Title: BENZOXAZOLE DERIVATIVES AND THEIR USE AS PESTICIDES

(57) Abstract: A compound of formula (I) wherein B is N, N-oxide or CR; D is O, S, NR, CR=CR, CR=CR, N=CR, CR=H, N=CR=NO) or N(O)=CR; E is N, N-oxide or CR; W is CR or N; X is N or CR with the proviso that the ring containing the D, E, X and W contains at least one atom that is other than a carbon atom and the ring containing the D, E, W and X may contain no more than 3 heteroatoms; M is NR; Z is O, S or NR; and A and the various R groups are defined organic radicals; their preparation and use and compositions containing them.
For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.
The present invention relates to azole and azine derivatives, to processes for preparing them, to fungicidal, insecticidal, acaricidal, mollusccidal and nematicidal compositions comprising them, to methods of using them to combat fungal diseases (especially fungal diseases of plants) and to methods of using them to combat and control insect, acarine, mollusc and nematode pests.


The present invention provides a compound of formula (I):

![Chemical Structure](image)

wherein

A is optionally substituted C\textsubscript{1-6} alkylene, optionally substituted C\textsubscript{2-6} alkenylene, optionally substituted C\textsubscript{2-6} alkynylene, optionally substituted cycloalkylene, optionally substituted C\textsubscript{1-6} alkylenooxy, optionally substituted oxy(C\textsubscript{1-6})alkylene, optionally substituted C\textsubscript{1-6} alkenenethio, optionally substituted thio(C\textsubscript{1-6})alkylene, optionally substituted C\textsubscript{1-6} alkyleneamino, optionally substituted amino(C\textsubscript{1-6})alkylene, optionally substituted [C\textsubscript{1-6} alkyleneoxy(C\textsubscript{1-6})alkylene], optionally substituted [C\textsubscript{1-6} alkenenethio(C\textsubscript{1-6})alkylene], optionally substituted [C\textsubscript{1-6} alkenesulfanyl(C\textsubscript{1-6})alkylene], optionally substituted [C\textsubscript{1-6} alkenylamine(C\textsubscript{1-6})alkylene];

B is N, N-oxide or CR\textsuperscript{19};

D is O, S, NR\textsuperscript{7}, CR\textsuperscript{8}=CR\textsuperscript{8}, CR\textsuperscript{8}=N, N=CR\textsuperscript{8}, CR\textsuperscript{8}=N(O) or N(O)=CR\textsuperscript{9};

E is N, N-oxide or CR\textsuperscript{12};

W is CR\textsuperscript{1} or N;

X is N or CR\textsuperscript{11} and R\textsuperscript{11} is hydrogen, optionally substituted C\textsubscript{1-6} alkyl or optionally substituted phenyl, with the proviso that the ring containing D, E, X and W contains at least one atom that is other than a carbon atom;

M is NR\textsuperscript{56};
Z is O, S or NR;

R is hydrogen, halogen, optionally substituted C alkyl, optionally substituted C alkenyl, optionally substituted C alkynyl, optionally substituted C alkoxy, optionally substituted C alkylthio, optionally substituted C cycloalkyl, cyano, nitro or SF;

R is hydrogen or optionally substituted C alkyl;

R is hydrogen, optionally substituted C alkyl, optionally substituted C alkyl(Calkyl), optionally substituted C alkynl(Calkyl), optionally substituted C cycloalkyl, optionally substituted C alkylcarbonyl, optionally substituted C alkoxycarbonyl, formyl, optionally substituted C alkylaminocarbonyl, optionally substituted di(Calkyl)alkylaminocarbonyl, optionally substituted phenoxy carbonyl, optionally substituted C alkylthio, optionally substituted C alkylsulfanyl, optionally substituted C alkylsulfonyl, optionally substituted C arylthio, optionally substituted C arylsulfanyl, optionally substituted C arylsulfonyl or RRS;

R, R and R are, independently, hydrogen, halogen, optionally substituted C alkyl, optionally substituted C alkoxy, optionally substituted C alkylthio, optionally substituted C alkylsulfanyl, optionally substituted C alkylsulfonyl, cyano, nitro, optionally substituted C alkylcarbonyl, optionally substituted C alkoxycarbonyl or SF;

R is hydrogen, halogen, cyano, optionally substituted C alkyl, optionally substituted C alkenyl, optionally substituted C alkynyl, optionally substituted C cycloalkyl, optionally substituted C cycloalkenyl, formyl, optionally substituted C alkoxycarbonyl, optionally substituted C alkylcarbonyl, aminocarbonyl, optionally substituted C alkylaminocarbonyl, optionally substituted di(Calkyl)alkylaminocarbonyl, optionally substituted aryloxycarbonyl, optionally substituted arylcarbonyl, optionally substituted arylaminocarbonyl, optionally substituted N-alkyl-N-arylaminocarbonyl, optionally substituted diarylaminocarbonyl, optionally substituted heteroaryloxycarbonyl, optionally substituted heteroarylcarbonyl, optionally substituted heteroarylaminocarbonyl, optionally substituted N-alkyl-N-heteroarylaminocarbonyl, optionally substituted diheteroarylaminocarbonyl, optionally substituted phenyl, optionally substituted heteroaryl, optionally substituted heterocyclyl, HS, optionally substituted C alkylthio, optionally substituted C alkylsulfanyl, optionally substituted C alkylsulfonyl, optionally
substituted arylthio, optionally substituted arylsulfinyl, optionally substituted arylsulfonyl, 
R^{29}O, R^{29}R^{29}N or R^{30}ON=C(R^{27});

R^8 and R^9 are, independently, hydrogen, halogen, cyano, nitro, optionally substituted 
C_{1-6} alkyl, optionally substituted C_{2-6} alkenyl, optionally substituted C_{2-6} alkynyl or
5 optionally substituted C_{1-6} alkoxy;

R^{12} is hydrogen, halogen, optionally substituted C_{1-6} alkyl, optionally substituted C_{2-6} 
alkenyl, optionally substituted C_{2-6} alkynyl, optionally substituted C_{1-6} alkoxy, optionally 
substituted C_{1-6} alkylthio, optionally substituted C_{1-6} alkylsulfinyl, optionally substituted C_{1-6} 
alkylsulfonyl, cyano, nitro, formyl, optionally substituted C_{1-6} alkylcarbonyl, optionally 
10 substituted C_{1-6} alkoxy carbonyl, SF_5, R^{32}ON=C(R^{29}), or R^1 and R^{12} together with the atoms to 
which they are attached may be joined to form a five, six or seven-membered saturated or 
unsaturated, carbocyclic or heterocyclic ring which may contain one or two heteroatoms 
selected from O, N or S and which may be optionally substituted by C_{1-6} alkyl, C_{1-6} haloalkyl 
or halogen;

R^{14} is hydrogen, cyano, optionally substituted C_{1-8} alkyl, optionally substituted [C_{2-6} 
alkenyl(C_{1-6})alkyl], optionally substituted [C_{2-6} alkynyl(C_{1-6})alkyl], optionally substituted C_{3-7} 
cycloalkyl, optionally substituted [C_{3-7} cycloalkyl(C_{1-6})alkyl], C_{1-6} alkoxy(C_{1-6})alkyl, 
optionally substituted C_{1-6} alkoxy carbonyl, optionally substituted C_{1-6} alkyl carbonyl, 
optionally substituted C_{1-6} alkylaminocarbonyl, optionally substituted di(C_{1-6})alkylaminocar- 
20 bonyl, optionally substituted phenyl, optionally substituted heteroaryl, optionally 
substituted alkylsulfonyl or optionally substituted arylsulfonyl;

R^{18} is hydrogen, halogen, nitro, cyano, optionally substituted C_{1-8} alkyl, optionally 
substituted C_{2-6} alkenyl, optionally substituted C_{2-6} alkynyl, optionally substituted C_{3-7} 
cycloalkyl, optionally substituted C_{1-6} alkoxy carbonyl, optionally substituted C_{1-6} 
alkyl carboxyln, optionally substituted C_{1-6} alkylaminocarbonyl, optionally substituted di(C_{1-6} 
alkylaminocarbonyl, optionally substituted phenyl or optionally substituted heteroaryl;

30 R^{20} and R^{31} are, independently, optionally substituted C_{1-6} alkyl or R^{30} and R^{31} together 
with the N atom to which they are attached form a five, six or seven-membered heterocyclic 
ring which may contain one or two further hetero atoms selected from O, N or S and which 
may be optionally substituted by one or two C_{1-6} alkyl groups;
R^{26} is hydrogen, optionally substituted C_{1-20} alkyl, optionally substituted [C_{2-20} alkenyl(C_{1-6})alkyl], optionally substituted [C_{2-20} alkynyl(C_{1-6})alkyl], optionally substituted C_{3-7} cycloalkyl, optionally substituted aryl, optionally substituted heteroaryl, optionally substituted [heterocycl(C_{1-6})alkylCH=NH] or di(C_{1-6})alkylC=NH;

R^{28} and R^{29} are, independently, hydrogen, optionally substituted C_{1-20} alkyl, optionally substituted C_{3,7} cycloalkyl, optionally substituted [C_{2-20} alkenyl(C_{1-6})alkyl], optionally substituted [C_{2-20} alkynyl(C_{1-6})alkyl], optionally substituted C_{1-20} alkoxy-carbonyl, optionally substituted phenoxy-carbonyl, formyl, optionally substituted C_{1-20} alkylcarbonyl, optionally substituted C_{1-20} alkylsulfonyl or optionally substituted phenylsulfonyl; or R^{28} and R^{29} together with the N atom to which they are attached form a five, six or seven-membered heterocyclic ring which may contain one or two further hetero atoms selected from O, N or S and which may be optionally substituted by one or two C_{1-6} alkyl groups;

R^{27} and R^{30} are independently hydrogen, optionally substituted phenyl or optionally substituted C_{1-6} alkyl; and R^{31} and R^{32} are, independently, hydrogen, optionally substituted phenyl (C_{1-6})alkyl or optionally substituted C_{1-20} alkyl provided that when E is N, W is CH, X is N, D is CR_{E}=CR_{D}, R^{3} is CH_{3}, CH_{2}C_{1-3} alkyl or CH_{2}C_{1-3} alkoxy and R^{9} is H, halo, CN, C_{1-6} alkyl or C_{1-6} alkoxy then R^{36} cannot be H, formyl, C_{1-6} alkyl, C_{2-6} alkoxy-carbonyl or C_{2-6} alkoxy-carbonyl and further provided that when E is N, W is CH, C-C_{1-6} alkyl, C-C_{1-6} alkoxy or C-C_{1-6} alkythio, X is N and D is CR_{E}=CR_{D} then B is not CR_{18}.

The ring containing D, E W and X may contain no more than 3 heteroatoms.

The compounds of formula (I) may exist in different geometric or optical isomers or tautomeric forms. This invention covers all such isomers and tautomers and mixtures thereof in all proportions as well as isotopic forms such as deuterated compounds.

When present, optional substituents on alkylene, alkenylene or alkynylene moieties include, subject to valency constraints, one or more of hydroxy, halogen, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} cyanoalkyl, C_{1-6} alkoxy(C_{1-6})alkyl, C_{1-6} alkoxy, cyano, =CR_{34}^{35}; R^{34} and R^{35} are, independently, hydrogen, C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} haloalkyl, cyano, C_{1-6} alkoxy-carbonyl, C_{1-6} alkylcarbonyl or R^{39}R^{40}N; R^{39} and R^{40} are, independently, hydrogen, C_{1-8} alkyl, C_{3-7} cycloalkyl, C_{2-6} alkenyl(C_{1-6})alkyl, C_{2-6} alkenyl(C_{1-6})alkyl, C_{2-6} haloalkyl, C_{1-6} alkoxy(C_{1-6})alkyl, C_{1-6} alkoxy-carbonyl(C_{1-6})alkyl, carboxy(C_{1-6})alkyl, phenyl(C_{1-2})alkyl, or R^{39} and R^{40} together with the N atom to which they are attached form a five, six or seven-
membered heterocyclic ring which may contain one or two further hetero atoms selected from O, N or S and which may be optionally substituted by one or two C<sub>1-6</sub> alkyl groups.

A further group of optional substituents on alkyne, alkenylene or alkynylene moieties include, subject to valency constraints, one or more of halogen, C<sub>1-6</sub> alkyl, C<sub>1-6</sub> haloalkyl, C<sub>1-6</sub> cyanoalkyl, C<sub>1-6</sub> alkoxycarbonylalkyl, C<sub>1-6</sub> alkoxy(C<sub>1-6</sub>)alkyl, C<sub>1-6</sub> alkoxy, cyano, =O, =NR<sup>33</sup> and =CR<sup>34</sup>R<sup>35</sup>, wherein R<sup>33</sup> is C<sub>1-6</sub> alkyl, C<sub>1-6</sub> haloalkyl, OR<sup>36</sup> or R<sup>37</sup>R<sup>38</sup>N; where R<sup>34</sup> and R<sup>35</sup> are, independently, hydrogen, C<sub>1-6</sub> alkyl, C<sub>1-6</sub> alkoxy, C<sub>1-6</sub> haloalkyl, cyano, C<sub>1-6</sub> alkoxyalkyl, C<sub>1-6</sub> alkylcarbonyl or R<sup>39</sup>R<sup>40</sup>N; R<sup>36</sup> is C<sub>1-6</sub> alkyl, C<sub>1-6</sub> haloalkyl or phenyl(C<sub>1-2</sub>)alkyl; R<sup>37</sup> and R<sup>38</sup> are, independently, hydrogen, C<sub>1-6</sub> alkyl, C<sub>3-7</sub> cycloalkyl, C<sub>2-6</sub> alkenyl(C<sub>1-6</sub>)alkyl, C<sub>2-6</sub> haloalkyl, C<sub>1-6</sub> alkoxy(C<sub>1-6</sub>)alkyl, C<sub>1-6</sub> alkoxyalkyl, C<sub>1-6</sub> alkoxyalkyl or phenyl(C<sub>1-2</sub>)alkyl or R<sup>27</sup> and R<sup>28</sup> together with the N atom to which they are attached form a five, six or seven-membered heterocyclic ring which may contain one or two further hetero atoms selected from O, N or S and which may be optionally substituted by one or two C<sub>1-6</sub> alkyl groups; R<sup>39</sup> and R<sup>40</sup> are, independently, hydrogen, C<sub>1-6</sub> alkyl, C<sub>3-7</sub> cycloalkyl, C<sub>2-6</sub> alkenyl(C<sub>1-6</sub>)alkyl, C<sub>2-6</sub> alkynyl(C<sub>1-6</sub>)alkyl, C<sub>2-6</sub> haloalkyl, C<sub>1-6</sub> alkoxy(C<sub>1-6</sub>)alkyl, C<sub>1-6</sub> alkoxyalkyl, C<sub>1-6</sub> alkoxyalkyl or phenyl(C<sub>1-2</sub>)alkyl; or R<sup>27</sup> and R<sup>28</sup> together with the N atom to which they are attached form a five, six or seven-membered heterocyclic ring which may contain one or two further hetero atoms selected from O, N or S and which may be optionally substituted by one or two C<sub>1-6</sub> alkyl groups.

Each alkyl moiety is a straight or branched chain and is, for example, methyl, ethyl, n-propyl, n-butyl, n-pentyl, n-hexyl, iso-propyl, n-butyl, sec-butyl, iso-butyl, tert-butyl or neo-pentyl.

When present, the optional substituents on alkyl include one or more of halogen, nitro, cyano, NCS-, C<sub>3-7</sub> cycloalkyl (which itself may be optionally substituted with C<sub>1-6</sub> alkyl or halogen), C<sub>3-7</sub> cycloalkenyl (which itself may be optionally substituted with C<sub>1-6</sub> alkyl or halogen), hydroxy, C<sub>1-10</sub> alkoxy, C<sub>1-10</sub> alkoxy(C<sub>1-10</sub>)alkoxy, tri(C<sub>1-4</sub>)alkylsilyl(C<sub>1-6</sub>)alkoxy, C<sub>1-6</sub> alkoxyalkyl(C<sub>1-6</sub>)alkoxy, C<sub>1-10</sub> haloalkoxy, C<sub>1-10</sub> deuteralkoxy, arylo(C<sub>1-4</sub>)alkoxy (where the aryl group may be further optionally substituted), C<sub>2-5</sub> cycloalkyloxy (where the cycloalkyl group may be optionally substituted with C<sub>1-6</sub> alkyl or halogen), C<sub>1-10</sub> alkenyloxy, C<sub>1-10</sub> alkynyloxy, SH, C<sub>1-10</sub> alkylthio, C<sub>1-10</sub> haloalkylthio, aryl(C<sub>1-4</sub>)alkylthio (where the aryl group may be further optionally substituted), C<sub>3-7</sub> cycloalkylthio (where the cycloalkyl group
may be optionally substituted with $C_{1-6}$ alkyl or halogen, tri($C_{1-4}$)alkylsilyl($C_{1-6}$)alkylthio, arythio (where the aryl group may be further optionally substituted), $C_{1-6}$ alkylsulfonfyl, $C_{1-6}$ haloalkylsulfonfyl, $C_{1-6}$ alkylsulfenyl, $C_{1-6}$ haloalkylsulfenyl, arylsulfonfyl (where the aryl group may be further optionally substituted), tri($C_{1-4}$)alkylsilyl, aryldi($C_{1-4}$)alkylsilyl, ($C_{1-4}$)alkyldiarylsilyl, triarylsilyl, $C_{1-10}$ alkylcarboxyl, $HO_2C$, $C_{1-10}$ alkoxy carbonyl, aminocarbonyl, $C_{1-6}$ alkylaminocarbonyl, di($C_{1-4}$ alkyl)aminocarbonyl, $N$-($C_{1-3}$ alkyl)-$N$-($C_{1-3}$ alkoxy)aminocarbonyl, $C_{1-6}$ alkylcarboxyloxy, arylcarboxyloxy (where the aryl group may be further optionally substituted), di($C_{1-4}$)alkylaminocarboxyloxy, aryl (which itself may be further optionally substituted), heterocyclil (which itself may be further optionally substituted with $C_{1-4}$ alkyl or halogen), aryloxy, (which itself may be further optionally substituted), heteroaryloxy, (which itself may be further optionally substituted), heterocycloxy, (which itself may be optionally substituted with $C_{1-4}$ alkyl or halogen), amino, $C_{1-6}$ alkylamino, di($C_{1-4}$)alkylamino, alkylcarbonylamino, N-alkylcarbonyl-N-alkylamino.

One group of optional preferred substituents for alkyl include one or more of halogen, nitro, cyano, $HO_2C$, $C_{1-10}$ alkoxy (itself optionally substituted by $C_{1-10}$ alkoxy), aryldi($C_{1-4}$)-alkoxy, $C_{1-10}$ alkylthio, $C_{1-10}$ alkylcarboxyl, $C_{1-10}$ alkoxy carbonyl, $C_{1-6}$ alkylaminocarbonyl, di($C_{1-4}$ alkyl)aminocarbonyl, ($C_{1-4}$)alkylcarboxyloxy, optionally substituted phenyl, heteroaryl, aryloxy, arylocarboxyloxy, heteroaryloxy, heterocyclo, heterocycloxy, $C_{3-7}$ cycloalkyl (itself optionally substituted with ($C_{1-4}$)alkyl or halogen), $C_{3-7}$ cycloalkyloxy, $C_{5-7}$ cycloalkenyl, $C_{1-8}$ alkylsulfonfyl, $C_{1-6}$ alkylsulfenyl, tri($C_{1-4}$)alkylsilyl, tri($C_{1-4}$)alkylsilyl-($C_{1-4}$)alkoxy, aryldi($C_{1-4}$)alkylsilyl, ($C_{1-4}$)alkyldiarylsilyl and triarylsilyl.

Alkenyl and alkynyl moieties can be in the form of straight or branched chains, and the alkenyl moieties, where appropriate, can be of either the (E)- or (Z)-configuration.

Examples are vinyl, allyl and propargyl. When present, the optional substituents on alkenyl or alkynyl include one or more of the substituents listed above for alkyl but especially preferred substituents are one or more of halogen, aryl and $C_{3-7}$ cycloalkyl.

In the context of this specification acyl is optionally substituted $C_{1-4}$ alkylcarboxyln (for example acetyl), optionally substituted $C_{2-4}$ alkenylcarboxyl, optionally substituted $C_{2-4}$ alkynylcarboxyl, optionally substituted arylocarbonyl (for example benzoyl) or optionally substituted heteroarylocarbonyl.
Halogen is fluorine, chlorine, bromine or iodine.

Haloalkyl groups are alkyl groups which are substituted with one or more of the same or different halogen atoms and are, for example, CF₃, CF₂Cl, CF₃CH₂ or CHF₂CH₂.

Aryl includes naphthyl, anthracyl, fluorenyl and indenyl but is preferably phenyl.

The term heteroaryl refers to an aromatic ring containing up to 10 atoms including one or more heteroatoms (preferably one or two heteroatoms) selected from O, S and N. Examples of such rings include pyridine, pyrimidine, furan, quinoline, quinazoline, pyrazole, thiophene, thiazole, oxazole and isoxazole.

