-membered heteroaromatic ring containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, and optionally substituted with up to 3 substituents independently selected from halogen, cyano, C_1–C_2 alkyl, C_1–C_2 haloalkyl, C_1–C_2 alkoxy and C_1–C_2 haloalkoxy on carbon atom ring members and cyano, C_1–C_2 alkyl and C_1–C_2 alkoxy on nitrogen atom ring members; or

a 3- to 7-membered nonaromatic ring containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, wherein up to 3 carbon atom ring members are independently selected from C(=O) and C(=S), the ring optionally substituted with up to 3 substituents independently selected from halogen, cyano, C_1–C_2 alkyl, C_1–C_2 haloalkyl, C_1–C_2 alkoxy and C_1–C_2 haloalkoxy on carbon atom ring members and cyano, C_1–C_2 alkyl and C_1–C_2 alkoxy on nitrogen atom ring members;

each R^{9b} is independently hydrogen, cyano, C_1–C_3 alkyl, C_1–C_3 haloalkyl, C_1–C_3 alkoxy, C_2–C_3 alkylcarbonyl, C_2–C_3 alkoxycarbonyl or C_3–C_6 cycloalkyl;

each R^{10} and R^{11} is independently C_1–C_5 alkyl, C_2–C_5 alkenyl, C_2–C_5 alkynyl, C_3–C_5 cycloalkyl, C_3–C_6 halocycloalkyl, C_4–C_{10} cycloalkylalkyl, C_4–C_7 alkylcycloalkyl, C_5–C_7 alkylcycloalkylalkyl, C_1–C_5 haloalkyl, C_1–C_5 alkoxy or C_1–C_5 haloalkoxy;

each R^{12} is independently hydrogen, halogen, hydroxy, cyano, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_1–C_4 alkoxy, C_1–C_4 haloalkoxy, C_2–C_4 alkoxyalkyl, C_2–C_4 alkylcarbonyl, C_2–C_4 alkoxycarbonyl or C_3–C_6 cycloalkyl;

each R^{13} is independently hydrogen, cyano, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_1–C_4 alkoxy, C_2–C_4 alkylcarbonyl, C_2–C_4 alkoxycarbonyl or C_3–C_6 cycloalkyl;

R^{15} is hydrogen, halogen, cyano, hydroxy, -CHO, C_1–C_4 alkyl, C_2–C_4 alkenyl, C_2–C_4 alkynyl, C_1–C_4 haloalkyl, C_2–C_4 haloalkenyl, C_2–C_4 haloalkynyl, C_2–C_4 alkoxyalkyl, C_2–C_4 alkylthioalkyl, C_2–C_4 alkylsulfinylalkyl, C_2–C_4 alkylsulfonylalkyl, C_3–C_5 alkoxycarbonylalkyl, C_2–C_4 alkylcarbonyl, C_2–C_4 haloalkylcarbonyl, C_2–C_5 alkoxycarbonyl, C_2–C_5 alkylaminocarbonyl, C_3–C_5 dialkylaminocarbonyl, 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; provided that when R^{15} is hydroxy, then R^{1a} is bonded through a carbon atom to A in Formula **1**;

R^{16} is hydrogen, C_1–C_4 alkyl, C_2–C_4 alkenyl, C_3–C_4 alkynyl, C_1–C_4 haloalkyl, C_2–C_4 haloalkenyl, C_2–C_4 haloalkynyl, C_2–C_4 alkoxyalkyl, C_2–C_4 alkylthioalkyl, 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_1–C_4 alkylsulfonyl or C_1–C_4 haloalkylsulfonyl;

each R^{17} is independently hydrogen, cyano, C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_3–C_8 cycloalkyl, C_3–C_8 halocycloalkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_1–C_6 alkylamino, C_2–C_8 dialkylamino, C_1–C_6 haloalkylamino or phenyl;

R^{18} and R^{19} independently are C_1–C_6 alkyl, C_3–C_6 alkenyl, C_3–C_6 alkynyl, C_1–C_6 haloalkyl, C_3–C_6 haloalkenyl, C_3–C_6 haloalkynyl, C_3–C_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_4–C_8 halocycloalkylalkyl, C_5–C_8 alkylcycloalkylalkyl, C_2–C_6 alkoxyalkyl, C_4–C_8 cycloalkoxyalkyl, C_3–C_6 alkoxyalkoxyalkyl, C_2–C_6 alkylthioalkyl, C_2–C_6 alkylsulfinylalkyl, C_2–C_6 alkylsulfonylalkyl, C_2–C_6 alkylaminoalkyl, C_3–C_6 dialkylaminoalkyl, C_2–C_6 haloalkylaminoalkyl, C_4–C_8 cycloalkylaminoalkyl, C_2–C_6 alkylcarbonyl, C_2–C_6 haloalkylcarbonyl, C_4–C_8 cycloalkylcarbonyl, C_2–C_6 alkoxycarbonyl, C_2–C_6 alkylaminocarbonyl, C_3–C_8 dialkylaminocarbonyl or C_4–C_8 cycloalkylaminocarbonyl;

R^{20} is hydrogen, cyano, hydroxy, amino, C_1–C_6 alkyl, C_3–C_6 alkenyl, C_3–C_6 alkynyl, C_1–C_6 haloalkyl, C_3–C_6 haloalkenyl, C_3–C_6 haloalkynyl, C_3–C_6 cycloalkyl, C_4–C_8 cycloalkylalkyl, C_2–C_6 alkoxyalkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_1–C_6 alkylsulfonyl, C_1–C_6 haloalkylsulfonyl, C_2–C_6 alkylcarbonyl, C_2–C_6 haloalkylcarbonyl, C_1–C_6 alkylamino, C_2–C_8 dialkylamino, C_1–C_6 haloalkylamino or C_2–C_8 halodialkylamino;

R^{21} is hydrogen, C_1–C_6 alkyl, C_3–C_6 alkenyl, C_3–C_6 alkynyl, C_1–C_6 haloalkyl or C_3–C_6 cycloalkyl; or

R^{20} and R^{21} are taken together as $-(CH_2)_4-$, $-(CH_2)_5-$ or $-(CH_2)_2O(CH_2)_2-$;

R^{22} is hydrogen, halogen, cyano, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_2–C_4 alkoxyalkyl, C_2–C_4 alkylcarbonyl, C_2–C_4 alkoxycarbonyl, C_2–C_3 alkylaminocarbonyl or C_3–C_6 dialkylaminocarbonyl;

each R^{23} is independently selected from R^{23a} on carbon atom ring members and independently selected from R^{23b} on nitrogen atom ring members;

R^{23a} is halogen, hydroxy, cyano, C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_1–C_4 alkoxy, C_1–C_4 haloalkoxy, C_2–C_6 alkoxyalkyl, C_2–C_4 alkylcarbonyl, C_2–C_6 alkoxycarbonyl or C_3–C_6 cycloalkyl;

R^{23b} is cyano, C_1–C_3 alkyl, C_1–C_3 haloalkyl, C_1–C_3 alkoxy, C_2–C_3 alkylcarbonyl, C_2–C_3 alkoxycarbonyl or C_3–C_6 cycloalkyl;

each R^{29a} is independently hydrogen, halogen, C_1–C_3 alkyl or C_1–C_3 haloalkyl;

each R^{30a} is independently hydrogen or C_1–C_3 alkyl;

n is 0, 1 or 2;

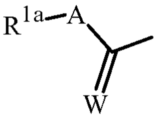
q is 0, 1 or 2; and

s and f are independently 0, 1 or 2 in each instance of $S(=O)_s(=NR^{17})_f$, provided that the sum of s and f is 0, 1 or 2;

provided that when Z is Z^1-13, then Q is other than unsubstituted phenyl.

Embodiment A. A compound of Embodiment AA or a compound of Formula **1** as described in the summary of the invention wherein

E is a radical selected from the group consisting of



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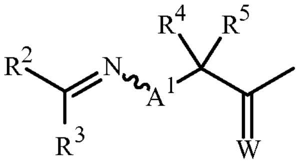
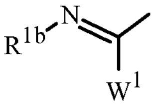


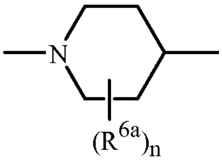
and



;

E-1 E-2 E-3

X is a radical selected from the group consisting of



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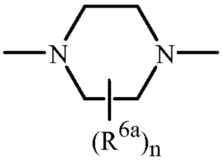

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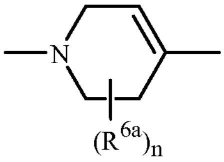
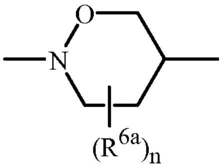


X-1 X-2 X-3



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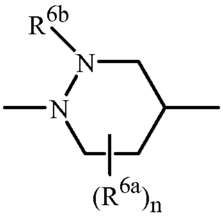

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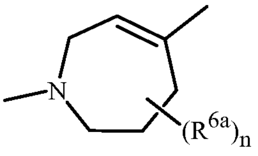
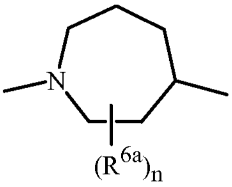


X-4 X-5 X-6



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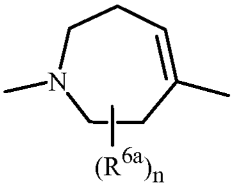

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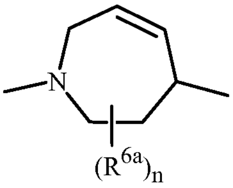
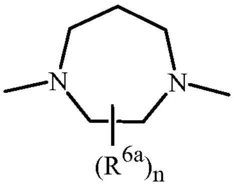


and

X-7 X-8 X-9


;

X-10

wherein the orientation of the X group is such that the bond extending to the left is attached to E in Formula **1** and the bond extending to the right is attached to G in Formula **1**;

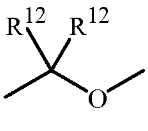
G is a 5-membered heterocyclic ring optionally substituted with up to 3 substituents independently selected from R^{29a} on carbon atom ring members and R^{30a} on nitrogen atom ring members;

J is a 5-, 6- or 7-membered ring, a 8- to 11-membered bicyclic ring system or a 7- to 11-membered spirocyclic ring system, each ring or ring system containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S, up to 4 N and up to 2 Si atoms, wherein up to 3 carbon atom ring members are independently selected from C(=O) and C(=S), the sulfur atom ring members are independently selected from $S(=O)_s(=NR^{17})_f$, and the silicon atom ring members are independently selected from $SiR^{10}R^{11}$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{23};

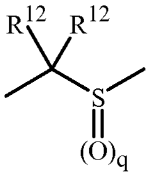
Z is Z^1; or

a 4-, 5- or 6-membered saturated or unsaturated chain containing chain members selected from carbon atoms and up to 2 heteroatoms independently selected from up to 2 O, up to 2 S, up to 2 N and up to 1 Si atoms, wherein up to 2 carbon atom chain members are independently selected from C(=O), C(=S) and C(=NOH), the sulfur atom chain members are independently selected from $S(=O)_s(=NR^{17})_f$, and the silicon atom chain members are independently selected from $SiR^{10}R^{11}$, each chain optionally substituted with up to 4 substituents independently selected from R^{12} on carbon atom chain members and R^{13} on nitrogen atom chain members;

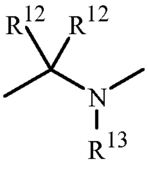
Z^1 is a radical selected from the group consisting of


,

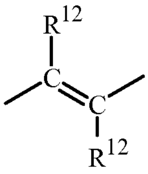
Z^1-1


,

Z^1-2

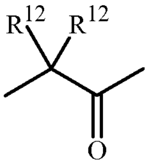

,

Z^1-3

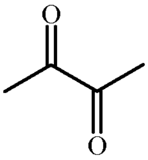


Z^1-4 ,

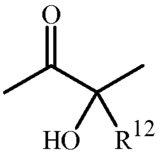
Z^1-5 ,



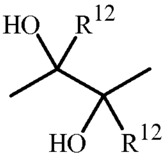
Z^1-6 ,



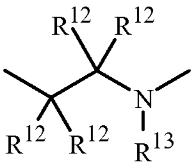
Z^1-7 ,



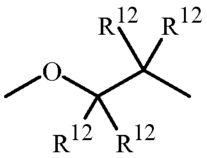
Z^1-8 ,



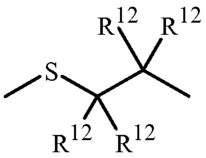
Z^1-9 ,



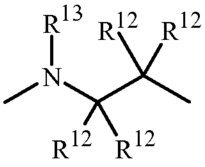
Z^1-10 ,



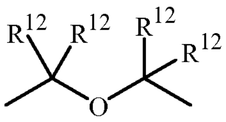
Z^1-11 ,



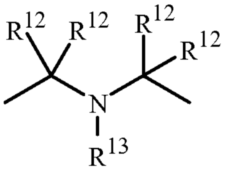
Z^1-12 ,



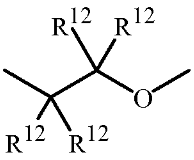
Z^1-13 ,



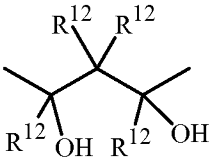
Z^1-14 ,



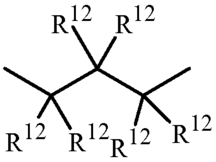
Z^1-15 ,



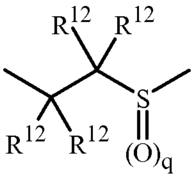
Z^1-16 ,



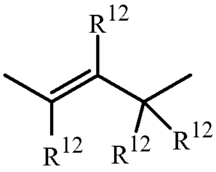
Z^1-17 ,



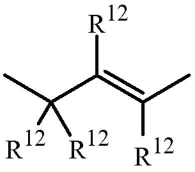
Z^1-18 ,



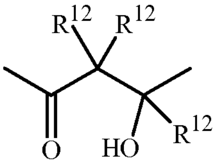
Z^1-19 ,



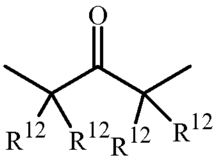
Z^1-20 ,



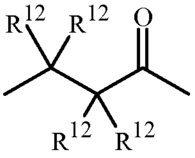
Z^1-21 ,



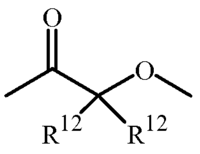
Z^1-22 ,



Z^1-23 ,



Z^1-24 ,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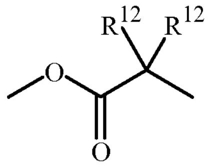
Z^1-25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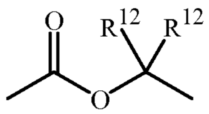
Z^1-26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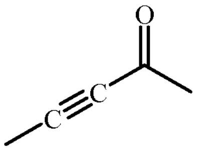
Z^1-27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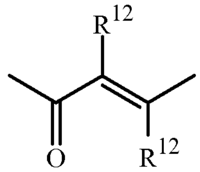
Z^1-28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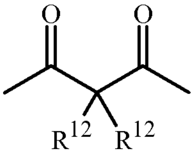
Z^1-29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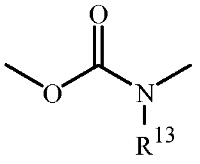
Z^1-30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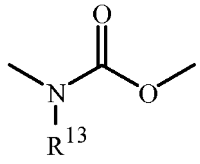
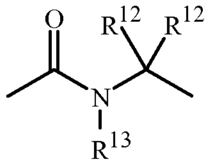
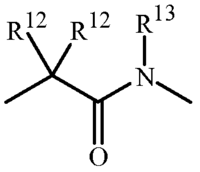
Z^1-31


,

Z^1-32


,

Z^1-33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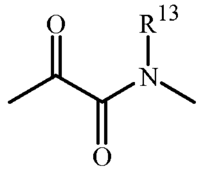
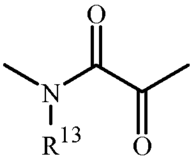
Z^1-34


,

Z^1-35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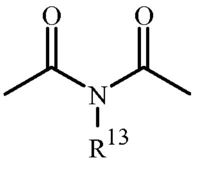
Z^1-36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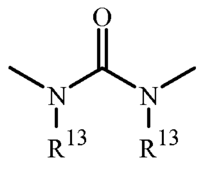
Z^1-37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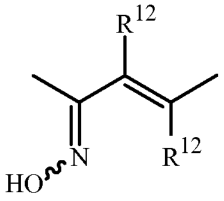
Z^1-38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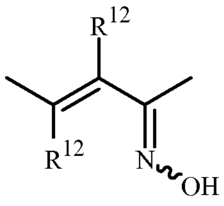
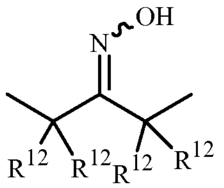
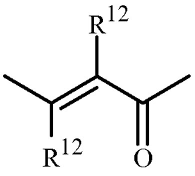
Z^1-39


,

Z^1-40


and

Z^1-41


;

Z^1-42

wherein the orientation of the Z^1 group is such that the bond extending to the left is attached to J in Formula **1** and the bond extending to the right is attached to Q in Formula **1**;

Q is phenyl or naphthalenyl each optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^{9a}; or

a 5- to 6-membered heteroaromatic ring or an 8- to 11-membered heteroaromatic bicyclic ring system containing ring members selected from carbon atoms and up

to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, and optionally substituted with up to 5 substituents independently selected from R^{9a} on carbon atom ring members and R^{9b} on nitrogen atom ring members; or

a 3- to 7-membered nonaromatic carbocyclic ring, a 5- to 7-membered nonaromatic heterocyclic ring or an 8- to 11-membered nonaromatic bicyclic ring system, each ring or ring system containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S, up to 4 N and up to 2 Si atoms, wherein up to 3 carbon atom ring members are independently selected from C(=O) and C(=S), the sulfur atom ring members are independently selected from $S(=O)_s(=NR^{17})_f$, and the silicon atom ring members are independently selected from $SiR^{10}R^{11}$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{9a} on carbon atom ring members and R^{9b} on nitrogen atom ring members;

A is CHR^{15}, NR^{16} or C(=O);

A^1 is -O-, -S-, $-N(R^7)-$, $-C(R^8)_2-$, $-OC(R^8)_2-$, $-SC(R^8)_2-$ or $-N(R^7)C(R^8)_2-$, wherein the bond projecting to the left is connected to $-N=C(R^2)(R^3)$, and the bond projecting to the right is connected to $-C(R^4)(R^5)-$;

W is O or S;

W^1 is OR^{18}, SR^{19}, $NR^{20}R^{21}$ or R^{22};

R^{1a} and R^{1b} independently are an optionally substituted phenyl, an optionally substituted naphthalenyl or an optionally substituted 5- to 6-membered heteroaromatic ring; or cyano, C_1–C_8 alkyl, C_2–C_8 alkenyl, C_2–C_8 alkynyl, C_1–C_8 haloalkyl, C_2–C_8 haloalkenyl, C_2–C_8 haloalkynyl, C_3–C_8 cycloalkyl, C_3–C_8 halocycloalkyl, C_4–C_{10} alkylcycloalkyl, C_4–C_{10} cycloalkylalkyl, C_4–C_{10} halocycloalkylalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_4–C_{10} cycloalkoxyalkyl, C_3–C_{10} alkoxyalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 haloalkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_3–C_8 alkoxycarbonylalkyl, C_3–C_8 haloalkoxycarbonylalkyl, C_2–C_8 alkylaminoalkyl, C_3–C_{10} dialkylaminoalkyl, C_2–C_8 haloalkylaminoalkyl, C_4–C_{10} cycloalkylaminoalkyl, C_1–C_8 alkoxy, C_1–C_8 haloalkoxy, C_3–C_8 cycloalkoxy, C_3–C_8 halocycloalkoxy, C_4–C_{10} cycloalkylalkoxy, C_2–C_8 alkenyloxy, C_2–C_8 haloalkenyloxy, C_2–C_8 alkynyloxy, C_3–C_8 haloalkynyloxy, C_2–C_8 alkoxyalkoxy, C_2–C_8 alkylcarbonyloxy, C_2–C_8 haloalkylcarbonyloxy, C_1–C_8 alkylthio, C_1–C_8 haloalkylthio, C_3–C_8 cycloalkylthio, C_3–C_{10} trialkylsilyl, C_1–C_8 alkylamino, C_2–C_8 dialkylamino, C_1–C_8 haloalkylamino, C_2–C_8 halodialkylamino, C_3–C_8 cycloalkylamino, C_2–C_8 alkylcarbonylamino,

C_2–C_8 haloalkylcarbonylamino, C_1–C_8 alkylsulfonylamino, C_1–C_8 haloalkylsulfonylamino, pyrrolidinyl, piperidinyl or morpholinyl;

R^2 is hydrogen, halogen, cyano, amino, -CHO, -C(=O)OH, -C(=O)NH_2, 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_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_4–C_6 alkylcycloalkyl, C_4–C_6 cycloalkylalkyl, C_4–C_6 halocycloalkylalkyl, C_3–C_6 cycloalkenyl, C_3–C_6 halocycloalkenyl, C_2–C_6 alkoxyalkyl, C_2–C_6 alkylthioalkyl, C_2–C_6 alkylsulfinylalkyl, C_2–C_6 alkylsulfonylalkyl, C_2–C_6 alkylaminoalkyl, C_3–C_6 dialkylaminoalkyl, C_2–C_6 haloalkylaminoalkyl, C_2–C_6 alkylcarbonyl, C_2–C_6 haloalkylcarbonyl, C_4–C_6 cycloalkylcarbonyl, C_2–C_6 alkoxycarbonyl, C_4–C_6 cycloalkoxycarbonyl, C_5–C_6 cycloalkylalkoxycarbonyl, C_2–C_6 alkylaminocarbonyl, C_3–C_6 dialkylaminocarbonyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_3–C_6 cycloalkoxy, C_3–C_6 halocycloalkoxy, C_2–C_6 alkenyloxy, C_2–C_6 haloalkenyloxy, C_2–C_6 alkynyloxy, C_3–C_6 haloalkynyloxy, C_2–C_6 alkoxyalkoxy, C_2–C_6 alkylcarbonyloxy, C_2–C_6 haloalkylcarbonyloxy, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio, C_3–C_6 cycloalkylthio, C_1–C_6 alkylamino, C_2–C_6 dialkylamino, C_1–C_6 haloalkylamino, C_2–C_6 halodialkylamino, C_3–C_6 cycloalkylamino, C_2–C_6 alkylcarbonylamino, C_2–C_6 haloalkylcarbonylamino, C_1–C_6 alkylsulfonylamino or C_1–C_6 haloalkylsulfonylamino;

R^3 is hydrogen, halogen, cyano, hydroxy, C_1–C_3 alkyl, C_1–C_3 haloalkyl, C_1–C_3 alkoxy or C_1–C_3 haloalkoxy; or

R^2 and R^3 are taken together with the carbon atom to which they are attached to form a 3- to 7-membered ring containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S, up to 2 N and up to 2 Si atoms, wherein up to 3 carbon atom ring members are independently selected from C(=O) and C(=S), the sulfur atom ring members are independently selected from $S(=O)_s(=NR^{17})_f$, and the silicon atom ring members are independently selected from $SiR^{10}R^{11}$, the ring optionally substituted with up to 4 substituents independently selected from halogen, cyano, C_1–C_2 alkyl, C_1–C_2 haloalkyl, C_1–C_2 alkoxy and C_1–C_2 haloalkoxy on carbon atom ring members and cyano, C_1–C_2 alkyl and C_1–C_2 alkoxy on nitrogen atom ring members;

R^4 is optionally substituted phenyl, optionally substituted naphthalenyl or an optionally substituted 5- to 6-membered heteroaromatic ring; or hydrogen, halogen, cyano, hydroxy, -CHO, C_1–C_4 alkyl, C_2–C_4 alkenyl, C_2–C_4 alkynyl, C_1–C_4 haloalkyl, C_2–C_4 haloalkenyl, C_2–C_4 haloalkynyl, C_2–C_4 alkoxyalkyl, C_2–C_4 alkylthioalkyl, 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_2–C_5

alkylaminocarbonyl, C_3–C_5 dialkylaminocarbonyl, 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, C_2–C_4 alkylcarbonyloxy, C_2–C_4 haloalkylcarbonyloxy, C_2–C_5 alkoxycarbonyloxy, C_2–C_5 alkylaminocarbonyloxy or C_3–C_5 dialkylaminocarbonyloxy;

R^5 is hydrogen, C_1–C_3 alkyl or C_1–C_3 haloalkyl;

each R^{6a} is independently C_1–C_4 alkyl, C_1–C_4 alkenyl, C_1–C_4 haloalkyl, C_1–C_4 alkoxy, halogen, cyano or hydroxy; or

two R^{6a} are taken together as C_1–C_4 alkylene or C_2–C_4 alkenylene to form a bridged bicyclic or fused bicyclic ring system; or

two R^{6a} attached to adjacent ring carbon atoms joined by a double bond are taken together as –CH=CH–CH=CH– optionally substituted with up to 3 substituents selected from C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_1–C_4 alkoxy, C_1–C_4 haloalkoxy, halogen, hydroxy, amino, cyano and nitro;

R^{6b} is hydrogen, cyano, C_1–C_3 alkyl, C_1–C_3 haloalkyl, C_1–C_3 alkoxy, C_2–C_3 alkylcarbonyl, C_2–C_3 alkoxycarbonyl or C_3–C_6 cycloalkyl;

R^7 is hydrogen, cyano, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_2–C_4 alkoxyalkyl, C_2–C_4 alkylthioalkyl, C_2–C_4 alkylcarbonyl, C_2–C_4 haloalkylcarbonyl, C_2–C_4 alkoxycarbonyl, C_2–C_4 alkylaminocarbonyl, C_3–C_5 dialkylaminocarbonyl, C_1–C_4 alkylsulfonyl or C_1–C_4 haloalkylsulfonyl; or

R^3 and R^7 are taken together with the linking atoms to which they are attached to form a 5- to 7-membered partially saturated ring containing ring members, in addition to the linking atoms, selected from carbon atoms and up to 3 heteroatoms independently selected from up to 1 O, up to 1 S and up to 1 N atom, the ring optionally substituted with up to 3 substituents independently selected from halogen, cyano, nitro, C_1–C_2 alkyl, C_1–C_2 haloalkyl, C_1–C_2 alkoxy and C_1–C_2 haloalkoxy on carbon atom ring members and cyano, C_1–C_2 alkyl and C_1–C_2 alkoxy on nitrogen atom ring members;

each R^8 is independently hydrogen, C_1–C_3 alkyl or C_1–C_3 haloalkyl;

each R^{9a} is independently halogen, hydroxy, amino, cyano, nitro, C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_6 cycloalkyl, C_4–C_{10} cycloalkylalkyl, C_4–C_{10} alkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_6–C_{14} cycloalkylcycloalkyl, C_1–C_6 haloalkyl, C_2–C_6 haloalkenyl, C_2–C_6 haloalkynyl, C_3–C_6 halocycloalkyl, C_1–C_4 alkoxy, C_1–C_4 haloalkoxy, C_1–C_4 alkylthio, C_1–C_4 alkylsulfinyl, C_1–C_4 alkylsulfonyl, C_1–C_4 haloalkylthio, C_1–C_4 haloalkylsulfinyl, C_1–C_4 haloalkylsulfonyl, C_1–C_4 alkylamino, C_2–C_8 dialkylamino, C_3–C_6 cycloalkylamino, C_2–C_4 alkoxyalkyl, C_1–C_4 hydroxyalkyl, C_2–C_4 alkylcarbonyl, C_2–C_6 alkoxycarbonyl, C_2–C_6 alkylcarbonyloxy, C_2–C_6

alkylcarbonylthio, C_2–C_6 alkylaminocarbonyl, C_3–C_8 dialkylaminocarbonyl or C_3–C_6 trialkylsilyl; or

phenyl or naphthalenyl optionally substituted with up to 3 substituents independently selected from halogen, cyano, C_1–C_2 alkyl, C_1–C_2 haloalkyl, C_1–C_2 alkoxy and C_1–C_2 haloalkoxy; or

a 5- to 6-membered heteroaromatic ring containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, and optionally substituted with up to 3 substituents independently selected from halogen, cyano, C_1–C_2 alkyl, C_1–C_2 haloalkyl, C_1–C_2 alkoxy and C_1–C_2 haloalkoxy on carbon atom ring members and cyano, C_1–C_2 alkyl and C_1–C_2 alkoxy on nitrogen atom ring members; or

a 3- to 7-membered nonaromatic ring containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, wherein up to 3 carbon atom ring members are independently selected from C(=O) and C(=S), the ring optionally substituted with up to 3 substituents independently selected from halogen, cyano, C_1–C_2 alkyl, C_1–C_2 haloalkyl, C_1–C_2 alkoxy and C_1–C_2 haloalkoxy on carbon atom ring members and cyano, C_1–C_2 alkyl and C_1–C_2 alkoxy on nitrogen atom ring members;

each R^{9b} is independently hydrogen, cyano, C_1–C_3 alkyl, C_1–C_3 haloalkyl, C_1–C_3 alkoxy, C_2–C_3 alkylcarbonyl, C_2–C_3 alkoxycarbonyl or C_3–C_6 cycloalkyl;

each R^{10} and R^{11} is independently C_1–C_5 alkyl, C_2–C_5 alkenyl, C_2–C_5 alkynyl, C_3–C_5 cycloalkyl, C_3–C_6 halocycloalkyl, C_4–C_{10} cycloalkylalkyl, C_4–C_7 alkylcycloalkyl, C_5–C_7 alkylcycloalkylalkyl, C_1–C_5 haloalkyl, C_1–C_5 alkoxy or C_1–C_5 haloalkoxy;

each R^{12} is independently hydrogen, halogen, hydroxy, cyano, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_1–C_4 alkoxy, C_1–C_4 haloalkoxy, C_2–C_4 alkoxyalkyl, C_2–C_4 alkylcarbonyl, C_2–C_4 alkoxycarbonyl or C_3–C_6 cycloalkyl;

each R^{13} is independently hydrogen, cyano, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_1–C_4 alkoxy, C_2–C_4 alkylcarbonyl, C_2–C_4 alkoxycarbonyl or C_3–C_6 cycloalkyl;

R^{15} is hydrogen, halogen, cyano, hydroxy, -CHO, C_1–C_4 alkyl, C_2–C_4 alkenyl, C_2–C_4 alkynyl, C_1–C_4 haloalkyl, C_2–C_4 haloalkenyl, C_2–C_4 haloalkynyl, C_2–C_4 alkoxyalkyl, C_2–C_4 alkylthioalkyl, C_2–C_4 alkylsulfinylalkyl, C_2–C_4 alkylsulfonylalkyl, C_3–C_5 alkoxycarbonylalkyl, C_2–C_4 alkylcarbonyl, C_2–C_4 haloalkylcarbonyl, C_2–C_5 alkoxycarbonyl, C_2–C_5 alkylaminocarbonyl, C_3–C_5 dialkylaminocarbonyl, 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; provided that when R^{15} is hydroxy, then R^{1a} is bonded through a carbon atom to A in Formula **1**;

R^{16} is hydrogen, C_1–C_4 alkyl, C_2–C_4 alkenyl, C_3–C_4 alkynyl, C_1–C_4 haloalkyl, C_2–C_4 haloalkenyl, C_2–C_4 haloalkynyl, C_2–C_4 alkoxyalkyl, C_2–C_4 alkylthioalkyl, 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_1–C_4 alkylsulfonyl or C_1–C_4 haloalkylsulfonyl;

each R^{17} is independently hydrogen, cyano, C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_3–C_8 cycloalkyl, C_3–C_8 halocycloalkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_1–C_6 alkylamino, C_2–C_8 dialkylamino, C_1–C_6 haloalkylamino or phenyl;

R^{18} and R^{19} independently are C_1–C_6 alkyl, C_3–C_6 alkenyl, C_3–C_6 alkynyl, C_1–C_6 haloalkyl, C_3–C_6 haloalkenyl, C_3–C_6 haloalkynyl, C_3–C_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_4–C_8 halocycloalkylalkyl, C_5–C_8 alkylcycloalkylalkyl, C_2–C_6 alkoxyalkyl, C_4–C_8 cycloalkoxyalkyl, C_3–C_6 alkoxyalkoxyalkyl, C_2–C_6 alkylthioalkyl, C_2–C_6 alkylsulfinylalkyl, C_2–C_6 alkylsulfonylalkyl, C_2–C_6 alkylaminoalkyl, C_3–C_6 dialkylaminoalkyl, C_2–C_6 haloalkylaminoalkyl, C_4–C_8 cycloalkylaminoalkyl, C_2–C_6 alkylcarbonyl, C_2–C_6 haloalkylcarbonyl, C_4–C_8 cycloalkylcarbonyl, C_2–C_6 alkoxycarbonyl, C_2–C_6 alkylaminocarbonyl, C_3–C_8 dialkylaminocarbonyl or C_4–C_8 cycloalkylaminocarbonyl;

R^{20} is hydrogen, cyano, hydroxy, amino, C_1–C_6 alkyl, C_3–C_6 alkenyl, C_3–C_6 alkynyl, C_1–C_6 haloalkyl, C_3–C_6 haloalkenyl, C_3–C_6 haloalkynyl, C_3–C_6 cycloalkyl, C_4–C_8 cycloalkylalkyl, C_2–C_6 alkoxyalkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_1–C_6 alkylsulfonyl, C_1–C_6 haloalkylsulfonyl, C_2–C_6 alkylcarbonyl, C_2–C_6 haloalkylcarbonyl, C_1–C_6 alkylamino, C_2–C_8 dialkylamino, C_1–C_6 haloalkylamino or C_2–C_8 halodialkylamino;

R^{21} is hydrogen, C_1–C_6 alkyl, C_3–C_6 alkenyl, C_3–C_6 alkynyl, C_1–C_6 haloalkyl or C_3–C_6 cycloalkyl; or

R^{20} and R^{21} are taken together as $-(CH_2)_4-$, $-(CH_2)_5-$ or $-(CH_2)_2O(CH_2)_2-$;

R^{22} is hydrogen, halogen, cyano, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_2–C_4 alkoxyalkyl, C_2–C_4 alkylcarbonyl, C_2–C_4 alkoxycarbonyl, C_2–C_3 alkylaminocarbonyl or C_3–C_6 dialkylaminocarbonyl;

each R^{23} is independently selected from R^{23a} on carbon atom ring members and independently selected from R^{23b} on nitrogen atom ring members;

R^{23a} is halogen, hydroxy, cyano, C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_1–C_4 alkoxy, C_1–C_4 haloalkoxy, C_2–C_6 alkoxyalkyl, C_2–C_4 alkylcarbonyl, C_2–C_6 alkoxycarbonyl or C_3–C_6 cycloalkyl;

R^{23b} is cyano, C_1–C_3 alkyl, C_1–C_3 haloalkyl, C_1–C_3 alkoxy, C_2–C_3 alkylcarbonyl, C_2–C_3 alkoxycarbonyl or C_3–C_6 cycloalkyl;

each R^{29a} is independently hydrogen, halogen, C_1–C_3 alkyl or C_1–C_3 haloalkyl;

each R^{30a} is independently hydrogen or C_1–C_3 alkyl;

n is 0, 1 or 2;

q is 0, 1 or 2; and

s and f are independently 0, 1 or 2 in each instance of $S(=O)_s(=NR^{17})_f$, provided that the sum of s and f is 0, 1 or 2;

provided that when Z is Z^1-13, then Q is other than unsubstituted phenyl.

