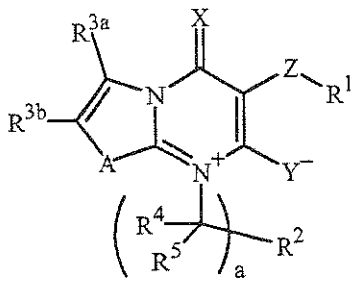
SUMMARY ~~OF THE INVENTION~~

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



1

wherein

X is O or S;

Y is O or S;

A is O, S, NR^{3e} or $C(R^{3c})=C(R^{3d})$, provided that the $C(R^{3c})=C(R^{3d})$ moiety is oriented so the carbon atom bonded to R^{3d} is connected directly to the pyrimidinium ring of Formula **1**;

Z is a direct bond, O, $S(O)_n$, NR^6, $C(R^7)_2O$, $OC(R^7)_2$, $C(=X^1)$, $C(=X^1)E$, $EC(=X^1)$, $C(=NOR^8)$ or $C(=NN(R^6)_2)$;

X^1 is O, S or NR^9;

E is O, S or NR^{9a};

R^1 is H, halogen, cyano, CHO, C(=O)OH, $C(=O)NH_2$ or $C(=S)NH_2$; or C_1–C_8 alkyl, C_2–C_8 alkenyl, C_2–C_8 alkynyl, C_3–C_{10} cycloalkyl, C_4–C_{10} alkylcycloalkyl, C_4–C_{10} cycloalkylalkyl, C_6–C_{14} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl or C_3–C_6 cycloalkenyl, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, $C(=O)R^{10}$, $C(=O)OR^{11}$, $C(=O)NR^{12}R^{13}$, $C(=O)NR^{21}NR^{22}R^{23}$, OR^{11}, $S(O)_nR^{10}$, $SO_2NR^{12}R^{13}$, $S(=O)(=NR^{21})R^{22}$, $Si(R^{10})_3$ and Z^1Q^t; or a 3- to 10-membered ring or a 7- to 11-membered 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 $S(=O)_u(=NR^{24})_z$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{14};

C_8 alkenylsulfonyl, C_2–C_8 alkynylthio, C_2–C_8 alkynylsulfinyl or C_2–C_8 alkynylsulfonyl, each unsubstituted or substituted with at least one substituent independently selected from R^{17};

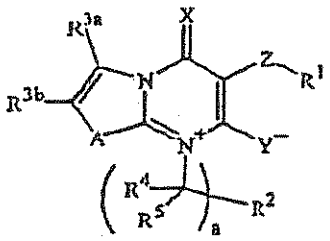
a is 1, 2 or 3;

each n is independently 0, 1 or 2; and

u and z in each instance of $S(=O)_u(=NR^{24})_z$ are independently 0, 1 or 2, provided that the sum of u and z in each instance of $S(=O)_u(=NR^{24})_z$ is 0, 1 or 2.

This invention is also directed to such compounds of Formula 1 (including all stereoisomers), *N*-oxides, and salts thereof, and compositions containing them and their use for controlling invertebrate pests as described above, and further herein, provided that when A is O, S, NCH_3 or $C(R^{3c})=C(R^{3d})$, R^{3c} is H or F, and R^{3d} is H, F, CF_2H or CF_3, then at least one of R^{3a} or R^{3b} is other than H.

In one aspect, there is provided a compound of Formula 1, an *N*-oxide, or salt thereof,



1

wherein

X is O or S;

Y is O or S;

A is O, S, NR^{3c} or $C(R^{3c})=C(R^{3d})$, provided that the $C(R^{3c})=C(R^{3d})$ moiety is oriented so the carbon atom bonded to R^{3d} is connected directly to the pyrimidinium ring of Formula 1;

Z is a direct bond, O, $S(O)_n$, NR^6, $C(R^7)_2O$, $OC(R^7)_2$, $C(=X^1)$, $C(=X^1)E$, $EC(=X^1)$, $C(=NOR^8)$ or $C(=NN(R^6)_2)$;

X^1 is O, S or NR^9;

E is O, S or NR^{9a};

R^1 is a 3- to 10-membered ring or a 7- to 11-membered 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 $S(=O)_n(=NR^{24})_z$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{14};

R^2 is H, halogen, cyano, hydroxy, amino, nitro, OCN, SCN, CHO, C(=O)OH, $C(=O)NH_2$, $C(=S)NH_2$, SO_2NH_2, $C(=O)R^{18}$, $C(=O)OR^{18}$, NHR^{18}, $NR^{18}R^{19}$, $C(=O)NR^{21}R^{19}$, $C(=S)NR^{21}R^{19}$, $SO_2NR^{21}R^{19}$, $OC(=O)R^{21}$, $OC(=O)OR^{18}$, $OC(=O)NR^{21}R^{19}$, $N(R^{21})C(=O)R^{21}$, $N(R^{21})C(=O)OR^{19}$, $N(R^{21})C(=O)NR^{21}R^{22}$, OSO_2R^{18}, $OSO_2NR^{21}R^{22}$, $NR^{21}SO_2R^{18}$, $NR^{21}SO_2NR^{21}R^{22}$ or $Si(R^{18}R^{19}R^{20})$; or C_1–C_8 alkyl, C_2–C_8 alkenyl, C_2–C_8 alkynyl, C_3–C_{10} cycloalkyl, C_4–C_{10} alkylcycloalkyl, C_4–C_{10} cycloalkylalkyl, C_6–C_{14} cycloalkylcycloalkyl, C_5–C_{10}

alkylcycloalkylalkyl, C_3–C_8 cycloalkenyl, C_1–C_8 alkoxy, C_3–C_8 cycloalkoxy, C_4–C_{10} cycloalkylalkoxy, C_2–C_8 alkenyloxy, C_2–C_8 alkynyloxy, C_1–C_8 alkylthio, C_1–C_8 alkylsulfinyl, C_1–C_8 alkylsulfonyl, C_3–C_8 cycloalkylthio, C_3–C_8 cycloalkylsulfinyl, C_3–C_8 cycloalkylsulfonyl, C_4–C_{10} cycloalkylalkylthio, C_4–C_{10} cycloalkylalkylsulfinyl, C_4–C_{10} cycloalkylalkylsulfonyl, C_2–C_8 alkenylthio, C_2–C_8 alkenylsulfinyl, C_2–C_8 alkenylsulfonyl, C_2–C_8 alkynylthio, C_2–C_8 alkynylsulfinyl or C_2–C_8 alkynylsulfonyl, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, $C(=O)R^{10}$, $C(=O)OR^{11}$, $C(=O)NR^{12}R^{13}$, OR^{11}, $S(O)_nR^{10}$, $SO_2NR^{12}R^{13}$ and $Si(R^{10})_3$; or a 3- to 10-membered ring or a 7- to 11-membered 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 $S(=O)_u(=NR^{24})_z$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{15};

R^{3a}, R^{3b}, R^{3c} and R^{3d} are independently H, halogen, cyano, hydroxy, amino, nitro, SF_5, OCN, SCN, CHO, C(=O)OH, $C(=O)NH_2$, $C(=S)NH_2$, SO_2NH_2, $C(=O)R^{18}$, $C(=O)OR^{18}$, NHR^{18}, $NR^{18}R^{19}$, $C(=O)NR^{21}R^{19}$, $C(=S)NR^{21}R^{19}$, $SO_2NR^{21}R^{19}$, $OC(=O)R^{21}$, $OC(=O)OR^{18}$, $OC(=O)NR^{21}R^{19}$, $N(R^{21})C(=O)R^{21}$, $N(R^{21})C(=O)OR^{19}$, $N(R^{21})C(=O)NR^{21}R^{22}$, OSO_2R^{18}, $OSO_2NR^{21}R^{22}$, $NR^{21}SO_2R^{18}$, $NR^{21}SO_2NR^{21}R^{22}$, $Si(R^{18}R^{19}R^{20})$ or Z^1Q^1; or C_1–C_8 alkyl, C_2–C_8 alkenyl, C_2–C_8 alkynyl, C_3–C_{10} cycloalkyl, C_4–C_{10} alkylcycloalkyl, C_4–C_{10} cycloalkylalkyl, C_6–C_{14} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_8 cycloalkenyl, C_1–C_8 alkoxy, C_3–C_8 cycloalkoxy, C_4–C_{10} cycloalkylalkoxy, C_2–C_8 alkenyloxy, C_2–C_8 alkynyloxy, C_1–C_8 alkylthio, C_1–C_8 alkylsulfinyl, C_1–C_8 alkylsulfonyl, C_3–C_8 cycloalkylthio, C_3–C_8 cycloalkylsulfinyl, C_3–C_8 cycloalkylsulfonyl, C_4–C_{10} cycloalkylalkylthio, C_4–C_{10} cycloalkylalkylsulfinyl, C_4–C_{10} cycloalkylalkylsulfonyl, C_2–C_8 alkenylthio, C_2–C_8 alkenylsulfinyl, C_2–C_8 alkenylsulfonyl, C_2–C_8 alkynylthio, C_2–C_8 alkynylsulfinyl or C_2–C_8 alkynylsulfonyl, each unsubstituted or substituted with at least one substituent independently selected from R^{17}; or R^{3a} and R^{3b}, or R^{3b} and R^{3c}, or R^{3c} and R^{3d} are taken together with the adjacent carbon atoms to which they are attached to form a 5- to 7-membered carbocyclic or heterocyclic ring, each ring containing ring members selected from carbon atoms and up to 3 heteroatoms independently selected from up to 2 O, up to 2 S, and up to 3 N, wherein up to 2 carbon atom ring members are independently selected from C(=O) and C(=S) and the sulfur atom ring members are independently selected from $S(=O)_m$, each ring optionally substituted with up to 3 substituents independently selected from the group

consisting of halogen, cyano, hydroxy, amino, nitro, C(=O)OH, C(=O)NH_2, SO_2NH_2, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_2–C_4 alkenyl, C_2–C_4 haloalkenyl, C_2–C_4 alkynyl, C_2–C_4 haloalkynyl, C_3–C_7 cycloalkyl, C_3–C_7 halocycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 haloalkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_4–C_8 halocycloalkylalkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_2–C_6 alkoxycarbonyl, C_2–C_6 haloalkoxycarbonyl, C_2–C_6 alkylcarbonyl and C_2–C_6 haloalkylcarbonyl;

R^{3e} is H, hydroxy, amino, CHO, C(=O)NH_2, C(=S)NH_2, SO_2NH_2, C(=O)R^{18}, C(=O)OR^{18}, NHR^{18}, $NR^{18}R^{19}$, C(=O)$NR^{21}R^{19}$, C(=S)$NR^{21}R^{19}$, $SO_2NR^{21}R^{19}$, OC(=O)R^{21}, OC(=O)OR^{18}, OC(=O)$NR^{21}R^{19}$, $N(R^{21})C(=O)R^{21}$, $N(R^{21})C(=O)OR^{19}$, $N(R^{21})C(=O)NR^{21}R^{22}$, OSO_2R^{18}, $OSO_2NR^{21}R^{22}$, $NR^{21}SO_2R^{18}$, $NR^{21}SO_2NR^{21}R^{22}$, $Si(R^{18}R^{19}R^{20})$ or Z^1Q^1; or C_1–C_8 alkyl, C_2–C_8 alkenyl, C_2–C_8 alkynyl, C_3–C_{10} cycloalkyl, C_4–C_{10} alkylcycloalkyl, C_4–C_{10} cycloalkylalkyl, C_6–C_{14} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_8 cycloalkenyl, C_1–C_8 alkoxy, C_3–C_8 cycloalkoxy, C_4–C_{10} cycloalkylalkoxy, C_2–C_8 alkenyloxy, C_2–C_8 alkynyloxy, C_1–C_8 alkylsulfinyl, C_1–C_8 alkylsulfonyl, C_3–C_8 cycloalkylsulfinyl, C_3–C_8 cycloalkylsulfonyl, C_4–C_{10} cycloalkylalkylsulfinyl, C_4–C_{10} cycloalkylalkylsulfonyl, C_2–C_8 alkenylsulfinyl, C_2–C_8 alkenylsulfonyl, C_2–C_8 alkynylsulfinyl or C_2–C_8 alkynylsulfonyl, each unsubstituted or substituted with at least one substituent independently selected from R^{17}; or R^{3e} and R^{3b} are taken together with the adjacent carbon atoms to which they are attached to form a 5- to 7-membered carbocyclic or heterocyclic ring, each ring containing ring members selected from carbon atoms and up to 3 heteroatoms independently selected from up to 2 O, up to 2 S, and up to 3 N, wherein up to 2 carbon atom ring members are independently selected from C(=O) and C(=S) and the sulfur atom ring members are independently selected from $S(=O)_m$, each ring optionally substituted with up to 3 substituents independently selected from the group consisting of halogen, cyano, hydroxy, amino, nitro, C(=O)OH, C(=O)NH_2, SO_2NH_2, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_2–C_4 alkenyl, C_2–C_4 haloalkenyl, C_2–C_4 alkynyl, C_2–C_4 haloalkynyl, C_3–C_7 cycloalkyl, C_3–C_7 halocycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 haloalkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_4–C_8 halocycloalkylalkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_2–C_6 alkoxycarbonyl, C_2–C_6 haloalkoxycarbonyl, C_2–C_6 alkylcarbonyl and C_2–C_6 haloalkylcarbonyl;

each R^4 and R^5 is independently H, halogen, cyano, hydroxy, amino, nitro, OCN, SCN, CHO, C(=O)OH, C(=O)NH_2, C(=S)NH_2 or SO_2NH_2; or C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{12} cycloalkylcycloalkyl, C_5–C_8 alkylcycloalkylalkyl, C_3–C_6 cycloalkenyl, C_1–C_6 alkoxy, C_3–C_6 cycloalkoxy, C_4–C_8 cycloalkylalkoxy, C_2–C_6 alkenyloxy or C_2–C_6 alkynyloxy, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of halogen,

cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, $C(=O)R^{10}$, $C(=O)OR^{11}$, $C(=O)NR^{12}R^{13}$, OR^{11}, $S(O)_nR^{10}$, $SO_2NR^{12}R^{13}$ and $Si(R^{10})_3$; or

R^4 and R^5 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 2 heteroatoms independently selected from one O, one S, and up to 2 N, wherein up to 2 carbon atom ring members are independently selected from C(=O) and C(=S) and the sulfur atom ring member is selected from S, S(O) or $S(O)_2$, said ring optionally substituted with up to 4 substituents independently selected from the group consisting of halogen, cyano and C_1–C_4 alkyl;

each R^6 is independently H; or C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_6 cycloalkenyl, C_2–C_6 alkylcarbonyl or C_2–C_6 alkoxycarbonyl, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, $C(=O)R^{10}$, $C(=O)OR^{11}$, $C(=O)NR^{12}R^{13}$, OR^{11}, $S(O)_nR^{10}$, $SO_2NR^{12}R^{13}$ and $Si(R^{10})_3$; or

two R^6 substituents are taken together with the nitrogen atom to which they are attached to form a 3- to 7-membered ring containing ring members selected from carbon atoms and up to 2 heteroatoms independently selected from one O, one S, and up to 2 N, wherein up to 2 carbon atom ring members are independently selected from C(=O) and C(=S) and the sulfur atom ring member is selected from S, S(O) or $S(O)_2$, said ring optionally substituted with up to 4 substituents independently selected from the group consisting of halogen, cyano and C_1–C_4 alkyl;

each R^7 and R^8 is independently H; or C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_6 cycloalkenyl, C_2–C_6 alkylcarbonyl or C_2–C_6 alkoxycarbonyl, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, $C(=O)R^{10}$, $C(=O)OR^{11}$, $C(=O)NR^{12}R^{13}$, OR^{11}, $S(O)_nR^{10}$, $SO_2NR^{12}R^{13}$ and $Si(R^{10})_3$;

each R^9 is independently C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_6 cycloalkenyl, C_2–C_6 alkylcarbonyl or C_2–C_6 alkoxycarbonyl, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, $C(=O)R^{10}$, $C(=O)OR^{11}$, $C(=O)NR^{12}R^{13}$, OR^{11}, $S(O)_nR^{10}$, $SO_2NR^{12}R^{13}$ and $Si(R^{10})_3$;

each R^{9a} is independently H; or C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_6 cycloalkenyl, C_2–C_6

alkylcarbonyl or C_2–C_6 alkoxycarbonyl, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, $C(=O)R^{10}$, $C(=O)OR^{11}$, $C(=O)NR^{12}R^{13}$, OR^{11}, $S(O)_nR^{10}$, $SO_2NR^{12}R^{13}$ and $Si(R^{10})_3$;

each R^{10} and R^{11} is independently C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl or C_3–C_6 cycloalkenyl, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, 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_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 and C_3–C_6 trialkylsilyl; or phenyl or a 5- or 6-membered heteroaromatic ring, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_6 cycloalkenyl, halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, 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_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 and C_3–C_6 trialkylsilyl;

each R^{12} and R^{13} is independently C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl or C_3–C_6 cycloalkenyl, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, 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_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 and C_3–C_6 trialkylsilyl; or phenyl or a 5- or 6-membered heteroaromatic ring, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–

C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_6 cycloalkenyl, halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, 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_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 and C_3–C_6 trialkylsilyl; or

