(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
02 April 2020 (02.04.2020)

WIPO | PCT

(10) International Publication Number
WO 2020/064480 A1

(51) International Patent Classification:
A01N 43/90 (2006.01)

(21) International Application Number:
PCT/EP2019/075103

(22) International Filing Date:
19 September 2019 (19.09.2019)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
18197455.1 28 September 2018 (28.09.2018) EP

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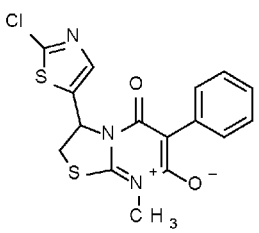
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:
— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
— *of inventorship (Rule 4.17(iv))*

Published:
— *with international search report (Art. 21(3))*

(54) Title: PESTICIDAL MIXTURE COMPRISING A MESOIONIC COMPOUND AND A BIOPESTICIDE



(I)

(57) Abstract: The present invention relates to pesticidal mixtures comprising as active components compound of formula I and at least one biopesticide II. Furthermore, the present invention relates to compositions comprising said mixtures, to methods and uses comprising the application of these mixtures and to seeds comprising the mixtures of the invention or a seed treatment composition thereof.

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Pesticidal mixture comprising a mesoionic compound and a biopesticide

Description

The present invention relates to mixtures of pesticidal active compounds having synergistically enhanced action and to methods and uses comprising applying said mixtures.

One typical problem arising in the field of pest control lies in the need to reduce the dosage rates of the active ingredient in order to reduce or avoid unfavorable environmental or toxicological effects whilst still allowing effective pest control.

Another problem encountered concerns the need to have available pest control agents which are effective against a broad spectrum of pests.

There also exists the need for pest control agents that combine knock-down activity with prolonged control, that is, fast action with long lasting action.

Another difficulty in relation to the use of pesticides is that the repeated and exclusive application of an individual pesticidal compound leads in many cases to a rapid selection of pests which have developed natural or adapted resistance against the active compound in question.

Therefore, there is a need for pest control agents that help prevent or overcome resistance induced by pesticides.

Furthermore, there is a desire for pesticide compounds or combinations of compounds, which - when applied - improve plants and which may result in “plant health”, “vitality of plant propagation material” or “increased plant yield”.

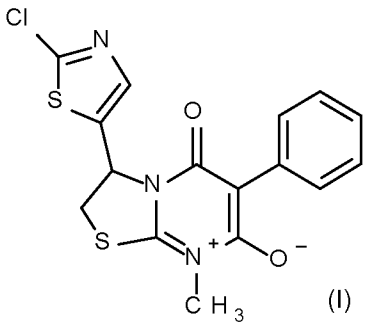
It is therefore an object of the present invention to provide pesticidal mixtures, which solve one or more than one of the discussed problems such as

- reducing the dosage rate,
- enhancing the spectrum of activity,
- combining knock-down activity with prolonged control,
- improving resistance management,
- improving plant health,
- improving vitality of plant propagation material, also termed seed vitality,
- increasing plant yield.

It has been found that this object is in part or in whole achieved by the combination of active compounds defined below.

The present invention relates to pesticidal mixtures comprising as active components

1) compound of formula (I)



(I)

or the tautomers, enantiomers, diastereomers or salts thereof,

and

2) at least one biopesticide II from the groups L1) to L6) selected from:

L1) Microbial pesticides with fungicidal, bactericidal, viricidal and/or plant defense activator activity: *Ampelomyces quisqualis*, *Aspergillus flavus*, *Aureobasidium pullulans*, *Bacillus altitudinis, B. amyloliquefaciens*, *B. megaterium*, *B. mojavensis*, *B. mycoides*, *B. pumilus*, *B. simplex*, *B. solisalsi*, *B. subtilis*, *B. subtilis* var. *amyloliquefaciens*, *Candida oleophila*, *C. saitoana*, *Clavibacter michiganensis* (bacteriophages), *Coniothyrium minitans*, *Cryphonectria parasitica*, *Dilophosphora alopecuri*, *Fusarium oxysporum*, *Clonostachys rosea* f. *catenulate* (also named *Gliocladium catenulatum*), *Gliocladium roseum*, *Lysobacter antibioticus*, *L. enzymogenes*, *Metschnikowia fructicola*, *Microdochium dimerum*, *Microsphaeropsis ochracea*, *Muscodor albus*, *Paenibacillus alvei*, *Paenibacillus epiphyticus*, *P. polymyxa*, *P. agglomerans*, *Pantoea vagans*, *Penicillium bilaiae*, *Phlebiopsis gigantea*, *Pseudomonas* sp., *Pseudomonas chloraphis*, *Pseudozyma flocculosa*, *P. fluorescens*, *P. putida*, *Pichia anomala*, *Pythium oligandrum*, *Sphaerodes mycoparasitica*, *Streptomyces griseoviridis*, *S. lydicus*, *S. violaceusniger*, *Talaromyces flavus*, *Trichoderma asperelloides, T. asperellum*, *T. atroviride*, *T. fertile*, *T. gamsii*, *T. harmatum*, *T. harzianum*, *T. polysporum*, *T. stromaticum*, *T. virens*, *T. viride*, *Typhula phacorrhiza*, *Ulocladium oudemansii*, *Verticillium dahlia*, zucchini yellow mosaic virus (avirulent strain);

L2) Biochemical pesticides with fungicidal, bactericidal, viricidal and/or plant defense activator activity selected from: chitosan (hydrolysate), harpin protein, laminarin, Menhaden fish oil, natamycin, Plum pox virus coat protein, potassium or sodium bicarbonate, *Reynoutria sachalinensis* extract, salicylic acid, tea tree oil;

L3) Microbial pesticides with insecticidal, acaricidal, molluscidal and/or nematicidal activity selected from: *Agrobacterium radiobacter*, *Bacillus cereus*, *B. firmus*, *B. thuringiensis*, *B. thuringiensis* ssp. *aizawai*, mixture of strain *B. firmus* CNCM I-1582 and strain *B. thuringiensis* EX297512, *B. t.* ssp. *israelensis*, *B. t.* ssp. *galleriae*, *B. t.* ssp. *kurstaki*, *B. t.* ssp. *tenebrionis*, *Beauveria bassiana*, *B. brongniartii*, *Burkholderia* spp., *Chromobacterium subtsugae*, *Cydia pomonella* granulovirus (CpGV), *Cryptophlebia leucotreta* granulovirus (CrleGV), *Flavobacterium* spp., *Helicoverpa armigera* nucleopolyhedrovirus (HearNPV), *Helicoverpa zea* nucleopolyhedrovirus (HzNPV), *Helicoverpa zea* single capsid nucleopolyhedrovirus (HzSNPV), *Heterorhabditis bacteriophora*, *Isaria fumosorosea*, *Lecanicillium longisporum*, *L. muscarium*, *Metarhizium anisopliae*, *Metarhizium anisopliae* var. *anisopliae*, *M. anisopliae* var. *acridum*, *Nomuraea rileyi*, *Paecilomyces fumosoroseus, P. lilacinus*, *Paenibacillus popilliae*, *Pasteuria* spp., *P. nishizawae*, *P. penetrans*, *P. ramosa*, *P. thornea*, *P. usgae*, *Pseudomonas fluorescens*, *Spodoptera littoralis* nucleopolyhedrovirus (SpliNPV), *Steinernema carpocapsae*, *S. feltiae*, *S. kraussei, Streptomyces galbus*, *S. microflavus*;

L4) Biochemical pesticides with insecticidal, acaricidal, molluscidal, pheromone and/or nematicidal activity selected from: L-carvone, citral, (E,Z)-7,9-dodecadien-1-yl acetate, ethyl formate, (E,Z)-2,4-ethyl decadienoate (pear ester), (Z,Z,E)-7,11,13-hexadecatrienal, heptyl butyrate, isopropyl myristate, lavanulyl senecioate, cis-jasmone, 2-methyl 1-butanol, methyl eugenol, methyl jasmonate, (E,Z)-2,13-octadecadien-1-ol, (E,Z)-2,13-octadecadien-1-ol acetate, (E,Z)-3,13-octadecadien-1-ol, R-1-octen-3-ol,

pentatermanone, potassium silicate, sorbitol octanoate, (E,Z,Z)-3,8,11-tetradecatrienyl acetate, (Z,E)-9,12-tetradecadien-1-yl acetate, Z-7-tetradecen-2-one, Z-9-tetradecen-1-yl acetate, Z-11-tetradecenal, Z-11-tetradecen-1-ol, Acacia negra extract, extract of grapefruit seeds and pulp, extract of *Chenopodium ambrosiode*s, Catnip oil, Tagetes oil, alpha-terpinene, p-cymene, limonene ;

L5) Microbial pesticides with plant stress reducing, plant growth regulator, plant growth promoting and/or yield enhancing activity selected from: *A. lipoferum*, *A. irakense*, *A. halopraeferens*, *Bradyrhizobium* spp., *B. elkanii*, *B. japonicum*, *B. liaoningense*, *B. lupini*, *Delftia acidovorans*, *Glomus intraradices*, *Mesorhizobium* spp., *Rhizobium leguminosarum* bv. *phaseoli*, *R. l.* bv. *trifolii*, *R. l.* bv. *viciae*, *Sinorhizobium meliloti*;

L6) Biochemical pesticides with plant stress reducing, plant growth regulator and/or plant yield enhancing activity selected from: abscisic acid, aluminium silicate (kaolin), 3-decen-2-one, formononetin, genistein, hesperetin, homobrassinolide, humates, jasmonic acid and its salts or derivatives thereof, lysophosphatidyl ethanolamine, naringenin, polymeric polyhydroxy acid, and *Ascophyllum nodosum* (Norwegian kelp, Brown kelp) extract;

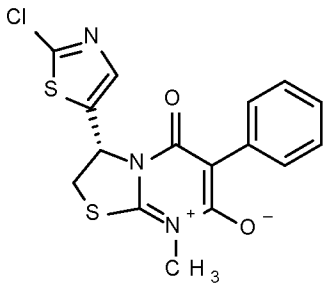
in synergistically effective amounts.

In an embodiment of the present invention, the mixture comprises component 1 and component 2, wherein component 2 is a binary mixture of 2 biopesticides from L1 to L6.

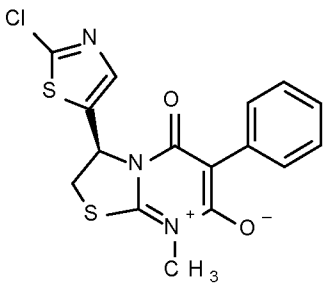
In an embodiment of the present invention, the mixture comprises component 1 and component 2, wherein component 2 is a ternary mixture of 3 biopesticides from L1 to L6.

According to a further embodiment, the mixture comprises in addition to component 1), as a component 2) mixture of strain *B. firmus* CNCM I-1582 and strain *B. thuringiensis* EX297512.

The compound of formula (I) are present in two enantiomeric forms I-R-1 and I-S-1 as shown below

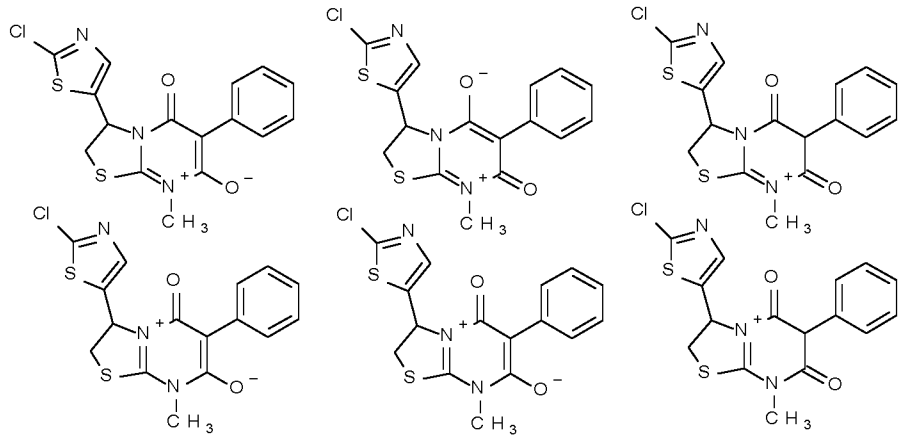


(I-R-1)



(I-S-1)

The compounds of the formula (I), are present in mesoionic forms. These forms may be expressed in different isoelectronic formulae, each having the formal positive and negative charges on different atoms (as shown below). The present invention extends to all representative isoelectronic structures of compounds of formula I.



The compounds of the formula I-R-1 and I-R-S are also present in mesoionic forms analogus to the compound of formula I as shown above.

The term “synergistically effective amounts” in a mixture or composition refers to the amount required for the synergism.

The invention relates to a method, in which the compound of formula (I) itself and its stereoisomers, salts, enantiomers or N-oxides, especially its enantiomers, and it mixtures.

The term “non-racemic compound of formula (I)” refers to the compound of formula (I) wherein its R- and S- enantiomers are not present in equal amount.

The term “racemic compound of formula (I)” refers to the compound of formula (I) wherein its R- and S- enantiomers are present in equal amount.

The term “Enantiomeric excess” indicates the excess of an enantiomer in a mixture of enantiomers, and is calculated according to the following formula:

$ee = [|m_1 - m_2| / (m_1 + m_2)] \times 100\%$

ee: enantiomeric excess

m_1: fraction of enantiomer 1

m_2: fraction of enantiomer 2

As used herein and unless otherwise stated, the term “enantiomer” means each individual optically active form of a compound of the invention.

The term "with enantiomeric excess" as used herein refers to a mixture of enantiomers wherein the enantiomer with respect to which the term with “enantiomeric excess” used is present in enantiomeric excees compared to other enantiomer, preferably in an amount of at least 60%, preferably at least 80%, more preferably at least 95%, most preferably at least 98% of the mixture of enantiomers. For example, the term “compound of formula I with enantiomeric excess of the compound I-R-1” referes to compound of formula I wherein the compound I-R-1 is present in enantiomeric excess amount compared to the compound I-S-1, preferably in an amount of at least 60%, preferably at least 80%, more preferably at least 95%, most preferably at least 98%.

The compounds according to the invention can be prepared as described in WO2014/167084, or as described below. The preparation of the compounds of formula (I) above may lead to them being obtained as isomer mixtures. If desired, these can be resolved by the methods customary for this purpose, such as crystallization or chromatography, also on optically active adsorbate, to give the pure isomers.

Agronomically acceptable salts of the compounds I can be formed in a customary manner, e.g. by reaction with an acid of the anion in question.

Mesoionic compounds of formula I showing generally pesticidal activity have been described previously. WO2014/167084 describe compounds of formula I, their preparation and their use as pest control agents.

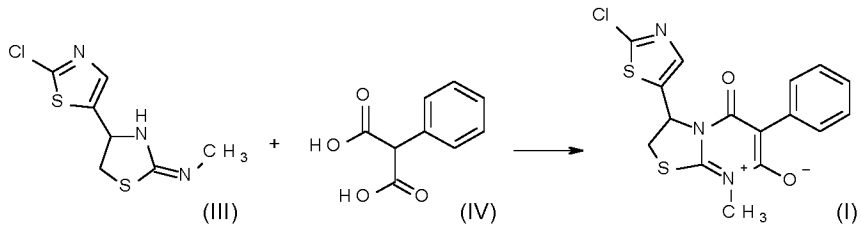
Preparation of the compound of formula I can further be accomplished according to standard methods of organic chemistry, e.g. by the methods or working examples described in compounds of formula I without being limited to the routes given therein.

However, individual mixtures of the compound of formula I or the compound of formula I with enantiomeric excess of the compound I-R-1 or the compound I-R-1, with selected biopesticides have not been described previously.

The prior art does not disclose pesticidal mixtures comprising the compound of formula I or the compound of formula I with enantiomeric excess of the compound I-R-1 or the compound I-R-1, according to the present invention showing unexpected and synergistic effects in combination with biopesticides.

Compounds of formula (I) can be prepared analogously to the methods described by Holyoke et al. in WO 2009/099929 (Scheme 1), from appropriately substituted compounds (III).

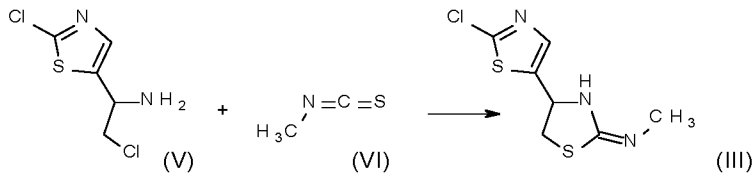
Scheme 1



(III) (IV) (I)

Compounds (III) can be prepared by methods described e.g. by Brian R. Dixon et al in US 6, 353, 006 from e.g. 2-chloro ethanamines like compound (V), and analogous methods thereto, with appropriately substituted reactants.

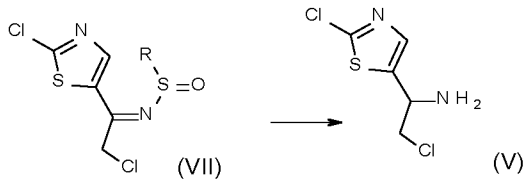
Scheme 2



(V) (VI) (III)

2-Chloro ethanamines compounds (V) in turn are available for example by reduction of sulfinylimines as exemplified in Denolf, Bram et al, Journal of Organic Chemistry, 72(9), 3211-3217; 2007.

Scheme 3



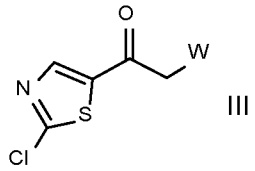
(VII) (V)

Compounds (VII) are obtained from α-halo-ketones, which are well known to persons skilled in the art.

The compound of formula I with enantiomeric excess can be prepared by the method described below or method analogous to the method described in example section:

The compound of formula I with enantiomeric excess of I-R-1 can be prepared by method comprising at least the steps of:

(A) reacting a compound of formula III,



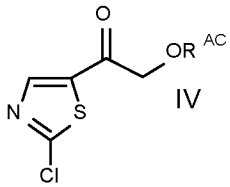
III

wherein

W is halogen, O-*p*-toluenesulfonyl, O-methanesulfonyl, or O-trifluoromethanesulfonyl;

with M^2OR^{AC} wherein M^2 is selected from lithium, sodium, potassium, aluminium, barium, caesium, calcium, and magnesium; R^{AC} is $C(=O)C_1$-C_4-alkyl;

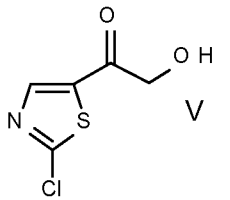
to obtain the compound of formula IV,



IV

wherein Het and R^{AC} are as defined herein;

(B) hydrolyzing the compound of formula IV as defined herein, in the presence of an acid or a base, to obtain a compound of formula V,

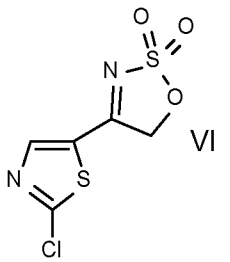


V

wherein Het is as defined in compound of formula IV;

(C) reacting the compound of formula V with $X^2SO_2NH_2$ wherein X^2 is halogen,

to obtain the compound of formula VI



VI

(D) hydrogenation of the compound of formula VI,

in the presence of a hydrogenation catalyst MXLn,

wherein

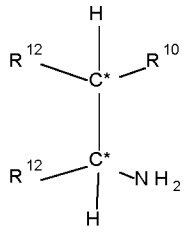
M is a transition metal from group VIII to group XII of the periodic table;

X is an anion;

Ln is Ln1 or Ln2,

wherein

Ln1 is a chiral ligand of the formula Ln1



Ln1

wherein

C* is an asymmetric carbon atom of S or R-configuration;

R^{10} is OH or NH-SO_2-R^{11}; wherein

R^{11} is aryl unsubstituted or substituted with halogen, C_1-C_{10}-alkyl, C_1-C_4-alkoxy, C_3-C_6-cycloalkyl, SO_3H, or SO_3Na,

or

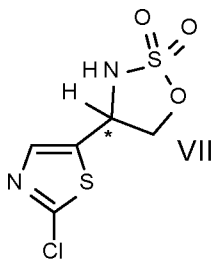
C_1-C_{10}-perfluoroalkyl, or $R^{13}R^{14}N$ wherein R^{13} and R^{14} independently represent C_1-C_{10}-alkyl unsubstituted or substituted with C_6-C_{10}-aryl, or R^{13} and R^{14} represent a C_6-C_{10}-cycloalkyl;

R^{12} independently represents aryl or C_6-C_{10}-cycloalkyl ring, wherein the ring is unsubstituted or substituted independently of each other with halogen, C_1-C_{10}-alkyl, C_1-C_4-alkoxy, C_3-C_6-cycloalkyl, SO_3H, or SO_3Na, or both R^{12} are linked together to form a 3- to 6-membered carbocyclic ring or a 5- to 10-membered partially unsaturated carbocyclic ring;

Ln2 is a chiral phosphorous ligand;

and a hydrogen source selected from a) mixture of $N(R)_3$, wherein R is H or C_1-C_6-alkyl, and HCOOH, b) HCOONa, and c) mixture of isopropyl alcohol, and *t*-BuOK or *t*-BuONa or *t*-BuOLi;

to obtain a compound of formula VII

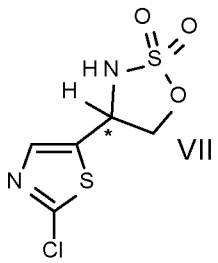


VII

wherein

C* is an asymmetric carbon atom of S or R-configuration;

(E) reacting the compound of formula VII,

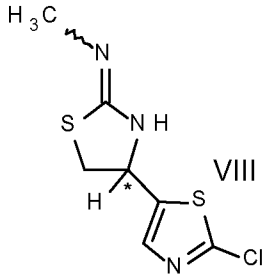


VII

wherein

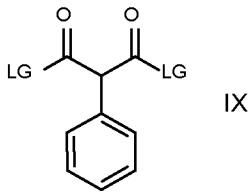
C* is an asymmetric carbon atom of S or R-configuration;

with CH_3NCS;
in the presence of a base,
to obtain a compound of formula VIII,



VIII

(F) reacting the compound of formula VIII as defined herein, with a compound of formula IX



IX

wherein,
LG is a leaving group selected from halogen, OR^u or SR^u; wherein
R^u is halogen, C_1-C_6-alkyl or aryl, which is unsubstituted or substituted with halogen;
to obtain the compound of formula I with enantiomeric excess as defined herein.

In one embodiment of the invention, the compound of formula I is non-racemic;

In one embodiment of the invention, the compound of formula I is the compound I-R-1;

In one embodiment of the invention, the compounds of formula (I) refer to the compound of formula (I) with enantiomeric excess of the compound I-R-1;

In one embodiment of the invention, the compounds of formula (I) refer to the compound of formula (I) with enantiomeric excess of at least 55% of the compound I-R-1;

In another embodiment of the invention, the compounds of formula (I) refer to the compound of formula (I) with enantiomeric excess of at least 60% of the compound I-R-1;

In another embodiment of the invention, the compounds of formula (I) refer to the compound of formula (I) with enantiomeric excess of at least 65% of the compound I-R-1;

In another embodiment of the invention, the compounds of formula (I) refer to the compound of formula (I) with enantiomeric excess of at least 70% of the compound I-R-1;

In another embodiment of the invention, the compounds of formula (I) refer to the compound of formula (I) with enantiomeric excess of at least 75% of the compound I-R-1;

In another embodiment of the invention, the compounds of formula (I) refer to the compound of formula (I) with enantiomeric excess of at least 80% of the compound I-R-1;

In another embodiment of the invention, the compounds of formula (I) refer to the compound of formula (I) with enantiomeric excess of at least 85% of the compound I-R-1;

In a preferred embodiment of the invention, the compounds of formula (I) refer to the compound of formula (I) with enantiomeric excess of at least 90% of the compound I-R-1;

In another preferred embodiment of the invention, the compounds of formula (I) refer to the compound of formula (I) with enantiomeric excess of at least 95% of the compound I-R-1;

In another preferred embodiment of the invention, the compounds of formula (I) refer to the compound of formula (I) with enantiomeric excess of at least 98% of the compound I-R-1;

In another preferred embodiment of the invention, the compounds of formula (I) refer to the compound of formula (I) with enantiomeric excess of at least 99% of the compound I-R-1;

In one embodiment of the invention, the compounds of formula (I) refer to the compound of formula (I) with enantiomeric excess of the compound I-R-1, wherein the compound I-R-1 is present in an amount from ≥55% to ≤100% and the compound I-S-1 is present in an amount from ≤ 45% to ≥0%;

In another embodiment of the invention, the compounds of formula (I) refer to the compound of formula (I) with enantiomeric excess of the compound I-R-1, wherein the the compound I-R-1 is present in an amount from ≥60% to ≤100% and the compound I-S-1 is present in an amount from ≤40% to ≥0%;

In another embodiment of the invention, the compounds of formula (I) refer to the compound of formula (I) with enantiomeric excess of the compound I-R-1, wherein the the compound I-R-1 is present in an amount from ≥65% to ≤100% and the compound I-S-1 is present in an amount from ≤35% to ≥0%;

In another embodiment of the invention, the compounds of formula (I) refer to the compound of formula (I) with enantiomeric excess of the compound I-R-1, wherein the the compound I-R-1 is present in an amount from ≥70% to ≤100% and the compound I-S-1 is present in an amount from ≤30% to ≥0%;

In another embodiment of the invention, the compounds of formula (I) refer to the compound of formula (I) with enantiomeric excess of the compound I-R-1, wherein the the compound I-R-1 is present in an amount from ≥75% to ≤100% and the compound I-S-1 is present in an amount from ≤25% to ≥0%;

In another embodiment of the invention, the compounds of formula (I) refer to the compound of formula (I) with enantiomeric excess of the compound I-R-1, wherein the the compound I-R-1 is present in an amount from ≥80% to ≤100% and the compound I-S-1 is present in an amount from ≤20% to ≥0%;

In another embodiment of the invention, the compounds of formula (I) refer to the compound of formula (I) with enantiomeric excess of the compound I-R-1, wherein the the compound I-R-1 is present in an amount from ≥85% to ≤100% and the compound I-S-1 is present in an amount from ≤15% to ≥0%;

In another embodiment of the invention, the compounds of formula (I) refer to the compound of formula (I) with enantiomeric excess of the compound I-R-1, wherein the the compound I-R-1 is present in an amount from ≥90% to ≤100% and the compound I-S-1 is present in an amount from ≤10% to ≥0%;

In another embodiment of the invention, the compounds of formula (I) refer to the compound of formula (I) with enantiomeric excess of the compound I-R-1, wherein the the compound I-R-1 is present in an amount from ≥95% to ≤100% and the compound I-S-1 is present in an amount from ≤5% to ≥0%;

In another embodiment of the invention, the compounds of formula (I) refer to the compound of formula (I) with enantiomeric excess of the compound I-R-1, wherein the the compound I-R-1 is

present in an amount from ≥98% to ≤100%, preferably ≥99% to ≤100%, and the compound I-S-1 is present in an amount from ≤2% to ≥0%, preferably ≤1% to ≥0%;

The “compound of formula I” as well " compound of formula I-R-1 ”, or “compound of formula I with enantiomeric excess of the compound I-R-1", and the terms "compound(s) for methods according to the (present) invention", "compound(s) according to the (present) invention" or which all compound(s) are applied in methods and uses according to the present invention comprise the compound(s) as defined herein as well as a known stereoisomer, salt, tautomer or N-oxide thereof (including a polymorphic crystalline form, a co-crystal or a solvate of a compound or a stereoisomer, salt, tautomer or N-oxide thereof).

Moreover, it has been found that simultaneous, that is joint or separate, application of the compound of formula I or the compound of formula I with enantiomeric excess of the compound I-R-1 or the compound I-R-1, and one or more biopesticide(s) II or successive application (that is immediately one after another and thereby creating the mixture "in-situ" on the desired location, as e.g. the plant) of the compound of formula I or the compound of formula I with enantiomeric excess of the compound I-R-1 or the compound I-R-1, and one or more biopesticide(s) II allows enhanced control of pests compared to the control rates that are possible with the individual compounds. Therefore, the term “mixture” as used herein is intended to include also combinations.

The present invention also relates to a seed treatment composition comprising a mixture of the compound of formula I or the compound of formula I with enantiomeric excess of the compound I-R-1 or the compound I-R-1, and at least one biopesticide II as defined above as well as at least one auxiliary.

The present invention also relates to the use of the mixture of the compound of formula I or the compound of formula I with enantiomeric excess of the compound I-R-1 or the compound I-R-1, and at least one biopesticide II for protecting a plant, plant propagation material, or soil or water, in which the plants are growing, against the attack or infestation by invertebrate pests. In particular, the present invention relates to the use of the mixture of the compound of formula I or the compound of formula I with enantiomeric excess of the compound I-R-1 or the compound I-R-1, and at least one biopesticide II for protecting plant propagation material, preferably seeds, from soil insects and the seedlings’ roots and shoots from soil and foliar insects, wherein the plant progagation material as e.g. the seeds are contacted with a pesticidally effective amount of the mixture before sowing and/or after pregermination.

The present invention further relates to a method for controlling invertebrate pests, which method comprises contacting the plant or the plant propagation material or the soil; the pests or their food supply, habitat or breeding grounds, with a pesticidally effective amount of the mixture of the compound of formula I or the compound of formula I with enantiomeric excess of the compound I-R-1 or the compound I-R-1, and at least one biopesticide II.

The present invention further relates to a method for controlling nematodes, which method comprises contacting the plant or the plant propagation material, such as the seeds, or the soil; the pests or their food supply, habitat or breeding grounds, with a pesticidally effective amount of the mixture of the compound of formula I or the compound of formula I with enantiomeric excess of the compound I-R-1 or the compound I-R-1, and at least one biopesticide II with nematicidal activity.

The invention also provides seeds comprising the mixture of the compound of formula I or the compound of formula I with enantiomeric excess of the compound I-R-1 or the compound I-R-1, and at least one biopesticide II.

The mixture(s) of the compound of formula I or the compound of formula I with enantiomeric excess of the compound I-R-1 or the compound I-R-1, with at least one biopesticide II are herein referred to as “mixture(s) according to the invention” or “mixture(s) of the invention”, wherein the compound of formula I or the compound of formula I with enantiomeric excess of the compound I-R-1 or the compound I-R-1, are understood to include their stereoisomers, salts, tautomers or N-oxides, or a polymorphic crystalline form, a co-crystal or a solvate of a compound or a stereoisomer, salt, tautomer or N-oxide thereof.

In a specific embodiment, the mixture according to the invention is a mixture of the compound of formula I or the compound of formula I with enantiomeric excess of the compound I-R-1 or the compound I-R-1, with one biopesticide II (binary mixture).

In another embodiment, the mixture according to the invention is a mixture of the compound of formula I or the compound of formula I with enantiomeric excess of the compound I-R-1 or the compound I-R-1, with at least one biopesticide II.

In yet another embodiment, the mixture according to the invention is a mixture of the compound of formula I or the compound of formula I with enantiomeric excess of the compound I-R-1 or the compound I-R-1, with one biopesticide II and another insecticidal active compound III (ternary mixture).

In yet another embodiment, the mixture according to the invention is a mixture of the compound of formula I or the compound of formula I with enantiomeric excess of the compound I-R-1 or the compound I-R-1, with one biopesticide II and one fungicidal active compound III (ternary mixture).

The term "composition(s) according to the invention" or "composition(s) of the present invention" encompasses composition(s) comprising the mixtures of the invention, i.e. mixtures of the compound of formula I or the compound of formula I with enantiomeric excess of the compound I-R-1 or the compound I-R-1, with at least one biopesticide II for being used and/or applied in methods according to the invention as defined herein, wherein the compound of formula I or the compound of formula I with enantiomeric excess of the compound I-R-1 or the compound I-R-1, are understood to include their salts or N-oxides, or a polymorphic crystalline form, a co-crystal or a solvate of a compound or a stereoisomer, salt, tautomer or N-oxide thereof.

Compounds II:

Biopesticides have been defined as a form of pesticides based on micro-organisms (bacteria, fungi, viruses, nematodes, etc.) or natural products (compounds, such as metabolites, proteins, or extracts from biological or other natural sources) (U.S. Environmental Protection Agency: http://www.epa.gov/pesticides/biopesticides/). Biopesticides fall into two major classes, microbial and biochemical pesticides:

(1) Microbial pesticides consist of bacteria, fungi or viruses (and often include the metabolites that bacteria and fungi produce). Entomopathogenic nematodes are also classified as microbial pesticides, even though they are multi-cellular.

(2) Biochemical pesticides are naturally occurring substances or structurally-similar and functionally identical to a naturally-occurring substance and extracts from biological sources that

control pests or provide other crop protection uses as defined below, but have non-toxic mode of actions (such as growth or developmental regulation, attractents, repellents or defence activators (e.g. induced resistance) and are relatively non-toxic to mammals.

The biopesticides from group L1) and/or L2) may also have insecticidal, acaricidal, molluscidal, pheromone, nematicidal, plant stress reducing, plant growth regulator, plant growth promoting and/or yield enhancing activity. The biopesticides from group L3) and/or L4) may also have fungicidal, bactericidal, viricidal, plant defense activator, plant stress reducing, plant growth regulator, plant growth promoting and/or yield enhancing activity. The biopesticides from group L5) and/or L6) may also have fungicidal, bactericidal, viricidal, plant defense activator, insecticidal, acaricidal, molluscidal, pheromone and/or nematicidal activity.

Many of these biopesticides have been deposited under deposition numbers mentioned herein (the prefices refer to the acronym of the respective culture collection), are referred to in literature, registered and/or are commercially available: aluminium silicate (Screen™ Duo from Certis LLC, USA), *Agrobacterium radiobacter* K1026 (e. g. NoGall® from BASF Agricultural Specialties Pty Ltd, Australia), *A. radiobacter* K84 (Nature 280, 697-699, 1979; e. g. GallTroll® from AG Biochem, Inc., C, USA), *Ampelomyces quisqualis* M-10 (e. g. AQ 10® from Intrachem Bio GmbH & Co. KG, Germany), *Ascophyllum nodosum* (Norwegian kelp, Brown kelp) extract or filtrate (e. g. ORKA GOLD from BASF Agricultural Specialities (Pty) Ltd., South Africa; or Goemar® from Laboratoires Goemar, France), *Aspergillus flavus* NRRL 21882 isolated from a peanut in Georgia in 1991 by USDA, National Peanut Research Laboratory (e. g. in Afla-Guard® from Syngenta, CH), mixtures of *Aureobasidium pullulans* DSM 14940 and DSM 14941 (e. g. blastospores in BlossomProtect® from bio-ferm GmbH, Germany), Plant Soil 331, 413-425, 2010), *A. lipoferum* BR 11646 (Sp31) (Proc. 9th Int. and 1st Latin American PGPR meeting, Quimara, Medellín, Colombia 2012, p. 60), *B. aryabhattani* ABU 5370, *Bacillus altitudinis* 41KF2b (DSM 21631; Int. J. Syst. Evol. Microbiol. 56(7), 1465-1473, 2006), *Bacillus amyloliquefaciens* strains AP-136 (NRRL B-50614 and B-50330), AP-188 (NRRL B-50615 and B-50331), AP-218 (NRRL B-50618), AP-219 (NRRL B-50619 and B-50332), and AP-295 (NRRL B-50620 and B-50333) all known from US 8,445,255; *B. amyloliquefaciens* IT-45 (CNCM I-3800) (e. g. Rhizocell C from ITHEC, France), *B. amyloliquefaciens* IN937a (J. Microbiol. Biotechnol. 17(2), 280–286, 2007; e. g. BioYield® from Gustafson LLC, TX, USA), *B. amyloliquefaciens* spp. *plantarum* D747 (US 20130236522 A1; FERM BP-8234; e. g. Double Nickel™ 55 WDG or Double Nickel™ LC from Certis LLC, USA), *B. amyloliquefaciens* spp. *plantarum* FZB24 isolated from plant pathogen-infested soil of a sugar beet field in Brandenburg, Germany (also called SB3615; DSM ID 96-2; J. Plant Dis. Prot. 105, 181–197, 1998; e. g. Taegro® from Novozyme Biologicals, Inc., USA),), *B. amyloliquefaciens* spp. *plantarum* SB3615vPPI being a phage-resistant variant of FZB24 (MRRL B-50349; US 2011/023045 A1; from Novozyme Biologicals, Inc., USA), *B. amyloliquefaciens* ssp. *plantarum* FZB42 isolated from plant pathogen-infested soil of a sugar beet field in Brandenburg, Germany (J. Plant Dis. Prot. 105, 181–197, 1998; DSM 23117; e. g. RhizoVital® 42 from AbiTEP GmbH, Berlin, Germany), *B. amyloliquefaciens* ssp. *plantarum* GB03 (also called GBO3; ATCC SD-1397; Phytopathol. 86(11), S36, 1996; e. g. Kodiak® or BioYield® from Gustafson, Inc., USA; or Companion® from Growth Products, Ltd., White Plains, NY 10603, USA), *B. amyloliquefaciens* ssp. *plantarum* MBI600 also referred to as 1430 (NRRL B-50595; Int. J. Microbiol. Res. 3(2) (2011), 120-130; US 2012/0149571 A1; e. g. Integral®,

Subtilex® NG from BASF Corp., USA), *B. amyloliquefaciens* spp. *plantarum* TJ1000 (also called 1BE; CA 2471555 A1; ATCC BAA-390; e. g. QuickRoots™ from TJ Technologies, Watertown, SD, USA), *Bacillus amyloliquefaciens* strain PTA-4838 (JP2016155862; e.g. AveoEZ from Sumitomo), *B. bassiana* PPRI5339 ,*B. cereus* CNCM I-1562 (US 6,406,690), *B. chitinosporus* AQ746 isolated from roots in Saskatchewan, Canada (NRRL B-21618; US 5,733,544; AgraQuest now Bayer CropScience LP, USA), *B. firmus* CNCM I-1582 (WO 2009/126473, WO 2009/124707, US 6,406,690; e. g. Votivo® from Bayer CropScience LP, USA), *B. megaterium* strains H491 (NRRL B-50769), M018 (NRRL B-50770) and J142 (NRRL B-50771) all known from US 2014/0051571 A1 from Marrone BioInnovations, Inc., USA; *B. megaterium AP-153 , B. mojavensis* AP-209 (NRRL B-50616; US 8,445,255), *B. mycoides* AQ726 (NRRL B-21664; US 5,906,818; from Bayer Crop Science, Germany), *B. mycoides* strain J (e.g. BmJ WG from Certis, USA against potato virus Y), *B. pumilus* GB34 (ATCC 700814; e. g. YieldShield® from Gustafson LLC, TX, USA), *B. pumilus* GHA 180 isolated from apple tree rhizosphere in Mexico (IDAC 260707-01; e. g. in PRO-MIX® BX from Premier Horticulture, 1, avenue Premier, Rivie`re-du-Loup, Quebec, Canada G5R6C1), *B. pumilus* KFP9F (NRRL B-50754; WO 2014/029697; e. g. BAC-UP or FUSION-P from BASF Agricultural Specialities (Pty) Ltd., South Africa), *B. pumilus* F-33 (NRRL B-50513),*B. pumilus* INR-7 otherwise referred to as BU-F22 and BU-F33 (NRRL B-50185, NRRL B-50153; US 8,445,255), *B. pumilus* QST 2808 (NRRL B-30087; e. g. Sonata® or Ballad® Plus from AgraQuest Inc., USA), *B. solisalsi* AP-217 (NRRL B-50617; US 8,445,255), *B. subtilis* CX-9060 (Federal Register 77(7), 1633-1637; by Certis U.S.A., L.L.C.), *B. subtilis* FB17 also called UD 1022 or UD10-22 isolated from red beet roots in North America (ATCC PTA-11857; System. Appl. Microbiol. 27, 372-379, 2004; US 2010/0260735; WO 2011/109395); *B. simplex* ABU 2372, *B. simplex* ABU 1645,*B. subtilis* GB07 (Phytopathol. 86(11), S36, 1996; Epic® from Gustafson, Inc., USA), *B. subtilis* QST-713 isolated from a California peach orchard in 1995 (NRRL B-21661; e. g. Rhapsody®, Serenade® MAX or Serenade® ASO from AgraQuest Inc., USA), *B. thuringiensis* ssp. *aizawai* ABTS-1857 (also called ABG-6346; ATCC SD-1372; e. g. XenTari® from BioFa AG, Münsingen, Germany), *B. t.* ssp. *aizawai* SAN 401 I, ABG-6305 (WO 2013/087709); *Bacillus t.* ssp. *israelensis* AM65-52 of Serotype H-14 (ATCC SD-1276; e. g. VectoBac® from Valent BioSciences, IL, USA), *Bacillus thuringiensis* ssp. *kurstaki* SB4 (NRRL B-50753; e. g. Beta Pro® from BASF Agricultural Specialities (Pty) Ltd., South Africa), *B. t.* ssp. *kurstaki* ABTS-351 identical to HD-1 (ATCC SD-1275; e. g. Dipel® DF from Valent BioSciences, IL, USA), *B. t.* ssp. *kurstaki* EG 2348 (NRRL B-18208; e. g. Lepinox® or Rapax® from CBC (Europe) S.r.l., Italy), *B. t.* ssp. *tenebrionis* DSM 2803 of Serotype H 8a, 8b (identical to NRRL B-15939; EP 0 585 215 B1; Mycogen Corp.), *B. t.* ssp. *tenebrionis* NB-125 (also referred to as SAN 418 I or ABG-6479; EP 0 585 215 B1; DSM 5526; former production strain of Novo-Nordisk), *B. t.* ssp. *tenebrionis* NB-176 (or NB-176-1; a gamma-irridated, induced high-yielding mutant of strain NB-125; EP 585 215 B1; DSM 5480; e. g. Novodor® from Valent BioSciences, Switzerland), *B. thuringiensis* EX 297512 (https://s3-us-west-1.amazonaws.com/www.agrian.com/pdfs/TWO.O_MSDS.pdf, WO2016/044529, WO2016/044542), *Beauveria bassiana* JW-1 (ATCC 74040; e. g. Naturalis® from CBC (Europe) S.r.l., Italy), mixture of strain *B. firmus* CNCM I-1582 and strain *B. thuringiensis* EX297512 (VOTiVo 2.0), *B. bassiana* DSM 12256 (US 200020031495; e. g. BioExpert® SC from Live Sytems Technology S.A., Colombia), *B. bassiana* GHA (ATCC 74250; e. g. BotaniGard®

22WGP from Laverlam Int. Corp., USA), *B. bassiana* PPRI 5339 (ARSEF 5339; NRRL 50757; e. g. BroadBand® from BASF Agricultural Specialities (Pty) Ltd., South Africa), *B. brongniartii* for control of cockchafer (J. Appl. Microbiol. 100(5),1063-72, 2006; e. g. Melocont® from Agrifutur, Agrianello, Italy), *Bradyrhizobium* sp. (e. g. Vault® from BASF Corp., USA), *B.* sp. (Arachis) strains deposited at SEMIA and known from FEMS Microbiol. Letters 303(2), 123–131, 2010; Revista Brasileira de Ciencia do Solo 35(3), 739-742, 2011, ISSN 0100-0683: SEMIA 6144, SEMIA 6462 (BR 3267) and SEMIA 6464 (BR 3262); *B.* sp. (Vigna) PNL01 (Bisson and Mason, April 29, 2010, Project report, Worcester Polytechnic Institute, Worcester, MA, USA: http://www.wpi.edu/Pubs/E-project/Available/E-project-042810-163614/; e. g. Vault® Peanut Liquid from BASF Corp., USA), *B. elkanii* USDA 76, *B. elkanii* USDA 94*B. elkanii* USDA 3254, *B. japonicum* (e. g. VAULT® from BASF Corp., USA), *B. japonicum* 532c isolated from Wisconsin field (Nitragin 61A152; Can. J. Plant. Sci. 70, 661-666, 1990; e. g. in Rhizoflo®, Histick®, Hicoat® Super from BASF Agricultural Specialties Ltd., Canada), *B. japonicum* E-109 variant of strain USDA 138 (INTA E109, SEMIA 5085; Eur. J. Soil Biol. 45, 28–35, 2009; Biol. Fertil. Soils 47, 81–89, 2011), *B. japonicum* G49 (MSDJ G49; C. R. Acad. Agric. Fr. 73, 163-171, 1987); SEMIA 586 originally isolated in Maryland, USA, in 1961 but received from Australia in 1966 (CB 1809, USDA 136, Nitragin 61A136, RCR 3407), *B. japonicum* CB1809 (deposited with Australian inoculant research group (AIRG)), *B. japonicum* TA-11 (TA11 NOD^+) (NRRL B-18466; US 5,021,076; Appl. Environ.

