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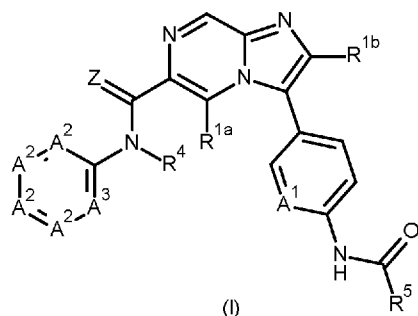
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(54) Title: IMIDAZO[1,2-A]PYRAZINE DERIVATIVES



(57) Abstract: The current invention relates to compounds of the formula (I) wherein the substituents are as defined in claim 1, to processes and methods for preparing compounds of formula (I), to agrochemical compositions comprising compounds of formula (I) as defined in claim 1, to preparation of these compositions and to the use of the compounds or compositions in agriculture or horticulture for combating, preventing or controlling infestation of plants, harvested food crops, seeds or non-living materials by phytopathogenic microorganisms, in particular fungi.

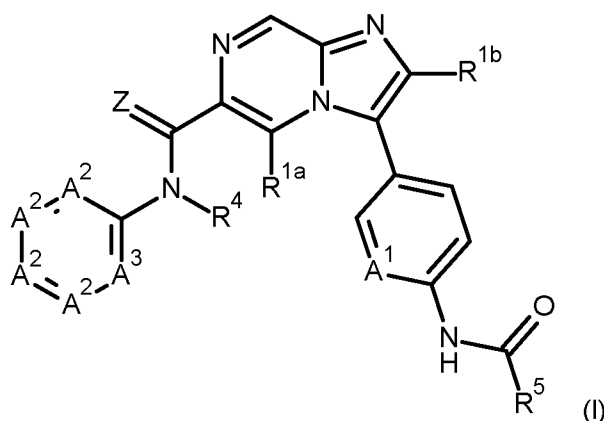
Imidazo[1,2-a]pyrazine derivatives

The present invention relates to microbiocidal imidazo[1,2-a]pyrazine derivatives, e.g. as active ingredients, which have microbiocidal activity, in particular fungicidal activity, more particularly activity
 5 against oomycetes. The invention also relates to preparation of these imidazo[1,2-a]pyrazine derivatives, to intermediates useful in the preparation of these imidazo[1,2-a]pyrazine derivatives, to the preparation of these intermediates, to agrochemical compositions which comprise at least one of the imidazo[1,2-a]pyrazine derivatives, to preparation of these compositions and to the use of the imidazo[1,2-a]pyrazine derivatives or compositions in agriculture or horticulture for combating,
 10 controlling or preventing infestation of plants, harvested food crops, seeds or non-living materials by phytopathogenic microorganisms, in particular fungi, more particularly oomycetes.

It has now surprisingly been found that certain novel imidazo[1,2-a]pyrazine derivatives have favourable fungicidal properties, in particular against oomycetes.

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Therefore, in a first aspect, the present invention provides compounds of formula (I), preferably used as a fungicide,



20 wherein Z is O or S, and preferably Z is O;

A¹ is CH or N, and preferably N;

R^{1a} and R^{1b} are independently selected from hydrogen, hydroxy, halogen, CN, C₁₋₆alkyl, C₃₋₆cycloalkyl,
 25 C₁₋₆alkoxy-C₁₋₆alkyl, C₃₋₆cycloalkyl-C₁₋₄alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, C₁₋₆alkoxy, amino, and NHC(O)C₁₋₆alkyl;

A² are independently CR² or N, with the proviso that no more than three A² are N, preferably no more than two A² are N, preferably no more than one A² is N, and more preferably the four A² are CR²;

30

R² are independently selected from hydrogen, hydroxy, halogen, CN, C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₂₋₆alkenyl, C₂₋₆alkynyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, C₁₋₆alkoxycarbonyl, C₁₋₆alkylaminocarbonyl, diC₁₋

alkylaminocarbonyl, and C₁₋₆alkylcarbonyl, wherein each of the C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₂₋₆alkenyl, C₂₋₆alkynyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, C₁₋₆alkoxycarbonyl, C₁₋₆alkylaminocarbonyl, diC₁₋₆alkylaminocarbonyl, and C₁₋₆alkylcarbonyl groups is optionally substituted with one to three substituents
 5 independently selected from halogen, hydroxy, and CN; and preferably with the proviso that at least two R² are not hydrogen;

A³ is independently CR³ or N;

10 R³ is selected from hydrogen, hydroxy, halogen, CN, C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₂₋₆alkenyl, C₂₋₆alkynyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, amino, C₁₋₆alkylamino, diC₁₋₆-alkylamino, and C₃₋₆cycloalkylamino, wherein each of the C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₂₋₆alkenyl, C₂₋₆alkynyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl,
 15 amino, C₁₋₆alkylamino, diC₁₋₆-alkylamino, and C₃₋₆cycloalkylamino groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN;

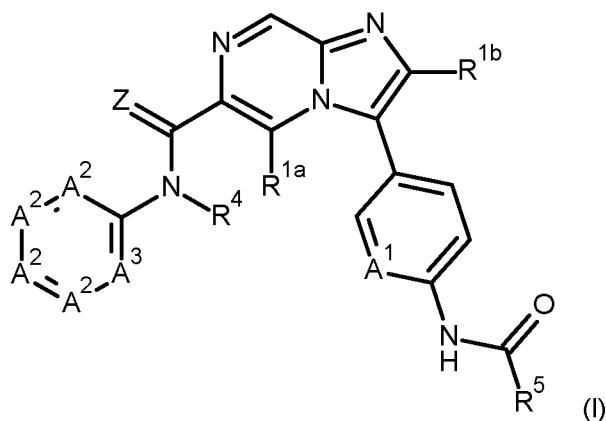
R⁴ is selected from C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₄alkyl, C₂₋₆alkenyl, C₂₋₆alkynyl, C₁₋₆alkoxy, C₁₋₆alkylsulfanyl-C₁₋₆alkyl, C₁₋₆alkylsulfinyl-C₁₋₆alkyl, C₁₋₆alkylsulfonyl-C₁₋₆alkyl, C₁₋₆alkoxycarbonyl-C₁₋₆alkyl, C₁₋₆alkylaminocarbonyl-C₁₋₆alkyl, diC₁₋₆alkylaminocarbonyl-C₁₋₆alkyl, and CN, wherein each of the C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₄alkyl, C₂₋₆alkenyl, C₂₋₆alkynyl, C₁₋₆alkoxy, C₁₋₆alkylsulfanyl-C₁₋₆alkyl, C₁₋₆alkylsulfinyl-C₁₋₆alkyl, C₁₋₆alkylsulfonyl-C₁₋₆alkyl, C₁₋₆alkoxycarbonyl-C₁₋₆alkyl, C₁₋₆alkylaminocarbonyl-C₁₋₆alkyl and diC₁₋₆alkylaminocarbonyl-C₁₋₆alkyl groups is optionally substituted with one to three substituents independently selected from halogen and
 25 CN;

wherein A³ and R⁴ taken together optionally form a ring, more preferably a 5-8-membered heterocycle, more preferably a 6-membered heterocycle; and

R⁵ is selected from C₁₋₆alkyl, C₁₋₆alkoxy, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkoxyC₁₋₆alkyl, C₁₋₆alkylamino, diC₁₋₆alkylamino, and C₁₋₆alkylC₁₋₆alkoxyamino, wherein each of said groups is optionally substituted with one to three substituents independently selected from halogen and CN;

or a salt or N-oxide thereof.

35 In a particular embodiment of this first aspect, the present invention can relate to the use of a compound of formula (I) as a fungicide



wherein Z is O or S, and preferably Z is O;

5 A¹ is CH or N, and preferably N;

R^{1a} and R^{1b} are independently selected from hydrogen, hydroxy, halogen, CN, C₁₋₆alkyl, C₃₋₆cycloalkyl, C₁₋₆alkoxy-C₁₋₆alkyl, C₃₋₆cycloalkyl-C₁₋₄alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, C₁₋₆alkoxy, amino, and NHC(O)C₁₋₆alkyl; and preferably R^{1a} and R^{1b} are hydrogen;

10

A² are independently CR² or N, with the proviso that no more than three A² are N, preferably no more than two A² are N, preferably no more than one A² is N, and more preferably the four A² are CR²;

R² are independently selected from hydrogen, hydroxy, halogen, CN, C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₂₋₆alkenyl, C₂₋₆alkynyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, C₁₋₆alkoxycarbonyl, C₁₋₆alkylaminocarbonyl, diC₁₋₆alkylaminocarbonyl, and C₁₋₆alkylcarbonyl, wherein each of the C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₂₋₆alkenyl, C₂₋₆alkynyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, C₁₋₆alkoxycarbonyl, C₁₋₆alkylaminocarbonyl, diC₁₋₆alkylaminocarbonyl, and C₁₋₆alkylcarbonyl groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN; preferably R² are independently selected from hydrogen, hydroxy, halogen, CN, C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₁₋₆alkoxycarbonyl, C₁₋₆alkylaminocarbonyl, diC₁₋₆alkylaminocarbonyl, and C₁₋₆alkylcarbonyl, wherein each of the C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₁₋₆alkoxycarbonyl, C₁₋₆alkylaminocarbonyl, diC₁₋₆alkylaminocarbonyl, and C₁₋₆alkylcarbonyl groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN; preferably R² are independently selected from hydrogen, halogen, CN, C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, and C₁₋₆alkoxy-C₁₋₆alkoxy, wherein each of the C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, and C₁₋₆alkoxy-C₁₋₆alkoxy groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN; and more preferably R² are independently selected from hydrogen, halogen, CN, C₁₋₆alkyl, and C₁₋₆alkoxy;

A³ is independently CR³ or N;

R³ is selected from hydrogen, hydroxy, halogen, CN, C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₂₋₆alkenyl, C₂₋₆alkynyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, amino, C₁₋₆alkylamino, diC₁₋₆-alkylamino, and C₃₋₆cycloalkylamino, wherein each of the C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₂₋₆alkenyl, C₂₋₆alkynyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, amino, C₁₋₆alkylamino, diC₁₋₆-alkylamino, and C₃₋₆cycloalkylamino groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN;

10

R⁴ is selected from C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₄alkyl, C₂₋₆alkenyl, C₂₋₆alkynyl, C₁₋₆alkoxy, C₁₋₆alkylsulfanyl-C₁₋₆alkyl, C₁₋₆alkylsulfinyl-C₁₋₆alkyl, C₁₋₆alkylsulfonyl-C₁₋₆alkyl, C₁₋₆alkoxycarbonyl-C₁₋₆alkyl, C₁₋₆alkylaminocarbonyl-C₁₋₆alkyl, diC₁₋₆alkylaminocarbonyl-C₁₋₆alkyl, and CN, wherein each of the C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₄alkyl, C₂₋₆alkenyl, C₂₋₆alkynyl, C₁₋₆alkoxy, C₁₋₆alkylsulfanyl-C₁₋₆alkyl, C₁₋₆alkylsulfinyl-C₁₋₆alkyl, C₁₋₆alkylsulfonyl-C₁₋₆alkyl, C₁₋₆alkoxycarbonyl-C₁₋₆alkyl, C₁₋₆alkylaminocarbonyl-C₁₋₆alkyl and diC₁₋₆alkylaminocarbonyl-C₁₋₆alkyl groups is optionally substituted with one to three substituents independently selected from halogen and CN;

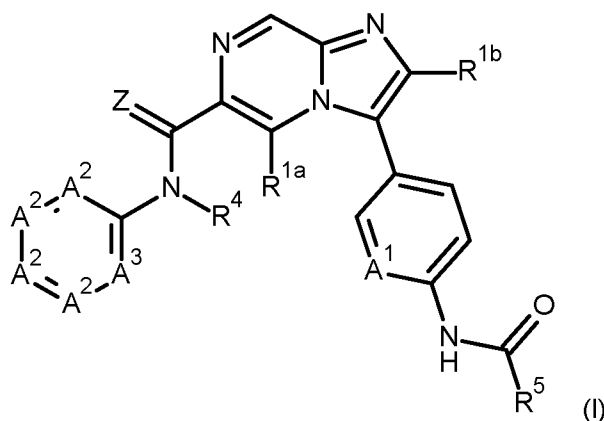
wherein A³ and R⁴ taken together optionally form a ring, more preferably a 5-8-membered heterocycle, more preferably a 6-membered heterocycle; and

25

R⁵ is selected from C₁₋₆alkyl, C₁₋₆alkoxy, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkoxyC₁₋₆alkyl, C₁₋₆alkylamino, diC₁₋₆alkylamino, and C₁₋₆alkylC₁₋₆alkoxyamino, wherein each of said groups is optionally substituted with one to three substituents independently selected from halogen and CN;

or a salt or N-oxide thereof.

In another particular embodiment of this first aspect, the present invention can relate to a compound of formula (I)



30

wherein Z is O or S, and preferably Z is O;

A¹ is CH or N, and preferably N;

R^{1a} and R^{1b} are independently selected from hydrogen, hydroxy, halogen, CN, C₁₋₆alkyl, C₃₋₆cycloalkyl, C₁₋₆alkoxy-C₁₋₆alkyl, C₃₋₆cycloalkyl-C₁₋₄alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, C₁₋₆alkoxy, amino, and NHC(O)C₁₋₆alkyl; and preferably R^{1a} and R^{1b} are hydrogen;

A² are independently CR² or N, with the proviso that no more than three A² are N, preferably no more than two A² are N, preferably no more than one A² is N, and more preferably the four A² are CR²;

R² are independently selected from hydrogen, hydroxy, halogen, CN, C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₂₋₆alkenyl, C₂₋₆alkynyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, C₁₋₆alkoxycarbonyl, C₁₋₆alkylaminocarbonyl, diC₁₋₆alkylaminocarbonyl, and C₁₋₆alkylcarbonyl, wherein each of the C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₂₋₆alkenyl, C₂₋₆alkynyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, C₁₋₆alkoxycarbonyl, C₁₋₆alkylaminocarbonyl, diC₁₋₆alkylaminocarbonyl, and C₁₋₆alkylcarbonyl groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN;

with the proviso that at least two R² are not hydrogen, said at least two R² being preferably selected from halogen, CN, C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, and C₁₋₆alkoxy-C₁₋₆alkoxy, wherein each of the C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, and C₁₋₆alkoxy-C₁₋₆alkoxy groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN; and more preferably selected from halogen, CN, C₁₋₆alkyl, and C₁₋₆alkoxy;

A³ is independently CR³ or N;

R³ is selected from hydrogen, hydroxy, halogen, CN, C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₂₋₆alkenyl, C₂₋₆alkynyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, amino, C₁₋₆alkylamino, diC₁₋₆-alkylamino, and C₃₋₆cycloalkylamino, wherein each of the C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₂₋₆alkenyl, C₂₋₆alkynyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, amino, C₁₋₆alkylamino, diC₁₋₆-alkylamino, and C₃₋₆cycloalkylamino groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN;

R⁴ is selected from C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₄alkyl, C₂₋₆alkenyl, C₂₋₆alkynyl, C₁₋₆alkoxy, C₁₋₆alkylsulfanyl-C₁₋₆alkyl, C₁₋₆alkylsulfinyl-C₁₋₆alkyl, C₁₋₆alkylsulfonyl-C₁₋₆alkyl, C₁₋₆alkoxycarbonyl-C₁₋₆alkyl, C₁₋₆alkylaminocarbonyl-C₁₋₆alkyl, diC₁₋₆alkylaminocarbonyl-C₁₋₆alkyl, and CN, wherein each of the C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₄alkyl, C₂₋₆alkenyl, C₂₋₆alkynyl, C₁₋₆alkoxy, C₁₋₆alkylsulfanyl-C₁₋₆alkyl, C₁₋₆alkylsulfinyl-C₁₋₆alkyl, C₁₋₆alkylsulfonyl-C₁₋₆alkyl, C₁₋₆alkoxycarbonyl-C₁₋₆alkyl, C₁₋₆alkylaminocarbonyl-C₁₋₆alkyl and diC₁₋₆alkylaminocarbonyl-C₁₋₆alkyl groups is optionally substituted with one to three substituents independently selected from halogen and CN;

wherein A³ and R⁴ taken together optionally form a ring, more preferably a 5-8-membered heterocycle, more preferably a 6-membered heterocycle; and

R⁵ is selected from C₁₋₆alkyl, C₁₋₆alkoxy, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkoxyC₁₋₆alkyl, C₁₋₆alkylamino, diC₁₋₆alkylamino, and C₁₋₆alkylC₁₋₆alkoxyamino, wherein each of said groups is optionally substituted with one to three substituents independently selected from halogen and CN;

or a salt or N-oxide thereof.

10 In a second aspect the present invention provides an agrochemical composition comprising a compound of formula (I), and more particularly an agrochemical composition comprising a fungicidally effective amount of a compound of formula (I). Said composition can further comprise at least one compound selected from an additional active ingredient, an appropriate formulation inert, a carrier, an adjuvant, and any mixtures thereof.

15

Compounds of formula (I) may be used to control phytopathogenic microorganisms. Thus, in order to control a phytopathogen a compound of formula (I), or a composition comprising a compound of formula (I) according to the invention, may be applied directly to the phytopathogen, to the locus of a phytopathogen, in particular to a plant susceptible to attack by phytopathogens, or to a propagation material of a plant.

20

Thus, in a third aspect the present invention provides the use of a compound of formula (I), or a composition comprising a compound of formula (I), as described herein to combat, prevent or control a phytopathogen.

25

In a fourth aspect the present invention provides a method of combating, preventing or controlling phytopathogens, comprising applying a compound of formula (I), or a composition comprising a compound of formula (I), as described herein to said phytopathogen, to the locus of said phytopathogen, in particular to a plant susceptible to attack by a phytopathogen, or to a propagation material of a plant.

30 According to this fourth aspect of the invention, the method may exclude methods for the treatment of the human or animal body by surgery or therapy.

Compounds of formula (I) are particularly effective in combating, preventing or controlling phytopathogenic fungi, in particular oomycetes. Thus, in a fifth aspect the present invention provides the use of a compound of formula (I), or a composition comprising a compound of formula (I), as described herein to control phytopathogenic fungi, in particular oomycetes.

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In a sixth aspect the present invention provides a method of combating, preventing or controlling phytopathogenic disease, such as phytopathogenic fungi, comprising applying a compound of formula (I), or a composition comprising a compound of formula (I), as described herein to said phytopathogenic fungi, or to the locus of said phytopathogenic fungi, in particular to a plant susceptible to attack by phytopathogenic fungi, in particular oomycetes, or to a propagation material of a plant. According to this

40

sixth aspect of the invention, the method may exclude methods for the treatment of the human or animal body by surgery or therapy.

Where a group is indicated as being substituted, e.g. alkyl, this includes those groups that are part of
5 other groups, e.g. the alkyl in alkylthio.

Definitions:

- The term "halogen" or "halo" refers to fluorine (fluoro or F), chlorine (chloro or Cl), bromine (bromo or Br) or iodine (iodo or I), preferably fluorine, chlorine or bromine.
10
- The term "amino" refers to a -NH₂ group.
- The term "Alkyl" as used herein- in isolation or as part of a chemical group – represents straight-chain or branched hydrocarbons, preferably with 1 to 6 carbon atoms, for example methyl, ethyl, n-propyl,
15 isopropyl, n-butyl, isobutyl, s-butyl, t-butyl, pentyl, 1- methylbutyl, 2-methylbutyl, 3-methylbutyl, 1,2-dimethylpropyl, 1,1 -dimethylpropyl, 2,2- dimethylpropyl, 1 -ethylpropyl, hexyl, 1 -methylpentyl, 2-methylpentyl, 3-methylpentyl, 4- methylpentyl, 1,2-dimethylpropyl, 1,3-dimethylbutyl, 1,4-dimethylbutyl, 2,3-dimethylbutyl, 1,1- dimethylbutyl, 2,2-dimethylbutyl, 3,3-dimethylbutyl, 1,1,2-trimethylpropyl, 1,2,2-trimethylpropyl, 1- ethylbutyl and 2-ethylbutyl. Alkyl groups with 1 to 4 carbon atoms are preferred, for
20 example methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, s-butyl or t-butyl.
- The term "Alkenyl" - in isolation or as part of a chemical group - represents straight-chain or branched hydrocarbons, preferably with 2 to 6 carbon atoms and at least one double bond, for example vinyl, 2-propenyl, 2-butenyl, 3-butenyl, 1-methyl-2-propenyl, 2-methyl-2-propenyl, 2-pentenyl, 3-pentenyl, 4-
25 pentenyl, 1-methyl-2-butenyl, 2-methyl-2-butenyl, 3-methyl-2-butenyl, 1-methyl-3-butenyl, 2-methyl-3-butenyl, 3-methyl-3-butenyl, 1,1-dimethyl-2-propenyl, 1,2-dimethyl-2-propenyl, 1-ethyl-2-propenyl, 2-hexenyl, 3-hexenyl, 4- hexenyl, 5-hexenyl, 1 -methyl-2-pentenyl, 2-methyl-2-pentenyl, 3-methyl-2-pentenyl, 4-methyl-2- pentenyl, 3-methyl-3-pentenyl, 4-methyl-3-pentenyl, 1 -methyl-4-pentenyl, 2-methyl-4-pentenyl, 3- methyl-4-pentenyl, 4-methyl-4-pentenyl, 1, 1 -dimethyl-2-butenyl, 1,1-dimethyl-3-
30 butenyl, 1,2- dimethyl-2-butenyl, 1,2-dimethyl-3-butenyl, 1,3-dimethyl-2-butenyl, 2,2-dimethyl-3-butenyl, 2,3- dimethyl-2-butenyl, 2,3-dimethyl-3-butenyl, 1 -ethyl-2-butenyl, 1-ethyl-3-butenyl, 2-ethyl-2-butenyl, 2-ethyl-3-butenyl, 1, 1,2-trimethyl-2-propenyl, 1 -ethyl- 1 -methyl-2-propenyl und 1-ethyl-2-methyl-2-propenyl. Alkenyl groups with 2 to 4 carbon atoms are preferred, for example 2-propenyl, 2-butenyl or 1-methyl-2-propenyl.
- The term "Alkynyl" - in isolation or as part of a chemical group - represents straight-chain or branched hydrocarbons, preferably with 2 to 6 carbon atoms and at least one triple bond, for example 2-propynyl, 2-butyne, 3-butyne, 1-methyl-2- propynyl, 2-pentynyl, 3-pentynyl, 4-pentynyl, 1-methyl-3-butyne, 2-methyl-3-butyne, 1-methyl-2- butynyl, 1,1 -dimethyl-2-propynyl, 1-ethyl-2-propynyl, 2-hexynyl, 3-
40 hexynyl, 4-hexynyl, 5-hexynyl, 1- methyl-2-pentynyl, 1-methyl-3-pentynyl, 1-methyl-4-pentynyl, 2-methyl-3-pentynyl, 2-methyl-4- pentynyl, 3 -methyl-4-pentynyl, 4-methyl-2-pentynyl, 1,1 -dimethyl-3 -butynyl, 1,2-dimethyl-3 -butynyl, 2,2- dimethyl-3-butynyl, 1-ethyl-3-butynyl, 2-ethyl-3-butynyl, 1-ethyl-1-

methyl-2-propynyl and 2,5-hexadiynyl. Alkynyls with 2 to 4 carbon atoms are preferred, for example ethynyl, 2-propynyl or 2-butynyl-2-propenyl.

5 - The term "haloalkyl" refers to an alkyl radical as generally defined above substituted by one or more of the same or different halogen atoms, for examples fluoromethyl, fluoroethyl, difluoromethyl, trifluoromethyl, or 2,2,2-trifluoroethyl.

- The term "cyanoalkyl" refers to an alkyl radical as generally defined above substituted by one or more cyano groups.

10

- The term "cycloalkyl" - in isolation or as part of a chemical group - represents saturated or partially unsaturated mono-, bi- or tricyclic hydrocarbons, preferably with 3 to 10 carbon atoms, for example cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, bicyclo[2.2.1]heptyl, bicyclo[2.2.2]octyl or adamantyl. Cycloalkyls with 3, 4, 5, 6 or 7 carbon atoms are preferred, for example
15 cyclopropyl or cyclobutyl.

- The term "halocycloalkyl" refers to a cycloalkyl ring as defined above substituted by one or more of the same or different halogen atoms.

20 - The term "cyanocycloalkyl" refers to a cycloalkyl radical as generally defined above substituted by one or more cyano groups.

- The term "alkoxy" refers to a radical of the formula $-OR_a$ wherein R_a is an alkyl radical as generally defined above. Examples of alkoxy include, but are not limited to methoxy, ethoxy, propoxy, iso-propoxy, and tert-butoxy. The term "alkoxyalkyl" refers to an alkyl radical (as mentioned above) substituted with
25 said alkoxy group. Examples are methoxymethyl, methoxyethyl, ethoxymethyl and propoxymethyl.

- The term "alkylsulfanyl" refers to a radical of the formula $-SR_a$ wherein R_a is an alkyl radical as generally defined above.

30

- The term "alkylsulfinyl" refers to a radical of the formula $-S(O)R_a$ wherein R_a is an alkyl radical as generally defined above.

- The term "alkylsulfonyl" refers to a radical of the formula $-S(O)_2R_a$ wherein R_a is an alkyl radical as
35 generally defined above.

- the term "alkoxycarbonyl" refers to a radical of the formula $R_aOC(O)-$, wherein R_a is an alkyl radical as generally defined above.

40 - The term "alkylamino" refers to a radical of the formula R_aNH- wherein R_a is an alkyl radical as generally defined above.

- The term "cycloalkylamino" refers to a radical of the formula $R_aNH\cdot$ wherein R_a is a cycloalkyl radical as generally defined above.

- The term "alkoxyamino" refers to a radical of the formula $R_aNH\cdot$, wherein R_a is an alkoxy radical as
5 generally defined above.

- The term "alkylaminocarbonyl" refers to a radical of the formula $R_aNHC(O)\cdot$ wherein R_a is an alkyl radical as generally defined above.

10 - Hydroxyl or hydroxy stands for a $-OH$ group.

The term "combating", "preventing" or "controlling", and its inflections, within the context of the present invention, mean reducing any undesired effect, such as pathogenic and more particularly phytopathogenic, especially fungi such as oomycetes, infestation or attack of, and pathogenic damage
15 to a plant or to a plant derived product to such a level that an improvement is demonstrated.

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

20 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 pathogen to be controlled & its lifecycle; the particular compound applied; the type of application; and other relevant circumstances.

25

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 C_{1-4} alkanecarboxylic acids which are unsubstituted or substituted, for example by
30 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 such as benzoic acid, or with organic sulfonic acids, such as C_{1-4} alkane- or arylsulfonic acids which are unsubstituted or substituted, for example by halogen, for example methane- or p-toluenesulfonic acid. Compounds of
35 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
40 triethanolamine.

In each case, the compounds of formula (I) according to the invention are in free form, in oxidized form as an N-oxide, in covalently hydrated form, or in salt form, e.g., an agronomically usable or agrochemically acceptable 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
 5 “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 salt formation.

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

10

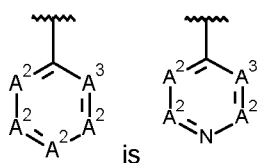
In a further embodiment, there is provided a compound of formula (I) according to the present invention, wherein R^{1a} and R^{1b} are independently selected from hydrogen, C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{1-6} alkoxy- C_{1-6} alkyl, C_{3-6} cycloalkyl- C_{1-4} alkyl, and C_{1-6} alkoxy; and preferably R^{1a} and R^{1b} are hydrogen.

15 In a further embodiment, there is provided a compound of formula (I) according to the present invention, wherein R^3 is selected from hydrogen, hydroxy, halogen, CN, C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkoxy, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-6} alkyl, amino, C_{1-6} alkylamino, di- C_{1-6} alkylamino, and C_{3-6} cycloalkylamino, wherein each of the C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkoxy, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-6} alkyl, amino, C_{1-6} alkylamino, di- C_{1-6} alkylamino and C_{3-6} cycloalkylamino groups is optionally substituted with one to three substituents independently selected
 20 from halogen, hydroxy, and CN. In a preferred embodiment, R^3 can be hydrogen.

In a further embodiment, there is provided a compound of formula (I) according to the present invention, wherein four A^2 are CR^2 and A^3 is N.

25

In a further embodiment, there is provided a compound of formula (I) according to the present invention, wherein

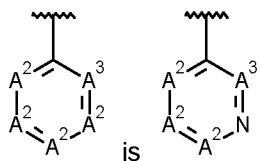


is

, and preferably the three A^2 are CR^2 and A^3 is CR^3 .

30

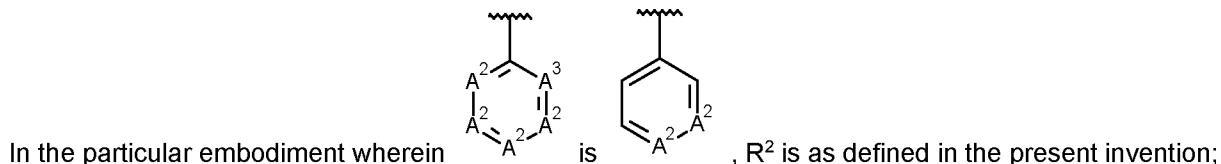
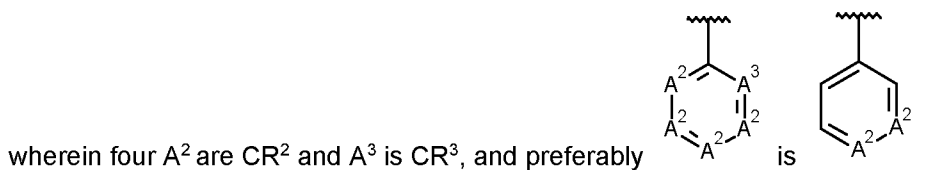
In a further embodiment, there is provided a compound of formula (I) according to the present invention, wherein



is

, and preferably the three A^2 are CR^2 and A^3 is CR^3 .

In a further embodiment, there is provided a compound of formula (I) according to the present invention,



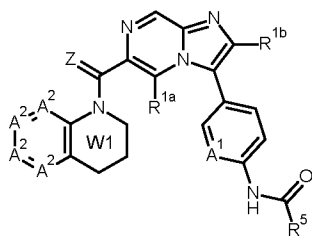
- preferably R^2 are independently selected from hydrogen, hydroxy, halogen, CN, C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkoxy, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-6} alkyl, C_{1-6} alkoxycarbonyl, C_{1-6} alkylaminocarbonyl, di- C_{1-6} alkylaminocarbonyl, and C_{1-6} alkylcarbonyl, wherein each of the C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkoxy, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-6} alkyl, C_{1-6} alkoxycarbonyl, C_{1-6} alkylaminocarbonyl, di- C_{1-6} alkylaminocarbonyl, and C_{1-6} alkylcarbonyl groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN; preferably R^2 are independently selected from hydrogen, halogen, CN, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, and C_{1-6} alkoxy- C_{1-6} alkoxy, wherein each of the C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, and C_{1-6} alkoxy- C_{1-6} alkoxy groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN; and more preferably R^2 are independently selected from hydrogen, halogen, CN, C_{1-6} alkyl, and C_{1-6} alkoxy.

15

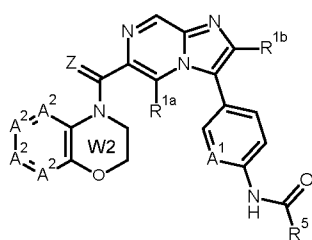
- In a further embodiment, there is provided a compound of formula (I) according to the present invention, wherein R^4 is selected from C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-4} alkyl, C_{2-6} alkenyl, C_{2-6} alkynyl, and C_{1-6} alkoxy, wherein each of the C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-4} alkyl, C_{2-6} alkenyl, C_{2-6} alkynyl, and C_{1-6} alkoxy groups is optionally substituted with one to three substituents independently selected from halogen and CN; preferably R^4 is selected from C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-4} alkyl, and C_{1-6} alkoxy, wherein each of the C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-4} alkyl, and C_{1-6} alkoxy groups is optionally substituted with one to three substituents independently selected from halogen and CN; and wherein A^3 and R^4 taken together optionally form a ring, more preferably a 5-8-membered heterocycle, more preferably a 6-membered heterocycle.

- In a further embodiment, there is provided a compound of formula (I) according to the present invention, wherein A^3 is CR^3 and wherein R^3 and R^4 taken together form a ring, preferably a 5-8-membered heterocycle, preferably a 6-membered heterocycle, and more preferably one of the rings W1, W2 or W3 as described in the compounds of the formula (I) below:

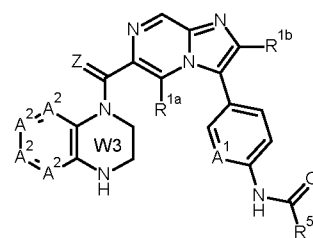
30



(I-W1)

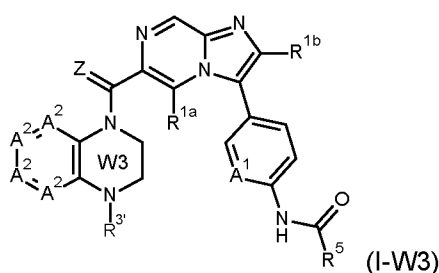


(I-W2)



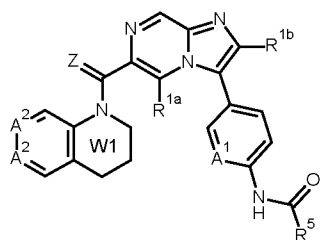
(I-W3)

The carbon and/or the nitrogen atoms forming said ring (W1, W2 or W3) can be substituted, especially by a $R^{3'}$ group, wherein $R^{3'}$ is selected from hydrogen, C_{1-6} alkyl, and C_{3-6} cycloalkyl, wherein each of the C_{1-6} alkyl and C_{3-6} cycloalkyl groups is optionally substituted with one to three substituents independently
5 selected from halogen and CN. For example, the compounds of the formula (I-W3) can be as follows:

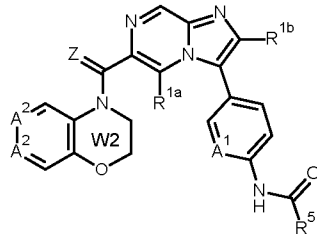


(I-W3)

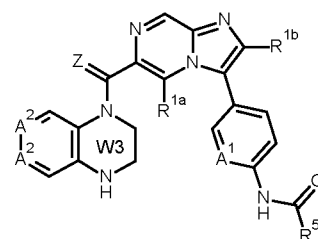
In a preferred embodiment, the compounds of the formula (I-W1), (I-W2) and (I-W3) can be as described below:



(I-W1)



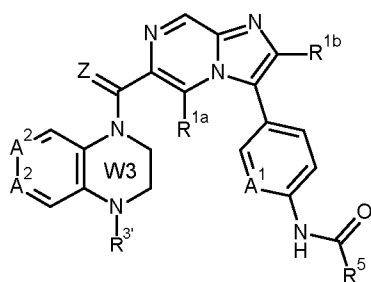
(I-W2)



(I-W3)

10

The carbon and/or the nitrogen atoms forming said ring (W1, W2 or W3) can be substituted, especially by a $R^{3'}$ group, wherein $R^{3'}$ is selected from hydrogen, C_{1-6} alkyl, and C_{3-6} cycloalkyl, wherein each of the C_{1-6} alkyl and C_{3-6} cycloalkyl groups is optionally substituted with one to three substituents independently
selected from halogen and CN. For example, the compounds of the formula (I-W3) can be as follows:



(I-W3)

In a further embodiment, there is provided a compound of formula (I) according to the present invention, wherein R^5 is selected from C_{1-6} alkyl, C_{1-6} alkoxy, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-6} alkyl, and C_{1-6} alkoxy- C_{1-6} alkyl, wherein each of said groups is optionally substituted with one to three substituents independently selected from halogen and CN.

In a particular embodiment, there is provided a compound of formula (I) according to the present invention, wherein

10 Z is O;

A^1 is N;

R^{1a} is selected from hydrogen, hydroxy, halogen, CN, C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{1-6} alkoxy- C_{1-6} alkyl, C_{3-6} cycloalkyl- C_{1-4} alkyl, C_{1-6} alkylsulfanyl, C_{1-6} alkylsulfinyl, C_{1-6} alkylsulfonyl, C_{1-6} alkoxy, amino, and $NHC(O)C_{1-6}$ alkyl; and preferably R^{1a} is hydrogen;

15 R^{1b} is selected from hydrogen, hydroxy, halogen, CN, C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{1-6} alkoxy- C_{1-6} alkyl, C_{3-6} cycloalkyl- C_{1-4} alkyl, C_{1-6} alkylsulfanyl, C_{1-6} alkylsulfinyl, C_{1-6} alkylsulfonyl, C_{1-6} alkoxy, amino, and $NHC(O)C_{1-6}$ alkyl; and preferably R^{1b} is hydrogen;

the four A^2 are CR^2 ; with R^2 being independently selected from hydrogen, hydroxy, halogen, CN, C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, and C_{1-6} alkoxy- C_{1-6} alkoxy, C_{1-6} alkoxycarbonyl, C_{1-6} alkylaminocarbonyl, diC_{1-6} alkylaminocarbonyl, and C_{1-6} alkylcarbonyl, wherein each of the C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkoxy, C_{1-6} alkoxycarbonyl, C_{1-6} alkylaminocarbonyl, diC_{1-6} alkylaminocarbonyl, and C_{1-6} alkylcarbonyl groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN; preferably R^2 are independently selected from hydrogen, halogen, CN, C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, and C_{1-6} alkoxy- C_{1-6} alkoxy, wherein

20 each of the C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, and C_{1-6} alkoxy- C_{1-6} alkoxy groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN; and more preferably R^2 are independently selected from hydrogen, halogen, CN, C_{1-6} alkyl, and C_{1-6} alkoxy;

A^3 is CR^3 with R^3 being independently selected from hydrogen, hydroxy, halogen, CN, C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkoxy, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-6} alkyl, amino, C_{1-6} alkylamino, diC_{1-6} alkylamino, and C_{3-6} cycloalkylamino, wherein each of the C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkoxy, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-6} alkyl, amino, C_{1-6} alkylamino, diC_{1-6} alkylamino and C_{3-6} cycloalkylamino groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN; and preferably R^3 is hydrogen;

25 each of the C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, and C_{1-6} alkoxy- C_{1-6} alkoxy groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN; and more preferably R^2 are independently selected from hydrogen, halogen, CN, C_{1-6} alkyl, and C_{1-6} alkoxy;

30 A^3 is CR^3 with R^3 being independently selected from hydrogen, hydroxy, halogen, CN, C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkoxy, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-6} alkyl, amino, C_{1-6} alkylamino, diC_{1-6} alkylamino, and C_{3-6} cycloalkylamino, wherein each of the C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkoxy, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-6} alkyl, amino, C_{1-6} alkylamino, diC_{1-6} alkylamino and C_{3-6} cycloalkylamino groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN; and preferably R^3 is hydrogen;

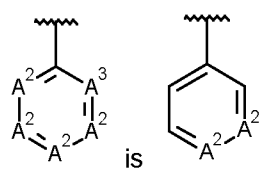
R⁴ is selected from C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₄alkyl, and C₁₋₆alkoxy, wherein each of the C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₄alkyl, and C₁₋₆alkoxy groups is optionally substituted with one to three substituents independently selected from halogen and CN; and wherein A³ and R⁴ taken together optionally form a ring, more preferably a 5-8-membered

5 heterocycle, more preferably a 6-membered heterocycle; and

R⁵ is selected from C₁₋₆alkyl, C₁₋₆alkoxy, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkoxyC₁₋₆alkyl, C₁₋₆alkylamino, diC₁₋₆alkylamino, and C₁₋₆alkylC₁₋₆alkoxyamino, wherein each of said groups is optionally substituted with one to three substituents independently selected from halogen and CN, and preferably

R⁵ is selected from C₁₋₆alkyl, C₁₋₆alkoxy, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, and C₁₋₆alkoxyC₁₋₆alkyl,

10 wherein each of said groups is optionally substituted with one to three substituents independently selected from halogen and CN.