R^{12} and R^{13} are taken together with the nitrogen atom to which they are attached to form a 3- to 7-membered ring containing ring members selected from carbon atoms and up to 2 heteroatoms independently selected from one O, one S, and up to 2 N, wherein up to 2 carbon atom ring members are independently selected from C(=O) and C(=S) and the sulfur atom ring member is selected from S, S(O) or $S(O)_2$, said ring optionally substituted with up to 4 substituents independently selected from the group consisting of halogen, cyano and C_1–C_4 alkyl;

each R^{14} is independently halogen, cyano, hydroxy, amino, nitro, SF_5, OCN, SCN, CHO, C(=O)OH, $C(=O)NH_2$, $C(=S)NH_2$, SO_2NH_2, $C(=O)R^{18}$, $C(=O)OR^{18}$, NHR^{18}, $NR^{18}R^{19}$, $C(=O)NR^{21}R^{19}$, $C(=O)NR^{21}NR^{22}R^{23}$, $C(=S)NR^{21}R^{19}$, $SO_2NR^{21}R^{19}$, $OC(=O)R^{21}$, $OC(=O)OR^{18}$, $OC(=O)NR^{21}R^{19}$, $N(R^{21})C(=O)R^{21}$, $N(R^{21})C(=O)OR^{19}$, $N(R^{21})C(=O)NR^{21}R^{22}$, OSO_2R^{18}, $OSO_2NR^{21}R^{22}$, $NR^{21}SO_2R^{18}$, $NR^{21}SO_2NR^{21}R^{22}$, $Si(R^{18}R^{19}R^{20})$, $C(=NR^{21})R^{22}$, $C(=NOR^{21})R^{22}$, $C(=NNR^{21}R^{22})R^{23}$, $C(=NN(C(=O)R^{19})R^{21})R^{22}$, $C(=NN(C(=O)OR^{19})R^{21})R^{22}$, $ON=CR^{21}R^{22}$, $ONR^{21}R^{22}$, $S(=O)(=NR^{21})R^{22}$, $SO_2NR^{21}C(=O)NR^{22}R^{23}$, $P(=X^2)R^{18}R^{19}$, $OP(=X^2)R^{18}R^{19}$, $OP(=X^2)(OR^{18})R^{19}$, $OP(=X^2)(OR^{18})OR^{19}$, $N=CR^{21}R^{22}$, $NR^{21}N=CR^{22}R^{23}$, $NR^{21}NR^{22}R^{23}$, $NR^{21}C(=X^2)NR^{22}R^{23}$, $NR^{21}C(=NR^{21})NR^{22}R^{23}$, $NR^{21}NR^{21}C(=X^2)NR^{22}R^{23}$, $NR^{21}NR^{21}SO_2NR^{22}R^{23}$, Z^1Q^1 or $Z^1Q^2Z^1Q^1$; or C_1–C_8 alkyl, C_2–C_8 alkenyl, C_2–C_8 alkynyl, C_3–C_{10} cycloalkyl, C_4–C_{10} alkylcycloalkyl, C_4–C_{10} cycloalkylalkyl, C_6–C_{14} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_8 cycloalkenyl, C_1–C_8 alkoxy, C_3–C_8 cycloalkoxy, C_4–C_{10} cycloalkylalkoxy, C_2–C_8 alkenyloxy, C_2–C_8 alkynyloxy, C_1–C_8 alkylthio, C_1–C_8 alkylsulfinyl, C_1–C_8 alkylsulfonyl, C_3–C_8 cycloalkylthio, C_3–C_8 cycloalkylsulfinyl, C_3–C_8 cycloalkylsulfonyl, C_4–C_{10} cycloalkylalkylthio, C_4–C_{10} cycloalkylalkylsulfinyl, C_4–C_{10} cycloalkylalkylsulfonyl, C_2–C_8 alkenylthio, C_2–C_8 alkenylsulfinyl, C_2–C_8 alkenylsulfonyl, C_2–C_8 alkynylthio, C_2–C_8 alkynylsulfinyl or C_2–C_8 alkynylsulfonyl, each unsubstituted or substituted with at least one substituent independently selected from R^{17}; or

two R^{14} substituents on adjacent ring atoms are taken together with the adjacent ring atoms to form a 5- to 7-membered carbocyclic or heterocyclic ring, each ring containing ring members selected from carbon atoms and up to 3 heteroatoms

independently selected from up to 2 O, up to 2 S, and up to 3 N, wherein up to 2 carbon atom ring members are independently selected from C(=O) and C(=S) and the sulfur atom ring members are independently selected from $S(=O)_n$, each ring optionally substituted with up to 3 substituents independently selected from the group consisting of halogen, cyano, hydroxy, amino, nitro, C(=O)OH, $C(=O)NH_2$, SO_2NH_2, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_2–C_4 alkenyl, C_2–C_4 haloalkenyl, C_2–C_4 alkynyl, C_2–C_4 haloalkynyl, C_3–C_7 cycloalkyl, C_3–C_7 halocycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 haloalkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_4–C_8 halocycloalkylalkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_2–C_6 alkoxycarbonyl, C_2–C_6 haloalkoxycarbonyl, C_2–C_6 alkylcarbonyl and C_2–C_6 haloalkylcarbonyl;

each X^2 is independently O or S;

each Z^1 is independently a direct bond, O, $S(O)_m$, NR^6, $C(R^7)_2$, $C(R^7)=C(R^7)$, C≡C, $C(R^7)_2O$, $OC(R^7)_2$, $C(=X^1)$, $C(=X^1)E$, $EC(=X^1)$, $C(=NOR^8)$ or $C(=NN(R^6)_2)$;

each Q^1 is independently a 3- to 10-membered ring or a 7- to 11-membered 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 $S(=O)_u(=NR^{24})_z$, each ring or ring system optionally substituted with up to 4 substituents independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, $C(=O)R^{10}$, $C(=O)OR^{11}$, $C(=O)NR^{12}R^{13}$, OR^{11}, $S(O)_nR^{10}$, $SO_2NR^{12}R^{13}$, $Si(R^{10})_3$ and R^{16};

each Q^1 is independently a 3- to 10-membered ring or a 7- to 11-membered 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 $S(=O)_u(=NR^{24})_z$, each ring or ring system optionally substituted with up to 5 substituents independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, $C(=O)R^{10}$, $C(=O)OR^{11}$, $C(=O)NR^{12}R^{13}$, $C(=O)NR^{21}NR^{22}R^{23}$, OR^{11}, $S(O)_nR^{10}$, $SO_2NR^{12}R^{13}$, $S(=O)(=NR^{21})R^{22}$, $Si(R^{10})_3$ and R^{16};

each R^{15} is independently halogen, cyano, hydroxy, amino, nitro, SF_5, OCN, SCN, CHO, C(=O)OH, $C(=O)NH_2$, $C(=S)NH_2$, SO_2NH_2, $C(=O)R^{18}$, $C(=O)OR^{18}$, NHR^{18}, $NR^{18}R^{19}$, $C(=O)NR^{21}R^{19}$, $C(=O)NR^{21}NR^{22}R^{23}$, $C(=S)NR^{21}R^{19}$, $SO_2NR^{21}R^{19}$, $S(=O)(=NR^{21})R^{22}$, $OC(=O)R^{21}$, $OC(=O)OR^{18}$, $OC(=O)NR^{21}R^{19}$, $N(R^{21})C(=O)R^{21}$, $N(R^{21})C(=O)OR^{19}$, $N(R^{21})C(=O)NR^{21}R^{22}$, OSO_2R^{18}, $OSO_2NR^{21}R^{22}$, $NR^{21}SO_2R^{18}$, $NR^{21}SO_2NR^{21}R^{22}$, $Si(R^{18}R^{19}R^{20})$ or Z^1Q^1; or C_1–C_8 alkyl, C_2–C_8 alkenyl, C_2–C_8 alkynyl, C_3–C_{10} cycloalkyl, C_4–C_{10} alkylcycloalkyl, C_4–C_{10} cycloalkylalkyl, C_6–C_{14} cycloalkylcycloalkyl, C_5–C_{10}

alkylcycloalkylalkyl, C_3–C_8 cycloalkenyl, C_1–C_8 alkoxy, C_3–C_8 cycloalkoxy, C_4–C_{10} cycloalkylalkoxy, C_2–C_8 alkenyloxy, C_2–C_8 alkynyloxy, C_1–C_8 alkylthio, C_1–C_8 alkylsulfinyl, C_1–C_8 alkylsulfonyl, C_3–C_8 cycloalkylthio, C_3–C_8 cycloalkylsulfinyl, C_3 C_8 cycloalkylsulfonyl, C_4 C_{10} cycloalkylalkylthio, C_4–C_{10} cycloalkylalkylsulfinyl, C_4–C_{10} cycloalkylalkylsulfonyl, C_2–C_8 alkenylthio, C_2–C_8 alkenylsulfinyl, C_2–C_8 alkenylsulfonyl, C_2–C_8 alkynylthio, C_2–C_8 alkynylsulfinyl or C_2–C_8 alkynylsulfonyl, each unsubstituted or substituted with at least one substituent independently selected from R^{17}; or

two R^{15} substituents on adjacent ring atoms are taken together with the adjacent ring atoms to form a 5- to 7-membered carbocyclic or heterocyclic ring, each ring containing ring members selected from carbon atoms and up to 3 heteroatoms independently selected from up to 2 O, up to 2 S, and up to 3 N, wherein up to 2 carbon atom ring members are independently selected from C(=O) and C(=S) and the sulfur atom ring members are independently selected from $S(=O)_n$, each ring optionally substituted with up to 3 substituents independently selected from the group consisting of halogen, cyano, hydroxy, amino, nitro, C(=O)OH, $C(=O)NH_2$, SO_2NH_2, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_2–C_4 alkenyl, C_2–C_4 haloalkenyl, C_2–C_4 alkynyl, C_2–C_4 haloalkynyl, C_3–C_7 cycloalkyl, C_3–C_7 halocycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 haloalkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_4–C_8 halocycloalkylalkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_2–C_6 alkoxycarbonyl, C_2–C_6 haloalkoxycarbonyl, C_2–C_6 alkylcarbonyl and C_2–C_6 haloalkylcarbonyl;

each R^{16} is independently C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl or C_3–C_6 cycloalkenyl, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, 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_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 and C_3–C_6 trialkylsilyl; or phenyl or a 5- or 6-membered heteroaromatic ring, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_6 cycloalkenyl, halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, 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_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 and C_3–C_6 trialkylsilyl;

each R^{17} is independently halogen, cyano, nitro, OH, CHO, C(=O)OH, $C(=O)NH_2$, $C(=O)R^{10}$, $C(=O)OR^{11}$, $C(=O)NR^{12}R^{13}$, OR^{11}, $S(O)_nR^{10}$, $SO_2NR^{12}R^{13}$, $Si(R^{10})_3$ or Z^1Q^1;

each R^{18}, R^{19} and R^{20} is independently Q^1; or C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl or C_3–C_6 cycloalkenyl, each unsubstituted or substituted with at least one substituent independently selected from R^{17};

each R^{21} is independently Q^1 or H; or C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl or C_3–C_6 cycloalkenyl, each unsubstituted or substituted with at least one substituent independently selected from R^{17};

each R^{22} and R^{23} is independently Q^1 or H; or C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl or C_3–C_6 cycloalkenyl, each unsubstituted or substituted with at least one substituent independently selected from R^{17}; or

R^{22} and R^{23} are taken together with the nitrogen atom to which they are attached to form a 3- to 7-membered ring containing ring members selected from carbon atoms and up to 2 heteroatoms independently selected from one O, one S, and up to 2 N, wherein up to 2 carbon atom ring members are independently selected from C(=O) and C(=S) and the sulfur atom ring member is selected from S, S(O) or $S(O)_2$, said ring optionally substituted with up to 4 substituents independently selected from the group consisting of halogen, cyano and C_1–C_4 alkyl;

each R^{24} is independently H, cyano, OCN, SCN, CHO, C(=O)OH, $C(=O)NH_2$, $C(=S)NH_2$, SO_2NH_2, $C(=O)R^{18}$, $C(=O)OR^{18}$, NHR^{18}, $NR^{18}R^{19}$, $C(=O)NR^{21}R^{19}$, $C(=S)NR^{21}R^{19}$, $SO_2NR^{21}R^{19}$, $OC(=O)R^{21}$, $OC(=O)OR^{18}$, $OC(=O)NR^{21}R^{19}$, $N(R^{21})C(=O)R^{21}$, $N(R^{21})C(=O)OR^{19}$, $N(R^{21})C(=O)NR^{21}R^{22}$, OSO_2R^{18}, $OSO_2NR^{21}R^{22}$, $NR^{21}SO_2R^{18}$, $NR^{21}SO_2NR^{21}R^{22}$, $Si(R^{18}R^{19}R^{20})$ or Z^1Q^1; or C_1–C_8 alkyl, C_2–C_8 alkenyl, C_2–C_8 alkynyl, C_3–C_{10} cycloalkyl, C_4–C_{10} alkylcycloalkyl, C_4–C_{10} cycloalkylalkyl, C_6–C_{14} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_8 cycloalkenyl, C_1–C_8 alkoxy, C_3–C_8 cycloalkoxy, C_4–C_{10} cycloalkylalkoxy, C_2–C_8 alkenyloxy, C_2–C_8 alkynyloxy, C_1–C_8 alkylthio, C_1–C_8 alkylsulfinyl, C_1–C_8 alkylsulfonyl, C_3–C_8 cycloalkylthio, C_3–C_8 cycloalkylsulfinyl, C_3–C_8 cycloalkylsulfonyl, C_4–C_{10} cycloalkylalkylthio, C_4–C_{10} cycloalkylalkylsulfinyl, C_4–C_{10} cycloalkylalkylsulfonyl, C_2–C_8 alkenylthio,

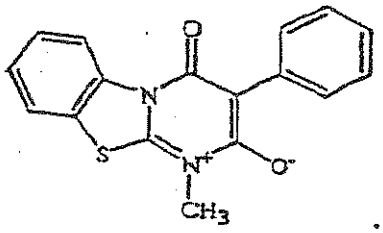
C_2–C_8 alkenylsulfinyl, C_2–C_8 alkenylsulfonyl, C_2–C_8 alkynylthio, C_2–C_8 alkynylsulfinyl or C_2–C_8 alkynylsulfonyl, each unsubstituted or substituted with at least one substituent independently selected from R^{17};

a is 1, 2 or 3;

each n is independently 0, 1 or 2; and

u and z in each instance of $S(=O)_u(=NR^{24})_z$ are independently 0, 1 or 2, provided that the sum of u and z in each instance of $S(=O)_u(=NR^{24})_z$ is 0, 1 or 2;

provided that (i) when A is O, S, NCH_3 or $C(R^{3c})=C(R^{3d})$, R^{3c} is H or F, and R^{3d} is H, F, CF_2H or CF_3, then at least one of R^{3a} or R^{3b} is other than H; and (ii) the compound of Formula 1 is other than



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

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

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

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

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

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

Another aspect~~This invention further~~ provides a composition for protecting an animal from an invertebrate parasitic pest comprising a parasiticidally effective amount of a compound of Formula **1**, an *N*-oxide, or a salt thereof as defined above, and at least one carrier.

This disclosure~~invention~~ further provides a method for treating, preventing, inhibiting and/or killing ecto and/or endoparasites comprising administering to and/or on an animal a parasiticidally effective amount of a compound of Formula **1**, an *N*-oxide, or a salt thereof (e.g., as a composition described herein). This disclosure~~invention~~ also relates to such method wherein a parasiticidally effective amount of a compound of Formula **1**, an *N*-oxide, or a salt thereof, (e.g., as a composition described herein) is administered to an environment (e.g., a stall or blanket) in which an animal resides.

Another aspect provides a non-therapeutic method for controlling an invertebrate pest comprising contacting the invertebrate pest or its environment with a biologically effective amount of a compound as defined above.

Another aspect provides a treated seed comprising a compound as defined above in an amount of from about 0.0001 to 1 % by weight of the seed before treatment.

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 or method that comprises a list of elements is not necessarily limited to only those elements but may include other elements not expressly listed or inherent to such composition, mixture, process or method.