The terms heterocycle and heterocyclyl refer to a non-aromatic ring containing up to 10 atoms including one or more (preferably one or two) heteroatoms selected from O, S and N. Examples of such rings include 1,3-dioxolane, tetrahydrofuran and morpholine. It is preferred that heterocyclyl is optionally substituted by C₁₋₄ alkyl.

Cycloalkyl includes cyclopropyl, cyclopentyl and cyclohexyl. The optional substituents for cycloalkyl include one or more of the substituents listed above for alkyl but especially preferred substituents are one or more of halogen, cyano and C₁₋₃ alkyl.

Cycloalkenyl includes cyclopentenyl and cyclohexenyl. The optional substituents for cycloalkenyl include one or more of the substituents listed above for alkyl but especially preferred substituents include one or more of C₁₋₃ alkyl, halogen and cyano.

Carbocyclic rings include aryl, cycloalkyl and cycloalkenyl groups.

For substituted aryl such as phenyl and heteroaryl groups the substituents are independently selected from one or more of halogen, nitro, cyano, NCS-, C₁₋₄ alkyl, C₁₋₆ haloalkyl, C₁₋₆ alkoxy(C₁₋₄)alkyl, C₂₋₆ alkenyl, C₂₋₆ haloalkenyl, C₂₋₆ alkynyl, C₃₋₇ cycloalkyl (which itself may be optionally substituted with C₁₋₄ alkyl or halogen), C₅₋₇ cycloalkenyl (which itself may be optionally substituted with C₁₋₄ alkyl or halogen), hydroxy, C₁₋₁₀ alkoxy, C₁₋₁₀ alkoxy(C₁₋₁₀)alkoxy, tri(C₁₋₄)alkylsilyl(C₁₋₄)alkoxy, C₁₋₆ alkoxy carbonyl(C₁₋₁₀)alkoxy, C₁₋₁₀ haloalkoxy, C₁₋₁₀ deuteralkoxy, aryl(C₁₋₄)alkoxy (where the aryl group may be further optionally substituted), C₃₋₇ cycloalkoxy (where the cycloalkyl group may be optionally substituted with C₁₋₆ alkyl or halogen), C₁₋₁₀ alkenyloxy, C₁₋₁₀ alkynyloxy, SH, C₁₋₁₀ alkylthio, C₁₋₁₀ haloalkylthio, aryl(C₁₋₄)alkylthio (where the aryl group may be further optionally substituted), C₃₋₇ cycloalkylthio (where the cycloalkyl group may be optionally substituted with C₁₋₆ alkyl or halogen), tri(C₁₋₄)alkylsilyl(C₁₋₆)alkylthio, arythio (where the aryl group
may be further optionally substituted), C<sub>1-6</sub> alkylsulfonyl, C<sub>1-6</sub> haloalkylsulfonyl, C<sub>1-6</sub> alkylsulfinyl, C<sub>1-6</sub> haloalkylsulfinyl, arylsulfonyl (where the aryl group may be further optionally substituted), tri(C<sub>1-4</sub>)alkylsilyl, aryl(di(C<sub>1-4</sub>)alkylsilyl, (C<sub>1-4</sub>)alkylidarylsilyl, triarylsilyl, C<sub>1-10</sub> alkylcarbonyl, HO2C, C<sub>1-10</sub> alkoxycarbonyl, aminocarbonyl, C<sub>1-6</sub> alkylaminocarbonyl, di(C<sub>1-6</sub>)alkyl)aminocarbonyl, N-(C<sub>1-3</sub> alkyl)-N-(C<sub>1-3</sub> alkoxy)aminocarbonyl, C<sub>1-6</sub> alkylcarbonyloxy, arylcarbonyloxy (where the aryl group may be further optionally substituted), di(C<sub>1-6</sub>)alkylaminocarbonyloxy, aryl (which itself may be further optionally substituted), heteroaryl (which itself may be further optionally substituted), heterocyclyl (which itself may be optionally substituted with C<sub>1-6</sub> alkyl or halogen), arylxy, (which itself may be further optionally substituted), heteroarylxy, (which itself may be further optionally substituted), heterocyclxyloxy, (which itself may be optionally substituted with C<sub>1-6</sub> alkyl or halogen), amino, C<sub>1-6</sub> alkylamino, di(C<sub>1-6</sub>)alkylamino, alkylcarbonylamino, N-alkylcarbonyl-N-alkylamino.

For substituted heterocyclyl groups the substituents include one or more of the substituents listed above for alkyl. For substituted phenyl moieties, heterocyclyl and heteroaryl groups one set of preferred substituents are independently selected from one or more of halogen, C<sub>1-6</sub> alkyl, C<sub>1-6</sub> haloalkyl, C<sub>1-6</sub> alkoxy(C<sub>1-6</sub>)alkyl, C<sub>1-6</sub> alkoxy, C<sub>1-6</sub> haloalkoxy, C<sub>1-6</sub> alkylthio, C<sub>1-6</sub> haloalkylthio, C<sub>1-6</sub> alkylsulfanyl, C<sub>1-6</sub> haloalkylsulfanyl, C<sub>1-6</sub> alkylsulfonyl, C<sub>1-6</sub> haloalkylsulfonyl, C<sub>2-6</sub> alkenyl, C<sub>2-6</sub> haloalkenyl, C<sub>2-6</sub> alkynyl, C<sub>3-7</sub> cycloalkyl, nitro, cyano, CO<sub>2</sub>H, C<sub>1-6</sub> alkylcarbonyl, C<sub>1-6</sub> alkoxy carbonyl, R<sup>41</sup>R<sup>42</sup>N or R<sup>43</sup>R<sup>44</sup>NC(O) wherein R<sup>41</sup>, R<sup>42</sup>, R<sup>43</sup> and R<sup>44</sup> are, independently, hydrogen or C<sub>1-6</sub> alkyl.

It is to be understood that dialkylamino substituents include those where the dialkyl groups together with the N atom to which they are attached form a five, six or seven-membered heterocyclic ring which may contain one or two further hetero atoms selected from O, N or S and which may be optionally substituted by one or two C<sub>1-6</sub> alkyl groups. When heterocyclic rings are formed by joining two groups on an N atom, the resulting rings are suitably pyrroldine, piperidine, thiomorpholine and morpholine each of which may be substituted by one or two (C<sub>1-6</sub>)alkyl groups.

In one particular aspect the present invention provides a compound of formula (IA) which are compounds of formula (I) where A is optionally substituted C<sub>1-6</sub> alkylene, optionally substituted C<sub>2-6</sub> alkenylene, optionally substituted C<sub>2-6</sub> alkynylene, optionally
substituted C\textsubscript{1-6} alkylenoxy, optionally substituted oxy(C\textsubscript{1-6})alkylene, optionally substituted C\textsubscript{1-6} alkylthienio, optionally substituted thio(C\textsubscript{1-6})alkylene, optionally substituted C\textsubscript{1-6}
alkylenamino, optionally substituted amino(C\textsubscript{1-6})alkylene, optionally substituted [C\textsubscript{1-6}
alkylenoxy(C\textsubscript{1-6})alkylene], optionally substituted [C\textsubscript{1-6} alkylthienio(C\textsubscript{1-6})alkylene],
optionally substituted [C\textsubscript{1-6} alkylensulfanyl(C\textsubscript{1-6})alkylene], optionally substituted [C\textsubscript{1-6}
aldehydesulfonyl(C\textsubscript{1-6})alkylene] or optionally substituted [C\textsubscript{1-6} alkyleneamino(C\textsubscript{1-6})alkylene];
B is N, N-oxide or CR\textsuperscript{12}; D is O, S, NR\textsuperscript{2}, CR\textsuperscript{8}=CR\textsuperscript{9}, CR\textsuperscript{8}=N, N=CR\textsuperscript{9}, CR\textsuperscript{8}=N(O) or
N(O)=CR\textsuperscript{3}; E is N, N-oxide or CR\textsuperscript{12}; W is CR\textsuperscript{1} or N; X is N or CR\textsuperscript{11}; R\textsuperscript{11} is hydrogen, C\textsubscript{1-6}
alkyl or phenyl with the proviso that the ring containing D, E, X and W contains at least one atom that is other than a carbon atom; M is NR\textsuperscript{56}; Z is O, S or NR\textsuperscript{44}; R\textsuperscript{1} is hydrogen, halogen,
optionally substituted C\textsubscript{1-6} alkyl, optionally substituted C\textsubscript{2-6} alkenyl, optionally substituted C\textsubscript{2-6}
alkenyl, optionally substituted C\textsubscript{1-6} alkoxy, optionally substituted C\textsubscript{1-6} alkylthio, optionally
substituted C\textsubscript{3-7} cycloalkyl, cyano, nitro or SF\textsubscript{5}; R\textsuperscript{2} is hydrogen or C\textsubscript{1-6} alkyl; R\textsuperscript{56} is hydrogen,
optionally substituted C\textsubscript{1-10} alkyl, optionally substituted [C\textsubscript{2-6} alkenyl(C\textsubscript{1-6})alkyl], optionally substituted C\textsubscript{3-7} cycloalkyl, optionally
substituted C\textsubscript{1-10} alkyllcarbonyl, optionally substituted C\textsubscript{1-10} alkoxy carbonyl, formyl,
optionally substituted C\textsubscript{1-10} alkylaminocarbonyl, optionally substituted di(C\textsubscript{1-10})alkylaminocarbonyl, optionally substituted phenoxy carbonyl, optionally substituted C\textsubscript{1-6} alkylthio,
optionally substituted C\textsubscript{1-6} alkylsulfanyl, optionally substituted C\textsubscript{1-6} alkylsulfonyle, optionally
substituted C\textsubscript{1-6} arythio, optionally substituted C\textsubscript{1-6} arylsulfanyl, optionally substituted C\textsubscript{1-6}
arlsulfonyle or R\textsuperscript{29}R\textsuperscript{21}NS; R\textsuperscript{3}, R\textsuperscript{4} and R\textsuperscript{5} are, independently, hydrogen, halogen, optionally
substituted C\textsubscript{1-6} alkyl, optionally substituted C\textsubscript{1-6} alkoxy, optionally substituted C\textsubscript{1-6} alkylthio,
optionally substituted C\textsubscript{1-6} alkylsulfanyl, optionally substituted C\textsubscript{1-6} alkylsulfonyle, cyano,
nitro, optionally substituted C\textsubscript{1-6} alkyllcarbonyl, optionally substituted C\textsubscript{1-6} alkoxy carbonyl or
SF\textsubscript{5}; R\textsuperscript{5} is hydrogen, halogen, cyano, optionally substituted C\textsubscript{1-20} alkyl, optionally substituted
C\textsubscript{2-20} alkenyl, optionally substituted C\textsubscript{2-20} alkoxy, optionally substituted C\textsubscript{3-7} cycloalkyl,
optionally substituted C\textsubscript{5-6} cycloalkenyl, formyl, optionally substituted C\textsubscript{1-20} alkylcarbonyl, optionally
substituted C\textsubscript{1-20} alkylaminocarbonyl, aminocarbonyl, optionally substituted C\textsubscript{1-20}
aldehydesulfonyl, optionally substituted di(C\textsubscript{1-20})alkylaminocarbonyl, optionally
substituted aryloxy carbonyl, optionally substituted arylcarbonyl, optionally substituted aryloxymecarbonyl, optionally substituted N-alkyl-N-arylaminocarbonyl, optionally
substituted diarylaminocarbonyl, optionally substituted heteroaryl oxycarbonyl, optionally substituted heteroaryl carbonyl, optionally substituted heteroarylaminocarbonyl, optionally substituted alkylheteroarylaminocarbonyl, optionally substituted diheteroarylaminocarbonyl, optionally substituted phenyl, optionally substituted heteroaryl, optionally substituted heterocyclyl, R^26O, HS, optionally substituted C_{1-20} alkylthio, optionally substituted C_{1-20} alkylsulfinyl, optionally substituted C_{1-20} alkylsulfonyle, optionally substituted arylthio, optionally substituted arylsulfinyl, optionally substituted arylsulfonyle, R^28R^29N or R^31ON=C(R^27); R^8 and R^9 are, independently, hydrogen, halogen, cyano, nitro, optionally substituted C_{1-6} alkyl, optionally substituted C_{2-6} alkenyl, optionally substituted C_{2-6} alkynyl or optionally substituted C_{1-6} alkoxy; R^{12} is hydrogen, halogen, optionally substituted C_{1-6} alkyl, optionally substituted C_{2-6} alkenyl, optionally substituted C_{2-6} alkynyl, optionally substituted C_{1-6} alkoxy, optionally substituted C_{1-6} alkylthio, optionally substituted C_{1-6} alkylsulfinyl, optionally substituted C_{1-6} alkylsulfonyle, cyano, nitro, formyl, R^32ON=C(R^30), optionally substituted C_{1-6} alkyllcarbonyl, optionally substituted C_{1-6} alkoxycarbonyl or SF_3; or R^1 and R^{12} together with the atoms to which they are attached may be joined to form a five, six or seven-membered saturated or unsaturated ring carbocyclic or heterocyclic ring which may contain one or two hetero atoms selected from O, N or S and which may be optionally substituted by C_{1-6} alkyl, C_{1-6} haloalkyl or halogen; R^{14} is hydrogen, cyano, optionally substituted C_{1-6} alkyl, optionally substituted [C_{2-6} alkenyl(C_{1-6})alkyl], optionally substituted [C_{2-6} alkenyl(C_{1-6})alkyl], optionally substituted C_{3-7} cycloalkyl, optionally substituted [C_{3-7} cycloalkyl(C_{1-6})alkyl], C_{1-6} alkoxy(C_{1-6})alkyl, optionally substituted C_{1-6} alkoxy carbonyl, optionally substituted C_{1-6} alkylcarbonyl, optionally substituted C_{1-6} alkyllaminocarbonyl, optionally substituted di(C_{1-6})alkylaminocarbonyl, optionally substituted phenyl, optionally substituted heteroaryl, optionally substituted alkylsulfonyle or optionally substituted arylsulfonyle; R^{18} is hydrogen, halogen, nitro, cyano, optionally substituted C_{1-6} alkyl, optionally substituted C_{2-6} alkenyl, optionally substituted C_{2-6} alkynyl, optionally substituted C_{3-7} cycloalkyl, optionally substituted C_{1-6} alkoxy carbonyl, optionally substituted C_{1-6} alkylcarbonyl, optionally substituted C_{1-6} alkyllaminocarbonyl, optionally substituted di(C_{1-6})alkylaminocarbonyl, optionally substituted phenyl or optionally substituted heteroaryl; R^{20} and R^{21} are, independently, optionally substituted C_{1-6} alkyl or R^{20} and R^{21} together with the N atom to which they are attached form a five, six or seven-
membered heterocyclic ring which may contain one or two further hetero atoms selected from O, N or S and which may be optionally substituted by one or two C\textsubscript{1-6} alkyl groups; R\textsuperscript{36} is hydrogen, optionally substituted C\textsubscript{1-20} alkyl, optionally substituted [C\textsubscript{2-20} alkenyl-(C\textsubscript{1-6})alkyl], optionally substituted [C\textsubscript{2-20} alkynyl(C\textsubscript{1-6})alkyl], optionally substituted C\textsubscript{3-7} cycloalkyl, optionally substituted aryl, optionally substituted heteroaryl, optionally substituted [heterocycl(C\textsubscript{1-6})alkylCH=N] or di(C\textsubscript{1-6})alkylC=N; R\textsuperscript{28} and R\textsuperscript{29} are, independently, hydrogen, optionally substituted C\textsubscript{1-20} alkyl, optionally substituted C\textsubscript{3-7} cycloalkyl, optionally substituted [C\textsubscript{2-20} alkenyl(C\textsubscript{1-6})alkyl], optionally substituted [C\textsubscript{2-20} alkynyl(C\textsubscript{1-6})alkyl], optionally substituted C\textsubscript{1-20} alkoxy carbonyl, optionally substituted phenoxy carbonyl, formyl, optionally substituted C\textsubscript{1-20} alky carbonyl, optionally substituted C\textsubscript{1-20} alkyl sulfonyl or optionally substituted phenyl sulfonyl; or R\textsuperscript{28} and R\textsuperscript{29} together with the N atom to which they are attached form a five, six or seven-membered heterocyclic ring which may contain one or two further hetero atoms selected from O, N or S and which may be optionally substituted by one or two C\textsubscript{1-6} alkyl groups; R\textsuperscript{37} and R\textsuperscript{30} are independently hydrogen, optionally substituted phenyl or optionally substituted C\textsubscript{1-6} alkyl; and R\textsuperscript{31} and R\textsuperscript{32} are, independently, hydrogen, optionally substituted phenyl (C\textsubscript{1-3})alkyl or optionally substituted C\textsubscript{1-20} alkyl provided that when E is N, W is CH, X is N, D is CR\textsuperscript{8} = CR\textsuperscript{8}, R\textsuperscript{8} is CH\textsubscript{3}, CH\textsubscript{2}C\textsubscript{1-3} alkyl or CH\textsubscript{2}C\textsubscript{1-3} alkoxy and R\textsuperscript{9} is H, halo, CN, C\textsubscript{1-6} alkyl or C\textsubscript{1-6} alkoxy then R\textsuperscript{56} cannot be H, formyl, C\textsubscript{1-6} alkyl, C\textsubscript{2-6} alky carbonyl or C\textsubscript{2-6} alkoxy carbonyl.

The invention also provides a compound of formula (I')

![Diagram](image)

where A, B, D, E, M, W, X, Z, R\textsuperscript{3}, R\textsuperscript{4}, R\textsuperscript{5}, and R\textsuperscript{6} have the values as defined for formula (I) above. The invention also provides a compound of formula (IA') which is a compound of formula I' wherein A, B, D, E, M, W, X, Z, R\textsuperscript{3}, R\textsuperscript{4}, R\textsuperscript{5}, and R\textsuperscript{6} have the values as defined for formula (IA) above. There is further provided a compound of formula (IB') which is a compound of formula I' wherein D is O, S or NR\textsuperscript{7} where R\textsuperscript{7} is C\textsubscript{1-6} alkyl; E is N or CR\textsuperscript{12}; W is CR\textsuperscript{1} or N; X is N or CR\textsuperscript{11}; R\textsuperscript{11} is hydrogen, C\textsubscript{1-6} alkyl or phenyl with the proviso that at least one of W and X is N; R\textsuperscript{1} is hydrogen, halogen, C\textsubscript{1-6} alkyl, C\textsubscript{2-6} alkenyl, C\textsubscript{2-6} alkynyl, C\textsubscript{1-6}}
cyanoalkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy, C_{1-6} haloalkoxy, C_{1-6} alkylthio, C_{1-6} haloalkylthio, C_{3-6} cycloalkyl, C_{3-7} cycloalkyl(C_{1-4})alkyl, C_{1-6} alkoxy(C_{1-6})alkyl, cyano, nitro or SF_5; A is C_{1-6} alkylene, C_{1-6} alkenylene, C_{1-6} alkylenoxy, oxy(C_{1-6})alkylene, C_{1-6} alkylenamino or C_{1-6} alkylenethio, each of which is optionally substituted by C_{1-3} alkyl, C_{1-3} haloalkyl, C_{1-3}

cyanoalkyl, halogen, C_{1-3} alkoxy, C_{1-4} alkoxyacarbonyl, cyano, =O, =NR^{13} or =CR^{16}R^{17}; B is N or CR^{18}; M is NR^{56}; Y is O, S or NR^{13}; Z is O, S or NR^{14}; R^{56} is hydrogen, C_{1-10} alkyl, benzylxoyxymethyl, benzoyloxymethyl, C_{1-8}alkoxy(C_{1-6})alkyl, C_{2-6} alkenyl(C_{1-6})alkyl (especially allyl), C_{2-6} alkynyl(C_{1-6})alkyl (especially propargyl), C_{1-10} alkylcarbonyl or C_{1-10} alkoxyacarbonyl (especially isobutoxycarbonyl); R^3, R^4 and R^5 are independently selected from hydrogen, halogen, C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} haloalkoxy, C_{1-6} alkylthio, C_{1-6} haloalkylthio, C_{1-6} alkenylsulfinyl, C_{1-4} haloalkylsulfinyl, C_{1-4} alkenylsulfonyl, C_{1-6} haloalkylsulfonyl, C_{1-6} haloalkyl, cyano, nitro, C_{1-6} alkylenecarbonyl, C_{1-6} alkoxyacarbonyl or SF_5; R^6 is cyano, C_{1-8} alkyl, C_{1-6} haloalkyl, C_{1-6} cyanoalkyl, C_{2-6} alkenyl, C_{2-6} alkenyl, C_{1-7} cycloalkyl, C_{3-7} halocycloalkyl, C_{3-7} cyano cycloalkyl, C_{1-13} alkyl(C_{3-7})cycloalkyl, C_{1-3}

