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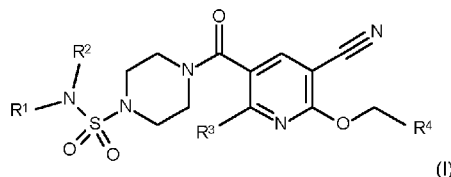
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(54) Title: PESTICIDALLY ACTIVE CYCLIC AMINE COMPOUNDS



(I)

(57) Abstract: Compounds of formula (I) wherein the substituents are as defined in claim 1, and the agrochemically acceptable salts, stereoisomers, enantiomers, tautomers and N-oxides of those compounds, can be used as insecticides.

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PESTICIDALLY ACTIVE CYCLIC AMINE COMPOUNDS

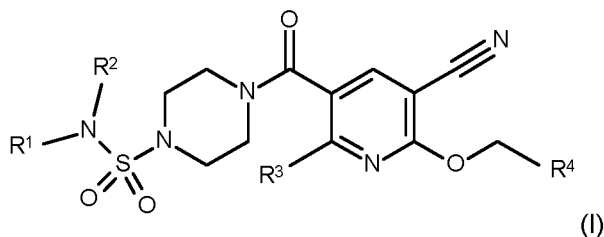
The present invention relates to pesticidally active, in particular insecticidally active piperazinyl pyridinyl carbonyl compounds, to processes for their preparation, to compositions comprising those compounds, and to their use for controlling animal pests, including arthropods and in particular insects or representatives of the order *Acarina*.

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WO2015032280, WO2019039429, JP2019077618, WO2021053161, WO2022070023 and WO2022207462 describe certain piperazinyl pyridinyl carbonyl compounds for use for controlling pests that damage plants.

10 There have now been found further novel pesticidally piperazinyl pyridinyl carbonyl compounds.

The present invention accordingly relates, in a first aspect, to a compound of the formula (I)



wherein

15 R¹ is ethyl;

R² is H or methyl;

R³ is C₁-C₃-alkyl, C₁-C₃-haloalkyl, C₃-C₄-cycloalkyl, or C₃-C₄-halocycloalkyl;

R⁴ is phenyl, phenyl substituted with 1 to 3 substituents R⁵, heteroaryl (which is either a 5 or 6 membered monocyclic or a 9 or 10 membered bicyclic), or heteroaryl (which is either a 5 or 6 membered monocyclic or a 9 or 10 membered bicyclic) substituted with 1 to 3 substituents R⁶; R⁵ and R⁶ are independently selected from halogen, C₁-C₃-haloalkyl, and C₁-C₃-haloalkoxy; and in the event two C₁-C₃-haloalkoxy groups are substituted on adjacent atoms on the phenyl ring, then they may form together with the carbons of the phenyl ring a 5- or 6-membered ring (such as -OC₁-C₂-haloalkylo-);

25 or an agrochemically acceptable salt, stereoisomer, enantiomer, tautomer and N-oxide of the compound of formula (I).

Compounds of formula (I) which have at least one basic centre can form, for example, acid addition salts, for example with strong inorganic acids such as mineral acids, for example perchloric acid, sulfuric acid, nitric acid, nitrous acid, a phosphorus acid or a hydrohalic acid, with strong organic carboxylic acids, such as C₁-C₄alkanecarboxylic acids which are unsubstituted or substituted, for example by halogen, for example acetic acid, such as saturated or unsaturated dicarboxylic acids, for example oxalic acid, malonic acid, succinic acid, maleic acid, fumaric acid or phthalic acid, such as hydroxycarboxylic acids, for example ascorbic acid, lactic acid, malic acid, tartaric acid or citric acid, or

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such as benzoic acid, or with organic sulfonic acids, such as C₁-C₄alkane- or arylsulfonic acids which are unsubstituted or substituted, for example by halogen, for example methane- or p-toluenesulfonic acid. Compounds of formula (I) which have at least one acidic group can form, for example, salts with bases, for example mineral salts such as alkali metal or alkaline earth metal salts, for example sodium, potassium or magnesium salts, or salts with ammonia or an organic amine, such as morpholine, piperidine, pyrrolidine, a mono-, di- or tri-lower-alkylamine, for example ethyl-, diethyl-, triethyl- or dimethylpropylamine, or a mono-, di- or trihydroxy-lower-alkylamine, for example mono-, di- or triethanolamine.

10 In each case, the compounds of formula (I) according to the invention are in free form, in oxidized form as a N-oxide or in salt form, e.g. an agronomically usable salt form.

N-oxides are oxidized forms of tertiary amines or oxidized forms of nitrogen containing heteroaromatic compounds. They are described for instance in the book "Heterocyclic N-oxides" by A. Albini and S. Pietra, CRC Press, Boca Raton 1991.

The compounds of formula (I) according to the invention also include hydrates which may be formed during the salt formation.

20 The term "C₁-C_n-alkyl" as used herein refers to a saturated straight-chain or branched hydrocarbon radical attached via any of the carbon atoms having 1 to n carbon atoms, for example, any one of the radicals methyl, ethyl or n-propyl.

The term "C₃-C_n-cycloalkyl" as used herein refers to 3-n membered cycloalkyl groups such as cyclopropane and cyclobutane.

Halogen is generally fluorine, chlorine, bromine or iodine. This also applies, correspondingly, to halogen in combination with other meanings, such as haloalkyl.

30 The term "C₁-C_n-haloalkyl" as used herein refers to a straight-chain or branched saturated alkyl radical attached via any of the carbon atoms having 1 to n carbon atoms (as mentioned above), where some or all of the hydrogen atoms in these radicals may be replaced by fluorine, chlorine, bromine and/or iodine, i.e., for example, any one of chloromethyl, dichloromethyl, trichloromethyl, fluoromethyl, difluoromethyl, trifluoromethyl, chlorofluoromethyl, dichlorofluoromethyl, chlorodifluoromethyl, 2-fluoroethyl, 2-chloroethyl, 2-bromoethyl, 2-iodoethyl, 2,2-difluoroethyl, 2,2,2-trifluoroethyl, 2-chloro-2-fluoroethyl, 2-chloro-2,2-difluoroethyl, 2,2-dichloro-2-fluoroethyl, 2,2,2-trichloroethyl, pentafluoroethyl, 2-fluoropropyl, 3-fluoropropyl, 2,2-difluoropropyl, 2,3-difluoropropyl, 2-chloropropyl, 3-chloropropyl, 2,3-dichloropropyl, 2-bromopropyl, 3-bromopropyl, 3,3,3-trifluoropropyl, 3,3,3-trichloropropyl, 2,2,3,3,3-pentafluoropropyl, heptafluoropropyl, 1-(fluoromethyl)-2-fluoroethyl, 1-(chloromethyl)-2-chloroethyl or

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1-(bromomethyl)-2-bromoethyl. According a term "C₁-C₂fluoroalkyl" would refer to a C₁-C₂alkyl radical which carries 1, 2, 3, 4, or 5 fluorine atoms, for example, any one of difluoromethyl, trifluoromethyl, 1-fluoroethyl, 2-fluoroethyl, 2,2-difluoroethyl, 2,2,2-trifluoroethyl, 1,1,2,2-tetrafluoroethyl or pentafluoroethyl. Similarly, the term "C₃-C_n-halocycloalkyl" as used herein refers to a C₃-C_n-cycloalkyl group substituted with one or more halo atoms which may be the same or different. Similarly, the term "C₁-C_n-haloalkyloxy" as used herein refers to a C₁-C_n-alkyloxy group substituted with one or more halo atoms which may be the same or different, and in the event two C₁-C_n-haloalkoxy groups are substituted on adjacent atoms on a phenyl ring, then they may form together with the carbons of the phenyl ring a 5- or 6-membered ring (such as -OC₁-C₂-haloalkylo-; or -O-C₁₋₂haloalkanediyl-O-substituent).

The term "5 or 6 membered monocyclic heteroaryl" as used herein refers to a 5 or 6 membered aromatic ring, wherein 1 to 3 carbon atoms in the ring are replaced independently by nitrogen, sulfur, or oxygen. Examples are pyridyl, pyridazinyl, pyrimidinyl, pyrazinyl, pyrrolyl, pyrazolyl, imidazolyl, triazolyl (e.g. 1,2,4 triazolyl), furanyl, thiophenyl, oxazolyl, isoxazolyl, oxadiazolyl, thiazolyl, isothiazolyl and thiadiazolyl.

The term "9 or 10 membered bicyclic heteroaryl" as used herein refers to a 9 or 10 membered aromatic ring made up of two rings, wherein 1 to 3 carbon atoms in the rings are replaced independently by nitrogen, sulfur, or oxygen (the heteroatoms can be in one ring or distributed amongst the two). Examples are purinyl, quinolinyl, cinnolinyl, quinoxalinyl, indolyl, indazolyl, benzimidazolyl, benzothiophenyl and benzothiazolyl.

As used herein, the term "controlling" refers to reducing the number of pests, eliminating pests and/or preventing further pest damage such that damage to a plant or to a plant derived product is reduced.

As used herein, the term "pest" refers to insects, and molluscs that are found in agriculture, horticulture, forestry, the storage of products of vegetable origin (such as fruit, grain and timber); and those pests associated with the damage of man-made structures. The term pest encompasses all stages in the life cycle of the pest.

As used herein, the term "effective amount" refers to the amount of the compound, or a salt thereof, which, upon single or multiple applications provides the desired effect.

An effective amount is readily determined by the skilled person in the art, by the use of known techniques and by observing results obtained under analogous circumstances. In determining the effective amount a number of factors are considered including, but not limited to: the type of plant or derived product to be applied; the pest to be controlled & its lifecycle; the particular compound applied; the type of application; and other relevant circumstances.

Embodiments according to the invention are provided as set out below.

In an embodiment of each aspect of the invention, R² is

- 5 A. hydrogen, or
 B. methyl.

In an embodiment of each aspect of the invention, R³ is

- 10 A. C₁-C₃-alkyl, C₁-C₃-haloalkyl; or C₃-C₄-cycloalkyl, or
 B. methyl, ethyl, difluoromethyl, trifluoromethyl or cyclopropyl; or
 C. methyl, difluoromethyl, trifluoromethyl or cyclopropyl; or
 D. difluoromethyl or trifluoromethyl; or
 E. difluoromethyl.

15 In an embodiment of each aspect of the invention, R⁴ is

- A. phenyl, phenyl substituted with 1 to 3 substituents R⁵, 5 or 6 membered monocyclic
 heteroaryl, or 5 or 6 membered monocyclic heteroaryl substituted with 1 to 3 substituents R⁶;
 or
 B. 5 or 6 membered monocyclic heteroaryl, or 5 or 6 membered monocyclic heteroaryl
20 substituted with 1 to 3 substituents R⁶; or
 C. 6 membered monocyclic heteroaryl substituted with 1 to 3 substituents R⁶; or
 D. pyridine substituted with 1 to 3 substituents R⁶; or
 E. pyridine substituted with 1 to 3 halogens; or
 F. pyridine substituted with 1 substituent R⁶; or
25 G. pyridine substituted with 1 halogen; or
 H. pyridine substituted with bromine; or
 I. phenyl substituted with 1 to 3 substituents R⁵; or
 J. phenyl substituted with 1 to 3 substituents independently selected from halogen, C₁-C₃-
 haloalkyl, and C₁-C₃-haloalkoxy; and in the event two C₁-C₃-haloalkoxy groups are substituted
30 on adjacent atoms on a phenyl ring, then they may form together with the carbons of the
 phenyl ring a 5- or 6-membered ring (such as -O-C₁₋₂haloalkanediyl-O- substituent); or
 K. phenyl substituted with 1-2 substituents independently selected from halogen, C₁-C₃-haloalkyl,
 and C₁-C₃-haloalkoxy; and in the event two C₁-C₃-haloalkoxy groups are substituted on
 adjacent atoms on a phenyl ring, then they may form together with the carbons of the phenyl
35 ring a 5- or 6-membered ring (such as -O-C₁₋₂haloalkanediyl-O- substituent); or
 L. phenyl substituted with 1-2 substituents independently selected from halogen, difluoromethyl,
 trifluoromethyl, difluoromethoxy, and trifluoromethoxy; and in the event two fluoroalkoxy
 groups are substituted on adjacent atoms on a phenyl ring, then they may form together with

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the carbons of the phenyl ring a 5- or 6-membered ring (such as -O-C₁₋₂haloalkanediyl-O-substituent);; or

- M. phenyl substituted with 1 to 2 substituents independently selected from chlorine, fluorine, bromine, iodine, difluoromethyl, trifluoromethyl, difluoromethoxy, trifluoromethoxy, and an -OCF₂-O- group (substituted on adjacent carbon atoms of the phenyl ring) forming together with the carbons of the phenyl ring a 5-membered ring; or
- N. phenyl substituted on adjacent carbons with an -OCF₂-O- group forming together with the carbons of the phenyl ring a 5-membered ring.

- 10 In an embodiment of each aspect of the invention, R⁵ is independently selected from
- A. halogen, C₁-C₃-haloalkyl, C₁-C₃-haloalkoxy and -OCF₂-O- (later being substituted on adjacent carbons group forming together with the carbons of the phenyl ring a 5-membered ring); or
- B. fluorine, chlorine, bromine, iodine, trifluoromethyl, difluoromethyl, trifluoromethoxy, difluoromethoxy and -OCF₂-O- (later being substituted on adjacent carbons group forming together with the carbons of the phenyl ring a 5-membered ring), or
- 15 C. fluorine, chlorine, bromine, iodine, trifluoromethyl, and -OCF₂-O- (later being substituted on adjacent carbons group forming together with the carbons of the phenyl ring a 5-membered ring), or
- D. fluorine, chlorine, bromine, iodine and -OCF₂-O- (later being substituted on adjacent carbons group forming together with the carbons of the phenyl ring a 5-membered ring), or
- 20 E. -OCF₂-O- (being substituted on adjacent carbons group forming together with the carbons of the phenyl ring a 5-membered ring).

In an embodiment of each aspect of the invention, R⁶ is independently selected from

- 25 A. halogen, C₁-C₃-haloalkyl, and C₁-C₃-haloalkoxy; or
- B. fluorine, chlorine, bromine, trifluoromethyl, difluoromethyl, trifluoromethoxy and difluoromethoxy; or
- C. fluorine, chlorine, bromine, trifluoromethyl, and difluoromethyl; or
- D. bromine.

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The present invention, accordingly, makes available a compound of formula (I) having the substituents R¹, R², R³, and R⁴ as defined above in all combinations / each permutation. Accordingly, made available, for example, is a compound of formula (I) with R¹ being ethyl; R² being embodiment B (i.e. R² is methyl); R³ being embodiment A (i.e. R³ is C₁-C₃-alkyl, C₁-C₃-haloalkyl; or C₃-C₄-cycloalkyl); and

35 R⁴ being embodiment I (i.e. R⁴ is phenyl substituted with 1 to 3 substituents R⁵; wherein R⁵ is embodiment D (i.e. R⁵ is independently selected from fluorine, chlorine, bromine, iodine and -OCF₂-O-)).

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In an embodiment of each aspect of the invention, the compound of formula (I) has as R¹ ethyl, as R² hydrogen or methyl, as R³ selected from methyl, difluoromethyl, trifluoromethyl or cyclopropyl; and as R⁴ phenyl substituted with 1 to 3 substituents R⁵, where R⁵ is independently selected from halogen, C₁-C₃-haloalkyl, C₁-C₃-haloalkoxy and -OCF₂-O-.

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In an embodiment of each aspect of the invention, the compound of formula (I) has as R¹ ethyl, as R² hydrogen, as R³ either difluoromethyl or trifluoromethyl; and as R⁴ phenyl substituted with 1 to 3 substituents R⁵, where R⁵ is independently selected from halogen, C₁-C₃-haloalkyl, C₁-C₃-haloalkoxy and -OCF₂-O-.

10

In an embodiment of each aspect of the invention, the compound of formula (I) has as R¹ ethyl, as R² hydrogen, as R³ either difluoromethyl or trifluoromethyl; and as R⁴ phenyl substituted with 1 to 2 substituents R⁵, where R⁵ is independently selected from halogen, C₁-C₃-haloalkyl, C₁-C₃-haloalkoxy and -OCF₂-O-.

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In an embodiment of each aspect of the invention, the compound of formula (I) has as R¹ ethyl, as R² hydrogen, as R³ difluoromethyl; and as R⁴ phenyl substituted with 1 to 2 substituents independently selected from fluorine, chlorine, bromine, iodine and -OCF₂-O-.

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In a second aspect, the present invention makes available a composition comprising a compound of formula (I) as defined in the first aspect, one or more auxiliaries and diluent, and optionally one more other active ingredient.

25

In a third aspect, the present invention makes available 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, nematocidally or molluscicidally effective amount of a compound as defined in the first aspect or a composition as defined in the second aspect.

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In a fourth aspect, the present invention makes available a method for the protection of plant propagation material from the attack by insects, acarines, nematodes or molluscs, which comprises treating the propagation material or the site, where the propagation material is planted, with an effective amount of a compound of formula (I) as defined in the first aspect or a composition as defined in the second aspect.

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In a fifth aspect, the present invention makes available a plant propagation material, such as a seed, comprising, or treated with or adhered thereto, a compound of formula (I) as defined in the first aspect or a composition as defined in the second aspect.

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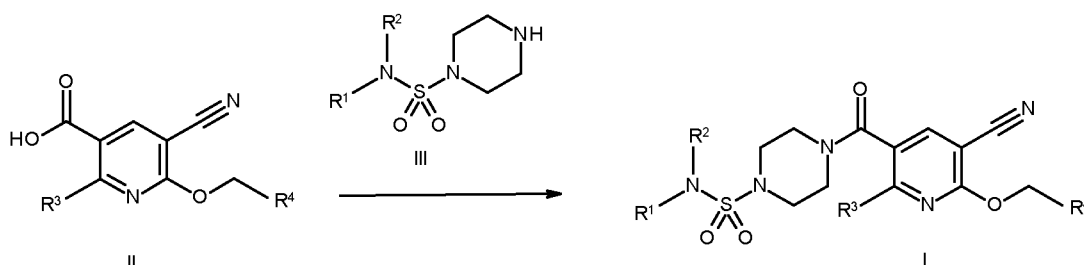
The present invention in a further aspect provides a method of controlling parasites in or on an animal in need thereof comprising administering an effective amount of a compound of the first aspect. The present invention further provides a method of controlling ectoparasites on an animal in need thereof comprising administering an effective amount of a compound of formula (I) as defined on the first aspect. The present invention further provides a method for preventing and/or treating diseases transmitted by ectoparasites comprising administering an effective amount of a compound of formula (I) as defined in the first aspect, to an animal in need thereof.

Compounds of formula (I) can be prepared by those skilled in the art following known methods. More specifically compounds of formulae I, and intermediates therefor can be prepared as described below in the schemes and examples. Certain stereogenic centers have been left unspecified for the clarity and are not intended to limit the teaching of the schemes in any way.

The process according to the invention for preparing compounds of formula (I) is carried out by methods known to those skilled in the art.

The compounds of formula (I) in which R^1 , R^2 , R^3 and R^4 are as defined in the first aspect are new and can be prepared by reacting an acid II in which R^3 and R^4 are as defined in the first aspect with a piperazine III in which R^1 and R^2 are as defined in the first aspect using known amide coupling reagents, such as 1-[bis(dimethylamino)-methylene]-1H-1,2,3-triazolo[4,5-b]pyridinium 3-oxide hexafluorophosphate (HATU), propanephosphonic acid anhydride (T3P) or butanephosphonic acid anhydride (T4P), and a base in a suitable solvent according to Scheme 1. Suitable bases are, for example, triethylamine, N,N-diisopropylethylamine (Hünig's base) and pyridine. Suitable solvents are, for example, 2-methyl-tetrahydrofuran, dimethylformamide (DMF), dimethylacetamide (DMA) and ethylacetate. Instead of piperazine III also the corresponding salt of piperazine III, for example, the chloride salt or the bromide salt of piperazine III, can be used.

Scheme 1:

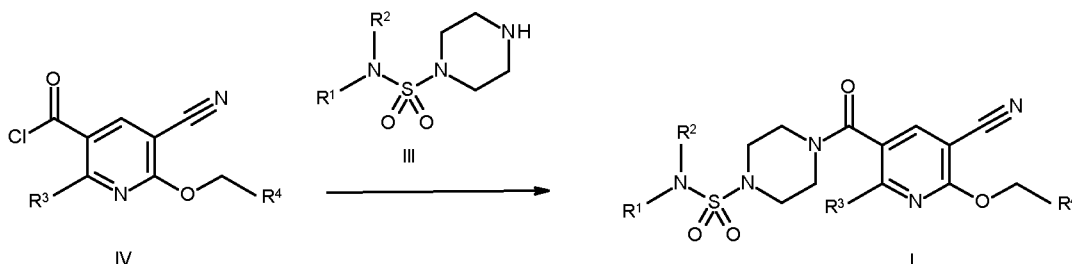


Alternatively the compounds of formula (I) in which R^1 , R^2 , R^3 and R^4 are as defined in the first aspect can be prepared by reacting an acid chloride IV in which R^3 and R^4 are as defined in the first aspect with an amine III in which R^1 and R^2 are as defined in the first aspect in the presence of a base, for example triethylamine or pyridine, and a suitable solvent, for example dichloromethane (DCM),

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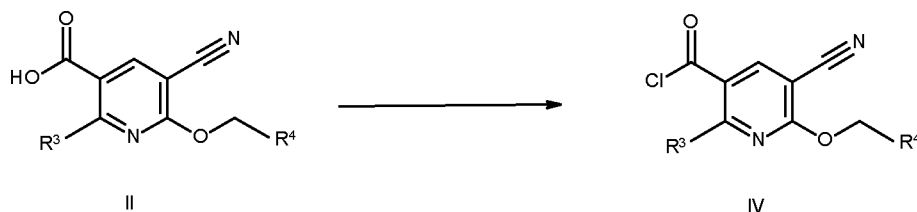
tetrahydrofuran (THF), 2-methyl-tetrahydrofuran (2-methyl-THF) or toluene, according to scheme 2. Instead of piperazine III also the corresponding salt of piperazine III, for example the chloride salt or the bromide salt of piperazine III, can be used.

5 Scheme 2:



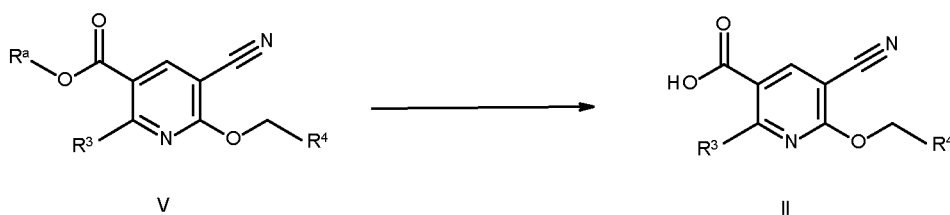
The acid chloride IV in which R³ and R⁴ are as defined in the first aspect can be prepared from the corresponding acid II in which R³ and R⁴ are as defined in the first aspect by treatment with for example, oxalyl chloride or thionyl chloride in the presence of catalytic quantities of DMF in inert solvents such as DCM, THF or 2-methyl-THF at temperatures between 20 °C to 100 °C, preferably 25 °C according to scheme 3.

Scheme 3:



The acid II in which R³ and R⁴ are as defined in the first aspect can be prepared by hydrolysis of the corresponding ester V in which R³ and R⁴ are as defined in the first aspect and R^a = C₁-C₆-alkyl under basic conditions, for example using an inorganic base such as lithium hydroxide, sodium hydroxide, potassium hydroxide or potassium carbonate in water, methanol, ethanol, THF or 2-methyl-THF, according to scheme 4.

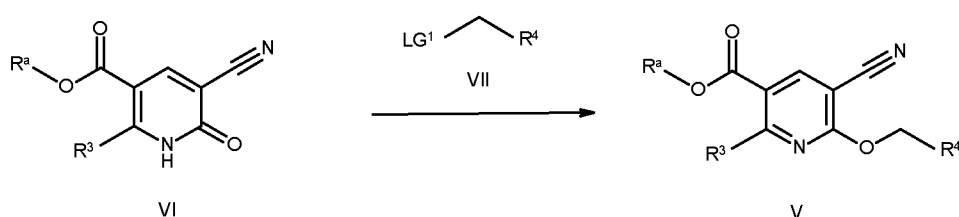
Scheme 4:



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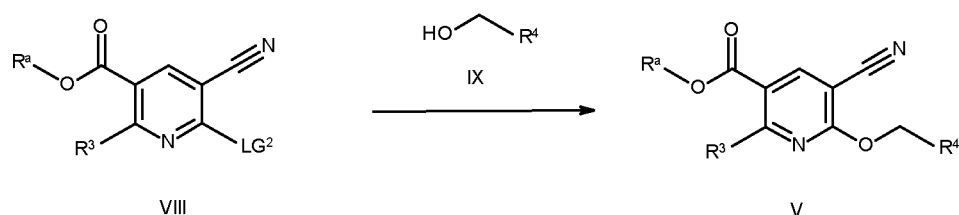
The ester V in which R^3 and R^4 are as defined in the first aspect, and R^a is as previously defined can be prepared by reaction of the pyridone VI in which R^3 is as defined in the first aspect and R^a is as previously defined with an alkylating reagent VII in which LG^1 is a leaving group, such as a halogen, e.g. bromine, chlorine, iodine, or a mesylate in the presence of a base, for example an inorganic base such as lithium hydroxide, sodium hydroxide, potassium hydroxide or potassium carbonate, and a suitable solvent, for example water, methanol, ethanol, acetone, THF, 2-methyl-THF, DMF or toluene according to scheme 5. It might be advantageous to add sodium iodide or a phase-transfer catalyst, for example tetrabutylammonium bromide or tetrabutylammonium iodide.

10 Scheme 5:



Alternatively, the ester V in which R^3 and R^4 are as defined in the first aspect, and R^a is as previously defined can be prepared by reacting the pyridine VIII in which R^3 is as defined in the first aspect, and R^a is as previously defined and LG^2 is a leaving group, such as a halogen, e.g. fluorine, bromine, chlorine, iodine, or a mesylate with an alcohol IX in the presence of a base, for example sodium hydride, lithium hydroxide, sodium hydroxide, potassium hydroxide or potassium carbonate and a suitable solvent, for example THF, 2-methyl-THF, DMF or toluene, according to scheme 6.

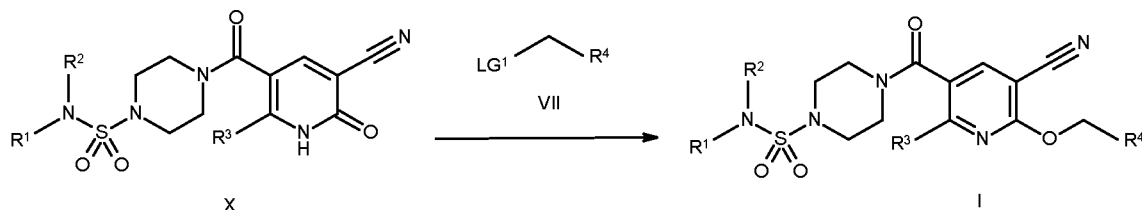
20 Scheme 6:



Alternatively, the compounds of formula (I) in which R^1 , R^2 , R^3 and R^4 are as defined in the first aspect can be obtained by reaction of the pyridone X in which R^1 , R^2 and R^3 are as defined in the first aspect with an alkylating reagent VII in which LG^1 is a leaving group, such as a halogen, e.g. bromine, chlorine, iodine, or a mesylate in the presence of a base, for example an inorganic base such as lithium hydroxide, sodium hydroxide, potassium hydroxide or potassium carbonate, in a suitable solvent, for example water, methanol, ethanol, acetone, THF, 2-methyl-THF, DMF or toluene according to scheme 7. It might be advantageous to add sodium iodide or a phase-transfer catalyst, for example tetrabutylammonium bromide or tetrabutylammonium iodide.

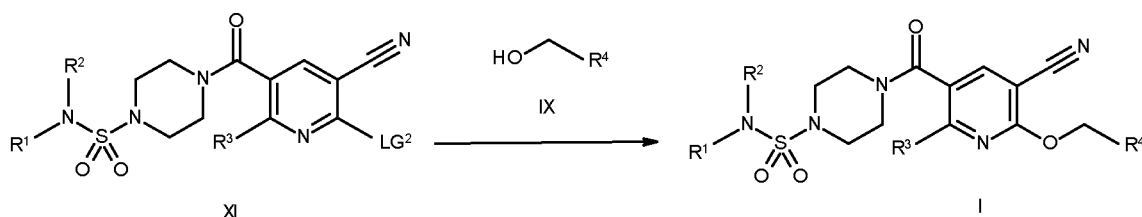
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Scheme 7:



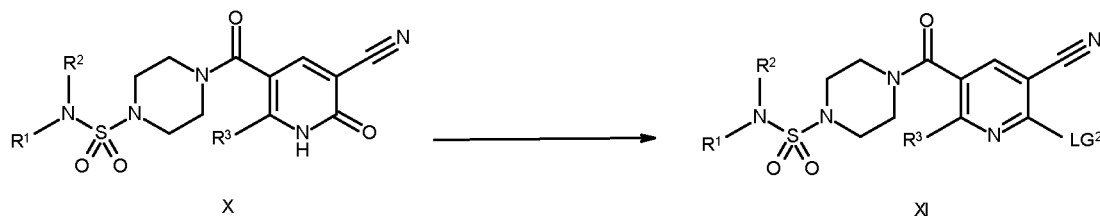
Alternatively, the compounds of formula (I) in which, R², R³ and R⁴ are as defined in the first aspect can be prepared by reacting the pyridine XI in which R¹, R² and R³ are as defined in the first aspect and LG² is a leaving group, such as a halogen, e.g. fluorine, bromine, chlorine, iodine, or a mesylate with an alcohol IX in the presence of a base, for example sodium hydride, lithium hydroxide, sodium hydroxide, potassium hydroxide or potassium carbonate and a suitable solvent, for example THF, 2-methyl-THF, DMF or toluene according to scheme 8.

Scheme 8:



Compounds of formula XI in which R¹, R² and R³ are as defined in the first aspect and LG² is a leaving group can be obtained by treating a pyridone X in which R¹, R² and R³ are as defined in the first aspect with a halogenation reagent, such as phosphorus oxychloride or oxalyl chloride or mesylchloride according to scheme 9.

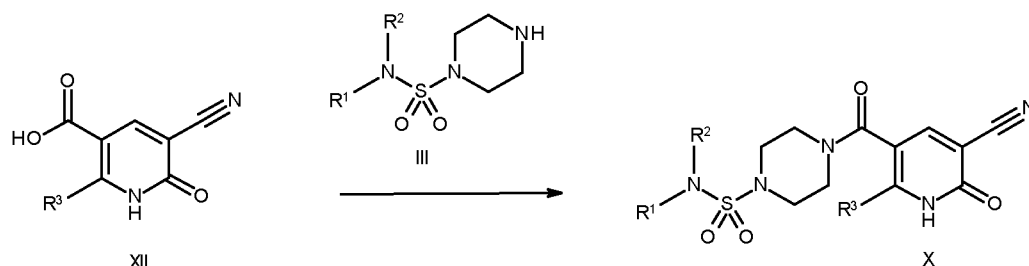
Scheme 9:



Pyridones X in which R¹, R² and R³ are as defined in the first aspect can be prepared by reacting an acid XII in which R³ is as defined in the first aspect with a piperazine III in which R¹ and R² are as defined in the first aspect using known amide coupling reagents, such as HATU and a base, for example Hünig's base, in a suitable solvent, for example DMF or DMA according to scheme 10. Instead of piperazine III also the corresponding salt of piperazine III, for example the chloride salt or the bromide salt of piperazine III, can be used.

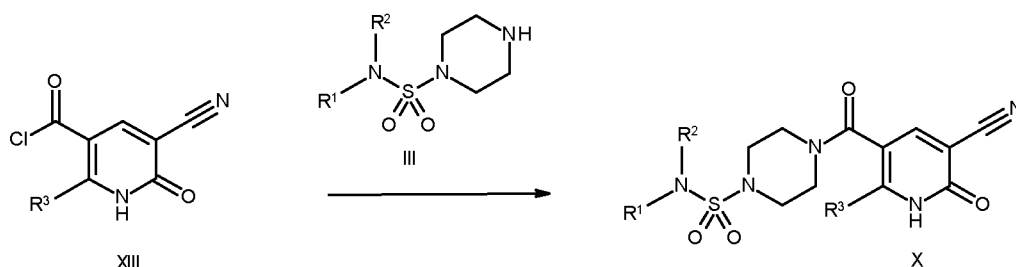
-11-

Scheme 10:



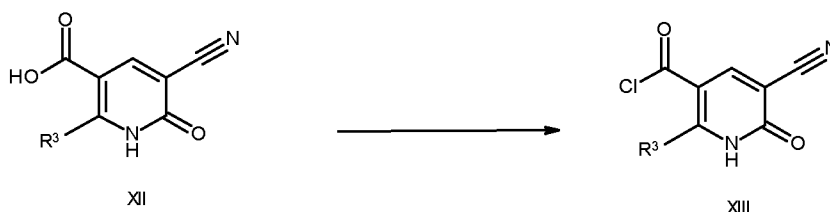
- 5 Alternatively the compounds of formula X in which R¹, R² and R³ are as defined in the first aspect can be prepared by reacting an acid chloride XIII in which R³ is as defined in the first aspect with a piperazine III in which R¹ and R² are as defined in the first aspect in the presence of a base, for example triethylamine or pyridine, and a suitable solvent, for example DCM, THF, 2-methyl-THF or toluene, according to scheme 11. Instead of piperazine III also the corresponding salt of piperazine III, for example the chloride salt or the bromide salt of piperazine III, can be used.
- 10

Scheme 11:



- 15 The acid chloride XIII in which R³ is as defined in the first aspect can be prepared from the corresponding acid XII in which R³ is as defined in the first aspect by treatment with for example, oxalyl chloride or thionyl chloride in the presence of catalytic quantities of DMF in inert solvents such as DCM, THF or 2-methyl-THF at temperatures between 20 °C to 100 °C, preferably 25 °C according to scheme 12.
- 20

Scheme 12:

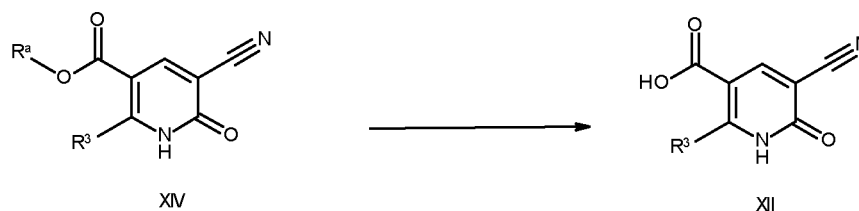


- The acid XII in which R³ is as defined in the first aspect can be prepared by hydrolysis of the corresponding ester XIV in which R³ is as defined in the first aspect and R^a is C₁-C₆-alkyl under basic
- 25

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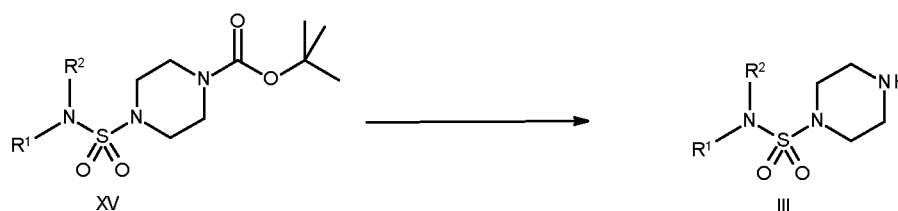
conditions, for example using an inorganic base such as lithium hydroxide, sodium hydroxide, potassium hydroxide or potassium carbonate in water, methanol, ethanol, THF or 2-methyl-THF as shown in scheme 13. Esters of the formula XIV in which R^3 is as defined in the first aspect, and R^a is as previously defined are known in the literature, for example Y. Xie et al., *Pest Manag. Sci.* **2017**, 73, 945-952, or can be prepared by the person skilled in the art.

Scheme 13:



- 10 Piperazine III in which R^1 and R^2 are as defined in the first aspect can be prepared by treating compound XV in which R^1 and R^2 are as defined in the first aspect with an acid, for example hydrochloric acid, hydrobromic acid or trifluoroacetic acid, in a suitable solvent, for example methanol, ethanol, ethylacetate, DCM, THF, 2-methyl-THF or toluene, at temperatures between 20 °C to 80 °C, preferably between 20 and 30 °C according to scheme 14. Depending on the work-up, the
- 15 corresponding salt of piperazine III, for example the chloride salt or the bromide salt of piperazine III, can be obtained instead of piperazine III.

Scheme 14:

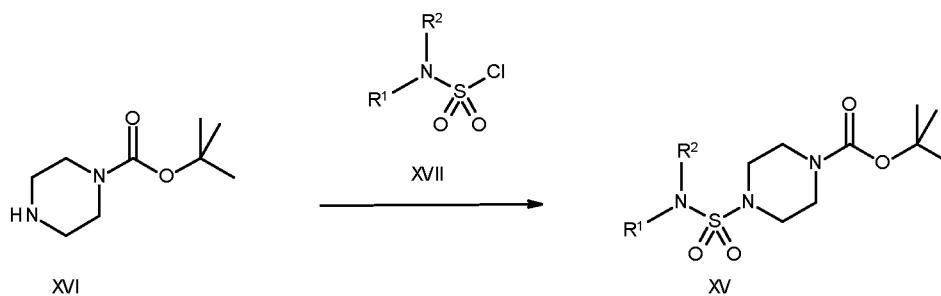


- 20 Piperazine XV in which R^1 and R^2 are as defined in the first aspect can be prepared by reacting compound XVI with sulfonyl chloride XVII in which R^1 and R^2 are as defined in the first aspect in a suitable solvent, for example acetonitrile, ethylacetate, DCM, THF, 2-methyl-THF or toluene, at temperatures between 20 °C to 80 °C, preferably between 20 and 30 °C according to scheme 15.