Microbiol. 56, 2399-2403, 1990; e. g. VAULT® NP, from BASF Corp., USA), *B. japonicum* strains deposited at USDA known from US 7,262,151 and Appl. Environ. Microbiol. 60, 940-94, 1994: USDA 3 isolated from *Glycine max* in Virginia (USA) in 1914, USDA 31 (= Nitragin 61A164) od Serogroup 31 isolated from *Glycine max* in Wisconsin (USA) in 1941, USDA 76 isolated from plant passage of strain USDA 74 (Serogroup 76) which has been isolated from *G. max* in California (USA) in 1956, USDA 110 (= IITA 2121, SEMIA 5032, RCR 3427, ARS I-110 and Nitragin 61A89; Serogroup 110) isolated from *G. max* in Florida in 1959, USDA 121 isolated from *G. max* in Ohio (USA) in 1965 (Crop Science 26(5), 911-916, 1986); *B. lupini* LL13 isolated from *Lupinus iuteus* nodules from French soils (deposited at INRA, France; http://agriculture.

gouv.fr/IMG/pdf/ch20060216.pdf), *B. lupini* strains from Australia and known from Palta J.A., Berger J.B. (eds), Proceed. 12th International Lupin Conference, 14-18 Sept. 2008, Fremantle, Western Australia, International Lupin Association, Canterbury, New Zealand, 47-50, http://www.lupins.org/pdf/conference/2008/Agronomy%20and%20Production/John%20Howieson%20and%20G%20OHara.pdf; Appl. Environ. Microbiol. 71, 7041-7052, 2005; Australian J. Exp. Agricult. 36(1), 63-70, 1996: strains WU425 isolated in Esperance, Western Australia from a non-Australian legume *Ornithopus compressus*, WSM471 isolated *from Ornithopus pinnatus* in Oyster Harbour, Western Australia, and WSM4024 isolated from lupins in Australia by CRS during a 2005 survey; *Bradyrhizobium spp NC92*, *Bradyrhizobium spp CB1024 (deposited with Australian inoculant research group (AIRG)), Burkholderia sp.* A396 (NRRL B-50319;

WO 2013/032693; Marrone Bio Innovations, Inc., USA), *Candida oleophila* I-182 (NRRL Y-18846; Phytoparasitica 23(3), 231-234, 1995; e. g. Aspire® from Ecogen Inc., USA;), *C. oleophila* strain O (NRRL Y-2317; Biological Control 51, 403–408, 2009), *Candida saitoana* (e. g. Biocure® [in mixture with lysozyme] and BioCoat® from Micro Flo Company, USA (BASF SE) and

Arysta), chitosan (e. g. Armour-Zen® from BotriZen Ltd., NZ), *Clonostachys rosea* f. *catenulate* (also named *Gliocladium catenulatum*) J1446 isolated from Finnish field soil (NJF seminar No 389: Pest, disease and weed management in strawberry; Finland 8-9. Nov. 2006 in NJF Report 2(10), 15-15, 2006; DSM 9212; e. g. Primastop® or Prestop® from Verdera Oy, Finland), *Chromobacterium subtsugae* PRAA4-1 isolated from soil under an eastern hemlock (*Tsuga canadensis*) in the Catoctin Mountain region of central Maryland (NRRL B-30655; e. g. Grandevo® from Marrone Bio Innovations, USA), *Coniothyrium minitans* CON/M/91-08 (WO 1996/021358; DSM 9660; e. g. Contans® WG, Intercept® WG from Prophyta Biologischer Pflanzenschutz GmbH, Germany), *Cryphonectria parasitica* (hypovirulent strains; Microbiol. Reviews 56(4), 561-576, 1992; e. g. product Endothia parasitica from CNICM, France), *Cryptophlebia leucotreta* granulovirus (CrleGV) (e. g. CRYPTEX from Adermatt Biocontrol, Switzerland), *Cydia pomonella* granulovirus (CpGV) V03 (DSM GV-0006; e. g. Madex® Max from Andermatt Biocontrol, Switzerland), CpGV V22 (DSM GV-0014; e. g. Madex® Twin from Adermatt Biocontrol, Switzerland), *Delftia acidovorans* RAY209 (ATCC PTA-4249; WO 2003/57861; e. g. BioBoost® from Brett Young, Winnipeg, Canada), *Dilophosphora alopecuri* (FarmNote 396, Feb. 2010, Department of Agriculture and Food, Government of Western Australia; e.g. Twist Fungus from BASF Agricultural Specialties Pty Ltd, Australia), *Flavobacterium sp.* H492 (ATCC B-505584; WO 2013/138398; e. g. MBI-302 from Marrone Bio Innovations, USA for soyean cyst nematode control), formononetin (US 5,002,603; e. g. Myconate® from Plant Health Care plc, U.K.), *Fusarium oxysporum* Fo47 (non-pathogenic strain isolated from a suppressive soil located at Châteaurenard, France; Appl. Environ. Microbiol 68(8), 4044–4060, 2002; Fusaclean® from Natural Plant Protection, N.P.P. (société anonyme) Route d'Artix F-64150 Nogueres, France), *F. oxysporum* 251/2RB (Prevention Today Vol. 2, n. 1-2, 47-62, 2006; e. g. Biofox® C from S.I.A.P.A., Italy); *Glomus intraradices* (e. g. Myc® 4000 from ITHEC, France), *Glomus intraradices* RTI-801 (e. g. MYKOS from Xtreme Gardening, USA or RTI Reforestation Technologies International; USA), grapefruit seeds and pulp extract (e. g. BC-1000 from Chemie S.A., Chile), harpin (alpha-beta) protein (Science 257, 85-88, 1992; e. g. Messenger™ or HARP-N-Tek from Plant Health Care plc, U.K.), *Helicoverpa armigera* nucleopolyhedrovirus (HearNPV) (J. Invertebrate Pathol. 107, 112–126, 2011; e. g. Helicovex® from Adermatt Biocontrol, Switzerland), *Heterorhabditis bacteriophora* (e. g. Nemasys® G from BASF Agricultural Specialities Limited, UK), *Isaria fumosorosea* Apopka-97 (ATCC 20874; Biocontrol Science Technol. 22(7), 747-761, 2012; e. g. PFR-97™ or PreFeRal® from Certis LLC, USA), *I. fumosorosea* FE 9901 (ARSEF 4490; Biocontrol Science Technol. 22(7), 747-761, 2012; e. g. blastospores in NoFly™ WP from Natural Industries, Inc., Houston, TX, USA or from Novozymes, U.S.A.), cis-jasmone (US 6,890,525; US 8,221,736; Plant Bioscience Limited, Norwich, U.K.), laminarin (e. g. in Vacciplant® from Laboratoires Goemar, St. Malo, France or Stähler SA, Switzerland), *Heterorhabditis bacteriophora* GPS11, *Lecanicillium longisporum* KV42 and KV71 (e. g. Vertalec® from Koppert BV, Netherlands), *L. muscarium* Ve6 (also called KV01; IMI 19-79, CABI 268317, CBS 102071, ARSEF 5128; e. g. Mycotal® from Koppert BV, Netherlands), *Lysobacter antibioticus* 13-1 (Biological Control 45, 288-296, 2008), *L. antibioticus* HS124 (Curr. Microbiol. 59(6), 608-615, 2009), *L. enzymogenes* 3.1T8 (Microbiol. Res. 158, 107-115, 2003; Biological Control 31(2), 145-154, 2004); *Mesorhizobium* spp. strains known from Soil Biol. Biochem. 36(8), 1309-1317, 2004; Plant and Soil 348(1-2), 231-243, 2011: *M.* sp. WSM1271 collected in Sardinia, Italy, from

plant host *Biserrula pelecinus*, *M.* sp. WSM 1497 collected in Mykonos, Greece, from *Biserrula pelecinus*, *Mesorhizobium ciceri* CC1192 collected in Israel from Cicer arietinum nodules (UPM 848, CECT 5549; Can. J. Microbiol. 48, 279-284, 2002; from Horticultural Research Station, Gosford, Australia), *Mesorhizobium ciceri* CP 1653 (deposited with Australian inoculant research group (AIRG)), *M. huakuii* HN3015 isolated from *Astralagus sinicus* in a rice-growing field of Southern China (World J. Microbiol. Biotechn. 23(6), 845-851, 2007, ISSN 0959-3993), *M. loti* CC829 isolated from *L. ulginosus* nodules in USA (NZP 2012; commerical inoculant for *Lotus pedunculatus* and *L. ulginosus* in Australia), and *M. loti* SU343 isolated from host nodules in USA (commercial inoculant for *Lotus corniculatus* in Australia); *Metarhizium anisopliae* FI-1045 (AGAL V10/0104285; WO 2012/018266; e. g. Biocane® from BASF Agricultural Specialties Pty Ltd, Australia), *M. anisopliae* var. *anisopliae* F52 also called 275 or V275 (DSM 3884, ATCC 90448; e. g. Met52® Novozymes Biologicals BioAg Group, Canada), *M. anisopliae* ICIPE 69 isolated from a soil sample obtained from the Democratic Republic of Congo (DRC) and using the Galleria bait method in 1990 (e. g. Metathripol from ICIPE, Nairobe, Kenya), *M. anisopliae* var. *acridum* IMI 330189 isolated from *Ornithacris cavroisi* in Niger (NRRL 50758; e. g. Green Muscle® from BASF Agricultural Specialities (Pty) Ltd., South Africa), *M. a.* var. *acridum* FI-985 isolated from a spur-throated locust, Austracris guttulosa (Walker), near Rockhampton, Queensland, Australia, in 1979 (ARSEF 324; Memoirs of the Entomological Society of Canada 171, 287-300, 1997; e. g. Green Guard® SC from BASF Agricultural Specialties Pty Ltd, Australia), *Metschnikowia fructicola* 277 isolated from the surface of grape berries (cv. Superior) grown in the central part of Israel (US 6,994,849; NRRL Y-30752; e. g. Shemer® from Agrogreen, Israel, now distributed by Bayer CropSciences, Germany), *Microdochium dimerum* L13 (CNCM I-3141; e. g. Antibot® from Agrauxine, France), *Microsphaeropsis ochracea* P130A isolated from apple leaves from an abandoned orchard, St-Joseph-du-Lac, Quebec, Canada in 1993 (ATCC 74412; Mycologia 94(2), 297-301, 2002), *Muscodor albus* QST 20799 also called 620 originally isolated from the bark of a cinnamon tree in Honduras (NRRL 30547; e. g. Muscudor™ or QRD300 from AgraQuest, USA), *Muscodor albus* SA-13 (NRRL B-50774; US 2014/0086879 A1; e. g. MBI-601-EP from Marrone BioInnovations, Inc., USA), *Nomuraea rileyi* strains SA86101, GU87401, SR86151, CG128 and VA9101 (Braz. Arch. Biol. Technol. 46(1), 13-19, 2003; WO 2013/110594), *Paecilomyces lilacinus* 251 isolated from infected nematode eggs in the Philippines (AGAL 89/030550; WO1991/02051; Crop Protection 27, 352-361, 2008; e. g. BioAct®/MeloCon® from Prophyta, Germany), *P. lilacinus* DSM 15169 (e. g. Nemata® SC from Live Systems Technology S.A., Colombia), *P. lilacinus* BCP2 (NRRL 50756; Acta agriculturae Slovenica, 101 - 2, 263-275, 2013; e. g. PL Gold from BASF Agricultural Specialities (Pty) Ltd., South Africa), *Paenibacillus alvei* NAS6G6 (WO 2014/029697; NRRL B-50755; e.g. BAC-UP from BASF Agricultural Specialities (Pty) Ltd., South Africa in mixture with *Bacillus pumilus* KFP9F), *Paenibacillus daejeonesis* Wolf 618 (DSMZ 26971) ,*P. polymyxa* PKB1 (ATCC 202127; Can. J. Microbiol. 48(2), 159-169, 2002), *Paenibacillus polymyxa* LU 17007, *Paenibacillus polymyxa metabolites Fusaricidin 1b*, *Paenibacillus polymyxa metabolites Fusaricidin 1a*, *Paenibacillus polymyxa metabolites Fusaricidin A* , *Paenibacillus polymyxa metabolites Fusaricidin B* , *Paenibacillus polymyxa metabolites Fusaricidin D* , *Paenibacillus polymyxa* Wolf 275 (DSMZ 26969) (The paenibacillus species are disclsosed in WO2016020371) , *Pantoea agglomerans* E325 (NRRL B-21856; Phytopathol. 101(10), 1234-41, 2011; Trees 26, 227-238,

2012; Bloomtime Biological™ from Northwest Agricultural Products, Inc., USA), *Pantoea vagans* (formerly *agglomerans*) C9-1 originally isolated in 1994 from apple stem tissue for control of fire blight in apple (J. Bacteriol. 192(24), 6486–6487, 2010; e. g. BlightBan C9-1® from NuFrams America Inc., USA), *Pasteuria* sp. ATCC PTA-9643 (WO 2010/085795), *Pasteuria* sp. Ph3 isolated from turfgrass soil samples collected at the DeBary Golf Course in central Florida (ATCC SD-5832; WO 2012/064527; for control of *Hoplolaimus galeatus* nematode from Pasteuria Bioscience, Inc. now Syngenta Crop Protection, LLC, USA), *Pasteuria* sp. Pr3 isolated from soil samples collected in the southeastern United States (ATCC SD-5834; for control of *Rotylenchulus reniformis* nematode potentially of species *P. ramosa*; Naviva® ST from Syngenta Crop Protection, LLC, USA), *P. nishizawae* (WO 2010/80619), *P. nishizawae* Pn1 (Federal Register 76(22), 5808, February 2, 2011; ATCC SD-5833; e.g. Clariva™ PN from Syngenta Crop Protection, LLC, USA), *P. penetrans* (US 5,248,500; Del Monte Corp.), *P. ramosa* (WO 2010/080619), *P. thornea* (WO 2010/080619), *P. usgae* BL1 (ATCC SD-5835; J. Nematol. 42(2): 87–90, 2010; *ibid.* 43(2), 101–109, 2011; e. g. Econem™ for control of *Belonolaimus longicaudatus* from Pasteuria BioScience now Syngenta sold by Harell`s LLC, Florida, USA for use on turf for management of *Belonolaimus longicaudatus*), *Peicillium bilaiae* (also called *P. bilaii*) strains ATCC 18309 (= ATCC 74319), ATCC 20851 and/or ATCC 22348 (= ATCC 74318) originally isolated from soil in southern Alberta (Fertilizer Res. 39, 97-103, 1994; Can. J. Plant Sci. 78(1), 91-102, 1998; US 5,026,417, WO 1995/017806; e. g. Jump Start®, Provide® from Novozymes Biologicals BioAg Group, Canada), *P. bilaiae* NRRL 50162 and NRRL 50169 (W0 2010/037228), *Phlebiopsis gigantea* (e. g. RotStop® from Verdera Oy, Finland), *Phasmarhabditis hermaphrodita* DMG 0001 , *Pichia anomala* WRL-076 (NRRL Y-30842; US 8,206,972), potassium bicarbonate (e. g. Amicarb® from Stähler SA, Switzerland), potassium silicate (e. g. Sil-MATRIX™ from Certis LLC, USA), *Pseudozyma flocculosa* PF-A22 UL (e. g. Sporodex® L from Plant Products Co. Ltd., Canada), *Pseudomonas* sp. Proradix (DSM 13134; WO 2001/40441, e. g. PRORADIX from Sourcon Padena GmbH & Co. KG, Hechinger Str. 262, 72072 Tübingen, Germany), *P. chloraphis* MA 342 (Microbiology Monographs 18, 21-43, 2011; e. g. Cerall® or Cedemon® from BioAgri AB, Uppsala, Sweden or Intrachem Bio Deutschland GmbH & Co. KG, Bad Camberg, Germany), *P. fluorescens* A506 (Phytopathol 97(2), 244-249, 2007; ATCC 31948; e. g. BlightBan® from NuFarm Americas, Inc., Morrisville, NC, USA), *P. fluorescens* ATCC 13525 of biovar I = biotype A; originally isolated from pre-filter tanks in England (DSM 50090; registered for use in Canada), *P. fluorescens* CHA0 (Mol. Plant Microbe Interact. 5(1), 4-13, 1992), *P. fluorescens* CL 145A (J. Invertebr. Pathol. 113(1), 104-14, 2013; e. g. Zequanox® from Marrone BioInnovations, Davis, CA, USA), *P. fluorescens* NCIB 12089 (EP 0210734 A!; Victus® from Mauri Laboratories, 9 Moorebank Ave., Moorebank, NSW 2170, Australia), *P. fluorescens* Pf-5 isolated from root surface of cotton (ATCC BAA-477), *P. putida* ATCC 202153 (EMBRAPA 63/88 4 B; WO 2004/0245865), *Pythium oligandrum* DV 74 (US 2013/0035230; ATCC 38472; e. g. Poyversum® from Remeslo SSRO, Biopreparaty, Czech Rep. and from Gowan, USA), *Reynoutria sachalinensis* extract (EP 0307510 B1; e. g. Regalia® SC from Marrone BioInnovations, Davis, CA, USA or Milsana® from BioFa AG, Germany), *Rhizobium spp.* SEMIA 6144 (deposited with Australian inoculant research group (AIRG)) , *Rhizobium leguminosarum* bv. *phaseoli* (e. g. RHIZO-STICK from BASF Corp., USA), *R. leguminosarum bv. phaseoli* RG-B10 (USDA 9041; from Int. J. Syst. Bacteriol. 46(1), 240-244, 1996;

Int. J. Syst. Evol. Microbiol. 50, 159-170, 2000; e. g. Nodulator® Dry Bean in Africa, HiStick NT Dry bean in US, and Nodulator® Dry Bean in Canada from BASF Corp., USA, or BASF Agricultural Specialties Ltd., Canada), *R. l.* bv. *trifolii* CB782 (Nodulaid® peat for Kenya white clover from BASF Agricultural Specialties Pty Ltd, Australia), *R. l.* bv. *trifolii* CC275e (Nodulaid® peat for NZ white clover from BASF Agricultural Specialties Pty Ltd, Australia), *R. l.* bv. *trifolii* CC283b (ICMP 4073b; Proc. New Zealand Grassland Assoc. 56, 101-105, 1994; Microbiol. 153, 3184-3195, 2007; Nodulaid® peat for Caucasian clover from BASF Agricultural Specialties Pty Ltd, Australia), *R. l.* bv. *trifolii* CC1099 (Inoculating Legumes: A Practical Guide, ed. Grain Research and Development Corporation, 2012, ISBN 978-1-921779-45-9; e. g. Nodulaid® peat for sainfoin from BASF Agricultural Specialties Pty Ltd, Australia), *R. l.* bv. *trifolii* RP113-7 (Appl. Environ. Microbiol. 44(5), 1096-1101, 1982; e. g. Dormal® from BASF Corp., USA), *R. l.* bv. *trifolii* TA1 (Appl. Environ. Microbiol. 49(1), 127-131, 1985; e. g. Nodulaid® peat for white clover from BASF Agricultural Specialties Pty Ltd, Australia), *R. l.* bv. *trifolii* strain WSM1325 isolated in 1993 from the Greek Island of Serifos (Stand. Genomic Sci. 2(3), 347-356, 2010; Inoculating Legumes: A Practical Guide, ed. Grain Research and Development Corporation, 2012, ISBN 978-1-921779-45-9; Nodulaid® peat for sub clover and Nodulator® granules for sub clover both from BASF Agricultural Specialties Pty Ltd, Australia, for a broad range of annual clovers of Mediterranean origin), *R. l.* bv. *trifolii* strain WSM2304 isolated from *Trifolium polymorphum* in Uruguay in 1998 (Stand. Genomic Sci. 2(1), 66-76, 2010), *R. l.* bv. *viciae* P1NP3Cst being a Streptomycin-resistant mutant of P1NP3C isolated from pea root nodules in Bretenière, France (also referred to as 1435; New Phytol. 176, 680-690, 2007; *ibid.* 179(1), 224-235, 2008; e. g. Nodulator® PL Peat Granule from BASF Corp., USA; or Nodulator® XL PL from BASF Agricultural Specialties Ltd., Canada), *R. l.* bv. *viciae* RG-P2 also called P2 isolated from pea root nodules in Sakatchewan, Canada (e. g RhizUP peat for peas and lentils in Canada from BASF Agricultural Specialties Ltd., Canada), *R. l.* bv. *viciae* SU303 (e. g. Nodulaid® Group E from BASF Agricultural Specialties Pty Ltd, Australia), *R. l.* bv. *viciae* WSM1455 (e. g. Nodulaid® Group F from BASF Agricultural Specialties Pty Ltd, Australia), *Sinorhizobium meliloti* RCR2011 also called 2011 or SU47 (MSDJ0848; Mol. Gen. Genomics 272, 1–17, 2004; e. g. Dormal® Alfalfa & Luzerne from BASF Corp., USA; Nitragin® Gold from Novozymes Biologicals BioAg Group, Canada), *Sinorhizobium medicae* SRDI554 (deposited with Australian inoculant research group (AIRG)), *Sinorhizobium medicae* WSM1115 (deposited with Australian inoculant research group (AIRG)), *Sphaerodes mycoparasitica* SMCD2220 also called SMCD2220-01 (IDAC 301008-01; WO 2011/022809), *Spodoptera littoralis* nucleopolyhedrovirus (SpliNPV) (e.g. in LITTOVIR from Adermatt Biocontrol, Switzerland), *Steinernema carpocapsae* (e. g. Millenium® from BASF Agricultural Specialities Limited, UK), *Steinernema feltiae* UK76 , *Steinernema riobrave 355, S. feltiae* (Nemashield® from BioWorks, Inc., USA; Nemasys® from BASF Agricultural Specialities Limited, UK), *S. kraussei* L137 (Nemasys® L from BASF Agricultural Specialities Limited, UK), *Streptomyces galbus* AQ6047 (NRRL 30232; WO 2012/135763; AgraQuest now Bayer CropScience LP, USA); *S. galbus* M1064 (NRRL 50334; WO 2012/135763; AgraQuest now Bayer CropScience LP, USA); *S. griseoviridis* K61 (Crop Protection 25, 468-475, 2006; e. g. Mycostop® from Verdera Oy, Espoo, Finland), *S. lydicus* WYEC 108 (US 5,403,584; e. g. Actinovate® from Natural Industries, Inc., USA), *S. violaceusniger* YCED-9 (US 5,968,503; e. g. DT-9® from Natural Industries, Inc., USA), *Talaromyces flavus* V117b isolated from soil (e. g.

Protus® WG from Prophyta, Germany), *Trichoderma asperelloides* JM41 and *Ulocladium oudemansii* HRU3 (Agronomy 3, 632-647, 2013; e. g. Botry-Zen® from Botry-Zen Ltd, NZ). Strains can be obtained from culture collections and deposition centers (listed by their acronym = strain prefix here: http://www.wfcc.info/ccinfo/collection/by_acronym/) such as strains with prefices AGAL or NMI from: National Measurement Institute, 1/153 Bertie Street, Port Melbourne, Victoria, Australia 3207; ATCC: American Type Culture Collection, 10801 University Blvd., Manassas, VA 20110-2209, USA; BR: Embrapa Agrobiology Diazothrophic Microbial Culture Collection, P.O.Box 74.505, Seropedica, Rio de Janeiro, 23.851-970, Brazil; CABI or IMI: CABI Europe - International Mycological Institute, Bakeham Lane, Egham, Surrey, TW20 9TYNRRL, UK; CB: The CB Rhizobium Collection, School of Environment and Agriculture, University of Western Sydney, Hawkesbury, Locked Bag 1797, South Penrith Distribution Centre, NSW 1797, Australia; CBS: Centraalbureau voor Schimmelcultures, Fungal Biodiversity Centre, Uppsalaan 8, PO Box 85167, 3508 AD Utrecht, Netherlands; CC: Division of Plant Industry, CSIRO, Canberra, Australia; CNCM: Collection Nationale de Cultures de Microorganismes, Institute Pasteur, 25 rue du Docteur Roux, F-75724 PARIS Cedex 15; CPAC: Embrapa-Cerrados, CX.Postal 08223,Planaltina,DF,73301-970, Brazil; DSM: Leibniz-Institut DSMZ-Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH, Inhoffenstraße 7 B, 38124 Braunschweig, Germany; IDAC: International Depositary Authority of Canada Collection, Canada; ICMP: Interntional Collection of Micro-organisms from Plants, Landcare Research, Private Bag 92170, Auckland Mail Centre, Auckland 1142, New Zealand; IITA: IITA, PMB 5320, Ibadan, Nigeria; INTA: Agriculture Collection Laboratory of the Instituto de Microbiologia y Zoologia Agrıcola (IMYZA), Instituto Nacional de Tecnologı´a Agropecuaria (INTA), Castelar, Argentina; MSDJ: Laboratoire de Microbiologie des Sols, INRA, Dijon, France; MUCL: Mycothèque de l'Université catholique de Louvain, Croix du Sud 2, box L7.05.06, 1348 Louvain-la-Neuve, Belgium; NCIMB or NICB: The National Collections of Industrial and Marine Bacteria Ltd., Torry Research Station, P.O. Box 31, 135 Abbey Road, Aberdeen, AB9 8DG, Scotland; Nitragin: Nitragin strain collection, The Nitragin Company, Milwaukee, Wisconsin, USA, NRRL or ARSEF (collection of entomopathogenic fungi): ARS Culture Collection of the National Center for Agricultural Utilization Research, Agricultural Research Service, U.S. Department of Agriculture, 1815 North University Street, Peoria, Illinois 61604, USA; NZP: Department of Scientific and Industrial Research Culture Collection, Applied Biochemistry Division, Palmerston North, New Zealand; PPRI: ARC-Plant Protection Research Institute, Private Bag X134, Queenswood Pretoria, Gauteng, 0121, South Africa; SEMIA: FEPAGRO-Fundação Estadual de Pesquisa Agropecuária, Rua Gonçalves Dias, 570, Bairro Menino Deus, Porto Alegre/RS, Brazil; SRDI: SARDI, Adelaide, South Australia; USDA: U.S. Department of Agriculture, Agricultural Research Service, Soybean and Alfalfa Research Laboratory, BARC-West, 10300 Baltimore Boulevard, Building 011, Beltsville, MD 20705, USA (Beltsville Rhiz. Cult. Catalog: http://pdf.usaid.gov/ pdf_docs/PNAAW891.pdf); and WSM: Murdoch University, Perth, Western Australia. Further strains may be found at: http://gcm.wfcc.info/; http://www.landcareresearch.co.nz/resources.

collections/icmp.Jasmonic acid, its salts (jasmonates) or derivatives include without limitation potassium, sodium, lithium, ammonium, dimethylammonium, isopropylammonium, diolammonium and diethtriethanolammonium jasmonate; and also jasmonic acid methyl ester, jasmonic acid amide, jasmonic acid methylamide, jasmonic acid-L-amino acid (amide-linked) conjugates

(e. g. conjugates with L-isoleucine, L-valine, L-leucine, or L-phenylalanine), 12-oxo-phytodienoic acid, coronatine, coronalon, coronafacoyl-L-serine, coronafacoyl-L-threonine, methyl esters of 1-oxo-indanoyl-isoleucine, methyl esters of 1-oxo-indanoyl-leucine, cis-jasmone, linoleic acid or derivatives thereof, and combinations of any of the above.

Humates are humic and fulvic acids extracted from a form of lignite coal and clay, known as leonardite. Humic acids are organic acids that occur in humus and other organically derived materials such as peat and certain soft coal. They have been shown to increase fertilizer efficiency in phosphate and micro-nutrient uptake by plants as well as aiding in the development of plant root systems.

According to one embodiment of the inventive mixtures, the at least one biopesticide II is selected from the groups L1) to L6):

L1) Microbial pesticides with fungicidal, bactericidal, viricidal and/or plant defense activator activity selected from: *Ampelomyces quisqualis* M-10 (L.1.1), *Aspergillus flavus* NRRL 21882 (L.1.2), *Aureobasidium pullulans* DSM 14940 (L.1.3), *A. pullulans* DSM 14941 (L.1.4), *Bacillus altitudinis* 41KF2b (L.1.5), *B. amyloliquefaciens* IN937a (L.1.11), *B. amyloliquefaciens* IT-45 (L.1.12), *B. amyloliquefaciens* ssp. *plantarum* D747 (L.1.13), *B. amyloliquefaciens* ssp. *plantarum* FZB24 (L.1.14), *B. amyloliquefaciens* ssp. *plantarum* FZB42 (L.1.15), *B. amyloliquefaciens* ssp. *plantarum* GB03 (L.1.16), *B. amyloliquefaciens* ssp. *plantarum* MBI600 (NRRL B-50595) (L.1.17), *B. amyloliquefaciens* ssp. *plantarum* QST-713 (L.1.18), *B. mycoides* AQ726 (L.1.21), *B. mycoides* strain J (L.1.22), *B. pumilus* INR-7 (L.1.23), *B. pumilus* KFP9F (L.1.24), B. *pumilus* QST 2808 (L.1.25), *B. pumilus* GHA 180 (L.1.26), *B. simplex* ABU 288 (L.1.27), *B. subtilis* CX-9060 (L.1.29), *B. subtilis* FB17 (L.1.30), *B. subtilis* GB07 (L.1.31), *Candida oleophila* I-82 (L.1.32), *C. oleophila* O (L.1.33), *C. saitoana* (L.1.34), *Clavibacter michiganensis* (bacteriophages) (L.1.35), *Coniothyrium minitans* CON/M/91-08 (L.1.36), *Cryphonectria parasitica* (L.1.37), *Dilophosphora alopecuri* (L.1.39), *Fusarium oxysporum* (L.1.40), *Clonostachys rosea* f. *catenulata* J1446 (L.1.41), *Gliocladium roseum* 321U (L.1.42), *Metschnikowia fructicola* NRRL Y-30752 (L.1.43), *Microdochium dimerum* (L.1.44), *Microsphaeropsis ochracea* P130A (L.1.45), *Muscodor albus* QST 20799 (L.1.46), *Muscodor albus* SA-13 (L.1.47), *Paenibacillus alvei* NAS6G6 (L.1.48), *Paenibacillus polymyxa* PKB1 (L.1.49), *Pantoea agglomerans* E325 (L.1.90), *Pantoea vagans* C9-1 (L.1.50), *Penicillium bilaiae* ATCC 22348 (L.1.51), *P. bilaiae* ATCC 20851 (L.1.52), *Penicillium bilaiae* ATCC 18309 (L.1.53), *Phlebiopsis gigantea* (L.1.54), *Pichia anomala* WRL-76 (L.1.55), *Pseudomonas* sp. Proradix (L.1.56), *Pseudomonas chloraphis* MA 342 (L.1.57), *P. fluorescens* A506 (L.1.58), *P. fluorescens* CL 145A (L.1.91), *P. fluorescens* NCIB 12089 (L.1.92), *P. fluorescens* Pf-5 (L.1.93), *P. fluorescens* WCS 374 (L.1.94), *P. fluorescens* ATCC 13525 (L.1.95), *P. fluorescens* CHA0 (L.1.96), *P. putida* ATCC 202153 (L.1.97), *Pseudozyma flocculosa* PF-A22 UL (L.1.59), *Pythium oligandrum* DV 74 (L.1.60), *Sphaerodes mycoparasitica* SMCD2220 (L.1.61), *Streptomyces griseoviridis* K61 (L.1.62), *S. lydicus* WYEC 108 (L.1.63), *S. violaceusniger* XL-2 (L.1.64), *S. violaceusniger* YCED-9 (L.1.65), *Talaromyces flavus* V117b (L.1.66), *Typhula phacorrhiza* 94671 (L.1.86), *Ulocladium oudemansii* HRU3 (L.1.87), *Verticillium dahlia* (L.1.88), zucchini yellow mosaic virus (avirulent strain) (L.1.89), *B. aryabhattani* ABU 5370 (L.1. 90), *Bacillus amyloliquefaciens*

AP-188 (L.1. 91)*B. megaterium AP-153* (L.1. 92), *B. pumilus* F-33 (L.1.93), *B. simplex* ABU 2372 (L.1.94), *B. simplex* ABU 1645(L.1.95), *B. subtilis* BU-1814 (L.1.96), *B. subtilis* AP278 (L.1.97), *Paenibacillus polymyxa* LU 17007 (L.1.98), *Paenibacillus polymyxa metabolites Fusaricidin 1b* (L.1.99), *Paenibacillus polymyxa metabolites Fusaricidin 1a* (L.1.100), *Paenibacillus polymyxa metabolites Fusaricidin A* (L.1.101), *Paenibacillus polymyxa metabolites Fusaricidin B* (L.1.102), *Paenibacillus polymyxa metabolites Fusaricidin D* (L.1.103), *Paenibacillus polymyxa* Wolf 275 (L.1.104), *Paenibacillus daejeonesis* Wolf 618 (L.1.105), *Penicillium steckii* 104.60 (L.1.106), *Trichoderma asperelloides* JM41 (L.1.107) Bacillus amyloliquefaciens strain PTA-4838 (L.1.108), *B. amyloliquefaciens* ssp. *plantarum* TJ1000 (L.1.109), *B. pumilus* GB34 (L.1.110), *Streptomyces microflavus* NRRL B-50550 (L.1.111), *Trichoderma asperelloides* JM41R (L.1.112), *T. harzianum* T-22(L.1.113)

L2) Biochemical pesticides with fungicidal, bactericidal, viricidal and/or plant defense activator activity selected from: chitosan (hydrolysate) (L.2.1), harpin protein (L.2.2), laminarin (L.2.3), Menhaden fish oil (L.2.4), natamycin (L.2.5), Plum pox virus coat protein (L.2.6), potassium bicarbonate (L.2.7), *Reynoutria sachalinensis* extract (L.2.8), salicylic acid (L.2.9), potassium or sodium bicarbonate (L.2.10), tea tree oil (L.2.11);