alkyl(C_{3-7})halocycloalkyl, C_{5-6} cycloalkenyl, C_{3-7} cycloalkyl(C_{1-6})alkyl, C_{1-5}
cycloalkenyl(C_{1-6})alkyl, C_{2-6} haloalkeny, C_{1-6} cyanoalkeny, C_{1-6} alkoxy(C_{1-6})alkyl, C_{3-6} alkenyloxy(C_{1-6})alkyl, C_{3-6} alkynlyloxy(C_{1-6})alkyl, aryloxy(C_{1-6})alkyl, formyl, C_{1-6} carboxylkyl, C_{1-6} alkylenecarbonyl(C_{1-6})alkyl, C_{2-6} alkenylcarbonyl(C_{1-6})alkyl, C_{1-6} alkylcarbonyl(C_{1-6})alkyl, C_{1-6} alkoxyacarbonyl(C_{1-6})alkyl, C_{1-6} alkenylcarbonyl(C_{1-6})alkyl, C_{1-6} alkylcarbonyl(C_{1-6})alkyl, C_{3-6} alkenylloxycarbonyl(C_{1-6})alkyl, C_{3-6} alkenylsulfinyl(C_{1-6})alkyl, C_{1-6} alkenylsulfonyl(C_{1-6})alkyl, aminocarbonyl(C_{2-6})alkeny, amino carbonyl(C_{2-6})alkynyl, C_{1-6} alkylaminocarbonyl(C_{1-6})alkyl, aminocarbonyl(C_{2-6})alkenyl, amino carbonyl(C_{2-6})alkynyl, C_{1-6} alkylaminocarbonyl(C_{1-6})alkyl, di(C_{1-6})alkylaminocarbonyl(C_{1-6})alkynyl, C_{1-6} alkylaminocarbonyl(C_{1-6})alkenyl, di(C_{1-6})alkylaminocarbonyl(C_{1-6})alkynyl, C_{1-6} alkylaminocarbonyl(C_{1-6})alkynyl, C_{1-6} alkylaminocarbonyl(C_{1-6})alkenyl, C_{1-6} alkylaminocarbonyl(C_{1-6})alkenyl, di(C_{1-6})alkylaminocarbonyl(C_{1-6})alkenyl, di(C_{1-6})alkylaminocarbonyl(C_{1-6})alkenyl, C_{1-6} alkylaminocarbonyl(C_{1-6})alkenyl, C_{1-6} alkoxyacarbonyl, C_{1-6} alkylenecarbonyl, aminocarbonyl, C_{1-6} alkylenaminocarbonyl, di(C_{1-6})alkylaminocarbonyl, phenyl (optionally substituted by halo, nitro, cyano, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy or C_{1-6} haloalkoxy), phenyl(C_{1-6})alkyl (wherein the phenyl group is optionally substituted by halo, nitro, cyano, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy or C_{1-6} haloalkoxy), phenyl(C_{2-6})alkeny, (wherein the phenyl group is optionally substituted by halo, nitro, cyano, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy or C_{1-6} haloalkoxy), heteroaryl (optionally substituted by halo, nitro, cyano, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy or C_{1-6} haloalkoxy),
C_{1-6} alkoxy or C_{1-6} haloalkoxy), heterocyclyl (optionall substituted by halo, nitro, cyano, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy or C_{1-6} haloalkoxy), heteroaryl(C_{1-6})alkyl (where the heteroaryl may be substituted by halo, nitro, cyano, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy or C_{1-6} haloalkoxy), heterocyclyl(C_{1-6})alkyl (where the heterocyclyl may be substituted by halo, cyano, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy or C_{1-6} haloalkoxy), R^{26}O, C_{1-6} alkylthio, R^{28}R^{29}N or R^{31}ON=C(R^{27}); R^8 and R^9 are, independently, hydrogen, halogen, C_{1-6} alkyl, C_{1-6} haloalkyl C_{2-6} alkenyl, C_{1-6} alkynyl, C_{1-6} alkoxy or C_{1-6} haloalkoxy; R^{12} is hydrogen, halogen, C_{1-6} alkyl, C_{2-6} alkenyl, C_{1-6} alkynyl, C_{1-6} haloalkyl, C_{1-6} alkoxy, C_{1-6} alkoxy(C_{1-6})alkyl, C_{1-6} haloalkoxy, C_{1-6} alkylthio, C_{1-6} haloalkylthio, C_{1-6} alkylsulfanyl, C_{1-6} haloalkylsulfanyl, C_{1-6} alkylsulfonyl, C_{1-6} haloalkylsulfonyl, C_{1-6} haloalkyl, cyano, nitro, formyl, CH=NOR^{32}, C_{1-6} alkylcarbonyl, C_{1-6} alkoxy carbonyl or SF_{5}; or together R^1 and R^{12} together with the atoms to which they are attached may be joined to form a five, six or seven-membered saturated or unsaturated ring carbocyclic or heterocyclic ring which may contain one or two hetero atoms selected from O, N or S and which may be optionally substituted by C_{1-6} alkyl, C_{1-6} haloalkyl or halogen; R^{14} is hydrogen, C_{1-4} alkyl, C_{1-6} haloalkyl, C_{1-6} cyanoalkyl, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{3-7} cycloalkyl, C_{2-6} haloalkenyl, C_{3-7} cycloalkyl(C_{1-6})alkyl, C_{1-6} alkoxy(C_{1-6})alkyl, C_{1-6} alkoxy carbonyl, C_{1-6} alkylcarbonyl, C_{1-6} alkylaminocarbonyl, di(C_{1-6})alkylaminocarbonyl, phenyl (optionally substituted by halo, nitro, cyano, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy or C_{1-6} haloalkoxy) or heteroaryl (optionally substituted by halo, nitro, cyano, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy or C_{1-6} haloalkoxy); R^{15} is C_{1-6} alkyl, OR^{22} or NR^{25}R^{24}; R^{16} is hydrogen, C_{1-4} alkyl or C_{1-6} haloalkyl; R^{17} is hydrogen, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy, cyano, C_{1-6} alkoxy carbonyl, C_{1-6} alkylcarbonyl or NR^{48}R^{48}; R^{18} is hydrogen, halogen, nitro, cyano, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} cyanoalkyl, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{3-7} cycloalkyl, C_{2-6} haloalkenyl, C_{3-7} cycloalkyl(C_{1-6})alkyl, C_{1-6} alkoxy(C_{1-6})alkyl, C_{1-6} alkoxy carbonyl, C_{1-6} alkylcarbonyl, C_{1-6} alkylaminocarbonyl, di(C_{1-6})alkylaminocarbonyl, C_{1-6} alkoxy carbonyl(C_{1-6})alkyl, C_{1-6} alkylcarbonyl(C_{1-6})alkyl, C_{1-6} alkylaminocarbonyl(C_{1-6})alkyl, di(C_{1-6})alkylaminocarbonyl(C_{1-6})alkyl, phenyl (optionally substituted by halo, nitro, cyano, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy or C_{1-6} haloalkoxy), phenyl(C_{1-6})alkyl (wherein the phenyl group is optionally substituted by halo, nitro, cyano, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy or C_{1-6} haloalkoxy), heteroaryl (optionally substituted by halo, nitro, cyano, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy or C_{1-6} haloalkoxy) or heteroaryl(C_{1-6})alkyl (wherein the heteroaryl group is optionally
substituted by halo, nitro, cyano, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy or C_{1-6} haloalkoxy); R^{20} and R^{21} are, independently, hydrogen, C_{1-6} alkyl, CH_{2}(C_{1-6} haloalkyl), C_{1-6} cyanoalkyl, C_{1-6} alkoxy(C_{1-6} alkyl, C_{1-6} alkylthio(C_{1-6} alkyl, C_{1-6} alkoxy(C_{1-6} alkoxy(C_{1-6} alkyl, phenyl(C_{1-6} alkoxy(C_{1-6} alkyl (wherein the phenyl group is optionally substituted by halo, nitro, cyano, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy or C_{1-6} haloalkoxy), heteroaryl(C_{1-6} alkyl (wherein the heteroaryl group is optionally substituted by halo, nitro, cyano, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy or C_{1-6} haloalkoxy), heterocyclyl(C_{1-6} alkyl (wherein the heterocyclyl group is optionally substituted by halo, nitro, cyano, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy or C_{1-6} haloalkoxy), or R^{20} and R^{21} together with the N atom to which they are attached form a five, six or seven-membered heterocyclic ring which may contain one or two further hetero atoms selected from O, N or S and which may be optionally substituted by one or two C_{1-6} alkyl groups; R^{22} is C_{1-6} alkyl or optionally substituted phenyl(C_{1-6} alkyl; R^{23} and R^{24} are, independently, hydrogen, C_{1-6} alkyl or phenyl (optionally substituted by halo, nitro, cyano, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy or C_{1-6} haloalkoxy); R^{26} is hydrogen, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} cyanoalkyl, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{1-6} alkoxy(C_{1-6} alkyl, phenyl(C_{1-6} alkyl, (wherein the phenyl group is optionally substituted by halo, nitro, cyano, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy or C_{1-6} haloalkoxy), heteroaryl(C_{1-6} alkyl (wherein the heteroaryl group is optionally substituted by halo, nitro, cyano, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy or C_{1-6} haloalkoxy), heterocyclyl (optionally substituted by halo, nitro, cyano, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy or C_{1-6} haloalkoxy), heterocyclyl(C_{1-6} alkyl (wherein the heterocyclyl group is optionally substituted by halo, nitro, cyano, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy or C_{1-6} haloalkoxy), C_{1-6} alkoxy(carbonyl(C_{1-6} alkyl or N=C(CH_{3})_{2}; R^{27} is C_{1-6} alkyl, C_{1-6} haloalkyl or phenyl (optionally substituted by halo, nitro, cyano, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy or C_{1-6} haloalkoxy), R^{28} and R^{29} are, independently, hydrogen, C_{1-8} alkyl, C_{3-7} cycloalkyl, C_{3-6} alkenyl, C_{3-6} alkynyl, C_{3-7} cycloalkyl(C_{1-6} alkyl, C_{2-6} haloalkyl, C_{1-6} alkoxy(C_{1-6} alkyl, C_{1-6} alkoxy(C_{1-6} alkyl, or R^{28} and R^{29} together with the N atom to which they are attached form a five, six or seven-membered heterocyclic ring which may contain one or two further hetero atoms selected from O, N or S and which may be optionally substituted by one or two C_{1-6} alkyl groups; R^{30} is hydrogen or C_{1-3} alkyl; R^{31} and R^{32} are, independently, C_{1-6} alkyl or phenyl(C_{1-6} alkyl (wherein the phenyl group is optionally substituted by halo, nitro, cyano, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy or C_{1-6} haloalkoxy); and R^{36} and R^{37} are, independently,
hydrogen, C_{1-8} alkyl, C_{3-7} cycloalkyl, C_{3-6} alkenyl, C_{3-6} alkynyl, C_{2-6} haloalkyl, C_{1-6} alkoxy(C_{1-6})alkyl, C_{1-6} alkoxycarbonyl(C_{1-6})alkyl, carboxy(C_{1-6})alkyl or phenyl(C_{1-2})alkyl; or R^{46} and R^{47} together with the N atom to which they are attached form a five, six or seven-membered heterocyclic ring which may contain one or two further hetero atoms selected from O, N or S and which may be optionally substituted by one or two C_{1-6} alkyl groups.

Preferably A is C_{1-4} alkylene (optionally substituted by halogen, C_{1-3} alkyl, C_{1-3} haloalkyl, C_{1-3} cyanoalkyl, C_{1-6} alkoxy(carbonyl), or C_{1-6} alkyleneoxy.

More preferably A is C_{1-4} alkylene (optionally substituted by C_{1-3} alkyl), or C_{1-4} alkyleneoxy.

Even more preferably A is CH_{2}, CH(CH_{3}) or CH_{2}O.

Most preferably A is CH_{2} or CH(CH_{3}).

Preferably Z is O or S, more preferably O.

Preferably B is N.

Preferred values for D are CR^{5}=N, S or NR^{7} where R^{7} is C_{1-6} alkyl (more preferably C_{1-3} alkyl) and R^{8} is H, halogen or C_{1-3} alkyl.

Most preferably D is CR^{5}=N or S where R^{8} is H, halogen or C_{1-3} alkyl.

Preferably E is N or CR^{12} where R^{12} is hydrogen, halogen, C_{1-6} alkyl, C_{1-4} haloalkyl, C_{1-6} alkoxy, C_{1-6} haloalkoxy, C_{1-6} alkoxy(C_{1-6})alkyl, C_{1-4} alkylthio or SF_{5} or R^{1} and R^{12} together with the atoms to which they are attached form a benzene, cyclopentane or isoxazole ring optionally substituted by C_{1-6} alkyl C_{1-6} haloalkyl or halogen.

It is more preferred that E is N or CR^{12} where R^{12} is hydrogen, halogen, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy(C_{1-6})alkyl, C_{1-6} alkoxy, C_{1-6} haloalkoxy, or R^{1} and R^{12} together with the atoms to which they are attached form a cyclopentane or isoxazole ring optionally substituted by C_{1-6} alkyl, C_{1-6} haloalkyl or halogen.

W is preferably N or CR^{1}.

It is preferred that X is N or CR^{11} where R^{11} is hydrogen or C_{1-4} alkyl.

X is preferably N or CR^{11} where R^{11} is hydrogen, C_{1-4} alkyl or phenyl and more preferably X is N.

Preferably R^{56} is hydrogen, C_{1-4} alkyl, C_{1-4} alkylcarbonyloxy(C_{1-6})alkyl, benzoyloxymethyl (where the phenyl ring may be optionally substituted with halogen or C_{1-4} alkyl), C_{1-6} alkoxy(C_{1-6})alkyl (with the alkyl group optionally substituted by aryl or C_{1-4}...
alkoxycarbonyl), C₂₋₆ alkenyloxy(C₁₋₄)alkyl, C₂₋₆ alkynlyloxy(C₁₋₄)alkyl, benzyl oxy(C₁₋₄)alkyl (where the phenyl ring may be optionally substituted with halogen or C₁₋₄ alkyl), C₃₋₇ cycloalkyl(C₁₋₄)alkyl, heteroaryl(C₁₋₃)alkyl (with the heteroaryl group optionally substituted with halogen), tri(C₁₋₄)alkylsilyl(C₁₋₆)alkyl, C₂₋₆ alkenyl(C₁₋₄)alkyl (especially allyl), C₂₋₆ haloalkeny(C₁₋₄)alkyl, C₁₋₄ alkoxy carbonyl(C₂₋₆)alkenyl(C₁₋₄)alkyl, C₂₋₆ alkynyl(C₁₋₄)alkyl, tri(C₁₋₄)alkylsilyl(C₂₋₆)alkynyl(C₁₋₄)alkyl, C₁₋₁₀ alkylicarbonyl, C₁₋₁₀ alkoxy carbonyl, formyl, C₁₋₁₀ alkylicaminocarbonyl, di(C₁₋₁₀)alkylicaminocarbonyl, phenoxy carbonyl, C₁₋₆ alkylsulfonyl or C₁₋₆ arylsulfonyl.

More preferably R⁵⁶ is hydrogen, C₁₋₆ alkyl, C₁₋₆ alkylicarbonyloxymethyl,
benzoyloxymethyl (where the phenyl ring may be optionally substituted with halogen or C₁₋₄ alkyl), C₁₋₆ alkoxy methyl, C₂₋₆ alkenyloxymethyl, C₂₋₆ alkynlyloxymethyl, benzyl oxymethyl (where the phenyl ring may be optionally substituted with halogen or C₁₋₄ alkyl), C₂₋₆ alkynyl(C₁₋₄)alkyl (especially propargyl), C₁₋₁₀ alkylicarbonyl, C₁₋₁₀ alkoxy carbonyl, C₁₋₁₀ alkylicaminocarbonyl, di(C₁₋₁₀)alkylicaminocarbonyl, phenoxy carbonyl, C₁₋₆ alkylsulfonyl or C₁₋₆ arylsulfonyl.

Even more preferably R⁵⁶ is hydrogen, C₁₋₆ alkyl, C₁₋₆ alkoxy (C₁₋₄)alkyl, benzoyloxymethyl or benzoyloxymethyl or alternatively C₁₋₆ alkylicarbonyloxymethyl, C₁₋₆ alkoxy methyl or C₁₋₁₀ alkylicarbonyl.

R⁵⁶ is most preferably hydrogen, C₁₋₆ alkyl, C₁₋₆ alkylicarbonyloxymethyl, C₁₋₆ alkoxy methyl or C₁₋₁₀ alkylicarbonyl.

R¹ is preferably hydrogen, halogen, C₁₋₆ alkyl, C₂₋₆ alkenyl, C₂₋₆ alkynyl, C₁₋₆ haloalkyl, C₁₋₄ alkoxy(C₁₋₄)alkyl, C₂₋₇ cycloalkyl(C₁₋₄)alkyl, C₁₋₆ cyanoalkyl, C₁₋₆ alkoxy, C₁₋₆ haloalkoxy, C₁₋₆ alkythio, C₁₋₆ haloalkythio, C₁₋₆ cycloalkyl, cyano, nitro or SF₅.

More preferably R¹ is hydrogen, halogen, C₁₋₆ alkyl, C₂₋₆ alkenyl, C₁₋₆ haloalkyl, C₁₋₆ alkoxy, C₁₋₆ haloalkoxy, C₁₋₆ alkythio, C₁₋₆ haloalkythio, C₁₋₆ cycloalkyl, cyano, nitro or SF₅.

Even more preferably R¹ is hydrogen, halogen, C₁₋₆ alkyl, C₂₋₆ alkenyl, C₁₋₆ haloalkyl, C₁₋₆ alkoxy, C₁₋₆ haloalkoxy, C₁₋₆ alkythio, C₁₋₆ haloalkythio, C₁₋₆ cycloalkyl, C₁₋₆ alkoxy(C₁₋₆)alkyl, cyano or nitro.

Most preferably R¹ is halogen, C₁₋₆ alkyl, C₁₋₆ haloalkyl, C₁₋₆ alkoxy or C₁₋₄ haloalkoxy.
Preferably R₁, R₄ and R₅ are, independently, hydrogen, halogen, C₁₋₄ alkyl, C₁₋₆ haloalkyl, C₁₋₆ alkylthio, C₁₋₆ haloalkylthio, C₁₋₆ alkoxy, C₁₋₆ haloalkoxy, C₁₋₆ alkylsulfanyl, C₁₋₆ haloalkylsulfanyl, C₁₋₆ alkylsulfonyl, C₁₋₆ haloalkylsulfonyl, cyano, nitro, C₁₋₆ alkylcarbonyl, or C₁₋₆ alkoxy carbonyl.

More preferably R₁, R₄ and R₅ are independently hydrogen, C₁₋₃ alkyl or halogen.

Most preferably R₁, R₄ and R₅ are independently, hydrogen, or halogen (especially fluorine) but most preferably each is hydrogen.