In a preferred embodiment, is , wherein R² is as defined in the present invention;

preferably R² are independently selected from hydrogen, hydroxy, halogen, CN, C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkoxycarbonyl,

15 C₁₋₆alkylaminocarbonyl, diC₁₋₆alkylaminocarbonyl, and C₁₋₆alkylcarbonyl, wherein each of the C₁₋₆alkyl,

C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkoxycarbonyl, C₁₋₆alkylaminocarbonyl, diC₁₋₆alkylaminocarbonyl, and C₁₋₆alkylcarbonyl groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN; more preferably R² are independently selected from hydrogen, halogen, CN, C₁₋₆alkoxy, C₁₋₆alkoxy-

20 C₁₋₆alkyl, and C₁₋₆alkoxy-C₁₋₆alkoxy, wherein each of the C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, and C₁₋₆alkoxy-

C₁₋₆alkoxy groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN; and even more preferably R² are independently selected from hydrogen, halogen, CN, C₁₋₆alkyl, and C₁₋₆alkoxy.

25 In a further embodiment, the compound according to the present invention is selected from:

methyl N-[5-[6-[(4-fluoro-3-methoxy-phenyl)-(methoxymethyl)carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate;

methyl N-[5-[6-[cyanomethyl-(4-fluoro-3-methoxy-phenyl)carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate;

30 methyl N-[5-[6-[(4-chloro-3-methoxy-phenyl)-(cyanomethyl)carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate;

methyl N-[5-[6-[(4-fluoro-3-methoxy-phenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate;

N-(4-chlorophenyl)-3-[4-[[methoxy(methyl)carbamoyl]amino]phenyl]-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide;

35 N-(4-chlorophenyl)-N-methyl-3-[4-(methylcarbamoylamino)phenyl]imidazo[1,2-a]pyrazine-6-carboxamide;

isopropyl N-[4-[6-[(4-chlorophenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]phenyl]carbamate;

ethyl N-[4-[6-[(4-chlorophenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]phenyl]carbamate;

- methyl N-[4-[6-[(4-cyanophenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]phenyl]carbamate;
N-[4-[6-(5-chloroindoline-1-carbonyl)imidazo[1,2-a]pyrazin-3-yl]phenyl]acetamide;
3-(4-acetamidophenyl)-N-(4-chlorophenyl)-N-ethyl-imidazo[1,2-a]pyrazine-6-carboxamide;
3-(4-acetamidophenyl)-N-(3,4-dichlorophenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide;
5 3-(4-acetamidophenyl)-N-(3,4-dimethylphenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide;
3-(4-acetamidophenyl)-N-(2,4-dichlorophenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide;
3-(4-acetamidophenyl)-N-(3-chlorophenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide;
3-(4-acetamidophenyl)-N-methyl-N-[2-(trifluoromethyl)phenyl]imidazo[1,2-a]pyrazine-6-carboxamide;
3-(4-acetamidophenyl)-N-methyl-N-[4-(trifluoromethyl)phenyl]imidazo[1,2-a]pyrazine-6-carboxamide;
10 3-(4-acetamidophenyl)-N-methyl-N-[4-(trifluoromethoxy)phenyl]imidazo[1,2-a]pyrazine-6-carboxamide;
3-(4-acetamidophenyl)-N-(2-chlorophenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide;
3-(4-acetamidophenyl)-N-(4-methoxyphenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide;
3-(4-acetamidophenyl)-N-(3-bromophenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide;
3-(4-acetamidophenyl)-N-(6-chloro-3-pyridyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide;
15 3-(4-acetamidophenyl)-N-methyl-N-(3-pyridyl)imidazo[1,2-a]pyrazine-6-carboxamide;
3-(4-acetamidophenyl)-N-methyl-N-pyrimidin-2-yl-imidazo[1,2-a]pyrazine-6-carboxamide;
N-(4-chlorophenyl)-N-methyl-3-[4-[(2,2,2-trifluoroacetyl)amino]phenyl]imidazo[1,2-a]pyrazine-6-carboxamide;
N-(4-chlorophenyl)-3-[4-[(2,2-difluoroacetyl)amino]phenyl]-N-methyl-imidazo[1,2-a]pyrazine-6-
20 carboxamide;
N-(4-chlorophenyl)-3-[4-[(2-methoxyacetyl)amino]phenyl]-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide;
methyl N-[4-[6-[(4-chlorophenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]phenyl]carbamate;
N-(4-chlorophenyl)-3-[4-[(1-fluorocyclopropanecarbonyl)amino]phenyl]-N-methyl-imidazo[1,2-
25 a]pyrazine-6-carboxamide;
N-(4-chlorophenyl)-3-[4-(cyclopropanecarbonylamino)phenyl]-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide;
N-(4-chlorophenyl)-N-methyl-3-[4-(2-methylpropanoylamino)phenyl]imidazo[1,2-a]pyrazine-6-carboxamide;
30 N-(4-chlorophenyl)-N-methyl-3-[4-(propanoylamino)phenyl]imidazo[1,2-a]pyrazine-6-carboxamide;
3-[4-[acetyl(methyl)amino]phenyl]-N-(4-chlorophenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide;
3-(4-acetamidophenyl)-N-(4-bromophenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide;
3-(4-acetamidophenyl)-N-(4-chloro-2-fluoro-phenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide;
3-(4-acetamidophenyl)-N-(4-cyanophenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide;
35 3-(4-acetamidophenyl)-N-(4-chlorophenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide;
3-(4-acetamidophenyl)-N-(4-fluorophenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide;
methyl N-[5-[6-[(4-methoxy-2-pyridyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate;
methyl N-[5-[6-[(4-chloro-3-methyl-phenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-
40 pyridyl]carbamate;
methyl N-[5-[6-[(4-acetamidophenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate

- methoxy N-[5-[6-(6-fluoro-3,4-dihydro-2H-quinoline-1-carbonyl)imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate;
- methoxy N-[5-[6-[methyl-(3-methylsulfonylphenyl)carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate;
- 5 3-[6-(ethylcarbamoylamino)-3-pyridyl]-N-(4-fluoro-3-methoxy-phenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide;
- N-(4-fluoro-3-methoxy-phenyl)-3-[4-[(2-methoxyacetyl)amino]phenyl]-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide;
- 3-[4-(cyclopropanecarbonylamino)phenyl]-N-(4-fluoro-3-methoxy-phenyl)-N-methyl-imidazo[1,2-
- 10 a]pyrazine-6-carboxamide;
- 3-[4-(ethylcarbamoylamino)phenyl]-N-(4-fluoro-3-methoxy-phenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide;
- 3-[4-(dimethylcarbamoylamino)phenyl]-N-(4-fluoro-3-methoxy-phenyl)-N-methyl-imidazo[1,2-
- a]pyrazine-6-carboxamide;
- 15 benzyl N-[4-[6-[(4-fluoro-3-methoxy-phenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]phenyl]carbamate;
- 3-[6-(cyclopropanecarbonylamino)-3-pyridyl]-N-(4-fluoro-3-methoxy-phenyl)-N-methyl-imidazo[1,2-
- a]pyrazine-6-carboxamide;
- 3-(4-acetamidophenyl)-N-(4-fluoro-3-methoxy-phenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-
- 20 carboxamide;
- 3-(6-acetamido-3-pyridyl)-N-(4-fluoro-3-methoxy-phenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide;
- methoxy N-[5-[6-(6-fluoro-4-methyl-2,3-dihydroquinoxaline-1-carbonyl)imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate;
- 25 methyl N-[5-[6-(7-fluoro-2,3-dihydro-1,4-benzoxazine-4-carbonyl)imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate;
- methoxy N-[5-[6-[(4-cyano-3-methoxy-phenyl)-(methoxymethyl)carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate;
- methoxy N-[5-[6-[(4-cyanophenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate;
- 30 methyl N-[5-[6-[(4-cyano-3-methyl-phenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate;
- methoxy N-[4-[6-[(4-fluoro-3-methoxy-phenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]phenyl]carbamate;
- methoxy N-[4-[6-[(4-cyano-3-methoxy-phenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-
- 35 yl]phenyl]carbamate; and
- methoxy N-[5-[6-[(4-cyano-3-methoxy-phenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate.

The method according to the present invention has advantageous properties for protecting plants

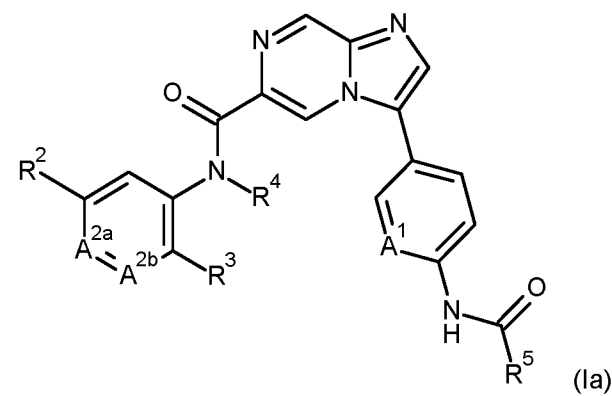
40 against pathogenic, such as phytopathogenic, especially fungi such as oomycetes, attack or infestation, which result in a disease and damage to the plant; particularly in instance of plants, the present invention

can control, limit or prevent pathogenic damage on plant, parts of plant, plant propagation material and/or plant grown.

The compounds in Tables 1.1 to 1.45 below illustrate specific compounds of the invention.

5

Table 1.1 provides compounds E1.1 to E1.360 of formula (Ia)



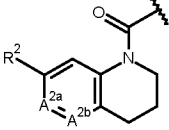
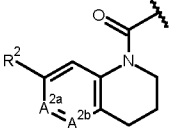
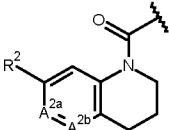
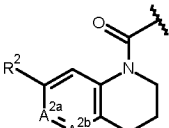
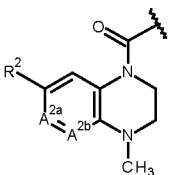
wherein A^{2a} is N, R⁵ is CH₃ and R², R³, R⁴, A¹, A^{2b} are as defined in table Z.

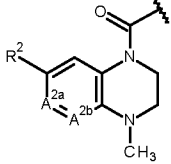
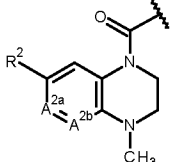
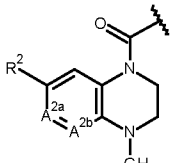
More particularly, table Z also includes compounds wherein R³ and R⁴ taken together form a ring. In this case, said ring is depicted in the R³ and R⁴ columns (Table Z) merged together, along the amide atom linked to the bicycle core of the formula (Ia). For example, see the R³ and R⁴ columns of the compound E1.29.

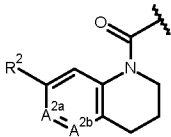
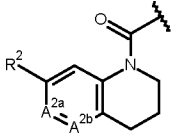
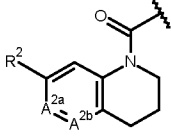
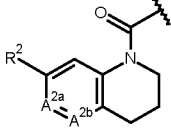
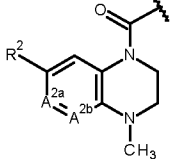
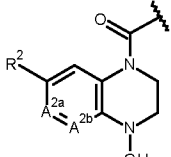
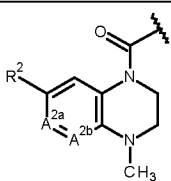
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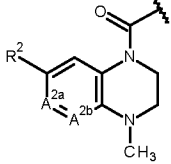
Table Z: Substituent definitions of R^{1a}, R², R³, R⁴ and A¹

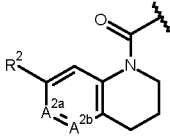
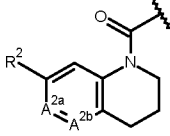
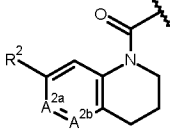
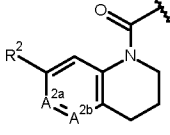
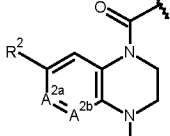
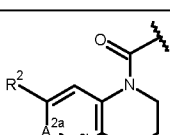
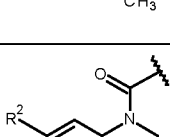
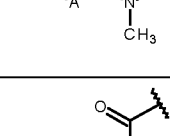
Compound	A ¹	A ^{2b}	R ²	R ³	R ⁴
E1.1	CH	CH	H	H	CH ₃
E1.2	CH	N	H	H	CH ₃
E1.3	N	CH	H	H	CH ₃
E1.4	N	N	H	H	CH ₃
E1.5	CH	CH	H	H	CH ₂ CH ₃
E1.6	CH	N	H	H	CH ₂ CH ₃
E1.7	N	CH	H	H	CH ₂ CH ₃
E1.8	N	N	H	H	CH ₂ CH ₃
E1.9	CH	CH	H	H	CH ₂ OCH ₃
E1.10	CH	N	H	H	CH ₂ OCH ₃
E1.11	N	CH	H	H	CH ₂ OCH ₃
E1.12	N	N	H	H	CH ₂ OCH ₃
E1.13	CH	CH	H	H	CH ₂ CH ₂ OCH ₃
E1.14	CH	N	H	H	CH ₂ CH ₂ OCH ₃

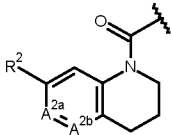
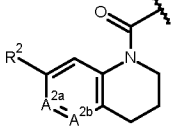
Compound	A ¹	A ^{2b}	R ²	R ³	R ⁴
E1.15	N	CH	H	H	CH ₂ CH ₂ OCH ₃
E1.16	N	N	H	H	CH ₂ CH ₂ OCH ₃
E1.17	CH	CH	H	H	allyl
E1.18	CH	N	H	H	allyl
E1.19	N	CH	H	H	allyl
E1.20	N	N	H	H	allyl
E1.21	CH	CH	H	H	CH ₂ CN
E1.22	CH	N	H	H	CH ₂ CN
E1.23	N	CH	H	H	CH ₂ CN
E1.24	N	N	H	H	CH ₂ CN
E1.25	CH	CH	H	H	CH ₂ CH ₂ CN
E1.26	CH	N	H	H	CH ₂ CH ₂ CN
E1.27	N	CH	H	H	CH ₂ CH ₂ CN
E1.28	N	N	H	H	CH ₂ CH ₂ CN
E1.29	CH	CH	H		
E1.30	CH	N	H		
E1.31	N	CH	H		
E1.32	N	N	H		
E1.33	CH	CH	H		

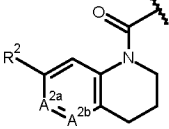
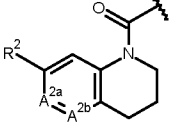
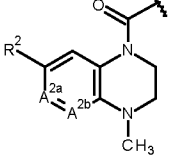
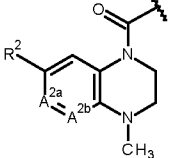
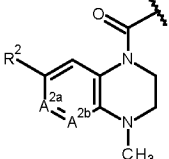
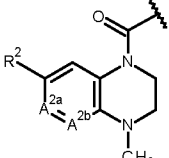
Compound	A ¹	A ^{2b}	R ²	R ³	R ⁴
E1.34	CH	N	H		
E1.35	N	CH	H		
E1.36	N	N	H		
E1.37	CH	CH	CH ₃	H	CH ₃
E1.38	CH	N	CH ₃	H	CH ₃
E1.39	N	CH	CH ₃	H	CH ₃
E1.40	N	N	CH ₃	H	CH ₃
E1.41	CH	CH	CH ₃	H	CH ₂ CH ₃
E1.42	CH	N	CH ₃	H	CH ₂ CH ₃
E1.43	N	CH	CH ₃	H	CH ₂ CH ₃
E1.44	N	N	CH ₃	H	CH ₂ CH ₃
E1.45	CH	CH	CH ₃	H	CH ₂ OCH ₃
E1.46	CH	N	CH ₃	H	CH ₂ OCH ₃
E1.47	N	CH	CH ₃	H	CH ₂ OCH ₃
E1.48	N	N	CH ₃	H	CH ₂ OCH ₃
E1.49	CH	CH	CH ₃	H	CH ₂ CH ₂ OCH ₃
E1.50	CH	N	CH ₃	H	CH ₂ CH ₂ OCH ₃
E1.51	N	CH	CH ₃	H	CH ₂ CH ₂ OCH ₃
E1.52	N	N	CH ₃	H	CH ₂ CH ₂ OCH ₃
E1.53	CH	CH	CH ₃	H	allyl
E1.54	CH	N	CH ₃	H	allyl
E1.55	N	CH	CH ₃	H	allyl
E1.56	N	N	CH ₃	H	allyl

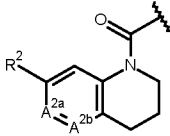
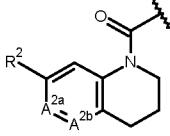
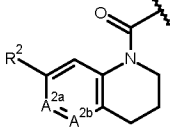
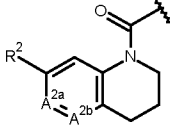
Compound	A ¹	A ^{2b}	R ²	R ³	R ⁴
E1.57	CH	CH	CH ₃	H	CH ₂ CN
E1.58	CH	N	CH ₃	H	CH ₂ CN
E1.59	N	CH	CH ₃	H	CH ₂ CN
E1.60	N	N	CH ₃	H	CH ₂ CN
E1.61	CH	CH	CH ₃	H	CH ₂ CH ₂ CN
E1.62	CH	N	CH ₃	H	CH ₂ CH ₂ CN
E1.63	N	CH	CH ₃	H	CH ₂ CH ₂ CN
E1.64	N	N	CH ₃	H	CH ₂ CH ₂ CN
E1.65	CH	CH	CH ₃		
E1.66	CH	N	CH ₃		
E1.67	N	CH	CH ₃		
E1.68	N	N	CH ₃		
E1.69	CH	CH	CH ₃		
E1.70	CH	N	CH ₃		
E1.71	N	CH	CH ₃		

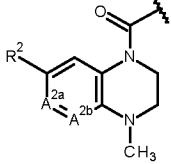
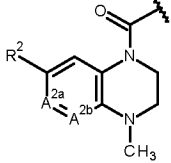
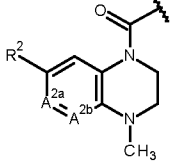
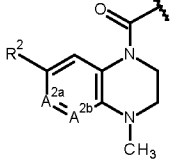
Compound	A ¹	A ^{2b}	R ²	R ³	R ⁴
E1.72	N	N	CH ₃		
E1.73	CH	CH	CH ₂ CH ₃	H	CH ₃
E1.74	CH	N	CH ₂ CH ₃	H	CH ₃
E1.75	N	CH	CH ₂ CH ₃	H	CH ₃
E1.76	N	N	CH ₂ CH ₃	H	CH ₃
E1.77	CH	CH	CH ₂ CH ₃	H	CH ₂ CH ₃
E1.78	CH	N	CH ₂ CH ₃	H	CH ₂ CH ₃
E1.79	N	CH	CH ₂ CH ₃	H	CH ₂ CH ₃
E1.80	N	N	CH ₂ CH ₃	H	CH ₂ CH ₃
E1.81	CH	CH	CH ₂ CH ₃	H	CH ₂ OCH ₃
E1.82	CH	N	CH ₂ CH ₃	H	CH ₂ OCH ₃
E1.83	N	CH	CH ₂ CH ₃	H	CH ₂ OCH ₃
E1.84	N	N	CH ₂ CH ₃	H	CH ₂ OCH ₃
E1.85	CH	CH	CH ₂ CH ₃	H	CH ₂ CH ₂ OCH ₃
E1.86	CH	N	CH ₂ CH ₃	H	CH ₂ CH ₂ OCH ₃
E1.87	N	CH	CH ₂ CH ₃	H	CH ₂ CH ₂ OCH ₃
E1.88	N	N	CH ₂ CH ₃	H	CH ₂ CH ₂ OCH ₃
E1.89	CH	CH	CH ₂ CH ₃	H	allyl
E1.90	CH	N	CH ₂ CH ₃	H	allyl
E1.91	N	CH	CH ₂ CH ₃	H	allyl
E1.92	N	N	CH ₂ CH ₃	H	allyl
E1.93	CH	CH	CH ₂ CH ₃	H	CH ₂ CN
E1.94	CH	N	CH ₂ CH ₃	H	CH ₂ CN
E1.95	N	CH	CH ₂ CH ₃	H	CH ₂ CN
E1.96	N	N	CH ₂ CH ₃	H	CH ₂ CN
E1.97	CH	CH	CH ₂ CH ₃	H	CH ₂ CH ₂ CN
E1.98	CH	N	CH ₂ CH ₃	H	CH ₂ CH ₂ CN
E1.99	N	CH	CH ₂ CH ₃	H	CH ₂ CH ₂ CN

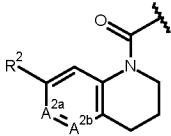
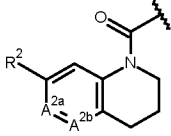
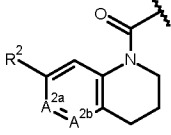
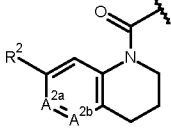
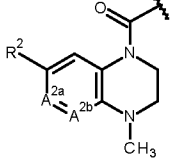
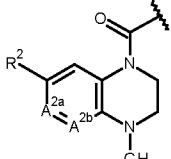
Compound	A ¹	A ^{2b}	R ²	R ³	R ⁴
E1.100	N	N	CH ₂ CH ₃	H	CH ₂ CH ₂ CN
E1.101	CH	CH	CH ₂ CH ₃		
E1.102	CH	N	CH ₂ CH ₃		
E1.103	N	CH	CH ₂ CH ₃		
E1.104	N	N	CH ₂ CH ₃		
E1.105	CH	CH	CH ₂ CH ₃		
E1.106	CH	N	CH ₂ CH ₃		
E1.107	N	CH	CH ₂ CH ₃		
E1.108	N	N	CH ₂ CH ₃		
E1.109	CH	CH	F	H	CH ₃
E1.110	CH	N	F	H	CH ₃
E1.111	N	CH	F	H	CH ₃
E1.112	N	N	F	H	CH ₃

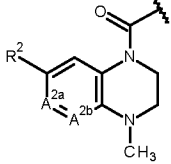
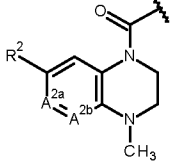
Compound	A ¹	A ^{2b}	R ²	R ³	R ⁴
E1.113	CH	CH	F	H	CH ₂ CH ₃
E1.114	CH	N	F	H	CH ₂ CH ₃
E1.115	N	CH	F	H	CH ₂ CH ₃
E1.116	N	N	F	H	CH ₂ CH ₃
E1.117	CH	CH	F	H	CH ₂ OCH ₃
E1.118	CH	N	F	H	CH ₂ OCH ₃
E1.119	N	CH	F	H	CH ₂ OCH ₃
E1.120	N	N	F	H	CH ₂ OCH ₃
E1.121	CH	CH	F	H	CH ₂ CH ₂ OCH ₃
E1.122	CH	N	F	H	CH ₂ CH ₂ OCH ₃
E1.123	N	CH	F	H	CH ₂ CH ₂ OCH ₃
E1.124	N	N	F	H	CH ₂ CH ₂ OCH ₃
E1.125	CH	CH	F	H	allyl
E1.126	CH	N	F	H	allyl
E1.127	N	CH	F	H	allyl
E1.128	N	N	F	H	allyl
E1.129	CH	CH	F	H	CH ₂ CN
E1.130	CH	N	F	H	CH ₂ CN
E1.131	N	CH	F	H	CH ₂ CN
E1.132	N	N	F	H	CH ₂ CN
E1.133	CH	CH	F	H	CH ₂ CH ₂ CN
E1.134	CH	N	F	H	CH ₂ CH ₂ CN
E1.135	N	CH	F	H	CH ₂ CH ₂ CN
E1.136	N	N	F	H	CH ₂ CH ₂ CN
E1.137	CH	CH	F		
E1.138	CH	N	F		

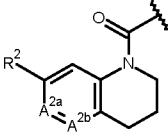
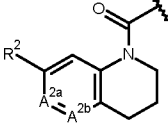
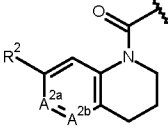
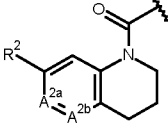
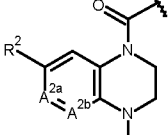
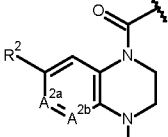
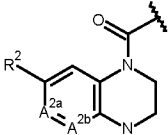
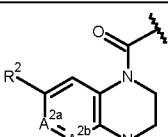
Compound	A ¹	A ^{2b}	R ²	R ³	R ⁴
E1.139	N	CH	F		
E1.140	N	N	F		
E1.141	CH	CH	F		
E1.142	CH	N	F		
E1.143	N	CH	F		
E1.144	N	N	F		
E1.145	CH	CH	Cl	H	CH ₃
E1.146	CH	N	Cl	H	CH ₃
E1.147	N	CH	Cl	H	CH ₃
E1.148	N	N	Cl	H	CH ₃
E1.149	CH	CH	Cl	H	CH ₂ CH ₃
E1.150	CH	N	Cl	H	CH ₂ CH ₃
E1.151	N	CH	Cl	H	CH ₂ CH ₃
E1.152	N	N	Cl	H	CH ₂ CH ₃
E1.153	CH	CH	Cl	H	CH ₂ OCH ₃
E1.154	CH	N	Cl	H	CH ₂ OCH ₃
E1.155	N	CH	Cl	H	CH ₂ OCH ₃

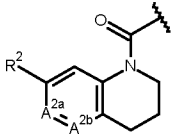
Compound	A ¹	A ^{2b}	R ²	R ³	R ⁴
E1.156	N	N	Cl	H	CH ₂ OCH ₃
E1.157	CH	CH	Cl	H	CH ₂ CH ₂ OCH ₃
E1.158	CH	N	Cl	H	CH ₂ CH ₂ OCH ₃
E1.159	N	CH	Cl	H	CH ₂ CH ₂ OCH ₃
E1.160	N	N	Cl	H	CH ₂ CH ₂ OCH ₃
E1.161	CH	CH	Cl	H	allyl
E1.162	CH	N	Cl	H	allyl
E1.163	N	CH	Cl	H	allyl
E1.164	N	N	Cl	H	allyl
E1.165	CH	CH	Cl	H	CH ₂ CN
E1.166	CH	N	Cl	H	CH ₂ CN
E1.167	N	CH	Cl	H	CH ₂ CN
E1.168	N	N	Cl	H	CH ₂ CN
E1.169	CH	CH	Cl	H	CH ₂ CH ₂ CN
E1.170	CH	N	Cl	H	CH ₂ CH ₂ CN
E1.171	N	CH	Cl	H	CH ₂ CH ₂ CN
E1.172	N	N	Cl	H	CH ₂ CH ₂ CN
E1.173	CH	CH	Cl		
E1.174	CH	N	Cl		
E1.175	N	CH	Cl		
E1.176	N	N	Cl		

Compound	A ¹	A ^{2b}	R ²	R ³	R ⁴
E1.177	CH	CH	Cl		
E1.178	CH	N	Cl		
E1.179	N	CH	Cl		
E1.180	N	N	Cl		
E1.181	CH	CH	Br	H	CH ₃
E1.182	CH	N	Br	H	CH ₃
E1.183	N	CH	Br	H	CH ₃
E1.184	N	N	Br	H	CH ₃
E1.185	CH	CH	Br	H	CH ₂ CH ₃
E1.186	CH	N	Br	H	CH ₂ CH ₃
E1.187	N	CH	Br	H	CH ₂ CH ₃
E1.188	N	N	Br	H	CH ₂ CH ₃
E1.189	CH	CH	Br	H	CH ₂ OCH ₃
E1.190	CH	N	Br	H	CH ₂ OCH ₃
E1.191	N	CH	Br	H	CH ₂ OCH ₃
E1.192	N	N	Br	H	CH ₂ OCH ₃
E1.193	CH	CH	Br	H	CH ₂ CH ₂ OCH ₃
E1.194	CH	N	Br	H	CH ₂ CH ₂ OCH ₃
E1.195	N	CH	Br	H	CH ₂ CH ₂ OCH ₃
E1.196	N	N	Br	H	CH ₂ CH ₂ OCH ₃
E1.197	CH	CH	Br	H	allyl

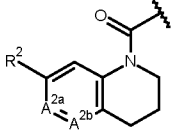
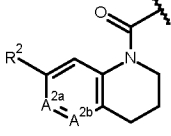
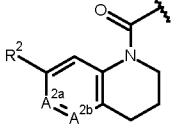
Compound	A ¹	A ^{2b}	R ²	R ³	R ⁴
E1.198	CH	N	Br	H	allyl
E1.199	N	CH	Br	H	allyl
E1.200	N	N	Br	H	allyl
E1.201	CH	CH	Br	H	CH ₂ CN
E1.202	CH	N	Br	H	CH ₂ CN
E1.203	N	CH	Br	H	CH ₂ CN
E1.204	N	N	Br	H	CH ₂ CN
E1.205	CH	CH	Br	H	CH ₂ CH ₂ CN
E1.206	CH	N	Br	H	CH ₂ CH ₂ CN
E1.207	N	CH	Br	H	CH ₂ CH ₂ CN
E1.208	N	N	Br	H	CH ₂ CH ₂ CN
E1.209	CH	CH	Br		
E1.210	CH	N	Br		
E1.211	N	CH	Br		
E1.212	N	N	Br		
E1.213	CH	CH	Br		
E1.214	CH	N	Br		

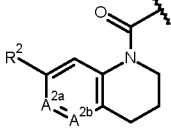
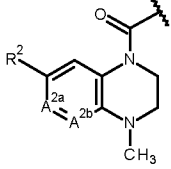
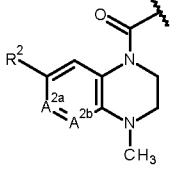
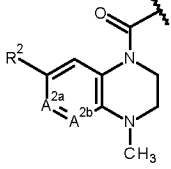
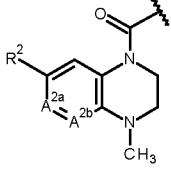
Compound	A ¹	A ^{2b}	R ²	R ³	R ⁴
E1.215	N	CH	Br		
E1.216	N	N	Br		
E1.217	CH	CH	CN	H	CH ₃
E1.218	CH	N	CN	H	CH ₃
E1.219	N	CH	CN	H	CH ₃
E1.220	N	N	CN	H	CH ₃
E1.221	CH	CH	CN	H	CH ₂ CH ₃
E1.222	CH	N	CN	H	CH ₂ CH ₃
E1.223	N	CH	CN	H	CH ₂ CH ₃
E1.224	N	N	CN	H	CH ₂ CH ₃
E1.225	CH	CH	CN	H	CH ₂ OCH ₃
E1.226	CH	N	CN	H	CH ₂ OCH ₃
E1.227	N	CH	CN	H	CH ₂ OCH ₃
E1.228	N	N	CN	H	CH ₂ OCH ₃
E1.229	CH	CH	CN	H	CH ₂ CH ₂ OCH ₃
E1.230	CH	N	CN	H	CH ₂ CH ₂ OCH ₃
E1.231	N	CH	CN	H	CH ₂ CH ₂ OCH ₃
E1.232	N	N	CN	H	CH ₂ CH ₂ OCH ₃
E1.233	CH	CH	CN	H	allyl
E1.234	CH	N	CN	H	allyl
E1.235	N	CH	CN	H	allyl
E1.236	N	N	CN	H	allyl
E1.237	CH	CH	CN	H	CH ₂ CN
E1.238	CH	N	CN	H	CH ₂ CN
E1.239	N	CH	CN	H	CH ₂ CN
E1.240	N	N	CN	H	CH ₂ CN

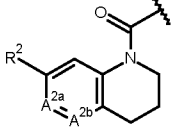
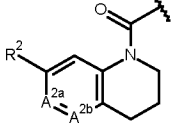
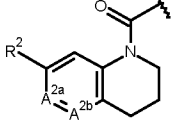
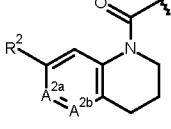
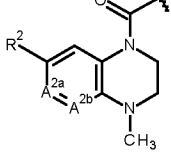
Compound	A ¹	A ^{2b}	R ²	R ³	R ⁴
E1.241	CH	CH	CN	H	CH ₂ CH ₂ CN
E1.242	CH	N	CN	H	CH ₂ CH ₂ CN
E1.243	N	CH	CN	H	CH ₂ CH ₂ CN
E1.244	N	N	CN	H	CH ₂ CH ₂ CN
E1.245	CH	CH	CN		
E1.246	CH	N	CN		
E1.247	N	CH	CN		
E1.248	N	N	CN		
E1.249	CH	CH	CN		
E1.250	CH	N	CN		
E1.251	N	CH	CN		
E1.252	N	N	CN		
E1.253	CH	CH	OCH ₃	H	CH ₃

Compound	A ¹	A ^{2b}	R ²	R ³	R ⁴
E1.254	CH	N	OCH ₃	H	CH ₃
E1.255	N	CH	OCH ₃	H	CH ₃
E1.256	N	N	OCH ₃	H	CH ₃
E1.257	CH	CH	OCH ₃	H	CH ₂ CH ₃
E1.258	CH	N	OCH ₃	H	CH ₂ CH ₃
E1.259	N	CH	OCH ₃	H	CH ₂ CH ₃
E1.260	N	N	OCH ₃	H	CH ₂ CH ₃
E1.261	CH	CH	OCH ₃	H	CH ₂ OCH ₃
E1.262	CH	N	OCH ₃	H	CH ₂ OCH ₃
E1.263	N	CH	OCH ₃	H	CH ₂ OCH ₃
E1.264	N	N	OCH ₃	H	CH ₂ OCH ₃
E1.265	CH	CH	OCH ₃	H	CH ₂ CH ₂ OCH ₃
E1.266	CH	N	OCH ₃	H	CH ₂ CH ₂ OCH ₃
E1.267	N	CH	OCH ₃	H	CH ₂ CH ₂ OCH ₃
E1.268	N	N	OCH ₃	H	CH ₂ CH ₂ OCH ₃
E1.269	CH	CH	OCH ₃	H	allyl
E1.270	CH	N	OCH ₃	H	allyl
E1.271	N	CH	OCH ₃	H	allyl
E1.272	N	N	OCH ₃	H	allyl
E1.273	CH	CH	OCH ₃	H	CH ₂ CN
E1.274	CH	N	OCH ₃	H	CH ₂ CN
E1.275	N	CH	OCH ₃	H	CH ₂ CN
E1.276	N	N	OCH ₃	H	CH ₂ CN
E1.277	CH	CH	OCH ₃	H	CH ₂ CH ₂ CN
E1.278	CH	N	OCH ₃	H	CH ₂ CH ₂ CN
E1.279	N	CH	OCH ₃	H	CH ₂ CH ₂ CN
E1.280	N	N	OCH ₃	H	CH ₂ CH ₂ CN
E1.281	CH	CH	OCH ₃		

Compound	A ¹	A ^{2b}	R ²	R ³	R ⁴
E1.282	CH	N	OCH ₃		
E1.283	N	CH	OCH ₃		
E1.284	N	N	OCH ₃		
E1.285	CH	CH	OCH ₃		
E1.286	CH	N	OCH ₃		
E1.287	N	CH	OCH ₃		
E1.288	N	N	OCH ₃		
E1.289	CH	CH	OCH ₂ CH ₃	H	CH ₃
E1.290	CH	N	OCH ₂ CH ₃	H	CH ₃
E1.291	N	CH	OCH ₂ CH ₃	H	CH ₃
E1.292	N	N	OCH ₂ CH ₃	H	CH ₃
E1.293	CH	CH	OCH ₂ CH ₃	H	CH ₂ CH ₃
E1.294	CH	N	OCH ₂ CH ₃	H	CH ₂ CH ₃
E1.295	N	CH	OCH ₂ CH ₃	H	CH ₂ CH ₃
E1.296	N	N	OCH ₂ CH ₃	H	CH ₂ CH ₃

Compound	A ¹	A ^{2b}	R ²	R ³	R ⁴
E1.297	CH	CH	OCH ₂ CH ₃	H	CH ₂ OCH ₃
E1.298	CH	N	OCH ₂ CH ₃	H	CH ₂ OCH ₃
E1.299	N	CH	OCH ₂ CH ₃	H	CH ₂ OCH ₃
E1.300	N	N	OCH ₂ CH ₃	H	CH ₂ OCH ₃
E1.301	CH	CH	OCH ₂ CH ₃	H	CH ₂ CH ₂ OCH ₃
E1.302	CH	N	OCH ₂ CH ₃	H	CH ₂ CH ₂ OCH ₃
E1.303	N	CH	OCH ₂ CH ₃	H	CH ₂ CH ₂ OCH ₃
E1.304	N	N	OCH ₂ CH ₃	H	CH ₂ CH ₂ OCH ₃
E1.305	CH	CH	OCH ₂ CH ₃	H	allyl
E1.306	CH	N	OCH ₂ CH ₃	H	allyl
E1.307	N	CH	OCH ₂ CH ₃	H	allyl
E1.308	N	N	OCH ₂ CH ₃	H	allyl
E1.309	CH	CH	OCH ₂ CH ₃	H	CH ₂ CN
E1.310	CH	N	OCH ₂ CH ₃	H	CH ₂ CN
E1.311	N	CH	OCH ₂ CH ₃	H	CH ₂ CN
E1.312	N	N	OCH ₂ CH ₃	H	CH ₂ CN
E1.313	CH	CH	OCH ₂ CH ₃	H	CH ₂ CH ₂ CN
E1.314	CH	N	OCH ₂ CH ₃	H	CH ₂ CH ₂ CN
E1.315	N	CH	OCH ₂ CH ₃	H	CH ₂ CH ₂ CN
E1.316	N	N	OCH ₂ CH ₃	H	CH ₂ CH ₂ CN
E1.317	CH	CH	OCH ₂ CH ₃		
E1.318	CH	N	OCH ₂ CH ₃		
E1.319	N	CH	OCH ₂ CH ₃		

Compound	A ¹	A ^{2b}	R ²	R ³	R ⁴
E1.320	N	N	OCH ₂ CH ₃		
E1.321	CH	CH	OCH ₂ CH ₃		
E1.322	CH	N	OCH ₂ CH ₃		
E1.323	N	CH	OCH ₂ CH ₃		
E1.324	N	N	OCH ₂ CH ₃		
E1.325	CH	CH	OCH ₂ CH ₂ OCH ₃	H	CH ₃
E1.326	CH	N	OCH ₂ CH ₂ OCH ₃	H	CH ₃
E1.327	N	CH	OCH ₂ CH ₂ OCH ₃	H	CH ₃
E1.328	N	N	OCH ₂ CH ₂ OCH ₃	H	CH ₃
E1.329	CH	CH	OCH ₂ CH ₂ OCH ₃	H	CH ₂ CH ₃
E1.330	CH	N	OCH ₂ CH ₂ OCH ₃	H	CH ₂ CH ₃
E1.331	N	CH	OCH ₂ CH ₂ OCH ₃	H	CH ₂ CH ₃
E1.332	N	N	OCH ₂ CH ₂ OCH ₃	H	CH ₂ CH ₃
E1.333	CH	CH	OCH ₂ CH ₂ OCH ₃	H	CH ₂ OCH ₃
E1.334	CH	N	OCH ₂ CH ₂ OCH ₃	H	CH ₂ OCH ₃
E1.335	N	CH	OCH ₂ CH ₂ OCH ₃	H	CH ₂ OCH ₃
E1.336	N	N	OCH ₂ CH ₂ OCH ₃	H	CH ₂ OCH ₃
E1.337	CH	CH	OCH ₂ CH ₂ OCH ₃	H	CH ₂ CH ₂ OCH ₃
E1.338	CH	N	OCH ₂ CH ₂ OCH ₃	H	CH ₂ CH ₂ OCH ₃

Compound	A ¹	A ^{2b}	R ²	R ³	R ⁴
E1.339	N	CH	OCH ₂ CH ₂ OCH ₃	H	CH ₂ CH ₂ OCH ₃
E1.340	N	N	OCH ₂ CH ₂ OCH ₃	H	CH ₂ CH ₂ OCH ₃
E1.341	CH	CH	OCH ₂ CH ₂ OCH ₃	H	allyl
E1.342	CH	N	OCH ₂ CH ₂ OCH ₃	H	allyl
E1.343	N	CH	OCH ₂ CH ₂ OCH ₃	H	allyl
E1.344	N	N	OCH ₂ CH ₂ OCH ₃	H	allyl
E1.345	CH	CH	OCH ₂ CH ₂ OCH ₃	H	CH ₂ CN
E1.346	CH	N	OCH ₂ CH ₂ OCH ₃	H	CH ₂ CN
E1.347	N	CH	OCH ₂ CH ₂ OCH ₃	H	CH ₂ CN
E1.348	N	N	OCH ₂ CH ₂ OCH ₃	H	CH ₂ CN
E1.349	CH	CH	OCH ₂ CH ₂ OCH ₃	H	CH ₂ CH ₂ CN
E1.350	CH	N	OCH ₂ CH ₂ OCH ₃	H	CH ₂ CH ₂ CN
E1.351	N	CH	OCH ₂ CH ₂ OCH ₃	H	CH ₂ CH ₂ CN
E1.352	N	N	OCH ₂ CH ₂ OCH ₃	H	CH ₂ CH ₂ CN
E1.353	CH	CH	OCH ₂ CH ₂ OCH ₃		
E1.354	CH	N	OCH ₂ CH ₂ OCH ₃		
E1.355	N	CH	OCH ₂ CH ₂ OCH ₃		
E1.356	N	N	OCH ₂ CH ₂ OCH ₃		
E1.357	CH	CH	OCH ₂ CH ₂ OCH ₃		

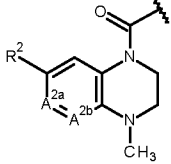
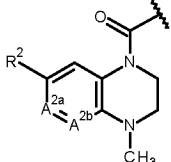
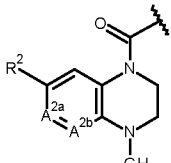
Compound	A ¹	A ^{2b}	R ²	R ³	R ⁴
E1.358	CH	N	OCH ₂ CH ₂ OCH ₃		
E1.359	N	CH	OCH ₂ CH ₂ OCH ₃		
E1.360	N	N	OCH ₂ CH ₂ OCH ₃		

Table 1.2 provides compounds E2.1 to E2.360 of formula (Ia) wherein A^{2a} is N, R⁵ is OCH₃ and R², R³, R⁴, A¹, A^{2b} are as defined in table Z.