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

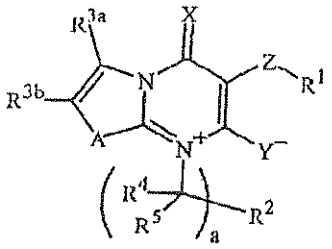
The transitional phrase "consisting essentially of" is used to define a composition or method that includes materials, steps, features, components or elements, in addition to those literally disclosed, provided that these additional materials, steps, features, components or elements do not materially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

CLAIMS

What is claimed is:

1. A compound of Formula 1, an *N*-oxide, or salt thereof,



1

wherein

X is O or S;

Y is O or S;

A is O, S, NR^{3e} or $C(R^{3c})=C(R^{3d})$, provided that the $C(R^{3c})=C(R^{3d})$ moiety is oriented so the carbon atom bonded to R^{3d} is connected directly to the pyrimidinium ring of Formula 1;

Z is a direct bond, O, $S(O)_n$, NR^6, $C(R^7)_2O$, $OC(R^7)_2$, $C(=X^1)$, $C(=X^1)E$, $EC(=X^1)$, $C(=NOR^8)$ or $C(=NN(R^6)_2)$;

X^1 is O, S or NR^9;

E is O, S or NR^{9a};

R^1 is a 3- to 10-membered ring or a 7- to 11-membered 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 $S(=O)_m(=NR^{24})_z$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{14};

R^2 is H, halogen, cyano, hydroxy, amino, nitro, OCN, SCN, CHO, C(=O)OH, $C(=O)NH_2$, $C(=S)NH_2$, SO_2NH_2, $C(=O)R^{18}$, $C(=O)OR^{18}$, NHR^{18}, $NR^{18}R^{19}$, $C(=O)NR^{21}R^{19}$, $C(=S)NR^{21}R^{19}$, $SO_2NR^{21}R^{19}$, $OC(=O)R^{21}$, $OC(=O)OR^{18}$, $OC(=O)NR^{21}R^{19}$, $N(R^{21})C(=O)R^{21}$, $N(R^{21})C(=O)OR^{19}$, $N(R^{21})C(=O)NR^{21}R^{22}$, OSO_2R^{18}, $OSO_2NR^{21}R^{22}$, $NR^{21}SO_2R^{18}$, $NR^{21}SO_2NR^{21}R^{22}$ or $Si(R^{18}R^{19}R^{20})$; or C_1–C_8 alkyl, C_2–C_8 alkenyl, C_2–C_8 alkynyl, C_3–C_{10} cycloalkyl, C_4–C_{10} alkylcycloalkyl, C_4–C_{10} cycloalkylalkyl, C_6–C_{14} cycloalkylcycloalkyl, C_5–C_{10}

alkylcycloalkylalkyl, C_3–C_8 cycloalkenyl, C_1–C_8 alkoxy, C_3–C_8 cycloalkoxy, C_4–C_{10} cycloalkylalkoxy, C_2–C_8 alkenyloxy, C_2–C_8 alkynyloxy, C_1–C_8 alkylthio, C_1–C_8 alkylsulfinyl, C_1–C_8 alkylsulfonyl, C_3–C_8 cycloalkylthio, C_3–C_8 cycloalkylsulfinyl, C_3–C_8 cycloalkylsulfonyl, C_4–C_{10} cycloalkylalkylthio, C_4–C_{10} cycloalkylalkylsulfinyl, C_4–C_{10} cycloalkylalkylsulfonyl, C_2–C_8 alkenylthio, C_2–C_8 alkenylsulfinyl, C_2–C_8 alkenylsulfonyl, C_2–C_8 alkynylthio, C_2–C_8 alkynylsulfinyl or C_2–C_8 alkynylsulfonyl, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, $C(=O)R^{10}$, $C(=O)OR^{11}$, $C(=O)NR^{12}R^{13}$, OR^{11}, $S(O)_nR^{10}$, $SO_2NR^{12}R^{13}$ and $Si(R^{10})_3$; or a 3- to 10-membered ring or a 7- to 11-membered 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 $S(=O)_u(=NR^{24})_z$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{15};

R^{3a}, R^{3b}, R^{3c} and R^{3d} are independently H, halogen, cyano, hydroxy, amino, nitro, SF_5, OCN, SCN, CHO, C(=O)OH, $C(=O)NH_2$, $C(=S)NH_2$, SO_2NH_2, $C(=O)R^{18}$, $C(=O)OR^{18}$, NHR^{18}, $NR^{18}R^{19}$, $C(=O)NR^{21}R^{19}$, $C(=S)NR^{21}R^{19}$, $SO_2NR^{21}R^{19}$, $OC(=O)R^{21}$, $OC(=O)OR^{18}$, $OC(=O)NR^{21}R^{19}$, $N(R^{21})C(=O)R^{21}$, $N(R^{21})C(=O)OR^{19}$, $N(R^{21})C(=O)NR^{21}R^{22}$, OSO_2R^{18}, $OSO_2NR^{21}R^{22}$, $NR^{21}SO_2R^{18}$, $NR^{21}SO_2NR^{21}R^{22}$, $Si(R^{18}R^{19}R^{20})$ or Z^1Q^t; or C_1–C_8 alkyl, C_2–C_8 alkenyl, C_2–C_8 alkynyl, C_3–C_{10} cycloalkyl, C_4–C_{10} alkylcycloalkyl, C_4–C_{10} cycloalkylalkyl, C_6–C_{14} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_8 cycloalkenyl, C_1–C_8 alkoxy, C_3–C_8 cycloalkoxy, C_4–C_{10} cycloalkylalkoxy, C_2–C_8 alkenyloxy, C_2–C_8 alkynyloxy, C_1–C_8 alkylthio, C_1–C_8 alkylsulfinyl, C_1–C_8 alkylsulfonyl, C_3–C_8 cycloalkylthio, C_3–C_8 cycloalkylsulfinyl, C_3–C_8 cycloalkylsulfonyl, C_4–C_{10} cycloalkylalkylthio, C_4–C_{10} cycloalkylalkylsulfinyl, C_4–C_{10} cycloalkylalkylsulfonyl, C_2–C_8 alkenylthio, C_2–C_8 alkenylsulfinyl, C_2–C_8 alkenylsulfonyl, C_2–C_8 alkynylthio, C_2–C_8 alkynylsulfinyl or C_2–C_8 alkynylsulfonyl, each unsubstituted or substituted with at least one substituent independently selected from R^{17}; or R^{3a} and R^{3b}, or R^{3b} and R^{3c}, or R^{3c} and R^{3d} are taken together with the adjacent carbon atoms to which they are attached to form a 5- to 7-membered carbocyclic or heterocyclic ring, each ring containing ring members selected from carbon atoms and up to 3 heteroatoms independently selected from up to 2 O, up to 2 S, and up to 3 N, wherein up to 2 carbon atom ring members are independently selected from C(=O) and C(=S) and the sulfur atom ring members are independently selected from $S(=O)_n$, each ring optionally substituted with up to 3 substituents independently selected from the group

consisting of halogen, cyano, hydroxy, amino, nitro, C(=O)OH, C(=O)NH_2, SO_2NH_2, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_2–C_4 alkenyl, C_2–C_4 haloalkenyl, C_2–C_4 alkynyl, C_2–C_4 haloalkynyl, C_3–C_7 cycloalkyl, C_3–C_7 halocycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 haloalkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_4–C_8 halocycloalkylalkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_2–C_6 alkoxycarbonyl, C_2–C_6 haloalkoxycarbonyl, C_2–C_6 alkylcarbonyl and C_2–C_6 haloalkylcarbonyl;

R^{3e} is H, hydroxy, amino, CHO, C(=O)NH_2, C(=S)NH_2, SO_2NH_2, C(=O)R^{18}, C(=O)OR^{18}, NHR^{18}, $NR^{18}R^{19}$, C(=O)$NR^{21}R^{19}$, C(=S)$NR^{21}R^{19}$, $SO_2NR^{21}R^{19}$, OC(=O)R^{21}, OC(=O)OR^{18}, OC(=O)$NR^{21}R^{19}$, N(R^{21})C(=O)R^{21}, N(R^{21})C(=O)OR^{19}, N(R^{21})C(=O)$NR^{21}R^{22}$, OSO_2R^{18}, $OSO_2NR^{21}R^{22}$, $NR^{21}SO_2R^{18}$, $NR^{21}SO_2NR^{21}R^{22}$, Si($R^{18}R^{19}R^{20}$) or Z^1Q^1; or C_1–C_8 alkyl, C_2–C_8 alkenyl, C_2–C_8 alkynyl, C_3–C_{10} cycloalkyl, C_4–C_{10} alkylcycloalkyl, C_4–C_{10} cycloalkylalkyl, C_6–C_{14} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_8 cycloalkenyl, C_1–C_8 alkoxy, C_3–C_8 cycloalkoxy, C_4–C_{10} cycloalkylalkoxy, C_2–C_8 alkenyloxy, C_2–C_8 alkynyloxy, C_1–C_8 alkylsulfinyl, C_1–C_8 alkylsulfonyl, C_3–C_8 cycloalkylsulfinyl, C_3–C_8 cycloalkylsulfonyl, C_4–C_{10} cycloalkylalkylsulfinyl, C_4–C_{10} cycloalkylalkylsulfonyl, C_2–C_8 alkenylsulfinyl, C_2–C_8 alkenylsulfonyl, C_2–C_8 alkynylsulfinyl or C_2–C_8 alkynylsulfonyl, each unsubstituted or substituted with at least one substituent independently selected from R^{17}; or R^{3e} and R^{3b} are taken together with the adjacent carbon atoms to which they are attached to form a 5- to 7-membered carbocyclic or heterocyclic ring, each ring containing ring members selected from carbon atoms and up to 3 heteroatoms independently selected from up to 2 O, up to 2 S, and up to 3 N, wherein up to 2 carbon atom ring members are independently selected from C(=O) and C(=S) and the sulfur atom ring members are independently selected from $S(=O)_n$, each ring optionally substituted with up to 3 substituents independently selected from the group consisting of halogen, cyano, hydroxy, amino, nitro, C(=O)OH, C(=O)NH_2, SO_2NH_2, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_2–C_4 alkenyl, C_2–C_4 haloalkenyl, C_2–C_4 alkynyl, C_2–C_4 haloalkynyl, C_3–C_7 cycloalkyl, C_3–C_7 halocycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 haloalkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_4–C_8 halocycloalkylalkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_2–C_6 alkoxycarbonyl, C_2–C_6 haloalkoxycarbonyl, C_2–C_6 alkylcarbonyl and C_2–C_6 haloalkylcarbonyl;

each R^4 and R^5 is independently H, halogen, cyano, hydroxy, amino, nitro, OCN, SCN, CHO, C(=O)OH, C(=O)NH_2, C(=S)NH_2 or SO_2NH_2; or C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{12} cycloalkylcycloalkyl, C_5–C_8 alkylcycloalkylalkyl, C_3–C_6 cycloalkenyl, C_1–C_6 alkoxy, C_3–C_6 cycloalkoxy, C_4–C_8 cycloalkylalkoxy, C_2–C_6 alkenyloxy or C_2–C_6 alkynyloxy, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of halogen,

cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, $C(=O)R^{10}$, $C(=O)OR^{11}$, $C(=O)NR^{12}R^{13}$, OR^{11}, $S(O)_nR^{10}$, $SO_2NR^{12}R^{13}$ and $Si(R^{10})_3$; or

R^4 and R^5 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 2 heteroatoms independently selected from one O, one S, and up to 2 N, wherein up to 2 carbon atom ring members are independently selected from C(=O) and C(=S) and the sulfur atom ring member is selected from S, S(O) or $S(O)_2$, said ring optionally substituted with up to 4 substituents independently selected from the group consisting of halogen, cyano and C_1–C_4 alkyl;

each R^6 is independently H; or C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_6 cycloalkenyl, C_2–C_6 alkylcarbonyl or C_2–C_6 alkoxycarbonyl, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, $C(=O)R^{10}$, $C(=O)OR^{11}$, $C(=O)NR^{12}R^{13}$, OR^{11}, $S(O)_nR^{10}$, $SO_2NR^{12}R^{13}$ and $Si(R^{10})_3$; or

two R^6 substituents are taken together with the nitrogen atom to which they are attached to form a 3- to 7-membered ring containing ring members selected from carbon atoms and up to 2 heteroatoms independently selected from one O, one S, and up to 2 N, wherein up to 2 carbon atom ring members are independently selected from C(=O) and C(=S) and the sulfur atom ring member is selected from S, S(O) or $S(O)_2$, said ring optionally substituted with up to 4 substituents independently selected from the group consisting of halogen, cyano and C_1–C_4 alkyl;

each R^7 and R^8 is independently H; or C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_6 cycloalkenyl, C_2–C_6 alkylcarbonyl or C_2–C_6 alkoxycarbonyl, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, $C(=O)R^{10}$, $C(=O)OR^{11}$, $C(=O)NR^{12}R^{13}$, OR^{11}, $S(O)_nR^{10}$, $SO_2NR^{12}R^{13}$ and $Si(R^{10})_3$;

each R^9 is independently C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_6 cycloalkenyl, C_2–C_6 alkylcarbonyl or C_2–C_6 alkoxycarbonyl, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, $C(=O)R^{10}$, $C(=O)OR^{11}$, $C(=O)NR^{12}R^{13}$, OR^{11}, $S(O)_nR^{10}$, $SO_2NR^{12}R^{13}$ and $Si(R^{10})_3$;

each R^{9a} is independently H; or C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_6 cycloalkenyl, C_2–C_6

alkylcarbonyl or C_2–C_6 alkoxycarbonyl, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, $C(=O)R^{10}$, $C(=O)OR^{11}$, $C(=O)NR^{12}R^{13}$, OR^{11}, $S(O)_nR^{10}$, $SO_2NR^{12}R^{13}$ and $Si(R^{10})_3$;

each R^{10} and R^{11} is independently C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl or C_3–C_6 cycloalkenyl, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, 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_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 and C_3–C_6 trialkylsilyl; or phenyl or a 5- or 6-membered heteroaromatic ring, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_6 cycloalkenyl, halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, 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_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 and C_3–C_6 trialkylsilyl;

each R^{12} and R^{13} is independently C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl or C_3–C_6 cycloalkenyl, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, 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_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 and C_3–C_6 trialkylsilyl; or phenyl or a 5- or 6-membered heteroaromatic ring, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–

C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_6 cycloalkenyl, halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, 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_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 and C_3–C_6 trialkylsilyl; or

R^{12} and R^{13} are taken together with the nitrogen atom to which they are attached to form a 3- to 7-membered ring containing ring members selected from carbon atoms and up to 2 heteroatoms independently selected from one O, one S, and up to 2 N, wherein up to 2 carbon atom ring members are independently selected from C(=O) and C(=S) and the sulfur atom ring member is selected from S, S(O) or $S(O)_2$, said ring optionally substituted with up to 4 substituents independently selected from the group consisting of halogen, cyano and C_1–C_4 alkyl;

each R^{14} is independently halogen, cyano, hydroxy, amino, nitro, SF_5, OCN, SCN, CHO, C(=O)OH, $C(=O)NH_2$, $C(=S)NH_2$, SO_2NH_2, $C(=O)R^{18}$, $C(=O)OR^{18}$, NHR^{18}, $NR^{18}R^{19}$, $C(=O)NR^{21}R^{19}$, $C(=O)NR^{21}NR^{22}R^{23}$, $C(=S)NR^{21}R^{19}$, $SO_2NR^{21}R^{19}$, $OC(=O)R^{21}$, $OC(=O)OR^{18}$, $OC(=O)NR^{21}R^{19}$, $N(R^{21})C(=O)R^{21}$, $N(R^{21})C(=O)OR^{19}$, $N(R^{21})C(=O)NR^{21}R^{22}$, OSO_2R^{18}, $OSO_2NR^{21}R^{22}$, $NR^{21}SO_2R^{18}$, $NR^{21}SO_2NR^{21}R^{22}$, $Si(R^{18}R^{19}R^{20})$, $C(=NR^{21})R^{22}$, $C(=NOR^{21})R^{22}$, $C(=NNR^{21}R^{22})R^{23}$, $C(=NN(C(=O)R^{19})R^{21})R^{22}$, $C(=NN(C(=O)OR^{19})R^{21})R^{22}$, $ON=CR^{21}R^{22}$, $ONR^{21}R^{22}$, $S(=O)(=NR^{21})R^{22}$, $SO_2NR^{21}C(=O)NR^{22}R^{23}$, $P(=X^2)R^{18}R^{19}$, $OP(=X^2)R^{18}R^{19}$, $OP(=X^2)(OR^{18})R^{19}$, $OP(=X^2)(OR^{18})OR^{19}$, $N=CR^{21}R^{22}$, $NR^{21}N=CR^{22}R^{23}$, $NR^{21}NR^{22}R^{23}$, $NR^{21}C(=X^2)NR^{22}R^{23}$, $NR^{21}C(=NR^{21})NR^{22}R^{23}$, $NR^{21}NR^{21}C(=X^2)NR^{22}R^{23}$, $NR^{21}NR^{21}SO_2NR^{22}R^{23}$, Z^1Q^1 or $Z^1Q^iZ^1Q^1$; or C_1–C_8 alkyl, C_2–C_8 alkenyl, C_2–C_8 alkynyl, C_3–C_{10} cycloalkyl, C_4–C_{10} alkylcycloalkyl, C_4–C_{10} cycloalkylalkyl, C_6–C_{14} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_8 cycloalkenyl, C_1–C_8 alkoxy, C_3–C_8 cycloalkoxy, C_4–C_{10} cycloalkylalkoxy, C_2–C_8 alkenyloxy, C_2–C_8 alkynyloxy, C_1–C_8 alkylthio, C_1–C_8 alkylsulfinyl, C_1–C_8 alkylsulfonyl, C_3–C_8 cycloalkylthio, C_3–C_8 cycloalkylsulfinyl, C_3–C_8 cycloalkylsulfonyl, C_4–C_{10} cycloalkylalkylthio, C_4–C_{10} cycloalkylalkylsulfinyl, C_4–C_{10} cycloalkylalkylsulfonyl, C_2–C_8 alkenylthio, C_2–C_8 alkenylsulfinyl, C_2–C_8 alkenylsulfonyl, C_2–C_8 alkynylthio, C_2–C_8 alkynylsulfinyl or C_2–C_8 alkynylsulfonyl, each unsubstituted or substituted with at least one substituent independently selected from R^{17}; or