L3) Microbial pesticides with insecticidal, acaricidal, molluscidal and/or nematicidal activity selected from: *Agrobacterium radiobacter* K1026 (L.3.1), *A. radiobacter* K84 (L.3.2), *Bacillus firmus* CNCM I-1582 (L.3.3); *B. thuringiensis* ssp. *aizawai* strains: ABTS-1857 (L.3.4), SAN 401 I (L.3.5), ABG-6305 (L.3.6) and ABG-6346 (L.3.7); *B. t.* ssp. *israelensis* AM65-52 (L.3.8), *B. t.* ssp. *israelensis* SUM-6218 (L.3.9), *B. t.* ssp. *galleriae* SDS-502 (L.3.10), *B. t.* ssp. *kurstaki* EG 2348 (L.3.11), *B. t.* ssp. *kurstaki* SB4 (L.3.12), *B. t.* ssp. *kurstaki* ABTS-351 (HD-1) (L.3.13), *Beauveria bassiana* ATCC 74040 (L.3.14), *B. bassiana* GHA (L.3.15), *B. bassiana* H123 (L.3.16), *B. bassiana* DSM 12256 (L.3.17), *B. bassiana* PPRI 5339 (L.3.18), *B. brongniartii* (L.3.19), *Burkholderia* sp. A396 (L.3.20), *Chromobacterium subtsugae* PRAA4-1 (L.3.21), *Cydia pomonella* granulosis virus V22 (L.3.22), *Cydia pomonella* granulosis virus V1 (L.3.23), *Cryptophlebia leucotreta* granulovirus (CrleGV) (L.3.57), *Flavobacterium sp.* H492 (L.3.60), *Helicoverpa armigera* nucleopolyhedrovirus (HearNPV) (L.3.58), *Isaria fumosorosea* Apopka-97 (L.3.24), *Lecanicillium longisporum* KV42 (L.3.25), *L. longisporum* KV71 (L.3.26), *L. muscarium* KV01 (L.3.27), *Metarhizium anisopliae* FI-985 (L.3.28), *M. anisopliae* FI-1045 (L.3.29), *M. anisopliae* F52 (L.3.30), *M. anisopliae* ICIPE 69 (L.3.31), *M. anisopliae* var. *acridum* IMI 330189 (L.3.32); *Nomuraea rileyi* strains: SA86101 (L.3.33), GU87401 (L.3.34), SR86151 (L.3.35), CG128 (L.3.36) and VA9101 (L.3.37); *Paecilomyces fumosoroseus* FE 9901 (L.3.38), *P. lilacinus* 251 (L.3.39), *P. lilacinus* DSM 15169 (L.3.40), *P. lilacinus* BCP2 (L.3.41), *Paenibacillus popilliae* Dutky-1940 (NRRL B-2309 = ATCC 14706) (L.3.42), *P. popilliae* Dutky 1 (L.3.43), *P. popilliae* KLN 3 (L.3.56), *Pasteuria sp.* Ph3 (L.3.44), *Pasteuria sp.* ATCC PTA-9643 (L.3.45), *Pasteuria sp.* ATCC SD-5832 (L.3.46), *P. nishizawae* Pn1 (L.3.46), *P. penetrans* (L.3.47), *P. ramosa* (L.3.48), *P.* sp. Pr-3 (L.3.49), *P. thornea* (L.3.50), *P. usgae* (L.3.51), *Pseudomonas fluorescens* CL 145A (L.3.52), *Spodoptera littoralis* nucleopolyhedrovirus (SpliNPV) (L.3.59), *Steinernema carpocapsae* (L.3.53), *S. feltiae* (L.3.54), *S. kraussei* L137 (L.3.55); B. bassiana PPRI5339

(L.3.61), Heterorhabditis bacteriophora GPS11 (L.3.62), Metarhizium anisopliae IMI330189 (L.3.63), Phasmarhabditis hermaphrodita DMG 0001 (L.3.64), Steinernema feltiae UK76 (L.3.65), Steinernema riobrave 355 (L.3.66). B. thuringiensis EX297512(L.3.67), *B. t.* ssp. *tenebrionis* NB-176-1 (L.3.68), *Helicoverpa zea* nucleopolyhedrovirus (HzNPV) ABA-NPV-U (L.3.69), *Helicoverpa zea* single capsid nucleopolyhedrovirus (HzSNPV) (L.3.70),

L4) Biochemical pesticides with insecticidal, acaricidal, molluscidal, pheromone and/or nematicidal activity selected from: L-carvone (L.4.1), citral (L.4.2), (E,Z)-7,9-dodecadien-1-yl acetate (L.4.3), ethyl formate (L.4.4), (E,Z)-2,4-ethyl decadienoate (pear ester) (L.4.5), (Z,Z,E)-7,11,13-hexadecatrienal (L.4.6), heptyl butyrate (L.4.7), isopropyl myristate (L.4.8), cis-jasmone (L.4.9), lavanulyl senecioate (L.4.10), 2-methyl 1-butanol (L.4.11), methyl eugenol (L.4.12), methyl jasmonate (L.4.13), (E,Z)-2,13-octadecadien-1-ol (L.4.14), (E,Z)-2,13-octadecadien-1-ol acetate (L.4.15), (E,Z)-3,13-octadecadien-1-ol (L.4.16), R-1-octen-3-ol (L.4.17), pentatermanone (L.4.18), potassium silicate (L.4.19), sorbitol octanoate (L.4.20), (E,Z,Z)-3,8,11-tetradecatrienyl acetate (L.4.21), (Z,E)-9,12-tetradecadien-1-yl acetate (L.4.22), Z-7-tetradecen-2-one (L.4.23), Z-9-tetradecen-1-yl acetate (L.4.24), Z-11-tetradecenal (L.4.25), Z-11-tetradecen-1-ol (L.4.26), Acacia negra extract (L.4.27), extract of grapefruit seeds and pulp (L.4.28), extract of *Chenopodium ambrosiodes* (L.4.29), Catnip oil (L.4.30), Tagetes oil (L.4.33), alpha-terpene (L.4.34), p-cymene(L.4.35),limonene(L.4.36)

L5) Microbial pesticides with plant stress reducing, plant growth regulator, plant growth promoting and/or yield enhancing activity selected from: *A. lipoferum* BR 11646 (Sp31) (L.5.6), *A. irakense* (L.5.7), *A. halopraeferens* (L.5.8), *Bradyrhizobium sp.* PNL01 (L.5.9), *B. sp.* (Arachis) CB1015 (L.5.10), *B. sp.* (Arachis) USDA 3446 (L.5.11), B. sp. (Arachis) SEMIA 6144 (L.5.12), B. sp. (Arachis) SEMIA 6462 (L.5.13), *B. sp.* (Arachis) SEMIA 6464 (L.5.14), *B. sp.* (Vigna) (L.5.15), *B. elkanii* SEMIA 587 (L.5.16), *B. elkanii* SEMIA 5019 (L.5.17), *B. elkanii* U-1301 (L.5.18), *B. elkanii* U-1302 (L.5.19), *B. elkanii* USDA 74 (L.5.20), *B. elkanii* USDA 76 (L.5.21), *B. elkanii* USDA 94 (L.5.22), *B. elkanii* USDA 3254 (L.5.23), *B. japonicum* 532c (L.5.24), *B. japonicum* CPAC 15 (L.5.25), *B. japonicum* E-109 (L.5.26), *B. japonicum* G49 (L.5.27), *B. japonicum* TA-11 (L.5.28), *B. japonicum* USDA 3 (L.5.29), *B. japonicum* USDA 31 (L.5.30), *B. japonicum* USDA 76 (L.5.31), *B. japonicum* USDA 110 (L.5.32), *B. japonicum* USDA 121 (L.5.33), *B. japonicum* USDA 123 (L.5.34), *B. japonicum* USDA 136 (L.5.35), B. japonicum SEMIA 566 (L.5.36), *B. japonicum* SEMIA 5079 (L.5.37), *B. japonicum* SEMIA 5080 (L.5.38), *B. japonicum* WB74 (L.5.39), *B. liaoningense* (L.5.40), *B. lupini* LL13 (L.5.41), *B. lupini* WU425 (L.5.42), *B. lupini* WSM471 (L.5.43), *B. lupini* WSM4024 (L.5.44), *Glomus intraradices* RTI-801 (L.5.45), *Mesorhizobium sp.* WSM1271 (L.5.46), *M. sp.* WSM1497 (L.5.47), *M. ciceri* CC1192 (L.5.48), *M. huakii* (L.5.49), *M. loti* CC829 (L.5.50), *M. loti* SU343 (L.5.51), *Rhizobium leguminosarum* bv. *phaseoli* RG-B10 (L.5.52), *R. l.* bv. *trifolii* RP113-7 (L.5.53), *R. l.* bv. *trifolii* 095 (L.5.57), *R. l.* bv. *trifolii* TA1 (L.5.58), *R. l.* bv. *trifolii* CC283b (L.5.59), *R. l.* bv. *trifolii* CC275e (L.5.60), *R. l.* bv. *trifolii* CB782 (L.5.61), *R. l.* bv. *trifolii* CC1099 (L.5.62), *R. l.* bv. *trifolii* WSM1325 (L.5.63), *R. l.* bv. *viciae* SU303 (L.5.64), *R. l.* bv. *viciae* WSM1455 (L.5.65), *R. l.* bv. *viciae* P1NP3Cst (L.5.66), *R. l.* bv. *viciae* RG-P2 (L.5.67),

Sinorhizobium meliloti RCR2011 (L.5.71), *S. meliloti* NRG185 (L.5.72), *S. meliloti* RRI128 (L.5.73); from *B. japonicum* CB1809 (L.5.76), B. japonicum 3407(L.5.77), *Bradyrhizobium spp NC92* (L.5.78), *Bradyrhizobium spp CB1024,* (L.5.79), *Mesorhizobium ciceri* CP 1653 (L.5.80), *Rhizobium spp*. SEMIA 6144 (L.5.84), *Sinorhizobium medicae* SRDI554 (L.5.85), *Sinorhizobium medicae* WSM1115 (L.5.86)

L6) Biochemical pesticides with plant stress reducing, plant growth regulator and/or plant yield enhancing activity selected from: abscisic acid (L.6.1), aluminium silicate (kaolin) (L.6.2), 3-decen-2-one (L.6.3), formononectin (L.6.4), genistein (L.6.5), hesperetin (L.6.6), homobrassinolide (L.6.7), humates (L.6.8), methyl jasmonate (L.6.9), cis-jasmone (L.6.10), lysophosphatidyl ethanlamine (L.6.11), naringenin (L.6.12), polymeric polyhydroxy acid (L.6.13), salicylic acid (L.6.14), and *Ascophyllum nodosum* (Norwegian kelp, Brown kelp) extract (L.6.15).

Also preferred biopesticides on strain level are selected from the following groups L1) to L5):

L1) Microbial pesticides with fungicidal, bactericidal, viricidal and/or plant defense activator activity: *Aureobasidium pullulans* DSM 14940 L.1.3 and DSM 14941 (L.1.4), *Bacillus amyloliquefaciens* AP-188 (L.1. 91), *B. amyloliquefaciens* ssp. *plantarum* D747 (L.1.13), *B. amyloliquefaciens* ssp. *plantarum* FZB24 (L.1.14), *B. amyloliquefaciens* ssp. *plantarum* FZB42 (L.1.15), *B. amyloliquefaciens* ssp. *plantarum* MBI600 (L.1.17), *B. amyloliquefaciens* ssp. *plantarum* QST-713 (L.1.18), *B. amyloliquefaciens* ssp. *plantarum* TJ1000 (L.1.109), *B. pumilus* GB34 (L.1.110), *B. pumilus* GHA 180 (L.1.26), *B. pumilus* INR-7 (L.1.23), *B. pumilus* KFP9F (L.1.24), *B. pumilus* QST 2808 (L.1.25), *B. simplex* ABU 288 (L.1.27), *B. subtilis* FB17 (L.1.30), *Coniothyrium minitans* CON/M/91-08 (L.1.36), *Metschnikowia fructicola* NRRL Y-30752 (L.1.43), *Paenibacillus alvei* NAS6G6 (L.1.48), *Penicillium bilaiae* ATCC 22348 (L.1.51), *P. bilaiae* ATCC 20851 (L.1.52), *Penicillium bilaiae* ATCC 18309 (L.1.53), *Streptomyces microflavus* NRRL B-50550 (L.1.111), *Trichoderma asperelloides* JM41R (L.1.112), *T. harzianum* T-22 (L.1.113);

L2) Biochemical pesticides with fungicidal, bactericidal, viricidal and/or plant defense activator activity: harpin protein (L.2.2), *Reynoutria sachalinensis* extract (L.2.8);

L3) Microbial pesticides with insecticidal, acaricidal, molluscidal and/or nematicidal activity: *Bacillus firmus* CNCM I-1582 (L.3.3); *B. thuringiensis* ssp. *aizawai* ABTS-1857 (L.3.4), *B. t.* ssp. *kurstaki* ABTS-351 (L.3.13), *B. t.* ssp. *kurstaki* SB4 (L.3.12), *B. t.* ssp. *tenebrionis* NB-176-1 (L.3.68), *Beauveria bassiana* GHA (L.3.15), *B. bassiana* ATCC 74040 (L.3.14), *B. bassiana* PPRI 5339 (L.3.18), *Burkholderia* sp. A396 (L.3.20), *Cydia pomonella* granulosis virus V22 (L.3.22), *Cydia pomonella* granulosis virus V1 (L.3.23), *Helicoverpa armigera* nucleopolyhedrovirus (HearNPV) (L.3.58), *Helicoverpa zea* nucleopolyhedrovirus (HzNPV) ABA-NPV-U (L.3.69), *Helicoverpa zea* single capsid nucleopolyhedrovirus (HzSNPV) (L.3.70), *Heterohabditis bacteriophora* (L.3.62), *Isaria fumosorosea* Apopka-97 (L.3.24), *Metarhizium anisopliae* var. *anisopliae* F52 (L.3.30), *Paecilomyces lilacinus* 251 (L.3.39), *Pasteuria nishizawae* Pn1 (L.3.46), *Steinernema carpocapsae* (L.3.53), *S. feltiae* (L.3.54);

L4) Biochemical pesticides with insecticidal, acaricidal, molluscidal, pheromone and/or nematicidal activity: cis-jasmone (L.4.9), methyl jasmonate (L.4.13), Quillay extract (L.4.32);

L5) Microbial pesticides with plant stress reducing, plant growth regulator, plant growth promoting and/or yield enhancing activity;

in particular selected from,

L1) Microbial pesticides with fungicidal, bactericidal, viricidal and/or plant defense activator activity: *Aureobasidium pullulans* DSM 14940 (L.1.3) and DSM 14941 (L.1.4), *Bacillus amyloliquefaciens* AP-188 (L.1. 91), *B. amyloliquefaciens* ssp. *plantarum* D747 (L.1.13), *B. amyloliquefaciens* ssp. *plantarum* FZB24 (L.1.14), *B. amyloliquefaciens* ssp. *plantarum* FZB42 (L.1.15), *B. amyloliquefaciens* ssp. *plantarum* MBI600 (L.1.17), *B. amyloliquefaciens* ssp. *plantarum* QST-713 (L.1.18), *B. amyloliquefaciens* ssp. *plantarum* TJ1000 (L.1.109), *B. pumilus* GB34 (L.1.110), *B. pumilus* GHA 180 (L.1.26), *B. pumilus* INR-7 (L.1.23), *B. pumilus* QST 2808 (L.1.25), *B. simplex* ABU 288 (L.1.27), *B. subtilis* FB17 (L.1.30), *Coniothyrium minitans* CON/M/91-08 (L.1.36), *Metschnikowia fructicola* NRRL Y-30752 (L.1.43), *Penicillium bilaiae* ATCC 22348 (L.1.51), *P. bilaiae* ATCC 20851 (L.1.52), *Penicillium bilaiae* ATCC 18309 (L.1.53), *Streptomyces microflavus* NRRL B-50550 (L.1.111), *T. harzianum* T-22 (L.1.113);

L2) Biochemical pesticides with fungicidal, bactericidal, viricidal and/or plant defense activator activity: harpin protein (L.2.2), *Reynoutria sachalinensis* extract (L.2.8);

L3) Microbial pesticides with insecticidal, acaricidal, molluscidal and/or nematicidal activity: *Bacillus firmus* I-1582 (L.3.3); *B. thuringiensis* ssp. *aizawai* ABTS-1857 (L.3.4), *B. t.* ssp. *kurstaki* ABTS-351 (L.3.13), *B. t.* ssp. *tenebrionis* NB-176-1 (L.3.68), *Beauveria bassiana* GHA (L.3.15), *B. bassiana* ATCC 74040 (L.3.14), *Burkholderia* sp. A396 (L.3.20), *Helicoverpa armigera* nucleopolyhedrovirus (HearNPV) (L.3.58), *Helicoverpa zea* nucleopolyhedrovirus (HzNPV) ABA-NPV-U (L.3.69), *Helicoverpa zea* single capsid nucleopolyhedrovirus (HzSNPV) (L.3.70), *Heterohabditis bacteriophora* (L.3.62), *Isaria fumosorosea* Apopka-97 (L.3.24), *Metarhizium anisopliae* var. *anisopliae* F52 (L.3.30), *Paecilomyces lilacinus* 251 (L.3.39), *Pasteuria nishizawae* Pn1 (L.3.46), *Steinernema carpocapsae* (L.3.53), *S. feltiae* (L.3.54);

L4) Biochemical pesticides with insecticidal, acaricidal, molluscidal, pheromone and/or nematicidal activity: cis-jasmone (L.4.9), methyl jasmonate (L.4.13), Quillay extract (L.4.32).

Also preferred biopesticides selected from the following groups L1) to L5):

L1) Microbial pesticides with fungicidal, bactericidal, viricidal and/or plant defense activator activity: *Ampelomyces quisqualis*, *Aspergillus flavus*, *Aureobasidium pullulans*, *Bacillus altitudinis, B. amyloliquefaciens*, *B. megaterium*, *B. mojavensis*, *B. mycoides*, *B. pumilus*, *B. simplex*, *B. solisalsi*, *B. subtilis*, *B. subtilis* var. *amyloliquefaciens*, *Candida oleophila*, *C. saitoana*, *Coniothyrium minitans*, *Cryphonectria parasitica*, *Dilophosphora alopecuri*, *Fusarium oxysporum*, *Clonostachys rosea* f. *catenulate* (also named *Gliocladium catenulatum*), *Lysobacter antibioticus*, *L. enzymogenes*, *Metschnikowia fructicola*, *Microdochium dimerum*, *Microsphaeropsis ochracea*, *Muscodor albus*, *P. polymyxa*, *P. agglomerans*, *Pantoea vagans*, *Phlebiopsis gigantea*, *Pseudomonas* sp., *Pseudomonas chloraphis*, *P. fluorescens*, *P. putida*, *Pythium oligandrum*, *Sphaerodes mycoparasitica*, *Streptomyces*

griseoviridis, *S. lydicus*, *S. violaceusniger*, *Talaromyces flavus*, *Trichoderma asperelloides, Ulocladium oudemansii*;

L2) Biochemical pesticides with fungicidal, bactericidal, viricidal and/or plant defense activator activity selected from: chitosan (hydrolysate), laminarin, *Reynoutria sachalinensis* extract;

L3) Microbial pesticides with insecticidal, acaricidal, molluscidal and/or nematicidal activity selected from: *Agrobacterium radiobacter*, *Bacillus cereus*, *B. firmus*, *B. thuringiensis*, *B. thuringiensis* ssp. *aizawai*, mixture of strain *B. firmus* CNCM I-1582 and strain *B. thuringiensis* EX297512, *B. t.* ssp. *israelensis*, *B. t.* ssp. *kurstaki*, *B. t.* ssp. *tenebrionis*, *Beauveria bassiana*, *B. brongniartii*, *Burkholderia* spp., *Chromobacterium subtsugae*, *Cydia pomonella* granulovirus (CpGV), *Cryptophlebia leucotreta* granulovirus (CrleGV), *Flavobacterium* spp., *Helicoverpa armigera* nucleopolyhedrovirus (HearNPV), *Heterorhabditis bacteriophora*, *Isaria fumosorosea*, *Lecanicillium longisporum*, *L. muscarium*, *Metarhizium anisopliae*, *Metarhizium anisopliae* var. *anisopliae*, *Nomuraea rileyi*, *P. lilacinus*, *Pasteuria* spp., *P. nishizawae*, *P. penetrans*, *P. ramosa*, *P. thornea*, *P. usgae*, *Pseudomonas fluorescens*, *Spodoptera littoralis* nucleopolyhedrovirus (SpliNPV), *Steinernema carpocapsae*, *S. feltiae*, *S. kraussei, Streptomyces galbus*;

L4) Biochemical pesticides with insecticidal, acaricidal, molluscidal, pheromone and/or nematicidal activity selected from: cis-jasmone, potassium silicate, extract of grapefruit seeds and pulp;

L5) Microbial pesticides with plant stress reducing, plant growth regulator, plant growth promoting and/or yield enhancing activity selected from: *A. lipoferum*, *Bradyrhizobium* spp., *B. elkanii*, *B. japonicum*, *B. lupini*, *Delftia acidovorans*, *Glomus intraradices*, *Mesorhizobium* spp., *Rhizobium leguminosarum* bv. *phaseoli*, *R. l.* bv. *trifolii*, *R. l.* bv. *viciae*, *Sinorhizobium meliloti*;

L6) Biochemical pesticides with plant stress reducing, plant growth regulator and/or plant yield enhancing activity selected from: aluminium silicate (kaolin), formononetin, *Ascophyllum nodosum* (Norwegian kelp, Brown kelp) extract;

Also preferred biopesticides on strain level are selected from the following group L3:

L3) Microbial pesticides with insecticidal, acaricidal, molluscidal and/or nematicidal activity selected from: *Agrobacterium radiobacter*, *Bacillus cereus*, *B. firmus*, *B. thuringiensis*, *B. thuringiensis* ssp. *aizawai*, mixture of strain *B. firmus* CNCM I-1582 and strain *B. thuringiensis* EX297512, *B. t.* ssp. *israelensis*, *B. t.* ssp. *kurstaki*, *B. t.* ssp. *tenebrionis*, *Beauveria bassiana*, *B. brongniartii*, *Burkholderia* spp., *Chromobacterium subtsugae*, *Cydia pomonella* granulovirus (CpGV), *Cryptophlebia leucotreta* granulovirus (CrleGV), *Flavobacterium* spp., *Helicoverpa armigera* nucleopolyhedrovirus (HearNPV), *Heterorhabditis bacteriophora*, *Isaria fumosorosea*, *Lecanicillium longisporum*, *L. muscarium*, *Metarhizium anisopliae*, *Metarhizium anisopliae* var. *anisopliae*, *Nomuraea rileyi*, *P. lilacinus*, *Pasteuria* spp., *P. nishizawae*, *P. penetrans*, *P. ramosa*, *P. thornea*, *P. usgae*, *Pseudomonas fluorescens*, *Spodoptera littoralis* nucleopolyhedrovirus (SpliNPV), *Steinernema carpocapsae*, *S. feltiae*, *S. kraussei, Streptomyces galbus*;

more preferred biopesticides is *Beauveria bassiana* or *S. feltiae*:
also more preferred biopesticides is *Beauveria bassiana*:
also more preferred biopesticides is *S. feltiae (Nemasys)*:

Preference is also given to mixtures comprising as pesticide II (component 2) a biopesticide selected from the groups L1), and L3), preferably selected from strains denoted above as (L.1.91), (L.1.13), (L.1.14), (L.1.15), (L.1.17), (L.1.18), (L.1.109), (L.1.26), (L.1.23), (L.1.24), (L.1.25), (L.1.27), (L.1.30), (L.1.43), (L.1.48), (L.1.51), (L.1.52), (L.1.53), (L.3.3); (L.3.20), (L.3.39), and (L.3.46); even more preferably selected from (L.1.18), (L.1.109), (L.1.26), (L.1.23);

Preference is also given to mixtures comprising as pesticide II (component 2) a biopesticide selected from *B. thuringiensis* ssp. *aizawai* ABTS-1857 (L.3.4), *Beauveria bassiana* GHA (L.3.15), *Cydia pomonella* granulosis virus V22 (L.3.22), *Cydia pomonella* granulosis virus V1 (L.3.23), These mixtures are particularly suitable for treatment of propagation mateials, i. e. seed treatment purposes and likewise for soil treatment. These seed treatment mixtures are particularly suitable for crops such as rice, cereals, corn and leguminous plants such as soybean.

For biopesticides II selected from groups L1, L3, and L5, the mixtures of the invention embrace not only the isolated, pure cultures of the respective microorganisms as defined herein, but also its cell-free extract having pesticidal activity, preferably a ketone-based extract, its suspensions in a whole broth culture or as a metabolite-containing supernatant or a purified metabolite obtained from a whole broth culture of the microorganism or microorganism strain.

"Whole broth culture" refers to a liquid culture containing both cells and media.

"Supernatant" or “culture medium” refers to the liquid broth remaining when cells grown in broth are removed by centrifugation, filtration, sedimentation, or other means well known in the art.

The term "metabolite" refers to any compound, substance or byproduct (including but not limited to small molecule secondary metabolites, polyketides, fatty acid synthase products, non-ribosomal peptides, ribosomal peptides, proteins and enzymes) produced by a microorganism (such as fungi and bacteria) that has pesticidal activity or improves plant growth, water use efficiency of the plant, plant health, plant appearance, or the population of beneficial microorganisms in the soil around the plant activity.

The term "mutant" refers to a microorganism, obtained by direct mutant selection but also includes microorganisms that have been further mutagenized or otherwise manipulated (e. g., via the introduction of a plasmid). Accordingly, embodiments include mutants, variants, and or derivatives of the respective microorganism, both naturally occurring and artificially induced mutants. For example, mutants may be induced by subjecting the microorganism to known mutagens, such as N-methyl-nitrosoguanidine, using conventional methods. Preferably such mutants retain the pesticidal activity of the respective microorganism.

The term "strain" refers to isolate or a group of isolates exhibiting phenotypic and/or genotypic traits belonging to the same lineage, distinct from those of other isolates or strains of the same species.

In an embodiment of the present invention, the mixture comprises component 1 and component 2, wherein component 2 is a mixture of two biopesticides from the group L1 and L2 or L3 or L4 or L5 or L6.

In an embodiment of the present invention, the mixture comprises component 1 and component 2, wherein component 2 is a mixture of two biopesticides from the group L2 and L3 or L4 or L5 or L6.

In an embodiment of the present invention, the mixture comprises component 1 and component 2, wherein component 2 is a mixture of two biopesticides from the group L3 and L4 or L5 or L6.

In an embodiment of the present invention, the mixture comprises component 1 and component 2, wherein component 2 is a mixture of two biopesticides from the group L4 and L5 or L6.

In an embodiment of the present invention, the mixture comprises component 1 and component 2, wherein component 2 is a mixture of two biopesticides from the group L5 and L6.

In an embodiment of the present invention, the mixture comprises component 1 and component 2, wherein component 2 is a ternary mixture of 3 biopesticides one each from L1 to L6.

According to a further embodiment, the mixture comprises in addition to component 1), as a component 2) strain *B. firmus* CNCM I-1582, and as a further active component 3) strain *B. thuringiensis* EX297512.

In addition to the above defined compound of formula I or the compound of formula I with enantiomeric excess of the compound I-R-1 or the compound I-R-1, the pesticidal mixtures of the invention comprise a component 2), which is a biopesticide II, which is selected from the groups L1 to L6 as defined above. Preferred biopesticides II are defined hereinafter.

The preferred embodiments regarding biopesticides II, which may be selected as component 2) of the mixtures of the invention, are to be understood as preferred on their own as well as preferably in combination with the preferred embodiments of the compounds of formula I, i.e. component 1) of the mixture of the invention, and, where applicable, as well as concerning the uses and methods according to the invention and the compositions according to the invention.

Preference is given to mixtures comprising as biopesticide II (component 2) a biopesticide selected from group L1, preferably selected from *Bacillus amyloliquefaciens* herein even more preferably from strains AP-136, AP-188, AP-218, AP-219, AP-295, IN937a, IT-45; *B. amyloliquefaciens* ssp. *plantarum* (formerly called *B. subtilis* or *B. subtilis* spp. *amyloliquefaciens*) herein even more preferably from strains MBI600, D747, FZB24, FZB42, GB03, QST-713 and TJ1000; *B. mojavensis* AP-209; *B. pumilus* herein even more preferably from strains GHA 180, INR-7, KFP9F and QST 2808; *B. simplex* herein more preferably strain ABU 288; *B. solisalsi* herein more preferably strain AP-217; *B. subtilis* herein even more preferably selected from strains CX-9060, FB17 and GB07; *Muscodor albus* herein more preferably strains QST 20799 and SA-13; *Paenibacillus alvei* herein more preferably strain NAS6G6, *Paenibacillus polymyxa* herein more preferably strain PKB1, *Penicillium bilaiae* herein more preferably strains ATCC 22348, ATCC 20581 and ATCC 18309; *Pseudomonas fluorescens* herein more preferably strain A506; *Sphaerodes mycoparasitica* herein more preferably strain SMCD2220; *Trichoderma fertile* herein more preferably strain JM41R; *Trichoderma harzianum* herein more preferably strain T-22; *Trichoderma virens* herein more preferably strais GI-3 and G-41.

Preference is also given to mixtures comprising as biopesticide II (component 2) a biopesticide selected from group L1, even more preferably selected from *B. amyloliquefaciens* AP-188, *B. amyloliquefaciens* ssp. *plantarum* MBI600, *B. amyloliquefaciens* ssp. *plantarum* QST-713, *B. pumilus* INR-7, *B. pumilus* QST 2808, *B. simplex* ABU 288, *B. subtilis* FB17, *Paenibacillus alvei* NAS6G6 and *Trichoderma fertile* JM41R.

According to one embodiment of the inventive mixtures, the at least one biopesticide II is *Bacillus amyloliquefaciens* ssp. *plantarum* MBI600. These mixtures are particularly suitable in rice and soybean.

According to another embodiment of the inventive mixtures, the at least one biopesticide II is *B. pumilus* INR-7. These mixtures are particularly suitable in rice, soybean and corn.

According to a further embodiment, the at least one biopesticide II is Bacillus simplex, preferably *B. simplex* ABU 288. These mixtures are particularly suitable in rice, soybean and corn.

According to a further embodiment, the at least one biopesticide II is *Bacillus subtilis*, preferably *B. subtilis* strain FB17.

According to one embodiment of the inventive mixtures, the at least one biopesticide II is selected from *Bacillus amyloliquefaciens* AP-136, *B. amyloliquefaciens* AP-188, *B. amyloliquefaciens* AP-218, *B. amyloliquefaciens* AP-219, *B. amyloliquefaciens* AP-295, *B. amyloliquefaciens* spp. *plantarum* FZB24, *B. amyloliquefaciens* ssp. *plantarum* FZB42, *B. amyloliquefaciens* ssp. *plantarum* TJ1000, *B. amyloliquefaciens* ssp. *plantarum* D747, *B. amyloliquefaciens* ssp. *plantarum* MBI600, *B. amyloliquefaciens* spp. *plantarum* GB03, *B. amyloliquefaciens* spp. *plantarum* QST-713, *B. mojavensis* AP-209, *B. pumilus* GB34, *B. pumilus* INR-7, *B. pumilus* KFP9F, *B. pumilus* QST 2808, *B. pumilus* GHA 180, *B. simplex* ABU 288, *B. solisalsi* AP-217, *B. subtilis* CX-9060, *B. subtilis* FB17 and *B. subtilis* GB07. These mixtures are particularly suitable in rice, soybean and corn, in particular for seed treatment.

According to a further embodiment, the at least one pesticide II is selected from *Streptomyces* spp., preferably from *S. griseoviridis*, *S. lydicus* and *S. violaceusniger*, in particular from strains *S. griseoviridis* K61, *S. lydicus* WYEC 108, *S. violaceusniger* XL-2 and *S. violaceusniger* YCED-9.

According to one embodiment of the inventive mixtures, the at least one biopesticide II is selected from the following fungi *Coniothyrium minitans* CON/M/91-08, *Trichoderma fertile* JM41R, *T. harzianum* T-22, *T. virens* GI-3, *T. virens* GL-21, *T. virens* G-41. These mixtures are particularly suitable for seed and/or soil treatment.

According to a further embodiment, the at least one biopesticide II is selected from *Pseudomonas* spp., preferably selected from *P. chloraphis* herein more preferably strain MA 342 and *Pseudomonas sp.* DSM 13134; *P. fluorescens* herein more preferably selected from strains A506, WCS 374 and Pf-5; and *P. putida* herein more preferably strain ATCC 202153.

The present invention also relates to mixtures wherein the at least one biopesticide II is selected from the fungal genus *Trichoderma*, preferably from the strains *T. asperellum* T34, *T. asperellum* SKT-1, *T. asperellum* ICC 012, *T. asperellum* TV1, *T. atroviride* LC52, *T. atroviride* CNCM I-1237, *T. fertile* JM41R, *T. gamsii* ICC 080, *T. harmatum* TH 382, *T. harzianum* T-22, *T. harzianum* T-35, *T. harzianum* T-39, *T. harzianum* T-315; mixture of *T. harzianum* ICC012 and *T. gamsii* ICC080; mixture of *T. polysporum* and *T. harzianum*; *T. stromaticum*, *T. virens* GI-3, *T. virens* GL-21, *T. virens* G-41 and; in particular *T. fertile* JM41R.

The present invention also relates to mixtures wherein the at least one biopesticide II is selected from the fungal species *Muscodor albus* preferably from the strains SA-13 and QST 20799, which are particularly suiable for soil and seed treatment against soil-borne pathogens and/or nematodes.

Preference is given to mixtures comprising as biopesticide II (component 2) a biopesticide selected from group L3), preferably selected from *Bacillus firmus* herein preferably strain I-1582, *Beauveria bassiana* herein preferably selected from strains GHA, H123, DSM 12256 and PPRI 5339; *Burkholderia* sp. and herein preferably strain A396, *Metarhizium anisopliae* var. *acridum* herein preferably strain IMI 330189, *M. anisopliae* herein preferably selected from strains FI-985, FI-1045, F52 and ICIPE 69; *Paecilomyces lilacinus* herein preferably selected from strains 251, DSM 15169 and BCP2, *Paenibacillus popilliae* herein preferably selected from strains Dutky-1940, KLN 3 and Dutky 1; *Pasteuria nishazawa* and herein preferably strain Pn1.

Preference is also given to mixtures comprising as biopesticide II (component 2) a biopesticide selected from group L3), even more preferably from *B. bassiana* DSM 12256, *B. bassiana* PPRI 5339, *Metarhizium anisopliae* var. *acridum* IMI 330189, *M. anisopliae* FI-985, *M. anisopliae* FI-1045, *Paecilomyces lilacinus* DSM 15169, *P. lilacinus* BCP2, *P. lilacinus* 251, *Paenibacillus popilliae* Dutky-1940, *P. popilliae* KLN 3 and *P. popilliae* Dutky 1.

According to a further embodiment, the at least one biopesticide II is *Beauveria brongniartii*.

According to a further embodiment, the at least one biopesticide II is *Metarhizium anisopliae* or *M. anisopliae* var. *acridium*, preferably selected from *M. anisopliae* FI-1045, *M. anisopliae* F52, *M. anisopliae* var. *acridum* strains FI-985 and IMI 330189; in particular strain IMI 330189. These mixtures are particularly suitable for control of arthropod pests in rice, soybean and corn.

According to a further embodiment, the at least one biopesticide II is *Paecilomyces fumosoroseus*, preferably strain FE 9901 especially for white fly control.

According to a further embodiment, the at least one biopesticide II is selected from *Nomuraea rileyi,* preferably strains SA86101, GU87401, SR86151, CG128 and VA9101; and *P. lilacinus*, preferably strains 251, DSM 15169 or BCP2, in particular BCP2, which strains especially control the growth of plant-pathogenic nematodes.

According to a further embodiment, the at least one biopesticide II is *Bacillus firmus*, preferably spores of strain CNCM I-1582, preferably useful for seed treatment of rice, cereals, soybean, cotton, sugarbeets, potato, canola, and corn against nematodes and insects.

According to a further embodiment, the at least one biopesticide II is *Pasteuria nishizawae*, preferably spores of strain Pn1, preferably useful for seed treatment of rice, cereals, soybean, cotton, sugarbeets and corn against nematodes and insects.

According to a further embodiment, the at least one biopesticide II is *Flavobacterium sp.*, preferably spores of strain H492, preferably useful for seed treatment of rice, cereals, soybean, cotton, sugarbeets and corn against nematodes and insects.

According to a further embodiment, the at least one biopesticide II is *Bacillus cereus*, preferably spores of CNCM I-1562, preferably useful for seed treatment of rice, soybean, cotton, cereals, and corn against nematodes and insects.

According to a further embodiment, the at least one biopesticide II is *Burkholderia* sp., preferably strain A396, preferably useful for seed treatment of rice, soybean, cotton, cereals, and corn.

According to a further embodiment, the at least one biopesticide II is *Paecilomyces lilacinus* 251, preferably useful for seed treatment of rice, soybean, cotton, cereals, and corn.

According to a further embodiment, the at least one biopesticide II is a mixture of spores of *B. firmus* and *B. cereus*, preferably mixtures spores of above mentioned strains CNCM I-1582 and CNCM I-1562, preferably useful for seed treatment of rice, soybean, cotton, cereals, and corn against nematodes and insects.

According to one preferred embodiment of the inventive mixtures, the at least one pesticide II is selected from *Bacillus firmus* CNCM I-1582, *Paecilomyces lilacinus* 251, *Pasteuria nishizawa* Pn1 and *Burkholderia sp.* A396 having nematicidal, acaricidal and/or insecticidal activity. These mixtures are particularly suitable in rice, cereals, soybean, cotton, sugarbeets, potato, canola, and corn, in particular for seed treatment.

According to a further embodiment, the at least one biopesticide II is *Bacillus firmus*, preferably spores of strain CNCM I-1582, preferably useful for controlling rice pests.

According to a further embodiment, the at least one biopesticide II is *Pasteuria nishizawae*, preferably spores of strain Pn1, preferably useful for controlling rice pests s.

According to a further embodiment, the at least one biopesticide II is *Flavobacterium sp.*, preferably spores of strain H492, preferably useful for controlling rice pests.

According to a further embodiment, the at least one biopesticide II is *Bacillus cereus*, preferably spores of CNCM I-1562, preferably useful for controlling rice pests.

According to a further embodiment, the at least one biopesticide II is *Burkholderia* sp., preferably strain A396, preferably useful for controlling rice pests.

According to a further embodiment, the at least one biopesticide II is *Paecilomyces lilacinus* 251, preferably useful for controlling rice pests.

According to a further embodiment, the at least one biopesticide II is a mixture of spores of *B. firmus* and *B. cereus*, preferably mixtures spores of above mentioned strains CNCM I-1582 and CNCM I-1562, preferably useful for controlling rice pests.

According to one preferred embodiment of the inventive mixtures, the at least one pesticide II is selected from *Bacillus firmus* CNCM I-1582, *Paecilomyces lilacinus* 251, *Pasteuria nishizawa* Pn1 and *Burkholderia sp.* A396 having nematicidal, acaricidal and/or insecticidal activity. These mixtures are particularly suitable for controlling rice pests.