R₄ is preferably C₁₋₄ alkyl, C₁₋₈ haloalkyl, C₁₋₈ cyanoalkyl, C₂₋₆ alkenyl, C₂₋₆ alkynyl, C₃₋₇ cycloalkyl, C₃₋₇ halo cycloalkyl, C₂₋₇ cyanocycloalkyl, C₁₋₃ alkyl(C₃₋₇) cycloalkyl, C₁₋₃ alky(C₃₋₇) halocycloalkyl, C₅₋₆ cycloalkenyl, C₃₋₇ cycloalkyl(C₁₋₄) alkyl, C₅₋₆ cycloalkenyl(C₁₋₄) alkyl, C₂₋₆ haloalkenyl, C₁₋₆ cyanoalkenyl, C₁₋₆ alkoxy(C₁₋₄) alkyl, C₁₋₆ alkoxyloxy(C₁₋₄) alkyl, C₁₋₆ alkynyl oxy(C₁₋₄) alkyl, aryloxy(C₁₋₄) alkyl, C₁₋₆ carboxyalkyl, C₁₋₆ alkyl carbonyl(C₁₋₆) alkyl, C₁₋₆ alkenyl carbonyl(C₁₋₆) alkyl, C₁₋₆ alkenyl oxycarbonyl(C₁₋₆) alkyl, C₁₋₆ alkynyl oxycarbonyl(C₁₋₆) alkyl, C₁₋₆ alkenyl oxycarbonyl(C₁₋₆) alkyl, aryloxy carbonyl(C₁₋₄) alkyl, C₁₋₆ alkythio(C₁₋₄) alkyl, C₁₋₆ alkyl sulfanyl(C₁₋₄) alkyl, C₁₋₆ alkyl sulfonyl(C₁₋₄) alkyl, aminocarbonyl(C₁₋₄) alkyl, aminocarbonyl(C₂₋₆) alkenyl, aminocarbonyl(C₂₋₆) alkynyl, C₁₋₆ alkylaminocarbonyl(C₁₋₆) alkyl, di(C₁₋₄) alkylaminocarbonyl(C₁₋₆) alkyl, di(C₁₋₆) alkylaminocarbonyl(C₁₋₆) alkenyl, alkylaminocarbonyl(C₁₋₆) alkynyl, di(C₁₋₆) alkylaminocarbonyl(C₁₋₆) alkenyl, phenyl (optionally substituted by halo, nitro, cyano, C₁₋₄ alkyl, C₁₋₆ haloalkyl, C₁₋₆ alkoxy or C₁₋₆ haloalkoxy), phenyl(C₁₋₄) alkyl (wherein the phenyl group is optionally substituted by halo, nitro, cyano, C₁₋₆ alkyl, C₁₋₆ haloalkyl, C₁₋₆ alkoxy or C₁₋₆ haloalkoxy), phenyl(C₂₋₄) alkenyl, (wherein the phenyl group is optionally substituted by halo, nitro, cyano, C₁₋₆ alkyl, C₁₋₆ haloalkyl, C₁₋₆ alkoxy or C₁₋₆ haloalkoxy), heteroaryl (optionally substituted by halo, nitro, cyano, C₁₋₆ alkyl, C₁₋₆ haloalkyl, C₁₋₆ alkoxy or C₁₋₆ haloalkoxy), heterocyclyl (wherein the heterocyclyl group is optionally substituted by halo, nitro, cyano, C₁₋₆ alkyl, C₁₋₆ haloalkyl, C₁₋₆ alkoxy or C₁₋₆ haloalkoxy), heteroaryl(C₁₋₄) alkyl (wherein the heteroaryl group is optionally substituted by halo, nitro, cyano, C₁₋₆ alkyl, C₁₋₆ haloalkyl, C₁₋₆ alkoxy or C₁₋₆ haloalkoxy), heterocyclyl(C₁₋₄) alkyl (wherein the heterocyclyl group is optionally substituted by halo, nitro, cyano, C₁₋₆ alkyl, C₁₋₆ haloalkyl, C₁₋₆ alkoxy or C₁₋₆ haloalkoxy), R³⁻O, C₁₋₃ alkythio, R²⁻R²⁻N or R¹⁻ON=C(R²⁻);
where R²⁸ is C₁-₆ alkyl, C₁-₆ haloalkyl; R²⁹ is C₁-₆ alkyl, C₁-₆ haloalkyl or phenyl (optionally substituted by halo, nitro, cyano, C₁-₆ alkyl, C₁-₆ haloalkyl, C₁-₆ alkoxy or C₁-₆ haloalkoxy); R²⁸ is C₁-₆ alkyl, C₁-₆ haloalkyl or phenyl (optionally substituted by halo, nitro, cyano, C₁-₆ alkyl, C₁-₆ haloalkyl, C₁-₆ alkoxy or C₁-₆ haloalkoxy);

R²⁸ and R²⁹ are, independently, hydrogen, C₁-₆ alkyl, C₃-₇ cycloalkyl, C₅-₆ alkenyl, C₃-₆ alkynyl, C₃-₇ cycloalkyl(C₁-₄)alkyl, C₂-₆ haloalkyl, C₁-₆ alkoxy(C₁-₄)alkyl, C₁-₆ alkoxy carbonyl, or R²⁸ and R²⁹ together with the N atom to which they are attached form a five, six or seven-membered heterocyclic ring which may contain one or two further hetero atoms selected from O, N or S and which may be optionally substituted by one or two C₁-₆ alkyl groups; and

R³¹ is C₁-₆ alkyl or phenyl(C₁-₂)alkyl (wherein the phenyl group is optionally substituted by halo, nitro, cyano, C₁-₆ alkyl, C₁-₆ haloalkyl, C₁-₆ alkoxy or C₁-₆ haloalkoxy).

More preferably R⁶ is C₁-₆ alkyl, C₁-₆ haloalkyl, C₁-₆ cyanoalkyl, C₃-₇ cycloalkyl(C₁-₄)alkyl, C₁-₆ cycloalkenyl(C₁-₄)alkyl, C₁-₆ alkoxy(C₁-₄)alkyl, C₃-₆ alkenyloxy(C₁-₄)alkyl, C₃-₆ alkynyl(C₁-₄)alkyl, C₁-₆ aryloxy(C₁-₄)alkyl, C₁-₆ carboxyalkyl, C₁-₆ alkylcarbonyl(C₁-₄)alkyl, C₂-₆ alkenylcarbonyl(C₁-₄)alkyl, C₂-₆ alkynylcarbonyl(C₁-₄)alkyl, C₁-₆ alkoxy carbonyl(C₁-₄)alkyl, C₃-₆ alkenyloxy carbonyl(C₁-₄)alkyl, C₁-₆ alkoxy carbonyl(C₁-₄)alkyl, C₃-₆ alkenyloxy carbonyl(C₁-₄)alkyl, C₁-₆ alkenyloxy carbonyl(C₁-₄)alkyl, C₁-₆ aryloxy carbonyl(C₁-₄)alkyl, C₁-₆ alkylthio(C₁-₄)alkyl, C₁-₆ alkylsulfanyl(C₁-₄)alkyl, C₁-₆ alkylsulfonyl(C₁-₄)alkyl, C₁-₆ aminocarbonyl(C₁-₄)alkyl, C₁-₆ alkylaminocarbonyl(C₁-₄)alkyl, C₁-₆ di(C₁-₄)alkylaminocarbonyl(C₁-₄)alkyl, phenyl(C₁-₄)alkyl (wherein the phenyl group may be optionally substituted by halo, nitro, cyano, C₁-₆ alkyl, C₁-₆ haloalkyl, C₁-₆ alkoxy or C₁-₆ haloalkoxy), heteroaryl(C₁-₄)alkyl (wherein the heteroaryl group may be optionally substituted by halo, nitro, cyano, C₁-₆ alkyl, C₁-₆ haloalkyl, C₁-₆ alkoxy or C₁-₆ haloalkoxy), heterocycl(C₁-₄)alkyl (wherein the heterocycl group may be optionally substituted by halo, nitro, cyano, C₁-₆ alkyl, C₁-₆ haloalkyl, C₁-₆ alkoxy or C₁-₆ haloalkoxy), C₂-₆ alkenyl, C₂-₆ haloalkenyl, C₁-₆ cyanoalkenyl, C₁-₆ cycloalkenyl, C₁-₆ aminocarbonyl(C₂-₆)alkenyl, C₁-₆ alkylaminocarbonyl(C₁-₆)alkenyl, di(C₁-₂)alkylaminocarbonyl(C₁-₄)alkenyl, phenyl(C₂-₄)alkenyl, (wherein the phenyl group may be optionally substituted by halo, nitro, cyano, C₁-₆ alkyl, C₁-₆ haloalkyl, C₁-₆ alkoxy or C₁-₆ haloalkoxy), C₂-₆ alkenyl, aminocarbonyl(C₂-₆)alkynyl, alkylaminocarbonyl(C₁-₆)alkynyl, di(C₁-₆)alkylaminocarbonyl(C₁-₆)alkynyl, C₃-₇ cycloalkyl, C₃-₇ halocycloalkyl, C₃-₇ cyano cycloalkyl, C₁-₃ alkyl(C₃-₇)cycloalkyl, C₁-₃ alkyl(C₃-₇)halocycloalkyl, phenyl (which may be optionally substituted by halo, nitro, cyano,
C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy or C_{1-6} haloalkoxy), heteroaryl (which may be optionally substituted by halo, nitro, cyano, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy or C_{1-6} haloalkoxy), heterocyclyl (which may be optionally substituted by halo, nitro, cyano, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy or C_{1-6} haloalkoxy), C_{1-6} alkylthio, R^{28}O, R^{28}R^{29}N or R^{31}ON=CR^{27} where R^{26} is C_{1-6} alkyl or C_{1-6} haloalkyl; R^{27} is phenyl (which may be optionally substituted by halo, nitro, cyano, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy or C_{1-6} haloalkoxy), C_{1-6} alkyl or C_{1-6} haloalkyl; R^{28} and R^{29} are, independently, hydrogen, C_{1-6} alkyl, C_{3-7} cycloalkyl(C_{1-4})alkyl, C_{2-6} haloalkyl, C_{1-6} alkoxy(C_{1-6})alkyl, C_{3-7} cycloalkyl, C_{3-6} alkenyl, C_{3-6} alkynyl or C_{1-6} alkoxy carbonyl; and R^{31} is phenyl(C_{1-2})alkyl (wherein the phenyl group may be optionally substituted by halo, nitro, cyano, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy or C_{1-6} haloalkoxy) or C_{1-6} alkyl.

Even more preferably R^{6} is C_{1-6} alkyl, C_{1-8} haloalkyl, C_{1-6} cyanoalkyl, C_{3-7} cycloalkyl, C_{1-3} alkyl (C_{3-7}) cycloalkyl, C_{1-6} alkoxy (C_{1-6}) alkyl, heterocyclic (optionally substituted by halo, nitro, cyano, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy or C_{1-6} haloalkoxy) or R^{28}R^{29}N where R^{28} and R^{29} are independently C_{1-6} alkyl or together with the N atom to which they are attached form a five, six or seven-membered heterocyclic ring which may contain one or two further hetero atoms selected from O, N or S and which may be optionally substituted by one or two C_{1-6} alkyl groups.

Most preferably R^{6} is C_{1-6} alkyl, C_{1-8} haloalkyl, C_{1-6} cyanoalkyl, C_{1-6} alkoxy (C_{1-6}) alkyl, C_{3-7} cycloalkyl, C_{1-3} alkyl (C_{3-7}) cycloalkyl, heterocyclyl (which may be optionally substituted by halo, nitro, cyano, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy or C_{1-6} haloalkoxy) or di(C_{1-6})alkylamino.

Preferably R^{12} is hydrogen, halogen, C_{1-6} alkyl, C_{1-6} haloalkyl, C_{1-6} alkoxy (C_{1-6}) alkyl, C_{2-6} alkenyl, C_{1-6} alkynyl, C_{1-6} alkoxy, C_{1-6} haloalkoxy, C_{1-6} alkylthio, C_{1-6} haloalkylthio, C_{1-6} alkylsulfanyl, C_{1-6} haloalkylsulfanyl, C_{1-6} alkyldisulfanyl, C_{1-6} haloalkylsulfanyl, cyano, nitro, formyl, C_{1-6} alkylcarbonyl, C_{1-6} alkoxy carbonyl, CH=NOR^{32}, or R^{1} and R^{12} together with the atoms to which they are attached may be joined to form a five, six or seven-membered saturated or unsaturated, carbocyclic or heterocyclic ring which may contain one or two heteroatoms selected from O, N or S and which may be optionally substituted by C_{1-6} alkyl, C_{1-6} haloalkyl or halogen; and R^{32} is phenyl(C_{1-2})alkyl (wherein the phenyl group may be
optionally substituted by halo, nitro, cyano, C<sub>1-6</sub> alkyl, C<sub>1-6</sub> haloalkyl, C<sub>1-6</sub> alkoxy or C<sub>1-6</sub> haloalkoxy) or C<sub>1-6</sub> alkyl.

More preferably R<sup>12</sup> is hydrogen, halogen, C<sub>1-6</sub> alkyl, C<sub>1-6</sub> haloalkyl, C<sub>1-6</sub> alkoxy (C<sub>1-6</sub> alkyl, C<sub>1-6</sub> alkoxy, C<sub>1-6</sub> haloalkoxy, C<sub>1-6</sub> alkylthio, or R<sup>1</sup> and R<sup>12</sup> together with the atoms to which they are attached form a cyclopentane, isoxazole or benzene ring optionally substituted by C<sub>1-6</sub> alkyl, C<sub>1-6</sub> haloalkyl or halogen.

Most preferably R<sup>12</sup> is hydrogen, halogen, C<sub>1-6</sub> alkyl, C<sub>1-6</sub> haloalkyl, C<sub>1-6</sub> alkoxy(C<sub>1-6</sub> alkyl, C<sub>1-6</sub> alkoxy, C<sub>1-6</sub> haloalkoxy, or R<sup>1</sup> and R<sup>12</sup> together with the atoms to which they are attached form a cyclopentane or isoxazole ring optionally substituted by C<sub>1-6</sub> alkyl, C<sub>1-6</sub> haloalkyl or halogen.

R<sup>13</sup> is preferably cyano, nitro, C<sub>1-4</sub> alkyl, C<sub>1-6</sub> haloalkyl, C<sub>3-7</sub> cycloalkyl(C<sub>1-6</sub>)alkyl, C<sub>3-7</sub> cycloalkyl, CH<sub>2</sub>(C<sub>2-6</sub>)alkenyl, CH<sub>2</sub>(C<sub>2-6</sub>)alkynyl, phenyl (which may be optionally substituted by halo, nitro, cyano, C<sub>1-6</sub> alkyl, C<sub>1-6</sub> haloalkyl, C<sub>1-6</sub> alkoxy or C<sub>1-6</sub> haloalkoxy), heteroaryl (which may be optionally substituted by halo, nitro, cyano, C<sub>1-4</sub> alkyl, C<sub>1-6</sub> haloalkyl, C<sub>1-6</sub> alkoxy or C<sub>1-6</sub> haloalkoxy), C<sub>1-6</sub> alkylcarbonyl, C<sub>1-6</sub> alkoxy carbonyl, C<sub>1-6</sub> alkylamino, di(C<sub>1-6</sub>)alkylamino, C<sub>1-6</sub> alkylcarbonylamino, C<sub>1-6</sub> alkoxy carbonylamino, C<sub>1-6</sub> alkoxy, C<sub>1-6</sub> alkylthio, C<sub>1-6</sub> haloalkylthio, C<sub>1-6</sub> alky sulf inyl, C<sub>1-6</sub> haloalkyl sulf inyl, C<sub>1-6</sub> alkyl sulf onyl, C<sub>1-6</sub> haloalkyl sulf onyl, arythio, aryl sulf inyl, aryl sulf onyl or (C<sub>1-6</sub>)alkylcarbonyloxy.

Preferably R<sup>14</sup> is hydrogen, C<sub>1-8</sub> alkyl, C<sub>1-6</sub> haloalkyl, C<sub>1-6</sub> cyanoalkyl, C<sub>2-6</sub> alkenyl, C<sub>2-6</sub> alkenyl, C<sub>3-7</sub> cycloalkyl, C<sub>3-7</sub> cycloalkyl(C<sub>1-6</sub>)alkyl, C<sub>1-6</sub> alkoxy(C<sub>1-6</sub> alkyl, C<sub>1-6</sub> alkoxy carbonyl, C<sub>1-6</sub> alkylcarbonyl, C<sub>1-6</sub> alkylaminocarbonyl, di(C<sub>1-6</sub>)alkylaminocarbonyl, phenyl (which may be optionally substituted by halo, nitro, cyano, C<sub>1-6</sub> alkyl, C<sub>1-6</sub> haloalkyl, C<sub>1-6</sub> alkoxy or C<sub>1-6</sub> haloalkoxy) or heteroaryl (which may be optionally substituted by halo, nitro, cyano, C<sub>1-4</sub> alkyl, C<sub>1-6</sub> haloalkyl, C<sub>1-6</sub> alkoxy or C<sub>1-6</sub> haloalkoxy).

More preferably R<sup>14</sup> is hydrogen, C<sub>1-8</sub> alkyl or C<sub>1-6</sub> haloalkyl.

Preferably R<sup>18</sup> is hydrogen, halogen, nitro, cyano, C<sub>1-8</sub> alkyl, C<sub>1-6</sub> haloalkyl, C<sub>1-6</sub> cyanoalkyl, C<sub>3-7</sub> cycloalkyl(C<sub>1-6</sub>)alkyl, C<sub>1-6</sub> alkoxy(C<sub>1-6</sub> alkyl, C<sub>1-6</sub> alkoxy carbonyl, C<sub>1-6</sub> alkylcarbonyl, C<sub>1-6</sub> alkylaminocarbonyl, di(C<sub>1-6</sub>)alkylaminocarbonyl, phenyl (wherein the phenyl group may be optionally substituted by halo, nitro, cyano, C<sub>1-6</sub> alkyl, C<sub>1-6</sub> haloalkyl, C<sub>1-6</sub> alkoxy or C<sub>1-6</sub> haloalkoxy), heteroaryl(C<sub>1-6</sub>)alkyl (wherein the heteroaryl group may be optionally
substituted by halo, nitro, cyano, C\textsubscript{1-6} alkyl, C\textsubscript{1-6} haloalkyl, C\textsubscript{1-6} alkoxy or C\textsubscript{1-6} haloalkoxy),
C\textsubscript{2-6} alkenyl, C\textsubscript{2-6} haloalkenyl, C\textsubscript{2-6} alkynyl, C\textsubscript{3-7} cycloalkyl, C\textsubscript{1-6} alkoxy carbonyl, C\textsubscript{1-6} alkyl carbonyl, C\textsubscript{1-6} alkylaminocarbonyl, di(C\textsubscript{1-6} alkylaminocarbonyl), phenyl (which may be optionally substituted by halo, nitro, cyano, C\textsubscript{1-6} alkyl, C\textsubscript{1-6} haloalkyl, C\textsubscript{1-6} alkoxy or C\textsubscript{1-6} haloalkoxy) or heteroaryl (which may be optionally substituted by halo, nitro, cyano, C\textsubscript{1-6} alkyl, C\textsubscript{1-6} haloalkyl, C\textsubscript{1-6} alkoxy or C\textsubscript{1-6} haloalkoxy).

More preferably R\textsuperscript{18} is hydrogen, halogen, C\textsubscript{1-8} alkyl or C\textsubscript{1-6} haloalkyl.

More preferred optionally substituted rings of formula

\[
\begin{array}{c}
\text{X} \\
\text{D} \\
\text{W} \\
\text{E} \\
\end{array}
\]

include optionally substituted isothiazolyl, optionally substituted pyrimidinyl and optionally substituted isoxazolo[4,5-\text{e}]pyrimidine groups in which the optional substituents may be chosen from halo, C\textsubscript{1-6} alkyl, C\textsubscript{1-6} haloalkyl, C\textsubscript{1-6} alkoxy, C\textsubscript{1-6} alkoxy(C\textsubscript{1-6})alkyl or C\textsubscript{1-6} haloalkoxy.

The compounds in the following Tables illustrate compounds of the invention.

Table 1 provides 100 compounds of formula:

\[
\begin{array}{c}
\text{W} \\
\text{E} \\
\text{D} \\
\text{X} \\
\end{array}
\]

wherein D, X, W, E and R\textsubscript{6} are as defined in Table 1

<table>
<thead>
<tr>
<th>Cpd No.</th>
<th>D</th>
<th>X</th>
<th>W</th>
<th>E</th>
<th>R\textsubscript{6}</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.01</td>
<td>S</td>
<td>N</td>
<td>C(CH\textsubscript{2})</td>
<td>C(Cl)</td>
<td>CH\textsubscript{3}</td>
</tr>
<tr>
<td>1.02</td>
<td>S</td>
<td>N</td>
<td>C(CH\textsubscript{2})</td>
<td>C(Cl)</td>
<td>CH\textsubscript{2}CH\textsubscript{3}</td>
</tr>
<tr>
<td>1.03</td>
<td>S</td>
<td>N</td>
<td>C(CH\textsubscript{2})</td>
<td>C(Cl)</td>
<td>CH\textsubscript{2}CH\textsubscript{2}CH\textsubscript{3}</td>
</tr>
<tr>
<td>1.04</td>
<td>S</td>
<td>N</td>
<td>C(CH\textsubscript{2})</td>
<td>C(Cl)</td>
<td>CH(CH\textsubscript{3})\textsubscript{2}</td>
</tr>
<tr>
<td>1.05</td>
<td>S</td>
<td>N</td>
<td>C(CH\textsubscript{2})</td>
<td>C(Cl)</td>
<td>CH\textsubscript{2}CH\textsubscript{2}CH\textsubscript{3}</td>
</tr>
<tr>
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<td>S</td>
<td>N</td>
<td>C(CH\textsubscript{2})</td>
<td>C(Cl)</td>
<td>CH\textsubscript{2}CH(CH\textsubscript{3})\textsubscript{2}</td>
</tr>
<tr>
<td>1.07</td>
<td>S</td>
<td>N</td>
<td>C(CH\textsubscript{2})</td>
<td>C(Cl)</td>
<td>CH\textsubscript{2}CH(CH\textsubscript{3})\textsubscript{3}</td>
</tr>
<tr>
<td>1.08</td>
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<tr>
<td>1.98</td>
<td>CH=N</td>
<td>N</td>
<td>C-O-N=C(CH₂CH₃)-C</td>
<td>CH₂CF₃</td>
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<td>1.99</td>
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<td>1.100</td>
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<td>C-O-N=C(CH₂CH₃)-C</td>
<td>CF₂CF₂CF₃</td>
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</table>

Table 2 provides 100 compounds of formula:

![Chemical Structure](image)

wherein D, X, W, E and R6 are as defined in Table 1

Table 3 provides 100 compounds of formula:

![Chemical Structure](image)

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Table 4 provides 100 compounds of formula:

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Table 5 provides 100 compounds of formula:

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The compounds of the invention may be made in a variety of ways. For example compounds of formula II (where W, X, E, A, Z, B, R³, R⁴, R⁵ and R⁶ are as defined above in relation to formula I, D is CR⁸=CR⁹, CR⁸=N, N=CR⁹, and R⁶ is hydrogen, alkyl, alkenylalkyl, alkynylalkyl or cycloalkyl) may be prepared by the condensation of a compound of formula III (where Hal is a halogen (especially chloro) and D, E, W and X are as defined above in relation to formula II) with a compound of formula IV (where A, Z, B, R³, R⁴, R⁵, R⁶ and R⁶ are as defined above in relation to formula II) optionally in the presence of a base such as triethylamine and in a suitable solvent such as tetrahydrofuran or toluene but preferably pyridine at approximately 100°C.
Alternatively a compound of formula II (where D, E, W, X, Z, B, R³, R⁴, R⁵ and R⁶ are as defined above in relation to formula I, R⁵ is hydrogen, alkyl, alkenylalkyl, alkylnylalkyl or cycloalkyl, and A is alkyne, alkenylene, alkynylene, cycloalkylene, alkylenoxy, alkylenthiol, alkylamino, alkylenoxyalkylene, alkylenthiolalkylene and alkenaminoalkene) may be prepared by the condensation of an appropriate amine V (where D, E, W, X and R⁵ are as defined earlier in this paragraph in relation to formula II) with an appropriate carbonyl compound VI (where Z, B, R³, R⁴, R⁵ and R⁶ are as defined earlier in this paragraph in relation to formula II, A is a bond, alkylene, alkenylene, alkyne, cycloalkylene, alkylenoxy, alkylenthiol, alkylamino, alkylenoxyalkylene, alkenaminoalkylene, alkylenthiolalkylene, alkylsulfynylalkylene and alkylsulfynylalkylene, and Q is hydrogen, C₁₋₃ alkyl or C₁₋₃ haloalkyl), and reduction of the imino intermediate formed using a suitable reducing agent such as sodium borohydride, sodium cyanoborohydride or sodium triacetoxyborohydride in a suitable solvent such as methanol, ethanol or acetic acid. Preferably the reducing agent is sodium triacetoxyborohydride and the solvent is acetic acid.