25

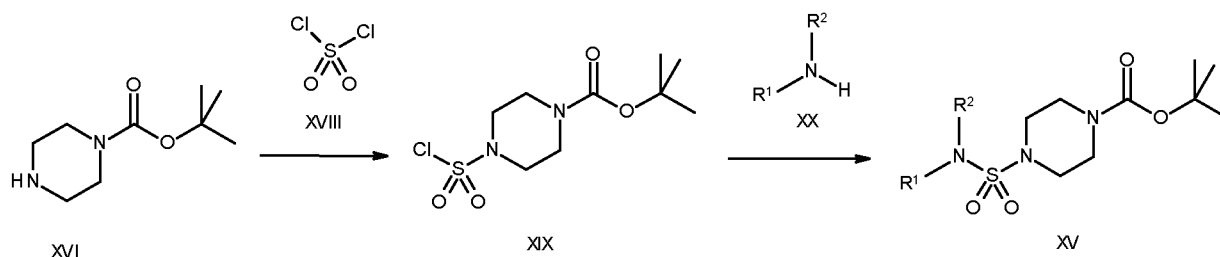
Scheme 15:

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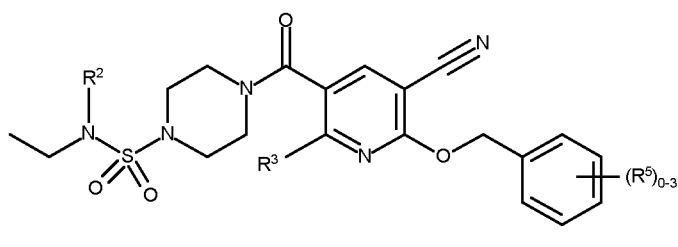


Alternatively, piperazine XV in which R^1 and R^2 are as defined in the first aspect can be prepared by reacting compound XVI first with sulfonyl chloride, followed by reacting with amine XIX in which R^1 and R^2 are as defined in the first aspect in a suitable solvent, for example acetonitrile, ethylacetate, DCM, THF, 2-methyl-THF or toluene, at temperatures between 20 °C to 80 °C, preferably between 20 and 30 °C according to scheme 16.

Scheme 16:



The compounds of formula (I) according to the following Tables 1 to 4 can be prepared according to the methods described above. The examples which follow are intended to illustrate the invention and show preferred compounds of formula (I), in the form of a compound of formula (I-a).



Each of Tables 1 to 4, which follow the Table M below, comprises 62 compounds of the formula (I-a) in which R^2 and R^5 have the values given in each row in Table M, and R^3 has the values given in the relevant Tables 1 to 4.

Thus compound 1.1 corresponds to a compound of formula (I-a) where R^2 and R^5 are as defined in row 1 of Table M and where R^3 is as defined in Table 1; compound 4.10 corresponds to a compound of formula (I-a) where R^2 and R^5 are as defined in row 10 of Table M and where R^3 is as defined in Table 4; and so on.

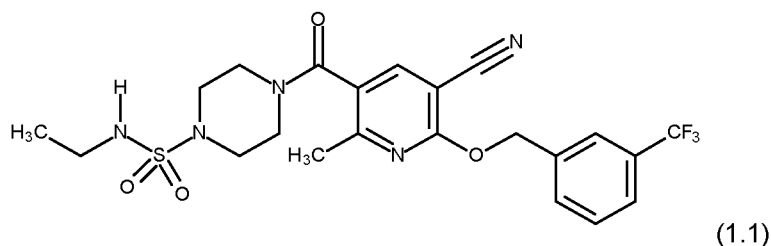
Table M:

Comp. No	R ²	R ⁵
M.1.	H	3-CF ₃
M.2.	H	4-CF ₃
M.3.	H	2-F, 4-CF ₃
M.4.	H	2-F, 5-CF ₃
M.5.	H	3,4-F ₂
M.6.	H	2,4,5-F ₃
M.7.	H	2-F, 4-Cl
M.8.	H	2-F, 5-Cl
M.9.	H	3-F, 4-Cl
M.10.	H	4-Br
M.11.	H	2-F, 4-Br
M.12.	H	2-F, 5-Br
M.13.	H	3-F, 4-Br
M.14.	H	3-Br, 4-F
M.15.	H	2-Cl, 4-Br
M.16.	H	2-Cl, 5-Br
M.17.	H	3-Cl, 4-Br
M.18.	H	2-Br, 4-Br
M.19.	H	4-I
M.20.	H	2-F, 4-I
M.21.	H	2-Cl, 4-I
M.22.	H	3-F, 4-I
M.23.	H	3-CF ₃
M.24.	H	4-CF ₃
M.25.	H	3-OCF ₃
M.26.	H	4-OCF ₃
M.27.	H	3-OCF ₂ -O-4
M.28.	H	2-Cl, 4-CF ₃
M.29.	H	2-Cl, 5-CF ₃
M.30.	H	3-Cl, 5-CF ₃
M.31.	H	4-Cl, 3-CF ₃
M.32.	CH ₃	3-CF ₃
M.33.	CH ₃	4-CF ₃
M.34.	CH ₃	2-F, 4-CF ₃
M.35.	CH ₃	2-F, 5-CF ₃
M.36.	CH ₃	3,4-F ₂

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Comp. No	R ²	R ⁵
M.37.	CH ₃	2,4,5-F ₃
M.38.	CH ₃	2-F, 4-Cl
M.39.	CH ₃	2-F, 5-Cl
M.40.	CH ₃	3-F, 4-Cl
M.41.	CH ₃	4-Br
M.42.	CH ₃	2-F, 4-Br
M.43.	CH ₃	2-F, 5-Br
M.44.	CH ₃	3-F, 4-Br
M.45.	CH ₃	3-Br, 4-F
M.46.	CH ₃	2-Cl, 4-Br
M.47.	CH ₃	2-Cl, 5-Br
M.48.	CH ₃	3-Cl, 4-Br
M.49.	CH ₃	2-Br, 4-Br
M.50.	CH ₃	4-I
M.51.	CH ₃	2-F, 4-I
M.52.	CH ₃	2-Cl, 4-I
M.53.	CH ₃	3-F, 4-I
M.54.	CH ₃	3-CF ₃
M.55.	CH ₃	4-CF ₃
M.56.	CH ₃	3-OCF ₃
M.57.	CH ₃	4-OCF ₃
M.58.	CH ₃	3-OCF ₂ -O-4
M.59.	CH ₃	2-Cl, 4-CF ₃
M.60.	CH ₃	2-Cl, 5-CF ₃
M.61.	CH ₃	3-Cl, 5-CF ₃
M.62.	CH ₃	4-Cl, 3-CF ₃

Table 1: This table discloses the 62 compounds 1.1 to 1.62 of the formula (I-a), wherein R³ is methyl and R² and R⁵ are as defined in Table M. For example, compound No. 1.1 has the following structure:



- 5 **Table 2:** This table discloses the 62 compounds 2.1 to 2.62 of the formula (I-a), wherein R³ is difluoromethyl and R² and R⁵ are as defined in Table M.

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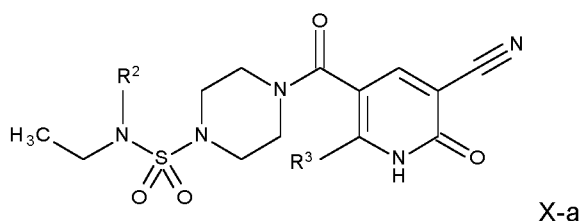
Table 3: This table discloses the 62 compounds 3.1 to 3.62 of the formula (I-a), wherein R^3 is trifluoromethyl and R^2 and R^5 are as defined in Table M.

Table 4: This table discloses the 62 compounds 4.1 to 4.62 of the formula (I-a), wherein R^3 is cyclopropyl and R^2 and R^5 are as defined in Table M.

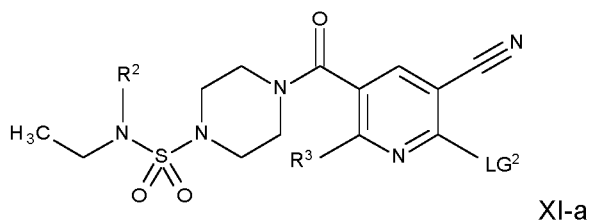
5

Also made available are certain intermediate compounds of formulae X-a, and XI-a, some of which are novel.

10 Accordingly, made available herein are:
compounds of formula X-a



15 wherein R^2 and R^3 are as defined in the first aspect; in an embodiment R^2 is hydrogen or methyl and R^3 is methyl, difluoromethyl, trifluoromethyl or cyclopropyl;
compounds of XI-a



20 wherein R^2 and R^3 are as defined in the first aspect; in an embodiment R^2 is hydrogen or methyl, R^3 is methyl, difluoromethyl, trifluoromethyl or cyclopropyl; and LG^2 is chloro, bromo or fluoro.

The compounds of formula (I) according to the invention are preventively and/or curatively valuable active ingredients in the field of pest control, even at low rates of application, which have a very favorable biocidal spectrum and are well tolerated by warm-blooded species, fish and plants. The active ingredients according to the invention act against all or individual developmental stages of normally sensitive, but also resistant, animal pests, such as insects or representatives of the order Acarina. The insecticidal or acaricidal activity of the active ingredients according to the invention can manifest itself directly, i. e. in destruction of the pests, which takes place either immediately or only after some time has elapsed, for example during ecdysis, or indirectly, for example in a reduced oviposition and/or hatching rate.

25

30

Examples of the above mentioned animal pests are:

from the order *Acarina*, for example,

Acalitus spp, Aculus spp, Acaricalus spp, Aceria spp, Acarus siro, Amblyomma spp., Argas spp.,
Boophilus spp., Brevipalpus spp., Bryobia spp, Calipitimerus spp., Chorioptes spp., Dermanyssus
5 gallinae, Dermatophagoides spp, Eotetranychus spp, Eriophyes spp., Hemitarsonemus spp,
Hyalomma spp., Ixodes spp., Olygonychus spp, Ornithodoros spp., Polyphagotarsonus latus,
Panonychus spp., Phyllocoptura oleivora, Phytionemus spp, Polyphagotarsonemus spp, Psoroptes
spp., Rhipicephalus spp., Rhizoglyphus spp., Sarcoptes spp., Steneotarsonemus spp, Tarsonemus
spp. and Tetranychus spp.;

10 from the order *Anoplura*, for example,

Haematopinus spp., Linognathus spp., Pediculus spp., Pemphigus spp. and Phylloxera spp.;

from the order *Coleoptera*, for example,

Agriotes spp., Amphimallon majale, Anomala orientalis, Anthonomus spp., Aphodius spp, Astylus
atromaculatus, Ataenius spp, Atomaria linearis, Chaetocnema tibialis, Cerotoma spp, Conoderus spp,
15 Cosmopolites spp., Cotinis nitida, Curculio spp., Cyclocephala spp, Dermestes spp., Diabrotica spp.,
Diloboderus abderus, Epilachna spp., Eremnus spp., Heteronychus arator, Hypothenemus hampei,
Lagria vilosa, Leptinotarsa decemlineata, Lissorhoptrus spp., Liogenys spp, Maecolaspis spp,
Maladera castanea, Megascelis spp, Meligethes aeneus, Melolontha spp., Myochrous armatus,
Orycaephilus spp., Otiorhynchus spp., Phyllophaga spp, Phlyctinus spp., Popillia spp., Psylliodes spp.,
20 Rhyssomatus aubtilis, Rhizopertha spp., Scarabeidae, Sitophilus spp., Sitotroga spp., Somaticus spp,
Sphenophorus spp, Sternechus subsignatus, Tenebrio spp., Tribolium spp. and Trogoderma spp.;

from the order *Diptera*, for example,

Aedes spp., Anopheles spp, Antherigona soccata, Bactrocea oleae, Bibio hortulanus, Bradysia spp,
Calliphora erythrocephala, Ceratitis spp., Chrysomyia spp., Culex spp., Cuterebra spp., Dacus spp.,
25 Delia spp, Drosophila melanogaster, Fannia spp., Gastrophilus spp., Geomyza tripunctata, Glossina
spp., Hypoderma spp., Hyppobosca spp., Liriomyza spp., Lucilia spp., Melanagromyza spp., Musca
spp., Oestrus spp., Orseolia spp., Oscinella frit, Pegomyia hyoscyami, Phorbia spp., Rhagoletis spp,
Rivelia quadrifasciata, Scatella spp, Sciara spp., Stomoxys spp., Tabanus spp., Tannia spp. and
Tipula spp.;

30 from the order *Hemiptera*, for example,

Acanthocoris scabrator, Acrosternum spp, Adelphocoris lineolatus, Aleurodes spp., Amblypelta nitida,
Bathycoelia thalassina, Blissus spp, Cimex spp., Clavigralla tomentosicollis, Creontiades spp,
Distantiella theobroma, Dichelops furcatus, Dysdercus spp., Edessa spp, Euchistus spp., Eurydema
pulchrum, Eurygaster spp., Halyomorpha halys, Horcias nobilellus, Leptocoris spp., Lygus spp,
35 Margarodes spp, Murgantia histrionic, Neomegalotomus spp, Nesidiocoris tenuis, Nezara spp., Nysius
simulans, Oebalus insularis, Piesma spp., Piezodorus spp, Rhodnius spp., Sahlbergella singularis,
Scaptocoris castanea, Scotinophara spp. , Thyanta spp , Triatoma spp., Vatica illudens;
Acyrtosium pisum, Adalges spp, Agalliana ensigera, Agonoscena targionii, Aleurodicus spp,
Aleurocanthus spp, Aleurolobus barodensis, Aleurothrixus floccosus, Aleyrodes brassicae, Amarasca

- biguttula, Amritodus atkinsoni, Aonidiella spp., Aphididae, Aphis spp., Aspidiotus spp., Aulacorthum solani, Bactericera cockerelli, Bemisia spp, Brachycaudus spp, Brevicoryne brassicae, Cacopsylla spp, Cavariella aegopodii Scop., Ceroplaster spp., Chrysomphalus aonidium, Chrysomphalus dictyospermi, Cicadella spp, Cofana spectra, Cryptomyzus spp, Cicadulina spp, Coccus hesperidum,
- 5 Dalbulus maidis, Dialeurodes spp, Diaphorina citri, Diuraphis noxia, Dysaphis spp, Empoasca spp., Eriosoma larigerum, Erythroneura spp., Gascardia spp., Glycaspis brimblecombei, Hyadaphis pseudobrassicae, Hyalopterus spp, Hyperomyzus pallidus, Idioscopus clypealis, Jacobiasca lybica, Laodelphax spp., Lecanium corni, Lepidosaphes spp., Lopaphis erysimi, Lyogenys maidis, Macrosiphum spp., Mahanarva spp, Metcalfa pruinosa, Metopolophium dirhodum, Myndus crudus,
- 10 Myzus spp., Neotoxoptera sp, Nephrotettix spp., Nilaparvata spp., Nippolachnus piri Mats, Odonaspis ruthae, Oregma lanigera Zehnter, Parabemisia myricae, Paratrioza cockerelli, Parlatoria spp., Pemphigus spp., Peregrinus maidis, Perkinsiella spp, Phorodon humuli, Phylloxera spp, Planococcus spp., Pseudaulacaspis spp., Pseudococcus spp., Pseudatomoscelis seriatus, Psylla spp., Pulvinaria aethiopica, Quadraspidiotus spp., Quesada gigas, Recilia dorsalis, Rhopalosiphum spp., Saissetia
- 15 spp., Scaphoideus spp., Schizaphis spp., Sitobion spp., Sogatella furcifera, Spissistilus festinus, Tarophagus Proserpina, Toxoptera spp, Trialeurodes spp, Tridiscus sporoboli, Trionymus spp, Trioza erytreae , Unaspis citri, Zyginia flammigera, Zyginidia scutellaris, ;
- from the order *Hymenoptera*, for example,
- Acromyrmex, Arge spp, Atta spp., Cephus spp., Diprion spp., Diprionidae, Gilpinia polytoma, Hoplo-
- 20 campa spp., Lasius spp., Monomorium pharaonis, Neodiprion spp., Pogonomymex spp, Slenopsis invicta, Solenopsis spp. and Vespa spp.;
- from the order *Isoptera*, for example,
- Coptotermes spp, Cornitermes cumulans, Incisitermes spp, Macrotermes spp, Mastotermes spp, Microtermes spp, Reticulitermes spp.; Solenopsis geminate
- 25 from the order *Lepidoptera*, for example,
- Acleris spp., Adoxophyes spp., Aegeria spp., Agrotis spp., Alabama argillaceae, Amylois spp., Anticarsia gemmatilis, Archips spp., Argyresthia spp, Argyrotaenia spp., Autographa spp., Bucculatrix thurberiella, Busseola fusca, Cadra cautella, Carposina nipponensis, Chilo spp., Choristoneura spp., Chrysoteuchia topiaria, Clysia ambiguella, Cnaphalocrocis spp., Cnephasia spp., Cochylis spp.,
- 30 Coleophora spp., Colias lesbia, Cosmophila flava, Crambus spp, Crocidolomia binotalis, Cryptophlebia leucotreta, Cydalima perspectalis, Cydia spp., Diaphania perspectalis, Diatraea spp., Diparopsis castanea, Earias spp., Elasmopalpus lignosellus, Eldana saccharina, Ephestia spp., Epinotia spp, Estigmene acrea, Etiella zinckinella, Eucosma spp., Eupoecilia ambiguella, Euproctis spp., Euxoa spp., Feltia jaculiferia, Grapholita spp., Hedya nubiferana, Heliothis spp., Hellula undalis,
- 35 Herpetogramma spp, Hyphantria cunea, Keiferia lycopersicella, Lasmopalpus lignosellus, Leucoptera scitella, Lithocollethis spp., Lobesia botrana, Loxostege bifidalis, Lymantria spp., Lyonetia spp., Malacosoma spp., Mamestra brassicae, Manduca sexta, Mythimna spp, Noctua spp, Operophtera spp., Orniodes indica, Ostrinia nubilalis, Pammene spp., Pandemis spp., Panolis flammea, Papaipema nebris, Pectinophora gossypiella, Perileucoptera coffeella, Pseudaletia unipuncta, Phthorimaea

operculella, *Pieris rapae*, *Pieris* spp., *Plutella xylostella*, *Prays* spp., *Pseudoplusia* spp, *Rachiplusia* nu, *Richia albicosta*, *Scirpophaga* spp., *Sesamia* spp., *Sparganothis* spp., *Spodoptera* spp., *Sylepta derogate*, *Synanthedon* spp., *Thaumetopoea* spp., *Tortrix* spp., *Trichoplusia* ni, *Tuta absoluta*, and *Yponomeuta* spp.;

- 5 from the order *Mallophaga*, for example,
Damalinea spp. and *Trichodectes* spp.;
- from the order *Orthoptera*, for example,
Blatta spp., *Blattella* spp., *Gryllotalpa* spp., *Leucophaea maderae*, *Locusta* spp., *Neocurtilla hexadactyla*, *Periplaneta* spp. , *Scapteriscus* spp, and *Schistocerca* spp.;
- 10 from the order *Psocoptera*, for example,
Liposcelis spp.;
- from the order *Siphonaptera*, for example,
Ceratophyllus spp., *Ctenocephalides* spp. and *Xenopsylla cheopis*;
- from the order *Thysanoptera*, for example,
- 15 *Calliothrips phaseoli*, *Frankliniella* spp., *Heliothrips* spp, *Hercinothrips* spp., *Parthenothrips* spp, *Scirtothrips aurantii*, *Sericothrips variabilis*, *Taeniothrips* spp., *Thrips* spp;
- from the order *Thysanura*, for example, *Lepisma saccharina*.

- In a further aspect, the invention may also relate to a method of controlling damage to plant and parts thereof by plant parasitic nematodes (Endoparasitic-, Semiendoparasitic- and Ectoparasitic
- 20 nematodes), especially plant parasitic nematodes such as root knot nematodes, *Meloidogyne hapla*, *Meloidogyne incognita*, *Meloidogyne javanica*, *Meloidogyne arenaria* and other *Meloidogyne* species; cyst-forming nematodes, *Globodera rostochiensis* and other *Globodera* species; *Heterodera avenae*, *Heterodera glycines*, *Heterodera schachtii*, *Heterodera trifolii*, and other *Heterodera* species; Seed gall
- 25 nematodes, *Anguina* species; Stem and foliar nematodes, *Aphelenchoides* species; Sting nematodes, *Belonolaimus longicaudatus* and other *Belonolaimus* species; Pine nematodes, *Bursaphelenchus xylophilus* and other *Bursaphelenchus* species; Ring nematodes, *Criconema* species, *Criconemella* species, *Criconemoides* species, *Mesocriconema* species; Stem and bulb nematodes, *Ditylenchus destructor*, *Ditylenchus dipsaci* and other *Ditylenchus* species; Awl nematodes, *Dolichodorus* species;
- 30 Spiral nematodes, *Helicotylenchus multicinctus* and other *Helicotylenchus* species; Sheath and sheathoid nematodes, *Hemicyclophora* species and *Hemicriconemoides* species; *Hirshmanniella* species; Lance nematodes, *Hoploaimus* species; false rootknot nematodes, *Nacobbus* species; Needle nematodes, *Longidorus elongatus* and other *Longidorus* species; Pin nematodes, *Pratylenchus* species; Lesion nematodes, *Pratylenchus neglectus*, *Pratylenchus penetrans*,
- 35 *Pratylenchus curvatus*, *Pratylenchus goodeyi* and other *Pratylenchus* species; Burrowing nematodes, *Radopholus similis* and other *Radopholus* species; Reniform nematodes, *Rotylenchus robustus*, *Rotylenchus reniformis* and other *Rotylenchus* species; *Scutellonema* species; Stubby root nematodes, *Trichodorus primitivus* and other *Trichodorus* species, *Paratrachodorus* species; Stunt nematodes, *Tylenchorhynchus claytoni*, *Tylenchorhynchus dubius* and other *Tylenchorhynchus*

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species; Citrus nematodes, Tylenchulus species; Dagger nematodes, Xiphinema species; and other plant parasitic nematode species, such as Subanguina spp., Hypsoperine spp., Macroposthonia spp., Melinius spp., Punctodera spp., and Quinisulcius spp..

- 5 The compounds of the invention may also have activity against the molluscs. Examples of which include, for example, Ampullariidae; Arion (A. ater, A. circumscriptus, A. hortensis, A. rufus); Bradybaenidae (Bradybaena fruticum); Cepaea (C. hortensis, C. Nemoralis); ochlodina; Deroceras (D. agrestis, D. empiricorum, D. laeve, D. reticulatum); Discus (D. rotundatus); Euomphalia; Galba (G. trunculata); Helicelia (H. itala, H. obvia); Helicidae Helicigona arbustorum); Helicodiscus; Helix (H. aperta); Limax (L. cinereoniger, L. flavus, L. marginatus, L. maximus, L. tenellus); Lymnaea; Milax (M. gagates, M. marginatus, M. sowerbyi); Opeas; Pomacea (P. canaticulata); Vallonia and Zanitoides.
- 10

- The active ingredients according to the invention can be used for controlling, i. e. containing or destroying, pests of the abovementioned type which occur in particular on plants, especially on useful plants and ornamentals in agriculture, in horticulture and in forests, or on organs, such as fruits, flowers, foliage, stalks, tubers or roots, of such plants, and in some cases even plant organs which are formed at a later point in time remain protected against these pests.
- 15

- Suitable target crops are, in particular, cereals, such as wheat, barley, rye, oats, rice, maize or sorghum; beet, such as sugar or fodder beet; fruit, for example pomaceous fruit, stone fruit or soft fruit, such as apples, pears, plums, peaches, almonds, cherries or berries, for example strawberries, raspberries or blackberries; leguminous crops, such as beans, lentils, peas or soya; oil crops, such as oilseed rape, mustard, poppies, olives, sunflowers, coconut, castor, cocoa or ground nuts; cucurbits, such as pumpkins, cucumbers or melons; fibre plants, such as cotton, flax, hemp or jute; citrus fruit, such as oranges, lemons, grapefruit or tangerines; vegetables, such as spinach, lettuce, asparagus, cabbages, carrots, onions, tomatoes, potatoes or bell peppers; Lauraceae, such as avocado, Cinnamonium or camphor; and also tobacco, nuts, coffee, eggplants, sugarcane, tea, pepper, grapevines, hops, the plantain family and latex plants.
- 20
- 25

- 30 In a particular embodiment, a compound of the formula (I) controls mites, rust mites and spider mites in crops, trees, and plants selected from vegetables (especially tomatoes and cucurbits), citrus, pome fruits, stone fruit, tree nuts, cotton, tropical crops, avocados, ornamentals, beans, soybean, strawberry, and grapes.

- 35 The compositions and/or methods of the present invention may be also used on any ornamental and/or vegetable crops, including flowers, shrubs, broad-leaved trees and evergreens.

For example the invention may be used on any of the following ornamental species: *Ageratum* spp., *Alonsoa* spp., *Anemone* spp., *Anisodonteia capensis*, *Anthemis* spp., *Antirrhinum* spp., *Aster* spp.,

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Begonia spp. (e.g. *B. elatior*, *B. semperflorens*, *B. tubéreux*), *Bougainvillea* spp., *Brachycome* spp., *Brassica* spp. (ornamental), *Calceolaria* spp., *Capsicum annuum*, *Catharanthus roseus*, *Canna* spp., *Centaurea* spp., *Chrysanthemum* spp., *Cineraria* spp. (*C. maritime*), *Coreopsis* spp., *Crassula coccinea*, *Cuphea ignea*, *Dahlia* spp., *Delphinium* spp., *Dicentra spectabilis*, *Dorotheantus* spp.,
 5 *Eustoma grandiflorum*, *Forsythia* spp., *Fuchsia* spp., *Geranium gnaphalium*, *Gerbera* spp., *Gomphrena globosa*, *Heliotropium* spp., *Helianthus* spp., *Hibiscus* spp., *Hortensia* spp., *Hydrangea* spp., *Hypoestes phyllostachya*, *Impatiens* spp. (*I. Walleriana*), *Iresines* spp., *Kalanchoe* spp., *Lantana camara*, *Lavatera trimestris*, *Leonotis leonurus*, *Lilium* spp., *Mesembryanthemum* spp., *Mimulus* spp., *Monarda* spp., *Nemesia* spp., *Tagetes* spp., *Dianthus* spp. (carnation), *Canna* spp., *Oxalis* spp., *Bellis*
 10 spp., *Pelargonium* spp. (*P. peltatum*, *P. Zonale*), *Viola* spp. (pansy), *Petunia* spp., *Phlox* spp., *Plecthranthus* spp., *Poinsettia* spp., *Parthenocissus* spp. (*P. quinquefolia*, *P. tricuspidata*), *Primula* spp., *Ranunculus* spp., *Rhododendron* spp., *Rosa* spp. (rose), *Rudbeckia* spp., *Saintpaulia* spp., *Salvia* spp., *Scaevola aemola*, *Schizanthus wisetonensis*, *Sedum* spp., *Solanum* spp., *Surfinia* spp., *Tagetes* spp., *Nicotinia* spp., *Verbena* spp., *Zinnia* spp. and other bedding plants.

For example the invention may be used on any of the following vegetable species: *Allium* spp. (*A. sativum*, *A. cepa*, *A. oschaninii*, *A. Porrum*, *A. ascalonicum*, *A. fistulosum*), *Anthriscus cerefolium*, *Apium graveolus*, *Asparagus officinalis*, *Beta vulgaris*, *Brassica* spp. (*B. Oleracea*, *B. Pekinensis*, *B. rapa*), *Capsicum annuum*, *Cicer arietinum*, *Cichorium endivia*, *Cichorium* spp. (*C. intybus*, *C. endivia*),
 20 *Citrillus lanatus*, *Cucumis* spp. (*C. sativus*, *C. melo*), *Cucurbita* spp. (*C. pepo*, *C. maxima*), *Cyanara* spp. (*C. scolymus*, *C. cardunculus*), *Daucus carota*, *Foeniculum vulgare*, *Hypericum* spp., *Lactuca sativa*, *Lycopersicon* spp. (*L. esculentum*, *L. lycopersicum*), *Mentha* spp., *Ocimum basilicum*, *Petroselinum crispum*, *Phaseolus* spp. (*P. vulgaris*, *P. coccineus*), *Pisum sativum*, *Raphanus sativus*, *Rheum rhaponticum*, *Rosemarinus* spp., *Salvia* spp., *Scorzonera hispanica*, *Solanum melongena*,
 25 *Spinacea oleracea*, *Valerianella* spp. (*V. locusta*, *V. eriocarpa*) and *Vicia faba*.

Preferred ornamental species include African violet, *Begonia*, *Dahlia*, *Gerbera*, *Hydrangea*, *Verbena*, *Rosa*, *Kalanchoe*, *Poinsettia*, *Aster*, *Centaurea*, *Coreopsis*, *Delphinium*, *Monarda*, *Phlox*, *Rudbeckia*, *Sedum*, *Petunia*, *Viola*, *Impatiens*, *Geranium*, *Chrysanthemum*, *Ranunculus*, *Fuchsia*, *Salvia*,
 30 *Hortensia*, rosemary, sage, St. Johnswort, mint, sweet pepper, tomato and cucumber.

The active ingredients according to the invention are especially suitable for controlling *Aphis craccivora*, *Diabrotica balteata*, *Heliothis virescens*, *Myzus persicae*, *Plutella xylostella* and *Spodoptera littoralis* in cotton, vegetable, maize, rice and soya crops. The active ingredients according
 35 to the invention are further especially suitable for controlling *Mamestra* (preferably in vegetables), *Cydia pomonella* (preferably in apples), *Empoasca* (preferably in vegetables, vineyards), *Leptinotarsa* (preferably in potatoes) and *Chilo supressalis* (preferably in rice).

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The compounds of formula (I) are particularly suitable for control of mites, spider mites and rust mites, for example, *Acarapis* spp; *Acarapis woodi*; *Acarus siro*; *Acarus* spp; *Aceria sheldoni*; *Aculops pelekassi*; *Aculops* spp; *Aculus schlechtendali*; *Aculus* spp; *Amblyseius fallacis*; *Brevipalpus* spp; *Brevipalpus phoenicis*; *Bryobia praetiosa*; *Bryobia rubrioculus*; *Caloglyphus* spp; *Cheyletiella blakei*;
 5 *Cheyletiella* spp; *Cheyletiella yasguri*; *Chorioptes bovis*; *Chorioptes* spp; *Cytodites* spp; *Demodex bovis*; *Demodex caballi*; *Demodex canis*; *Demodex caprae*; *Demodex equi*; *Demodex ovis*; *Demodex* spp; *Demodex suis*; *Dermanyssus gallinae*; *Dermanyssus* spp; *Eotetranychus* spp; *Eotetranychus willamettei*; *Epitrimerus pyri*; *Eriophyes ribis*; *Eriophyes* spp; *Eriophyes vitis*; *Eutetranychus* spp; *Halotydeus destructor*; *Hemitarsonemus* spp; *Knemidocoptes* spp; *Laminosioptes* spp; *Listrophorus*
 10 spp; *Myobia* spp; *Neoschongastia xerothermobia*; *Neotrombicula autumnalis*; *Neotrombicula desaleri*; *Notoedres cati*; *Notoedres* spp; *Oligonychus coffeae*; *Oligonychus ilicis*; *Oligonychus* spp; *Ornithocheyletia* spp; *Ornithonyssus bursa*; *Ornithonyssus* spp; *Ornithonyssus sylviarum*; *Otodectes cynotis*; *Otodectes* spp; *Panonychus citri*; *Panonychus* spp; *Panonychus ulmi*; *Phyllocoptura oleivora*; *Phyllocoptura* spp.; *Phytoseiulus* spp.; *Pneumonyssoides caninum*; *Polyphagotarsonemus latus*;
 15 *Polyphagotarsonemus* spp; *Psorergates ovis*; *Psorergates* spp; *Psoroptes cuniculi*; *Psoroptes equi*; *Psoroptes ovis*; *Psoroptes* spp; *Pterolichus* spp; *Raillietia* spp; *Rhizoglyphus* spp; *Sarcoptes bovis*; *Sarcoptes canis*; *Sarcoptes caprae*; *Sarcoptes equi*; *Sarcoptes ovis*; *Sarcoptes rupicaprae*; *Sarcoptes* spp; *Sarcoptes suis*; *Steneotarsonemus spinki*; *Steneotarsonemus* spp; *Sternostoma* spp;
 20 *Tarsonemus* spp; *Tetranychus cinnabarinus*; *Tetranychus kanzawai*; *Tetranychus* spp; *Tetranychus urticae*; *Trombicula akamushi*; *Trombicula* spp; *Typhlodromus occidentalis*; *Tyrophagus* spp; *Varroa jacobsoni*; *Varroa* spp; *Vasates lycopersici*; and *Zetzellia mali*.

In an embodiment, a compound of formula (I) are especially suitable for controlling one or more of: *Aceria sheldoni* ; *Aculus lycopersici*; *Aculus pelekassi*; *Aculus schlechtendali*; *Brevipalpus phoenicis*;
 25 *Brevipalpus* spp.; *Bryobia rubrioculus*; *Eotetranychus carpini*; *Eotetranychus* spp.; *Epitrimerus pyri*; *Eriophyes piri*; *Eriophyes* spp.; *Eriophyes vitis*; *Eutetranychus africanus*; *Eutetranychus orientalis*; *Oligonychus pratensis*; *Panonychus citri*; *Panonychus ulmi*; *Phyllocoptes vitis*; *Phyllocoptura oleivora*; *Polyphagotarsonemus latus*; *Tetranychus cinnabarinus*; *Tetranychus kanzawai*; *Tetranychus* spp.; and *Tetranychus urticae*.

In a further embodiment, a compound of formula (I) are more especially suitable for controlling one or more of: *Aceria sheldoni* ; *Aculus pelekassi*; *Brevipalpus phoenicis*; *Brevipalpus* spp.; *Eriophyes piri*; *Eriophyes vitis*; *Eutetranychus africanus*; *Eutetranychus orientalis*; *Oligonychus pratensis*;
 35 *Panonychus ulmi*; *Phyllocoptes vitis*; *Phyllocoptura oleivora*; *Polyphagotarsonemus latus*; *Tetranychus cinnabarinus*; *Tetranychus kanzawai*; *Tetranychus* spp.; and *Tetranychus urticae*.

The term "crops" is to be understood as including also crop plants which have been so transformed by the use of recombinant DNA techniques that they are capable of synthesising one or more selectively

acting toxins, such as are known, for example, from toxin-producing bacteria, especially those of the genus *Bacillus*.

Toxins that can be expressed by such transgenic plants include, for example, insecticidal proteins, for example insecticidal proteins from *Bacillus cereus* or *Bacillus popilliae*; or insecticidal proteins from *Bacillus thuringiensis*, such as δ -endotoxins, e.g. Cry1Ab, Cry1Ac, Cry1F, Cry1Fa2, Cry2Ab, Cry3A, Cry3Bb1 or Cry9C, or vegetative insecticidal proteins (Vip), e.g. Vip1, Vip2, Vip3 or Vip3A; or insecticidal proteins of bacteria colonising nematodes, for example *Photorhabdus* spp. or *Xenorhabdus* spp., such as *Photorhabdus luminescens*, *Xenorhabdus nematophilus*; toxins produced by animals, such as scorpion toxins, arachnid toxins, wasp toxins and other insect-specific neurotoxins; toxins produced by fungi, such as *Streptomyces* toxins, plant lectins, such as pea lectins, barley lectins or snowdrop lectins; agglutinins; proteinase inhibitors, such as trypsin inhibitors, serine protease inhibitors, patatin, cystatin, papain inhibitors; ribosome-inactivating proteins (RIP), such as ricin, maize-RIP, abrin, luffin, saporin or bryodin; steroid metabolism enzymes, such as 3-hydroxysteroidoxidase, ecdysteroid-UDP-glycosyl-transferase, cholesterol oxidases, ecdysone inhibitors, HMG-COA-reductase, ion channel blockers, such as blockers of sodium or calcium channels, juvenile hormone esterase, diuretic hormone receptors, stilbene synthase, bibenzyl synthase, chitinases and glucanases.

In the context of the present invention there are to be understood by δ -endotoxins, for example Cry1Ab, Cry1Ac, Cry1F, Cry1Fa2, Cry2Ab, Cry3A, Cry3Bb1 or Cry9C, or vegetative insecticidal proteins (Vip), for example Vip1, Vip2, Vip3 or Vip3A, expressly also hybrid toxins, truncated toxins and modified toxins. Hybrid toxins are produced recombinantly by a new combination of different domains of those proteins (see, for example, WO 02/15701). Truncated toxins, for example a truncated Cry1Ab, are known. In the case of modified toxins, one or more amino acids of the naturally occurring toxin are replaced. In such amino acid replacements, preferably non-naturally present protease recognition sequences are inserted into the toxin, such as, for example, in the case of Cry3A055, a cathepsin-G-recognition sequence is inserted into a Cry3A toxin (see WO 03/018810).

Examples of such toxins or transgenic plants capable of synthesising such toxins are disclosed, for example, in EP-A-0 374 753, WO 93/07278, WO 95/34656, EP-A-0 427 529, EP-A-451 878 and WO 03/052073.

The processes for the preparation of such transgenic plants are generally known to the person skilled in the art and are described, for example, in the publications mentioned above. CryI-type deoxyribonucleic acids and their preparation are known, for example, from WO 95/34656, EP-A-0 367 474, EP-A-0 401 979 and WO 90/13651.

The toxin contained in the transgenic plants imparts to the plants tolerance to harmful insects. Such insects can occur in any taxonomic group of insects, but are especially commonly found in the beetles (Coleoptera), two-winged insects (Diptera) and moths (Lepidoptera).