Embodiment A1. A compound of Embodiment A wherein

E is E-1;

X is X-1, X-2, X-3, X-4 or X-5;

G is a 5-membered heterocyclic ring optionally substituted with up to 2 substituents independently selected from R^{29a} on carbon atom ring members and R^{30a} on nitrogen atom ring members; and

J is selected from J-1 through J-83 shown in Exhibit 4.

Embodiment A2. A compound of Embodiment A1 wherein

X is X-1, X-2 or X-3;

G is selected from G-1 through G-48 shown in Exhibit 3;

each R^{29a} is H;

R^{30a} is independently hydrogen or methyl;

J is selected from the group consisting of J-1, J-2, J-3, J-4, J-5, J-7, J-8, J-9, J-10, J-11, J-12, J-14, J-15, J-16, J-20, J-24, J-25, J-26, J-29, J-30, J-37, J-38, J-45 and J-69; and

Q is selected from Q-1 through Q-102.

Embodiment A3. A compound of Embodiment A2 wherein

R^{1a} is U-1, U-20 or U-50;

each R^{33a} is independently halogen, C_1-C_3 alkyl, C_1-C_3 haloalkyl or C_2-C_3 alkoxyalkyl;

k is 0, 1, 2 or 3;

A is CHR^{15};

R^{15} is H;

W is O;

X is X-1;

n is 0;

G is G-1;

J is J-29;

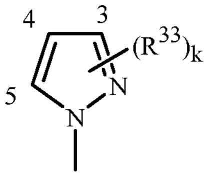
x is 0;

each R^{9a} is independently halogen, C_1–C_6 alkyl, C_1–C_6 haloalkyl or C_1–C_4 alkoxy; and

p is 0, 1, 2 or 3.

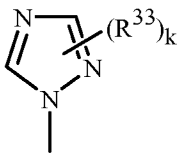
Embodiment A3a.

R^{1a} is



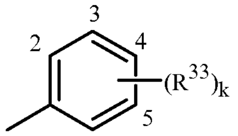
U-1

,



U-20

or



U-50

each R^{33} is independently halogen, C_1-C_3 alkyl, C_1-C_3 haloalkyl or C_2-C_3 alkoxyalkyl;

k is 0, 1, 2 or 3;

A is CHR^{15};

R^{15} is H;

W is O;

X is X-1;

n is 0;

G is G-1;

J is J-29;

x is 0;

each R^{9a} is independently halogen, C_1–C_6 alkyl, C_1–C_6 haloalkyl or C_1–C_4 alkoxy; and

p is 0, 1, 2 or 3.

Embodiment A4. A compound of Embodiment A3 wherein

Z is selected from Z^1-1, Z^1-4, Z^1-14, Z^1-16, Z^1-18, Z-1, Z-2 and Z-3; and

Q is Q-45.

Embodiment A5. Acompound of Embodiment A4 wherein

Z is selected from Z^1-1, Z^1-16, Z^1-18, Z-1 and Z-3.

Embodiment A6. compound of Embodiment A5 wherein

Z is Z^1-1 , Z^1-16 or Z-1.

Embodiment A7. Acompound of Embodiment A6 wherein

R^{12} is hydrogen.

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

1-[4-[4-[5-[2-[(2,6-difluorophenoxy)ethyl]-4,5-dihydro-3-isoxazolyl]-2-thiazolyl]-1-piperdinyl]-2-[5-methyl-3-(trifluoromethyl)-1*H*-pyrazol-1-yl]ethanone,

1-[4-[4-[5-[(2,6-difluorophenoxy)methyl]-4,5-dihydro-3-isoxazolyl]-2-thiazolyl]-1-piperdinyl]-2-[5-methyl-3-(trifluoromethyl)-1*H*-pyrazol-1-yl]ethanone and
1-[4-[4-[5-[(2,6-difluoro-4-methoxyphenoxy)methyl]-4,5-dihydro-3-isoxazolyl]-2-thiazolyl]-1-piperdinyl]-2-[5-methyl-3-(trifluoromethyl)-1*H*-pyrazol-1-yl]ethanone.

This invention provides a fungicidal composition comprising a compound of Formula **1** (including all stereoisomers, *N*-oxides, and salts thereof), and at least one other fungicide. Of note as embodiments of such compositions are compositions comprising a compound corresponding to any of the compound embodiments described above.

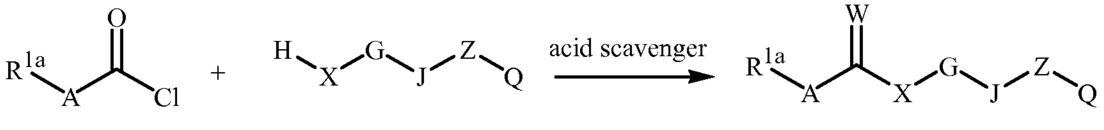
This invention provides a fungicidal composition comprising a compound of Formula **1** (including all stereoisomers, *N*-oxides, and salts thereof) (i.e. in a fungicidally effective amount), and at least one additional component selected from the group consisting of surfactants, solid diluents and liquid diluents. Of note as embodiments of such compositions are compositions comprising a compound corresponding to any of the compound embodiments described above.

This invention provides a method for controlling plant diseases caused by fungal plant pathogens comprising applying to the plant or portion thereof, or to the plant seed, a fungicidally effective amount of a compound of Formula **1** (including all stereoisomers, *N*-oxides, and salts thereof). Of note as embodiment of such methods are methods comprising applying a fungicidally effective amount of a compound corresponding to any of the compound embodiments describe above. Of particular notes are embodiment where the compounds are applied as compositions of this invention.

One or more of the following methods and variations as described in Schemes 1–27 can be used to prepare the compounds of Formula **1**. The definitions of E, X, G, J, Z, Z^1, Q, W, W^1, A, A^1, R^{1a}, R^{1b}, R^2, R^3, R^4, R^5, R^7, R^8, R^{12}, R^{13}, R^{16}, R^{19}, R^{20}, R^{21} and R^{22} (in the compounds of Formulae **1–50)** below are as defined above in the Summary of the Invention unless otherwise noted. Compounds of Formulae **1a–1i** are various subsets of the compounds of Formula **1**, and all substituents for Formulae **1a–1i** are as defined above for Formula **1**.

As shown in Scheme 1, compounds of Formula **1a** (Formula **1** wherein E is E-1, A is CHR^{15} or C=O) wherein W is O can be prepared by coupling an acid chloride of Formula **2** with an amine 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 and potassium hydroxide and carbonates such as sodium carbonate and potassium carbonate. 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. One skilled in the art will recognize that mixtures may result when an amine of Formula **3** contains a second NH function and standard methods of separation can be employed to isolate the desired isomer.

Scheme 1



2 **3** **1a**

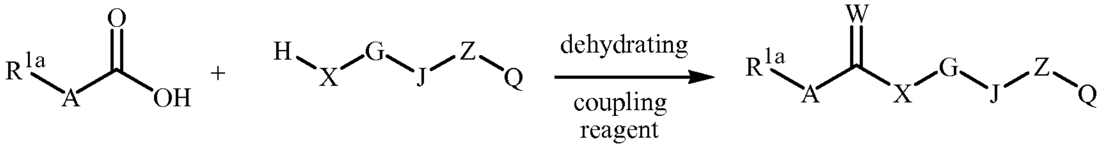
X is bonded to H through nitrogen

wherein E is E-1, A is CHR^{15} or C(=O) and W is O

Acid salts of the Formula **3** amines can also be used in this reaction, provided that at least 2 equivalents of the acid scavenger is present. Typical acids used to form salts with amines include hydrochloric acid, oxalic acid and trifluoroacetic acid. In a subsequent step, amides of Formula **1a** wherein W is O can be converted to thioamides of Formula **1a** 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).

An alternate procedure for the preparation of compounds of Formula **1a** wherein W is O is depicted in Scheme 2 and involves coupling of an acid of Formula **4** with an amine of Formula **3** (or its acid salt) in the presence of a dehydrative coupling reagent such as dicyclohexylcarbodiimide (DCC), 1-(3-dimethylaminopropyl)-3-ethylcarbodiimide hydrochloride (EDC) or *O*-benzotriazol-1-yl-*N*,*N*,*N'*,*N'*-tetramethyluronium hexafluorophosphate (HBTU). Polymer-supported reagents are again useful here, such as polymer-bound cyclohexylcarbodiimide. These reactions are typically run at 0-40 °C in a solvent such as dichloromethane or acetonitrile in the presence of a base such as triethylamine or *N*,*N*-diisopropylethylamine. One skilled in the art will recognize that mixtures may result when an amine of Formula **3** contains a second NH function and standard methods of separation can be employed to isolate the desired isomer.

Scheme 2



4 **3** **1a**

X is bonded to H through nitrogen

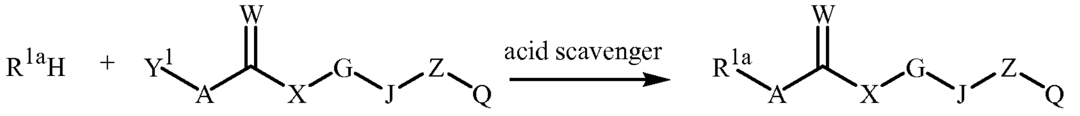
wherein E is E-1, A is CHR^{15} or C(=O) and W is O

The acids of Formula **4** are known or can be prepared by methods known to one skilled in the art. For example, $R^{1a}CH_2COOH$ where R^{1a} is linked to the acetic acid residue via a heteroatom can be prepared by reacting the corresponding $R^{1a}H$ with a haloacetic acid or ester in the presence of base; see, for example, U.S. Patent 4,084,955. $R^{1a}CH_2COOH$ wherein R^{1a} is linked to the acetic acid residue via a carbon atom can be prepared from the corresponding $R^{1a}CH_2$-halogen compounds by displacement of the halogen with cyanide followed by hydrolysis; see, for example, K. Adachi, *Yuki Gosei Kagaku Kyokaishi* **1969**, *27*, 875–876; or from $R^{1a}C(=O)CH_3$ by the Willgerodt-Kindler reaction; see, for example, H. R. Darabi et al., *Tetrahedron Letters* **1999**, *40*, 7549–7552 and M. M. Alam and S. R. Adapa, *Synthetic Communications* **2003**, *33*, 59–63 and references cited therein; or from $R^{1a}Br$ or $R^{1a}I$ by palladium-catalyzed cross-coupling with *tert*-butyl acetate or diethyl malonate followed by ester hydrolysis; see, for example, W. A. Moradi and S. L. Buchwald, *J. Am. Chem. Soc.* **2001**, *123*, 7996–8002 and J. F. Hartwig et al., *J. Am. Chem. Soc.* **2002**, *124*, 12557–12565.

As the synthetic literature includes many amide-forming methods, the synthetic procedures of Schemes 1 and 2 are simply representative examples of a wide variety of methods useful for the preparation of Formula **1** compounds. One skilled in the art also realizes that acid chlorides of Formula **2** can be prepared from acids of Formula **4** by numerous well-known methods.

Certain compounds of Formula **1a** (Formula **1** wherein E is E-1, A is CHR^{15} or C=O, and W is O) wherein R^{1a} is linked to A via a heteroatom can be prepared by reaction of the compound of Formula **5** and a haloacetamide or oxalyl chloride of Formula **6** as shown in Scheme 3. The reaction is carried out in the presence of a base such as sodium hydride, potassium carbonate or triethylamine in a solvent such as tetrahydrofuran, *N*,*N*-dimethylformamide or acetonitrile at 0 to 80 °C. The haloacetamide of Formula **6** can be prepared by the reaction of an amine of Formula **3** with an α-halo carboxylic acid halide or an α-halo carboxylic acid or its anhydride, analogous to the amide-forming reactions described in Schemes 1 and 2, respectively. The oxalyl chlorides of Formula **6** (i.e. where A is C(=O) can be prepared by the reaction of an amine of Formula **3** and oxalyl chloride as known to one skilled in the art.

Scheme 3



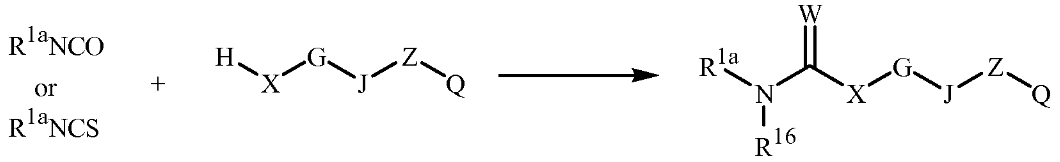
5 **6** **1a**

Y^1 is Cl, Br or I

wherein E is E-1, A is CHR^{15} or C(=O),
W is O and R^{1a} is linked to A via a heteroatom

Compounds of Formula **1b** (Formula **1** wherein E is E-1 and A is NR^{16}), wherein R^{16} is H, and W is O or S, can be prepared by reaction of an amine of Formula **3** with an isocyanate or isothiocyanate, respectively, of Formula **7** as depicted in Scheme 4. This reaction is typically carried out at ambient temperature in an aprotic solvent such as dichloromethane or acetonitrile.

Scheme 4



7

3

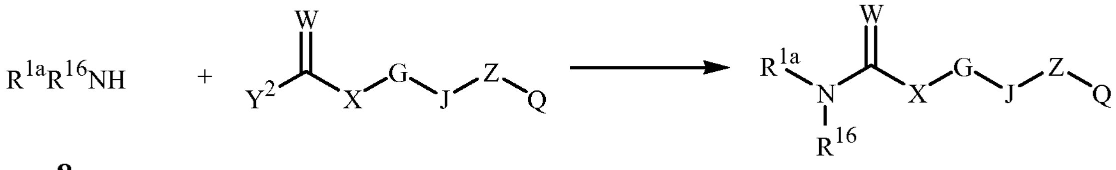
X is bonded to H through nitrogen

1b

wherein E is E-1, R^{16} is H and W is O or S

Compounds of Formula **1b** can also be prepared by the reaction of an amine of Formula **8** with a carbamoyl or thiocarbamoyl chloride or imidazole of Formula **9** as shown in Scheme 5. When Y^2 is chlorine, the reaction is typically carried out 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 and potassium hydroxide and carbonates such as sodium carbonate and potassium carbonate. The carbamoyl or thiocarbamoyl chlorides of Formula **9** (wherein Y^2 is Cl) can be prepared from amines of Formula **3** by treatment with phosgene or thiophosgene, respectively, or their equivalents, while carbamoyl or thiocarbamoyl imidazoles of Formula **9** (wherein Y^2 is imidazol-1-yl) can be prepared from amines of Formula **3** by treatment with 1,1'-carbonyldiimidazole or 1,1'-thiocarbonyldiimidazole, respectively, according to general methods known to one skilled in the art.

Scheme 5



8

9

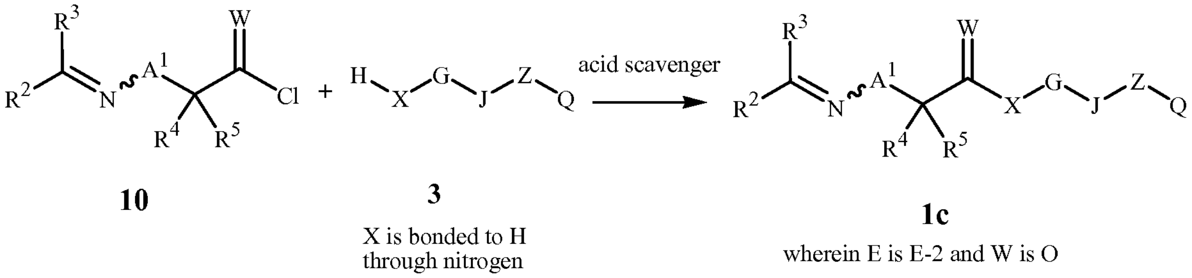
Y^2 is Cl or imidazol-1-yl

1b

wherein E is E-1, W is O or S

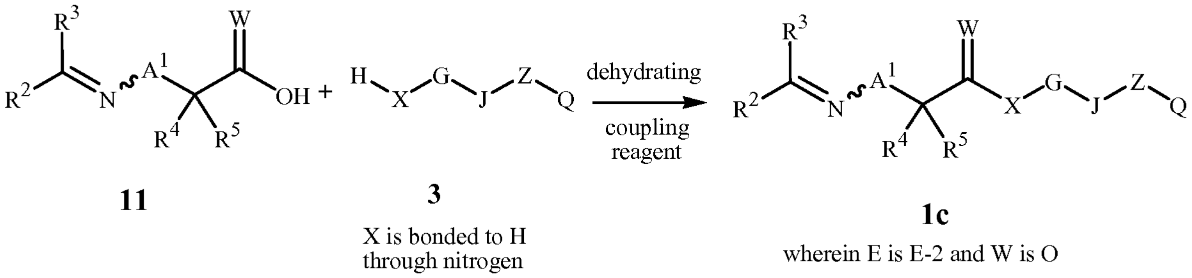
As shown in Scheme 6, compounds of Formula **1c** (Formula **1** wherein E is E-2,) wherein W is O can be prepared by coupling an acid chloride of Formula **10** with an amine of Formula **3** in the presence of an acid scavenger, analogous to the method described in Scheme 1. In a subsequent step, compounds of Formula **1c** wherein W is O are 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).

Scheme 6



An alternate procedure for the preparation of compounds of Formula **1c** (Formula **1** wherein E is E-2 and W is O) is depicted in Scheme 7 and involves coupling of an acid of Formula **11** with an amine of Formula **3** (or its acid salt) in the presence of a dehydrative coupling reagent analogous to the method described in Scheme 2. The acids of Formula **11** are known or can be prepared by methods known to one skilled in the art. For leading references see, for example, Schumann, Paquette et al., *J. Med. & Pharm. Chem.* **1962**, *5*, 464-77; Van Dijk, Jan et al., *J. Med. Chem.* **1977**, *20*(9), 1199-206; A. Balsamo et al., *J. Med. Chem.* **1989**, *32*, 1398-1401 and references cited therein, and U.S. Patent 4,584,014.

Scheme 7



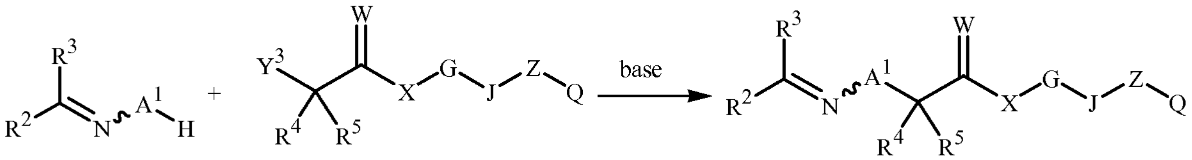
Analogous to Scheme 6, compounds of Formula **1c** wherein W is O are converted to the corresponding thioamides wherein W is S using a variety of standard thiating reagents such as phosphorus pentasulfide or 2,4-bis(4-methoxyphenyl)-1,3-dithia-2,4-diphosphetane-2,4-disulfide (Lawesson's reagent).

Acid chlorides of Formula **10** can be prepared from acids of Formula **11** by numerous well known methods.

As the synthetic literature includes many amide-forming methods, the methods of Schemes 6 and 7 are simply representative examples of a wide variety of methods useful for the preparation of Formula **1** compounds.

Compounds of Formula **1c** (Formula **1** wherein E is E-2,) wherein A^1 is -O-, -S- and -N(R^7)- and W is O can be prepared by reaction of a compound of Formula **12** and a haloacetamide of Formula **13** wherein Y^3 is Cl, Br or I as shown in Scheme 8. The reaction is carried out in the presence of a base such as sodium hydride or potassium carbonate in a solvent such as tetrahydrofuran, *N*,*N*-dimethylformamide or acetonitrile typically at 0 to 80 °C. The imines, oximes and hydrazones of Formula **12** are known or can be prepared by methods known in the art; see, for example, S. Dayagi et al., in *The Chemistry of the Carbon-Nitrogen Double Bond*, ed. S. Patei, Interscience, New York **1970**; S.R. Sandler et al., *Organic Functional Group Preparations*, Academic Press, New York **1972**, *3*, 372 and G. Hilgetag et al., *Preparative Organic Chemistry*, John Wiley & Sons, New York **1972**, 504-515.

Scheme 8



12

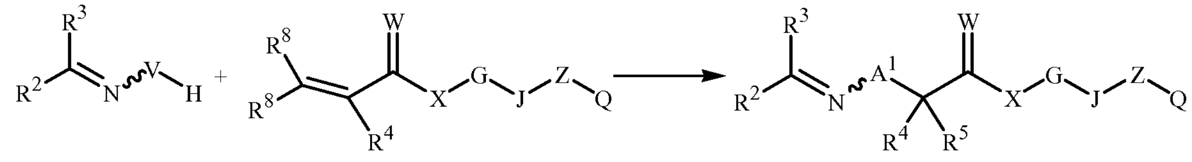
13
wherein W is O and Y^3 is Cl, Br or I

1c
wherein E is E-2, A^1 is O, S or NR^7 and W is O

Haloacetamide compounds of Formula **13** can be prepared by the reaction of an amine of Formula **3** with an α-halo carboxylic acid halide or an α-halo carboxylic acid or its anhydride, analogous to the amide-forming reactions described in Schemes 1 and 2, respectively.

Compounds of Formula **1c** (Formula **1** wherein E is E-2) wherein A^1 is $-OC(R^8)_2-$, $-SC(R^8)_2-$ or $-N(R^7)C(R^8)_2-$ and R^5 is H can be prepared by a base-catalyzed condensation reaction of a compound of Formula **12a** with an α,β-unsaturated amide of Formula **14** as depicted in Scheme 9 wherein V in Formula **12a** and $C(R^8)_2$ in Formula **14** forms A^1 in Formula **1c**. The reaction is carried out in the presence of a base such as sodium or potassium hydroxide, sodium hydride or potassium carbonate in a solvent such as tetrahydrofuran, *N*,*N*-dimethylformamide, ethanol or acetonitrile typically at 0 to 80 °C. The α,β-unsaturated amide of Formula **14** can be prepared by coupling of the corresponding α,β-unsaturated acid or acid chloride with an amine of Formula **3** by a method analogous to methods described in Scheme 1 and 2.

Scheme 9



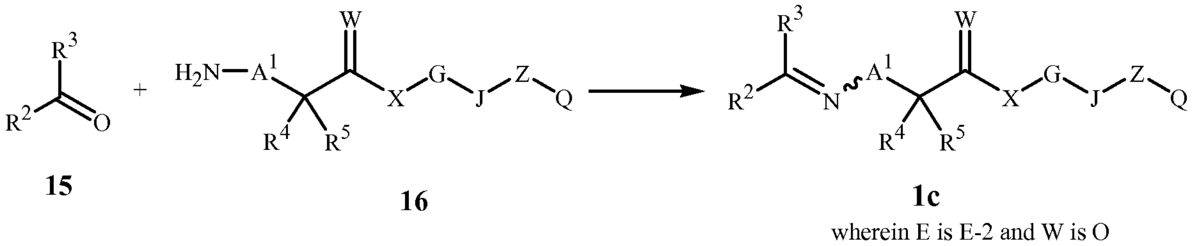
12a
wherein V is O, S or NR^7

14

1c
wherein E is E-2, A^1 is $OC(R^8)_2$, $SC(R^8)_2$ and $N(R^7)C(R^8)_2$, W is O and R^5 is H

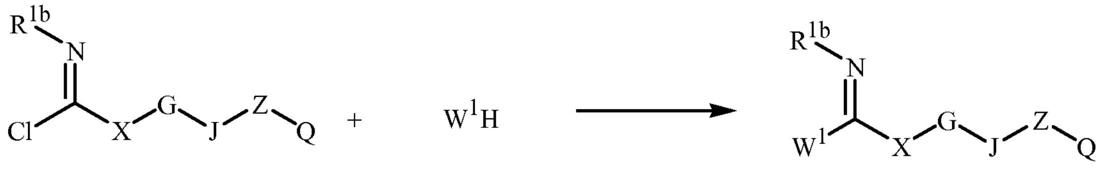
Compounds of Formula **1c** (Formula **1** wherein E is E-2) can also be prepared by reacting a compound of Formula **15** with a compound of Formula **16** as illustrated in Scheme 10. The reaction can be carried out in a solvent such as ethanol, tetrahydrofuran or water, and optionally in the presence of an acid catalyst such as acetic acid, hydrochloric acid or sulfuric acid. Acid salts of Formula **16** can also be used in the method of Scheme 10, preferably in the presence of at least one molar equivalent of an acid scavenger such as pyridine or triethylamine. Typical acids used to form salts with amines include hydrochloric acid, oxalic acid and trifluoroacetic acid. The reaction of amines with carbonyl compounds is well known see, for example, S. Dayagi et al. in *The Chemistry of the Carbon-Nitrogen Double Bond*, ed. S. Patei, Interscience, New York **1970**; S. R. Sandler et al., *Organic Functional Group Preparations*, Academic Press, New York **1972**, *3*, 372 and G. Hilgetag et al., *Preparative Organic Chemistry*, John Wiley & Sons, New York **1972**, 504-515. Compounds of Formula **15** are known or can be prepared by methods known to one skilled in the art. Compounds of Formula **16** can be prepared directly or by deprotection of corresponding *N*-protected compounds of Formula **16**. The *N*-protected compounds of Formula **16** can be prepared by methods analogous to those already described for Schemes 1, 2, 3, and 4. The choice and use of a suitable *N*-protected nitrogen will be apparent to one skilled in the art; for representative examples see T. W. Greene and P. G. M. Wuts, *Protective Groups in Organic Synthesis*, 2nd ed.; Wiley: New York, 1991.

Scheme 10



As shown in Scheme 11 certain compounds of Formulae **1d**-**1g** (Formula **1** wherein E is E-3 and W^1 is OR^{18}, SR^{19}, $NR^{20}R^{21}$ or CN) can be prepared by reacting an imidoyl chloride of Formula **17** with a compound of Formula **18** in the presence of an acid scavenger. Suitable acid scavengers include, but are not limited to, amine bases such as triethylamine, *N*,*N*-diisopropylethylamine and pyridine, hydroxides such as sodium and potassium hydroxide, and carbonates such as sodium carbonate and potassium carbonate. Alternatively, the compounds of Formulae **17** and **18** can be contacted in the absence of an acid scavenger to provide compounds Formulae **1d**-**1f** as the corresponding HCl salts, which are also compounds of the present invention. If desired, the HCl salts can be free-based by standard methods to give compounds of Formulae **1d**-**1f**. Regardless of whether the reaction is conducted with or without an acid scavenger, it is typically conducted in a suitable organic solvent at a temperature between about –20 and 100°C. A variety of solvents can be used to form the suitable solvent for this method, for example nitriles, such as acetonitrile, ethers such as tetrahydrofuran, and halogenated hydrocarbons such as dichloromethane, and amides such as *N,N*-dimethylformamide, and mixtures thereof. Compounds of Formulae **1d**-**1g** can be generally classified as isoureas, isothioureas, guanidines and cyanoamidines, respectively. For leading references on these classes of compounds see J. Lon Mathias, *Organic Preparations and Procedures International* **1980**, *12*(5), 309-326; *Comprehensive Organic Chemistry*, vol. 2, I. O. Sutherland, Ed., Pergamon Press, Oxford; *Rodd's Chemistry of Carbon Compounds*, vol. 1C, Elsevier, New York; A. R. Katritzky et al., *J. Organic Chem.* **2004**, *69*, 309-313. One skilled in the art will recognize that certain compounds of Formulae **1d**, **1f** and **1g** can be prepared from the corresponding compound of Formula **1e** by treatment with an appropriate compound of Formula **18**. For example, the preparation of thiuronium salts and their conversion to guanidines is described in the literature, see C. R. Rasmussen et al., *Synthesis* **1988**, *6*, 460-466. Imidoyl chlorides of Formula **17** can be prepared from compounds of Formula **1b** (Formula **1** wherein E is E-1, A is NH) by treating with thionyl chloride, phosphorous oxychloride or phosphorous pentachloride in a solvent such as dichlormethane. For typical reactions conditions see, for example, W. Zielinski et al., *Heterocycles* **1998**, *48*, 319-327 or World Patent Publication WO/2009/094445. Many compounds of Formula **18** are commercially available and can be prepared by methods well documented in the chemistry art.

Scheme 11

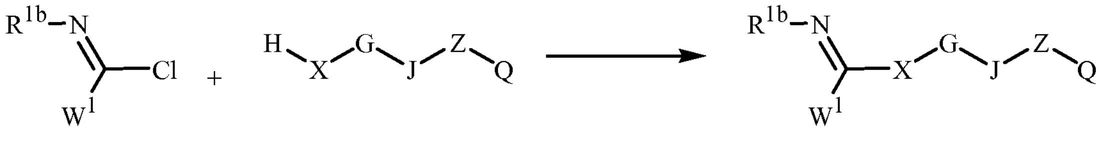


17 **18**

1d wherein E is E-3, W^1 is OR^{18}
1e wherein E is E-3, W^1 is SR^{19}
1f wherein E is E-3, W^1 is $NR^{20}R^{21}$
1g wherein E is E-3, W^1 is CN

In an alternate procedure shown in Scheme 12, certain compounds of Formulae **1d**-**1f** and Formula **1h** (Formula **1** wherein E is E-3 and W^1 is CR^{22}) can be prepared by reacting an amine of Formula **3** with an imidoyl chloride of Formula **19** using conditions analogous to those described in Scheme 11. Many imidoyl chlorides of Formula **19** can be prepared by methods disclosed in the art, for example, see R. Bonnett in The Chemistry of the Carbon-Nitrogen Double Bond, S. Patei, Ed., Interscience Publishers, and references cited therein. Some imidoyl chlorides of Formula **19** are commercially available (e.g., Formula **19** wherein R^{1b} is phenyl, substituted phenyl or lower alkyl and W^1 is OMe, SMe, or $N(Me)_2$ can be commercially obtained) and can be prepared by methods documented in the chemistry art.

Scheme 12



19

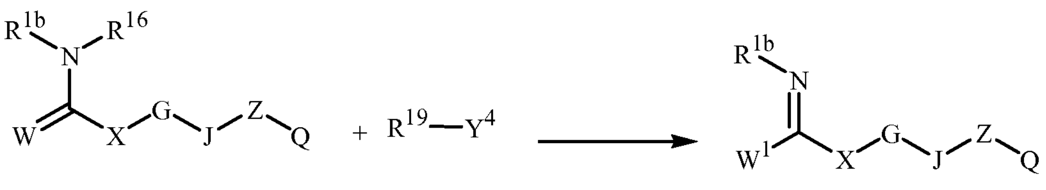
3

X is bonded to H through nitrogen

1d wherein E is E-3, W^1 is OR^{19}
1e wherein E is E-3, W^1 is SR^{19}
1f wherein E is E-3, W^1 is $NR^{20}R^{21}$
1h wherein E is E-3, W^1 is R^{22}

Schemes 11 and 12 are representative of just two methods of preparing compounds of Formula **1e**. In another method, as shown in Scheme 13, compounds of Formula **1e** can be prepared by reacting a thiourea of Formula **1b** (Formula **1** wherein E is E-1, A is NH and W is S) with an alkylating or acylating agent of a compound of Formula **20** wherein Y^4 is a nucleophic reaction leaving group such as halide (e.g., Cl, Br, I) or sulfonate (e.g., mesylate, triflate, *p*-toluenesulfonate), and the like. The method can be conducted in the presence of an acid scavenger and a suitable organic solvent at a temperature between about 0 and 100 °C. Suitable solvents include, for example, dichloromethane, tetrahydrofuran, acetonitrile, *N,N*-dimethylformamide, and mixtures thereof. Suitable acid scavengers comprise, for example, amine bases such as triethylamine, *N,N*-diisopropylethylamine and pyridine, hydroxides such as sodium and potassium hydroxide and carbonates such as sodium carbonate and potassium carbonate. Alternatively, compounds of Formulae **1b** and **20** can be contacted in the absence of an acid scavenger to provide the corresponding isothiuronium salts of Formula **1e**, which are also compounds of the present invention. In a subsequent reaction the salt can be free-based using standard methods described in the art to provide compounds of Formula **1e**. For an example illustrating the preparation of thiuronium salts and their conversion to guanidines see C. R. Rasmussen et al., *Synthesis* **1988**, *6*, 460-466 or PCT Patent Publication WO/2009/094445. Many compounds of Formula **20** are known and can be prepared by general methods disclosed in the art.

Scheme 13



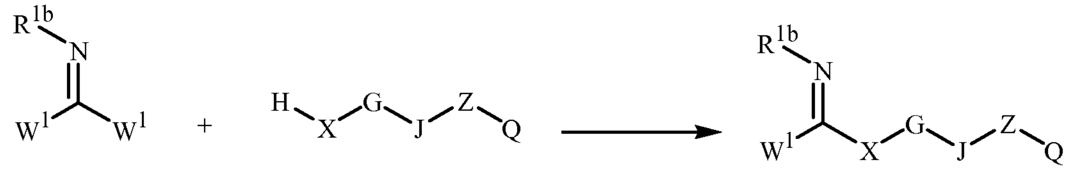
1b
wherein R^{16} is H and W is S

20
wherein Y^4 is Cl, Br or I

1e
wherein E is E-3 and W^1 is SR^{19}

Compounds of Formula **1e** can also be prepared by reacting an amine of Formula **3** with a dithiocarbamic acid of Formula **21** as illustrated in Scheme 14. The reaction of Scheme 14 is typically conducted in a suitable solvent at a temperature between about 0 to 100 °C. Examples of suitable solvents include acetonitrile, tetrahydrofuran, dichloromethane, *N,N*-dimethylformamide, and mixtures thereof. Dithiocarbamic acids of Formula **21** can be prepared from the corresponding amines, carbon disulfide and two equivalents of a base, followed by treatment with an alkylating agent according to the general method of Alvarez-Ibarra et al., *Organic Preparations and Procedures* **1991**, *23*(5), 611-616.

Scheme 14



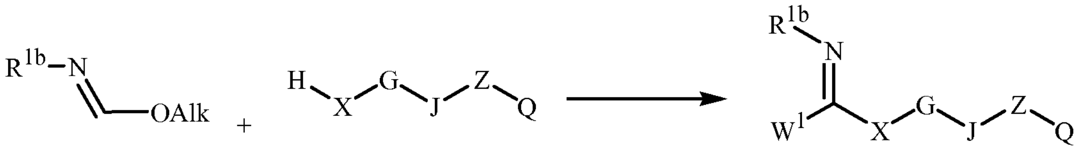
21

3
X is bonded to H through nitrogen

1e
wherein E is E-3 and W^1 is SR^{19}

Certain compounds of Formula **1h** wherein R^{22} is H can be prepared by treating an amine of Formula **3** with a methoxy or ethoxy imine of Formula **22** as shown in Scheme 15. Imines of Formula **22** can be obtained from the corresponding amines. The procedure involves heating the amines with trimethylorthoformate or triethylorthoformate in toluene or xylenes in the presence of a catalytic amount of *p*-toluenesulfonic acid.