Alternatively, compounds of formula II (where A, E, W, X, D, B, Z, R³, R⁴, R⁵ and R⁶ are as defined above in relation to formula I and R⁵ is hydrogen) may be treated with an alkylating agent (such as an alkyl halide, dialkyl sulfate, chloromethylether or trialkyloxonium salt) optionally in the presence of a base to give compounds II (where A, E, W, X, D, B, Z, R³, R⁴, R⁵ and R⁶ are as defined above in relation to formula I and R⁵ is alkyl (including alkoxyalkyl), alkenylalkyl, alkynylalkyl and cycloalkyl). Those skilled in the art will recognise that analogous reactions involving sulfenylation, sulfonylation, and acylation are possible for compounds of formula II.

Compounds of formula II (where A, E, W, X, D, B, Z, R³, R⁴, R⁵ and R⁶ are as defined above in relation to formula I and R⁵ is alkoxyalkyl or acyloxyalkyl) may also be prepared from Compound II (where A, E, W, X, D, B, Z, R³, R⁴, R⁵ and R⁶ are as defined
above in relation to formula I and R^6 is H) by sequential reaction with formaldehyde and an alkylating or acylating agent.

Additional compounds of formula II (where A, E, W, X, D, B, Z, R^2, R^4, R^5 and R^6 are as defined above in relation to formula I and R^6 is alkyl, alkenyl, alkynyl) may be prepared by condensation of compounds of formula II (where A, E, W, X, D, B, Z, R^3, R^4, R^5 and R^6 are as defined above in relation to formula I and R^6 is H) with an appropriate aldehyde or ketone and reduction of the imino intermediate thus formed using a suitable reducing agent such as sodium borohydride, sodium cyanoborohydride or sodium triacetoxyborohydride in a suitable solvent such as methanol, ethanol or acetic acid.

Compounds as described above of formula III, formula IV, formula V and formula VI are either known compounds or can be made from known compounds using known methods.

A particularly suitable method for making the amines of formula IV (where R^1, R^4, R^5, B and Z are as defined above in relation to formula I, R^6 is hydrogen and A is alkylene, alkenylene, alkynylene, alkyleneoxy, alkyleneamino, alkylennethio, alkyleneoxyalkylene, alkyleneaminoalkylene, alkylennethioalkylene, alkylenesulfinylalkylene, alkylenesulfonylalkylene) is from the corresponding carboxylic acids of formula VII (where A, Z, B, R^3, R^4, R^5 and R^6 are as defined earlier in this paragraph in relation to formula IV) employing a Curtius or similar rearrangement.

![Chemical structures](image)

The degradation of the acid VII (where A, Z, B, R^1, R^4, R^5 and R^6 are as defined in the previous paragraph in relation to formula IV) to the isocyanate VIII (where A, Z, B, R^1, R^4, R^5 and R^6 are as defined in the previous paragraph in relation to formula IV) can be achieved by treatment with a reagent such as diphenylphosphoryl azide in the presence of a base such as triethylamine in a solvent such as toluene at reflux. Treatment of the isocyanate (which may or may not be isolated) with an alcohol of formula R_n-OH (such as t-butanol or 2-trimethylsilylethanol) may give the carbamate IX (where A, Z, B, R^3, R^4, R^5 and R^6 are as defined in the previous paragraph in relation to formula IV, and R_n is the alkyl group derived
from the alcohol). Conditions for the removal of the carbamate group from intermediate VIII depends on the nature of $R_b$. For example if $R_b = t$-butyl then treatment with an acid such as trifluoroacetic acid in a solvent such as tetrahydrofuran may produce amine IV (where $R^3$, $R^4$, $R^5$, $R^6$, B and Z are as defined above in relation to formula I, $R^6$ is hydrogen and A is alkylene, alkenylene, alkynylene, alkyleneoxy, alkyleneamino, alkylbenethio, alkyleneoxyalkylene, alkyleneaminoalkylene, alkylbenethioalkylene, alkylensulfanylalkylene, alkylensulfonylalkylene). If however $R_b = 2$-trimethylsilylethyl then treatment with tetrabutylammonium fluoride in a solvent such as tetrahydrofuran may produce amine IV.


An alternative method for making compounds I (where Z is O, B is N and M, A, W, X, D, E, $R^3$, $R^4$, $R^5$ and $R^6$ are as defined above in relation to formula I) involves the
acylation of compound X followed by cyclisation, optionally in the presence of an acidic catalyst such as *para*-toluene sulfonic acid in a suitable solvent such as xylene or 1,1,2,2-tetrachloroethane.

Compound X (where A, D, E, W, X, M, R3, R4 and R5 are as defined above in relation to formula I) may be prepared from compound XI (where A, D, E, W, X, M, R3, R4 and R5 are as defined above in relation to formula I) by a sequential procedure of nitration followed by reduction, using known procedures. In turn, compound XI may be prepared by the dealkylation of compound XII (where A, D, E, W, X, M, R3, R4 and R5 are as defined above in relation to formula I and where R is an alkyl group (especially methyl) or substituted alkyl group (especially benzyl)) under standard conditions. Compound XII may be prepared from compound II by processes analogous to those already described for compounds of formula II.

Compounds of formula IV (where Z, B, R3, R4, R5 and R6 are as defined above in relation to formula I, R5b is H and A is oxyalkylene) may be prepared from compounds of formula XIII (where Z, B, R3, R4, R5 and R6 are as defined above in relation to formula I, A2 is alkylene and Q1 is OH) by treatment with, for example 3,3-di-tert-butyl-oxaziridine in the presence of potassium hydride, 18-crown-6 and 1,3-dimethyl-3,4,5,6-tetrahydro-2(1H)-pyrimidine, or alternatively sequential treatment with N-hydroxyphthalimide, a phosphine (such as triphenylphosphine) and a diazo compound (such as diethyl azodicarboxylate) followed by treatment with hydrazine.

Similarly compounds of formula IV (where Z, B, R3, R4, R5 and R6 are as defined above in relation to formula II, R5b is H and A is aminoalkylene) may be prepared from
compounds of formula XIII (where Z, B, R³, R⁴, R⁵ and R⁶ are as defined above in relation to formula II, A₂ is alkylene and Q₁ is NH₂Cl) by treatment with, for example NH₂Cl.

Compounds of formula II (where W, X, D, E, Z, B, R³, R⁴, R⁵ and R⁶ are as defined above in relation to formula I, R⁶ is H and A is thioalkylene, sulfinylalkylene and sulfonylalkylene) may be prepared from the reaction of a compound of formula V (where W, X, D and E are as defined above in relation to formula I and R⁵ is H) with a compound of formula XIII (where Z, B, R³, R⁴, R⁵ and R⁶ are as defined above in relation to formula II, A₂ is alkylene and Q₁ is SO₂Cl where n is 0, 1 or 2), optionally in the presence of a base.

Compounds of formula XIII as defined above are either known compounds or may be made by known methods.

Heteroaryl N-oxides may be made by known methods.

The compounds of formula (I) can be used to combat and control infestations of insect pests such as Lepidoptera, Diptera, Hemiptera, Thysanoptera, Orthoptera, Dictyoptera, Coleoptera, Siphonaptera, Hymenoptera and Isoptera and also other invertebrate pests, for example, acarine, nematode and mollusc pests. Insects, acarines, nematodes and molluscs are hereinafter collectively referred to as pests. The pests which may be combated and controlled by the use of the invention compounds include those pests associated with agriculture (which term includes the growing of crops for food and fibre products), horticulture and animal husbandry, companion animals, forestry and the storage of products of vegetable origin (such as fruit, grain and timber); those pests associated with the damage of man-made structures and the transmission of diseases of man and animals; and also nuisance pests (such as flies).

Examples of pest species which may be controlled by the compounds of formula (I) include: Myzus persicae (aphid), Aphis gossypii (aphid), Aphis fabae (aphid), Lygus spp. (capsids), Dysdercus spp. (capsids), Nilaparvata lugens (planthopper), Nephrotettix dicincticeps (leafhopper), Nezara spp. (stinkbugs), Euschistus spp. (stinkbugs), Leptocorisa spp. (stinkbugs), Frankliniella occidentalis (thrip), Thrips spp. (thrips), Leptinotarsa decemlineata (Colorado potato beetle), Anthonomus grandis (boll weevil), Aonidiella spp. (scale insects), Trialeurodes spp. (white flies), Bemisia tabaci (white fly), Ostrinia nubilalis (European corn borer), Spodoptera littoralis (cotton leafworm), Heliotis virescens (tobacco budworm), Helicoverpa armigera (cotton bollworm), Helicoverpa zea (cotton bollworm),
Sylepta derogata (cotton leaf roller), Pieris brassicae (white butterfly), Plutella xylostella (diamond back moth), Agrotis spp. (cutworms), Chilo suppressalis (rice stem borer), Locusta migratoria (locust), Chorticetes terminifera (locust), Diabrotica spp. (rootworms), Panonychus ulmi (European red mite), Panonychus citri (citrus red mite), Tetranychus urticae (two-spotted spider mite), Tetranychus cinnabarinus (carmine spider mite), Phyllocoptruta oleivora (citrus rust mite), Polyphagotarsonemus latus (broad mite), Brevipalpus spp. (flat mites), Boophilus microplus (cattle tick), Dermacentor variabilis (American dog tick), Ctenocephalides felis (cat flea), Liriomyza spp. (leafminer), Musca domestica (housefly), Aedes aegypti (mosquito), Anopheles spp. (mosquitoes), Culex spp. (mosquitoes), Lucilia spp. (blowflies), Blattella germanica (cockroach), Periplaneta americana (cockroach), Blatta orientalis (cockroach), termites of the Mastotermitidae (for example Mastotermes spp.), the Kalotermitidae (for example Neotermes spp.), the Rhinotermitidae (for example Coptotermes formosanus, Reticulitermes flavipes, R. speratu, R. virginicus, R. hesperus, and R. santonensis) and the Termitidae (for example Globitermes sulphureus), Solenopsis geminata (fire ant), Monomorium pharaonis (pharaoh’s ant), Damalinia spp. and Linognathus spp. (biting and sucking lice), Meloidogyne spp. (root knot nematodes), Globodera spp. and Heterodera spp. (cyst nematodes), Pratylenchus spp. (lesion nematodes), Rhodopholus spp. (banana burrowing nematodes), Tylenchulus spp. (citrus nematodes), Haemonchus contortus (barber pole worm), Caenorhabditis elegans (vinegar eelworm), Trichostrongylus spp. (gastro intestinal nematodes) and Deroceras reticulatum (slug).

The compounds of formula (I) are also active fungicides and may be used to control one or more of the following pathogens: Pyricularia oryzae (Magnaporthe grisea) on rice and wheat and other Pyricularia spp. on other hosts; Puccinia recondita, Puccinia striiformis and other rusts on wheat, Puccinia hordei, Puccinia striiformis and other rusts on barley, and rusts on other hosts (for example turf, rye, coffee, pears, apples, peanuts, sugar beet, vegetables and ornamental plants); Erysiphe cichoracearum on cucurbits (for example melon); Erysiphe graminis (powdery mildew) on barley, wheat, rye and turf and other powdery mildews on various hosts, such as Sphaerotheca macularis on hops, Sphaerotheca fusca (Sphaerotheca fuliginea) on cucurbits (for example cucumber), Leveillula taurica on tomatoes, aubergine and green pepper, Podosphaera leucotricha on apples and Uncinula
necator on vines; Cochliobolus spp., Helminthosporium spp., Drechslera spp. (Pyrenophora spp.), Rhyhchosporium spp., Mycosphaerella graminicola (Septoria tritici) and Phaeosphaeria nodorum (Stagonospora nodorum or Septoria nodorum), Pseudocercosporella herpotrichoides and Gaemannomyces graminis on cereals (for example wheat, barley, rye), turf and other hosts; Cercospora arachidicola and Cercosporidium personatum on peanuts and other Cercospora spp. on other hosts, for example sugar beet, bananas, soya beans and rice; Botrytis cinerea (grey mould) on tomatoes, strawberries, vegetables, vines and other hosts and other Botrytis spp. on other hosts; Alternaria spp. on vegetables (for example carrots), oil-seed rape, apples, tomatoes, potatoes, cereals (for example wheat) and other hosts; Venturia spp. (including Venturia inaequalis (scab)) on apples, pears, stone fruit, tree nuts and other hosts; Cladosporium spp. on a range of hosts including cereals (for example wheat) and tomatoes; Monilinia spp. on stone fruit, tree nuts and other hosts; Didymella spp. on tomatoes, turf, wheat, cucurbits and other hosts; Phoma spp. on oil-seed rape, turf, rice, potatoes, wheat and other hosts; Aspergillus spp. and Aureobasidium spp. on wheat, lumber and other hosts; Ascochyta spp. on peas, wheat, barley and other hosts; Stemphylium spp. (Pleospora spp.) on apples, pears, onions and other hosts; summer diseases (for example bitter rot (Glomerella cingulata), black rot or frogeye leaf spot (Botryosphaeria obtusa), Brooks fruit spot (Mycosphaerella pomi), Cedar apple rust (Gymnosporangium juniper-virginianae), sooty blotch (Gloeodes pomigena), flyspeck (Schizothyrium pomi) and white rot (Botryosphaeria dothidea)) on apples and pears; Plasmopara viticola on vines; other downy mildews, such as Bremia lactucae on lettuce, Peronospora spp. on soybeans, tobacco, onions and other hosts, Pseudoperonospora humuli on hops and Pseudoperonospora cubensis on cucurbits; Pythium spp. (including Pythium ultimum) on turf and other hosts; Phytophthora infestans on potatoes and tomatoes and other Phytophthora spp. on vegetables, strawberries, avocado, pepper, ornamentals, tobacco, cocoa and other hosts; Thanatephorus cucumeris on rice and turf and other Rhizoctonia spp. on various hosts such as wheat and barley, peanuts, vegetables, cotton and turf; Sclerotinia spp. on turf, peanuts, potatoes, oil-seed rape and other hosts; Sclerotium spp. on turf, peanuts and other hosts; Gibberella fujikuroi on rice; Colletotrichum spp. on a range of hosts including turf, coffee and vegetables; Laetisaria fuciformis on turf; Mycosphaerella spp. on bananas, peanuts, citrus, pecans, papaya and other hosts; Diaporthe spp. on citrus, soybean,
melon, pears, lupin and other hosts; *Elsinoe* spp. on citrus, vines, olives, pecans, roses and other hosts; *Verticillium* spp. on a range of hosts including hops, potatoes and tomatoes; *Pyrenopeziza* spp. on oil-seed rape and other hosts; *Oncobasidium theobromae* on cocoa causing vascular streak dieback; *Fusarium* spp., *Typhula* spp., *Microdochium nivale*, *Ustilago* spp., *Urocystis* spp., *Tilletia* spp. and *Claviceps purpurea* on a variety of hosts but particularly wheat, barley, turf and maize; *Ramularia* spp. on sugar beet, barley and other hosts; post-harvest diseases particularly of fruit (for example *Penicillium digitatum*, *Penicillium italicum* and *Trichoderma viride* on oranges, *Colletotrichum musae* and *Gloeosporium musarum* on bananas and *Botrytis cinerea* on grapes); other pathogens on vines, notably *Eutypa lata*, *Guignardia bidwellii*, *Phellinus igniarius*, *Phomopsis viticola*, *Pseudopeziza tracheiphila* and *Stereum hirsutum*; other pathogens on trees (for example *Lophodermium seditiosum*) or lumber, notably *Cephaloascus fragrans*, *Ceratoctis* spp., *Ophiostoma piceae*, *Penicillium* spp., *Trichoderma pseudokoningii*, *Trichoderma viride*, *Trichoderma harzianum*, *Aspergillus niger*, *Leptographium lindbergii* and *Aureobasidium pullulans*; and fungal vectors of viral diseases (for example *Polymyxa graminis* on cereals as the vector of barley yellow mosaic virus (BYMV) and *Polymyxa betae* on sugar beet as the vector of rhizomania).

A compound of formula (I) may move acropetally, basipetally or locally in plant tissue to be active against one or more fungi. Moreover, a compound of formula (I) may be volatile enough to be active in the vapour phase against one or more fungi on the plant.

The invention therefore provides a method of combating and controlling insects, acarines, nematodes or molluscs which comprises applying an insecticidally, acaricidally, nematicidally or molluscicidally effective amount of a compound of formula (I), or a composition containing a compound of formula (I), to a pest, a locus of pest, or to a plant susceptible to attack by a pest, and a method of combating and controlling fungi which comprises applying a fungicidally effective amount of a compound of formula (I), or a composition containing a compound of formula (I), to a plant, to a seed of a plant, to the locus of the plant or seed, to soil or to any other growth medium (for example a nutrient solution). The compounds of formula (I) are preferably used against insects, acarines, nematodes or fungi.
The term "plant" as used herein includes seedlings, bushes and trees. Furthermore, the fungicidal method of the invention includes protectant, curative, systemic, eradicant and antisporelant treatments.

As fungicides, the compounds of formula (I) are preferably used for agricultural, horticultural and turfgrass purposes in the form of a composition.

In order to apply a compound of formula (I) as an insecticide, acaricide, nematicide or molluscicide to a pest, a locus of pest, or to a plant susceptible to attack by a pest, or, as a fungicide to a plant, to a seed of a plant, to the locus of the plant or seed, to soil or to any other growth medium, a compound of formula (I) is usually formulated into a composition which includes, in addition to the compound of formula (I), a suitable inert diluent or carrier and, optionally, a surface active agent (SFA). SFAs are chemicals which are able to modify the properties of an interface (for example, liquid/solid, liquid/air or liquid/liquid interfaces) by lowering the interfacial tension and thereby leading to changes in other properties (for example dispersion, emulsification and wetting). It is preferred that all compositions (both solid and liquid formulations) comprise, by weight, 0.0001 to 95%, more preferably 1 to 85%, for example 5 to 60%, of a compound of formula (I). The composition is generally used for the control of pests or fungi such that a compound of formula (I) is applied at a rate of from 0.1g to 10kg per hectare, preferably from 1g to 6kg per hectare, more preferably from 1g to 1kg per hectare.

When used in a seed dressing, a compound of formula (I) is used at a rate of 0.0001g to 10g (for example 0.001g or 0.05g), preferably 0.005g to 10g, more preferably 0.005g to 4g, per kilogram of seed.

In another aspect the present invention provides an insecticidal, acaricidal, nematicidal, molluscicidal or fungicidal composition comprising an insecticidally, acaricidally, nematicidally, molluscicidally or fungicidally effective amount of a compound of formula (I) and a suitable carrier or diluent therefor. The composition is preferably an insecticidal, acaricidal, nematicidal or fungicidal composition.

In a still further aspect the invention provides a method of combating and controlling pests or fungi at a locus which comprises treating the pests or fungi or the locus of the pests or fungi with an insecticidally, acaricidally, nematicidally, molluscicidally or fungicidally...
effective amount of a composition comprising a compound of formula (I). The compounds of formula (I) are preferably used against insects, acarines, nematodes or fungi.