Table 1.3 provides compounds E3.1 to E3.360 of formula (Ia) wherein A^{2a} is N, R⁵ is cyclopropyl and R², R³, R⁴, A¹, A^{2b} are as defined in table Z.

Table 1.4 provides compounds E4.1 to E4.360 of formula (Ia) wherein A^{2a} is N, R⁵ is CH₂OCH₃ and R², R³, R⁴, A¹, A^{2b} are as defined in table Z.

Table 1.5 provides compounds E5.1 to E5.360 of formula (Ia) wherein A^{2a} is N, R⁵ is NHCH₂CH₃ and R², R³, R⁴, A¹, A^{2b} are as defined in table Z.

Table 1.6 provides compounds E6.1 to E6.360 of formula (Ia) wherein A^{2a} is CH, R⁵ is CH₃ and R², R³, R⁴, A¹, A^{2b} are as defined in table Z.

Table 1.7 provides compounds E7.1 to E7.360 of formula (Ia) wherein A^{2a} is CH, R⁵ is OCH₃ and R², R³, R⁴, A¹, A^{2b} are as defined in table Z.

Table 1.8 provides compounds E8.1 to E8.360 of formula (Ia) wherein A^{2a} is CH, R⁵ is cyclopropyl and R², R³, R⁴, A¹, A^{2b} are as defined in table Z.

Table 1.9 provides compounds E9.1 to E9.360 of formula (Ia) wherein A^{2a} is CH, R⁵ is CH₂OCH₃ and R², R³, R⁴, A¹, A^{2b} are as defined in table Z.

Table 1.10 provides compounds E10.1 to E10.360 of formula (Ia) wherein A^{2a} is CH, R⁵ is NHCH₂CH₃ and R², R³, R⁴, A¹, A^{2b} are as defined in table Z.

Table 1.11 provides compounds E11.1 to E11.360 of formula (Ia) wherein A^{2a} is CF, R⁵ is CH₃ and R², R³, R⁴, A¹, A^{2b} are as defined in table Z.

Table 1.12 provides compounds E12.1 to E12.360 of formula (Ia) wherein A^{2a} is CF, R⁵ is OCH₃ and R², R³, R⁴, A¹, A^{2b} are as defined in table Z.

Table 1.13 provides compounds E13.1 to E13.360 of formula (Ia) wherein A^{2a} is CF, R⁵ is cyclopropyl and R², R³, R⁴, A¹, A^{2b} are as defined in table Z.

Table 1.14 provides compounds E14.1 to E14.360 of formula (Ia) wherein A^{2a} is CF, R⁵ is CH₂OCH₃ and R², R³, R⁴, A¹, A^{2b} are as defined in table Z.

Table 1.15 provides compounds E15.1 to E15.360 of formula (Ia) wherein A^{2a} is CF, R^5 is $NHCH_2CH_3$ and $R^2, R^3, R^4, A^1, A^{2b}$ are as defined in table Z.

Table 1.16 provides compounds E16.1 to E16.360 of formula (Ia) wherein A^{2a} is CCl, R^5 is CH_3 and $R^2, R^3, R^4, A^1, A^{2b}$ are as defined in table Z.

- 5 Table 1.17 provides compounds E17.1 to E17.360 of formula (Ia) wherein A^{2a} is CCl, R^5 is OCH_3 and $R^2, R^3, R^4, A^1, A^{2b}$ are as defined in table Z.

Table 1.18 provides compounds E18.1 to E18.360 of formula (Ia) wherein A^{2a} is CCl, R^5 is cyclopropyl and $R^2, R^3, R^4, A^1, A^{2b}$ are as defined in table Z.

- Table 1.19 provides compounds E19.1 to E19.360 of formula (Ia) wherein A^{2a} is CCl, R^5 is CH_2OCH_3
10 and $R^2, R^3, R^4, A^1, A^{2b}$ are as defined in table Z.

Table 1.20 provides compounds E20.1 to E20.360 of formula (Ia) wherein A^{2a} is CCl, R^5 is $NHCH_2CH_3$ and $R^2, R^3, R^4, A^1, A^{2b}$ are as defined in table Z.

Table 1.21 provides compounds E21.1 to E21.360 of formula (Ia) wherein A^{2a} is CBr, R^5 is CH_3 and $R^2, R^3, R^4, A^1, A^{2b}$ are as defined in table Z.

- 15 Table 1.22 provides compounds E22.1 to E22.360 of formula (Ia) wherein A^{2a} is CBr, R^5 is OCH_3 and $R^2, R^3, R^4, A^1, A^{2b}$ are as defined in table Z.

Table 1.23 provides compounds E23.1 to E23.360 of formula (Ia) wherein A^{2a} is CBr, R^5 is cyclopropyl and $R^2, R^3, R^4, A^1, A^{2b}$ are as defined in table Z.

- Table 1.24 provides compounds E24.1 to E24.360 of formula (Ia) wherein A^{2a} is CBr, R^5 is CH_2OCH_3
20 and $R^2, R^3, R^4, A^1, A^{2b}$ are as defined in table Z.

Table 1.25 provides compounds E25.1 to E25.360 of formula (Ia) wherein A^{2a} is CBr, R^5 is $NHCH_2CH_3$ and $R^2, R^3, R^4, A^1, A^{2b}$ are as defined in table Z.

Table 1.26 provides compounds E26.1 to E26.360 of formula (Ia) wherein A^{2a} is CCH_3 , R^5 is CH_3 and $R^2, R^3, R^4, A^1, A^{2b}$ are as defined in table Z.

- 25 Table 1.27 provides compounds E27.1 to E27.360 of formula (Ia) wherein A^{2a} is CCH_3 , R^5 is OCH_3 and $R^2, R^3, R^4, A^1, A^{2b}$ are as defined in table Z.

Table 1.28 provides compounds E28.1 to E28.360 of formula (Ia) wherein A^{2a} is CCH_3 , R^5 is cyclopropyl and $R^2, R^3, R^4, A^1, A^{2b}$ are as defined in table Z.

- Table 1.29 provides compounds E29.1 to E29.360 of formula (Ia) wherein A^{2a} is CCH_3 , R^5 is CH_2OCH_3
30 and $R^2, R^3, R^4, A^1, A^{2b}$ are as defined in table Z.

Table 1.30 provides compounds E30.1 to E30.360 of formula (Ia) wherein A^{2a} is CCH_3 , R^5 is $NHCH_2CH_3$ and $R^2, R^3, R^4, A^1, A^{2b}$ are as defined in table Z.

Table 1.31 provides compounds E31.1 to E31.360 of formula (Ia) wherein A^{2a} is CCH_2CH_3 , R^5 is CH_3 and $R^2, R^3, R^4, A^1, A^{2b}$ are as defined in table Z.

- 35 Table 1.32 provides compounds E32.1 to E32.360 of formula (Ia) wherein A^{2a} is CCH_2CH_3 , R^5 is OCH_3 and $R^2, R^3, R^4, A^1, A^{2b}$ are as defined in table Z.

Table 1.33 provides compounds E33.1 to E33.360 of formula (Ia) wherein A^{2a} is CCH_2CH_3 , R^5 is cyclopropyl and $R^2, R^3, R^4, A^1, A^{2b}$ are as defined in table Z.

- Table 1.34 provides compounds E34.1 to E34.360 of formula (Ia) wherein A^{2a} is CCH_2CH_3 , R^5 is
40 CH_2OCH_3 and $R^2, R^3, R^4, A^1, A^{2b}$ are as defined in table Z.

Table 1.35 provides compounds E35.1 to E35.360 of formula (Ia) wherein A^{2a} is CCH_2CH_3 , R^5 is $NHCH_2CH_3$ and $R^2, R^3, R^4, A^1, A^{2b}$ are as defined in table Z.

Table 1.36 provides compounds E36.1 to E36.360 of formula (Ia) wherein A^{2a} is CCN, R⁵ is CH₃ and R², R³, R⁴, A¹, A^{2b} are as defined in table Z.

Table 1.37 provides compounds E37.1 to E37.360 of formula (Ia) wherein A^{2a} is CCN, R⁵ is OCH₃ and R², R³, R⁴, A¹, A^{2b} are as defined in table Z.

- 5 Table 1.38 provides compounds E38.1 to E38.360 of formula (Ia) wherein A^{2a} is CCN, R⁵ is cyclopropyl and R², R³, R⁴, A¹, A^{2b} are as defined in table Z.

Table 1.39 provides compounds E39.1 to E39.360 of formula (Ia) wherein A^{2a} is CCN, R⁵ is CH₂OCH₃ and R², R³, R⁴, A¹, A^{2b} are as defined in table Z.

- 10 Table 1.40 provides compounds E40.1 to E40.360 of formula (Ia) wherein A^{2a} is CCN, R⁵ is NHCH₂CH₃ and R², R³, R⁴, A¹, A^{2b} are as defined in table Z.

Table 1.41 provides compounds E41.1 to E41.360 of formula (Ia) wherein A^{2a} is COCH₃, R⁵ is CH₃ and R², R³, R⁴, A¹, A^{2b} are as defined in table Z.

Table 1.42 provides compounds E42.1 to E42.360 of formula (Ia) wherein A^{2a} is COCH₃, R⁵ is OCH₃ and R², R³, R⁴, A¹, A^{2b} are as defined in table Z.

- 15 Table 1.43 provides compounds E43.1 to E43.360 of formula (Ia) wherein A^{2a} is COCH₃, R⁵ is cyclopropyl and R², R³, R⁴, A¹, A^{2b} are as defined in table Z.

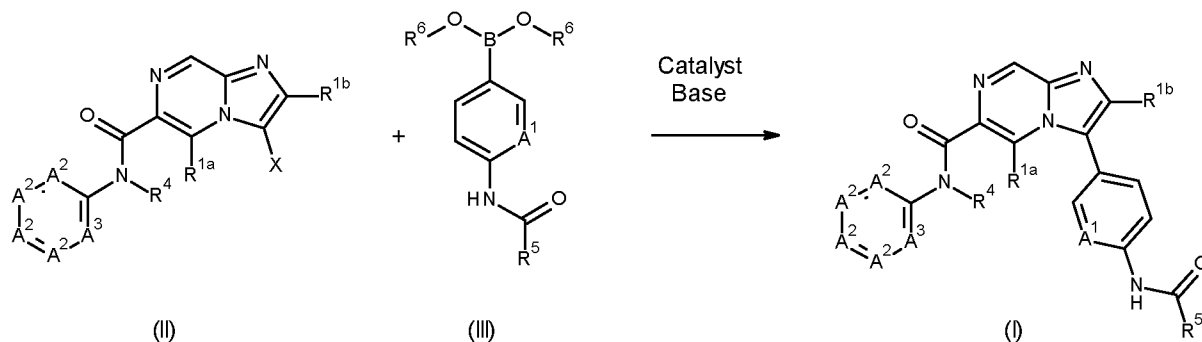
Table 1.44 provides compounds E44.1 to E44.360 of formula (Ia) wherein A^{2a} is COCH₃, R⁵ is CH₂OCH₃ and R², R³, R⁴, A¹, A^{2b} are as defined in table Z.

- 20 Table 1.45 provides compounds E45.1 to E45.360 of formula (Ia) wherein A^{2a} is COCH₃, R⁵ is NHCH₂CH₃ and R², R³, R⁴, A¹, A^{2b} are as defined in table Z.

Compounds according to the invention may possess any number of benefits including, *inter alia*, advantageous levels of biological activity for protecting plants against diseases that are caused by fungi or superior properties for use as agrochemical active ingredients (for example, greater biological activity, an advantageous spectrum of activity, an increased safety profile, improved physico-chemical properties, or increased biodegradability). Compounds according to the invention have particularly advantageous levels of biological activity for protecting plants against oomycetes such as *Phytophthora*, *Plasmopara* and *Pythium*.

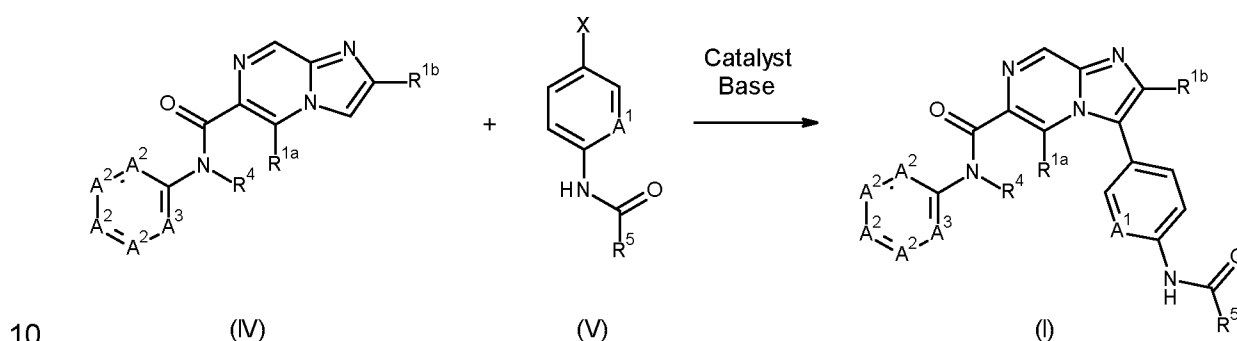
- 30 Compounds of formula (I), wherein Z is O, can be made as shown in the following schemes 1 to 13, in which, unless otherwise stated, the definition of each variable is as defined in the present invention.

Compounds of formula (I) can be prepared via Suzuki cross coupling of compounds of formula (II), wherein X is Cl, Br or I, and a compound of formula (III), wherein either R⁶ is independently from each other hydrogen, C₁₋₆alkyl or wherein two R⁶ together can form a C₃₋₈cycloalkyl, in the presence of a base, such as Cs₂CO₃, K₂CO₃ or NaOtBu, and a suitable palladium catalyst, such as tetrakis(triphenylphosphine)palladium, [1,1-bis(diphenylphosphino)ferrocene]dichloropalladium(II), bis(diphenylphosphine)palladium(II) chloride, palladium dichloride or palladium acetate, in a suitable solvent, such as dimethylformamide, dioxane, tetrahydrofuran, ethanol or water. Compounds of formula (III), wherein either R⁶ is independently from each other hydrogen, C₁₋₆alkyl or wherein two R⁶ together can form a C₃₋₈cycloalkyl are prepared by known methods or are commercially available. This transformation is depicted in Scheme 1.



Scheme 1

5 Alternatively, compounds of formula (I) can be prepared by direct arylation of compounds of formula (IV) with compounds of formula (V), wherein X is Cl, Br or I, in the presence of a catalyst such as palladium diacetate, a ligand such as triphenylphosphine or (dicyclohexylphosphino)biphenyl, and a base such as cesium carbonate or potassium carbonate. This coupling reaction is depicted in Scheme 2.

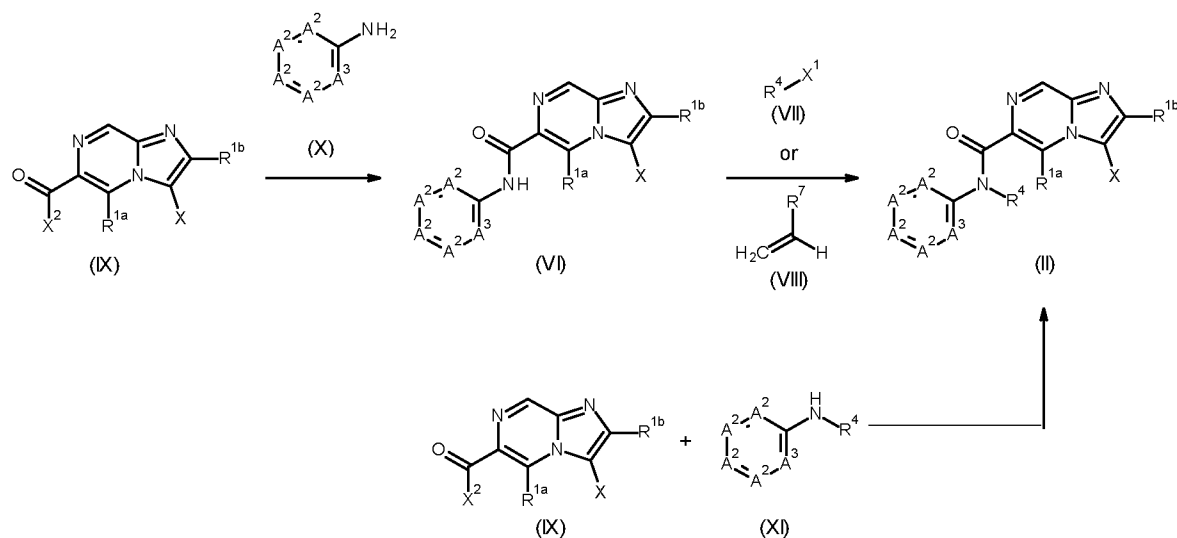


Scheme 2

Compounds of formula (II), wherein X is Cl, Br or I, can be prepared by reacting compounds of formula (VI), wherein X is Cl, Br or I, with an a reagent of formula (VII), wherein X¹ is a good leaving group such as Cl, Br, I, triflate, tosyl or mesyl, in the presence of a base such as Cs₂CO₃, K₂CO₃, NaH or NaOtBu. A compound of formula (VIII) wherein R⁷ is an electron-withdrawing group such as a cyano or an ester, can alternatively be used to functionalize the amide nitrogen, optionally in the presence of a base such as triethylamine or 1,8-diazabicyclo[5.4.0]undec-7-ene. Compounds of formula (VI), wherein X is Cl, Br or I, can be prepared by a peptide-coupling reaction between a compound of formula (IX), wherein X² is OH and X is Cl, Br or I, and an amine of formula (X), and by activating the carboxylic acid function of the compounds of formula (IX), a process that usually takes place by converting the -OH of the carboxylic acid into a good leaving group, such as a chloride group, for example by using (COCl)₂ or SOCl₂, prior to treatment with amines of formula (X), preferably in a suitable solvent (e.g., N-methylpyrrolidone, acetonitrile, dimethylacetamide, dichloromethane or tetrahydrofuran), preferably at temperatures between 25°C and 60°C, and optionally in the presence of a base such as triethylamine or N,N-diisopropylethylamine; or alternatively under conditions described in the literature for an amide coupling such as 1-propanephosphonic acid cyclic anhydride (T3P) in suitable solvent (e.g., acetonitrile) optionally in the presence of a base (e.g., triethylamine or N,N-diisopropylethylamine). For examples,

see *Chem. Soc. Rev.* **2009**, 38, 606 and *Chem. Soc. Rev.* **2011**, 40, 5084. Alternatively, compounds of formula (II), wherein X is Cl, Br or I, can be obtained by an amide-coupling transformation between compounds of formula (IX), wherein X² is OH, and X is Cl, Br or I, and amines of formula (XI) using the conditions described above. These transformations are depicted in Scheme 3.

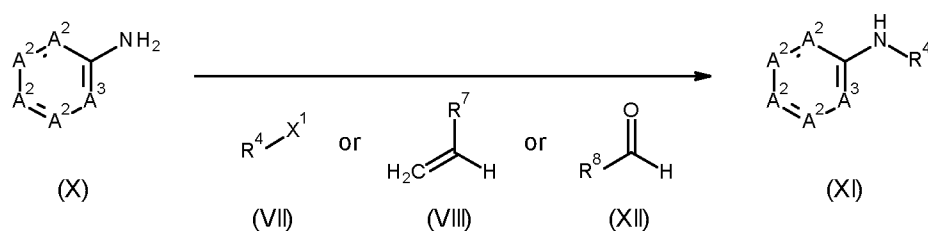
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Scheme 3

Compounds of formula (XI) are commercially available or can be obtained by reaction of compounds of formula (X) with a compound of formula (VII) wherein X¹ is a good leaving group such as Cl, Br, I, triflate, tosyl or mesyl, in the presence of a base such as Cs₂CO₃, K₂CO₃, NaH or NaOtBu. Alternatively, compounds of formula (XI) can also be synthesized by reacting compounds of formula (X) with compounds of formula (VIII), wherein R⁷ is an electron-withdrawing group such as cyano or ester, optionally in the presence of a base such as triethylamine or 1,8-diazabicyclo[5.4.0]undec-7-ene.

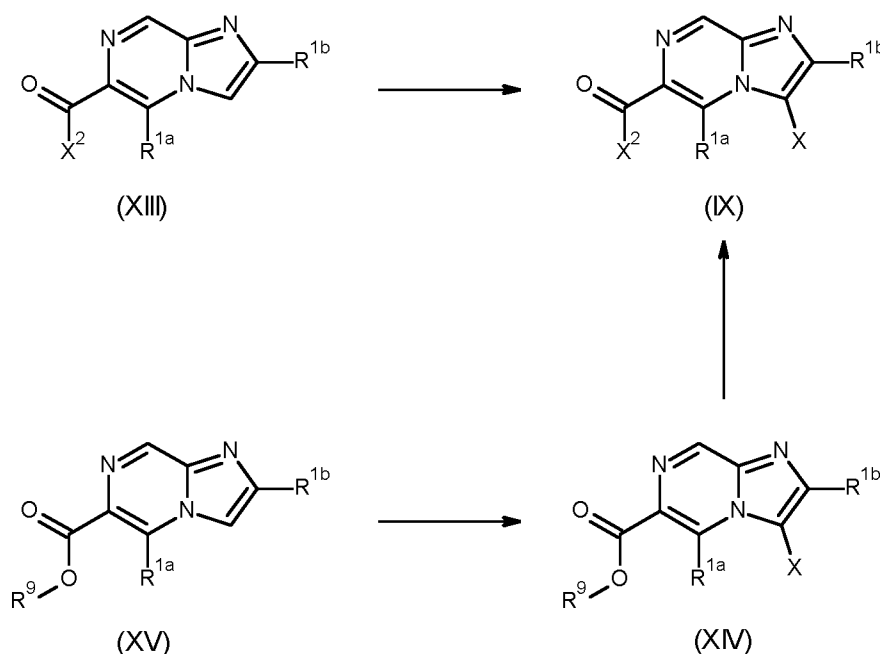
Alternatively, compounds of formula (XI) can be obtained from amines of formula (X) by a reductive amination with aldehydes of formula (XII), wherein R⁸ is selected from C₁₋₅alkyl, C₁₋₆alkoxy-C₁₋₅alkyl, C₃₋₆cycloalkyl-C₁₋₃alkyl, C₁₋₅alkenyl, C₁₋₅alkynyl, C₁₋₅alkoxy, C₁₋₆alkylsulfanyl-C₁₋₅alkyl, C₁₋₆alkylsulfinyl-C₁₋₅alkyl, C₁₋₆alkylsulfonyl-C₁₋₅alkyl, C₁₋₆alkoxycarbonyl-C₁₋₅alkyl, C₁₋₆alkylaminocarbonyl-C₁₋₅alkyl, diC₁₋₆alkylaminocarbonyl-C₁₋₅alkyl., e.g. in the presence of NaBH(OAc)₃ or NaBH₃CN, in a suitable solvent, optionally in the presence of a Brønsted or Lewis acid such as acetic acid. Alternatively, another reagent system for the reductive amination uses a combination of titanium isopropoxide and NaBH₄. The synthesis of compounds of formula (XI) from amines of formula (X) is depicted in Scheme 4.



Scheme 4

25

Compounds of formula (IX), wherein X^2 is OH and X is Cl, Br or I, are commercially available or can be obtained by halogenation of compounds of formula (XIII), wherein X^2 is OH, using a halogenating agent, such as N-chlorosuccinimide, N-bromosuccinimide, N-iodosuccinimide or bromine in a suitable solvent, such as dichloromethane, chloroform, tetrahydrofuran or acetonitrile. Compounds of formula (XIII),
5 wherein X^2 is OH, are commercially available or can be prepared using methods commonly known by those skilled in the art. Alternatively, compounds of formula (IX), wherein X^2 is OH and X is Cl, Br or I, can be obtained by hydrolysis of the ester function of compounds of formula (XIV), wherein X is Cl, Br or I, and R^9 is C_{1-6} alkyl, for instance by using a base such as lithium hydroxide or sodium hydroxide. Compounds of formula (XIV), wherein X is Cl, Br or I, and R^9 is C_{1-6} alkyl, are commercially available or
10 can be prepared by halogenation of compounds of formula (XV), wherein R^9 is C_{1-6} alkyl, using a halogenating agent following the conditions described above. Compounds of formula (XV), wherein R^9 is C_{1-6} alkyl, are commercially available or can be prepared using methods commonly known by those skilled in the art. These transformations are depicted in Scheme 5.



Scheme 5

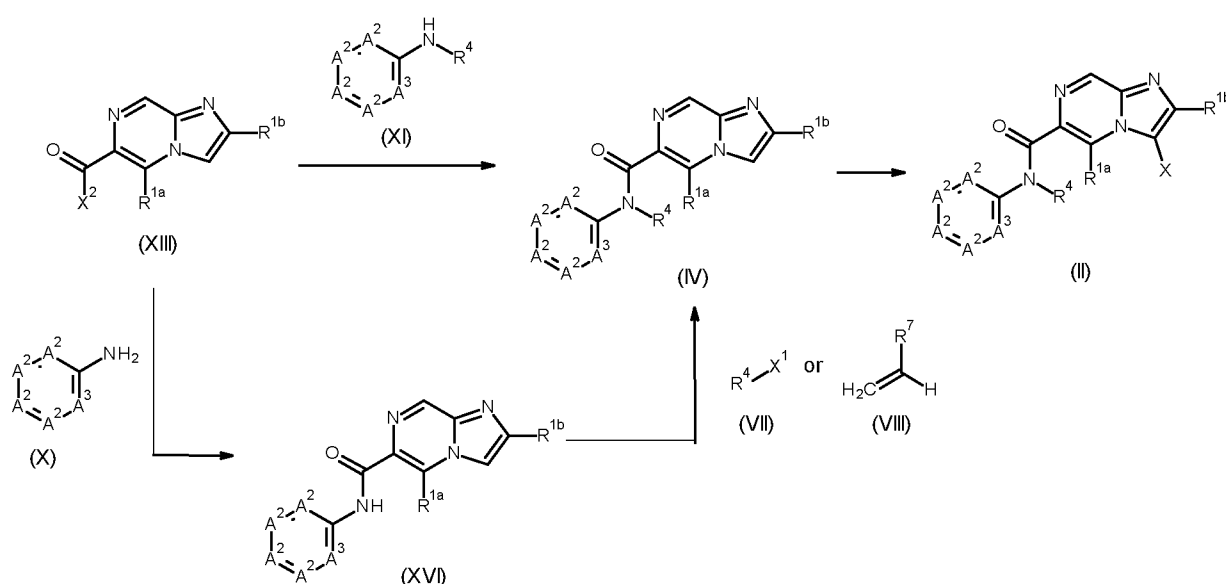
Alternatively, compounds of formula (II), wherein X is Cl, Br or I, can be prepared from the reaction of a compound of formula (IV) and a halogenating agent, such as N-chlorosuccinimide, N-bromosuccinimide,
20 N-iodosuccinimide or bromine in a suitable solvent, such as dichloromethane, chloroform, tetrahydrofuran or acetonitrile. Compounds of formula (IV) can be obtained by an amide-coupling transformation of amines of formula (XI) with compounds of formula (XIII), wherein X^2 is OH, and by activating the carboxylic acid function of the compounds of formula (XIII), a process that usually takes place by converting the -OH of the carboxylic acid into a good leaving group, such as a chloride group,
25 for example by using $(COCl)_2$ or $SOCl_2$, prior to treatment with amines of formula (XI), preferably in a suitable solvent (e.g., N-methylpyrrolidone, acetonitrile, dimethylacetamide, dichloromethane or tetrahydrofuran), preferably at temperatures between 25 °C and 60 °C, and optionally in the presence of a base such as triethylamine or N,N-diisopropylethylamine; or alternatively under conditions

described in the literature for an amide coupling such as 1-propanephosphonic acid cyclic anhydride (T3P) in suitable solvent (e.g., acetonitrile) optionally in the presence of a base (e.g., triethylamine or N,N-diisopropylethylamine). Alternatively, compounds of formula (IV) can be obtained by alkylation of compounds of formula (XVI) with compounds of formula (VII), wherein X^1 is a good leaving group such as Cl, Br, I, triflate, tosyl or mesyl, in the presence of a base such as Cs_2CO_3 , K_2CO_3 , NaH or NaOtBu.

5 Alternatively, compounds of formula (IV) can also be synthesized by reacting compounds of formula (XVI) with compounds of formula (VIII), wherein R^7 is an electron-withdrawing group such as cyano or ester, optionally in the presence of a base such as triethylamine or 1,8-diazabicyclo[5.4.0]undec-7-ene.

Compounds of formula (XVI) can be prepared by a peptide-coupling transformation from compounds of formula (XIII), wherein X^2 is OH, with amines of formula (X) using the conditions described above. These

10 transformations are depicted in Scheme 6.

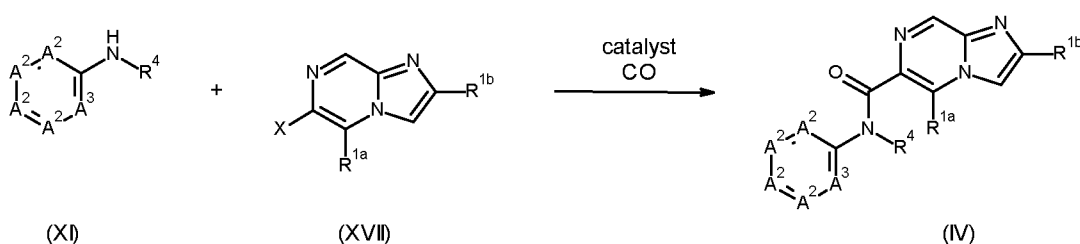


Scheme 6

15

Alternatively, compounds of formula (IV) can be synthesized by reacting compounds of formula (XVII), wherein X is Cl, Br or I, with amines of formula (XI) and carbon monoxide in the presence of a catalyst such as 1,1-bis(diphenylphosphino)ferrocene]dichloropalladium(II), and, optionally, a base such as triethylamine. This transformation is depicted in Scheme 7.

20



Scheme 7

Alternatively, compounds of formula (I) can be prepared by an amide-coupling transformation of amines of formula (XI) with compounds of formula (XVIII), wherein X^2 is OH, and by activating the carboxylic

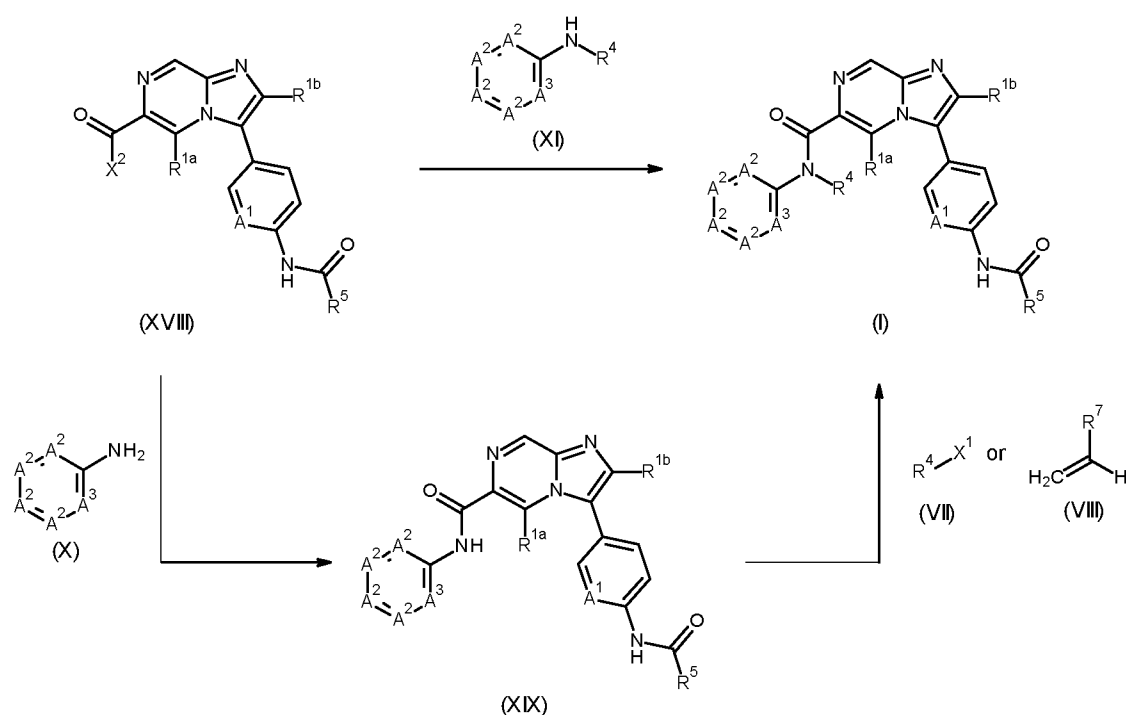
25

acid function of the compounds of formula (XVIII), a process that usually takes place by converting the -OH of the carboxylic acid into a good leaving group, such as a chloride group, for example by using (COCl)₂ or SOCl₂, prior to treatment with amines of formula (XI), preferably in a suitable solvent (e.g., N-methylpyrrolidone, acetonitrile, dimethylacetamide, dichloromethane or tetrahydrofuran), preferably

5 at temperatures between 25 °C and 60 °C, and optionally in the presence of a base such as triethylamine or N,N-diisopropylethylamine; or alternatively under conditions described in the literature for an amide coupling such as 1-propanephosphonic acid cyclic anhydride (T3P) in suitable solvent (e.g., acetonitrile) optionally in the presence of a base (e.g., triethylamine or N,N-diisopropylethylamine). Compounds of formula (I) can alternatively be prepared by alkylation of compounds of formula (XIX) with compounds

10 of formula (VII), wherein X¹ is a good leaving group such as Cl, Br, I, triflate, tosyl or mesyl, in the presence of a base such as Cs₂CO₃, K₂CO₃, NaH or NaOtBu. Alternatively, compounds of formula (I) can also be synthesized by reacting compounds of formula (XIX) with compounds of formula (VIII), wherein R⁷ is an electron-withdrawing group such as cyano or ester, optionally in the presence of a base such as triethylamine or 1,8-diazabicyclo[5.4.0]undec-7-ene. Compounds of formula (XIX) can be

15 synthesized by a peptide-coupling transformation from compounds of formula (XVIII), wherein X² is OH, and amines of formula (X) using the conditions described above. These transformations are depicted in Scheme 8.



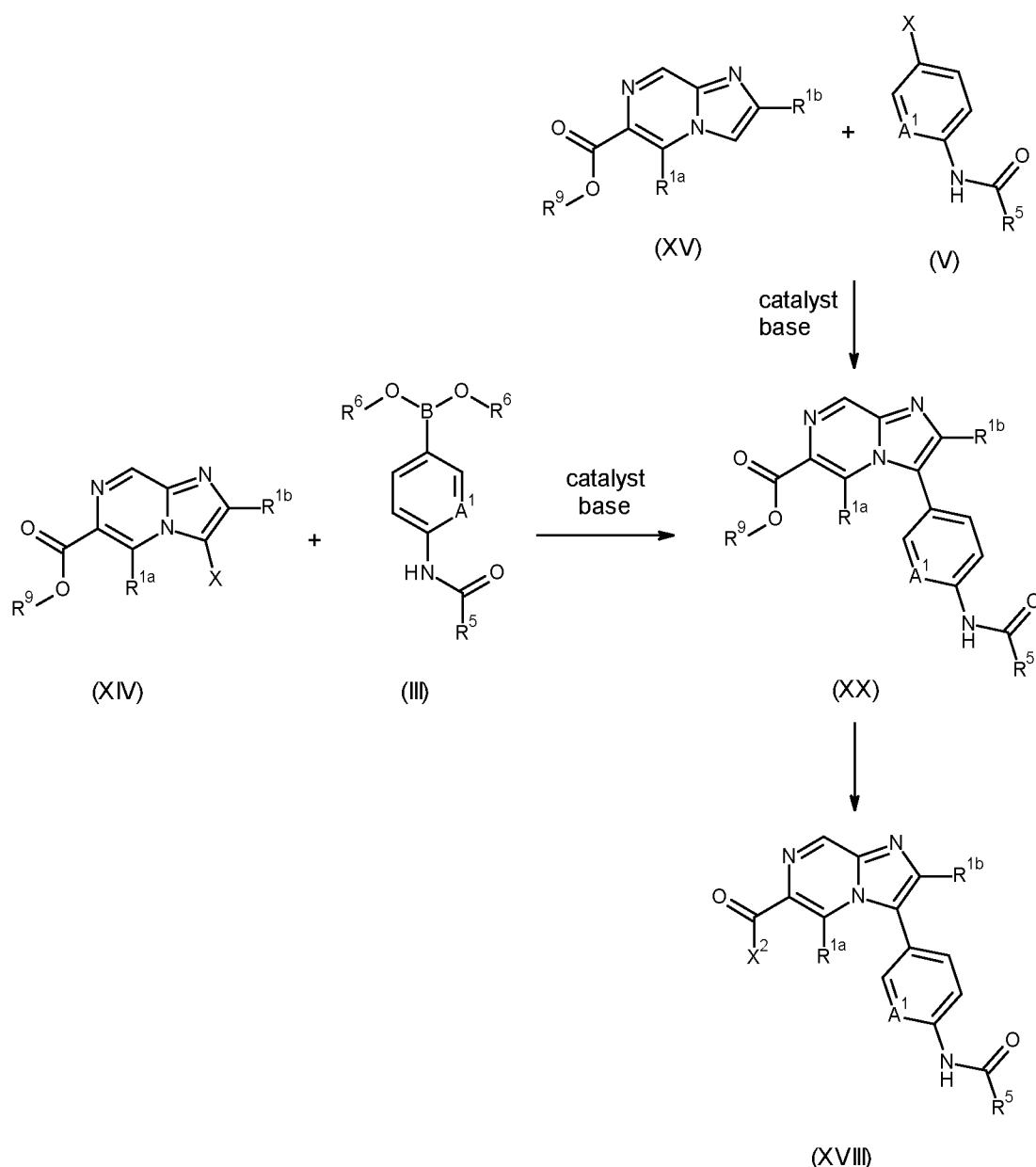
Scheme 8

20

Compounds of formula (XVIII), wherein X² is OH, can be obtained by hydrolysis of the ester moiety of compounds of formula (XX), wherein R⁹ is C₁₋₆alkyl. Compounds of formula (XX), wherein R⁹ is C₁₋₆alkyl, can be prepared by direct arylation of compounds of formula (XV), wherein R⁹ is C₁₋₆alkyl,

25 with compounds of formula (V), wherein X is Cl, Br or I, in the presence of a catalyst such as palladium diacetate, a ligand such as triphenylphosphine or (dicyclohexylphosphino)biphenyl, and a base such as cesium carbonate or potassium carbonate. Alternatively, compounds of formula (XX), wherein R⁹ is C₁₋

alkyl, can result from a Suzuki cross-coupling reaction between compounds of formula (XIV), wherein X is Cl, Br or I, and R⁹ is C₁₋₆alkyl, and compounds of formula (III), wherein either R⁶ is independently from each other hydrogen, C₁₋₆alkyl or wherein two R⁶ together can form a C₃₋₈cycloalkyl, in the presence of a base, such as Cs₂CO₃, K₂CO₃ or NaOtBu, and a suitable palladium catalyst, such as tetrakis(triphenylphosphine)palladium, [1,1-bis(diphenylphosphino)ferrocene]dichloropalladium(II), bis(diphenylphosphine)palladium(II) chloride, palladium dichloride or palladium acetate, in a suitable solvent, such as dimethylformamide, dioxane, tetrahydrofuran, ethanol or water. These transformations are depicted in Scheme 9.