two R^{14} substituents on adjacent ring atoms are taken together with the adjacent ring atoms to form a 5- to 7-membered carbocyclic or heterocyclic ring, each ring containing ring members selected from carbon atoms and up to 3 heteroatoms

independently selected from up to 2 O, up to 2 S, and up to 3 N, wherein up to 2 carbon atom ring members are independently selected from C(=O) and C(=S) and the sulfur atom ring members are independently selected from $S(=O)_n$, each ring optionally substituted with up to 3 substituents independently selected from the group consisting of halogen, cyano, hydroxy, amino, nitro, C(=O)OH, $C(=O)NH_2$, SO_2NH_2, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_2–C_4 alkenyl, C_2–C_4 haloalkenyl, C_2–C_4 alkynyl, C_2–C_4 haloalkynyl, C_3–C_7 cycloalkyl, C_3–C_7 halocycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 haloalkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_4–C_8 halocycloalkylalkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_2–C_6 alkoxycarbonyl, C_2–C_6 haloalkoxycarbonyl, C_2–C_6 alkylcarbonyl and C_2–C_6 haloalkylcarbonyl;

each X^2 is independently O or S;

each Z^1 is independently a direct bond, O, $S(O)_n$, NR^6, $C(R^7)_2$, $C(R^7)=C(R^7)$, C≡C, $C(R^7)_2O$, $OC(R^7)_2$, $C(=X^1)$, $C(=X^1)E$, $EC(=X^1)$, $C(=NOR^8)$ or $C(=NN(R^6)_2)$;

each Q^1 is independently a 3- to 10-membered ring or a 7- to 11-membered 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 $S(=O)_u(=NR^{24})_z$, each ring or ring system optionally substituted with up to 4 substituents independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, $C(=O)R^{10}$, $C(=O)OR^{11}$, $C(=O)NR^{12}R^{13}$, OR^{11}, $S(O)_nR^{10}$, $SO_2NR^{12}R^{13}$, $Si(R^{10})_3$ and R^{16};

each Q^1 is independently a 3- to 10-membered ring or a 7- to 11-membered 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 $S(=O)_u(=NR^{24})_z$, each ring or ring system optionally substituted with up to 5 substituents independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, $C(=O)R^{10}$, $C(=O)OR^{11}$, $C(=O)NR^{12}R^{13}$, $C(=O)NR^{21}NR^{22}R^{23}$, OR^{11}, $S(O)_nR^{10}$, $SO_2NR^{12}R^{13}$, $S(=O)(=NR^{21})R^{22}$, $Si(R^{10})_3$ and R^{16};

each R^{15} is independently halogen, cyano, hydroxy, amino, nitro, SF_5, OCN, SCN, CHO, C(=O)OH, $C(=O)NH_2$, $C(=S)NH_2$, SO_2NH_2, $C(=O)R^{18}$, $C(=O)OR^{18}$, NHR^{18}, $NR^{18}R^{19}$, $C(=O)NR^{21}R^{19}$, $C(=O)NR^{21}NR^{22}R^{23}$, $C(=S)NR^{21}R^{19}$, $SO_2NR^{21}R^{19}$, $S(=O)(=NR^{21})R^{22}$, $OC(=O)R^{21}$, $OC(=O)OR^{18}$, $OC(=O)NR^{21}R^{19}$, $N(R^{21})C(=O)R^{21}$, $N(R^{21})C(=O)OR^{19}$, $N(R^{21})C(=O)NR^{21}R^{22}$, OSO_2R^{18}, $OSO_2NR^{21}R^{22}$, $NR^{21}SO_2R^{18}$, $NR^{21}SO_2NR^{21}R^{22}$, $Si(R^{18}R^{19}R^{20})$ or Z^1Q^1; or C_1–C_8 alkyl, C_2–C_8 alkenyl, C_2–C_8 alkynyl, C_3–C_{10} cycloalkyl, C_4–C_{10} alkylcycloalkyl, C_4–C_{10} cycloalkylalkyl, C_6–C_{14} cycloalkylcycloalkyl, C_5–C_{10}

alkylcycloalkylalkyl, C_3–C_8 cycloalkenyl, C_1–C_8 alkoxy, C_3–C_8 cycloalkoxy, C_4–C_{10} cycloalkylalkoxy, C_2–C_8 alkenyloxy, C_2–C_8 alkynyloxy, C_1–C_8 alkylthio, C_1–C_8 alkylsulfinyl, C_1–C_8 alkylsulfonyl, C_3–C_8 cycloalkylthio, C_3–C_8 cycloalkylsulfinyl, C_3 C_8 cycloalkylsulfonyl, C_4 C_{10} cycloalkylalkylthio, C_4–C_{10} cycloalkylalkylsulfinyl, C_4–C_{10} cycloalkylalkylsulfonyl, C_2–C_8 alkenylthio, C_2–C_8 alkenylsulfinyl, C_2–C_8 alkenylsulfonyl, C_2–C_8 alkynylthio, C_2–C_8 alkynylsulfinyl or C_2–C_8 alkynylsulfonyl, each unsubstituted or substituted with at least one substituent independently selected from R^{17}; or

two R^{15} substituents on adjacent ring atoms are taken together with the adjacent ring atoms to form a 5- to 7-membered carbocyclic or heterocyclic ring, each ring containing ring members selected from carbon atoms and up to 3 heteroatoms independently selected from up to 2 O, up to 2 S, and up to 3 N, wherein up to 2 carbon atom ring members are independently selected from C(=O) and C(=S) and the sulfur atom ring members are independently selected from $S(=O)_n$, each ring optionally substituted with up to 3 substituents independently selected from the group consisting of halogen, cyano, hydroxy, amino, nitro, C(=O)OH, $C(=O)NH_2$, SO_2NH_2, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_2–C_4 alkenyl, C_2–C_4 haloalkenyl, C_2–C_4 alkynyl, C_2–C_4 haloalkynyl, C_3–C_7 cycloalkyl, C_3–C_7 halocycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 haloalkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_4–C_8 halocycloalkylalkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_2–C_6 alkoxycarbonyl, C_2–C_6 haloalkoxycarbonyl, C_2–C_6 alkylcarbonyl and C_2–C_6 haloalkylcarbonyl;

each R^{16} is independently C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl or C_3–C_6 cycloalkenyl, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, 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_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 and C_3–C_6 trialkylsilyl; or phenyl or a 5- or 6-membered heteroaromatic ring, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_6 cycloalkenyl, halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, 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_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 and C_3–C_6 trialkylsilyl;

each R^{17} is independently halogen, cyano, nitro, OH, CHO, C(=O)OH, $C(=O)NH_2$, $C(=O)R^{10}$, $C(=O)OR^{11}$, $C(=O)NR^{12}R^{13}$, OR^{11}, $S(O)_nR^{10}$, $SO_2NR^{12}R^{13}$, $Si(R^{10})_3$ or Z^1Q^t;

each R^{18}, R^{19} and R^{20} is independently Q^t; or C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl or C_3–C_6 cycloalkenyl, each unsubstituted or substituted with at least one substituent independently selected from R^{17};

each R^{21} is independently Q^t or H; or C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl or C_3–C_6 cycloalkenyl, each unsubstituted or substituted with at least one substituent independently selected from R^{17};

each R^{22} and R^{23} is independently Q^t or H; or C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl or C_3–C_6 cycloalkenyl, each unsubstituted or substituted with at least one substituent independently selected from R^{17}; or

R^{22} and R^{23} are taken together with the nitrogen atom to which they are attached to form a 3- to 7-membered ring containing ring members selected from carbon atoms and up to 2 heteroatoms independently selected from one O, one S, and up to 2 N, wherein up to 2 carbon atom ring members are independently selected from C(=O) and C(=S) and the sulfur atom ring member is selected from S, S(O) or $S(O)_2$, said ring optionally substituted with up to 4 substituents independently selected from the group consisting of halogen, cyano and C_1–C_4 alkyl;

each R^{24} is independently H, cyano, OCN, SCN, CHO, C(=O)OH, $C(=O)NH_2$, $C(=S)NH_2$, SO_2NH_2, $C(=O)R^{18}$, $C(=O)OR^{18}$, NHR^{18}, $NR^{18}R^{19}$, $C(=O)NR^{21}R^{19}$, $C(=S)NR^{21}R^{19}$, $SO_2NR^{21}R^{19}$, $OC(=O)R^{21}$, $OC(=O)OR^{18}$, $OC(=O)NR^{21}R^{19}$, $N(R^{21})C(=O)R^{21}$, $N(R^{21})C(=O)OR^{19}$, $N(R^{21})C(=O)NR^{21}R^{22}$, OSO_2R^{18}, $OSO_2NR^{21}R^{22}$, $NR^{21}SO_2R^{18}$, $NR^{21}SO_2NR^{21}R^{22}$, $Si(R^{18}R^{19}R^{20})$ or Z^1Q^t; or C_1–C_8 alkyl, C_2–C_8 alkenyl, C_2–C_8 alkynyl, C_3–C_{10} cycloalkyl, C_4–C_{10} alkylcycloalkyl, C_4–C_{10} cycloalkylalkyl, C_6–C_{14} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_8 cycloalkenyl, C_1–C_8 alkoxy, C_3–C_8 cycloalkoxy, C_4–C_{10} cycloalkylalkoxy, C_2–C_8 alkenyloxy, C_2–C_8 alkynyloxy, C_1–C_8 alkylthio, C_1–C_8 alkylsulfinyl, C_1–C_8 alkylsulfonyl, C_3–C_8 cycloalkylthio, C_3–C_8 cycloalkylsulfinyl, C_3–C_8 cycloalkylsulfonyl, C_4–C_{10} cycloalkylalkylthio, C_4–C_{10} cycloalkylalkylsulfinyl, C_4–C_{10} cycloalkylalkylsulfonyl, C_2–C_8 alkenylthio,

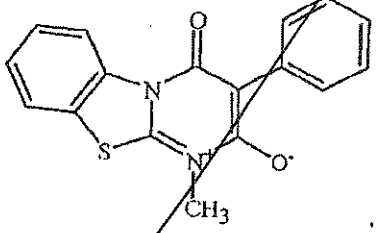
C_2–C_8 alkenylsulfinyl, C_2–C_8 alkenylsulfonyl, C_2–C_8 alkynylthio, C_2–C_8 alkynylsulfinyl or C_2–C_8 alkynylsulfonyl, each unsubstituted or substituted with at least one substituent independently selected from R^{17};

a is 1, 2 or 3;

each n is independently 0, 1 or 2; and

u and z in each instance of $S(=O)_u(=NR^{24})_z$ are independently 0, 1 or 2, provided that the sum of u and z in each instance of $S(=O)_u(=NR^{24})_z$ is 0, 1 or 2;

provided that (i) when A is O, S, NCH_3 or $C(R^{3c})=C(R^{3d})$, R^{3c} is H or F, and R^{3d} is H, F, CF_2H or CF_3, then at least one of R^{3a} or R^{3b} is other than H; and (ii) the compound of Formula 1 is other than



2. A compound of Claim 1 wherein

X is O;

Y is O;

Z is a direct bond, $C(=X^1)$ or $C(=X^1)E$;

X^1 is O;

E is O;

A is $C(R^{3c})=C(R^{3d})$ or NR^{3c};

R^2 is $C(=O)OR^{18}$; or C_1–C_8 alkyl optionally substituted with halogen; or a 3- to 10-membered ring or a 7- to 11-membered 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 $S(=O)_u(=NR^{24})_z$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{15};

R^{3a}, R^{3b} R^{3c} are independently H or halogen;

R^{3d} is halogen, C_1–C_8 alkyl, C_1–C_8 alkoxy, C_1–C_8 haloalkyl or C_1–C_8 haloalkoxy; or

R^{3c} and R^{3d} are taken together to form a 5- to 7-membered carbocyclic or heterocyclic ring, each ring containing ring members selected from carbon atoms and up to 3 heteroatoms independently selected from up to 2 O, up to 2 S, and up to 3 N, wherein up to 2 carbon atom ring members are independently selected from C(=O) and C(=S) and the sulfur atom ring members are independently selected from $S(=O)_n$, each ring optionally substituted with up to 3 substituents independently selected from the group consisting of halogen, cyano, hydroxy,

amino, nitro, C(=O)OH, C(=O)NH_2, SO_2NH_2, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_2–C_4 alkenyl, C_2–C_4 haloalkenyl, C_2–C_4 alkynyl, C_2–C_4 haloalkynyl, C_3–C_7 cycloalkyl, C_3–C_7 halocycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 haloalkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_4–C_8 halocycloalkylalkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_2–C_6 alkoxycarbonyl, C_2–C_6 haloalkoxycarbonyl, C_2–C_6 alkylcarbonyl and C_2–C_6 haloalkylcarbonyl;

R^{3e} is C_1–C_4 alkyl;

R^4 and R^5 are H; and

a is 1.

3. A compound of Claim 2 wherein

R^1 is phenyl or a 5- or 6-membered heteroaromatic ring, each optionally substituted with up to 3 substituents independently selected from R^{14};

R^{14} is halogen, cyano, C(=O)OR^{18}, C(=O)$NR^{21}R^{19}$, C(=NOR^{21})R^{22} or Z^1Q^t; or C_1–C_8 alkyl, C_1–C_8 alkoxy or C_1–C_8 alkylthio, each optionally substituted with halogen;

R^{21} is C_1–C_4 alkyl;

R^{22} is C_1–C_4 alkyl;

Z is a direct bond;

each Z^1 is independently a direct bond or O; and

each Q^t is independently phenyl or a 5- or 6-membered heteroaromatic ring, each optionally substituted with up to 5 substituents independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, C(=O)NH_2, C(=O)R^{10}, C(=O)OR^{11}, C(=O)$NR^{12}R^{13}$, C(=O)$NR^{21}NR^{22}R^{23}$, OR^{11}, $S(O)_nR^{10}$, $SO_2NR^{12}R^{13}$, S(=O)(=NR^{21})R^{22}, $Si(R^{10})_3$ and R^{16}.

4. A compound of Claim 3 wherein

R^2 is pyridinyl, pyrimidinyl, oxazolyl or thiazolyl, each optionally substituted with up to 3 substituents independently selected from the group consisting of halogen and C_1–C_4 alkyl.

5. A compound of Claim 4 wherein

R^1 is phenyl or pyridinyl, each optionally substituted with up to 3 substituents independently selected from R^{14}; and

each Q^t is independently phenyl, pyridinyl or pyrimidinyl, each optionally substituted with up to 5 substituents independently selected from the group consisting of halogen, cyano, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_1–C_4 alkoxy and C_1–C_4 haloalkoxy.

6. A compound of Claim 5 wherein

A is C(R^{3c})=C(R^{3d});

R^{3a}, R^{3b} and R^{3c} are H; and

R^{3d} is halogen, C_1–C_4 alkyl or C_1–C_4 alkoxy.

7. A compound of Claim 1 that is selected from the group consisting of:

9-bromo-1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-4-oxo-3-[3-(trifluoromethoxy)phenyl]-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
9-bromo-1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-4-oxo-3-[3-(trifluoromethyl)phenyl]-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
9-bromo-3-(3-bromophenyl)-1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
9-bromo-1-[(2-chloro-5-thiazolyl)methyl]-3-[3-chloro-5-(trifluoromethyl)phenyl]-2-hydroxy-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
9-bromo-3-[3-chloro-2-fluoro-5-(trifluoromethyl)phenyl]-1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
9-chloro-1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-4-oxo-3-[3-(trifluoromethoxy)phenyl]-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-9-methyl-4-oxo-3-[3-(trifluoromethoxy)phenyl]-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-9-methyl-4-oxo-3-[3-(trifluoromethyl)phenyl]-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-3-(2-fluorophenyl)-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
9-bromo-1-[(2-chloro-5-thiazolyl)methyl]-3-[3-chloro-5-(trifluoromethoxy)phenyl]-2-hydroxy-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-3-[3-chloro-5-(trifluoromethoxy)phenyl]-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-3-(2,6-difluorophenyl)-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-9-methyl-4-oxo-3-[3-[(trifluoromethyl)thio]phenyl]-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
3-(2-fluorophenyl)-2-hydroxy-9-methyl-4-oxo-1-(5-pyrimidinylmethyl)-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-9-methyl-4-oxo-3-phenyl-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-3-[2-fluoro-5-(trifluoromethyl)phenyl]-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-3-(4-fluorophenyl)-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;

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1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-9-methoxy-4-oxo-3-[3-(trifluoromethoxy)phenyl]-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-3-[2-fluoro-5-(trifluoromethyl)phenyl]-2-hydroxy-9-methoxy-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-3-[2-methoxy-5-(trifluoromethoxy)phenyl]-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-3-(2-methoxyphenyl)-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
3-[3-chloro-2-fluoro-5-(trifluoromethyl)phenyl]-1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-9-methyl-4-oxo-3-[4-[(trifluoromethyl)thio]phenyl]-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-3-(2,4-difluorophenyl)-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
3-(3-chloro-2-fluorophenyl)-1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-3-(3-methoxyphenyl)-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
7-bromo-1-[(2-chloro-5-thiazolyl)methyl]-3-[2-fluoro-3-(trifluoromethyl)phenyl]-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-3-(3-iodophenyl)-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
2-hydroxy-9-methyl-1-[(2-methyl-5-thiazolyl)methyl]-4-oxo-3-[3-(trifluoromethoxy)phenyl]-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
2-hydroxy-9-methyl-1-[(2-methyl-5-thiazolyl)methyl]-4-oxo-3-[3-(trifluoromethyl)phenyl]-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
3-(2-fluorophenyl)-2-hydroxy-9-methyl-1-[(2-methyl-5-thiazolyl)methyl]-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
3-[3-bromo-5-(trifluoromethyl)phenyl]-1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
3-[3-bromo-5-(trifluoromethoxy)phenyl]-1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-3-[3-chloro-5-(trifluoromethyl)phenyl]-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-3-[3-fluoro-5-(trifluoromethyl)phenyl]-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-3-(3-iodo-5-methoxyphenyl)-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
3-(3-bromophenyl)-1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-9-methyl-4-oxo-

4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-9-methyl-4-oxo-3-[3'-(trifluoromethoxy)[1,1'-biphenyl]-3-yl]-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-3-(2',5'-difluoro[1,1'-biphenyl]-3-yl)-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
3-[3-(6-chloro-3-pyridinyl)-5-(trifluoromethoxy)phenyl]-1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-3-(2',4'-dichloro[1,1'-biphenyl]-3-yl)-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-4-oxo-3-phenyl-4*H*-pyrimido[2,1-*a*]isoquinolinium inner salt; and
1-[(2-chloro-5-thiazolyl)methyl]-3-(3-ethenylphenyl)-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt.