The compositions can be chosen from a number of formulation types, including dustable powders (DP), soluble powders (SP), water soluble granules (SG), water dispersible granules (WG), wettable powders (WP), granules (GR) (slow or fast release), soluble concentrates (SL), oil miscible liquids (OL), ultra low volume liquids (UL), emulsifiable concentrates (EC), dispersible concentrates (DC), emulsions (both oil in water (EW) and water in oil (EO)), micro-emulsions (ME), suspension concentrates (SC), aerosols, fogging/smoke formulations, capsule suspensions (CS) and seed treatment formulations.

The formulation type chosen in any instance will depend upon the particular purpose envisaged and the physical, chemical and biological properties of the compound of formula (I).

Dustable powders (DP) may be prepared by mixing a compound of formula (I) with one or more solid diluents (for example natural clays, kaolin, pyrophyllite, bentonite, alumina, montmorillonite, kieselguhr, chalk, diatomaceous earths, calcium phosphates, calcium and magnesium carbonates, sulphur, lime, flours, talc and other organic and inorganic solid carriers) and mechanically grinding the mixture to a fine powder.

Soluble powders (SP) may be prepared by mixing a compound of formula (I) with one or more water-soluble inorganic salts (such as sodium bicarbonate, sodium carbonate or magnesium sulphate) or one or more water-soluble organic solids (such as a polysaccharide) and, optionally, one or more wetting agents, one or more dispersing agents or a mixture of said agents to improve water dispersibility/solubility. The mixture is then ground to a fine powder. Similar compositions may also be granulated to form water soluble granules (SG).

Wettable powders (WP) may be prepared by mixing a compound of formula (I) with one or more solid diluents or carriers, one or more wetting agents and, preferably, one or more dispersing agents and, optionally, one or more suspending agents to facilitate the dispersion in liquids. The mixture is then ground to a fine powder. Similar compositions may also be granulated to form water dispersible granules (WG).

Granules (GR) may be formed either by granulating a mixture of a compound of formula (I) and one or more powdered solid diluents or carriers, or from pre-formed blank granules by absorbing a compound of formula (I) (or a solution thereof, in a suitable agent)
in a porous granular material (such as pumice, attapulgite clays, fuller's earth, kieselguhr, diatomaceous earths or ground corn cobs) or by adsorbing a compound of formula (I) (or a solution thereof, in a suitable agent) on to a hard core material (such as sands, silicates, mineral carbonates, sulphates or phosphates) and drying if necessary. Agents which are commonly used to aid absorption or adsorption include solvents (such as aliphatic and aromatic petroleum solvents, alcohols, ethers, ketones and esters) and sticking agents (such as polyvinyl acetates, polyvinyl alcohols, dextrins, sugars and vegetable oils). One or more other additives may also be included in granules (for example an emulsifying agent, wetting agent or dispersing agent).

Dispersible Concentrates (DC) may be prepared by dissolving a compound of formula (I) in water or an organic solvent, such as a ketone, alcohol or glycol ether. These solutions may contain a surface active agent (for example to improve water dilution or prevent crystallisation in a spray tank).

Emulsifiable concentrates (EC) or oil-in-water emulsions (EW) may be prepared by dissolving a compound of formula (I) in an organic solvent (optionally containing one or more wetting agents, one or more emulsifying agents or a mixture of said agents). Suitable organic solvents for use in ECs include aromatic hydrocarbons (such as alkylbenzenes or alkynaphthalenes, exemplified by SOLVESSO 100, SOLVESSO 150 and SOLVESSO 200; SOLVESSO is a Registered Trade Mark), ketones (such as cyclohexanone or methylcyclohexanone) and alcohols (such as benzyl alcohol, furfuryl alcohol or butanol), N-alkylpyrrrolidones (such as N-methylpyrrrolidone or N-octylpyrrrolidone), dimethyl amides of fatty acids (such as C₈-C₁₀ fatty acid dimethylamide) and chlorinated hydrocarbons. An EC product may spontaneously emulsify on addition to water, to produce an emulsion with sufficient stability to allow spray application through appropriate equipment. Preparation of an EW involves obtaining a compound of formula (I) either as a liquid (if it is not a liquid at room temperature, it may be melted at a reasonable temperature, typically below 70°C) or in solution (by dissolving it in an appropriate solvent) and then emulsifying the resultant liquid or solution into water containing one or more SFAs, under high shear, to produce an emulsion. Suitable solvents for use in EWs include vegetable oils, chlorinated hydrocarbons (such as chlorobenzenes), aromatic solvents (such as alkylbenzenes or alkynaphthalenes) and other appropriate organic solvents which have a low solubility in water.
Microemulsions (ME) may be prepared by mixing water with a blend of one or more solvents with one or more SFAs, to produce spontaneously a thermodynamically stable isotropic liquid formulation. A compound of formula (I) is present initially in either the water or the solvent/SFA blend. Suitable solvents for use in MEs include those hereinbefore described for use in in ECs or in EWs. An ME may be either an oil-in-water or a water-in-oil system (which system is present may be determined by conductivity measurements) and may be suitable for mixing water-soluble and oil-soluble pesticides in the same formulation. An ME is suitable for dilution into water, either remaining as a microemulsion or forming a conventional oil-in-water emulsion.

Suspension concentrates (SC) may comprise aqueous or non-aqueous suspensions of finely divided insoluble solid particles of a compound of formula (I). SCs may be prepared by ball or bead milling the solid compound of formula (I) in a suitable medium, optionally with one or more dispersing agents, to produce a fine particle suspension of the compound. One or more wetting agents may be included in the composition and a suspending agent may be included to reduce the rate at which the particles settle. Alternatively, a compound of formula (I) may be dry milled and added to water, containing agents hereinbefore described, to produce the desired end product.

Aerosol formulations comprise a compound of formula (I) and a suitable propellant (for example n-butane). A compound of formula (I) may also be dissolved or dispersed in a suitable medium (for example water or a water miscible liquid, such as n-propanol) to provide compositions for use in non-pressurised, hand-actuated spray pumps.

A compound of formula (I) may be mixed in the dry state with a pyrotechnic mixture to form a composition suitable for generating, in an enclosed space, a smoke containing the compound.

Capsule suspensions (CS) may be prepared in a manner similar to the preparation of EW formulations but with an additional polymerisation stage such that an aqueous dispersion of oil droplets is obtained, in which each oil droplet is encapsulated by a polymeric shell and contains a compound of formula (I) and, optionally, a carrier or diluent therefor. The polymeric shell may be produced by either an interfacial polycondensation reaction or by a coacervation procedure. The compositions may provide for controlled release of the compound of formula (I) and they may be used for seed treatment. A compound of formula
(I) may also be formulated in a biodegradable polymeric matrix to provide a slow, controlled release of the compound.

A composition may include one or more additives to improve the biological performance of the composition (for example by improving wetting, retention or distribution on surfaces; resistance to rain on treated surfaces; or uptake or mobility of a compound of formula (I)). Such additives include surface active agents, spray additives based on oils, for example certain mineral oils or natural plant oils (such as soy bean and rape seed oil), and blends of these with other bio-enhancing adjuvants (ingredients which may aid or modify the action of a compound of formula (I)).

A compound of formula (I) may also be formulated for use as a seed treatment, for example as a powder composition, including a powder for dry seed treatment (DS), a water soluble powder (SS) or a water dispersible powder for slurry treatment (WS), or as a liquid composition, including a flowable concentrate (FS), a solution (LS) or a capsule suspension (CS). The preparations of DS, SS, WS, FS and LS compositions are very similar to those of, respectively, DP, SP, WP, SC and DC compositions described above. Compositions for treating seed may include an agent for assisting the adhesion of the composition to the seed (for example a mineral oil or a film-forming barrier).

Wetting agents, dispersing agents and emulsifying agents may be surface SFAs of the cationic, anionic, amphoteric or non-ionic type.

Suitable SFAs of the cationic type include quaternary ammonium compounds (for example cetyltrimethyl ammonium bromide), imidazolines and amine salts.

Suitable anionic SFAs include alkali metals salts of fatty acids, salts of aliphatic monoesters of sulphuric acid (for example sodium lauryl sulphate), salts of sulphonated aromatic compounds (for example sodium dodecylbenzenesulphonate, calcium dodecylbenzenesulphonate, butynaphthalene sulphonate and mixtures of sodium di-iso-propyl- and tri-iso-propyl-naphthalene sulphonates), ether sulphates, alcohol ether sulphates (for example sodium laureth-3-sulphate), ether carboxylates (for example sodium laureth-3-carboxylate), phosphate esters (products from the reaction between one or more fatty alcohols and phosphoric acid (predominately mono-esters) or phosphorus pentoxide (predominately di-esters), for example the reaction between lauryl alcohol and
tetraphosphoric acid; additionally these products may be ethoxylated), sulposuccinamates, paraffin or olefine sulphonates, taurates and lignosulphonates.

Suitable SFAs of the amphoteric type include betaines, propionates and glycinites.

Suitable SFAs of the non-ionic type include condensation products of alkylene oxides, such as ethylene oxide, propylene oxide, butylene oxide or mixtures thereof, with fatty alcohols (such as oleyl alcohol or cetyl alcohol) or with alkylphenols (such as octylphenol, nonylphenol or octylcresol); partial esters derived from long chain fatty acids or hexitol anhydrides; condensation products of said partial esters with ethylene oxide; block polymers (comprising ethylene oxide and propylene oxide); alkanolamides; simple esters (for example fatty acid polyethylene glycol esters); amine oxides (for example lauryl dimethyl amine oxide); and lecithins.

Suitable suspending agents include hydrophilic colloids (such as polysaccharides, polyvinylpyrrolidone or sodium carboxymethylcellulose) and swelling clays (such as bentonite or attapulgite).

A compound of formula (I) may be applied by any of the known means of applying pesticidal or fungicidal compounds. For example, it may be applied, formulated or unformulated, to the pests or to a locus of the pests (such as a habitat of the pests, or a growing plant liable to infestation by the pests) or to any part of the plant, including the foliage, stems, branches or roots, to the seed before it is planted or to other media in which plants are growing or are to be planted (such as soil surrounding the roots, the soil generally, paddy water or hydroponic culture systems), directly or it may be sprayed on, dusted on, applied by dipping, applied as a cream or paste formulation, applied as a vapour or applied through distribution or incorporation of a composition (such as a granular composition or a composition packed in a water-soluble bag) in soil or an aqueous environment.

A compound of formula (I) may also be injected into plants or sprayed onto vegetation using electrodynamic spraying techniques or other low volume methods, or applied by land or aerial irrigation systems.

Compositions for use as aqueous preparations (aqueous solutions or dispersions) are generally supplied in the form of a concentrate containing a high proportion of the active ingredient, the concentrate being added to water before use. These concentrates, which may include DCs, SCs, ECs, EWs, MEs SGs, SPs, WPs, WGs and CSs, are often required to
withstand storage for prolonged periods and, after such storage, to be capable of addition to water to form aqueous preparations which remain homogeneous for a sufficient time to enable them to be applied by conventional spray equipment. Such aqueous preparations may contain varying amounts of a compound of formula (I) (for example 0.0001 to 10%, by weight) depending upon the purpose for which they are to be used.

A compound of formula (I) may be used in mixtures with fertilisers (for example nitrogen-, potassium- or phosphorus-containing fertilisers). Suitable formulation types include granules of fertiliser. The mixtures suitably contain up to 25% by weight of the compound of formula (I).

The invention therefore also provides a fertiliser composition comprising a fertiliser and a compound of formula (I).

The compositions of this invention may contain other compounds having biological activity, for example micronutrients or compounds having similar or complementary fungicidal activity or which possess plant growth regulating, herbicidal, insecticidal, nematicidal or acaricidal activity.

By including another fungicide, the resulting composition may have a broader spectrum of activity or a greater level of intrinsic activity than the compound of formula (I) alone. Further the other fungicide may have a synergistic effect on the fungicidal activity of the compound of formula (I).

The compound of formula (I) may be the sole active ingredient of the composition or it may be admixed with one or more additional active ingredients such as a pesticide, fungicide, synergist, herbicide or plant growth regulator where appropriate. An additional active ingredient may: provide a composition having a broader spectrum of activity or increased persistence at a locus; synergise the activity or complement the activity (for example by increasing the speed of effect or overcoming repellency) of the compound of formula (I); or help to overcome or prevent the development of resistance to individual components. The particular additional active ingredient will depend upon the intended utility of the composition. Examples of suitable pesticides include the following:

a) Pyrethroids, such as permethrin, cypermethrin, fenvalerate, esfenvalerate, deltamethrin, cyhalothrin (in particular lambda-cyhalothrin), bifenthrin, fenpropathrin, cyfluthrin, tefluthrin, fish safe pyrethroids (for example ethofenprox), natural pyrethrin, tetramethrin,
s-bioallethrin, fenfluthrin, prallethrin or 5-benzyl-3-furylimethyl-(E)-(1R,3S)-2,2-dimethyl-3-(2-oxothiolan-3-ylidenemethyl)cyclopropane carboxylate;
b) Organophosphates, such as, profenofos, sulprofos, acephate, methyl parathion, azinphos-methyl, demeton-s-methyl, heptenophos, thiometon, fenamiphos, monocrotophos, profenofos, triazophos, methamidophos, dimethoate, phosphamidon, malathion, chlorpyrifos, phosalone, terbufos, fensulfothion, fonofos, phorate, phoxim, pirimiphos-methyl, pirimiphos-ethyl, fenitrothion, fosthiazate or diazinon;
c) Carbamates (including aryl carbamates), such as pirimicarb, triazamate, cloethocarb, carbofuran, furathiocarb, ethiofencarb, aldicarb, thiofurox, carbosulfan, bendiocarb, fenobucarb, propoxur, methomyl or oxamyl;
d) Benzoyl ureas, such as diflubenzuron, triflumuron, hexaflumuron, flufenoxuron or chlorfluazuron;
e) Organic tin compounds, such as cyhexatin, fenbutatin oxide or azocyclotin;
f) Pyrazoles, such as tebufenpyrad and fenpyroximate;
g) Macrolides, such as avermectins or milbemycins, for example abamectin, emamectin benzoate, ivermectin, milbemycin, spinosad or azadirachtin;
h) Hormones or pheromones;
i) Organochlorine compounds such as endosulfan, benzene hexachloride, DDT, chlordane or dieldrin;
j) Amidines, such as chlordimeform or amitraz;
k) Fumigant agents, such as chloropicrin, dichloropropane, methyl bromide or metam;
l) Chloronicotinyl compounds such as imidacloprid, thiacloprid, acetamiprid, nitenpyram or thiamethoxam;
m) Diacylhydrazines, such as tebufenozide, chromafenozide or methoxyfenozide;
n) Diphenyl ethers, such as diofenolan or pyriproxifen;
o) Indoxacarb;
p) Chlorfenapyr; or
q) Pymetrozine.

In addition to the major chemical classes of pesticide listed above, other pesticides having particular targets may be employed in the composition, if appropriate for the intended utility of the composition. For instance, selective insecticides for particular crops, for
example stemborer specific insecticides (such as cartap) or hopper specific insecticides (such as buprofezin) for use in rice may be employed. Alternatively insecticides or acaricides specific for particular insect species/stages may also be included in the compositions (for example acaricidal ovo-larvicides, such as clofentezine, flubenzimine, hexythiazox or tetradifen; acaricidal motilicides, such as dicofol or propargite; acaricides, such as bromopropylate or chlorobenzilate; or growth regulators, such as hydramethylnon, cyromazine, methoprene, chlorfluazuron or diflubenzuron).

Examples of fungicidal compounds which may be included in the composition of the invention are (E)-N-methyl-2-[2-(2,5-dimethylphenoxy)methyl]phenyl]-2-methoxy-iminoacetamide (SSF-129), 4-bromo-2-cyano-N,N-dimethyl-6-trifluoromethylbenzimidazole-1-sulphonamide, 3α-[N-(3-chloro-2,6-xylyl)-2-methoxy-acetamido]-γ-butyrolactone, 4-chloro-2-cyano-N,N-dimethyl-5-p-tolylimidazole-1-sulfonamide (IKF-916, cyamidazosulfamid), 3-5-dichloro-N-(3-chloro-1-ethyl-1-methyl-2-oxopropyl)-4-methylbenzamide (RH-7281, zoxamide), N-allyl-4,5,6-dimethyl-2-trimethylsilylthiophene-3-carboxamide (MON65500), N-(1-cyano-1,2-dimethylpropyl)-2-(2,4-dichlorophenoxoy)propionamide (AC382042), N-(2-methoxy-5-pyridyl)-cyclopropane carboxamide, acibenzolar (CGA245704), alanycarb, aldimorph, anilazine, azaconazole, azoxystrobins, benalaxyl, benomyl, biloxazol, bitertanol, blasticidin S, bremuconazole, bupiriminate, captan, captafol, captan, carbendazim, carbendazim chloride, carboxin, carproamid, carvone, CGA41396, CGA41397, chinomethionate, chlorothalonil, chloroxoline, clozylacon, copper containing compounds such as copper oxychloride, copper oxyquinolate, copper sulphate, copper tallate and Bordeaux mixture, cymoxanil, cyproconazole, cyprodinil, debacarb, di-2-pyridyl disulphide 1,1'-dioxide, dichlofluanid, diclomezine, dicloran, diethofencarb, difenoconazole, difenoquat, diflumetorim, O,O-di-iso-propyl-S-benzyl thiophosphate, dimefluazame, dimeconazole, dinmethomorph, dimetrimol, diniconazole, dinocap, dithianon, dodecyl dimethyl ammonium chloride, dodemorph, dodine, doguadine, edifenphos, epoxiconazole, ethirimol, ethyl(Z)-N-benzyl-N-[methyl(methylthioethylideneaminoxyacarbonyl)amino]thio)-β-alaninate, etridiazole, famoxadone, fenamidone (RPA407213), fenarimol, fenbuconazole, fenfuram, fenhexamid (KBR2738), fenpiclonil, fenpropidin, fenpropimorph, fentin acetate, fentin hydroxide, ferbam, ferimzone, fluazinam, fludioxonil, flumezolate, fluoroimide, fluquinconazole, flusilazole, flutolanil,
flutriafol, folpet, fuberidazole, furalaxyl, furametpyr, guazatine, hexaconazole, hydroxyisoxazole, hymexazol, imazalil, imibenconazole, iminoctadine, iminoctadine triacetate, ipaconazole, iprobenfos, iprodione, iprovalicarb (SZX0722), isopropanyl butyl carbamate, isoprop thiolane, kasugamycin, kresoxim-methyl, LY186054, LY211795, LY248908, mancozeb, maneB, mefenoxam, mepanipyrim, mepronil, metalaxyl, metconazole, metiram, metiram-zinc, metominostrobin, myclobutanil, neoasozin, nickel dimethyl dithiocarbamate, nitrothal-isopropyl, nuarimol, ofurace, organomercury compounds, oxadixyl, oxasulfuron, oxolinic acid, o xoconazole, oxycarboxin, pefurazoate, penconazole, pencycuron, phenazin oxide, phosetyl-Al, phosphorus acids, phthalide, picoxy strobin (ZA1963), polyoxin D, polyram, probenazole, prochloraz, procymidone, propamocarb, propiconazole, propineb, propionic acid, pyrazophos, pyrifl oxox, pyramidath, pyroqulon, pyr oxyfur, pyrrolin tri, quaternary ammonium compounds, quinomethionate, quinoxyfen, quintozene, sipaconazole (F-155), sodium pentachlorophenate, spiroxamine, streptomycin, sulphur, tebuconazole, tecloftalam, tecnazene, tetraconazole, thiabendazole, thifluzazam, 2-(thiocyanomethylthio) benzothiazole, thiophanate-methyl, thiram, timibenconazole, tolclofos-methyl, tolylfluanid, triadimefon, triadinol, triazbutil, triazoxide, tricyclazole, tridemorph, trifloxystrobin (CGA279202), triforine, triflumizole, triticonazole, validamycin A, vapam, vinclozolin, zineB and ziram.

The compounds of formula (I) may be mixed with soil, peat or other rooting media for the protection of plants against seed-borne, soil-borne or foliar fungal diseases.

Examples of suitable synergists for use in the compositions include piperonyl butoxide, sesamex, safro xan and dodecyl imidazole.

Suitable herbicides and plant-growth regulators for inclusion in the compositions will depend upon the intended target and the effect required.

An example of a rice selective herbicide which may be included is propanil. An example of a plant growth regulator for use in cotton is PIX™.

Some mixtures may comprise active ingredients which have significantly different physical, chemical or biological properties such that they do not easily lend themselves to the same conventional formulation type. In these circumstances other formulation types may be prepared. For example, where one active ingredient is a water insoluble solid and the other a water insoluble liquid, it may nevertheless be possible to disperse each active ingredient in
the same continuous aqueous phase by dispersing the solid active ingredient as a suspension (using a preparation analogous to that of an SC) but dispersing the liquid active ingredient as an emulsion (using a preparation analogous to that of an EW). The resultant composition is a suspoemulsion (SE) formulation.