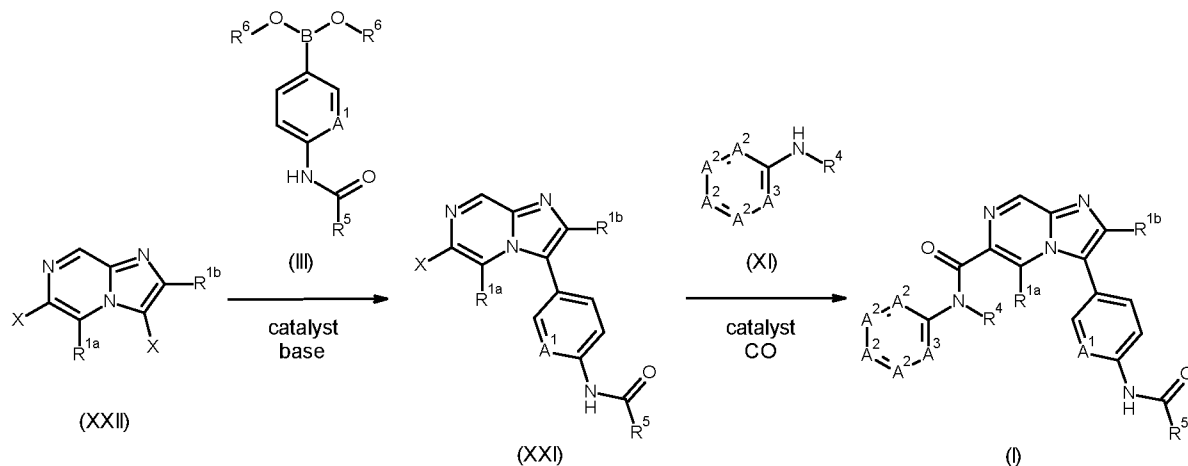


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Scheme 9

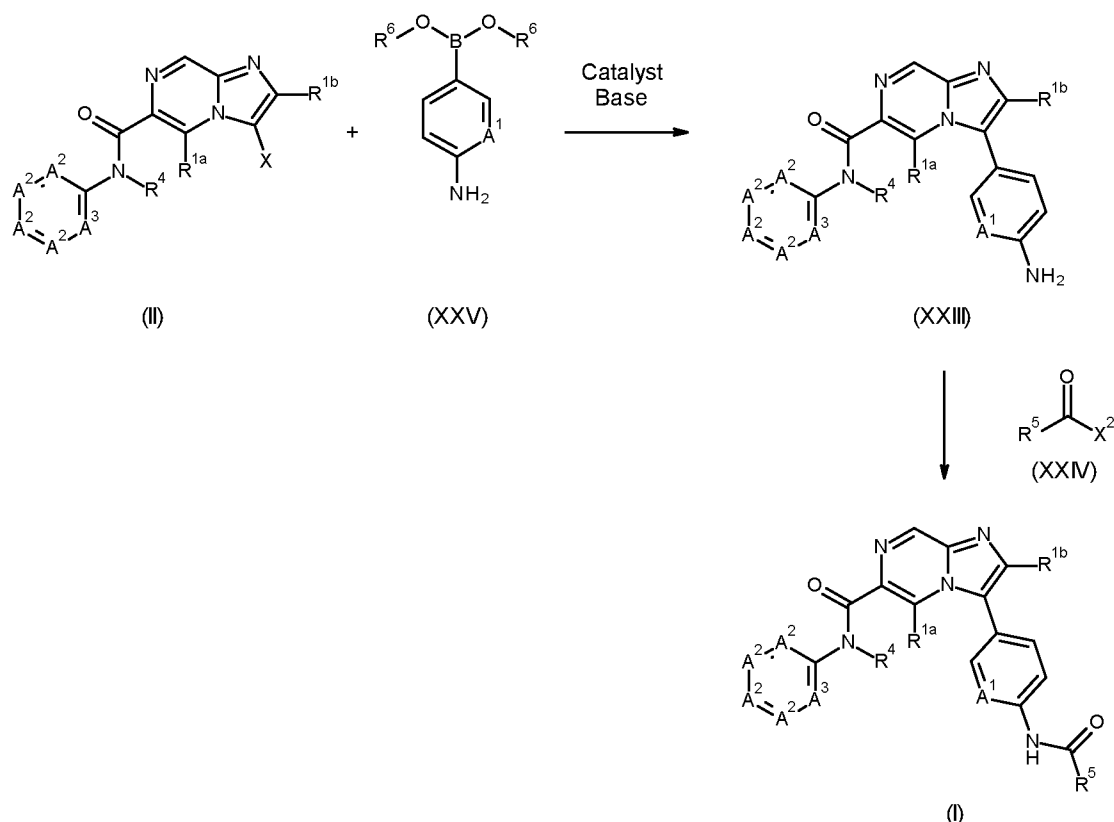
Alternatively, compounds of formula (I) can be synthesized by reacting compounds of formula (XXI), wherein X is Cl, Br or I, with amines of formula (XI) and carbon monoxide in the presence of a catalyst such as [1,1-bis(diphenylphosphino)ferrocene]dichloropalladium(II), and, optionally, a base such as triethylamine. Compounds of formula (XXI), wherein X is Cl, Br or I, can be prepared from compounds

of formula (XXII), wherein either X is independently from each other Cl, Br or I, through a Suzuki cross-coupling with compounds of formula (III), wherein either R⁶ is independently from each other hydrogen, C₁₋₆alkyl or wherein two R⁶ together can form a C₃₋₈cycloalkyl, in the presence of a base, such as Cs₂CO₃, K₂CO₃ or NaOtBu, and a suitable palladium catalyst, such as tetrakis(triphenylphosphine)palladium, [1,1-bis(diphenylphosphino)ferrocene]dichloropalladium(II), bis(diphenylphosphine)palladium(II) chloride, palladium dichloride or palladium acetate, in a suitable solvent, such as dimethylformamide, dioxane, tetrahydrofuran, ethanol or water. These transformations are depicted in Scheme 10.



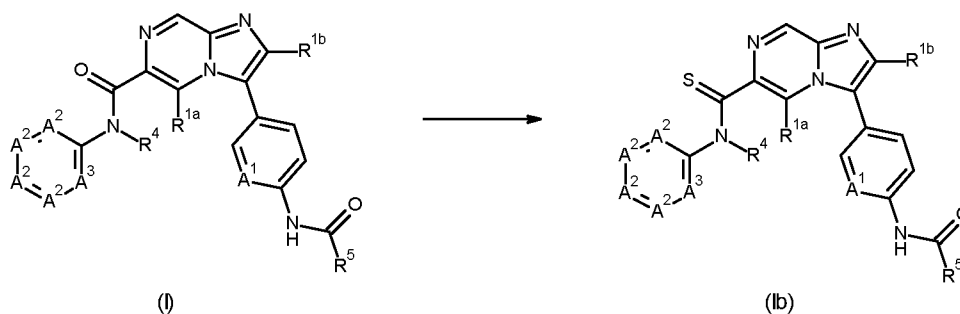
Scheme 10

Alternatively, compounds of formula (I) can be prepared by the reaction of a compound of formula (XXIII) with compounds of formula (XXIV), wherein X² is OH, in a peptide-coupling transformation, using the conditions described above. Compounds of formula (XXIII) can be prepared via Suzuki cross-coupling of a compound of formula (II), wherein X is Cl, Br or I, and a compound of formula (XXV), wherein either R⁶ is independently from each other hydrogen, C₁₋₆alkyl or wherein two R⁶ together can form a C₃₋₈cycloalkyl, in the presence of a base, such as Cs₂CO₃, K₂CO₃ or NaOtBu, and a suitable palladium catalyst, such as bis(diphenylphosphino)ferrocene]dichloropalladium(II), tetrakis(triphenylphosphine)palladium, [1,1-bis(diphenylphosphine)palladium(II) chloride, palladium dichloride or palladium acetate, in a suitable solvent, such as dimethylformamide, dioxane, tetrahydrofuran, ethanol or water. Compounds of formula (XXV), wherein either R⁶ is independently from each other hydrogen, C₁₋₆alkyl or wherein two R⁶ together can form a C₃₋₈cycloalkyl are prepared by known methods or are commercially available. These transformations are depicted in Scheme 11.



Scheme 11

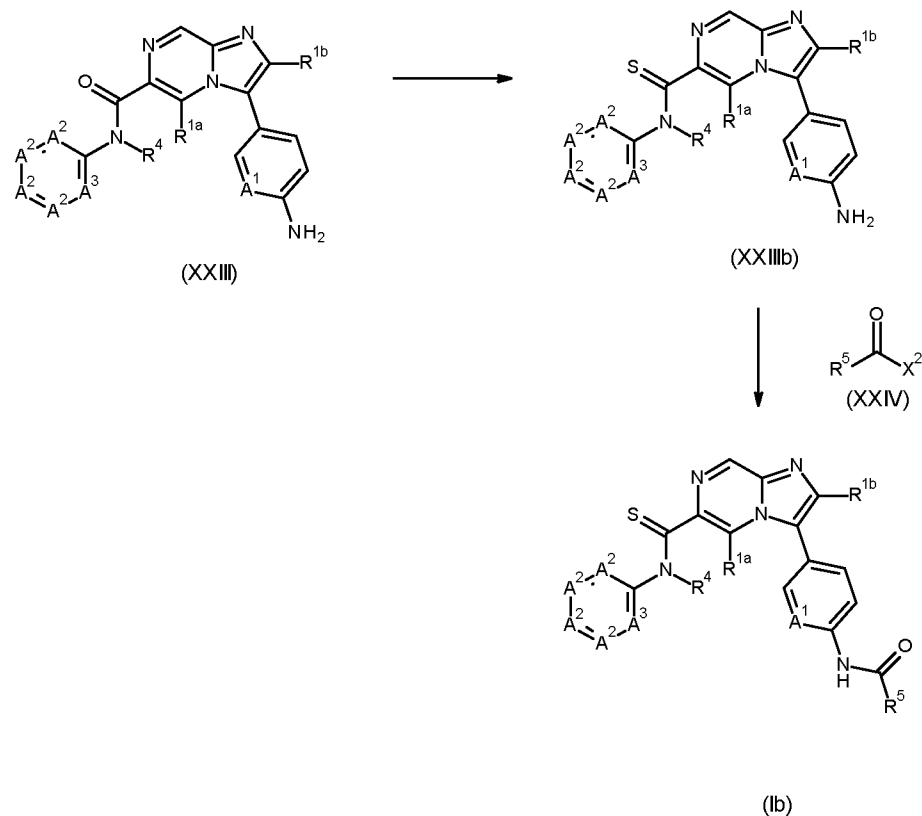
Compounds of formula (Ib), wherein Z is S, can be prepared by the reaction of a compound of formula (I), wherein Z is O, with phosphorus pentasulfide or Lawesson's reagent (CAS: 19172-47-5) in a suitable solvent such as toluene, xylene or dichloromethane. This transformation is depicted in Scheme 12.



Scheme 12

10

Alternatively, compounds of formula (Ib), wherein Z is S, can be prepared by the reaction of a compound of formula (XXIIIb) with compounds of formula (XXIV), wherein X^2 is OH, in a peptide-coupling transformation, using the conditions described above. Compounds of formula (XXIIIb) can be prepared by the reaction of a compound of formula (XXIII), with phosphorus pentasulfide or Lawesson's reagent (CAS: 19172-47-5) in a suitable solvent such as toluene, xylene or dichloromethane. This transformation is depicted in Scheme 13.



Scheme 13

It is understood by the person skilled in the art that the amide coupling reactions described above
 5 between an acid, an amine and a coupling agent could also be performed using the corresponding acid
 chloride and amine. The transformation of an acid into its corresponding acid chloride is well known by
 the person skilled in the art.

When the term "compound/compounds according to the invention" is used, then this refers to
 10 compounds according to the present invention.

Alternatively, the compounds according to the present invention can be obtained by using standard
 synthesis techniques known to the person skilled in the art. Non-exhaustive examples include oxidation
 reactions, reduction reactions, hydrolysis reactions, coupling reactions, aromatic nucleophilic or
 15 electrophilic substitution reactions, nucleophilic substitution reactions, nucleophilic addition reactions,
 olefination reactions, oxime formation, alkylation and halogenation reactions.

A compound according to the present invention can be converted in a manner known per se into another
 compound according to the present invention by replacing one or more substituents of the starting
 20 compound according to the present invention in the customary manner by (an)other substituent(s)
 according to the invention.

Depending on the choice of the reaction conditions and starting materials which are suitable in each
 case, it is possible, for example, in one reaction step only to replace one substituent by another

substituent according to the invention, or a plurality of substituents can be replaced by other substituents according to the invention in the same reaction step.

Salts of the compounds according to the present invention can be prepared in a manner known per se.

- 5 Thus, for example, acid addition salts of the compounds according to the present invention are obtained by treatment with a suitable acid or a suitable ion exchanger reagent and salts with bases are obtained by treatment with a suitable base or with a suitable ion exchanger reagent.

- 10 Salts of compounds the compounds according to the present invention can be converted in the customary manner into the free compounds, acid addition salts, for example, by treatment with a suitable basic compound or with a suitable ion exchanger reagent and salts with bases, for example, by treatment with a suitable acid or with a suitable ion exchanger reagent.

- 15 Salts of the compounds according to the present invention can be converted in a manner known per se into other salts of the compounds according to the present invention, acid addition salts, for example, into other acid addition salts, for example by treatment of a salt of inorganic acid such as hydrochloride with a suitable metal salt such as a sodium, barium or silver salt, of an acid, for example with silver acetate, in a suitable solvent in which an inorganic salt which forms, for example silver chloride, is insoluble and thus precipitates from the reaction mixture.

- 20 Depending on the procedure or the reaction conditions, the compounds according to the present invention, which have salt-forming properties can be obtained in free form or in the form of salts.

- 25 The compounds according to the present invention and, where appropriate, the tautomers thereof, in each case in free form or in salt form, can be present in the form of one of the stereoisomers which are possible or as a mixture of these, for example in the form of pure stereoisomers, such as antipodes and/or diastereomers, or as stereoisomer mixtures, such as enantiomer mixtures, for example racemates, diastereomer mixtures or racemate mixtures, depending on the number, absolute and relative configuration of asymmetric carbon atoms which occur in the molecule and/or depending on the configuration of non-aromatic double bonds which occur in the molecule; the invention relates to the pure stereoisomers and also to all stereoisomer mixtures which are possible and is to be understood in each case in this sense hereinabove and hereinbelow, even when stereochemical details are not mentioned specifically in each case.

- 35 Diastereomer mixtures or racemate mixtures of the compounds according to the present invention, in free form or in salt form, which can be obtained depending on which starting materials and procedures have been chosen can be separated in a known manner into the pure diastereomers or racemates on the basis of the physicochemical differences of the components, for example by fractional crystallization, distillation and/or chromatography.

- 40 Enantiomer mixtures, such as racemates, which can be obtained in a similar manner can be resolved into the optical antipodes by known methods, for example by recrystallization from an optically active

solvent, by chromatography on chiral adsorbents, for example high-performance liquid chromatography (HPLC) on acetyl cellulose, with the aid of suitable microorganisms, by cleavage with specific, immobilized enzymes, via the formation of inclusion compounds, for example using chiral crown ethers, where only one enantiomer is complexed, or by conversion into diastereomeric salts, for example by
5 reacting a basic end-product racemate with an optically active acid, such as a carboxylic acid, for example camphor, tartaric or malic acid, or sulfonic acid, for example camphorsulfonic acid, and separating the diastereomer mixture which can be obtained in this manner, for example by fractional crystallization based on their differing solubilities, to give the diastereomers, from which the desired enantiomer can be set free by the action of suitable agents, for example basic agents.

10

Pure diastereomers or enantiomers can be obtained according to the invention not only by separating suitable stereoisomer mixtures, but also by generally known methods of diastereoselective or enantioselective synthesis, for example by carrying out the process according to the invention with starting materials of a suitable stereochemistry.

15 N-oxides can be prepared by reacting a compound according to the present invention with a suitable oxidizing agent, for example the H₂O₂/urea adduct in the presence of an acid anhydride, e.g. trifluoroacetic anhydride. Such oxidations are known from the literature, for example from J. Med. Chem., 32 (12), 2561-73, 1989 or WO 00/15615.

It is advantageous to isolate or synthesize in each case the biologically more effective stereoisomer, for
20 example enantiomer or diastereomer, or stereoisomer mixture, for example enantiomer mixture or diastereomer mixture, if the individual components have a different biological activity.

The compounds according to the present invention and, where appropriate, the tautomers thereof, in each case in free form or in salt form, can, if appropriate, also be obtained in the form of hydrates and/or include other solvents, for example those which may have been used for the crystallization of
25 compounds which are present in solid form.

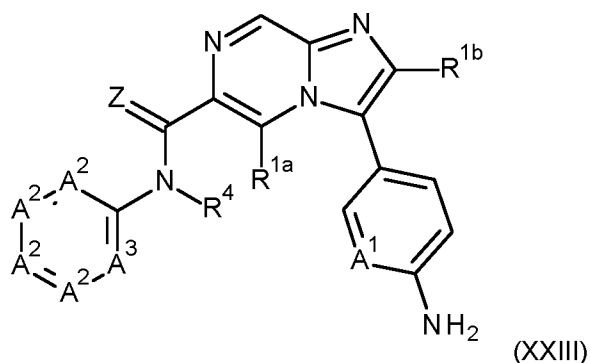
The following Examples illustrate, but do not limit, the invention.

The present invention also provides intermediates useful for the preparation of compounds according to the present invention.

30

The below intermediates form a further aspect of the invention.

A compound of formula (XXIII)



wherein Z is O or S, and preferably Z is O;

A¹ is CH or N, and preferably N;

R^{1a} and R^{1b} are independently selected from hydrogen, hydroxy, halogen, CN, C₁₋₆alkyl, C₃₋₆cycloalkyl, C₁₋₆alkoxy-C₁₋₆alkyl, C₃₋₆cycloalkyl-C₁₋₄alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, C₁₋₆alkoxy, amino, and NHC(O)C₁₋₆alkyl; and preferably R^{1a} and R^{1b} are hydrogen;

A² are independently CR² or N, with the proviso that no more than three A² are N, preferably no more than two A² are N, preferably no more than one A² is N, and more preferably the four A² are CR²;

R² are independently selected from hydrogen, hydroxy, halogen, CN, C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₂₋₆alkenyl, C₂₋₆alkynyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, C₁₋₆alkoxycarbonyl, C₁₋₆alkylaminocarbonyl, diC₁₋₆alkylaminocarbonyl, and C₁₋₆alkylcarbonyl, wherein each of the C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₂₋₆alkenyl, C₂₋₆alkynyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, C₁₋₆alkoxycarbonyl, C₁₋₆alkylaminocarbonyl, diC₁₋₆alkylaminocarbonyl, and C₁₋₆alkylcarbonyl groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN; preferably R² are independently selected from hydrogen, halogen, CN, C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, and C₁₋₆alkoxy-C₁₋₆alkoxy, wherein each of the C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, and C₁₋₆alkoxy-C₁₋₆alkoxy groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN; and more preferably R² are independently selected from hydrogen, halogen, CN, C₁₋₆alkyl, and C₁₋₆alkoxy; with the proviso that at least two R² are preferably not hydrogen;

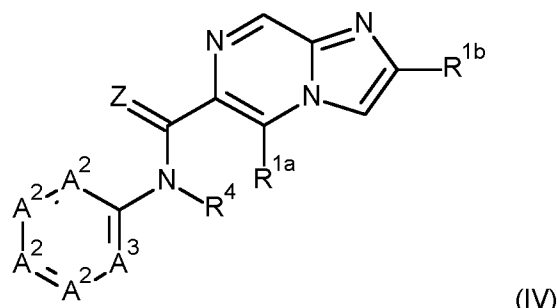
A³ is independently CR³ or N;

R³ is selected from hydrogen, hydroxy, halogen, CN, C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₂₋₆alkenyl, C₂₋₆alkynyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, amino, C₁₋₆alkylamino, diC₁₋₆-alkylamino, and C₃₋₆cycloalkylamino, wherein each of the C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₂₋₆alkenyl, C₂₋₆alkynyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, amino, C₁₋₆alkylamino, diC₁₋₆-alkylamino, and C₃₋₆cycloalkylamino groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN; preferably R³ is selected from hydrogen, hydroxy, halogen, CN, C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, amino, C₁₋₆alkylamino, diC₁₋₆-alkylamino, and C₃₋₆cycloalkylamino, wherein each of the C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, amino, C₁₋₆alkylamino, diC₁₋₆-alkylamino and C₃₋₆cycloalkylamino groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN; and more preferably R³ is hydrogen;

R⁴ is selected from C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₄alkyl, C₂₋₆alkenyl, C₂₋₆alkynyl, C₁₋₆alkoxy, C₁₋₆alkylsulfanyl-C₁₋₆alkyl, C₁₋₆alkylsulfinyl-C₁₋₆alkyl, C₁₋₆alkylsulfonyl-C₁₋₆alkyl, C₁₋₆alkoxycarbonyl-C₁₋₆alkyl, C₁₋₆alkylaminocarbonyl-C₁₋₆alkyl, diC₁₋₆alkylaminocarbonyl-C₁₋₆alkyl, and CN, wherein each of the C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₄alkyl, C₂₋₆alkenyl, C₂₋₆alkynyl, C₁₋₆alkoxy, C₁₋₆alkylsulfanyl-C₁₋₆alkyl, C₁₋₆alkylsulfinyl-C₁₋₆alkyl, C₁₋₆alkylsulfonyl-C₁₋₆alkyl, C₁₋₆alkoxycarbonyl-C₁₋₆alkyl, C₁₋₆alkylaminocarbonyl-C₁₋₆alkyl and diC₁₋₆alkylaminocarbonyl-C₁₋₆alkyl groups is optionally substituted with one to three substituents independently selected from halogen and CN; and

wherein A³ and R⁴ taken together optionally form a ring, more preferably a 5-8-membered heterocycle, more preferably a 6-membered heterocycle;
or a salt or N-oxide thereof.

5 A compound of formula (IV)



wherein Z is O or S, and preferably Z is O;

- R^{1a} and R^{1b} are independently selected from hydrogen, hydroxy, halogen, CN, C₁₋₆alkyl, C₃₋₆cycloalkyl, C₁₋₆alkoxy-C₁₋₆alkyl, C₃₋₆cycloalkyl-C₁₋₄alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, C₁₋₆alkoxy, amino, and NHC(O)C₁₋₆alkyl; and preferably R^{1a} and R^{1b} are hydrogen;
- A² are independently CR² or N, with the proviso that no more than three A² are N, preferably no more than two A² are N, preferably no more than one A² is N, and more preferably the four A² are CR²;
- R² are independently selected from hydrogen, hydroxy, halogen, CN, C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₂₋₆alkenyl, C₂₋₆alkynyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, C₁₋₆alkoxycarbonyl, C₁₋₆alkylaminocarbonyl, diC₁₋₆alkylaminocarbonyl, and C₁₋₆alkylcarbonyl, wherein each of the C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₂₋₆alkenyl, C₂₋₆alkynyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, C₁₋₆alkoxycarbonyl, C₁₋₆alkylaminocarbonyl, diC₁₋₆alkylaminocarbonyl, and C₁₋₆alkylcarbonyl groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN; preferably R² are independently selected from hydrogen, halogen, CN, C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, and C₁₋₆alkoxy-C₁₋₆alkoxy, wherein each of the C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, and C₁₋₆alkoxy-C₁₋₆alkoxy groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN; and more preferably R² are independently selected from hydrogen, halogen, CN, C₁₋₆alkyl, and C₁₋₆alkoxy;
- A³ is independently CR³ or N; with the proviso that at least two R² are preferably not hydrogen;
- R³ is selected from hydrogen, hydroxy, halogen, CN, C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₂₋₆alkenyl, C₂₋₆alkynyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, amino, C₁₋₆alkylamino, diC₁₋₆-alkylamino, and C₃₋₆cycloalkylamino, wherein each of the C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₂₋₆alkenyl, C₂₋₆alkynyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, amino, C₁₋₆alkylamino, diC₁₋₆-alkylamino, and C₃₋₆cycloalkylamino groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN; preferably R³ is selected from hydrogen, hydroxy, halogen, CN, C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, amino, C₁₋₆alkylamino, diC₁₋₆-alkylamino, and C₃₋₆cycloalkylamino, wherein each of the C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, amino, C₁₋₆alkylamino, diC₁₋₆-alkylamino and C₃₋₆cycloalkylamino

groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN; and more preferably R³ is hydrogen;

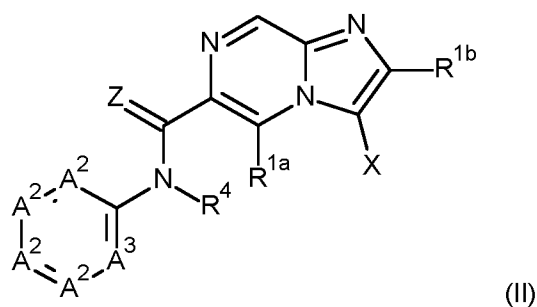
R⁴ is selected from C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₄alkyl, C₂₋₆alkenyl, C₂₋₆alkynyl, C₁₋₆alkoxy, C₁₋₆alkylsulfanyl-C₁₋₆alkyl, C₁₋₆alkylsulfinyl-C₁₋₆alkyl, C₁₋₆alkylsulfonyl-C₁₋₆alkyl, C₁₋₆alkoxycarbonyl-C₁₋₆alkyl, C₁₋₆alkylaminocarbonyl-C₁₋₆alkyl, diC₁₋₆alkylaminocarbonyl-C₁₋₆alkyl, and CN, wherein each of the C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₄alkyl, C₂₋₆alkenyl, C₂₋₆alkynyl, C₁₋₆alkoxy, C₁₋₆alkylsulfanyl-C₁₋₆alkyl, C₁₋₆alkylsulfinyl-C₁₋₆alkyl, C₁₋₆alkylsulfonyl-C₁₋₆alkyl, C₁₋₆alkoxycarbonyl-C₁₋₆alkyl, C₁₋₆alkylaminocarbonyl-C₁₋₆alkyl and diC₁₋₆alkylaminocarbonyl-C₁₋₆alkyl groups is optionally substituted with one to three substituents independently selected from halogen and

10 CN; and

wherein A³ and R⁴ taken together optionally form a ring, more preferably a 5-8-membered heterocycle, more preferably a 6-membered heterocycle;

or a salt or N-oxide thereof.

15 A compound of formula (II)



wherein Z is O or S, and preferably Z is O;

R^{1a} and R^{1b} are independently selected from hydrogen, hydroxy, halogen, CN, C₁₋₆alkyl, C₃₋₆cycloalkyl, C₁₋₆alkoxy-C₁₋₆alkyl, C₃₋₆cycloalkyl-C₁₋₄alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, C₁₋₆alkoxy, amino, and NHC(O)C₁₋₆alkyl; and preferably R^{1a} and R^{1b} are hydrogen;

20 6alkoxy, amino, and NHC(O)C₁₋₆alkyl; and preferably R^{1a} and R^{1b} are hydrogen;

A² are independently CR² or N, with the proviso that no more than three A² are N, preferably no more than two A² are N, preferably no more than one A² is N, and more preferably the four A² are CR²;

R² are independently selected from hydrogen, hydroxy, halogen, CN, C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₂₋₆alkenyl, C₂₋₆alkynyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, C₁₋₆alkoxycarbonyl, C₁₋₆alkylaminocarbonyl, diC₁₋₆alkylaminocarbonyl, and C₁₋₆alkylcarbonyl, wherein each of the C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₂₋₆alkenyl, C₂₋₆alkynyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, C₁₋₆alkoxycarbonyl, C₁₋₆alkylaminocarbonyl, diC₁₋₆alkylaminocarbonyl, and C₁₋₆alkylcarbonyl groups is optionally substituted with one to three substituents

30 independently selected from halogen, hydroxy, and CN; preferably R² are independently selected from hydrogen, halogen, CN, C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, and C₁₋₆alkoxy-C₁₋₆alkoxy, wherein each of the C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, and C₁₋₆alkoxy-C₁₋₆alkoxy groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN; and more preferably R² are independently selected from hydrogen, halogen, CN, C₁₋₆alkyl, and C₁₋₆alkoxy;

35 with the proviso that at least two R² are preferably not hydrogen;

A³ is independently CR³ or N;

R^3 is selected from hydrogen, hydroxy, halogen, CN, C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkoxy, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-6} alkyl, C_{1-6} alkylsulfanyl, C_{1-6} alkylsulfinyl, C_{1-6} alkylsulfonyl, amino, C_{1-6} alkylamino, di- C_{1-6} alkylamino, and C_{3-6} cycloalkylamino, wherein each of the C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkoxy, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-6} alkyl, C_{1-6} alkylsulfanyl, C_{1-6} alkylsulfinyl, C_{1-6} alkylsulfonyl, amino, C_{1-6} alkylamino, di- C_{1-6} alkylamino, and C_{3-6} cycloalkylamino groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN; preferably R^3 is selected from hydrogen, hydroxy, halogen, CN, C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkoxy, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-6} alkyl, amino, C_{1-6} alkylamino, di- C_{1-6} alkylamino, and C_{3-6} cycloalkylamino, wherein each of the C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkoxy, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-6} alkyl, amino, C_{1-6} alkylamino, di- C_{1-6} alkylamino and C_{3-6} cycloalkylamino groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN; and more preferably R^3 is hydrogen;

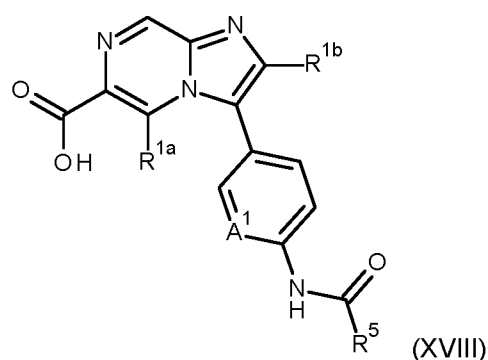
R^4 is selected from C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-4} alkyl, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{1-6} alkoxy, C_{1-6} alkylsulfanyl- C_{1-6} alkyl, C_{1-6} alkylsulfinyl- C_{1-6} alkyl, C_{1-6} alkylsulfonyl- C_{1-6} alkyl, C_{1-6} alkoxycarbonyl- C_{1-6} alkyl, C_{1-6} alkylaminocarbonyl- C_{1-6} alkyl, di- C_{1-6} alkylaminocarbonyl- C_{1-6} alkyl, and CN, wherein each of the C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-4} alkyl, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{1-6} alkoxy, C_{1-6} alkylsulfanyl- C_{1-6} alkyl, C_{1-6} alkylsulfinyl- C_{1-6} alkyl, C_{1-6} alkylsulfonyl- C_{1-6} alkyl, C_{1-6} alkoxycarbonyl- C_{1-6} alkyl, C_{1-6} alkylaminocarbonyl- C_{1-6} alkyl and di- C_{1-6} alkylaminocarbonyl- C_{1-6} alkyl groups is optionally substituted with one to three substituents independently selected from halogen and CN;

wherein A^3 and R^4 taken together optionally form a ring, more preferably a 5-8-membered heterocycle, more preferably a 6-membered heterocycle; and

X is Cl, Br or I;

or a salt or N-oxide thereof.

A compound of formula (XVIII)



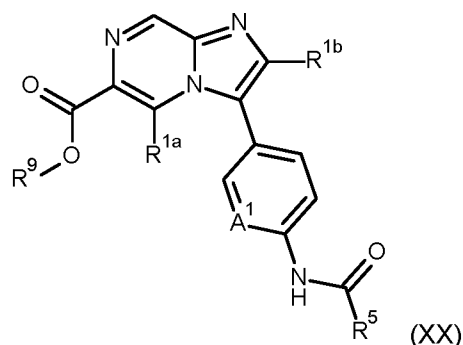
wherein A^1 is CH or N, and preferably N;

R^{1a} and R^{1b} are independently selected from hydrogen, hydroxy, halogen, CN, C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{1-6} alkoxy- C_{1-6} alkyl, C_{3-6} cycloalkyl- C_{1-4} alkyl, C_{1-6} alkylsulfanyl, C_{1-6} alkylsulfinyl, C_{1-6} alkylsulfonyl, C_{1-6} alkoxy, amino, and $NHC(O)C_{1-6}$ alkyl; and preferably R^{1a} and R^{1b} are hydrogen; and

R^5 is selected from C_{1-6} alkyl, C_{1-6} alkoxy, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkyl, C_{1-6} alkylamino, di- C_{1-6} alkylamino, and C_{1-6} alkyl- C_{1-6} alkoxyamino, wherein each of said groups is optionally substituted with one to three substituents independently selected from halogen and CN;

or a salt or N-oxide thereof.

A compound of formula (XX)



5 wherein A¹ is CH or N, and preferably N;

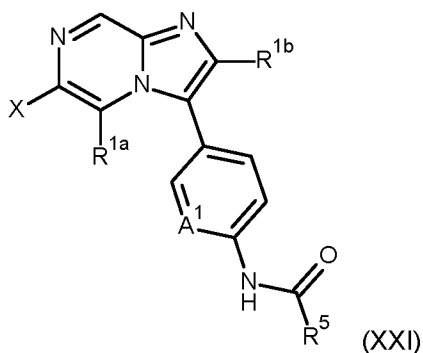
R^{1a} and R^{1b} are independently selected from hydrogen, hydroxy, halogen, CN, C₁₋₆alkyl, C₃₋₆cycloalkyl, C₁₋₆alkoxy-C₁₋₆alkyl, C₃₋₆cycloalkyl-C₁₋₄alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, C₁₋₆alkoxy, amino, and NHC(O)C₁₋₆alkyl; and preferably R^{1a} and R^{1b} are hydrogen;

R⁵ is selected from C₁₋₆alkyl, C₁₋₆alkoxy, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkoxyC₁₋₆alkyl, C₁₋₆alkylamino, diC₁₋₆alkylamino, and C₁₋₆alkylC₁₋₆alkoxyamino, wherein each of said groups is optionally substituted with one to three substituents independently selected from halogen and CN; and

R⁹ is a C₁₋₆ alkyl;

or a salt or N-oxide thereof.

15 A compound of formula (XXI)



wherein A¹ is CH or N, and preferably N;

R^{1a} and R^{1b} are independently selected from hydrogen, hydroxy, halogen, CN, C₁₋₆alkyl, C₃₋₆cycloalkyl, C₁₋₆alkoxy-C₁₋₆alkyl, C₃₋₆cycloalkyl-C₁₋₄alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, C₁₋₆alkoxy, amino, and NHC(O)C₁₋₆alkyl; and preferably R^{1a} and R^{1b} are hydrogen;

R⁵ is selected from C₁₋₆alkyl, C₁₋₆alkoxy, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkoxyC₁₋₆alkyl, C₁₋₆alkylamino, diC₁₋₆alkylamino, and C₁₋₆alkylC₁₋₆alkoxyamino, wherein each of said groups is optionally substituted with one to three substituents independently selected from halogen and CN; and

X is Cl, Br or I;

25 or a salt or N-oxide thereof.

The compounds of formula (I) as defined in the present invention can be used in the agricultural sector and related fields of use e.g. as active ingredients for controlling plant pathogens or on non-living

materials for control of spoilage microorganisms or organisms potentially harmful to man. The novel compounds are distinguished by excellent activity at low rates of application, by being well tolerated by plants and by being environmentally safe. They have very useful curative, preventive and systemic properties and may be used for protecting numerous cultivated plants. The compounds of formula (I) as

5 defined in the present invention can be used to inhibit or destroy the pathogens that occur on plants or parts of plants (fruit, blossoms, leaves, stems, tubers, roots) of different crops of useful plants, while at the same time protecting also those parts of the plants that grow later e.g. from phytopathogenic microorganisms.

- 10 It is also possible to use compounds of formula (I) as defined in the present invention as fungicide. The term "fungicide" as used herein means a compound that controls, modifies, or prevents the growth of fungi. The term "fungicidally effective amount" means the quantity of such a compound or combination of such compounds that is capable of producing an effect on the growth of fungi. Controlling or modifying effects include all deviation from natural development, such as killing, retardation and the like, and
- 15 prevention includes barrier or other defensive formation in or on a plant to prevent fungal infection.

It is also possible to use compounds of formula (I) as defined in the present invention as dressing agents for the treatment of plant propagation material, e.g., seed, such as fruits, tubers or grains, or plant cuttings (for example rice), for the protection against fungal infections as well as against

20 phytopathogenic fungi occurring in the soil. The propagation material can be treated with a composition comprising a compound of formula (I) as defined in the present invention before planting: seed, for example, can be dressed before being sown. The compounds of formula (I) as defined in the present invention can also be applied to grains (coating), either by impregnating the seeds in a liquid formulation or by coating them with a solid formulation. The composition can also be applied to the planting site

25 when the propagation material is being planted, for example, to the seed furrow during sowing. The invention relates also to such methods of treating plant propagation material and to the plant propagation material so treated.

Furthermore the compounds of formula (I) as defined in the present invention can be used for controlling

30 fungi in related areas, for example in the protection of technical materials, including wood and wood related technical products, in food storage, in hygiene management.

In addition, the invention could be used to protect non-living materials from fungal attack, e.g. lumber, wall boards and paint.

35

Compounds of formula (I) as defined in the present invention and fungicidal compositions containing them may be used to control plant diseases caused by a broad spectrum of fungal plant pathogens. They are effective in controlling a broad spectrum of plant diseases, such as foliar pathogens of ornamental, turf, vegetable, field, cereal, and fruit crops.