- 5 Transgenic plants containing one or more genes that code for an insecticidal resistance and express one or more toxins are known and some of them are commercially available. Examples of such plants are: YieldGard® (maize variety that expresses a Cry1Ab toxin); YieldGard Rootworm® (maize variety that expresses a Cry3Bb1 toxin); YieldGard Plus® (maize variety that expresses a Cry1Ab and a Cry3Bb1 toxin); Starlink® (maize variety that expresses a Cry9C toxin); Herculex I® (maize variety
10 that expresses a Cry1Fa2 toxin and the enzyme phosphinothricine N-acetyltransferase (PAT) to achieve tolerance to the herbicide glufosinate ammonium); NuCOTN 33B® (cotton variety that expresses a Cry1Ac toxin); Bollgard I® (cotton variety that expresses a Cry1Ac toxin); Bollgard II® (cotton variety that expresses a Cry1Ac and a Cry2Ab toxin); VipCot® (cotton variety that expresses a Vip3A and a Cry1Ab toxin); NewLeaf® (potato variety that expresses a Cry3A toxin); NatureGard®,
15 Agrisure® GT Advantage (GA21 glyphosate-tolerant trait), Agrisure® CB Advantage (Bt11 corn borer (CB) trait) and Protecta®.

Further examples of such transgenic crops are:

1. **Bt11 Maize** from Syngenta Seeds SAS, Chemin de l'Hobit 27, F-31 790 St. Sauveur, France,
20 registration number C/FR/96/05/10. Genetically modified *Zea mays* which has been rendered resistant to attack by the European corn borer (*Ostrinia nubilalis* and *Sesamia nonagrioides*) by transgenic expression of a truncated Cry1Ab toxin. Bt11 maize also transgenically expresses the enzyme PAT to achieve tolerance to the herbicide glufosinate ammonium.
2. **Bt176 Maize** from Syngenta Seeds SAS, Chemin de l'Hobit 27, F-31 790 St. Sauveur, France,
25 registration number C/FR/96/05/10. Genetically modified *Zea mays* which has been rendered resistant to attack by the European corn borer (*Ostrinia nubilalis* and *Sesamia nonagrioides*) by transgenic expression of a Cry1Ab toxin. Bt176 maize also transgenically expresses the enzyme PAT to achieve tolerance to the herbicide glufosinate ammonium.
3. **MIR604 Maize** from Syngenta Seeds SAS, Chemin de l'Hobit 27, F-31 790 St. Sauveur, France,
30 registration number C/FR/96/05/10. Maize which has been rendered insect-resistant by transgenic expression of a modified Cry3A toxin. This toxin is Cry3A055 modified by insertion of a cathepsin-G-protease recognition sequence. The preparation of such transgenic maize plants is described in WO 03/018810.
4. **MON 863 Maize** from Monsanto Europe S.A. 270-272 Avenue de Tervuren, B-1150 Brussels,
35 Belgium, registration number C/DE/02/9. MON 863 expresses a Cry3Bb1 toxin and has resistance to certain Coleoptera insects.
5. **IPC 531 Cotton** from Monsanto Europe S.A. 270-272 Avenue de Tervuren, B-1150 Brussels, Belgium, registration number C/ES/96/02.

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6. **1507 Maize** from Pioneer Overseas Corporation, Avenue Tedesco, 7 B-1160 Brussels, Belgium, registration number C/NL/00/10. Genetically modified maize for the expression of the protein Cry1F for achieving resistance to certain Lepidoptera insects and of the PAT protein for achieving tolerance to the herbicide glufosinate ammonium.

5 7. **NK603 × MON 810 Maize** from Monsanto Europe S.A. 270-272 Avenue de Tervuren, B-1150 Brussels, Belgium, registration number C/GB/02/M3/03. Consists of conventionally bred hybrid maize varieties by crossing the genetically modified varieties NK603 and MON 810. NK603 × MON 810 Maize transgenically expresses the protein CP4 EPSPS, obtained from *Agrobacterium sp.* strain CP4, which imparts tolerance to the herbicide Roundup® (contains glyphosate), and also a Cry1Ab toxin
10 obtained from *Bacillus thuringiensis subsp. kurstaki* which brings about tolerance to certain Lepidoptera, include the European corn borer.

Transgenic crops of insect-resistant plants are also described in BATS (Zentrum für Biosicherheit und Nachhaltigkeit, Zentrum BATS, Clarastrasse 13, 4058 Basel, Switzerland) Report 2003, (<http://bats.ch>).

15 The term "crops" is to be understood as including also crop plants which have been so transformed by the use of recombinant DNA techniques that they are capable of synthesising antipathogenic substances having a selective action, such as, for example, the so-called "pathogenesis-related proteins" (PRPs, see e.g. EP-A-0 392 225). Examples of such antipathogenic substances and
20 transgenic plants capable of synthesising such antipathogenic substances are known, for example, from EP-A-0 392 225, WO 95/33818 and EP-A-0 353 191. The methods of producing such transgenic plants are generally known to the person skilled in the art and are described, for example, in the publications mentioned above.

25 Crops may also be modified for enhanced resistance to fungal (for example Fusarium, Anthracnose, or Phytophthora), bacterial (for example Pseudomonas) or viral (for example potato leafroll virus, tomato spotted wilt virus, cucumber mosaic virus) pathogens.

30 Crops also include those that have enhanced resistance to nematodes, such as the soybean cyst nematode.

Crops that are tolerance to abiotic stress include those that have enhanced tolerance to drought, high salt, high temperature, chill, frost, or light radiation, for example through expression of NF-YB or other proteins known in the art.

35 Antipathogenic substances which can be expressed by such transgenic plants include, for example, ion channel blockers, such as blockers for sodium and calcium channels, for example the viral KP1, KP4 or KP6 toxins; stilbene synthases; bibenzyl synthases; chitinases; glucanases; the so-called "pathogenesis-related proteins" (PRPs; see e.g. EP-A-0 392 225); antipathogenic substances

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produced by microorganisms, for example peptide antibiotics or heterocyclic antibiotics (see e.g. WO 95/33818) or protein or polypeptide factors involved in plant pathogen defence (so-called "plant disease resistance genes", as described in WO 03/000906).

5 Further areas of use of the compositions according to the invention are the protection of stored goods and store rooms and the protection of raw materials, such as wood, textiles, floor coverings or buildings, and also in the hygiene sector, especially the protection of humans, domestic animals and productive livestock against pests of the mentioned type.

10 The present invention provides a compound of the first aspect for use in therapy. The present invention provides a compound of the first aspect, for use in controlling parasites in or on an animal. The present invention further provides a compound of the first aspect, for use in controlling ectoparasites on an animal. The present invention further provides a compound of the first aspect, for use in preventing and/or treating diseases transmitted by ectoparasites.

15 The present invention provides the use of a compound of the first aspect, for the manufacture of a medicament for controlling parasites in or on an animal. The present invention further provides the use of a compound of the first aspect, for the manufacture of a medicament for controlling ectoparasites on an animal. The present invention further provides the use of a compound of the first aspect, for the
20 manufacture of a medicament for preventing and/or treating diseases transmitted by ectoparasites.

The present invention provides the use of a compound of the first aspect, in controlling parasites in or on an animal. The present invention further provides the use of a compound of the first aspect , in controlling ectoparasites on an animal.

25 The term "controlling" when used in context of parasites in or on an animal refers to reducing the number of pests or parasites, eliminating pests or parasites and/or preventing further pest or parasite infestation.

30 The term "treating" when used in context of parasites in or on an animal refers to restraining, slowing, stopping or reversing the progression or severity of an existing symptom or disease. The term "preventing" when used in context of parasites in or on an animal refers to the avoidance of a symptom or disease developing in the animal.

35 The term "animal" when used in context of parasites in or on an animal may refer to a mammal and a non-mammal, such as a bird or fish. In the case of a mammal, it may be a human or non-human mammal. Non-human mammals include, but are not limited to, livestock animals and companion animals. Livestock animals include, but are not limited to, cattle, camellids, pigs, sheep, goats and horses. Companion animals include, but are not limited to, dogs, cats and rabbits.

A "parasite" is a pest which lives in or on the host animal and benefits by deriving nutrients at the host animal's expense. An "endoparasite" is a parasite which lives in the host animal. An "ectoparasite" is a parasite which lives on the host animal. Ectoparasites include, but are not limited to, acari, insects and crustaceans (e.g. sea lice). The Acari (or Acarina) sub-class comprises ticks and mites. Ticks include, but are not limited to, members of the following genera: *Rhipicaphalus*, for example, *Rhipicaphalus* (*Boophilus*) *microplus* and *Rhipicephalus sanguineus*; *Amblyomma*; *Dermacentor*; *Haemaphysalis*; *Hyalomma*; *Ixodes*; *Rhipicentor*; *Margaropus*; *Argas*; *Otobius*; and *Ornithodoros*. Mites include, but are not limited to, members of the following genera: *Chorioptes*, for example *Chorioptes bovis*; *Psoroptes*, for example *Psoroptes ovis*; *Cheyletiella*; *Dermanyssus*; for example *Dermanyssus gallinae*; *Ornithonyssus*; *Demodex*, for example *Demodex canis*; *Sarcoptes*, for example *Sarcoptes scabiei*; and *Psorergates*. Insects include, but are not limited to, members of the orders: Siphonaptera, Diptera, Phthiraptera, Lepidoptera, Coleoptera and Homoptera. Members of the Siphonaptera order include, but are not limited to, *Ctenocephalides felis* and *Ctenocephalides canis*. Members of the Diptera order include, but are not limited to, *Musca spp.*; bot fly, for example *Gasterophilus intestinalis* and *Oestrus ovis*; biting flies; horse flies, for example *Haematopota spp.* and *Tabanus spp.*; *haematobia*, for example *haematobia irritans*; *Stomoxys*; *Lucilia*; midges; and mosquitoes. Members of the Phthiraptera class include, but are not limited to, blood sucking lice and chewing lice, for example *Bovicola Ovis* and *Bovicola Bovis*.

The term "effective amount" when used in context of parasites in or on an animal refers to the amount or dose of the compound of the invention, or a salt thereof, which, upon single or multiple dose administration to the animal, provides the desired effect in or on the animal. The effective amount can be readily determined by the attending diagnostician, as one skilled in the art, by the use of known techniques and by observing results obtained under analogous circumstances. In determining the effective amount a number of factors are considered by the attending diagnostician, including, but not limited to: the species of mammal; its size, age, and general health; the parasite to be controlled and the degree of infestation; the specific disease or disorder involved; the degree of or involvement or the severity of the disease or disorder; the response of the individual; the particular compound administered; the mode of administration; the bioavailability characteristics of the preparation administered; the dose regimen selected; the use of concomitant medication; and other relevant circumstances.

The compounds of the invention may be administered to the animal by any route which has the desired effect including, but not limited to topically, orally, parenterally and subcutaneously. Topical administration is preferred. Formulations suitable for topical administration include, for example, solutions, emulsions and suspensions and may take the form of a pour-on, spot-on, spray-on, spray race or dip. In the alternative, the compounds of the invention may be administered by means of an ear tag or collar.

Salt forms of the compounds of the invention include both pharmaceutically acceptable salts and veterinary acceptable salts, which can be different to agrochemically acceptable salts.

Pharmaceutically and veterinary acceptable salts and common methodology for preparing them are well known in the art. See, for example, Gould, P.L., "Salt selection for basic drugs", *International Journal of Pharmaceutics*, 33: 201 -217 (1986); Bastin, R.J., *et al.* "Salt Selection and Optimization Procedures for Pharmaceutical New Chemical Entities", *Organic Process Research and Development*, 4: 427-435 (2000); and Berge, S.M., *et al.*, "Pharmaceutical Salts", *Journal of Pharmaceutical Sciences*, 66: 1-19, (1977). One skilled in the art of synthesis will appreciate that the compounds of the invention are readily converted to and may be isolated as a salt, such as a hydrochloride salt, using techniques and conditions well known to one of ordinary skill in the art. In addition, one skilled in the art of synthesis will appreciate that the compounds of the invention are readily converted to and may be isolated as the corresponding free base from the corresponding salt.

The present invention also provides a method for controlling pests (such as mosquitoes and other disease vectors; see also http://www.who.int/malaria/vector_control/irs/en/). In one embodiment, the method for controlling pests comprises applying the compositions of the invention to the target pests, to their locus or to a surface or substrate by brushing, rolling, spraying, spreading or dipping. By way of example, an IRS (indoor residual spraying) application of a surface such as a wall, ceiling or floor surface is contemplated by the method of the invention. In another embodiment, it is contemplated to apply such compositions to a substrate such as non-woven or a fabric material in the form of (or which can be used in the manufacture of) netting, clothing, bedding, curtains and tents.

In one embodiment, the method for controlling such pests comprises applying a pesticidally effective amount of the compositions of the invention to the target pests, to their locus, or to a surface or substrate so as to provide effective residual pesticidal activity on the surface or substrate. Such application may be made by brushing, rolling, spraying, spreading or dipping the pesticidal composition of the invention. By way of example, an IRS application of a surface such as a wall, ceiling or floor surface is contemplated by the method of the invention so as to provide effective residual pesticidal activity on the surface. In another embodiment, it is contemplated to apply such compositions for residual control of pests on a substrate such as a fabric material in the form of (or which can be used in the manufacture of) netting, clothing, bedding, curtains and tents.

Substrates including non-woven, fabrics or netting to be treated may be made of natural fibres such as cotton, raffia, jute, flax, sisal, hessian, or wool, or synthetic fibres such as polyamide, polyester, polypropylene, polyacrylonitrile or the like. The polyesters are particularly suitable. The methods of textile treatment are known, e.g. WO 2008/151984, WO 2003/034823, US 5631072, WO 2005/64072, WO2006/128870, EP 1724392, WO 2005113886 or WO 2007/090739.

Further areas of use of the compositions according to the invention are the field of tree injection/trunk treatment for all ornamental trees as well all sort of fruit and nut trees.

- 5 In the field of tree injection/trunk treatment, the compounds according to the present invention are especially suitable against wood-boring insects from the order *Lepidoptera* as mentioned above and from the order *Coleoptera*, especially against woodborers listed in the following tables A and B:

Table A. Examples of exotic woodborers of economic importance.

Family	Species	Host or Crop Infested
Buprestidae	<i>Agrilus planipennis</i>	Ash
Cerambycidae	<i>Anoplura glabripennis</i>	Hardwoods
Scolytidae	<i>Xylosandrus crassiusculus</i>	Hardwoods
	<i>X. mutilatus</i>	Hardwoods
	<i>Tomicus piniperda</i>	Conifers

10 Table B. Examples of native woodborers of economic importance.

Family	Species	Host or Crop Infested
Buprestidae	<i>Agrilus anxius</i>	Birch
	<i>Agrilus politus</i>	Willow, Maple
	<i>Agrilus sayi</i>	Bayberry, Sweetfern
	<i>Agrilus vittaticollis</i>	Apple, Pear, Cranberry, Serviceberry, Hawthorn
	<i>Chrysobothris femorata</i>	Apple, Apricot, Beech, Boxelder, Cherry, Chestnut, Currant, Elm, Hawthorn, Hackberry, Hickory, Horsechestnut, Linden, Maple, Mountain-ash, Oak, Pecan, Pear, Peach, Persimmon, Plum, Poplar, Quince, Redbud, Serviceberry, Sycamore, Walnut, Willow
	<i>Texania campestris</i>	Basswood, Beech, Maple, Oak, Sycamore, Willow, Yellow-poplar
Cerambycidae	<i>Goes pulverulentus</i>	Beech, Elm, Nuttall, Willow, Black oak, Cherrybark oak, Water oak, Sycamore
	<i>Goes tigrinus</i>	Oak
	<i>Neoclytus acuminatus</i>	Ash, Hickory, Oak, Walnut, Birch, Beech, Maple, Eastern

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Family	Species	Host or Crop Infested
		hophornbeam, Dogwood, Persimmon, Redbud, Holly, Hackberry, Black locust, Honeylocust, Yellow-poplar, Chestnut, Osage-orange, Sassafras, Lilac, Mountain-mahogany, Pear, Cherry, Plum, Peach, Apple, Elm, Basswood, Sweetgum
	<i>Neoptychodes trilineatus</i>	Fig, Alder, Mulberry, Willow, Nettleleaf hackberry
	<i>Oberea ocellata</i>	Sumac, Apple, Peach, Plum, Pear, Currant, Blackberry
	<i>Oberea tripunctata</i>	Dogwood, Viburnum, Elm, Sourwood, Blueberry, Rhododendron, Azalea, Laurel, Poplar, Willow, Mulberry
	<i>Oncideres cingulata</i>	Hickory, Pecan, Persimmon, Elm, Sourwood, Basswood, Honeylocust, Dogwood, Eucalyptus, Oak, Hackberry, Maple, Fruit trees
	<i>Saperda calcarata</i>	Poplar
	<i>Strophiona nitens</i>	Chestnut, Oak, Hickory, Walnut, Beech, Maple
Scolytidae	<i>Corthylus columbianus</i>	Maple, Oak, Yellow-poplar, Beech, Boxelder, Sycamore, Birch, Basswood, Chestnut, Elm
	<i>Dendroctonus frontalis</i>	Pine
	<i>Dryocoetes betulae</i>	Birch, Sweetgum, Wild cherry, Beech, Pear
	<i>Monarthrum fasciatum</i>	Oak, Maple, Birch, Chestnut, Sweetgum, Blackgum, Poplar, Hickory, Mimosa, Apple, Peach, Pine
	<i>Phloeotribus liminaris</i>	Peach, Cherry, Plum, Black cherry, Elm, Mulberry, Mountain-ash
	<i>Pseudopityophthorus pruinus</i>	Oak, American beech, Black cherry, Chickasaw plum, Chestnut, Maple, Hickory, Hornbeam, Hophornbeam

Family	Species	Host or Crop Infested
Sesiidae	<i>Paranthrene simulans</i>	Oak, American chestnut
	<i>Sannina uroceriformis</i>	Persimmon
	<i>Synanthedon exitiosa</i>	Peach, Plum, Nectarine, Cherry, Apricot, Almond, Black cherry
	<i>Synanthedon pictipes</i>	Peach, Plum, Cherry, Beach, Black Cherry
	<i>Synanthedon rubrofascia</i>	Tupelo
	<i>Synanthedon scitula</i>	Dogwood, Pecan, Hickory, Oak, Chestnut, Beech, Birch, Black cherry, Elm, Mountain-ash, Viburnum, Willow, Apple, Loquat, Ninebark, Bayberry
	<i>Vitacea polistiformis</i>	Grape

The present invention may be also used to control any insect pests that may be present in turfgrass, including for example beetles, caterpillars, fire ants, ground pearls, millipedes, sow bugs, mites, mole crickets, scales, mealybugs, ticks, spittlebugs, southern chinch bugs and white grubs. The present invention may be used to control insect pests at various stages of their life cycle, including eggs, larvae, nymphs and adults.

In particular, the present invention may be used to control insect pests that feed on the roots of turfgrass including white grubs (such as *Cyclocephala* spp. (e.g. masked chafer, *C. lurida*), *Rhizotrogus* spp. (e.g. European chafer, *R. majalis*), *Cotinus* spp. (e.g. Green June beetle, *C. nitida*), *Popillia* spp. (e.g. Japanese beetle, *P. japonica*), *Phyllophaga* spp. (e.g. May/June beetle), *Ataenius* spp. (e.g. Black turfgrass ataenius, *A. spretulus*), *Maladera* spp. (e.g. Asiatic garden beetle, *M. castanea*) and *Tomarus* spp.), ground pearls (*Margarodes* spp.), mole crickets (tawny, southern, and short-winged; *Scapteriscus* spp., *Gryllotalpa africana*) and leatherjackets (European crane fly, *Tipula* spp.).

The present invention may also be used to control insect pests of turfgrass that are thatch dwelling, including armyworms (such as fall armyworm *Spodoptera frugiperda*, and common armyworm *Pseudaletia unipuncta*), cutworms, billbugs (*Sphenophorus* spp., such as *S. venatus verstitus* and *S. parvulus*), and sod webworms (such as *Crambus* spp. and the tropical sod webworm, *Herpetogramma phaeopteralis*).

The present invention may also be used to control insect pests of turfgrass that live above the ground and feed on the turfgrass leaves, including chinch bugs (such as southern chinch bugs, *Blissus*

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insularis), Bermudagrass mite (*Eriophyes cynodoniensis*), rhodesgrass mealybug (*Antonina graminis*), two-lined spittlebug (*Prospapia bicincta*), leafhoppers, cutworms (*Noctuidae* family), and greenbugs.

The present invention may also be used to control other pests of turfgrass such as red imported fire ants (*Solenopsis invicta*) that create ant mounds in turf.

In the hygiene sector, the compositions according to the invention are active against ectoparasites such as hard ticks, soft ticks, mange mites, harvest mites, flies (biting and licking), parasitic fly larvae, lice, hair lice, bird lice and fleas.

Examples of such parasites are:

Of the order Anoplurida: Haematopinus spp., Linognathus spp., Pediculus spp. and Phtirus spp., Solenopotes spp..

Of the order Mallophagida: Trimenopon spp., Menopon spp., Trinoton spp., Bovicola spp., Werneckiella spp., Lepikentron spp., Damalina spp., Trichodectes spp. and Felicola spp..

Of the order Diptera and the suborders Nematocera and Brachycera, for example Aedes spp., Anopheles spp., Culex spp., Simulium spp., Eusimulium spp., Phlebotomus spp., Lutzomyia spp., Culicoides spp., Chrysops spp., Hybomitra spp., Atylotus spp., Tabanus spp., Haematopota spp., Philipomyia spp., Braula spp., Musca spp., Hydrotaea spp., Stomoxys spp., Haematobia spp., Morellia spp., Fannia spp., Glossina spp., Calliphora spp., Lucilia spp., Chrysomyia spp., Wohlfahrtia spp., Sarcophaga spp., Oestrus spp., Hypoderma spp., Gasterophilus spp., Hippobosca spp., Lipoptena spp. and Melophagus spp..

Of the order Siphonaptera, for example Pulex spp., Ctenocephalides spp., Xenopsylla spp., Ceratophyllus spp..

Of the order Heteroptera, for example Cimex spp., Triatoma spp., Rhodnius spp., Panstrongylus spp..

Of the order Blattaria, for example Blatta orientalis, Periplaneta americana, Blattella germanica and Supella spp..

Of the subclass Acaria (Acarida) and the orders Meta- and Meso-stigmata, for example Argas spp., Ornithodoros spp., Otobius spp., Ixodes spp., Amblyomma spp., Boophilus spp., Dermacentor spp., Haemaphysalis spp., Hyalomma spp., Rhipicephalus spp., Dermanyssus spp., Raillietia spp., Pneumonyssus spp., Sternostoma spp. and Varroa spp..

Of the orders Actinedida (Prostigmata) and Acaridida (Astigmata), for example *Acarapis* spp., *Cheyletiella* spp., *Ornithocheyletia* spp., *Myobia* spp., *Psorergates* spp., *Demodex* spp., *Trombicula* spp., *Listrophorus* spp., *Acarus* spp., *Tyrophagus* spp., *Caloglyphus* spp., *Hypodectes* spp., *Pterolichus* spp., *Psoroptes* spp., *Chorioptes* spp., *Otodectes* spp., *Sarcoptes* spp., *Notoedres* spp.,
 5 *Knemidocoptes* spp., *Cytodites* spp. and *Laminosioptes* spp..

The compositions according to the invention are also suitable for protecting against insect infestation in the case of materials such as wood, textiles, plastics, adhesives, glues, paints, paper and card, leather, floor coverings and buildings.

The compositions according to the invention can be used, for example, against the following pests: beetles such as *Hylotrupes bajulus*, *Chlorophorus pilosis*, *Anobium punctatum*, *Xestobium rufovillosum*, *Ptilinuspecticornis*, *Dendrobium pertinex*, *Ernobius mollis*, *Priobium carpini*, *Lyctus brunneus*, *Lyctus africanus*, *Lyctus planicollis*, *Lyctus linearis*, *Lyctus pubescens*, *Trogoxylon aequale*,
 15 *Minthesrugicollis*, *Xyleborus* spec., *Tryptodendron* spec., *Apate monachus*, *Bostrychus capucins*, *Heterobostrychus brunneus*, *Sinoxylon* spec. and *Dinoderus minutus*, and also hymenopterans such as *Sirex juvencus*, *Urocerus gigas*, *Urocerus gigas taignus* and *Urocerus augur*, and termites such as *Kaloterme flavicollis*, *Cryptotermes brevis*, *Heterotermes indicola*, *Reticulitermes flavipes*, *Reticulitermes santonensis*, *Reticulitermes lucifugus*, *Mastotermes darwiniensis*, *Zootermopsis*
 20 *nevadensis* and *Coptotermes formosanus*, and bristletails such as *Lepisma saccharina*. The compounds of formulae I, or salts thereof, are especially suitable for controlling one or more pests selected from the family: Noctuidae, Plutellidae, Chrysomelidae, Thripidae, Pentatomidae, Tortricidae, Delphacidae, Aphididae, Noctuidae, Crambidae, Meloidogynidae, and Heteroderidae. In a preferred embodiment of each aspect, a compound TX (where the abbreviation "TX" means "one compound
 25 selected from the compounds defined in Tables 1 to 4 and Tables P1 to P2") controls one or more of pests selected from the family: Noctuidae, Plutellidae, Chrysomelidae, Thripidae, Pentatomidae, Tortricidae, Delphacidae, Aphididae, Noctuidae, Crambidae, Meloidogynidae, and Heteroderidae.

The compounds of formulae I, or salts thereof, are especially suitable for controlling one or more of
 30 pests selected from the genus: Spodoptera spp, Plutella spp, Frankliniella spp, Thrips spp, Euschistus spp, Cydia spp, Nilaparvata spp, Myzus spp, Aphis spp, Diabrotica spp, Rhopalosiphum spp, Pseudoplusia spp and Chilo spp. . In a preferred embodiment of each aspect, a compound TX (where the abbreviation "TX" means "one compound selected from the compounds defined in Tables 1 to 4 and Tables P1 to P2") controls one or more of pests selected from the genus: Spodoptera spp,
 35 Plutella spp, Frankliniella spp, Thrips spp, Euschistus spp, Cydia spp, Nilaparvata spp, Myzus spp, Aphis spp, Diabrotica spp, Rhopalosiphum spp, Pseudoplusia spp and Chilo spp.

The compounds of formulae I, or salts thereof, are especially suitable for controlling one or more of *Spodoptera littoralis*, *Plutella xylostella*, *Frankliniella occidentalis*, *Thrips tabaci*, *Euschistus heros*,

Cydia pomonella, *Nilaparvata lugens*, *Myzus persicae*, *Chrysodeixis includens*, *Aphis craccivora*, *Diabrotica balteata*, *Rhopalosiphum padi*, and *Chilo suppressalis*.

In a preferred embodiment of each aspect, a compound TX (where the abbreviation "TX" means "one compound selected from the compounds defined in Tables 1 to 4 and Tables P1 to P2") controls one or more of *Spodoptera littoralis*, *Plutella xylostella*, *Frankliniella occidentalis*, *Thrips tabaci*, *Euschistus heros*, *Cydia pomonella*, *Nilaparvata lugens*, *Myzus persicae*, *Chrysodeixis includens*, *Aphis craccivora*, *Diabrotica balteata*, *Rhopalosiphum Padi*, and *Chilo Suppressalis*, such as *Spodoptera littoralis* + TX, *Plutella xylostella* + TX; *Frankliniella occidentalis* + TX, *Thrips tabaci* + TX, *Euschistus heros* + TX, *Cydia pomonella* + TX, *Nilaparvata lugens* + TX, *Myzus persicae* + TX, *Chrysodeixis includens* + TX, *Aphis craccivora* + TX, *Diabrotica balteata* + TX, *Rhopalosiphum Padi* + TX, and *Chilo suppressalis* + TX.

In an embodiment, of each aspect, one compound from Tables 1 to 4 and Tables P1 to P2 is suitable for controlling *Spodoptera littoralis*, *Plutella xylostella*, *Frankliniella occidentalis*, *Thrips tabaci*, *Euschistus heros*, *Cydia pomonella*, *Nilaparvata lugens*, *Myzus persicae*, *Chrysodeixis includens*, *Aphis craccivora*, *Diabrotica balteata*, *Rhopalosiphum Padi*, and *Chilo Suppressalis* in cotton, vegetable, maize, cereal, rice and soya crops.

In an embodiment, one compound from Tables 1 to 4 and Tables P1 to P2 is suitable for controlling Mamestra (preferably in vegetables), *Cydia pomonella* (preferably in apples), *Empoasca* (preferably in vegetables, vineyards), *Leptinotarsa* (preferably in potatoes) and *Chilo suppressalis* (preferably in rice).

Compounds according to the invention may possess any number of benefits including, inter alia, advantageous levels of biological activity for protecting plants against insects or superior properties for use as agrochemical active ingredients (for example, greater biological activity, an advantageous spectrum of activity, an increased safety profile (against non-target organisms above and below ground (such as fish, birds and bees), improved physico-chemical properties, or increased biodegradability). In particular, it has been surprisingly found that certain compounds of formula (I) may show an advantageous safety profile with respect to non-target arthropods, in particular pollinators such as honey bees, solitary bees, and bumble bees. Most particularly, *Apis mellifera*.

The compounds according to the invention can be used as pesticidal agents in unmodified form, but they are generally formulated into compositions in various ways using formulation adjuvants, such as carriers, solvents and surface-active substances. The formulations can be in various physical forms, e.g. in the form of dusting powders, gels, wettable powders, water-dispersible granules, water-dispersible tablets, effervescent pellets, emulsifiable concentrates, microemulsifiable concentrates, oil-in-water emulsions, oil-flowables, aqueous dispersions, oily dispersions, suspo-emulsions, capsule suspensions, emulsifiable granules, soluble liquids, water-soluble concentrates (with water or a water-

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miscible organic solvent as carrier), impregnated polymer films or in other forms known e.g. from the Manual on Development and Use of FAO and WHO Specifications for Pesticides, United Nations, First Edition, Second Revision (2010). Such formulations can either be used directly or diluted prior to use. The dilutions can be made, for example, with water, liquid fertilisers, micronutrients, biological organisms, oil or solvents.

The formulations can be prepared e.g. by mixing the active ingredient with the formulation adjuvants in order to obtain compositions in the form of finely divided solids, granules, solutions, dispersions or emulsions. The active ingredients can also be formulated with other adjuvants, such as finely divided solids, mineral oils, oils of vegetable or animal origin, modified oils of vegetable or animal origin, organic solvents, water, surface-active substances or combinations thereof.

The active ingredients can also be contained in very fine microcapsules. Microcapsules contain the active ingredients in a porous carrier. This enables the active ingredients to be released into the environment in controlled amounts (e.g. slow-release). Microcapsules usually have a diameter of from 0.1 to 500 microns. They contain active ingredients in an amount of about from 25 to 95 % by weight of the capsule weight. The active ingredients can be in the form of a monolithic solid, in the form of fine particles in solid or liquid dispersion or in the form of a suitable solution. The encapsulating membranes can comprise, for example, natural or synthetic rubbers, cellulose, styrene/butadiene copolymers, polyacrylonitrile, polyacrylate, polyesters, polyamides, polyureas, polyurethane or chemically modified polymers and starch xanthates or other polymers that are known to the person skilled in the art. Alternatively, very fine microcapsules can be formed in which the active ingredient is contained in the form of finely divided particles in a solid matrix of base substance, but the microcapsules are not themselves encapsulated.

The formulation adjuvants that are suitable for the preparation of the compositions according to the invention are known *per se*. As liquid carriers there may be used: water, toluene, xylene, petroleum ether, vegetable oils, acetone, methyl ethyl ketone, cyclohexanone, acid anhydrides, acetonitrile, acetophenone, amyl acetate, 2-butanone, butylene carbonate, chlorobenzene, cyclohexane, cyclohexanol, alkyl esters of acetic acid, diacetone alcohol, 1,2-dichloropropane, diethanolamine, p-diethylbenzene, diethylene glycol, diethylene glycol abietate, diethylene glycol butyl ether, diethylene glycol ethyl ether, diethylene glycol methyl ether, *N,N*-dimethylformamide, dimethyl sulfoxide, 1,4-dioxane, dipropylene glycol, dipropylene glycol methyl ether, dipropylene glycol dibenzoate, diproxitol, alkyldipyrrolidone, ethyl acetate, 2-ethylhexanol, ethylene carbonate, 1,1,1-trichloroethane, 2-heptanone, alpha-pinene, d-limonene, ethyl lactate, ethylene glycol, ethylene glycol butyl ether, ethylene glycol methyl ether, gamma-butyrolactone, glycerol, glycerol acetate, glycerol diacetate, glycerol triacetate, hexadecane, hexylene glycol, isoamyl acetate, isobornyl acetate, isooctane, isophorone, isopropylbenzene, isopropyl myristate, lactic acid, laurylamine, mesityl oxide, methoxypropanol, methyl isoamyl ketone, methyl isobutyl ketone, methyl laurate, methyl octanoate, methyl

oleate, methylene chloride, m-xylene, *n*-hexane, *n*-octylamine, octadecanoic acid, octylamine acetate, oleic acid, oleylamine, o-xylene, phenol, polyethylene glycol, propionic acid, propyl lactate, propylene carbonate, propylene glycol, propylene glycol methyl ether, p-xylene, toluene, triethyl phosphate, triethylene glycol, xylenesulfonic acid, paraffin, mineral oil, trichloroethylene, perchloroethylene, ethyl acetate, amyl acetate, butyl acetate, propylene glycol methyl ether, diethylene glycol methyl ether, methanol, ethanol, isopropanol, and alcohols of higher molecular weight, such as amyl alcohol, tetrahydrofurfuryl alcohol, hexanol, octanol, ethylene glycol, propylene glycol, glycerol, *N*-methyl-2-pyrrolidone and the like.

- 10 Suitable solid carriers are, for example, talc, titanium dioxide, pyrophyllite clay, silica, attapulgite clay, kieselguhr, limestone, calcium carbonate, bentonite, calcium montmorillonite, cottonseed husks, wheat flour, soybean flour, pumice, wood flour, ground walnut shells, lignin and similar substances.

- 15 A large number of surface-active substances can advantageously be used in both solid and liquid formulations, especially in those formulations which can be diluted with a carrier prior to use. Surface-active substances may be anionic, cationic, non-ionic or polymeric and they can be used as emulsifiers, wetting agents or suspending agents or for other purposes. Typical surface-active substances include, for example, salts of alkyl sulfates, such as diethanolammonium lauryl sulfate; salts of alkylarylsulfonates, such as calcium dodecylbenzenesulfonate; alkylphenol/alkylene oxide addition products, such as nonylphenol ethoxylate; alcohol/alkylene oxide addition products, such as tridecylalcohol ethoxylate; soaps, such as sodium stearate; salts of alkyl naphthalenesulfonates, such as sodium dibutyl naphthalenesulfonate; dialkyl esters of sulfosuccinate salts, such as sodium di(2-ethylhexyl)sulfosuccinate; sorbitol esters, such as sorbitol oleate; quaternary amines, such as lauryltrimethylammonium chloride, polyethylene glycol esters of fatty acids, such as polyethylene glycol stearate; block copolymers of ethylene oxide and propylene oxide; and salts of mono- and di-alkylphosphate esters; and also further substances described e.g. in McCutcheon's Detergents and Emulsifiers Annual, MC Publishing Corp., Ridgewood New Jersey (1981).

- 30 Further adjuvants that can be used in pesticidal formulations include crystallisation inhibitors, viscosity modifiers, suspending agents, dyes, anti-oxidants, foaming agents, light absorbers, mixing auxiliaries, antifoams, complexing agents, neutralising or pH-modifying substances and buffers, corrosion inhibitors, fragrances, wetting agents, take-up enhancers, micronutrients, plasticisers, glidants, lubricants, dispersants, thickeners, antifreezes, microbicides, and liquid and solid fertilisers.

- 35 The compositions according to the invention can include an additive comprising an oil of vegetable or animal origin, a mineral oil, alkyl esters of such oils or mixtures of such oils and oil derivatives. The amount of oil additive in the composition according to the invention is generally from 0.01 to 10 %, based on the mixture to be applied. For example, the oil additive can be added to a spray tank in the desired concentration after a spray mixture has been prepared. Preferred oil additives comprise

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mineral oils or an oil of vegetable origin, for example rapeseed oil, olive oil or sunflower oil, emulsified vegetable oil, alkyl esters of oils of vegetable origin, for example the methyl derivatives, or an oil of animal origin, such as fish oil or beef tallow. Preferred oil additives comprise alkyl esters of C₈-C₂₂ fatty acids, especially the methyl derivatives of C₁₂-C₁₈ fatty acids, for example the methyl esters of lauric acid, palmitic acid and oleic acid (methyl laurate, methyl palmitate and methyl oleate, respectively). Many oil derivatives are known from the Compendium of Herbicide Adjuvants, 10th Edition, Southern Illinois University, 2010.

The inventive compositions generally comprise from 0.1 to 99 % by weight, especially from 0.1 to 95 % by weight, of compounds of the present invention and from 1 to 99.9 % by weight of a formulation adjuvant which preferably includes from 0 to 25 % by weight of a surface-active substance. Whereas commercial products may preferably be formulated as concentrates, the end user will normally employ dilute formulations.

The rates of application vary within wide limits and depend on the nature of the soil, the method of application, the crop plant, the pest to be controlled, the prevailing climatic conditions, and other factors governed by the method of application, the time of application and the target crop. As a general guideline compounds may be applied at a rate of from 1 to 2000 l/ha, especially from 10 to 1000 l/ha.

Preferred formulations can have the following compositions (weight %):

Emulsifiable concentrates:

active ingredient:	1 to 95 %, preferably 60 to 90 %
surface-active agent:	1 to 30 %, preferably 5 to 20 %
liquid carrier:	1 to 80 %, preferably 1 to 35 %

Dusts:

active ingredient:	0.1 to 10 %, preferably 0.1 to 5 %
solid carrier:	99.9 to 90 %, preferably 99.9 to 99 %

Suspension concentrates:

active ingredient:	5 to 75 %, preferably 10 to 50 %
water:	94 to 24 %, preferably 88 to 30 %
surface-active agent:	1 to 40 %, preferably 2 to 30 %

Wettable powders:

active ingredient:	0.5 to 90 %, preferably 1 to 80 %
surface-active agent:	0.5 to 20 %, preferably 1 to 15 %
solid carrier:	5 to 95 %, preferably 15 to 90 %

Granules:

active ingredient: 0.1 to 30 %, preferably 0.1 to 15 %

solid carrier: 99.5 to 70 %, preferably 97 to 85 %

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The following Examples further illustrate, but do not limit, the invention.