The invention is illustrated by the following Examples:

EXAMPLE 1

This Example describes the preparation of Compound No 21.07 in Table 21

Step 1

A solution of oxaly chloride (2.1 g, 16.2 mmol) in tetrahydrofuran (4 ml) was added dropwise to a solution of [2-(2,2-dimethyl)propylbenzoxazol-5-yl]acetic acid (4.0 g, 16.2 mmol) and N,N-dimethylformamide (1 drop) in tetrahydrofuran (50 ml) and the mixture stirred at room temperature until effervescence ceased and then for a further one hour. The solvent was evaporated in vacuo and the residue used directly in the next step.

Step 2

Di-tert-butyl malonate (3.5 g, 16.2 mmol) was added to a slurry of magnesium chloride (1.54 g, 16.2 mmol) in acetonitrile (45 ml) and the resulting mixture cooled to 0 °C. Triethylamine (3.3 g, 32.4 mmol) was added and the mixture stirred for 30 minutes, then a solution of the acid chloride (4.4 g, 16.2 mmol) prepared in Step 1 in acetonitrile (10 ml) was added dropwise. The mixture was stirred at 0 °C for 1 hour and then allowed to warm slowly to room temperature overnight. The mixture was partitioned between water and diethyl ether and the organic extract dried over anhydrous magnesium sulfate, filtered and the filtrate evaporated in vacuo. Trituration with a mixture of ethyl acetate (10%) and hexane (90%) gave di-tert-butyl [2-(2,2-dimethylpropyl)benzoxazol-5-yl]acetyl malonate (3.1 g) as a colourless solid.

Step 3

Di-tert-butyl [2-(2,2-dimethylpropyl)benzoxazol-5-yl]acetyl malonate (3.2 g, 7.2 mmol) was stirred in trifluoroacetic acid at room temperature for 2.5 hours. The solvent was removed in vacuo, the residue taken up in N,N-dimethylformamide and the mixture heated at 120 °C for 2.5 hours. The mixture was cooled to room temperature, and the solvent evaporated in vacuo. The residue was purified by flash column chromatography, eluting with
ethyl acetate: hexane 1:3 to give [2-(2,2-dimethylpropyl)benzoxazol-5-yl]propanone (1.42 g)

1H NMR (CDCl₃) δ ppm: 1.08 (s, 9H); 2.18 (s, 3H); 2.82 (s, 2H); 3.82 (s, 2H); 7.12 (dd, 1H); 7.44 (d, 1H); 7.52 (d, 1H)

5 Step 4

Sodium triacetoxyborohydride (0.43 g, 2.02 mmol) was added to a mixture of [2-(2,2-dimethylpropyl)benzoxazol-5-yl]propanone (0.248 g, 1.01 mmol) and 5-amino-4-chloro-3-methylisothiazole (0.15 g, 1.01 mmol) in glacial acetic acid (8 ml), and the mixture stirred at room temperature for 48 hours. The mixture was poured into dilute aqueous sodium hydroxide solution and extracted with ethyl acetate. The organic extract was washed sequentially with water and saturated aqueous sodium bicarbonate solution, dried over anhydrous magnesium sulfate, filtered and the filtrate evaporated in vacuo. The residue was purified by flash column chromatography, eluting with ethyl acetate: hexane 1:4 to give the required compound (0.09 g), m.p. 96-97 °C.

1H NMR (CDCl₃) δ ppm: 1.10 (s, 9H); 1.30 (d, 3H); 2.32 (s, 3H); 2.82(s, 2H); 3.00 (dq, 2H); 3.52 (m, 1H); 4.50 (bd, 1H); 7.10 (dd, 1H); 7.42 (d, 1H); 7.50 (d, 1H)

 EXAMPLE 2

This Example describes the preparation of Compound No 2.87 in Table 2

Step 1

Methyl (2-(2,2-dimethylpropyl)benzoxazol-5-yl)acetate (14.85 g, 57.0 mmol) was dissolved in THF (200 ml) and the solution was cooled to -75°C. Lithium bis-trimethylsilylamide (1.0 M in THF, 62.7 ml, 62.7 mmol) was added dropwise over 90 minutes so that the temperature never exceeded -70°C. The mixture was then allowed to stir for 1 hour at -75°C and methyl iodide (63 ml, 570 mmol) was added dropwise. The mixture was allowed to warm to room temperature overnight. The mixture was partitioned between water and ethyl acetate and the organic solution was washed with brine, dried (MgSO₄), filtered and evaporated to give methyl 2-(2,2-dimethylpropyl)benzoxazol-5-yl)propionate which was used without further purification.

1H NMR (CDCl₃) δ ppm: 1.10 (s,9H); 1.55 (d,3H); 2.82 (s,2H); 4.68 (s,3H); 4.85 (q,1H); 7.23 (dd,1H); 7.43 (d,1H); 7.62 (d,1H)

Step 2
Methyl 2-(2-(2,2-dimethylpropyl)benzoxazol-5-yl)propionate (2.92 g, 10.6 mmol) was dissolved in methanol (25 ml) and aqueous sodium hydroxide (1.0 M, 11 ml, 11 mmol) was added dropwise and the mixture was stirred at room temperature for 45 minutes. Brine (100 ml) and aqueous hydrochloric acid (2.0 M, 10 ml) were added and the mixture was extracted with ethyl acetate which was dried (MgSO₄), filtered and evaporated to give 2-(2-(2,2-dimethylpropyl)benzoxazol-5-yl)propionic acid as a yellow oil which crystallised on standing (2.63 g, 95%).

1H NMR (CDCl₃) δ ppm: 1.11 (s,9H); 1.58 (d,3H); 2.82 (s,2H); 3.88 (q,1H); 7.26 (dd,1H); 7.43 (d,1H); 7.69 (d,1H)

**Step 3**

2-(2-(2,2-Dimethylpropyl)benzoxazol-5-yl)propionic acid (2.63 g, 10 mmol) was suspended in toluene (20 ml) and triethylamine (1.70 ml, 12 mmol) was added. The mixture was heated to reflux and a solution of diphenylphosphoryl azide (2.4 ml, 11 mmol) in toluene (5 ml) was added dropwise. The mixture was heated at reflux for 90 min after which it was allowed to cool and 2-trimethylsilylethanol (1.75 ml, 12 mmol) was added. The resulting mixture was then heated at reflux for 3 hours. The mixture was allowed to cool and then diluted with toluene (100 ml) and washed with water (5 x 100 ml) and brine (100 ml). The organic layer was dried (MgSO₄), filtered and under reduced pressure. The residue was purified by flash chromatography on silica gel eluting with 15% ethyl acetate in hexane to give N-(2-trimethylsilylethoxycarbonyl)-1-(2-(2,2-dimethylpropyl)benzoxazol-5-yl)ethylamine (2.65 g, 72%).

1H NMR (CDCl₃) δ ppm: 0.01 (s,9H); 0.95 (t,2H); 1.08 (s,9H); 1.50 (d,3H); 2.81 (s,2H); 4.13 (t,2H); 4.35 (m,1H); 4.95 (m,1H); 7.25 (dd,1H); 7.44 (d,1H); 7.63 (d,1H)

**Step 4**

N-(2-Trimethylsilylethoxycarbonyl)-1-(2-(2,2-dimethylpropyl)benzoxazol-5-yl)ethylamine (2.65 g, 7.1 mmol) was suspended in THF (25 ml) and tetrabutylammonium fluoride (1.0 M in THF, 10.0 ml, 10.0 mmol) was added. The mixture was heated to reflux for 30 minutes after which it was allowed to cool. The solvent was evaporated under reduced pressure and the residue was partitioned between water and ether. The organic layer was washed with brine, dried (MgSO₄) filtered and evaporated under reduced pressure to give 1-
(2-(2,2-dimethylpropyl)benzoxazol-5-yl)ethylamine which was used with no further purification (1.36 g, 83%).

1H NMR (CDCl₃) δ ppm: 1.09 (s,9H); 1.44 (d,3H); 1.80 (br s,2H); 2.82 (s,2H); 4.25 (q,1H); 7.31 (dd,1H); 7.44 (d,1H); 7.67 (d,1H)

**Step 5**

1-(2-(2,2-Dimethylpropyl)benzoxazol-5-yl)ethylamine (350 mg, 1.5 mmol) was dissolved in methanol (10 ml) and O-ethyl-N-(3-methyl-4-cyanoisoxazol-5-yl)formimidate (270 mg, 1.5 mmol) was added and the mixture was left to stir at room temperature overnight. Metallic sodium (35 mg, 1.5 mmol) was added and the mixture was heated at reflux for 1 hour. The mixture was allowed to cool and partitioned between ethyl acetate and brine. The organic layer was dried (MgSO₄), filtered and evaporated and the residue was purified by flash chromatography on silica gel (eluting with 25-35% ethyl acetate in hexane) to give Compound No 2.87 (312 mg, 57%).

1H NMR (CDCl₃) δ ppm: 1.09 (s,9H); 1.74 (d,3H); 2.62 (s,3H); 2.81 (s,2H); 5.49 (br d,1H); 5.73 (m,1H); 7.36 (dd,1H); 7.50 (d,1H); 7.72 (d,1H); 8.50 (s,1H)

The following compounds were prepared by analogous methods: Compounds 1.87 in Table 1; 2.81 in Table 2; 1.84 in Table 1; 2.84 in Table 2 and 19.84 in Table 19.

Compound 1.87 in Table 1

1H NMR (CDCl₃) δ ppm: 1.10 (s,9H); 2.60 (s,3H); 2.81 (s,2H); 4.99 (d,2H); 5.58 (br t,1H); 7.33 (dd,1H); 7.49 (d,1H); 7.69 (d,1H); 8.56 (s,1H)

Compound 2.81 in Table 2

1H NMR (CDCl₃) δ ppm: 1.72 (d,3H); 2.62 (s,3H); 2.65 (s,3H); 5.37 (m,1H); 5.73 (m,1H); 7.35 (dd,1H); 7.48 (d,1H); 7.59 (d,1H); 8.49 (s,1H)

Compound 1.84 in Table 1

1.45 (d,6H); 2.60 (s,3H); 3.25 (m,1H); 4.95 (d,2H); 5.70 (br t,1H); 7.32 (dd,1H); 7.48 (d,1H); 7.69 (d,1H); 8.52 (s,1H).

Compound 2.84 in Table 2

1.45 (d,6H); 1.70 (d,3H); 2.60 (s,3H); 3.25 (m,1H); 5.38 (br d,1H); 5.70 (m,1H); 7.35 (dd,1H); 7.49 (d,1H); 7.72 (d,1H); 8.49 (s,1H).

Compound 19.84 in Table 19
0.98 (t,3H); 1.45 (d,6H); 2.00 (m,1H); 2.10 (m,1H); 2.63 (s,3H); 3.25 (m,1H); 5.40 (br d,1H); 5.45 (q,1H); 7.32 (dd,1H); 7.48 (d,1H); 7.69 (d,1H); 8.47 (s,1H).

EXAMPLE 3

This Example describes the preparation of Compound No 2.37 in Table 2.

1-(2-(2,2-Dimethylpropyl)benzoxazol-5-yl)ethylamine (260 mg, 1.12 mmol) and 4,5-dichloro-6-ethylpyrimidine (200 mg, 1.12 mmol) were dissolved in pyridine (0.5 ml) and the mixture was heated at 100°C for 30 min. The mixture was allowed to cool and was partitioned between water and ethyl acetate. The organic layer was washed with brine, dried (Na₂SO₄), filtered and evaporated and the residue was purified by flash chromatography on silica gel (eluting with ethyl acetate) to give Compound No 2.37 (130 mg, 29%).

1H NMR (CDCl₃) δ ppm: 1.10 (s,9H); 1.26 (t,3H); 1.66 (d,3H); 2.80 (q,1H); 2.81 (s,2H); 5.46 (m,1H); 5.65 (br d,1H); 7.33 (dd,1H); 7.47 (d,1H); 7.70 (d,1H); 8.40 (s,1H)

Compound 1.37 in Table 1 was prepared by an analogous method.

Compound 1.37 in Table 1

1H NMR (CDCl₃) δ ppm: 1.09 (s,9H); 1.29 (t,3H); 2.83 (m,4H); 4.83 (d,2H); 5.77 (br t,1H); 7.31 (dd,1H); 7.49 (d,1H); 7.68 (d,1H); 8.49 (s,1H)

EXAMPLE 4

This Example describes the preparation of Compound No 2.47 in Table 2.

1-(2-(2,2-Dimethylpropyl)benzoxazol-5-yl)ethylamine (246 mg, 1.06 mmol) and 4-chloro-5-methoxy-6-methoxymethylpyrimidine (200 mg, 1.06 mmol) were dissolved in pyridine (0.5 ml) and the mixture was heated at 100°C for 10 hours. The solvent was evaporated under reduced pressure and the residue was purified by preparative thin layer chromatography (eluting with ethyl acetate and extracting with methanol) to give Compound No 2.47 (90 mg, 22%).

1H NMR (CDCl₃) δ ppm: 1.09 (s,9H); 1.66 (d,3H); 2.81 (s,2H); 3.49 (s,3H); 3.82 (s,3H); 4.47 (s,2H); 5. (m,1H); 5.55 (br d,1H); 7.32 (dd,1H); 7.46 (d,1H); 7.69 (d,1H); 8.35 (s,1H)

Compound 1.47 in Table 1 and Compound 2.41 in Table 2 were prepared by analogous methods.

Compound 1.47 in Table 1

1H NMR (CDCl₃) δ ppm: 1.09 (s,9H); 2.82 (s, 2H); 3.49 (s,3H); 3.80 (s,3H); 4.49 (s,2H); 4.80 (d,2H); 5.66 (br t,1H); 7.29 (dd,1H); 7.45 (d,1H); 7.66 (d,1H); 8.42 (s,1H)
Compound 2.41 in Table 2
1.63 (d,3H); 2.62 (s,3H); 3.45 (s,3H); 3.80 (s,3H); 4.47 (s,2H); 5.43 (m,1H); 5.59 (br d,1H); 7.31 (dd,1H); 7.42 (d,1H); 7.63 (d,1H); 8.33 (s,1H).

EXAMPLE 5

This Example illustrates the pesticidal/insecticidal properties of compounds of formula (I). The activities of individual compounds of formula (I) were determined using a variety of pests. The pests were treated with a liquid composition containing 500 parts per million (ppm) by weight of a compound. Each composition was made by dissolving the compound in an acetone and ethanol (50:50 by volume) mixture and diluting the solution with water containing 0.05% by volume of a wetting agent, SYNPERONIC NP8, until the liquid composition contained the required concentration of the compound.

The test procedure adopted with regard to each pest was essentially the same and comprised supporting a number of the pests on a medium which was usually a substrate, a host plant or a foodstuff on which the pests feed, and treating either or both the medium and the pests with a composition. Pest mortality was assessed usually between two and five days after treatment.

The results of the tests against peach aphid (Myzus persicae) are presented below. In this test Chinese cabbage leaves were infested with aphids, the infested leaves were sprayed with the test composition, and the mortality assessed after three days. The results indicate a grading of mortality (score) designated as 9, 5 or 0 wherein 9 indicates 80-100% mortality, 5 indicates 40-79% mortality and 0 indicates less than 40% mortality.

Compound Nos. 1.37, 1.47, 2.37, 2.41 and 2.47 each gave a mortality score of 9.

In addition, in a similar test against two-spotted spider mites (Tetranychus urticae) Compound Nos. 1.37, 1.47, 2.37, 2.41 and 2.47 each gave a mortality score of 9 whilst compound No. 21.07 gave a score of 5.

EXAMPLE 6

This Example illustrates the fungicidal properties of compounds of formula (I). The compounds were tested against a variety of foliar fungal diseases of plants. The technique employed was as follows.

Plants were grown in John Innes Potting Compost (No.1 or 2) in 4cm diameter, 3.5cm depth minipots. The test compounds were individually formulated as a solution either in
acetone or acetone/ethanol (1:1 by volume) which was diluted in deionised water to a concentration of 100ppm (that is, 1mg of compound in a final volume of 10ml) immediately before use. When foliar sprays were applied to monocotyledonous crops, TWEEN 20 (0.1% by volume) was added. TWEEN is a registered trade mark.

Individual compounds of formula (I) were applied as a foliar (Folr) application (where the chemical solution was applied to the foliage of the test plants by spraying the plant to maximum droplet retention.)

These tests were carried out against Uncinula necator (UNCINE), on vines; Phytophthora infestans lycopersici (PHYTIN) on tomatoes; Puccinia recondita (PUCCRT), on wheat; and Pyricularia oryzae (PYRIO) on rice. Each treatment was applied to two or more replicate plants for Phytophthora infestans lycopersici and Uncinula necator. For tests on Puccinia recondita and Pyricularia oryzae two replicate pots each containing 6 to 10 plants were used for each treatment. The plants were inoculated one day before (Erad) or one day after (Prot) chemical application. The Phytophthora infestans lycopersici, Puccinia recondita and Pyricularia oryzae plants were inoculated with a calibrated fungal spore suspension. The Uncinula necator plants were inoculated using a ‘blowing’ inoculation technique.

After chemical application and inoculation, the plants were incubated under high humidity conditions and then put into an appropriate environment to allow infection to proceed, until the disease was ready for assessment. The time period between chemical application and assessment varied from five to fourteen days according to the disease and environment. However, each individual disease was assessed after the same time period for all compounds.

Assessments were performed on each of two leaves on each of the replicate plants for Phytophthora infestans lycopersici. Assessments were performed on a single leaf of each of the replicate plants for Uncinula necator. For Puccinia recondita and Pyricularia recondita assessments were carried out collectively on the plants in each replicate pot.

The disease level present (that is, the percentage leaf area covered by actively sporulating disease) was assessed visually. For each treatment, the assessed values for all its replicates were mean to provide mean disease values. Untreated control plants were
assessed in the same manner. The data were then processed by the method, described hereinafter, to provide PRCO (Percentage Reduction from Control) values.

An example of a typical calculation is as follows:

Mean disease level for treatment A = 25%
Mean disease level on untreated controls = 85%

PRCO = 100 - \left\{ \frac{\text{Mean disease level for treatment A}}{\text{Mean disease level on untreated controls}} \right\} \times 100

= 100 - \left( \frac{25}{85} \times 100 \right) = 70.6

The PRCO is then rounded to the nearest whole number; therefore, in this particular example, the PRCO result is 71.

It is possible for negative PRCO values to be obtained. If no test data were available this is indicated in the Table below by a "-".

PRCO results are shown below.