8. A composition comprising a compound of Claim 1 and at least one additional component selected from the group consisting of surfactants, solid diluents and liquid diluents.

9. The composition of Claim 8 further comprising at least one additional biologically active compound or agent.

10. The composition of Claim 9 wherein the at least one additional biologically active compound or agent is selected from the group consisting of abamectin, acephate, acequinocyl, acetamiprid, acrinathrin, amidoflumet, amitraz, avermectin, azadirachtin, azinphos-methyl, bensultap, bifenthrin, bifenazate, bistrifluron, borate, buprofezin, cadusafos, carbaryl, carbofuran, cartap, carzol, chlorantraniliprole, chlorfenapyr, chlorfluazuron, chlorpyrifos, chlorpyrifos-methyl, chromafenozide, clofentezin, clothianidin, cyantraniliprole, cyflumetofen, cyfluthrin, beta-cyfluthrin, cyhalothrin, gamma-cyhalothrin, lambda-cyhalothrin, cypermethrin, alpha-cypermethrin, zeta-cypermethrin, cyromazine, deltamethrin, diafenthiuron, diazinon, dieldrin, diflubenzuron, dimefluthrin, dimehypo, dimethoate, dinotefuran, diofenolan, emamectin, endosulfan, esfenvalerate, ethiprole, etofenprox, etoxazole, fenbutatin oxide, fenothiocarb, fenoxycarb, fenpropathrin, fenvalerate, fipronil, flonicamid, flubendiamide, flucythrinate, flufenerim, flufenoxuron, fluvalinate, tau-fluvalinate, fonophos, formetanate, fosthiazate, halofenozide, hexaflumuron, hexythiazox, hydramethylnon, imidacloprid, indoxacarb, insecticidal soaps, isofenphos, lufenuron, malathion, metaflumizone, metaldehyde, methamidophos, methidathion, methiodicarb, methomyl, methoprene, methoxychlor, metofluthrin, monocrotophos, methoxyfenozide, nitenpyram, nithiazine, novaluron, noviflumuron, oxamyl, parathion, parathion-methyl, permethrin, phorate, phosalone, phosmet, phosphamidon, pirimicarb, profenofos, profluthrin, propargite, protrifenbute, pymetrozine, pyrafluprole, pyrethrin, pyridaben, pyridalyl,

pyrifluquinazon, pyriprole, pyriproxyfen, rotenone, ryanodine, spinetoram, spinosad, spirodiclofen, spiromesifen, spirotetramat, sulprofos, sulfoxaflor, tebufenozide, tebufenpyrad, teflubenzuron, tefluthrin, terbufos, tetrachlorvinphos, tetramethrin, thiacloprid, thiamethoxam, thiodicarb, thiosultap-sodium, tolfenpyrad, tralomethrin, triazamate, trichlorfon, triflumuron, *Bacillus thuringiensis* delta-endotoxins, entomopathogenic bacteria, entomopathogenic viruses and entomopathogenic fungi.

11. A composition for protecting an animal from an invertebrate parasitic pest comprising a parasiticidally effective amount of a compound of Claim 1 and at least one carrier.

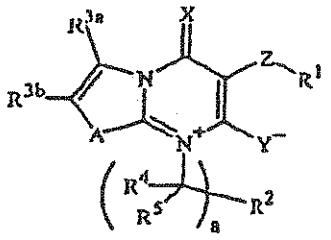
12. A method for controlling an invertebrate pest comprising contacting the invertebrate pest or its environment with a biologically effective amount of a compound of Claim 1.

13. A treated seed comprising a compound of Claim 1 in an amount of from about 0.0001 to 1 % by weight of the seed before treatment.

CLAIMS

What is claimed is:

1. A compound of Formula 1, an *N*-oxide, or salt thereof,



1

wherein

X is O or S;

Y is O or S;

A is O, S, NR^{3c} or $C(R^{3c})=C(R^{3d})$, provided that the $C(R^{3c})=C(R^{3d})$ moiety is oriented so the carbon atom bonded to R^{3d} is connected directly to the pyrimidinium ring of Formula 1;

Z is a direct bond, O, $S(O)_m$, NR^6, $C(R^7)_2O$, $OC(R^7)_2$, $C(=X^1)$, $C(=X^1)E$, $EC(=X^1)$, $C(=NOR^8)$ or $C(=NN(R^6)_2)$;

X^1 is O, S or NR^9;

E is O, S or NR^{9a};

R^1 is a 3- to 10-membered ring or a 7- to 11-membered 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 $S(=O)_m(=NR^{24})_z$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{14};

R^2 is H, halogen, cyano, hydroxy, amino, nitro, OCN, SCN, CHO, C(=O)OH, $C(=O)NH_2$, $C(=S)NH_2$, SO_2NH_2, $C(=O)R^{18}$, $C(=O)OR^{18}$, NHR^{18}, $NR^{18}R^{19}$, $C(=O)NR^{21}R^{19}$, $C(=S)NR^{21}R^{19}$, $SO_2NR^{21}R^{19}$, $OC(=O)R^{21}$, $OC(=O)OR^{18}$, $OC(=O)NR^{21}R^{19}$, $N(R^{21})C(=O)R^{21}$, $N(R^{21})C(=O)OR^{19}$, $N(R^{21})C(=O)NR^{21}R^{22}$, OSO_2R^{18}, $OSO_2NR^{21}R^{22}$, $NR^{21}SO_2R^{18}$, $NR^{21}SO_2NR^{21}R^{22}$ or $Si(R^{18}R^{19}R^{20})$; or C_1–C_8 alkyl, C_2–C_8 alkenyl, C_2–C_8 alkynyl, C_3–C_{10} cycloalkyl, C_4–C_{10} alkylcycloalkyl, C_4–C_{10} cycloalkylalkyl, C_6–C_{14} cycloalkylcycloalkyl, C_5–C_{10}

alkylcycloalkylalkyl, C_3–C_8 cycloalkenyl, C_1–C_8 alkoxy, C_3–C_8 cycloalkoxy, C_4–C_{10} cycloalkylalkoxy, C_2–C_8 alkenyloxy, C_2–C_8 alkynyloxy, C_1–C_8 alkylthio, C_1–C_8 alkylsulfinyl, C_1–C_8 alkylsulfonyl, C_3–C_8 cycloalkylthio, C_3–C_8 cycloalkylsulfinyl, C_3–C_8 cycloalkylsulfonyl, C_4–C_{10} cycloalkylalkylthio, C_4–C_{10} cycloalkylalkylsulfinyl, C_4–C_{10} cycloalkylalkylsulfonyl, C_2–C_8 alkenylthio, C_2–C_8 alkenylsulfinyl, C_2–C_8 alkenylsulfonyl, C_2–C_8 alkynylthio, C_2–C_8 alkynylsulfinyl or C_2–C_8 alkynylsulfonyl, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, $C(=O)R^{10}$, $C(=O)OR^{11}$, $C(=O)NR^{12}R^{13}$, OR^{11}, $S(O)_nR^{10}$, $SO_2NR^{12}R^{13}$ and $Si(R^{10})_3$; or a 3- to 10-membered ring or a 7- to 11-membered 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 $S(=O)_u(=NR^{24})_z$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{15};

R^{3a}, R^{3b}, R^{3c} and R^{3d} are independently H, halogen, cyano, hydroxy, amino, nitro, SF_5, OCN, SCN, CHO, C(=O)OH, $C(=O)NH_2$, $C(=S)NH_2$, SO_2NH_2, $C(=O)R^{18}$, $C(=O)OR^{18}$, NHR^{18}, $NR^{18}R^{19}$, $C(=O)NR^{21}R^{19}$, $C(=S)NR^{21}R^{19}$, $SO_2NR^{21}R^{19}$, $OC(=O)R^{21}$, $OC(=O)OR^{18}$, $OC(=O)NR^{21}R^{19}$, $N(R^{21})C(=O)R^{21}$, $N(R^{21})C(=O)OR^{19}$, $N(R^{21})C(=O)NR^{21}R^{22}$, OSO_2R^{18}, $OSO_2NR^{21}R^{22}$, $NR^{21}SO_2R^{18}$, $NR^{21}SO_2NR^{21}R^{22}$, $Si(R^{18}R^{19}R^{20})$ or Z^1Q^1; or C_1–C_8 alkyl, C_2–C_8 alkenyl, C_2–C_8 alkynyl, C_3–C_{10} cycloalkyl, C_4–C_{10} alkylcycloalkyl, C_4–C_{10} cycloalkylalkyl, C_6–C_{14} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_8 cycloalkenyl, C_1–C_8 alkoxy, C_3–C_8 cycloalkoxy, C_4–C_{10} cycloalkylalkoxy, C_2–C_8 alkenyloxy, C_2–C_8 alkynyloxy, C_1–C_8 alkylthio, C_1–C_8 alkylsulfinyl, C_1–C_8 alkylsulfonyl, C_3–C_8 cycloalkylthio, C_3–C_8 cycloalkylsulfinyl, C_3–C_8 cycloalkylsulfonyl, C_4–C_{10} cycloalkylalkylthio, C_4–C_{10} cycloalkylalkylsulfinyl, C_4–C_{10} cycloalkylalkylsulfonyl, C_2–C_8 alkenylthio, C_2–C_8 alkenylsulfinyl, C_2–C_8 alkenylsulfonyl, C_2–C_8 alkynylthio, C_2–C_8 alkynylsulfinyl or C_2–C_8 alkynylsulfonyl, each unsubstituted or substituted with at least one substituent independently selected from R^{17}; or R^{3a} and R^{3b}, or R^{3b} and R^{3c}, or R^{3c} and R^{3d} are taken together with the adjacent carbon atoms to which they are attached to form a 5- to 7-membered carbocyclic or heterocyclic ring, each ring containing ring members selected from carbon atoms and up to 3 heteroatoms independently selected from up to 2 O, up to 2 S, and up to 3 N, wherein up to 2 carbon atom ring members are independently selected from C(=O) and C(=S) and the sulfur atom ring members are independently selected from $S(=O)_m$, each ring optionally substituted with up to 3 substituents independently selected from the group

consisting of halogen, cyano, hydroxy, amino, nitro, C(=O)OH, C(=O)NH_2, SO_2NH_2, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_2–C_4 alkenyl, C_2–C_4 haloalkenyl, C_2–C_4 alkynyl, C_2–C_4 haloalkynyl, C_3–C_7 cycloalkyl, C_3–C_7 halocycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 haloalkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_4–C_8 halocycloalkylalkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_2–C_6 alkoxycarbonyl, C_2–C_6 haloalkoxycarbonyl, C_2–C_6 alkylcarbonyl and C_2–C_6 haloalkylcarbonyl;

R^{3e} is H, hydroxy, amino, CHO, C(=O)NH_2, C(=S)NH_2, SO_2NH_2, C(=O)R^{18}, C(=O)OR^{18}, NHR^{18}, $NR^{18}R^{19}$, C(=O)$NR^{21}R^{19}$, C(=S)$NR^{21}R^{19}$, $SO_2NR^{21}R^{19}$, OC(=O)R^{21}, OC(=O)OR^{18}, OC(=O)$NR^{21}R^{19}$, $N(R^{21})C(=O)R^{21}$, $N(R^{21})C(=O)OR^{19}$, $N(R^{21})C(=O)NR^{21}R^{22}$, OSO_2R^{18}, $OSO_2NR^{21}R^{22}$, $NR^{21}SO_2R^{18}$, $NR^{21}SO_2NR^{21}R^{22}$, $Si(R^{18}R^{19}R^{20})$ or Z^1Q^1; or C_1–C_8 alkyl, C_2–C_8 alkenyl, C_2–C_8 alkynyl, C_3–C_{10} cycloalkyl, C_4–C_{10} alkylcycloalkyl, C_4–C_{10} cycloalkylalkyl, C_6–C_{14} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_8 cycloalkenyl, C_1–C_8 alkoxy, C_3–C_8 cycloalkoxy, C_4–C_{10} cycloalkylalkoxy, C_2–C_8 alkenyloxy, C_2–C_8 alkynyloxy, C_1–C_8 alkylsulfinyl, C_1–C_8 alkylsulfonyl, C_3–C_8 cycloalkylsulfinyl, C_3–C_8 cycloalkylsulfonyl, C_4–C_{10} cycloalkylalkylsulfinyl, C_4–C_{10} cycloalkylalkylsulfonyl, C_2–C_8 alkenylsulfinyl, C_2–C_8 alkenylsulfonyl, C_2–C_8 alkynylsulfinyl or C_2–C_8 alkynylsulfonyl, each unsubstituted or substituted with at least one substituent independently selected from R^{17}; or R^{3e} and R^{3b} are taken together with the adjacent carbon atoms to which they are attached to form a 5- to 7-membered carbocyclic or heterocyclic ring, each ring containing ring members selected from carbon atoms and up to 3 heteroatoms independently selected from up to 2 O, up to 2 S, and up to 3 N, wherein up to 2 carbon atom ring members are independently selected from C(=O) and C(=S) and the sulfur atom ring members are independently selected from $S(=O)_m$, each ring optionally substituted with up to 3 substituents independently selected from the group consisting of halogen, cyano, hydroxy, amino, nitro, C(=O)OH, C(=O)NH_2, SO_2NH_2, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_2–C_4 alkenyl, C_2–C_4 haloalkenyl, C_2–C_4 alkynyl, C_2–C_4 haloalkynyl, C_3–C_7 cycloalkyl, C_3–C_7 halocycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 haloalkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_4–C_8 halocycloalkylalkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_2–C_6 alkoxycarbonyl, C_2–C_6 haloalkoxycarbonyl, C_2–C_6 alkylcarbonyl and C_2–C_6 haloalkylcarbonyl;

each R^4 and R^5 is independently H, halogen, cyano, hydroxy, amino, nitro, OCN, SCN, CHO, C(=O)OH, C(=O)NH_2, C(=S)NH_2 or SO_2NH_2; or C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{12} cycloalkylcycloalkyl, C_5–C_8 alkylcycloalkylalkyl, C_3–C_6 cycloalkenyl, C_1–C_6 alkoxy, C_3–C_6 cycloalkoxy, C_4–C_8 cycloalkylalkoxy, C_2–C_6 alkenyloxy or C_2–C_6 alkynyloxy, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of halogen,

cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, $C(=O)R^{10}$, $C(=O)OR^{11}$, $C(=O)NR^{12}R^{13}$, OR^{11}, $S(O)_nR^{10}$, $SO_2NR^{12}R^{13}$ and $Si(R^{10})_3$; or