<u>Wettable powders</u>	a)	b)	c)
active ingredients	25 %	50 %	75 %
sodium lignosulfonate	5 %	5 %	-
sodium lauryl sulfate	3 %	-	5 %
sodium diisobutyl naphthalenesulfonate	-	6 %	10 %
phenol polyethylene glycol ether (7-8 mol of ethylene oxide)	-	2 %	-
highly dispersed silicic acid	5 %	10 %	10 %
Kaolin	62 %	27 %	-

The combination is thoroughly mixed with the adjuvants and the mixture is thoroughly ground in a suitable mill, affording wettable powders that can be diluted with water to give suspensions of the desired concentration.

10

<u>Powders for dry seed treatment</u>	a)	b)	c)
active ingredients	25 %	50 %	75 %
light mineral oil	5 %	5 %	5 %
highly dispersed silicic acid	5 %	5 %	-
Kaolin	65 %	40 %	-
Talcum	-		20 %

The combination is thoroughly mixed with the adjuvants and the mixture is thoroughly ground in a suitable mill, affording powders that can be used directly for seed treatment.

<u>Emulsifiable concentrate</u>	
active ingredients	10 %
octylphenol polyethylene glycol ether (4-5 mol of ethylene oxide)	3 %
calcium dodecylbenzenesulfonate	3 %
castor oil polyglycol ether (35 mol of ethylene oxide)	4 %
Cyclohexanone	30 %
xylene mixture	50 %

Emulsions of any required dilution, which can be used in plant protection, can be obtained from this concentrate by dilution with water.

<u>Dusts</u>	a)	b)	c)
Active ingredients	5 %	6 %	4 %
Talcum	95 %	-	-
Kaolin	-	94 %	-
mineral filler	-	-	96 %

Ready-for-use dusts are obtained by mixing the combination with the carrier and grinding the mixture in a suitable mill. Such powders can also be used for dry dressings for seed.

<u>Extruder granules</u>	
Active ingredients	15 %
sodium lignosulfonate	2 %
carboxymethylcellulose	1 %
Kaolin	82 %

The combination is mixed and ground with the adjuvants, and the mixture is moistened with water. The mixture is extruded and then dried in a stream of air.

<u>Coated granules</u>	
Active ingredients	8 %
polyethylene glycol (mol. wt. 200)	3 %
Kaolin	89 %

- 10 The finely ground combination is uniformly applied, in a mixer, to the kaolin moistened with polyethylene glycol. Non-dusty coated granules are obtained in this manner.

Suspension concentrate

active ingredients	40 %
propylene glycol	10 %
nonylphenol polyethylene glycol ether (15 mol of ethylene oxide)	6 %
Sodium lignosulfonate	10 %
carboxymethylcellulose	1 %
silicone oil (in the form of a 75 % emulsion in water)	1 %
Water	32 %

- 15 The finely ground combination is intimately mixed with the adjuvants, giving a suspension concentrate from which suspensions of any desired dilution can be obtained by dilution with water. Using such dilutions, living plants as well as plant propagation material can be treated and protected against infestation by microorganisms, by spraying, pouring or immersion.

Flowable concentrate for seed treatment

active ingredients	40 %
propylene glycol	5 %
copolymer butanol PO/EO	2 %
Tristyrenephenole with 10-20 moles EO	2 %
1,2-benzisothiazolin-3-one (in the form of a 20% solution in water)	0.5 %
monoazo-pigment calcium salt	5 %
Silicone oil (in the form of a 75 % emulsion in water)	0.2 %
Water	45.3 %

The finely ground combination is intimately mixed with the adjuvants, giving a suspension concentrate from which suspensions of any desired dilution can be obtained by dilution with water. Using such dilutions, living plants as well as plant propagation material can be treated and protected against infestation by microorganisms, by spraying, pouring or immersion.

Slow Release Capsule Suspension

28 parts of the combination are mixed with 2 parts of an aromatic solvent and 7 parts of toluene diisocyanate/polymethylene-polyphenylisocyanate-mixture (8:1). This mixture is emulsified in a mixture of 1.2 parts of polyvinylalcohol, 0.05 parts of a defoamer and 51.6 parts of water until the desired particle size is achieved. To this emulsion a mixture of 2.8 parts 1,6-diaminohexane in 5.3 parts of water is added. The mixture is agitated until the polymerization reaction is completed. The obtained capsule suspension is stabilized by adding 0.25 parts of a thickener and 3 parts of a dispersing agent. The capsule suspension formulation contains 28% of the active ingredients. The medium capsule diameter is 8-15 microns. The resulting formulation is applied to seeds as an aqueous suspension in an apparatus suitable for that purpose.

Formulation types include an emulsion concentrate (EC), a suspension concentrate (SC), a suspo-emulsion (SE), a capsule suspension (CS), a water dispersible granule (WG), an emulsifiable granule (EG), an emulsion, water in oil (EO), an emulsion, oil in water (EW), a micro-emulsion (ME), an oil dispersion (OD), an oil miscible flowable (OF), an oil miscible liquid (OL), a soluble concentrate (SL), an ultra-low volume suspension (SU), an ultra-low volume liquid (UL), a technical concentrate (TK), a dispersible concentrate (DC), a wettable powder (WP), a soluble granule (SG) or any technically feasible formulation in combination with agriculturally acceptable adjuvants.

Preparatory Examples:LCMS Methods:Method 1:

Spectra were recorded on a Mass Spectrometer from Waters Corporation (SQD, SQDII or QDA Single quadrupole mass spectrometer) equipped with an electrospray source (Polarity: positive and negative

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ions), Capillary: 0.8-3.00 kV, Cone: 5-30 V, Source Temperature: 120-150°C, Desolvation Temperature: 350-600°C, Cone Gas Flow: 50-150 L/h, Desolvation Gas Flow: 650-1000 L/h, Mass range: 110 to 950 Da and an Acquity UPLC from Waters Corporation: Binary pump, heated column compartment, diode-array detector and ELSD. Column: Waters UPLC HSS T3, 1.8 µm, 30 x 2.1 mm, Temp: 60 °C, DAD Wavelength range (nm): 210 to 400, Runtime: 1.5 min; Solvents: A = water + 5% MeOH + 0.05 % HCOOH, B= Acetonitrile + 0.05 % HCOOH; Flow (ml/min) 0.85, Gradient: 10% B isocratic for 0.2 min, then 10-100% B in 1.0 min, 100% B isocratic for 0.2min, 100-10% B in 0.05min, 10% B isocratic for 0.05 min.

Method 2:

Spectra were recorded on a Mass Spectrometer from Waters (SQD2 or QDA Single quadrupole mass spectrometer) equipped with an electrospray source (Polarity: Positive and Negative Polarity Switch), Capillary: 0.8-3.00 kV, Cone range: 25 Source Temperature: 120-150°C, Desolvation Temperature: 500-600°C, Cone Gas Flow: 50 L/h, Desolvation Gas Flow: 1000 L/h, Mass range: 110 to 850 Da) and an Acquity UPLC from Waters: Quaternary solvent manager, heated column compartment, diode-array detector. Column: Acquity UPLC HSS T3 C18, 1.8 µm, 30 x 2.1 mm, Temp: 40 °C, DAD Wavelength range (nm): 200 to 400, Solvent Gradient: A = water + 5% Acetonitrile + 0.1 % HCOOH, B= Acetonitrile + 0.05 % HCOOH: gradient: 0 min 10% B; 0.-0.2 min 10-50% B; 0.2-0.6 min 50-100% B; 0.6-1.3 min 100% B; 1.3-1.4 min 100-10% B; 1.4-1.6 min 10% B; Flow (mL/min) 0.6.

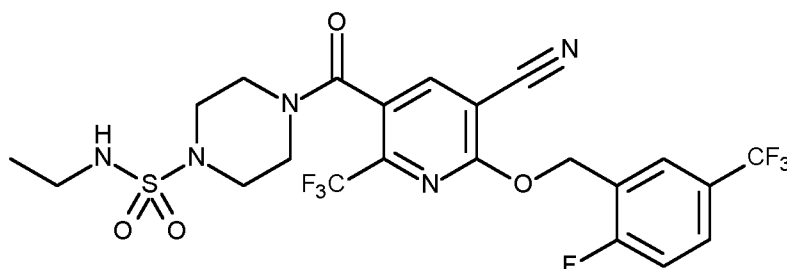
Method 3:

Spectra were recorded on a ACQUITY Mass Spectrometer from Waters Corporations (SQD or SQDII Single quadrupole mass spectrometer) equipped with an electrospray source (Polarity: positive or negative ions, Capillary: 3.0 kV, Cone: 30V, Extractor: 3.00 V, Source Temperature: 150°C, Desolvation Temperature: 400°C, Cone Gas Flow: 60 L/hr, Desolvation Gas Flow: 700 L/hr, Mass range: 140 to 800 Da) and an ACQUITY UPLC from Waters Corporations with solvent degasser, binary pump, heated column compartment and diode-array detector. Column: Waters UPLC HSS T3, 1.8 µm, 30 x 2.1 mm, Temp: 60 °C, DAD Wavelength range (nm): 210 to 400, Solvent Gradient: A = Water/Methanol 9:1 + 0.1% formic acid, B= Acetonitrile + 0.1% formic acid, gradient: 0-100% B in 2.5 min; Flow (ml/min) 0.75.

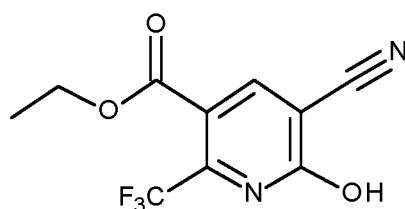
The following abbreviations are used in the experimental description below: s =singlet, d = doublet, t = triplet, q = quartet, m = multiplet, RT = retention time, min = minutes.

EXAMPLE P1: 4-[5-Cyano-6-[[2-fluoro-5-(trifluoromethyl)phenyl]methoxy]-2-(trifluoromethyl)pyridine-3-carbonyl]-N-ethyl-piperazine-1-sulfonamide (compound P1.1):

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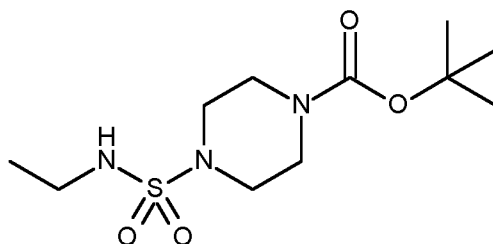


Step 1: Ethyl 5-cyano-6-hydroxy-2-(trifluoromethyl)pyridine-3-carboxylate



- 5 A solution of sodium ethoxide (1.1 eq) in ethanol (20% w/w) was added slowly at 4°C to a suspension of 2-cyano-acetamide (5.9 g, 70.2 mmol, 1 eq) and the mixture was stirred for 15 minutes. Then a solution ethyl-2-(ethoxymethylene)-4,4,4-trifluoro-3-oxo-butanoate (17 g, 70.1 mmol) in 34 ml of ethanol was added under ice cooling. The reaction mixture was stirred 16 hours and allowed to reach room temperature. Then the reaction mixture was poured into ice-cold solution of 1 N hydrochloric acid.
- 10 The resulting mixture was diluted with ice-cold water and stirred for 20 minutes. The precipitate was filtered, washed twice with ice-cold water and dried. 12.4 g of ethyl 5-cyano-6-hydroxy-2-(trifluoromethyl)pyridine-3-carboxylate were obtained in a purity higher than 95% determined by quantitative NMR. ¹H-NMR [ppm] in CDCl₃: 1.29 (t, 3 H), 4.29 (q, 2 H), 8.27 (s, 1 H).

- 15 Step 2: *tert*-Butyl 4-(ethylsulfamoyl)piperazine-1-carboxylate

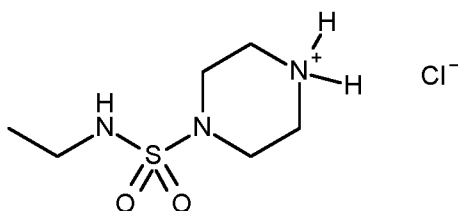


- tert*-Butyl piperazine-1-carboxylate (2.00 g, 10.7 mmol) was dissolved in DCM (43 mL) and under nitrogen atmosphere pyridine (1.31 mL, 16.1 mmol, 1.5 eq) was added, followed by addition of sulfonyl chloride (1.01 mL, 12.9 mmol, 1.2 eq). The mixture was stirred at room temperature for 16 hours. Then
- 20 1N HCl was added and the mixture was extracted with ethylacetate. The combined organic phases were dried over sodium sulfate, filtered and concentrated in vacuum. The residue consisting of *tert*-butyl 4-chlorosulfonylpiperazine-1-carboxylate (2 g, 7.02 mmol) was dissolved in DCM (14 mL). Triethylamine (1.97 mL, 14.04 mmol, 2 eq), 4-dimethylamino-pyridine (172 mg, 0.18 mL, 1.40 mmol, 0.2 eq) and ethylamine (14.04 mmol, 7 mL of a 2.0 mol/L solution in THF) were added. The reaction

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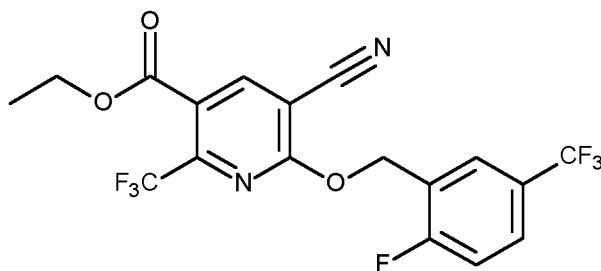
mixture was stirred at room temperature for 16 hours. Then 1N HCl was added and the mixture was extracted twice with ethylacetate. The combined organic phases were washed with saturated sodium chloride solution, dried over magnesium sulfate, filtered and concentrated in vacuum to give 2.20 g of *tert*-butyl 4-(ethylsulfamoyl)piperazine-1-carboxylate. ¹H-NMR [ppm] in CDCl₃: 1.17 (t, 3 H), 1.45 (s, 9H), 3.09 (quintett, 2H), 3.12-3.17 (m, 4 H), 3.45-3.50 (m, 4 H), 4.57 (t, 1 H).

Step 3: N-Ethylpiperazin-4-ium-1-sulfonamide chloride



- 10 To a solution of *tert*-butyl 4-(ethylsulfamoyl)piperazine-1-carboxylate (3.50 g, 12.0 mmol) in methanol (35 mL) was added a hydrogen chloride (35 mL, 4 mol/L solution in 1,4 dioxane). The reaction mixture was stirred at room temperature for 16 hours and then evaporated to dryness. The residue was washed with n-pentane followed by washing with ethyl acetate and dried under vacuum to get 2.5 g of N-ethylpiperazin-4-ium-1-sulfonamide chloride. ¹H-NMR [ppm] in DMSO-d₆: 1.06 (t, 3 H), 2.93 (quintett, 2H), 3.05-3.18 (m, 4 H), 3.23-3.32 (m, 4 H), 7.45-7.53 (m, 1 H), 9.48 (broad s, 2H).

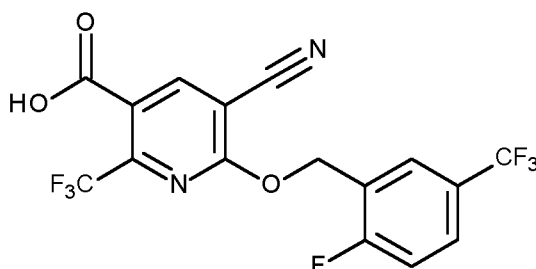
Step 4: Ethyl 5-cyano-6-[[2-fluoro-5-(trifluoromethyl)phenyl]methoxy]-2-(trifluoromethyl)pyridine-3-carboxylate



- 20 To a solution of ethyl 5-cyano-6-hydroxy-2-(trifluoromethyl)pyridine-3-carboxylate (3.00 g, 11.5 mmol) in acetone (58 mL) was added potassium carbonate (4.88 g, 34.6 mmol, 3 eq), sodium iodide (364 mg, 2.31 mmol, 0.2 eq) followed by 2-(bromomethyl)-1-fluoro-4-(trifluoromethyl)benzene (4.45 g, 2.71 mL, 17.3 mmol, 1.5 eq). The reaction mixture was stirred at 70°C for 3 hours. The suspension was filtered and washed with acetone and dried under vacuum. The residue was purified by combiflash to
- 25 give 4.55 g of ethyl 5-cyano-6-[[2-fluoro-5-(trifluoromethyl)phenyl]methoxy]-2-(trifluoromethyl)pyridine-3-carboxylate. ¹H-NMR [ppm] in CDCl₃: 1.39 (t, 3H), 4.45 (q, 2H), 5.70 (s, 2H), 7.22-7.29 (m, 1H), 7.64-7.72 (m, 1H), 7.89-7.94 (m, 1H), 8.42 (s, 1H). LC-MS (method 1): RT = 1.21 min; [M+H]⁺ = 437.

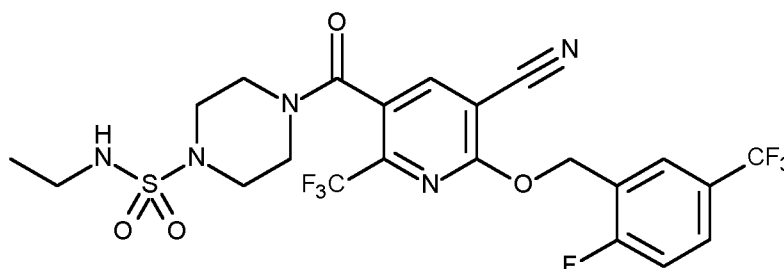
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Step 5: 5-Cyano-6-[[2-fluoro-5-(trifluoromethyl)phenyl]methoxy]-2-(trifluoromethyl)pyridine-3-carboxylic acid



Ethyl 5-cyano-6-[[2-fluoro-5-(trifluoromethyl)phenyl]methoxy]-2-(trifluoromethyl)pyridine-3-carboxylate (4.50 g, 10.3 mmol) was solved in THF (26 mL) and water (12 mL) and lithium hydroxide monohydrate (1.01 g, 41.3 mmol, 4 eq) was added at room temperature. The reaction mixture was stirred at room temperature until the starting material had disappeared on TLC. Then the reaction mixture was diluted with ethylacetate and 2N hydrochloric acid. The mixture was extracted three times with ethylacetate. The combined organic phases were washed twice with water and once with brine, dried over sodium sulfate, filtered and concentrated under vacuo. After titration with a small amount of DCM 1.63 g of 5-cyano-6-[[2-fluoro-5-(trifluoromethyl)phenyl]methoxy]-2-(trifluoromethyl)pyridine-3-carboxylic acid were obtained. ¹H-NMR [ppm] in DMSO-d₆: 5.68 (s, 2H), 7.54 (t, 1H), 7.83-7.89 (m, 1H), 8.05-8.11 (m, 1H), 8.83 (s, 1H), 14.16 (broad s, 1H). LC-MS (method 1): RT = 1.04 min; [M+H]⁺ = 409.

Step 6: 4-[5-Cyano-6-[[2-fluoro-5-(trifluoromethyl)phenyl]methoxy]-2-(trifluoromethyl)pyridine-3-carbonyl]-N-ethyl-piperazine-1-sulfonamide (compound P1.1)

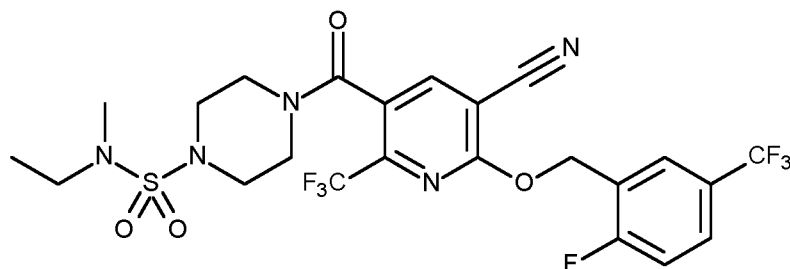


To a solution of 5-cyano-6-[[2-fluoro-5-(trifluoromethyl)phenyl]methoxy]-2-(trifluoromethyl)pyridine-3-carboxylic (180 mg, 0.441 mmol) in ethylacetate (6.6 mL) was added N-ethylpiperazine-1-sulfonamide (128 mg, 0.661 mmol, 1.5 eq), followed by propanephosphonic acid anhydride (T3P, 505 mg, 0.473 mL, 0.794 mmol, 1.8 eq; 50% solution in ethylacetate) and N,N-diisopropylethylamine (228 mg, 0.307 mL, 1.76 mmol, 4.0 eq). The reaction mixture was stirred at room temperature for 3 hours. The reaction mixture was poured into an aqueous NaHCO₃ solution. The mixture was extracted twice with ethylacetate. The combined organic layers were dried over sodium sulfate, filtered and concentrated under reduced pressure. The residue was purified via combiflash. 180 mg 4-[5-cyano-6-[[2-fluoro-5-(trifluoromethyl)phenyl]methoxy]-2-(trifluoromethyl)pyridine-3-carbonyl]-N-ethyl-piperazine-1-sulfonamide were obtained as a white foam. ¹H-NMR [ppm] in CDCl₃: 1.24 (t, 3H), 3.16 (quintett, 2H), 3.11-3.43 (m, 6H), 3.74-3.87 (m, 1H), 3.93-4.04 (m, 1H), 4.08 (t, 1H), 5.62-5.73 (m, 2H), 7.22-7.29 (m,

-45-

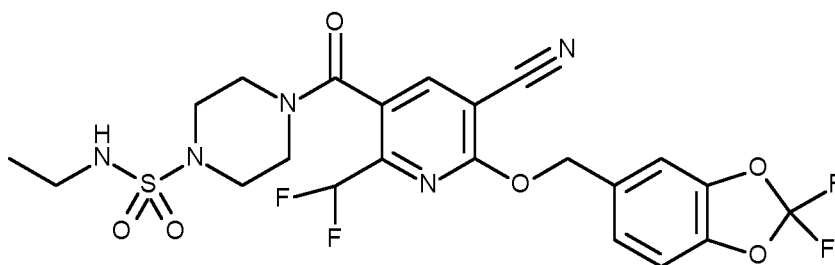
1 H), 7.64-7.72 (m, 1H), 7.88-7.94 (m, 1H), 7.98 (s, 1H). LC-MS (method 1): RT = 1.07 min; [M+H]⁺ = 584.

EXAMPLE P2: 4-[5-Cyano-6-[[2-fluoro-5-(trifluoromethyl)phenyl]methoxy]-2-(trifluoromethyl)pyridine-3-carbonyl]-N-ethyl-N-methyl-piperazine-1-sulfonamide (compound P1.2):



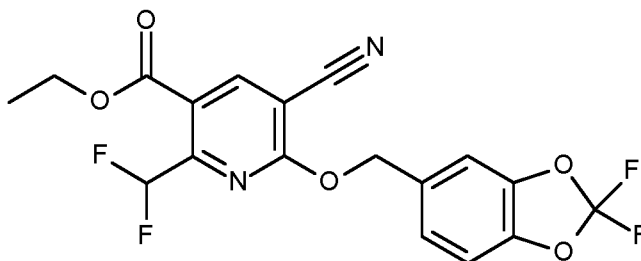
To a solution of 5-cyano-6-[[2-fluoro-5-(trifluoromethyl)phenyl]methoxy]-2-(trifluoromethyl)pyridine-3-carboxylic (200 mg, 0.490 mmol) in ethylacetate (7.4 mL) was added N-ethyl-N-methyl-piperazine-1-sulfonamide (152 mg, 0.735 mmol, 1.5 eq), followed by propanephosphonic acid anhydride (T3P, 561 mg, 0.523 mL, 0.882 mmol, 1.8 eq; 50% solution in ethylacetate) and N,N-diisopropylethylamine (253 mg, 0.341 mL, 1.96 mmol, 4.0 eq). The reaction mixture was stirred at room temperature for 3 hours. The reaction mixture was poured into an aqueous NaHCO₃ solution. The mixture was extracted twice with ethylacetate. The combined organic layers were dried over sodium sulfate, filtered and concentrated under reduced pressure. The residue was purified via combiflash. 230 mg 4-[5-cyano-6-[[2-fluoro-5-(trifluoromethyl)phenyl]methoxy]-2-(trifluoromethyl)pyridine-3-carbonyl]-N-ethyl-N-methyl-piperazine-1-sulfonamide were obtained as a white foam. ¹H-NMR [ppm] in CDCl₃: 1.21 (t, 3H), 2.86 (s, 3H), 3.12-3.40 (m, 8H), 3.74-3.86 (m, 1H), 3.90-3.99 (m, 1H), 5.63-5.73 (m, 2H), 7.22-7.29 (m, 1H), 7.63-7.72 (m, 1H), 7.88-7.94 (m, 1H), 7.96 (s, 1H). LC-MS (method 1): RT = 1.12 min; [M+H]⁺ = 598.

EXAMPLE P3: 4-[5-Cyano-6-[(2,2-difluoro-1,3-benzodioxol-5-yl)methoxy]-2-(difluoromethyl)pyridine-3-carbonyl]-N-ethyl-piperazine-1-sulfonamide (compound P1.3):



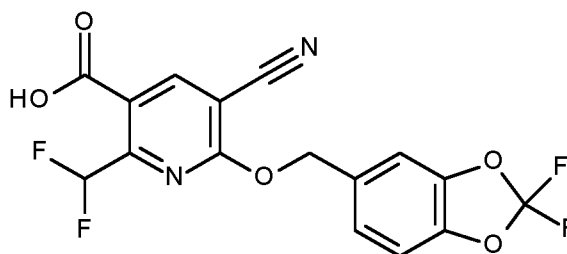
Step 1: Ethyl 5-cyano-6-[(2,2-difluoro-1,3-benzodioxol-5-yl)methoxy]-2-(difluoromethyl)pyridine-3-carboxylate

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To a solution of ethyl 5-cyano-2-(difluoromethyl)-6-hydroxy-pyridine-3-carboxylate (5.0 g, 20.6 mmol) which was synthesized as described in Nippon Soda patent application WO 2017195703 in DMF (52 mL) was added potassium carbonate (8.5 g, 61.8 mmol, 3 eq) and 5-(chloromethyl)-2,2-difluoro-1,3-benzodioxole (5.4 g, 25 mmol, 1.2 eq). The mixture was stirred at 60°C for 3 hours. Then water (30 mL) was added and the mixture was extracted with ethyl acetate (2 x 20 mL). The organic layers were combined, washed with brine (20 mL), dried with sodium sulfate, filtered, and concentrated. The residue was purified using combiflash (40-50% ethylacetate/caclohexane) to afford 3.8 g of ethyl 5-cyano-6-[(2,2-difluoro-1,3-benzodioxol-5-yl)methoxy]-2-(difluoromethyl)pyridine-3-carboxylate. ¹H-NMR 400 MHz in CDCl₃ [ppm]: 1.44 (t, 3H), 4.45 (q, 2H), 5.63 (s, 2H), 7.08 (d, 1H), 7.30 (d, 1H), 7.34 (s, 1H), 7.52 (t, 1H), 8.59 (s, 1H).

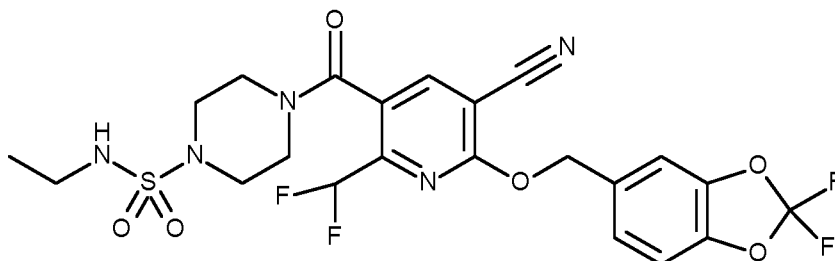
Step 2: 5-Cyano-6-[(2,2-difluoro-1,3-benzodioxol-5-yl)methoxy]-2-(difluoromethyl)pyridine-3-carboxylic acid



Ethyl 5-cyano-6-[(2,2-difluoro-1,3-benzodioxol-5-yl)methoxy]-2-(difluoromethyl)pyridine-3-carboxylate (3.8 g, 9.2 mmol) was dissolved in 1,4-dioxane (17 mL) and water (14 mL). Then lithium hydroxide hydrate (0.55 g, 23 mmol, 2.5 eq) was added and the mixture was stirred at room temperature for 6 hours. Then diluted hydrochloric acid was added and under cooling a precipitate formed. The precipitate was filtered, washed with cold water and dissolved in ethylacetate. The solution was dried with sodium sulfate, filtered and concentrated under vacuum to afford 3.5 g of 5-cyano-6-[(2,2-difluoro-1,3-benzodioxol-5-yl)methoxy]-2-(difluoromethyl)pyridine-3-carboxylic acid. ¹H-NMR 400 MHz in DMSO-d₆ [ppm]: 5.58 (s, 2H), 7.34-7.47 (m, 2H), 7.55 (t, 1H), 7.58 (s, 1H), 8.80 (s, 1H), 13.73-14.69 (broad s, 1H).

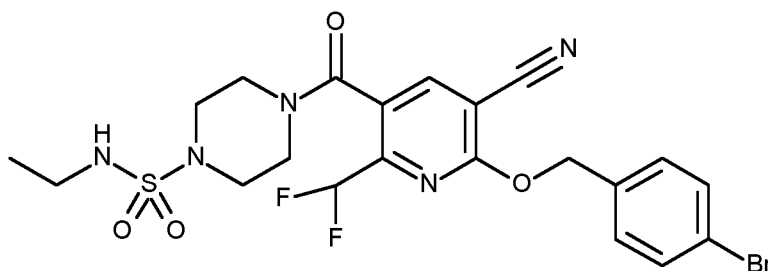
Step 3: 4-[5-Cyano-6-[(2,2-difluoro-1,3-benzodioxol-5-yl)methoxy]-2-(difluoromethyl)pyridine-3-carbonyl]-N-ethyl-piperazine-1-sulfonamide (compound P1.3):

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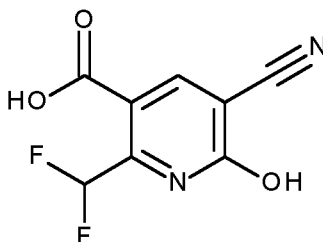


5-Cyano-6-[(2,2-difluoro-1,3-benzodioxol-5-yl)methoxy]-2-(difluoromethyl)pyridine-3-carboxylic acid (250 mg, 0.651 mmol) in ethyl acetate (5.2 mL) was treated with N,N-diisopropylethylamine (0.33 mL, 1.95 mmol, 3.0 eq), N-ethylpiperazin-4-ium-1-sulfonamide chloride (209 mg, 0.911 mmol, 1.4 eq) and propanephosphonic acid anhydride (T3P, 1.24 g, 1.16 mL, 1.95 mmol, 3 eq; 50% solution in ethylacetate). The resulting light yellow solution was stirred at room temperature for 3 hours. Water was added to the reaction mixture. The mixture was extracted three times with ethyl acetate. The combined organic layers were washed with saturated potassium carbonate solution (10 mL) and brine (10 mL), dried over sodium sulfate, filtered and concentrated under reduced pressure. The residue was purified with reverse phase chromatography to afford 150 mg of 4-[5-cyano-6-[(2,2-difluoro-1,3-benzodioxol-5-yl)methoxy]-2-(difluoromethyl)pyridine-3-carbonyl]-N-ethyl-piperazine-1-sulfonamide. ¹H-NMR [ppm] in CDCl₃: 1.21 (t, 3H), 3.14 (quintett, 2H), 3.11-3.22 (m, 2H), 3.25-3.43 (m, 4H), 3.65-4.10 (m, 2H), 4.19 (t, 1H), 5.54 (s, 2H), 6.71 (t, 1H), 7.08 (d, 1H), 7.23-7.28 (m, 2H), 7.89 (s, 1H). LC-MS (method 1): RT = 1.06 min; [M+H]⁺ = 560.

EXAMPLE P4: 4-[6-[(4-Bromophenyl)methoxy]-5-cyano-2-(difluoromethyl)pyridine-3-carbonyl]-N-ethyl-piperazine-1-sulfonamide (compound P1.7):



Step 1: 5-Cyano-2-(difluoromethyl)-6-hydroxy-pyridine-3-carboxylic acid

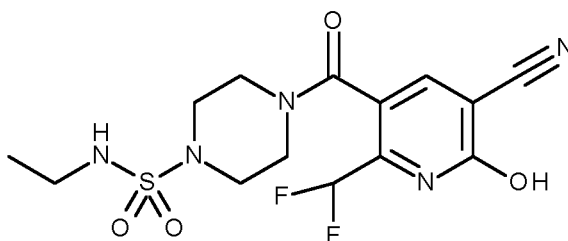


Ethyl 5-cyano-2-(difluoromethyl)-6-hydroxy-pyridine-3-carboxylate (4.0 g, 17 mmol) which was synthesized as described in Nippon Soda patent application WO 2017195703 was dissolved in

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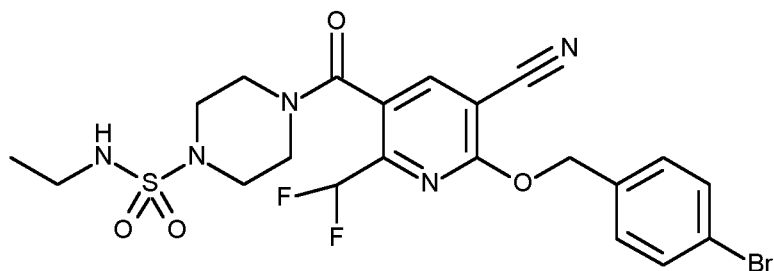
ethanol (130 mL) and potassium hydroxide (3.3 g, 50 mmol, 2.9 eq) dissolved in ethanol (33 mL) was added. The reaction mixture was stirred under reflux for 20 hours. Then the reaction mixture was diluted with ethyl acetate and 2 N hydrochloric acid. The mixture was extracted three times with ethyl acetate. The combined organic layer was washed two times with water and once with brine, dried over sodium sulfate and the solvent was removed. 3.5 g of 5-cyano-2-(difluoromethyl)-6-hydroxy-pyridine-3-carboxylic acid were obtained as a white solid. ¹H-NMR [ppm] in DMSO: 7.59 (t, 1H), 8.58 (s, 1 H), 13.75 (broad s, 2 H). LC-MS (method 2): RT = 0.23 min; [M+H]⁺ = 215.

Step 2: 4-[5-cyano-2-(difluoromethyl)-6-hydroxy-pyridine-3-carbonyl]-N-ethyl-piperazine-1-sulfonamide



To a solution of 5-cyano-2-(difluoromethyl)-6-hydroxy-pyridine-3-carboxylic acid (2.00 g, 9.34 mmol) in ethyl acetate (140 mL) were added the N-ethylpiperazine-1-sulfonamide (2.71 g, 14 mmol, 1.5 eq), N,N-diisopropylethylamine (8.13 mL, 46.7 mmol, 5.0 eq), and propanephosphonic acid anhydride (T3P, 10.7 g, 10.0 mL, 16.8 mmol, 1.8 eq; 50% solution in ethylacetate). The reaction mixture was stirred at room temperature for 18 hours and then quenched with 2 N HCl. The mixture was diluted with water and extracted 3 times with 2-methyl-THF. The combined organic layers were dried over Na₂SO₄, filtered and concentrated under reduced pressure. The residue was suspended in methanol and filtered of to afford 2.00 g of 4-[5-cyano-2-(difluoromethyl)-6-hydroxy-pyridine-3-carbonyl]-N-ethyl-piperazine-1-sulfonamide as a white solid. ¹H-NMR [ppm] in DMSO-d₆: 1.03 (t, 3H), 2.96 (quintett, 2H), 2.95-3.18 (m, 4H), 3.23-3.45 (m, 2H), 3.58-3.75 (m, 2H), 6.91 (t, 1H), 7.34 (t, 1H), 8.38 (s, 1H), 13.62 (broad s, 1H). LC-MS (method 1): RT = 0.55 min; [M+H]⁺ = 390.

Step 3: 4-[6-[(4-Bromophenyl)methoxy]-5-cyano-2-(difluoromethyl)pyridine-3-carbonyl]-N-ethyl-piperazine-1-sulfonamide (compound P1.7)

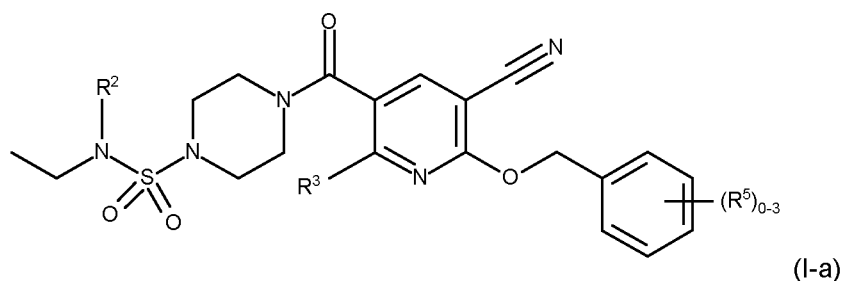


To a solution of 4-[5-cyano-2-(difluoromethyl)-6-hydroxy-pyridine-3-carbonyl]-N-ethyl-piperazine-1-sulfonamide (250 mg, 0.642 mmol) in acetone (3.2 mL) were added potassium carbonate (272 mg, 1.93 mmol, 3.0 eq), sodium iodide (20 mg, 0.128 mmol, 0.2 eq) followed by 1-bromo-4-

(bromomethyl)benzene (180 mg, 0.706 mmol, 1.1 eq). The reaction mixture was stirred at 70°C for 4 hours. Then the suspension was filtered. The residue was washed with acetone, dried under vacuo suspenden in methanol, filtered and dried to afford 240 mg of 4-[6-[(4-bromophenyl)methoxy]-5-cyano-2-(difluoromethyl)pyridine-3-carbonyl]-N-ethyl-piperazine-1-sulfonamide (compound P1.7). ¹H-NMR [ppm] in CDCl₃: 1.22 (t, 3H), 3.12 (quintett, 2H), 3.10-3.44 (m, 6H), 3.72-4.08 (m, 2H), 4.28 (t, 1H), 5.04 (s, 2H), 6.71 (t, 1H), 7.39 (d, 2H), 7.55 (d, 2H), 7.90 (s, 1H). LC-MS (method 1): RT = 1.04 min; [M+H]⁺ = 558/560.