Scheme 15



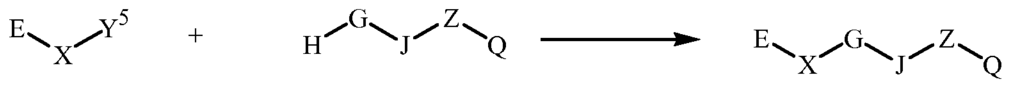
22
wherein Alk is C_1-C_2 alkyl

3
X is bonded to H through nitrogen

1h
wherein E is E-3, W^1 is R^{22} and R^{22} is H

Compounds of Formula **1** wherein a carbon in X is linked to a nitrogen atom in G, can be prepared by displacement of an appropriate leaving group (i.e. Y^5) in a compound of Formula **23** with a nitrogen-containing heterocycle of Formula **24** in the presence of a base as depicted in Scheme 16. Suitable bases include sodium hydride or potassium carbonate, and the reaction can be carried out in a solvent such as *N,N*-dimethylformamide or acetonitrile at 0 to 80 °C. Suitable leaving groups in the compounds of Formula **23** include bromide, iodide, mesylate ($OS(O)_2CH_3$), triflate ($OS(O)_2CF_3$) and the like. Compounds of Formula **23** can be prepared from the corresponding compounds wherein Y^5 is OH, using general methods known in the art.

Scheme 16



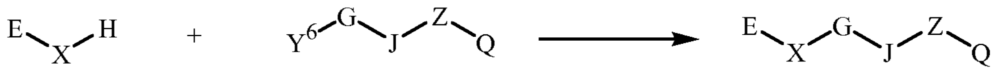
23
wherein Y^5 is connected to a carbon atom in X

24
G is bonded to H through nitrogen

1

Compounds of Formula **1** wherein a nitrogen in X is linked to a carbon atom in G can be prepared by reaction of a compound of Formula **25** with a heterocyclic compound of Formula **26** wherein Y^6 is a leaving group (e.g., bromide, iodide, mesylate ($OS(O)_2CH_3$), triflate ($OS(O)_2CF_3$) and the like) as shown in Scheme 17. The reaction can be carried out in the presence of a base such as potassium carbonate in a solvent such as dimethylsulfoxide, *N*,*N*-dimethylformamide or acetonitrile at temperatures between about 0 to 80 °C. Compounds of Formula **26** can be prepared from corresponding compounds wherein Y^6 is OH by methods known to one skilled in the art.

Scheme 17



25
wherein X is X-2 and H is connected to the nitrogen atom

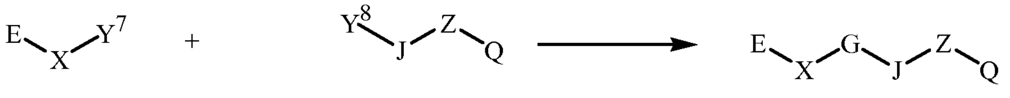
26
G is bonded to Y^6 through carbon

1

Compounds of Formula **1** can also be prepared by reaction of a suitably functionalized compound of Formula **27** with a suitably functionalized compound of Formula **28** as shown in Scheme 18. The functional groups Y^7 and Y^8 are selected from, but not limited to, moieties such as aldehydes, ketones, esters, acids, amides, thioamides, nitriles, amines, alcohols, thiols, hydrazines, oximes, amidines, amideoximes, olefins, acetylenes, halides, alkyl halides, methanesulfonates, trifluoromethanesulfonates, boronic acids, boronates, and the like, which under the appropriate reaction conditions, will allow the construction of the various heterocyclic rings G. The synthetic literature describes many general methods for forming 5-membered heteroaromatic rings (i.e., G-1 through G-48); see, for example, *Comprehensive Heterocyclic Chemistry*, Vol. 4–6, A. R. Katritzky and C. W. Rees editors, Pergamon Press, New York, **1984**; *Comprehensive Heterocyclic Chemistry II*, Vol. 2–4, A. R. Katritzky, C. W. Rees, and E. F. Scriven editors, Pergamon Press, New York, **1996**; and the series, *The Chemistry of Heterocyclic Compounds*, E. C. Taylor, editor, Wiley, New York. One skilled in the art knows how to select the appropriate functional groups to construct the desired heterocyclic ring G.

Thioamides of Formula **27**, (compounds of Formula **27** wherein Y^7 is $-C(=S)NH_2$), are particularly useful intermediates for preparing compounds of Formula **1** as shown in Scheme 18 wherein G is, for example, a thiazole (i.e., G is G-1). As an example, reaction of a compound of Formula **27** wherein Y^7 is a thioamide group with a compound of Formula **28** wherein Y^8 is a bromoacetyl group will give a compound of Formula **1** wherein G is a thiazole ring.

Scheme 18



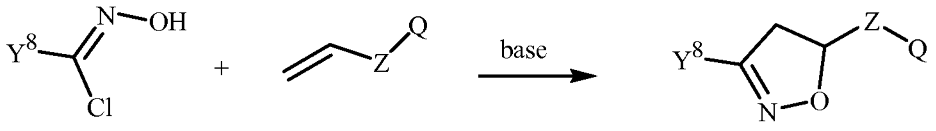
27 **28** **1**

In one typical procedure, a bromomethyl ketone of Formula **28** (compounds of Formula **28** wherein Y^8 is $BrCH_2C(=O)$) is mixed with a thioamide derivative of Formula **27** at a temperature typically between room temperature and the reflux temperature of the solvent. Typical solvents include but are not limited to acetone and acetonitrile. For less reactive chloromethyl ketone (compounds of Formula **28** wherein Y^8 is $ClCH_2C(=O)$, it is useful to prepare a more activated halomethyl keone *in situ* with the addition of halide salt such as sodium bromide or sodium iodide. In such cases, the chloromethyl ketone and sodium bromide, for example, are heated together briefly before the addition of the thioamide of Formula **27**. The thioamides of Formula **27** are known and can be prepared by the methods described in Scheme 25.

Certain compounds of Formula **28a** can be prepared by cycloaddition of the corresponding hydroxamoyl chlorides of Formula **29** with olefin derivatives of Formula **30**, as shown in Scheme 19.

The halomethyl ketones of Formula **28a** wherein J is for example, J-29 (i.e., isoxazoline) as depicted in Exhibit 4 are particularly useful. In this method, all three reacting components (the compounds of Formulae **29** and **30**, and the base) are contacted so as to minimize hydrolysis or dimerization of the hydroxamoyl chloride of Formula **29**. In one typical procedure, the base, which can either be a tertiary amine base such as triethylamine or an inorganic base such as an alkali metal or alkaline-earth carbonate, bicarbonate or phosphate, is mixed with the olefin derivative of Formula **30**, and the hydroxamoyl chloride of Formula **29** is added gradually at a temperature at which the cycloaddition proceeds at a relatively rapid rate, typically between 5 and 25 °C. Alternatively, the base can be added gradually to the other two components (the compounds of Formulae **29** and **30**). This alternative procedure is preferable when the hydroxamoyl chloride of Formula **29** is substantially insoluble in the reaction medium. The solvent in the reaction medium can be water or an inert organic solvent such as toluene, hexane or even the olefin derivative used in excess. The product can be separated from the salt co-product by filtration or washing with water, followed by evaporation of the solvent. The crude product can be purified by crystallization, or the crude product can be used directly in the methods of Scheme 18. This method is exemplified in Examples 1, Step B; Example 2, Step B; Example 3, Step B; and Example 4, Step A.

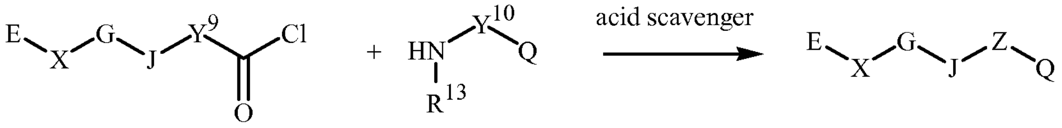
Scheme 19



29 **30** **28a**

As shown in Scheme 20, compounds of Formula **1i** (Formula **1** wherein Z or Z^1 (e.g., Z-2) contains an amide) can be prepared by coupling an acid chloride of Formula **31** with an amine or aniline of Formula **32** 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 and potassium hydroxide and carbonates such as sodium carbonate and potassium carbonate. 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. One skilled in the art will recognize that mixtures may result when an amine of Formula **32** contains a second NH function and standard methods of separation can be employed to isolate the desired isomer.

Scheme 20



31 **32** **1i**

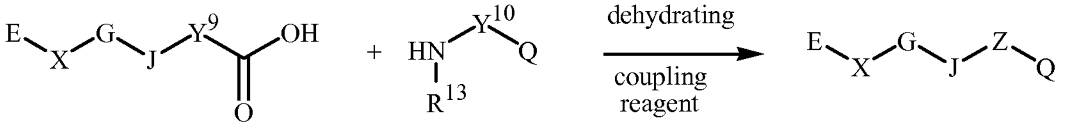
Y^9 and Y^{10} are $C(R^{12})_2$ or $C(R^{12})_2C(R^{12})_2$

Z is Z^1-33, Z^1-34, Z^1-35 or Z-2

Acid salts of the Formula **32** amines can also be used in this reaction, provided that at least 2 equivalents of the acid scavenger is present. Typical acids used to form salts with amines include hydrochloric acid, oxalic acid and trifluoroacetic acid.

An alternate procedure for the preparation of compounds of Formula **1i** wherein wherein Z or Z^1 (e.g., Z-2) contains an amide is depicted in Scheme 21 and involves coupling of an acid of Formula **33** with an amine or aniline of Formula **32** (or its acid salt) in the presence of a dehydrative coupling reagent such as dicyclohexylcarbodiimide (DCC), 1-3-dimethylaminopropyl)-3-ethylcarbodiimide hydrochloride (EDC) or *O*-benzotriazol-1-yl-*N*,*N*,*N'*,*N'*-tetramethyluronium hexafluorophosphate (HBTU). Polymer-supported reagents are again useful here, such as polymer-bound cyclohexylcarbodiimide. These reactions are typically run at 0-40 °C in a solvent such as dichloromethane or acetonitrile in the presence of a base such as triethylamine or *N*,*N*-diisopropylethylamine. One skilled in the art will recognize that mixtures may result when an amine of Formula **32** contains a second NH function and standard methods of separation can be employed to isolate the desired isomer. This method is exemplified in Example 4, Step C for Z-2.

Scheme 21



33 **32** **1i**

Y^9 and Y^{10} are $C(R^{12})_2$ or $C(R^{12})_2C(R^{12})_2$

Z is Z^1-33, Z^1-34, Z^1-35 or Z-2

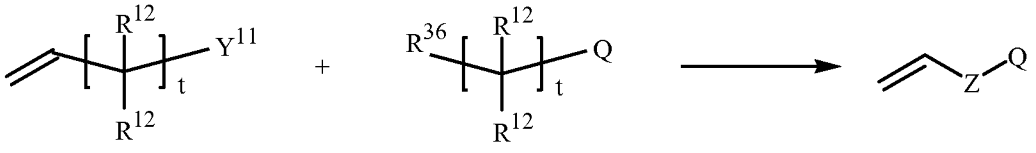
As the synthetic literature includes many amide-forming methods, the synthetic procedures of Schemes 20 and 21 are simply representative examples of a wide variety of methods useful for the preparation of Formula **1** compounds. One skilled in the art also realizes that acid chlorides of Formula **31** can be prepared from acids of Formula **33** by numerous well-known methods.

One skilled in the art will recognize that many of the compounds of Formula **33** can be prepared directly by methods analogous to those described in Schemes 18 and 19 above wherein the -ZQ is replaced by $–Y^9CO_2H$. Thus compounds corresponding to Formulae **28** and **30** in which -ZQ is replaced by Y^9CO_2H are useful intermediates for the preparation of compounds of Formula 1. This method is described in Example 4, Step A and B.

Certain olefins of Formula **30a** can be prepared by displacement of an appropriate leaving group Y^{11} in compounds of Formula **34** with a compound of Formula **35** in the presence of a base as depicted in Scheme 22. Suitable bases include sodium hydride, potassium carbonate or sodium carbonate, and the reaction is carried out in a solvent such as *N*,*N*-dimethylforamide or acetonitrile at 0 to 80 °C. Suitable leaving groups in the compounds of Formula **34** include chloride, bromide, iodide, mesylate ($-OS(O_2)CH_3$), triflate ($-OS(O)_2CF_3$) and the like. Compounds of Formula **34** can be prepared from the corresponding compounds where Y^{11} is OH by general methods known in the art. Many of the compounds of Formula **34** are known or can be prepared by general methods known in the art. This method is described in Example 1, Step A for Z^1-1. The synthetic literature also describes many general methods for forming olefins of Formula **30a** see, for example, see Z^1-2, A. Saha and B. C. Ranu, *Tet. Lett.* **2010**, 51, 1902-1905; Z^1-3, S. Nandi and J. K.

Ray, *Tet. Lett.* **2009**, 50, 6993-6997; Z^1-10, A. deMeijere, et. al., *Eur. J. Org. Chem.* **2009**, 2635-2641; Z^1-14, L. Yingchun, et. al., WO 2008/043019; Z^1-15, P. P. Santos, et. al., *Tetrahedron* **2005**, 61(*50*), 11986-11990; Z^1-16, B. H. Lipshutz, et. al., *J. Org. Chem.* **2009**, 74, 2854-2857 and Z^1-19, S. Mobashery, et. al., *J. Am. Chem. Soc.* **2000**, 122, 6799-6800.

Scheme 22



34 **35** **30a**

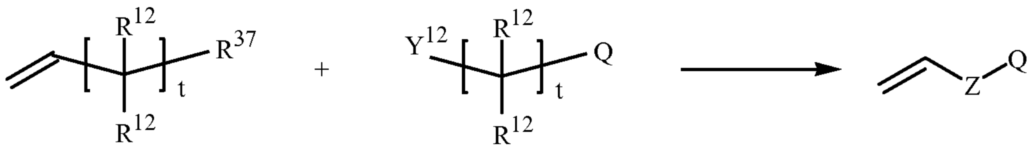
wherein R^{36} is OH, NHR^{13}, SH
Y^{11} is a leaving group such as halogen or tosylate
t is 0 or 1

Z is Z^1-1, Z^1-2, Z^1-3, Z^1-10, Z^1-14, Z^1-15, Z^1-16 or Z^1-19

One skilled in the art will recognize that compounds of Formula **30b** wherein Q is a ring system that has a ring nitrogen as the point of attachment to Z (e.g., wherein Q is Q-70, R^{36} is H and t is 0) can be prepared using the corresponding NH of ring system as the nucleophile. Displacement of an appropriate leaving group Y^{11} in compounds of Formula **35** are carried out using conditions similar to those described in Scheme 16 and Example 3, Step A for Z^1-18.

Certain compounds of Formula **30c** can also be prepared by displacement of an appropriate leaving group Y^{12} in compounds of Formula **37** with a compound of Formula **36** in the presence of a base as shown in Scheme 23. Suitable bases include sodium hydride, potassium carbonate or sodium carbonate, and the reaction is carried out in a solvent such as *N,N*-dimethylforamide or acetonitrile at 0 to 80 °C. Suitable leaving groups in the compounds of Formula **37** include chloride, bromide, iodide, mesylate ($-OS(O_2)CH_3$), triflate ($-OS(O)_2CF_3$) and the like. Compounds of Formula **37** can be prepared from the corresponding compounds where Y^{12} is OH by general methods known in the art. Many of the compounds of Formula **36** are know or can be prepared by general methods known in the art. This method is described in Example 2, Step A for Z^1-14. The synthetic literature also describes many general methods for forming olefins of Formula **30c** see, for example, see Z^1-1, S. G. Ouellet, et. al., *Tet. Lett.* **2009**, 50, 3776-3779; Z^1-2, S. Saubern, et. al., *Tetrahedron* **2010**, 66, 2761-2767; Z^1-3, S. Ahmad, et. al., *Bioorg. Med. Chem. Lett.* **2010**, 20, 1128-1133; Z^1-11, S. E. Yoo, et. al., WO 2002/018455; Z^1-15, N. D. Smith, et. al., WO 2008/103615.

Scheme 23



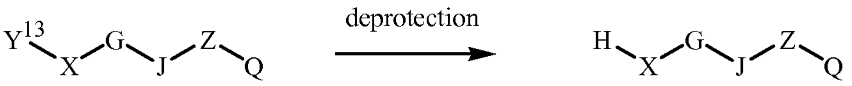
36 **37** **30c**

wherein R^{37} is OH, NHR^{13}, SH
Y^{12} is a leaving group such as halogen
t is 0 or 1

Z is Z^1-1, Z^1-2, Z^1-3, Z^1-11, Z^1-12, Z^1-13, Z^1-14, Z^1-15 or Z^1-19

Amines of Formula **3** can be prepared from compounds of Formula **38** wherein Y^{13} is an amine protecting group via a deprotection reaction as shown in Scheme 24. A wide array of amine protecting groups are suitable for the method of Scheme 24 (see, for example, T. W. Greene and P. G. M. Wuts, *Protective Groups in Organic Synthesis*, 2nd ed.; Wiley: New York, **1991**), and the choice of the appropriate protecting groups will be apparent to one skilled in chemical synthesis. After deprotection, the amine of Formula **3** can be isolated as its acid salt or the free amine by general methods known in the art.

Scheme 24



38

Y^{13} is an amine protecting group
connected to nitrogen in X

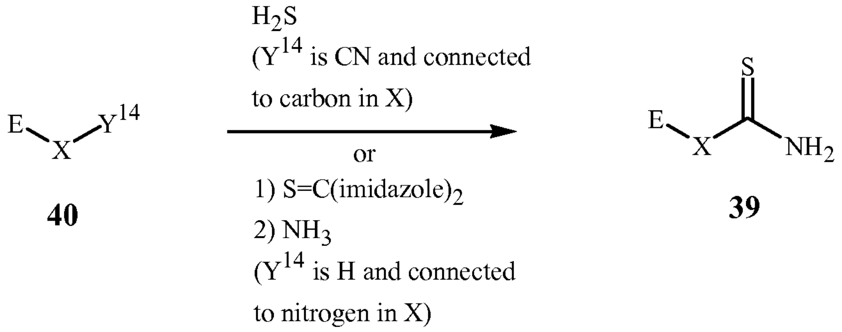
3

One skilled in the art will recognize that many compounds of Formula **38** can be prepared by methods analogous to those described in Schemes 16 through 18 and Schemes 20 and 21 above where the group E is replaced by Y^{13}. Thus, compounds corresponding to Formulae **23**, **25**, **27**, **31** and **33** in which E is replaced by Y^{13} are useful intermediates for the preparation of compounds of Formula **1**.

Thioamides of Formula **39** are particularly useful intermediates for preparing compounds of Formulae **1** and **27**. A thioamide of Formula **39** can be prepared by the addition of hydrogen sulfide to the corresponding nitrile of Formula **40** wherein Y^{14} is a nitrile moiety connected to carbon in X as shown in Scheme 25. The methods of Scheme 25 can be carried out by contacting a compound of Formula **40** with hydrogen sulfide in the presence of an amine such as pyridine, diethylamine or diethanolamine. Alternatively, hydrogen sulfide can be used in the form of its bisulfide salt with an alkali metal or ammonia. This type of reaction is well documented in the literature see; for example, European Patent EP 696581.

As also shown in Scheme 25, a thioamide of Formula **39** can be prepared by the reaction of a compound of Formula **40** (wherein Y^{14} is H and connected to nitrogen in X) is contacted with thiocarbonyl diimidazole followed by treatment with ammonia as described by J. L. Collins, et. al., *J. Med. Chem.* **1998**, *41*(25), 5037-5054.

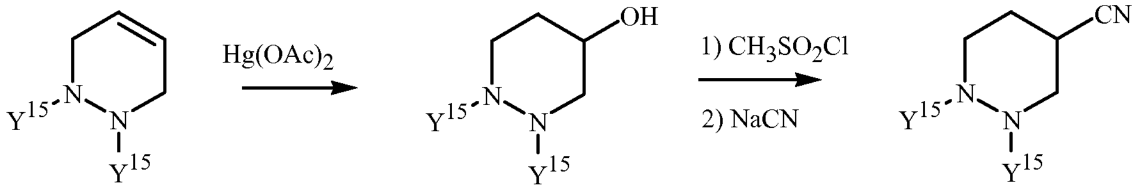
Scheme 25



The core 6-membered and 7-membered heterocyclic ring systems depicted in the above Schemes (X in Formula **1**) are known or can be prepared by methods known to one skilled in the art. The synthetic literature describes many general methods for forming saturated and partially unsaturated 6- and 7-membered heterocyclic ring systems. See, for example, *Comprehensive Heterocyclic Chemistry*, Vol. 3 and 7, A. R. Katritzky and C. W. Rees editors, Pergamon Press, New York, **1984**; *Comprehensive Heterocyclic Chemistry II*, Vol. 6 and 9, A. R. Katritzky, C. W. Rees, and E. F. Scriven editors, Pergamon Press, New York, **1996**; and the series, *The Chemistry of Heterocyclic Compounds*, E. C. Taylor, editor, Wiley, New York. In addition, numerous specific examples of many of these ring systems can be found in the original synthetic literature via structure searches using electronic databases such as Scifinder and Bielstein as known to one skilled in the art. One skilled in the art will know how to select the appropriate protecting groups and functional groups to construct the desired heterocyclic rings.

For example, the intermediate cyano compound **42** wherein the core heterocycle is a hexahydropyridazine (e.g., X-5) can be prepared by a three step sequence outlined in Scheme 26. The tetrahydropyridazine **43** is hydroxylated in the presence of mercuric acetate to give compound **44** (see Vartanyan, R. S. et al. *Armyanskii Khimicheskii Zhurnal* **1991**, *44*(4), 259). The hydroxyl group in compound **44** can be converted into its corresponding mesylate and displaced with a cyanide anion using standard methods to give compound **42**.

Scheme 26

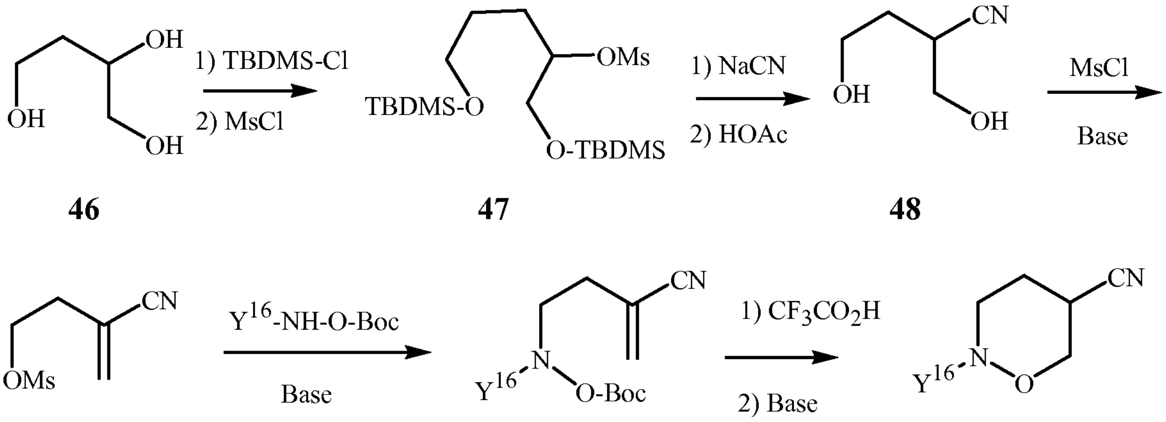


43 **44** **42**

Y^{15} is an amine protecting group such as ethoxycarbonyl

In a second example, the intermediate cyano compound **45** wherein the core heterocycle is a tetrahydro-1,2-oxazine (e.g., X-4) can be prepared in eight steps as outlined in Scheme 27. The primary hydroxyl groups of triol **46** are protected, the secondary hydroxyl group is mesylated and displaced by cyanide followed by deprotection to give cyanodiol **48**. Mesylation followed by base treatment gives olefin **49** and the mesyl group is displaced by an *O,N* di-protected hydroxylamine. The *O* protecting group can be removed followed by base catalyzed cyclization to provide a compound of Formula **45**.

Scheme 27



46 **47** **48**

49 **50** **45**

Y^{16} is an amine protecting group such as ethoxycarbonyl
Ms is CH_3SO_2Cl

Alternatively, tetrahydro-1,2-oxazines (e.g. X-4) can be prepared by cycloaddition of nitrosyl hydride or nitrosoformaldehyde with substituted dienes as described by Ensley, H.E. and Mahadevan, S., *Tetrahedron Lett.* **1989**, *30*(25), 3255, or by reaction of substituted 1,4-dibromobutanes with *N*-hydroxyurethane as described by Riddell, F. G. and Williams, D. A. R., *Tetrahedron* **1974**, *30*(9), 1083.

It is recognized that some reagents and reaction conditions described above for preparing compounds of Formula **1** may not be compatible with certain functionalities present in the intermediates. In these instances, the incorporation of protection/deprotection sequences or functional group interconversions into the synthesis will aid in obtaining the desired products. The use and choice of the protecting groups will be apparent to one skilled in chemical synthesis (see, for example, Greene, T. W.; Wuts, P. G. M. *Protective Groups in Organic Synthesis*, 2nd ed.; Wiley: New York, 1991). One skilled in the art will recognize that, in some cases, after the introduction of a given reagent as it is depicted in any individual scheme, it may be necessary to perform additional routine synthetic steps not described in detail to complete the synthesis of compounds of Formula **1**. One skilled in the art will also recognize that it may be necessary to perform a combination of the steps illustrated in the above schemes in an order other than that implied by the particular sequence presented to prepare the compounds of Formula **1**.

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

Without further elaboration, it is believed that one skilled in the art using the preceding description can utilize the present 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, “q” means quartet, “m” means multiplet, “dd” means doublet of doublets, “dt” means doublet of triplets, “br s” means broad singlet.

In the following examples the intermediate, 1-[2-[5-methyl-3-(trifluoromethyl)-1*H*-pyrazol-1-yl]acetyl]-4-piperidinecarbothioamide was prepared by the methods disclosed in World Patent Publication WO 2008/013622 Example 8, Steps A or A1, B and C.

EXAMPLE 1

Preparation of 1-[4-[4-[5-[2-(2,6-difluorophenoxy)ethyl]-4,5-dihydro-3-isoxazolyl]-2-thiazolyl]-1-piperdinyl]-2-[5-methyl-3-(trifluoromethyl)-1*H*-pyrazol-1-yl]ethanone (Compound 2)

Step A: Preparation of 2-(3-buten-1-yloxy)-1,3-difluorobenzene

A suspension of 4-bromo-1-butene (4.21 g, 31.38 mmol), 2,6-difluorophenol (3.4 g, 26.15 mmol) and potassium carbonate (5.41 g, 39.23 mmol) in acetonitrile (40 mL) was heated at 50 °C for 8 hr. The resulting mixture was cooled to room temperature and filtered. The filtrate was diluted with water and extracted with ethyl acetate. The combined extracts were washed with saturated aqueous NaCl solution, dried ($MgSO_4$) and concentrated under reduced pressure to provide 3.37 g of the title compound as a light yellow liquid.

^{1}H NMR ($CDCl_3$) δ 2.50-2.60 (m, 2H), 4.10-4.22 (m, 2H), 5.14 (dd, 2H), 5.83-5.99 (m, 1H), 6.83-7.00 (m, 3H).

Step B: Preparation of Preparation of 2-chloro-1-[5-[2-(2,6-difluorophenoxy)ethyl]-4,5-dihydro-3-isoxazolyl]ethanone

A suspension of 2-(3-buten-1-yloxy)-1,3-difluorobenzene (i.e. the product of Step A) (3.37 g, 18.3 mmol), 3-chloro-*N*-hydroxy-2-oxo-propanimidoyl chloride (2.84 g, 18.3 mmol) and sodium carbonate (4.62 g, 54.9 mmol) in acetonitrile (50 mL) was stirred overnight at room temperature. The resulting mixture was concentrated onto silica gel and purified by column chromatography with 20% ethyl acetate/hexanes as eluents to obtain 3.22 g of the title compound as a light yellow oil which crystallized on standing.

^{1}H NMR ($CDCl_3$) δ 2.00-2.23 (m, 2H), 3.01 (dd, 1H), 3.40 (dd, 1H), 4.20-4.30 (m, 2H), 4.68 (s, 2H), 5.10-5.27 (m, 1H), 6.83-7.02 (m, 3H).

Step C: Preparation of 1-[4-[4-[5-[2-(2,6-difluorophenoxy)ethyl]-4,5-dihydro-3-isoxazolyl]-2-thiazolyl]-1-piperdinyl]-2-[5-methyl-3-(trifluoromethyl)-1*H*-pyrazol-1-yl]ethanone

A mixture of 2-chloro-1-[5-[2-(2,6-difluorophenoxy)ethyl]-4,5-dihydro-3-isoxazolyl]ethanone (i.e. the product of Step B) (0.5 g, 1.65 mmol), sodium bromide (0.25 g, 2.48 mmol) and acetone (10 mL) was heated at 50 °C for 40 min. After cooling to room temperature, 1-[2-[5-methyl-3-(trifluoromethyl)-1*H*-pyrazol-1-yl]acetyl]-4-piperidinecarbothioamide (0.55 g, 1.65 mmol) was added and the reaction mixture stirred overnight. The reaction was concentrated under reduced pressure, the residue was diluted with water and extracted twice with ethyl acetate. The organic phase was separated, dried over magnesium sulfate, filtered, concentrated onto silica gel and purified by medium pressure column chromatography with 50 to 100% EtOAc/hexanes as eluents to provide 511 mg of the title compound, a compound of the present invention, as a solid yellow foam.

^{1}H NMR ($CDCl_3$): δ 1.70-1.90 (m, 2H), 2.10-2.30 (m, 4H), 2.32 (s, 3H), 2.90 (br t, 1H), 3.20-3.40 (m, 3H), 3.58 (dd, 1H), 4.05 (d. !H), 4.32 (t, 2H), 4.58 (d, 1H), 4.95-5.10 (m, 3H), 6.33 (s, 1H), 6.82-7.00 (m, 3H), 7.59 (s, 1H), M+1 = 584.

EXAMPLE 2

Preparation of 2-[[[4,5-dihydro-3-[2-[1-[2-[5-methyl-3-(trifluoromethyl)-1*H*-pyrazol-1-yl]acetyl]-4-piperidinyl]-4-thiazolyl]-5-isoxazolyl]methoxy]methyl]-1*H*-isoindole-1,3(2*H*)-dione (Compound 3)

Step A: Preparation of 2-[(2-propen-1-yloxy)methyl]-1*H*-isoindole-1,3(2*H*)-dione

A suspension of allyl alcohol (1.46 g, 25.1 mmol), 2-(bromomethyl)-1*H*-isoindole-1,3(2*H*)-dione, (5.0 g, 20.9 mmol) and sodium bicarbonate (3.5 g, 41.84 mmol) in acetonitrile (40 mL) was heated at reflux for 4 hr. An additional 5 mL of allyl alcohol was added and the reaction heated at reflux for another 4 hr. The resulting mixture was cooled to room temperature decanted and concentrated onto silica gel and purified by medium pressure column chromatography with 40 to 100% EtOAc/hexanes as eluents to provide 1 g of the title compound as a white solid containing some starting material bromide.

^{1}H NMR (CDCl$_3$) δ 4.11-4.15 (m, 2H) 5.10-5.20 (m, 3H), 5.37 (d, 1H), 5.83-5.95 (m, 1H), 7.70-8.00 (m, 4H).

Step B: Preparation of 2-[[[3-(2-chloroacetyl)-4,5-dihydro-5-isoxazolyl]methoxy]methyl]-1*H*-isoindole-1,3(2*H*)-dione

A suspension of 2-[(2-propen-1-yloxy)methyl]-1*H*-isoindole-1,3(2*H*)-dione (i.e. the product of Step A) (1.0 g, 4.61 mmol), 3-chloro-N-hydroxy-2-oxo-propanimidoyl chloride (0.71 g, 4.61 mmol) and sodium carbonate (1.16 g, 13.83 mmol) in acetonitrile (15 mL) was stirred overnight at room temperature. The resulting mixture was filtered, concentrated onto silica gel and purified by medium pressure liquid chromatography with 20 to 100% ethyl acetate/hexanes as eluents to obtain 0.73 g of the title compound as a light yellow oil.

^{1}H NMR (CDCl$_3$) δ 3.03-3.20 (m, 2H), 3.75-3.90 (m, 2H), 4.65 (s, 2H), 4.87-4.97 (m, 1H), 5.18 (s, 2H), 7.77-7.90 (m, 4H).

Step C: Preparation of 2-[[[4,5-dihydro-3-[2-[1-[2-[5-methyl-3-(trifluoromethyl)-1*H*-pyrazol-1-yl]acetyl]-4-piperidinyl]-4-thiazolyl]-5-isoxazolyl]methoxy]methyl]-1*H*-isoindole-1,3(2*H*)-dione

A mixture of 2-[[[3-(2-chloroacetyl)-4,5-dihydro-5-isoxazolyl]methoxy]methyl]-1*H*-isoindole-1,3(2*H*)-dione (i.e. the product of Step B) (0.73 g, 2.17 mmol), sodium bromide (0.34 g, 3.26 mmol) and acetonitrile (25 mL) was heated at 50 °C for 30 min. After cooling to room temperature, 1-[2-[5-methyl-3-(trifluoromethyl)-1*H*-pyrazol-1-yl]acetyl]-4-piperidinecarbothioamide (0.73 g, 2.17 mmol) was added and the reaction mixture stirred overnight. The reaction was concentrated under reduced pressure, diluted with water and extracted three times with methylene chloride. The combined organic phase was dried over magnesium sulfate, filtered, concentrated onto silica gel and purified by medium pressure liquid chromatography with 100% ethyl acetate as eluent to provide 193 mg of the title compound, a compound of the present invention, as a pale yellow solid foam.

^{1}H NMR (CDCl$_3$): δ 1.70-1.82 (m, 2H), 2.20 (br t, 2H), 2.32 (s, 3H), 2.89 (t, 1H), 3.30-3.40 (m, 3H), 3.60 (dd, 1H), 3.80 (d, 2H), 4.03 (d, 1H), 4.58 (d, 1H), 4.83-5.05 (m, 3H), 5.21 (s, 2H), 6.35 (s, 1H), 7.56 (s, 1H), 7.75-7.80 (m, 2H), 7.87-7.97 (m, 2H).