R^4 and R^5 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 2 heteroatoms independently selected from one O, one S, and up to 2 N, wherein up to 2 carbon atom ring members are independently selected from C(=O) and C(=S) and the sulfur atom ring member is selected from S, S(O) or $S(O)_2$, said ring optionally substituted with up to 4 substituents independently selected from the group consisting of halogen, cyano and C_1–C_4 alkyl;

each R^6 is independently H; or C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_6 cycloalkenyl, C_2–C_6 alkylcarbonyl or C_2–C_6 alkoxycarbonyl, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, $C(=O)R^{10}$, $C(=O)OR^{11}$, $C(=O)NR^{12}R^{13}$, OR^{11}, $S(O)_nR^{10}$, $SO_2NR^{12}R^{13}$ and $Si(R^{10})_3$; or

two R^6 substituents are taken together with the nitrogen atom to which they are attached to form a 3- to 7-membered ring containing ring members selected from carbon atoms and up to 2 heteroatoms independently selected from one O, one S, and up to 2 N, wherein up to 2 carbon atom ring members are independently selected from C(=O) and C(=S) and the sulfur atom ring member is selected from S, S(O) or $S(O)_2$, said ring optionally substituted with up to 4 substituents independently selected from the group consisting of halogen, cyano and C_1–C_4 alkyl;

each R^7 and R^8 is independently H; or C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_6 cycloalkenyl, C_2–C_6 alkylcarbonyl or C_2–C_6 alkoxycarbonyl, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, $C(=O)R^{10}$, $C(=O)OR^{11}$, $C(=O)NR^{12}R^{13}$, OR^{11}, $S(O)_nR^{10}$, $SO_2NR^{12}R^{13}$ and $Si(R^{10})_3$;

each R^9 is independently C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_6 cycloalkenyl, C_2–C_6 alkylcarbonyl or C_2–C_6 alkoxycarbonyl, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, $C(=O)R^{10}$, $C(=O)OR^{11}$, $C(=O)NR^{12}R^{13}$, OR^{11}, $S(O)_nR^{10}$, $SO_2NR^{12}R^{13}$ and $Si(R^{10})_3$;

each R^{9a} is independently H; or C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_6 cycloalkenyl, C_2–C_6

alkylcarbonyl or C_2–C_6 alkoxycarbonyl, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, $C(=O)R^{10}$, $C(=O)OR^{11}$, $C(=O)NR^{12}R^{13}$, OR^{11}, $S(O)_nR^{10}$, $SO_2NR^{12}R^{13}$ and $Si(R^{10})_3$;

each R^{10} and R^{11} is independently C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl or C_3–C_6 cycloalkenyl, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, 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_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 and C_3–C_6 trialkylsilyl; or phenyl or a 5- or 6-membered heteroaromatic ring, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_6 cycloalkenyl, halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, 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_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 and C_3–C_6 trialkylsilyl;

each R^{12} and R^{13} is independently C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl or C_3–C_6 cycloalkenyl, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, 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_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 and C_3–C_6 trialkylsilyl; or phenyl or a 5- or 6-membered heteroaromatic ring, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–

C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_6 cycloalkenyl, halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, 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_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 and C_3–C_6 trialkylsilyl; or

R^{12} and R^{13} are taken together with the nitrogen atom to which they are attached to form a 3- to 7-membered ring containing ring members selected from carbon atoms and up to 2 heteroatoms independently selected from one O, one S, and up to 2 N, wherein up to 2 carbon atom ring members are independently selected from C(=O) and C(=S) and the sulfur atom ring member is selected from S, S(O) or $S(O)_2$, said ring optionally substituted with up to 4 substituents independently selected from the group consisting of halogen, cyano and C_1–C_4 alkyl;

each R^{14} is independently halogen, cyano, hydroxy, amino, nitro, SF_5, OCN, SCN, CHO, C(=O)OH, $C(=O)NH_2$, $C(=S)NH_2$, SO_2NH_2, $C(=O)R^{18}$, $C(=O)OR^{18}$, NHR^{18}, $NR^{18}R^{19}$, $C(=O)NR^{21}R^{19}$, $C(=O)NR^{21}NR^{22}R^{23}$, $C(=S)NR^{21}R^{19}$, $SO_2NR^{21}R^{19}$, $OC(=O)R^{21}$, $OC(=O)OR^{18}$, $OC(=O)NR^{21}R^{19}$, $N(R^{21})C(=O)R^{21}$, $N(R^{21})C(=O)OR^{19}$, $N(R^{21})C(=O)NR^{21}R^{22}$, OSO_2R^{18}, $OSO_2NR^{21}R^{22}$, $NR^{21}SO_2R^{18}$, $NR^{21}SO_2NR^{21}R^{22}$, $Si(R^{18}R^{19}R^{20})$, $C(=NR^{21})R^{22}$, $C(=NOR^{21})R^{22}$, $C(=NNR^{21}R^{22})R^{23}$, $C(=NN(C(=O)R^{19})R^{21})R^{22}$, $C(=NN(C(=O)OR^{19})R^{21})R^{22}$, $ON=CR^{21}R^{22}$, $ONR^{21}R^{22}$, $S(=O)(=NR^{21})R^{22}$, $SO_2NR^{21}C(=O)NR^{22}R^{23}$, $P(=X^2)R^{18}R^{19}$, $OP(=X^2)R^{18}R^{19}$, $OP(=X^2)(OR^{18})R^{19}$, $OP(=X^2)(OR^{18})OR^{19}$, $N=CR^{21}R^{22}$, $NR^{21}N=CR^{22}R^{23}$, $NR^{21}NR^{22}R^{23}$, $NR^{21}C(=X^2)NR^{22}R^{23}$, $NR^{21}C(=NR^{21})NR^{22}R^{23}$, $NR^{21}NR^{21}C(=X^2)NR^{22}R^{23}$, $NR^{21}NR^{21}SO_2NR^{22}R^{23}$, Z^1Q^1 or $Z^1Q^1Z^1Q^1$; or C_1–C_8 alkyl, C_2–C_8 alkenyl, C_2–C_8 alkynyl, C_3–C_{10} cycloalkyl, C_4–C_{10} alkylcycloalkyl, C_4–C_{10} cycloalkylalkyl, C_6–C_{14} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_8 cycloalkenyl, C_1–C_8 alkoxy, C_3–C_8 cycloalkoxy, C_4–C_{10} cycloalkylalkoxy, C_2–C_8 alkenyloxy, C_2–C_8 alkynyloxy, C_1–C_8 alkylthio, C_1–C_8 alkylsulfinyl, C_1–C_8 alkylsulfonyl, C_3–C_8 cycloalkylthio, C_3–C_8 cycloalkylsulfinyl, C_3–C_8 cycloalkylsulfonyl, C_4–C_{10} cycloalkylalkylthio, C_4–C_{10} cycloalkylalkylsulfinyl, C_4–C_{10} cycloalkylalkylsulfonyl, C_2–C_8 alkenylthio, C_2–C_8 alkenylsulfinyl, C_2–C_8 alkenylsulfonyl, C_2–C_8 alkynylthio, C_2–C_8 alkynylsulfinyl or C_2–C_8 alkynylsulfonyl, each unsubstituted or substituted with at least one substituent independently selected from R^{17}; or

two R^{14} substituents on adjacent ring atoms are taken together with the adjacent ring atoms to form a 5- to 7-membered carbocyclic or heterocyclic ring, each ring containing ring members selected from carbon atoms and up to 3 heteroatoms

independently selected from up to 2 O, up to 2 S, and up to 3 N, wherein up to 2 carbon atom ring members are independently selected from C(=O) and C(=S) and the sulfur atom ring members are independently selected from $S(=O)_n$, each ring optionally substituted with up to 3 substituents independently selected from the group consisting of halogen, cyano, hydroxy, amino, nitro, C(=O)OH, $C(=O)NH_2$, SO_2NH_2, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_2–C_4 alkenyl, C_2–C_4 haloalkenyl, C_2–C_4 alkynyl, C_2–C_4 haloalkynyl, C_3–C_7 cycloalkyl, C_3–C_7 halocycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 haloalkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_4–C_8 halocycloalkylalkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_2–C_6 alkoxycarbonyl, C_2–C_6 haloalkoxycarbonyl, C_2–C_6 alkylcarbonyl and C_2–C_6 haloalkylcarbonyl;

each X^2 is independently O or S;

each Z^1 is independently a direct bond, O, $S(O)_n$, NR^6, $C(R^7)_2$, $C(R^7)=C(R^7)$, C≡C, $C(R^7)_2O$, $OC(R^7)_2$, $C(=X^1)$, $C(=X^1)E$, $EC(=X^1)$, $C(=NOR^8)$ or $C(=NN(R^6)_2)$;

each Q^1 is independently a 3- to 10-membered ring or a 7- to 11-membered 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 $S(=O)_u(=NR^{24})_z$, each ring or ring system optionally substituted with up to 4 substituents independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, $C(=O)R^{10}$, $C(=O)OR^{11}$, $C(=O)NR^{12}R^{13}$, OR^{11}, $S(O)_nR^{10}$, $SO_2NR^{12}R^{13}$, $Si(R^{10})_3$ and R^{16};

each Q^1 is independently a 3- to 10-membered ring or a 7- to 11-membered 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 $S(=O)_u(=NR^{24})_z$, each ring or ring system optionally substituted with up to 5 substituents independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, $C(=O)R^{10}$, $C(=O)OR^{11}$, $C(=O)NR^{12}R^{13}$, $C(=O)NR^{21}NR^{22}R^{23}$, OR^{11}, $S(O)_nR^{10}$, $SO_2NR^{12}R^{13}$, $S(=O)(=NR^{21})R^{22}$, $Si(R^{10})_3$ and R^{16};

each R^{15} is independently halogen, cyano, hydroxy, amino, nitro, SF_5, OCN, SCN, CHO, C(=O)OH, $C(=O)NH_2$, $C(=S)NH_2$, SO_2NH_2, $C(=O)R^{18}$, $C(=O)OR^{18}$, NHR^{18}, $NR^{18}R^{19}$, $C(=O)NR^{21}R^{19}$, $C(=O)NR^{21}NR^{22}R^{23}$, $C(=S)NR^{21}R^{19}$, $SO_2NR^{21}R^{19}$, $S(=O)(=NR^{21})R^{22}$, $OC(=O)R^{21}$, $OC(=O)OR^{18}$, $OC(=O)NR^{21}R^{19}$, $N(R^{21})C(=O)R^{21}$, $N(R^{21})C(=O)OR^{19}$, $N(R^{21})C(=O)NR^{21}R^{22}$, OSO_2R^{18}, $OSO_2NR^{21}R^{22}$, $NR^{21}SO_2R^{18}$, $NR^{21}SO_2NR^{21}R^{22}$, $Si(R^{18}R^{19}R^{20})$ or Z^1Q^1; or C_1–C_8 alkyl, C_2–C_8 alkenyl, C_2–C_8 alkynyl, C_3–C_{10} cycloalkyl, C_4–C_{10} alkylcycloalkyl, C_4–C_{10} cycloalkylalkyl, C_6–C_{14} cycloalkylcycloalkyl, C_5–C_{10}

alkylcycloalkylalkyl, C_3–C_8 cycloalkenyl, C_1–C_8 alkoxy, C_3–C_8 cycloalkoxy, C_4–C_{10} cycloalkylalkoxy, C_2–C_8 alkenyloxy, C_2–C_8 alkynyloxy, C_1–C_8 alkylthio, C_1–C_8 alkylsulfinyl, C_1–C_8 alkylsulfonyl, C_3–C_8 cycloalkylthio, C_3–C_8 cycloalkylsulfinyl, C_3 C_8 cycloalkylsulfonyl, C_4 C_{10} cycloalkylalkylthio, C_4–C_{10} cycloalkylalkylsulfinyl, C_4–C_{10} cycloalkylalkylsulfonyl, C_2–C_8 alkenylthio, C_2–C_8 alkenylsulfinyl, C_2–C_8 alkenylsulfonyl, C_2–C_8 alkynylthio, C_2–C_8 alkynylsulfinyl or C_2–C_8 alkynylsulfonyl, each unsubstituted or substituted with at least one substituent independently selected from R^{17}; or

two R^{15} substituents on adjacent ring atoms are taken together with the adjacent ring atoms to form a 5- to 7-membered carbocyclic or heterocyclic ring, each ring containing ring members selected from carbon atoms and up to 3 heteroatoms independently selected from up to 2 O, up to 2 S, and up to 3 N, wherein up to 2 carbon atom ring members are independently selected from C(=O) and C(=S) and the sulfur atom ring members are independently selected from $S(=O)_n$, each ring optionally substituted with up to 3 substituents independently selected from the group consisting of halogen, cyano, hydroxy, amino, nitro, C(=O)OH, $C(=O)NH_2$, SO_2NH_2, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_2–C_4 alkenyl, C_2–C_4 haloalkenyl, C_2–C_4 alkynyl, C_2–C_4 haloalkynyl, C_3–C_7 cycloalkyl, C_3–C_7 halocycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 haloalkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_4–C_8 halocycloalkylalkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_2–C_6 alkoxycarbonyl, C_2–C_6 haloalkoxycarbonyl, C_2–C_6 alkylcarbonyl and C_2–C_6 haloalkylcarbonyl;

each R^{16} is independently C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl or C_3–C_6 cycloalkenyl, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, 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_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 and C_3–C_6 trialkylsilyl; or

phenyl or a 5- or 6-membered heteroaromatic ring, each unsubstituted or substituted with at least one substituent independently selected from the group consisting of C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_6 cycloalkenyl, halogen, cyano, nitro, CHO, C(=O)OH, $C(=O)NH_2$, 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_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 and C_3–C_6 trialkylsilyl;

each R^{17} is independently halogen, cyano, nitro, OH, CHO, C(=O)OH, $C(=O)NH_2$, $C(=O)R^{10}$, $C(=O)OR^{11}$, $C(=O)NR^{12}R^{13}$, OR^{11}, $S(O)_nR^{10}$, $SO_2NR^{12}R^{13}$, $Si(R^{10})_3$ or Z^1Q^t;

each R^{18}, R^{19} and R^{20} is independently Q^t; or C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl or C_3–C_6 cycloalkenyl, each unsubstituted or substituted with at least one substituent independently selected from R^{17};

each R^{21} is independently Q^t or H; or C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl or C_3–C_6 cycloalkenyl, each unsubstituted or substituted with at least one substituent independently selected from R^{17};

each R^{22} and R^{23} is independently Q^t or H; or C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_3–C_8 cycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_6–C_{10} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl or C_3–C_6 cycloalkenyl, each unsubstituted or substituted with at least one substituent independently selected from R^{17}; or

R^{22} and R^{23} are taken together with the nitrogen atom to which they are attached to form a 3- to 7-membered ring containing ring members selected from carbon atoms and up to 2 heteroatoms independently selected from one O, one S, and up to 2 N, wherein up to 2 carbon atom ring members are independently selected from C(=O) and C(=S) and the sulfur atom ring member is selected from S, S(O) or $S(O)_2$, said ring optionally substituted with up to 4 substituents independently selected from the group consisting of halogen, cyano and C_1–C_4 alkyl;

each R^{24} is independently H, cyano, OCN, SCN, CHO, C(=O)OH, $C(=O)NH_2$, $C(=S)NH_2$, SO_2NH_2, $C(=O)R^{18}$, $C(=O)OR^{18}$, NHR^{18}, $NR^{18}R^{19}$, $C(=O)NR^{21}R^{19}$, $C(=S)NR^{21}R^{19}$, $SO_2NR^{21}R^{19}$, $OC(=O)R^{21}$, $OC(=O)OR^{18}$, $OC(=O)NR^{21}R^{19}$, $N(R^{21})C(=O)R^{21}$, $N(R^{21})C(=O)OR^{19}$, $N(R^{21})C(=O)NR^{21}R^{22}$, OSO_2R^{18}, $OSO_2NR^{21}R^{22}$, $NR^{21}SO_2R^{18}$, $NR^{21}SO_2NR^{21}R^{22}$, $Si(R^{18}R^{19}R^{20})$ or Z^1Q^t; or C_1–C_8 alkyl, C_2–C_8 alkenyl, C_2–C_8 alkynyl, C_3–C_{10} cycloalkyl, C_4–C_{10} alkylcycloalkyl, C_4–C_{10} cycloalkylalkyl, C_6–C_{14} cycloalkylcycloalkyl, C_5–C_{10} alkylcycloalkylalkyl, C_3–C_8 cycloalkenyl, C_1–C_8 alkoxy, C_3–C_8 cycloalkoxy, C_4–C_{10} cycloalkylalkoxy, C_2–C_8 alkenyloxy, C_2–C_8 alkynyloxy, C_1–C_8 alkylthio, C_1–C_8 alkylsulfinyl, C_1–C_8 alkylsulfonyl, C_3–C_8 cycloalkylthio, C_3–C_8 cycloalkylsulfinyl, C_3–C_8 cycloalkylsulfonyl, C_4–C_{10} cycloalkylalkylthio, C_4–C_{10} cycloalkylalkylsulfinyl, C_4–C_{10} cycloalkylalkylsulfonyl, C_2–C_8 alkenylthio,

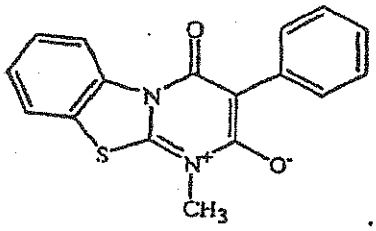
C_2–C_8 alkenylsulfinyl, C_2–C_8 alkenylsulfonyl, C_2–C_8 alkynylthio, C_2–C_8 alkynylsulfinyl or C_2–C_8 alkynylsulfonyl, each unsubstituted or substituted with at least one substituent independently selected from R^{17};

a is 1, 2 or 3;

each n is independently 0, 1 or 2; and

u and z in each instance of $S(=O)_u(=NR^{24})_z$ are independently 0, 1 or 2, provided that the sum of u and z in each instance of $S(=O)_u(=NR^{24})_z$ is 0, 1 or 2;

provided that (i) when A is O, S, NCH_3 or $C(R^{3c})=C(R^{3d})$, R^{3c} is H or F, and R^{3d} is H, F, CF_2H or CF_3, then at least one of R^{3a} or R^{3b} is other than H; and (ii) the compound of Formula 1 is other than



2. A compound of Claim 1 wherein

X is O;

Y is O;

Z is a direct bond, $C(=X^1)$ or $C(=X^1)E$;

X^1 is O;

E is O;

A is $C(R^{3c})=C(R^{3d})$ or NR^{3e};

R^2 is $C(=O)OR^{18}$; or C_1–C_8 alkyl optionally substituted with halogen; or a 3- to 10-membered ring or a 7- to 11-membered 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 $S(=O)_u(=NR^{24})_z$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{15};

R^{3a}, R^{3b}, R^{3c} are independently H or halogen;

R^{3d} is halogen, C_1–C_8 alkyl, C_1–C_8 alkoxy, C_1–C_8 haloalkyl or C_1–C_8 haloalkoxy; or

R^{3c} and R^{3d} are taken together to form a 5- to 7-membered carbocyclic or heterocyclic ring, each ring containing ring members selected from carbon atoms and up to 3 heteroatoms independently selected from up to 2 O, up to 2 S, and up to 3 N, wherein up to 2 carbon atom ring members are independently selected from C(=O) and C(=S) and the sulfur atom ring members are independently selected from $S(=O)_n$, each ring optionally substituted with up to 3 substituents independently selected from the group consisting of halogen, cyano, hydroxy,

amino, nitro, C(=O)OH, C(=O)NH_2, SO_2NH_2, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_2–C_4 alkenyl, C_2–C_4 haloalkenyl, C_2–C_4 alkynyl, C_2–C_4 haloalkynyl, C_3–C_7 cycloalkyl, C_3–C_7 halocycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 haloalkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_4–C_8 halocycloalkylalkyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_2–C_6 alkoxycarbonyl, C_2–C_6 haloalkoxycarbonyl, C_2–C_6 alkylcarbonyl and C_2–C_6 haloalkylcarbonyl;

R^{3e} is C_1–C_4 alkyl;

R^4 and R^5 are H; and

a is 1.