40

These fungi and fungal vectors of disease, as well as phytopathogenic bacteria and viruses, which may be controlled are for example:

Absidia corymbifera, *Alternaria* spp, *Aphanomyces* spp, *Ascochyta* spp, *Aspergillus* spp. including *A. flavus*, *A. fumigatus*, *A. nidulans*, *A. niger*, *A. terreus*, *Aureobasidium* spp. including *A. pullulans*, *Blastomyces dermatitidis*, *Blumeria graminis*, *Bremia lactucae*, *Botryosphaeria* spp. including *B. dothidea*, *B. obtusa*, *Botrytis* spp. including *B. cinerea*, *Candida* spp. including *C. albicans*, *C. glabrata*,
 5 *C. krusei*, *C. lusitanae*, *C. parapsilosis*, *C. tropicalis*, *Cephalosporium fragrans*, *Ceratocystis* spp, *Cercospora* spp. including *C. arachidicola*, *Cercosporidium personatum*, *Cladosporium* spp, *Claviceps purpurea*,
Coccidioides immitis, *Cochliobolus* spp, *Colletotrichum* spp. including *C. musae*,
Cryptococcus neoformans, *Diaporthe* spp, *Didymella* spp, *Drechslera* spp, *Elsinoe* spp,
 10 *Epidermophyton* spp, *Erwinia amylovora*, *Erysiphe* spp. including *E. cichoracearum*,
Eutypa lata, *Fusarium* spp. including *F. culmorum*, *F. graminearum*, *F. langsethiae*, *F. moniliforme*, *F. oxysporum*, *F. proliferatum*, *F. subglutinans*, *F. solani*, *Gaeumannomyces graminis*, *Gibberella fujikuroi*,
Gloeodes pomigena, *Gloeosporium musarum*, *Glomerella cingulate*, *Guignardia bidwellii*, *Gymnosporangium juniperi-virginianae*, *Helminthosporium* spp, *Hemileia* spp, *Histoplasma* spp.
 15 including *H. capsulatum*, *Laetisaria fuciformis*, *Leptographium lindbergii*, *Leveillula taurica*,
Lophodermium segetis, *Microdochium nivale*, *Microsporum* spp, *Monilinia* spp, *Mucor* spp,
Mycosphaerella spp. including *M. graminicola*, *M. pomi*, *Oncobasidium theobromae*, *Ophiostoma piceae*, *Paracoccidioides* spp, *Penicillium* spp. including *P. digitatum*, *P. italicum*, *Petriellidium* spp,
Peronosclerospora spp. Including *P. maydis*, *P. philippinensis* and *P. sorghi*, *Peronospora* spp,
 20 *Phaeosphaeria nodorum*, *Phakopsora pachyrhizi*, *Phellinus igniarius*, *Phialophora* spp, *Phoma* spp,
Phomopsis viticola, *Phytophthora* spp. including *P. infestans*, *Plasmopara* spp. including *P. halstedii*, *P. viticola*, *Pleospora* spp., *Podosphaera* spp. including *P. leucotricha*, *Polymyxa graminis*, *Polymyxa betae*,
Pseudocercospora herpotrichoides, *Pseudomonas* spp, *Pseudoperonospora* spp. including *P. cubensis*, *P. humuli*, *Pseudopeziza tracheiphila*, *Puccinia* Spp. including *P. hordei*, *P. recondita*, *P.*
 25 *striiformis*, *P. tritici*, *Pyrenopeziza* spp, *Pyrenophora* spp, *Pyricularia* spp. including *P. oryzae*, *Pythium* spp. including *P. ultimum*, *Ramularia* spp, *Rhizoctonia* spp, *Rhizomucor pusillus*, *Rhizopus arrhizus*,
Rhynchosporium spp, *Scedosporium* spp. including *S. apiospermum* and *S. prolificans*, *Schizothyrium pomi*,
Sclerotinia spp, *Sclerotium* spp, *Septoria* spp, including *S. nodorum*, *S. tritici*, *Sphaerotheca macularis*,
 30 *Sphaerotheca fusca* (*Sphaerotheca fuliginea*), *Sporothrix* spp, *Stagonospora nodorum*, *Stemphylium* spp., *Stereum hirsutum*, *Thanatephorus cucumeris*, *Thielaviopsis basicola*, *Tilletia* spp, *Trichoderma* spp. including *T. harzianum*, *T. pseudokoningii*, *T. viride*,
Trichophyton spp, *Typhula* spp, *Ucinula necator*, *Urocystis* spp, *Ustilago* spp, *Venturia* spp. including *V. inaequalis*, *Verticillium* spp, and *Xanthomonas* spp.

35

In particular, compounds of formula (I) as defined in the present invention and fungicidal compositions containing them may be used to control plant diseases caused by a broad spectrum of fungal plant pathogens in the Basidiomycete, Ascomycete, Oomycete and/or Deuteromycete, Blasocladiomycete, Chytridiomycete, Glomeromycete and/or Mucoromycete classes. More particularly, the compounds of
 40 formula (I) as defined in the present invention may be used to control oomycetes.

These pathogens may include:

- Oomycetes, including Phytophthora diseases such as those caused by *Phytophthora capsici*, *Phytophthora infestans*, *Phytophthora sojae*, *Phytophthora fragariae*, *Phytophthora nicotianae*, *Phytophthora cinnamomi*, *Phytophthora citricola*, *Phytophthora citrophthora* and *Phytophthora erythroseptica*; Pythium diseases such as those caused by *Pythium aphanidermatum*, *Pythium arrhenomanes*, *Pythium graminicola*, *Pythium irregulare*, *Pythium sylvaticum* and *Pythium ultimum*; diseases caused by Peronosporales such as *Peronospora destructor*, *Peronospora parasitica*, *Plasmopara viticola*, *Plasmopara halstedii*, *Pseudoperonospora cubensis*, *Albugo candida*, *Sclerophthora macrospora* and *Bremia lactucae*; and others such as *Aphanomyces cochlioides*, *Labyrinthula zosterae*, *Peronosclerospora sorghi* and *Sclerospora graminicola*.
- 10 Ascomycetes, including blotch, spot, blast or blight diseases and/or rots for example those caused by Pleosporales such as *Stemphylium solani*, *Stagonospora tainanensis*, *Spilocaea oleaginea*, *Setosphaeria turcica*, *Pyrenochaeta lycopersici*, *Pleospora herbarum*, *Phoma destructiva*, *Phaeosphaeria herpotrichoides*, *Phaeocryptocus gaeumannii*, *Ophiosphaerella graminicola*, *Ophiobolus graminis*, *Leptosphaeria maculans*, *Hendersonia creberrima*, *Helminthosporium*
- 15 *tritici-repentis*, *Setosphaeria turcica*, *Drechslera glycines*, *Didymella bryoniae*, *Cycloconium oleagineum*, *Corynespora cassicola*, *Cochliobolus sativus*, *Bipolaris cactivora*, *Venturia inaequalis*, *Pyrenophora teres*, *Pyrenophora tritici-repentis*, *Alternaria alternata*, *Alternaria brassicicola*, *Alternaria solani* and *Alternaria tomatophila*, Capnodiales such as *Septoria tritici*, *Septoria nodorum*, *Septoria glycines*, *Cercospora arachidicola*, *Cercospora sojae*, *Cercospora zeae-maydis*, *Cercospora capsellae* and
- 20 *Cercospora herpotrichoides*, *Cladosporium carpophilum*, *Cladosporium effusum*, *Passalora fulva*, *Cladosporium oxysporum*, *Dothistroma septosporum*, *Isariopsis clavispora*, *Mycosphaerella fijiensis*, *Mycosphaerella graminicola*, *Mycovellosiella koepkei*, *Phaeoisariopsis bataticola*, *Pseudocercospora vitis*, *Pseudocercospora herpotrichoides*, *Ramularia beticola*, *Ramularia collo-cygni*, Magnaporthales such as *Gaeumannomyces graminis*, *Magnaporthe grisea*, *Pyricularia oryzae*, Diaporthales such as
- 25 *Anisogramma anomala*, *Apiognomonina errabunda*, *Cytospora platani*, *Diaporthe phaseolorum*, *Discula destructiva*, *Gnomonia fructicola*, *Greeneria uvicola*, *Melanconium juglandinum*, *Phomopsis viticola*, *Sirococcus clavigignenti-juglandacearum*, *Tubakia dryina*, *Dicarpella* spp., *Valsa ceratosperma*, and others such as *Actinothyrium graminis*, *Ascochyta pisi*, *Aspergillus flavus*, *Aspergillus fumigatus*, *Aspergillus nidulans*, *Asperisporium caricae*, *Blumeriella jaapii*, *Candida* spp., *Capnodium ramosum*,
- 30 *Cephalosporium* spp., *Cephalosporium gramineum*, *Ceratocystis paradoxa*, *Chaetomium* spp., *Hymenoscyphus pseudoalbidus*, *Coccidioides* spp., *Cylindrosporium padi*, *Diplocarpon malae*, *Drepanopeziza campestris*, *Elsinoe ampelina*, *Epicoccum nigrum*, *Epidermophyton* spp., *Eutypa lata*, *Geotrichum candidum*, *Gibellina cerealis*, *Gloeocercospora sorghi*, *Gloeodes pomigena*, *Gloeosporium perennans*; *Gloeotinia temulenta*, *Griphosphaeria corticola*, *Kabatiella lini*, *Leptographium microsporum*,
- 35 *Leptosphaerulina crassiasca*, *Lophodermium seditiosum*, *Marssonina graminicola*, *Microdochium nivale*, *Monilinia fructicola*, *Monographella albescens*, *Monosporascus cannonballus*, *Naemacyclus* spp., *Ophiostoma novo-ulmi*, *Paracoccidioides brasiliensis*, *Penicillium expansum*, *Pestalotia rhododendri*, *Petriellidium* spp., *Pezicula* spp., *Phialophora gregata*, *Phyllachora pomigena*, *Phymatotrichum omnivora*, *Physalospora abdita*, *Plectosporium tabacinum*, *Polyscytalum pustulans*,
- 40 *Pseudopeziza medicaginis*, *Pyrenopeziza brassicae*, *Ramulispora sorghi*, *Rhabdocline pseudotsugae*, *Rhynchosporium secalis*, *Sacrocladium oryzae*, *Scedosporium* spp., *Schizothyrium pomi*, *Sclerotinia sclerotiorum*, *Sclerotinia minor*, *Sclerotium* spp., *Typhula ishikariensis*, *Seimatosporium mariae*,

Lepteutypa cupressi, *Septocytia ruborum*, *Sphaceloma perseae*, *Sporonema phacidiodioides*, *Stigmia palmivora*, *Tapesia yallundae*, *Taphrina bullata*, *Thielviopsis basicola*, *Trichoseptoria fructigena*, *Zygophiala jamaicensis*; powdery mildew diseases for example those caused by Erysiphales such as *Blumeria graminis*, *Erysiphe polygoni*, *Uncinula necator*, *Sphaerotheca fuliginea*, *Podosphaera*
5 *leucotricha*, *Podosphaera macularis* *Golovinomyces cichoracearum*, *Leveillula taurica*, *Microsphaera diffusa*, *Oidiopsis gossypii*, *Phyllactinia guttata* and *Oidium arachidis*; molds for example those caused by Botryosphaerales such as *Dothiorella aromatica*, *Diplodia seriata*, *Guignardia bidwellii*, *Botrytis cinerea*, *Botryotinia allii*, *Botryotinia fabae*, *Fusicoccum amygdali*, *Lasiodiplodia theobromae*, *Macrophoma theicola*, *Macrophomina phaseolina*, *Phyllosticta cucurbitacearum*; anthracnoses for
10 example those caused by Glomerellales such as *Colletotrichum gloeosporioides*, *Colletotrichum lagenarium*, *Colletotrichum gossypii*, *Glomerella cingulata*, and *Colletotrichum graminicola*; and wilts or blights for example those caused by Hypocreales such as *Acremonium strictum*, *Claviceps purpurea*, *Fusarium culmorum*, *Fusarium graminearum*, *Fusarium virguliforme*, *Fusarium oxysporum*, *Fusarium subglutinans*, *Fusarium oxysporum* f.sp. *cubense*, *Gerlachia nivale*, *Gibberella fujikuroi*, *Gibberella*
15 *zeae*, *Gliocladium* spp., *Myrothecium verrucaria*, *Nectria ramulariae*, *Trichoderma viride*, *Trichothecium roseum*, and *Verticillium theobromae*.

Basidiomycetes, including smuts for example those caused by Ustilaginales such as *Ustilaginoidea virens*, *Ustilago nuda*, *Ustilago tritici*, *Ustilago zeae*, rusts for example those caused by Pucciniales such as *Cerotelium fici*, *Chrysomyxa arctostaphyli*, *Coleosporium ipomoeae*, *Hemileia vastatrix*, *Puccinia*
20 *arachidis*, *Puccinia cacabata*, *Puccinia graminis*, *Puccinia recondita*, *Puccinia sorghi*, *Puccinia hordei*, *Puccinia striiformis* f.sp. *Hordei*, *Puccinia striiformis* f.sp. *Secalis*, *Pucciniastrum coryli*, or Uredinales such as *Cronartium ribicola*, *Gymnosporangium juniperi-viginianae*, *Melampsora medusae*, *Phakopsora pachyrhizi*, *Phragmidium mucronatum*, *Physopella ampeloidis*, *Tranzschelia discolor* and *Uromyces viciae-fabae*; and other rots and diseases such as those caused by *Cryptococcus* spp., *Exobasidium*
25 *vexans*, *Marasmiellus inoderma*, *Mycena* spp., *Sphacelotheca reiliana*, *Typhula ishikariensis*, *Urocystis agropyri*, *Itersonilia perplexans*, *Corticium invisum*, *Laetisaria fuciformis*, *Waitea circinata*, *Rhizoctonia solani*, *Thanetophorus cucurmeris*, *Entyloma dahliae*, *Entylomella microspora*, *Neovossia molinae* and *Tilletia caries*.

Blastocladiomycetes, such as *Physoderma maydis*.

30 Mucoromycetes, such as *Choanephora cucurbitarum*.; *Mucor* spp.; *Rhizopus arrhizus*.

As well as diseases caused by other species and genera closely related to those listed above.

In addition to their fungicidal activity, the compounds and compositions comprising compounds of formula (I) as defined in the present invention may also have activity against bacteria such as *Erwinia*
35 *amylovora*, *Erwinia caratovora*, *Xanthomonas campestris*, *Pseudomonas syringae*, *Strptomyces scabies* and other related species as well as certain protozoa.

Within the scope of the present invention, target crops and/or useful plants to be protected typically comprise perennial and annual crops, such as berry plants for example blackberries, blueberries,
40 cranberries, raspberries and strawberries; cereals for example barley, maize (corn), millet, oats, rice, rye, sorghum triticales and wheat; fibre plants for example cotton, flax, hemp, jute and sisal; field crops for example sugar and fodder beet, coffee, hops, mustard, oilseed rape (canola), poppy, sugar cane,

sunflower, tea and tobacco; fruit trees for example apple, apricot, avocado, banana, cherry, citrus, nectarine, peach, pear and plum; grasses for example Bermuda grass, bluegrass, bentgrass, centipede grass, fescue, ryegrass, St. Augustine grass and Zoysia grass; herbs such as basil, borage, chives, coriander, lavender, lovage, mint, oregano, parsley, rosemary, sage and thyme; legumes for example

5 beans, lentils, peas and soya beans; nuts for example almond, cashew, ground nut, hazelnut, peanut, pecan, pistachio and walnut; palms for example oil palm; ornamentals for example flowers, shrubs and trees; other trees, for example cacao, coconut, olive and rubber; vegetables for example asparagus, aubergine, broccoli, cabbage, carrot, cucumber, garlic, lettuce, marrow, melon, okra, onion, pepper, potato, pumpkin, rhubarb, spinach and tomato; and vines for example grapes.

10

The useful plants and / or target crops in accordance with the invention include conventional as well as genetically enhanced or engineered varieties such as, for example, insect resistant (e.g. Bt. and VIP varieties) as well as disease resistant, herbicide tolerant (e.g. glyphosate- and glufosinate-resistant maize varieties commercially available under the trade names RoundupReady® and LibertyLink®) and

15 nematode tolerant varieties. By way of example, suitable genetically enhanced or engineered crop varieties include the Stoneville 5599BR cotton and Stoneville 4892BR cotton varieties.

The term "useful plants" and/or "target crops" is to be understood as including also useful plants that have been rendered tolerant to herbicides like bromoxynil or classes of herbicides (such as, for example,

20 HPPD inhibitors, ALS inhibitors, for example primisulfuron, prosulfuron and trifloxysulfuron, EPSPS (5-enol-pyrovyl-shikimate-3-phosphate-synthase) inhibitors, GS (glutamine synthetase) inhibitors or PPO (protoporphyrinogen-oxidase) inhibitors) as a result of conventional methods of breeding or genetic engineering. An example of a crop that has been rendered tolerant to imidazolinones, e.g. imazamox, by conventional methods of breeding (mutagenesis) is Clearfield® summer rape (Canola). Examples of

25 crops that have been rendered tolerant to herbicides or classes of herbicides by genetic engineering methods include glyphosate- and glufosinate-resistant maize varieties commercially available under the trade names RoundupReady® , Herculex I® and LibertyLink®.

The term "useful plants" and/or "target crops" is to be understood as including those which naturally are

30 or have been rendered resistant to harmful insects. This includes plants transformed by the use of recombinant DNA techniques, for example, to be capable of synthesising one or more selectively acting toxins, such as are known, for example, from toxin-producing bacteria. Examples of toxins which can be expressed include δ -endotoxins, vegetative insecticidal proteins (Vip), insecticidal proteins of bacteria colonising nematodes, and toxins produced by scorpions, arachnids, wasps and fungi. An

35 example of a crop that has been modified to express the *Bacillus thuringiensis* toxin is the Bt maize KnockOut® (Syngenta Seeds). An example of a crop comprising more than one gene that codes for insecticidal resistance and thus expresses more than one toxin is VipCot® (Syngenta Seeds). Crops or seed material thereof can also be resistant to multiple types of pests (so-called stacked transgenic events when created by genetic modification). For example, a plant can have the ability to express an

40 insecticidal protein while at the same time being herbicide tolerant, for example Herculex I® (Dow AgroSciences, Pioneer Hi-Bred International).

The term "useful plants" and/or "target crops" is to be understood as including also useful 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

5 "pathogenesis-related proteins" (PRPs, see e.g. EP-A-0 392 225). Examples of such antipathogenic substances and 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.

10

Toxins that can be expressed by transgenic plants include, 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

15 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-

20 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.

25

Further, 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

30 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 WO03/018810).

35

More examples of such toxins or transgenic plants capable of synthesising such toxins are disclosed, for example, in EP-A-0 374 753, WO93/07278, WO95/34656, EP-A-0 427 529, EP-A-451 878 and WO03/052073.

40 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 butterflies (Lepidoptera).

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 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®, Agrisure® GT Advantage (GA21 glyphosate-tolerant trait), Agrisure® CB Advantage (Bt11 corn borer (CB) trait) and Protecta®.

20

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, 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, 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, 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, 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.
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.
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 obtained from *Bacillus thuringiensis subsp. kurstaki* which brings about tolerance to certain Lepidoptera, include the European corn borer.
- 15 The term "locus" as used herein means fields in or on which plants are growing, or where seeds of cultivated plants are sown, or where seed will be placed into the soil. It includes soil, seeds, and seedlings, as well as established vegetation.

The term "plants" refers to all physical parts of a plant, including seeds, seedlings, saplings, roots, tubers, stems, stalks, foliage, and fruits.

The term "plant propagation material" is understood to denote generative parts of the plant, such as seeds, which can be used for the multiplication of the latter, and vegetative material, such as cuttings or tubers, for example potatoes. There may be mentioned for example seeds (in the strict sense), roots, fruits, tubers, bulbs, rhizomes and parts of plants. Germinated plants and young plants which are to be transplanted after germination or after emergence from the soil, may also be mentioned. These young plants may be protected before transplantation by a total or partial treatment by immersion. Preferably "plant propagation material" is understood to denote seeds.

Pesticidal agents referred to herein using their common name are known, for example, from "The Pesticide Manual", 19th Ed., British Crop Protection Council 2021.

The compounds of formula (I) as defined in the present invention may be used in unmodified form or, preferably, together with the adjuvants conventionally employed in the art of formulation. To this end they may be conveniently formulated in known manner to emulsifiable concentrates, coatable pastes, directly sprayable or dilutable solutions or suspensions, dilute emulsions, wettable powders, soluble powders, dusts, granulates, and also encapsulations e.g. in polymeric substances. As with the type of the compositions, the methods of application, such as spraying, atomising, dusting, scattering, coating or pouring, are chosen in accordance with the intended objectives and the prevailing circumstances. The compositions may also contain further adjuvants such as stabilizers, antifoams, viscosity regulators, binders or tackifiers as well as fertilizers, micronutrient donors or other formulations for obtaining special effects.

Suitable carriers and/or adjuvants, e.g. for agricultural use, can be solid or liquid and are substances useful in formulation technology, e.g. natural or regenerated mineral substances, solvents, dispersants, wetting agents, tackifiers, thickeners, binders or fertilizers. Such carriers are for example described in WO 97/33890.

5

Suspension concentrates are aqueous formulations in which finely divided solid particles of the active compound are suspended. Such formulations include anti-settling agents and dispersing agents and may further include a wetting agent to enhance activity as well an anti-foam and a crystal growth inhibitor. In use, these concentrates are diluted in water and normally applied as a spray to the area to be treated. The amount of active ingredient may range from 0.5% to 95% of the concentrate.

Wettable powders are in the form of finely divided particles which disperse readily in water or other liquid carriers. The particles contain the active ingredient retained in a solid matrix. Typical solid matrices include fuller's earth, kaolin clays, silicas and other readily wet organic or inorganic solids. Wettable powders normally contain from 5% to 95% of the active ingredient plus a small amount of wetting, dispersing or emulsifying agent.

Emulsifiable concentrates are homogeneous liquid compositions dispersible in water or other liquid and may consist entirely of the active compound with a liquid or solid emulsifying agent, or may also contain a liquid carrier, such as xylene, heavy aromatic naphthas, isophorone and other non-volatile organic solvents. In use, these concentrates are dispersed in water or other liquid and normally applied as a spray to the area to be treated. The amount of active ingredient may range from 0.5% to 95% of the concentrate.

Granular formulations include both extrudates and relatively coarse particles and are usually applied without dilution to the area in which treatment is required. Typical carriers for granular formulations include sand, fuller's earth, attapulgite clay, bentonite clays, montmorillonite clay, vermiculite, perlite, calcium carbonate, brick, pumice, pyrophyllite, kaolin, dolomite, plaster, wood flour, ground corn cobs, ground peanut hulls, sugars, sodium chloride, sodium sulphate, sodium silicate, sodium borate, magnesia, mica, iron oxide, zinc oxide, titanium oxide, antimony oxide, cryolite, gypsum, diatomaceous earth, calcium sulphate and other organic or inorganic materials which absorb or which can be coated with the active compound. Granular formulations normally contain 5% to 25% of active ingredients which may include surface-active agents such as heavy aromatic naphthas, kerosene and other petroleum fractions, or vegetable oils; and/or stickers such as dextrans, glue or synthetic resins.

35

Dusts are free-flowing admixtures of the active ingredient with finely divided solids such as talc, clays, flours and other organic and inorganic solids which act as dispersants and carriers.

Microcapsules are typically droplets or granules of the active ingredient enclosed in an inert porous shell which allows escape of the enclosed material to the surroundings at controlled rates. Encapsulated droplets are typically 1 to 50 microns in diameter. The enclosed liquid typically constitutes 50 to 95% of the weight of the capsule and may include solvent in addition to the active compound. Encapsulated

granules are generally porous granules with porous membranes sealing the granule pore openings, retaining the active species in liquid form inside the granule pores. Granules typically range from 1 millimetre to 1 centimetre and preferably 1 to 2 millimetres in diameter. Granules are formed by extrusion, agglomeration or prilling, or are naturally occurring. Examples of such materials are

5 vermiculite, sintered clay, kaolin, attapulgite clay, sawdust and granular carbon. Shell or membrane materials include natural and synthetic rubbers, cellulosic materials, styrene-butadiene copolymers, polyacrylonitriles, polyacrylates, polyesters, polyamides, polyureas, polyurethanes and starch xanthates.

- 10 Other useful formulations for agrochemical applications include simple solutions of the active ingredient in a solvent in which it is completely soluble at the desired concentration, such as acetone, alkylated naphthalenes, xylene and other organic solvents. Pressurised sprayers, wherein the active ingredient is dispersed in finely-divided form as a result of vaporisation of a low boiling dispersant solvent carrier, may also be used.

15

Suitable agricultural adjuvants and/or carriers that are useful in formulating the compositions of the invention in the formulation types described above are well known to those skilled in the art.

- Liquid carriers that can be employed include, for example, water, toluene, xylene, petroleum naphtha,
- 20 crop oil, acetone, methyl ethyl ketone, cyclohexanone, acetic anhydride, acetonitrile, acetophenone, amyl acetate, 2-butanone, chlorobenzene, cyclohexane, cyclohexanol, alkyl acetates, diacetonalcohol, 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-dimethyl formamide, dimethyl sulfoxide, 1,4-dioxane, dipropylene glycol, dipropylene glycol methyl ether,
- 25 dipropylene glycol dibenzoate, diproxitol, alkyl pyrrolidinone, ethyl acetate, 2-ethyl hexanol, ethylene carbonate, 1,1,1-trichloroethane, 2-heptanone, alpha pinene, d-limonene, ethylene glycol, ethylene glycol butyl ether, ethylene glycol methyl ether, gamma-butyrolactone, glycerol, glycerol diacetate, glycerol monoacetate, glycerol triacetate, hexadecane, hexylene glycol, isoamyl acetate, isobornyl acetate, isooctane, isophorone, isopropyl benzene, isopropyl myristate, lactic acid, laurylamine, mesityl
- 30 oxide, methoxy-propanol, methyl isoamyl ketone, methyl isobutyl ketone, methyl laurate, methyl octanoate, methyl oleate, methylene chloride, m-xylene, n-hexane, n-octylamine, octadecanoic acid, octyl amine acetate, oleic acid, oleylamine, o-xylene, phenol, polyethylene glycol (PEG400), propionic acid, propylene glycol, propylene glycol monomethyl ether, p-xylene, toluene, triethyl phosphate, triethylene glycol, xylene sulfonic acid, paraffin, mineral oil, trichloroethylene, perchloroethylene, ethyl
- 35 acetate, amyl acetate, butyl acetate, methanol, ethanol, isopropanol, and higher molecular weight alcohols such as amyl alcohol, tetrahydrofurfuryl alcohol, hexanol, octanol, etc., ethylene glycol, propylene glycol, glycerine and N-methyl-2-pyrrolidinone. Water is generally the carrier of choice for the dilution of concentrates.

- 40 Suitable solid carriers include, for example, talc, titanium dioxide, pyrophyllite clay, silica, attapulgite clay, kieselguhr, chalk, diatomaceous earth, lime, calcium carbonate, bentonite clay, fuller's earth, cotton seed hulls, wheat flour, soybean flour, pumice, wood flour, walnut shell flour and lignin.

A broad range of surface-active agents are advantageously employed in both said liquid and solid compositions, especially those designed to be diluted with carrier before application. These agents, when used, normally comprise from 0.1% to 15% by weight of the formulation. They can be anionic, cationic, non-ionic or polymeric in character and can be employed as emulsifying agents, wetting agents, suspending agents or for other purposes. Typical surface active agents include salts of alkyl sulfates, such as diethanolammonium lauryl sulphate; alkylarylsulfonate salts, such as calcium dodecylbenzenesulfonate; alkylphenol-alkylene oxide addition products, such as nonylphenol-C.sub. 18 ethoxylate; alcohol-alkylene oxide addition products, such as tridecyl alcohol-C.sub. 16 ethoxylate; soaps, such as sodium stearate; alkylnaphthalenesulfonate salts, such as sodium dibutylnaphthalenesulfonate; dialkyl esters of sulfosuccinate salts, such as sodium di(2-ethylhexyl) sulfosuccinate; sorbitol esters, such as sorbitol oleate; quaternary amines, such as lauryl trimethylammonium 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 dialkyl phosphate esters.

Other adjuvants commonly utilized in agricultural compositions include crystallisation inhibitors, viscosity modifiers, suspending agents, spray droplet modifiers, pigments, antioxidants, foaming agents, anti-foaming agents, light-blocking agents, compatibilizing agents, antifoam agents, sequestering agents, neutralising agents and buffers, corrosion inhibitors, dyes, odorants, spreading agents, penetration aids, micronutrients, emollients, lubricants and sticking agents.

In addition, further, other biocidally active ingredients or compositions may be combined with the compositions of the invention and used in the methods of the invention and applied simultaneously or sequentially with the compositions of the invention. When applied simultaneously, these further active ingredients may be formulated together with the compositions of the invention or mixed in, for example, the spray tank. These further biocidally active ingredients may be fungicides, herbicides, insecticides, bactericides, acaricides, nematocides, plant growth regulators, and/or biologicals.

The following combinations of a compound of formula I with another active substance in a weight ratio of 1:1 are preferred (where the abbreviation "TX" means one compound selected from the compounds defined in the Tables 1.1 to 1.45 and Table A):

(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, (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 + TX, 14-methyloctadec-1-ene + TX, 1-hydroxy-1H-pyridine-2-thione + TX, 2-(octylthio)ethanol + TX, 2-chlorophenyl N-methylcarbamate (CPMC) + TX, 3-(4-chlorophenyl)-5-methylrhodanine + TX, 3,4-dichlorotetrahydrothiophene 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 + TX, aminocarb + TX, Anagrapha 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 chitinosporus 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 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, Bacillus thuringiensis subsp. Japonensis + TX, Bacillus thuringiensis subsp. Kurstaki + TX, Bacillus thuringiensis subsp. Tenebrionis + TX, Bacillus thuringiensis subsp. kurstaki BMP 123 + TX, Beauveria bassiana + TX, Beauveria brongniartii + TX, benclothiaz + TX, benomyl + TX, bensultap + TX, benzoximate + TX, benzpyrimoxan + TX, betacyfluthrin + TX, beta-cypermethrin + TX, bethoxazin + TX, bifenazate + TX, bifenthrin + TX, 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, butopyronoxyl + TX, butoxy(polypropylene glycol) + TX, butylpyridaben + TX, cadusafos + TX, calcium arsenate + TX, carbaryl + TX, carbofuran + TX, carbon disulfide + TX, carbosulfan + TX, cartap + TX, 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: 1445683-71-5 + TX, CAS number: 1445684-82-1 + 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 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: 2128706-04-5 + 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: 2408220-94-8 + TX, CAS number: 2415706-16-8 + TX, Piperflanilide (CAS number: 2615135-05-0) + TX, CAS number: 2719848-60-7 + 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, cruformate + TX, Cryptolaemus montrouzieri + TX, cuclure + TX, cyanofenphos + TX, cyantraniliprole + 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, cyhalothrin + TX, cypermethrin + TX, cyphenothrin + TX, cyproflanilide + 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, 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-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, 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, 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 + TX, flufenerim + TX, flufenprox + TX, flufiprole + TX, fluhexafon + TX, flumethrin + TX, fluopyram + TX, flupyradifurone + TX, flupyrimin + TX, flupyroxystrobin + TX, fluralaner + TX, fluvalinate + TX, fluxametamide + TX, formaldehyde + TX, fosthiazate + TX, fothietan + TX, frontaline + TX, furfural + 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, grandlure + TX, grandlure I + TX, grandlure II + TX, grandlure III + TX, grandlure IV + TX, Granulovirus + TX, guadiapyr + 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, 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, Indazaproxamet + 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 + 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, oxazosulfyl + 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, 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, quinoclamine + 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, spirobudifen + TX, spiroadiclofen + TX, spiromesifen + TX, spiropidion + 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 riobravus + 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, sulfoxaflor + 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, thiacycpermethrin + TX, thiachloprid + TX, thiafenox + TX, thiamethoxam + TX, thiocyclam + TX, thiodicarb + TX, thiofanox + TX, thiohempa + TX, thiomersal + TX, thiometon + TX, thionazin + TX, thiophanate + TX, thiosultap + TX, thiotepa + TX, tigolaner + TX, tiorantraniliprole + TX, tioazafen + 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, trifluenfuronate + TX, triflumezopyrim + TX, trimedlure + TX, trimedlure A + TX, trimedlure B1 + TX, trimedlure B2 + TX, trimedlure C + TX, trimethacarb + TX, triphenyltin acetate + TX, triphenyltin hydroxide + TX, trunc-call + TX, tyclopyrazoflor + TX, Typhlodromus occidentalis + TX, uredepa + TX, Verticillium lecanii + TX, Verticillium spp. + TX, xlenols + 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-formamidine (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-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, (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-chlorophenyl] 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-methylpyrazolo[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-chlorophenyl)-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-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 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 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-dichlorophenyl)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 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-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 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-dichlorotetrahydrothiophene 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 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 dimethylcarbamate + 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, ametotradin + TX, amidithion + TX, amidothioate + TX, aminocarb + TX, aminopyrifin + TX, amisulbrom + TX, amiton + TX, amiton hydrogen oxalate + TX, amitraz + TX, anabasine + TX, Anagrapta 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, 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, bromocyclen + 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-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 hydrochloride + TX, CAS Number: 2132414-04-9 + TX, CAS Number: 2344721-61-3 + TX, cevadine + TX, chinomethionat + TX, chloralose + TX, chlorbenside + TX, chlorbicyclen + TX, chlordan + 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 + TX, chloropropylate + TX, chlorothalonil + 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, clocythr + 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 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, cridine + TX, crotamiton + TX, crotoxyphos + TX, crufomate + TX, cryolite + TX, Cryptolaemus montrouzieri + TX, CS 708 + TX, cuelure + TX, cufraneb + TX, cyanofenphos + TX, cyanophos + TX, cyanthoate + TX, cyazofamid + TX, cybutryne + TX, cycethrin + TX, cyclobutirfluram + 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, 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, dimethomorph + 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, dinocron + TX, dinopenton + TX, dinoprop + TX, dinosam + TX, dinoseb + TX, dinosulfon + TX, dinoterbon + TX, diofenolan + TX, dioxabenzofos + TX, dioxathion + TX, diphacinone + TX, diphenyl sulfone + TX, dipymetitrone + 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, 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, epoxiconazole + 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-en-1-yn-1-yl]phenyl]methyl]pyrazole-3-carboxylate (may be prepared 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, 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, famoxadone + TX, farnesol + TX, farnesol with nerolidol + TX, fenamidone + TX, fenaminosulf + TX, fenaminstrobin + TX, fenanimol + TX, fenazaflor + TX, fenbuconazole + TX, fenbutatin oxide + TX, fenchlorphos + TX, fenethacarb + TX, fenfuram + TX, fenhexamid + TX, fenitrothion + TX, fenothiocarb + TX, fenoxacrim + TX, fenoxanil + TX, fempiclonil + TX, fempicoxamid + TX, fempirithrin + TX, fenpropidin + TX, fenpropimorph + TX, fenpyrad + TX, fenpyrazamine + TX, fenpyroximate + 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, fluazinam + TX, flubeneteram + TX, flubenzimine + TX, flucofuron + TX, flucycloxuron + TX, fludioxonil + TX, fluenetil + TX, flufenoxadiazam + TX, flufenoxystrobin + TX, fluindapyr + TX, flumetylsulfurim + 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, 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, frontaline + TX, fuberidazole + TX, furalaxyl + TX, furametpyr + TX, furathiocarb + 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, HDDN + TX, Hippodamia convergens + TX, hydrargaphen + TX, hydrated lime + TX, 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, 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, lirifos + TX, litlure + TX, looplure + TX, lvenmixianan + TX, lythidathion + TX, 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, mepanipirim + TX, meperfluthrin + TX, mephosfolan + TX, mepronil + TX, mercuric oxide + TX, mercurous chloride + TX, mesulfen + TX, mesulfenfos + TX, metalaxyl + TX, metam + TX, metam-potassium + TX, metam-sodium + TX, *Metaphycus helvolus* + TX, *Metarhizium anisopliae* var. *acidum* + TX, *Metarhizium anisopliae* var. *anisopliae* + TX, metarylpicoxamid + TX, metconazole + TX, metepa + TX, methacrifos + TX, methanesulfonyl fluoride + TX, methasulfocarb + 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, metominostrobin + 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-(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, 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, 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, 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, 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, pyrifenox + TX, pyrimethanil + TX, pyrimitate + TX, pyrimorph + TX, pyrinuron + TX, pyriofenone + TX, pyrisoxazole + TX, pyroquilon + TX, quassia + TX, quinalphos + TX, quinalphos-methyl + TX, quinoclamine + TX, quinofumelin + TX, quinonamid + TX, quinothion + TX, quinoxifen + TX, quintiofos + TX, quintozone + TX, R-1492 + TX, rafoxanide + TX, resmethrin + TX, Reynoutria sachalinensis extract + TX, ribavirin + TX, Rmetalaxyl + TX, rotenone + TX, ryania + TX, ryanodine + TX, S421 + TX, sabadilla + TX, schradan + TX, scilliroside + TX, 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 riobravus + 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, thiabendazole + TX, thiafenox + TX, thiapronil + TX, thicrofos + 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, triadimenol + 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, xyleneols + TX, zeatin + TX, zetamethrin + TX, zhongshengmycin + TX, zinc naphthenate + TX, zinc phosphide + TX, zinc thiazole + TX, zineb + TX, ziram + TX, zolaprofos + 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, 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 (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 cinerea + TX, Bradyrhizobium japonicum (TerraMax®) + TX, 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, 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, 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, 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®, PreFeRa®) + 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 coerules + 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 aureofaciens (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 (Triatum-P®, PlantShield HC®, RootShield®, Triatum-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, Aeniaspis citricola + TX, Aeniaspis 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 loecki + 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®, EnStrip®) + 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 ceratitivorus + 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, 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 (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, 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 tricusps + TX, Pseudaphycus maculipennis + TX, Pseudleptomastix mexicana + TX, Psyllaephagus pilosus + TX, Psytalia concolor (complex) + TX, 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®, 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 minutum + TX, Trichogramma ostrinae + TX, Trichogramma platneri + TX, Trichogramma pretiosum + TX, Xanthopimpla stemmator + TX;

abscisic acid + TX, Aminomite® + TX, BioGain® + TX, bioSea® + TX, CAS Number: 2643947-26-4 + 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 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 (Takitrapiine y + b®) + TX;

Bacillus mojavensis 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 TGAI® 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 prora*dix (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, *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, *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 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 No. ATCC 20906) (e.g., ROOTSHIELD® PLUS WP and TURFSHIELD® PLUS WP from BioWorks, US) + TX, *Trichoderma viride* in particular strain B35 (Pietri et al., 1993, Zesz.

Nauk. A R w Szczecinie 161: 125-137) + TX, *Trichoderma viride* strain TV1 (e.g. Triatum-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 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*, 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 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 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* 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 prora*dix (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

ATCC20851 + 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;

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), + 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 (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* 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 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 TGAI and ZELTO® from Marrone Bio Innovations), +

TX, *Chromobacterium subtsugae* in 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* (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 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, *Adoxophyes orana* (summer fruit tortrix) granulosis virus (GV) + TX, *Spodoptera exigua* (beet armyworm) mNPV + TX, *Spodoptera frugiperda* (fall armyworm) mNPV + TX;

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;

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™ 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, 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, aluminium phosphide + TX, anthraquinone + TX, antu + TX, arsenous oxide + TX, barium carbonate + TX, benoxacor + TX, bithiosemi + 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, 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.

In addition, the compositions of the invention may also be applied with one or more systemically acquired resistance inducers ("SAR" inducer). SAR inducers are known and described in, for example, United States Patent No. US 6,919,298 and include, for example, salicylates and the commercial SAR inducer

5 acibenzolar-S-methyl.

The compounds of formula (I) as defined in the present invention are normally used in the form of compositions and can be applied to the crop area or plant to be treated, simultaneously or in succession with further compounds. These further compounds can be e.g. fertilizers or micronutrient donors or other

10 preparations, which influence the growth of plants. They can also be selective herbicides or non-selective herbicides as well as insecticides, fungicides, bactericides, nematocides, molluscicides or mixtures of several of these preparations, if desired together with further carriers, surfactants or application promoting adjuvants customarily employed in the art of formulation.

15 The compounds of formula (I) as defined in the present invention may be used in the form of (fungicidal) compositions for controlling or protecting against phytopathogenic microorganisms, comprising as active ingredient at least one compound of formula (I) as defined in the present invention or of at least one preferred individual compound as above-defined, in free form or in agrochemically usable salt form, and at least one of the above-mentioned adjuvants.

20

The invention therefore provides a composition, preferably a fungicidal composition, comprising at least one compound of formula (I) as defined in the present invention, an agriculturally acceptable carrier and optionally an adjuvant. An agricultural acceptable carrier is for example a carrier that is suitable for

agricultural use. Agricultural carriers are well known in the art. Preferably said composition may comprise at least one or more pesticidally active compounds, for example an additional fungicidal active ingredient in addition to the compound of formula (I) as defined in the present invention.

- 5 A further aspect of invention is related to a method of controlling or preventing an infestation of plants, e.g. useful plants such as crop plants, propagation material thereof, e.g. seeds, harvested crops, e.g. harvested food crops, or of non-living materials by phytopathogenic or spoilage microorganisms or organisms potentially harmful to man, especially fungal organisms, which comprises the application of a compound of formula (I) as defined in the present invention or of a preferred individual compound as
10 above-defined as active ingredient to the plants, to parts of the plants or to the locus thereof, to the propagation material thereof, or to any part of the non-living materials.

- Controlling or preventing means reducing infestation by insects or by phytopathogenic or spoilage microorganisms or organisms potentially harmful to man, especially fungal organisms, to such a level
15 that an improvement is demonstrated.