The compounds in Tables P1 and P2 were prepared as described in the examples above or similar methodology.

Table P1: Compounds of formula (I-a)



The compounds in Table P1 can be prepared as described in the examples above or similar methodology. The following abbreviations are used in the table below: RT = retention time, min = minutes.

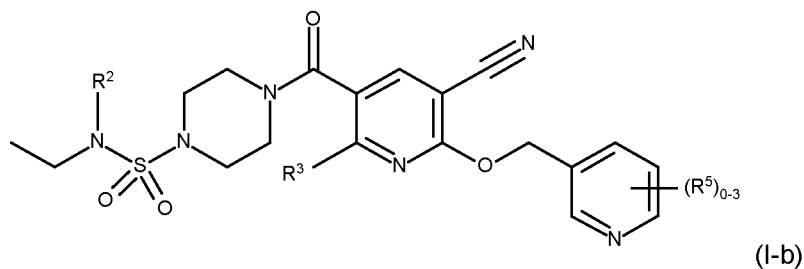
Table P1:

Comp. No	R ²	R ³	R ⁵	a) [M+H] ⁺ or b) [M-H] ⁻	LC-MS RT (min)	Method
P1.1	H	CF ₃	2-F, 5-CF ₃	584 ^a	1.07	1
P1.2	CH ₃	CF ₃	2-F, 5-CF ₃	598 ^a	1.12	1
P1.3	H	CHF ₂	3-OCF ₂ O-4	560 ^a	1.06	1
P1.4	H	CHF ₂	2-F, 5-CF ₃	566 ^a	1.05	1
P1.5	H	CHF ₂	3,4-F ₂	516 ^a	1.00	1
P1.6	H	CHF ₂	2,4,5-F ₃	534 ^a	1.01	1
P1.7	H	CHF ₂	4-Br	558/560 ^a	1.04	1
P1.8	H	CHF ₂	3-F, 4-Br	576/578 ^a	1.04	1
P1.9	H	CHF ₂	2-F, 5-Br	576/579 ^a	1.04	1

Comp. No	R ²	R ³	R ⁵	a) [M+H] ⁺ or b) [M-H] ⁻	LC-MS RT (min)	Method
P1.10	H	CH ₃	3-F, 4-Br	540/542 ^a	1.01	1
P1.11	H	CHF ₂	2-F, 4-Cl	532/534 ^a	1.02	1
P1.12	H	CHF ₂	2-F, 5-Cl	532/534 ^a	1.00	1
P1.13	H	CH ₃	2-F, 5-Br	540/542 ^a	1.01	1
P1.14	H	CHF ₂	2-Cl, 5-Br	592/594/596 ^a	1.05	1
P1.15	H	CH ₃	4-Br	522/524 ^a	1.01	1
P1.16	H	CHF ₂	3-Br, 4-F	576/578 ^a	1.02	1
P1.17	H	CH ₃	3-Br, 4-F	540/542 ^a	1.01	1
P1.18	H	CHF ₂	2,4-Br ₂	634/636/638 ^b	1.09	1
P1.19	H	CHF ₂	4-I	606 ^a	1.05	1
P1.20	H	cyclo- propyl	2,4,5-F ₃	524 ^a	1.16	2
P1.21	H	CHF ₂	2-Cl, 4-I	638/640 ^b	1.09	1
P1.22	H	cyclo- propyl	3-F, 4-Br	566/588 ^a	1.19	2
P1.23	H	cyclo- propyl	3-OCF ₂ O-4	550 ^a	1.20	2
P1.24	H	CHF ₂	3-F, 4-I	624 ^a	1.03	1
P1.25	H	CHF ₂	2-F, 4-I	622 ^b	1.04	1
P1.26	H	CH ₃	4-CF ₃	512.48 ^a	1.60	3
P1.27	H	CH ₃	3-CF ₃	512.48 ^a	1.58	3
P1.28	H	CH ₃	2-F, 5-CF ₃	530.48 ^a	1.59	3
P1.29	H	CHF ₂	4-CF ₃	548.49 ^a	1.62	3
P1.30	H	CHF ₂	3-CF ₃	548.49 ^a	1.60	3
P1.31	H	CF ₃	4-CF ₃	566.49 ^a	1.71	3
P1.32	H	CF ₃	3-CF ₃	566.49 ^a	1.69	3
P1.33	H	CF ₃	3-F, 4-Br	594.42 ^a	1.70	3

Table P2: Compounds of formula (I-b)

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The compounds in Table P2 can be prepared as described in the examples above or similar methodology. The following abbreviations are used in the table below: RT = retention time, min = minutes

5

Table P2:

Comp. No	R ²	R ³	R ⁵	[M+H] ⁺	LC-MS RT (min)	Method
P2.1	H	CHF ₂	4-Br	559/561	0.90	1

The intermediates in Table U1 are new and useful for the synthesis of some compounds of the general structure I. They can be prepared as described in the examples above or similar methodology. The following abbreviations are used in the table below: RT = retention time, min = minutes.

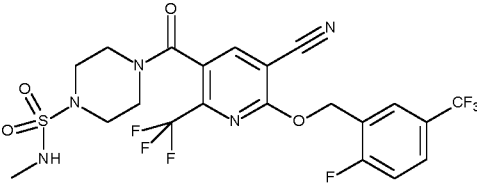
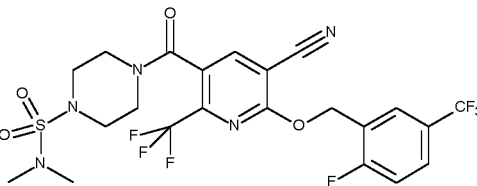
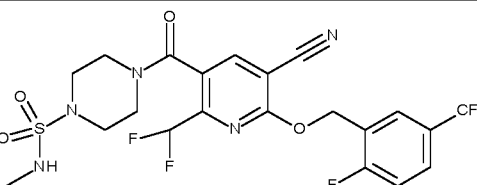
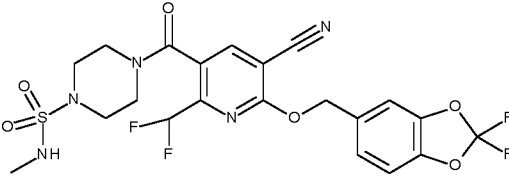
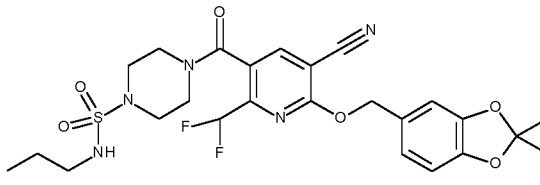
10

Table U1:

Comp. No	Structure	[M+H] ⁺	LC-MS RT (min)	Method
U1.1		390	0.55	1
U1.2		354	0.42	1
U1.3		377	1.23	1

Comp. No	Structure	[M+H] ⁺	LC-MS RT (min)	Method
U1.4		349	1.04	1
U1.5		403	1.26	1
U1.6		375	1.08	1
U1.7		387	1.13	1
U1.8		445/449 /451	1.22	1
U1.9		429/431	1.19	1

Table C: Comparative compounds

Comp. No	Structure	[M+H] ⁺	LC-MS RT (min)	Method
C1.1	 Compound P8.7 in WO2021053161	570	1.04	1
C1.2	 compound P8.10 in WO2021053161	584	1.09	1
C1.3	 Compound 74.356 in Table 74 of WO2021053161	552	1.00	1
C1.4	 compound 74.313 in Table 74 of WO2021053161	546	1.13	2
C1.5	 Prepared according to disclosure in WO2021053161	574.24	1.68	3

The activity of the compositions according to the invention can be broadened considerably, and adapted to prevailing circumstances, by adding other insecticidally, acaricidally and/or fungicidally active ingredients. The mixtures of the compounds of formula (I) with other insecticidally, acaricidally and/or fungicidally active ingredients may also have further surprising advantages which can also be described, in a wider sense, as synergistic activity. For example, better tolerance by plants, reduced

phytotoxicity, insects can be controlled in their different development stages or better behaviour during their production, for example during grinding or mixing, during their storage or during their use.

Suitable additions to active ingredients here are, for example, representatives of the following classes of active ingredients: organophosphorus compounds, nitrophenol derivatives, thioureas, juvenile hormones, formamidines, benzophenone derivatives, ureas, pyrrole derivatives, carbamates, pyrethroids, chlorinated hydrocarbons, acylureas, pyridylmethyleamino derivatives, macrolides, neonicotinoids and *Bacillus thuringiensis* preparations.

- 10 The following combinations (or mixtures) of a compound of formula (I) with another active substance in a weight ratio of 1:1 are preferred (the abbreviation "TX" means "one compound selected from the compounds defined in the Tables 1 to 4 and Tables P1 to P2"):
- (7E,9Z)-dodeca-7,9-dien-1-yl acetate + TX, (9Z,11E)-tetradeca-9,11-dien-1-yl acetate + TX, (9Z,12E)-tetradeca-9,12-dien-1-yl acetate + TX, (E)-6-methylhept-2-en-4-ol + TX, (E)-dec-5-en-1-yl acetate with
 15 (E)-dec-5-en-1-ol + TX, (E)-tridec-4-en-1-yl acetate + TX, (E,Z)-tetradeca-4,10-dien-1-yl acetate + TX, (Z)-dodec-7-en-1-yl acetate + TX, (Z)-hexadec-11-en-1-yl acetate + TX, (Z)-hexadec-11-enal + TX, (Z)-hexadec-13-en-11-yn-1-yl acetate + TX, (Z)-icos-13-en-10-one + TX, (Z)-tetradec-7-en-1-al + TX, (Z)-tetradec-9-en-1-ol + TX, (Z)-tetradec-9-en-1-yl acetate + TX, 1,2-dibromo-3-chloropropane + TX, 1,2-dichloropropane + TX, 1,2-dichloropropane with 1,3-dichloropropene + TX, 1,3-dichloropropene +
 20 TX, 14-methyloctadec-1-ene + TX, 1-hydroxy-1H-pyridine-2-thione + TX, 2-(octylthio)-ethanol + TX, 2-[5-(2-chloro-3,3,3-trifluoro-prop-1-enyl)-1-methyl-imidazol-2-yl]-5-cyclopropyl-3-ethylsulfonyl-pyridine + TX, 2-chlorophenyl N-methylcarbamate (CPMC) + TX, 3-(4-chlorophenyl)-5-methylrhodanine + TX, 3,4-dichlorotetrahydrothio-phenone 1,1-dioxide + TX, 4-(quinoxalin-2-ylamino)benzenesulfonamide + TX, 4-methylnonan-5-ol with 4-methylnonan-5-one + TX, 5-methyl-6-thioxo-1,3,5-thiadiazinan-3-ylacetic acid + TX, 6-isopentenylaminopurine + TX, 8-hydroxyquinoline sulfate + TX, abamectin + TX, acequinocyl + TX, acetamiprid + TX, acetoprole + TX, acrinathrin + TX, acynonapyr + TX, Adoxophyes orana GV + TX, afidopyropen + TX, afoxolaner + TX, Agrobacterium radiobacter + TX, AKD-3088 + TX, alanycarb + TX, aldicarb + TX, aldoxycarb + TX, allethrin + TX, alpha-cypermethrin + TX, alphamethrin + TX, alpha-multistriatin + TX, Amblyseius spp. + TX, amidoflumet + TX, amino acids +
 25 TX, aminocarb + TX, Anagrapta falcifera NPV + TX, Anagrus atomus + TX, Aphelinus abdominalis + TX, Aphidius colemani + TX, Aphidoletes aphidimyza + TX, apholate + TX, Autographa californica NPV + TX, AZ 60541 + TX, azadirachtin + TX, azocyclotin + TX, Bacillus aizawai + TX, Bacillus chitosporus AQ746 (NRRL Accession No B-21 618) + TX, Bacillus firmus + TX, Bacillus kurstaki + TX, Bacillus mycoides AQ726 (NRRL Accession No. B-21664) + TX, Bacillus pumilus (NRRL
 30 Accession No B-30087) + TX, Bacillus pumilus AQ717 (NRRL Accession No. B-21662) + TX, Bacillus sp. AQ175 (ATCC Accession No. 55608) + TX, Bacillus sp. AQ177 (ATCC Accession No. 55609) + TX, Bacillus sp. AQ178 (ATCC Accession No. 53522) + TX, Bacillus sphaericus Neide + TX, Bacillus subtilis AQ153 (ATCC Accession No. 55614) + TX, Bacillus subtilis AQ30002 (NRRL Accession No. B-50421) + TX, Bacillus subtilis AQ30004 (NRRL Accession No. B- 50455) + TX, Bacillus subtilis

AQ713 (NRRL Accession No. B-21661) + TX, *Bacillus subtilis* AQ743 (NRRL Accession No. B-21665) + TX, *Bacillus subtilis* unspecified + TX, *Bacillus thuringiensis* AQ52 (NRRL Accession No. B-21619) + TX, *Bacillus thuringiensis* BD#32 (NRRL Accession No B-21530) + TX, *Bacillus thuringiensis* Berliner + TX, *Bacillus thuringiensis* subsp. Aizawai + TX, *Bacillus thuringiensis* subsp. Israelensis + TX,

5 *Bacillus thuringiensis* subsp. Japonensis + TX, *Bacillus thuringiensis* subsp. Kurstaki + TX, *Bacillus thuringiensis* subsp. Tenebrionis + TX, *Bacillus thuringiensis* subspec. kurstaki BMP 123 + TX, *Beauveria bassiana* + TX, *Beauveria brongniartii* + TX, benclotiaz + TX, benomyl + TX, bensultap + TX, bentioflumin (CAS Number: 2566451-67-8) + TX, benzoximate + TX, benzpyrimoxan + TX, betacyfluthrin + TX, beta-cypermethrin + TX, bethoxazin + TX, bifenazate + TX, bifenthrin + TX,

10 binapacryl + TX, bioallethrin + TX, bioresmethrin + TX, bis(tributyltin) oxide + TX, bisazir + TX, bistrifluron + TX, bisulflufen + TX, brevicomin + TX, broflanilide + TX, brofluthrin + TX, bromoacetamide + TX, bromophos-ethyl + TX, bronopol + TX, busulfan + TX, butocarboxim + TX, butopyrroxyl + TX, butoxy(polypropylene glycol) + TX, butylpyridaben + TX, cadusafos + TX, calcium arsenate + TX, carbaryl + TX, carbofuran + TX, carbon disulfide + TX, carbosulfan + TX, cartap + TX,

15 CAS number: 1594624-87-9 + TX, CAS number: 1922957-47-8 + TX, CAS number: 1255091-74-7 + TX, CAS number: 1365070-72-9 + TX, CAS Number: 158062-71-6 + TX, CAS number: 1594626-19-3 + TX, CAS number: 1594637-65-6 + TX, CAS number: 1632218-00-8 + TX, CAS number: 1808115-49-2 + TX, CAS number: 1922957-46-7 + TX, CAS number: 1922957-48-9 + TX, CAS number: 1956329-03-5 + TX, CAS number: 1990457-52-7 + TX, CAS number: 1990457-55-0 + TX, CAS

20 number: 1990457-57-2 + TX, CAS number: 1990457-66-3 + TX, CAS number: 1990457-77-6 + TX, CAS number: 1990457-85-6 + TX, CAS number: 2032403-97-5 + TX, CAS number: 2044701-44-0 + TX, CAS number: 2095470-94-1 + TX, CAS number: 2128706-05-6 + TX, CAS number: 2133042-31-4 + TX, CAS number: 2133042-44-9 + TX, CAS number: 2171099-09-3 + TX, CAS number: 2220132-55-6 + TX, CAS number: 2396747-83-2 + TX, CAS number: 2408220-91-5 + TX, CAS number:

25 2408220-94-8 + TX, CAS number: 2415706-16-8 + TX, CAS Number: 2583740-14-9 + TX, CAS Number: 2583751-98-6 + TX, CAS number: 2719848-60-7 + TX, CAS number: 2898489-71-7 + TX, CAS Number: 34763-86-5 + TX, CAS number: RNA (*Leptinotarsa decemlineata*-specific recombinant double-stranded interfering GS2) + TX, chlorantraniliprole + TX, chlordane + TX, chlorfenapyr + TX, chloropicrin + TX, chloroprallethrin + TX, chlorpyrifos + TX, chromafenozide + TX, *Chrysoperla carnea* + TX, clenpirin + TX, cloethocarb + TX, clothianidin + TX, codlure + TX, codlemone + TX, copper acetoarsenite + TX, copper dioctanoate + TX, copper hydroxide + TX, copper sulfate + TX, cresol + TX, crufomate + TX, *Cryptolaemus montrouzieri* + TX, cuelure + TX, cyanofenphos + TX, cyantraniliprole + TX, cybenzoxasulfyl (CAS Number: 2128706-04-5) + TX, cybutryne + TX, cyclaniliprole + TX, cyclobutrifluram + TX, cycloprothrin + TX, cycloxaprid + TX, *Cydia pomonella* GV + TX, cyenopyrafen + TX, cyetpyrafen + TX, cyflumetofen + TX, cyfluthrin + TX, cyhalodiamide + TX, cylohalothrin + TX, cypermethrin + TX, cyphenothrin + TX, cyproflinilide + TX, cyromazine + TX, cytokinins + TX, *Dacnusa sibirica* + TX, dazomet + TX, DBCP + TX, DCIP + TX, deltamethrin + TX, diafenthiuron + TX, dialifos + TX, diamidafos + TX, dibrom + TX, dibutyl adipate + TX, dibutyl phthalate + TX, dibutyl succinate + TX, dichlofenthion + TX, dichlone + TX, dichlorophen + TX,

35

dicliphos + TX, dicloromezotiaz + TX, diethyltoluamide + TX, diflubenzuron + TX, Diglyphus isaea + TX, dimatif + TX, dimethoate + TX, dimethyl carbate + TX, dimethyl phthalate + TX, dimpropyridaz + TX, dinactin + TX, dinocap + TX, dinotefuran + TX, dioxabenzofos + TX, dipyrithione + TX, disparlure + TX, D-limonene + TX, dodec-8-en-1-yl acetate + TX, dodec-9-en-1-yl acetate + TX, dodeca-8,10-
5 dien-1-yl acetate + TX, dodicin + TX, dominicalure + TX, doramectin + TX, emamectin + TX, emamectin benzoate + TX, empenethrin + TX, Encarsia formosa + TX, endothal + TX, endrin + TX, eprinomectin + TX, epsilon - momfluorothrin + TX, epsilon-metofluthrin + TX, Eretmocerus eremicus + TX, esfenvalerate + TX, ethion + TX, ethiprole + TX, ethoprophos + TX, ethyl 4-methyloctanoate + TX, ethyl hexanediol + TX, ethylene dibromide + TX, etofenprox + TX, etoxazole + TX, etpyrafen + TX,
10 eugenol + TX, Extract of seaweed and fermentation product derived from melasse + TX, Extract of seaweed and fermentation product derived from melasse comprising urea + TX, Extract of seaweed and fermented plant products + TX, Extract of seaweed and fermented plant products comprising phytohormones, vitamins, EDTA-chelated copper, zinc, and iron + TX, famphur + TX, fenaminosulf + TX, fenamiphos + TX, fenazaquin + TX, fenfluthrin + TX, fenitrothion + TX, fenmezoditiaz + TX,
15 fenobucarb + TX, fenothiocarb + TX, fenoxycarb + TX, fenpropathrin + TX, fenpyrad + TX, fenpyroximate + TX, fensulfothion + TX, fenthion + TX, fentin + TX, fentinacetate + TX, fenvalerate + TX, ferric phosphate + TX, fipronil + TX, flometoquin + TX, flonicamid + TX, fluacrypyrim + TX, fluazaindolizine + TX, fluazuron + TX, flubendiamide + TX, flubenzimine + TX, fluchlordiniliprole + TX, flucitrinate + TX, flucycloxuron + TX, flucythrinate + TX, fluensulfone [318290-98-1] + TX, fluensulfone
20 + TX, flufenimer + TX, flufenprox + TX, flufiprole + TX, fluhexafon + TX, flumethrin + TX, fluopyram + TX, flupentiofenox + TX, flupyradifurone + TX, flupyrimin + TX, flupyroxystrobin + TX, fluralaner + TX, fluvalinate + TX, fluxametamide + TX, formaldehyde + TX, fosthiazate + TX, fosthietan + TX, frontalin + TX, furfural + TX, galquin (CAS Number: 2644770-30-7) + TX, gamma-cyhalothrin + TX, Gossyplure® (1:1 mixture of the (Z,E) and (Z,Z) isomers of hexadeca-7,11-dien-1-yl-acetate) + TX,
25 grandlure + TX, grandlure I + TX, grandlure II + TX, grandlure III + TX, grandlure IV + TX, Granulovirus + TX, guadipyr + TX, GY-81 + TX, halfenprox + TX, halofenozide + TX, Harpin + TX, Helicoverpa armigera Nucleopolyhedrovirus + TX, Helicoverpa zea NPV + TX, Helicoverpa zea Nucleopolyhedrovirus + TX, Heliothis punctigera Nucleopolyhedrovirus + TX, Heliothis virescens Nucleopolyhedrovirus + TX, hemel + TX, hempa + TX, heptafluthrin + TX, heterophos + TX,
30 Heterorhabditis bacteriophora and H. megidis + TX, hexalure + TX, hexamide + TX, hexythiazox + TX, Hippodamia convergens + TX, hydramethylnon + TX, hydrargaphen + TX, hydrated lime + TX, imicyafos + TX, imidacloprid + TX, imiprothrin + TX, Indazapyroxamet + TX, indoxacarb + TX, iodomethane + TX, iprodione + TX, ipsdienol + TX, ipsenol + TX, isamidofos + TX, isazofos + TX, isocycloseram + TX, Isoflualanam (CAS number: 2892524-05-7) + TX, isothioate + TX, ivermectin +
35 TX, japonilure + TX, kappa-bifenthrin + TX, kappa-tefluthrin + TX, kasugamycin + TX, kasugamycin hydrochloride hydrate + TX, kinetin + TX, lambda-cyhalothrin + TX, ledprona + TX, lepimectin + TX, Leptomastix dactylopii + TX, lineatin + TX, litlure + TX, looplure + TX, lotilaner + TX, lufenuron + TX, Macrolophus caliginosus + TX, Mamestra brassicae NPV + TX, mecarphon + TX, medlure + TX, megatomoic acid + TX, metaflumizone + TX, metaldehyde + TX, metam + TX, metam-potassium +

TX, metam-sodium + TX, Metaphycus helvolus + TX, Metarhizium anisopliae var. acridum + TX, Metarhizium anisopliae var. anisopliae + TX, Metarhizium spp. + TX, metepa + TX, methiocarb + TX, methiotepa + TX, methomyl + TX, methoquin-butyl + TX, methoxyfenozide + TX, methyl apholate + TX, methyl bromide + TX, methyl eugenol + TX, methyl isothiocyanate + TX, methylneodecanamide + TX, metofluthrin + TX, metolcarb + TX, mexacarbate + TX, milbemectin + TX, milbemycin oxime + TX, momfluorothrin + TX, morzid + TX, moxidectin + TX, muscalure + TX, Muscodor albus 620 (NRRL Accession No. 30547) + TX, Muscodor roseus A3-5 (NRRL Accession No. 30548) + TX, Myrothecium verrucaria composition + TX, nabam + TX, NC-184 + TX, Neem tree based products + TX, Neodiprion sertifer NPV and N. lecontei NPV + TX, nickel bis(dimethyldithiocarbamate) + TX, niclosamide + TX, niclosamide-olamine + TX, nicofluprole + TX, nitenpyram + TX, nithiazine + TX, nitrapyrin + TX, octadeca-2,13-dien-1-yl acetate + TX, octadeca-3,13-dien-1-yl acetate + TX, octhilinone + TX, omethoate + TX, orfralure + TX, Orius spp. + TX, oryctalure + TX, ostramone + TX, oxamate + TX, oxamyl + TX, oxazosulfonyl + TX, oxolinic acid + TX, oxytetracycline + TX, Paecilomyces fumosoroseus + TX, Paecilomyces lilacinus + TX, parathion-ethyl + TX, Pasteuria nishizawae + TX, Pasteuria penetrans + TX, Pasteuria ramosa + TX, Pasteuria thornei + TX, Pasteuria usgae + TX, P-cymene + TX, penfluron + TX, pentachlorophenol + TX, permethrin + TX, phenothrin + TX, phorate + TX, phosphamidon + TX, phosphocarb + TX, Phytoseiulus persimilis + TX, picaridin + TX, pioxaniliprole + TX, piperazine + TX, piperflaniide (CAS number: 2615135-05-0) + TX, piperonylbutoxide + TX, pirimicarb + TX, pirimiphos-ethyl + TX, pirimiphos-methyl + TX, Plutella xylostella Granulosis virus + TX, Plutella xylostella Nucleopolyhedrovirus + TX, Polyhedrosis virus + TX, potassium and molybdenum and EDTA-chelated manganese + TX, potassium ethylxanthate + TX, potassium hydroxyquinoline sulfate + TX, prallethrin + TX, probenazole + TX, profenofos + TX, profluthrin + TX, propargite + TX, propetamphos + TX, propoxur + TX, prothiophos + TX, protrifenbute + TX, pyflubumide + TX, pymetrozine + TX, pyraclofos + TX, pyrafluprole + TX, pyrethrum + TX, pyridaben + TX, pyridalyl + TX, pyridin-4-amine + TX, pyrifluquinazon + TX, pyrimidifen + TX, pyriminostrobin + TX, pyriprole [394730-71-3] + TX, pyriprole + TX, pyriproxyfen + TX, QRD 420 (a terpenoid blend) + TX, QRD 452 (a terpenoid blend) + TX, QRD 460 (a terpenoid blend) + TX, Quillaja saponaria + TX, quinclamine + TX, quinonamid + TX, resmethrin + TX, Rhodococcus globerulus AQ719 (NRRL Accession No B-21663) + TX, sarolaner + TX, S-bioallethrin + TX, sebufos + TX, selamectin + TX, siglure + TX, silafluofen + TX, simazine + TX, sodium pentachlorophenoxide + TX, sordidin + TX, spidoxamat + TX, spinetoram + TX, spinosad + TX, spirotetramat + TX, spirotetramat + TX, Spodoptera exigua multicapsid nuclear polyhedrosis virus + TX, Spodoptera frugiperda Nucleopolyhedrovirus + TX, Steinernema bibionis + TX, Steinernema carpocapsae + TX, Steinernema feltiae + TX, Steinernema glaseri + TX, Steinernema riobrave + TX, Steinernema riobrave + TX, Steinernema scapterisci + TX, Steinernema spp. + TX, Streptomyces galbus (NRRL Accession No. 30232) + TX, Streptomyces sp. (NRRL Accession No. B-30145) + TX, streptomycin + TX, streptomycin sesquisulfate + TX, strychnine + TX, sulcatol + TX, sulfiflumin (CAS number: 2377084-09-6) + TX, sulfoxaflo + TX, tazimcarb + TX, tebufenozide + TX, tebufenpyrad + TX, tebupirimiphos + TX, tecloftalam + TX, tefluthrin + TX,

temephos + TX, tepa + TX, terbam + TX, terbufos + TX, terpenoid blend + TX, tetrachlorantraniliprole + TX, tetrachlorothiophene + TX, tetradec-11-en-1-yl acetate + TX, tetradiphon + TX, tetramethrin + TX, tetramethylfluthrin + TX, tetranactin + TX, tetraniliprole + TX, theta-cypermethrin + TX, thiacloprid + TX, thiafenox + TX, thiamethoxam + TX, thiocyclam + TX, thiodicarb + TX, thiofanox + TX,

5 thiohempa + TX, thiomersal + TX, thiometon + TX, thionazin + TX, thiophanate + TX, thiosultap + TX, thiotepa + TX, tiapyrachlor (CAS Number: 1255091-74-7) + TX, tigolaner + TX, tiorantraniliprole + TX, tioxazafen + TX, tolfenpyrad + TX, toxaphene + TX, tralomethrin + TX, transfluthrin + TX, tretamine + TX, triazamate + TX, triazophos + TX, triazuron + TX, tributyltin oxide + TX, trichlorfon + TX, trichloronate + TX, trichlorphon + TX, Trichogramma spp. + TX, trifenmorph + TX, trifluenfurionate + TX, triflumezopyrim + TX, trimedlure + TX, trimedlure A + TX, trimedlure B1 + TX, trimedlure B2 + TX,

10 trimedlure C + TX, trimethacarb + TX, triphenyltin acetate + TX, triphenyltin hydroxide + TX, trunc-call + TX, tylocyprazoflor + TX, Typhlodromus occidentalis + TX, uredepa + TX, Verticillium lecanii + TX, Verticillium spp. + TX, xyleneols + TX, YI-5302 + TX, zeatin + TX, zeta-Cypermethrin + TX;

N-[(1R)-1-benzyl-3-chloro-1-methyl-but-3-enyl]-8-fluoro-quinoline-3-carboxamide + TX, N-[(1S)-1-benzyl-3-chloro-1-methyl-but-3-enyl]-8-fluoro-quinoline-3-carboxamide + TX, N-ethyl-N'-[5-methoxy-2-methyl-4-[(2-trifluoromethyl)tetrahydrofuran-2-yl]phenyl]-N-methyl-formamidinium (these compounds may be prepared from the methods described in WO2019/110427) + TX, (3',4',5'-trifluoro-biphenyl-2-yl)-amide + TX, (3-methylisoxazol-5-yl)-[4-[5-(trifluoromethyl)-1,2,4-oxadiazol-3-yl]phenyl]methanone (these compounds may be prepared from the methods described in WO 2017/220485) + TX, (4-phenoxyphenyl)methyl 2-amino-6-methyl-pyridine-3-carboxylate (this compound may be prepared from the methods described in WO 2014/006945) + TX, (5-methyl-2-pyridyl)-[4-[5-(trifluoromethyl)-1,2,4-oxadiazol-3-yl]phenyl]methanone + TX, (7E,9Z)-dodeca-7,9-dien-1-yl acetate + TX, (9Z,11E)-tetradeca-9,11-dien-1-yl acetate + TX, (9Z,12E)-tetradeca-9,12-dien-1-yl acetate + TX, (E)-6-methylhept-2-en-4-ol + TX, (E)-dec-5-en-1-yl acetate with (E)-dec-5-en-1-ol + TX, (E)-tridec-4-en-1-yl acetate + TX, (E,Z)-tetradeca-4,10-dien-1-yl acetate, + TX, (R)-3-(difluoromethyl)-1-methyl-N-[1,1,3-trimethylindan-4-yl]pyrazole-4-carboxamide + TX, (Z)-dodec-7-en-1-yl acetate + TX, (Z)-hexadec-11-en-1-yl acetate + TX, (Z)-hexadec-11-enal + TX, (Z)-hexadec-13-en-1-yn-1-yl acetate + TX, (Z)-icos-13-en-10-one + TX, (Z)-tetradec-7-en-1-al + TX, (Z)-tetradec-9-en-1-ol + TX, (Z)-tetradec-9-en-1-yl acetate + TX, (Z,2E)-5-[1-(2,4-dichlorophenyl)pyrazol-3-yl]oxy-2-methoxyimino-N,3-dimethyl-pent-3-enamide (this compound may be prepared from the methods described in WO 2018/153707) + TX, (Z,2E)-5-[1-(4-chlorophenyl)pyrazol-3-yl]oxy-2-methoxyimino-N,3-dimethyl-pent-3-enamide + TX, , [2-[3-[2-[1-[2-[3,5-bis(difluoromethyl)pyrazol-1-yl]acetyl]-4-piperidyl]thiazol-4-yl]-4,5-dihydroisoxazol-5-yl]-3-chloro-phenyl] methanesulfonate + TX, 1-(4,5-dimethylbenzimidazol-1-yl)-4,4,5-trifluoro-3,3-dimethyl-isoquinoline + TX, 1-(4,5-dimethylbenzimidazol-1-yl)-4,4-difluoro-3,3-dimethyl-isoquinoline + TX, 1-(6,7-dimethylpyrazolo[1,5-a]pyridin-3-yl)-4,4,5-trifluoro-3,3-dimethyl-isoquinoline + TX, 1-(6,7-dimethylpyrazolo[1,5-a]pyridin-3-yl)-4,4,6-trifluoro-3,3-dimethyl-isoquinoline + TX, 1-(6-chloro-7-methyl-pyrazolo[1,5-a]pyridin-3-yl)-4,4-difluoro-3,3-dimethyl-isoquinoline (these compounds may be prepared from the methods described in WO2017/025510) + TX, 1,1-bis(4-chloro-phenyl)-2-ethoxyethanol + TX, 1,1-dichloro-2,2-bis(4-ethylphenyl)-ethane + TX, 1,2-dibromo-3-chloropropane +