3. A compound of Claim 2 wherein

R^1 is phenyl or a 5- or 6-membered heteroaromatic ring, each optionally substituted with up to 3 substituents independently selected from R^{14};

R^{14} is halogen, cyano, C(=O)OR^{18}, C(=O)$NR^{21}R^{19}$, C(=NOR^{21})R^{22} or Z^1Q^t; or C_1–C_8 alkyl, C_1–C_8 alkoxy or C_1–C_8 alkylthio, each optionally substituted with halogen;

R^{21} is C_1–C_4 alkyl;

R^{22} is C_1–C_4 alkyl;

Z is a direct bond;

each Z^1 is independently a direct bond or O; and

each Q^t is independently phenyl or a 5- or 6-membered heteroaromatic ring, each optionally substituted with up to 5 substituents independently selected from the group consisting of halogen, cyano, nitro, CHO, C(=O)OH, C(=O)NH_2, C(=O)R^{10}, C(=O)OR^{11}, C(=O)$NR^{12}R^{13}$, C(=O)$NR^{21}NR^{22}R^{23}$, OR^{11}, $S(O)_nR^{10}$, $SO_2NR^{12}R^{13}$, S(=O)(=NR^{21})R^{22}, $Si(R^{10})_3$ and R^{16}.

4. A compound of Claim 3 wherein

R^2 is pyridinyl, pyrimidinyl, oxazolyl or thiazolyl, each optionally substituted with up to 3 substituents independently selected from the group consisting of halogen and C_1–C_4 alkyl.

5. A compound of Claim 4 wherein

R^1 is phenyl or pyridinyl, each optionally substituted with up to 3 substituents independently selected from R^{14}; and

each Q^t is independently phenyl, pyridinyl or pyrimidinyl, each optionally substituted with up to 5 substituents independently selected from the group consisting of halogen, cyano, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_1–C_4 alkoxy and C_1–C_4 haloalkoxy.

6. A compound of Claim 5 wherein

A is C(R^{3c})=C(R^{3d});

R^{3a}, R^{3b} and R^{3c} are H; and

R^{3d} is halogen, C_1–C_4 alkyl or C_1–C_4 alkoxy.

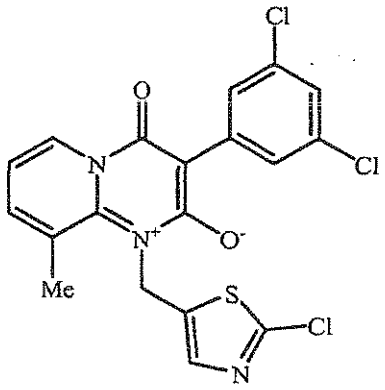
7. A compound of Claim 1 that is selected from the group consisting of:

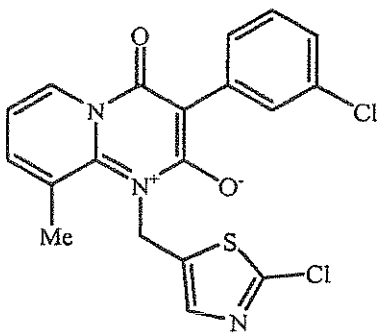
9-bromo-1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-4-oxo-3-[3-(trifluoromethoxy)phenyl]-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
9-bromo-1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-4-oxo-3-[3-(trifluoromethyl)phenyl]-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
9-bromo-3-(3-bromophenyl)-1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
9-bromo-1-[(2-chloro-5-thiazolyl)methyl]-3-[3-chloro-5-(trifluoromethyl)phenyl]-2-hydroxy-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
9-bromo-3-[3-chloro-2-fluoro-5-(trifluoromethyl)phenyl]-1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
9-chloro-1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-4-oxo-3-[3-(trifluoromethoxy)phenyl]-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-9-methyl-4-oxo-3-[3-(trifluoromethoxy)phenyl]-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-9-methyl-4-oxo-3-[3-(trifluoromethyl)phenyl]-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-3-(2-fluorophenyl)-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
9-bromo-1-[(2-chloro-5-thiazolyl)methyl]-3-[3-chloro-5-(trifluoromethoxy)phenyl]-2-hydroxy-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-3-[3-chloro-5-(trifluoromethoxy)phenyl]-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-3-(2,6-difluorophenyl)-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-9-methyl-4-oxo-3-[3-[(trifluoromethyl)thio]phenyl]-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
3-(2-fluorophenyl)-2-hydroxy-9-methyl-4-oxo-1-(5-pyrimidinylmethyl)-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-9-methyl-4-oxo-3-phenyl-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-3-[2-fluoro-5-(trifluoromethyl)phenyl]-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-3-(4-fluorophenyl)-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;

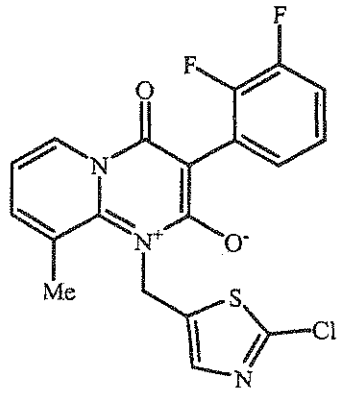
1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-9-methoxy-4-oxo-3-[3-(trifluoromethoxy)phenyl]-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-3-[2-fluoro-5-(trifluoromethyl)phenyl]-2-hydroxy-9-methoxy-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-3-[2-methoxy-5-(trifluoromethoxy)phenyl]-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-3-(2-methoxyphenyl)-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
3-[3-chloro-2-fluoro-5-(trifluoromethyl)phenyl]-1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-9-methyl-4-oxo-3-[4-[(trifluoromethyl)thio]phenyl]-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-3-(2,4-difluorophenyl)-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
3-(3-chloro-2-fluorophenyl)-1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-3-(3-methoxyphenyl)-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
7-bromo-1-[(2-chloro-5-thiazolyl)methyl]-3-[2-fluoro-3-(trifluoromethyl)phenyl]-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-3-(3-iodophenyl)-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
2-hydroxy-9-methyl-1-[(2-methyl-5-thiazolyl)methyl]-4-oxo-3-[3-(trifluoromethoxy)phenyl]-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
2-hydroxy-9-methyl-1-[(2-methyl-5-thiazolyl)methyl]-4-oxo-3-[3-(trifluoromethyl)phenyl]-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
3-(2-fluorophenyl)-2-hydroxy-9-methyl-1-[(2-methyl-5-thiazolyl)methyl]-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
3-[3-bromo-5-(trifluoromethyl)phenyl]-1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
3-[3-bromo-5-(trifluoromethoxy)phenyl]-1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-3-[3-chloro-5-(trifluoromethyl)phenyl]-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-3-[3-fluoro-5-(trifluoromethyl)phenyl]-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-3-(3-iodo-5-methoxyphenyl)-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
3-(3-bromophenyl)-1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-9-methyl-4-oxo-

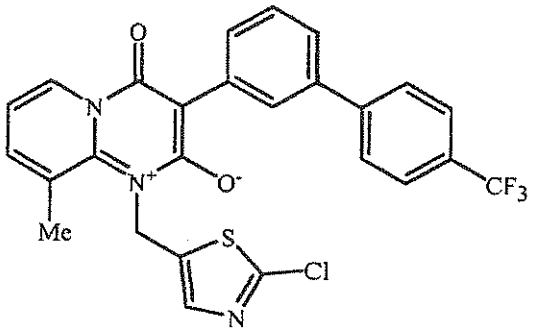
4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-9-methyl-4-oxo-3-[3'-(trifluoromethoxy)[1,1'-biphenyl]-3-yl]-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-3-(2',5'-difluoro[1,1'-biphenyl]-3-yl)-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
3-[3-(6-chloro-3-pyridinyl)-5-(trifluoromethoxy)phenyl]-1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-3-(2',4'-dichloro[1,1'-biphenyl]-3-yl)-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt;
1-[(2-chloro-5-thiazolyl)methyl]-2-hydroxy-4-oxo-3-phenyl-4*H*-pyrimido[2,1-*a*]isoquinolinium inner salt; and
1-[(2-chloro-5-thiazolyl)methyl]-3-(3-ethenylphenyl)-2-hydroxy-9-methyl-4-oxo-4*H*-pyrido[1,2-*a*]pyrimidinium inner salt.

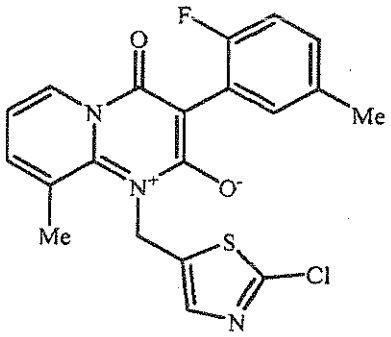
8. A compound of Claim 1 that is selected from the group consisting of:

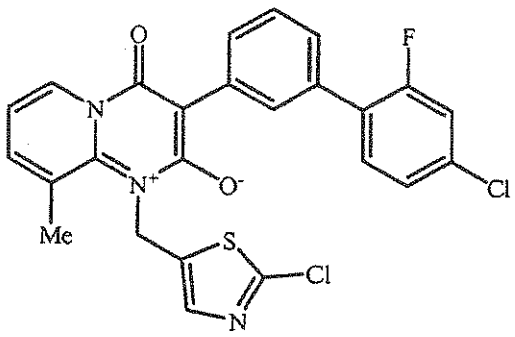


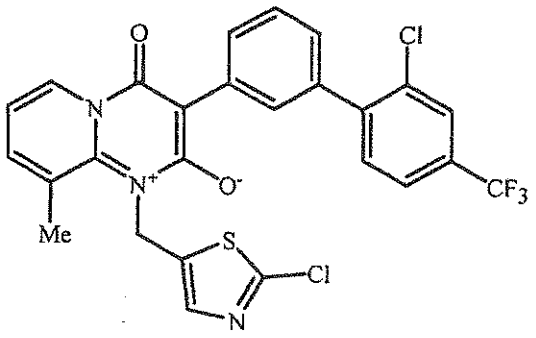


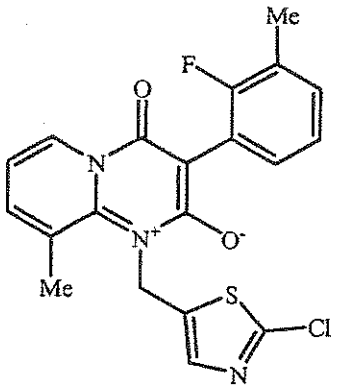


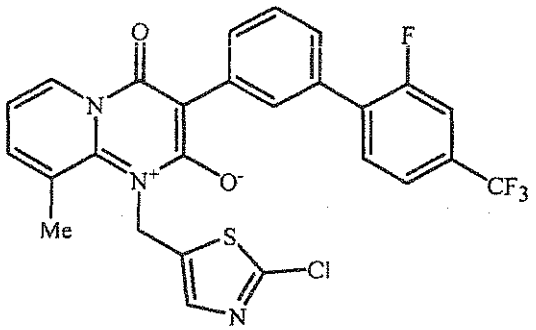


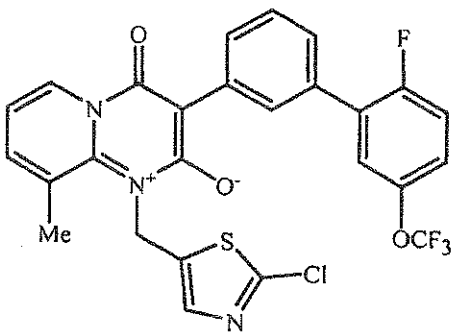


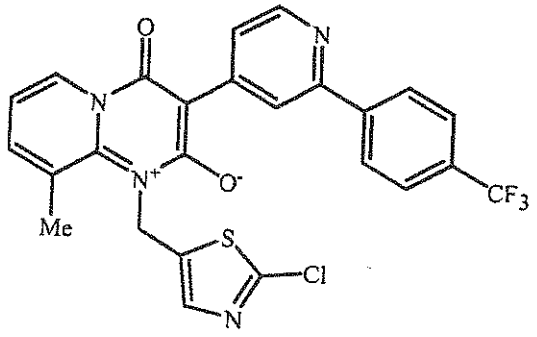


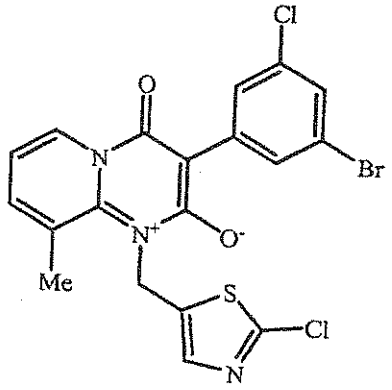


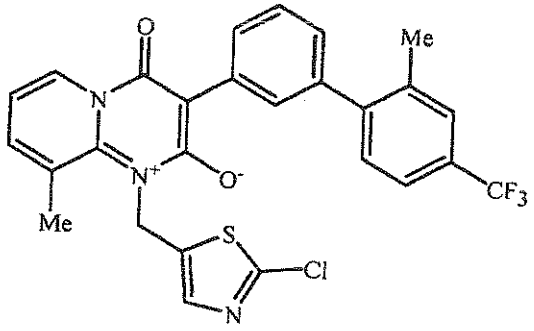


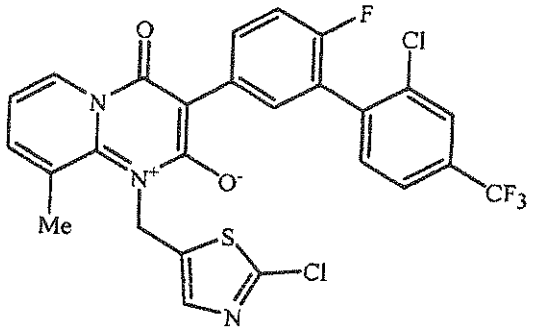


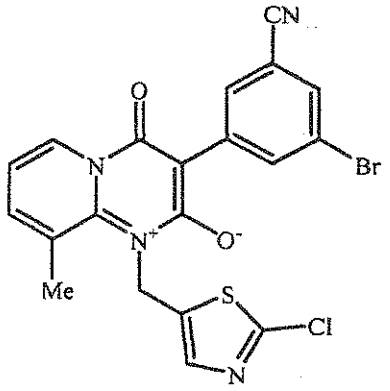


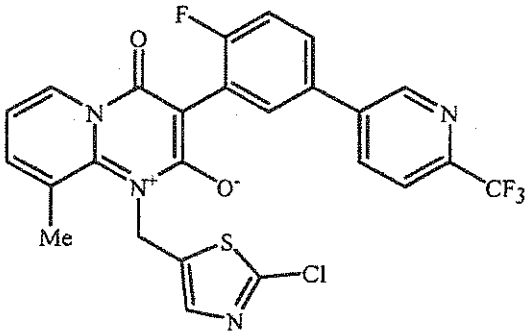


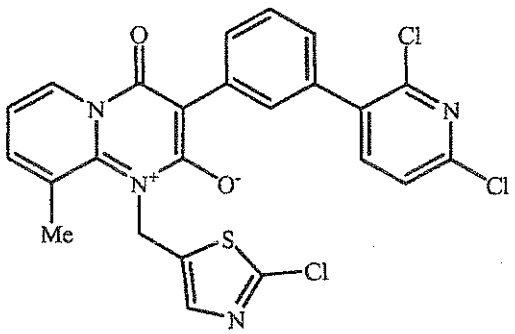


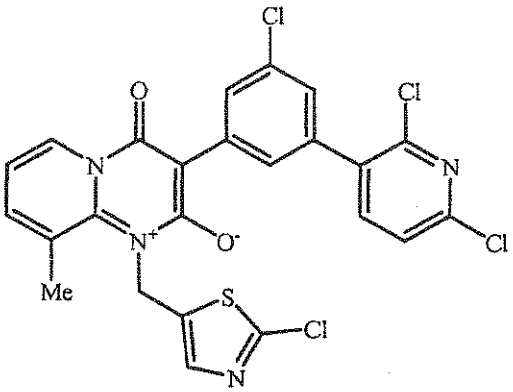


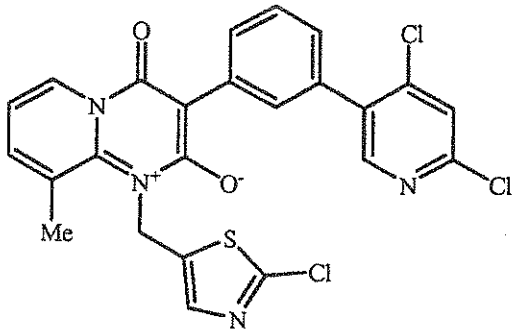


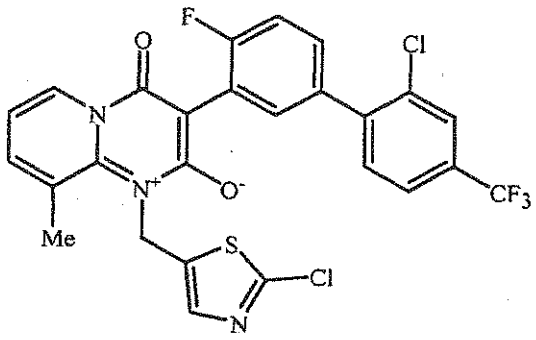

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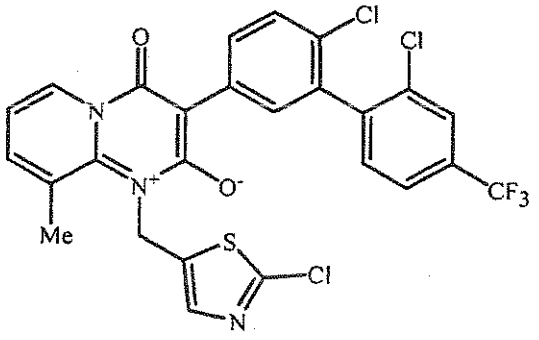

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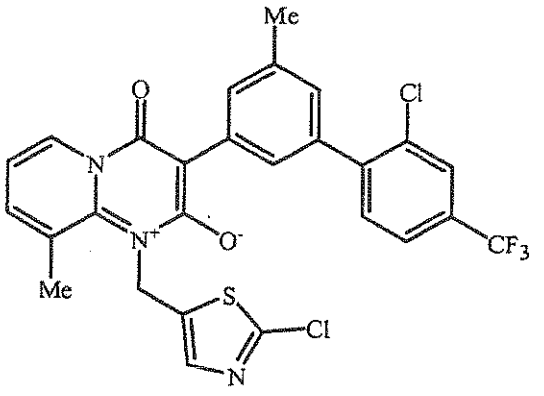

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N

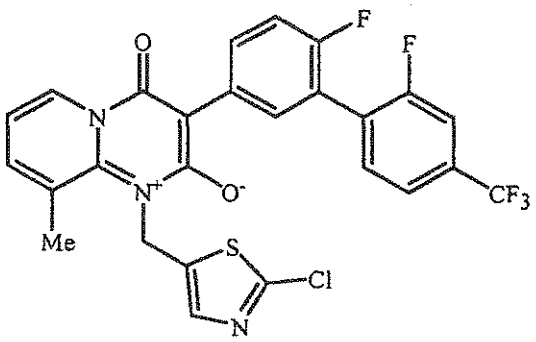

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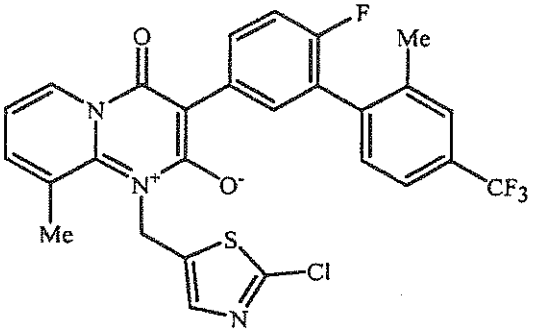


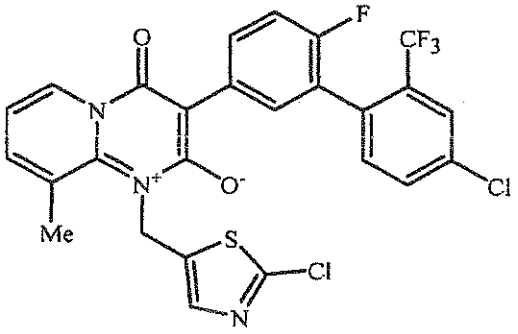


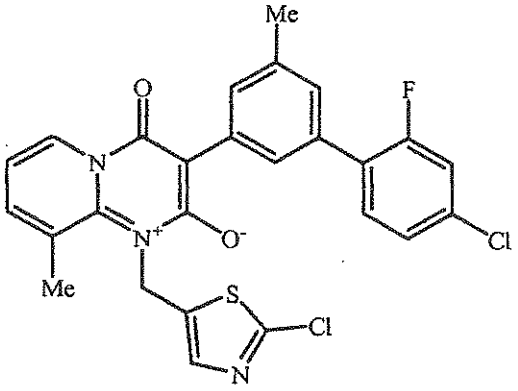


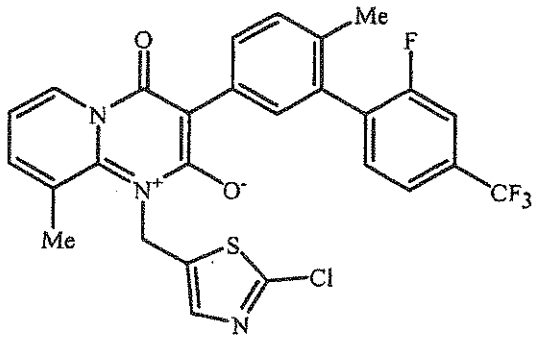


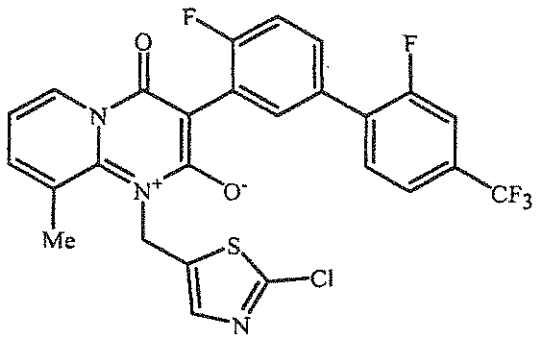


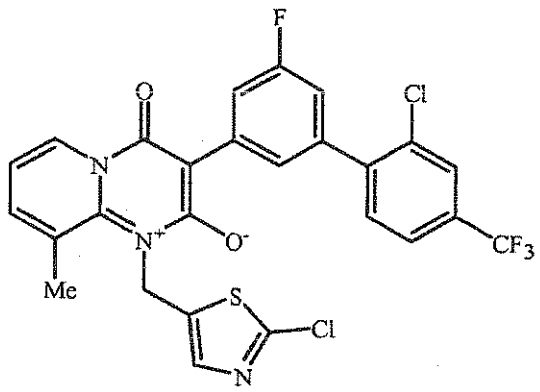


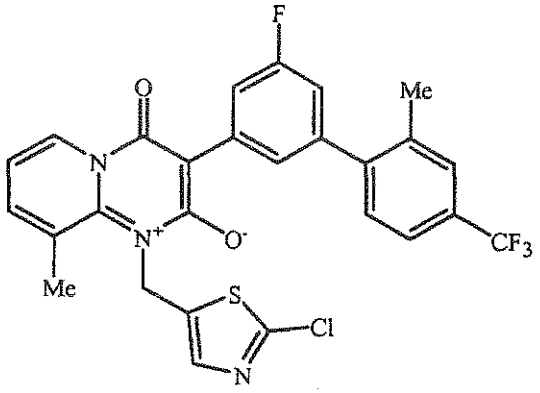


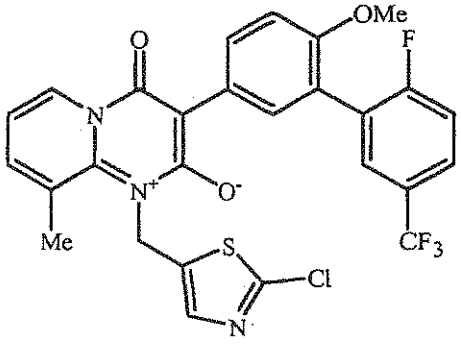


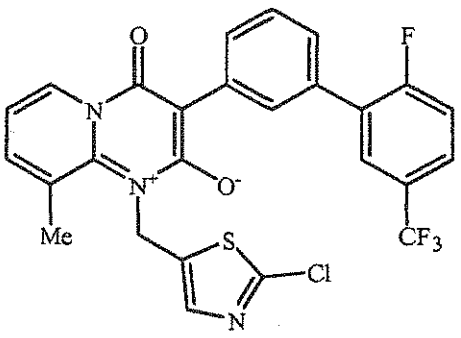

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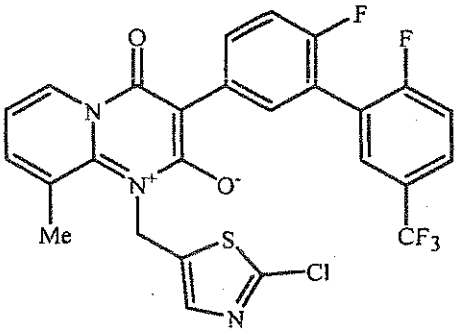

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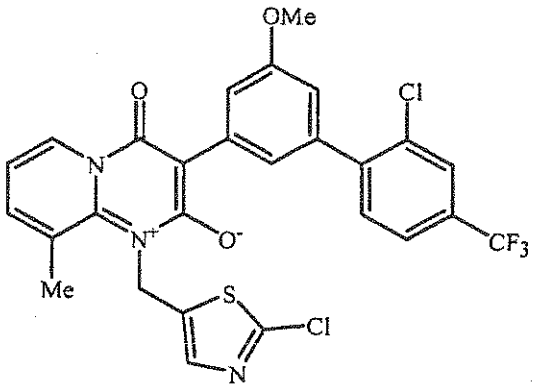

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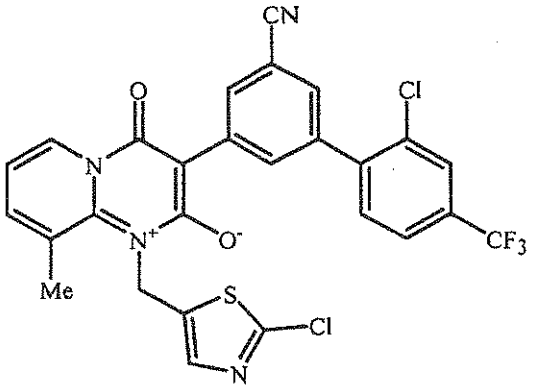

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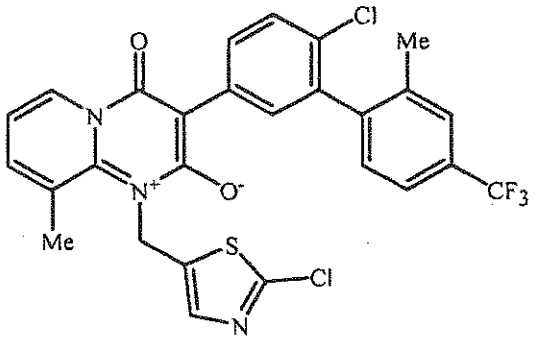

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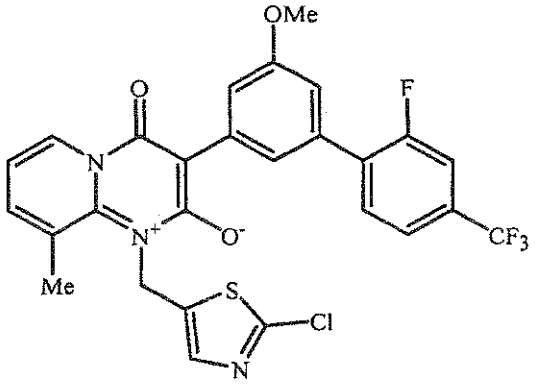

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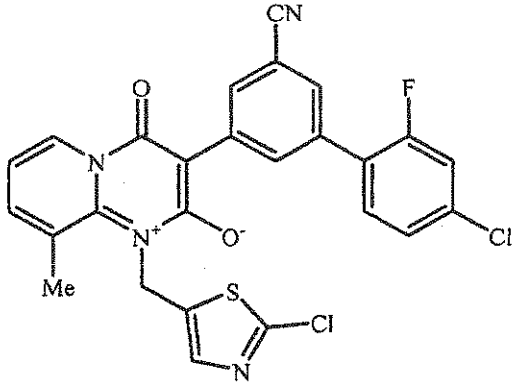

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9. A composition comprising a compound of any of Claims 1 to 8 and at least one additional component selected from the group consisting of surfactants, solid diluents and liquid diluents.

10. The composition of Claim 9 further comprising at least one additional biologically active compound or agent.

11. The composition of Claim 10 wherein the at least one additional biologically active compound or agent is selected from the group consisting of abamectin, acephate, acequinocyl, acetamiprid, acrinathrin, amidoflumet, amitraz, avermectin, azadirachtin, azinphos-methyl, bensultap, bifenthrin, bifenazate, bistrifluron, borate, buprofezin, cadusafos, carbaryl, carbofuran, cartap, carzol, chlorantraniliprole, chlorfenapyr, chlorfluazuron, chlorpyrifos, chlorpyrifos-methyl, chromafenozide, clofentezin, clothianidin, cyantraniliprole, cyflumetofen, cyfluthrin, beta-cyfluthrin, cyhalothrin, gamma-cyhalothrin, lambda-cyhalothrin, cypermethrin, alpha-cypermethrin, zeta-cypermethrin, cyromazine, deltamethrin, diafenthiuron, diazinon, dieldrin, diflubenzuron, dimefluthrin, dimehypo, dimethoate, dinotefuran, diofenolan, emamectin, endosulfan, esfenvalerate, ethiprole, etofenprox, etoxazole, fenbutatin oxide, fenothiocarb, fenoxycarb, fenpropathrin, fenvalerate, fipronil, flonicamid, flubendiamide, flucythrinate, flufenerim, flufenoxuron, fluvalinate, tau-fluvalinate, fonophos, formetanate, fosthiazate, halofenozide, hexaflumuron, hexythiazox, hydramethylnon, imidacloprid, indoxacarb, insecticidal soaps, isofenphos, lufenuron, malathion, metaflumizone, metaldehyde, methamidophos, methidathion, methiodicarb, methomyl, methoprene, methoxychlor, metofluthrin, monocrotophos, methoxyfenozide, nitenpyram, nithiazine, novaluron, noviflumuron, oxamyl, parathion, parathion-methyl, permethrin, phorate, phosalone, phosmet, phosphamidon, pirimicarb, profenofos, profluthrin, propargite, protrifenbute, pymetrozine, pyrafluprole, pyrethrin, pyridaben, pyridalyl, pyrifluquinazon, pyriprole, pyriproxyfen, rotenone, ryanodine, spinetoram, spinosad, spirodiclofen, spiromesifen, spirotetramat, sulprofos, sulfoxaflor, tebufenozide, tebufenpyrad, teflubenzuron, tefluthrin, terbufos, tetrachlorvinphos, tetramethrin, thiacloprid, thiamethoxam, thiodicarb, thiosultap-sodium, tolfenpyrad, tralomethrin, triazamate, trichlorfon, triflumuron, *Bacillus thuringiensis* delta-endotoxins, entomopathogenic bacteria, entomopathogenic viruses and entomopathogenic fungi.

12. A composition for protecting an animal from an invertebrate parasitic pest comprising a parasiticidally effective amount of a compound of any of Claims 1 to 8 and at least one carrier.

13. A non-therapeutic method for controlling an invertebrate pest comprising contacting the invertebrate pest or its environment with a biologically effective amount of a compound of any of Claims 1 to 8.

14. A treated seed comprising a compound of any of Claims 1 to 8 in an amount of from about 0.0001 to 1 % by weight of the seed before treatment.