- A preferred method of controlling or preventing an infestation of crop plants by phytopathogenic microorganisms, especially fungal organisms, which comprises the application of a compound of formula (I) as defined in the present invention, or an agrochemical composition which contains at least one of
20 said compounds, is foliar application. The frequency of application and the rate of application will depend on the risk of infestation by the corresponding pathogen or insect. However, the compounds of formula (I) as defined in the present invention can also penetrate the plant through the roots via the soil (systemic action) by drenching the locus of the plant with a liquid formulation, or by applying the compounds in solid form to the soil, e.g. in granular form (soil application). In crops of water rice such granulates can
25 be applied to the flooded rice field. The compounds of formula (I) as defined in any the present invention may also be applied to seeds (coating) by impregnating the seeds or tubers either with a liquid formulation of the fungicide or coating them with a solid formulation.

- A formulation, e.g. a composition containing the compound of formula (I) as defined in the present
30 invention, and, if desired, a solid or liquid adjuvant or monomers for encapsulating the compound of formula (I) as defined in the present invention, may be prepared in a known manner, typically by intimately mixing and/or grinding the compound with extenders, for example solvents, solid carriers and, optionally, surface active compounds (surfactants).

- 35 The application methods for the compositions, that is the methods of controlling pathogens 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 pathogens 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
40 active ingredient. The rate of application per hectare is preferably 1g to 2000 g of active ingredient per hectare, more preferably 10 to 1000 g/ha, most preferably 10 to 600 g/ha. When used as seed drenching agent, convenient dosages are from 10mg to 1g of active substance per kg of seeds.

When the combinations of the present invention are used for treating seed, rates of 0.001 to 50 g of a compound of formula (I) per kg of seed, preferably from 0.01 to 10g per kg of seed are generally sufficient.

5

Suitably, a composition comprising a compound of formula (I) as defined in the present invention according to the present invention is applied either preventative, meaning prior to disease development or curative, meaning after disease development.

- 10 The compositions of the invention may be employed in any conventional form, for example in the form of a twin pack, a powder for dry seed treatment (DS), an emulsion for seed treatment (ES), a flowable concentrate for seed treatment (FS), a solution for seed treatment (LS), a water dispersible powder for seed treatment (WS), a capsule suspension for seed treatment (CF), a gel for seed treatment (GF), an emulsion concentrate (EC), a suspension concentrate (SC), a suspo-emulsion (SE), a capsule
- 15 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) or any technically feasible formulation in combination with agriculturally
- 20 acceptable adjuvants.

Such compositions may be produced in conventional manner, e.g. by mixing the active ingredients with appropriate formulation inerts (diluent, solvents, fillers and optionally other formulating ingredients such as surfactants, biocides, anti-freeze, stickers, thickeners and compounds that provide adjuvancy

25 effects). Also conventional slow release formulations may be employed where long lasting efficacy is intended. Particularly formulations to be applied in spraying forms, such as water dispersible concentrates (e.g. EC, SC, DC, OD, SE, EW, EO and the like), wettable powders and granules, may contain surfactants such as wetting and dispersing agents and other compounds that provide adjuvancy effects, e.g. the condensation product of formaldehyde with naphthalene sulphonate, an

30 alkylarylsulphonate, a lignin sulphonate, a fatty alkyl sulphate, and ethoxylated alkylphenol and an ethoxylated fatty alcohol.

A seed dressing formulation is applied in a manner known per se to the seeds employing the combination of the invention and a diluent in suitable seed dressing formulation form, e.g. as an aqueous

35 suspension or in a dry powder form having good adherence to the seeds. Such seed dressing formulations are known in the art. Seed dressing formulations may contain the single active ingredients or the combination of active ingredients in encapsulated form, e.g. as slow release capsules or microcapsules.

- 40 In general, the formulations include from 0.01 to 90% by weight of active agent, from 0 to 20% agriculturally acceptable surfactant and 10 to 99.99% solid or liquid formulation inerts and adjuvant(s), the active agent consisting of at least the compound of formula (I) as defined in the present invention

together with component (B) and (C), and optionally other active agents, particularly microbiocides or conservatives or the like. Concentrated forms of compositions generally contain in between about 2 and 80%, preferably between about 5 and 70% by weight of active agent. Application forms of formulation may for example contain from 0.01 to 20% by weight, preferably from 0.01 to 5% by weight of active agent. Whereas commercial products will preferably be formulated as concentrates, the end user will normally employ diluted formulations.

Whereas it is preferred to formulate commercial products as concentrates, the end user will normally use dilute formulations.

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.

Formulation Examples

Wettable powders

	a)	b)	c)
active ingredient [compound of formula (I)]	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 active ingredient 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.

Powders for dry seed treatment

	a)	b)	c)
active ingredient [compound of formula (I)]	25 %	50 %	75 %
light mineral oil	5 %	5 %	5 %
highly dispersed silicic acid	5 %	5 %	-
Kaolin	65 %	40 %	-
Talcum	-	-	20%

The active ingredient 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.

Emulsifiable concentrate

active ingredient [compound of formula (I)]	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.

5

Dusts

	a)	b)	c)
Active ingredient [compound of formula (I)]	5 %	6 %	4 %
talcum	95 %	-	-
Kaolin	-	94 %	-
mineral filler	-	-	96 %

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

Extruder granules

Active ingredient [compound of formula (I)]	15 %
sodium lignosulfonate	2 %
carboxymethylcellulose	1 %
Kaolin	82 %

10

The active ingredient 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.

Coated granules

Active ingredient [compound of formula (I)]	8 %
polyethylene glycol (mol. wt. 200)	3 %
Kaolin	89 %

15 The finely ground active ingredient 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 ingredient [compound of formula (I)]	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 %

The finely ground active ingredient 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

5 infestation by microorganisms, by spraying, pouring or immersion.

Flowable concentrate for seed treatment

active ingredient [compound of formula (I)]	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 active ingredient is intimately mixed with the adjuvants, giving a suspension

10 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

- 15 28 parts of a combination of the compound of formula (I) 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.
- 20 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.

25

Analytical Methods:

Throughout this description, temperatures are given in degrees Celsius (°C) and “mp.” means melting point. LC/MS means Liquid Chromatography Mass Spectrometry and the description of the apparatus and the method is as follows:

5 Method A:

Equipment: Shimadzu LCMS 2020 Mass Spectrometer; Column: HALO C₁₈ 2.7 µm, 3.0 mm × 30 mm; Mobile Phase: MeCN (with either 0.05% HCOOH or 0.05% TFA) - Water (with either 0.05% HCOOH or 0.05% TFA); Gradient: MeCN from 5% to 95% over 1.4 min, hold 0.6 min, total run time is 2.5 min; Flow rate: 1.8 mL/min; Column temperature: 50 °C; Wavelength: 214 and 254 nm PDA.

10

Method B:

Spectra were recorded on a Mass Spectrometer from Agilent (Single quad mass spectrometer) equipped with a Multimode- Electron Spray and APCI (Polarity: positive and negative ions), Capillary: 4.00 kV, Corona Current 4.0 µA, Charging Voltage, 2.00 kV, Nitrogen Gas Flow: 12.0 L/min, Nebulizer
15 Pressure: 40 psig, Mass range: 100 to 1000 m/z), dry gas temperature 250 °C, Vaporizer temperature 200 °C and an UPLC from Waters: quaternary pump, heated column compartment, Variable wave length detector. Column: X-Bridge BEH C18, 2.5 µm (2.1 * 50 mm), column Temp: Ambient, Wavelength (nm): 215 nm, Gradient: A = 0.05% TFA in water, B = 0.05% TFA in Acetonitrile. Gradient: time/%B: 0/5, 1/5, 5/70, 7/95, 8.5/95, 8.6/5, 10/5; Flow rate: 0.6 mL/min.

20

Method C:

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 ions), Capillary: 0.8-3.00 kV, Cone: 5-30 V, Source Temperature: 120-150°C, Desolvation Temperature:
25 350-600°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,
30 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 D:

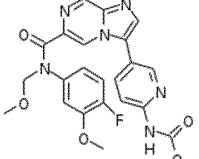
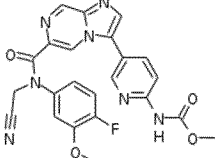
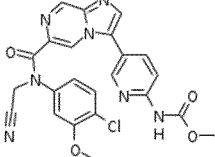
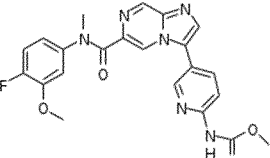
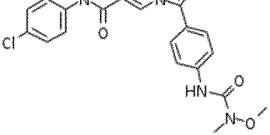
Spectra were recorded on a ACQUITY Mass Spectrometer from Waters Corporations (SQD or SQDII
35 Single quadrupole mass spectrometer) equipped with an electrospray source (Polarity: positive or negative ions, Capillary: 3.0 kV, Cone: 30V, Extractor: 3.00 V, Source Temperature: 150°C, Desolvation Temperature: 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,
40 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.

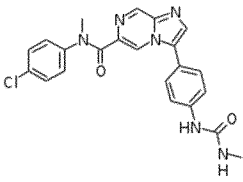
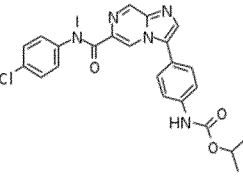
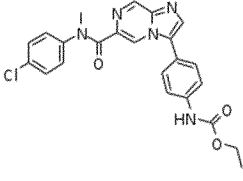
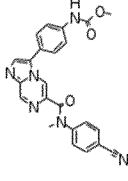
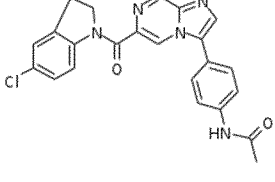
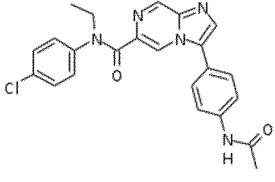
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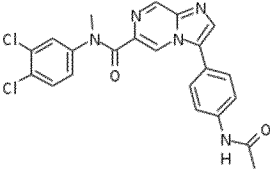
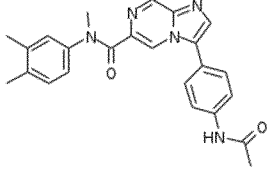
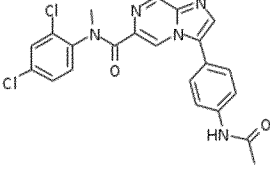
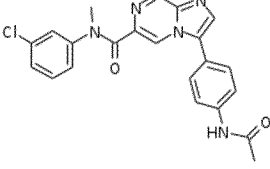
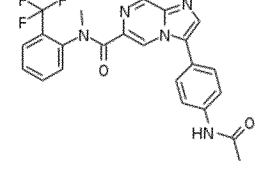
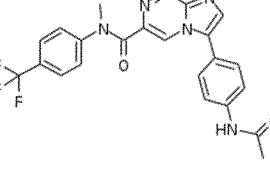
- LC-MS data, such as retention time (RT), [M+H]⁺,
- the type of method, and/or
- melting point (mp).

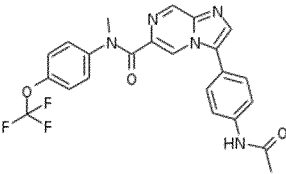
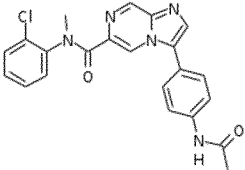
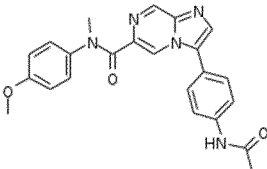
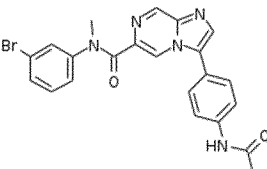
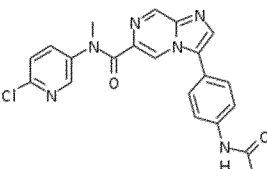
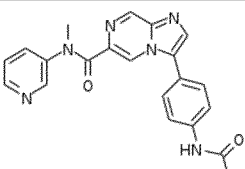
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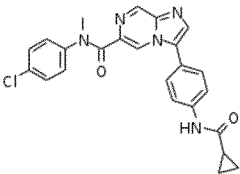
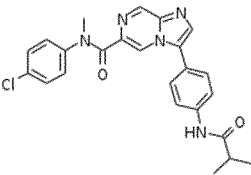
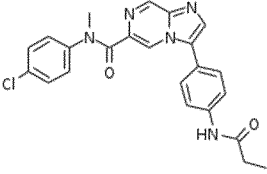
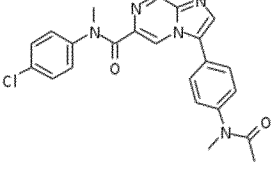
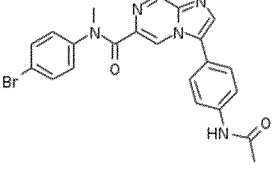
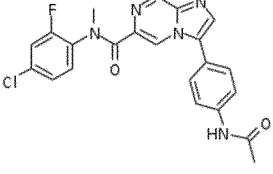
	Compound name	Structure	RT (min)	[M+H] (measured)	Method	mp (°C)
1	methyl N-[5-[6-[(4-fluoro-3-methoxyphenyl)-(methoxymethyl)carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate		0.15	481	B	190 - 195
2	methyl N-[5-[6-[cyanomethyl-(4-fluoro-3-methoxyphenyl)carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate		0.79	476	C	209 - 210
3	methyl N-[5-[6-[(4-chloro-3-methoxyphenyl)-(cyanomethyl)carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate		0.85	492	C	229 - 230
4	methyl N-[5-[6-[(4-fluoro-3-methoxyphenyl)-methylcarbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate		0.79	451	C	
5	N-(4-chlorophenyl)-3-[4-[[methoxy(methyl)carbamoyl]amino]phenyl]pyrazine		0.89	465/467	C	

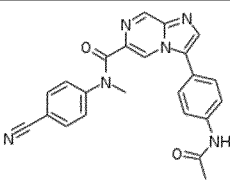
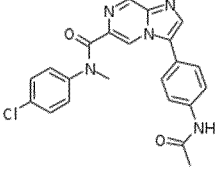
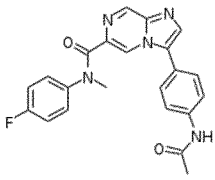
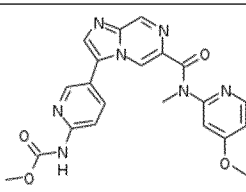
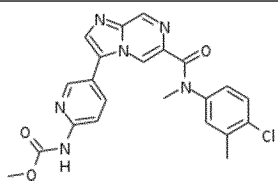
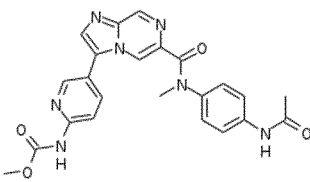
	enyl]-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide					
6	N-(4-chlorophenyl)-N-methyl-3-[4-(methylcarbamoylamino)phenyl]imidazo[1,2-a]pyrazine-6-carboxamide		0.80	435/437	C	
7	isopropyl N-[4-[6-[(4-chlorophenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]phenyl]carbamate		1.00	465/466	C	
8	ethyl N-[4-[6-[(4-chlorophenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]phenyl]carbamate		0.94	450/452	C	
9	methyl N-[4-[6-[(4-cyanophenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]phenyl]carbamate		0.81	427	C	
10	N-[4-[6-(5-chloroindoline-1-carbonyl)imidazo[1,2-a]pyrazin-3-yl]phenyl]acetamide		0.90	432/434	C	
11	3-(4-acetamidophenyl)-N-(4-chlorophenyl)-N-ethyl-imidazo[1,2-a]pyrazine-6-carboxamide		0.83	434/436	C	

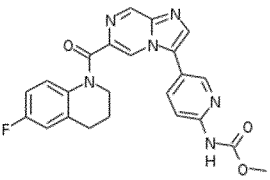
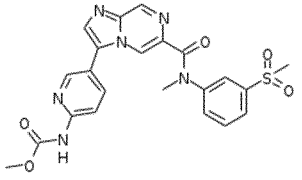
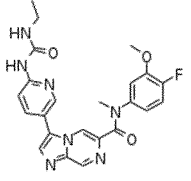
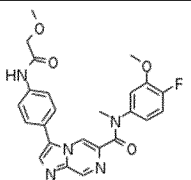
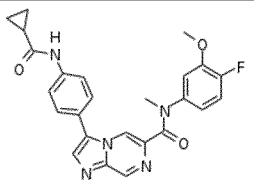
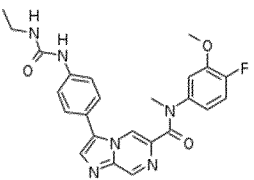
12	3-(4-acetamidophenyl)-N-(3,4-dichlorophenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide		0.85	454/456	C	
13	3-(4-acetamidophenyl)-N-(3,4-dimethylphenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide		0.79	414	C	
14	3-(4-acetamidophenyl)-N-(2,4-dichlorophenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide		0.86	454/456	C	
15	3-(4-acetamidophenyl)-N-(3-chlorophenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide		0.78	420/422	C	
16	3-(4-acetamidophenyl)-N-methyl-N-[2-(trifluoromethyl)phenyl]imidazo[1,2-a]pyrazine-6-carboxamide		0.82	454	C	
17	3-(4-acetamidophenyl)-N-methyl-N-[4-(trifluoromethyl)phenyl]imidazo[1,2-		0.83	454	C	

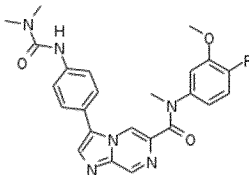
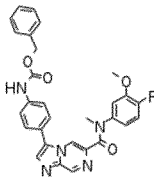
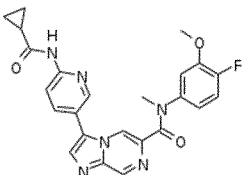
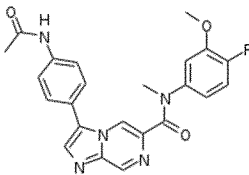
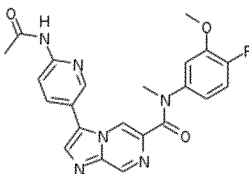
	a]pyrazine-6-carboxamide					
18	3-(4-acetamidophenyl)-N-methyl-N-[4-(trifluoromethoxy)phenyl]imidazo[1,2-a]pyrazine-6-carboxamide		0.85	470	C	
19	3-(4-acetamidophenyl)-N-(2-chlorophenyl)-N-methylimidazo[1,2-a]pyrazine-6-carboxamide		0.77	420/422	C	
20	3-(4-acetamidophenyl)-N-(4-methoxyphenyl)-N-methylimidazo[1,2-a]pyrazine-6-carboxamide		0.72	416	C	
21	3-(4-acetamidophenyl)-N-(3-bromophenyl)-N-methylimidazo[1,2-a]pyrazine-6-carboxamide		0.80	464/466	C	
22	3-(4-acetamidophenyl)-N-(6-chloro-3-pyridyl)-N-methylimidazo[1,2-a]pyrazine-6-carboxamide		0.71	421/423	C	
23	3-(4-acetamidophenyl)-N-methyl-N-(3-pyridyl)imidazo[1,2-		0.57	387	C	

	a]pyrazine-6-carboxamide					
24	3-(4-acetamidophenyl)-N-methyl-N-pyrimidin-2-yl-imidazo[1,2-a]pyrazine-6-carboxamide		0.63	388	C	
25	N-(4-chlorophenyl)-N-methyl-3-[4-[(2,2,2-trifluoroacetyl)amino]phenyl]imidazo[1,2-a]pyrazine-6-carboxamide		0.96	474/476	C	
26	N-(4-chlorophenyl)-3-[4-[(2,2-difluoroacetyl)amino]phenyl]-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide		0.88	456/458	C	
27	N-(4-chlorophenyl)-3-[4-[(2-methoxyacetyl)amino]phenyl]-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide		0.85	450/452	C	
28	methyl N-[4-[6-[(4-chlorophenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]phenyl]carbamate		0.88	434 (H)	C	220 - 237
29	N-(4-chlorophenyl)-3-[4-[(1-fluorocyclopropanecarbonyl)amino]phenyl]-N-methyl-		0.94	464/466	C	

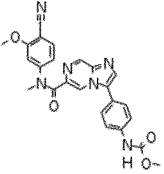
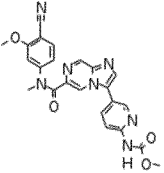
	imidazo[1,2-a]pyrazine-6-carboxamide					
30	N-(4-chlorophenyl)-3-[4-(cyclopropanecarboxylamino)phenyl]-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide		0.89	446/448	C	
31	N-(4-chlorophenyl)-N-methyl-3-[4-(2-methylpropanoylamino)phenyl]imidazo[1,2-a]pyrazine-6-carboxamide		0.92	448/450	C	
32	N-(4-chlorophenyl)-N-methyl-3-[4-(propanoylamino)phenyl]imidazo[1,2-a]pyrazine-6-carboxamide		0.85	434/436	C	
33	3-[4-[acetyl(methyl)amino]phenyl]-N-(4-chlorophenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide		0.82	434/436	C	
34	3-(4-acetamidophenyl)-N-(4-bromophenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide		0.81	464/466	C	
35	3-(4-acetamidophenyl)-N-(4-chloro-2-fluoro-phenyl)-N-methyl-imidazo[1,2-a]		0.84	438/440	C	

	a]pyrazine-6-carboxamide					
36	3-(4-acetamidophenyl)-N-(4-cyanophenyl)-N-methylimidazo[1,2-a]pyrazine-6-carboxamide		0.70	411	C	
37	3-(4-acetamidophenyl)-N-(4-chlorophenyl)-N-methylimidazo[1,2-a]pyrazine-6-carboxamide		0.79	420/422	C	
38	3-(4-acetamidophenyl)-N-(4-fluorophenyl)-N-methylimidazo[1,2-a]pyrazine-6-carboxamide		0.74	404	C	
39	methyl N-[5-[6-[(4-methoxy-2-pyridyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate		0.90	434	D	
40	methyl N-[5-[6-[(4-chloro-3-methylphenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate		1.29	451	D	
41	methyl N-[5-[6-[(4-acetamidophenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate		0.82	460	D	

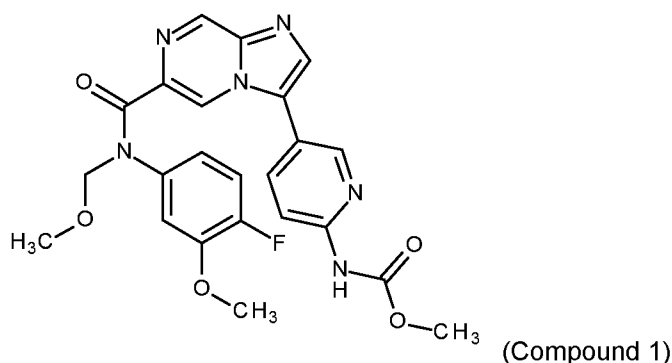
42	methyl N-[5-[6-(6-fluoro-3,4-dihydro-2H-quinoline-1-carbonyl)imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate		1.21	447	D	
43	methyl N-[5-[6-[methyl-(3-methylsulfonylphenyl)carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate		0.88	481	D	
44	3-[6-(ethylcarbamoylamino)-3-pyridyl]-N-(4-fluoro-3-methoxyphenyl)-N-methylimidazo[1,2-a]pyrazine-6-carboxamide		1.09	464	D	
45	N-(4-fluoro-3-methoxyphenyl)-3-[4-[(2-methoxyacetyl)amino]phenyl]-N-methylimidazo[1,2-a]pyrazine-6-carboxamide		1.10	464	D	
46	3-[4-(cyclopropanecarbonylamino)phenyl]-N-(4-fluoro-3-methoxyphenyl)-N-methylimidazo[1,2-a]pyrazine-6-carboxamide		1.19	460	D	
47	3-[4-(ethylcarbamoylamino)phenyl]-N-(4-fluoro-3-methoxy-		1.09	463	D	

	phenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide					
48	3-[4-(dimethylcarbamoyl amino)phenyl]-N-(4-fluoro-3-methoxy-phenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide		1.09	463	D	
49	benzyl N-[4-[6-[(4-fluoro-3-methoxy-phenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]phenyl]carbamate		1.52	526	D	
50	3-[6-(cyclopropanecarboxylamino)-3-pyridyl]-N-(4-fluoro-3-methoxy-phenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide		1.16	461	D	
51	3-(4-acetamidophenyl)-N-(4-fluoro-3-methoxy-phenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide		1.03	434	D	
52	3-(6-acetamido-3-pyridyl)-N-(4-fluoro-3-methoxy-phenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide		0.99	435	D	

53	methyl N-[5-[6-(6-fluoro-4-methyl-2,3-dihydroquinoxaline-1-carbonyl)imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate		1.14	462	A	228-229
54	methyl N-[5-[6-(7-fluoro-2,3-dihydro-1,4-benzoxazine-4-carbonyl)imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate		1.15	449	A	189-192
55	methyl N-[5-[6-[(4-cyano-3-methoxyphenyl)-(methoxymethyl)carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate		2.03	488	A	112-115
56	methyl N-[5-[6-[(4-cyanophenyl)-methylcarbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate		1.05	428	A	235-238
57	methyl N-[5-[6-[(4-cyano-3-methylphenyl)-methylcarbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate		1.05	442	A	244-246
58	methyl N-[4-[6-[(4-fluoro-3-methoxyphenyl)-methylcarbamoyl]imidazo[1,2-a]pyrazin-3-yl]phenyl]carbamate		1.13	450	A	202-204

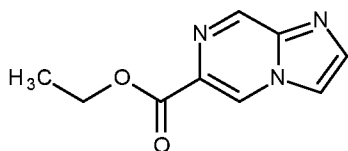
59	methyl N-[4-[6-[(4-cyano-3-methoxy-phenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]phenyl]carbamate		1.11	457	A	131-132
60	methyl N-[5-[6-[(4-cyano-3-methoxy-phenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate		1.01	458	A	254-256

Example 1: Preparation of methyl N-[5-[6-[(4-fluoro-3-methoxy-phenyl)-(methoxymethyl)carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate (Compound 1)



5

Step A: Preparation of ethyl imidazo[1,2-a]pyrazine-6-carboxylate

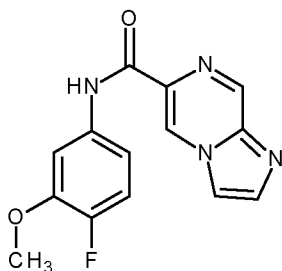


To a suspension of ethyl 5-aminopyrazine-2-carboxylate (0.500 g, 2.90 mmol, 1.00 equiv.) in water (15 mL) was added sodium acetate (0.480 g, 5.80 mmol, 2.00 equiv.) followed by chloroacetaldehyde (0.68 g, 0.55 mL, 1.50 equiv.). The reaction mixture was stirred at 40 °C for 16 hours. The reaction mixture was quenched with saturated Na₂CO₃ solution, extracted with ethylacetate and the combined organic layers were washed with brine, dried over Na₂SO₄, filtered, and concentrated under reduced pressure. The crude residue was purified over a silica gel cartridge (cyclohexane/ethyl acetate) to afford ethyl imidazo[1,2-a]pyrazine-6-carboxylate as a beige solid.

15 LC-MS (method A): Rt 0.48 min, m/z = 192 (M+H)⁺

¹H-NMR (400 MHz, CDCl₃, ppm) δ = 1.39 - 1.59 (m, 3 H), 4.43 - 4.66 (m, 2 H), 7.75 - 7.87 (m, 1 H), 7.90 - 8.01 (m, 1 H), 8.96 - 9.07 (m, 1 H), 9.11 - 9.24 (m, 1 H).

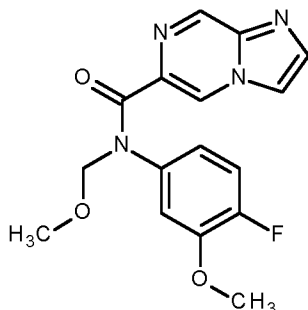
Step B: Preparation of N-(4-fluoro-3-methoxy-phenyl)imidazo[1,2-a]pyrazine-6-carboxamide



To a stirred solution of ethyl imidazo[1,2-a]pyrazine-6-carboxylate (1.00 g, 4.97 mmol, 1.00 equiv.), and 4-fluoro-3-methoxy-aniline (1.05 g, 7.45 mmol, 1.50 equiv.) in dry toluene (25.0 mL) was added trimethylaluminium (6.21 mL, 12.4 mmol, 2.50 equiv.) in toluene. The resulting reaction mixture was stirred at 90 °C for 2 hours under nitrogen atmosphere. The reaction mixture was cooled to 0 °C, quenched with aqueous Rochelle's salt and diluted with ethyl acetate. The reaction mixture was filtered through a celite pad and washed with ethyl acetate. The combined organic layers were washed with brine, dried over Na₂SO₄, filtered, and concentrated under reduced pressure. The crude residue was purified over a silica gel cartridge (dichloromethane/methanol) to afford N-(4-fluoro-3-methoxy-phenyl)imidazo[1,2-a]pyrazine-6-carboxamide as a yellow solid.

¹H-NMR (400 MHz, DMSO-d₆, ppm) δ = 3.85 (s, 3 H), 7.17-7.22 (m, 1 H), 7.55-7.59 (m, 1 H), 7.79-7.82 (dd, J = 2.4, 8.0 Hz, 1 H), 7.96 (d, J = 1.2 Hz, 1 H), 8.35 (s, 1 H), 9.16 (dd, J = 0.8, 1.6 Hz, 1 H), 9.41 (d, J = 1.2 Hz, 1 H), 10.59 (s, 1 H)

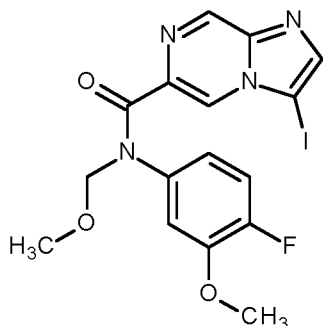
15 Step C: Preparation of N-(4-fluoro-3-methoxy-phenyl)-N-(methoxymethyl)imidazo[1,2-a]pyrazine-6-carboxamide



To an ice-cooled solution of N-(4-fluoro-3-methoxy-phenyl)imidazo[1,2-a]pyrazine-6-carboxamide (500 mg, 1.48 mmol, 1.00 equiv.) in THF (10.0 mL) was added potassium;2-methylpropan-2-olate (250 mg, 2.23 mmol, 1.50 equiv.) and tetrabutylammoniumhydrogensulfate (151 mg, 0.445 mmol, 0.30 equiv.) followed by chloro(methoxy)methane (179 mg, 2.23 mmol, 1.50 equiv.). The reaction mixture was stirred at room temperature for 3 hours. The reaction mixture was cooled down to 0 °C, quenched with water and extracted with ethyl acetate. The combined organic layers were washed with brine, dried over Na₂SO₄ and concentrated under reduced pressure. The crude residue was purified over a silica gel cartridge (dichloromethane/methanol) to afford N-(4-fluoro-3-methoxy-phenyl)-N-(methoxymethyl)imidazo[1,2-a]pyrazine-6-carboxamide as an yellow solid.

¹H-NMR (400 MHz, CDCl₃, ppm) δ = 3.47 (s, 3 H), 3.84 (s, 3 H), 5.30 (s, 2 H), 6.68 (brs, 1 H), 6.90 - 6.95 (m, 2 H), 7.74 (s, 1 H), 7.85 (s, 1 H), 8.68 (s, 1 H), 8.76 (brs, 1 H)

30 Step D: Preparation of N-(4-fluoro-3-methoxy-phenyl)-3-iodo-N-(methoxymethyl)imidazo[1,2-

a)pyrazine-6-carboxamide

To a solution of N-(4-fluoro-3-methoxy-phenyl)-N-(methoxymethyl)imidazo[1,2-a]pyrazine-6-carboxamide (80.0 mg, 0.206 mmol, 1.00 equiv.) in DMF (3.00 mL) was added N-iodosuccinimide (60.2 mg, 0.268 mmol, 1.30 equiv.). The reaction mixture was stirred at room temperature for 16 hours. The reaction mixture was poured into water and extracted with ethyl acetate. The combined organic layers were washed with brine, dried over Na₂SO₄ and concentrated under reduced pressure. The crude residue was purified over a silica gel cartridge (dichloromethane/methanol) to afford N-(4-fluoro-3-methoxy-phenyl)-3-iodo-N-(methoxymethyl)imidazo[1,2-a]pyrazine-6-carboxamide as an off-white solid.

¹H-NMR (400 MHz, DMSO-d₆, ppm) δ = 3.37 (s, 3 H), 3.74 (s, 3 H), 5.23 (s, 2 H), 6.79 (brs, 1 H), 7.03-7.08 (m, 1 H), 7.21 - 7.24 (dd, J = 2.8, 8.0 Hz, 1 H), 8.01 (s, 1 H), 8.64 (s, 1 H), 8.76 (brs, 1 H).

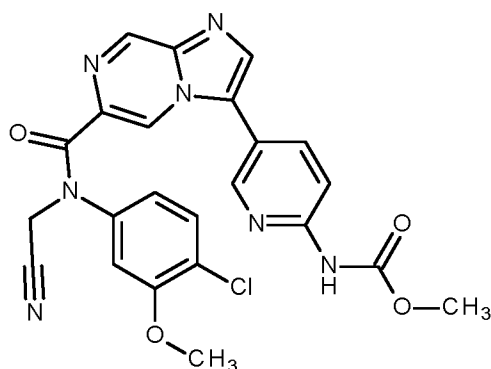
Step E: Preparation of methyl N-[5-[6-[(4-fluoro-3-methoxy-phenyl)-(methoxymethyl)carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate (Compound 1)

To a stirred solution of N-(4-fluoro-3-methoxy-phenyl)-3-iodo-N-(methoxymethyl)imidazo[1,2-a]pyrazine-6-carboxamide (250 mg, 0.521 mmol, 1.00 equiv.), methyl N-[5-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-2-pyridyl]carbamate (185 mg, 0.651 mmol, 1.25 equiv.) in 1,4-dioxane/water (3:1) (7.0 mL) was added cesium carbonate (339 mg, 1.04 mmol, 2.00 equiv.), the mixture was purged with a stream of argon for 2 minutes. CataCXium® A Pd G3 (CAS 1651823-59-4) (19.0 mg, 0.0260 mmol, 0.05 equiv.) was added to the reaction mixture under N₂ atmosphere. The resulting reaction mixture was irradiated in the microwaves at 100 °C for 1 hour. After cooling down to room temperature, the reaction mixture was filtered through a Celite pad and washed with ethyl acetate. The filtrate was washed with water, then brine, dried over sodium sulfate, filtered, and concentrated under reduced pressure. The crude residue was purified over reverse phase combiflash (acetonitrile/water) to afford methyl N-[5-[6-[(4-fluoro-3-methoxy-phenyl)-(methoxymethyl)carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate as an off-white solid.

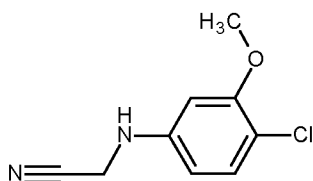
LC-MS (method F): Rt 0.15 min, m/z = 481 (M+H)⁺

¹H-NMR (400 MHz, DMSO-d₆, ppm) δ = 3.34 (s, 3 H), 3.70 (s, 3 H), 3.73 (s, 3 H), 5.22 (s, 2 H), 6.80 (brs, 1 H), 7.05 - 7.09 (t, J = 19.2 Hz, 1 H), 7.20 - 7.22 (dd, J = 2.4, 8.0 Hz, 1 H), 8.04-8.12 (m, 3 H), 8.59 (d, J = 1.2 Hz, 1 H), 8.80 (s, 1 H), 8.90 (brs, 1 H), 10.54 (s, 1 H).

Example 2: preparation of methyl N-[5-[6-[(4-chloro-3-methoxy-phenyl)-(cyanomethyl)carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate (compound 3)



(Compound 3)

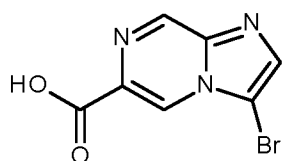
Step A: Preparation of 2-(4-chloro-3-methoxy-anilino)acetonitrile

- 5 To a solution of 4-chloro-3-methoxy-aniline (1.50 g, 9.50 mmol, 1.00 equiv.) in acetonitrile (19 mL) were added 2-bromoacetonitrile (1.40 mL, 20.0 mmol, 2.05 equiv.), sodium iodide (0.710 g, 4.80 mmol, 0.50 equiv.) and potassium carbonate (1.60 g, 11.0 mmol, 1.20 equiv.). The reaction mixture was stirred at room temperature for 16 hours and then a reflux for 6 hours. The reaction mixture was filtered, diluted with 2 M NaOH and extracted with ethyl acetate. The combined organic layers were washed with brine, dried over Na₂SO₄ and concentrated under reduced pressure. The crude residue was purified over a silica gel cartridge (cyclohexane/ethyl acetate) to afford 2-(4-chloro-3-methoxy-anilino)acetonitrile as a brown oil.

LC-MS (method C): Rt 0.80 min, m/z = 197/199 (M+H)⁺

¹H-NMR (400 MHz, CDCl₃, ppm) δ = 3.87 - 3.92 (m, 3 H), 3.96 - 4.05 (m, 1 H), 4.09 - 4.14 (m, 2 H),

- 15 6.23 - 6.31 (m, 2 H), 7.21 - 7.26 (m, 1 H).

Step B: Preparation of 3-bromoimidazo[1,2-a]pyrazine-6-carboxylic acid (Compound X-1)

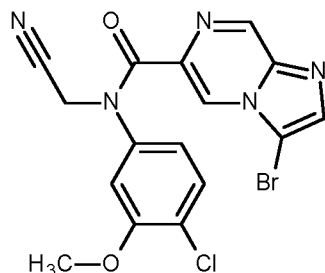
(Compound X-1)

- To a stirred solution of imidazo[1,2-a]pyrazine-6-carboxylic acid (50 mg, 0.30 mmol, 1.0 equiv.) in DMF (10 mL) was added N-bromosuccinimide (60 mg, 0.34 mmol, 1.1 equiv.) at room temperature and stirred for 16 hours. The reaction mixture was quenched with a saturated aqueous solution of Na₂S₂O₃ and the precipitate was collected by filtration. The filter cake was washed with water and dried in vacuo at 40 °C overnight to afford 3-bromoimidazo[1,2-a]pyrazine-6-carboxylic acid.

LC-MS (method B): Rt 0.88 min, m/z = 242/244 (M+H)⁺

- 25 ¹H-NMR (400 MHz, DMSO-d₆, ppm) δ = 1.00 (s, 1 H), 1.02 (s, 1 H), 8.09 (s, 1 H)

Step C: Preparation of 3-bromo-N-(4-chloro-3-methoxy-phenyl)-N-(cyanomethyl)imidazo[1,2-

a]pyrazine-6-carboxamide

To a solution of 2-(4-chloro-3-methoxy-anilino)acetonitrile (0.150 g, 0.763 mmol, 1.00 equiv.) in ethyl acetate (3.05 mL) were added 1-propanephosphonic anhydride (50% in ethyl acetate) (0.500 mL, 0.839 mmol, 1.10 equiv.), 3-bromoimidazo[1,2-a]pyrazine-6-carboxylic acid (Compound X-1) (0.203 g, 0.839 mmol, 1.10 equiv.) and N-ethyl-N-isopropyl-propan-2-amine (0.522 mL, 3.05 mmol, 4.00 equiv.). The reaction mixture was stirred at 85 °C for 16 hours. The reaction mixture quenched with water and diluted with ethyl acetate. The combined organic layers were washed with brine, dried over Na₂SO₄ and concentrated under reduced pressure. The crude residue was purified over a silica gel cartridge (cyclohexane/ethyl acetate) to afford 3-bromo-N-(4-chloro-3-methoxy-phenyl)-N-(cyanomethyl)imidazo[1,2-a]pyrazine-6-carboxamide as a gum.