Preference is also given to mixtures comprising as biopesticide II (component 2) a biopesticide selected from group L4), preferably methyl jasmonate.

Preference is also given to mixtures comprising as biopesticide II (component 2) a biopesticide selected from group L5), preferably selected from *A. lipoferum*, *A. irakense*, *A. halopraeferens*, *Paenibacillus alvei*, *Penicillium bilaiae, Rhizobium leguminosarum* bv. *phaseoli*, *R. l.* bv. *trifolii*, *R. l.* bv. *viciae*, and *Sinorhizobium meliloti*.

Preference is also given to mixtures comprising as biopesticide II (component 2) a biopesticide selected from group L5) selected from *B. japonicum* TA-11, *Paenibacillus alvei* NAS6G6, *Peniciillium bilaiae* strains ATCC 18309, ATCC 20851 and ATCC 22348; *Rhizobium leguminosarum* bv. *phaseoli* RG-B10, *R. l.* bv. *viciae* P1NP3Cst, *R. l.* bv. *viciae* R^G-P2, *R. l.* bv. *trifolii* RP113-7, *R. l.* bv. *viciae* SU303, *R. l.* bv. *viciae* WSM1455, and *Sinorhizobium meliloti*;

The present invention also relates to mixtures, wherein the at least one biopesticide II is selected from *A. lipoferum*, *A. irakense* and *A. halopraeferens*, These mixtures are particularly suitable in rice and soybean, especially as seed treatment.

The present invention also relates to mixtures, wherein the at least one biopesticide II is selected from *A. lipoferum*, *A. irakense* and *A. halopraeferens*, These mixtures are particularly suitable for controlling rice pests.

In one embodiment, component 2), i.e. the biopesticide II, of the mixtures of the invention is selected from *Azospirillum lipoferum*, *Azospirillum irakense*, *Azospirillum halopraeferens*, *Bradyrhizobium* spp., *Bradyrhizobium* sp. (Arachis), *Bradyrhizobium* sp. (Vigna), *Bradyrhizobium liaoningense*, *Bradyrhizobium lupini*, *Delftia acidovorans*, *Glomus intraradices*, *Mesorhizobium* sp., *Mesorhizobium ciceri*, *Mesorhizobium huakii*, *Mesorhizobium loti*, *Rhizobium leguminosarum* bv. *phaseoli*, *Rhizobium leguminosarum* bv. *trifolii*, *Rhizobium leguminosarum* bv. *viciae*, *Sinorhizobium meliloti*, *Bacillus altitudinis, Bacillus amyloliquefaciens*, *Bacillus amyloliquefaciens* ssp. *plantarum*, *Bacillus firmus*, *Bacillus megaterium*, *Bacillus mojavensis*, *Bacillus mycoides*, *Bacillus pumilus*, *Bacillus simplex*, *Bacillus solisalsi*, *Bacillus subtilis*, *Burkholderia* sp., *Coniothyrium minitans*, *Paecilomyces lilacinus*, *Paenibacillus alvei*, *Paenibacillus polymyxa*, *Paenibacillus popilliae*, *Pasteuria nishizawae*, *Pasteuria usgae*, *Penicillium bilaiae*, *Pseudomonas chloraphis*, *Pseudomonas fluorescens*, *Pseudomonas putida*, abscisic acid, harpin protein (alpha-beta), jasmonic acid or salts or derivatives thereof, cis-jasmone, methyl jasmonate.

In a preferred embodiment, component 2), i.e. the biopesticide II, of the mixtures of the invention is selected from *Bradyrhizobium* sp. (Arachis) CB1015, *Bradyrhizobium* sp. (Arachis) SEMIA 6144, *Bradyrhizobium* sp. (Arachis) SEMIA 6462, *Bradyrhizobium* sp. (Arachis) SEMIA 6464, *Bradyrhizobium* sp. (Vigna) PNL1, *Mesorhizobium* sp. WSM1497, *Rhizobium leguminosarum* bv. *phaseoli* RG-B10, *Rhizobium leguminosarum* bv. *trifolii* 095, *Rhizobium leguminosarum* bv. *trifolii* CB782, *Rhizobium leguminosarum* bv. *trifolii* CC1099, *Rhizobium leguminosarum* bv. *trifolii* CC275e, *Rhizobium leguminosarum* bv. *trifolii* CC283b, *Rhizobium leguminosarum* bv. *trifolii* RP113-7, *Rhizobium leguminosarum* bv. *trifolii* TA1, *Rhizobium leguminosarum* bv. *trifolii* WSM1325, *Rhizobium leguminosarum* bv. *trifolii* WSM2304, *Rhizobium leguminosarum* bv. *viciae* P1NP3Cst also referred to as 1435, *Rhizobium leguminosarum* bv. *viciae* RG-P2 also called P2, *Rhizobium leguminosarum* bv. *viciae* SU303, *Rhizobium leguminosarum* bv. *viciae* WSM1455, *Sinorhizobium meliloti* NRG185, *Sinorhizobium meliloti* RCR2011 also called 2011 or SU47, *Sinorhizobium meliloti*, RRI128, *Bacillus altitudinis* 41KF2b, *Bacillus amyloliquefaciens* AP-136, *Bacillus amyloliquefaciens* AP-188, *Bacillus amyloliquefaciens* AP-218, *Bacillus amyloliquefaciens* AP-219, *Bacillus amyloliquefaciens* AP-295, *Bacillus amyloliquefaciens* ssp. *plantarum* D747, *Bacillus amyloliquefaciens* ssp. *plantarum* FZB24 also called SB3651, *Bacillus amyloliquefaciens* ssp. *plantarum* FZB42, *Bacillus amyloliquefaciens* ssp. *plantarum* GB03 also called GBO3 formerly *B. subtilis*, *Bacillus amyloliquefaciens* ssp. *plantarum* MBI600 also referred to as 1430, formerly *B. subtilis*, *Bacillus amyloliquefaciens* ssp. *plantarum* QST-713, formerly *B. subtilis*, *Bacillus amyloliquefaciens* ssp. *plantarum* TJ1000, also called 1BE, *Bacillus firmus* CNCM I-1582, *Bacillus megaterium* H491, *Bacillus megaterium* J142, *Bacillus megaterium* M018, *Bacillus mojavensis* AP-209, *Bacillus mojavensis* SR11, *Bacillus mycoides* AQ726, *Bacillus mycoides* J also called BmJ, *Bacillus pumilus* GB34, *Bacillus pumilus* GHA 180, *Bacillus pumilus* INR-7 otherwise referred to as BU F22 and BU-F33, *Bacillus*

pumilus KFP9F, *Bacillus pumilus* QST 2808, *Bacillus simplex* ABU 288, *Bacillus subtilis* CX-9060, *Bacillus subtilis* FB17, *Bacillus subtilis* GB07, *Burkholderia* sp. A396, *Coniothyrium minitans* CON/M/91-08, *Paecilomyces lilacinus* 251, *Paecilomyces lilacinus* BCP2, *Paenibacillus alvei* NAS6G6, *Paenibacillus polymyxa* PKB1, *Paenibacillus popilliae* 14F-D80 also called K14F-0080, *Paenibacillus popilliae* KLN 3, *Pasteuria nishizawae* Pn1, *Pasteuria* sp. Ph3, *Pasteuria* sp. Pr3, *Pasteuria* sp. ATCC PTA-9643, *Pasteuria usage* BL1, *Penicillium bilaiae* (also called *P. bilaii*) NRRL 50162, *Penicillium bilaiae* (also called *P. bilaii*) NRRL 50169, *Penicillium bilaiae* (also called *P. bilaii*) ATCC 18309 (= ATCC 74319), *Penicillium bilaiae* (also called *P. bilaii*) ATCC 20851, *Penicillium bilaiae* (also called *P. bilaii*) ATCC 22348 (=ATCC 74318), *Pseudomonas fluorescens* A506, *Pseudomonas fluorescens* ATCC 13525, *Pseudomonas fluorescens* CHA0, *Pseudomonas fluorescens* CL 145A, *Pseudomonas fluorescens* NCIB 12089, *Pseudomonas fluorescens* Pf-5, *Pseudomonas fluorescens* WCS374, *Pseudomonas putida* ATCC 202153.

In one embodiment, component 2), i.e. the biopesticide II, of the mixtures of the invention is selected from

L1) Microbial pesticides with fungicidal, bactericidal, viricidal and/or plant defense activator activity: *Ampelomyces quisqualis*, *Aspergillus flavus*, *Aureobasidium pullulans*, *Bacillus altitudinis, B. amyloliquefaciens*, *B. megaterium*, *B. mojavensis*, *B. mycoides*, *B. pumilus*, *B. simplex*, *B. solisalsi*, *B. subtilis*, *B. subtilis* var. *amyloliquefaciens*, *Candida oleophila*, *C. saitoana*, *Clavibacter michiganensis* (bacteriophages), *Coniothyrium minitans*, *Cryphonectria parasitica*, *Dilophosphora alopecuri*, *Fusarium oxysporum*, *Clonostachys rosea* f. *catenulate* (also named *Gliocladium catenulatum*), *Gliocladium roseum*, *Lysobacter antibioticus*, *L. enzymogenes*, *Metschnikowia fructicola*, *Microdochium dimerum*, *Microsphaeropsis ochracea*, *Muscodor albus*, *Paenibacillus alvei*, *Paenibacillus polymyxa*, *Pantoea vagans*, *Penicillium bilaiae*, *P.steckii*, *Phlebiopsis gigantea*, *Pseudomonas* sp., *Pseudomonas chloraphis*, *Pseudozyma flocculosa*, *Pichia anomala*, *Pythium oligandrum*, *Sphaerodes mycoparasitica*, *Streptomyces griseoviridis*, *S. lydicus*, *S. violaceusniger*, *Talaromyces flavus*, *Trichoderma asperelloides, T. asperellum*, *T. atroviride*, *T. fertile*, *T. gamsii*, *T. harmatum*, *T. harzianum*, *T. polysporum*, *T. stromaticum*, *T. virens*, *T. viride*, *Typhula phacorrhiza*, *Ulocladium oudemansii*, *Verticillium dahlia*;

L2) Biochemical pesticides with fungicidal, bactericidal, viricidal and/or plant defense activator activity: harpin protein, *Reynoutria sachalinensis* extract;

L3) Microbial pesticides with insecticidal, acaricidal, molluscidal and/or nematicidal activity: *Agrobacterium radiobacter*, *Bacillus cereus*, *B. firmus*, *Burkholderia* sp., *Chromobacterium subtsugae*, *Flavobacterium* sp., *Paecilomyces fumosoroseus, P. lilacinus*, *Paenibacillus popilliae*, *Pasteuria* sp., *P. nishizawae*, *P. penetrans*, *P. ramosa*, *P. thornea*, *P. usgae*, *Pseudomonas fluorescens*, *Streptomyces galbus*, *S. microflavus*;

L4) Biochemical pesticides with insecticidal, acaricidal, molluscidal, pheromone and/or nematicidal activity: cis-jasmone, methyl jasmonate, jasmonic acid or salts or derivatives thereof;

L5) Microbial pesticides with plant stress reducing, plant growth regulator, plant growth promoting and/or yield enhancing activity: *A. lipoferum*, *A. irakense*, *A. halopraeferens*, *Bradyrhizobium* sp., *B. liaoningense*, *B. lupini*, *Delftia acidovorans*, *Glomus intraradices*,

Mesorhizobium sp., *Rhizobium leguminosarum* bv. *phaseoli*, *R. l.* bv. *trifolii*, *R. l.* bv. *viciae*, *Sinorhizobium meliloti.*

In a preferred embodiment, component 2), i.e. the biopesticide II, of the mixtures of the invention is selected from the group L1, i.e. microbial pesticides with fungicidal, bactericidal, viricidal and/or plant defense activator activity: *Ampelomyces quisqualis*, *Aspergillus flavus*, *Aureobasidium pullulans*, *Bacillus altitudinis, B. amyloliquefaciens*, *B. megaterium*, *B. mojavensis*, *B. mycoides*, *B. pumilus*, *B. simplex*, *B. solisalsi*, *B. subtilis*, *B. subtilis* var. *amyloliquefaciens*, *Candida oleophila*, *C. saitoana*, *Clavibacter michiganensis* (bacteriophages), *Coniothyrium minitans*, *Cryphonectria parasitica*, *Dilophosphora alopecuri*, *Fusarium oxysporum*, *Clonostachys rosea* f. *catenulate* (also named *Gliocladium catenulatum*), *Gliocladium roseum*, *Lysobacter antibioticus*, *L. enzymogenes*, *Metschnikowia fructicola*, *Microdochium dimerum*, *Microsphaeropsis ochracea*, *Muscodor albus*, *Paenibacillus alvei*, *Paenibacillus polymyxa*, *Pantoea vagans*, *Penicillium bilaiae*, *P.steckii*, *Phlebiopsis gigantea*, *Pseudomonas* sp., *Pseudomonas chloraphis*, *Pseudozyma flocculosa*, *Pichia anomala*, *Pythium oligandrum*, *Sphaerodes mycoparasitica*, *Streptomyces griseoviridis*, *S. lydicus*, *S. violaceusniger*, *Talaromyces flavus*, *Trichoderma asperelloides, T. asperellum*, *T. atroviride*, *T. fertile*, *T. gamsii*, *T. harmatum*, *T. harzianum*, *T. polysporum*, *T. stromaticum*, *T. virens*, *T. viride*, *Typhula phacorrhiza*, *Ulocladium oudemansii*, *Verticillium dahlia*.

In a more preferred embodiment, component 2), i.e. the biopesticide II, of the mixtures of the invention is selected from *Bacillus amyloliquefaciens*, *Bacillus pumilus*, *Bacillus simplex*, and *Bacillus subtilis*, in particular from the strains *Bacillus amyloliquefaciens* MBI600, *B. amyloliquefaciens* AP-188, *Bacillus pumilus* INR-7 (otherwise referred to as BU-F22 and BU-F33), *Bacillus simplex* ABU 288, and *Bacillus subtilis* FB17 (also called UD 1022 or UD10-22).

According to one particularly preferred embodiment, the biopesticide II of the mixtures of the invention is *Bacillus pumilus*, preferably spores of strain INR-7.

According to another particularly preferred embodiment, the biopesticide II of the mixtures of the invention is *Bacillus simplex*, preferably spores of strain ABU 288.

According to another particularly preferred embodiment, the biopesticide II of the mixtures of the invention is *Bacillus subtilis*, preferably spores of strain FB17.

In a further preferred embodiment, component 2), i.e. the biopesticide II, of the mixture of the invention is *Penicillium steckii*, preferably *Penicillium steckii* strain IBWF104-06 as deposited with DSMZ under the deposit number DSM 27859. Strain IBWF104-06 was determined to have potent antifungal activity, in particular, against infestion with plant pathogens including Phytophthora infestans, Botrytis cinerea and Alternaria solani (PCT/EP2014/074165).

In another preferred embodiment, component 2), i.e. the biopesticide II, of the mixtures of the invention is selected from the group L2, i.e. biochemical pesticides with fungicidal, bactericidal, viricidal and/or plant defense activator activity: harpin protein, *Reynoutria sachalinensis* extract.

According to one particularly preferred embodiment, the biopesticide II of the mixture of the invention is harpin protein (alpha-beta).

In another preferred embodiment, component 2), i.e. the biopesticide II, of the mixtures of the invention is selected from the group L4, i.e. biochemical pesticides with insecticidal, acaricidal, molluscidal, pheromone and/or nematicidal activity: cis-jasmone, methyl jasmonate, jasmonic acid or salts or derivatives thereof.

According to one particularly preferred embodiment, the biopesticide II of the mixtures of the invention is cis-jasmone.

According to another particularly preferred embodiment, the biopesticide II of the mixture of the invention is methyl jasmonate.

According to another particularly preferred embodiment, the biopesticide II of the mixture of the invention is jasmonic acid or a salt or derivative thereof.

In a particularly preferred embodiment, component 2), i.e. the biopesticide II, of the mixtures of the invention is selected from the group L3, i.e. microbial pesticides with insecticidal, acaricidal, molluscidal and/or nematicidal activity: *Agrobacterium radiobacter*, *Bacillus cereus*, *B. firmus*, *Burkholderia* sp., *Chromobacterium subtsugae*, *Flavobacterium* sp., *Paecilomyces fumosoroseus, P. lilacinus*, *Paenibacillus popilliae*, *Pasteuria* sp., *P. nishizawae*, *P. penetrans*, *P. ramosa*, *P. thornea*, *P. usgae*, *Pseudomonas fluorescens*, *Streptomyces galbus*, *S. microflavus*.

In a more preferred embodiment, component 2), i.e. the biopesticide II, of the mixtures of the invention is selected from *Bacillus firmus*, *Pasteuria nishazawa* sp., *Flavobacterium* sp., *Paecilomyces lilacinus*, and *Burkholderia* sp, in particular from the strains *Burkholderia* sp. A396, *Paecilomyces lilacinus* 251, *Bacillus firmus* CNCM I-1582, *Pasteuria nishizawae* Pn1, and *Flavobacterium* sp. H492.

In an even more preferred embodiment, component 2), i.e. the biopesticide II, of the mixtures of the invention is selected from *Bacillus firmus*, *Pasteuria nishizawa*, and *Flavobacterium* sp., in particular from the strains *Bacillus firmus* CNCM I-1582, *Pasteuria nishizawae* Pn1, and *Flavobacterium sp.* H492.

According to one particularly preferred embodiment, the biopesticide II of the mixtures of the invention is *Bacillus cereus*, preferably spores of strain CNCM I-1562.

According to another particularly preferred embodiment, the biopesticide II of the mixtures of the invention is *Burkholderia* sp., preferably strain A396.

According to another particularly preferred embodiment, the biopesticide II of the mixtures of the invention is *Paecilomyces lilacinus*, preferably strain 251, DSM 15169 or BCP2, particularly preferably strain 251.

With regard to one embodiment of the present invention, which is the use of mixtures according to the present invention for the control of nematodes, the compound I is preferably combined with biopesticides II having a nematicidal activity.

According to another particularly preferred embodiment, the biopesticide II of the mixtures of the invention is *Bacillus firmus*, preferably spores of strain CNCM I-1582; e.g. VOTiVO® from Bayer CropScience LP, USA, which is suitable for nematode control.

According to another particularly preferred embodiment, the biopesticide II of the mixtures of the invention is *Pasteuria nishizawae*, preferably spores of strain Pn1, e.g. Clariva® PN from Syngenta Crop Protection, LLC, USA, which is suitable for nematode control.

According to yet another particularly preferred embodiment, the biopesticide II of the mixtures of the invention is *Flavobacterium sp.*, preferably spores of strain H492, e.g. MBI-302 from Marrone Bio Innovations, USA, which is suitable for nematode control.

In summary, particularly preferred biopesticides II may be selected from the following biopesticides II-1 to II-14 in accordance with each row of table II, of which biopesticides II-12, II-13, and

II-14 are particularly preferred, biopesticides II-15, II-16, and II-17 are particularly preferred, II-17 and II-18 are most preferred.

Table II

No	biopesticide
II-1	*Bacillus amyloliquefaciens*
II-2	*Bacillus pumilus*
II-3	*Bacillus simplex*
II-4	*Bacillus subtilis*
II-5	*Penicillium steckii*
II-6	harpin protein (alpha-beta)
II-7	cis-jasmone
II-8	methyl jasmonate
II-9	jasmonic acid or a salt or derivative thereof

No	biopesticide
II-10	*Burkholderia* sp.
II-11	*Paecilomyces lilacinus*
II-12	*Bacillus firmus*
II-13	*Pasteuria nishizawae*
II-14	*Flavobacterium sp.*
II-15	*Bacillus thuringiensis*
II-16	*cydia pomonella granulosis virus*
II-17	*Beauveria bassiana*
II-18	Steinernema feltia

Furthermore, particularly preferred strains of biopesticides II may be selected from the following biopesticide strains IIa-1 to IIa-11 in accordance with each row of table IIa, of which the biopesticide strains IIa-9, IIa-10, and IIa-11 are particularly preferred.

Table IIa

No	biopesticide
IIa-1	*Bacillus amyloliquefaciens* MBI600
IIa-2	*Bacillus amyloliquefaciens* AP-188
IIa-3	*Bacillus pumilus* INR-7
IIa-4	*Bacillus simplex* ABU 288
IIa-5	*Bacillus subtilis* FB17

No	biopesticide
IIa-6	*Penicillium steckii* IBWF104-06
IIa-7	*Burkholderia* sp. A396
IIa-8	*Paecilomyces lilacinus* 251
IIa-9	*Bacillus firmus* CNCM I-1582
IIa-10	*Pasteuria nishizawae* Pn1
IIa-11	*Flavobacterium sp.* H492

A preferred embodiment of the invention relates to pesticidal mixtures wherein compound of formula I is selected from compounds I-1 to I-3:

(I-1): Racemic compound of formula I,

(I-2): Compound of formula I-R-1, and

(I-3): Compound of formula I with enantiomeric excess of the compound I-R-1, wherein the the compound I-R-1 is present in an amount from >98% to <100%, and the compound I-S-1 is present in an amount from <2% to >0%.

In the context of the present invention, the following mixtures of compounds I, preferably compound of formula I, and biopesticides II as in Table A are preferred and represent embodiments of the invention:

Table A

No.	Compound	Compound II
A-1	I-1	II-1
A-2	I-1	II-2
A-3	I-1	II-3
A-4	I-1	II-4
A-5	I-1	II-5

No.	Compound	Compound II
A-6	I-1	II-6
A-7	I-1	II-7
A-8	I-1	II-8
A-9	I-1	II-9
A-10	I-1	II-10

No.	Compound	Compound II
A-11	I-1	II-11
A-12	I-1	II-12
A-13	I-1	II-13
A-14	I-1	II-14
A-15	I-1	II-15
A-16	I-1	II-16
A-17	I-1	II-17
A-18	I-2	II-1
A-19	I-2	II-2
A-20	I-2	II-3
A-21	I-2	II-4
A-22	I-2	II-5
A-23	I-2	II-6
A-24	I-2	II-7
A-25	I-2	II-8
A-26	I-2	II-9
A-27	I-2	II-10
A-28	I-2	II-11
A-29	I-2	II-12
A-30	I-2	II-13
A-31	I-2	II-14
A-32	I-2	II-15
A-33	I-2	II-16
A-34	I-2	II-17
A-35	I-2	II-18
A-36	I-3	II-1
A-37	I-3	II-2
A-38	I-3	II-3
A-39	I-3	II-4
A-40	I-3	II-5
A-41	I-3	II-6
A-42	I-3	II-7
A-43	I-3	II-8
A-44	I-3	II-9
A-45	I-3	II-10
A-46	I-3	II-11
A-47	I-3	II-12
A-48	I-3	II-13
A-49	I-3	II-14
A-50	I-3	II-15
A-51	I-3	II-16
A-52	I-3	II-17
A-53	I-3	II-18

The mixtures A-1 to A-53 as presented in table A represents binary mixtures according to the present invention.

Furthermore, the following mixtures of compound I, preferably compound i of formula I, and biopesticide strains IIa, as in Table B are preferred and represent embodiments of the invention:

Table B

No.	Compound	Compound II
B-1	I-1	IIa-1
B-2	I-1	IIa-2
B-3	I-1	IIa-3
B-4	I-1	IIa-4
B-5	I-1	IIa-5
B-6	I-1	IIa-6
B-7	I-1	IIa-7
B-8	I-1	IIa-8
B-9	I-1	IIa-9
B-10	I-1	IIa-10
B-11	I-1	IIa-11
B-12	I-2	IIa-1
B-13	I-2	IIa-2
B-14	I-2	IIa-3
B-15	I-2	IIa-4
B-16	I-2	IIa-5
B-17	I-2	IIa-6
B-18	I-2	IIa-7
B-19	I-2	IIa-8
B-20	I-2	IIa-9
B-21	I-2	IIa-10
B-22	I-2	IIa-11
B-23	I-3	IIa-1
B-24	I-3	IIa-2
B-25	I-3	IIa-3
B-26	I-3	IIa-4
B-27	I-3	IIa-5
B-28	I-3	IIa-6
B-29	I-3	IIa-7
B-30	I-3	IIa-8
B-31	I-3	IIa-9
B-32	I-3	IIa-10
B-33	I-3	IIa-11

The mixtures B-1 to B-33 as presented in table B represents binary mixtures according to the present invention.

According to the invention, the solid material (dry matter) of the biopesticides are considered as active components (e. g. to be obtained after drying or evaporation of the extraction or suspension medium in case of liquid formulations of the microbial pesticides).

In accordance with the present invention, the weight ratios and percentages used herein for a biological extract such as Quillay extract are based on the total weight of the dry content (solid material) of the respective extract(s).

The total weight ratios of compositions comprising at least one microbial pesticide in the form of viable microbial cells including dormant forms, can be determined using the amount of CFU of the respective microorganism to calclulate the total weight of the respective active component with the following equation that 1 x 10^{10} CFU equals one gram of total weight of the respective active component. Colony forming unit is measure of viable microbial cells, in particular fungal and bacterial cells. In addition, here “CFU” may also be understood as the number of (juvenile) individual nematodes in case of (entomopathogenic) nematode biopesticides, such as *Steinernema feltiae*.

These ratios are also suitable for inventive mixtures applied by seed treatment.

In an embodiment of the present invention the composition comprises a mixture of component 1), and at least one biopesticide selected from the group L.1.1 to L.1.113 in the ratio of (10000-n):1 to 1: (10000-n) where n is a number from 0 to 9998.

In an embodiment of the present invention the composition comprises a mixture of component 1), and at least one biopesticide selected from the group L.2.1 to L.2.11 in the ratio of (10000-n):1 to 1: (10000-n) where n is a number from 0 to 9998.

In an embodiment of the present invention the composition comprises a mixture of component 1), and at least one biopesticide selected from the group L.3.1 to L.3.70 in the ratio of (10000-n):1 to 1: (10000-n) where n is a number from 0 to 9998.

In an embodiment of the present invention the composition comprises a mixture of component 1), and at least one biopesticide selected from the group L.4.1 to L.4.36 in the ratio of (10000-n):1 to 1: (10000-n) where n is a number from 0 to 9998.

In an embodiment of the present invention the composition comprises a mixture of component 1), and at least one biopesticide selected from the group L.5.1 to L.5.86 in the ratio of (10000-n):1 to 1: (10000-n) where n is a number from 0 to 9998.

In an embodiment of the present invention the composition comprises a mixture of component 1), and at least one biopesticide selected from the group L.6.1 to L.6.16 in the ratio of (10000-n):1 to 1: (10000-n) where n is a number from 0 to 9998.

As already indicated above, component 1), the compound of formula I or the compound of formula I with enantiomeric excess of the compound I-R-1 or the compound I-R-1, and component 2) of the mixtures of the invention are present in synergistically effective amounts.

In one embodiment, component 1), the compound of formula I or the compound of formula I with enantiomeric excess of the compound I-R-1 or the compound I-R-1, and component 2) of the mixtures of the invention are present in a total weight ratio of from 1:10000 to 10000:1, preferably from 100:1 to 1:100, wherein the total weight of component 2) is based on the amount of the solid material (dry mater) of component 2).

In the binary mixtures and compositions according to the invention the weight ratio of the component 1), the compound of formula I or the compound of formula I with enantiomeric excess of the compound I-R-1 or the compound I-R-1, and the component 2) generally depends from the properties of the active components used, usually it is in the range of from 1:10000 to 10000:1, often it is in the range of from 1:100 to 100:1, regularly in the range of from 1:50 to 50:1, preferably in the range of from 1:20 to 20:1, more preferably in the range of from 1:10 to 10:1, even more preferably in the range of from 1:4 to 4:1 and in particular in the range of from 1:2 to 2:1.

According to further embodiments of the binary mixtures and compositions, the weight ratio of the component 1), the compound of formula I or the compound of formula I with enantiomeric excess of the compound I-R-1 or the compound I-R-1, and the component 2) usually is in the range of from 1000:1 to 1:1, often in the range of from 100: 1 to 1:1, regularly in the range of from 50:1 to 1:1, preferably in the range of from 20:1 to 1:1, more preferably in the range of from 10:1 to 1:1, even more preferably in the range of from 4:1 to 1:1 and in particular in the range of from 2:1 to 1:1.

According to further embodiments of the mixtures and compositions, the weight ratio of the component 1), the compound of formula I or the compound of formula I with enantiomeric excess of the compound I-R-1 or the compound I-R-1, and the component 2) usually is in the

range of from 20,000:1 to 1:10, often in the range of from 10,000:1 to 1:1, regularly in the range of from 5,000:1 to 5:1, preferably in the range of from 5,000:1 to 10:1, more preferably in the range of from 2,000:1 to 30:1, even more preferably in the range of from 2,000:1 to 100:1 and in particular in the range of from 1,000:1 to 100:1.

According to a further embodiments of the binary mixtures and compositions, the weight ratio of the component 1), the compound of formula I or the compound of formula I with enantiomeric excess of the compound I-R-1 or the compound I-R-1, and the component 2) usually is in the range of from 1:1 to 1:1000, often in the range of from 1:1 to 1:100, regularly in the range of from 1:1 to 1:50, preferably in the range of from 1:1 to 1:20, more preferably in the range of from 1:1 to 1:10, even more preferably in the range of from 1:1 to 1:4 and in particular in the range of from 1:1 to 1:2.

According to further embodiments of the mixtures and compositions, the weight ratio of the component 1), the compound of formula I or the compound of formula I with enantiomeric excess of the compound I-R-1 or the compound I-R-1, and the component 2) usually is in the range of from 10:1 to 1:20,000, often in the range of from 1:1 to 1:10,000, regularly in the range of from 1:5 to 1:5,000, preferably in the range of from 1:10 to 1:5,000, more preferably in the range of from 1:30 to 1:2,000, even more preferably in the range of from 1:100 to 1:2,000 to and in particular in the range of from 1:100 to 1:1,000.

In the ternary mixtures, i.e. compositions according to the invention comprising the component 1), the compound of formula I or the compound of formula I with enantiomeric excess of the compound I-R-1 or the compound I-R-1, and component 2) and a compound III (component 3), the weight ratio of component 1), the compound of formula I or the compound of formula I with enantiomeric excess of the compound I-R-1 or the compound I-R-1, and component 2) depends from the properties of the active substances used, usually it is in the range of from 1:100 to 100:1, regularly in the range of from 1:50 to 50:1, preferably in the range of from 1:20 to 20:1, more preferably in the range of from 1:10 to 10:1 and in particular in the range of from 1:4 to 4:1, and the weight ratio of component 1), the compound of formula I or the compound of formula I with enantiomeric excess of the compound I-R-1 or the compound I-R-1, and component 3) usually it is in the range of from 1:100 to 100:1, regularly in the range of from 1:50 to 50:1, preferably in the range of from 1:20 to 20:1, more preferably in the range of from 1:10 to 10:1 and in particular in the range of from 1:4 to 4:1.

Any further active components are, if desired, added in a ratio of from 20:1 to 1:20 to the component 1), the compound of formula I or the compound of formula I with enantiomeric excess of the compound I-R-1 or the compound I-R-1.

These ratios are also suitable for inventive mixtures applied by seed treatment.

When mixtures comprising microbial pesticides are employed in crop protection, the application rates preferably range from about 1 x 10^6 to 5 x 10^{15} (or more) CFU/ha, preferably from about 1 x 10^8 to about 1 x 10^{13} CFU/ha, and even more preferably from about 1 x 10^9 to about 1 x 10^{12} CFU/ha. In the case of (entomopathogenic) nematodes as microbial pesticides (e. g. Steinernema feltiae), the application rates preferably range inform about 1 x 10^5 to 1 x 10^{12} (or more), more preferably from 1 x 10^8 to 1 x 10^{11}, even more preferably from 5 x 10^8 to 1 x 10^{10} individuals (e. g. in the form of eggs, juvenile or any other live stages, preferably in an infetive juvenile stage) per ha.

When mixtures comprising microbial pesticides are employed in seed treatment, the application rates with respect to plant propagation material preferably range from about 1 x 10^6 to 1 x 10^{12} (or more) CFU/seed. Preferably, the concentration is about 1 x 10^6 to about 1 x 10^9 CFU/seed. In the case of the microbial pesticides II, the application rates with respect to plant propagation material also preferably range from about 1 x 10^7 to 1 x 10^{14} (or more) CFU per 100 kg of seed, preferably from 1 x 10^9 to about 1 x 10^{12} CFU per 100 kg of seed.

Binary mixtures have been described above as one embodiment of the present invention.

Ternary or higher mixtures represent another embodiment of the present invention.

In one embodiment, the mixtures of the invention, in particular the mixtures A-1 to A-51 or B-1 to B-33, further comprise as active component 3) a further active compound III as mixing partner, which is selected from known pesticides.

Mixing partners i.e.the component 3) can be selected from known pesticides, in particular insecticides, nematicides, and acaricides, fungicides, herbicides, plant growth regulators, fertilizers. Preferred mixing partners are insecticides, nematicides and fungicides.

The following list M of known pesticides, together with which the mixtures of the invention can be used and with which potential synergistic effects might be produced, is intended to illustrate the possible combinations, but not to impose any limitation:

M.1 Acetylcholine esterase (AChE) inhibitors: M.1A carbamates, e.g. aldicarb, alanycarb, bendiocarb, benfuracarb, butocarboxim, butoxycarboxim, carbaryl, carbofuran, carbosulfan, ethiofencarb, fenobucarb, formetanate, furathiocarb, isoprocarb, methiocarb, methomyl, metolcarb, oxamyl, pirimicarb, propoxur, thiodicarb, thiofanox, trimethacarb, XMC, xylylcarb and triazamate; or M.1B organophosphates, e.g. acephate, azamethiphos, azinphos-ethyl, azinphosmethyl, cadusafos, chlorethoxyfos, chlorfenvinphos, chlormephos, chlorpyrifos, chlorpyrifos-methyl, coumaphos, cyanophos, demeton-S-methyl, diazinon, dichlorvos/ DDVP, dicrotophos, dimethoate, dimethylvinphos, disulfoton, EPN, ethion, ethoprophos, famphur, fenamiphos, fenitrothion, fenthion, fosthiazate, heptenophos, imicyafos, isofenphos, isopropyl O-(methoxyaminothio-phosphoryl) salicylate, isoxathion, malathion, mecarbam, methamidophos, methidathion, mevinphos, monocrotophos, naled, omethoate, oxydemeton-methyl, parathion, parathion-methyl, phenthoate, phorate, phosalone, phosmet, phosphamidon, phoxim, pirimiphos- methyl, profenofos, propetamphos, prothiofos, pyraclofos, pyridaphenthion, quinalphos, sulfotep, tebupirimfos, temephos, terbufos, tetrachlorvinphos, thiometon, triazophos, trichlorfon, and vamidothion;

M.2. GABA-gated chloride channel antagonists: M.2A cyclodiene organochlorine compounds, e.g. endosulfan or chlordane; or M.2B fiproles (phenylpyrazoles), e.g. ethiprole, fipronil, flufiprole, pyrafluprole, and pyriprole;

M.3 Sodium channel modulators from the class of M.3A pyrethroids, e.g. acrinathrin, allethrin, d-cis-trans allethrin, d-trans allethrin, bifenthrin (in particular kappa-bifenthrin), bioallethrin, bioallethrin S-cylclopentenyl, bioresmethrin, cycloprothrin, cyfluthrin, beta-cyfluthrin, cyhalothrin, lambda-cyhalothrin, gamma-cyhalothrin, cypermethrin, alpha-cypermethrin, beta-cypermethrin, theta-cypermethrin, zeta-cypermethrin, cyphenothrin, deltamethrin, empenthrin, esfenvalerate, etofenprox, fenpropathrin, fenvalerate, flucythrinate, flumethrin, tau-fluvalinate, halfenprox, heptafluthrin, imiprothrin, meperfluthrin, metofluthrin, momfluorothrin (in particular epsilon-momfluorothrin), permethrin, phenothrin, prallethrin, profluthrin, pyrethrin (pyrethrum), resmethrin,

silafluofen, tefluthrin (in particular kappa-tefluthrin), tetramethylfluthrin, tetramethrin, tralomethrin, and transfluthrin; or M.3B sodium channel modulators such as DDT or methoxychlor;

M.4 Nicotinic acetylcholine receptor agonists (nAChR): M.4A neonicotinoids, e.g. acetamiprid, clothianidin, cycloxaprid, dinotefuran, imidacloprid, nitenpyram, thiacloprid and thiamethoxam; or the compounds M.4A.1 4,5-Dihydro-N-nitro-1-(2-oxiranylmethyl)-1H-imidazol-2-amine, M.4A.2: (2E-)-1-[(6-Chloropyridin-3-yl)methyl]-N'-nitro-2-pentylidenehydrazinecarboximidamide; or M4.A.3: 1-[(6-Chloropyridin-3-yl)methyl]-7-methyl-8-nitro-5-propoxy-1,2,3,5,6,7-hexahydroimidazo[1,2-a]pyridine; or M.4B nicotine; M.4C sulfoxaflor; M.4D flupyradifurone; M.4E triflumezopyrim;

M.5 Nicotinic acetylcholine receptor allosteric activators: spinosyns, e.g. spinosad or spinetoram;

M.6 Chloride channel activators from the class of avermectins and milbemycins, e.g. abamectin, emamectin benzoate, ivermectin, lepimectin, or milbemectin;

M.7 Juvenile hormone mimics, such as M.7A juvenile hormone analogues hydroprene, kinoprene, and methoprene; or M.7B fenoxycarb, or M.7C pyriproxyfen;

M.8 miscellaneous non-specific (multi-site) inhibitors, e.g. M.8A alkyl halides as methyl bromide and other alkyl halides, M.8B chloropicrin, M.8C sulfuryl fluoride, M.8D borax, or M.8E tartar emetic;

M.9 Chordotonal organ TRPV channel modulators, e.g. M.9B pymetrozine; pyrifluquinazon;

M.10 Mite growth inhibitors, e.g. M.10A clofentezine, hexythiazox, and diflovidazin, or M.10B etoxazole;

M.12 Inhibitors of mitochondrial ATP synthase, e.g. M.12A diafenthiuron, or M.12B organotin miticides such as azocyclotin, cyhexatin, or fenbutatin oxide, M.12C propargite, or M.12D tetradifon;

M.13 Uncouplers of oxidative phosphorylation via disruption of the proton gradient, e.g. chlorfenapyr, DNOC, or sulfluramid;

M.14 Nicotinic acetylcholine receptor (nAChR) channel blockers, e.g. nereistoxin analogues bensultap, cartap hydrochloride, thiocyclam, or thiosultap sodium;

M.15 Inhibitors of the chitin biosynthesis type 0, such as benzoylureas e.g. bistrifluron, chlorfluazuron, diflubenzuron, flucycloxuron, flufenoxuron, hexaflumuron, lufenuron, novaluron, noviflumuron, teflubenzuron, or triflumuron;

M.16 Inhibitors of the chitin biosynthesis type 1, e.g. buprofezin;

M.17 Moulting disruptors, Dipteran, e.g. cyromazine;

M.18 Ecdyson receptor agonists such as diacylhydrazines, e.g. methoxyfenozide, tebufenozide, halofenozide, fufenozide, or chromafenozide;

M.19 Octopamin receptor agonists, e.g. amitraz;