EXAMPLE 3

Preparation of 5-chloro-3-[3-[4,5-dihydro-3-[2-[1-[2-[5-methyl-3-(trifluoromethyl)-1*H*-pyrazol-1-yl]acetyl]-4-piperidinyl]-4-thiazolyl]-5-isoxazolyl]propyl]-2(3*H*)-benzothiazolone (Compound 8)

Step A: Preparation of 5-chloro-3-(4-penten-1-yl)-2(3*H*)-benzothiazolone

A suspension of 5-bromo-1-pentene (12.5 g, 84.5 mmol), 5-chloro-2(3*H*)-benzothiazolone, (5.22 g, 28.2 mmol) and potassium carbonate (11.66 g, 84.5 mmol) in acetonitrile (30 mL) was stirred at room temperature for 48 hours. The resulting mixture was filtered and concentrated to provide 6.5 g of the title compound as a yellow oil.

^{1}H NMR ($CDCl_3$) δ 1.80-1.90 (m, 2H), 2.17-2.22 (m, 2H), 3.92 (t, 2H), 5.00-5.18 (m, 2H), 5.80-5.90 (m, 1H), 7.03 (s, 1H), 7.15 (d, 1H), 7.34 (d, 1H).

Step B: Preparation of 5-chloro-3-[3-[3-(2-chloroacetyl)-4,5-dihydro-5-isoxazolyl]propyl]-2(3*H*)-benzothiazolone

A suspension of 5-chloro-3-(4-penten-1-yl)-2(3*H*)-benzothiazolone (i.e. the product of Step A) (2.17 g, 8.58 mmol), 3-chloro-N-hydroxy-2-oxo-propanimidoyl chloride (1.33 g, 8.58 mmol) and sodium carbonate (2.49 g, 29.64 mmol) in acetonitrile (30 mL) was stirred overnight at room temperature. The reaction mixture was diluted with water and extracted three times with ethyl acetate. The combined organic phase was washed with saturated aqueous NaCl solution, dried over magnesium sulfate, filtered and concentrated to provide 2.77 g of the title compound as a dark yellow oil.

^{1}H NMR ($CDCl_3$) δ 1.70-2.00 (m, 4H), 2.85 (dd, 1H), 3.25(dd, 1H), 3.90-4.03 (m, 2H), 4.66 (s, 2H), 4.85-4.95 (m, 1H), 7.05 (d, 1H), 7.17 (dd, 1H), 7.36 (d, 1H).

Step C: Preparation of 5-chloro-3-[3-[4,5-dihydro-3-[2-[1-[2-[5-methyl-3-(trifluoromethyl)-1*H*-pyrazol-1-yl]acetyl]-4-piperidinyl]-4-thiazolyl]-5-isoxazolyl]propyl]-2(3*H*)-benzothiazolone

A mixture of 5-chloro-3-[3-[3-(2-chloroacetyl)-4,5-dihydro-5-isoxazolyl]propyl]-2(3*H*)-benzothiazolone (i.e. the product of Step B) (0.81 g, 2.17 mmol), sodium bromide (0.34 g, 3.26 mmol), 1-[2-[5-methyl-3-(trifluoromethyl)-1*H*-pyrazol-1-yl]acetyl]-4-piperidinecarbothioamide (0.73 g, 2.19 mmol), and acetonitrile (15 mL) was stirred at room temperature for 6 days. The reaction mixture was diluted with water and extracted three times with ethyl acetate. The combined organic phases were washed with saturated aqueous NaCl solution, dried over magnesium sulfate, filtered, concentrated onto silica gel and purified by medium pressure liquid chromatography with 60 to 100% ethyl acetate/hexanes as eluents to provide 435 mg of the title compound, a compound of the present invention, as a light yellow solid foam.

^{1}H NMR ($CDCl_3$): δ 1.70-2.03 (m, 6H), 2.20 (br t, 2H), 2.33 (s, 3H), 2.90 (t, 1H), 3.10 (dd, 1H), 3.25-3.35 (m, 2H), 3.50 (dd, 1H), 3.95-4.10 (m, 3H), 4.55 (d, 1H), 4.75-4.90 (m, 1H), 4.95-5.05 (m, 2H), 6.38 (s, 1H), 7.08 (s, 1H), 7.18 (d, 1H), 7.38 (d, 1H), 7.58 (s, 1H).

EXAMPLE 4

Preparation of *N*-[(2,6-difluorophenyl)methyl]-4,5-dihydro-3-[2-[1-[2-[5-methyl-3-(trifluoromethyl)-1*H*-pyrazol-1-yl]acetyl]-4-piperidinyl]-4-thiazolyl]-5-isoxazoleacetamide (Compound 4)

Step A: Preparation of 3-(2-chloroacetyl)-4,5-dihydro-5-isoxazoleacetic acid

A mixture of 3-chloro-*N*-hydroxy-2-oxo-propanimidoyl chloride (3.6 g, 23.23 mmol), 3-butenoic acid (2.0 g, 23.23 mmol) and sodium bicarbonate (5.86 g, 69.77 mmol) in acetonitrile (50 mL) was stirred overnight at room temperature. The resulting mixture was diluted with water, adjusted to pH 6 with 1 N HCL and extracted twice with ethyl acetate. The combined organic phases were washed with saturated aqueous NaCl solution, dried over magnesium sulfate, filtered, concentrated and triturated with 1-chlorobutane/hexanes to obtain 0.70 g of the title compound as a pale yellow solid.

^{1}H NMR (DMSO-d_6) δ 2.60-2.70 (m, 2H), 2.90 (dd, 1H), 3.30 (dd, 1H), 4.80-4.90 (m, 2H), 5.05-5.18 (m, 1H), 12.45 (br s, 1H).

Step B: Preparation of 4,5-dihydro-3-[2-[1-[2-[5-methyl-3-(trifluoromethyl)-1*H*-pyrazol-1-yl]acetyl]-4-piperidinyl]-4-thiazolyl]-5-isoxazoleacetic acid

A mixture of 3-(2-chloroacetyl)-4,5-dihydro-5-isoxazoleacetic acid (i.e. the product of Step A) (0.70 g, 3.4 mmol), sodium bromide (0.52 g, 5.1 mmol) and acetone (10 mL) was heated at 50 °C for 30 min. After cooling to room temperature, 1-[2-[5-methyl-3-(trifluoromethyl)-1*H*-pyrazol-1-yl]acetyl]-4-piperidinecarbothioamide (1.13 g, 3.39 mmol) was added and the reaction mixture stirred overnight. The reaction was concentrated under reduced pressure, the residue was diluted with water, adjusted to pH 6 with 1 N HCl and extracted twice with ethyl acetate. The combined organic phases were washed with saturated aqueous NaCl solution, dried over magnesium sulfate, filtered, concentrated to provide 1.07 g of the title compound as a light yellow solid foam.

^{1}H NMR ($CDCl_3$): δ 1.70-1.85 (m, 2H), 2.10-2.30 (m, 2H), 2.32 (s, 3H), 2.70 (dd, 1H), 2.85-2.95 (m, 3H), 3.23 (dd, 1H), 3.30-3.40 (m, 2H), 3.60 (dd, 1H), 4.07 (br d, 1H), 4.60 (br d, 1H), 4.95-5.20 (m, 3H), 6.35 (s, 1H), 7.61 (s, 1H).

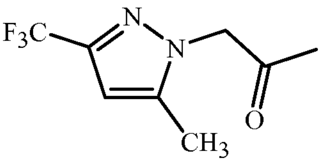
Step C: Preparation of *N*-[(2,6-difluorophenyl)methyl]-4,5-dihydro-3-[2-[1-[2-[5-methyl-3-(trifluoromethyl)-1*H*-pyrazol-1-yl]acetyl]-4-piperidinyl]-4-thiazolyl]-5-isoxazoleacetamide

A mixture of 4,5-dihydro-3-[2-[1-[2-[5-methyl-3-(trifluoromethyl)-1*H*-pyrazol-1-yl]acetyl]-4-piperidinyl]-4-thiazolyl]-5-isoxazoleacetic acid (i.e. the product of Step B) (150 mg, 0.31 mmol), 2,6-difluorobenzylamine (49 mg, 0.34 mmol), 1-ethyl-3-(3-dimethylaminopropyl)carbodiimide (89 mg, 0.46 mmol), 4-(dimethylamino)pyridine (4 mg, 0.034 mmol) and methylene chloride (3 mL) was stirred at room temperature for 6 hr. The resulting mixture was diluted with water, extracted with ethyl acetate. The combined organic extracts were washed with saturated aqueous NaCl solution, dried over magnesium sulfate, filtered, concentrated onto silica gel and purified by medium pressure liquid chromatography with 50 to 100% ethyl acetate/hexanes as eluents to obtain 57 mg of the title compound, a compound of the present invention, as a solid pale yellow foam.

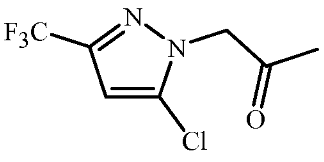
^{1}H NMR ($CDCl_3$): δ 1.70-1.83 (m, 2H), 2.10-2.25 (m, 2H), 2.32 (s, 3H), 2.58 (dd, 1H), 2.65 (dd, 1H), 2.89 (t, 1H), 3.18-3.98 (m, 3H), 3.55 (dd, 1H), 4.00-4.10 (m, 1H), 4.50-4.60 (m, 3H), 4.85-5.15 (m, 3H), 6.27 (t, 1H), 6.33 (s, 1H), 6.80-6.90 (m, 2H), 7.20-7.30 (m, 1H), 7.55 (s, 1H).

By the procedures described herein together with methods known in the art, the following compounds of Tables 1 to 10 can be prepared. The following abbreviations are used in the Tables which follow: *n* means normal, *i* means iso, Me means methyl, Et means ethyl, Ph means phenyl, OMe means methoxy, SMe means methylthio, CN means cyano, Ph means phenyl, NO_2 means nitro, S(O)Me means methylsulfinyl, and $S(O)_2Me$ means methylsulfonyl.

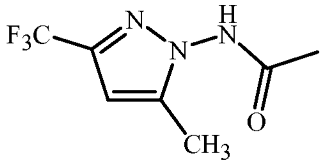
Fragments E-1a through E-3d shown below are referred to in Tables 1 to 10.



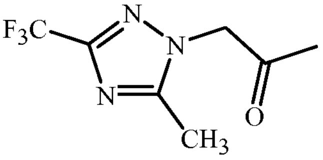
E-1a



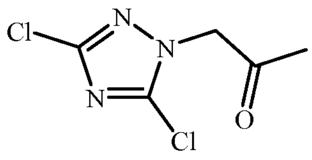
E-1b



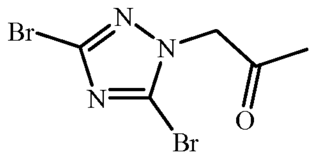
E-1c



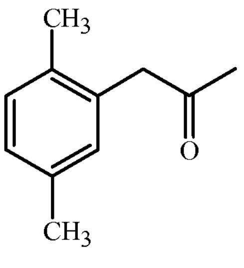
E-1d



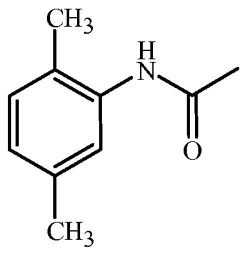
E-1e



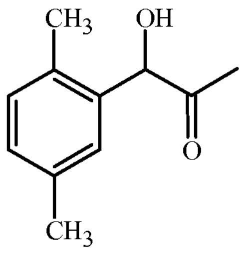
E-1f



E-1g



E-1h



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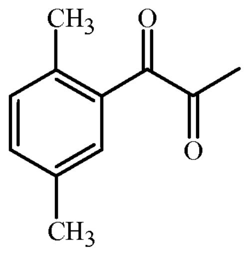
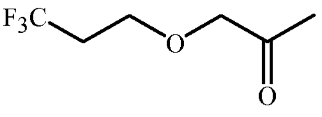
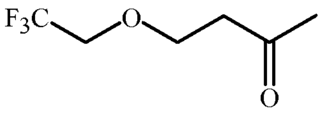


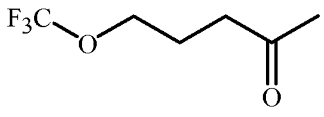
E-1j



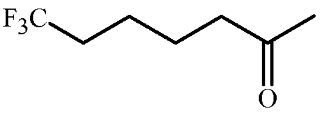
E-1k



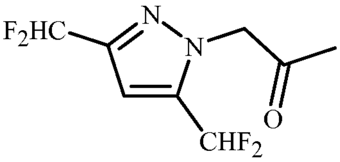
E-1l



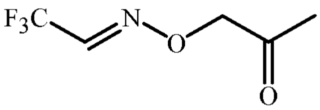
E-1m



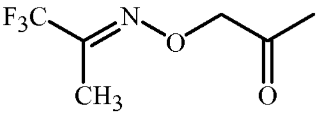
E-1n



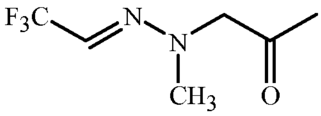
E-1o



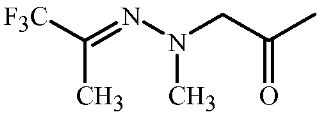
E-2a



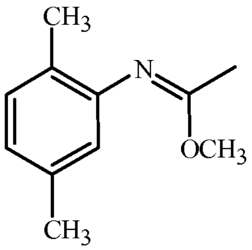
E-2b



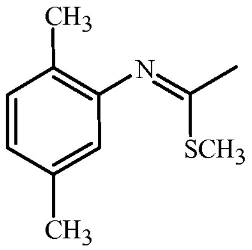
E-2c



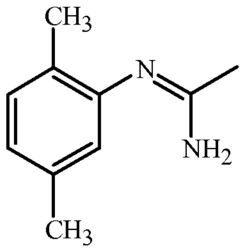
E-2d



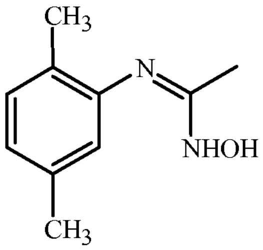
E-3a



E-3b



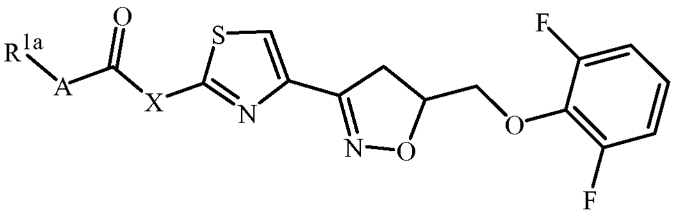
E-3c



E-3d

The invention includes but is not limited to the following exemplary species.

TABLE 1a



A is CHR^{15}, R^{15} is H, X is X-1 and n is 0.

R^{1a}	R^{1a}
Ph	3-ethylphenyl
2-methylphenyl	3-(CF$_3$)phenyl
2-methoxyphenyl	3-cyanophenyl
2-chlorophenyl	3-nitrophenyl
2-bromophenyl	2,5-dichlorophenyl
2-ethoxyphenyl	5-bromo-2-chlorophenyl

R^{1a}
2-(methylthio)phenyl
3-chlorophenyl
3-bromophenyl
3-iodophenyl
3-methylphenyl
2-chloro-5-(CF_3)phenyl
2,5-dibromophenyl
2-bromo-5-methylphenyl
2-bromo-5-(CF_3)phenyl
5-chloro-2-methylphenyl
5-bromo-2-methylphenyl
2,5-dimethylphenyl
2-methyl-5-(CF_3)phenyl
5-cyano-2-methylphenyl
2-methyl-5-nitrophenyl
5-chloro-2-methoxyphenyl
5-bromo-2-methoxyphenyl
2-methoxy-5-methylphenyl
3-ethyl-5-methylpyrazol-1-yl
5-methyl-3-(CF_3)pyrazol-1-yl
5-methyl-3-(C_2F_5)pyrazol-1-yl
5-chloro-3-methylpyrazol-1-yl
3,5-dichloropyrazol-1-yl
5-chloro-3-(CF_3)pyrazol-1-yl
5-bromo-3-methylpyrazol-1-yl
3,5-dibromopyrazol-1-yl
5-bromo-3-(CF_3)pyrazol-1-yl
3,5-dimethyl-2-thienyl
3,5-dichloro-2-thienyl
3,5-dimethyl-2-furyl
4-methyl-2-(CF_3)-5-thiazolyl
4-methyl-2-(CF_3)-5-oxazolyl
1-methyl-4-(CF_3)-2-imidazolyl
2,4-dimethyl-1-pyrrolyl
1-methyl-3-(CF_3)pyrazol-5-yl
3-bromo-5-(CF_3)pyrazol-1-yl
3-methyl-5-(CF_3)-pyrazol-1-yl

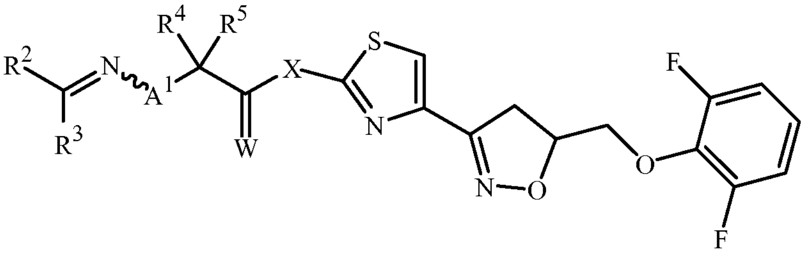
R^{1a}
2-chloro-5-methylphenyl
2-methoxy-5-(CF_3)phenyl
2,5-diethylphenyl
3-methylpyrazol-1-yl
3-chloropyrazol-1-yl
3-bromopyrazol-1-yl
3-(CF_3)pyrazol-1-yl
3,5-dimethylpyrazol-1-yl
3-chloro-5-methylpyrazol-1-yl
3-bromo-5-methylpyrazol-1-yl
5-methoxy-3-methylpyrazol-1-yl
3,5-diethylpyrazol-1-yl
5-ethyl-3-(CF_3)pyrazol-1-yl
2,5-dimethyl-3-furyl
2,5-dimethyl-3-thienyl
2,5-dichloro-3-thienyl
1,4-dimethyl-3-pyrrolyl
1,4-dimethyl-3-pyrazolyl
1,3-dimethyl-4-pyrazolyl
2,5-dimethyl-4-oxazolyl
2,5-dimethyl-4-thiazolyl
3,6-dimethyl-2-pyridyl
2,5-dimethyl-3-pyridyl
2,5-dimethyl-4-pyridyl
3,6-dichloro-2-pyridyl
2,5-dichloro-3-pyridyl
2,5-dichloro-4-pyridyl
4-bromo-3-pyridazinyl
4-(CF_3)-2-pyrimidinyl
3,6-dimethyl-2-pyrazinyl
2,5-dimethyl-4-pyrimidinyl
4-methoxy-5-pyrimidinyl
3,6-dimethyl-4-pyridazinyl
1-methyl-4-(CF_3)imidazol-2-yl
3,5-bis-(CF_3)pyrazol-1-yl
3-chloro-5-(CF_3)-pyrazol-1-yl
3,5-bis-(difluoromethoxy)pyrazol-1-yl

R^{1a}	R^{1a}
3-methoxy-5-(CF_3)-pyrazol-1-yl	3,5-dimethoxypyrazol-1-yl
3,5-dibromopyrazol-1-yl	5-ethoxy-3-methylpyrazol-1-yl
5-methoxy-3-methylpyrazol-1-yl	5-ethoxy-3-(CF_3)pyrazol-1-yl
5-methoxy-3-(CF_3)pyrazol-1-yl	3,5-dibromotriazol-1-yl
3,5-dichlorotriazol-1-yl	3-chloro-5-methyltriazol-1-yl
3-methyl-5-chlorotriazol-1-yl	3-bromo-5-methyltriazol-1-yl
3-methyl-5-bromotriazol-1-yl	3-(CF_3)-5-chlorotriazol-1-yl
3-chloro-5-(CF_3)triazol-1-yl	3-(CF_3)-5-bromotriazol-1-yl
3-bromo-5-(CF_3)triazol-1-yl	3,5-bis(CF_3)triazol-1-yl
n-butyl	Trifluoromethoxyethyl
i-amyl	2-methoxyethoxy
3-methyl-2-buten-1-yl	3,3,3-trifluoropropoxy
propargyl	2,2,2-trifluoroethylcarbonyloxy
4,4,4-trifluorobutan-1-yl	allyloxy
3,3-dichloro-2-propen-1-yl	propylthio
2-(CF_3)cyclopropyl-1-yl	3,3,3-trifluoropropylthio
i-butoxy	3,3,3-trifluoropropylamino
2,2,2-trifluoroethoxymethyl	3,5-bis-(difluoromethyl)pyrazol-1-yl

The present disclosure also includes Table 1b through 1d, each of which is constructed the same as Table 1a above except that the table heading in Table 1a (i.e. “A is CHR^{15}, R^{15} is H, X is X-1 and n is 0” is replaced with the respective table headings shown below. For example, in Table 1b the table heading is “A is CHR^{15}, R^{15} is H, X is X-2 and n is 0” and R^{1a} is as defined in Table 1a above. Thus, the first entry in Table 1b specifically discloses a compound of Formula **1** wherein A is CHR^{15}, R^{15} is H, X is X-2, n is 0 and R^{1a} is phenyl.

Table	Table Headings A is	X is	n	R^{6b} is
1b	CHR^{15}, R^{15} is H	X-2	0	-
1c	CHR^{15}, R^{15} is H	X-4	0	-
1d	CHR^{15}, R^{15} is H	X-5	0	H

TABLE 2

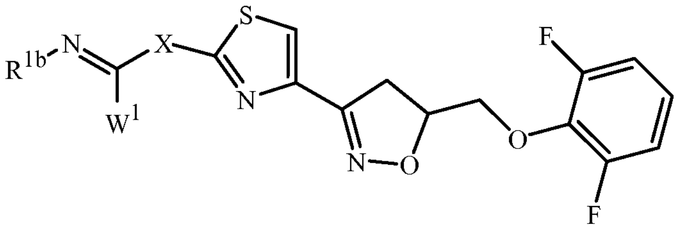


W is O, X is X-1 and n is 0.

R^2	R^3	R^4	R^5	A^1
CH_3	CH_3	H	H	O
CH_3	CH_3	H	H	S
CH_3	CH_3	H	H	NH
CH_3	CH_3	H	H	N(Me)
CH_3	CH_3	H	H	CH_2
CH_3	CH_3	H	H	OCH_2
CH_3	CH_3	H	H	SCH_2
CH_3	CH_3	H	H	$NHCH_2$
CH_3	CH_3	H	H	$-N(Me)CH_2-$
CH_3	CH_3	CH_3	H	O
CH_3	CH_3	CH_3	CH_3	O
CH_3	CH_3	H	H	O
CF_3	H	H	H	O
CF_3	H	H	H	S
CF_3	H	H	H	NH
CF_3	H	H	H	N(Me)
CF_3	H	H	H	CH_2
CF_3	H	H	H	OCH_2
CF_3	H	H	H	SCH_2
CF_3	H	H	H	$NHCH_2$
CF_3	H	H	H	$-N(Me)CH_2-$
CF_3	CH_3	H	H	O
CF_3	CH_3	H	H	S
CF_3	CH_3	H	H	NH
CF_3	CH_3	H	H	N(Me)
CF_3	CH_3	H	H	CH_2
CF_3	CH_3	H	H	OCH_2
CF_3	CH_3	H	H	SCH_2
CF_3	CH_3	H	H	$NHCH_2$

R^2	R^3	R^4	R^5	A^1
CF_3	CH_3	H	H	-N(Me)CH_2-
CF_3	H	Me	H	O
CF_3	CH_3	H	Me	O
CF_3CH_2	H	H	H	O
CF_3CH_2	CH_3	H	H	O
Et	H	H	H	O
Et	CH_3	H	H	O
CH_3	H	H	H	O

TABLE 3

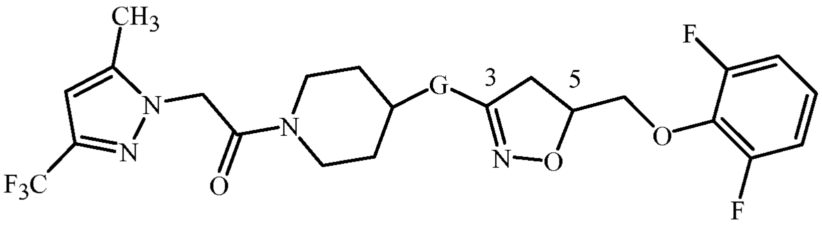


X is X-1 and n is 0.

R^{1b}	W^1	R^{1b}	W^1
2-methylphenyl	OMe	2-methoxy-5-methylphenyl	NHOH
2-methoxyphenyl	SMe	2-methoxy-5-(CF_3)-phenyl	NHOMe
2-chlorophenyl	NH_2	2,5-diethylphenyl	$NHNH_2$
2-bromophenyl	NHOH	3,5-dimethylpyrazol-1-yl	OMe
2-ethylphenyl	NHOMe	3,5-dichloropyrazol-1-yl	SMe
2-ethoxyphenyl	$NHNH_2$	3,5-dibromopyrazol-1-yl	NH_2
2-(methylthio)-phenyl	OMe	3,5-bis-(CF_3)-pyrazol-1-yl	NHOH
2-(trifluoromethoxy)-phenyl	SMe	5-methyl-3-(CF_3)-pyrazol-1-yl	NHOMe
3-chlorophenyl	NH_2	3,5-dimethyl-1,2,4-triazol-1-yl	$NHNH_2$
3-bromophenyl	NHOH	3,5-dichlorol-1,2,4-triazol-1-yl	OMe
3-methylphenyl	NHOMe	3,5-dibromo-1,2,4-triazol-1-yl	SMe
2,5-dimethylphenyl	$NHNH_2$	*n*-butyl	NH_2
2,5-dichlorophenyl	OMe	*i*-amyl	NHOH
2-chloro-5-(CF_3)-phenyl	SMe	3-methyl-2-buten-1-yl	NHOMe
2,5-dibromophenyl	NH_2	Propargyl	$NHNH_2$
2-bromo-5-(CF_3)-phenyl	NHOH	4,4,4-trifluorobutan-1-yl	OMe
5-chloro-2-methylphenyl	NHOMe	3,3-dichloro-2-propen-1-yl	SMe
5-bromo-2-methylphenyl	$NHNH_2$	2-CF_3cyclopropyl-1-yl	NH_2
2-methyl-5-(CF_3)-phenyl	OMe	*i*-butoxy	NHOH
5-chloro-2-methoxyphenyl	SMe	Trifluoromethoxyethyl	NHOMe

R^{1b}	W^1	R^{1b}	W^1
5-bromo-2-methoxyphenyl	NH_2	3,3,3-trifluoropropoxy	$NHNH_2$

TABLE 4

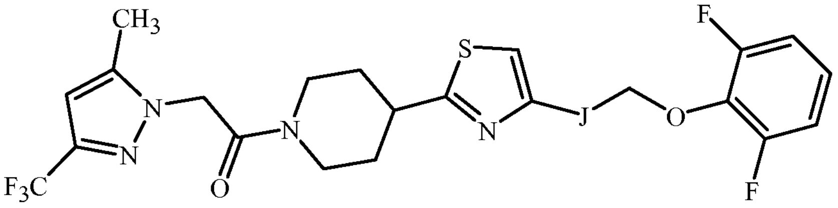


In Table 4 the individual G structures are from Exhibit 3 (i.e., G-1 through G-48) where the bond projecting to the left in G is connected to X (e.g. X-1) of Formula **1** and the bond projecting to the right in G is bonded to the carbon or nitrogen of J. For instance, the first compound listed in Table 4 is a compound of Formula **1** wherein E is E-1a, X is X-1, n is 0, J is J-29 (3/5), x is 0, Z is Z^1-1, each R^{12} is substituent H, Q is Q-45 and $(R^{9a})_p$ is 2,6-di-F. The numbers in parentheses following J refer to the attachment point of the J ring to G and Z (e.g. Z^1-1). The first number is the ring position on J where G is attached, and the second number is the ring position on J where Z is attached.

G	R^{29a}	R^{30a}	G	R^{29a}	R^{30a}
G-2	H	-	G-26	H	-
G-3	H	1-Me	G-27	H	-
G-4	H	-	G-28	H	-
G-5	H	-	G-29	H	-
G-6	H	1-Me	G-29	5-Me	-
G-7	-	-	G-29	5-Cl	-
G-8	-	-	G-29	5-Br	-
G-9	-	1-Me	G-29	5-CF_3	-
G-9	-	H	G-30	H	-
G-10	H	-	G-31	H	-
G-11	H	-	G-32	H	-
G-12	H	1-Me	G-33	H	-
G-13	H	H	G-34	H	-
G-14	H	-	G-35	H	-
G-14	5-Me	-	G-36	H	-
G-15	H	-	G-37	H	-
G-15	5-Me	-	G-38	H	-
G-16	H	1-Et	G-39	H	1-Me
G-17	H	-	G-40	H	-
G-18	H	-	G-41	H	-

G	R^{29a}	R^{30a}	G	R^{29a}	R^{30a}
G-19	-	H	G-42	H	1-Me
G-20	-	-	G-43	H	1-Me
G-21	-	-	G-44	H	-
G-22	H	1-Me	G-45	H	-
G-23	H	-	G-46	-	-
G-24	H	-	G-47	-	-
G-25	H	-	G-48	-	4-Me

TABLE 5

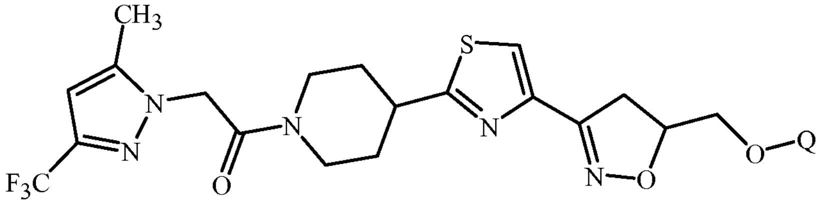


In Table 5 the structure of J (e.g. J-1 through J-83) is shown in Exhibit 4 in the above Embodiments and there are no $(R^{23})_x$ substituents. The thiazole ring in the above structure corresponds to G in Formula 1. The numbers in parentheses following J refer to the attachment point of the J ring to G (i.e. thiazole) and Z (i.e. Z^1-1). The first number is the ring position on J where G is attached, and the second number is the ring position on J where Z is attached. For instance, the first compound listed in Table 5 is a compound of Formula 1 wherein E is E-1a, X is X-1, n is 0, G is G-1, R^{29a} is H, Z is Z^1-1, each R^{12} is H, Q is Q-45, $(R^{9a})_p$ is 2,6-di-F, and J is J-1 (2/4).

J	J	J	J	J	J
J-1 (2/4)	J-9 (1/4)	J-24 (4/2)	J-32 (5/3)	J-44 (2/5)	J-70 (1/3)
J-1 (2/5)	J-9 (4/1)	J-24 (5/2)	J-32 (5/2)	J-44 (2/6)	J-71 (2/4)
J-1 (4/2)	J-10 (3/5)	J-25 (2/4)	J-32 (4/2)	J-45 (2/4)	J-71 (4/2)
J-1 (5/2)	J-10 (5/3)	J-25 (2/5)	J-33 (2/4)	J-45 (2/5)	J-72 (2/4)
J-2 (2/4)	J-11 (3/5)	J-25 (4/2)	J-33 (2/5)	J-45 (2/6)	J-72 (4/2)
J-2 (2/5)	J-11 (5/3)	J-25 (5/2)	J-33 (3/5)	J-46 (2/4)	J-73 (2/4)
J-2 (4/2)	J-12 (3/5)	J-26 (2/4)	J-33 (5/3)	J-46 (2/5)	J-73 (4/2)
J-2 (5/2)	J-12 (5/3)	J-26 (2/5)	J-33 (5/2)	J-46 (4/2)	J-73 (1/3)
J-3 (2/4)	J-12 (1/3)	J-26 (4/2)	J-33 (4/2)	J-46 (5/2)	J-73 (1/4)
J-3 (2/5)	J-12 (3/1)	J-26 (5/2)	J-34 (1/3)	J-47 (2/4)	J-73 (4/1)
J-3 (4/2)	J-13 (1/4)	J-26 (1/4)	J-34 (1/4)	J-47 (2/5)	J-74 (2/4)
J-3 (5/2)	J-13 (4/1)	J-26 (4/1)	J-34 (3/5)	J-47 (4/2)	J-74 (2/5)
J-3 (1/4)	J-14 (3/5)	J-27 (2/4)	J-34 (3/1)	J-47 (5/2)	J-74 (4/2)
J-3 (4/1)	J-14 (5/3)	J-27 (2/5)	J-34 (4/1)	J-48 (3/5)	J-74 (5/2)

J	J	J	J	J	J
J-4 (2/4)	J-15 (2/5)	J-27 (3/5)	J-35 (1/4)	J-49 (2/4)	J-74 (3/5)
J-4 (2/5)	J-16 (2/5)	J-27 (4/2)	J-35 (4/1)	J-49 (2/5)	J-74 (5/3)
J-4 (4./2)	J-17 (2/4)	J-27 (5/2)	J-36 (1/3)	J-49 (4/2)	J-75 (3/5)
J-4 (5/2)	J-17 (4/2)	J-27 (5/3)	J-36 (3/1)	J-49 (5/2)	J-75 (5/3)
J-4 (3/5)	J-18 (2/5)	J-28 (3/5)	J-36 (3/5)	J-50 (2/6)	J-75 (2/4)
J-4 (5/3)	J-18 (5/2)	J-28 (5/3)	J-36 (5/3)	J-51 (2/6)	J-75 (2/5)
J-5 (2/4)	J-19 (2/4)	J-29 (5/3)	J-37 (2/5)	J-52 (2/6)	J-75 (3/5)
J-5 (2/5)	J-19 (4/2)	J-30 (3/5)	J-37 (5/2)	J-53 (2/3)	J-75 (5/3)
J-5 (4/2)	J-20 (2/4)	J-30 (5/3)	J-37 (2/4)	J-54 (2/3)	J-76 (3/6)
J-5 (5/2)	J-20 (2/5)	J-30 (1/3)	J-37 (4/2)	J-55 (2/3)	J-76 (6/3)
J-5 (3/5)	J-20 (2/6)	J-30 (3/1)	J-38 (2/5)	J-56 (2/3)	J-77 (3/5)
J-5 (5/3)	J-20 (3/5)	J-30 (1/4)	J-38 (5/2)	J-57 (2/4)	J-77 (5/3)
J-6 (2/4)	J-20 (4/2)	J-30 (4/1)	J-38 (2/4)	J-58 (3/4)	J-78 (1/3)
J-6 (2/5)	J-20 (5/2)	J-31 (1/3)	J-38 (4/2)	J-59 (2/4)	J-79 (1/3)
J-6 (4/2)	J-21 (3/5)	J-31 (1/4)	J-39 (3/5)	J-60 (2/4)	J-79 (3/1)
J-6 (5/2)	J-21 (3/6)	J-31 (2/4)	J-39 (5/3)	J-61 (2/4)	J-80 (1/3)
J-6 (3/5)	J-21 (5/3)	J-31 (2/5)	J-40 (3/5)	J-62 (2/4)	J-80 (3/1)
J-6 (5/3)	J-22 (2/4)	J-31 (3/5)	J-40 (5/3)	J-63 (3/4)	J-81 (3/5)
J-6 (1/3)	J-22 (2/5)	J-31 (3/1)	J-41 (1/3)	J-64 (2/3)	J-81 (5/3)
J-6 (3/1)	J-22 (4/6)	J-31 (4/1)	J-41 (1/4)	J-65 (3/4)	J-82 (3/5)
J-7 (5/3)	J-22 (4/2)	J-31 (4/2)	J-42 (1/3)	J-66 (6/7)	J-82 (3/6)
J-7 (3/5)	J-22 (5/2)	J-31 (5/2)	J-42 (1/4)	J-67 (2/3)	J-82 (5/3)
J-8 (5/3)	J-23 (2/5)	J-32 (2/4)	J-43 (1/4)	J-68 (2/3)	J-82 (6/3)
J-8 (3/5)	J-23 (2/6)	J-32 (2/5)	J-44 (1/3)	J-69 (1/3)	J-83 (3/5)
J-9 (5/3)	J-24 (2/4)	J-32 (3/5)	J-44 (2/4)	J-69 (1/4)	J-83 (3/6)
J-9 (3/5)	J-24 (2/5)				

TABLE 6

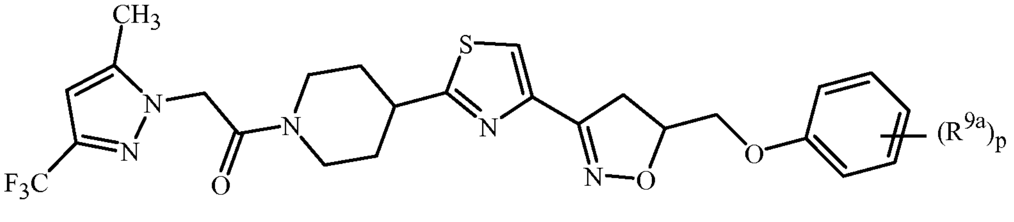


In Table 6 the individual Q structures are from Exhibit 5 (i.e., Q-1 through Q-102). The –CH_2-O- bridge in the above structure corresponds to Z is Z^1-1 wherein each R^{12} is H in Formula **1**. For instance, the first compound listed in Table 6 is a compound of Formula **1** wherein E is E-1a, X is X-1, n is 0, G is G-1, R^{29a} is H, J is J-29 (3/5), there is no $(R^{23})_x$ substituent, Z is Z^1-1, and each R^{12} is H.