**TABLE 79**

<table>
<thead>
<tr>
<th>COMPOUND NO.</th>
<th>PHYTIN Prot</th>
<th>PUC CRT Prot</th>
<th>PYR IOR Prot</th>
<th>UNCINE Erad</th>
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<td>34</td>
<td>74</td>
<td>96</td>
</tr>
<tr>
<td>1.87</td>
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<td>-</td>
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<td>100</td>
</tr>
<tr>
<td>2.87</td>
<td>94</td>
<td>87</td>
<td>78</td>
<td>99</td>
</tr>
<tr>
<td>2.37</td>
<td>-</td>
<td>100</td>
<td>70</td>
<td>100</td>
</tr>
</tbody>
</table>
1. A compound of formula (I):

![Chemical Structure](image)

wherein

A is optionally substituted C₁₋₆ alkylene, optionally substituted C₂₋₆ alkenylene, optionally substituted C₂₋₆ alkylnylene, optionally substituted cycloalkylene, optionally substituted C₁₋₆ alkylenoxy, optionally substituted oxy(C₁₋₆)alkylene, optionally substituted C₁₋₆ alkenethio, optionally substituted thio(C₁₋₆)alkylene, optionally substituted C₁₋₆ alkyleneamino, optionally substituted amino(C₁₋₆)alkylene, optionally substituted [C₁₋₆ alkylenoxy(C₁₋₆)alkylene], optionally substituted [C₁₋₆ alkenethio(C₁₋₆)alkylene], optionally substituted [C₁₋₆ alkylenesulfinyl(C₁₋₆)alkylene], optionally substituted [C₁₋₆ alkylenesulfonyl(C₁₋₆)alkylene] or optionally substituted [C₁₋₆ alkylenoxy(C₁₋₆)alkylene];

B is N, N-oxide or CR¹²;

D is O, S, NR⁷, CR⁸=CR⁹, CR⁸=N, N=CR⁹, CR⁸=N(O) or N(O)=CR⁹;

E is N, N-oxide or CR¹²;

W is CR¹ or N;

X is N or CR¹¹ and R¹¹ is hydrogen, optionally substituted C₁₋₆ alkyl or optionally substituted phenyl, with the proviso that the ring containing D, E, X and W contains at least one atom that is other than a carbon atom and that the ring containing D, E W and X may contain no more than 3 heteroatoms;

M is NR⁵⁶;

Z is O, S or NR¹⁴;

R¹ is hydrogen, halogen, optionally substituted C₁₋₆ alkyl, optionally substituted C₂₋₆ alkenyl, optionally substituted C₂₋₆ alkynyl, optionally substituted C₁₋₆ alkoxy, optionally substituted C₁₋₆ alkylthio, optionally substituted C₃₋₇ cycloalkyl, cyano, nitro or SF₅;
R' is hydrogen or optionally substituted C₁₋₆ alkyl;
R² is hydrogen, optionally substituted C₁₋₁₀ alkyl, optionally substituted [C₂₋₆
alkenyl(C₁₋₆)alkyl], optionally substituted [C₂₋₆ alkynyl(C₁₋₆)alkyl], optionally
substituted C₃₋₇ cycloalkyl, optionally substituted C₁₋₁₀ alkyllcarbonyl, optionally
substituted C₁₋₁₀ alkoxyacarbonyl, formyl, optionally substituted C₁₋₁₀
alkylaminocarbonyl, optionally substituted di(C₁₋₁₀)alkylaminocarbonyl, optionally
substituted phenoxyacarbonyl, optionally substituted C₁₋₆ alkylthio, optionally
substituted C₁₋₆ alkylsulfinyl, optionally substituted C₁₋₆ alkylsulfonyl, optionally
substituted C₁₋₆ arythio, optionally substituted C₁₋₆ arylsulfinyl, optionally substituted
C₁₋₆ arylsulfonyl or R²⁰R²¹NS;
R³, R⁴ and R⁵ are, independently, hydrogen, halogen, optionally substituted C₁₋₆ alkyl,
optionally substituted C₁₋₆ alkoxy, optionally substituted C₁₋₆ alkylthio, optionally
substituted C₁₋₆ alkylsulfinyl, optionally substituted C₁₋₆ alkylsulfonyl, cyano, nitro,
optionally substituted C₁₋₆ alkyllcarbonyl, optionally substituted C₁₋₆ alkoxyacarbonyl
or SF₅;
R⁶ is hydrogen, halogen, cyano, optionally substituted C₁₋₂₀ alkyl, optionally
substituted C₂₋₂₀ alkenyl, optionally substituted C₂₋₂₀ alkynyl, optionally substituted
C₃₋₇ cycloalkyl, optionally substituted C₅₋₆ cycloalkenyl, formyl, optionally substituted
C₁₋₂₀ alkoxyacarbonyl, optionally substituted C₁₋₂₀ alkyllcarbonyl, aminocarbonyl,
optionally substituted C₁₋₂₀ alkyllaminocarbonyl, optionally substituted
di(C₁₋₂₀)alkylaminocarbonyl, optionally substituted aryloxycarbonyl, optionally
substituted arylcarbonyl, optionally substituted arylaminocarbonyl, optionally
substituted N-alkyl-N-arylaminocarbonyl, optionally substituted
diarylaminocarbonyl, optionally substituted heteroaryloxycarbonyl, optionally
substituted heteroarylcarbonyl, optionally substituted heteroarylaminocarbonyl,
optionally substituted N-alkyl-N-heteroarylaminocarbonyl, optionally substituted
diheteroarylaminocarbonyl, optionally substituted phenyl, optionally substituted
deroaryl, optionally substituted heterocyclyl, HS, optionally substituted C₁₋₂₀
alkylthio, optionally substituted C₁₋₂₀ alkylsulfinyl, optionally substituted C₁₋₂₀
alkylsulfonyl, optionally substituted arylthio, optionally substituted arylsulfinyl,
optionally substituted arylsulfonyl, R²⁶O, R²⁸R²⁵N or R³¹ON=C(R²⁷);
$R^1$ and $R^2$ are, independently, hydrogen, halogen, cyano, nitro, optionally substituted C$_{1-6}$ alkyl, optionally substituted C$_{2-6}$ alkenyl, optionally substituted C$_{2-6}$ alkynyl or optionally substituted C$_{1-6}$ alkoxy;

$R^{12}$ is hydrogen, halogen, optionally substituted C$_{1-6}$ alkyl, optionally substituted C$_{2-6}$ alkenyl, optionally substituted C$_{2-6}$ alkynyl, optionally substituted C$_{1-6}$ alkoxy, optionally substituted C$_{1-6}$ alkylthio, optionally substituted C$_{1-6}$ alkylsulfanyl, optionally substituted C$_{1-6}$ alkylsulfonyl, cyano, nitro, formyl, optionally substituted C$_{1-6}$ alkylcarbonyl, optionally substituted C$_{1-6}$ alkoxy carbonyl, SF$_5$, $R^{32}$ON=C($R^{30}$), or $R^1$ and $R^{12}$ together with the atoms to which they are attached may be joined to form a five, six or seven-membered saturated or unsaturated, carbocyclic or heterocyclic ring which may contain one or two heteroatoms selected from O, N or S and which may be optionally substituted by C$_{1-6}$ alkyl, C$_{1-6}$ haloalkyl or halogen;

$R^{14}$ is hydrogen, cyano, optionally substituted C$_{1-6}$ alkyl, optionally substituted [C$_{2-6}$ alkenyl(C$_{1-6}$)alkyl], optionally substituted [C$_{2-6}$ alkynyl(C$_{1-6}$)alkyl], optionally substituted C$_{3-7}$ cycloalkyl, optionally substituted [C$_{3-7}$ cycloalkyl(C$_{1-6}$)alkyl], C$_{1-6}$ alkoxy(C$_{1-6}$)alkyl, optionally substituted C$_{1-6}$ alkoxy carbonyl, optionally substituted C$_{1-6}$ alkylcarbonyl, optionally substituted C$_{1-6}$ alkylaminocarbonyl, optionally substituted di(C$_{1-6}$)alkylaminocarbonyl, optionally substituted phenyl, optionally substituted heteroaryl, optionally substituted alkylsulfonfyl or optionally substituted arylsulfonfyl;

$R^{18}$ is hydrogen, halogen, nitro, cyano, optionally substituted C$_{1-6}$ alkyl, optionally substituted C$_{2-6}$ alkenyl, optionally substituted C$_{2-6}$ alkynyl, optionally substituted C$_{3-7}$ cycloalkyl, optionally substituted C$_{1-6}$ alkoxy carbonyl, optionally substituted C$_{1-6}$ alkylcarbonyl, optionally substituted C$_{1-6}$ alkylaminocarbonyl, optionally substituted di(C$_{1-6}$)alkylaminocarbonyl, optionally substituted phenyl or optionally substituted heteroaryl;

$R^{20}$ and $R^{21}$ are, independently, optionally substituted C$_{1-6}$ alkyl or $R^{20}$ and $R^{21}$ together with the N atom to which they are attached form a five, six or seven-membered heterocyclic ring which may contain one or two further hetero atoms selected from O, N or S and which may be optionally substituted by one or two C$_{1-6}$ alkyl groups;
R²⁶ is hydrogen, optionally substituted C₁₂₋₂₀ alkyl, optionally substituted [C₂₋₂₀ alkenyl(C₁₋₆)alkyl], optionally substituted [C₂₋₂₀ alkynyl(C₁₋₆)alkyl], optionally substituted C₃₋₇ cycloalkyl, optionally substituted aryl, optionally substituted heteroaryl, optionally substituted [heterocyclyl(C₁₋₆)alkylC=NH] or di(C₁₋₆)-alkylC=NH;

R²⁸ and R²⁹ are, independently, hydrogen, optionally substituted C₁₋₂₀ alkyl, optionally substituted C₃₋₇ cycloalkyl, optionally substituted [C₂₋₂₀ alkenyl(C₁₋₆)alkyl], optionally substituted [C₂₋₂₀ alkynyl(C₁₋₆)alkyl], optionally substituted C₁₋₂₀ alkoxy carbonyl, optionally substituted phenoxy carbonyl, formyl, optionally substituted C₁₋₂₀ alkyl carbonyl, optionally substituted C₁₋₂₀ alkoxy sulfonyl or optionally substituted phenyl sulfonyl; or R²⁸ and R²⁹ together with the N atom to which they are attached form a five, six or seven-membered heterocyclic ring which may contain one or two further hetero atoms selected from O, N or S and which may be optionally substituted by one or two C₁₋₆ alkyl groups;

R²⁷ and R³⁰ are independently hydrogen, optionally substituted phenyl or optionally substituted C₁₋₆ alkyl; and

R³¹ and R³² are, independently, hydrogen, optionally substituted phenyl (C₁₋₂)alkyl or optionally substituted C₁₋₂₀ alkyl provided that when E is N, W is CH, X is N, D is CR⁸=CR⁹, R⁸ is CH₃, CH₂C₁₋₃ alkyl or CH₂C₁₋₃ alkoxy and R⁹ is H, halo, CN, C₁₋₆ alkyl or C₁₋₆ alkoxy then R³⁶ cannot be H, formyl, C₁₋₆ alkyl, C₂₋₆ alkoxy carbonyl or C₂₋₆ alkoxy carbonyl provided that when E is N, W is CH, X is N, D is CR⁸=CR⁹, R⁸ is CH₃, CH₂C₁₋₃ alkyl or CH₂C₁₋₃ alkoxy and R⁹ is H, halo, CN, C₁₋₆ alkyl or C₁₋₆ alkoxy then R³⁶ cannot be H, formyl, C₁₋₆ alkyl, C₂₋₆ alkoxy carbonyl or C₂₋₆ alkoxy carbonyl and further provided that when E is N, W is CH, C-C₁₋₆ alkyl, C-C₁₋₆ alkoxy or C-C₁₋₆ alkyl thio, X is N and D is CR⁸=CR⁹ then B is not CR¹⁸.

2. A compound according to claim 1 of formula I'
where A, B, D, E, M, W, X, Z, R³, R⁴, R⁵, and R⁶ have the values as defined for formula (I).

3. A compound according to claim 1 or claim 2 wherein R⁶ is hydrogen, C₁₋₁₀ alkyl, C₁₋₆ alkylcarbonyloxy(C₁₋₄)alkyl, benzyloxymethyl (where the phenyl ring may be optionally substituted with halogen or C₁₋₄ alkyl), C₁₋₆ alkoxy(C₁₋₄)alkyl (with the alkyl group optionally substituted by aryl or C₁₋₄ alkoxy carbonyl), C₂₋₆ alkenyloxy(C₁₋₄)alkyl, C₂₋₆ alkynyloxy(C₁₋₄)alkyl, benzylxy(C₁₋₄)alkyl (where the phenyl ring may be optionally substituted with halogen or C₁₋₄ alkyl), C₅₋₇ cycloalkyl(C₁₋₄)alkyl, heteroaryl(C₁₋₃)alkyl (with the heteroaryl group optionally substituted with halogen), tri(C₁₋₄)alkylsilyl(C₁₋₄)alkyl, C₂₋₆ alkeny(C₁₋₆)alkyl (especially allyl), C₂₋₆ holoalkenyl(C₁₋₄)alkyl, C₁₋₄ alkoxy carbonyl(C₂₋₆)alkenyl(C₁₋₄)-alkyl, C₂₋₆ alkylnyl(C₁₋₆)alkyl, tri(C₁₋₆)alkylsilyl(C₂₋₆)alkynyl(C₁₋₆)alkyl, C₁₋₁₀ alky lacarbonyl, C₁₋₁₀ alkoxy carbonyl, formyl, C₁₋₁₀ alky laminocarbonyl, di(C₁₋₁₀) alkylaminocarbonyl, phenoxy carbonyl, C₁₋₆ alkylsulfonyl or C₁₋₆ arylsulfonyl.

4. A compound according to any preceding claim wherein A is is C₁₋₆ alkylene (optionally substituted by halogen, C₁₋₃ alkyl, C₁₋₃ holoalkyl, C₁₋₃ cyanoalkyl, C₁₋₆ alkoxy carbonyl), or C₁₋₆ alkyleneoxy.

5. A compound according to any preceding claim wherein Z is O or S and B is N.

6. A compound according to any preceding claim wherein the optionally substituted ring of formula

\[
\begin{align*}
\text{W} & \quad \text{E} \\
\text{X} \quad & \quad \text{D}
\end{align*}
\]

is isothiazolyl, optionally substituted pyrimidinyl and optionally substituted isoxazolo[4,5-e]pyrimidine groups in which the optional substituents may be chosen from halo, C₁₋₆ alkyl, C₁₋₆ holoalkyl, C₁₋₆ alkoxy, C₁₋₆ alkoxy(C₁₋₆)alkyl or C₁₋₆ haloalkoxy.
7. A compound according to any preceding claim wherein R⁶ is C₁₋₈ alkyl, C₁₋₄ haloalkyl, C₁₋₆ cyanoalkyl, C₂₋₆ alkenyl, C₂₋₆ alkynyl, C₃₋₇ cycloalkyl, C₃₋₇ halocycloalkyl, C₃₋₇ cyanocycloalkyl, C₅₋₇ alkyl(C₅₋₇)cyloalkyl, C₁₋₃ alkyl(C₃₋₇)halocycloalkyl, C₅₋₆ cycloalkenyl, C₃₋₇ cycloalkyl(C₁₋₆)alkyl, C₅₋₆ cycloalkenyl(C₁₋₆)alkyl, C₂₋₆ haloalkenyl, C₁₋₆ cyanoalkenyl, C₁₋₆ alkoxy(C₁₋₆)alkyl, C₃₋₆ alkenyloxy(C₁₋₆)alkyl, C₃₋₆ alkynyloxy(C₁₋₆)alkyl, aryloxy(C₁₋₆)alkyl, C₁₋₆ carboxyalkyl, C₁₋₆ alkylcarbonyl-(C₁₋₆)alkyl, C₂₋₆ alkenylcarbonyl(C₁₋₆)alkyl, C₂₋₆ alkynylcarbonyl(C₁₋₆)alkyl, C₁₋₆ alkoxycarbonyl(C₁₋₆)alkyl, C₃₋₆ alkenyloxy carbonyl(C₁₋₆)alkyl, C₁₋₆ alkynyloxy carbonyl(C₁₋₆)alkyl, aryloxy carbonyl(C₁₋₆)alkyl, C₁₋₆ alkythio(C₁₋₆)alkyl, C₁₋₆ alkylsulfanyl(C₁₋₆)alkyl, C₁₋₆ alkylsulfonyl(C₁₋₆)alkyl, C₁₋₆ aminocarbonyl(C₁₋₆)alkyl, C₁₋₆ aminocarboxy(C₂₋₆)alkenyl, C₁₋₆ aminocarboxy(C₂₋₆)alkenyl, C₁₋₆ alkylaminocarbonyl-(C₁₋₆)alkyl, di(C₁₋₆)alkylaminocarbonyl(C₁₋₆)alkyl, C₁₋₆ alkylaminocarbonyl(C₁₋₆)-alkenyl, di(C₁₋₆)alkylaminocarbonyl(C₁₋₆)alkenyl, alkylaminocarbonyl(C₁₋₆)alkenyl, di(C₁₋₆)alkylaminocarbonyl(C₁₋₆)alkenyl, phenyl (optionally substituted by halo, nitro, cyano, C₁₋₆ alky, C₁₋₆ haloalkyl, C₁₋₆ alkoxy or C₁₋₆ haloalkoxy), phenyl(C₁₋₆)alkyl (wherein the phenyl group is optionally substituted by halo, nitro, cyano, C₁₋₆ alky, C₁₋₆ haloalkyl, C₁₋₆ alkoxy or C₁₋₆ haloalkoxy), phenyl(C₁₋₆)alkenyl, (wherein the phenyl group is optionally substituted by halo, nitro, cyano, C₁₋₆ alky, C₁₋₆ haloalkyl, C₁₋₆ alkoxy or C₁₋₆ haloalkoxy), heteroaryl (optionally substituted by halo, nitro, cyano, C₁₋₆ alky, C₁₋₆ haloalkyl, C₁₋₆ alkoxy or C₁₋₆ haloalkoxy), heterocyclyl (wherein the heterocyclyl group is optionally substituted by halo, nitro, cyano, C₁₋₆ alky, C₁₋₆ haloalkyl, C₁₋₆ alkoxy or C₁₋₆ haloalkoxy), heteroaryl(C₁₋₆)alkyl (wherein the heteroaryl group is optionally substituted by halo, nitro, cyano, C₁₋₆ alky, C₁₋₆ haloalkyl, C₁₋₆ alkoxy or C₁₋₆ haloalkoxy), heterocyclyl(C₁₋₆)alkyl (wherein the heterocyclyl group is optionally substituted by halo, nitro, cyano, C₁₋₆ alky, C₁₋₆ haloalkyl, C₁₋₆ alkoxy or C₁₋₆ haloalkoxy), R²⁶O, C₁₋₃ alkylthio, R²³R²⁵N or R³¹ON=C(R²⁷); where R²⁶ is C₁₋₈ alky, C₁₋₆ haloalkyl; R²⁷ is C₁₋₆ alky, C₁₋₆ haloalkyl or phenyl (optionally substituted by halo, nitro, cyano, C₁₋₆ alky, C₁₋₆ haloalkyl, C₁₋₆ alkoxy or C₁₋₆ haloalkoxy); R²⁷ is C₁₋₆ alky, C₁₋₆ haloalkyl or phenyl (optionally substituted by halo, nitro, cyano, C₁₋₆ alky, C₁₋₆ haloalkyl, C₁₋₆ alkoxy or C₁₋₆ haloalkoxy); R²⁸ and R²⁹ are, independently, hydrogen, C₁₋₃ alky, C₃₋₇ cycloalkyl, C₃₋₆
alkenyl, C₃₋₆ alkynyl, C₃₋₅ cycloalkyl(C₁₋₄)alkyl, C₂₋₄ haloalkyl, C₁₋₄ alkoxy(C₁₋₄)alkyl, C₁₋₄ alkoxy carbonyl, or R²₈ and R²⁹ together with the N atom to which they are attached form a five, six or seven-membered heterocyclic ring which may contain one or two further hetero atoms selected from O, N or S and which may be optionally substituted by one or two C₁₋₄ alkyl groups; and R³¹ is C₁₋₄ alkyl or phenyl(C₁₋₂)alkyl (wherein the phenyl group is optionally substituted by halo, nitro, cyano, C₁₋₆ alkyl, C₁₋₄ haloalkyl, C₁₋₆ alkoxy or C₁₋₄ haloalkoxy).

8. A fungicidal, insecticidal, acaricidal, molluscicidal or nematicidal composition comprising a fungicidally, insecticidally, acaricidally, molluscicidally or nematicidally effective amount of a compound of formula (I) as claimed in claim 1 and a carrier or diluent therefor.

9. A method of combating and controlling fungi comprising applying to a plant, to a seed of a plant, to the locus of the plant or seed or to the soil a fungicidally effective amount of a compound of formula (I) as claimed in claim 1.

10. A method of combating and controlling insects, acarines, nematodes or molluscs which comprises applying to a pest, to a locus of a pest, or to a plant susceptible to attack by a pest an insecticidally, acaricidally, nematicidally or molluscicidally effective amount of a compound of formula (I) as claimed in claim 1.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 C07D417/12  C07D413/12  C07D498/04  A01N43/76  A01N43/80  A01N43/90

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
IPC 7 C07D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ, CHEM ABS Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
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<th>Relevant to claim No.</th>
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<td>WO 00 06566 A (ZENECA) 10 February 2000 (2000-02-10) claims; examples</td>
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<td>DE 198 25 379 A (BAYER AG) 9 December 1999 (1999-12-09) page 2, line 29 - line 35; claims; examples 121,122</td>
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<td>A</td>
<td>US 4 675 331 A (KUME ET. AL.) 23 June 1997 (1997-06-23) claims; examples</td>
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X Further documents are listed in the continuation of box C.
X Patent family members are listed in annex.

* Special categories of cited documents:
  *A* document defining the general state of the art which is not considered to be of particular relevance
  *E* earlier document but published on or after the international filing date
  *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
  *D* document referring to an oral disclosure, use, exhibition or other means
  *P* document published prior to the international filing date but later than the priority date claimed
  *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
  *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
  *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
  *&* document member of the same patent family

Date of the actual completion of the international search
12 April 2001

Date of mailing of the international search report
\[ 25.04.01 \]

Name and mailing address of the ISA
European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 342-2040, Tx. 31 651 epo nl
Fax (+31-70) 340-3016

Authorized officer
Helps, I
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| A        | US 5 491 156 A (STREETING ET. AL.)  
13 February 1996 (1996-02-13)  
claims; examples | 1-10                   |
INTERNATIONAL SEARCH REPORT

**Box I  Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)**

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.☐ Claims Nos.:
   because they relate to subject matter not required to be searched by this Authority, namely:

2.☒ Claims Nos. 1-10 (part)
   because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
   
   see FURTHER INFORMATION sheet PCT/ISA/210

3.☐ Claims Nos.:
   because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

**Box II  Observations where unity of invention is lacking (Continuation of item 2 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

1.☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2.☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3.☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4.☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

**Remark on Protest**

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.
Continuation of Box I.2

Claims Nos.: 1-10 (part)

The formula of claim 1 is so broad, including vague definitions such as "optionally substituted alkyl" and "heteroaryl" in the definitions of the groups, that it was not possible to carry out a complete search within a reasonable time limit. The search has been carried out limited to the scope covered by the prepared examples (see Guidelines, B-III, 3.7).

The applicant's attention is drawn to the fact that claims, or parts of claims, relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure.
# INTERNATIONAL SEARCH REPORT

### Information on patent family members

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