M.20 Mitochondrial complex III electron transport inhibitors, e.g. M.20A hydramethylnon, M.20B acequinocyl, M.20C fluacrypyrim; or M.20D bifenazate;

M.21 Mitochondrial complex I electron transport inhibitors, e.g. M.21A METI acaricides and insecticides such as fenazaquin, fenpyroximate, pyrimidifen, pyridaben, tebufenpyrad or tolfenpyrad, or M.21B rotenone;

M.22 Voltage-dependent sodium channel blockers, e.g. M.22A indoxacarb, M.22B metaflumizone, or M.22B.1: 2-[2-(4-Cyanophenyl)-1-[3-(trifluoromethyl)phenyl]ethylidene]-N-[4-

(difluoromethoxy)phenyl]-hydrazinecarboxamide or M.22B.2: N-(3-Chloro-2-methylphenyl)-2-[(4-chlorophenyl)[4-[methyl(methylsulfonyl)amino]phenyl]methylene]-hydrazinecarboxamide;

M.23 Inhibitors of the of acetyl CoA carboxylase, such as Tetronic and Tetramic acid derivatives, e.g. spirodiclofen, spiromesifen, or spirotetramat; M.23.1 spiropidion

M.24 Mitochondrial complex IV electron transport inhibitors, e.g. M.24A phosphine such as aluminium phosphide, calcium phosphide, phosphine or zinc phosphide, or M.24B cyanide;

M.25 Mitochondrial complex II electron transport inhibitors, such as beta-ketonitrile derivatives, e.g. cyenopyrafen or cyflumetofen;

M.28 Ryanodine receptor-modulators from the class of diamides, e.g. flubendiamide, chlorantraniliprole, cyantraniliprole, tetraniliprole, M.28.1: (R)-3-Chlor-N1-{2-methyl-4-[1,2,2,2 –tetrafluoro-1-(trifluoromethyl)ethyl]phenyl}-N2-(1-methyl-2-methylsulfonylethyl)phthalamid, M.28.2: (S)-3-Chloro-N1-{2-methyl-4-[1,2,2,2-tetrafluoro-1-(trifluoromethyl)ethyl]phenyl}-N2-(1-methyl-2-methylsulfonylethyl)phthalamid, M.28.3: cyclaniliprole, or M.28.4: methyl-2-[3,5-dibromo-2-({[3-bromo-1-(3-chlorpyridin-2-yl)-1H-pyrazol-5-yl]carbonyl}amino)benzoyl]-1,2-dimethylhydrazinecarboxylate; or M.28.5a) N-[4,6-dichloro-2-[(diethyl-lambda-4-sulfanylidene)carbamoyl]-phenyl]-2-(3-chloro-2-pyridyl)-5-(trifluoromethyl)pyrazole-3-carboxamide; M.28.5b) N-[4-chloro-2-[(diethyl-lambda-4-sulfanylidene)carbamoyl]-6-methyl-phenyl]-2-(3-chloro-2-pyridyl)-5-(trifluoromethyl)pyrazole-3-carboxamide; M.28.5c) N-[4-chloro-2-[(di-2-propyl-lambda-4-sulfanylidene)carbamoyl]-6-methyl-phenyl]-2-(3-chloro-2-pyridyl)-5-(trifluoromethyl)pyrazole-3-carboxamide; M.28.5d) N-[4,6-dichloro-2-[(di-2-propyl-lambda-4-sulfanylidene)carbamoyl]-phenyl]-2-(3-chloro-2-pyridyl)-5-(trifluoromethyl)pyrazole-3-carboxamide; M.28.5h) N-[4,6-dibromo-2-[(diethyl-lambda-4-sulfanylidene)carbamoyl]-phenyl]-2-(3-chloro-2-pyridyl)-5-(trifluoromethyl)pyrazole-3-carboxamide; M.28.5i) N-[2-(5-Amino-1,3,4-thiadiazol-2-yl)-4-chloro-6-methylphenyl]-3-bromo-1-(3-chloro-2-pyridinyl)-1H-pyrazole-5-carboxamide; M.28.5j) 3-Chloro-1-(3-chloro-2-pyridinyl)-N-[2,4-dichloro-6-[[(1-cyano-1-methylethyl)amino]carbonyl]phenyl]-1H-pyrazole-5-carboxamide; M.28.5k) 3-Bromo-N-[2,4-dichloro-6-(methylcarbamoyl)phenyl]-1-(3,5-dichloro-2-pyridyl)-1H-pyrazole-5-carboxamide; M.28.5l) N-[4-Chloro-2-[[(1,1-dimethylethyl)amino]carbonyl]-6-methyl-phenyl]-1-(3-chloro-2-pyridinyl)-3-(fluoromethoxy)-1H-pyrazole-5-carboxamide; or

M.28.6: cyhalodiamide; or

M.29: Chordotonal organ Modulators – undefined target site, e.g. flonicamid;

M.UN. insecticidal active compounds of unknown or uncertain mode of action, e.g. afidopyropen, afoxolaner, azadirachtin, amidoflumet, benzoximate, broflanilide, bromopropylate, chinomethionat, cryolite, dicloromezotiaz, dicofol, flufenerim, flometoquin, fluensulfone, fluhexafon, fluopyram, fluralaner, metoxadiazone, piperonyl butoxide, pyflubumide, pyridalyl, tioxazafen,

M.UN.3: 11-(4-chloro-2,6-dimethylphenyl)-12-hydroxy-1,4-dioxa-9-azadispiro[4.2.4.2]-tetradec-11-en-10-one,

M.UN.4: 3-(4'-fluoro-2,4-dimethylbiphenyl-3-yl)-4-hydroxy-8-oxa-1-azaspiro[4.5]dec-3-en-2-one,

M.UN.5: 1-[2-fluoro-4-methyl-5-[(2,2,2-trifluoroethyl)sulfinyl]phenyl]-3-(trifluoromethyl)-1H-1,2,4-triazole-5-amine, or actives on basis of *bacillus firmus* (Votivo, I-1582);

M.UN.6: flupyrimin;

M.UN.8: fluazaindolizine; M.UN.9.a): 4-[5-(3,5-dichlorophenyl)-5-(trifluoromethyl)-4H-isoxazol-3-yl]-2-methyl-N-(1-oxothietan-3-yl)benzamide; M.UN.9.b): fluxametamide; M.UN.10: 5-[3-[2,6-dichloro-4-(3,3-dichloroallyloxy)phenoxy]propoxy]-1H-pyrazole;

M.UN.11.b) 3-(benzoylmethylamino)-N-[2-bromo-4-[1,2,2,3,3,3-hexafluoro-1-(trifluoromethyl)propyl]-6-(trifluoromethyl)phenyl]-2-fluoro-benzamide; M.UN.11.c) 3-(benzoylmethylamino)-2-fluoro-N-[2-iodo-4-[1,2,2,2-tetrafluoro-1-(trifluoromethyl)ethyl]-6-(trifluoromethyl)phenyl]-benzamide; M.UN.11.d) N-[3-[[[2-iodo-4-[1,2,2,2-tetrafluoro-1-(trifluoromethyl)ethyl]-6-(trifluoromethyl)phenyl]amino]carbonyl]phenyl]-N-methyl-benzamide; M.UN.11.e) N-[3-[[[2-bromo-4-[1,2,2,2-tetrafluoro-1-(trifluoromethyl)ethyl]-6-(trifluoromethyl)phenyl]amino]carbonyl]-2-fluoro-phenyl]-4-fluoro-N-methyl-benzamide; M.UN.11.f) 4-fluoro-N-[2-fluoro-3-[[[2-iodo-4-[1,2,2,2-tetrafluoro-1-(trifluoromethyl)ethyl]-6-(trifluoromethyl)phenyl]amino]carbonyl]phenyl]-N-methyl-benzamide; M.UN.11.g) 3-fluoro-N-[2-fluoro-3-[[[2-iodo-4-[1,2,2,2-tetrafluoro-1-(trifluoromethyl)-ethyl]-6-(trifluoromethyl)phenyl]amino]carbonyl]phenyl]-N-methyl-benzamide; M.UN.11.h) 2-chloro-N-[3-[[[2-iodo-4-[1,2,2,2-tetrafluoro-1-(trifluoromethyl)ethyl]-6-(trifluoromethyl)phenyl]amino]carbonyl]phenyl]- 3-pyridinecarboxamide; M.UN.11.i) 4-cyano-N-[2-cyano-5-[[2,6-dibromo-4-[1,2,2,3,3,3-hexafluoro-1-(trifluoromethyl)propyl]phenyl]carbamoyl]phenyl]-2-methyl-benzamide; M.UN.11.j) 4-cyano-3-[(4-cyano-2-methyl-benzoyl)amino]-N-[2,6-dichloro-4-[1,2,2,3,3,3-hexafluoro-1-(trifluoromethyl)propyl]phenyl]-2-fluoro-benzamide; M.UN.11.k) N-[5-[[2-chloro-6-cyano-4-[1,2,2,3,3,3-hexafluoro-1-(trifluoromethyl)propyl]phenyl]carbamoyl]-2-cyano-phenyl]-4-cyano-2-methyl-benzamide; M.UN.11.l) N-[5-[[2-bromo-6-chloro-4-[2,2,2-trifluoro-1-hydroxy-1-(trifluoromethyl)ethyl]phenyl]carbamoyl]-2-cyano-phenyl]-4-cyano-2-methyl-benzamide; M.UN.11.m) N-[5-[[2-bromo-6-chloro-4-[1,2,2,3,3,3-hexafluoro-1-(trifluoromethyl)propyl]phenyl]carbamoyl]-2-cyano-phenyl]-4-cyano-2-methyl-benzamide; M.UN.11.n) 4-cyano-N-[2-cyano-5-[[2,6-dichloro-4-[1,2,2,3,3,3-hexafluoro-1-(trifluoromethyl)propyl]phenyl]carbamoyl]phenyl]-2-methyl-benzamide; M.UN.11.o) 4-cyano-N-[2-cyano-5-[[2,6-dichloro-4-[1,2,2,2-tetrafluoro-1-(trifluoromethyl)ethyl]phenyl]carbamoyl]phenyl]-2-methyl-benzamide; M.UN.11.p) N-[5-[[2-bromo-6-chloro-4-[1,2,2,2-tetrafluoro-1-(trifluoromethyl)ethyl]phenyl]carbamoyl]-2-cyano-phenyl]-4-cyano-2-methyl-benzamide; or

M.UN.12.a) 2-(1,3-Dioxan-2-yl)-6-[2-(3-pyridinyl)-5-thiazolyl]-pyridine; M.UN.12.b) 2-[6-[2-(5-Fluoro-3-pyridinyl)-5-thiazolyl]-2-pyridinyl]-pyrimidine; M.UN.12.c) 2-[6-[2-(3-Pyridinyl)-5-thiazolyl]-2-pyridinyl]-pyrimidine; M.UN.12.d) N-Methylsulfonyl-6-[2-(3-pyridyl)thiazol-5-yl]pyridine-2-carboxamide; M.UN.12.e) N-Methylsulfonyl-6-[2-(3-pyridyl)thiazol-5-yl]pyridine-2-carboxamide; M.UN.12.f) N-Ethyl-N-[4-methyl-2-(3-pyridyl)thiazol-5-yl]-3-methylthio-propanamide; M.UN.12.g) N-Methyl-N-[4-methyl-2-(3-pyridyl)thiazol-5-yl]-3-methylthio-propanamide; M.UN.12.h) N,2-Dimethyl-N-[4-methyl-2-(3-pyridyl)thiazol-5-yl]-3-methylthio-propanamide; M.UN.12.i) N-Ethyl-2-methyl-N-[4-methyl-2-(3-pyridyl)thiazol-5-yl]-3-methylthio-propanamide; M.UN.12.j) N-[4-Chloro-2-(3-pyridyl)thiazol-5-yl]-N-ethyl-2-methyl-3-methylthio-propanamide; M.UN.12.k) N-[4-Chloro-2-(3-pyridyl)thiazol-5-yl]-N,2-dimethyl-3-methylthio-propanamide; M.UN.12.l) N-[4-Chloro-2-(3-pyridyl)thiazol-5-yl]-N-methyl-3-methylthio-propanamide; M.UN.12.m) N-[4-Chloro-2-(3-pyridyl)thiazol-5-yl]-N-ethyl-3-methylthio-propanamide;

M.UN.14a) 1-[(6-Chloro-3-pyridinyl)methyl]-1,2,3,5,6,7-hexahydro-5-methoxy-7-methyl-8-nitro-imidazo[1,2-a]pyridine; or M.UN.14b) 1-[(6-Chloropyridin-3-yl)methyl]-7-methyl-8-nitro-1,2,3,5,6,7-hexahydroimidazo[1,2-a]pyridin-5-ol;

M.UN.16a) 1-isopropyl-N,5-dimethyl-N-pyridazin-4-yl-pyrazole-4-carboxamide; or M.UN.16b) 1-(1,2-dimethylpropyl)-N-ethyl-5-methyl-N-pyridazin-4-yl-pyrazole-4-carboxamide; M.UN.16c) N,5-dimethyl-N-pyridazin-4-yl-1-(2,2,2-trifluoro-1-methyl-ethyl)pyrazole-4-carboxamide; M.UN.16d) 1-[1-(1-cyanocyclopropyl)ethyl]-N-ethyl-5-methyl-N-pyridazin-4-yl-pyrazole-4-carboxamide; M.UN.16e) N-ethyl-1-(2-fluoro-1-methyl-propyl)-5-methyl-N-pyridazin-4-yl-pyrazole-4-carboxamide; M.UN.16f) 1-(1,2-dimethylpropyl)-N,5-dimethyl-N-pyridazin-4-yl-pyrazole-4-carboxamide; M.UN.16g) 1-[1-(1-cyanocyclopropyl)ethyl]-N,5-dimethyl-N-pyridazin-4-yl-pyrazole-4-carboxamide; M.UN.16h) N-methyl-1-(2-fluoro-1-methyl-propyl]-5-methyl-N-pyridazin-4-yl-pyrazole-4-carboxamide; M.UN.16i) 1-(4,4-difluorocyclohexyl)-N-ethyl-5-methyl-N-pyridazin-4-yl-pyrazole-4-carboxamide; or M.UN.16j) 1-(4,4-difluorocyclohexyl)-N,5-dimethyl-N-pyridazin-4-yl-pyrazole-4-carboxamide,

M.UN.17a) N-(1-methylethyl)-2-(3-pyridinyl)-2H-indazole-4-carboxamide; M.UN.17b) N-cyclopropyl-2-(3-pyridinyl)-2H-indazole-4-carboxamide; M.UN.17c) N-cyclohexyl-2-(3-pyridinyl)-2H-indazole-4-carboxamide; M.UN.17d) 2-(3-pyridinyl)-N-(2,2,2-trifluoroethyl)-2H-indazole-4-carboxamide; M.UN.17e) 2-(3-pyridinyl)-N-[(tetrahydro-2-furanyl)methyl]-2H-indazole-5-carboxamide; M.UN.17f) methyl 2-[[2-(3-pyridinyl)-2H-indazol-5-yl]carbonyl]hydrazinecarboxylate; M.UN.17g) N-[(2,2-difluorocyclopropyl)methyl]-2-(3-pyridinyl)-2H-indazole-5-carboxamide; M.UN.17h) N-(2,2-difluoropropyl)-2-(3-pyridinyl)-2H-indazole-5-carboxamide; M.UN.17i) 2-(3-pyridinyl)-N-(2-pyrimidinylmethyl)-2H-indazole-5-carboxamide; M.UN.17j) N-[(5-methyl-2-pyrazinyl)methyl]-2-(3-pyridinyl)-2H-indazole-5-carboxamide,

M.UN.18a) N-[3-chloro-1-(3-pyridyl)pyrazol-4-yl]-N-ethyl-3-(3,3,3-trifluoropropylsulfanyl)propanamide; M.UN.18b) N-[3-chloro-1-(3-pyridyl)pyrazol-4-yl]-N-ethyl-3-(3,3,3-trifluoropropylsulfinyl)propanamide; M.UN.18c) N-[3-chloro-1-(3-pyridyl)pyrazol-4-yl]-3-[(2,2-difluorocyclopropyl)methylsulfanyl]-N-ethyl-propanamide; M.UN.18d) N-[3-chloro-1-(3-pyridyl)pyrazol-4-yl]-3-[(2,2-difluorocyclopropyl)methylsulfinyl]-N-ethyl-propanamide;

M.UN.19 sarolaner, M.UN.20 lotilaner;

M.UN.21 N-[4-Chloro-3-[[(phenylmethyl)amino]carbonyl]phenyl]-1-methyl-3-(1,1,2,2,2-pentafluoroethyl)-4-(trifluoromethyl)-1H-pyrazole-5-carboxamide; M.UN.22a 2-(3-ethylsulfonyl-2-pyridyl)-3-methyl-6-(trifluoromethyl)imidazo[4,5-b]pyridine, or M.UN.22b 2-[3-ethylsulfonyl-5-(trifluoromethyl)-2-pyridyl]-3-methyl-6-(trifluoromethyl)imidazo[4,5-b]pyridine;

M.UN.23a 4-[5-(3,5-dichlorophenyl)-5-(trifluoromethyl)-4H-isoxazol-3-yl]-N-[(4R)-2-ethyl-3-oxo-isoxazolidin-4-yl]-2-methyl-benzamide, or M.UN.23b 4-[5-(3,5-dichloro-4-fluoro-phenyl)-5-(trifluoromethyl)-4H-isoxazol-3-yl]-N-[(4R)-2-ethyl-3-oxo-isoxazolidin-4-yl]-2-methyl-benzamide;

M.UN.24a) N-[4-chloro-3-(cyclopropylcarbamoyl)phenyl]-2-methyl-5-(1,1,2,2,2-pentafluoroethyl)-4-(trifluoromethyl)pyrazole-3-carboxamide or M.UN.24b) N-[4-chloro-3-[(1-cyanocyclopropyl)carbamoyl]phenyl]-2-methyl-5-(1,1,2,2,2-pentafluoroethyl)-4-(trifluoromethyl)pyrazole-3-carboxamide; M.UN.25 acynonapyr; M.UN.26 benzpyrimoxan; M.UN.27 2-chloro-N-(1-cyanocyclopropyl)-5-[1-[2-methyl-5-(1,1,2,2,2-pentafluoroethyl)-4-(trifluoromethyl)pyrazol-3-yl]pyrazol-4-yl]benzamide; M.UN.28 oxazosulfyl (2-(3-ethylsulfonyl-2-pyridyl)-5-(trifluoromethylsulfonyl)-1,3-benzoxazole); M.UN.29 Tetrachlorantraniliprole; M.UN.30 Tyclopyrazoflor;

A) Respiration inhibitors

- Inhibitors of complex III at Qo site: azoxystrobin (A.1.1), coumethoxystrobin (A.1.2), coumoxystrobin (A.1.3), dimoxystrobin (A.1.4), enestroburin (A.1.5), fenaminstrobin (A.1.6),

fenoxystrobin/flufenoxystrobin (A.1.7), fluoxastrobin (A.1.8), kresoxim-methyl (A.1.9), mandestrobin (A.1.10), metominostrobin (A.1.11), orysastrobin (A.1.12), picoxystrobin (A.1.13), pyraclostrobin (A.1.14), pyrametostrobin (A.1.15), pyraoxystrobin (A.1.16), trifloxystrobin (A.1.17), 2 (2-(3-(2,6-dichlorophenyl)-1-methyl-allylideneaminooxymethyl)-phenyl)-2 methoxyimino-N methyl-acetamide (A.1.18), pyribencarb (A.1.19), triclopyricarb/chlorodincarb (A.1.20), famoxadone (A.1.21), fenamidone (A.1.21), methyl-N-[2-[(1,4-dimethyl-5 phenyl-pyrazol-3-yl)oxylmethyl]phenyl]-N-methoxy-carbamate (A.1.22), 1-[3-chloro-2 [[1 (4-chlorophenyl)-1H-pyrazol-3-yl]oxymethyl]phenyl]-4-methyl-tetrazol-5-one (A.1.23), 1-[3-bromo-2-[[1-(4-chlorophenyl)pyrazol-3-yl]oxymethyl]phenyl]-4-methyl-tetrazol-5-one (A.1.24), 1-[2-[[1-(4-chlorophenyl)pyrazol-3-yl]oxymethyl]-3-methyl-phenyl]-4-methyl-tetrazol-5-one (A.1.25), 1-[2-[[1-(4-chlorophenyl)pyrazol-3-yl]oxymethyl]-3-fluoro-phenyl]-4-methyl-tetrazol-5-one (A.1.26), 1-[2-[[1-(2,4-dichlorophenyl)pyrazol-3-yl]oxymethyl]-3-fluoro-phenyl]-4-methyl-tetrazol-5-one (A.1.27), 1-[3-cyclopropyl-2-[[2-methyl-4 (1 methylpyrazol-3-yl)phenoxy]methyl]phenyl]-4 methyl-tetrazol-5-one (A.1.30), 1 [3 (difluoromethoxy)-2-[[2-methyl-4-(1 methylpyrazol-3 yl)phenoxy]methyl]phenyl]-4 methyl-tetrazol-5-one (A.1.31), 1-methyl-4-[3-methyl-2 [[2 methyl-4-(1-methylpyrazol-3 yl)phenoxy]methyl]phenyl]tetrazol-5-one (A.1.32), (Z,2E)-5-[1-(2,4-dichlorophenyl)pyrazol-3-yl]-oxy-2-methoxyimino-N,3-dimethyl-pent-3-enamide (A.1.34), (Z,2E) 5 [1 (4-chlorophenyl)pyrazol-3-yl]oxy-2-methoxyimino-N,3-dimethyl-pent-3-enamide (A.1.35), pyriminostrobin (A.1.36), bifujunzhi (A.1.37), 2-(ortho-((2,5-dimethylphenyl-oxy-methylen)phenyl)-3-methoxy-acrylic acid methylester (A.1.38);

- inhibitors of complex III at Qi site: cyazofamid (A.2.1), amisulbrom (A.2.2), [(6S,7R,8R) 8 benzyl-3-[(3-hydroxy-4-methoxy-pyridine-2-carbonyl)amino]-6-methyl-4,9-dioxo-1,5-dioxonan-7-yl] 2-methylpropanoate (A.2.3), fenpicoxamid (A.2.4);
- inhibitors of complex II: benodanil (A.3.1), benzovindiflupyr (A.3.2), bixafen (A.3.3), boscalid (A.3.4), carboxin (A.3.5), fenfuram (A.3.6), fluopyram (A.3.7), flutolanil (A.3.8), fluxapyroxad (A.3.9), furametpyr (A.3.10), isofetamid (A.3.11), isopyrazam (A.3.12), mepronil (A.3.13), oxycarboxin (A.3.14), penflufen (A.3.15), penthiopyrad (A.3.16), pydiflumetofen (A.3.17), pyraziflumid (A.3.18), sedaxane (A.3.19), tecloftalam (A.3.20), thifluzamide (A.3.21), 3 (difluoromethyl)-1-methyl-N-(1,1,3-trimethylindan-4-yl)pyrazole-4 carboxamide (A.3.22), 3 (trifluoromethyl)-1-methyl-N-(1,1,3-trimethylindan-4-yl)pyrazole-4 carboxamide (A.3.23), 1,3-dimethyl-N-(1,1,3-trimethylindan-4-yl)pyrazole-4-carboxamide (A.3.24), 3-(trifluoromethyl)-1,5 dimethyl-N-(1,1,3-trimethylindan-4-yl)pyrazole-4-carboxamide (A.3.25), 1,3,5-trimethyl-N-(1,1,3-trimethylindan-4-yl)pyrazole-4-carboxamide (A.3.26), 3-(difluoromethyl)-1,5 dimethyl-N-(1,1,3-trimethylindan-4-yl)pyrazole-4-carboxamide (A.3.27), 3-(difluoromethyl)-N (7 fluoro-1,1,3-trimethyl-indan-4-yl)-1-methyl-pyrazole-4-carboxamide (A.3.28), N-[(5-chloro-2-isopropyl-phenyl)methyl]-N-cyclopropyl-5-fluoro-1,3-dimethyl-pyrazole-4-carboxamide (A.3.29), methyl (E)-2-[2-[(5-cyano-2-methyl-phenoxy)methyl]phenyl]-3-methoxy-prop-2 enoate (A.3.30), N-[(5-chloro-2-isopropyl-phenyl)methyl]-N-cyclopropyl-3-(difluoromethyl)-5 fluoro-1-methyl-pyrazole-4-carboxamide (A.3.31), 2-(difluoromethyl)-N-(1,1,3-trimethyl-indan-4-yl)pyridine-3-carboxamide (A.3.32), 2-(difluoromethyl)-N-[(3R)-1,1,3-trimethylindan-4-yl]pyridine-3-carboxamide (A.3.33), 2-(difluoromethyl)-N-(3-ethyl-1,1-dimethyl-indan-4-yl)pyridine-3-carboxamide (A.3.34), 2-(difluoromethyl)-N-[(3R)-3-ethyl-1,1-dimethyl-indan-4-yl]pyridine-3-carboxamide (A.3.35), 2-(difluoromethyl)-N-(1,1-dimethyl-3-propyl-indan-4-yl)pyridine-3-carboxamide (A.3.36), 2-(difluoromethyl)-N-[(3R)-1,1-dimethyl-3-propyl-indan-4-yl]pyridine-3-carboxamide (A.3.37), 2-(difluoromethyl)-N-(3-isobutyl-1,1-dimethyl-

indan-4-yl)pyridine-3-carboxamide (A.3.38), 2-(difluoromethyl)-N-[(3R)-3-isobutyl-1,1-dimethyl-indan-4 yl]pyridine-3-carboxamide (A.3.39);

- other respiration inhibitors: diflumetorim (A.4.1); nitrophenyl derivates: binapacryl (A.4.2), dinobuton (A.4.3), dinocap (A.4.4), fluazinam (A.4.5), meptyldinocap (A.4.6), ferimzone (A.4.7); organometal compounds: fentin salts, e. g. fentin-acetate (A.4.8), fentin chloride (A.4.9) or fentin hydroxide (A.4.10); ametoctradin (A.4.11); silthiofam (A.4.12);

B) Sterol biosynthesis inhibitors (SBI fungicides)

- C14 demethylase inhibitors: triazoles: azaconazole (B.1.1), bitertanol (B.1.2), bromu-conazole (B.1.3), cyproconazole (B.1.4), difenoconazole (B.1.5), diniconazole (B.1.6), diniconazole-M (B.1.7), epoxiconazole (B.1.8), fenbuconazole (B.1.9), fluquinconazole (B.1.10), flusilazole (B.1.11), flutriafol (B.1.12), hexaconazole (B.1.13), imibenconazole (B.1.14), ipconazole (B.1.15), metconazole (B.1.17), myclobutanil (B.1.18), oxpoconazole (B.1.19), paclobutrazole (B.1.20), penconazole (B.1.21), propiconazole (B.1.22), prothioconazole (B.1.23), simeconazole (B.1.24), tebuconazole (B.1.25), tetraconazole (B.1.26), triadimefon (B.1.27), triadimenol (B.1.28), triticonazole (B.1.29), uniconazole (B.1.30), ipfentrifluconazole, (B.1.37), mefentrifluconazole (B.1.38), 2-(chloromethyl)-2-methyl-5-(p-tolylmethyl)-1 (1,2,4-triazol-1-ylmethyl)cyclopentanol (B.1.43); imidazoles: imazalil (B.1.44), pefurazoate (B.1.45), prochloraz (B.1.46), triflumizol (B.1.47); pyrimidines, pyridines and piperazines: fenarimol (B.1.49), pyrifenox (B.1.50), triforine (B.1.51), [3-(4-chloro-2-fluoro-phenyl)-5-(2,4-difluorophenyl)isoxazol-4-yl]-(3-pyridyl)methanol (B.1.52);
- Delta14-reductase inhibitors: aldimorph (B.2.1), dodemorph (B.2.2), dodemorph-acetate (B.2.3), fenpropimorph (B.2.4), tridemorph (B.2.5), fenpropidin (B.2.6), piperalin (B.2.7), spiroxamine (B.2.8);
- Inhibitors of 3-keto reductase: fenhexamid (B.3.1);
- Other Sterol biosynthesis inhibitors: chlorphenomizole (B.4.1);

C) Nucleic acid synthesis inhibitors

- phenylamides or acyl amino acid fungicides: benalaxyl (C.1.1), benalaxyl-M (C.1.2), kiralaxyl (C.1.3), metalaxyl (C.1.4), metalaxyl-M (C.1.5), ofurace (C.1.6), oxadixyl (C.1.7);
- other nucleic acid synthesis inhibitors: hymexazole (C.2.1), octhilinone (C.2.2), oxolinic acid (C.2.3), bupirimate (C.2.4), 5-fluorocytosine (C.2.5), 5-fluoro-2-(p-tolylmethoxy)pyrimidin-4 amine (C.2.6), 5-fluoro-2-(4-fluorophenylmethoxy)pyrimidin-4 amine (C.2.7), 5-fluoro-2 (4 chlorophenylmethoxy)pyrimidin-4 amine (C.2.8);

D) Inhibitors of cell division and cytoskeleton

- tubulin inhibitors: benomyl (D.1.1), carbendazim (D.1.2), fuberidazole (D1.3), thiabendazole (D.1.4), thiophanate-methyl (D.1.5), 3-chloro-4-(2,6-difluorophenyl)-6-methyl-5-phenyl-pyridazine (D.1.6), 3-chloro-6-methyl-5-phenyl-4-(2,4,6-trifluorophenyl)pyridazine (D.1.7), N ethyl-2-[(3-ethynyl-8-methyl-6-quinolyl)oxy]butanamide (D.1.8), N-ethyl-2-[(3-ethynyl-8 methyl-6 quinolyl)oxy]-2-methylsulfanyl-acetamide (D.1.9), 2-[(3-ethynyl-8-methyl-6-quinol-yl)oxy]-N (2-fluoroethyl)butanamide (D.1.10), 2-[(3-ethynyl-8-methyl-6-quinolyl)oxy]-N-(2-flu-oroethyl)-2-methoxy-acetamide (D.1.11), 2-[(3-ethynyl-8-methyl-6-quinolyl)oxy]-N-propyl-butanamide (D.1.12), 2-[(3-ethynyl-8-methyl-6-quinolyl)oxy]-2-methoxy-N-propyl-acetamide (D.1.13), 2-[(3-ethynyl-8-methyl-6-quinolyl)oxy]-2-methylsulfanyl-N-propyl-acetamide (D.1.14), 2 [(3 ethynyl-8-methyl-6-quinolyl)oxy]-N-(2-fluoroethyl)-2-methylsulfanyl-acetamide (D.1.15), 4-(2-bromo-4-

fluoro-phenyl)-N-(2-chloro-6-fluoro-phenyl)-2,5-dimethyl-pyrazol-3 amine (D.1.16);

- other cell division inhibitors: diethofencarb (D.2.1), ethaboxam (D.2.2), pencycuron (D.2.3), fluopicolide (D.2.4), zoxamide (D.2.5), metrafenone (D.2.6), pyriofenone (D.2.7);

E) Inhibitors of amino acid and protein synthesis

- methionine synthesis inhibitors: cyprodinil (E.1.1), mepanipyrim (E.1.2), pyrimethanil (E.1.3);
- protein synthesis inhibitors: blasticidin-S (E.2.1), kasugamycin (E.2.2), kasugamycin hydrochloride-hydrate (E.2.3), mildiomycin (E.2.4), streptomycin (E.2.5), oxytetracyclin (E.2.6);

F) Signal transduction inhibitors

- MAP / histidine kinase inhibitors: fluoroimid (F.1.1), iprodione (F.1.2), procymidone (F.1.3), vinclozolin (F.1.4), fludioxonil (F.1.5);
- G protein inhibitors: quinoxyfen (F.2.1);

G) Lipid and membrane synthesis inhibitors

- Phospholipid biosynthesis inhibitors: edifenphos (G.1.1), iprobenfos (G.1.2), pyrazophos (G.1.3), isoprothiolane (G.1.4);
- lipid peroxidation: dicloran (G.2.1), quintozene (G.2.2), tecnazene (G.2.3), tolclofos-methyl (G.2.4), biphenyl (G.2.5), chloroneb (G.2.6), etridiazole (G.2.7);
- phospholipid biosynthesis and cell wall deposition: dimethomorph (G.3.1), flumorph (G.3.2), mandipropamid (G.3.3), pyrimorph (G.3.4), benthiavalicarb (G.3.5), iprovalicarb (G.3.6), valifenalate (G.3.7);
- compounds affecting cell membrane permeability and fatty acids: propamocarb (G.4.1);
- inhibitors of oxysterol binding protein: oxathiapiprolin (G.5.1), 2-{3-[2-(1-{[3,5-bis(difluoromethyl-1H-pyrazol-1-yl]acetyl}piperidin-4-yl)-1,3-thiazol-4-yl]-4,5-dihydro-1,2 oxazol-5-yl}phenyl methanesulfonate (G.5.2), 2-{3-[2-(1-{[3,5-bis(difluoromethyl)-1H-pyrazol-1-yl]acetyl}piperidin-4-yl) 1,3-thiazol-4-yl]-4,5-dihydro-1,2-oxazol-5 yl}-3-chlorophenyl methanesulfonate (G.5.3), 4-[1-[2-[3-(difluoromethyl)-5-methyl-pyrazol-1-yl]acetyl]-4-piperidyl]-N-tetralin-1-yl-pyridine-2-carboxamide (G.5.4), 4-[1-[2-[3,5-bis(difluoromethyl)pyrazol-1-yl]acetyl]-4-piperidyl]-N-tetralin-1-yl-pyridine-2-carboxamide (G.5.5), 4-[1-[2-[3-(difluoromethyl)-5-(trifluoromethyl)pyrazol-1-yl]acetyl]-4-piperidyl]-N-tetralin-1-yl-pyridine-2-carboxamide (G.5.6), 4-[1-[2-[5-cyclopropyl-3-(difluoromethyl)pyrazol-1-yl]acetyl]-4-piperidyl]-N-tetralin-1-yl-pyridine-2-carboxamide (G.5.7), 4-[1-[2-[5-methyl-3-(trifluoromethyl)pyrazol-1-yl]acetyl]-4-piperidyl]-N-tetralin-1-yl-pyridine-2-carboxamide (G.5.8), 4-[1-[2-[5-(difluoromethyl)-3-(trifluoromethyl)pyrazol-1-yl]acetyl]-4-piperidyl]-N-tetralin-1-yl-pyridine-2-carboxamide (G.5.9), 4 [1 [2-[3,5-bis(trifluoromethyl)pyrazol-1-yl]acetyl]-4-piperidyl]-N-tetralin-1-yl-pyridine-2-carboxamide (G.5.10), (4-[1-[2-[5-cyclopropyl-3-(trifluoromethyl)pyrazol-1-yl]acetyl]-4-piperidyl]-N-tetralin-1-yl-pyridine-2-carboxamide (G.5.11);

H) Inhibitors with Multi Site Action

- inorganic active substances: Bordeaux mixture (H.1.1), copper (H.1.2), copper acetate (H.1.3), copper hydroxide (H.1.4), copper oxychloride (H.1.5), basic copper sulfate (H.1.6), sulfur (H.1.7);
- thio- and dithiocarbamates: ferbam (H.2.1), mancozeb (H.2.2), maneb (H.2.3), metam (H.2.4), metiram (H.2.5), propineb (H.2.6), thiram (H.2.7), zineb (H.2.8), ziram (H.2.9);
- organochlorine compounds: anilazine (H.3.1), chlorothalonil (H.3.2), captafol (H.3.3), captan (H.3.4), folpet (H.3.5), dichlofluanid (H.3.6), dichlorophen (H.3.7), hexachlorobenzene

(H.3.8), pentachlorphenole (H.3.9) and its salts, phthalide (H.3.10), tolylfluanid (H.3.11);

- guanidines and others: guanidine (H.4.1), dodine (H.4.2), dodine free base (H.4.3), guazatine (H.4.4), guazatine-acetate (H.4.5), iminoctadine (H.4.6), iminoctadine-triacetate (H.4.7), iminoctadine-tris(albesilate) (H.4.8), dithianon (H.4.9), 2,6-dimethyl-1H,5H-[1,4]dithiino[2,3-c:5,6-c']dipyrrole-1,3,5,7(2H,6H)-tetraone (H.4.10);

I) Cell wall synthesis inhibitors

- inhibitors of glucan synthesis: validamycin (I.1.1), polyoxin B (I.1.2);
- melanin synthesis inhibitors: pyroquilon (I.2.1), tricyclazole (I.2.2), carpropamid (I.2.3), diclomet (I.2.4), fenoxanil (I.2.5);

J) Plant defence inducers

- acibenzolar-S-methyl (J.1.1), probenazole (J.1.2), isotianil (J.1.3), tiadinil (J.1.4), prohexadione-calcium (J.1.5); phosphonates: fosetyl (J.1.6), fosetyl-aluminum (J.1.7), phosphorous acid and its salts (J.1.8), calcium phosphonate (J.1.11), potassium phosphonate (J.1.12), potassium or sodium bicarbonate (J.1.9), 4 cyclopropyl-N-(2,4-dimethoxyphenyl)thiadiazole-5-carboxamide (J.1.10);

K) Unknown mode of action

- bronopol (K.1.1), chinomethionat (K.1.2), cyflufenamid (K.1.3), cymoxanil (K.1.4), dazomet (K.1.5), debacarb (K.1.6), diclocymet (K.1.7), diclomezine (K.1.8), difenzoquat (K.1.9), difenzoquat-methylsulfate (K.1.10), diphenylamin (K.1.11), fenitropan (K.1.12), fenpyrazamine (K.1.13), flumetover (K.1.14), flusulfamide (K.1.15), flutianil (K.1.16), harpin (K.1.17), metha-sulfocarb (K.1.18), nitrapyrin (K.1.19), nitrothal-isopropyl (K.1.20), tolprocarb (K.1.21), oxin-copper (K.1.22), proquinazid (K.1.23), tebufloquin (K.1.24), tecloftalam (K.1.25), triazoxide (K.1.26), N'-(4-(4-chloro-3-trifluoromethyl-phenoxy)-2,5-dimethyl-phenyl)-N-ethyl-N methyl formamidine (K.1.27), N' (4-(4-fluoro-3-trifluoromethyl-phenoxy)-2,5-dimethyl-phenyl)-N-ethyl-N-methyl formamidine (K.1.28), N'-[4-[[3-[(4-chlorophenyl)methyl]-1,2,4-thiadiazol-5-yl]oxy]-2,5-dimethyl-phenyl]-N-ethyl-N-methyl-formamidine (K.1.29), N'-(5-bromo-6-indan-2-yloxy-2-methyl-3-pyridyl)-N-ethyl-N-methyl-formamidine (K.1.30), N'-[5-bromo-6-[1-(3,5-difluorophenyl)ethoxy]-2-methyl-3-pyridyl]-N-ethyl-N-methyl-formamidine (K.1.31), N'-[5-bromo-6-(4-isopropylcyclohexoxy)-2-methyl-3-pyridyl]-N-ethyl-N-methyl-formamidine (K.1.32), N' [5 bromo-2-methyl-6-(1-phenylethoxy)-3-pyridyl]-N-ethyl-N-methyl-formamidine (K.1.33), N'-(2-methyl-5-trifluoromethyl-4-(3-trimethylsilanyl-propoxy)-phenyl)-N-ethyl-N-methyl formamidine (K.1.34), N'-(5-difluoromethyl-2 methyl-4-(3-trimethylsilanyl-propoxy)-phenyl)-N-ethyl-N-methyl formamidine (K.1.35), 2-(4-chloro-phenyl)-N-[4-(3,4-dimethoxy-phenyl)-isoxazol-5 yl]-2-prop-2-ynyloxy-acetamide (K.1.36), 3 [5-(4-chloro-phenyl)-2,3-dimethyl-isoxazolidin-3-yl]-pyridine (pyrisoxazole) (K.1.37), 3-[5-(4-methylphenyl)-2,3-dimethyl-isoxazolidin-3 yl]-pyridine (K.1.38), 5-chloro-1 (4,6-dimethoxy-pyrimidin-2-yl)-2-methyl-1H-benzoimidazole (K.1.39), ethyl (Z) 3 amino-2-cyano-3-phenyl-prop-2-enoate (K.1.40), picarbutrazox (K.1.41), pentyl N-[6-[[(Z)-[(1-methyltetrazol-5-yl)-phenyl-methylene]amino]oxymethyl]-2-pyridyl]carbamate (K.1.42), but-3-ynyl N-[6-[[(Z)-[(1-methyltetrazol-5-yl)-phenyl-methylene]amino]oxymethyl]-2-pyridyl]carbamate (K.1.43), 2-[2-[(7,8-difluoro-2-methyl-3-quinolyl)oxy]-6-fluoro-phenyl]propan-2-ol (K.1.44), 2-[2-fluoro-6-[(8-fluoro-2-methyl-3-quinolyl)oxy]phen-yl]propan-2-ol (K.1.45), quinofumelin (K.1.47), 9-fluoro-2,2-dimethyl-5-(3-quinolyl)-3H 1,4 benzoxazepine (K.1.49), 2-(6-benzyl-2-pyridyl)quinazoline (K.1.50), 2-[6-(3-fluoro-4 methoxy-phenyl)-5-methyl-2-pyridyl]quinazoline (K.1.51), dichlobentiazox (K.1.52), N'-(2,5-

dimethyl-4-phenoxy-phenyl)-N-ethyl-N-methyl-formamidine (K.1.53); dipymetitrone, isoflucypram; fluindapyr, inpyrfluxam, pyrifenamine.