Q	$(R^{9a})_p$	R^{9b}	Q	$(R^{9a})_p$	R^{9b}
Q-1	H	-	Q-60	H	-
Q-2	H	-	Q-61	H	-
Q-3	H	1-CH_3	Q-62	H	-
Q-4	2-Me	-	Q-63	H	-
Q-5	5-(2-F-phenyl)	-	Q-63	5-Cl	-
Q-6	5-Ph	-	Q-63	5-CN	-
Q-7	2-Ph	-	Q-63	5-Ph	-
Q-8	H	-	Q-63	5-CF3	-
Q-9	H	-	Q-63	5-CH3	-
Q-10	H	1-CH_3	Q-64	H	-
Q-11	H	1-CH_3	Q-65	H	-
Q-12	H	1-CH_3	Q-66	H	-
Q-13	H	4-CH_3	Q-67	H	-
Q-14	H	1-CH_3	Q-68	H	-
Q-15	5-(2-Cl-phenyl)	-	Q-69	H	-
Q-16	Ph	-	Q-70	H	-
Q-17	Ph	-	Q-70	4-Cl	-
Q-18	H	-	Q-70	4-CH_3	-
Q-19	H	-	Q-70	4-OCH_3	-
Q-20	H	-	Q-70	5-F	-
Q-21	H	1-CH_3	Q-70	5-Cl	-
Q-22	H	1-CH_3	Q-70	6-F	-
Q-23	H	1-CH_3	Q-71	H	-
Q-24	2-Ph	-	Q-71	5-Cl	-
Q-25	2-Ph	-	Q-72	H	H
Q-26	H	-	Q-72	H	1-CH_3
Q-27	H	-	Q-72	H	1-CO_2CH_3
Q-28	H	1-CH_2CH_3	Q-72	H	1-OCH_3
Q-29	Ph	-	Q-72	H	1-C(=O)CH_3
Q-30	H	-	Q-73	H	-
Q-31	Ph	1-CH_3	Q-74	H	-
Q-32	3-CH_3	-	Q-75	H	3-CH_3
Q-33	4-CH_3	-	Q-76	H	-
Q-34	H	-	Q-77	H	-

Q	$(R^{9a})_p$	R^{9b}	Q	$(R^{9a})_p$	R^{9b}
Q-35	4-Ph	-	Q-78	H	3-CH_3
Q-36	H	-	Q-79	H	1-CH_3
Q-37	H	-	Q-83	H	-
Q-38	H	-	Q-84	H	-
Q-39	H	-	Q-85	5,5-di-CH_3	-
Q-40	H	-	Q-86	H	1-CH_3
Q-41	H	-	Q-86	5,5-di-CH_3	1-CH_3
Q-42	H	-	Q-87	H	-
Q-43	H	-	Q-88	H	1-CH_3
Q-44	H	-	Q-89	H	-
Q-45	H	-	Q-90	H	-
Q-46	H	-	Q-91	H	-
Q-47	H	-	Q-92	H	1-CH_3
Q-48	2-F	-	Q-93	H	-
Q-50	H	-	Q-94	H	-
Q-51	H	-	Q-95	H	1-CH_3
Q-52	H	-	Q-96	H	-
Q-53	H	-	Q-97	H	-
Q-54	H	-	Q-98	H	-
Q-55	H	-	Q-99	H	-
Q-56	H	-	Q-100	H	-
Q-57	H	-	Q-101	H	-
Q-58	H	-	Q-102	5,5-di-CH_3	1-CH_3
Q-59	H	-			

TABLE 7a



The first compound listed in Table 7 is a compound of Formula **1** wherein E is E is E-1a, X is X-1, n is 0, G is G-1, R^{29a} is H, J is J-29 (3/5), there is no $(R^{23})_x$ substituent, Z is Z^1-1, each R^{12} is H, and Q is Q-45.

$(R^{9a})_p$	$(R^{9a})_p$	$(R^{9a})_p$
2-F-4-CN	2-F-6-CN	2-F-4-CH_3

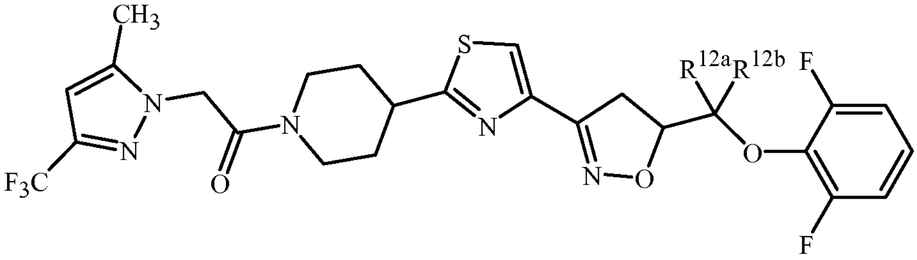
$(R^{9a})_p$
2-F-6-CH$_3$
2-F-4-OCH$_3$
2-F-3-Cl
2-CH$_3$-6-CF$_3$
2,6-di-F-4-CH$_3$
2,6-di-F-4-Cl
2,6-di-Cl-4-F
2-F-4,6-di-Cl
2,6-di-Cl
2,6-di-CF$_3$
2-F
2-CN
3-Et
2-cyclopropyl
2-CF$_3$
3-OCH$_3$
2-S(=O)CH$_3$
2-NH(CH$_3$)
2-CH$_2$OCH$_3$
2-CO$_2$CH$_2$CH$_3$
2-C(=O)NH(CH$_3$)
2-phenyl
3-(1*H*-1,2,4-triazol-1-yl)
2-[1,1'-bicyclopropyl]-2-yl
2-F-4-CF$_3$
2-F-6-OCH$_3$
2-F-3-CN
2-CH$_3$-6-CN
2,6-di-F-4-OCH$_3$
2,4-di-F-6-Cl
2,4-di-Cl-6-F
2-Cl-4,6-di-F
2,6-di-CH$_3$
2-F-4-OCF$_3$
2-OH
2-NO$_2$
3-CH=CH$_2$
2-cyclohexyl
2-CH=CHCl
2-OCF$_3$
3-SO$_2$CH$_3$
2-N(CH$_3$)$_2$
3-CH$_2$OH
3-OC(=O)CH$_3$
2-C(=O)N(CH$_3$)$_2$
2-(naphthalen-1-yl)
2-(4-morpholinyl)
2-F-6-CF$_3$
2,6-di-F-4-CN
2-CH$_3$-6-OCH$_3$
2-CH$_3$-6-Cl
2,6-di-F-4-CF$_3$
2,4,6-tri-F
2,4,6-tri-Cl
2,6-di-F-4-Br
2,6-di-OCH$_3$
2-F-6-(1*H*-1,2,4-triazol-1-yl)
2-NH2
2-CH$_3$
2-C≡CH
2-CH$_2$-cyclohexyl
2-C≡CCl
3-SCH$_3$
2-SCF$_3$
2-NH-cyclohexyl
2-C(=O)CH$_3$
3-SC(=O)CH$_3$
3-Si(CH$_3$)$_3$
2-(pyridin-3-yl)
2-(2,6-di-F-phenyl)

The present disclosure also includes Table 7b through 7v, each of which is constructed the same as Table 7a above except that the Table Heading in Table 7a (i.e. “E is E-1a”) is replaced with the respective table headings shown below. For example, in Table 7b the table heading is “E is E-1b”, $(R^{9a})_p$ is as defined in Table 7a above. Thus, the first entry in Table 7b specifically discloses a compound of Formula **1** wherein E-1b, X is X-1, n is 0, G is G-1, R^{29a} is H, J is J-29 (3/5), there is no $(R^{23})_x$ substituent, Z is Z^1-1, each R^{12} is H, Q is Q-45, and $(R^{9a})_p$ is 2-F-4-CN.

Table	Table Heading	Table	Table Heading	Table	Table Heading
7b	E is E-1b	7j	E is E-1j	7r	E is E-2c
7c	E is E-1c	7k	E is E-1k	7s	E is E-2d
7d	E is E-1d	7l	E is E-1l	7t	E is E-3a
7e	E is E-1e	7m	E is E-1m	7u	E is E-3b

Table	Table Heading	Table	Table Heading	Table	Table Heading
7f	E is E-1f	7n	E is E-1n	7v	E is E-3c
7g	E is E-1g	7o	E is E-1o	7w	E is E-3d
7h	E is E-1h	7p	E is E-2a		
7i	E is E-1i	7q	E is E-2b		

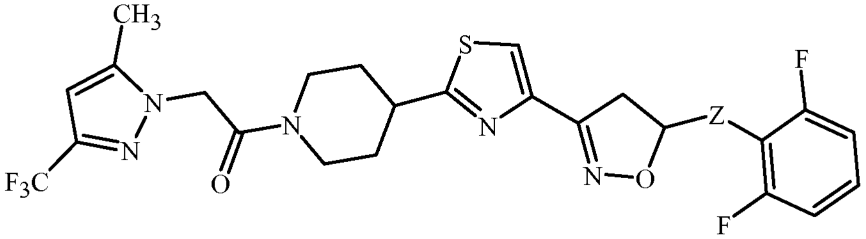
TABLE 8



The first compound listed in Table 8 is a compound of Formula **1** wherein wherein E is E is E-1a, X is X-1, n is 0, G is G-1, R^{29a} is H, J is J-29 (3/5), there is no $(R^{23})_x$ substituent, Z is Z^1-1, Q is Q-45, and $(R^{9a})_p$ is 2,6-di-F.

R^{12a}	R^{12b}	R^{12a}	R^{12b}	R^{12a}	R^{12b}
H	F	H	CH_2CH_3	H	$C(=O)CH_3$
H	Br	CH_3	CH_3	H	$C(=O)OCH_3$
H	Cl	H	OCH_3	H	cyclopropyl
H	CN	H	CH_2OCH_3	H	cyclohexyl
H	CH_3				

Table 9

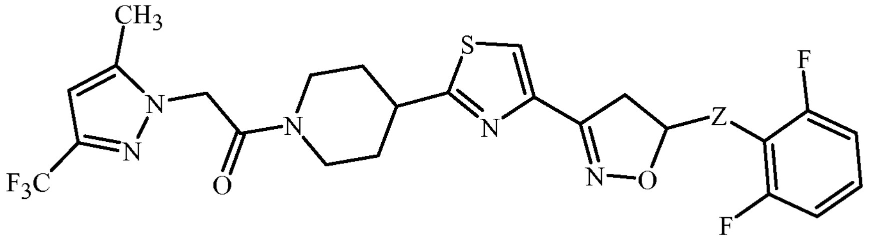


In Table 9 the structure of Z (e.g. Z^1-3) is shown in Summary of the Invention. For instance, the first compound listed in Table 9 is a compound of Formula **1** wherein E is E is E-1a, X is X-1, n is 0, G is G-1, R^{29a} is H, J is J-29 (3/5), there is no $(R^{23})_x$ substituent, Q is Q-45, and $(R^{9a})_p$ is 2,6-di-F, Z is Z^1-3, R^{12a} is H, R^{12b} is H and R^{13} is H.

Z	R^{12a}	R^{12b}	R^{13}	Z	R^{12a}	R^{12b}	R^{13}
Z^1-3	H	H	H	Z^1-28	-	-	-
Z^1-3	H	H	CH_3	Z^1-30	H	H	-
Z^1-5	-	-	-	Z^1-31	-	-	CH_3

Z	R^{12a}	R^{12b}	R^{13}	Z	R^{12a}	R^{12b}	R^{13}
Z^1-6	H	H	-	Z^1-32	-	-	CH_3
Z^1-7	-	-	-	Z^1-33	H	H	CH_3
Z^1-8	H	-	-	Z^1-34	H	H	CH_3
Z^1-25	H	H	-	Z^1-35	-	-	CH_3
Z^1-26	H	H	-	Z^1-36	-	-	CH_3
Z^1-27	H	H	-	Z^1-37	-	-	CH_3

Table 10



In Table 10 the structure of Z wherein Z is Z^1 (e.g. Z^1-2) is shown in Summary of the Invention and the structure of Z wherein Z is Z-1 through Z-3 is shown in Embodiment 126. For instance, the first compound listed in Table 10 is a compound of Formula **1** wherein E is E is E-1a, X is X-1, n is 0, G is G-1, R^{29a} is H, J is J-29 (3/5), there is no $(R^{23})_x$ substituent, Q is Q-45, and $(R^{9a})_p$ is 2,6-di-F, Z is Z^1-2, each R^{12} is H, and q is 0. In Z the bond projecting to the left is connected to J and the bond projecting to the right is connected to Q.

	Z		Z
Z^1-2	$-CH_2S-$	Z^1-19	$-CH_2CH_2S(=O)-$
Z^1-2	$-CH_2S(=O)-$	Z^1-19	$-CH_2CH_2S(=O)_2-$
Z^1-2	$-CH_2S(=O)_2-$	Z^1-20	$-CH_2CH=CH-$
Z^1-4	$-CH=CH-$	Z^1-21	$-CH=CHCH_2-$
Z^1-6	$-CH_2C(=O)-$	Z^1-22	$-C(=O)CH_2CH(OH)-$
Z^1-9	$-CH(OH)CH(OH)-$	Z^1-23	$-CH_2C(=O)CH_2-$
Z^1-10	$-CH_2CH_2NH-$	Z^1-24	$-CH_2CH_2C(=O)-$
Z^1-11	$-OCH_2CH_2-$	Z^1-29	$-C(=O)CH=CH-$
Z^1-12	$-SCH_2CH_2-$	Z^1-38	$-NHC(=O)NH-$
Z^1-13	$-NHCH_2CH_2-$	Z^1-39	$-C(=NOH)CH=CH-$
Z^1-14	$-CH_2OCH_2-$	Z^1-40	$-CH=CHC(=NOH)-$
Z^1-15	$-CH_2NHCH_2-$	Z^1-41	$-CH_2C(=NOH)CH_2-$
Z^1-16	$-CH_2CH_2O-$	Z^1-42	$-CH=CHC(=O)-$
Z^1-17	$-CH(OH)CH_2CH(OH)-$	Z-1	$-CH_2CH_2CH_2O-$
Z^1-18	$-CH_2CH_2CH_2-$	Z-2	$-CH_2C(=O)NHCH_2-$
Z^1-19	$-CH_2CH_2S-$	Z-3	$-CH_2CH_2CH_2CH_2O-$

Formulation/Utility

A compound of Formula **1** of this invention (including *N*-oxides and salts thereof) will generally be used as a fungicidal 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 serve 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 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 and suspo-emulsion. 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. 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	0.001–95	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), 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 and 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 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 invention 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 invention 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 percentages are by weight and all formulations are prepared in conventional ways. Compound numbers refer to compounds in Index Tables A–B. Without further elaboration, it is believed that one skilled in the art using the preceding description can utilize the present invention to its fullest extent. The following Examples are, therefore, to be constructed 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 10	65.0%
dodecylphenol polyethylene glycol ether	2.0%
sodium ligninsulfonate	4.0%
sodium silicoaluminate	6.0%
montmorillonite (calcined)	23.0%

Example C

Granule

Compound 16	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 2	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 10	10.0%
polyoxyethylene sorbitol hexoleate	20.0%
C_6–C_{10} fatty acid methyl ester	70.0%

Example F

Microemulsion

Compound 16	5.0%
polyvinylpyrrolidone-vinyl acetate copolymer	30.0%
alkylpolyglycoside	30.0%
glyceryl monooleate	15.0%
water	20.0%

Example G

Seed Treatment

Compound 2	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%

Water-soluble and water-dispersible formulations are typically diluted with water to form aqueous compositions before application. Aqueous compositions for direct applications to the plant or portion thereof (e.g., spray tank compositions) typically at least about 1 ppm or more (e.g., from 1 ppm to 100 ppm) of the compound(s) of this invention.

The compounds of this invention are useful as plant disease control agents. The present invention therefore further comprises a method for controlling plant diseases caused by fungal plant pathogens comprising applying to the plant or portion thereof to be protected, or to the plant seed to be protected, an effective amount of a compound of the invention or a fungicidal composition containing said compound. The compounds and/or compositions of this invention provide control of diseases caused by a broad spectrum of fungal plant pathogens in the Basidiomycete, Ascomycete, Oomycete and Deuteromycete classes. They are effective in controlling a broad spectrum of plant diseases, particularly foliar pathogens of ornamental, turf, vegetable, field, cereal, and fruit crops. These pathogens include: Oomycetes, including *Phytophthora* diseases such as *Phytophthora infestans*, *Phytophthora megasperma*, *Phytophthora parasitica*, *Phytophthora cinnamomi* and *Phytophthora capsici*, *Pythium* diseases such as *Pythium aphanidermatum*, and diseases in the Peronosporaceae family such as *Plasmopara viticola*, *Peronospora* spp. (including *Peronospora tabacina* and *Peronospora parasitica*), *Pseudoperonospora* spp. (including *Pseudoperonospora cubensis)* and *Bremia lactucae*; Ascomycetes, including *Alternaria* diseases such as *Alternaria solani* and *Alternaria brassicae*, *Guignardia* diseases such as *Guignardia bidwell*, *Venturia* diseases such as *Venturia inaequalis*, *Septoria* diseases such as *Septoria nodorum* and *Septoria tritici*, powdery mildew diseases such as *Erysiphe* spp. (including *Erysiphe graminis* and *Erysiphe polygoni*), *Uncinula necatur*, *Sphaerotheca fuligena* and *Podosphaera leucotricha*, *Pseudocercosporella herpotrichoides*, *Botrytis* diseases such as *Botrytis cinerea*, *Monilinia fructicola*, *Sclerotinia* diseases such as *Sclerotinia sclerotiorum*, *Magnaporthe grisea*, *Phomopsis viticola*, *Helminthosporium* diseases such as *Helminthosporium tritici repentis*, *Pyrenophora teres*, anthracnose diseases such as *Glomerella* or *Colletotrichum* spp. (such as *Colletotrichum graminicola* and *Colletotrichum orbiculare*), and *Gaeumannomyces graminis*; Basidiomycetes, including rust diseases caused by *Puccinia* spp. (such as *Puccinia recondita*, *Puccinia striiformis*, *Puccinia hordei*, *Puccinia graminis* and *Puccinia arachidis)*, *Hemileia vastatrix* and *Phakopsora pachyrhizi*; other pathogens including *Rutstroemia floccosum* (also known as *Sclerontina homoeocarpa*); *Rhizoctonia* spp. (such as *Rhizoctonia solani)*; *Fusarium* diseases such as *Fusarium roseum*, *Fusarium graminearum* and *Fusarium oxysporum*; *Verticillium dahliae*; *Sclerotium rolfsii*; *Rynchosporium secalis*; *Cercosporidium personatum*, *Cercospora arachidicola* and *Cercospora beticola*; and other genera and species closely related to these pathogens. In addition to their fungicidal activity, the compositions or combinations also have activity against bacteria such as *Erwinia amylovora*, *Xanthomonas campestris*, *Pseudomonas syringae*, and other related species.

Plant disease control is ordinarily accomplished by applying an effective amount of a compound of this invention either pre- or post-infection, to the portion of the plant to be protected such as the roots, stems, foliage, fruit, seeds, tubers or bulbs, or to the media (soil or sand) in which the plants to be protected are growing. The compounds can also be applied to seeds to protect the seeds and seedlings developing from the seeds. The compounds can also be applied through irrigation water to treat plants.

Rates of application for these compounds (i.e. a fungicidally effective amount) can be influenced by factors such as the plant diseases to be controlled, the plant species to be protected, ambient moisture and temperature and should be determined under actual use conditions. One skilled in the art can easily determine through simple experimentation the fungicidally effective amount necessary for the desired level of plant disease control. Foliage can normally be protected when treated at a rate of from less than about 1 g/ha to about 5,000 g/ha of active ingredient. Seed and seedlings can normally be protected when seed is treated at a rate of from about 0.1 to about 10 g per kilogram of seed.

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

Of note is a composition which in addition to the compound of Formula **1** include at least one fungicidal compound selected from the group consisting of the classes (1) methyl benzimidazole carbamate (MBC) fungicides; (2) dicarboximide fungicides; (3) demethylation inhibitor (DMI) fungicides; (4) phenylamide fungicides; (5) amine/morpholine fungicides; (6) phospholipid biosynthesis inhibitor fungicides; (7) carboxamide fungicides; (8) hydroxy(2-amino-)pyrimidine fungicides; (9) anilinopyrimidine fungicides; (10) *N*-phenyl carbamate fungicides; (11) quinone outside inhibitor (QoI) fungicides; (12) phenylpyrrole fungicides; (13) quinoline fungicides; (14) lipid peroxidation inhibitor fungicides; (15) melanin biosynthesis inhibitors-reductase (MBI-R) fungicides; (16) melanin biosynthesis inhibitors-dehydratase (MBI-D) fungicides; (17) hydroxyanilide fungicides; (18) squalene-epoxidase inhibitor fungicides; (19) polyoxin fungicides; (20) phenylurea fungicides; (21) quinone inside inhibitor (QiI) fungicides; (22) benzamide fungicides; (23) enopyranuronic acid antibiotic fungicides; (24) hexopyranosyl antibiotic fungicides; (25) glucopyranosyl antibiotic: protein synthesis fungicides; (26) glucopyranosyl antibiotic: trehalase and inositol biosynthesis fungicides; (27) cyanoacetamideoxime fungicides; (28) carbamate fungicides; (29) oxidative phosphorylation uncoupling fungicides; (30) organo tin fungicides; (31) carboxylic acid fungicides; (32) heteroaromatic fungicides; (33) phosphonate fungicides; (34) phthalamic acid fungicides; (35) benzotriazine fungicides; (36) benzene-sulfonamide fungicides; (37) pyridazinone fungicides; (38) thiophene-carboxamide fungicides; (39) pyrimidinamide fungicides; (40) carboxylic acid amide (CAA) fungicides; (41) tetracycline antibiotic fungicides; (42) thiocarbamate fungicides; (43) benzamide fungicides; (44) host plant defense induction fungicides; (45) multi-site contact activity fungicides; (46) fungicides other than classes (1) through (45); and salts of compounds of classes (1) through (46).

Further descriptions of these classes of fungicidal compounds are provided below.

(1) "Methyl benzimidazole carbamate (MBC) fungicides" (Fungicide Resistance Action Committee (FRAC) code 1) inhibit mitosis by binding to β-tubulin during microtubule assembly. Inhibition of microtubule assembly can disrupt cell division, transport within the cell and cell structure. Methyl benzimidazole carbamate fungicides include benzimidazole and thiophanate fungicides. The benzimidazoles include benomyl, carbendazim, fuberidazole and thiabendazole. The thiophanates include thiophanate and thiophanate-methyl.

(2) "Dicarboximide fungicides" (Fungicide Resistance Action Committee (FRAC) code 2) are proposed to inhibit a lipid peroxidation in fungi through interference with NADH cytochrome c reductase. Examples include chlozolinate, iprodione, procymidone and vinclozolin.

(3) "Demethylation inhibitor (DMI) fungicides" (Fungicide Resistance Action Committee (FRAC) code 3) inhibit C14-demethylase, which plays a role in sterol production. Sterols, such as ergosterol, are needed for membrane structure and function, making them essential for the development of functional cell walls. Therefore, exposure to these fungicides results in abnormal growth and eventually death of sensitive fungi. DMI fungicides are divided between several chemical classes: azoles (including triazoles and imidazoles), pyrimidines, piperazines and pyridines. The triazoles include azaconazole, bitertanol, bromuconazole, cyproconazole, difenoconazole, diniconazole (including diniconazole-M), epoxiconazole, fenbuconazole, fluquinconazole, flusilazole, flutriafol, hexaconazole, imibenconazole, ipconazole, metconazole, myclobutanil, penconazole, propiconazole, prothioconazole, simeconazole, tebuconazole, tetraconazole, triadimefon, triadimenol, triticonazole and uniconazole. The imidazoles include clotrimazole, imazalil, oxpoconazole, prochloraz, pefurazoate and triflumizole. The pyrimidines include fenarimol and nuarimol. The piperazines include triforine. The pyridines include pyrifenox. Biochemical investigations have shown that all of the above mentioned fungicides are DMI fungicides as described by K. H. Kuck et al. in *Modern Selective Fungicides - Properties, Applications and Mechanisms of Action*, H. Lyr (Ed.), Gustav Fischer Verlag: New York, 1995, 205–258.

(4) "Phenylamide fungicides" (Fungicide Resistance Action Committee (FRAC) code 4) are specific inhibitors of RNA polymerase in Oomycete fungi. Sensitive fungi exposed to these fungicides show a reduced capacity to incorporate uridine into rRNA. Growth and development in sensitive fungi is prevented by exposure to this class of fungicide. Phenylamide fungicides include acylalanine, oxazolidinone and butyrolactone fungicides. The acylalanines include benalaxyl, benalaxyl-M, furalaxyl, metalaxyl and metalaxyl-M/mefenoxam. The oxazolidinones include oxadixyl. The butyrolactones include ofurace.

(5) "Amine/morpholine fungicides" (Fungicide Resistance Action Committee (FRAC) code 5) inhibit two target sites within the sterol biosynthetic pathway, $\Delta^8 \rightarrow \Delta^7$ isomerase and Δ^{14} reductase. Sterols, such as ergosterol, are needed for membrane structure and function, making them essential for the development of functional cell walls. Therefore, exposure to these fungicides results in abnormal growth and eventually death of sensitive fungi. Amine/morpholine fungicides (also known as non-DMI sterol biosynthesis inhibitors) include morpholine, piperidine and spiroketal-amine fungicides. The morpholines include aldimorph, dodemorph, fenpropimorph, tridemorph and trimorphamide. The piperidines include fenpropidin and piperalin. The spiroketal-amines include spiroxamine.

(6) “Phospholipid biosynthesis inhibitor fungicides” (Fungicide Resistance Action Committee (FRAC) code 6) inhibit growth of fungi by affecting phospholipid biosynthesis. Phospholipid biosynthesis fungicides include phophorothiolate and dithiolane fungicides. The phosphorothiolates include edifenphos, iprobenfos and pyrazophos. The dithiolanes include isoprothiolane.

(7) “Carboxamide fungicides” (Fungicide Resistance Action Committee (FRAC) code 7) inhibit Complex II (succinate dehydrogenase) fungal respiration by disrupting a key enzyme in the Krebs Cycle (TCA cycle) named succinate dehydrogenase. Inhibiting respiration prevents the fungus from making ATP, and thus inhibits growth and reproduction. Carboxamide fungicides include benzamides, furan carboxamides, oxathiin carboxamides, thiazole carboxamides, pyrazole carboxamides and pyridine carboxamides. The benzamides include benodanil, flutolanil and mepronil. The furan carboxamides include fenfuram. The oxathiin carboxamides include carboxin and oxycarboxin. The thiazole carboxamides include thifluzamide. The pyrazole carboxamides include furametpyr, penthiopyrad, bixafen, isopyrazam, *N*-[2-(1*S*,2*R*)-[1,1'-bicyclopropyl]-2-ylphenyl]-3-(difluoromethyl)-1-methyl-1*H*-pyrazole-4-carboxamide and penflufen (*N*-[2-(1,3-dimethylbutyl)phenyl]-5-fluoro-1,3-dimethyl-1*H*-pyrazole-4-carboxamide). The pyridine carboxamides include boscalid.

(8) “Hydroxy(2-amino-)pyrimidine fungicides” (Fungicide Resistance Action Committee (FRAC) code 8) inhibit nucleic acid synthesis by interfering with adenosine deaminase. Examples include bupirimate, dimethirimol and ethirimol.

(9) “Anilinopyrimidine fungicides” (Fungicide Resistance Action Committee (FRAC) code 9) are proposed to inhibit biosynthesis of the amino acid methionine and to disrupt the secretion of hydrolytic enzymes that lyse plant cells during infection. Examples include cyprodinil, mepanipyrim and pyrimethanil.

(10) “*N*-Phenyl carbamate fungicides” (Fungicide Resistance Action Committee (FRAC) code 10) inhibit mitosis by binding to β-tubulin and disrupting microtubule assembly. Inhibition of microtubule assembly can disrupt cell division, transport within the cell and cell structure. Examples include diethofencarb.

(11) “Quinone outside inhibitor (QoI) fungicides” (Fungicide Resistance Action Committee (FRAC) code 11) inhibit Complex III mitochondrial respiration in fungi by affecting ubiquinol oxidase. Oxidation of ubiquinol is blocked at the “quinone outside” (Q_O) site of the cytochrome bc_1 complex, which is located in the inner mitochondrial membrane of fungi. Inhibiting mitochondrial respiration prevents normal fungal growth and development. Quinone outside inhibitor fungicides (also known as strobilurin fungicides) include methoxyacrylate, methoxycarbamate, oximinoacetate, oximinoacetamide, oxazolidinedione, dihydrodioxazine, imidazolinone and benzylcarbamate fungicides. The methoxyacrylates include azoxystrobin, enestroburin (SYP-Z071), picoxystrobin and

pyraoxystrobin (SYP-3343). The methoxycarbamates include pyraclostrobin and pyrametostrobin (SYP-4155). The oximinoacetates include kresoxim-methyl and trifloxystrobin. The oximinoacetamides include dimoxystrobin, metominostrobin, orysastrobin, α-[methoxyimino]-*N*-methyl-2-[[[1-[3-(trifluoromethyl)phenyl]ethoxy]imino]-methyl]benzeneacetamide and 2-[[[3-(2,6-dichlorophenyl)-1-methyl-2-propen-1-ylidene]-amino]oxy]methyl]-α-(methoxyimino)-*N*-methylbenzeneacetamide. The oxazolidinediones include famoxadone. The dihydrodioxazines include fluoxastrobin. The imidazolinones include fenamidone. The benzylcarbamates include pyribencarb.

(12) "Phenylpyrrole fungicides" (Fungicide Resistance Action Committee (FRAC) code 12) inhibit a MAP protein kinase associated with osmotic signal transduction in fungi. Fenpiclonil and fludioxonil are examples of this fungicide class.

(13) "Quinoline fungicides" (Fungicide Resistance Action Committee (FRAC) code 13) are proposed to inhibit signal transduction by affecting G-proteins in early cell signaling. They have been shown to interfere with germination and/or appressorium formation in fungi that cause powder mildew diseases. Quinoxyfen and tebufloquin are examples of this class of fungicide.

(14) "Lipid peroxidation inhibitor fungicides" (Fungicide Resistance Action Committee (FRAC) code 14) are proposed to inhibit lipid peroxidation which affects membrane synthesis in fungi. Members of this class, such as etridiazole, may also affect other biological processes such as respiration and melanin biosynthesis. Lipid peroxidation fungicides include aromatic carbon and 1,2,4-thiadiazole fungicides. The aromatic carbon fungicides include biphenyl, chloroneb, dicloran, quintozene, tecnazene and tolclofos-methyl. The 1,2,4-thiadiazole fungicides include etridiazole.

(15) "Melanin biosynthesis inhibitors-reductase (MBI-R) fungicides" (Fungicide Resistance Action Committee (FRAC) code 16.1) inhibit the naphthal reduction step in melanin biosynthesis. Melanin is required for host plant infection by some fungi. Melanin biosynthesis inhibitors-reductase fungicides include isobenzofuranone, pyrroloquinolinone and triazolobenzothiazole fungicides. The isobenzofuranones include fthalide. The pyrroloquinolinones include pyroquilon. The triazolobenzothiazoles include tricyclazole.

(16) "Melanin biosynthesis inhibitors-dehydratase (MBI-D) fungicides" (Fungicide Resistance Action Committee (FRAC) code 16.2) inhibit scytalone dehydratase in melanin biosynthesis. Melanin in required for host plant infection by some fungi. Melanin biosynthesis inhibitors-dehydratase fungicides include cyclopropanecarboxamide, carboxamide and propionamide fungicides. The cyclopropanecarboxamides include carpropamid. The carboxamides include diclocymet. The propionamides include fenoxanil.

(17) "Hydroxyanilide fungicides (Fungicide Resistance Action Committee (FRAC) code 17) inhibit C4-demethylase which plays a role in sterol production. Examples include fenhexamid.

(18) “Squalene-epoxidase inhibitor fungicides” (Fungicide Resistance Action Committee (FRAC) code 18) inhibit squalene-epoxidase in ergosterol biosynthesis pathway. Sterols such as ergosterol are needed for membrane structure and function, making them essential for the development of functional cell walls. Therefore exposure to these fungicides results in abnormal growth and eventually death of sensitive fungi. Squalene-epoxidase inhibitor fungicides include thiocarbamate and allylamine fungicides. The thiocarbamates include pyributicarb. The allylamines include naftifine and terbinafine.