TX, 1,2-dichloropropane with 1,3-dichloropropene + TX, 1,3-dichloropropene + TX, 1,3-dimethoxy-1-
[[4-[5-(trifluoromethyl)-1,2,4-oxadiazol-3-yl]phenyl]methyl]urea + TX, 1-[2-[[1-(4-chlorophenyl)pyrazol-
3-yl]oxymethyl]-3-methyl-phenyl]-4-methyl-tetrazol-5-one + TX, 10-dien-1-yl acetate + TX, 14-
methyloctadec-1-ene + TX, 1-bromo-2-chloroethane + TX, 1-dichloro-1-nitroethane + TX, 1-hydroxy-
5 1H-pyridine-2-thione + TX, 1-methoxy-3-methyl-1-[[4-[5-(trifluoromethyl)-1,2,4-oxadiazol-3-
yl]phenyl]methyl]urea + TX, 1-methyl-4-[3-methyl-2-[[2-methyl-4-(3,4,5-trimethylpyrazol-1-
yl)phenoxy]methyl]phenyl]tetrazol-5-one + TX, 2-(difluoromethyl)-N-((3R)-1,1,3-trimethylindan-4-
yl)pyridine-3-carboxamide + TX, 2-(difluoromethyl)-N-((3R)-1,1,3-trimethylindan-4-yl)pyridine-
3-carboxamide + TX, 2-(1,3-dithiolan-2-yl)phenyl dimethylcarbamate + TX, 2-(2-butoxyethoxy)-ethyl
10 piperonylate + TX, 2-(2-butoxyethoxy)ethyl thiocyanate + TX, 2-(4,5-dimethyl-1,3-dioxolan-2-yl)phenyl
methylcarbamate + TX, 2-(4-chloro-3,5-xylyloxy)ethanol + TX, 2-(difluoromethyl)-N-(3-ethyl-1,1-
dimethyl-indan-4-yl)pyridine-3-carboxamide + TX, 2-(difluoromethyl)-N-[(3R)-3-ethyl-1,1-dimethyl-
indan-4-yl]pyridine-3-carboxamide + TX, 2-(difluoromethyl)-N-[(3S)-3-ethyl-1,1-dimethyl-indan-4-
yl]pyridine-3-carboxamide (this compound may be prepared from the methods described in WO
15 2014/095675) + TX, 2-(difluoromethyl)-N-[3-ethyl-1,1-dimethyl-indan-4-yl]pyridine-3-carboxamide +
TX, 2-(octylthio)-ethanol + TX, 2,2,2-trichloro-1-(3,4-dichloro-phenyl)ethyl acetate + TX, 2,2-
dichlorovinyl 2-ethylsulfinyethyl methyl phosphate + TX, 2,2-difluoro-N-methyl-2-[4-[5-(trifluoromethyl)-
1,2,4-oxadiazol-3-yl]phenyl]acetamide + TX, 2,4-dichlorophenyl benzenesulfonate + TX, 2,6-Dimethyl-
1H,5H-[1,4]dithiino[2,3-c:5,6-c']dipyrrole-1,3,5,7(2H,6H)-tetrone (this compound may be prepared from
20 the methods described in WO 2011/138281) + TX, 2-[2-fluoro-6-[(8-fluoro-2-methyl-3-
quinolyl)oxy]phenyl]propan-2-ol + TX, 2-[6-(4-bromophenoxy)-2-(trifluoromethyl)-3-pyridyl]-1-(1,2,4-
triazol-1-yl)propan-2-ol (this compound may be prepared from the methods described in WO
2017/029179) + TX, 2-[6-(4-chlorophenoxy)-2-(trifluoromethyl)-3-pyridyl]-1-(1,2,4-triazol-1-yl)propan-2-
ol (this compound may be prepared from the methods described in WO 2017/029179) + TX, 2-
25 chlorovinyl diethyl phosphate + TX, 2-fluoro-N-methyl-N-1-naphthylacetamide + TX, 2-imidazolidone +
TX, 2-isovalerylindan-1,3-dione + TX, 2-methyl(prop-2-ynyl)aminophenyl methylcarbamate + TX, 2-
oxo-N-propyl-2-[4-[5-(trifluoromethyl)-1,2,4-oxadiazol-3-yl]phenyl]acetamide (this compound may be
prepared from the methods described in WO 2018/065414) + TX, 2-thiocyanatoethyl laurate + TX, 3-
(4,4-difluoro-3,3-dimethyl-1-isoquinolyl)-7,8-dihydro-6H-cyclopenta[e]benzimidazole (these
30 compounds may be prepared from the methods described in WO2016/156085) + TX, 3-(4,4-difluoro-
3,4-dihydro-3,3-dimethylisoquinolin-1-yl)quinolone + TX, 3-(4-chlorophenyl)-5-methylrhodanine + TX,
3-(difluoromethyl)-1-methyl-N-[1,1,3-trimethylindan-4-yl]pyrazole-4-carboxamide + TX, 3,4-
dichlorotetrahydrothio-phenene 1,1-dioxide + TX, 3-[2-(1-chlorocyclopropyl)-3-(2-fluorophenyl)-2-
hydroxy-propyl]imidazole-4-carbonitrile (this compound may be prepared from the methods described
35 in WO 2016/156290) + TX, 3-[2-(1-chlorocyclopropyl)-3-(3-chloro-2-fluoro-phenyl)-2-hydroxy-
propyl]imidazole-4-carbonitrile (this compound may be prepared from the methods described in WO
2016/156290) + TX, 3-bromo-1-chloroprop-1-ene + TX, 3-chloro-6-methyl-5-phenyl-4-(2,4,6-
trifluorophenyl)pyridazine + TX, 3-difluoromethyl-1-methyl-1H-pyrazole-4-carboxylic acid + TX, 3-ethyl-
1-methoxy-1-[[4-[5-(trifluoromethyl)-1,2,4-oxadiazol-3-yl]phenyl]methyl]urea + TX, 3-methyl-1-

phenylpyrazol-5-yl dimethyl-carbamate + TX, 4-(2-bromo-4-fluorophenyl)-N-(2-chloro-6-fluorophenyl)-1,3-dimethyl-1H-pyrazol-5-amine + TX, 4-(2,6-difluorophenyl)-6-methyl-5-phenylpyridazine-3-carbonitrile + TX, 4-(2-bromo-4-fluoro-phenyl)-N-(2-chloro-6-fluoro-phenyl)-2,5-dimethylpyrazol-3-amine + TX, 4-(quinoxalin-2-ylamino)benzenesulfonamide + TX, 4,4-difluoro-1-(5-fluoro-4-methyl-benzimidazol-1-yl)-3,3-dimethyl-isoquinoline + TX, 4,4-difluoro-3,3-dimethyl-1-(6-methylpyrazolo[1,5-a]pyridin-3-yl)isoquinoline + TX, 4,4-difluoro-3,3-dimethyl-1-(7-methylpyrazolo[1,5-a]pyridin-3-yl)isoquinoline + TX, 4,4-dimethyl-2-[[4-[5-(trifluoromethyl)-1,2,4-oxadiazol-3-yl]phenyl]methyl]isoxazolidin-3-one + TX, 4-[[6-[2-(2,4-difluorophenyl)-1,1-difluoro-2-hydroxy-3-(1,2,4-triazol-1-yl)propyl]-3-pyridyl]oxy] benzonitrile + TX, 4-[[6-[2-(2,4-difluorophenyl)-1,1-difluoro-2-hydroxy-3-(5-sulfanyl-1,2,4-triazol-1-yl)propyl]-3-pyridyl]oxy] benzonitrile + TX, 4-[[6-[2-(2,4-difluorophenyl)-1,1-difluoro-2-hydroxy-3-(5-thioxo-4H-1,2,4-triazol-1-yl)propyl]-3-pyridyl]oxy] benzonitrile + TX, 4-chloro-2-(2-chloro-2-methyl-propyl)-5-[(6-iodo-3-pyridyl)methoxy]pyridazin-3-one + TX, 4-chlorophenyl phenyl sulfone + TX, 4-methyl(prop-2-ynyl)amino-3,5-xylyl methylcarbamate + TX, 4-methylnonan-5-ol with 4-methylnonan-5-one + TX, 5-(1,3-benzodioxol-5-yl)-3-hexylcyclohex-2-enone + TX, 5,5-dimethyl-2-[[4-[5-(trifluoromethyl)-1,2,4-oxadiazol-3-yl]phenyl]methyl]isoxazolidin-3-one + TX, 5,5-dimethyl-3-oxocyclohex-1-enyl dimethylcarbamate + TX, 5-amino-1,3,4-thiadiazole-2-thiol zinc salt (2:1) + TX, 5-methyl-6-thioxo-1,3,5-thiadiazinan-3-ylacetic acid + TX, 6-chloro-3-(3-cyclopropyl-2-fluoro-phenoxy)-N-[2-(2,4-dimethylphenyl)-2,2-difluoro-ethyl]-5-methyl-pyridazine-4-carboxamide (may be prepared from the methods described in WO 2020/109391) + TX, 6-chloro-3-(3-cyclopropyl-2-fluoro-phenoxy)-N-[2-(3,4-dimethylphenyl)-2,2-difluoro-ethyl]-5-methyl-pyridazine-4-carboxamide (may be prepared from the methods described in WO 2020/109391) + TX, 6-chloro-4,4-difluoro-3,3-dimethyl-1-(4-methylbenzimidazol-1-yl)isoquinoline + TX, 6-chloro-N-[2-(2-chloro-4-methyl-phenyl)-2,2-difluoro-ethyl]-3-(3-cyclopropyl-2-fluoro-phenoxy)-5-methyl-pyridazine-4-carboxamide (may be prepared from the methods described in WO 2020/109391) + TX, 6-ethyl-5,7-dioxo-pyrrolo[4,5][1,4]dithiino[1,2-c]isothiazole-3-carbonitrile + TX, 6-isopentenylaminopurine + TX, 8-fluoro-N-[(1R)-1-(3-fluorophenyl)methyl]-1,3-dimethyl-butyl]quinoline-3-carboxamide + TX, 8-fluoro-N-[(1S)-1-(3-fluorophenyl)methyl]-1,3-dimethyl-butyl]quinoline-3-carboxamide + TX, 8-hydroxyquinoline sulfate + TX, acethion + TX, acetoprole + TX, acibenzolar + TX, acibenzolar-S-methyl + TX, acrylonitrile + TX, Adoxophyes orana GV + TX, Agrobacterium radiobacter + TX, aldoxycarb + TX, aldrin + TX, allosamidin + TX, allyxycarb + TX, alpha-chlorohydrin + TX, alpha-ecdysone + TX, alpha-multistriatin + TX, aluminium phosphide + TX, Amblyseius spp. + TX, amectotractin + TX, ametocradin + TX, amidithion + TX, amidothioate + TX, aminocarb + TX, aminopyrifin + TX, amisulbrom + TX, amiton + TX, amiton hydrogen oxalate + TX, amitraz + TX, anabasine + TX, Anagrapha falcifera NPV + TX, Anagrus atomus + TX, ancymidol + TX, anilazine + TX, anisiflupurin + TX, anthraquinone + TX, antu + TX, Aphelinus abdominalis + TX, Aphidius colemani + TX, Aphidoletes aphidimyza + TX, apholate + TX, aramite + TX, arsenous oxide + TX, athidathion + TX, Autographa californica NPV + TX, azaconazole + TX, azamethiphos + TX, azobenzene + TX, azothoate + TX, azoxystrobin + TX, Bacillus sphaericus Neide + TX, Bacillus thuringiensis delta endotoxins + TX, barium carbonate + TX, barium hexafluorosilicate + TX, barium polysulfide + TX, barthrin + TX, Bayer 22/190 + TX, Bayer

22408 + TX, Beauveria brongniartii + TX, benalaxyl + TX, benclotiaz + TX, benomyl + TX,
 benoxafos + TX, benthiavalicarb + TX, benzothiofostrobin + TX, benzovindiflupyr + TX, benzyl
 benzoate + TX, beta-cyfluthrin + TX, beta-cypermethrin + TX, bethoxazin + TX, bioethanomethrin +
 TX, biopermethrin + TX, bis(2-chloroethyl) ether + TX, bis(tributyltin) oxide + TX, bisazir + TX,
 5 bisthiosemi + TX, bitertanol + TX, bixafen + TX, blasticidin-S + TX, borax + TX, bordeaux mixture +
 TX, boscalid + TX, brevicomin + TX, brodifacoum + TX, brofenvalerate + TX, bromadiolone + TX,
 bromethalin + TX, bromfenvinfos + TX, bromoacetamide + TX, bromo-cyclen + TX, bromo-DDT + TX,
 bromophos + TX, bromopropylate + TX, bromuconazole + TX, bronopol + TX, bufencarb + TX,
 bupirimate + TX, buprofezin + TX, busulfan + TX, but-3-ynyl N-[6-[(Z)-[(1-methyltetrazol-5-yl)-phenyl-
 10 methylene]amino]oxymethyl]-2-pyridyl]carbamate + TX, butacarb + TX, butathiofos + TX,
 butocarboxim + TX, butonate + TX, butopyronoxyl + TX, butoxy(polypropylene glycol) + TX,
 butoxycarboxim + TX, butylpyridaben + TX, calcium arsenate + TX, calcium cyanide + TX, calcium
 polysulfide + TX, camphechlor + TX, captafol + TX, captan + TX, carbanolate + TX, carbendazim +
 TX, carbon disulfide + TX, carbon tetrachloride + TX, carbophenothion + TX, carboxin + TX, cartap
 15 hydrochloride + TX, CAS Number: 2454319-63-0 + TX, CAS Number: 83-46-5 + TX, cevadine + TX,
 chino-methionat + TX, chloralose + TX, chlorbenside + TX, chlorbicyclen + TX, chlordane + TX,
 chlordecone + TX, chlordimeform + TX, chlordimeform hydrochloride + TX, chlorfenethol + TX,
 chlorfenson + TX, chlorfensulfide + TX, chlorobenzilate + TX, chloroform + TX, chloroinconazide + TX,
 chloromebuform + TX, chloromethiuron + TX, chloroneb + TX, chlorophacinone + TX, chloropicrin +
 20 TX, chloropropylate + TX, chloro-tha-lo-nil + TX, chlorphoxim + TX, chlorprazophos + TX,
 chlorthiophos + TX, chlozolate + TX, cholecalciferol + TX, Chrysoperla carnea + TX, cinerin I + TX,
 cinerin II + TX, cinerins + TX, cismethrin + TX, cis-resmethrin + TX, clocythrins + TX, closantel + TX,
 codlure + TX, codlemone + TX, copper acetoarsenite + TX, copper arsenate + TX, copper
 dioctanoate + TX, copper hydroxide + TX, copper naphthenate + TX, copper oleate + TX, copper
 25 oxide + TX, copper oxychloride + TX, copper sulfate + TX, coumachlor + TX, coumafuryl + TX,
 coumaphos + TX, coumatetralyl + TX, coumethoxystrobin (jiaxiangjunzhi) + TX, coumithoate + TX,
 coumoxystrobin + TX, cresol + TX, crimidine + TX, crotamiton + TX, crotoxyphos + TX, crufoamate +
 TX, cryolite + TX, Cryptolaemus montrouzieri + TX, CS 708 + TX, cuclure + TX, cufraneb + TX,
 cyanofenphos + TX, cyanophos + TX, cyanthoate + TX, cyazofamid + TX, cybutryne + TX, cyclothrin +
 30 TX, cyclobutrifluram + TX, Cydia pomonella GV + TX, cyflufenamid + TX, cymiazole + TX, cymoxanil +
 TX, cyproconazole + TX, cyprodinil + TX, cythioate + TX, cytokinins + TX, Dacnusa sibirica + TX,
 DAEP + TX, dazomet + TX, DCIP + TX, DCPM + TX, DDT + TX, debacarb + TX, decarbofuran + TX,
 demephion + TX, demephion-O + TX, demephion-S + TX, demeton-methyl + TX, demeton-O + TX,
 demeton-O-methyl + TX, demeton-S + TX, demeton-S-methyl + TX, demeton-S-methylsulfon + TX,
 35 diamidafos + TX, dibutyl adipate + TX, dibutyl phthalate + TX, dibutyl succinate + TX, dicapthon + TX,
 dichlobentiazox + TX, dichlofenthion + TX, dichlofluanid + TX, dichlone + TX, dichlorophen + TX,
 dichlorvos + TX, dichlozoline + TX, dicliphos + TX, diclocymet + TX, diclomezine + TX, dicloran + TX,
 dicresyl + TX, dicyclanil + TX, dicyclopentadiene + TX, dieldrin + TX, dienochlor + TX, diethofencarb +
 TX, diethyl 5-methylpyrazol-3-yl phosphate + TX, diethyltoluamide + TX, difenacoum + TX,

difenoconazole + TX, difethialone + TX, diflovidazin + TX, Diglyphus isaea + TX, dilor + TX, dimatif + TX, dimefluthrin + TX, dimefox + TX, dimetan + TX, dimethirimol + TX, dimetho-morph + TX, dimethrin + TX, dimethyl carbate + TX, dimethyl phthalate + TX, dimethylvinphos + TX, dimetilan + TX, dimoxystrobin + TX, dinex + TX, dinex-diclexine + TX, diniconazole + TX, dinocap-4 + TX, dinocap-6 + TX,

5 TX, dinocton + TX, dino-penton + TX, dinoprop + TX, dinosam + TX, dinoseb + TX, dinosulfon + TX, dinoterbon + TX, diofenolan + TX, dioxabenzofos + TX, dioxathion + TX, diphacinone + TX, diphenyl sulfone + TX, dipymetitron + TX, dipyrithione + TX, disparlure + TX, disulfiram + TX, dithianon + TX, dithicrofos + TX, DNOC + TX, dodec-8-en-1-yl acetate + TX, dodec-9-en-1-yl acetate + TX, dodeca-8 + TX, dodemorph + TX, dodicin + TX, dodine + TX, dofenapyn + TX, dominicalure + TX, doramectin + TX,

10 TX, DSP + TX, d-tetramethrin + TX, ecdysterone + TX, edifenphos + TX, EI 1642 + TX, EMPC + TX, Encarsia formosa + TX, endothal + TX, endothion + TX, enestroburin + TX, enoxastrobin + TX, EPBP + TX, epoxicon-azole + TX, eprinomectin + TX, Eretmocerus eremicus + TX, ergocalciferol + TX, etaphos + TX, ethaboxam + TX, ethiofencarb + TX, ethirimol + TX, ethoate-methyl + TX, ethyl 1-[[4-[(Z)-2-ethoxy-3,3,3-trifluoro-prop-1-enoxy]phenyl]methyl]pyrazole-3-carboxylate (may be prepared

15 from the methods described in WO 2020/056090) + TX, ethyl 1-[[4-[[2-(trifluoromethyl)-1,3-dioxolan-2-yl]methoxy]phenyl]methyl]pyrazole-3-carboxylate (may be prepared from the methods described in WO 2020/056090) + TX, ethyl 1-[[4-[5-(trifluoromethyl)-1,2,4-oxadiazol-3-yl]phenyl]methyl]pyrazole-4-carboxylate + TX, ethyl 1-[[5-[5-(trifluoromethyl)-1,2,4-oxadiazol-3-yl]-2-thienyl]methyl]pyrazole-4-carboxylate (this compound may be prepared from the methods described in WO 2018/158365) + TX,

20 ethyl 4-methyloctanoate + TX, ethyl formate + TX, ethyl hexanediol + TX, ethylene dibromide + TX, ethylene dichloride + TX, ethylene oxide + TX, etridiazole + TX, etrimfos + TX, eugenol + TX, EXD + TX, famoxa-done + TX, farnesol + TX, farnesol with nerolidol + TX, fenamidone + TX, fenaminosulf + TX, fenaminstrobin + TX, fenarimol + TX, fenazaflor + TX, fenbuconazole + TX, fenbutatin oxide + TX, fenchlorphos + TX, feneptamidoquin (CAS Number: 2132414-04-9) + TX, fenethacarb + TX, fenfuram

25 + TX, fenhexamid + TX, fenitrothion + TX, fenopyramid (CAS Number: 2344721-61-3) + TX, fenothiocab + TX, fenoxacrim + TX, fenoxanil + TX, fencpiclonil + TX, fencpicoxamid + TX, fempirithrin + TX, fenpropidin + TX, fenpropimorph + TX, fenpyrad + TX, fenpyrazamine + TX, fen-pyroximate + TX, fenson + TX, fensulfothion + TX, fenthion + TX, fenthion-ethyl + TX, fentin + TX, fentrifanil + TX, ferbam + TX, ferimzone + TX, ferric phosphate + TX, flocoumafen + TX, florylpicoxamid + TX,

30 fluazinam + TX, flubeneteram + TX, flubenzimine + TX, flucofuron + TX, flucycloxuron + TX, fludioxonil + TX, fluenetil + TX, flufenoxadiazam + TX, flufenoxystrobin + TX, fluindapyr + TX, flumetylsulforim + TX, flumorph + TX, fluopicolide + TX, fluopimomide + TX, fluopyram + TX, fluorbenside + TX, fluoroacetamide + TX, fluoroimide + TX, fluoxapiprolin + TX, fluoxastrobin + TX, fluoxytioconazole + TX, flupropadine + TX, flupropadine hydrochloride + TX, fluquinconazole + TX, flusilazole + TX,

35 flusulfamide + TX, flutianil + TX, flutolanil + TX, flutriafol + TX, fluxapyroxad + TX, FMC 1137 + TX, folpet + TX, formaldehyde + TX, formetanate + TX, formetanate hydrochloride + TX, formparanate + TX, fosetyl-aluminium + TX, fosmethilan + TX, fospirate + TX, fosthietan + TX, frontalinal + TX, fuberidazole + TX, furalaxyl + TX, furametpyr + TX, furathiocab + TX, furethrin + TX, furfural + TX, gamma-HCH + TX, glyodin + TX, grandlure + TX, grandlure I + TX, grandlure II + TX, grandlure III +

TX, grandlure IV + TX, guazatine + TX, guazatine acetates + TX, halfenprox + TX, HCH + TX, hemel + TX, hempa + TX, HEOD + TX, heptachlor + TX, heterophos + TX, Heterorhabditis bacteriophora and H. megidis + TX, hexaconazole + TX, hexadecyl cyclopropanecarboxylate + TX, hexalure + TX, hexamide + TX, HHDN + TX, Hippodamia convergens + TX, hydrargaphen + TX, hydrated lime + TX,

5 hydrogen cyanide + TX, hymexazol + TX, hyquincarb + TX, imanin + TX, imazalil + TX, imibenconazole + TX, iminoctadine + TX, inpyrfluxam + TX, ipconazole + TX, ipfentrifluconazole + TX, ipflufenquin + TX, iprobenphos + TX, iprodione + TX, iprovalicarb + TX, ipsdienol + TX, ipsenol + TX, IPSP + TX, isamidofos + TX, isazofos + TX, isobenzan + TX, isocarbophos + TX, isodrin + TX, isofenphos + TX, isofetamid + TX, isoflucypram + TX, isolane + TX, isoprothiolane + TX, isopyrazam + TX, isotianil + TX, isoxathion + TX, japonilure + TX, jasmolin I + TX, jasmolin II + TX, jodfenphos + TX,

10 juvenile hormone I + TX, juvenile hormone II + TX, juvenile hormone III + TX, kadethrin + TX, kasugamycin + TX, kasugamycin hydrochloride hydrate + TX, kelevan + TX, kinetin + TX, kinoprene + TX, kresoxim-methyl + TX, lead arsenate + TX, Leptomastix dactylopii + TX, leptophos + TX, lindane + TX, lineatin + TX, lirimfos + TX, litlure + TX, looplure + TX, Ivbenmixianan + TX, lythidathion + TX,

15 Macrolophus caliginosus + TX, magnesium phosphide + TX, malonoben + TX, Mamestra brassicae NPV + TX, mancopper + TX, mancozeb + TX, mandestrobin + TX, mandipropamid + TX, maneb + TX, mazidox + TX, m-cumenyl methylcarbamate + TX, mecarbam + TX, mecarphon + TX, medlure + TX, mefentrifluconazole + TX, megatomoic acid + TX, menazon + TX, mepanipyrin + TX, meperfluthrin + TX, mephosfolan + TX, mepronil + TX, mercuric oxide + TX, mercurous chloride + TX, mesulfen + TX,

20 mesulfenfos + TX, meta-laxyl + TX, metam + TX, metam-potassium + TX, metam-sodium + TX, Metaphycus helvolus + TX, Metarhizium anisopliae var. acridum + TX, Metarhizium anisopliae var. anisopliae + TX, metarylpicoxamid + TX, metconazole + TX, metepa + TX, methacrifos + TX, methanesulfonyl fluoride + TX, methasulfo-carb + TX, methiotepa + TX, methocrotophos + TX, methoprene + TX, methoquin-butyl + TX, methothrin + TX, methoxychlor + TX, methyl (Z)-2-(5-cyclohexyl-2-methyl-phenoxy)-3-methoxy-prop-2-enoate + TX, methyl (Z)-2-(5-cyclopentyl-2-methyl-phenoxy)-3-methoxy-prop-2-enoate (these compounds may be prepared from the methods described in WO2020/193387) + TX, methyl (Z)-2-[5-(3-isopropylpyrazol-1-yl)-2-methyl-phenoxy]-3-methoxy-prop-2-enoate + TX, methyl (Z)-3-methoxy-2-[2-methyl-5-(3-propylpyrazol-1-yl)phenoxy]prop-2-enoate + TX, methyl (Z)-3-methoxy-2-[2-methyl-5-(4-propyltriazol-2-yl)phenoxy]prop-2-enoate + TX, methyl (Z)-3-methoxy-2-[2-methyl-5-[3-(trifluoromethyl)pyrazol-1-yl]phenoxy]prop-2-enoate (these compounds may be prepared from the methods described in WO2020/079111) + TX, methyl (Z)-3-methoxy-2-[2-methyl-5-[4-(trifluoromethyl)triazol-2-yl]phenoxy]prop-2-enoate + TX, methyl apholate + TX, methyl bromide + TX, methyl eugenol + TX, methyl isothiocyanate + TX, methyl N-[[4-[1-(2,6-difluoro-4-isopropyl-phenyl)pyrazol-4-yl]-2-methyl-phenyl]methyl]carbamate (may be prepared from the methods described in WO 2020/097012) + TX, methyl N-[[4-[1-(4-cyclopropyl-2,6-difluoro-phenyl)pyrazol-4-yl]-2-methyl-phenyl]methyl]carbamate (may be prepared from the methods described in WO 2020/097012) + TX, methyl N-[[5-[4-(2,4-dimethylphenyl)triazol-2-yl]-2-methyl-phenyl]methyl]carbamate + TX, methylchloroform + TX, methylene chloride + TX, methylneodecanamide + TX, metiram + TX, metolcarb + TX, metomi-nostrobin + TX, metoxadiazone +

TX, metrafenone + TX, metyltetraprole + TX, MGK 264 + TX, milbemycin oxime + TX, mipafox + TX, mirex + TX, monocrotophos + TX, morphothion + TX, morzid + TX, moxidectin + TX, muscalure + TX, myclobutanil + TX, myclozoline + TX, Myrothecium verrucaria composition + TX, N-((1R)-1-benzyl-3-chloro-1-methyl-but-3-enyl)-8-fluoro-quinoline-3-carboxamide (these compounds may be prepared from the methods described in WO2017/153380) + TX, N-((1S)-1-benzyl-3-chloro-1-methyl-but-3-enyl)-8-fluoro-quinoline-3-carboxamide (these compounds may be prepared from the methods described in WO2017/153380) + TX, N'-(2,5-dimethyl-4-phenoxy-phenyl)-N-ethyl-N-methyl-formamidine + TX, N'-(2-chloro-5-methyl-4-phenoxy-phenyl)-N-ethyl-N-methyl-formamidine + TX, N,2-dimethoxy-N-[[4-[5-(trifluoromethyl)-1,2,4-oxadiazol-3-yl]phenyl]methyl]propanamide + TX, N,N-dimethyl-1-[[4-[5-(trifluoromethyl)-1,2,4-oxadiazol-3-yl]phenyl]methyl]-1,2,4-triazol-3-amine (THESE COMPOUNDS may be prepared from the methods described in WO 2017/055473, WO 2017/055469, WO 2017/093348 and WO 2017/118689) + TX, N-[(1R)-1-benzyl-1,3-dimethyl-butyl]-7,8-difluoro-quinoline-3-carboxamide + TX, N-[(1R)-1-benzyl-1,3-dimethyl-butyl]-8-fluoro-quinoline-3-carboxamide + TX, N-[(1R)-1-benzyl-3,3,3-trifluoro-1-methyl-propyl]-8-fluoro-quinoline-3-carboxamide + TX, N-[(1S)-1-benzyl-1,3-dimethyl-butyl]-7,8-difluoro-quinoline-3-carboxamide + TX, N-[(1S)-1-benzyl-1,3-dimethyl-butyl]-8-fluoro-quinoline-3-carboxamide + TX, N-[(1S)-1-benzyl-3,3,3-trifluoro-1-methyl-propyl]-8-fluoro-quinoline-3-carboxamide + TX, N-[(E)-methoxyiminomethyl]-4-[5-(trifluoromethyl)-1,2,4-oxadiazol-3-yl]benzamide + TX, N-[(Z)-methoxyiminomethyl]-4-[5-(trifluoromethyl)-1,2,4-oxadiazol-3-yl]benzamide + TX, N-[[4-[5-(trifluoromethyl)-1,2,4-oxadiazol-3-yl]phenyl]methyl]propanamide + TX, N-[2-[2,4-dichloro-phenoxy]phenyl]-3-(difluoromethyl)-1-methyl-pyrazole-4-carboxamide + TX, N-[2-[2-chloro-4-(trifluoromethyl)phenoxy]phenyl]-3-(difluoromethyl)-1-methyl-pyrazole-4-carboxamide + TX, N'-[2-chloro-4-(2-fluorophenoxy)-5-methyl-phenyl]-N-ethyl-N-methyl-formamidine (this compound may be prepared from the methods described in WO 2016/202742) + TX, N'-[4-(4,5-dichlorothiazol-2-yl)oxy-2,5-dimethyl-phenyl]-N-ethyl-N-methyl-formamidine + TX, N'-[5-bromo-2-methyl-6-(1-methyl-2-propoxy-ethoxy)-3-pyridyl]-N-ethyl-N-methyl-formamidine + TX, N'-[5-bromo-2-methyl-6-(1-methyl-2-propoxy-ethoxy)-3-pyridyl]-N-isopropyl-N-methyl-formamidine (these compounds may be prepared from the methods described in WO2015/155075) + TX, N'-[5-bromo-2-methyl-6-(2-propoxypropoxy)-3-pyridyl]-N-ethyl-N-methyl-formamidine (this compound may be prepared from the methods described in IPCOM000249876D) + TX, N'-[5-bromo-2-methyl-6-[(1R)-1-methyl-2-propoxy-ethoxy]-3-pyridyl]-N-ethyl-N-methyl-formamidine + TX, N'-[5-bromo-2-methyl-6-[(1S)-1-methyl-2-propoxy-ethoxy]-3-pyridyl]-N-ethyl-N-methyl-formamidine + TX, N'-[5-chloro-2-methyl-6-(1-methyl-2-propoxy-ethoxy)-3-pyridyl]-N-ethyl-N-methyl-formamidine + TX, N-[N-methoxy-C-methyl-carbonimidoyl]-4-[5-(trifluoromethyl)-1,2,4-oxadiazol-3-yl]benzamide (these compounds may be prepared from the methods described in WO 2018/202428) + TX, N'-[4-(1-cyclopropyl-2,2,2-trifluoro-1-hydroxy-ethyl)-5-methoxy-2-methyl-phenyl]-N-isopropyl-N-methyl-formamidine (these compounds may be prepared from the methods described in WO2018/228896) + TX, nabam + TX, naftalofos + TX, naled + TX, naphthalene + TX, NC-170 + TX, Neodiprion sertifer NPV and N. lecontei NPV + TX, nerolidol + TX, N-ethyl-2-methyl-N-[[4-[5-(trifluoromethyl)-1,2,4-oxadiazol-3-yl]phenyl]methyl]propanamide + TX, N-ethyl-N'-[5-methoxy-2-methyl-4-[(2-trifluoromethyl)oxetan-2-yl]phenyl]-N-methyl-formamidine + TX, nickel

- bis(dimethyldithiocarbamate) + TX, niclosamide-olamine + TX, nicotine + TX, nicotine sulfate + TX, nifluridide + TX, nikkomycins + TX, N-isopropyl-N'-[5-methoxy-2-methyl-4-(2,2,2-trifluoro-1-hydroxy-1-phenyl-ethyl)phenyl]-N-methyl-formamidine + TX, nithiazine + TX, nitrapyrin + TX, nitrilacarb + TX, nitrilacarb 1:1 zinc chloride complex + TX, nitrothal-isopropyl + TX, N-methoxy-N-[[4-[5-
- 5 (trifluoromethyl)-1,2,4-oxadiazol-3-yl]phenyl]methyl]cyclopropanecarboxamide + TX, N-methyl-4-[5-(trifluoromethyl)-1,2,4-oxadiazol-3-yl]benzamide + TX, N-methyl-4-[5-(trifluoromethyl)-1,2,4-oxadiazol-3-yl]benzenecarbothioamide + TX, norbormide + TX, nuarimol + TX, O,O,O',O'-tetrapropyl dithiopyrophosphate + TX, octadeca-2,13-dien-1-yl acetate + TX, octadeca-3,13-dien-1-yl acetate + TX, octhilinone + TX, ofurace + TX, oleic acid + TX, omethoate + TX, orfuralure + TX, Orius spp. + TX,
- 10 oryctalure + TX, orysastrobin + TX, ostramone + TX, oxadixyl + TX, oxamate + TX, oxathiapiroline + TX, oxine-copper + TX, oxolinic acid + TX, oxycarboxin + TX, oxydeprofos + TX, oxydisulfoton + TX, oxytetracycline + TX, paclobutrazole + TX, Paecilomyces fumosoroseus + TX, para-dichlorobenzene + TX, parathion + TX, parathion-methyl + TX, pefurazoate + TX, penconazole + TX, pencycuron + TX, penflufen + TX, penfluron + TX, pentachlorophenol + TX, pentachlorophenyl laurate + TX,
- 15 penthiopyrad + TX, permethrin + TX, PH 60-38 + TX, phenamacril + TX, phenkapton + TX, phosacetim + TX, phosalone + TX, phosdiphen + TX, phosfolan + TX, phosglycin + TX, phosnichlor + TX, phosphamidon + TX, phosphine + TX, phosphorus + TX, phoxim-methyl + TX, phthalide + TX, Phytoseiulus persimilis + TX, picarbutrazox + TX, picaridin + TX, picoxystrobin + TX, pindone + TX, piperazine + TX, piperonyl butoxide + TX, piprotal + TX, pirimetaphos + TX,
- 20 polychlorodicyclopentadiene isomers + TX, polychloroterpenes + TX, polynactins + TX, polyoxins + TX, potassium arsenite + TX, potassium ethylxanthate + TX, potassium hydroxyquinoline sulfate + TX, potassium thiocyanate + TX, pp'-DDT + TX, precocene I + TX, precocene II + TX, precocene III + TX, primidophos + TX, probenazole + TX, prochloraz + TX, proclonol + TX, procymidone + TX, profluthrin + TX, promacyl + TX, promecarb + TX, propamocarb + TX, propiconazole + TX, propineb + TX,
- 25 propoxur + TX, propyl isomer + TX, proquinazid + TX, prothidathion + TX, prothioconazole + TX, prothiofos + TX, prothoate + TX, pydiflumetofen + TX, pyraclostrobin + TX, pyrametostrobin + TX, pyraoxystrobin + TX, pyrapropoyne + TX, pyraziflumid + TX, pyrazophos + TX, pyresmethrin + TX, pyrethrin I + TX, pyrethrin II + TX, pyrethrins + TX, pyribencarb + TX, pyridachlometyl + TX, pyridaphenthion + TX, pyridin-4-amine + TX, pyrifenoxy + TX, pyrimethanil + TX, pyrimite + TX,
- 30 pyrimorph + TX, pyrinuron + TX, pyriofenone + TX, pyrisoxazole + TX, pyroquilon + TX, quassia + TX, quinalphos + TX, quinalphos-methyl + TX, quinoctamine + TX, quinoctumel + TX, quinonamid + TX, quinothion + TX, quinoxifen + TX, quintiofos + TX, quintozone + TX, R-1492 + TX, rafoxanide + TX, resmethrin + TX, Reynoutria sachalinensis extract + TX, ribavirin + TX, R metalaxyl + TX, rotenone + TX, ryania + TX, ryanodine + TX, S421 + TX, sabadilla + TX, schradan + TX, scilliroside + TX,
- 35 seboctylamine + TX, sebufos + TX, sedaxane + TX, selamectin + TX, sesamex + TX, sesasmolin + TX, SI-0009 + TX, siglure + TX, simazine + TX, simeconazole + TX, sodium arsenite + TX, sodium cyanide + TX, sodium fluoride + TX, sodium fluoroacetate + TX, sodium hexafluorosilicate + TX, sodium pentachlorophenoxide + TX, sodium selenate + TX, sodium tetrathiocarbonate + TX, sodium thiocyanate + TX, sophamide + TX, sordidin + TX, spiroxamine + TX, SSI-121 + TX, Steinernema

bibionis + TX, *Steinernema carpocapsae* + TX, *Steinernema feltiae* + TX, *Steinernema glaseri* + TX, *Steinernema riobrave* + TX, *Steinernema riobavis* + TX, *Steinernema scapterisci* + TX, *Steinernema* spp. + TX, streptomycin + TX, streptomycin sesquisulfate + TX, strychnine + TX, sulcatol + TX, sulcofuron + TX, sulcofuron-sodium + TX, sulfiram + TX, sulfluramid + TX, sulfotep + TX, sulfoxide + TX, sulfur + TX, sulfuryl fluoride + TX, sulprofos + TX, tar oils + TX, tau-fluvalinate + TX, tazimcarb + TX, TDE + TX, tebuconazole + TX, tebufloquin + TX, tebupirimfos + TX, tecloftalam + TX, temephos + TX, tepa + TX, TEPP + TX, terallethrin + TX, terbam + TX, tert-butyl N-[6-[[[(1-methyltetrazol-5-yl)-phenyl-methylene]amino]oxymethyl]-2-pyridyl]carbamate + TX, tetrachloroethane + TX, tetrachlorothiophene + TX, tetraconazole + TX, tetradec-11-en-1-yl acetate + TX, tetradifon + TX, tetramethylfluthrin + TX, tetrasul + TX, thallium sulfate + TX, thiaben-dazole + TX, thiafenox + TX, thiapronil + TX, thicofos + TX, thifluzamide + TX, thiocarboxime + TX, thiocyclam + TX, thiocyclam hydrogen oxalate + TX, thiodiazole copper + TX, thiofanox + TX, thiohempa + TX, thiomersal + TX, thiometon + TX, thionazin + TX, thiophanate + TX, thiophanate-methyl + TX, thioquinox + TX, thiosultap + TX, thiosultap-sodium + TX, thiotepa + TX, thiram + TX, thuringiensin + TX, tiadinil + TX, tolclofos-methyl + TX, tolprocarb + TX, tolylfluanid + TX, tralomethrin + TX, transpermethrin + TX, tretamine + TX, triadimefon + TX, triadime-nol + TX, triamiphos + TX, triarathene + TX, triazamate + TX, triazophos + TX, triazoxide + TX, triazuron + TX, tributyltin oxide + TX, trichlormetaphos-3 + TX, trichloronat + TX, *Trichogramma* spp. + TX, triclopyricarb + TX, tricyclazole + TX, tridemorph + TX, trifenmorph + TX, trifenofos + TX, trifloxystrobin + TX, triflumizole + TX, triforine + TX, trimedlure + TX, trimedlure A + TX, trimedlure B1 + TX, trimedlure B2 + TX, trimedlure C + TX, trimethacarb + TX, trinactin + TX, trinexapac + TX, triphenyltin acetate + TX, triphenyltin hydroxide + TX, triprene + TX, triticonazole + TX, trunc-call + TX, *Typhlodromus occidentalis* + TX, uredepa + TX, validamycin + TX, valifenalate + TX, vamidothion + TX, vaniliprole + TX, veratridine + TX, veratrine + TX, verbutin + TX, *Verticillium lecanii* + TX, vinclozoline + TX, warfarin + TX, XMC + TX, xlenols + TX, zeatin + TX, zetamethrin + TX, zhongshengmycin + TX, zinc naphthenate + TX, zinc phosphide + TX, zinc thiazole + TX, zineb + TX, ziram + TX, zolaprofos + TX, zoxamide + TX;

Acinetobacter lwoffii + TX, *Acremonium alternatum* + TX, *Acremonium cephalosporium* + TX, *Acremonium diospyri* + TX, *Acremonium obclavatum* + TX, *Adoxophyes orana* granulovirus (AdoxGV) (Capex®) + TX, *Agrobacterium radiobacter* strain K84 (Galltrol-A®) + TX, *Alternaria alternate* + TX, *Alternaria cassia* + TX, *Alternaria destruens* (Smolder®) + TX, *Ampelomyces quisqualis* (AQ10®) + TX, *Aspergillus flavus* AF36 (AF36®) + TX, *Aspergillus flavus* NRRL 21882 (Aflaguard®) + TX, *Aspergillus* spp. + TX, *Aureobasidium pullulans* + TX, *Azospirillum* (MicroAZ®, TAZO B®) + TX, *Azotobacter* + TX, *Azotobacter chroococcum* (Azotomeal®) + TX, *Azotobacter* cysts (Bionatural Blooming Blossoms®) + TX, *Bacillus amyloliquefaciens* + TX, *Bacillus cereus* + TX, *Bacillus chitinosporus* strain AQ746 + TX, *Bacillus chitinosporus* strain CM-1 + TX, *Bacillus circulans* + TX, *Bacillus firmus* (BioSafe®, BioNem-WP®) in particular strain CNMC 1-1582 (e.g. VOTIVO® from BASF SE) + TX, *Bacillus licheniformis* strain 3086 (EcoGuard®, Green Releaf®) + TX, *Bacillus licheniformis* strain HB-2 (Biostart™ formerly Rhizoboost®) + TX, *Bacillus macerans* + TX, *Bacillus marismortui* + TX, *Bacillus megaterium* + TX, *Bacillus mycoides* strain AQ726 + TX, *Bacillus papillae*