The commercially available compounds of the mixing partners listed above may be found in The Pesticide Manual, 17th Edition, C. MacBean, British Crop Protection Council (2015) among other publications. The online Pesticide Manual is updated regularly and is accessible through http://bcpcdata.com/pesticide-manual.html.

Another online data base for pesticides providing the ISO common names is http://www.alanwood.net/pesticides.

The M.4 cycloxaprid is known from WO2010/069266 and WO2011/069456. M.4A.1 is known from CN 103814937; CN105367557, CN 105481839. M.4A.2, guadipyr, is known from WO 2013/003977, and M.4A.3 (approved as paichongding in China) is known from WO 2007/101369. M.22B.1 is described in CN10171577 and M.22B.2 in CN102126994. Spiropidion M.23.1 is known from WO 2014/191271. M.28.1 and M.28.2 are known from WO2007/101540. M.28.3 is described in WO2005/077934. M.28.4 is described in WO2007/043677. M.28.5a) to M.28.5d) and M.28.5h) are described in WO 2007/006670, WO2013/024009 and WO 2013/024010, M.28.5i) is described in WO2011/085575, M.28.5j) in WO2008/134969, M.28.5k) in US2011/046186 and M.28.5l) in WO2012/034403. M.28.6 can be found in WO2012/034472. M.UN.3 is known from WO2006/089633 and M.UN.4 from WO2008/067911. M.UN.5 is described in WO2006/043635, and biological control agents on the basis of *bacillus firmus* are described in WO2009/124707. Flupyrimin is described in WO2012/029672. M.UN.8 is known from WO2013/055584. M.UN.9.a) is described in WO2013/050317. M.UN.9.b) is described in WO2014/126208. M.UN.10 is known from WO2010/060379. Broflanilide and M.UN.11.b) to M.UN.11.h) are described in WO2010/018714, and M.UN.11i) to M.UN.11.p) in WO 2010/127926. M.UN.12.a) to M.UN.12.c) are known from WO2010/006713, M.UN.12.d) and M.UN.12.e) are known from WO2012/000896, and M.UN.12.f) to M.UN.12.m) from WO 2010/129497. M.UN.14a) and M.UN.14b) are known from WO2007/101369. M.UN.16.a) to M.UN.16h) are described in WO2010/034737, WO2012/084670, and WO2012/143317, resp., and M.UN.16i) and M.UN.16j) are described in WO2015/055497. M.UN.17a) to M.UN.17.j) are described in WO2015/038503. M.UN.18a) to M.UN.18d) are described in US2014/0213448. M.UN.19 is described in WO2014/036056. M.UN.20 is known from WO2014/090918. M.UN.21 is known from EP2910126. M.UN.22a and M.UN.22b are known from WO2015/059039 and WO2015/190316. M.UN.23a and M.UN.23b are known from WO2013/050302. M.UN.24a and M.UN.24b are known from WO2012/126766. Acynonapyr M.UN.25 is known from WO 2011/105506. Benzpyrimoxan M.UN.26 is known from WO2016/104516. M.UN.27 is known from WO2016174049. The compound M.29.28 is known from WO2017104592. The compound M.29.29 (CAS number- 1104384-14-6) and its pesticidal action is known from CN101333213, WO20103350. The compound M.29.30 (CAS number- 1477919-27-9) and its pesticidal action is known from WO201S/125S20.

The fungicides described by IUPAC nomenclature, their preparation and their pesticidal activity is also known (cf. Can. J. Plant Sci. 48(6), 587-94, 1968; EP-A 141 317; EP-A 152 031; EP-A 226 917; EP-A 243 970; EP-A 256 503; EP-A 428 941; EP-A 532 022; EP-A 1 028 125; EP-A 1 035 122; EP-A 1 201 648; EP-A 1 122 244, JP 2002316902; DE 19650197; DE 10021412; DE 102005009458; US 3,296,272; US 3,325,503; WO 98/46608; WO 99/14187; WO 99/24413;

WO 99/27783; WO 00/29404; WO 00/46148; WO 00/65913; WO 01/54501; WO 01/56358; WO 02/22583; WO 02/40431; WO 03/10149; WO 03/11853; WO 03/14103; WO 03/16286; WO 03/53145; WO 03/61388; WO 03/66609; WO 03/74491; WO 04/49804; WO 04/83193; WO 05/120234; WO 05/123689; WO 05/123690; WO 05/63721; WO 05/87772; WO 05/87773; WO 06/15866; WO 06/87325; WO 06/87343; WO 07/82098; WO 07/90624, WO 10/139271, WO 11/028657, WO2012/168188, WO 2007/006670, WO 2011/77514; WO13/047749, WO 10/069882, WO 13/047441, WO 03/16303, WO 09/90181, WO 13/007767, WO 13/010862, WO 13/127704, WO 13/024009, WO 13/024010 and WO 13/047441, WO 13/162072, WO 13/092224, WO 11/135833), CN 1907024, CN 1456054, CN 103387541, CN 1309897, WO 12/84812, CN 1907024, WO 09094442, WO 14/60177, WO 13/116251, WO 08/013622, WO 15/65922, WO 94/01546, EP 2865265, WO 07/129454, WO 12/165511, WO 11/081174, WO 13/47441).

The insecticides, which are hereinabove described by common names, are commercially available and may be found in The Pesticide Manual, 16th Edition, C. MacBean, British Crop Protection Council (2013) among other publications. The online Pesticide Manual is updated regularly and is accessible through http://bcpcdata.com/pesticide-manual.html. Another online data base for pesticides providing the ISO common names is http://www.alanwood.net/pesticides.

The fungicides, which are hereinafter described by common names, are commercially available and may be found in the database http://www.alanwood.net/pesticides

The user applies the composition according to the invention usually from a predosage device, a knapsack sprayer, a spray tank, a spray plane, or an irrigation system. Usually, the agrochemical composition is made up with water, buffer, and/or further auxiliaries to the desired application concentration and the ready-to-use spray liquor or the agrochemical composition according to the invention is thus obtained. Usually, 20 to 2000 liters, preferably 50 to 400 liters, of the ready-to-use spray liquor are applied per hectare of agricultural useful area.

Preferences regarding suitable formulations and auxiliaries, which may be present in such agricultural compositions are defined below.

According to one embodiment, individual components of the composition according to the invention such as parts of a kit or parts of a binary or ternary mixture may be mixed by the user himself in a spray tank or any other kind of vessel used for applications (e. g. seed treater drums, seed pelleting machinery, knapsack sprayer) and further auxiliaries may be added, if appropriate.

When living microorganisms, such as microbial pesticides from groups L1), L3) and L5), form part of such kit, it must be taken care that choice and amounts of the components (e. g. chemical pesticides) and of the further auxiliaries should not influence the viability of the microbial pesticides in the composition mixed by the user. Especially for bactericides and solvents, compatibility with the respective microbial pesticide has to be taken into account.

Consequently, one embodiment of the invention is a kit for preparing a usable pesticidal composition, the kit comprising a) a composition comprising component 1) , preferably compound of formula I as defined herein and at least one auxiliary; and b) a composition comprising component 2) as defined herein and at least one auxiliary; and optionally c) a composition comprising at least one auxiliary and optionally a further active component 3) as defined herein.

In a further embodiment, the present invention relates to a seed treatment composition comprising an auxiliary and a mixture of the invention, preferably any one of the mixtures A-1 to A-51 or B-1 to B-33 or M-1 to I-M-1450 or I-N-1 to I-N-1450 or I-O-1 to I-O-1450, wherein the auxiliary is preferably selected from the group consisting of surfactants, antifreezing agents, binders, and pigments, and is particularly preferably a surfactant or a binder.

In a preferred embodiment, the seed treatment composition is in the form of a flowable concentrate FS, a solution LS, a powder for dry treatment DS, a water dispersible powder for slurry treatment WS, a water-soluble powder SS, an emulsion ES or EC, or a gel formulation, and is preferably in the form of a flowable concentrate.

Further preferences regarding seed treatment compositions of the invention are defined below.

In one embodiment, the present invention relates to the use of a mixture of the invention, in particular a mixture selected from the mixtures A-1 to A-51 or B-1 to B-33 or M-1 to I-M-1450 or I-N-1 to I-N-1450 or I-O-1 to I-O-1450, or a seed treatment composition as defined above, for protecting a plant, plant propagation material, or soil or water, in which the plants are growing, against the attack or infestation by invertebrate pests.

In another embodiment, the present invention relates to a method for controlling invertebrate pests, which method comprises contacting the plant or the plant propagation material or the soil; the pests or their food supply, habitat or breeding grounds, with a pesticidally effective amount of a mixture of the invention, in particular a mixture selected from the mixtures A-1 to A-51 or B-1 to B-33, or a seed treatment composition as defined above.

Preferences regarding plants, pests and application methods are defined below.

In one embodiment, the present invention relates to seeds comprising the mixture of the invention, in particular a mixture selected from the mixtures A-1 to A-51 or B-1 to B-33 or M-1 to I-M-1450 or I-N-1 to I-N-1450 or I-O-1 to I-O-1450, or a seed treatment composition as defined above in an amount of from 0.01 g to 10000 g per 100 kg of seeds.

It is noted that the amount per 100 kg seeds is based on the weight of the pesticidal mixture irrespective of whether it is referred to the mixture as such or the seed treatment composition thereof.

Preferred seeds are seeds selected from wheat, maize, barley, oat, rye, rice, soybean, cotton, sugarbeet, rapeseed, and potato.

With regard to all the mixtures of the invention as defined herein, the following embodiments are additionally preferred.

Additional mixing partners

The mixtures of the present invention may be combined and applied in agriculture in mixture with other active ingredients, for example with other pesticides, insecticides, nematicides, fungicides, herbicides, safeners, fertilizers such as ammonium nitrate, urea, potash, and superphosphate, phytotoxicants and plant growth regulators.

These additional ingredients may be used sequentially or in combination with the mixtures of the invention, if appropriate also added only immediately prior to use (tank mix). For example, the plant(s) may be sprayed with a mixture of this invention either before or after being treated with other active ingredients.

The invention also relates to agrochemical compositions comprising an auxiliary and at least one mixture of the present invention.

An agrochemical composition comprises a pesticidally effective amount of a mixture of the present invention. The term "pesticidally effective amount" is defined below.

The mixtures of the present invention can be converted into customary types of agro-chemical compositions, e. g. solutions, emulsions, suspensions, dusts, powders, pastes, granules, pressings, capsules, and mixtures thereof. Examples for composition types are suspensions (e.g. SC, OD, FS), emulsifiable concentrates (e.g. EC), emulsions (e.g. EW, EO, ES, ME), capsules (e.g. CS, ZC), pastes, pastilles, wettable powders or dusts (e.g. WP, SP, WS, DP, DS), pressings (e.g. BR, TB, DT), granules (e.g. WG, SG, GR, FG, GG, MG), insecticidal articles (e.g. LN), as well as gel formulations for the treatment of plant propagation materials such as seeds (e.g. GF). These and further compositions types are defined in the “Catalogue of pesticide formulation types and international coding system”, Technical Mono-graph No. 2, 6th Ed. May 2008, CropLife International.

The compositions are prepared in a known manner, such as described by Mollet and Grubemann, Formulation technology, Wiley VCH, Weinheim, 2001; or Knowles, New developments in crop protection product formulation, Agrow Reports DS243, T&F Informa, London, 2005.

Examples for suitable auxiliaries are solvents, liquid carriers, solid carriers or fillers, surfactants, dispersants, emulsifiers, wetters, adjuvants, solubilizers, penetration enhancers, protective colloids, adhesion agents, thickeners, humectants, repellents, attractants, feeding stimulants, compatibilizers, bactericides, anti-freezing agents, anti-foaming agents, colorants, tackifiers and binders.

Suitable solvents and liquid carriers are water and organic solvents, such as mineral oil fractions of medium to high boiling point, e.g. kerosene, diesel oil; oils of vegetable or animal origin; aliphatic, cyclic and aromatic hydrocarbons, e. g. toluene, paraffin, tetrahydronaphthalene, alkylated naphthalenes; alcohols, e.g. ethanol, propanol, butanol, benzylalcohol, cyclo¬hexanol; glycols; DMSO; ketones, e.g. cyclohexanone; esters, e.g. lactates, carbonates, fatty acid esters, gamma-butyrolactone; fatty acids; phosphonates; amines; amides, e.g. N-methylpyrrolidone, fatty acid dimethylamides; and mixtures thereof.

Suitable solid carriers or fillers are mineral earths, e.g. silicates, silica gels, talc, kaolins, limestone, lime, chalk, clays, dolomite, diatomaceous earth, bentonite, calcium sulfate, magnesium sulfate, magnesium oxide; polysaccharide powders, e.g. cellulose, starch; fertilizers, e.g. ammonium sulfate, ammonium phosphate, ammonium nitrate, ureas; products of vegetable origin, e.g. cereal meal, tree bark meal, wood meal, nutshell meal, and mixtures thereof.

Suitable surfactants are surface-active compounds, such as anionic, cationic, nonionic and amphoteric surfactants, block polymers, polyelectrolytes, and mixtures thereof. Such surfactants can be used as emusifier, dispersant, solubilizer, wetter, penetration enhancer, protective colloid, or adjuvant. Examples of surfactants are listed in McCutcheon’s, Vol.1: Emulsifiers & Detergents, McCutcheon’s Directories, Glen Rock, USA, 2008 (International Ed. or North American Ed.).

Suitable anionic surfactants are alkali, alkaline earth or ammonium salts of sulfonates, sulfates, phosphates, carboxylates, and mixtures thereof. Examples of sulfonates are alkylaryl-sulfonates, diphenylsulfonates, alpha-olefin sulfonates, lignine sulfonates, sulfonates of fatty acids and oils, sulfonates of ethoxylated alkylphenols, sulfonates of alkoxylated arylphenols, sulfonates of condensed naphthalenes, sulfonates of dodecyl- and tridecylbenzenes, sulfonates of

naphthalenes and alkyl¬naphthalenes, sulfosuccinates or sulfosuccinamates. Examples of sulfates are sulfates of fatty acids and oils, of ethoxylated alkylphenols, of alcohols, of ethox-ylated alcohols, or of fatty acid esters. Examples of phosphates are phosphate esters. Exam-ples of carboxylates are alkyl carboxylates, and carboxylated alcohol or alkylphenol eth-oxylates.

Suitable nonionic surfactants are alkoxylates, N-subsituted fatty acid amides, amine oxides, esters, sugar-based surfactants, polymeric surfactants, and mixtures thereof. Examples of alkoxylates are compounds such as alcohols, alkylphenols, amines, amides, arylphenols, fatty acids or fatty acid esters which have been alkoxylated with 1 to 50 equivalents. Ethylene oxide and/or propylene oxide may be employed for the alkoxylation, preferably ethylene oxide. Examples of N-subsititued fatty acid amides are fatty acid glucamides or fatty acid alkanolamides. Examples of esters are fatty acid esters, glycerol esters or monoglycerides. Examples of sugar-based surfactants are sorbitans, ethoxylated sorbitans, sucrose and glucose esters or alkylpolyglucosides. Examples of polymeric surfactants are homo- or copolymers of vinylpyrrolidone, vinylalcohols, or vinylacetate.

Suitable cationic surfactants are quaternary surfactants, for example quaternary ammonium compounds with one or two hydrophobic groups, or salts of long-chain primary amines. Suitable amphoteric surfactants are alkylbetains and imidazolines. Suitable block polymers are block polymers of the A-B or A-B-A type comprising blocks of polyethylene oxide and polypropylene oxide, or of the A-B-C type comprising alkanol, polyethylene oxide and polypropylene oxide. Suitable polyelectrolytes are polyacids or polybases. Examples of polyacids are alkali salts of polyacrylic acid or polyacid comb polymers. Examples of polybases are polyvinylamines or polyethyleneamines.

Suitable adjuvants are compounds, which have a neglectable or even no pesticidal activity themselves, and which improve the biological performance of the mixtures of the present invention on the target. Examples are surfactants, mineral or vegetable oils, and other auxilaries. Further examples are listed by Knowles, Adjuvants and additives, Agrow Reports DS256, T&F Informa UK, 2006, chapter 5.

Suitable thickeners are polysaccharides (e.g. xanthan gum, carboxymethylcellulose), anorganic clays (organically modified or unmodified), polycarboxylates, and silicates.

Suitable bactericides are bronopol and isothiazolinone derivatives such as alkylisothiazolinones and benzisothiazolinones.

Suitable anti-freezing agents are ethylene glycol, propylene glycol, urea and glycerin.

Suitable anti-foaming agents are silicones, long chain alcohols, and salts of fatty acids.

Suitable colorants (e.g. in red, blue, or green) are pigments of low water solubility and water-soluble dyes. Examples are inorganic colorants (e.g. iron oxide, titan oxide, iron hexacyanoferrate) and organic colorants (e.g. alizarin-, azo- and phthalocyanine colorants).

Suitable tackifiers or binders are polyvinylpyrrolidons, polyvinylacetates, polyvinyl alcohols, polyacrylates, biological or synthetic waxes, and cellulose ethers.

Examples for composition types and their preparation are:

i) Water-soluble concentrates (SL, LS)

10-60 wt% of the mixture according to the invention and 5-15 wt% wetting agent (e.g. alcohol alkoxylates) are dissolved in water and/or in a water-soluble solvent (e.g. alcohols) up to 100 wt%. The active substance dissolves upon dilution with water.

ii) Dispersible concentrates (DC)

5-25 wt% of the mixture according to the invention and 1-10 wt% dispersant (e. g. polyvinylpyrrolidone) are dissolved in up to 100 wt% organic solvent (e.g. cyclohexanone). Dilution with water gives a dispersion.

iii) Emulsifiable concentrates (EC)

15-70 wt% of the mixture according to the invention and 5-10 wt% emulsifiers (e.g. calcium dodecylbenzenesulfonate and castor oil ethoxylate) are dissolved in up to 100 wt% water-insoluble organic solvent (e.g. aromatic hydrocarbon). Dilution with water gives an emulsion.

iv) Emulsions (EW, EO, ES)

5-40 wt% of the mixture according to the invention and 1-10 wt% emulsifiers (e.g. calcium dodecylbenzenesulfonate and castor oil ethoxylate) are dissolved in 20-40 wt% water-insoluble organic solvent (e.g. aromatic hydrocarbon). This mixture is introduced into up to 100 wt% water by means of an emulsifying machine and made into a homogeneous emulsion. Dilution with water gives an emulsion.

v) Suspensions (SC, OD, FS)

In an agitated ball mill, 20-60 wt% of the mixture according to the invention are comminuted with addition of 2-10 wt% dispersants and wetting agents (e.g. sodium lignosulfonate and alcohol ethoxylate), 0,1-2 wt% thickener (e.g. xanthan gum) and up to 100 wt% water to give a fine active substance suspension. Dilution with water gives a stable suspension of the active substance. For FS type composition up to 40 wt% binder (e.g. polyvinylalcohol) is added.

vi) Water-dispersible granules and water-soluble granules (WG, SG)

50-80 wt% of the mixture according to the invention are ground finely with addition of up to 100 wt% dispersants and wetting agents (e.g. sodium lignosulfonate and alcohol ethoxylate) and prepared as water-dispersible or water-soluble granules by means of technical appliances (e. g. extrusion, spray tower, fluidized bed). Dilution with water gives a stable dispersion or solution of the active substance.

vii) Water-dispersible powders and water-soluble powders (WP, SP, WS)

50-80 wt% of the mixture according to the invention are ground in a rotor-stator mill with addition of 1-5 wt% dispersants (e.g. sodium lignosulfonate), 1-3 wt% wetting agents (e.g. alcohol ethoxylate) and up to 100 wt% solid carrier, e.g. silica gel. Dilution with water gives a stable dispersion or solution of the active substance.

viii) Gel (GW, GF)

In an agitated ball mill, 5-25 wt% of the mixture according to the invention are comminuted with addition of 3-10 wt% dispersants (e.g. sodium lignosulfonate), 1-5 wt% thickener (e.g. carboxymethylcellulose) and up to 100 wt% water to give a fine suspension of the active substance. Dilution with water gives a stable suspension of the active substance.

ix) Microemulsion (ME)

5-20 wt% of the mixture according to the invention are added to 5-30 wt% organic solvent blend (e.g. fatty acid dimethylamide and cyclohexanone), 10-25 wt% surfactant blend (e.g. alkohol ethoxylate and arylphenol ethoxylate), and water up to 100 %. This mixture is stirred for 1 h to produce spontaneously a thermodynamically stable microemulsion.

x) Microcapsules (CS)

An oil phase comprising 5-50 wt% of the mixture according to the invention, 0-40 wt% water insoluble organic solvent (e.g. aromatic hydrocarbon), 2-15 wt% acrylic monomers (e.g. methylmethacrylate, methacrylic acid and a di- or triacrylate) are dispersed into an aqueous solution of a protective colloid (e.g. polyvinyl alcohol). Radical polymerization initiated by a radi-cal initiator results in the formation of poly(meth)acrylate microcapsules. Alternatively, an oil phase comprising 5-50 wt% of the mixture according to the invention, 0-40 wt% water insolu-ble organic solvent (e.g. aromatic hydrocarbon), and an isocyanate monomer (e.g. diphenylme-thene-4,4'-diisocyanatae) are dispersed into an aqueous solution of a protective colloid (e.g. polyvinyl alcohol). The addition of a polyamine (e.g. hexamethylenediamine) results in the for-mation of a polyurea microcapsule. The monomers amount to 1-10 wt%. The wt% relate to the total CS composition.

xi) Dustable powders (DP, DS)

1-10 wt% of a the mixture according to the invention are ground finely and mixed intimately with up to 100 wt% solid carrier, e.g. finely divided kaolin.

xii) Granules (GR, FG)

0.5-30 wt% of the mixture according to the invention is ground finely and associated with up to 100 wt% solid carrier (e.g. silicate). Granulation is achieved by extrusion, spray-drying or the fluidized bed.

xiii) Ultra-low volume liquids (UL)

1-50 wt% of the mixture according to the invention are dissolved in up to 100 wt% organic solvent, e.g. aromatic hydrocarbon.

The compositions types i) to xi) may optionally comprise further auxiliaries, such as 0.1-1 wt% bactericides, 5-15 wt% anti-freezing agents, 0.1-1 wt% anti-foaming agents, and 0.1-1 wt% colorants.

The agrochemical compositions generally comprise between 0.01 and 95%, preferably between 0.1 and 90%, and most preferably between 0.5 and 75%, by weight of active substance. The active substances are employed in a purity of from 90% to 100%, preferably from 95% to 100% (according to NMR spectrum).

Various types of oils, wetters, adjuvants, fertilizer, or micronutrients, and other pesticides (e.g. herbicides, insecticides, fungicides, growth regulators, safeners) may be added to the active substances or the compositions com¬prising them as premix or, if appropriate not until immediately prior to use (tank mix). These agents can be admixed with the compositions according to the invention in a weight ratio of 1:100 to 100:1, preferably 1:10 to 10:1.

The user applies the composition according to the invention usually from a predosage de-vice, a knapsack sprayer, a spray tank, a spray plane, or an irrigation system. Usually, the agrochemical composition is made up with water, buffer, and/or further auxiliaries to the desired application concentration and the ready-to-use spray liquor or the agrochemical composition according to the invention is thus obtained. Usually, 20 to 2000 liters, preferably 50 to 400 liters, of the ready-to-use spray liquor are applied per hectare of agricultural useful area.

According to one embodiment, individual components of the composition according to the invention such as parts of a kit or parts of a binary or ternary mixture may be mixed by the user himself in a spray tank and further auxiliaries may be added, if appropriate.

In a further embodiment, either individual components of the composition according to the invention or partially premixed components, e.g. components comprising mixtures of the present invention, may be mixed by the user in a spray tank and further auxiliaries and additives may be added, if appropriate.

In a further embodiment, either individual components of the composition according to the invention or partially premixed components, e. g. components comprising mixtures of the present invention, can be applied jointly (e.g. after tank mix) or consecutively.

The mixtures of the present invention are suitable for use in protecting crops, plants, plant propagation materials, such as seeds, or soil or water, in which the plants are growing, from attack or infestation by animal pests. Therefore, the present invention also relates to a plant protection method, which comprises contacting crops, plants, plant propagation materials, such as seeds, or soil or water, in which the plants are growing, to be protected from attack or infestation by animal pests, with a pesticidally effective amount of a mixture of the present invention.

The mixtures of the present invention are also suitable for use in combating or controlling animal pests. Therefore, the present invention also relates to a method of combating or controlling animal pests, which comprises contacting the animal pests, their habitat, breeding ground, or food supply, or the crops, plants, plant propagation materials, such as seeds, or soil, or the area, material or environment in which the animal pests are growing or may grow, with a pesticidally effective amount of a mixture of the present invention.

The mixtures of the present invention are effective through both contact and ingestion. Furthermore, the mixtures of the present invention can be applied to any and all developmental stages, such as egg, larva, pupa, and adult.

The mixtures of the present invention can be applied as such or in form of compositions comprising them as defined above. Furthermore, the mixtures of the present invention can be applied together with a mixing partner as defined above or in form of compositions comprising said mixtures as defined above. The components of said mixture can be applied simultaneously, jointly or separately, or in succession, that is immediately one after another and thereby creating the mixture “in situ” on the desired location, e.g. the plant, the sequence, in the case of separate application, generally not having any effect on the result of the control measures.

The application can be carried out both before and after the infestation of the crops, plants, plant propagation materials, such as seeds, soil, or the area, material or environment by the pests.

Suitable application methods include inter alia soil treatment, seed treatment, in furrow application, and foliar application. Soil treatment methods include drenching the soil, drip irrigation (drip application onto the soil), dipping roots, tubers or bulbs, or soil injection. Seed treatment techniques include seed dressing, seed coating, seed dusting, seed soaking, and seed pelleting. In furrow applications typically include the steps of making a furrow in cultivated land, seeding the furrow with seeds, applying the pesticidally active mixture to the furrow, and closing the furrow. Foliar application refers to the application of the pesticidally active mixture to plant foliage, e.g. through spray equipment. For foliar applications, it can be advantageous to modify the behavior of the pests by use of pheromones in combination with the mixtures of the present invention. Suitable pheromones for specific crops and pests are known to a skilled person and

publicly available from databases of pheromones and semiochemicals, such as http://www.pherobase.com.

As used herein, the term "contacting" includes both direct contact (applying the mixtures/compositions of the invention directly on the animal pest or plant - typically to the foliage, stem or roots of the plant) and indirect contact (applying the mixtures/compositions of the invention to the locus, i.e. habitat, breeding ground, plant, seed, soil, area, material or environment in which a pest is growing or may grow, of the animal pest or plant).

The term “animal pest” includes arthropods, gastropods, and nematodes. Preferred animal pests according to the invention are arthropods, preferably insects and arachnids, in particular insects. Insects, which are of particular relevance for crops, are typically referred to as crop insect pests.

The term "crop" refers to both, growing and harvested crops.

The term “plant” includes cereals, e.g. durum and other wheat, rye, barley, triticale, oats, rice, or maize (fodder maize and sugar maize / sweet and field corn); beet, e.g. sugar beet or fodder beet; fruits, such as pomes, stone fruits or soft fruits, e.g. apples, pears, plums, peaches, nectarines, almonds, cherries, papayas, strawberries, raspberries, blackberries or gooseberries; leguminous plants, such as beans, lentils, peas, alfalfa or soybeans; oil plants, such as rapeseed (oilseed rape), turnip rape, mustard, olives, sunflowers, coconut, cocoa beans, castor oil plants, oil palms, ground nuts or soybeans; cucurbits, such as squashes, pumpkins, cucumber or melons; fiber plants, such as cotton, flax, hemp or jute; citrus fruit, such as oranges, lemons, grapefruits or mandarins; vegetables, such as eggplant, spinach, lettuce (e.g. iceberg lettuce), chicory, cabbage, asparagus, cabbages, carrots, onions, garlic, leeks, tomatoes, potatoes, cucurbits or sweet peppers; lauraceous plants, such as avocados, cinnamon or camphor; energy and raw material plants, such as corn, soybean, rapeseed, sugar cane or oil palm; tobacco; nuts, e.g. walnuts; pistachios; coffee; tea; bananas; vines (table grapes and grape juice grape vines); hop; sweet leaf (also called Stevia); natural rubber plants or ornamental and forestry plants, such as flowers (e.g. carnation, petunias, geranium/pelargoniums, pansies and impatiens), shrubs, broad-leaved trees (e.g. poplar) or evergreens, e.g. conifers; eucalyptus; turf; lawn; grass such as grass for animal feed or ornamental uses. Preferred plants include potatoes sugar beets, tobacco, wheat, rye, barley, oats, rice, corn, cotton, soybeans, rapeseed, legumes, sunflowers, coffee or sugar cane; fruits; vines; ornamentals; or vegetables, such as cucumbers, tomatoes, beans or squashes.

The term "cultivated plants" is to be understood as including plants which have been modified by mutagenesis or genetic engineering in order to provide a new trait to a plant or to modify an already present trait.

Mutagenesis includes techniques of random mutagenesis using X-rays or mutagenic chemicals, but also techniques of targeted mutagenesis, in order to create mutations at a specific locus of a plant genome. Targeted mutagenesis techniques frequently use oligonucleotides or proteins like CRISPR/Cas, zinc-finger nucleases, TALENs or meganucleases to achieve the targeting effect.

Genetic engineering usually uses recombinant DNA techniques to create modifications in a plant genome which under natural circumstances cannot readily be obtained by cross breeding, mutagenesis or natural recombination. Typically, one or more genes are integrated into the

genome of a plant in order to add a trait or improve a trait. These integrated genes are also referred to as transgenes in the art, while plant comprising such transgenes are referred to as transgenic plants. The process of plant transformation usually produces several transformation events, which differ in the genomic locus in which a transgene has been integrated. Plants comprising a specific transgene on a specific genomic locus are usually described as comprising a specific "event", which is referred to by a specific event name. Traits which have been introduced in plants or hae been modified include in particular herbicide tolerance, insect resistance, increased yield and tolerance to abiotic conditions, like drought.

Herbicide tolerance has been created by using mutagenesis as well as using genetic engineering. Plants which have been rendered tolerant to acetolactate synthase (ALS) inhibitor herbicides by conventional methods of mutagenesis and breeding comprise plant varieties commercially available under the name Clearfield®. However, most of the herbicide tolerance traits have been created via the use of transgenes.

Herbicide tolerance has been created to glyphosate, glufosinate, 2,4-D, dicamba, oxynil herbicides, like bromoxynil and ioxynil, sulfonylurea herbicides, ALS inhibitor herbicides and 4-hydroxyphenylpyruvate dioxygenase (HPPD) inhibitors, like isoxaflutole and mesotrione.

Transgenes wich have been used to provide herbicide tolerance traits comprise: for tolerance to glyphosate: cp4 epsps, epsps grg23ace5, mepsps, 2mepsps, gat4601, gat4621 and goxv247, for tolerance to glufosinate: pat and bar, for tolerance to 2,4-D: aad-1 and aad-12, for tolerance to dicamba: dmo, for tolerance to oxynil herbicies: bxn, for tolerance to sulfonylurea herbicides: zm-hra, csr1-2, gm-hra, S4-HrA, for tolerance to ALS inhibitor herbicides: csr1-2, for tolerance to HPPD inhibitor herbicides: hppdPF, W336 and avhppd-03.

Transgenic corn events comprising herbicide tolerance genes are for example, but not excluding others, DAS40278, MON801, MON802, MON809, MON810, MON832, MON87411, MON87419, MON87427, MON88017, MON89034, NK603, GA21, MZHG0JG, HCEM485, VCO-Ø1981-5, 676, 678, 680, 33121, 4114, 59122, 98140, Bt10, Bt176, CBH-351, DBT418, DLL25, MS3, MS6, MZIR098, T25, TC1507 and TC6275.

Transgenic soybean events comprising herbicide tolerance genes are for example, but not excluding others, GTS 40-3-2, MON87705, MON87708, MON87712, MON87769, MON89788, A2704-12, A2704-21, A5547-127, A5547-35, DP356043, DAS44406-6, DAS68416-4, DAS-81419-2, GU262, SYHTØH2, W62, W98, FG72 and CV127.

Transgenic cotton events comprising herbicide tolerance genes are for example, but not excluding others, 19-51a, 31707, 42317, 81910, 281-24-236, 3006-210-23, BXN10211, BXN10215, BXN10222, BXN10224, MON1445, MON1698, MON88701, MON88913, GHB119, GHB614, LLCotton25, T303-3 and T304-40.

Transgenic canola events comprising herbicide tolerance genes are for example, but not excluding others, MON88302, HCR-1, HCN10, HCN28, HCN92, MS1, MS8, PHY14, PHY23, PHY35, PHY36, RF1, RF2 and RF3.

Insect resistance has mainly been created by transferring bacterial genes for insecticidal proteins to plants. Transgenes which have most frequently been used are toxin genes of *Bacillus spec.* and synthetic variants thereof, like cry1A, cry1Ab, cry1Ab-Ac, cry1Ac, cry1A.105, cry1F, cry1Fa2, cry2Ab2, cry2Ae, mcry3A, ecry3.1Ab, cry3Bb1, cry34Ab1, cry35Ab1, cry9C, vip3A(a), vip3Aa20. However, also genes of plant origin have been transferred to other plants. In

particular genes coding for protease inhibitors, like CpTI and pinII. A further approach uses transgenes in order to produce double stranded RNA in plants to target and downregulate insect genes. An example for such a transgene is dvsnf7.

Transgenic corn events comprising genes for insecticidal proteins or double stranded RNA are for example, but not excluding others, Bt10, Bt11, Bt176, MON801, MON802, MON809, MON810, MON863, MON87411, MON88017, MON89034, 33121, 4114, 5307, 59122, TC1507, TC6275, CBH-351, MIR162, DBT418 and MZIR098.

Transgenic soybean events comprising genes for insecticidal proteins are for example, but not excluding others, MON87701, MON87751 and DAS-81419.

Transgenic cotton events comprising genes for insecticidal proteins are for example, but not excluding others, SGK321, MON531, MON757, MON1076, MON15985, 31707, 31803, 31807, 31808, 42317, BNLA-601, Event1, COT67B, COT102, T303-3, T304-40, GFM Cry1A, GK12, MLS 9124, 281-24-236, 3006-210-23, GHB119 and SGK321.

Increased yield has been created by increasing ear biomass using the transgene athb17, being present in corn event MON87403, or by enhancing photosynthesis using the transgene bbx32, being present in the soybean event MON87712.

Cultivated plants comprising a modified oil content have been created by using the transgenes: gm-fad2-1, Pj.D6D, Nc.Fad3, fad2-1A and fatb1-A. Soybean events comprising at least one of these genes are: 260-05, MON87705 and MON87769.

Tolerance to abiotic conditions, in particular to tolerance to drought, has been created by using the transgene cspB, comprised by the corn event MON87460 and by using the transgene Hahb-4, comprised by soybean event IND-ØØ41Ø-5.

Traits are frequently combined by combining genes in a transformation event or by combining different events during the breeding process. Preferred combination of traits are herbicide tolerance to different groups of herbicides, insect tolerance to different kind of insects, in particular tolerance to lepidopteran and coleopteran insects, herbicide tolerance with one or several types of insect resistance, herbicide tolerance with increased yield as well as a combination of herbicide tolerance and tolerance to abiotic conditions.

Plants comprising singular or stacked traits as well as the genes and events providing these traits are well known in the art. For example, detailed information as to the mutagenized or integrated genes and the respective events are available from websites of the organizations “International Service for the Acquisition of Agri-biotech Applications (ISAAA)” (http://www.isaaa.org/gmapprovaldatabase) and the “Center for Environmental Risk Assessment (CERA)” (http://cera-gmc.org/GMCropDatabase), Further information on specific events and methods to detect them can be found for canola events MS1, MS8, RF3, GT73, MON88302, KK179 in WO01/031042, WO01/041558, WO01/041558, WO02/036831, WO11/153186, WO13/003558, for cotton events MON1445, MON15985, MON531(MON15985), LLCotton25, MON88913, COT102, 281-24-236, 3006-210-23, COT67B, GHB614, T304-40, GHB119, MON88701, 81910 in WO02/034946, WO02/100163, WO02/100163, WO03/013224, WO04/072235, WO04/039986, WO05/103266, WO05/103266, WO06/128573, WO07/017186, WO08/122406, WO08/151780, WO12/134808, WO13/112527, for corn events GA21, MON810, DLL25, TC1507, MON863, MIR604, LY038, MON88017, 3272, 59122, NK603, MIR162, MON89034, 98140, 32138, MON87460, 5307, 4114, MON87427,

DAS40278, MON87411, 33121, MON87403, MON87419 in WO98/044140, US02/102582, US03/126634, WO04/099447, WO04/011601, WO05/103301, WO05/061720, WO05/059103, WO06/098952, WO06/039376, US2007/292854, WO07/142840, WO07/140256, WO08/112019, WO09/103049, WO09/111263, WO10/077816, WO11/084621, WO11/062904, WO11/022469, WO13/169923, WO14/116854, WO15/053998, WO15/142571, for potato events E12, F10, J3, J55, V11, X17, Y9 in WO14/178910, WO14/178913, WO14/178941, WO14/179276, WO16/183445, WO17/062831, WO17/062825, for rice events LLRICE06, LLRICE601, LLRICE62 in WO00/026345, WO00/026356, WO00/026345 for soybean events H7-1, MON89788, A2704-12, A5547-127, DP305423, DP356043, MON87701, MON87769, CV127, MON87705, DAS68416-4, MON87708, MON87712, SYHT0H2, DAS81419, DAS81419 x DAS44406-6, MON87751 in WO04/074492, WO06/130436, WO06/108674, WO06/108675, WO08/054747, WO08/002872, WO09/064652, WO09/102873, WO10/080829, WO10/037016, WO11/066384, WO11/034704, WO12/051199, WO12/082548, WO13/016527, WO13/016516, WO14/201235.