LC-MS (method C): Rt 0.87 min, m/z = 420 (M+H)⁺

¹H-NMR (400 MHz, DMSO-d₆, ppm) δ = 3.90 (s, 3 H), 4.81 (br s, 2 H), 6.74 (br d, J = 7.63 Hz, 1 H), 6.92 (d, J = 2.18 Hz, 1 H), 7.31 (br d, J = 7.63 Hz, 1 H), 7.86 (s, 1 H), 8.56 - 8.73 (m, 1 H), 8.80 (s, 1 H)

15

Step D: Preparation of methyl N-[5-[6-[(4-chloro-3-methoxy-phenyl)-(cyanomethyl)carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate (Compound 3)

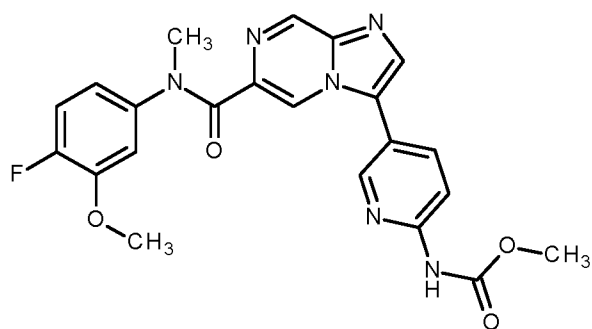
A mixture of 3-bromo-N-(4-chloro-3-methoxy-phenyl)-N-(cyanomethyl)imidazo[1,2-a]pyrazine-6-carboxamide (0.060 g, 0.14 mmol, 1.00 equiv.), methyl N-[5-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-2-pyridyl]carbamate (0.056 g, 0.20 mmol, 1.40 equiv.) and cesium carbonate (0.070 g, 0.21 mmol, 1.50 equiv.) in water (0.29 mL) and 2-methyltetrahydrofuran (1.60 mL) was flushed with argon for 5 min. Tetrakis(triphenylphosphine)palladium(0) (0.0085 g, 0.0071 mmol, 0.05 equiv.) was then added and the reaction mixture was heated under microwave irradiation at 100 °C and stirred for 1 hour. The reaction mixture was cooled down to room temperature and then water was added. The aqueous layer was extracted with ethyl acetate and the combined organic layers were washed with brine, dried over Na₂SO₄, filtered, and concentrated under reduced pressure. The crude residue was diluted in minimum of dichloromethane, heated up, cooled down again and diisopropylether was added. A beige solid was filtered and dried under vacuo at 60 °C to afford methyl N-[5-[6-[(4-chloro-3-methoxy-phenyl)-(cyanomethyl)carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate as a beige solid.

LC-MS (method C): Rt 0.85 min, m/z = 492 (M+H)⁺

¹H-NMR (400 MHz, CDCl₃, ppm) δ = 3.90 (s, 3 H), 3.90 (s, 3 H), 4.79 (br s, 2 H), 6.74 (br d, J = 7.63 Hz, 1 H), 6.92 (d, J = 2.18 Hz, 1 H), 7.33 (br d, J = 8.36 Hz, 1 H), 7.83 - 7.91 (m, 2 H), 7.94 (s, 1 H), 8.25 (d, J = 8.36 Hz, 1 H), 8.47 (d, J = 1.82 Hz, 1 H), 8.77 (br s, 1 H), 8.81 (br s, 1 H).

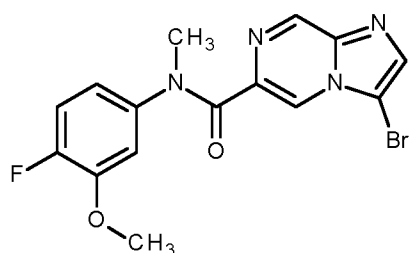
Example 3: preparation of methyl N-[5-[6-[(4-fluoro-3-methoxy-phenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate (compound 4)

35



(Compound 4)

Step A: Preparation of 3-bromo-N-(4-fluoro-3-methoxy-phenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide (Compound X-2)



5

(Compound X-2)

To a solution of 4-fluoro-3-methoxy-N-methylaniline (0.134 mL, 0.930 mmol, 1.50 equiv.) in N,N-dimethylacetamide (3.75 mL) were added 1-propanephosphonic anhydride (50% in ethyl acetate) (0.922 mL, 1.55 mmol, 2.50 equiv.), 3-bromoimidazo[1,2-a]pyrazine-6-carboxylic acid (Compound X-1) (0.203 g, 0.839 mmol, 1.00 equiv.) and N-ethyl-N-isopropyl-propan-2-amine (0.530 mL, 3.10 mmol, 5.00 equiv.). The reaction mixture was stirred at 55 °C for 35 minutes. The reaction mixture quenched with a saturated solution of NaHCO₃ and diluted with ethyl acetate. The combined organic layers were washed with brine, dried over Na₂SO₄ and concentrated under reduced pressure. The crude residue was purified over a silica gel cartridge (cyclohexane/ethyl acetate) to afford 3-bromo-N-(4-fluoro-3-methoxy-phenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide as a yellow solid.

15 LC-MS (method C): Rt 0.79 min, m/z = 379/381 (M+H)⁺

¹H-NMR (400 MHz, CDCl₃, ppm) δ = 3.47 - 3.59 (m, 3 H), 3.73 - 3.89 (m, 3 H), 6.45 - 6.71 (m, 1 H), 6.77 - 6.99 (m, 2 H), 7.73 - 7.87 (m, 1 H), 8.53 - 8.62 (m, 1 H), 8.62 - 8.76 (m, 1 H).

Step B: Preparation of methyl N-[5-[6-((4-fluoro-3-methoxy-phenyl)-methyl-carbamoyl)imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate (Compound 4)

20

A mixture of 3-bromo-N-(4-fluoro-3-methoxy-phenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide (0.180 g, 0.475 mmol, 1.00 equiv.), 2-methoxycarbonylaminopyridine-5-boronic acid pinacol ester (0.195 g, 0.665 mmol, 1.40 equiv.) and cesium carbonate (0.232 g, 0.712 mmol, 1.50 equiv.) in water (0.94 mL) and 2-methyltetrahydrofuran (2.84 mL) was flushed with argon for 5 min.

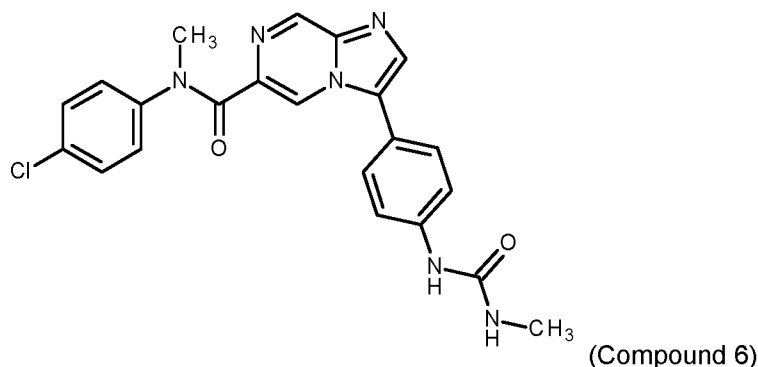
25 Tetrakis(triphenylphosphine)palladium(0) (0.0283 g, 0.0237 mmol, 0.05 equiv.) was then added and the reaction mixture was heated under microwave irradiation at 100 °C and stirred for 1 hour. The reaction mixture was cooled down to room temperature and then water was added. The aqueous layer was extracted with ethyl acetate. The combined organic layers were washed with brine, dried over Na₂SO₄ and concentrated under reduced pressure. The crude residue was purified over a silica gel cartridge

(cyclohexane/ethyl acetate) to afford methyl N-[5-[6-[(4-fluoro-3-methoxy-phenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate as a solid.

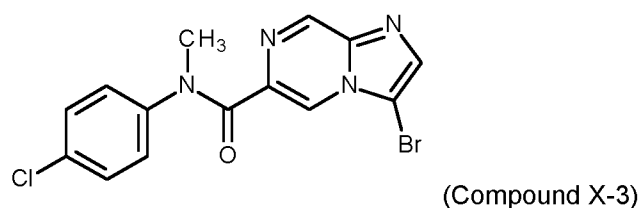
LC-MS (method C): Rt 1.10 min, m/z = 451 (M+H)⁺

¹H-NMR (400 MHz, CDCl₃, ppm) δ = 3.43 - 3.57 (m, 3 H), 3.74 - 3.97 (m, 6 H), 6.50 - 6.65 (m, 1 H), 6.79 - 6.89 (m, 1 H), 6.89 - 7.02 (m, 1 H), 7.77 - 7.86 (m, 1 H), 7.86 - 7.98 (m, 1 H), 8.13 - 8.28 (m, 2 H), 8.38 - 8.47 (m, 1 H), 8.52 - 8.64 (m, 1 H), 8.69 - 8.89 (m, 1 H).

Example 4: preparation of N-(4-chlorophenyl)-N-methyl-3-[4-(methylcarbamoylamino)phenyl]imidazo[1,2-a]pyrazine-6-carboxamide (compound 6)



Step A: Preparation of 3-bromo-N-(4-chlorophenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide (Compound X-3)

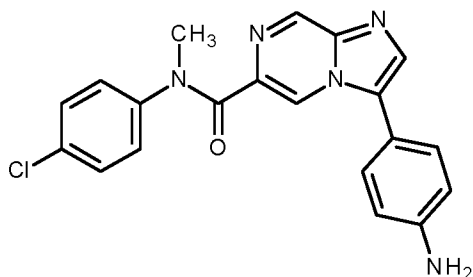


To a solution of 3-bromoimidazo[1,2-a]pyrazine-6-carboxylic acid (Compound X-1) (0.950 g, 3.93 mmol, 1.00 equiv.) in dichloromethane (27.5 mL) were added 4-chloro-N-methylaniline (0.686 mL, 5.50 mmol, 1.40 equiv.), triethylamine (1.66 mL, 11.8 mmol, 3.00 equiv.) and 1-propanephosphonic anhydride (50% in ethyl acetate) (5.84 mL, 9.81 mmol, 2.50 equiv.). The reaction mixture was stirred overnight at room temperature, then water was added, and the aqueous layer was extracted with dichloromethane. The combined organic layers were washed with brine, dried over Na₂SO₄, filtered, and concentrated under reduced pressure. The crude product was purified over silica gel cartridge (cyclohexane/ethyl acetate) to afford 3-bromo-N-(4-chlorophenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide as white solid.

LC-MS (method C): Rt 0.88 min, m/z = 365 (M+H)⁺

¹H-NMR (400 MHz, CDCl₃, ppm) δ = 3.55 (s, 3 H), 7.09 (br d, J = 8.1 Hz, 2 H), 7.26 (br d, J = 8.4 Hz, 2 H), 7.82 (s, 1 H), 8.63 - 8.66 (m, 1 H), 8.67 (d, J = 1.5 Hz, 1 H).

Step B: Preparation of 3-(4-aminophenyl)-N-(4-chlorophenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide



To a solution of 3-bromo-N-(4-chlorophenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide (Compound X-3) (1.23 g, 3.36 mmol, 1.00 equiv.) in 1,2-dimethoxyethane (60.6 mL) and water (13.5 mL), 4-aminophenylboronic acid hydrochloride (0.875 g, 5.05 mmol, 1.50 equiv.), tetrakis(triphenylphosphine)palladium(0) (0.390 g, 0.336 mmol, 0.100 equiv.) and sodium carbonate (1.07 g, 10.1 mmol, 3.00 equiv.) were added. The reaction mixture was stirred overnight at 80 °C, then it was quenched with water and extracted with ethyl acetate. The combined organic layers were washed with brine, dried over Na₂SO₄, filtered, and concentrated under reduced pressure. The crude product was purified over silica gel cartridge (dichloromethane/methanol) to afford 3-(4-aminophenyl)-N-(4-chlorophenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide as yellow solid.

LC-MS (method C): Rt 0.82 min, m/z = 378 (M+H)⁺

¹H-NMR (400 MHz, CDCl₃, ppm) δ = 3.53 (s, 3 H), 6.81 - 6.87 (m, 1 H), 7.09 (br d, J = 8.4 Hz, 2 H), 7.22 - 7.34 (m, 5 H), 7.80 (s, 1 H), 8.71 (s, 1 H), 8.73 - 8.76 (s, 1 H),

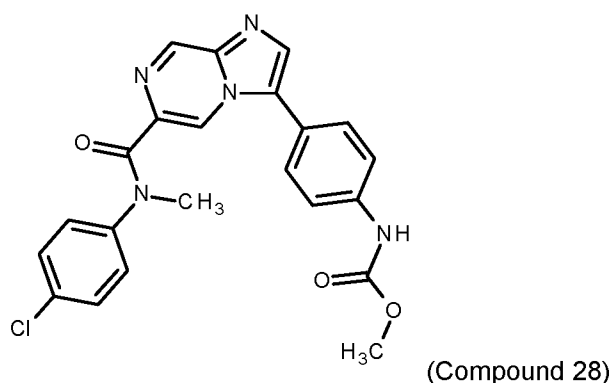
15 Step C: Preparation of N-(4-chlorophenyl)-N-methyl-3-[4-(methylcarbamoylamino)phenyl]imidazo[1,2-a]pyrazine-6-carboxamide (Compound 6)

To a solution of 3-(4-aminophenyl)-N-(4-chlorophenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide (50.0 mg, 0.130 mmol, 1.00 equiv.) in dichloromethane (1.30 mL), methylaminoformyl chloride (15.0 mg, 0.160 mmol, 1.20 equiv.) was added and the resulting solution was stirred at room temperature for 3 hours. Triethylamine (0.0180 mL, 0.130 mmol, 1.00 equiv.) was added and stirring continued at room temperature overnight. Another portion of methylaminoformyl chloride (15.0 mg, 0.160 mmol, 1.20 equiv.) and triethylamine (0.0180 mL, 0.130 mmol, 1.00 equiv.) were added and stirring continued at room temperature for 3 hours. The reaction mixture was quenched with saturated aqueous NaHCO₃ solution and extracted by putting through a chromabond pts phase separation cartridge with NaHCO₃ solution and dichloromethane. The organic layer was concentrated under reduced pressure and purified over silica gel cartridge (dichloromethane/methanol) to afford N-(4-chlorophenyl)-N-methyl-3-[4-(methylcarbamoylamino)phenyl]imidazo[1,2-a]pyrazine-6-carboxamide as yellow gum.

LC-MS (method C): Rt 0.80 min, m/z = 435 (M+H)⁺

¹H-NMR (400 MHz, CDCl₃, ppm) δ = 2.87 (s, 3 H), 3.53 (s, 3 H), 5.80 (br s, 1 H), 7.03 - 7.18 (m, 2 H), 7.21 - 7.35 (m, 4 H), 7.54 (d, J = 8.4 Hz, 2 H), 7.80 (s, 1 H), 8.04 (s, 1 H), 8.56 (br s, 1 H), 8.66 - 8.88 (br s, 1 H).

Example 5: preparation of methyl N-[4-[6-[(4-chlorophenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]phenyl]carbamate (compound 28)

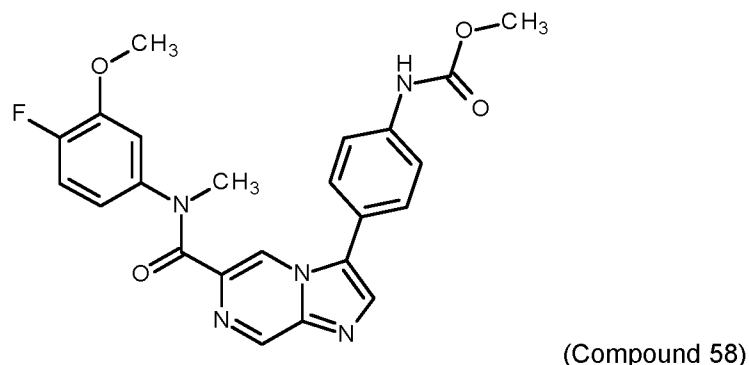


To a solution of methyl N-[4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)phenyl]carbamate (prepared as described for example in *Tet. Lett.*, **2015**, 56, 4790 (0.110 g, 0.378 mmol, 1.50 equiv.) and 3-bromo-5 N-(4-chlorophenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide (Compound X-3) (0.100 g, 0.252 mmol, 1.00 equiv.) in dioxane (3.5 mL) and water (1.10 mL), cesium carbonate (0.166 g, 0.503 mmol, 2.00 equiv.) was added and the mixture was purged with argon for 5 minutes. Then tetrakis(triphenylphosphine) palladium(0) (14.7 mg, 0.0126 mmol, 0.0500 equiv.) was added and it was irradiated in the microwave oven at 100 °C for 45 minutes. The mixture was diluted with ethyl acetate, quenched with saturated aqueous NaHCO₃ solution, and extracted with ethyl acetate. The combined organic layers were washed with water and brine, dried over Na₂SO₄, filtered, and concentrated under reduced pressure. The crude product was purified by reversed phase chromatography (water/acetonitrile) to afford methyl N-[4-[6-[(4-chlorophenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]phenyl]carbamate as white crystals.

LC-MS (method C): Rt 0.88 min, m/z = 436 (M+H)⁺

¹H-NMR (400 MHz, DMSO-d₆, ppm) δ = 3.41 (s, 3 H), 3.72 (s, 3 H), 7.28 - 7.33 (m, 4 H), 7.61 (s, 2 H), 7.67 - 7.73 (m, 2 H), 8.03 (s, 1 H), 8.72 (d, J = 1.5 Hz, 1 H), 8.82 (s, 1 H), 9.95 (s, 1 H).

Example 6: Preparation of methyl N-[4-[6-[(4-fluoro-3-methoxy-phenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]phenyl]carbamate (Compound 58)



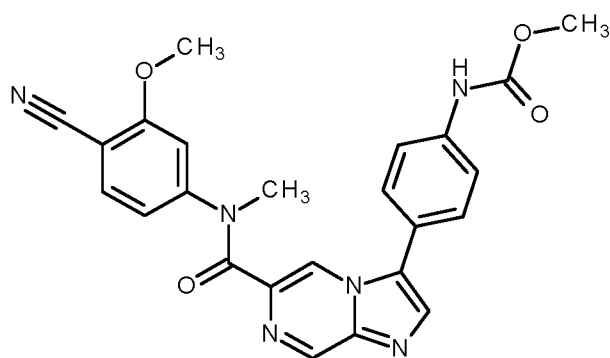
To a solution of 3-bromo-N-(4-fluoro-3-methoxy-phenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide (Compound X-2) (0.150 g, 0.396 mmol) in dioxane/H₂O (4:1, 2.5 mL) was added methyl N-[4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)phenyl]carbamate (CAS 844500-75-0) (0.274 g, 0.989 mmol), potassium carbonate (0.137 g, 0.989 mmol) and [1,1-bis(diphenylphosphino)ferrocene]dichloropalladium(II) (0.0289 g, 0.0396 mmol). The mixture was

stirred at 55 °C for 1.5 hours under N₂ atmosphere. Then the resulting mixture was concentrated under vacuum. The crude product was purified by flash chromatography using a dichloromethane/MeOH gradient. The desired product was further purified by trituration with methyl tert-butyl ether/acetonitrile (1:1) to afford methyl N-[4-[6-[(4-fluoro-3-methoxy-phenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]phenyl]carbamate as a white solid.

LC-MS (method A): Rt 1.13 min, m/z = 450 (M+H)⁺

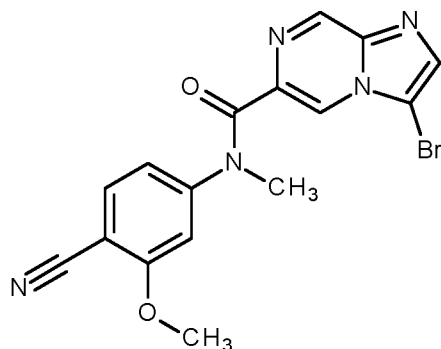
¹H-NMR (400 MHz, DMSO-d₆, ppm) δ = 9.95 (s, 1 H), 8.85 (s, 1 H), 8.66 (s, 1 H), 8.01 (s, 1 H), 7.69 (d, J = 8.6 Hz, 2 H), 7.56 (d, J = 8.4 Hz, 2H), 7.23 (dd, J = 7.8, 2.4 Hz, 1 H), 7.05 (t, J = 9.8 Hz, 1 H), 6.75 (s, 1 H), 3.71 (d, J = 2.8 Hz, 6 H), 3.41 (s, 3 H).

Example 7: Preparation of methyl N-[4-[6-[(4-cyano-3-methoxy-phenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]phenyl]carbamate (Compound 59)



(Compound 59)

Step A: Preparation of 3-bromo-N-(4-cyano-3-methoxy-phenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide (Compound X-4)



(Compound X-4)

To a solution of 2-methoxy-4-(methylamino)benzonitrile (0.210 g, 1.29 mmol) and 3-bromoimidazo[1,2-a]pyrazine-6-carboxylic acid (Compound X-1) (0.407 g, 1.68 mmol) in pyridine (4.00 mL) at 65 °C was added dropwise 1-propanephosphonic anhydride (50% in ethyl acetate) (2.47 g, 3.88 mmol). The reaction mixture was stirred at 65 °C for 2 hours. The reaction mixture quenched with a saturated solution of NaHCO₃ and diluted with ethyl acetate. The aqueous layer was extracted with ethyl acetate. The combined organic layers were washed with brine, dried over Na₂SO₄ and concentrated under reduced pressure. The crude residue was purified over a silica gel cartridge (cyclohexane/methanol) to afford 3-bromo-N-(4-cyano-3-methoxy-phenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide as a yellow solid.

LC-MS (method A): Rt 1.07 min, m/z = 386 (M+H)⁺

¹H-NMR (400 MHz, DMSO-d⁶, ppm) δ = 8.80 (d, J = 1.2 Hz, 1 H), 8.69 (d, J = 1.4 Hz, 1 H), 8.06 (s, 1 H), 7.56 (d, J = 8.2 Hz, 1 H), 7.22 (d, J = 1.8 Hz, 1 H), 6.89 (dd, J = 8.2, 1.8 Hz, 1 H), 3.78 (s, 3 H), 3.49 (s, 3 H).

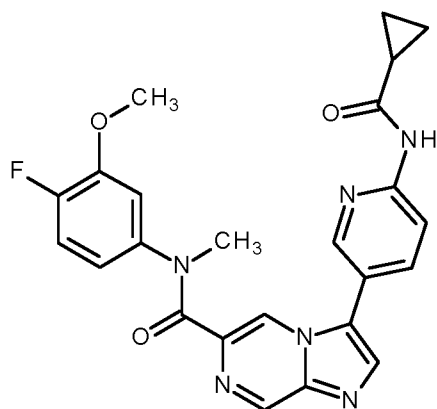
5 Step B: Preparation of methyl N-[4-[6-[(4-cyano-3-methoxy-phenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]phenyl]carbamate (Compound 59)

To a solution of 3-bromo-N-(4-cyano-3-methoxy-phenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide (Compound X-4) (0.150 g, 0.388 mmol) in dioxane/H₂O (4:1, 2.5 mL) was added methyl N-[4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)phenyl]carbamate (0.269 g, 0.971 mmol), potassium
10 carbonate (0.134 g, 0.971 mmol) and [1,1-bis(diphenylphosphino)ferrocene]dichloropalladium(II) (0.0284 g, 0.0388 mmol). The mixture was stirred at 55 °C for 1.5 hours under nitrogen atmosphere. The reaction mixture was concentrated under reduced pressure. The crude product was purified by silica gel column chromatography (eluting with dichloromethane/methanol) to obtain the desired compound, which was further purified by trituration with methyl tert-butyl ether/acetonitrile (1:1) to obtain
15 methyl N-[4-[6-[(4-cyano-3-methoxy-phenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]phenyl]carbamate as a white solid.

LC-MS (method A): Rt 1.11 min, m/z = 457 (M+H)⁺

¹H-NMR (400 MHz, DMSO-d⁶, ppm) δ = 9.96 (s, 1 H), 8.82 (s, 1 H), 8.77 (s, 1 H), 8.04 (s, 1 H), 7.70 (d, J = 8.4 Hz, 2 H), 7.61 (d, J = 8.6 Hz, 2 H), 7.57 (d, J = 8.2 Hz, 1 H), 7.25 (d, J = 1.2 Hz, 1 H), 6.93 –
20 6.88 (m, 1 H), 3.77 (s, 3 H), 3.72 (s, 3 H), 3.48 (s, 3 H).

Example 8: Preparation of 3-[6-(cyclopropanecarbonylamino)-3-pyridyl]-N-(4-fluoro-3-methoxy-phenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide (Compound 50)



(Compound 50)

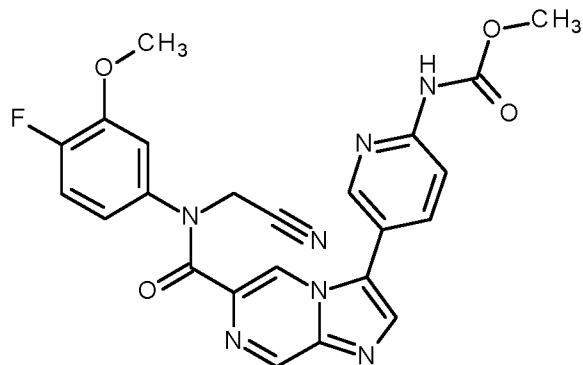
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Under an argon atmosphere, N-[5-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-2-pyridyl]cyclopropanecarboxamide (CAS 1201644-41-8) (0.052 mmol), XPhos Pd G3 (CAS 1445085-55-1) (3.455 mg, 0.00408 mmol) were placed in a vial. Then a solution of 3-bromo-N-(4-fluoro-3-methoxy-phenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide (Compound X-2) (0.0408 mmol) in 1,4-dioxane (0.40 mL, degassed with argon) was added, followed by a solution of sodium carbonate (12.9 mg, 0.12 mmol) in water (0.10 mL, degassed with argon). The reaction mixture was stirred under argon,
30 at 100 °C for 16 hours. Then, the solvent was evaporated. The residue was dissolved in dimethylacetamide (0.4 mL) and methanol (0.4 mL). The resulting suspension was filtered and filtrate

was purified by reverse phase chromatography to afford 3-[6-(cyclopropanecarbonylamino)-3-pyridyl]-N-(4-fluoro-3-methoxy-phenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide.

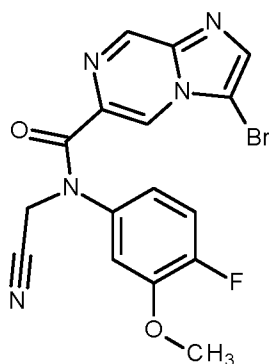
LC-MS (method D): Rt 1.16 min, m/z = 461 (M+H)⁺

5 **Example 9: Preparation of methyl N-[5-[6-[cyanomethyl-(4-fluoro-3-methoxy-phenyl)carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate (Compound 2)**



(Compound 2)

10 **Step A: Preparation of 3-bromo-N-(cyanomethyl)-N-(4-fluoro-3-methoxy-phenyl)imidazo[1,2-a]pyrazine-6-carboxamide**



Under argon atmosphere, to a solution of 3-bromoimidazo[1,2-a]pyrazine-6-carboxylic acid (Compound X-1) (0.230 g, 0.92 mmol) in ethyl acetate (3.3 mL) was added 2-(4-fluoro-3-methoxyanilino)acetonitrile (CAS 1600967-16-5) (0.150 g, 0.83 mmol), N,N-diisopropylethylamine (0.58 mL, 3.3 mmol) and 1-propanephosphonic anhydride (50% in ethyl acetate) (0.58 g, 0.92 mmol) at 85 °C. The reaction mixture was stirred at 85 °C for 17 hours. Then the mixture was cooled to room temperature diluted with ethyl acetate then water. The organic layer was washed with brine and dried over sodium sulfate, filtered and concentrated. The crude was purified by flash chromatography using a cyclohexane/ethyl acetate gradient to afford 3-bromo-N-(cyanomethyl)-N-(4-fluoro-3-methoxy-phenyl)imidazo[1,2-a]pyrazine-6-carboxamide as a beige solid.

LC-MS (method C): Rt 0.81 min, m/z = 406 (M+H)⁺

¹H-NMR (400 MHz, CDCl₃, ppm) δ = 3.85 - 3.94 (m, 3 H), 4.79 (br s, 2 H), 6.68 - 6.81 (m, 1 H), 6.92 - 7.06 (m, 2 H), 7.85 (s, 1 H), 8.56 - 8.70 (m, 1 H), 8.78 (br s, 1 H).

25 **Step B: Preparation of methyl N-[5-[6-[cyanomethyl-(4-fluoro-3-methoxy-phenyl)carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate (Compound 2)**

To a solution of 3-bromo-N-(cyanomethyl)-N-(4-fluoro-3-methoxy-phenyl)imidazo[1,2-a]pyrazine-6-carboxamide (0.22 g, 0.54 mmol) in 2-methyltetrahydrofuran (3.3 mL) was added methyl N-[5-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-2-pyridyl]carbamate (0.21 g, 0.76 mmol), water (1.1 mL) and cesium carbonate (0.27 g, 0.82 mmol). The reaction mixture was degassed with argon, then

5 tetrakis(triphenylphosphine)palladium (0) (0.032 g, 0.027 mmol) was added. The mixture was heated in a microwave for 30 min at 100 °C. Then, the reaction mixture was cooled to room temperature and diluted with water. The resulting suspension was extracted with ethyl acetate. The organic layer was washed with water, then with brine, dried over sodium sulfate, filtered and evaporated. The crude was purified by flash chromatography using a cyclohexane/EtOAc gradient to afford methyl N-[5-[6-

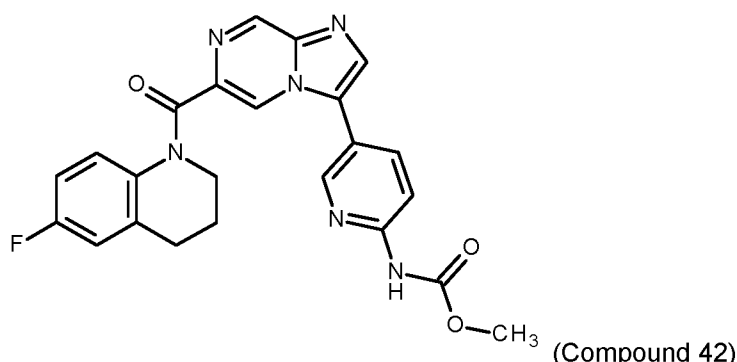
10 [cyanomethyl-(4-fluoro-3-methoxy-phenyl)carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate as a beige solid.

LC-MS (method C): Rt 0.79 min, m/z = 476 (M+H)⁺

¹H-NMR (400 MHz, CDCl₃, ppm) δ = 3.88 - 3.91 (m, 6 H), 4.76 (br s, 2 H), 6.74 (br d, J = 5.45 Hz, 1 H), 6.90 - 7.14 (m, 2 H), 7.78 (s, 1 H), 7.87 (dd, J = 8.72, 2.18 Hz, 1 H), 7.94 (s, 1 H), 8.25 (d, J = 8.72 Hz,

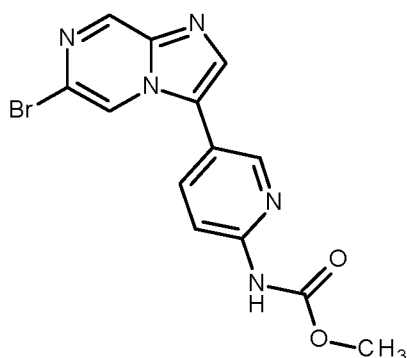
15 1 H), 8.46 (d, J = 2.18 Hz, 1 H), 8.69 - 8.93 (m, 2 H).

Example 10: Preparation of methyl N-[5-[6-(6-fluoro-3,4-dihydro-2H-quinoline-1-carbonyl)]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate (Compound 42)



20

Step A: Preparation of methyl N-[5-(6-bromoimidazo[1,2-a]pyrazin-3-yl)-2-pyridyl]carbamate



To a solution of 6-bromo-3-iodo-imidazo[1,2-a]pyrazine (2.00 g, 6.17 mmol) in dioxane/H₂O (4:1, 45 mL) was added methyl N-[5-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-2-pyridyl]carbamate (2.58 g, 9.26

25 mmol), potassium carbonate (2.13 g, 15.4 mmol) and [1,1-bis(diphenylphosphino)ferrocene]dichloropalladium(II) (0.452 g, 0.617 mmol). The mixture was stirred at 40 °C for 4 hours under nitrogen atmosphere. The reaction mixture was concentrated under reduced

pressure. The crude product was purified by silica gel column chromatography (eluting with dichloromethane/methanol) to obtain the desired compound, which was further purified by trituration with acetonitrile to obtain methyl N-[5-(6-bromoimidazo[1,2-a]pyrazin-3-yl)-2-pyridyl]carbamate as an off-white solid.

5 LC-MS (method A): Rt 1.032 min, m/z = 348 (M+H)⁺

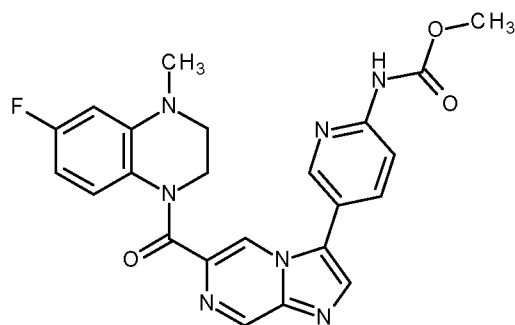
¹H-NMR (400 MHz, DMSO-d₆, ppm) δ = 10.49 (s, 1 H), 9.02 (d, J = 1.0 Hz, 1 H), 8.81 (d, J = 1.0 Hz, 1 H), 8.63 (d, J = 2.0 Hz, 1 H), 8.19 (dd, J = 8.6, 2.4 Hz, 1 H), 8.13 (s, 1 H), 8.02 (d, J = 8.6 Hz, 1 H), 3.72 (s, 3 H).

10 Step B: Preparation of methyl N-[5-[6-(6-fluoro-3,4-dihydro-2H-quinoline-1-carbonyl)imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate (Compound 42)

In a glovebox, under inert conditions, a reactor was charged with XantPhos Pd G3 (CAS 1445085-97-1) (4.99 mg, 0.00526 mmol), sodium carbonate (16.1 mg, 0.150 mmol) and 6-fluoro-1,2,3,4-tetrahydroquinoline (CAS 59611-52-8) (12.8 mg, 0.075 mmol). Then, methyl N-[5-(6-bromoimidazo[1,2-a]pyrazin-3-yl)-2-pyridyl]carbamate (17.41 mg, 0.05003 mmol) in degassed 1,4-dioxane (0.20 mL) was added. The reactor was flushed with argon, then pressurized with carbon monoxide to 10 bar. The reaction mixture was stirred at 80 °C for 16 hours. Then, solvent was evaporated and dimethylacetamide (0.40 mL) and methanol (0.40 mL) were added to the residue. The resulting suspension was filtered. The residue was purified by reverse phase prep. chromatography to afford methyl N-[5-[6-(6-fluoro-3,4-dihydro-2H-quinoline-1-carbonyl)imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate (Compound 42).

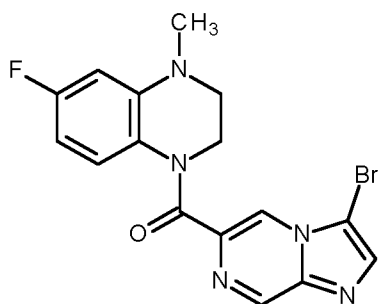
LC-MS (method D): Rt 1.21 min, m/z = 447 (M+H)⁺

25 Example 11: Preparation of methyl N-[5-[6-(6-fluoro-4-methyl-2,3-dihydroquinoxaline-1-carbonyl)imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate (compound 53)



(Compound 53)

Step A: Preparation of (3-bromoimidazo[1,2-a]pyrazin-6-yl)-(6-fluoro-4-methyl-2,3-dihydroquinoxalin-1-yl)methanone



To a solution of 3-bromoimidazo[1,2-a]pyrazine-6-carboxylic acid (Compound X-1) (100 mg, 0.413 mmol) and 6-fluoro-4-methyl-2,3-dihydro-1H-quinoxaline (0.0696 g, 0.454 mmol) in pyridine. (2.0 mL) was added 1-propanephosphonic anhydride (50% in ethyl acetate) (0.789 g, 1.24 mmol) dropwise at 65 °C under nitrogen atmosphere. The mixture was heated at 65 °C for 2 hours. The reaction mixture was diluted with saturated aqueous NaHCO₃ solution and extracted with ethyl acetate. The combined organic layers were washed with water, dried with sodium sulfate, filtered and concentrated under vacuum. The residue was purified by silica gel column chromatography (eluting with dichloromethane/methanol) to give (3-bromoimidazo[1,2-a]pyrazin-6-yl)-(6-fluoro-4-methyl-2,3-dihydroquinoxalin-1-yl)methanone as a green solid.

LC-MS (method A): Rt 1.20 min, m/z = 390 (M+H)⁺

¹H-NMR (400 MHz, DMSO-d₆, ppm) δ = 9.00 (s, 1 H), 8.67 (d, J = 1.0 Hz, 1 H), 8.08 (s, 1 H), 7.19 (s, 1 H), 6.53 (dd, J = 12.0, 2.4 Hz, 1 H), 6.19 (s, 1 H), 3.89 (s, 2 H), 3.43 (s, 2 H), 2.94 (s, 3 H).

15 Step B: Preparation of methyl N-[5-[6-(6-fluoro-4-methyl-2,3-dihydroquinoxaline-1-carbonyl)imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate (compound 53)

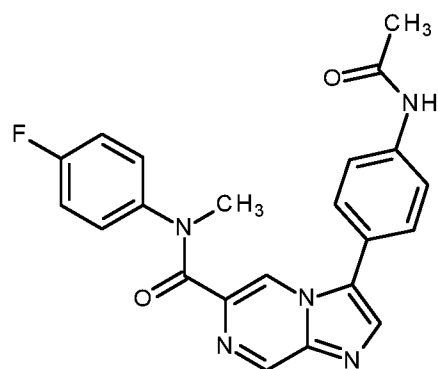
To a solution of (3-bromoimidazo[1,2-a]pyrazin-6-yl)-(6-fluoro-4-methyl-2,3-dihydroquinoxalin-1-yl)methanone (0.150 g, 0.384 mmol) in dioxane/H₂O (4:1, 2.5 mL) was added methyl N-[5-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-2-pyridyl]carbamate (0.160 g, 0.577 mmol), potassium carbonate (0.133 g, 0.961 mmol) and [1,1-bis(diphenylphosphino)ferrocene]dichloropalladium(II) (0.0281 g, 0.0384 mmol). The mixture was stirred at 50 °C for 1.5 hours under nitrogen atmosphere. The reaction mixture was concentrated under reduced pressure. The crude product was purified by silica gel column chromatography (eluting with dichloromethane/methanol) to obtain the desired compound, which was further purified by trituration with acetonitrile to obtain methyl N-[5-[6-(6-fluoro-4-methyl-2,3-dihydroquinoxaline-1-carbonyl)imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate as a yellow solid.

LC-MS (method A): Rt 1.14 min, m/z = 462 (M+H)⁺

¹H-NMR (400 MHz, DMSO-d₆, ppm) δ = 10.10 (s, 1 H), 9.00 (s, 1 H), 8.71 (s, 1 H), 8.59 (d, J = 1.0 Hz, 1 H), 8.10 - 8.06 (m, 2 H), 7.99 (d, J = 8.6 Hz, 1 H), 7.07 (s, 1 H), 6.49 (dd, J = 12.0, 2.4 Hz, 1 H), 6.18 (t, J = 7.2 Hz, 1 H), 3.89 (t, J = 5.2 Hz, 2 H), 3.73 (s, 3 H), 3.42 (t, J = 5.2 Hz, 2 H), 2.93 (s, 3 H).

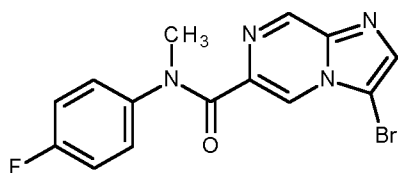
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Example 12: Preparation of 3-(4-acetamidophenyl)-N-(4-fluorophenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide (Compound 38)



(Compound 38)

Step A: Preparation of 3-bromo-N-(4-fluorophenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide



- 5 To a solution of 3-bromoimidazo[1,2-a]pyrazine-6-carboxylic acid (Compound X-1) (0.200 g, 0.83 mmol, 1.00 equiv.) in dichloromethane (5.8 mL) were added 4-fluoro-N-methylaniline (0.139 mL, 1.16 mmol, 1.40 equiv.), triethylamine (0.35 mL, 2.48 mmol, 3.00 equiv.) and 1-propanephosphonic anhydride (50% in ethyl acetate) (1.23 mL, 2.07 mmol, 2.50 equiv.). The reaction mixture was stirred overnight at room temperature, then water was added, and the aqueous layer was extracted with
- 10 dichloromethane. The combined organic layers were washed with brine, dried over Na₂SO₄, filtered, and concentrated under reduced pressure. The crude product was purified over silica gel cartridge (cyclohexane/ethyl acetate) to afford 3-bromo-N-(4-fluorophenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide as white solid.