- (Milky Spore Powder®) + TX, *Bacillus pumilus* spp. + TX, *Bacillus pumilus* strain AQ717 + TX, *Bacillus pumilus* strain GB34 (Yield Shield®) + TX, *Bacillus pumilus* strain QST 2808 (Sonata®, Ballad Plus®) + TX, *Bacillus sphaericus* (VectoLex®) + TX, *Bacillus* spp. + TX, *Bacillus* spp. strain AQ175 + TX, *Bacillus* spp. strain AQ177 + TX, *Bacillus* spp. strain AQ178 + TX, *Bacillus subtilis* strain AQ153 + TX,
- 5 *Bacillus subtilis* strain AQ743 + TX, *Bacillus subtilis* strain QST 713 (CEASE®, Serenade®, Rhapsody®) + TX, *Bacillus subtilis* strain QST 714 (JAZZ®) + TX, *Bacillus subtilis* strain QST3002 + TX, *Bacillus subtilis* strain QST3004 + TX, *Bacillus subtilis* var. *amyloliquefaciens* strain FZB24 (Taegro®, Rhizopro®) + TX, *Bacillus thuringiensis* aizawai GC 91 (Agree®) + TX, *Bacillus thuringiensis* Cry 2Ae + TX, *Bacillus thuringiensis* Cry1Ab + TX, *Bacillus thuringiensis* israelensis
- 10 (BMP123®, Aquabac®, VectoBac®) + TX, *Bacillus thuringiensis* kurstaki (Javelin®, Deliver®, CryMax®, Bonide®, Scutella WP®, Turilav WP®, Astuto®, Dipel WP®, Biobit®, Foray®) + TX, *Bacillus thuringiensis* kurstaki BMP 123 (Baritone®) + TX, *Bacillus thuringiensis* kurstaki HD-1 (Bioprotec-CAF / 3P®) + TX, *Bacillus thuringiensis* strain AQ52 + TX, *Bacillus thuringiensis* strain BD#32 + TX, *Bacillus thuringiensis* tenebrionis (Novodor®, BtBooster) + TX, *Bacillus thuringiensis* var. *aizawai* (XenTari®, DiPel®) + TX, *bacteria* spp. (GROWMEND®, GROWSWEET®, Shootup®) + TX, *bacteriophage* of *Clavipacter michiganensis* (AgriPhage®, Bakflor®) + TX, *Beauveria bassiana* (Beaugenic®, Brocaril WP®) + TX, *Beauveria bassiana* GHA (Mycotrol ES®, Mycotrol O®, BotaniGuard®) + TX, *Beauveria brongniartii* (Engerlingspilz®, Schweizer Beauveria®, Melocont®) + TX, *Beauveria* spp. + TX, *Botrytis cineria* + TX, *Bradyrhizobium japonicum* (TerraMax®) + TX,
- 20 *Brevibacillus brevis* + TX, *Burkholderia cepacia* (Deny®, Intercept®, Blue Circle®) + TX, *Burkholderia gladii* + TX, *Burkholderia gladioli* + TX, *Burkholderia* spp. + TX, *Canadian thistle fungus* (CBH Canadian Bioherbicide®) + TX, *Candida butyri* + TX, *Candida famata* + TX, *Candida fructus* + TX, *Candida glabrata* + TX, *Candida guilliermondii* + TX, *Candida melibiosica* + TX, *Candida oleophila* strain O + TX, *Candida parapsilosis* + TX, *Candida pelliculosa* + TX, *Candida pulcherrima* + TX,
- 25 *Candida reukaufii* + TX, *Candida saitoana* (Bio-Coat®, Biocure®) + TX, *Candida sake* + TX, *Candida* spp. + TX, *Candida tenuis* + TX, *Cedecea davisae* + TX, *Cellulomonas flavigena* + TX, *Chaetomium cochliodes* (Nova-Cide®) + TX, *Chaetomium globosum* (Nova-Cide®) + TX, *Chromobacterium subtsugae* strain PRAA4-1T (Grandevo®) + TX, *Cladosporium chlorocephalum* + TX, *Cladosporium cladosporioides* + TX, *Cladosporium oxysporum* + TX, *Cladosporium* spp. + TX, *Cladosporium tenuissimum* + TX, *Clonostachys rosea* (EndoFine®) + TX, *Colletotrichum acutatum* + TX,
- 30 *Coniothyrium minitans* (Cotans WG®) + TX, *Coniothyrium* spp. + TX, *Cryptococcus albidus* (YIELDPLUS®) + TX, *Cryptococcus humicola* + TX, *Cryptococcus infirmo-minutus* + TX, *Cryptococcus laurentii* + TX, *Cryptophlebia leucotreta* granulovirus (Cryptex®) + TX, *Cupriavidus campinensis* + TX, *Cydia pomonella* granulovirus (CYD-X®, Madex®, Madex® Plus, Madex Max, Carpovirusine®) + TX, *Cylindrobasidium laeve* (Stumpout®) + TX, *Cylindrocladium* + TX,
- 35 *Debaryomyces hansenii* + TX, *Drechslera hawaiiensis* + TX, *Enterobacter cloacae* + TX, *Enterobacteriaceae* + TX, *Entomophthora virulenta* (Vektor®) + TX, *Epicoccum nigrum* + TX, *Epicoccum purpurascens* + TX, *Epicoccum* spp. + TX, *Filobasidium floriforme* + TX, *Fusarium acuminatum* + TX, *Fusarium chlamydosporum* + TX, *Fusarium oxysporum* (Fusaclean®, Biofox C®) +

- TX, *Fusarium proliferatum* + TX, *Fusarium* spp. + TX, *Galactomyces geotrichum* + TX, *Gliocladium catenulatum* (Primastop®, Prestop®) + TX, *Gliocladium roseum* + TX, *Gliocladium* spp. (SoilGard®) + TX, *Gliocladium virens* (Soilgard®) + TX, *Granulovirus* (Granupom®) + TX, *Halobacillus halophilus* + TX, *Halobacillus litoralis* + TX, *Halobacillus trueperi* + TX, *Halomonas* spp. + TX, *Halomonas subglaciescola* + TX, *Halovibrio variabilis* + TX, *Hanseniaspora uvarum* + TX, *Helicoverpa armigera* nucleopolyhedrovirus (Helicovex®) + TX, *Helicoverpa zea* nuclear polyhedrosis virus (Gemstar®) + TX, *Isaria fumosorosea* (previously known as *Paecilomyces fumosoroseus* strain, PFR-97®, PreFeRal®) + TX, Isoflavone formononetin (Myconate®) + TX, *Kloeckera apiculata* + TX, *Kloeckera* spp. + TX, *Lagenidium giganteum* (Laginex®) + TX, *Lecanicillium lecanii* (formerly known as *Verticillium lecanii* (Mycotal®) conidia of strain KV01 (e.g. Vertalec® by Koppert/Arysta) + TX, *Lecanicillium longisporum* (Vertiblast®) + TX, *Lecanicillium muscarium* (Vertikil®) + TX, *Lymantria Dispar* nucleopolyhedrosis virus (Disparvirus®) + TX, *Marinococcus halophilus* + TX, *Meira geulakonigii* + TX, *Metarhizium anisopliae* (Destruxin WP®) + TX, *Metarhizium anisopliae* (Met52®) + TX, *Metschnikowia fruticola* (Shemer®) + TX, *Metschnikowia pulcherrima* + TX, *Microdochium dimerum* (Antibot®) + TX, *Micromonospora coerulea* + TX, *Microsphaeropsis ochracea* + TX, *Muscodor albus* 620 (Muscudor®) + TX, *Muscodor roseus* in particular strain A3-5 (Accession No. NRRL 30548) + TX, *Mycorrhizae* spp. (AMykor®, Root Maximizer®) + TX, *Myrothecium verrucaria* strain AARC-0255 (DiTera®, BROS PLUS®) + TX, *Ophiostoma piliferum* strain D97 (Sylvanex®) + TX, *Paecilomyces farinosus* + TX, *Paecilomyces lilacinus* strain 251 (MeloCon WG®) + TX, *Paecilomyces linacinus* (Biostat WP®) + TX, *Paenibacillus polymyxa* + TX, *Pantoea agglomerans* (BlightBan C9-1®) + TX, *Pantoea* spp. + TX, *Pasteuria nishizawae* in particular strain Pn1 (CLARIVA from Syngenta/ChemChina); + TX, *Pasteuria* spp. (Econem®) + TX, *Penicillium aurantiogriseum* + TX, *Penicillium billai* (Jumpstart®, TagTeam®) + TX, *Penicillium brevicompactum* + TX, *Penicillium frequentans* + TX, *Penicillium griseofulvum* + TX, *Penicillium purpurogenum* + TX, *Penicillium* spp. + TX, *Penicillium viridicatum* + TX, *Phlebiopsis gigantea* (Rotstop®) + TX, phosphate solubilizing bacteria (Phosphomeal®) + TX, *Phytophthora cryptogea* + TX, *Phytophthora palmivora* (Devine®) + TX, *Pichia anomala* + TX, *Pichia guilliermondii* + TX, *Pichia membranaefaciens* + TX, *Pichia onychis* + TX, *Pichia stipites* + TX, *Pseudomonas aeruginosa* + TX, *Pseudomonas aureofasciens* (Spot-Less Biofungicide®) + TX, *Pseudomonas cepacia* + TX, *Pseudomonas chlororaphis* (AtEze®) + TX, *Pseudomonas corrugate* + TX, *Pseudomonas fluorescens* (Zequanox®) + TX, *Pseudomonas fluorescens* strain A506 (BlightBan A506®) + TX, *Pseudomonas putida* + TX, *Pseudomonas reactans* + TX, *Pseudomonas* spp. + TX, *Pseudomonas syringae* (Bio-Save®) + TX, *Pseudomonas viridiflava* + TX, *Pseudozyma flocculosa* strain PF-A22 UL (Sporodex L®) + TX, *Puccinia canaliculata* + TX, *Puccinia thlaspeos* (Wood Warrior®) + TX, *Pythium paroecandrum* + TX, *Pythium oligandrum* (Polygandron®, Polyversum®) + TX, *Pythium periplocum* + TX, *Rhanella aquatilis* + TX, *Rhanella* spp. + TX, *Rhizobia* (Dormal®, Vault®) + TX, *Rhizoctonia* + TX, *Rhodococcus globerulus* strain AQ719 + TX, *Rhodosporidium diobovatum* + TX, *Rhodosporidium toruloides* + TX, *Rhodotorula glutinis* + TX, *Rhodotorula graminis* + TX, *Rhodotorula mucilagnosa* + TX, *Rhodotorula rubra* + TX, *Rhodotorula* spp. + TX, *Saccharomyces cerevisiae* + TX, *Salinococcus roseus* + TX, *Sclerotinia minor*

- (SARRITOR®) + TX, Sclerotinia minor + TX, Scytalidium spp. + TX, Scytalidium uredinicola + TX, Serratia marcescens + TX, Serratia plymuthica + TX, Serratia spp. + TX, Sordaria fimicola + TX, Spodoptera exigua nuclear polyhedrosis virus (Spod-X®, Spexit®) + TX, Spodoptera littoralis nucleopolyhedrovirus (Littovir®) + TX, Sporobolomyces roseus + TX, Stenotrophomonas maltophilia + TX, Streptomyces albaduncus + TX, Streptomyces exfoliates + TX, Streptomyces galbus + TX, Streptomyces griseoplanus + TX, Streptomyces griseoviridis (Mycostop®) + TX, Streptomyces hygroscopicus + TX, Streptomyces lydicus (Actinovate®) + TX, Streptomyces lydicus WYEC-108 (ActinoGrow®) + TX, Streptomyces violaceus + TX, Tilletiopsis minor + TX, Tilletiopsis spp. + TX, Trichoderma asperellum (T34 Biocontrol®) + TX, Trichoderma atroviride (Plantmate®) + TX, Trichoderma gamsii (Tenet®) + TX, Trichoderma hamatum TH 382 + TX, Trichoderma harzianum rifai (Mycostar®) + TX, Trichoderma harzianum T-22 (Trianum-P®, PlantShield HC®, RootShield®, Trianum-G®) + TX, Trichoderma harzianum T-39 (Trichodex®) + TX, Trichoderma inhamatum + TX, Trichoderma koningii + TX, Trichoderma lignorum + TX, Trichoderma longibrachiatum + TX, Trichoderma polysporum (Binab T®) + TX, Trichoderma spp. LC 52 (Sentinel®) + TX, Trichoderma taxi + TX, Trichoderma virens (formerly Gliocladium virens GL-21) (SoilGuard®) + TX, Trichoderma virens + TX, Trichoderma viride + TX, Trichoderma viride strain ICC 080 (Remedier®) + TX, Trichosporon pullulans + TX, Trichosporon spp. + TX, Trichothecium roseum + TX, Trichothecium spp. + TX, Typhula phacorrhiza strain 94670 + TX, Typhula phacorrhiza strain 94671 + TX, Ulocladium atrum + TX, Ulocladium oudemansii (Botry-Zen®) + TX, Ustilago maydis + TX, various bacteria and supplementary micronutrients (Natural II®) + TX, various fungi (Millennium Microbes®) + TX, Verticillium chlamydosporium + TX, Vip3Aa20 (VIPtera®) + TX, Virgibacillus marismortui + TX, Xanthomonas campestris pv. Poae (Camperico®) + TX, Xenorhabdus bovienii + TX, Xenorhabdus nematophilus + TX;
- AGNIQUE® MMF + TX, azadirachtin (Plasma Neem Oil®, AzaGuard®, MeemAzal®, Molt-X® e.g. AZATIN XL from Certis, US) + TX, Botanical IGR (Neemazad®, Neemix®) + TX, BugOil® + TX, canola oil (Lilly Miller Vegol®) + TX, Chenopodium ambrosioides near ambrosioides (Requiem®) + TX, Chrysanthemum extract (Crisant®) + TX, essentials oils of Labiatae (Botania®) + TX, extract of neem oil (Trilogy®) + TX, extracts of clove rosemary peppermint and thyme oil (Garden insect killer®) + TX, garlic + TX, Glycinebetaine (Greenstim®) + TX, kaolin (Screen®) + TX, lemongrass oil (GreenMatch®) + TX, Melaleuca alternifolia extract (also called tea tree oil) (Timorex Gold®) + TX, mixture of clove peppermint garlic oil and mint (Soil Shot®) + TX, mixture of clove rosemary and peppermint extract (EF 400®) + TX, mixture of rosemary sesame peppermint thyme and cinnamon extracts (EF 300®) + TX, neem oil + TX, Nepeta cataria (Catnip oil) + TX, Nepeta catarina + TX, nicotine + TX, oregano oil (MossBuster®) + TX, Pedaliaceae oil (Nematon®) + TX, pine oil (Retenol®) + TX, pyrethrum + TX, Quillaja saponaria (NemaQ®) + TX, Reynoutria sachalinensis (Regalia®, Sakalia®) + TX, rotenone (Eco Roten®) + TX, Rutaceae plant extract (Soleo®) + TX, soybean oil (Ortho ecosense®) + TX, storage glucan of brown algae (Laminarin®) + TX, thyme oil + TX; (E,Z)-7,9-Dodecadien-1-yl acetate + TX, (E,Z,Z)-3,8,11 Tetradecatrienyl acetate + TX, (Z,Z,E)-7,11,13-Hexadecatrienal + TX, 2-Methyl-1-butanol + TX, Biolure® + TX, blackheaded fireworm

pheromone (3M Sprayable Blackheaded Fireworm Pheromone®) + TX, Calcium acetate + TX, Check-Mate® + TX, Codling Moth Pheromone (Paramount dispenser-(CM)/ Isomate C-Plus®) + TX, Entostat powder (extract from palm tree) (Exosex CM®) + TX, Grape Berry Moth Pheromone (3M MEC-GBM Sprayable Pheromone®) + TX, Lavandulyl senecioate + TX, Leafroller pheromone (3M MEC – LR Sprayable Pheromone®) + TX, Muscamone (Snip7 Fly Bait® + TX, Oriental Fruit Moth Pheromone (3M oriental fruit moth sprayable pheromone®) + TX, Peachtree Borer Pheromone (Isomate-P®) + TX, Scenturion® + TX, Starbar Premium Fly Bait®) + TX, Tomato Pinworm Pheromone (3M Sprayable pheromone®) + TX;

- Acerophagus papaya + TX, Adalia bipunctata (Adalia-System®) + TX, Adalia bipunctata (Adaline®) + TX, Adalia bipunctata (Aphidalia®) + TX, Ageniaspis citricola + TX, Ageniaspis fuscicollis + TX, Amblyseius andersoni (Anderline®, Andersoni-System®) + TX, Amblyseius californicus (Amblyline®, Spical®) + TX, Amblyseius cucumeris (Thripex®, Bugline cucumeris®) + TX, Amblyseius fallacis (Fallacis®) + TX, Amblyseius swirskii (Bugline swirskii®, Swirskii-Mite®) + TX, Amblyseius womersleyi (WomerMite®) + TX, Amitus hesperidum + TX, Anagrus atomus + TX, Anagrus fusciventris + TX, Anagrus kamali + TX, Anagrus loeckii + TX, Anagrus pseudococci (Citripar®) + TX, Anicetus benefices + TX, Anisopteromalus calandrae + TX, Anthocoris nemoralis (Anthocoris-System®) + TX, Aphelinus abdominalis (Apheline®, Aphiline®), + TX, Aphelinus asychis + TX, Aphidius colemani (Aphipar®) + TX, Aphidius ervi (Aphelinus-System®) + TX, Aphidius ervi (Ervipar®) + TX, Aphidius gifuensis + TX, Aphidius matricariae (Aphipar-M®) + TX, Aphidoletes aphidimyza (Aphidend®, Aphidoline®) + TX, Aphytis lingnanensis + TX, Aphytis melinus + TX, Aprostocetus hagenowii + TX, Atheta coriaria (Staphyline®) + TX, Bombus spp. + TX, Bombus terrestris (Beeline®, Tripol®) + TX, Bombus terrestris (Natupol Beehive®) + TX, Cephalonomia stephanoderis + TX, Chilocorus nigritus + TX, Chrysoperla carnea (Chrysoline®, Chrysopa®) + TX, Chrysoperla rufilabris + TX, Cirrospilus ingenuus + TX, Cirrospilus quadristriatus + TX, Citrostichus phyllocnistoides + TX, Closterocerus chamaeleon + TX, Closterocerus spp. + TX, Coccidoxenoides perminutus (Planopar®) + TX, Coccophagus cowperi + TX, Coccophagus lycimnia + TX, Cotesia flavipes + TX, Cotesia plutellae + TX, Cryptolaemus montrouzieri (Cryptobug®, Cryptoline®) + TX, Cybocephalus nipponicus + TX, Dacnusa sibirica (Minusa®, DacDigline®, Minex®) + TX, Delphastus catalinae (Delphastus®) + TX, Delphastus pusillus + TX, Diachasmimorpha krausii + TX, Diachasmimorpha longicaudata + TX, Diaparsis jucunda + TX, Diaphorencyrtus aligarhensis + TX, Diglyphus isaea (Diminex®, Miglyphus®, Digline®) + TX, Diversinervus spp. + TX, Encarsia citrina + TX, Encarsia formosa (Encarsia max®, Encarline®, En-Strip®) + TX, Encarsia guadeloupae + TX, Encarsia haitiensis + TX, Episyrphus balteatus (Syrphidend®) + TX, Eretmocerus siphonini + TX, Eretmocerus californicus + TX, Eretmocerus eremicus (Enermix®, Ercal®, Eretline e®, Bemimix®) + TX, Eretmocerus hayati + TX, Eretmocerus mundus (Bemipar®, Eretline m®) + TX, Eretmocerus siphonini + TX, Exochomus quadripustulatus + TX, Feltiella acarisuga (Feltiline®) + TX, Feltiella acarisuga (Spidend®) + TX, Fopius arisanus + TX, Fopius ceratitivorius + TX, Formononetin (Wirless Beehome®) + TX, Franklinothrips vespiformis (Vespop®) + TX, Galendromus occidentalis + TX, Goniozus legneri + TX, Habrobracon hebetor + TX, Harmonia axyridis (HarmoBeetle®) + TX, Heterorhabditis bacteriophora

- (NemaShield HB®, Nemaseek®, Terranem-Nam®, Terranem®, Larvanem®, B-Green®, NemAttack
®, Nematop®) + TX, Heterorhabditis megidis (Nemasys H®, BioNem H®, Exhibitline hm®, Larvanem-
M®) + TX, Heterorhabditis spp. (Lawn Patrol®) + TX, Hippodamia convergens + TX, Hypoaspis
aculeifer (Aculeifer-System®, Entomite-A®) + TX, Hypoaspis miles (Hypoline m®, Entomite-M®) + TX,
- 5 Lbalia leucospoides + TX, Lecanoideus floccissimus + TX, Lemophagus errabundus + TX,
Leptomastidea abnormis + TX, Leptomastix dactylopii (Leptopar®) + TX, Leptomastix epona + TX,
Lindorus lophanthae + TX, Lipolexis oregmae + TX, Lucilia caesar (Natufly®) + TX, Lysiphlebus
testaceipes + TX, Macrolophus caliginosus (Mirical-N®, Macroline c®, Mirical®) + TX, Mesoseiulus
longipes + TX, Metaphycus flavus + TX, Metaphycus lounsburyi + TX, Micromus angulatus
- 10 (Milacewing®) + TX, Microterys flavus + TX, Muscidifurax raptorellus and Spalangia cameroni
(Biopar®) + TX, Neodryinus typhlocybae + TX, Neoseiulus californicus + TX, Neoseiulus cucumeris
(THRYPEX®) + TX, Neoseiulus fallacis + TX, Nesideocoris tenuis (NesidioBug®, Nesibug®) + TX,
Ophyra aenescens (Biofly®) + TX, Orius insidiosus (Thripor-l®, Oriline i®) + TX, Orius laevigatus
(Thripor-L®, Oriline l®) + TX, Orius majusculus (Oriline m®) + TX, Orius strigicollis (Thripor-S®) + TX,
- 15 Pauesia juniperorum + TX, Pediobius foveolatus + TX, Phasmarhabditis hermaphrodita (Nemaslug®)
+ TX, Phymastichus coffea + TX, Phytoseiulus macropilus + TX, Phytoseiulus persimilis (Spidex®,
Phytoline p®) + TX, Podisus maculiventris (Podisus®) + TX, Pseudacteon curvatus + TX,
Pseudacteon obtusus + TX, Pseudacteon tricuspis + TX, Pseudaphycus maculipennis + TX,
Pseudleptomastix mexicana + TX, Psyllaephagus pilosus + TX, Psytalia concolor (complex) + TX,
- 20 Quadrastichus spp. + TX, Rhyzobius lophanthae + TX, Rodolia cardinalis + TX, Rumina decollate +
TX, Semielacher petiolatus + TX, Sitobion avenae (Ervibank®) + TX, Steinernema carpocapsae
(Nematac C®, Millenium®, BioNem C®, NemAttack®, Nemastar®, Capsanem®) + TX, Steinernema
feltiae (NemaShield®, Nemasys F®, BioNem F®, Steinernema-System®, NemAttack®, Nemaplus®,
Exhibitline sf®, Scia-rid®, Entonem®) + TX, Steinernema kraussei (Nemasys L®, BioNem L®,
- 25 Exhibitline srb®) + TX, Steinernema riobrave (BioVector®, BioVektor®) + TX, Steinernema scapterisci
(Nematac S®) + TX, Steinernema spp. + TX, Steinernematid spp. (Guardian Nematodes®) + TX,
Stethorus punctillum (Stethorus®) + TX, Tamarixia radiata + TX, Tetrastichus setifer + TX, Thripobius
semiluteus + TX, Tormus sinensis + TX, Trichogramma brassicae (Tricholine b®) + TX,
Trichogramma brassicae (Tricho-Strip®) + TX, Trichogramma evanescens + TX, Trichogramma
- 30 minutum + TX, Trichogramma ostrinae + TX, Trichogramma platneri + TX, Trichogramma pretiosum +
TX, Xanthopimpla stemmator + TX;
abscisic acid + TX, Aminomite® + TX, BioGain® + TX, bioSea® + TX, Chondrostereum purpureum
(Chontrol Paste®) + TX, Colletotrichum gloeosporioides (Collego®) + TX, Copper Octanoate
(Cueva®) + TX, Delta traps (Trapline d®) + TX, Erwinia amylovora (Harpin) (ProAct®, Ni-HIBIT Gold
- 35 CST®) + TX, fatty acids derived from a natural by-product of extra virgin olive oil (FLIPPER®) + TX,
Ferri-phosphate (Ferramol®) + TX, Funnel traps (Trapline y®) + TX, Gallex® + TX, Grower's Secret®
+ TX, Homo-brassonolide + TX, Iron Phosphate (Lilly Miller Worry Free Ferramol Slug & Snail Bait®) +
TX, MCP hail trap (Trapline f®) + TX, Microctonus hyperodae + TX, Mycoleptodiscus terrestris (Des-
X®) + TX, Nosema locustae (Semaspore Organic Grasshopper Control®) + TX, Pheromone trap

(Thripline ams®) + TX, potassium bicarbonate (MilStop®) + TX, potassium iodide + potassiumthiocyanate (Enzicur®) + TX, potassium salts of fatty acids (Sanova®) + TX, potassium silicate solution (Sil-Matrix®) + TX, Spider venom + TX, Sticky traps (Trapline YF®, Rebell Amarillo®) + TX, SuffOil-X® + TX, Traps (Takitrapline y + b®) + TX, vadescana (CAS Number: 2643947-26-4) + TX;

Bacillus mojavenensis strain R3B (Accession No. NCAIM (P) B001389) (WO 2013/034938) from Certis USA LLC + TX, Bacillus pumilus, in particular strain BU F-33, having NRRL Accession No. 50185 (CARTISSA® from BASF, EPA Reg. No. 71840-19) + TX, Bacillus subtilis CX-9060 from Certis USA LLC, Bacillus sp., in particular strain D747 (available as DOUBLE NICKEL® from Kumiai Chemical Industry Co., Ltd.), having Accession No. FERM BP-8234, U.S. Patent No. 7,094,592 + TX, Bacillus subtilis strain BU1814, (VELONDIS® PLUS, VELONDIS® FLEX and VELONDIS® EXTRA from BASF SE) + TX, Bacillus subtilis var. amyloliquefaciens strain FZB24 having Accession No. DSM 10271 (available from Novozymes as TAEGRO® or TAEGRO® ECO (EPA Registration No. 70127-5)) + TX, Bacillus subtilis, in particular strain QST713/AQ713 (having NRRL Accession No. B-21661 and described in U.S. Patent No. 6,060,051, available as SERENADE® OPTI or SERENADE® ASO from Bayer CropScience LP, US) + TX, Paenibacillus polymyxa, in particular strain AC-1 (e.g. TOPSEED® from Green Biotech Company Ltd.) + TX, Paenibacillus sp. strain having Accession No. NRRL B-50972 or Accession No. NRRL B-67129, WO 2016/154297 + TX, Pantoea agglomerans, in particular strain E325 (Accession No. NRRL B-21856) (available as BLOOMTIME BIOLOGICAL™ FD BIOPESTICIDE from Northwest Agri Products) + TX, Pseudomonas proradix (e.g. PRORADIX® from Sourcon Padena) + TX;

Aureobasidium pullulans, in particular blastospores of strain DSM14940, blastospores of strain DSM 14941 or mixtures of blastospores of strains DSM14940 and DSM14941 (e.g., BOTECTOR® and BLOSSOM PROTECT® from bio-ferm, CH) + TX, Pseudozyma aphidis (as disclosed in WO2011/151819 by Yissum Research Development Company of the Hebrew University of Jerusalem) + TX, Saccharomyces cerevisiae, in particular strains CNCM No. 1-3936, CNCM No. 1-3937, CNCM No. 1-3938 or CNCM No. 1-3939 (WO 2010/086790) from Lesaffre et Compagnie, FR + TX; Agrobacterium radiobacter strain K84 (e.g. GALLTROL-A® from AgBioChem, CA) + TX, Bacillus amyloliquefaciens isolate B246 (e.g. AVOGREEN™ from University of Pretoria) + TX, Bacillus amyloliquefaciens strain F727 (also known as strain MBI110) (NRRL Accession No. B-50768, WO 2014/028521) (STARGUS® from Marrone Bio Innovations) + TX, Bacillus amyloliquefaciens strain FZB42, Accession No. DSM 23117 (available as RHIZOVITAL® from ABiTEP, DE) + TX, Bacillus amyloliquefaciens, in particular strain D747 (available as Double Nickel™ from Kumiai Chemical Industry Co., Ltd., having accession number FERM BP-8234, US Patent No. 7,094,592) + TX, Bacillus licheniformis FMCH001 and Bacillus subtilis FMCH002 (QUARTZO® (WG) and PRESENCE® (WP) from FMC Corporation) + TX, Bacillus licheniformis, in particular strain SB3086, having Accession No. ATCC 55406, WO 2003/000051 (available as ECOGUARD® Biofungicide and GREEN RELEAF™ from Novozymes) + TX, Bacillus methylotrophicus strain BAC-9912 (from Chinese Academy of Sciences' Institute of Applied Ecology) + TX, Bacillus mycoides, isolate, having Accession No. B-

30890 (available as BMJ TGA1® or WG and LifeGard™ from Certis USA LLC) + TX, *Bacillus pumilus*, in particular strain GB34 (available as Yield Shield® from Bayer AG, DE) + TX, *Bacillus pumilus*, in particular strain QST2808 (available as SONATA® from Bayer CropScience LP, US, having Accession No. NRRL B-30087 and described in U.S. Patent No. 6,245,551) + TX, *Bacillus subtilis* CX-9060 from Certis USA LLC + TX, *Bacillus subtilis* IAB/BS03 (AVIV™ from STK Bio-Ag Technologies, PORTENTO® from Idai Nature) + TX, *Bacillus subtilis* KTSB strain (FOLIACTIVE® from Donaghys) + TX, *Bacillus subtilis* strain BU1814, (available as VELONDIS® PLUS, VELONDIS® FLEX and VELONDIS® EXTRA from BASF SE) + TX, *Bacillus subtilis* strain GB03 (available as Kodiak® from Bayer AG, DE) + TX, *Bacillus subtilis* strain MBI 600 (available as SUBTILEX from BASF SE), having Accession Number NRRL B-50595, U.S. Patent No. 5,061,495 + TX, *Bacillus subtilis* strain Y1336 (available as BIOBAC® WP from Bion-Tech, Taiwan, registered as a biological fungicide in Taiwan under Registration Nos. 4764, 5454, 5096 and 5277) + TX, *Bacillus subtilis* var. *amyloliquefaciens* strain FZB24 having Accession No. DSM 10271 (available from Novozymes as TAEGRO® or TAEGRO® ECO (EPA Registration No. 70127-5)) + TX, *Bacillus subtilis* Y1336 (available as BIOBAC® WP from Bion-Tech, Taiwan, registered as a biological fungicide in Taiwan under Registration Nos. 4764, 5454, 5096 and 5277) + TX, *Paenibacillus epiphyticus* (WO 2016/020371) from BASF SE + TX, *Paenibacillus polymyxa* ssp. *plantarum* (WO 2016/020371) from BASF SE + TX, *Paenibacillus* sp. strain having Accession No. NRRL B-50972 or Accession No. NRRL B-67129, WO 2016/154297 + TX, *Pseudomonas chlororaphis* strain AFS009, having Accession No. NRRL B-50897, WO 2017/019448 (e.g., HOWLER™ and ZIO® from AgBiome Innovations, US) + TX, *Pseudomonas chlororaphis*, in particular strain MA342 (e.g. CEDOMON®, CERALL®, and CEDRESS® by Bioagri and Koppert) + TX, *Pseudomonas fluorescens* strain A506 (e.g. BLIGHTBAN® A506 by NuFarm) + TX, *Pseudomonas proradix* (e.g. PRORADIX® from Sourcon Padena) + TX, *Streptomyces griseoviridis* strain K61 (also known as *Streptomyces galbus* strain K61) (Accession No. DSM 7206) (MYCOSTOP® from Verdera, PREFENCE® from BioWorks, cf. Crop Protection 2006, 25, 468-475) + TX, *Streptomyces lydicus* strain WYEC108 (also known as *Streptomyces lydicus* strain WYCD108US) (ACTINO-IRON® and ACTINOVATE® from Novozymes) + TX;

Trichoderma atroviride strain T11 (IMI352941/ CECT20498) + TX, *Ampelomyces quisqualis* strain AQ10, having Accession No. CNCM 1-807 (e.g., AQ 10® by IntrachemBio Italia) + TX, *Ampelomyces quisqualis*, in particular strain AQ 10 (e.g. AQ 10® by IntrachemBio Italia) + TX, *Aspergillus flavus* strain NRRL 21882 (products known as AFLA-GUARD® from Syngenta/ChemChina) + TX, *Aureobasidium pullulans*, in particular blastospores of strain DSM 14941 + TX, *Aureobasidium pullulans*, in particular blastospores of strain DSM14940 + TX, *Aureobasidium pullulans*, in particular mixtures of blastospores of strains DSM14940 and DSM 14941 (e.g. Botector® by bio-ferm, CH) + TX, *Chaetomium cupreum* (Accession No. CABI 353812) (e.g. BLOKUPRUM™ by AgriLife) + TX, *Chaetomium globosum* (available as RIVADIOM® by Rivale) + TX, *Cladosporium cladosporioides*, strain H39, having Accession No. CBS122244, US 2010/0291039 (by Stichting Dienst Landbouwkundig Onderzoek) + TX, *Coniothyrium minitans*, in particular strain CON/M/91-8 (Accession No. DSM9660, e.g. Contans ® from Bayer CropScience Biologics GmbH) + TX,

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Cryptococcus flavescens, strain 3C (NRRL Y-50378), + TX, *Dactylaria candida*, *Dilophosphora alopecuri* (available as TWIST FUNGUS®), *Fusarium oxysporum*, strain Fo47 (available as FUSACLEAN® by Natural Plant Protection) + TX, *Gliocladium catenulatum* (Synonym: *Clonostachys rosea* f. *catenulate*) strain J1446 (e.g. Prestop® by Lallemand) + TX, *Gliocladium roseum* (also known as *Clonostachys rosea* f. *rosea*) strain IK726 (Jensen DF, et al. Development of a biocontrol agent for plant disease control with special emphasis on the near commercial fungal antagonist *Clonostachys rosea* strain 'IK726', Australasian Plant Pathol. 2007,36(2):95-101) + TX, *Gliocladium roseum* (also known as *Clonostachys rosea* f. *rosea*), in particular strain 321U from Adjuvants Plus, strain ACM941 as disclosed in Xue A.G. (Efficacy of *Clonostachys rosea* strain ACM941 and fungicide seed treatments for controlling the root rot complex of field pea, Can Jour Plant Sci 2003, 83(3): 519-524) + TX, *Metschnikowia fructicola*, in particular strain NRRL Y-30752 + TX, *Microsphaeropsis ochracea*, *Penicillium steckii* (DSM 27859, WO 2015/067800) from BASF SE + TX, mixtures of *Trichoderma asperellum* strain ICC 012 (also known as *Trichoderma harzianum* ICC012), having Accession No. CABI CC IMI 392716 and *Trichoderma gamsii* (formerly *T. viride*) strain ICC 080, having Accession No. IMI 392151 (e.g., BIO-TAM™ from Isagro USA, Inc. or BIODERMA® by Agrobiosol de Mexico, S.A. de C.V.) + TX, *Penicillium vermiculatum* + TX, *Phlebiopsis gigantea* strain VRA 1992 (ROTSTOP® C from Danstar Ferment) + TX, *Pseudozyma flocculosa*, strain PF-A22 UL (available as SPORODEX® L by Plant Products Co., CA) + TX, *Saccharomyces cerevisiae* strain LAS117 cell walls (CEREVISANE® from Lesaffre, ROMEO® from BASF SE) + TX, *Saccharomyces cerevisiae* strains CNCM No. 1-3936, CNCM No. 1-3937, CNCM No. 1-3938, CNCM No. 1-3939 (WO 2010/086790) from Lesaffre et Compagnie, FR + TX, *Saccharomyces cerevisiae*, in particular strain LASO2 (from Agro-Levures et Dérivés) + TX, *Simplicillium lanosoniveum* + TX, strain T34 (e.g. T34 Biocontrol by Biocontrol Technologies S.L., ES) or strain ICC 012 from Isagro + TX, strain WRL-076 (NRRL Y-30842), U.S. Patent No. 7,579,183 + TX, *Talaromyces flavus*, strain V117b + TX, *Trichoderma asperelloides* JM41R (Accession No. NRRL B-50759) (TRICHO PLUS® from BASF SE) + TX, *Trichoderma asperellum*, in particular strain SKT-1, having Accession No. FERM P-16510 (e.g. ECO-HOPE® from Kumiai Chemical Industry) + TX, *Trichoderma asperellum*, in particular, strain kd (e.g. T-Gro from Andermatt Biocontrol) + TX, *Trichoderma atroviride* strain 77B (T77 from Andermatt Biocontrol) + TX, *Trichoderma atroviride* strain ATCC 20476 (IMI 206040) + TX, *Trichoderma atroviride* strain LC52 (e.g. Tenet by Agrimm Technologies Limited) + TX, *Trichoderma atroviride* strain LU132 (e.g. Sentinel from Agrimm Technologies Limited) + TX, *Trichoderma atroviride* strain NMI no. V08/002388 + TX, *Trichoderma atroviride* strain NMI no. V08/002389 + TX, *Trichoderma atroviride* strain NMI no. V08/002390 + TX, *Trichoderma atroviride* strain no. V08/002387 + TX, *Trichoderma atroviride* strain SKT-1 (FERM P-16510), JP Patent Publication (Kokai) 11-253151 A + TX, *Trichoderma atroviride* strain SKT-2 (FERM P-16511), JP Patent Publication (Kokai) 11-253151 A + TX, *Trichoderma atroviride* strain SKT-3 (FERM P-17021), JP Patent Publication (Kokai) 11-253151 A + TX, *Trichoderma atroviride*, in particular strain SC1 (Accession No. CBS 122089, WO 2009/116106 and U.S. Patent No. 8,431,120 (from Bi-PA)) + TX, *Trichoderma atroviride*, strain CNCM 1-1237 (e.g. Esquive® WP from Agrauxine, FR) + TX, *Trichoderma fertile* (e.g. product TrichoPlus

from BASF) + TX, *Trichoderma gamsii* (formerly *T. viride*) + TX, *Trichoderma gamsii* (formerly *T. viride*) strain ICC 080 (IMI CC 392151 CABI) (available as BIODERMA® by AGROBIOSOL DE MEXICO, S.A. DE C.V.), + TX, *Trichoderma gamsii* strain ICC080 (IMI CC 392151 CABI, e.g. BioDerma by AGROBIOSOL DE MEXICO, S.A. DE C.V.), + TX, *Trichoderma harmatum* + TX,