The use of compositions according to the invention on cultivated plants may result in effects which are specific to a cultivated plant comprising a certain gene or event. These effects might involve changes in growth behavior or changed resistance to biotic or abiotic stress factors. Such effects may in particular comprise enhanced yield, enhanced resistance or tolerance to insects, nematodes, fungal, bacterial, mycoplasma, viral or viroid pathogens as well as early vigour, early or delayed ripening, cold or heat tolerance as well as changed amino acid or fatty acid spectrum or content.

It has surprisingly been found that the pesticidal activity of the mixtures of the present invention may be enhanced by the insecticidal trait of a modified plant. Furthermore, it has been found that the mixtures of the present invention are suitable for preventing insects to become resistant to the insecticidal trait or for combating pests, which already have become resistant to the insecticidal trait of a modified plant. Moreover, the mixtures of the present invention are suitable for combating pests, against which the insecticidal trait is not effective, so that a complementary insecticidal activity can advantageously be used.

The term "plant propagation material" refers to all the generative parts of the plant such as seeds and vegetative plant material such as cuttings and tubers (e.g. potatoes), which can be used for the multiplication of the plant. This includes seeds, roots, fruits, tubers, bulbs, rhizomes, shoots, sprouts and other parts of plants. Seedlings and young plants, which are to be transplanted after germination or after emergence from soil, may also be included. These plant propagation materials may be treated prophylactically with a plant protection mixture either at or before planting or transplanting.

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

In general, "pesticidally effective amount" means the amount of active ingredient needed to achieve an observable effect on growth, including the effects of necrosis, death, retardation, prevention, and removal, destruction, or otherwise diminishing the occurrence and activity of the target organism. The pesticidally effective amount can vary for the various mixtures/compositions of the invention used in the invention. A pesticidally effective amount of the compositions

will also vary according to the prevailing conditions such as desired pesticidal effect and duration, weather, target species, locus, mode of application, and the like.

In the case of soil treatment, in furrow application or of application to the pests dwelling place or nest, the quantity of active ingredient ranges from 0.0001 to 500 g per 100 m^2, preferably from 0.001 to 20 g per 100 m^2.

For use in treating crop plants, e.g. by foliar application, the rate of application of the active ingredients of this invention may be in the range of 0.0001 g to 4000 g per hectare, e.g. from 1 g to 2 kg per hectare or from 1 g to 750 g per hectare, desirably from 1 g to 100 g per hectare, more desirably from 10 g to 50 g per hectare, e.g., 10 to 20 g per hectare, 20 to 30 g per hectare, 30 to 40 g per hectare, or 40 to 50 g per hectare.

The mixtures of the present invention are particularly suitable for use in the treatment of seeds in order to protect the seeds from insect pests, in particular from soil-living insect pests, and the resulting seedling's roots and shoots against soil pests and foliar insects. The present invention therefore also relates to a method for the protection of seeds from insects, in particular from soil insects, and of the seedling's roots and shoots from insects, in particular from soil and foliar insects, said method comprising treating the seeds before sowing and/or after pregermination with a mixture of the present invention. The protection of the seedling's roots and shoots is preferred. More preferred is the protection of seedling's shoots from piercing and sucking insects, chewing insects and nematodes.

The term "seed treatment" comprises all suitable seed treatment techniques known in the art, such as seed dressing, seed coating, seed dusting, seed soaking, seed pelleting, and in-furrow application methods. Preferably, the seed treatment application of the active mixture is carried out by spraying or by dusting the seeds before sowing of the plants and before emergence of the plants.

The present invention also comprises seeds coated with or containing the active mixture. The term "coated with and/or containing" generally signifies that the active ingredient is for the most part on the surface of the propagation product at the time of application, although a greater or lesser part of the ingredient may penetrate into the propagation product, depending on the method of application. When the said propagation product is (re)planted, it may absorb the active ingredient.

Suitable seed is for example seed of cereals, root crops, oil crops, vegetables, spices, ornamentals, for example seed of durum and other wheat, barley, oats, rye, maize (fodder maize and sugar maize / sweet and field corn), soybeans, oil crops, crucifers, cotton, sunflowers, bananas, rice, oilseed rape, turnip rape, sugarbeet, fodder beet, eggplants, potatoes, grass, lawn, turf, fodder grass, tomatoes, leeks, pumpkin/squash, cabbage, iceberg lettuce, pepper, cucumbers, melons, Brassica species, melons, beans, peas, garlic, onions, carrots, tuberous plants such as potatoes, sugar cane, tobacco, grapes, petunias, geranium/pelargoniums, pansies and impatiens.

In addition, the active mixture may also be used for the treatment of seeds from plants, which have been modified by mutagenisis or genetic engineering, and which e.g. tolerate the action of herbicides or fungicides or insecticides. Such modified plants have been described in detail above.

Conventional seed treatment formulations include for example flowable concentrates FS, solutions LS, suspoemulsions (SE), powders for dry treatment DS, water dispersible powders for slurry treatment WS, water-soluble powders SS and emulsion ES and EC and gel formulation GF. These formulations can be applied to the seed diluted or undiluted. Application to the seeds is carried out before sowing, either directly on the seeds or after having pregerminated the latter. Preferably, the formulations are applied such that germination is not included.

The active substance concentrations in ready-to-use formulations, which may be obtained after two-to-tenfold dilution, are preferably from 0.01 to 60% by weight, more preferably from 0.1 to 40 % by weight.

In a preferred embodiment a FS formulation is used for seed treatment. Typically, a FS formulation may comprise 1-800 g/l of active ingredient, 1-200 g/l Surfactant, 0 to 200 g/l antifreezing agent, 0 to 400 g/l of binder, 0 to 200 g/l of a pigment and up to 1 liter of a solvent, preferably water.

Especially preferred FS formulations of the mixtures of the present invention for seed treatment usually comprise from 0.1 to 80% by weight (1 to 800 g/l) of the active ingredient, from 0.1 to 20 % by weight (1 to 200 g/l) of at least one surfactant, e.g. 0.05 to 5 % by weight of a wetter and from 0.5 to 15 % by weight of a dispersing agent, up to 20 % by weight, e.g. from 5 to 20 % of an anti-freeze agent, from 0 to 15 % by weight, e.g. 1 to 15 % by weight of a pigment and/or a dye, from 0 to 40 % by weight, e.g. 1 to 40 % by weight of a binder (sticker /adhesion agent), optionally up to 5 % by weight, e.g. from 0.1 to 5 % by weight of a thickener, optionally from 0.1 to 2 % of an anti-foam agent, and optionally a preservative such as a biocide, antioxidant or the like, e.g. in an amount from 0.01 to 1 % by weight and a filler/vehicle up to 100 % by weight.

In the treatment of seed, the application rates of the mixtures of the invention are generally from 0.1 g to 10 kg per 100 kg of seed, preferably from 1 g to 5 kg per 100 kg of seed, more preferably from 1 g to 1000 g per 100 kg of seed and in particular from 1 g to 200 g per 100 kg of seed, e.g. from 1 g to 100 g or from 5 g to 100 g per 100 kg of seed.

The invention therefore also relates to seed comprising a mixture of the present invention, or an agriculturally useful salt thereof, as defined herein. The amount of the mixture of the present invention or the agriculturally useful salt thereof will in general vary from 0.1 g to 10 kg per 100 kg of seed, preferably from 1 g to 5 kg per 100 kg of seed, in particular from 1 g to 1000 g per 100 kg of seed. For specific crops such as lettuce the rate can be higher.

The mixtures of the present invention may also be used for improving the health of a plant. Therefore, the present invention also relates to a method for improving plant health by treating a plant, plant propagation material and/or the locus where the plant is growing or is to grow with an effective and non-phytotoxic amount of a mixture of the present invention.

As used herein “an effective and non-phytotoxic amount” means that the mixture is used in a quantity which allows to obtain the desired effect but which does not give rise to any phytotoxic symptom on the treated plant or on the plant grown from the treated propagule or treated soil.

The terms “plant” and “plant propagation material” are defined above.

"Plant health" is defined as a condition of the plant and/or its products which is determined by several aspects alone or in combination with each other such as yield (for example increased biomass and/or increased content of valuable ingredients), quality (for example improved content or composition of certain ingredients or shelf life), plant vigour (for example improved plant

growth and/or greener leaves ("greening effect"), tolerance to abiotic (for example drought) and/or biotic stress (for example disease) and production efficiency (for example, harvesting efficiency, processability).

The above identified indicators for the health condition of a plant may be interdependent and may result from each other. Each indicator is defined in the art and can be determined by methods known to a skilled person.

The mixtures of the invention are also suitable for use against non-crop insect pests. For use against said non-crop pests, mixtures of the present invention can be used as bait composition, gel, general insect spray, aerosol, as ultra-low volume application and bed net (impregnated or surface applied). Furthermore, drenching and rodding methods can be used.

As used herein, the term "non-crop insect pest" refers to pests, which are particularly relevant for non-crop targets, such as ants, termites, wasps, flies, ticks, mosquitos, crickets, or cockroaches.

The bait can be a liquid, a solid or a semisolid preparation (e.g. a gel). The bait employed in the composition is a product, which is sufficiently attractive to incite insects such as ants, termites, wasps, flies, mosquitos, crickets etc. or cockroaches to eat it. The attractiveness can be manipulated by using feeding stimulants or sex pheromones. Food stimulants are chosen, for example, but not exclusively, from animal and/or plant proteins (meat-, fish- or blood meal, insect parts, egg yolk), from fats and oils of animal and/or plant origin, or mono-, oligo- or polyorganosaccharides, especially from sucrose, lactose, fructose, dextrose, glucose, starch, pectin or even molasses or honey. Fresh or decaying parts of fruits, crops, plants, animals, insects or specific parts thereof can also serve as a feeding stimulant. Sex pheromones are known to be more insect specific. Specific pheromones are described in the literature (e.g. http://www.pherobase.com), and are known to those skilled in the art.

For use in bait compositions, the typical content of active ingredient is from 0.001 weight % to 15 weight %, desirably from 0.001 weight % to 5% weight % of active mixture.

Formulations of the mixtures of the present invention as aerosols (e.g in spray cans), oil sprays or pump sprays are highly suitable for the non-professional user for controlling pests such as flies, fleas, ticks, mosquitos or cockroaches. Aerosol recipes are preferably composed of the active mixture, solvents, furthermore auxiliaries such as emulsifiers, perfume oils, if appropriate stabilizers, and, if required, propellants.

The oil spray formulations differ from the aerosol recipes in that no propellants are used.

For use in spray compositions, the content of active ingredient is from 0.001 to 80 weights %, preferably from 0.01 to 50 weight % and most preferably from 0.01 to 15 weight %.

The mixtures of the present invention and its respective compositions can also be used in mosquito and fumigating coils, smoke cartridges, vaporizer plates or long-term vaporizers and also in moth papers, moth pads or other heat-independent vaporizer systems.

Methods to control infectious diseases transmitted by insects (e.g. malaria, dengue and yellow fever, lymphatic filariasis, and leishmaniasis) with mixtures of the present invention and its respective compositions also comprise treating surfaces of huts and houses, air spraying and impregnation of curtains, tents, clothing items, bed nets, tsetse-fly trap or the like. Insecticidal compositions for application to fibers, fabric, knitgoods, nonwovens, netting material or foils and

tarpaulins preferably comprise a mixture including the insecticide, optionally a repellent and at least one binder.

The mixtures of the present invention and its compositions can be used for protecting wooden materials such as trees, board fences, sleepers, frames, artistic artifacts, etc. and buildings, but also construction materials, furniture, leathers, fibers, vinyl articles, electric wires and cables etc. from ants and/or termites, and for controlling ants and termites from doing harm to crops or human being (e.g. when the pests invade into houses and public facilities).

Customary application rates in the protection of materials are, for example, from 0.001 g to 2000 g or from 0.01 g to 1000 g of active mixture per m^2 treated material, desirably from 0.1 g to 50 g per m^2.

Insecticidal compositions for use in the impregnation of materials typically contain from 0.001 to 95 weight %, preferably from 0.1 to 45 weight %, and more preferably from 1 to 25 weight % of at least one repellent and/or insecticide.

The mixtures of the the present invention are especially suitable for efficiently combating animal pests such as arthropods, gastropods and nematodes including but not limited to:

insects from the order of Lepidoptera, for example *Achroia grisella*, *Acleris* spp. such as *A. fimbriana, A. gloverana, A. variana; Acrolepiopsis assectella, Acronicta major, Adoxophyes* spp. such as *A. cyrtosema, A. orana; Aedia leucomelas, Agrotis* spp. such as *A. exclamationis, A. fucosa, A. ipsilon, A. orthogoma, A. segetum, A. subterranea; Alabama argillacea, Aleurodicus dispersus, Alsophila pometaria, Ampelophaga rubiginosa, Amyelois transitella, Anacampsis sarcitella, Anagasta kuehniella, Anarsia lineatella, Anisota senatoria, Antheraea pernyi, Anticarsia (=Thermesia)* spp. such as *A. gemmatalis; Apamea* spp., *Aproaerema modicella, Archips* spp. such as *A. argyrospila, A. fuscocupreanus, A. rosana, A. xyloseanus; Argyresthia conjugella, Argyroploce* spp., *Argyrotaenia* spp. such as *A. velutinana; Athetis mindara, Austroasca viridigrisea, Autographa gamma, Autographa nigrisigna, Barathra brassicae, Bedellia* spp., *Bonagota salubricola, Borbo cinnara, Bucculatrix thurberiella, Bupalus piniarius, Busseola* spp., *Cacoecia* spp. such as *C. murinana, C. podana; Cactoblastis cactorum, Cadra cautella, Calingo braziliensis, Caloptilis theivora, Capua reticulana, Carposina* spp. such as *C. niponensis, C. sasakii; Cephus* spp., *Chaetocnema aridula, Cheimatobia brumata, Chilo* spp. such as *C. Indicus, C. suppressalis, C. partellus; Choreutis pariana, Choristoneura* spp. such as *C. conflictana, C. fumiferana, C. longicellana, C. murinana, C. occidentalis, C. rosaceana; Chrysodeixis (=Pseudoplusia)* spp. *such as C. eriosoma, C. includens; Cirphis unipuncta, Clysia ambiguella, Cnaphalocerus* spp., *Cnaphalocrocis medinalis, Cnephasia* spp., *Cochylis hospes, Coleophora* spp., *Colias eurytheme, Conopomorpha* spp., *Conotrachelus* spp., *Copitarsia* spp., *Corcyra cephalonica, Crambus caliginosellus, Crambus teterrellus, Crocidosema (=Epinotia) aporema, Cydalima (=Diaphania) perspectalis, Cydia (=Carpocapsa)* spp. such as *C. pomonella, C. latiferreana; Dalaca noctuides, Datana integerrima, Dasychira pinicola, Dendrolimus* spp. such as *D. pini, D. spectabilis, D. sibiricus; Desmia funeralis, Diaphania* spp. such as *D. nitidalis, D. hyalinata; Diatraea grandiosella, Diatraea saccharalis, Diphthera festiva, Earias* spp. such as *E. insulana, E. vittella; Ecdytolopha aurantianu, Egira (=Xylomyges) curialis, Elasmopalpus lignosellus, Eldana saccharina, Endopiza viteana, Ennomos subsignaria, Eoreuma loftini, Ephestia* spp. such as *E. cautella, E. elutella, E. kuehniella; Epinotia aporema, Epiphyas postvittana, Erannis tiliaria, Erionota thrax, Etiella* spp., *Eulia* spp., *Eupoecilia ambiguella, Euproctis chrysorrhoea, Euxoa* spp.,

Evetria bouliana, Faronta albilinea, Feltia spp. such as *F. subterranean; Galleria mellonella, Gracillaria* spp., *Grapholita* spp. such as *G. funebrana, G. molesta, G. inopinata; Halysidota* spp., *Harrisina americana*, *Hedylepta* spp., *Helicoverpa* spp. such as *H. armigera (=Heliothis armigera), H. zea (=Heliothis zea); Heliothis* spp. such as *H. assulta, H. subflexa, H. virescens; Hellula* spp. such as *H. undalis, H. rogatalis; Helocoverpa gelotopoeon, Hemileuca oliviae, Herpetogramma licarsisalis, Hibernia defoliaria, Hofmannophila pseudospretella, Homoeosoma electellum, Homona magnanima, Hypena scabra, Hyphantria cunea, Hyponomeuta padella, Hyponomeuta malinellus, Kakivoria flavofasciata, Keiferia lycopersicella, Lambdina fiscellaria fiscellaria, Lambdina fiscellaria lugubrosa, Lamprosema indicata*, *Laspeyresia molesta, Leguminivora glycinivorella, Lerodea eufala, Leucinodes orbonalis, Leucoma salicis, Leucoptera* spp. such as *L. coffeella, L. scitella; Leuminivora lycinivorella, Lithocolletis blancardella, Lithophane antennata, Llattia octo (=Amyna axis), Lobesia botrana, Lophocampa* spp., *Loxagrotis albicosta, Loxostege* spp. such as *L. sticticalis, L. cereralis; Lymantria* spp. such as *L. dispar, L. monacha; Lyonetia clerkella, Lyonetia prunifoliella, Malacosoma* spp. such as *M. americanum, M. californicum, M. constrictum, M. neustria; Mamestra* spp. such as *M. brassicae, M. configurata; Mamstra brassicae, Manduca* spp. such as *M. quinquemaculata, M. sexta; Marasmia spp, Marmara* spp., *Maruca testulalis, Megalopyge lanata, Melanchra picta, Melanitis leda, Mocis* spp. such as *M. lapites, M. repanda; Mocis latipes, Monochroa fragariae, Mythimna separata, Nemapogon cloacella, Neoleucinodes elegantalis, Nepytia* spp., *Nymphula* spp., *Oiketicus* spp., *Omiodes indicata, Omphisa anastomosalis, Operophtera brumata, Orgyia pseudotsugata, Oria* spp., *Orthaga thyrisalis, Ostrinia* spp. such as *O. nubilalis; Oulema oryzae, Paleacrita vernata, Panolis flammea, Parnara* spp., *Papaipema nebris*, *Papilio cresphontes, Paramyelois transitella, Paranthrene regalis*, *Paysandisia archon*, *Pectinophora* spp. such as *P. gossypiella; Peridroma saucia, Perileucoptera* spp., such as *P. coffeella; Phalera bucephala, Phryganidia californica*, *Phthorimaea* spp. such as *P. operculella; Phyllocnistis citrella, Phyllonorycter* spp. such as *P. blancardella, P. crataegella, P. issikii, P. ringoniella; Pieris* spp. such as *P. brassicae, P. rapae, P. napi; Pilocrocis tripunctata, Plathypena scabra, Platynota* spp. such as *P. flavedana, P. idaeusalis, P. stultana; Platyptilia carduidactyla, Plebejus argus, Plodia interpunctella, Plusia spp, Plutella maculipennis, Plutella xylostella, Pontia protodica, Prays* spp., *Prodenia* spp., *Proxenus lepigone, Pseudaletia* spp. such as *P. sequax, P. unipuncta; Pyrausta nubilalis, Rachiplusia nu, Richia albicosta, Rhizobius ventralis, Rhyacionia frustrana, Sabulodes aegrotata, Schizura concinna, Schoenobius* spp., *Schreckensteinia festaliella, Scirpophaga* spp. such as *S. incertulas, S. innotata; Scotia segetum, Sesamia* spp. such as *S. inferens, Seudyra subflava, Sitotroga cerealella, Sparganothis pilleriana, Spilonota lechriaspis, S. ocellana, Spodoptera (=Lamphygma)* spp. such as *S. cosmoides, S. eridania, S. exigua, S. frugiperda, S. latisfascia, S. littoralis, S. litura, S. omithogalli; Stigmella* spp., *Stomopteryx subsecivella, Strymon bazochii, Sylepta derogata, Synanthedon* spp. such as S. exitiosa, *Tecia solanivora, Telehin licus, Thaumatopoea pityocampa, Thaumatotibia (=Cryptophlebia) leucotreta, Thaumetopoea pityocampa, Thecla* spp., *Theresimima ampelophaga, Thyrinteina* spp, *Tildenia inconspicuella, Tinea* spp. such as *T. cloacella, T. pellionella; Tineola bisselliella, Tortrix* spp. such as *T. viridana; Trichophaga tapetzella, Trichoplusia* spp. such as *T. ni; Tuta (=Scrobipalpula) absoluta, Udea* spp. such as *U. rubigalis, U. rubigalis; Virachola* spp., *Yponomeuta padella, and Zeiraphera canadensis;*

insects from the order of Coleoptera, for example *Acalymma vittatum*, *Acanthoscehdes obtectus, Adoretus* spp., *Agelastica alni, Agrilus* spp. such as *A. anxius, A. planipennis, A. sinuatus; Agriotes* spp. such as *A. fuscicollis, A. lineatus, A. obscurus; Alphitobius diaperinus, Amphimallus solstitialis, Anisandrus dispar, Anisoplia austriaca, Anobium punctatum, Anomala corpulenta, Anomala rufocuprea, Anoplophora* spp. such as *A. glabripennis; Anthonomus* spp. such as *A. eugenii, A. grandis, A. pomorum; Anthrenus* spp., *Aphthona euphoridae, Apion* spp., *Apogonia* spp., *Athous haemorrhoidalis, Atomaria* spp. such as *A. linearis; Attagenus* spp., *Aulacophora femoralis, Blastophagus piniperda, Blitophaga undata, Bruchidius obtectus, Bruchus* spp. such as *B. lentis, B. pisorum, B. rufimanus; Byctiscus betulae, Callidiellum rufipenne, Callopistria floridensis, Callosobruchus chinensis, Cameraria ohridella, Cassida nebulosa, Cerotoma trifurcata, Cetonia aurata, Ceuthorhynchus* spp. such as *C. assimilis, C. napi; Chaetocnema tibialis, Cleonus mendicus, Conoderus* spp. such as *C. vespertinus; Conotrachelus nenuphar, Cosmopolites* spp., *Costelytra zealandica, Crioceris asparagi, Cryptolestes ferrugineus, Cryptorhynchus lapathi, Ctenicera* spp. such as *C. destructor; Curculio* spp., *Cylindrocopturus* spp., *Cyclocephala* spp., *Dactylispa balyi, Dectes texanus, Dermestes* spp., *Diabrotica* spp. such as *D. undecimpunctata, D. speciosa, D. longicornis, D. semipunctata, D. virgifera; Diaprepes abbreviates, Dichocrocis* spp., *Dicladispa armigera, Diloboderus abderus, Diocalandra frumenti (Diocalandra stigmaticollis), Enaphalodes rufulus, Epilachna* spp. such as *E. varivestis, E. vigintioctomaculata; Epitrix* spp. such as *E. hirtipennis, E. similaris; Eutheola humilis, Eutinobothrus brasiliensis, Faustinus cubae, Gibbium psylloides, Gnathocerus cornutus, Hellula undalis, Heteronychus arator, Hylamorpha elegans, Hylobius abietis, Hylotrupes bajulus, Hypera* spp. such as *H. brunneipennis, H. postica; Hypomeces squamosus, Hypothenemus* spp., *Ips typographus, Lachnosterna consanguinea, Lasioderma serricorne, Latheticus oryzae, Lathridius* spp., *Lema* spp. such as *L. bilineata, L. melanopus; Leptinotarsa* spp. such as *L. decemlineata; Leptispa pygmaea, Limonius californicus, Lissorhoptrus oryzophilus, Lixus* spp., *Luperodes* spp., *Lyctus* spp. such as *L. bruneus; Liogenys fuscus, Macrodactylus* spp. such as *M. subspinosus; Maladera matrida, Megaplatypus mutates, Megascelis* spp., *Melanotus communis, Meligethes* spp. such as *M. aeneus; Melolontha* spp. such as *M. hippocastani, M. melolontha; Metamasius hemipterus, Microtheca* spp., *Migdolus* spp. such as *M. fryanus, Monochamus* spp. such as *M. alternatus; Naupactus xanthographus, Niptus hololeucus, Oberia brevis, Oemona hirta, Oryctes rhinoceros, Oryzaephilus surinamensis, Oryzaphagus oryzae, Otiorrhynchus sulcatus, Otiorrhynchus ovatus, Otiorrhynchus sulcatus, Oulema melanopus, Oulema oryzae, Oxycetonia jucunda, Phaedon* spp. such as *P. brassicae, P. cochleariae; Phoracantha recurva, Phyllobius pyri, Phyllopertha horticola, Phyllophaga* spp. such as *P. helleri; Phyllotreta* spp. such as *P. chrysocephala, P. nemorum, P. striolata, P. vittula; Phyllopertha horticola, Popillia japonica, Premnotrypes* spp., *Psacothea hilaris, Psylliodes chrysocephala, Prostephanus truncates, Psylliodes* spp., *Ptinus* spp., *Pulga saltona, Rhizopertha dominica, Rhynchophorus* spp. such as *R. billineatus, R. ferrugineus, R. palmarum, R. phoenicis, R. vulneratus; Saperda candida, Scolytus schevyrewi, Scyphophorus acupunctatus, Sitona lineatus, Sitophilus* spp. such as *S. granaria, S. oryzae, S. zeamais; Sphenophorus* spp. such as *S. levis; Stegobium paniceum, Sternechus* spp. such as *S. subsignatus; Strophomorphus ctenotus, Symphyletes* spp., *Tanymecus* spp., *Tenebrio molitor, Tenebrioides mauretanicus, Tribolium* spp. such as *T. castaneum;*

Trogoderma spp., *Tychius* spp., *Xylotrechus* spp. such as *X. pyrrhoderus; and, Zabrus* spp. *such as Z. tenebrioides;*

insects from the order of Diptera e.g. *Aedes* spp. such as *A. aegypti, A. albopictus, A. vexans; Anastrepha ludens, Anopheles* spp. such as *A. albimanus, A. crucians, A. freeborni, A. gambiae, A. leucosphyrus, A. maculipennis, A. minimus, A. quadrimaculatus, A. sinensis; Bactrocera invadens, Bibio hortulanus, Calliphora erythrocephala, Calliphora vicina, Ceratitis capitata, Chrysomyia* spp. such as *C. bezziana, C. hominivorax, C. macellaria; Chrysops atlanticus, Chrysops discalis, Chrysops silacea, Cochliomyia* spp. such as *C. hominivorax; Contarinia* spp. such as *C. sorghicola; Cordylobia anthropophaga, Culex* spp. such as *C. nigripalpus, C. pipiens, C. quinquefasciatus, C. tarsalis, C. tritaeniorhynchus; Culicoides furens, Culiseta inornata, Culiseta melanura, Cuterebra* spp., *Dacus cucurbitae, Dacus oleae, Dasineura brassicae, Dasineura oxycoccana, Delia* spp. such as *D. antique, D. coarctata, D. platura, D. radicum; Dermatobia hominis, Drosophila* spp. such as *D. suzukii, Fannia* spp. such as *F. canicularis; Gastraphilus* spp. such as *G. intestinalis; Geomyza tipunctata, Glossina* spp. such as *G. fuscipes, G. morsitans, G. palpalis, G. tachinoides; Haematobia irritans, Haplodiplosis equestris, Hippelates* spp., Hylemyia spp. such as *H. platura; Hypoderma* spp. such as *H. lineata; Hyppobosca* spp., *Hydrellia philippina, Leptoconops torrens, Liriomyza* spp. such as *L. sativae, L. trifolii; Lucilia* spp. such as *L. caprina, L. cuprina, L. sericata; Lycoria pectoralis, Mansonia titillanus, Mayetiola* spp. such as *M. destructor; Musca* spp. such as *M. autumnalis, M. domestica; Muscina stabulans, Oestrus* spp. such as *O. ovis; Opomyza florum, Oscinella* spp. such as *O. frit; Orseolia oryzae, Pegomya hysocyami, Phlebotomus argentipes, Phorbia* spp. such as *P. antiqua, P. brassicae, P. coarctata; Phytomyza gymnostoma, Prosimulium mixtum, Psila rosae, Psorophora columbiae, Psorophora discolor, Rhagoletis* spp. such as *R. cerasi, R. cingulate, R. indifferens, R. mendax, R. pomonella; Rivellia quadrifasciata, Sarcophaga* spp. such as *S. haemorrhoidalis; Simulium vittatum, Sitodiplosis mosellana, Stomoxys* spp. such as *S. calcitrans; Tabanus* spp. such as *T. atratus, T. bovinus, T. lineola, T. similis; Tannia spp., Thecodiplosis japonensis, Tipula oleracea, Tipula paludosa,* and *Wohlfahrtia* spp;

insects from the order of Thysanoptera for example, *Baliothrips biformis, Dichromothrips corbetti, Dichromothrips* ssp., *Echinothrips americanus, Enneothrips flavens, Frankliniella* spp. such as *F. fusca, F. occidentalis, F. tritici; Heliothrips* spp., *Hercinothrips femoralis, Kakothrips* spp., *Microcephalothrips abdominalis, Neohydatothrips samayunkur, Pezothrips kellyanus, Rhipiphorothrips cruentatus, Scirtothrips* spp. such as *S. citri, S. dorsalis, S. perseae; Stenchaetothrips spp, Taeniothrips cardamoni, Taeniothrips inconsequens, Thrips* spp. such as *T. imagines, T. hawaiiensis, T. oryzae, T. palmi, T. parvispinus, T. tabaci;*

insects from the order of Hemiptera for example, *Acizzia jamatonica*, *Acrosternum* spp. such as *A. hilare;* Acyrthosipon spp. such as *A. onobrychis, A. pisum; Adelges laricis, Adelges tsugae, Adelphocoris* spp., such as *A. rapidus, A. superbus; Aeneolamia* spp., *Agonoscena* spp., *Aulacorthum solani, Aleurocanthus woglumi, Aleurodes* spp., *Aleurodicus disperses, Aleurolobus barodensis, Aleurothrixus* spp., *Amrasca* spp., *Anasa tristis, Antestiopsis* spp., *Anuraphis cardui, Aonidiella* spp., *Aphanostigma piri, Aphidula nasturtii, Aphis* spp. such as *A. craccivora, A. fabae, A. forbesi, A. gossypii, A. grossulariae, A. maidiradicis, A. pomi, A. sambuci, A. schneideri, A. spiraecola; Arboridia apicalis, Arilus critatus, Aspidiella* spp., *Aspidiotus* spp., *Atanus* spp., *Aulacaspis yasumatsui, Aulacorthum solani, Bactericera cockerelli (Paratrioza*

cockerelli), Bemisia spp. such as *B. argentifolii, B. tabaci (Aleurodes tabaci); Blissus* spp. such as *B. leucopterus; Brachycaudus* spp. such as *B. cardui, B. helichrysi, B. persicae, B. prunicola; Brachycolus* spp., *Brachycorynella asparagi, Brevicoryne brassicae, Cacopsylla* spp. such as *C. fulguralis, C. pyricola (Psylla piri); Calligypona marginata, Calocoris* spp., *Campylomma livida, Capitophorus horni, Carneocephala fulgida, Cavelerius* spp., *Ceraplastes* spp., *Ceratovacuna lanigera, Ceroplastes ceriferus, Cerosipha gossypii, Chaetosiphon fragaefolii, Chionaspis tegalensis, Chlorita onukii, Chromaphis juglandicola, Chrysomphalus ficus, Cicadulina mbila, Cimex* spp. such as *C. hemipterus, C. lectularius; Coccomytilus halli, Coccus* spp. such as *C. hesperidum, C. pseudomagnoliarum*; *Corythucha arcuata, Creontiades dilutus, Cryptomyzus ribis, Chrysomphalus aonidum, Cryptomyzus ribis, Ctenarytaina spatulata, Cyrtopeltis notatus, Dalbulus* spp., *Dasynus piperis, Dialeurodes* spp. such as *D. citrifolii; Dalbulus maidis, Diaphorina* spp. such as *D. citri; Diaspis* spp. such as *D. bromeliae; Dichelops furcatus, Diconocoris hewetti, Doralis* spp., *Dreyfusia nordmannianae, Dreyfusia piceae, Drosicha* spp., *Dysaphis* spp. such as *D. plantaginea, D. pyri, D. radicola; Dysaulacorthum pseudosolani, Dysdercus* spp. such as *D. cingulatus, D. intermedius; Dysmicoccus* spp., *Edessa* spp., *Geocoris* spp., *Empoasca* spp. such as *E. fabae, E. solana; Epidiaspis leperii, Eriosoma* spp. such as *E. lanigerum, E. pyricola; Erythroneura* spp., *Eurygaster* spp. such as *E. integriceps; Euscelis bilobatus, Euschistus* spp. such as *E. heros, E. impictiventris, E. servus; Fiorinia theae, Geococcus coffeae, Glycaspis brimblecombei, Halyomorpha* spp. such as *H. halys; Heliopeltis* spp., *Homalodisca vitripennis (=H. coagulata), Horcias nobilellus, Hyalopterus pruni, Hyperomyzus lactucae, Icerya* spp. such as *I. purchase; Idiocerus* spp., *Idioscopus* spp., *Laodelphax striatellus, Lecanium* spp., *Lecanoideus floccissimus, Lepidosaphes* spp. such as *L. ulmi; Leptocorisa* spp., *Leptoglossus phyllopus, Lipaphis erysimi, Lygus* spp. such as *L. hesperus, L. lineolaris, L. pratensis; Maconellicoccus hirsutus, Marchalina hellenica, Macropes excavatus, Macrosiphum* spp. such as *M. rosae, M. avenae, M. euphorbiae; Macrosteles quadrilineatus, Mahanarva fimbriolata, Megacopta cribraria, Megoura viciae, Melanaphis pyrarius, Melanaphis sacchari, Melanocallis (=Tinocallis) caryaefoliae, Metcafiella* spp., *Metopolophium dirhodum, Monellia costalis, Monelliopsis pecanis, Myzocallis coryli, Murgantia* spp., *Myzus* spp. such as *M. ascalonicus, M. cerasi, M. nicotianae, M. persicae, M. varians; Nasonovia ribis-nigri, Neotoxoptera formosana, Neomegalotomus spp, Nephotettix* spp. such as *N. malayanus, N. nigropictus, N. parvus, N. virescens; Nezara* spp. such as *N. viridula; Nilaparvata lugens, Nysius huttoni, Oebalus* spp. such as *O. pugnax; Oncometopia* spp., *Orthezia praelonga, Oxycaraenus hyalinipennis, Parabemisia myricae, Parlatoria* spp., *Parthenolecanium* spp. such as *P. corni, P. persicae; Pemphigus* spp. such as *P. bursarius, P. populivenae; Peregrinus maidis, Perkinsiella saccharicida, Phenacoccus* spp. such as *P. aceris, P. gossypii; Phloeomyzus passerinii, Phorodon humuli, Phylloxera* spp. such as *P. devastatrix, Piesma quadrata, Piezodorus* spp. such as *P. guildinii; Pinnaspis aspidistrae, Planococcus* spp. such as *P. citri, P. ficus; Prosapia bicincta, Protopulvinaria pyriformis, Psallus seriatus, Pseudacysta persea, Pseudaulacaspis pentagona, Pseudococcus* spp. such as *P. comstocki; Psylla* spp. such as *P. mali; Pteromalus* spp., *Pulvinaria amygdali, Pyrilla* spp., *Quadraspidiotus* spp., such as *Q. perniciosus; Quesada gigas, Rastrococcus* spp., *Reduvius senilis, Rhizoecus americanus, Rhodnius* spp., *Rhopalomyzus ascalonicus, Rhopalosiphum* spp. such as *R. pseudobrassicas, R. insertum, R. maidis, R. padi; Sagatodes* spp., *Sahlbergella singularis, Saissetia* spp., *Sappaphis mala, Sappaphis mali, Scaptocoris* spp.,

Scaphoides titanus, Schizaphis graminum, Schizoneura lanuginosa, Scotinophora spp., *Selenaspidus articulatus, Sitobion avenae, Sogata* spp., *Sogatella furcifera, Solubea insularis, Spissistilus festinus (=Stictocephala festina), Stephanitis nashi, Stephanitis pyrioides, Stephanitis takeyai, Tenalaphara malayensis, Tetraleurodes perseae, Therioaphis maculate, Thyanta* spp. such as *T. accerra, T. perditor; Tibraca* spp., *Tomaspis* spp., *Toxoptera* spp. such as *T. aurantii; Trialeurodes* spp. such as *T. abutilonea, T. ricini, T. vaporariorum; Triatoma* spp., *Trioza* spp., *Typhlocyba* spp., *Unaspis* spp. such as *U. citri, U. yanonensis; and Viteus vitifolii,*

Insects from the order Hymenoptera for example *Acanthomyops interjectus*, *Athalia rosae, Atta* spp. *such as A. capiguara, A. cephalotes, A. cephalotes, A. laevigata, A. robusta, A. sexdens, A. texana, Bombus* spp., *Brachymyrmex* spp., *Camponotus* spp. such as *C. floridanus, C. pennsylvanicus, C. modoc; Cardiocondyla nuda, Chalibion sp, Crematogaster* spp., *Dasymutilla occidentalis, Diprion* spp., *Dolichovespula maculata, Dorymyrmex* spp., *Dryocosmus kuriphilus, Formica* spp., *Hoplocampa* spp. such as *H. minuta, H. testudinea; Iridomyrmex humilis,* Lasius spp. such as *L. niger, Linepithema humile, Liometopum* spp., *Leptocybe invasa, Monomorium* spp. such as *M. pharaonis, Monomorium, Nylandria fulva, Pachycondyla chinensis, Paratrechina longicornis, Paravespula* spp., such as *P. germanica, P. pennsylvanica, P. vulgaris; Pheidole* spp. such as *P. megacephala; Pogonomyrmex* spp. such as *P. barbatus, P. californicus, Polistes rubiginosa, Prenolepis impairs, Pseudomyrmex gracilis, Schelipron* spp., *Sirex cyaneus, Solenopsis* spp. such as *S. geminata, S.invicta, S. molesta, S. richteri, S. xyloni, Sphecius speciosus, Sphex* spp., *Tapinoma* spp. such as *T. melanocephalum, T. sessile; Tetramorium* spp. such as *T. caespitum, T. bicarinatum, Vespa* spp. such as *V. crabro; Vespula* spp. such as *V. squamosal; Wasmannia auropunctata*, *Xylocopa* sp;