(19) “Polyoxin fungicides” (Fungicide Resistance Action Committee (FRAC) code 19) inhibit chitin synthase. Examples include polyoxin.

(20) “Phenylurea fungicides” (Fungicide Resistance Action Committee (FRAC) code 20) are proposed to affect cell division. Examples include pencycuron.

(21) “Quinone inside inhibitor (QiI) fungicides” (Fungicide Resistance Action Committee (FRAC) code 21) inhibit Complex III mitochondrial respiration in fungi by affecting ubiquinol reductase. Reduction of ubiquinol is blocked at the “quinone inside” (Q_i) site of the cytochrome bc_1 complex, which is located in the inner mitochondrial membrane of fungi. Inhibiting mitochondrial respiration prevents normal fungal growth and development. Quinone inside inhibitor fungicides include cyanoimidazole and sulfamoyltriazole fungicides. The cyanoimidazoles include cyazofamid. The sulfamoyltriazoles include amisulbrom.

(22) “Benzamide fungicides” (Fungicide Resistance Action Committee (FRAC) code 22) inhibit mitosis by binding to β-tubulin and disrupting microtubule assembly. Inhibition of microtubule assembly can disrupt cell division, transport within the cell and cell structure. Examples include zoxamide.

(23) “Enopyranuronic acid antibiotic fungicides” (Fungicide Resistance Action Committee (FRAC) code 23) inhibit growth of fungi by affecting protein biosynthesis. Examples include blasticidin-S.

(24) “Hexopyranosyl antibiotic fungicides” (Fungicide Resistance Action Committee (FRAC) code 24) inhibit growth of fungi by affecting protein biosynthesis. Examples include kasugamycin.

(25) “Glucopyranosyl antibiotic: protein synthesis fungicides” (Fungicide Resistance Action Committee (FRAC) code 25) inhibit growth of fungi by affecting protein biosynthesis. Examples include streptomycin.

(26) “Glucopyranosyl antibiotic: trehalase and inositol biosynthesis fungicides” (Fungicide Resistance Action Committee (FRAC) code 26) inhibit trehalase in inositol biosynthesis pathway. Examples include validamycin.

(27) “Cyanoacetamideoxime fungicides (Fungicide Resistance Action Committee (FRAC) code 27) include cymoxanil.

(28) “Carbamate fungicides” (Fungicide Resistance Action Committee (FRAC) code 28) are considered multi-site inhibitors of fungal growth. They are proposed to interfere with the synthesis of fatty acids in cell membranes, which then disrupts cell membrane permeability. Propamacarb, propamacarb-hydrochloride, iodocarb, and prothiocarb are examples of this fungicide class.

(29) “Oxidative phosphorylation uncoupling fungicides” (Fungicide Resistance Action Committee (FRAC) code 29) inhibit fungal respiration by uncoupling oxidative phosphorylation. Inhibiting respiration prevents normal fungal growth and development. This class includes 2,6-dinitroanilines such as fluazinam, pyrimidonehydrazones such as ferimzone and dinitrophenyl crotonates such as dinocap, meptyldinocap and binapacryl.

(30) “Organo tin fungicides” (Fungicide Resistance Action Committee (FRAC) code 30) inhibit adenosine triphosphate (ATP) synthase in oxidative phosphorylation pathway. Examples include fentin acetate, fentin chloride and fentin hydroxide.

(31) “Carboxylic acid fungicides” (Fungicide Resistance Action Committee (FRAC) code 31) inhibit growth of fungi by affecting deoxyribonucleic acid (DNA) topoisomerase type II (gyrase). Examples include oxolinic acid.

(32) “Heteroaromatic fungicides” (Fungicide Resistance Action Committee (FRAC) code 32) are proposed to affect DNA/ribonucleic acid (RNA) synthesis. Heteroaromatic fungicides include isoxazole and isothiazolone fungicides. The isoxazoles include hymexazole and the isothiazolones include octhilinone.

(33) “Phosphonate fungicides” (Fungicide Resistance Action Committee (FRAC) code 33) include phosphorous acid and its various salts, including fosetyl-aluminum.

(34) “Phthalamic acid fungicides” (Fungicide Resistance Action Committee (FRAC) code 34) include teclofthalam.

(35) “Benzotriazine fungicides” (Fungicide Resistance Action Committee (FRAC) code 35) include triazoxide.

(36) “Benzene-sulfonamide fungicides” (Fungicide Resistance Action Committee (FRAC) code 36) include flusulfamide.

(37) “Pyridazinone fungicides” (Fungicide Resistance Action Committee (FRAC) code 37) include diclomezine.

(38) “Thiophene-carboxamide fungicides” (Fungicide Resistance Action Committee (FRAC) code 38) are proposed to affect ATP production. Examples include silthiofam.

(39) “Pyrimidinamide fungicides” (Fungicide Resistance Action Committee (FRAC) code 39) inhibit growth of fungi by affecting phospholipid biosynthesis and include diflumetorim.

(40) “Carboxylic acid amide (CAA) fungicides” (Fungicide Resistance Action Committee (FRAC) code 40) are proposed to inhibit phospholipid biosynthesis and cell wall deposition. Inhibition of these processes prevents growth and leads to death of the target

fungus. Carboxylic acid amide fungicides include cinnamic acid amide, valinamide carbamate and mandelic acid amide fungicides. The cinnamic acid amides include dimethomorph and flumorph. The valinamide carbamates include benthiavalicarb, benthiavalicarb-isopropyl, iprovalicarb, valifenalate and valiphenal. The mandelic acid amides include mandipropamid, *N*-[2-[4-[[3-(4-chlorophenyl)-2-propyn-1-yl]oxy]-3-methoxyphenyl]ethyl]-3-methyl-2-[(methylsulfonyl)amino]butanamide and *N*-[2-[4-[[3-(4-chlorophenyl)-2-propyn-1-yl]oxy]-3-methoxyphenyl]ethyl]-3-methyl-2-[(ethylsulfonyl)amino]butanamide.

(41) “Tetracycline antibiotic fungicides” (Fungicide Resistance Action Committee (FRAC) code 41) inhibit growth of fungi by affecting complex 1 nicotinamide adenine dinucleotide (NADH) oxidoreductase. Examples include oxytetracycline.

(42) “Thiocarbamate fungicides (b42)” (Fungicide Resistance Action Committee (FRAC) code 42) include methasulfocarb.

(43) “Benzamide fungicides” (Fungicide Resistance Action Committee (FRAC) code 43) inhibit growth of fungi by delocalization of spectrin-like proteins. Examples include acylpicolide fungicides such as fluopicolide and fluopyram.

(44) “Host plant defense induction fungicides” (Fungicide Resistance Action Committee (FRAC) code P) induce host plant defense mechanisms. Host plant defense induction fungicides include benzo-thiadiazole, benzisothiazole and thiadiazole-carboxamide fungicides. The benzo-thiadiazoles include acibenzolar-S-methyl. The benzisothiazoles include probenazole. The thiadiazole-carboxamides include tiadinil and isotianil.

(45) “Multi-site contact fungicides” inhibit fungal growth through multiple sites of action and have contact/preventive activity. This class of fungicides includes: (45.1) “copper fungicides” (Fungicide Resistance Action Committee (FRAC) code M1)”, (45.2) “sulfur fungicides” (Fungicide Resistance Action Committee (FRAC) code M2), (45.3) “dithiocarbamate fungicides” (Fungicide Resistance Action Committee (FRAC) code M3), (45.4) “phthalimide fungicides” (Fungicide Resistance Action Committee (FRAC) code M4), (45.5) “chloronitrile fungicides” (Fungicide Resistance Action Committee (FRAC) code M5), (45.6) “sulfamide fungicides” (Fungicide Resistance Action Committee (FRAC) code M6), (45.7) “guanidine fungicides” (Fungicide Resistance Action Committee (FRAC) code M7), (45.8) “triazine fungicides” (Fungicide Resistance Action Committee (FRAC) code M8) and (45.9) “quinone fungicides” (Fungicide Resistance Action Committee (FRAC) code M9). “Copper fungicides” are inorganic compounds containing copper, typically in the copper(II) oxidation state; examples include copper oxychloride, copper sulfate and copper hydroxide, including compositions such as Bordeaux mixture (tribasic copper sulfate). “Sulfur fungicides” are inorganic chemicals containing rings or chains of sulfur atoms; examples include elemental sulfur. “Dithiocarbamate fungicides” contain a dithiocarbamate molecular moiety; examples include mancozeb, metiram, propineb, ferbam, maneb, thiram,

zineb and ziram. “Phthalimide fungicides” contain a phthalimide molecular moiety; examples include folpet, captan and captafol. “Chloronitrile fungicides” contain an aromatic ring substituted with chloro and cyano; examples include chlorothalonil. “Sulfamide fungicides” include dichlofluanid and tolyfluanid. “Guanidine fungicides” include dodine, guazatine, iminoctadine albesilate and iminoctadine triacetate. “Triazine fungicides” include anilazine. “Quinone fungicides” include dithianon.

(46) “Fungicides other than fungicides of classes (1) through (45)” include certain fungicides whose mode of action may be unknown. These include: (46.1) “thiazole carboxamide fungicides” (Fungicide Resistance Action Committee (FRAC) code U5), (46.2) “phenyl-acetamide fungicides” (Fungicide Resistance Action Committee (FRAC) code U6), (46.3) “quinazolinone fungicides” (Fungicide Resistance Action Committee (FRAC) code U7), (46.4) “benzophenone fungicides” (Fungicide Resistance Action Committee (FRAC) code U8) and (46.5) “triazolopyrimidine fungicides”. The thiazole carboxamides include ethaboxam. The phenyl-acetamides include cyflufenamid and *N*-[[(cyclopropylmethoxy)-amino][6-(difluoromethoxy)-2,3-difluorophenyl]-methylene]benzeneacetamide. The quinazolinones include proquinazid. The benzophenones include metrafenone. The triazolopyrimidines include ametoctradin. The (b46) class also includes bethoxazin, fluxapyroxad, neo-asozin (ferric methanearsonate), pyriofenone, pyrrolnitrin, quinomethionate, tebufloquin, *N*-[2-[4-[[3-(4-chlorophenyl)-2-propyn-1-yl]oxy]-3-methoxy-phenyl]ethyl]-3-methyl-2-[(methylsulfonyl)amino]butanamide, *N*-[2-[4-[[3-(4-chloro-phenyl)-2-propyn-1-yl]oxy]-3-methoxyphenyl]ethyl]-3-methyl-2-[(ethylsulfonyl)amino]-butanamide, 2-[[2-fluoro-5-(trifluoromethyl)phenyl]thio]-2-[3-(2-methoxyphenyl)-2-thiazo-lidinylidene]acetonitrile, 3-[5-(4-chlorophenyl)-2,3-dimethyl-3-isoxazolidinyl]pyridine, 4-fluorophenyl *N*-[1-[[[1-(4-cyanophenyl)ethyl]sulfonyl]methyl]propyl]carbamate, 5-chloro-6-(2,4,6-trifluorophenyl)-7-(4-methylpiperidin-1-yl)[1,2,4]triazolo[1,5-*a*]pyrimidine, *N*-(4-chloro-2-nitrophenyl)-*N*-ethyl-4-methylbenzenesulfonamide, *N*-[[(cyclopropylmethoxy)-amino][6-(difluoromethoxy)-2,3-difluorophenyl]methylene]benzeneacetamide, *N*'-[4-[4-chloro-3-(trifluoromethyl)phenoxy]-2,5-dimethylphenyl]-*N*-ethyl-*N*-methylmethanimid-amide, 1-[(2-propenylthio)carbonyl]-2-(1-methylethyl)-4-(2-methylphenyl)-5-amino-1*H*-pyrazol-3-one, *N*-[9-(dichloromethylene)-1,2,3,4-tetrahydro-1,4-methanonaphthalen-5-yl]-3-(difluoromethyl)-1-methyl-1*H*-pyrazole-4-carboxamide, 3-(difluoromethyl)-*N*-[9-(difluoro-methylene)-1,2,3,4-tetrahydro-1,4-methanonaphthalen-5-yl]-1-methyl-1*H*-pyrazole-4-carboxamide, *N*-[9-(dibromomethylene)-1,2,3,4-tetrahydro-1,4-methanonaphthalen-5-yl]-3-(difluoromethyl)-1-methyl-1*H*-pyrazole-4-carboxamide, *N*-[9-(dibromomethylene)-1,2,3,4-tetrahydro-1,4-methanonaphthalen-5-yl]-1-methyl-3-(trifluoromethyl)-1*H*-pyrazole-4-carboxamide, *N*-[9-(difluoromethylene)-1,2,3,4-tetrahydro-1,4-methanonaphthalen-5-yl]-1-methyl-3-(trifluoromethyl)-1*H*-pyrazole-4-carboxamide, *N*-[9-(dichloromethylene)-1,2,3,4-tetrahydro-1,4-methanonaphthalen-5-yl]-1-methyl-3-(trifluoromethyl)-1*H*-pyrazole-4-

carboxamide and *N*'-[4-[[3-[(4-chlorophenyl)methyl]-1,2,4-thiadiazol-5-yl]oxy]-2,5-dimethylphenyl]-*N*-ethyl-*N*-methyl-methanimidamide.

Therefore of note is a mixture (i.e. composition) comprising a compound of Formula **1** and at least one fungicidal compound selected from the group consisting of the aforedescribed classes (1) through (46). Also of note is a composition comprising said mixture (in fungicidally effective amount) and further comprising at least one additional component selected from the group consisting of surfactants, solid diluents and liquid diluents. Of particular note is a mixture (i.e. composition) comprising a compound of Formula **1** and at least one fungicidal compound selected from the group of specific compounds listed above in connection with classes (1) through (46). Also of particular note is a composition comprising said mixture (in fungicidally effective amount) and further comprising at least one additional surfactant selected from the group consisting of surfactants, solid diluents and liquid diluents.

Examples of other biologically active compounds or agents with which compounds of this invention can be formulated are: insecticides such as abamectin, acephate, acetamiprid, acrinathrin, amidoflumet (S-1955), avermectin, azadirachtin, azinphos-methyl, bifenthrin, bifenazate, buprofezin, carbofuran, cartap, chlorantraniliprole, chlorfenapyr, chlorfluazuron, chlorpyrifos, chlorpyrifos-methyl, chromafenozide, clothianidin, cyantraniliprole (3-bromo-1-(3-chloro-2-pyridinyl)-*N*-[4-cyano-2-methyl-6-[(methylamino)carbonyl]phenyl]-1*H*-pyrazole-5-carboxamide), cyflumetofen, cyfluthrin, beta-cyfluthrin, cyhalothrin, lambda-cyhalothrin, cypermethrin, cyromazine, deltamethrin, diafenthiuron, diazinon, dieldrin, diflubenzuron, dimefluthrin, dimethoate, dinotefuran, diofenolan, emamectin, endosulfan, esfenvalerate, ethiprole, fenothiocarb, fenoxycarb, fenpropathrin, fenvalerate, fipronil, flonicamid, flubendiamide, flucythrinate, tau-fluvalinate, flufenerim (UR-50701), flufenoxuron, fonophos, halofenozide, hexaflumuron, hydramethylnon, imidacloprid, indoxacarb, isofenphos, lufenuron, malathion, meperfluthrin, metaflumizone, metaldehyde, methamidophos, methidathion, methomyl, methoprene, methoxychlor, methoxyfenozide, metofluthrin, milbemycin oxime, monocrotophos, nicotine, nitenpyram, nithiazine, novaluron, noviflumuron (XDE-007), oxamyl, parathion, parathion-methyl, permethrin, phorate, phosalone, phosmet, phosphamidon, pirimicarb, profenofos, profluthrin, pymetrozine, pyrafluprole, pyrethrin, pyridalyl, pyrifluquinazon, pyriprole, pyriproxyfen, rotenone, ryanodine, spinetoram, spinosad, spirodiclofen, spiromesifen (BSN 2060), spirotetramat, sulfoxaflor, sulprofos, tebufenozide, teflubenzuron, tefluthrin, terbufos, tetrachlorvinphos, tetramethylfluthrin, thiacloprid, thiamethoxam, thiodicarb, thiosultap-sodium, tolfenpyrad, tralomethrin, triazamate, trichlorfon and triflumuron; and biological agents including entomopathogenic bacteria, such as *Bacillus thuringiensis* subsp. *aizawai*, *Bacillus thuringiensis* subsp. *kurstaki*, and the encapsulated delta-endotoxins of *Bacillus thuringiensis* (e.g., Cellcap, MPV, MPVII); entomopathogenic fungi, such as green muscardine fungus; and entomopathogenic virus including baculovirus, nucleopolyhedro virus (NPV) such as HzNPV, AfNPV; and granulosis virus (GV) such as CpGV.

Compounds of this invention and compositions thereof can be applied to plants genetically transformed to express proteins toxic to invertebrate pests (such as *Bacillus thuringiensis* delta-endotoxins). The effect of the exogenously applied fungicidal compounds of this invention may be synergistic with the expressed toxin proteins.

General references for 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.

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 may expand the spectrum of diseases controlled beyond the spectrum controlled by the compound of Formula **1** alone.

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

Of note is a combination of a compound of Formula **1** with at least one other fungicidal active ingredient. Of particular note is such a combination where the other fungicidal active ingredient has different site of action from the compound of Formula **1**. In certain instances, a combination with at least one other fungicidal 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 invention can further comprise a biologically effective amount of at least one additional fungicidal active ingredient having a similar spectrum of control but a different site of action.

Of particular note are compositions which in addition to compound of Formula **1** include at least one compound selected from the group consisting of (1) alkylenebis(dithiocarbamate) fungicides; (2) cymoxanil; (3) phenylamide fungicides; (4) proquinazid (6-iodo-3-propyl-2-propyloxy-4(3*H*)-quinazolinone); (5) chlorothalonil; (6)

carboxamides acting at complex II of the fungal mitochondrial respiratory electron transfer site; (7) quinoxyfen; (8) metrafenone; (9) cyflufenamid; (10) cyprodinil; (11) copper compounds; (12) phthalimide fungicides; (13) fosetyl-aluminum; (14) benzimidazole fungicides; (15) cyazofamid; (16) fluazinam; (17) iprovalicarb; (18) propamocarb; (19) validomycin; (20) dichlorophenyl dicarboximide fungicides; (21) zoxamide; (22) fluopicolide; (23) mandipropamid; (24) carboxylic acid amides acting on phospholipid biosynthesis and cell wall deposition; (25) dimethomorph; (26) non-DMI sterol biosynthesis inhibitors; (27) inhibitors of demethylase in sterol biosynthesis; (28) bc_1 complex fungicides; and salts of compounds of (1) through (28).

Further descriptions of classes of fungicidal compounds are provided below.

Sterol biosynthesis inhibitors (group (27)) control fungi by inhibiting enzymes in the sterol biosynthesis pathway. Demethylase-inhibiting fungicides have a common site of action within the fungal sterol biosynthesis pathway, involving inhibition of demethylation at position 14 of lanosterol or 24-methylene dihydrolanosterol, which are precursors to sterols in fungi. Compounds acting at this site are often referred to as demethylase inhibitors, DMI fungicides, or DMIs. The demethylase enzyme is sometimes referred to by other names in the biochemical literature, including cytochrome P-450 (14DM). The demethylase enzyme is described in, for example, *J. Biol. Chem.* **1992**, *267*, 13175–79 and references cited therein. DMI fungicides are divided between several chemical classes: azoles (including triazoles and imidazoles), pyrimidines, piperazines and pyridines. The triazoles include azaconazole, bromuconazole, cyproconazole, difenoconazole, diniconazole (including diniconazole-M), epoxiconazole, etaconazole, fenbuconazole, fluquinconazole, flusilazole, flutriafol, hexaconazole, imibenconazole, ipconazole, metconazole, myclobutanil, penconazole, propiconazole, prothioconazole, quinconazole, simeconazole, tebuconazole, tetraconazole, triadimefon, triadimenol, triticonazole and uniconazole. The imidazoles include clotrimazole, econazole, imazalil, isoconazole, miconazole, oxpoconazole, prochloraz and triflumizole. The pyrimidines include fenarimol, nuarimol and triarimol. The piperazines include triforine. The pyridines include buthiobate and pyrifenox. Biochemical investigations have shown that all of the above mentioned fungicides are DMI fungicides as described by K. H. Kuck et al. in *Modern Selective Fungicides - Properties, Applications and Mechanisms of Action*, H. Lyr (Ed.), Gustav Fischer Verlag: New York, 1995, 205–258.

bc_1 Complex Fungicides (group 28) have a fungicidal mode of action which inhibits the bc_1 complex in the mitochondrial respiration chain. The bc_1 complex is sometimes referred to by other names in the biochemical literature, including complex III of the electron transfer chain, and ubihydroquinone:cytochrome *c* oxidoreductase. This complex is uniquely identified by Enzyme Commission number EC1.10.2.2. The bc_1 complex is described in, for example, *J. Biol. Chem.* **1989**, *264*, 14543–48; *Methods Enzymol.* **1986**, *126*, 253–71; and references cited therein. Strobilurin fungicides such as azoxystrobin, dimoxystrobin, enestroburin (SYP-Z071), fluoxastrobin, kresoxim-methyl, metominostrobin, orysastrobin, picoxystrobin, pyraclostrobin, pyrametostrobin, pyraoxystrobin and trifloxystrobin are known to have this mode of action (H. Sauter et al., *Angew. Chem. Int. Ed.* **1999**, *38*, 1328–1349). Other fungicidal compounds that inhibit the bc_1 complex in the mitochondrial respiration chain include famoxadone and fenamidone.

Alkylenebis(dithiocarbamate)s (group (1)) include compounds such as mancozeb, maneb, propineb and zineb. Phenylamides (group (3)) include compounds such as metalaxyl, benalaxyl, furalaxyl and oxadixyl. Carboxamides (group (6)) include compounds such as boscalid, carboxin, fenfuram, flutolanil, furametpyr, mepronil, oxycarboxin, thifluzamide, penthiopyrad and *N*-[2-(1,3-dimethylbutyl)phenyl]-5-fluoro-1,3-dimethyl-1*H*-pyrazole-4-carboxamide (PCT Patent Publication WO 2003/010149), and are known to inhibit mitochondrial function by disrupting complex II (succinate dehydrogenase) in the respiratory electron transport chain. Copper compounds (group (11)) include compounds such as copper oxychloride, copper sulfate and copper hydroxide, including compositions such as Bordeaux mixture (tribasic copper sulfate). Phthalimides (group (12)) include compounds such as folpet and captan. Benzimidazole fungicides (group (14)) include benomyl and carbendazim. Dichlorophenyl dicarboximide fungicides (group (20)) include chlozolinate, dichlozoline, iprodione, isovaledione, myclozolin, procymidone and vinclozolin.

Non-DMI sterol biosynthesis inhibitors (group (26)) include morpholine and piperidine fungicides. The morpholines and piperidines are sterol biosynthesis inhibitors that have been shown to inhibit steps in the sterol biosynthesis pathway at a point later than the inhibitions achieved by the DMI sterol biosynthesis (group (27)). The morpholines include aldimorph, dodemorph, fenpropimorph, tridemorph and trimorphamide. The piperidines include fenpropidin.

Of further note are combinations of compounds of Formula **1** with azoxystrobin, kresoxim-methyl, trifloxystrobin, pyraclostrobin, picoxystrobin, dimoxystrobin, metominostrobin/fenominostrobin, carbendazim, chlorothalonil, quinoxyfen, metrafenone, cyflufenamid, fenpropidine, fenpropimorph, bromuconazole, cyproconazole, difenoconazole, epoxiconazole, fenbuconazole, flusilazole, hexaconazole, ipconazole, metconazole, penconazole, propiconazole, proquinazid, prothioconazole, tebuconazole, triticonazole, famoxadone, prochloraz, penthiopyrad and boscalid (nicobifen).

Preferred for better control of plant diseases caused by fungal plant pathogens (e.g., lower use rate or broader spectrum of plant pathogens controlled) or resistance management are mixtures of a compound of this invention with a fungicide selected from the group: azoxystrobin, kresoxim-methyl, trifloxystrobin, pyraclostrobin, picoxystrobin, dimoxystrobin, metominostrobin/fenominostrobin, quinoxyfen, metrafenone, cyflufenamid, fenpropidine, fenpropimorph, cyproconazole, epoxiconazole, flusilazole, metconazole, propiconazole, proquinazid, prothioconazole, tebuconazole, triticonazole, famoxadone and penthiopyrad.

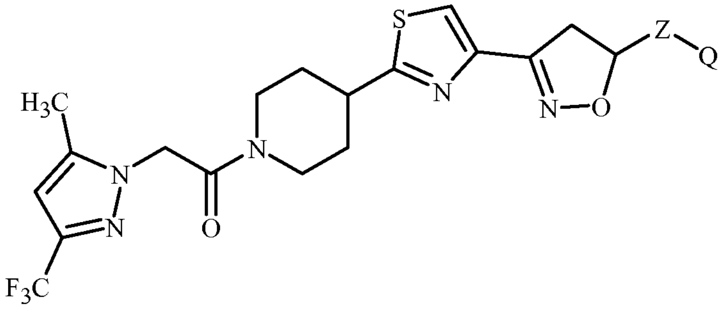
Specifically preferred mixtures (compound numbers refer to compounds in Index Tables A-C) are selected from the group: combinations of Compound 2, Compound 10 or Compound 16 with ametoctradin, combinations of Compound 2, Compound 10 or Compound 16 with azoxystrobin, combinations of Compound 2, Compound 10 or Compound 16 with bixafen, combinations of Compound 2, Compound 10 or Compound 16 with boscalid, combinations of Compound 2, Compound 10 or Compound 16 with cyflufenamid, combinations of Compound 2, Compound 10 or Compound 16 with cyproconazole, combinations of Compound 2, Compound 10 or Compound 16 with dimoxystrobin, combinations of Compound 2, Compound 10 or Compound 16 with epoxiconazole, combinations of Compound 2, Compound 10 or Compound 16 with famoxadone, combinations of Compound 2, Compound 10 or Compound 16 with fenpropidine, combinations of Compound 2, Compound 10 or Compound 16 with fenpropimorph, combinations of Compound 2, Compound 10 or Compound 16 with fluopyram, combinations of Compound 2, Compound 10 or Compound 16 with flusilazole, combinations of Compound 2, Compound 10 or Compound 16 with flutianil, combinations of Compound 2, Compound 10 or Compound 16 with isopyrazam, combinations of Compound 2, Compound 10 or Compound 16 with isotianil, combinations of Compound 2, Compound 10 or Compound 16 with kresoxim-methyl, combinations of Compound 2, Compound 10 or Compound 16 with mandipropamid, combinations of Compound 2, Compound 10 or Compound 16 with meptyldinocap, combinations of Compound 2, Compound 10 or Compound 16 with metconazole, combinations of Compound 2, Compound 10 or Compound 16 with metominostrobin/fenominostrobin, combinations of Compound 2, Compound 10 or Compound 16 with metrafenone, combinations of Compound 2, Compound 10 or Compound 16 with penflufen, combinations of Compound 2, Compound 10 or Compound 16 with penthiopyrad, combinations of Compound 2, Compound 10 or Compound 16 with picoxystrobin, combinations of Compound 2, Compound 10 or Compound 16 with propiconazole, combinations of Compound 2, Compound 10 or Compound 16 with proquinazid, combinations of Compound 2, Compound 10 or Compound 16 with prothioconazole, combinations of Compound 2, Compound 10 or Compound 16 with pyraclostrobin, combinations of Compound 2, Compound 10 or Compound 16 with pyrametostrobin, combinations of Compound 2, Compound 10 or Compound 16 with pyraoxystrobin, combinations of Compound 2, Compound 10 or Compound 16 with pyribencarb, combinations of Compound 2, Compound 10 or Compound 16 with quinoxyfen, combinations of Compound 2, Compound 10 or Compound 16 with tebuconazole, combinations of Compound 2, Compound 10 or Compound 16 with tebufloquin, combinations of Compound 2, Compound 10 or Compound 16 with trifloxystrobin, combinations of Compound 2, Compound 10 or Compound 16 with triticonazole and combinations of Compound 2, Compound 10 or Compound 16 with valifenalate.

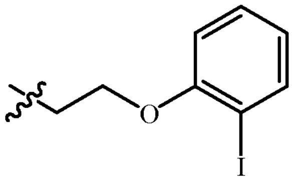
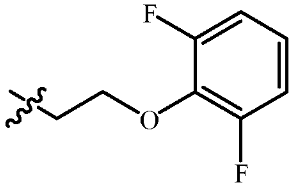
The following Tests demonstrate the control efficacy of compounds of this invention on specific pathogens. The pathogen control protection afforded by the compounds is not limited, however, to these species. See Index Table A for compound descriptions.

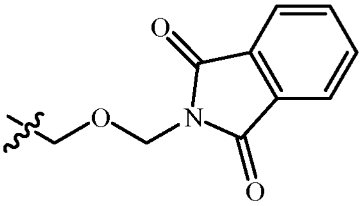
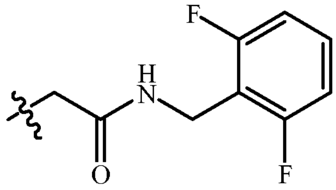
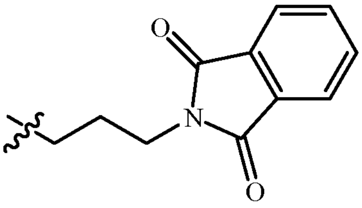
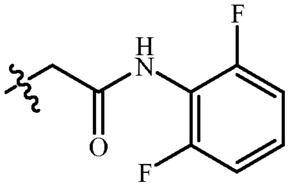
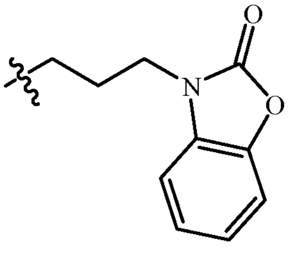
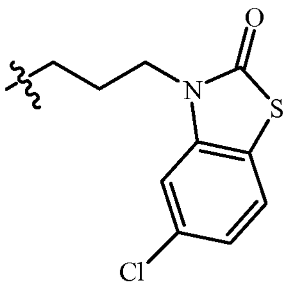
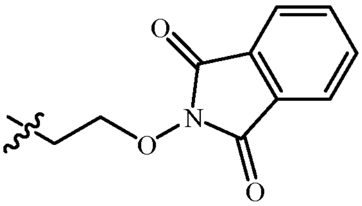
In Index Table A the numerical value reported in the column "MS (M+1)", is the molecular weight of the observed molecular ion formed by addition of H^+ (molecular weight of 1) to the molecule having the greatest isotopic abundance (i.e. M). The presence of molecular ions containing one or more higher atomic weight isotopes of lower abundance (e.g., ^{37}Cl, ^{81}Br) is not reported. The alternate molecular ion peaks (e.g., M+2 or M+4) that occur with compounds containing multiple halogens are not reported. The reported M+1 peaks were observed by mass spectrometry using atmospheric pressure chemical ionization (AP^+) or electrospray ionization (ESI)

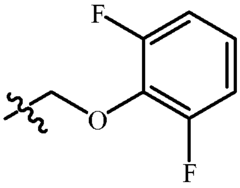
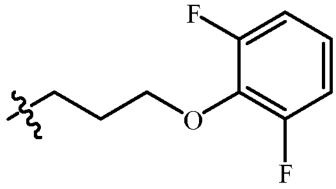
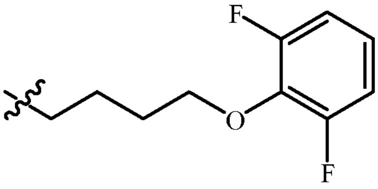
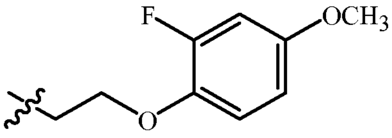
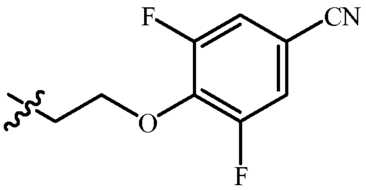
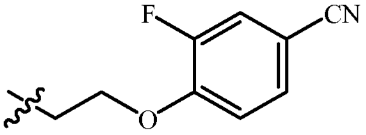
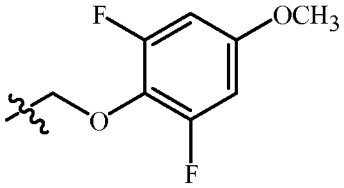
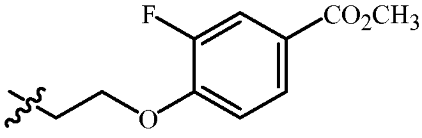
Then wavy line in Index Table A indicates the point of attachment of each Z-Q group to the J ring (isoxazoline).

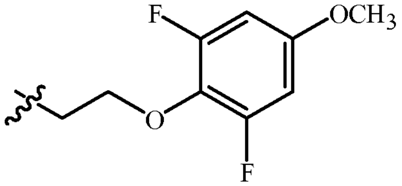
INDEX TABLE A



Cmpd.	Z-Q	MS (M+1)
1		674
2		584**

Cmpd.	Z-Q	MS (M+1)
3		617**
4		611**
5		615
6		597
7		603
8		653**
9		617

Cmpd.	Z-Q	MS (M+1)
10		570
11		598
12		612
13		596
14		609
15		591
16		600
17		624

Cmpd.	Z-Q	MS (M+1)
18		614

** See synthesis example for ^{1}H NMR data.

BIOLOGICAL EXAMPLES OF THE INVENTION

General protocol for preparing test suspensions for Test A–C: The test compounds were first dissolved in acetone in an amount equal to 3 % of the final volume and then suspended at the desired concentration (in ppm) in acetone and purified water (50/50 mix by volume) containing 250 ppm of the surfactant Trem® 014 (polyhydric alcohol esters). The resulting test suspensions were then used in Tests A–C. Spraying a 40 ppm test suspension to the point of run-off on the test plants was equivalent to a rate of 160 g/ha.

TEST A

Grape seedlings were inoculated with a spore suspension of *Plasmopara viticola* (the causal agent of grape downy mildew) and incubated in a saturated atmosphere at 20 °C for 24 h. After a short drying period, the test suspension was sprayed to the point of run-off on the grape seedlings, which were then moved to a growth chamber at 20 °C for 5 days, after which time the grape seedling were placed back into a saturated atmosphere at 20 °C for 24 h. Upon removal, visual disease ratings were made.

TEST B

The test suspension was sprayed to the point of run-off on tomato seedlings. The following day the seedlings were inoculated with a spore suspension of *Phytophthora infestans* (the causal agent of tomato late blight) and incubated in a saturated atmosphere at 20 °C for 24 h, and then moved to a growth chamber at 20 °C for 5 days, after which time visual disease ratings were made.