LC-MS (method C): Rt 0.77 min, m/z = 351 (M+H)⁺

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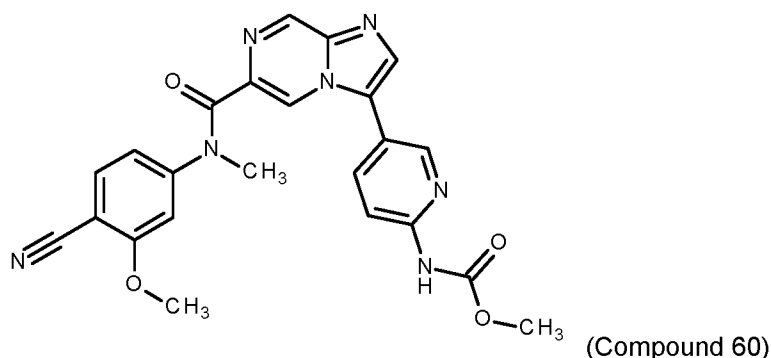
Step B: Preparation of 3-(4-acetamidophenyl)-N-(4-fluorophenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide (Compound 38)

- A mixture of 3-bromo-N-(4-fluorophenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide (0.210 g, 0.601 mmol), 4-acetamidophenylboronic acid (0.224 g, 1.20 mmol, 2.00 equiv.) in 1,2-dimethoxyethane
- 20 (0.69 mL) was flushed with nitrogen for 5 min. Tetrakis(triphenylphosphine)palladium(0) (0.0035 g, 0.0030 mmol, 0.05 equiv.) was then added followed by a solution of potassium fluoride (0.0699 g, 1.20 mmol, 2.00 equiv.) in water (1.20 mL). The reaction mixture was heated under microwave irradiation at 100 °C and stirred for 1 hour. The reaction mixture was cooled down to room temperature and then saturated aqueous sodium bicarbonate solution was added. The aqueous layer was extracted with ethyl
- 25 acetate and the combined organic layers were washed with brine, dried over Na₂SO₄, filtered, and concentrated under reduced pressure. The crude residue was purified by flash chromatography over silica gel (eluting dichloromethane/methanol) to afford 3-(4-acetamidophenyl)-N-(4-fluorophenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide as a beige solid.

LC-MS (method C): Rt 0.75 min, m/z = 404 (M+H)⁺

30

Example 13 : Preparation of methyl N-[5-[6-[(4-cyano-3-methoxy-phenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate (Compound 60)



To a solution of 3-bromo-N-(4-cyano-3-methoxy-phenyl)-N-methyl-imidazo[1,2-a]pyrazine-6-carboxamide (0.150 g, 0.388 mmol) in dioxane/H₂O (4:1, 2.5 mL) was added methyl N-[5-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-2-pyridyl]carbamate (0.270 g, 0.971 mmol), potassium carbonate (0.134 g, 0.971 mmol) and [1,1-bis(diphenylphosphino)ferrocene]dichloropalladium(II) (0.0284 g, 0.0388 mmol). The mixture was stirred at 55 °C for 1.5 hours under nitrogen atmosphere. Then the reaction mixture was concentrated under reduced pressure. The crude product was purified by silica gel column chromatography (eluting with dichloromethane/methanol) to obtain the desired compound, which was further purified by trituration with methyl tert-butyl ether/acetonitrile (1:1) to obtain methyl N-[5-[6-[(4-cyano-3-methoxy-phenyl)-methyl-carbamoyl]imidazo[1,2-a]pyrazin-3-yl]-2-pyridyl]carbamate as a white solid.

LC-MS (method A): Rt 1.01 min, m/z = 458 (M+H)⁺

¹H-NMR (400 MHz, DMSO-d₆, ppm) δ = 10.53 (s, 1 H), 8.85 (d, J = 1.2 Hz, 1 H), 8.80 (d, J = 1.2 Hz, 1 H), 8.62 (d, J = 1.8 Hz, 1 H), 8.16 – 8.09 (m, 2 H), 8.05 (d, J = 8.6 Hz, 1 H), 7.57 (d, J = 8.2 Hz, 1 H), 7.24 (d, J = 1.8 Hz, 1 H), 6.91 (dd, J = 8.2, 1.8 Hz, 1 H), 3.77 (s, 3 H), 3.73 (s, 3 H), 3.48 (s, 3 H).

20 **Biological examples:**

The fungicidal activity of the compounds of the invention have been tested as follows:

***Monographella nivalis* (*Microdochium nivale*) / liquid culture (foot rot cereals)**

Conidia of the fungus from cryogenic storage are directly mixed into nutrient broth (PDB potato dextrose broth). After placing a (DMSO) solution of test compound into a microtiter plate (96-well format), the nutrient broth containing the fungal spores is added. The test plates are incubated at 24 °C and the inhibition of growth is determined photometrically 4-5 days after application.

The following compounds gave at least 80% control of *Monographella nivalis* at 20 ppm when compared to untreated control under the same conditions, which showed extensive disease development:

5, 6, 8, 28, 34

***Phytophthora infestans* / tomato / leaf disc preventative (late blight)**

Tomato leaf disks are placed on water agar in multiwell plates (24-well format) and sprayed with the formulated test compound diluted in water. The leaf disks are inoculated with a spore suspension of the fungus 1 day after application. The inoculated leaf disks are incubated at 16 °C and 75% rh under a light regime of 24 h darkness followed by 12 h light / 12 h darkness in a climate cabinet and the activity of a compound is assessed as percent disease control compared to untreated when an appropriate level of disease damage appears in untreated check leaf disks (5 - 7 days after application).

The following compounds gave at least 80% control of *Phytophthora infestans* at 200 ppm when compared to untreated control under the same conditions, which showed extensive disease development:

1, 2, 3, 4, 37, 42, 46, 50, 51, 58, 59

***Plasmopara viticola* / grape / leaf disc preventative (late blight)**

Grape vine leaf disks are placed on water agar in multiwell plates (24-well format) and sprayed with the formulated test compound diluted in water. The leaf disks are inoculated with a spore suspension of the fungus 1 day after application. The inoculated leaf disks are incubated at 19 °C and 80% rh under a light regime of 12 h light / 12 h darkness in a climate cabinet and the activity of a compound is assessed as percent disease control compared to untreated when an appropriate level of disease damage appears in untreated check leaf disks (6 - 8 days after application).

The following compounds gave at least 80% control of *Plasmopara viticola* at 200 ppm when compared to untreated control under the same conditions, which showed extensive disease development:

1, 6, 8, 28, 36, 37, 55, 58, 59

***Pythium ultimum* / liquid culture (seedling damping off)**

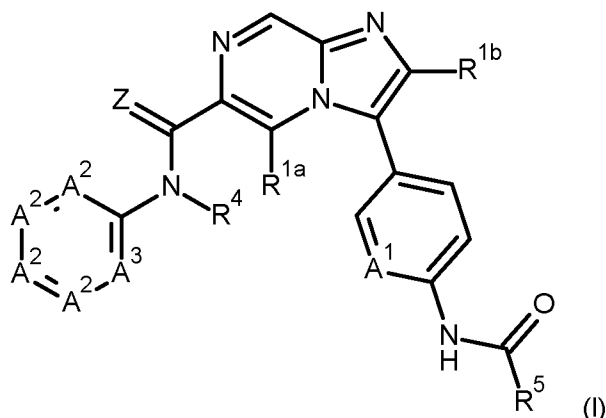
Mycelia fragments and oospores of a newly grown liquid culture of the fungus are directly mixed into nutrient broth (PDB potato dextrose broth). After placing a (DMSO) solution of test compound into a microtiter plate (96-well format), the nutrient broth containing the fungal mycelia/spore mixture is added. The test plates are incubated at 24 °C and the inhibition of growth is determined photometrically 2-3 days after application.

The following compounds gave at least 80% control of *Pythium ultimum* at 20 ppm when compared to untreated control under the same conditions, which showed extensive disease development:

1, 2, 3, 4, 9, 27, 28, 34, 38, 53, 55, 58, 59

Claims

1. A compound of formula (I)



5

wherein Z is O or S, and preferably Z is O;

A^1 is CH or N, and preferably N;

10 R^{1a} and R^{1b} are independently selected from hydrogen, hydroxy, halogen, CN, C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{1-6} alkoxy- C_{1-6} alkyl, C_{3-6} cycloalkyl- C_{1-4} alkyl, C_{1-6} alkylsulfanyl, C_{1-6} alkylsulfinyl, C_{1-6} alkylsulfonyl, C_{1-6} alkoxy, amino, and $NHC(O)C_{1-6}$ alkyl;

15 A^2 are independently CR^2 or N, with the proviso that no more than three A^2 are N, preferably no more than two A^2 are N, preferably no more than one A^2 is N, and more preferably the four A^2 are CR^2 ;

R^2 are independently selected from hydrogen, hydroxy, halogen, CN, C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkoxy, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-6} alkyl, C_{1-6} alkylsulfanyl, C_{1-6} alkylsulfinyl, C_{1-6} alkylsulfonyl, C_{1-6} alkoxycarbonyl, C_{1-6} alkylaminocarbonyl, di- C_{1-6} alkylaminocarbonyl, and C_{1-6} alkylcarbonyl, wherein each of the C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkoxy, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-6} alkyl, C_{1-6} alkylsulfanyl, C_{1-6} alkylsulfinyl, C_{1-6} alkylsulfonyl, C_{1-6} alkoxycarbonyl, C_{1-6} alkylaminocarbonyl, di- C_{1-6} alkylaminocarbonyl, and C_{1-6} alkylcarbonyl groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN;

25

A^3 is independently CR^3 or N;

R^3 is selected from hydrogen, hydroxy, halogen, CN, C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkoxy, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-6} alkyl, C_{1-6} alkylsulfanyl, C_{1-6} alkylsulfinyl, C_{1-6} alkylsulfonyl, amino, C_{1-6} alkylamino, di- C_{1-6} alkylamino, and C_{3-6} cycloalkylamino, wherein each of the C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkoxy, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-6} alkyl, C_{1-6} alkylsulfanyl, C_{1-6} alkylsulfinyl, C_{1-6} alkylsulfonyl,

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amino, C₁₋₆alkylamino, diC₁₋₆alkylamino, and C₃₋₆cycloalkylamino groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN;

R⁴ is selected from C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₄alkyl, C₂₋₆alkenyl, C₂₋₆alkynyl, C₁₋₆alkoxy, C₁₋₆alkylsulfanyl-C₁₋₆alkyl, C₁₋₆alkylsulfinyl-C₁₋₆alkyl, C₁₋₆alkylsulfonyl-C₁₋₆alkyl, C₁₋₆alkoxycarbonyl-C₁₋₆alkyl, C₁₋₆alkylaminocarbonyl-C₁₋₆alkyl, diC₁₋₆alkylaminocarbonyl-C₁₋₆alkyl, and CN, wherein each of the C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₄alkyl, C₂₋₆alkenyl, C₂₋₆alkynyl, C₁₋₆alkoxy, C₁₋₆alkylsulfanyl-C₁₋₆alkyl, C₁₋₆alkylsulfinyl-C₁₋₆alkyl, C₁₋₆alkylsulfonyl-C₁₋₆alkyl, C₁₋₆alkoxycarbonyl-C₁₋₆alkyl, C₁₋₆alkylaminocarbonyl-C₁₋₆alkyl and diC₁₋₆alkylaminocarbonyl-C₁₋₆alkyl groups is optionally substituted with one to three substituents independently selected from halogen and CN;

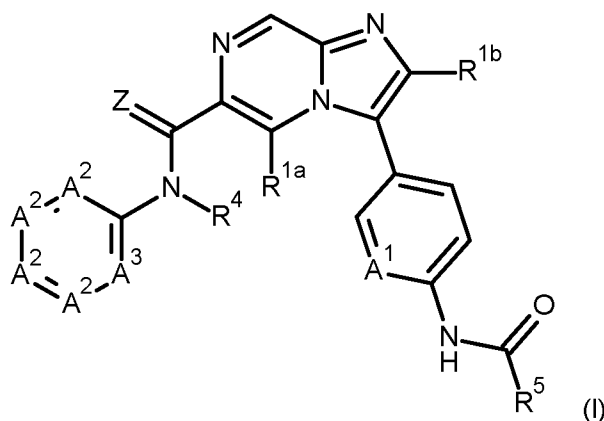
wherein A³ and R⁴ taken together optionally form a ring, preferably a 5-8-membered heterocycle, and more preferably a 6-membered heterocycle; and

R⁵ is selected from C₁₋₆alkyl, C₁₋₆alkoxy, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkoxyC₁₋₆alkyl, C₁₋₆alkylamino, diC₁₋₆alkylamino, and C₁₋₆alkylC₁₋₆alkoxyamino, wherein each of said groups is optionally substituted with one to three substituents independently selected from halogen and CN;

or a salt or N-oxide thereof,

wherein the compound of formula (I) is used as fungicide.

2. A compound of formula (I)



wherein Z is O or S, and preferably Z is O;

A¹ is CH or N, and preferably N;

R^{1a} and R^{1b} are independently selected from hydrogen, hydroxy, halogen, CN, C₁₋₆alkyl, C₃₋₆cycloalkyl, C₁₋₆alkoxy-C₁₋₆alkyl, C₃₋₆cycloalkyl-C₁₋₄alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, C₁₋₆alkoxy, amino, and NHC(O)C₁₋₆alkyl;

A² are independently CR² or N, with the proviso that no more than three A² are N, preferably no more than two A² are N, preferably no more than one A² is N, and more preferably the four A² are CR²;

R² are independently selected from hydrogen, hydroxy, halogen, CN, C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-
5 C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₂₋₆alkenyl, C₂₋₆alkynyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, C₁₋₆alkoxycarbonyl, C₁₋₆alkylaminocarbonyl, diC₁₋₆alkylaminocarbonyl, and C₁₋₆alkylcarbonyl, wherein each of the C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₂₋₆alkenyl, C₂₋₆alkynyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, C₁₋₆alkoxycarbonyl, C₁₋₆alkylaminocarbonyl, diC₁₋₆alkylaminocarbonyl, and C₁₋₆alkylcarbonyl groups is optionally substituted with one to three substituents
10 independently selected from halogen, hydroxy, and CN; with the proviso that at least two R² are not hydrogen;

A³ is independently CR³ or N;

15

R³ is selected from hydrogen, hydroxy, halogen, CN, C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₂₋₆alkenyl, C₂₋₆alkynyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, amino, C₁₋₆alkylamino, diC₁₋₆-alkylamino, and C₃₋₆cycloalkylamino, wherein each of the C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₂₋₆alkenyl, C₂₋₆alkynyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, amino, C₁₋₆alkylamino, diC₁₋₆-alkylamino, and C₃₋₆cycloalkylamino groups is optionally substituted with
20 one to three substituents independently selected from halogen, hydroxy, and CN;

R⁴ is selected from C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₄alkyl, C₂₋₆alkenyl, C₂₋₆alkynyl, C₁₋₆alkoxy, C₁₋₆alkylsulfanyl-C₁₋₆alkyl, C₁₋₆alkylsulfinyl-C₁₋₆alkyl, C₁₋₆alkylsulfonyl-C₁₋₆alkyl, C₁₋₆alkoxycarbonyl-C₁₋₆alkyl, C₁₋₆alkylaminocarbonyl-C₁₋₆alkyl, diC₁₋₆alkylaminocarbonyl-C₁₋₆alkyl, and CN, wherein each of the C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₄alkyl, C₂₋₆alkenyl, C₂₋₆alkynyl, C₁₋₆alkoxy, C₁₋₆alkylsulfanyl-C₁₋₆alkyl, C₁₋₆alkylsulfinyl-C₁₋₆alkyl, C₁₋₆alkylsulfonyl-C₁₋₆alkyl, C₁₋₆alkoxycarbonyl-C₁₋₆alkyl, C₁₋₆alkylaminocarbonyl-C₁₋₆alkyl and diC₁₋₆alkylaminocarbonyl-C₁₋₆alkyl
25 groups is optionally substituted with one to three substituents independently selected from halogen and CN;

wherein A³ and R⁴ taken together optionally form a ring, preferably a 5-8-membered heterocycle, and more preferably a 6-membered heterocycle; and

35 R⁵ is selected from C₁₋₆alkyl, C₁₋₆alkoxy, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkoxyC₁₋₆alkyl, C₁₋₆alkylamino, diC₁₋₆alkylamino, and C₁₋₆alkylC₁₋₆alkoxyamino, wherein each of said groups is optionally substituted with one to three substituents independently selected from halogen and CN;

or a salt or N-oxide thereof.

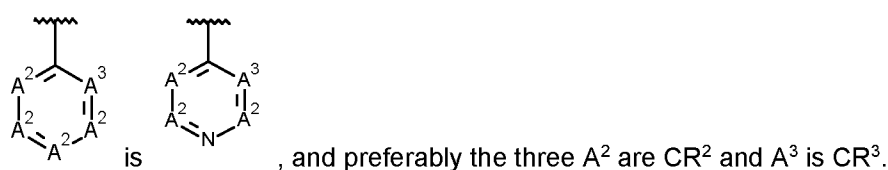
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3. The compound according to claim 1 or 2, wherein R^{1a} and R^{1b} are independently selected from hydrogen, C₁₋₆alkyl, C₃₋₆cycloalkyl, C₁₋₆alkoxy-C₁₋₆alkyl, C₃₋₆cycloalkyl-C₁₋₄alkyl, and C₁₋₆alkoxy.

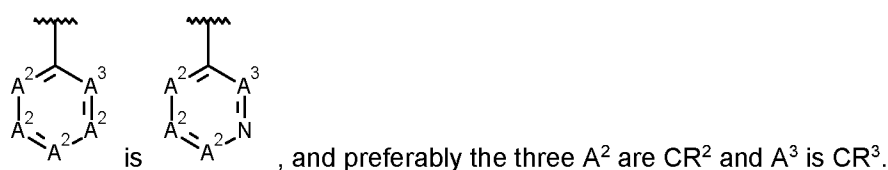
4. The compound according to any one of the preceding claims, wherein R^{1a} and R^{1b} are hydrogen.
5. The compound according to any one of the preceding claims, wherein R^2 are independently selected from hydrogen, halogen, CN, C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, and C_{1-6} alkoxy- C_{1-6} alkoxy,
- 5 wherein each of the C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, and C_{1-6} alkoxy- C_{1-6} alkoxy groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN.
6. The compound according to any one of the preceding claims, wherein R^3 is selected from hydrogen,
- 10 hydroxy, halogen, CN, C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkoxy, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-6} alkyl, amino, C_{1-6} alkylamino, di- C_{1-6} -alkylamino, and C_{3-6} cycloalkylamino, wherein each of the C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkoxy, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-6} alkyl, amino, C_{1-6} alkylamino, di- C_{1-6} -alkylamino and C_{3-6} cycloalkylamino groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and
- 15 CN.
7. The compound according to any one of the preceding claims, wherein four A^2 are CR^2 and A^3 is N.

8. The compound according to any one of the claims 1 to 6, wherein

20

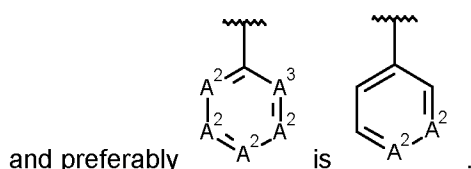


9. The compound according to any one of the claims 1 to 6, wherein



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10. The compound according to any one of the claims 1 to 6, wherein four A^2 are CR^2 and A^3 is CR^3 ,



11. The compound according to any one of the preceding claims, wherein R^4 is selected from C_{1-6} alkyl,
- 30 C_{1-6} alkoxy- C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-4} alkyl, C_{2-6} alkenyl, C_{2-6} alkynyl, and C_{1-6} alkoxy, wherein each of the C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-4} alkyl, C_{2-6} alkenyl, C_{2-6} alkynyl, and C_{1-6} alkoxy groups is optionally substituted with one to three substituents independently selected from halogen and CN.

12. The compound according to any one of the preceding claims, wherein R^5 is selected from C_{1-6} alkyl, C_{1-6} alkoxy, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-6} alkyl, and C_{1-6} alkoxy- C_{1-6} alkyl, wherein each of said groups is optionally substituted with one to three substituents independently selected from halogen and CN.

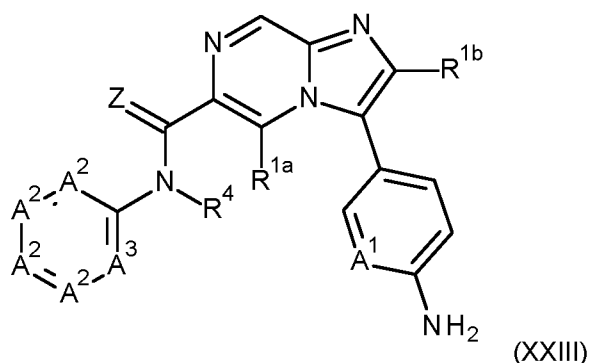
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13. A composition comprising a fungicidally effective amount of a compound as defined in any one of claims 1 to 12.

14. A composition according to claim 13, wherein the composition further comprises at least one compound selected from an additional active ingredient, an appropriate formulation inert, a carrier, an adjuvant, and any mixtures thereof.

15. A method of combating, preventing or controlling phytopathogenic diseases which comprises applying to a phytopathogen, to the locus of a phytopathogen, to a plant susceptible to attack by a phytopathogen, or to a plant propagation material thereof, a fungicidally effective amount of a compound according to any one of claims 1 to 12, or a composition comprising a compound according to any one of claims 1 to 12, or a composition according to claim 13 or 14.

16. A compound of formula (XXIII)



20

wherein Z is O or S, and preferably Z is O;

A^1 is CH or N, and preferably N;

R^{1a} and R^{1b} are independently selected from hydrogen, hydroxy, halogen, CN, C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{1-6} alkoxy- C_{1-6} alkyl, C_{3-6} cycloalkyl- C_{1-4} alkyl, C_{1-6} alkylsulfanyl, C_{1-6} alkylsulfinyl, C_{1-6} alkylsulfonyl, C_{1-6} alkoxy, amino, and $NHC(O)C_{1-6}$ alkyl; and preferably R^{1a} and R^{1b} are hydrogen;

25

A^2 are independently CR^2 or N, with the proviso that no more than three A^2 are N, preferably no more than two A^2 are N, preferably no more than one A^2 is N, and more preferably the four A^2 are CR^2 ;

R^2 are independently selected from hydrogen, hydroxy, halogen, CN, C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkoxy, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-6} alkyl, C_{1-6} alkylsulfanyl, C_{1-6} alkylsulfinyl, C_{1-6} alkylsulfonyl, C_{1-6} alkoxycarbonyl, C_{1-6} alkylaminocarbonyl, di- C_{1-6} alkylaminocarbonyl, and C_{1-6} alkylcarbonyl, wherein each of the C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkoxy, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-6} alkyl, C_{1-6} alkylsulfanyl, C_{1-6} alkylsulfinyl, C_{1-6} alkylsulfonyl, C_{1-6} alkoxycarbonyl, C_{1-6} alkylaminocarbonyl, di- C_{1-6} alkylaminocarbonyl, and C_{1-6} alkylcarbonyl groups is optionally substituted with one to three substituents

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independently selected from halogen, hydroxy, and CN; with the proviso that at least two R² are preferably not hydrogen;

A³ is independently CR³ or N;

R³ is selected from hydrogen, hydroxy, halogen, CN, C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋

5 ₆alkoxy-C₁₋₆alkoxy, C₂₋₆alkenyl, C₂₋₆alkynyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkylsulfanyl, C₁₋
₆alkylsulfinyl, C₁₋₆alkylsulfonyl, amino, C₁₋₆alkylamino, diC₁₋₆-alkylamino, and C₃₋₆cycloalkylamino,
 wherein each of the C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₂₋₆alkenyl, C₂₋
₆alkynyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl,
 amino, C₁₋₆alkylamino, diC₁₋₆-alkylamino, and C₃₋₆cycloalkylamino groups is optionally substituted with
 10 one to three substituents independently selected from halogen, hydroxy, and CN;

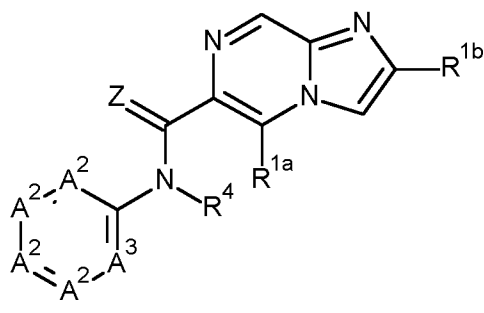
R⁴ is selected from C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₄alkyl, C₂₋₆alkenyl, C₂₋
₆alkynyl, C₁₋₆alkoxy, C₁₋₆alkylsulfanyl-C₁₋₆alkyl, C₁₋₆alkylsulfinyl-C₁₋₆alkyl, C₁₋₆alkylsulfonyl-C₁₋₆alkyl, C₁₋
₆alkoxycarbonyl-C₁₋₆alkyl, C₁₋₆alkylaminocarbonyl-C₁₋₆alkyl, diC₁₋₆alkylaminocarbonyl-C₁₋₆alkyl, and CN,
 wherein each of the C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₄alkyl, C₂₋₆alkenyl, C₂₋
 15 ₆alkynyl, C₁₋₆alkoxy, C₁₋₆alkylsulfanyl-C₁₋₆alkyl, C₁₋₆alkylsulfinyl-C₁₋₆alkyl, C₁₋₆alkylsulfonyl-C₁₋₆alkyl, C₁₋
₆alkoxycarbonyl-C₁₋₆alkyl, C₁₋₆alkylaminocarbonyl-C₁₋₆alkyl and diC₁₋₆alkylaminocarbonyl-C₁₋₆alkyl
 groups is optionally substituted with one to three substituents independently selected from halogen and
 CN; and

wherein A³ and R⁴ taken together optionally form a ring, more preferably a 5-8-membered heterocycle,

20 more preferably a 6-membered heterocycle;

or a salt or N-oxide thereof.

17. A compound of formula (IV)



(IV)

25 wherein Z is O or S, and preferably Z is O;

R^{1a} and R^{1b} are independently selected from hydrogen, hydroxy, halogen, CN, C₁₋₆alkyl, C₃₋₆cycloalkyl,
 C₁₋₆alkoxy-C₁₋₆alkyl, C₃₋₆cycloalkyl-C₁₋₄alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, C₁₋
₆alkoxy, amino, and NHC(O)C₁₋₆alkyl; and preferably R^{1a} and R^{1b} are hydrogen;

A² are independently CR² or N, with the proviso that no more than three A² are N, preferably no more
 30 than two A² are N, preferably no more than one A² is N, and more preferably the four A² are CR²;

R² are independently selected from hydrogen, hydroxy, halogen, CN, C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-
 C₁₋₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₂₋₆alkenyl, C₂₋₆alkynyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋
₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, C₁₋₆alkoxycarbonyl, C₁₋₆alkylaminocarbonyl, diC₁₋
₆alkylaminocarbonyl, and C₁₋₆alkylcarbonyl, wherein each of the C₁₋₆alkyl, C₁₋₆alkoxy, C₁₋₆alkoxy-C₁₋
 35 ₆alkyl, C₁₋₆alkoxy-C₁₋₆alkoxy, C₂₋₆alkenyl, C₂₋₆alkynyl, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋
₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, C₁₋₆alkoxycarbonyl, C₁₋₆alkylaminocarbonyl, diC₁₋

C_{1-6} alkylaminocarbonyl, and C_{1-6} alkylcarbonyl groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN; with the proviso that at least two R^2 are preferably not hydrogen;

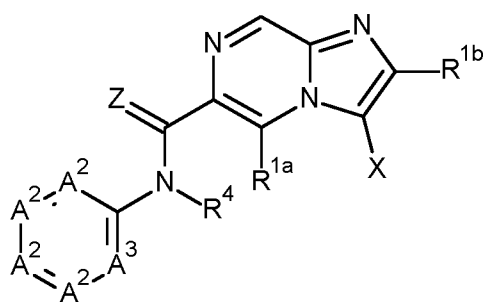
R^3 is selected from hydrogen, hydroxy, halogen, CN, C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkoxy, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-6} alkyl, C_{1-6} alkylsulfanyl, C_{1-6} alkylsulfinyl, C_{1-6} alkylsulfonyl, amino, C_{1-6} alkylamino, di- C_{1-6} alkylamino, and C_{3-6} cycloalkylamino, wherein each of the C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkoxy, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-6} alkyl, C_{1-6} alkylsulfanyl, C_{1-6} alkylsulfinyl, C_{1-6} alkylsulfonyl, amino, C_{1-6} alkylamino, di- C_{1-6} alkylamino, and C_{3-6} cycloalkylamino groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN;

R^4 is selected from C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-4} alkyl, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{1-6} alkoxy, C_{1-6} alkylsulfanyl- C_{1-6} alkyl, C_{1-6} alkylsulfinyl- C_{1-6} alkyl, C_{1-6} alkylsulfonyl- C_{1-6} alkyl, C_{1-6} alkoxycarbonyl- C_{1-6} alkyl, C_{1-6} alkylaminocarbonyl- C_{1-6} alkyl, di- C_{1-6} alkylaminocarbonyl- C_{1-6} alkyl, and CN, wherein each of the C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-4} alkyl, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{1-6} alkoxy, C_{1-6} alkylsulfanyl- C_{1-6} alkyl, C_{1-6} alkylsulfinyl- C_{1-6} alkyl, C_{1-6} alkylsulfonyl- C_{1-6} alkyl, C_{1-6} alkoxycarbonyl- C_{1-6} alkyl, C_{1-6} alkylaminocarbonyl- C_{1-6} alkyl and di- C_{1-6} alkylaminocarbonyl- C_{1-6} alkyl groups is optionally substituted with one to three substituents independently selected from halogen and CN; and

wherein A^3 and R^4 taken together optionally form a ring, more preferably a 5-8-membered heterocycle, more preferably a 6-membered heterocycle; or a salt or N-oxide thereof;

or

a compound of formula (II)



wherein Z is O or S, and preferably Z is O;

R^{1a} and R^{1b} are independently selected from hydrogen, hydroxy, halogen, CN, C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{1-6} alkoxy- C_{1-6} alkyl, C_{3-6} cycloalkyl- C_{1-4} alkyl, C_{1-6} alkylsulfanyl, C_{1-6} alkylsulfinyl, C_{1-6} alkylsulfonyl, C_{1-6} alkoxy, amino, and NHC(O)C_{1-6} alkyl; and preferably R^{1a} and R^{1b} are hydrogen;

A^2 are independently CR^2 or N, with the proviso that no more than three A^2 are N, preferably no more than two A^2 are N, preferably no more than one A^2 is N, and more preferably the four A^2 are CR^2 ;

R^2 are independently selected from hydrogen, hydroxy, halogen, CN, C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkoxy, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-6} alkyl, C_{1-6} alkylsulfanyl, C_{1-6} alkylsulfinyl, C_{1-6} alkylsulfonyl, C_{1-6} alkoxycarbonyl, C_{1-6} alkylaminocarbonyl, di- C_{1-6} alkylaminocarbonyl, and C_{1-6} alkylcarbonyl, wherein each of the C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6}

C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkoxy, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-6} alkyl, C_{1-6} alkylsulfanyl, C_{1-6} alkylsulfinyl, C_{1-6} alkylsulfonyl, C_{1-6} alkoxycarbonyl, C_{1-6} alkylaminocarbonyl, diC_{1-6} alkylaminocarbonyl, and C_{1-6} alkylcarbonyl groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN; with the proviso that at least two R^2 are

5 preferably not hydrogen;

A^3 is independently CR^3 or N;

R^3 is selected from hydrogen, hydroxy, halogen, CN, C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkoxy, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-6} alkyl, C_{1-6} alkylsulfanyl, C_{1-6} alkylsulfinyl, C_{1-6} alkylsulfonyl, amino, C_{1-6} alkylamino, diC_{1-6} -alkylamino, and C_{3-6} cycloalkylamino,

10 wherein each of the C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkoxy- C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkoxy, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-6} alkyl, C_{1-6} alkylsulfanyl, C_{1-6} alkylsulfinyl, C_{1-6} alkylsulfonyl, amino, C_{1-6} alkylamino, diC_{1-6} -alkylamino, and C_{3-6} cycloalkylamino groups is optionally substituted with one to three substituents independently selected from halogen, hydroxy, and CN;

R^4 is selected from C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-4} alkyl, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{1-6} alkoxy, C_{1-6} alkylsulfanyl- C_{1-6} alkyl, C_{1-6} alkylsulfinyl- C_{1-6} alkyl, C_{1-6} alkylsulfonyl- C_{1-6} alkyl, C_{1-6} alkoxycarbonyl- C_{1-6} alkyl, C_{1-6} alkylaminocarbonyl- C_{1-6} alkyl, diC_{1-6} alkylaminocarbonyl- C_{1-6} alkyl, and CN, wherein each of the C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-4} alkyl, C_{2-6} alkenyl, C_{2-6} alkynyl, C_{1-6} alkoxy, C_{1-6} alkylsulfanyl- C_{1-6} alkyl, C_{1-6} alkylsulfinyl- C_{1-6} alkyl, C_{1-6} alkylsulfonyl- C_{1-6} alkyl, C_{1-6} alkoxycarbonyl- C_{1-6} alkyl, C_{1-6} alkylaminocarbonyl- C_{1-6} alkyl and diC_{1-6} alkylaminocarbonyl- C_{1-6} alkyl

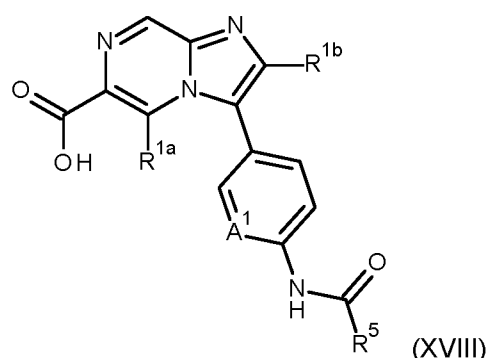
20 groups is optionally substituted with one to three substituents independently selected from halogen and CN;

wherein A^3 and R^4 taken together optionally form a ring, more preferably a 5-8-membered heterocycle, more preferably a 6-membered heterocycle; and

X is Cl, Br or I;

25 or a salt or N-oxide thereof.

18. A compound of formula (XVIII)



wherein A^1 is CH or N, and preferably N;

30 R^{1a} and R^{1b} are independently selected from hydrogen, hydroxy, halogen, CN, C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{1-6} alkoxy- C_{1-6} alkyl, C_{3-6} cycloalkyl- C_{1-4} alkyl, C_{1-6} alkylsulfanyl, C_{1-6} alkylsulfinyl, C_{1-6} alkylsulfonyl, C_{1-6} alkoxy, amino, and NHC(O)C_{1-6} alkyl; and preferably R^{1a} and R^{1b} are hydrogen; and

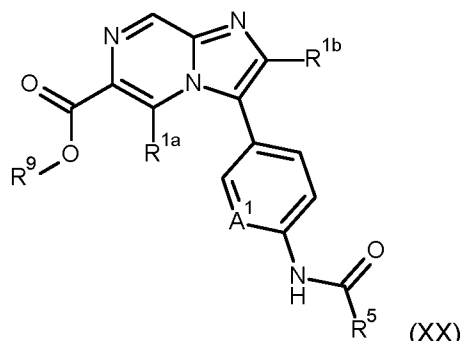
R^5 is selected from C_{1-6} alkyl, C_{1-6} alkoxy, C_{3-6} cycloalkyl, C_{3-6} cycloalkyl- C_{1-6} alkyl, C_{1-6} alkoxy- C_{1-6} alkyl, C_{1-6} alkylamino, diC_{1-6} alkylamino, and C_{1-6} alkyl- C_{1-6} alkoxyamino, wherein each of said groups is optionally

35 substituted with one to three substituents independently selected from halogen and CN;

or a salt or N-oxide thereof;

or

5 a compound of formula (XX)



wherein A¹ is CH or N, and preferably N;

R^{1a} and R^{1b} are independently selected from hydrogen, hydroxy, halogen, CN, C₁₋₆alkyl, C₃₋₆cycloalkyl, C₁₋₆alkoxy-C₁₋₆alkyl, C₃₋₆cycloalkyl-C₁₋₄alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, C₁₋₆alkoxy, amino, and NHC(O)C₁₋₆alkyl; and preferably R^{1a} and R^{1b} are hydrogen;

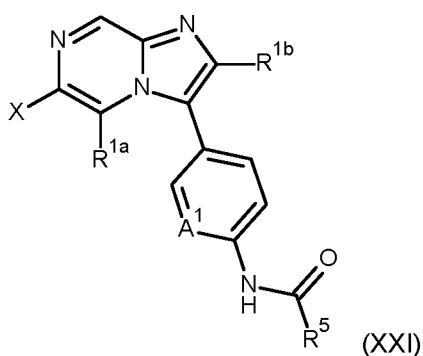
R⁵ is selected from C₁₋₆alkyl, C₁₋₆alkoxy, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkoxyC₁₋₆alkyl, C₁₋₆alkylamino, diC₁₋₆alkylamino, and C₁₋₆alkylC₁₋₆alkoxyamino, wherein each of said groups is optionally substituted with one to three substituents independently selected from halogen and CN; and

R⁹ is a C₁₋₆ alkyl;

15 or a salt or N-oxide thereof;

or

a compound of formula (XXI)



20

wherein A¹ is CH or N, and preferably N;

R^{1a} and R^{1b} are independently selected from hydrogen, hydroxy, halogen, CN, C₁₋₆alkyl, C₃₋₆cycloalkyl, C₁₋₆alkoxy-C₁₋₆alkyl, C₃₋₆cycloalkyl-C₁₋₄alkyl, C₁₋₆alkylsulfanyl, C₁₋₆alkylsulfinyl, C₁₋₆alkylsulfonyl, C₁₋₆alkoxy, amino, and NHC(O)C₁₋₆alkyl; and preferably R^{1a} and R^{1b} are hydrogen;

25 R⁵ is selected from C₁₋₆alkyl, C₁₋₆alkoxy, C₃₋₆cycloalkyl, C₃₋₆cycloalkyl-C₁₋₆alkyl, C₁₋₆alkoxyC₁₋₆alkyl, C₁₋₆alkylamino, diC₁₋₆alkylamino, and C₁₋₆alkylC₁₋₆alkoxyamino, wherein each of said groups is optionally substituted with one to three substituents independently selected from halogen and CN; and

X is Cl, Br or I;

or a salt or N-oxide thereof.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2024/059878

A. CLASSIFICATION OF SUBJECT MATTER INV. C07D487/04 A01N43/60 A01N47/08 A01N47/18 A01P3/00 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, WPI 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 2014/078813 A1 (IRM LLC [US]; NOVARTIS AG [CH] ET AL.) 22 May 2014 (2014-05-22)	13,14,16
A	the whole document; in particular the claims and the examples, e.g. comp.6, 22, 23, 236, 245, 247, 254, 373, 415, 482; intermediate compounds e.g. 124, 272, I-14, I-11, I-15, I-57, I-59, I-65, I-66, I-71, I-72, I-74, I-75 and I-78 -----	1-12,15,17,18
A	WO 02/48146 A2 (BASF AG [DE]; CULLMANN OLIVER [DE] ET AL.) 20 June 2002 (2002-06-20) the whole document, in particular the claims and table 1 on page 43f ----- -/-	1-18
☒ 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 27 June 2024		Date of mailing of the international search report 11/07/2024
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Hanisch, Inken

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2024/059878

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	ZOU BIN ET AL: "Lead Optimization of Imidazopyrazines: A New Class of Antimalarial with Activity on Plasmodium Liver Stages", ACS MEDICINAL CHEMISTRY LETTERS, vol. 5, no. 8, 6 July 2014 (2014-07-06), pages 947-950, XP055840395, US ISSN: 1948-5875, DOI: 10.1021/ml500244m Retrieved from the Internet: URL:https://pubs.acs.org/doi/pdf/10.1021/ml500244m> intermediate compounds 9 in scheme 1 with the definition of R1 of the final compounds 10-12, 16, 18 and 20 given in table 1	17
X	----- WO 2022/079616 A1 (NOVARTIS AG [CH]) 21 April 2022 (2022-04-21) compound 1.01d in example 1.01 -----	17

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Information on patent family members

International application No

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