5 *Trichoderma harmatum*, having Accession No. ATCC 28012 + TX, *Trichoderma harzianum* + TX, *Trichoderma harzianum* rifai T39 (e.g. Trichodex® from Makhteshim, US) + TX, *Trichoderma harzianum* strain Cepa SimbT5 (from Simbiose Agro), + TX, *Trichoderma harzianum* strain DB 103 (available as T-GRO® 7456 by Dagutat Biolab) + TX, *Trichoderma harzianum* strain ITEM 908 (e.g. Trianum-P from Koppert) + TX, *Trichoderma harzianum* strain T-22 (e.g. Trianum-P from Andermatt

10 Biocontrol or Koppert) + TX, *Trichoderma harzianum* strain TH35 (e.g. Root-Pro by Mycontrol) + TX, *Trichoderma polysporum* strain IMI 206039 (e.g. Binab TF WP by BINAB Bio-Innovation AB, Sweden) + TX, *Trichoderma stromaticum* having Accession No. Ts3550 (e.g. Tricovab by CEPLAC, Brazil) + TX, *Trichoderma virens* (also known as *Gliocladium virens*) in particular strain GL-21 (e.g. SoilGard by Certis, US) + TX, *Trichoderma virens* strain G-41, formerly known as *Gliocladium virens* (Accession

15 No. ATCC 20906) (e.g., ROOTSHIELD® PLUS WP and TURFSHIELD® PLUS WP from BioWorks, US) + TX, *Trichoderma viride* in particular strain B35 (Pietr et al., 1993, Zesz. Nauk. A R w Szczecinie 161: 125-137) + TX, *Trichoderma viride* strain TV1 (e.g. Trianum-P by Koppert) + TX, *Ulocladium oudemansii* strain U3, having Accession No. NM 99/06216 (e.g., BOTRY-ZEN® by Botry-Zen Ltd, New Zealand and BOTRYSTOP® from BioWorks, Inc.) + TX, *Verticillium albo-atrum* (formerly *V. dahliae*) strain WCS850 having Accession No. WCS850, deposited at the Central Bureau for Fungi

20 Cultures (e.g., DUTCH TRIG® by Tree Care Innovations) + TX, *Verticillium chlamydosporium* + TX; a mixture of *Azotobacter vinelandii* and *Clostridium pasteurianum* (available as INVIGORATE® from Agrinos) + TX, a mixture of *Bacillus licheniformis* FMCH001 and *Bacillus subtilis* FMCH002 (available as QUARTZO® (WG), PRESENCE® (WP) from FMC Corporation) + TX, *Azorhizobium caulinodans*,

25 in particular strain ZB-SK-5 + TX, *Azospirillum brasilense* (e.g., VIGOR® from KALO, Inc.) + TX, *Azospirillum lipoferum* (e.g., VERTEX-IF™ from TerraMax, Inc.) + TX, *Azotobacter chroococcum*, in particular strain H23 + TX, *Azotobacter vinelandii*, in particular strain ATCC 12837 + TX, *Bacillus amyloliquefaciens* BS27 (Accession No. NRRL B-5015) + TX, *Bacillus amyloliquefaciens* in particular strain FZB42 (e.g. RHIZOVITAL® from ABiTEP, DE) + TX, *Bacillus amyloliquefaciens* in particular

30 strain IN937a + TX, *Bacillus amyloliquefaciens* pm414 (LOLI-PEPTA® from Biofilm Crop Protection) + TX, *Bacillus amyloliquefaciens* SB3281 (ATCC # PTA-7542, WO 2017/205258) + TX, *Bacillus amyloliquefaciens* TJ1000 (available as QUIKROOTS® from Novozymes) + TX, *Bacillus cereus* family member EE128 (NRRL No. B-50917) + TX, *Bacillus cereus* family member EE349 (NRRL No. B-50928) + TX, *Bacillus cereus* in particular strain BP01 (ATCC 55675, e.g. MEPICHLOR® from Arysta

35 Lifescience, US) + TX, *Bacillus mycoides* BT155 (NRRL No. B-50921) + TX, *Bacillus mycoides* BT46-3 (NRRL No. B-50922) + TX, *Bacillus mycoides* EE118 (NRRL No. B-50918) + TX, *Bacillus mycoides* EE141 (NRRL No. B-50916) + TX, *Bacillus pumilus* in particular strain GB34 (e.g. YIELD SHIELD® from Bayer Crop Science, DE), + TX, *Bacillus pumilus* in particular strain QST2808 (Accession No. NRRL No. B-30087) + TX, *Bacillus siamensis* in particular strain KCTC 13613T + TX, *Bacillus subtilis*

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in particular strain AQ30002 (Accession No. NRRL No. B-50421 and described in U.S. Patent Application No. 13/330,576) + TX, *Bacillus subtilis* in particular strain AQ30004 (NRRL No. B-50455 and described in U.S. Patent Application No. 13/330,576) + TX, *Bacillus subtilis* in particular strain MBI 600 (e.g. SUBTILEX® from BASF SE) + TX, *Bacillus subtilis* rm303 (RHIZOMAX® from Biofilm Crop Protection) + TX, *Bacillus subtilis* strain BU1814 (available as TEQUALIS® from BASF SE) + TX, *Bacillus tequilensis* in particular strain NII-0943 + TX, *Bacillus thuringiensis* BT013A (NRRL No. B-50924) also known as *Bacillus thuringiensis* 4Q7 + TX, *Bradyrhizobium japonicum* (e.g. OPTIMIZE® from Novozymes) + TX, *Delftia acidovorans* in particular strain RAY209 (e.g. BIOBOOST® from Brett Young Seeds) + TX, *Lactobacillus* sp. (e.g. LACTOPLANT® from LactoPAFI) + TX, *Mesorhizobium cicer* (e.g., NODULATOR from BASF SE) + TX, *Paenibacillus polymyxa* in particular strain AC-1 (e.g. TOPSEED® from Green Biotech Company Ltd.) + TX, *Pseudomonas aeruginosa* in particular strain PN1 + TX, *Pseudomonas proradix* (e.g. PRORADIX® from Sourcon Padena) + TX, *Rhizobium leguminosarium* biovar *viciae* (e.g., NODULATOR from BASF SE) + TX, *Rhizobium leguminosarum* in particular bv. *viciae* strain Z25 (Accession No. CECT 4585) + TX, *Serratia marcescens* in particular strain SRM (Accession No. MTCC 8708), + TX, *Sinorhizobium meliloti* strain NRG-185-1 (NITRAGIN® GOLD from Bayer CropScience) + TX, *Thiobacillus* sp. (e.g. CROPAID® from Cropaid Ltd UK) + TX;

Myrothecium verrucaria strain AARC-0255 (e.g. DiTera™ from Valent Biosciences) + TX, *Penicillium bilaii* strain ATCC 22348 (e.g. JumpStart® from Acceleron BioAg) + TX, *Penicillium bilaii* strain ATCC 20851 + TX, *Purpureocillium lilacinum* (previously known as *Paecilomyces lilacinus*) strain 251 (AGAL 89/030550, e.g. BioAct from Bayer CropScience Biologics GmbH) + TX, *Pythium oligandrum* strain DV74 + TX, *Pythium oligandrum* strain M1 (ATCC 38472 e.g. Polyversum from Bioprepaty, CZ) + TX, *Rhizopogon amylopogon* (Myco-Sol from Agri-Enterprise, LLC, formerly Helena Chemical Company) + TX, *Rhizopogon fulvigleba* (e.g. Myco-Sol from Agri-Enterprise, LLC, formerly Helena Chemical Company) + TX, *Talaromyces flavus* strain V117b + TX, *Trichoderma asperellum* strain (Eco-T from Plant Health Products, ZA) + TX, *Trichoderma asperellum* strain kd (e.g. T-Gro from Andermatt Biocontrol) + TX, *Trichoderma atroviride* in particular strain no. V08/002387 + TX, *Trichoderma atroviride* strain CNCM 1-1237 (e.g. Esquive® WP from Agrauxine, FR) + TX, *Trichoderma atroviride* strain LC52 (also known as *Trichoderma atroviride* strain LU132, e.g. Sentinel from Agrimm Technologies Limited) + TX, *Trichoderma atroviride* strain no. NMI No. V08/002388 + TX, *Trichoderma atroviride* strain no. NMI No. V08/002389 + TX, *Trichoderma atroviride* strain no. NMI No. V08/002390 + TX, *Trichoderma atroviride* strain SC1 (described in WO2009/116106) + TX, *Trichoderma harzianum* strain 1295-22 + TX, *Trichoderma harzianum* strain ITEM 908 + TX, *Trichoderma harzianum* strain T-22 (e.g. Trianum-P from Andermatt Biocontrol or Koppert) + TX, *Trichoderma harzianum* strain TSTh20, + TX, *Trichoderma virens* strain GI-3 + TX, *Trichoderma virens* strain GL-21 (e.g. SoilGard® from Certis, USA) + TX, *Trichoderma viride* strain B35 (Pietr et al., 1993, Zesz. Nauk. A R w Szczecinie 161: 125-137) + TX, *Verticillium albo-atrum* (formerly *V. dahliae*) strain WCS850 (CBS 276.92, e.g. Dutch Trig from Tree Care Innovations) + TX;

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Agrobacterium radiobacter strain K84 (Galltrol from AgBiochem Inc.), + TX, Bacillus
 amyloliquefaciens in particular strain PTS-4838 (e.g. AVEO from Valent Biosciences, US), + TX,
 Bacillus mycoides, isolate J. (e.g. BmJ from Certis USA LLC), + TX, Bacillus sphaericus in particular
 Serotype H5a5b strain 2362 (strain ABTS-1743) (e.g. VECTOLEX® from Valent BioSciences, US), +
 5 TX, Bacillus thuringiensis israelensis strain BMP 144 (e.g. AQUABAC® by Becker Microbial Products
 IL) + TX, Bacillus thuringiensis subsp. aizawai strain GC-91 + TX, Bacillus thuringiensis subsp.
 aizawai, in particular serotype H-7 (e.g. FLORBAC® WG from Valent BioSciences, US) + TX, Bacillus
 thuringiensis subsp. aizawai, in particular strain ABTS-1857 (SD-1372, e.g. XENTARI® from Valent
 BioSciences) + TX, Bacillus thuringiensis subsp. israelensis (serotype H-14) strain AM65-52
 10 (Accession No. ATCC 1276) (e.g. VECTOBAC® by Valent BioSciences, US) + TX, Bacillus
 thuringiensis subsp. kurstaki strain ABTS 351 + TX, Bacillus thuringiensis subsp. kurstaki strain BMP
 123 (from Becker Microbial Products, IL, BARITONE from Bayer CropScience) + TX, Bacillus
 thuringiensis subsp. kurstaki strain EG 2348 (LEPINOX from Certis, US) + TX, Bacillus thuringiensis
 subsp. kurstaki strain EG 7841 (CRYMAX from Certis, US) + TX, Bacillus thuringiensis subsp. kurstaki
 15 strain HD-1 (e.g. DIPEL® ES from Valent BioSciences, US) + TX, Bacillus thuringiensis subsp.
 kurstaki strain PB 54 + TX, Bacillus thuringiensis subsp. kurstaki strain SA 11 (JAVELIN from Certis,
 US) + TX, Bacillus thuringiensis subsp. kurstaki strain SA 12 (THURICIDE from Certis, US) + TX,
 Bacillus thuringiensis subsp. tenebrionis strain NB 176 (SD-5428, e.g. NOVODOR® FC from BioFa
 DE) + TX, Bacillus thuringiensis var. Colmeri (e.g. TIANBAOBTC by Changzhou Jianghai Chemical
 20 Factory) + TX, Bacillus thuringiensis var. japonensis strain Buibui + TX, Bacillus thuringiensis var.
 kurstaki strain EVB-113-19 (e.g., BIOPROTEC® from AEF Global) + TX, Brevibacillus laterosporus +
 TX, Burkholderia spp. in particular Burkholderia rinojensis strain A396 (also known as Burkholderia
 rinojensis strain MBI 305) (Accession No. NRRL B-50319, WO 2011/106491 and WO 2013/032693,
 e.g. MBI206 TGA1 and ZELTO® from Marrone Bio Innovations), + TX, Chromobacterium subtsugae in
 25 particular strain PRAA4-1T (e.g. MBI-203, e.g. GRANDEVO® from Marrone Bio Innovations) + TX,
 Lecanicillium muscarium Ve6 (MYCOTAL from Koppert) + TX, Paenibacillus popilliae (formerly
 Bacillus popilliae, e.g. MILKY SPORE POWDER™ or MILKY SPORE GRANULAR™ from St. Gabriel
 Laboratories) + TX, Serratia entomophila (e.g. INVADE® by Wrightson Seeds) + TX, Serratia
 marcescens in particular strain SRM (Accession No. MTCC 8708) + TX, Trichoderma asperellum
 30 (TRICHODERMAX from Novozymes) + TX, Wolbachia pipientis ZAP strain (e.g., ZAP MALES® from
 MosquitoMate) + TX;
 Beauveria bassiana strain ATCC 74040 (e.g. NATURALIS® from Intrachem Bio Italia) + TX,
 Beauveria bassiana strain ATP02 (Accession No. DSM 24665), Apopka 97 (PREFERAL from SePRO)
 + TX, Beauveria bassiana strain GHA (Accession No. ATCC74250, e.g. BOTANIGUARD® ES and
 35 MYCONTROL-O® from Laverlam International Corporation) + TX, Metarhizium anisopliae 3213-1
 (deposited under NRRL accession number 67074 disclosed in WO 2017/066094, Pioneer Hi-Bred
 International) + TX, Metarhizium robertsii 15013-1 (deposited under NRRL accession number 67073)
 + TX, Metarhizium robertsii 23013-3 (deposited under NRRL accession number 67075) + TX,
 Paecilomyces lilacinus strain 251 (MELOCON from Certis, US) + TX;

Cydia pomonella (codling moth) granulosis virus (GV) + TX, Helicoverpa armigera (cotton bollworm) nuclear polyhedrosis virus (NPV) + TX, of Adoxophyes orana (summer fruit tortrix) granulosis virus (GV) + TX, Spodoptera exigua (beet armyworm) mNPV + TX, Spodoptera frugiperda (fall armyworm) mNPV + TX;

- 5 Burkholderia spp. in particular Burkholderia cepacia (formerly known as Pseudomonas cepacia) + TX, Gigaspora spp. + TX, Glomus spp. + TX, Laccaria spp. + TX, LactoBacillus buchneri + TX, Paraglomus spp. + TX, Pisolithus tinctorius + TX, Pseudomonas spp. + TX, Rhizobium spp. in particular Rhizobium trifolii + TX, Rhizopogon spp. + TX, Scleroderma spp. + TX, Streptomyces spp. + TX, Suillus spp. + TX, Agrobacterium spp. + TX, Azorhizobium caulinodans + TX, Azospirillum spp. + TX, Azotobacter spp. + TX, Bradyrhizobium spp. + TX, Gigaspora monosporum + TX;
- 10 Allium sativum (NEMGUARD from Eco-Spray, BRALIC from ADAMA) + TX, Armour-Zen + TX, Artemisia absinthium + TX, Biokeeper WP + TX, Brassicaceae extract in particular oilseed rape powder or mustard powder + TX, Cassia nigricans + TX, Celastrus angulatus + TX, Chenopodium anthelminticum + TX, Chenopodium quinoa saponin extract from quinoa seeds (e.g. Heads Up® (Saponins of Quinoa) from Heads Up plant Protectants, CA) + TX, Chitin + TX, Dryopteris filix-mas + TX, Equisetum arvense + TX, Fortune Aza + TX, Fungastop + TX, Melaleuca alternifolia extract (TIMOREX GOLD from STK) + TX, naturally occurring Blad polypeptide extracted from Lupin seeds (FRACTURE® from FMC) + TX, naturally occurring Blad polypeptide extracted from Lupin seeds (PROBLAD® from Certis EU) + TX, Pyrethrins + TX, Quassia amara + TX, Quercus + TX, Quillaja extract (QL AGRI 35 from BASF) + TX, REGALIA MAXX from Marrone Bio) + TX, Requiem™
- 20 Insecticide + TX, Reynoutria sachalinensis extract (REGALLIA + TX, ryania/ryanodine + TX, Symphytum officinale + TX, Tanacetum vulgare + TX, Thymol + TX, Thymol mixed with Geraniol (CEDROZ from Eden Research) + TX, Thymol mixed with Geraniol and Eugenol (MEVALONE from Eden Research) + TX, Triact 70 + TX, TriCon + TX, Tropaeolum majus + TX, Urtica dioica + TX,
- 25 Veratrin + TX, Viscum album + TX;
- mercuric oxide + TX, octhilinone + TX, thiophanate-methyl + TX;
- MGK 264 + TX, 2-(2-butoxyethoxy)-ethyl piperonylate + TX, 2-isovalerylindan-1,3-dione + TX, 4-(quinoxalin-2-ylamino)benzenesulfonamide + TX, 5-(1,3-benzodioxol-5-yl)-3-hexylcyclohex-2-enone + TX, acibenzolar + TX, acibenzolar-S-methyl + TX, alpha-bromadiolone + TX, alpha-chlorohydrin + TX,
- 30 aluminium phosphide + TX, anthraquinone + TX, antu + TX, arsenous oxide + TX, barium carbonate + TX, benoxacor + TX, bisthiosemi + TX, brodifacoum + TX, bromadiolone + TX, bromethalin + TX, calcium cyanide + TX, chloralose + TX, chlorophacinone + TX, cholecalciferol + TX, cloquintocet (including cloquintocet-mexyl) + TX, copper naphthenate + TX, copper oxychloride + TX, coumachlor + TX, coumafuryl + TX, coumatetralyl + TX, crimidine + TX, cyprosulfamide + TX, diazinon + TX,
- 35 dichlormid + TX, dicyclopentadiene + TX, difenacoum + TX, difethialone + TX, diphacinone + TX, ergocalciferol + TX, farnesol + TX, farnesol with nerolidol + TX, fenchlorazole (including fenchlorazole-ethyl) + TX, fenclorim + TX, flocoumafen + TX, fluoroacetamide + TX, flupropadine + TX, flupropadine hydrochloride + TX, fluxofenim + TX, furilazole + TX, gamma-HCH + TX, guazatine + TX, guazatine acetates + TX, HCH + TX, hydrogen cyanide + TX, imanin + TX, iodomethane + TX, isoxadifen

(including isoxadifen-ethyl) + TX, lindane + TX, magnesium phosphide + TX, MB-599 + TX, mefenpyr (including mefenpyr-diethyl) + TX, metcamifen + TX, methiocarb + TX, methyl bromide + TX, nerolidol + TX, norbormide + TX, petroleum oils + TX, phosacetim + TX, phosphine + TX, phosphorus + TX, pindone + TX, piperonyl butoxide + TX, piprotal + TX, potassium arsenite + TX, probenazole + TX, propyl isomer + TX, pyridin-4-amine + TX, pyrinuron + TX, Reynoutria sachalinensis extract + TX, ribavirin + TX, S421 + TX, scilliroside + TX, sesamex + TX, sesasmolin + TX, sodium arsenite + TX, sodium cyanide + TX, sodium fluoroacetate + TX, strychnine + TX, sulfoxide + TX, thallium sulfate + TX, thiram + TX, trimethacarb + TX, warfarin + TX, zinc naphthenate + TX, zinc phosphide + TX, ziram + TX.

The references in brackets behind the active ingredients (if present), e.g. [3878-19-1] refer to the Chemical Abstracts Registry number. The above described mixing partners are known. Where the active ingredients are included in "The Pesticide Manual" [The Pesticide Manual - A World Compendium; Thirteenth Edition; Editor: C. D. S. Tomlin; The British Crop Protection Council], they are described therein under the entry number given in round brackets hereinabove for the particular compound; for example, the compound "abamectin" is described under entry number (1). Where "[CCN]" is added hereinabove to the particular compound, the compound in question is included in the "Compendium of Pesticide Common Names", which is accessible on the internet [A. Wood; Compendium of Pesticide Common Names, Copyright © 1995-2004]; for example, the compound "acetoprole" is described under the internet address <http://www.alanwood.net/pesticides/acetoprole.html>.

Most of the active ingredients described above are referred to hereinabove by a so-called "common name", the relevant "ISO common name" or another "common name" being used in individual cases. If the designation is not a "common name", the nature of the designation used instead is given in round brackets for the particular compound; in that case, the IUPAC name, the IUPAC/Chemical Abstracts name, a "chemical name", a "traditional name", a "compound name" or a "development code" is used or, if neither one of those designations nor a "common name" is used, an "alternative name" is employed. "CAS Reg. No" means the Chemical Abstracts Registry Number.

The active ingredient mixture of the compounds of formula (I) selected from the compounds defined in the Tables 1 to 4 and Tables P1 to P2 with active ingredients described above comprises a compound selected from one compound defined in the Tables 1 to 4 and Tables P1 to P2 and an active ingredient as described above preferably in a mixing ratio of from 100:1 to 1:6000, especially from 50:1 to 1:50, more especially in a ratio of from 20:1 to 1:20, even more especially from 10:1 to 1:10, very especially from 5:1 and 1:5, special preference being given to a ratio of from 2:1 to 1:2, and a ratio of from 4:1 to 2:1 being likewise preferred, above all in a ratio of 1:1, or 5:1, or 5:2, or 5:3, or 5:4, or 4:1, or 4:2, or 4:3, or 3:1, or 3:2, or 2:1, or 1:5, or 2:5, or 3:5, or 4:5, or 1:4, or 2:4, or 3:4, or 1:3, or 2:3, or 1:2, or 1:600, or 1:300, or 1:150, or 1:35, or 2:35, or 4:35, or 1:75, or 2:75, or 4:75, or 1:6000,

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or 1:3000, or 1:1500, or 1:350, or 2:350, or 4:350, or 1:750, or 2:750, or 4:750. Those mixing ratios are by weight.

The mixtures as described above can be used in a method for controlling pests, which comprises applying a composition comprising a mixture as described above to the pests or their environment, with the exception of a method for treatment of the human or animal body by surgery or therapy and diagnostic methods practised on the human or animal body.

The mixtures comprising a compound of formula (I) selected from the compounds defined in the Tables 1 to 4 and Tables P1 to P2 and one or more active ingredients as described above can be applied, for example, in a single "ready-mix" form, in a combined spray mixture composed from separate formulations of the single active ingredient components, such as a "tank-mix", and in a combined use of the single active ingredients when applied in a sequential manner, i.e. one after the other with a reasonably short period, such as a few hours or days. The order of applying the compounds of formula (I) and the active ingredients as described above is not essential for working the present invention.

The compositions according to the invention can also comprise further solid or liquid auxiliaries, such as stabilizers, for example unepoxidized or epoxidized vegetable oils (for example epoxidized coconut oil, rapeseed oil or soya oil), antifoams, for example silicone oil, preservatives, viscosity regulators, binders and/or tackifiers, fertilizers or other active ingredients for achieving specific effects, for example bactericides, fungicides, nematocides, plant activators, molluscicides or herbicides.

The compositions according to the invention are prepared in a manner known per se, in the absence of auxiliaries for example by grinding, screening and/or compressing a solid active ingredient and in the presence of at least one auxiliary for example by intimately mixing and/or grinding the active ingredient with the auxiliary (auxiliaries). These processes for the preparation of the compositions and the use of the compounds (I) for the preparation of these compositions are also a subject of the invention.

The application methods for the compositions, that is the methods of controlling pests of the abovementioned type, such as spraying, atomizing, dusting, brushing on, dressing, scattering or pouring - which are to be selected to suit the intended aims of the prevailing circumstances - and the use of the compositions for controlling pests of the abovementioned type are other subjects of the invention. Typical rates of concentration are between 0.1 and 1000 ppm, preferably between 0.1 and 500 ppm, of active ingredient. The rate of application per hectare is generally 1 to 2000 g of active ingredient per hectare, in particular 10 to 1000 g/ha, preferably 10 to 600 g/ha.

A preferred method of application in the field of crop protection is application to the foliage of the plants (foliar application), it being possible to select frequency and rate of application to match the danger of infestation with the pest in question. Alternatively, the active ingredient can reach the plants via the root system (systemic action), by drenching the locus of the plants with a liquid composition or by incorporating the active ingredient in solid form into the locus of the plants, for example into the soil, for example in the form of granules (soil application). In the case of paddy rice crops, such granules can be metered into the flooded paddy-field.

The compounds of formula (I) of the invention and compositions thereof are also be suitable for the protection of plant propagation material, for example seeds, such as fruit, tubers or kernels, or nursery plants, against pests of the abovementioned type. The propagation material can be treated with the compound prior to planting, for example seed can be treated prior to sowing. Alternatively, the compound can be applied to seed kernels (coating), either by soaking the kernels in a liquid composition or by applying a layer of a solid composition. It is also possible to apply the compositions when the propagation material is planted to the site of application, for example into the seed furrow during drilling. These treatment methods for plant propagation material and the plant propagation material thus treated are further subjects of the invention. Typical treatment rates would depend on the plant and pest/fungi to be controlled and are generally between 1 to 200 grams per 100 kg of seeds, preferably between 5 to 150 grams per 100 kg of seeds, such as between 10 to 100 grams per 100 kg of seeds.

The term seed embraces seeds and plant propagules of all kinds including but not limited to true seeds, seed pieces, suckers, corns, bulbs, fruit, tubers, grains, rhizomes, cuttings, cut shoots and the like and means in a preferred embodiment true seeds.

The present invention also comprises seeds coated or treated with or containing a compound of formula I. The term "coated or treated with and/or containing" generally signifies that the active ingredient is for the most part on the surface of the seed at the time of application, although a greater or lesser part of the ingredient may penetrate into the seed material, depending on the method of application. When the said seed product is (re)planted, it may absorb the active ingredient. In an embodiment, the present invention makes available a plant propagation material adhered thereto with a compound of formula I. Further, it is hereby made available, a composition comprising a plant propagation material treated with a compound of formula I.

Seed treatment comprises all suitable seed treatment techniques known in the art, such as seed dressing, seed coating, seed dusting, seed soaking and seed pelleting. The seed treatment application of the compound formula (I) can be carried out by any known methods, such as spraying or by dusting the seeds before sowing or during the sowing/planting of the seeds.

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The compounds of the invention can be distinguished from other similar compounds by virtue of greater efficacy at low application rates and/or different pest control, which can be verified by the person skilled in the art using the experimental procedures, using lower concentrations if necessary, for example 10 ppm, 5 ppm, 2 ppm, 1 ppm or 0.2 ppm; or lower application rates, such as 300, 200 or 100, mg of AI per m². The greater efficacy can be observed by an increased safety profile (against non-target organisms above and below ground (such as fish, birds and bees), improved physico-chemical properties, or increased biodegradability).

In each aspect and embodiment of the invention, "consisting essentially" and inflections thereof are a preferred embodiment of "comprising" and its inflections, and "consisting of" and inflections thereof are a preferred embodiment of "consisting essentially of" and its inflections.

The disclosure in the present application makes available each and every combination of embodiments disclosed herein.

Biological Examples:

The Examples which follow serve to illustrate the invention. Certain compounds of the invention can be distinguished from known compounds by virtue of greater efficacy at low application rates, which can be verified by the person skilled in the art using the experimental procedures outlined in the Examples, using lower application rates if necessary, for example 50 ppm, 24 ppm, 12.5 ppm, 6 ppm, 3 ppm, 1.5 ppm, 0.8 ppm or 0.2 ppm.

Example B1: *Tetranychus urticae* (Two-spotted spider mite): Feeding/contact activity

Bean leaf discs on agar in 24-well microtiter plates were sprayed with aqueous test solutions prepared from 10'000 ppm DMSO stock solutions. After drying the leaf discs were infested with a mite population of mixed ages. The samples were assessed for mortality on mixed population (mobile stages) 6 days after infestation.

The following compounds resulted in at least 80% mortality at an application rate of 200 ppm:

P1.1 , P1.2 , P1.3, P1.4 , P1.5 , P1.6 , P1.7 , P1.8 , P1.9 , P1.10 , P1.11 , P1.12 , P1.13 , P1.14 , P1.15 , P1.16 , P1.17 , P1.18 , P1.19 , P1.20 , P1.21 , P1.22 , P1.23 , P1.24 , P1.25 , P1.26 , P1.27 , P1.28 , P1.29 , P1.30 , P1.31 , P1.32 , P1.33 , P2.1.

Comparison of P1.3 with C1.4 and C1.5

concentration in ppm	evaluation 6 days after application		
	C1.4	C1.5	P1.3
200	100	100	100
50	100	80	100
13	100	0	100

3	0	0	80
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Example B2: *Tetranychus urticae* (Two-spotted spider mite): Mixed population, feeding/contact

French bean plants infested with mixed aged mite population were sprayed 1 day after infestation in a spray chamber with diluted test solutions. 1 and 8 days later, samples at different concentrations were checked for, larval and adult mortality.

Compound C1.1

concentration in ppm	Tetranychus urticae adult mortality in %		Tetranychus urticae larval mortality in %	
	evaluation 1 day after application	evaluation 8 days after application	evaluation 1 day after application	evaluation 8 days after application
200	100	100	100	100
50	100	100	99	100
13	95	100	95	100
3	30	95	35	98
0.8	0	0	0	0

Compound P1.1

concentration in ppm	Tetranychus urticae adult mortality in %		Tetranychus urticae larval mortality in %	
	evaluation 1 day after application	evaluation 8 days after application	evaluation 1 day after application	evaluation 8 days after application
200	100	100	100	100
50	100	100	100	100
13	100	100	100	100
3	90	100	80	100
0.8	15	100	0	88

Compound C1.2

concentration in ppm	Tetranychus urticae adult mortality in %		Tetranychus urticae larval mortality in %	
	evaluation 1 day after application	evaluation 8 days after application	evaluation 1 day after application	evaluation 8 days after application
200	100	100	99	100
50	100	100	93	100
13	95	100	90	100
3	50	75	50	100
0.8	0	0	0	0

Compound P1.2

concentration in ppm	Tetranychus urticae adult mortality in %		Tetranychus urticae larval mortality in %	
	evaluation 1 day after application	evaluation 8 days after application	evaluation 1 day after application	evaluation 8 days after application
200	100	100	93	100

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50	100	100	90	100
13	100	100	90	100
3	100	100	90	99
0.8	50	100	50	97

Compound C1.4

concentration in ppm	Tetranychus urticae adult mortality in %		Tetranychus urticae larval mortality in %	
	evaluation 1 day after application	evaluation 8 days after application	evaluation 1 day after application	evaluation 8 days after application
200	100	100	100	100
50	80	100	65	100
13	60	100	60	100
3	0	80	20	80
0.8	0	0	0	0

Compound P1.3

concentration in ppm	Tetranychus urticae adult mortality in %		Tetranychus urticae larval mortality in %	
	evaluation 1 day after application	evaluation 8 days after application	evaluation 1 day after application	evaluation 8 days after application
200	99	100	100	100
50	99	100	100	100
13	100	100	100	100
3	90	100	99	100
0.8	45	100	65	95

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Compound C1.3

concentration in ppm	Tetranychus urticae adult mortality in %		Tetranychus urticae larval mortality in %	
	evaluation 1 day after application	evaluation 8 days after application	evaluation 1 day after application	evaluation 8 days after application
200	100	100	100	100
50	100	100	99	100
13	95	100	90	100
3	30	80	30	85
0.8	0	15	0	35

Compound P1.4

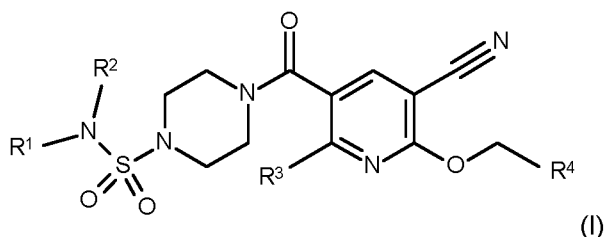
concentration in ppm	Tetranychus urticae adult mortality in %		Tetranychus urticae larval mortality in %	
	evaluation 1 day after application	evaluation 8 days after application	evaluation 1 day after application	evaluation 8 days after application
200	100	100	99	100
50	100	100	99	100
13	100	100	95	100
3	93	100	90	99

0.8	15	100	0	89
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CLAIMS

1. A compound of the formula (I)



wherein

- 5 R^1 is ethyl;
 R^2 is H or methyl;
 R^3 is C_1 - C_3 -alkyl, C_1 - C_3 -haloalkyl, C_3 - C_4 -cycloalkyl, or C_3 - C_4 -halocycloalkyl;
 R^4 is phenyl, phenyl substituted with 1 to 3 substituents R^5 , heteroaryl (which is either a 5 or 6
 10 membered monocyclic or a 9 or 10 membered bicyclic), or heteroaryl (which is either a 5 or 6
 membered monocyclic or a 9 or 10 membered bicyclic) substituted with 1 to 3 substituents R^6 ;
 R^5 and R^6 are independently selected from halogen, C_1 - C_3 -haloalkyl, and C_1 - C_3 -haloalkoxy; and in the
 event two C_1 - C_3 -haloalkoxy groups are substituted on adjacent atoms on the phenyl ring, then they
 may form together with the carbons of the phenyl ring a 5- or 6-membered ring (such as $-OC_1-C_2-$
 haloalkylo-);
 15 or an agrochemically acceptable salt, stereoisomer, enantiomer, tautomer and N-oxide of the
 compound of formula (I).
2. The compound according to either claim 1, wherein R^2 is methyl.
- 20 3. The compound according to either claim 1, wherein R^2 is H.
4. The compound according to any one of claims 1 to 3, wherein R^3 is methyl, difluoromethyl,
 trifluoromethyl or cyclopropyl.
- 25 5. The compound according to any one of claims 1 to 4, wherein R^4 is phenyl substituted with 1 to
 2 substituents independently selected from chlorine, fluorine, bromine, iodine, difluoromethyl,
 trifluoromethyl, difluoromethoxy, trifluoromethoxy, and an $-OCF_2-O-$ group (substituted on adjacent
 carbon atoms of the phenyl ring) forming together with the carbons of the phenyl ring a 5-membered
 30 ring.
6. The compound according to claim 1, wherein R^1 is ethyl; R^2 is H; R^3 is difluoromethyl or
 trifluoromethyl; and R^4 is phenyl substituted with 1 to 2 substituents independently selected from
 chlorine, fluorine, bromine, iodine, difluoromethyl, trifluoromethyl, difluoromethoxy, trifluoromethoxy,
 and an $-OCF_2-O-$ group (substituted on adjacent carbon atoms of the phenyl ring) forming together
 35 with the carbons of the phenyl ring a 5-membered ring.

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7. A composition comprising a compound as defined in any one of claims 1 to 6, one or more auxiliaries and diluent, and optionally one more other active ingredient.

8. A method

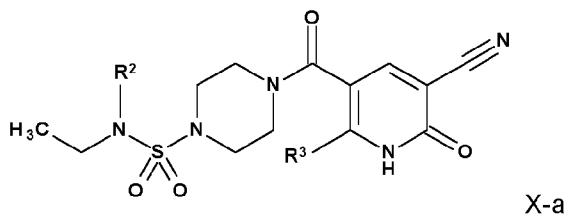
(i) of combating and controlling insects, acarines, nematodes or molluscs which comprises applying to a pest, to a locus of a pest, or to a plant susceptible to attack by a pest an insecticidally, acaricidally, nematocidally or molluscicidally effective amount of a compound as defined in any one of claims 1 to 6 or a composition as defined claim 7; or

(ii) for the protection of plant propagation material from the attack by insects, acarines, nematodes or molluscs, which comprises treating the propagation material or the site, where the propagation material is planted, with an effective amount of a compound as defined in any one of claims 1 to 6 or a composition as defined claim 7; or

(iii) of controlling parasites in or on an animal in need thereof comprising administering an effective amount of a compound as defined in any one of claims 1 to 6 or a composition as defined claim 7.

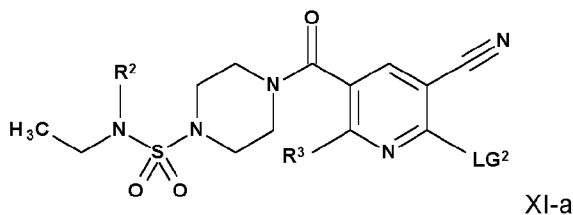
9. A plant propagation material, such as a seed, comprising, or treated with or adhered thereto, a compound as defined in any one of claims 1 to 6 or a composition as defined claim 7.

10. A compound of formula X-a



wherein R^2 and R^3 are as defined in claim 1.

11. A compound of XI-a



wherein R^2 and R^3 are as defined in claim 1, and LG^2 is chloro, bromo or fluoro.

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2024/079158

A. CLASSIFICATION OF SUBJECT MATTER

INV. C07D401/06 A01N43/60

ADD.

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)

C07D A01N

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 practicable, search terms used)

EPO-Internal, CHEM ABS Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2021/053161 A1 (SYNGENTA CROP PROTECTION AG [CH]) 25 March 2021 (2021-03-25) cited in the application	1 - 13
Y	Page 1, paragraph 1; Page 139, Table, entreis P8.7, P8.10; claims 1-12	1 - 13
Y	WO 2022/207462 A1 (SYNGENTA CROP PROTECTION AG [CH]) 6 October 2022 (2022-10-06) cited in the application Page 1, first paragraph; Page 104, table, entries P2.4, P2.5, P2.6; claims 1-14	1 - 13



Further documents are listed in the continuation of Box C.



See patent family 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 application or patent 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)

"O" 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

14 January 2025

Date of mailing of the international search report

03/02/2025

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Kleidernigg, Oliver

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2024/079158

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