TEST C

Tomato seedlings were inoculated with a spore suspension of *Phytophthora infestans* (the causal agent of tomato late blight) and incubated in a saturated atmosphere at 20 °C for 17 h. After a short drying period, the test suspension was sprayed to the point of run-off on the tomato seedlings, which were then moved to a growth chamber at 20 °C for 4 days, after which time visual disease ratings were made.

In addition to Tests A–C, the compounds were also sprayed on tomato plants, which were inoculated with *Botrytis cinerea* 24 h after treatment, and wheat plants, which were inoculated with *Blumeria graminis* f. sp. *tritici*. Test compounds did not show noticeable activity against these additional pathogens under the test conditions at the application rates tested.

Results for Tests A–C are given in Table A. In the table, a rating of 100 indicates 100 % disease control and a rating of 0 indicates no disease control (relative to the controls).

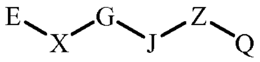
Table A

Cmpd No.	Test A	Test B	Test C
1	86	99	91
2	96	100	99
3	40	95	46
4	24	100	99
5	67	100	99
6	0	9	46
8	0	100	0
9	0	99	73
10	0	100	64
11	100	100	99
12	100	99	92
13	100	100	95
14	99	100	73
15	100	100	99
16	99	100	99
17	100	100	99
18	79	71	17

CLAIMS

What is claimed is:

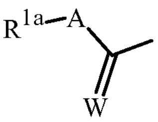
1. A compound selected from Formula **1**, *N*-oxides and salts thereof,



1

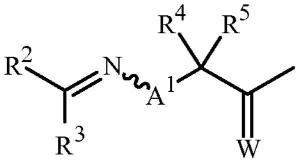
wherein

E is a radical selected from the group consisting of



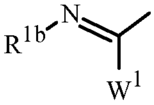
E-1

,



E-2

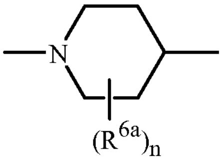
and



E-3

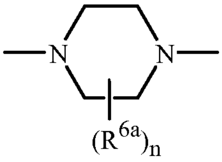
;

X is a radical selected from the group consisting of



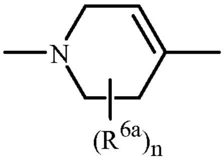
X-1

,



X-2

,



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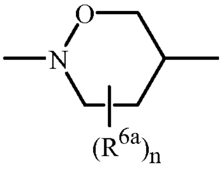
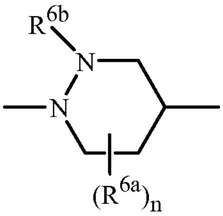


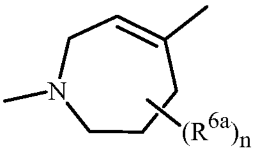
X-4

,

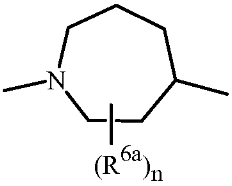


X-5

,

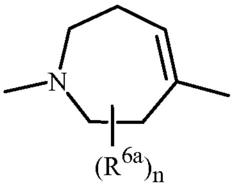


X-6



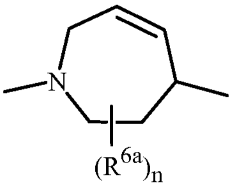
X-7

,



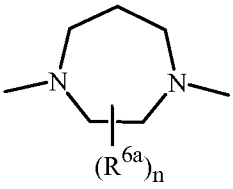
X-8

,



X-9

and



X-10

wherein the orientation of the X group is such that the bond extending to the left is attached to E in Formula **1** and the bond extending to the right is attached to G in Formula **1**;

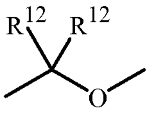
G is a 5-membered heterocyclic ring optionally substituted with up to 3 substituents independently selected from R^{29a} on carbon atom ring members and R^{30a} on nitrogen atom ring members;

J is a 5-, 6- or 7-membered ring, a 8- to 11-membered bicyclic ring system or a 7- to 11-membered spirocyclic ring system, each ring or ring system containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S, up to 4 N and up to 2 Si atoms, wherein up to 3 carbon atom ring members are independently selected from C(=O) and C(=S), the sulfur atom ring members are independently selected from $S(=O)_s(=NR^{17})_f$, and the silicon atom ring members are independently selected from $SiR^{10}R^{11}$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{23};

Z is Z^1; or

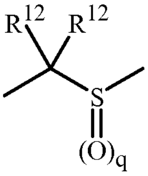
a 4-, 5- or 6-membered saturated or unsaturated chain containing chain members selected from carbon atoms and up to 2 heteroatoms independently selected from up to 2 O, up to 2 S, up to 2 N and up to 1 Si atoms, wherein up to 2 carbon atom chain members are independently selected from C(=O), C(=S) and C(=NOH), the sulfur atom chain members are independently selected from $S(=O)_s(=NR^{17})_f$, and the silicon atom chain members are independently selected from $SiR^{10}R^{11}$, each chain optionally substituted with up to 4 substituents independently selected from R^{12} on carbon atom chain members and R^{13} on nitrogen atom chain members;

Z^1 is a radical selected from the group consisting of



,

Z^1-1



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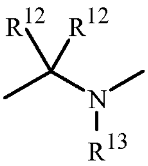
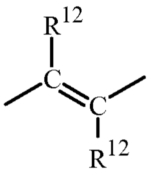
Z^1-2



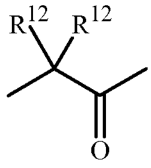
,

Z^1-3

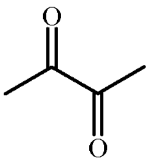


Z^1-4 ,

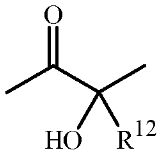
Z^1-5 ,



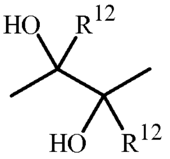
Z^1-6 ,



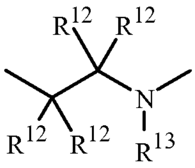
Z^1-7 ,



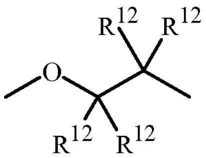
Z^1-8 ,



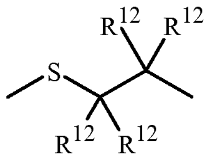
Z^1-9 ,



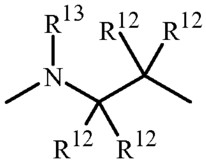
Z^1-10 ,



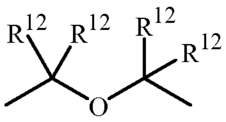
Z^1-11 ,



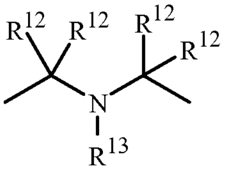
Z^1-12 ,



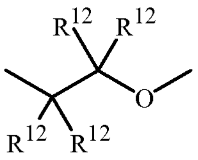
Z^1-13 ,



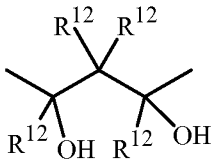
Z^1-14 ,



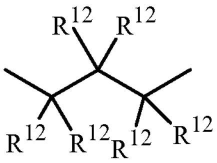
Z^1-15 ,



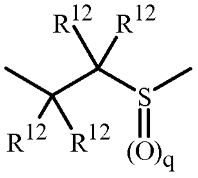
Z^1-16 ,



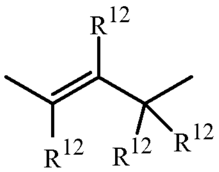
Z^1-17 ,



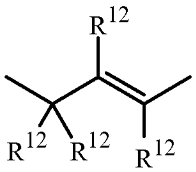
Z^1-18 ,



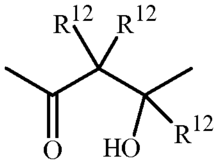
Z^1-19 ,



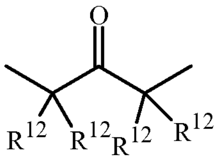
Z^1-20 ,



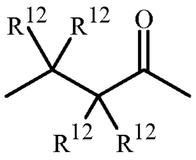
Z^1-21 ,



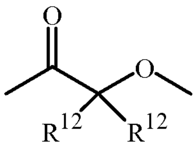
Z^1-22 ,



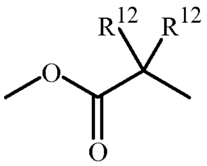
Z^1-23 ,



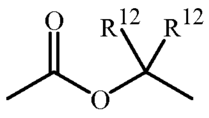
Z^1-24 ,



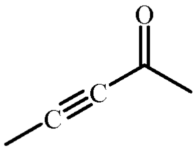
Z^1-25 ,



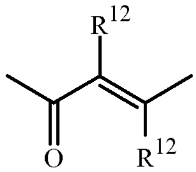
Z^1-26 ,



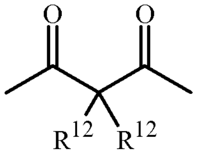
Z^1-27 ,



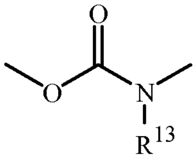
Z^1-28 ,



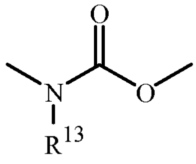
Z^1-29 ,



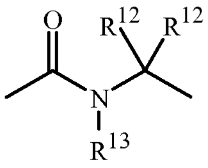
Z^1-30 ,



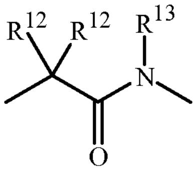
Z^1-31 ,



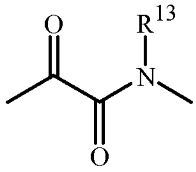
Z^1-32 ,



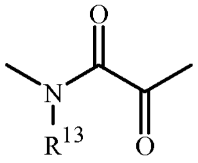
Z^1-33 ,



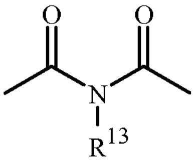
Z^1-34 ,



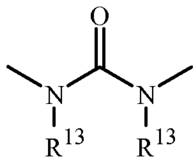
Z^1-35 ,



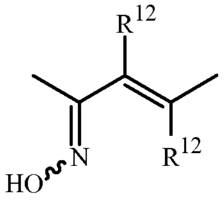
Z^1-36 ,



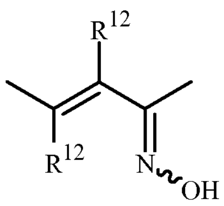
Z^1-37 ,



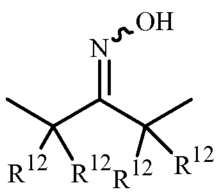
Z^1-38 ,



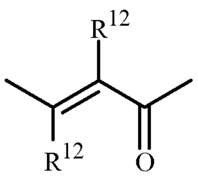
Z^1-39



Z^1-40 ,



Z^1-41 and



Z^1-42 ;

wherein the orientation of the Z^1 group is such that the bond extending to the left is attached to J in Formula **1** and the bond extending to the right is attached to Q in Formula **1**;

Q is phenyl or naphthalenyl each optionally substituted on carbon atom ring members with up to 5 substituents independently selected from R^{9a}; or

a 5- to 6-membered heteroaromatic ring or an 8- to 11-membered heteroaromatic bicyclic ring system containing ring members selected from carbon atoms and up

to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, and optionally substituted with up to 5 substituents independently selected from R^{9a} on carbon atom ring members and R^{9b} on nitrogen atom ring members; or

a 3- to 7-membered nonaromatic carbocyclic ring, a 5- to 7-membered nonaromatic heterocyclic ring or an 8- to 11-membered nonaromatic bicyclic ring system, each ring or ring system containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S, up to 4 N and up to 2 Si atoms, wherein up to 3 carbon atom ring members are independently selected from C(=O) and C(=S), the sulfur atom ring members are independently selected from $S(=O)_s(=NR^{17})_f$, and the silicon atom ring members are independently selected from $SiR^{10}R^{11}$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{9a} on carbon atom ring members and R^{9b} on nitrogen atom ring members;

A is CHR^{15}, NR^{16} or C(=O);

A^1 is -O-, -S-, $-N(R^7)-$, $-C(R^8)_2-$, $-OC(R^8)_2-$, $-SC(R^8)_2-$ or $-N(R^7)C(R^8)_2-$, wherein the bond projecting to the left is connected to $-N=C(R^2)(R^3)$, and the bond projecting to the right is connected to $-C(R^4)(R^5)-$;

W is O or S;

W^1 is OR^{18}, SR^{19}, $NR^{20}R^{21}$ or R^{22};

R^{1a} and R^{1b} independently are an optionally substituted phenyl, an optionally substituted naphthalenyl or an optionally substituted 5- to 6-membered heteroaromatic ring; or cyano, C_1–C_8 alkyl, C_2–C_8 alkenyl, C_2–C_8 alkynyl, C_1–C_8 haloalkyl, C_2–C_8 haloalkenyl, C_2–C_8 haloalkynyl, C_3–C_8 cycloalkyl, C_3–C_8 halocycloalkyl, C_4–C_{10} alkylcycloalkyl, C_4–C_{10} cycloalkylalkyl, C_4–C_{10} halocycloalkylalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_4–C_{10} cycloalkoxyalkyl, C_3–C_{10} alkoxyalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 haloalkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_3–C_8 alkoxycarbonylalkyl, C_3–C_8 haloalkoxycarbonylalkyl, C_2–C_8 alkylaminoalkyl, C_3–C_{10} dialkylaminoalkyl, C_2–C_8 haloalkylaminoalkyl, C_4–C_{10} cycloalkylaminoalkyl, C_1–C_8 alkoxy, C_1–C_8 haloalkoxy, C_3–C_8 cycloalkoxy, C_3–C_8 halocycloalkoxy, C_4–C_{10} cycloalkylalkoxy, C_2–C_8 alkenyloxy, C_2–C_8 haloalkenyloxy, C_2–C_8 alkynyloxy, C_3–C_8 haloalkynyloxy, C_2–C_8 alkoxyalkoxy, C_2–C_8 alkylcarbonyloxy, C_2–C_8 haloalkylcarbonyloxy, C_1–C_8 alkylthio, C_1–C_8 haloalkylthio, C_3–C_8 cycloalkylthio, C_3–C_{10} trialkylsilyl, C_1–C_8 alkylamino, C_2–C_8 dialkylamino, C_1–C_8 haloalkylamino, C_2–C_8 halodialkylamino, C_3–C_8 cycloalkylamino, C_2–C_8 alkylcarbonylamino,

C_2–C_8 haloalkylcarbonylamino, C_1–C_8 alkylsulfonylamino, C_1–C_8 haloalkylsulfonylamino, pyrrolidinyl, piperidinyl or morpholinyl;

R^2 is hydrogen, halogen, cyano, amino, -CHO, -C(=O)OH, -C(=O)NH_2, 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_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_4–C_6 alkylcycloalkyl, C_4–C_6 cycloalkylalkyl, C_4–C_6 halocycloalkylalkyl, C_3–C_6 cycloalkenyl, C_3–C_6 halocycloalkenyl, C_2–C_6 alkoxyalkyl, C_2–C_6 alkylthioalkyl, C_2–C_6 alkylsulfinylalkyl, C_2–C_6 alkylsulfonylalkyl, C_2–C_6 alkylaminoalkyl, C_3–C_6 dialkylaminoalkyl, C_2–C_6 haloalkylaminoalkyl, C_2–C_6 alkylcarbonyl, C_2–C_6 haloalkylcarbonyl, C_4–C_6 cycloalkylcarbonyl, C_2–C_6 alkoxycarbonyl, C_4–C_6 cycloalkoxycarbonyl, C_5–C_6 cycloalkylalkoxycarbonyl, C_2–C_6 alkylaminocarbonyl, C_3–C_6 dialkylaminocarbonyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_3–C_6 cycloalkoxy, C_3–C_6 halocycloalkoxy, C_2–C_6 alkenyloxy, C_2–C_6 haloalkenyloxy, C_2–C_6 alkynyloxy, C_3–C_6 haloalkynyloxy, C_2–C_6 alkoxyalkoxy, C_2–C_6 alkylcarbonyloxy, C_2–C_6 haloalkylcarbonyloxy, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio, C_3–C_6 cycloalkylthio, C_1–C_6 alkylamino, C_2–C_6 dialkylamino, C_1–C_6 haloalkylamino, C_2–C_6 halodialkylamino, C_3–C_6 cycloalkylamino, C_2–C_6 alkylcarbonylamino, C_2–C_6 haloalkylcarbonylamino, C_1–C_6 alkylsulfonylamino or C_1–C_6 haloalkylsulfonylamino;

R^3 is hydrogen, halogen, cyano, hydroxy, C_1–C_3 alkyl, C_1–C_3 haloalkyl, C_1–C_3 alkoxy or C_1–C_3 haloalkoxy; or

R^2 and R^3 are taken together with the carbon atom to which they are attached to form a 3- to 7-membered ring containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S, up to 2 N and up to 2 Si atoms, wherein up to 3 carbon atom ring members are independently selected from C(=O) and C(=S), the sulfur atom ring members are independently selected from $S(=O)_s(=NR^{17})_f$, and the silicon atom ring members are independently selected from $SiR^{10}R^{11}$, the ring optionally substituted with up to 4 substituents independently selected from halogen, cyano, C_1–C_2 alkyl, C_1–C_2 haloalkyl, C_1–C_2 alkoxy and C_1–C_2 haloalkoxy on carbon atom ring members and cyano, C_1–C_2 alkyl and C_1–C_2 alkoxy on nitrogen atom ring members;

R^4 is optionally substituted phenyl, optionally substituted naphthalenyl or an optionally substituted 5- to 6-membered heteroaromatic ring; or hydrogen, halogen, cyano, hydroxy, -CHO, C_1–C_4 alkyl, C_2–C_4 alkenyl, C_2–C_4 alkynyl, C_1–C_4 haloalkyl, C_2–C_4 haloalkenyl, C_2–C_4 haloalkynyl, C_2–C_4 alkoxyalkyl, C_2–C_4 alkylthioalkyl, 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_2–C_5

alkylaminocarbonyl, $C_3–C_5$ dialkylaminocarbonyl, $C_1–C_4$ 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, $C_2–C_4$ alkylcarbonyloxy, $C_2–C_4$ haloalkylcarbonyloxy, $C_2–C_5$ alkoxycarbonyloxy, $C_2–C_5$ alkylaminocarbonyloxy or $C_3–C_5$ dialkylaminocarbonyloxy;

R^5 is hydrogen, $C_1–C_3$ alkyl or $C_1–C_3$ haloalkyl;

each R^{6a} is independently $C_1–C_4$ alkyl, $C_1–C_4$ alkenyl, $C_1–C_4$ haloalkyl, $C_1–C_4$ alkoxy, halogen, cyano or hydroxy; or

two R^{6a} are taken together as $C_1–C_4$ alkylene or $C_2–C_4$ alkenylene to form a bridged bicyclic or fused bicyclic ring system; or

two R^{6a} attached to adjacent ring carbon atoms joined by a double bond are taken together as –CH=CH–CH=CH– optionally substituted with up to 3 substituents selected from $C_1–C_4$ alkyl, $C_1–C_4$ haloalkyl, $C_1–C_4$ alkoxy, $C_1–C_4$ haloalkoxy, halogen, hydroxy, amino, cyano and nitro;

R^{6b} is hydrogen, cyano, $C_1–C_3$ alkyl, $C_1–C_3$ haloalkyl, $C_1–C_3$ alkoxy, $C_2–C_3$ alkylcarbonyl, $C_2–C_3$ alkoxycarbonyl or $C_3–C_6$ cycloalkyl;

R^7 is hydrogen, cyano, $C_1–C_4$ alkyl, $C_1–C_4$ haloalkyl, $C_2–C_4$ alkoxyalkyl, $C_2–C_4$ alkylthioalkyl, $C_2–C_4$ alkylcarbonyl, $C_2–C_4$ haloalkylcarbonyl, $C_2–C_4$ alkoxycarbonyl, $C_2–C_4$ alkylaminocarbonyl, $C_3–C_5$ dialkylaminocarbonyl, $C_1–C_4$ alkylsulfonyl or $C_1–C_4$ haloalkylsulfonyl; or

R^3 and R^7 are taken together with the linking atoms to which they are attached to form a 5- to 7-membered partially saturated ring containing ring members, in addition to the linking atoms, selected from carbon atoms and up to 3 heteroatoms independently selected from up to 1 O, up to 1 S and up to 1 N atom, the ring optionally substituted with up to 3 substituents independently selected from halogen, cyano, nitro, $C_1–C_2$ alkyl, $C_1–C_2$ haloalkyl, $C_1–C_2$ alkoxy and $C_1–C_2$ haloalkoxy on carbon atom ring members and cyano, $C_1–C_2$ alkyl and $C_1–C_2$ alkoxy on nitrogen atom ring members;

each R^8 is independently hydrogen, $C_1–C_3$ alkyl or $C_1–C_3$ haloalkyl;

each R^{9a} is independently halogen, hydroxy, amino, cyano, nitro, $C_1–C_6$ alkyl, $C_2–C_6$ alkenyl, $C_2–C_6$ alkynyl, $C_3–C_6$ cycloalkyl, $C_4–C_{10}$ cycloalkylalkyl, $C_4–C_{10}$ alkylcycloalkyl, $C_5–C_{10}$ alkylcycloalkylalkyl, $C_6–C_{14}$ cycloalkylcycloalkyl, $C_1–C_6$ haloalkyl, $C_2–C_6$ haloalkenyl, $C_2–C_6$ haloalkynyl, $C_3–C_6$ halocycloalkyl, $C_1–C_4$ alkoxy, $C_1–C_4$ haloalkoxy, $C_1–C_4$ alkylthio, $C_1–C_4$ alkylsulfinyl, $C_1–C_4$ alkylsulfonyl, $C_1–C_4$ haloalkylthio, $C_1–C_4$ haloalkylsulfinyl, $C_1–C_4$ haloalkylsulfonyl, $C_1–C_4$ alkylamino, $C_2–C_8$ dialkylamino, $C_3–C_6$ cycloalkylamino, $C_2–C_4$ alkoxyalkyl, $C_1–C_4$ hydroxyalkyl, $C_2–C_4$ alkylcarbonyl, $C_2–C_6$ alkoxycarbonyl, $C_2–C_6$ alkylcarbonyloxy, $C_2–C_6$

alkylcarbonylthio, C_2–C_6 alkylaminocarbonyl, C_3–C_8 dialkylaminocarbonyl or C_3–C_6 trialkylsilyl; or

phenyl or naphthalenyl optionally substituted with up to 3 substituents independently selected from halogen, cyano, C_1–C_2 alkyl, C_1–C_2 haloalkyl, C_1–C_2 alkoxy and C_1–C_2 haloalkoxy; or

a 5- to 6-membered heteroaromatic ring containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, and optionally substituted with up to 3 substituents independently selected from halogen, cyano, C_1–C_2 alkyl, C_1–C_2 haloalkyl, C_1–C_2 alkoxy and C_1–C_2 haloalkoxy on carbon atom ring members and cyano, C_1–C_2 alkyl and C_1–C_2 alkoxy on nitrogen atom ring members; or

a 3- to 7-membered nonaromatic ring containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, wherein up to 3 carbon atom ring members are independently selected from C(=O) and C(=S), the ring optionally substituted with up to 3 substituents independently selected from halogen, cyano, C_1–C_2 alkyl, C_1–C_2 haloalkyl, C_1–C_2 alkoxy and C_1–C_2 haloalkoxy on carbon atom ring members and cyano, C_1–C_2 alkyl and C_1–C_2 alkoxy on nitrogen atom ring members;

each R^{9b} is independently hydrogen, cyano, C_1–C_3 alkyl, C_1–C_3 haloalkyl, C_1–C_3 alkoxy, C_2–C_3 alkylcarbonyl, C_2–C_3 alkoxycarbonyl or C_3–C_6 cycloalkyl;

each R^{10} and R^{11} is independently C_1–C_5 alkyl, C_2–C_5 alkenyl, C_2–C_5 alkynyl, C_3–C_5 cycloalkyl, C_3–C_6 halocycloalkyl, C_4–C_{10} cycloalkylalkyl, C_4–C_7 alkylcycloalkyl, C_5–C_7 alkylcycloalkylalkyl, C_1–C_5 haloalkyl, C_1–C_5 alkoxy or C_1–C_5 haloalkoxy;

each R^{12} is independently hydrogen, halogen, hydroxy, cyano, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_1–C_4 alkoxy, C_1–C_4 haloalkoxy, C_2–C_4 alkoxyalkyl, C_2–C_4 alkylcarbonyl, C_2–C_4 alkoxycarbonyl or C_3–C_6 cycloalkyl;

each R^{13} is independently hydrogen, cyano, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_1–C_4 alkoxy, C_2–C_4 alkylcarbonyl, C_2–C_4 alkoxycarbonyl or C_3–C_6 cycloalkyl;

R^{15} is hydrogen, halogen, cyano, hydroxy, -CHO, C_1–C_4 alkyl, C_2–C_4 alkenyl, C_2–C_4 alkynyl, C_1–C_4 haloalkyl, C_2–C_4 haloalkenyl, C_2–C_4 haloalkynyl, C_2–C_4 alkoxyalkyl, C_2–C_4 alkylthioalkyl, C_2–C_4 alkylsulfinylalkyl, C_2–C_4 alkylsulfonylalkyl, C_3–C_5 alkoxycarbonylalkyl, C_2–C_4 alkylcarbonyl, C_2–C_4 haloalkylcarbonyl, C_2–C_5 alkoxycarbonyl, C_2–C_5 alkylaminocarbonyl, C_3–C_5 dialkylaminocarbonyl, 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; provided that when R^{15} is hydroxy, then R^{1a} is bonded through a carbon atom to A in Formula **1**;

R^{16} is hydrogen, C_1–C_4 alkyl, C_2–C_4 alkenyl, C_3–C_4 alkynyl, C_1–C_4 haloalkyl, C_2–C_4 haloalkenyl, C_2–C_4 haloalkynyl, C_2–C_4 alkoxyalkyl, C_2–C_4 alkylthioalkyl, 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_1–C_4 alkylsulfonyl or C_1–C_4 haloalkylsulfonyl;

each R^{17} is independently hydrogen, cyano, C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_3–C_8 cycloalkyl, C_3–C_8 halocycloalkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_1–C_6 alkylamino, C_2–C_8 dialkylamino, C_1–C_6 haloalkylamino or phenyl;

R^{18} and R^{19} independently are C_1–C_6 alkyl, C_3–C_6 alkenyl, C_3–C_6 alkynyl, C_1–C_6 haloalkyl, C_3–C_6 haloalkenyl, C_3–C_6 haloalkynyl, C_3–C_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_4–C_8 halocycloalkylalkyl, C_5–C_8 alkylcycloalkylalkyl, C_2–C_6 alkoxyalkyl, C_4–C_8 cycloalkoxyalkyl, C_3–C_6 alkoxyalkoxyalkyl, C_2–C_6 alkylthioalkyl, C_2–C_6 alkylsulfinylalkyl, C_2–C_6 alkylsulfonylalkyl, C_2–C_6 alkylaminoalkyl, C_3–C_6 dialkylaminoalkyl, C_2–C_6 haloalkylaminoalkyl, C_4–C_8 cycloalkylaminoalkyl, C_2–C_6 alkylcarbonyl, C_2–C_6 haloalkylcarbonyl, C_4–C_8 cycloalkylcarbonyl, C_2–C_6 alkoxycarbonyl, C_2–C_6 alkylaminocarbonyl, C_3–C_8 dialkylaminocarbonyl or C_4–C_8 cycloalkylaminocarbonyl;

R^{20} is hydrogen, cyano, hydroxy, amino, C_1–C_6 alkyl, C_3–C_6 alkenyl, C_3–C_6 alkynyl, C_1–C_6 haloalkyl, C_3–C_6 haloalkenyl, C_3–C_6 haloalkynyl, C_3–C_6 cycloalkyl, C_4–C_8 cycloalkylalkyl, C_2–C_6 alkoxyalkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_1–C_6 alkylsulfonyl, C_1–C_6 haloalkylsulfonyl, C_2–C_6 alkylcarbonyl, C_2–C_6 haloalkylcarbonyl, C_1–C_6 alkylamino, C_2–C_8 dialkylamino, C_1–C_6 haloalkylamino or C_2–C_8 halodialkylamino;

R^{21} is hydrogen, C_1–C_6 alkyl, C_3–C_6 alkenyl, C_3–C_6 alkynyl, C_1–C_6 haloalkyl or C_3–C_6 cycloalkyl; or

R^{20} and R^{21} are taken together as $-(CH_2)_4-$, $-(CH_2)_5-$ or $-(CH_2)_2O(CH_2)_2-$;

R^{22} is hydrogen, halogen, cyano, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_2–C_4 alkoxyalkyl, C_2–C_4 alkylcarbonyl, C_2–C_4 alkoxycarbonyl, C_2–C_3 alkylaminocarbonyl or C_3–C_6 dialkylaminocarbonyl;

each R^{23} is independently selected from R^{23a} on carbon atom ring members and independently selected from R^{23b} on nitrogen atom ring members;

R^{23a} is halogen, hydroxy, cyano, C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_1–C_4 alkoxy, C_1–C_4 haloalkoxy, C_2–C_6 alkoxyalkyl, C_2–C_4 alkylcarbonyl, C_2–C_6 alkoxycarbonyl or C_3–C_6 cycloalkyl;

R^{23b} is cyano, C_1–C_3 alkyl, C_1–C_3 haloalkyl, C_1–C_3 alkoxy, C_2–C_3 alkylcarbonyl, C_2–C_3 alkoxycarbonyl or C_3–C_6 cycloalkyl;

each R^{29a} is independently hydrogen, halogen, C_1–C_3 alkyl or C_1–C_3 haloalkyl;

each R^{30a} is independently hydrogen or C_1–C_3 alkyl;

n is 0, 1 or 2;

q is 0, 1 or 2; and

s and f are independently 0, 1 or 2 in each instance of $S(=O)_s(=NR^{17})_f$, provided that the sum of s and f is 0, 1 or 2;

provided that when Z is Z^1-13, then Q is other than unsubstituted phenyl.

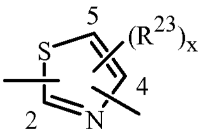
2. A compound of Claim 1 wherein:

E is E-1;

X is X-1, X-2, X-3, X-4 or X-5;

G is a 5-membered heterocyclic ring optionally substituted with up to 2 substituents independently selected from R^{29a} on carbon atom ring members and R^{30a} on nitrogen atom ring members; and

J is a ring selected from the group consisting of



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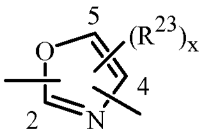

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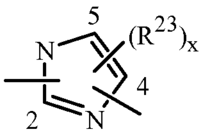

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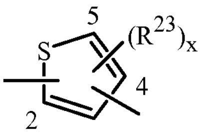

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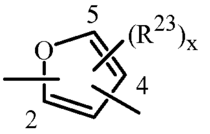

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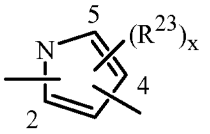

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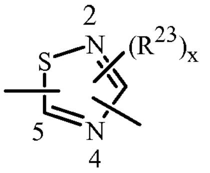

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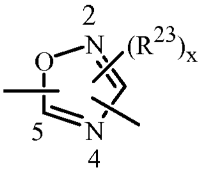

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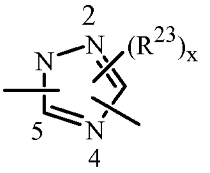

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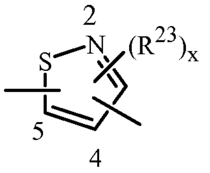

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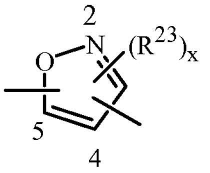

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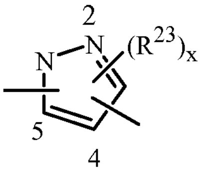

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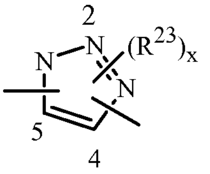

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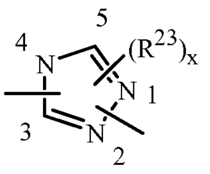

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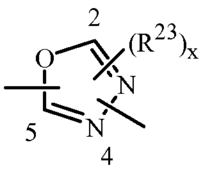

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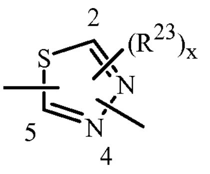

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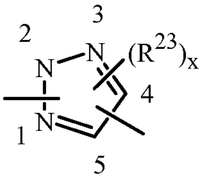

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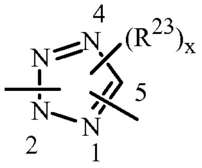

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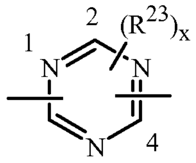

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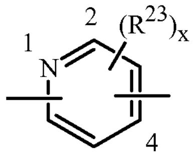

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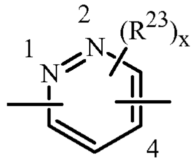

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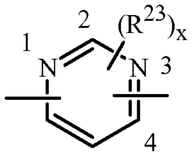

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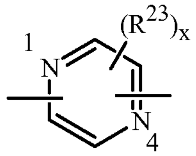

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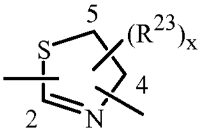

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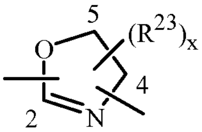

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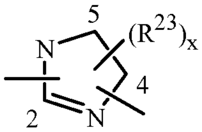

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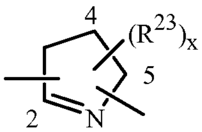

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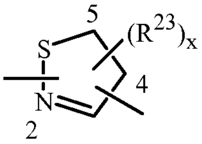

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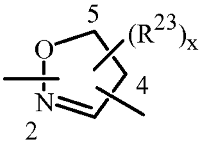

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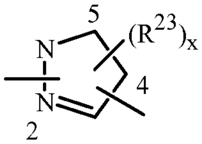

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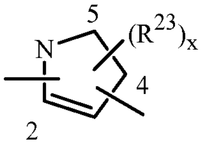

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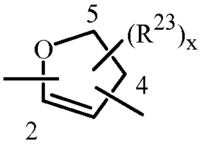

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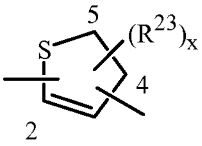

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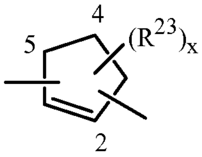

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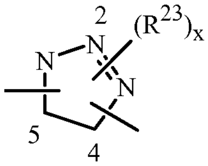

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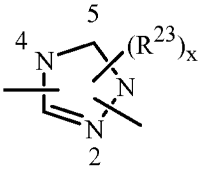

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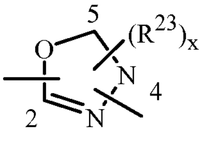

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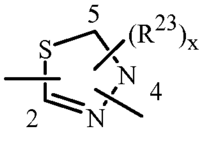

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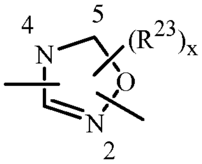

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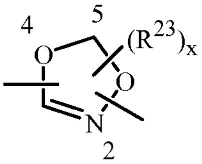

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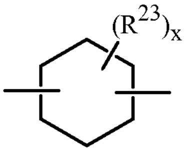

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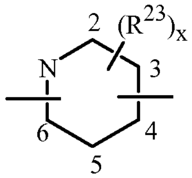

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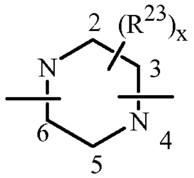

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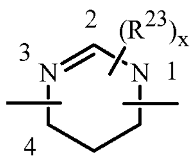

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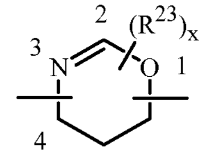

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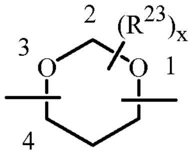

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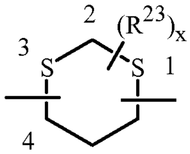

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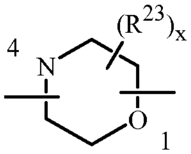

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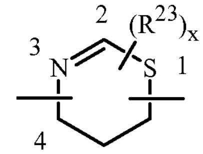

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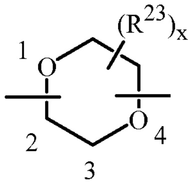

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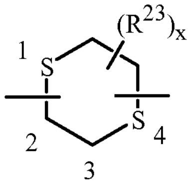

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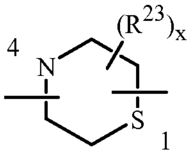

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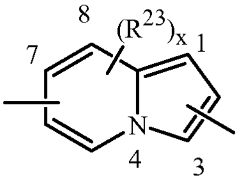

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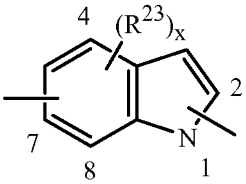

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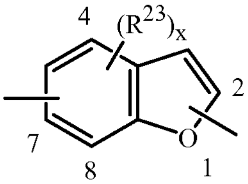

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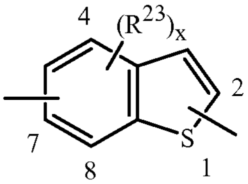

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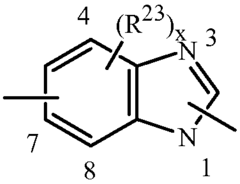

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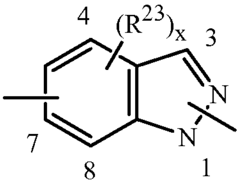

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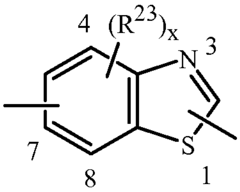

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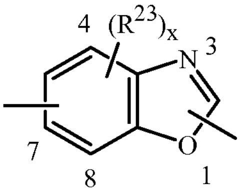

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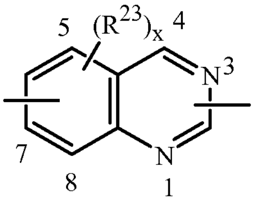

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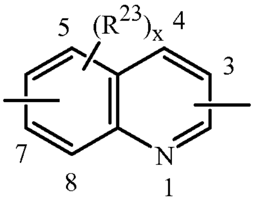

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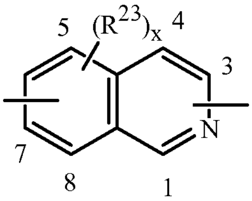

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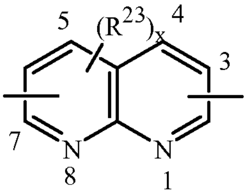

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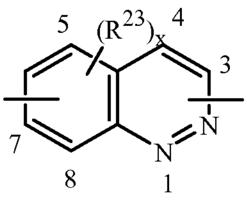

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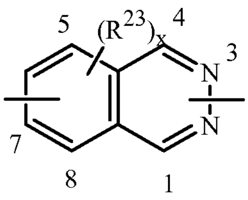

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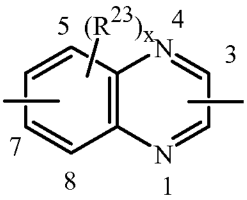

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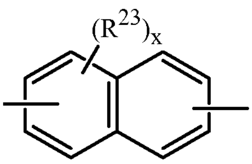

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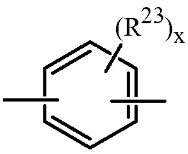

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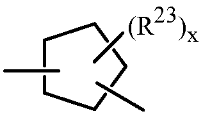

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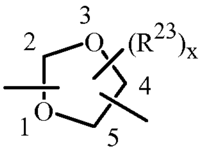

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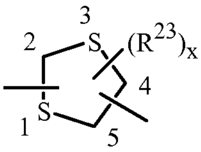

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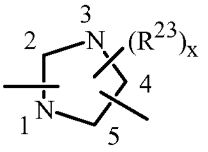

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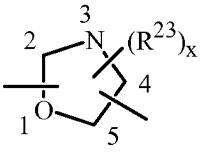

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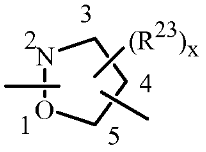

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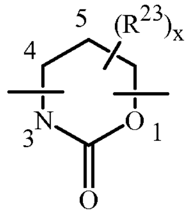

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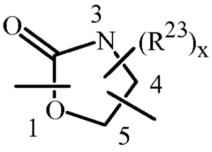

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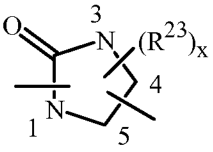

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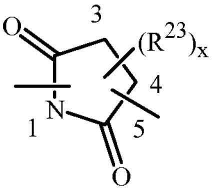

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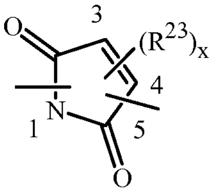

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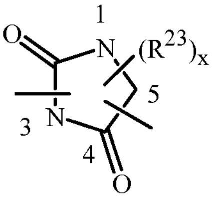

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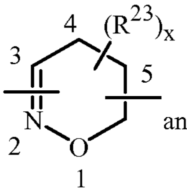
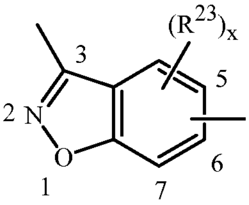


and

J-82



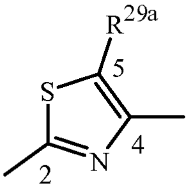
J-83

wherein one of the floating bonds is connected to G in Formula **1** through any available carbon or nitrogen atom of the depicted ring or ring system and the other floating bond is connected to Z in Formula **1** through any available carbon or nitrogen atom of the depicted ring or ring system; when R^{23} is attached to a carbon ring member, said R^{23} is selected from R^{23a}, and when R^{23} is attached to a nitrogen ring member, said R^{23} is selected from R^{23b}; and x is an integer from 0 to 5.

3. A compound of Claim 2 wherein:

X is X-1, X-2 or X-3;

G is a ring selected from the group consisting of



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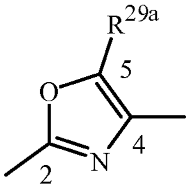
G-1



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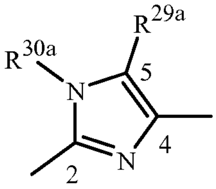
G-2



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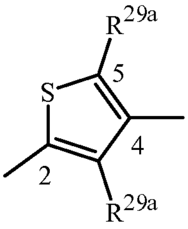
G-3



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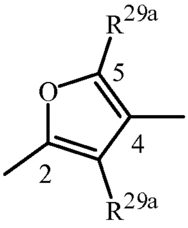

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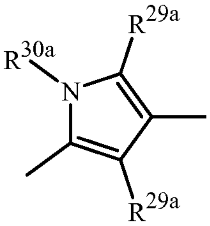

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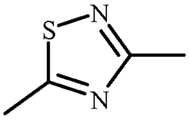

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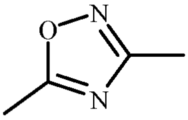

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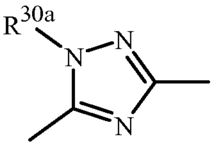

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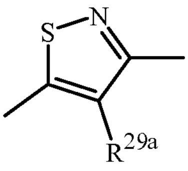

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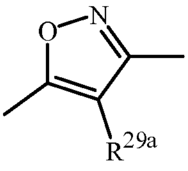

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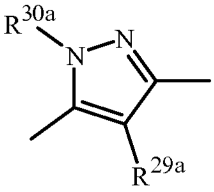

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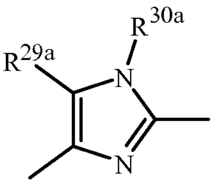

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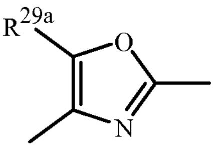

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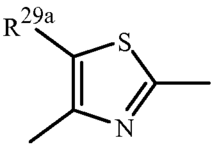

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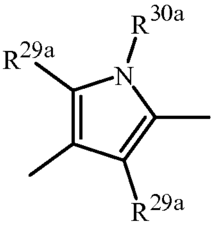

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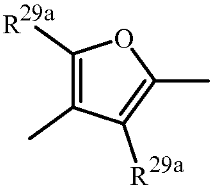

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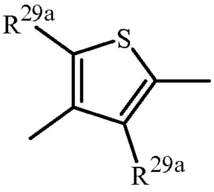

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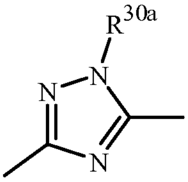

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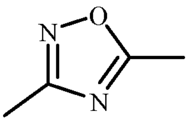

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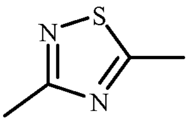

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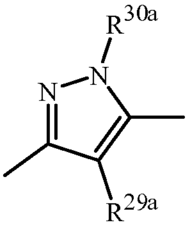

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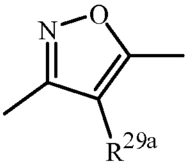

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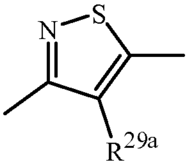

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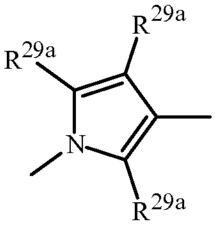

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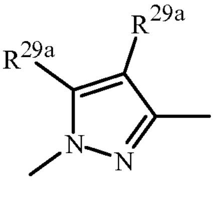

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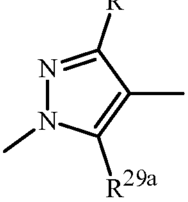

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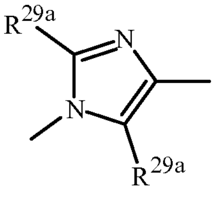

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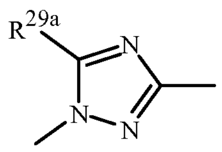
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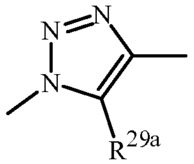
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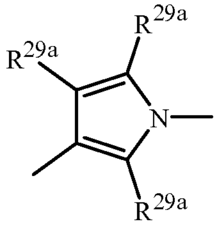
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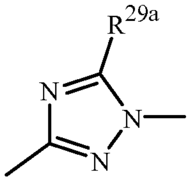
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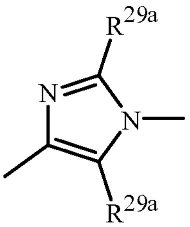
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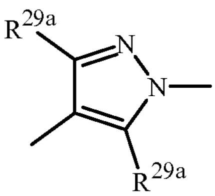
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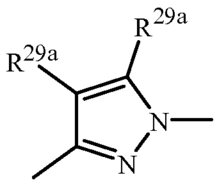
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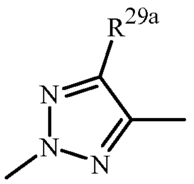
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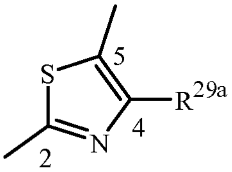
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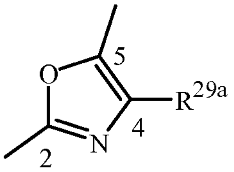
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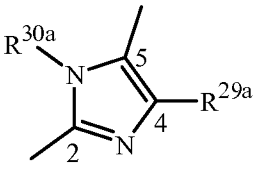
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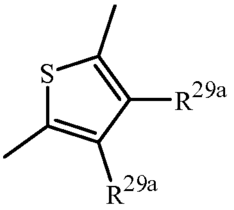
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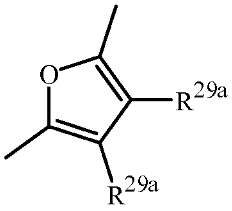
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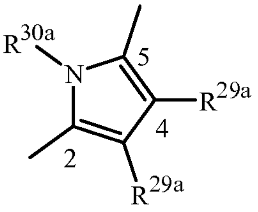
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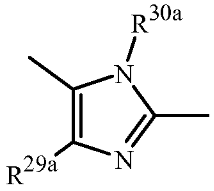
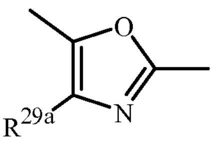

G-43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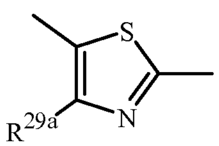
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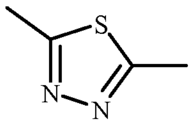
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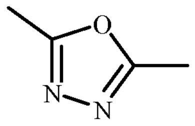
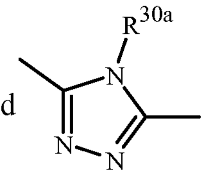

G-47

and


G-48

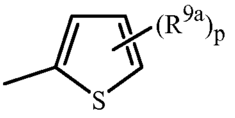
wherein the bond projecting to the left is bonded to X in Formula **1**, and the bond projecting to the right is bonded to J in Formula **1**;

each R^{29a} is H;

R^{30a} is hydrogen or methyl;

J is selected from the group consisting of J-1, J-2, J-3, J-4, J-5, J-7, J-8, J-9, J-10, J-11, J-12, J-14, J-15, J-16, J-20, J-24, J-25, J-26, J-29, J-30, J-37, J-38, J-45 and J-69; and

Q is a ring selected from the group consisting of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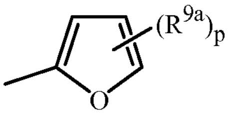
Q-1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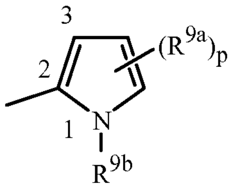
Q-2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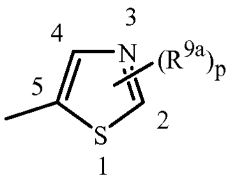
Q-3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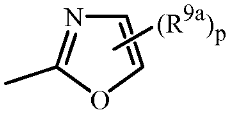
Q-4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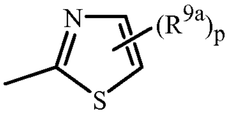
Q-5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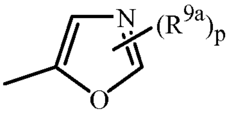
Q-6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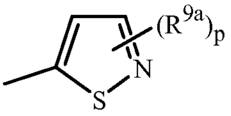
Q-7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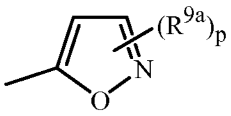
Q-8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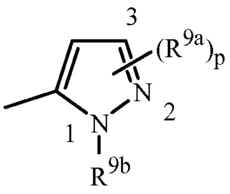
Q-9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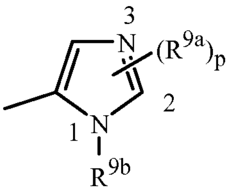
Q-10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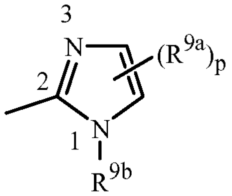
Q-11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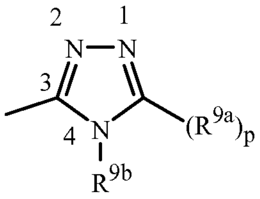
Q-12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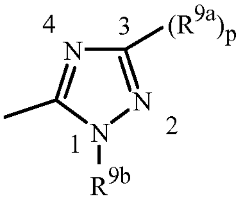
Q-13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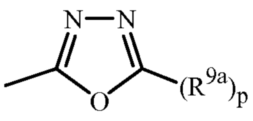
Q-14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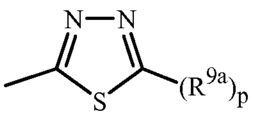
Q-15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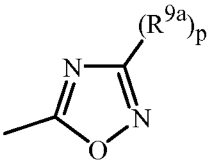
Q-16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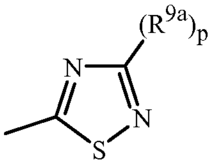
Q-17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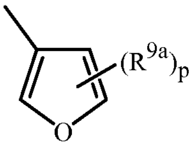
Q-18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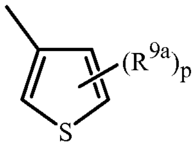
Q-19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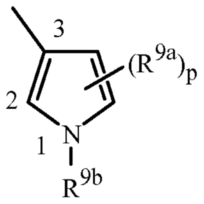
Q-20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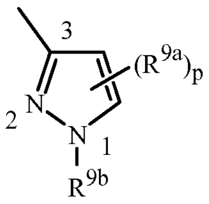
Q-21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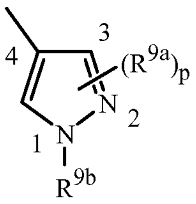
Q-22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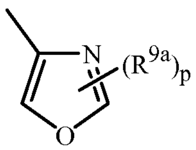
Q-23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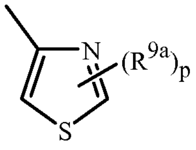
Q-24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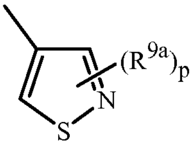
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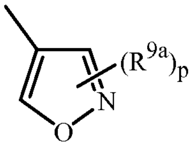
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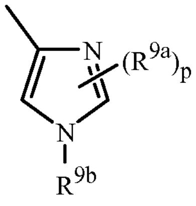
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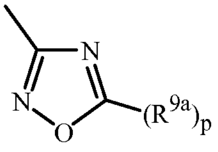
Q-28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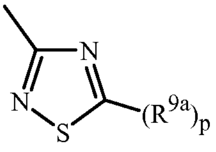
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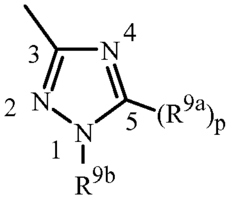
Q-30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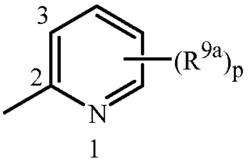
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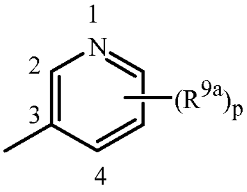
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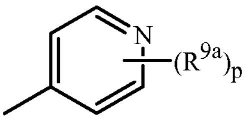
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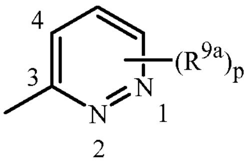
Q-34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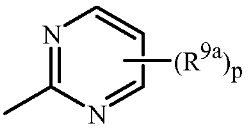
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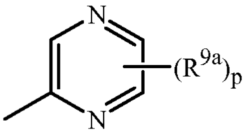
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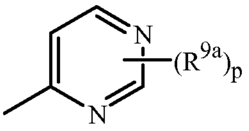
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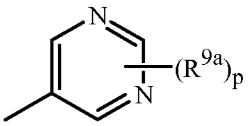
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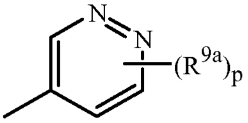
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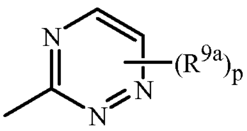
Q-40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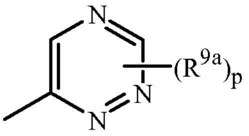
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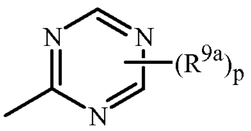
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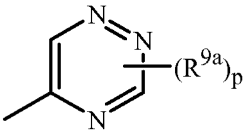
Q-43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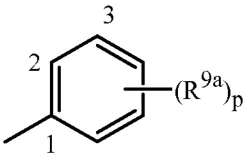
Q-44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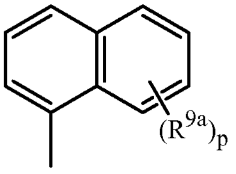
Q-45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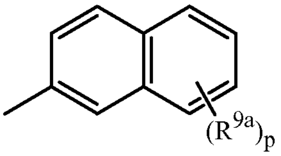
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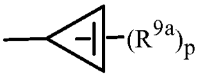
Q-47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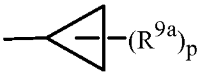
Q-48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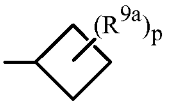
Q-49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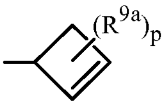
Q-50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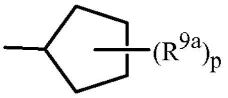
Q-51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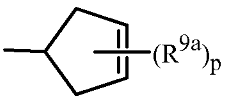
Q-52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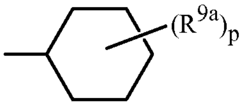
Q-53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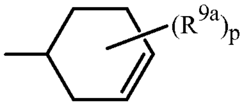
Q-54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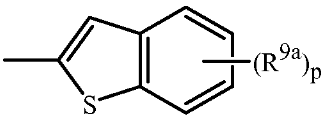
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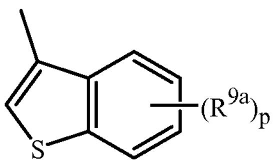
Q-56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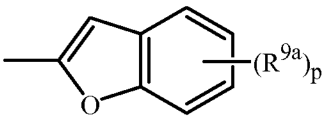
Q-57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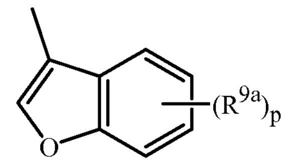

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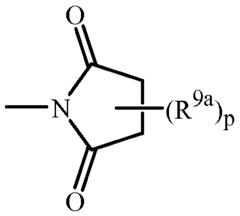

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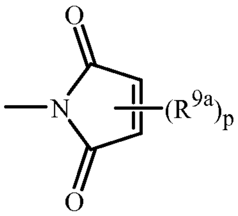

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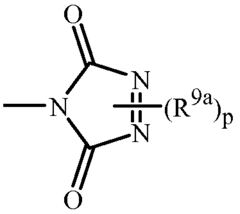

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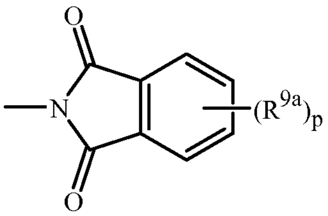

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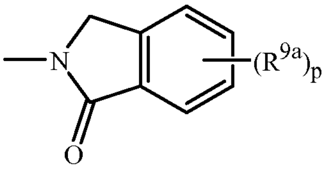

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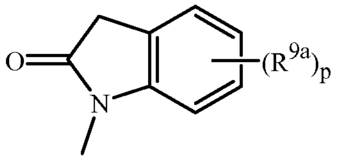

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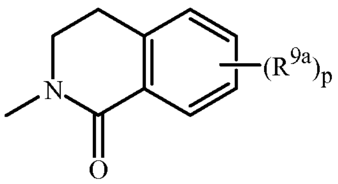

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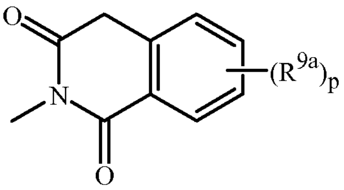

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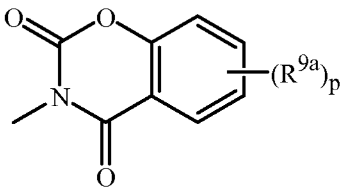

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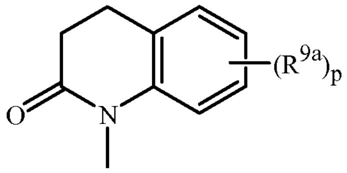

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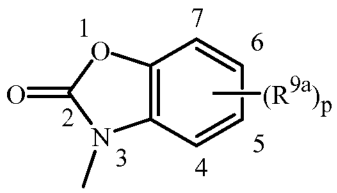

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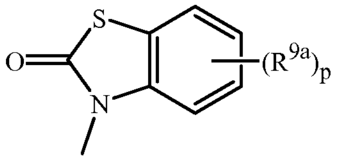

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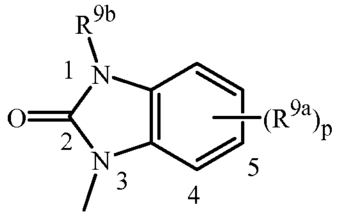

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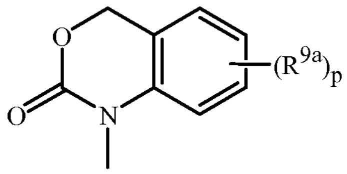

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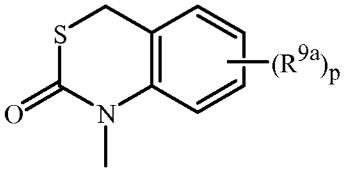

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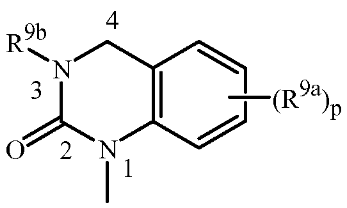

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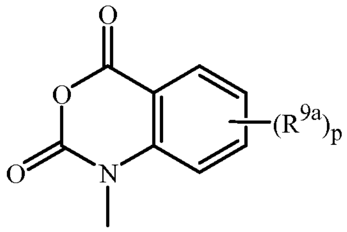

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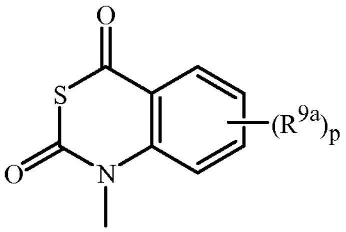

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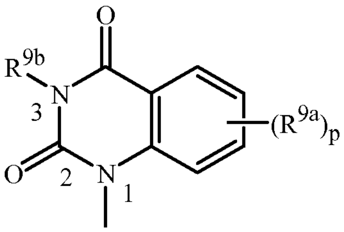

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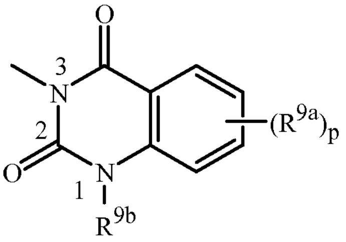

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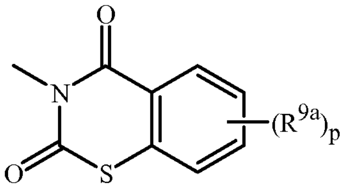

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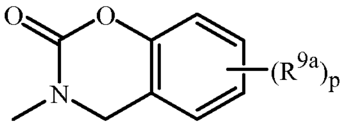

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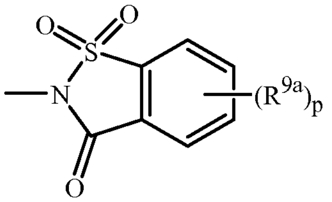

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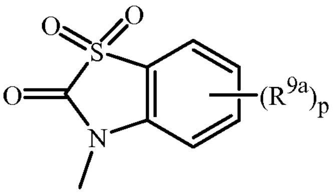

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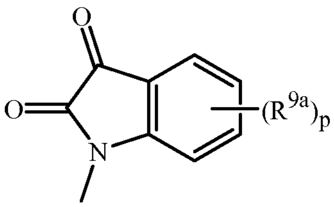

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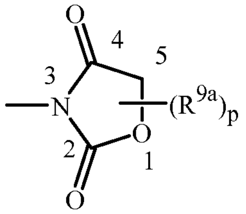

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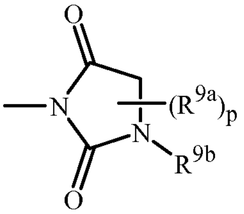

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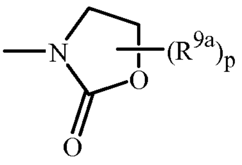

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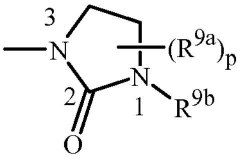

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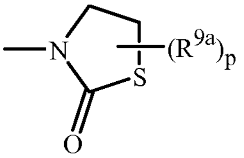

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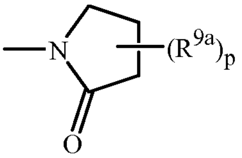

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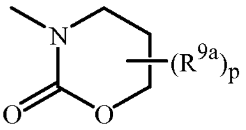

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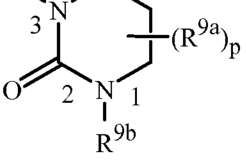

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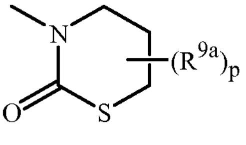

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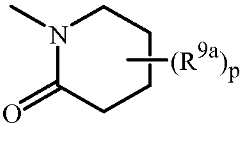

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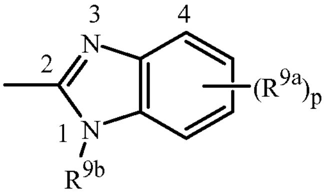

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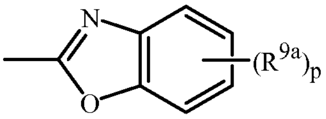

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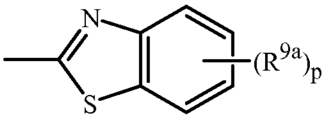

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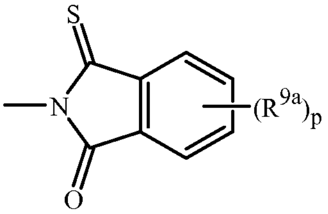

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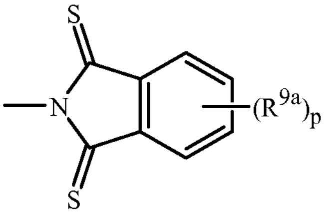

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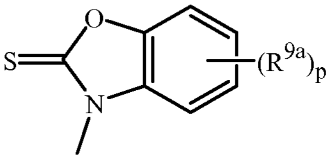

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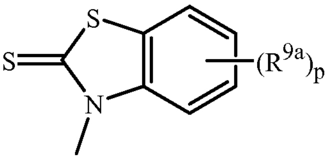
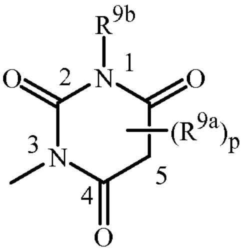


Q-101

and

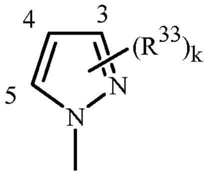


Q-102

wherein p is 0, 1, 2, 3, 4 or 5.

4. A compound of Claim 3 wherein:

R^{1a} is



U-1

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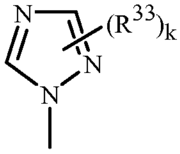
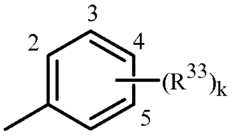


U-20

or



U-50

each R^{33} is independently halogen, C_1-C_3 alkyl, C_1-C_3 haloalkyl or C_2-C_3 alkoxyalkyl;

k is 0, 1, 2 or 3;

A is CHR^{15};

R^{15} is H;

W is O;

X is X-1;

n is 0;

G is G-1;

J is J-29;

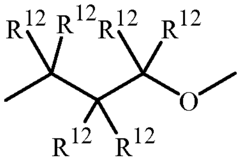
x is 0;

each R^{9a} is independently halogen, C_1–C_6 alkyl, C_1–C_6 haloalkyl or C_1–C_4 alkoxy; and

p is 0, 1, 2 or 3.

5. A compound of Claim 4 wherein:

Z is selected from Z^1-1, Z^1-4, Z^1-14, Z^1-16, Z^1-18,



Z-1

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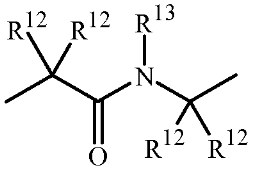
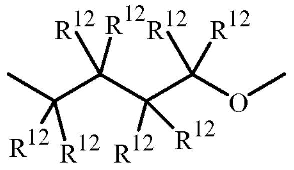


Z-2

and



Z-3

;

wherein the orientation of the Z group is such that the bond extending to the left is attached to J in Formula **1** and the bond extending to the right is attached to Q in Formula **1**; and

Q is Q-45.

6. A compound of Claim 5 wherein:

Z is selected from Z^1-1, Z^1-16, Z^1-18, Z-1 and Z-3.

7. A compound of Claim 6 wherein:

Z is Z^1-1, Z^1-16 or Z-1.

8. A compound of Claim 7 wherein:

R^{12} is hydrogen.

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

1-[4-[4-[5-[2-[(2,6-difluorophenoxy)ethyl]-4,5-dihydro-3-isoxazolyl]-2-thiazolyl]-1-piperdinyl]-2-[5-methyl-3-(trifluoromethyl)-1*H*-pyrazol-1-yl]ethanone,

1-[4-[4-[5-[(2,6-difluorophenoxy)methyl]-4,5-dihydro-3-isoxazolyl]-2-thiazolyl]-1-piperdinyl]-2-[5-methyl-3-(trifluoromethyl)-1*H*-pyrazol-1-yl]ethanone and

1-[4-[4-[5-[(2,6-difluoro-4-methoxyphenoxy)methyl]-4,5-dihydro-3-isoxazolyl]-2-thiazolyl]-1-piperdinyl]-2-[5-methyl-3-(trifluoromethyl)-1*H*-pyrazol-1-yl]ethanone.

10. A fungicidal composition comprising (a) a compound of Claim 1; and (b) at least one other fungicide.

11. A fungicidal composition comprising (a) a compound of Claim 1; and (b) at least one additional component selected from the group consisting of surfactants, solid diluents and liquid diluents.

12. A method for controlling plant diseases caused by fungal plant pathogens comprising applying to the plant or portion thereof, or to the plant seed, a fungicidally effective amount of a compound of Claim 1.