Insects from the order Orthoptera for example *Acheta domesticus, Calliptamus italicus, Chortoicetes terminifera, Ceuthophilus* spp., *Diastrammena asynamora, Dociostaurus maroccanus, Gryllotalpa* spp. such as *G. africana, G. gryllotalpa; Gryllus* spp., *Hieroglyphus daganensis, Kraussaria angulifera, Locusta* spp. such as *L. migratoria, L. pardalina; Melanoplus* spp. such as *M. bivittatus, M. femurrubrum, M. mexicanus, M. sanguinipes, M. spretus; Nomadacris septemfasciata, Oedaleus senegalensis, Scapteriscus* spp., *Schistocerca* spp. such as *S. americana, S. gregaria, Stemopelmatus* spp., *Tachycines asynamorus,* and *Zonozerus variegatus;*

Pests from the Class Arachnida for example Acari,e.g. of the families Argasidae, Ixodidae and Sarcoptidae, such as *Amblyomma* spp. (e.g. *A. americanum, A. variegatum, A. maculatum*), Argas spp. such as *A. persicu*), *Boophilus* spp. such as *B. annulatus, B. decoloratus, B. microplus, Dermacentor* spp. such as *D.silvarum, D. andersoni, D. variabilis, Hyalomma* spp. such as *H. truncatum, Ixodes* spp. such as *I. ricinus, I. rubicundus, I. scapularis, I. holocyclus, I. pacificus, Rhipicephalus sanguineus, Ornithodorus* spp. such as *O. moubata, O. hermsi, O. turicata, Ornithonyssus bacoti, Otobius megnini, Dermanyssus gallinae, Psoroptes* spp. such as *P. ovis, Rhipicephalus* spp. such as *R. sanguineus, R. appendiculatus, Rhipicephalus evertsi, Rhizoglyphus* spp., *Sarcoptes* spp. such as*S. Scabiei*; and Family Eriophyidae including *Aceria* spp. such as *A. sheldoni*, *A. anthocoptes*, *Acallitus* spp., *Aculops* spp. such as *A. lycopersici*, *A. pelekassi*; *Aculus* spp. such as *A. schlechtendali; Colomerus vitis, Epitrimerus pyri, Phyllocoptruta oleivora; Eriophytes ribis* and *Eriophyes* spp. such as *Eriophyes sheldoni*; Family Tarsonemidae including *Hemitarsonemus* spp., *Phytonemus pallidus and Polyphagotarsonemus latus, Stenotarsonemus* spp. *Steneotarsonemus spinki*; Family Tenuipalpidae including Brevipalpus spp.

such as *B. phoenicis*; Family Tetranychidae including *Eotetranychus* spp., *Eutetranychus* spp., *Oligonychus* spp., *Petrobia latens*, *Tetranychus* spp. such as *T. cinnabarinus, T. evansi, T. kanzawai, T, pacificus, T. phaseulus, T. telarius* and *T. urticae*; *Bryobia praetiosa*; *Panonychus* spp. such as *P. ulmi*, *P. citri*; *Metatetranychus* spp. and *Oligonychus* spp. such as *O. pratensis, O. perseae*, *Vasates lycopersici*; *Raoiella indica, Family* Carpoglyphidae including *Carpoglyphus* spp.; *Penthaleidae* spp. such as *Halotydeus destructor*; Family Demodicidae with species such as *Demodex* spp.; Family Trombicidea including *Trombicula* spp.; Family Macronyssidae including *Ornothonyssus* spp.; Family Pyemotidae including *Pyemotes tritici*; *Tyrophagus putrescentiae*; Family Acaridae including *Acarus siro*; Family Araneida including *Latrodectus mactans*, *Tegenaria agrestis, Chiracanthium sp, Lycosa sp Achaearanea tepidariorum* and *Loxosceles reclusa*;

Pests from the Phylum Nematoda, for example, plant parasitic nematodes such as root-knot nematodes, *Meloidogyne* spp. such as *M. hapla, M. incognita, M. javanica;* cyst-forming nematodes, *Globodera* spp. such as *G. rostochiensis; Heterodera* spp. such as *H. avenae, H. glycines, H. schachtii, H. trifolii;* Seed gall nematodes, *Anguina* spp.; Stem and foliar nematodes, *Aphelenchoides* spp. such as *A. besseyi;* Sting nematodes, *Belonolaimus* spp. such as *B. longicaudatus;* Pine nematodes, *Bursaphelenchus* spp. such as *B. lignicolus, B. xylophilus;* Ring nematodes, *Criconema* spp., *Criconemella* spp. such as *C. xenoplax* and *C. ornata;* and, *Criconemoides* spp. such as *Criconemoides informis; Mesocriconema* spp.; Stem and bulb nematodes, *Ditylenchus* spp. such as *D. destructor, D. dipsaci;* Awl nematodes, *Dolichodorus* spp.; Spiral nematodes, *Heliocotylenchus multicinctus;* Sheath and sheathoid nematodes, *Hemicycliophora* spp. and *Hemicriconemoides* spp.; *Hirshmanniella* spp.; Lance nematodes, *Hoploaimus* spp.; False rootknot nematodes, *Nacobbus* spp.; Needle nematodes, *Longidorus* spp. such as *L. elongatus;* Lesion nematodes, *Pratylenchus* spp. such as *P. brachyurus, P. neglectus, P. penetrans, P. curvitatus, P. goodeyi;* Burrowing nematodes, *Radopholus* spp. such as *R. similis; Rhadopholus* spp.; *Rhodopholus* spp.; Reniform nematodes, *Rotylenchus* spp. such as *R. robustus, R. reniformis; Scutellonema* spp.; Stubby-root nematode, *Trichodorus* spp. such as *T. obtusus*, *T. primitivus; Paratrichodorus* spp. such as *P. minor;* Stunt nematodes, *Tylenchorhynchus* spp. such as *T. claytoni*, *T. dubius;* Citrus nematodes, *Tylenchulus* spp. such as *T. semipenetrans;* Dagger nematodes, *Xiphinema* spp.; and other plant parasitic nematode species;

Insects from the order Isoptera for example *Calotermes flavicollis, Coptotermes* spp. such as *C. formosanus, C. gestroi, C. acinaciformis; Cornitermes cumulans, Cryptotermes* spp. such as *C. brevis, C. cavifrons; Globitermes sulfureus, Heterotermes* spp. such as *H. aureus, H. longiceps, H. tenuis; Leucotermes flavipes, Odontotermes spp., Incisitermes* spp. such as *I. minor, I. Snyder*, *Marginitermes hubbardi*, *Mastotermes* spp. such as *M. darwiniensis Neocapritermes* spp. such as *N. opacus, N. parvus; Neotermes* spp., *Procornitermes* spp., *Zootermopsis* spp. *such as Z. angusticollis*, *Z. nevadensis*, *Reticulitermes* spp. such as *R. hesperus, R. tibialis, R. speratus, R. flavipes, R. grassei, R. lucifugus, R. santonensis, R. virginicus; Termes natalensis,*

Insects from the order Blattaria for example *Blatta* spp. such as *B. orientalis, B. lateralis; Blattella* spp. such as *B. asahinae, B. germanica; Leucophaea maderae, Panchlora nivea, Periplaneta* spp. such as *P. americana, P. australasiae, P. brunnea, P. fuligginosa, P. japonica;* Supella longipalpa, *Parcoblatta pennsylvanica, Eurycotis floridana, Pycnoscelus surinamensis,*

Insects from the order Siphonoptera for example *Cediopsylla simples*, *Ceratophyllus* spp., *Ctenocephalides* spp. such as *C. felis*, *C. canis*, *Xenopsylla cheopis*, *Pulex irritans*, *Trichodectes canis*, *Tunga penetrans*, and *Nosopsyllus fasciatus*,

Insects from the order Thysanura for example *Lepisma saccharina*, *Ctenolepisma urbana*, and *Thermobia domestica*,

Pests from the class Chilopoda for example *Geophilus* spp., Scutigera spp. such as *Scutigera coleoptrata*;

Pests from the class Diplopoda for example *Blaniulus guttulatus*, *Julus* spp., *Narceus* spp.,

Pests from the class Symphyla for example *Scutigerella immaculata*,

Insects from the order Dermaptera, for example *Forficula auricularia*,

Insects from the order Collembola, for example *Onychiurus* spp., such as *Onychiurus armatus*,

Pests from the order Isopoda for example, *Armadillidium vulgare, Oniscus asellus, Porcellio scaber*,

Insects from the order Phthiraptera, for example *Damalinia* spp., Pediculus spp. such as *Pediculus humanus capitis, Pediculus humanus corporis, Pediculus humanus humanus; Pthirus pubis*, Haematopinus spp. such as *Haematopinus eurysternus*, *Haematopinus suis*; Linognathus spp. such as *Linognathus vituli; Bovicola bovis, Menopon gallinae, Menacanthus stramineus* and *Solenopotes capillatus, Trichodectes* spp.,

Examples of further pest species which may be controlled by mixtures of the invention include: from the Phylum Mollusca, class Bivalvia, for example, *Dreissena* spp.; class Gastropoda, for example, *Arion* spp., *Biomphalaria* spp., *Bulinus* spp., *Deroceras* spp., *Galba* spp., *Lymnaea* spp., *Oncomelania* spp., *Pomacea canaliclata, Succinea* spp.; from the class of the helminths, for example, *Ancylostoma duodenale, Ancylostoma ceylanicum, Acylostoma braziliensis, Ancylostoma* spp., *Ascaris lubricoides, Ascaris spp., Brugia malayi, Brugia timori, Bunostomum* spp., *Chabertia* spp., *Clonorchis* spp., *Cooperia* spp., *Dicrocoelium* spp., *Dictyocaulus filaria, Diphyllobothrium latum, Dracunculus medinensis, Echinococcus granulosus, Echinococcus multilocularis, Enterobius vermicularis, Faciola* spp., Haemonchus spp. such as *Haemonchus contortus; Heterakis* spp., *Hymenolepis nana, Hyostrongulus* spp., *Loa Loa, Nematodirus* spp., *Oesophagostomum* spp., *Opisthorchis* spp., *Onchocerca volvulus, Ostertagia* spp., *Paragonimus* spp., *Schistosomen* spp., *Strongyloides fuelleborni, Strongyloides stercora lis, Stronyloides* spp., *Taenia saginata, Taenia solium, Trichinella spiralis, Trichinella nativa, Trichinella britovi, Trichinella nelsoni, Trichinella pseudopsiralis, Trichostrongulus spp., Trichuris trichuria, Wuchereria bancrofti.*

The mixtures of the present inventon are particularly suitable for controlling the following plant diseases:

Albugo spp. (white rust) on ornamentals, vegetables (e. g. *A. candida*) and sunflowers (e. g. *A. tragopogonis*); *Alternaria* spp. (Alternaria leaf spot) on vegetables, rape (*A. brassicola* or *brassicae*), sugar beets (*A. tenuis*), fruits, rice, soybeans, potatoes (e. g. *A. solani* or *A. alternata*), tomatoes (e. g. *A. solani* or *A. alternata*) and wheat; *Aphanomyces* spp. on sugar beets and vegetables; *Ascochyta* spp. on cereals and vegetables, e. g. *A. tritici* (anthracnose) on wheat and *A. hordei* on barley; *Bipolaris* and *Drechslera* spp. (teleomorph: *Cochliobolus* spp.), e. g. Southern leaf blight (*D. maydis)* or Northern leaf blight (*B. zeicola*) on corn, e. g. spot blotch (*B. sorokiniana*) on cereals and e. g. *B. oryzae* on rice and turfs; *Blumeria* (formerly *Erysiphe*) *graminis*

(powdery mildew) on cereals (e. g. on wheat or barley); *Botrytis cinerea* (teleomorph: *Botryotinia fuckeliana*: grey mold) on fruits and berries (e. g. strawberries), vegetables (e. g. lettuce, carrots, celery and cabbages), rape, flowers, vines, forestry plants and wheat; *Bremia lactucae* (downy mildew) on lettuce; *Ceratocystis* (syn. *Ophiostoma*) spp. (rot or wilt) on broad-leaved trees and evergreens, e. g. *C. ulmi* (Dutch elm disease) on elms; *Cercospora* spp. (Cercospora leaf spots) on corn (e. g. Gray leaf spot: *C. zeae-maydis*), rice, sugar beets (e. g. *C. beticola*), sugar cane, vegetables, coffee, soybeans (e. g. *C. sojina* or *C. kikuchii*) and rice; *Cladosporium* spp. on tomatoes (e. g. *C. fulvum*: leaf mold) and cereals, e. g. *C. herbarum* (black ear) on wheat; *Claviceps purpurea* (ergot) on cereals; *Cochliobolus* (anamorph: *Helminthosporium* of *Bipolaris*) spp. (leaf spots) on corn (*C. carbonum*), cereals (e. g. *C. sativus*, anamorph: *B. sorokiniana*) and rice (e. g. *C. miyabeanus*, anamorph: *H. oryzae*); *Colletotrichum* (teleomorph: *Glomerella*) spp. (anthracnose) on cotton (e. g. *C. gossypii*), corn (e. g. *C. graminicola:* Anthracnose stalk rot), soft fruits, potatoes (e. g. *C. coccodes*: black dot), beans (e. g. *C. lindemuthianum*) and soybeans (e. g. *C. truncatum* or *C. gloeosporioides*); *Corticium* spp., e. g. *C. sasakii* (sheath blight) on rice; *Corynespora cassiicola* (leaf spots) on soybeans and ornamentals; *Cycloconium* spp., e. g. *C. oleaginum* on olive trees; *Cylindrocarpon* spp. (e. g. fruit tree canker or young vine decline, teleomorph: *Nectria* or *Neonectria* spp.) on fruit trees, vines (e. g. *C. liriodendri*, teleomorph: *Neonectria liriodendri*: Black Foot Disease) and ornamentals; *Dematophora* (teleomorph: *Rosellinia*) *necatrix* (root and stem rot) on soybeans; *Diaporthe* spp., e. g. *D. phaseolorum* (damping off) on soybeans; *Drechslera* (syn. *Helminthosporium*, teleomorph: *Pyrenophora*) spp. on corn, cereals, such as barley (e. g. *D. teres*, net blotch) and wheat (e. g. *D. tritici-repentis*: tan spot), rice and turf; Esca (dieback, apoplexy) on vines, caused by *Formitiporia* (syn. *Phellinus*) *punctata*, *F. mediterranea*, *Phaeomoniella chlamydospora* (earlier *Phaeoacremonium chlamydosporum*), *Phaeoacremonium aleophilum* and/or *Botryosphaeria obtusa*; *Elsinoe* spp. on pome fruits (*E. pyri*), soft fruits (*E. veneta*: anthracnose) and vines (*E. ampelina*: anthracnose); *Entyloma oryzae* (leaf smut) on rice; *Epicoccum* spp. (black mold) on wheat; *Erysiphe* spp. (powdery mildew) on sugar beets (*E. betae*), vegetables (e. g. *E. pisi*), such as cucurbits (e. g. *E. cichoracearum*), cabbages, rape (e. g. *E. cruciferarum*); *Eutypa lata* (Eutypa canker or dieback, anamorph: *Cytosporina lata*, syn. *Libertella blepharis*) on fruit trees, vines and ornamental woods; *Exserohilum* (syn. *Helminthosporium*) spp. on corn (e. g. *E. turcicum*); *Fusarium* (teleomorph: *Gibberella*) spp. (wilt, root or stem rot) on various plants, such as *F. graminearum* or *F. culmorum* (root rot, scab or head blight) on cereals (e. g. wheat or barley), *F. oxysporum* on tomatoes, *F. solani* (f. sp. *glycines* now syn. *F. virguliforme*) and *F. tucumaniae* and *F. brasiliense* each causing sudden death syndrome on soybeans, and *F. verticillioides* on corn; *Gaeumannomyces graminis* (take-all) on cereals (e. g. wheat or barley) and corn; *Gibberella* spp. on cereals (e. g. *G. zeae*) and rice (e. g. *G. fujikuroi*: Bakanae disease); *Glomerella cingulata* on vines, pome fruits and other plants and *G. gossypii* on cotton; Grainstaining complex on rice; *Guignardia bidwellii* (black rot) on vines; *Gymnosporangium* spp. on rosaceous plants and junipers, e. g. *G. sabinae* (rust) on pears; *Helminthosporium* spp. (syn. *Drechslera*, teleomorph: *Cochliobolus*) on corn, cereals and rice; *Hemileia* spp., e. g. *H. vastatrix* (coffee leaf rust) on coffee; *Isariopsis clavispora* (syn. *Cladosporium vitis*) on vines; *Macrophomina phaseolina* (syn. *phaseoli*) (root and stem rot) on soybeans and cotton; *Microdochium* (syn. *Fusarium*) *nivale* (pink snow mold) on cereals (e. g. wheat or barley); *Microsphaera diffusa*

(powdery mildew) on soybeans; *Monilinia* spp., e. g. *M. laxa*, *M. fructicola* and *M. fructigena* (bloom and twig blight, brown rot) on stone fruits and other rosaceous plants; *Mycosphaerella* spp. on cereals, bananas, soft fruits and ground nuts, such as e. g. *M. graminicola* (anamorph: *Septoria tritici*, Septoria blotch) on wheat or *M. fijiensis* (black Sigatoka disease) on bananas; *Peronospora* spp. (downy mildew) on cabbage (e. g. *P. brassicae*), rape (e. g. *P. parasitica*), onions (e. g. *P. destructor*), tobacco (*P. tabacina*) and soybeans (e. g. *P. manshurica*); *Phakopsora pachyrhizi* and *P. meibomiae* (soybean rust) on soybeans; *Phialophora* spp. e. g. on vines (e. g. *P. tracheiphila* and *P. tetraspora*) and soybeans (e. g. *P. gregata*: stem rot); *Phoma lingam* (root and stem rot) on rape and cabbage and *P. betae* (root rot, leaf spot and damping-off) on sugar beets; *Phomopsis* spp. on sunflowers, vines (e. g. *P. viticola*: can and leaf spot) and soybeans (e. g. stem rot: *P. phaseoli*, teleomorph: *Diaporthe phaseolorum*); *Physoderma maydis* (brown spots) on corn; *Phytophthora* spp. (wilt, root, leaf, fruit and stem root) on various plants, such as paprika and cucurbits (e. g. *P. capsici*), soybeans (e. g. *P. megasperma*, syn. *P. sojae*), potatoes and tomatoes (e. g. *P. infestans*: late blight) and broad-leaved trees (e. g. *P. ramorum*: sudden oak death); *Plasmodiophora brassicae* (club root) on cabbage, rape, radish and other plants; *Plasmopara* spp., e. g. *P. viticola* (grapevine downy mildew) on vines and *P. halstedii* on sunflowers; *Podosphaera* spp. (powdery mildew) on rosaceous plants, hop, pome and soft fruits, e. g. *P. leucotricha* on apples; *Polymyxa* spp., e. g. on cereals, such as barley and wheat (*P. graminis*) and sugar beets (*P. betae*) and thereby transmitted viral diseases; *Pseudocercosporella herpotrichoides* (eyespot, teleomorph: *Tapesia yallundae*) on cereals, e. g. wheat or barley; *Pseudoperonospora* (downy mildew) on various plants, e. g. *P. cubensis* on cucurbits or *P. humili* on hop; *Pseudopezicula tracheiphila* (red fire disease or ‚rotbrenner', anamorph: *Phialophora*) on vines; *Puccinia* spp. (rusts) on various plants, e. g. *P. triticina* (brown or leaf rust), *P. striiformis* (stripe or yellow rust), *P. hordei* (dwarf rust), *P. graminis* (stem or black rust) or *P. recondita* (brown or leaf rust) on cereals, such as e. g. wheat, barley or rye, *P. kuehnii* (orange rust) on sugar cane and *P. asparagi* on asparagus; *Pyrenophora* (anamorph: *Drechslera*) *tritici-repentis* (tan spot) on wheat or *P. teres* (net blotch) on barley; *Pyricularia* spp., e. g. *P. oryzae* (teleomorph: *Magnaporthe grisea*, rice blast) on rice and *P. grisea* on turf and cereals; *Pythium* spp. (damping-off) on turf, rice, corn, wheat, cotton, rape, sunflowers, soybeans, sugar beets, vegetables and various other plants (e. g. *P. ultimum* or *P. aphanidermatum*); *Ramularia* spp., e. g. *R. collo-cygni* (Ramularia leaf spots, Physiological leaf spots) on barley and *R. beticola* on sugar beets; *Rhizoctonia* spp. on cotton, rice, potatoes, turf, corn, rape, potatoes, sugar beets, vegetables and various other plants, e. g. *R. solani* (root and stem rot) on soybeans, *R. solani* (sheath blight) on rice or *R. cerealis* (Rhizoctonia spring blight) on wheat or barley; *Rhizopus stolonifer* (black mold, soft rot) on strawberries, carrots, cabbage, vines and tomatoes; *Rhynchosporium secalis* (scald) on barley, rye and triticale; *Sarocladium oryzae* and *S. attenuatum* (sheath rot) on rice; *Sclerotinia* spp. (stem rot or white mold) on vegetables and field crops, such as rape, sunflowers (e. g. *S. sclerotiorum*) and soybeans (e. g. *S. rolfsii* or *S. sclerotiorum*); *Septoria* spp. on various plants, e. g. *S. glycines* (brown spot) on soybeans, *S. tritici* (Septoria blotch) on wheat and *S.* (syn. *Stagonospora*) nodorum (Stagonospora blotch) on cereals; *Uncinula* (syn. *Erysiphe*) *necator* (powdery mildew, anamorph: *Oidium tuckeri*) on vines; *Setospaeria* spp. (leaf blight) on corn (e. g. *S. turcicum*, syn. *Helminthosporium turcicum*) and turf; *Sphacelotheca* spp. (smut) on corn, (e. g. *S. reiliana*:

head smut), sorghum und sugar cane; *Sphaerotheca fuliginea* (powdery mildew) on cucurbits; *Spongospora subterranea* (powdery scab) on potatoes and thereby transmitted viral diseases; *Stagonospora* spp. on cereals, e. g. *S. nodorum* (Stagonospora blotch, teleomorph: *Leptosphaeria* [syn. *Phaeosphaeria*] *nodorum*) on wheat; *Synchytrium endobioticum* on potatoes (potato wart disease); *Taphrina* spp., e. g. *T. deformans* (leaf curl disease) on peaches and *T. pruni* (plum pocket) on plums; *Thielaviopsis* spp. (black root rot) on tobacco, pome fruits, vegetables, soybeans and cotton, e. g. *T. basicola* (syn. *Chalara elegans*); *Tilletia* spp. (common bunt or stinking smut) on cereals, such as e. g. *T. tritici* (syn. *T. caries*, wheat bunt) and *T. controversa* (dwarf bunt) on wheat; *Typhula incarnata* (grey snow mold) on barley or wheat; *Urocystis* spp., e. g. *U. occulta* (stem smut) on rye; *Uromyces* spp. (rust) on vegetables, such as beans (e. g. *U. appendiculatus*, syn. *U. phaseoli*) and sugar beets (e. g. *U. betae*); *Ustilago* spp. (loose smut) on cereals (e. g. *U. nuda* and *U. avaenae*), corn (e. g. *U. maydis*: corn smut) and sugar cane; *Venturia* spp. (scab) on apples (e. g. *V. inaequalis*) and pears; and *Verticillium* spp. (wilt) on various plants, such as fruits and ornamentals, vines, soft fruits, vegetables and field crops, e. g. *V. dahliae* on strawberries, rape, potatoes and tomatoes.

The mixtures of the invention are suitable for use in treating or protecting animals against infestation or infection by parasites. Therefore, the invention also relates to the use of a mixture of the invention for the manufacture of a medicament for the treatment or protection of animals against infestation or infection by parasites. Furthermore, the invention relates to a method of treating or protecting animals against infestation and infection by parasites, which comprises orally, topically or parenterally administering or applying to the animals a parasiticidally effective amount of a mixture of the invention.

The present invention also relates to the non-therapeutic use of mixtures of the invention for treating or protecting animals against infestation and infection by parasites. Moreover, the invention relates to a non-therapeutic method of treating or protecting animals against infestation and infection by parasites, which comprises applying to a locus a parasiticidally effective amount of a mixture of the invention.

The mixtures of the invention are further suitable for use in combating or controlling parasites in and on animals. Furthermore, the invention relates to a method of combating or controlling parasites in and on animals, which comprises contacting the parasites with a parasitically effective amount of a mixture of the invention.

The invention also relates to the non-therapeutic use of mixtures of the invention for controlling or combating parasites. Moreover, the invention relates to a non-therapeutic method of combating or controlling parasites, which comprises applying to a locus a parasiticidally effective amount of a mixture of the invention.

The mixtures of the invention can be effective through both contact (via soil, glass, wall, bed net, carpet, blankets or animal parts) and ingestion (e.g. baits). Furthermore, the mixtures of the invention can be applied to any and all developmental stages.

The mixtures of the invention can be applied as such or in form of compositions comprising the mixtures of the invention.

The mixtures of the invention can also be applied together with a mixing partner, which acts against pathogenic parasites, e.g. with synthetic coccidiosis compounds, polyetherantibiotics such as Amprolium, Robenidin, Toltrazuril, Monensin, Salinomycin, Maduramicin, Lasalocid,

Narasin or Semduramicin, or with other mixing partners as defined above, or in form of compositions comprising said mixtures.

The mixtures of the invention and compositions comprising them can be applied orally, parenterally or topically, e.g. dermally. The mixtures of the invention can be systemically or non-systemically effective.

The application can be carried out prophylactically, therapeutically or non-therapeutically. Furthermore, the application can be carried out preventively to places at which occurrence of the parasites is expected.

As used herein, the term "contacting" includes both direct contact (applying the mixtures/compositions directly on the parasite, including the application directly on the animal or excluding the application directly on the animal, e.g. at it's locus for the latter) and indirect contact (applying the mixtures/compositions to the locus of the parasite). The contact of the parasite through application to its locus is an example of a non-therapeutic use of the mixtures of the invention.

The term "locus" means the habitat, food supply, breeding ground, area, material or environment in which a parasite is growing or may grow outside of the animal.

As used herein, the term “parasites” includes endo- and ectoparasites. In some embodiments of the invention, endoparasites can be preferred. In other embodiments, ectoparasites can be preferred. Infestations in warm-blooded animals and fish include, but are not limited to, lice, biting lice, ticks, nasal bots, keds, biting flies, muscoid flies, flies, myiasitic fly larvae, chiggers, gnats, mosquitoes and fleas.

The mixtures of the invention are especially useful for combating parasites of the following orders and species, respectively:

fleas (Siphonaptera), e.g. *Ctenocephalides felis*, *Ctenocephalides canis, Xenopsylla cheopis*, *Pulex irritans*, *Tunga penetrans*, and *Nosopsyllus fasciatus;* cockroaches (Blattaria - Blattodea), e.g. *Blattella germanica, Blattella asahinae, Periplaneta americana, Periplaneta japonica, Periplaneta brunnea, Periplaneta fuligginosa*, *Periplaneta australasiae*, and *Blatta orientalis;* flies, mosquitoes (Diptera), e.g. *Aedes aegypti, Aedes albopictus*, *Aedes vexans, Anastrepha ludens, Anopheles maculipennis, Anopheles crucians, Anopheles albimanus, Anopheles gambiae, Anopheles freeborni, Anopheles leucosphyrus, Anopheles minimus, Anopheles quadrimaculatus*, *Calliphora vicina, Chrysomya bezziana, Chrysomya hominivorax, Chrysomya macellaria, Chrysops discalis, Chrysops silacea, Chrysops atlanticus, Cochliomyia hominivorax, Cordylobia anthropophaga, Culicoides furens, Culex pipiens, Culex nigripalpus, Culex quinquefasciatus*, *Culex tarsalis, Culiseta inornata, Culiseta melanura*, *Dermatobia hominis, Fannia canicularis, Gasterophilus intestinalis, Glossina morsitans, Glossina palpalis, Glossina fuscipes, Glossina tachinoides, Haematobia irritans, Haplodiplosis equestris, Hippelates spp., Hypoderma lineata, Leptoconops torrens, Lucilia caprina, Lucilia cuprina, Lucilia sericata, Lycoria pectoralis, Mansonia spp., Musca domestica, Muscina stabulans, Oestrus ovis, Phlebotomus argentipes, Psorophora columbiae, Psorophora discolor, Prosimulium mixtum*, *Sarcophaga haemorrhoidalis*, *Sarcophaga sp., Simulium vittatum, Stomoxys calcitrans, Tabanus bovinus, Tabanus atratus, Tabanus lineola,* and *Tabanus similis;* lice (Phthiraptera), e.g. *Pediculus humanus capitis, Pediculus humanus corporis, Pthirus pubis*, *Haematopinus eurysternus*, *Haematopinus suis*, *Linognathus vituli, Bovicola bovis, Menopon gallinae, Menacanthus stramineus* and *Solenopotes capillatus;* ticks and parasitic mites (Parasitiformes): ticks (Ixodida), e.g. *Ixodes scapularis, Ixodes*

holocyclus, Ixodes pacificus, Rhiphicephalus sanguineus, Dermacentor andersoni, Dermacentor variabilis, *Amblyomma americanum, Ambryomma maculatum, Ornithodorus hermsi, Ornithodorus turicata* and parasitic mites (Mesostigmata), e.g. *Ornithonyssus bacoti* and *Dermanyssus gallinae*; Actinedida (Prostigmata) und Acaridida (Astigmata), e.g. *Acarapis spp., Cheyletiella spp., Ornithocheyletia spp., Myobia spp., Psorergates spp., Demodex spp., Trombicula spp., Listrophorus spp., Acarus spp., Tyrophagus spp., Caloglyphus spp., Hypodectes spp., Pterolichus spp., Psoroptes spp., Chorioptes spp., Otodectes spp., Sarcoptes spp., Notoedres spp.,Knemidocoptes spp., Cytodites spp.,* and *Laminosioptes spp;* Bugs (Heteropterida): *Cimex lectularius, Cimex hemipterus, Reduvius senilis, Triatoma spp., Rhodnius ssp., Panstrongylus ssp.,* and *Arilus critatus;* Anoplurida, e.g. *Haematopinus spp., Linognathus spp., Pediculus spp., Phtirus spp.,* and *Solenopotes spp.;* Mallophagida (suborders Arnblycerina and Ischnocerina), e.g. *Trimenopon spp., Menopon spp., Trinoton spp., Bovicola spp., Werneckiella spp., Lepikentron spp., Trichodectes spp.,* and *Felicola spp.;* Roundworms Nematoda: Wipeworms and Trichinosis (Trichosyringida), e.g. Trichinellidae *(Trichinella spp.), (*Trichuridae*) Trichuris spp., Capillaria spp.;* Rhabditida, e.g. *Rhabditis spp., Strongyloides spp., Helicephalobus spp.;* Strongylida, e.g. *Strongylus spp., Ancylostoma spp., Necator americanus, Bunostomum spp. (Hookworm), Trichostrongylus spp., Haemonchus contortus, Ostertagia spp., Cooperia spp., Nematodirus spp., Dictyocaulus spp., Cyathostoma spp., Oesophagostomum spp., Stephanurus dentatus, Ollulanus spp., Chabertia spp., Stephanurus dentatus, Syngamus trachea*, *Ancylostoma spp., Uncinaria spp., Globocephalus spp., Necator spp., Metastrongylus spp., Muellerius capillaris, Protostrongylus spp., Angiostrongylus spp., Parelaphostrongylus spp., Aleurostrongylus abstrusus,* and *Dioctophyma renale;* Intestinal roundworms (Ascaridida), e.g. *Ascaris lumbricoides, Ascaris suum, Ascaridia galli, Parascaris equorum, Enterobius vermicularis (Threadworm), Toxocara canis, Toxascaris leonine, Skrjabinema spp.,* and *Oxyuris equi;* Camallanida, e.g. *Dracunculus medinensis* (guinea worm); Spirurida, e.g. *Thelazia spp., Wuchereria spp., Brugia spp., Onchocerca spp., Dirofilari spp.a, Dipetalonema spp., Setaria spp., Elaeophora spp., Spirocerca lupi,* and *Habronema spp.;* Thorny headed worms (Acanthocephala), e.g. *Acanthocephalus spp., Macracanthorhynchus hirudinaceus* and *Oncicola spp.;* Planarians (Plathelminthes): Flukes (Trematoda), e.g. *Faciola spp., Fascioloides magna, Paragonimus spp., Dicrocoelium spp., Fasciolopsis buski, Clonorchis sinensis, Schistosoma spp., Trichobilharzia spp., Alaria alata, Paragonimus spp.,* and *Nanocyetes spp.*; Cercomeromorpha, in particular Cestoda (Tapeworms), e.g. *Diphyllobothrium spp., Tenia spp., Echinococcus spp., Dipylidium caninum, Multiceps spp., Hymenolepis spp., Mesocestoides spp., Vampirolepis spp., Moniezia spp., Anoplocephala spp., Sirometra spp., Anoplocephala spp.,* and *Hymenolepis spp.*.

As used herein, the term “animal” includes warm-blooded animals (including humans) and fish. Preferred are mammals, such as cattle, sheep, swine, camels, deer, horses, pigs, poultry, rabbits, goats, dogs and cats, water buffalo, donkeys, fallow deer and reindeer, and also in fur-bearing animals such as mink, chinchilla and raccoon, birds such as hens, geese, turkeys and ducks and fish such as fresh- and salt-water fish such as trout, carp and eels. Particularly preferred are domestic animals, such as dogs or cats.

In general, "parasiticidally effective amount" means the amount of active ingredient needed to achieve an observable effect on growth, including the effects of necrosis, death, retardation, prevention, and removal, destruction, or otherwise diminishing the occurrence and activity of the

target organism. The parasiticidally effective amount can vary for the various mixtures/compositions used in the invention. A parasiticidally effective amount of the compositions will also vary according to the prevailing conditions such as desired parasiticidal effect and duration, target species, mode of application, and the like.

Generally, it is favorable to apply the mixtures of the invention in total amounts of 0.5 mg/kg to 100 mg/kg per day, preferably 1 mg/kg to 50 mg/kg per day.

For oral administration to warm-blooded animals, mixtures of the invention may be formulated as animal feeds, animal feed premixes, animal feed concentrates, pills, solutions, pastes, suspensions, drenches, gels, tablets, boluses and capsules. In addition, the mixtures of the inventions may be administered to the animals in their drinking water. For oral administration, the dosage form chosen should provide the animal with 0.01 mg/kg to 100 mg/kg of animal body weight per day of the mixtures of the invention, preferably with 0.5 mg/kg to 100 mg/kg of animal body weight per day.

Alternatively, the mixtures of the inventions may be administered to animals parenterally, for example, by intraruminal, intramuscular, intravenous or subcutaneous injection. The mixtures of the inventions may be dispersed or dissolved in a physiologically acceptable carrier for subcutaneous injection. Alternatively, the mixtures of the inventions may be formulated into an implant for subcutaneous administration. In addition the mixtures of the invention may be transdermally administered to animals. For parenteral administration, the dosage form chosen should provide the animal with 0.01 mg/kg to 100 mg/kg of animal body weight per day of the mixtures of the invention.

The mixtures of the inventions may also be applied topically to the animals in the form of dips, dusts, powders, collars, medallions, sprays, shampoos, spot-on and pour-on formulations and in ointments or oil-in-water or water-in-oil emulsions. For topical application, dips and sprays usually contain 0.5 ppm to 5,000 ppm and preferably 1 ppm to 3,000 ppm of the mixtures of the invention. In addition, the mixtures of the inventions may be formulated as ear tags for animals, particularly quadrupeds such as cattle and sheep.

Suitable preparations are:

- Solutions such as oral solutions, concentrates for oral administration after dilution, solutions for use on the skin or in body cavities, pouring-on formulations, gels;
- Emulsions and suspensions for oral or dermal administration; semi-solid preparations;
- Formulations in which the active mixture is processed in an ointment base or in an oil-in-water or water-in-oil emulsion base;
- Solid preparations such as powders, premixes or concentrates, granules, pellets, tablets, boluses, capsules; aerosols and inhalants, and active mixture-containing shaped articles.

Compositions suitable for injection are prepared by dissolving the active ingredient in a suitable solvent and optionally adding further auxiliaries such as acids, bases, buffer salts, preservatives, and solubilizers. Suitable auxiliaries for injection solutions are known in the art. The solutions are filtered and filled sterile.

Oral solutions are administered directly. Concentrates are administered orally after prior dilution to the use concentration. Oral solutions and concentrates are prepared according to the state of the art and as described above for injection solutions, sterile procedures not being necessary.

Solutions for use on the skin are trickled on, spread on, rubbed in, sprinkled on or sprayed on. Solutions for use on the skin are prepared according to the state of the art and according to what is described above for injection solutions, sterile procedures not being necessary.

Gels are applied to or spread on the skin or introduced into body cavities. Gels are prepared by treating solutions which have been prepared as described in the case of the injection solutions with sufficient thickener that a clear material having an ointment-like consistency results. Suitable thickeners are known in the art.

Pour-on formulations are poured or sprayed onto limited areas of the skin, the active mixture penetrating the skin and acting systemically. Pour-on formulations are prepared by dissolving, suspending or emulsifying the active mixture in suitable skin-compatible solvents or solvent mixtures. If appropriate, other auxiliaries such as colorants, bioabsorption-promoting substances, antioxidants, light stabilizers, adhesives are added. Suitable such auxiliaries are known in the art.

Emulsions can be administered orally, dermally or as injections. Emulsions are either of the water-in-oil type or of the oil-in-water type. They are prepared by dissolving the active mixture either in the hydrophobic or in the hydrophilic phase and homogenizing this with the solvent of the other phase with the aid of suitable emulsifiers and, if appropriate, other auxiliaries such as colorants, absorption-promoting substances, preservatives, antioxidants, light stabilizers, viscosity-enhancing substances. Suitable hydrophobic phases (oils), suitable hydrophilic phases, suitable emulsifiers, and suitable further auxiliaries for emulsions are known in the art.

Suspensions can be administered orally or topically/dermally. They are prepared by suspending the active mixture in a suspending agent, if appropriate with addition of other auxiliaries such as wetting agents, colorants, bioabsorption-promoting substances, preservatives, antioxidants, light stabilizers. Suitable suspending agents, and suitable other auxiliaries for suspensions including wetting agents are known in the art.

Semi-solid preparations can be administered orally or topically/dermally. They differ from the suspensions and emulsions described above only by their higher viscosity.

For the production of solid preparations, the active mixture is mixed with suitable excipients, if appropriate with addition of auxiliaries, and brought into the desired form. Suitable auxiliaries for this purpose are known in the art.

The compositions which can be used in the invention can comprise generally from about 0.001 to 95% of the mixture of the invention.

Ready-to-use preparations contain the mixtures of the invention acting against parasites, preferably ectoparasites, in concentrations of 10 ppm to 80 per cent by weight, preferably from 0.1 to 65 per cent by weight, more preferably from 1 to 50 per cent by weight, most preferably from 5 to 40 per cent by weight.

Preparations which are diluted before use contain the mixtures of the invention acting against ectoparasites in concentrations of 0.5 to 90 per cent by weight, preferably of 1 to 50 per cent by weight.

Furthermore, the preparations comprise the mixtures of the invention against endoparasites in concentrations of 10 ppm to 2 per cent by weight, preferably of 0.05 to 0.9 per cent by weight, very particularly preferably of 0.005 to 0.25 per cent by weight.

Topical application may be conducted with mixture-containing shaped articles such as collars, medallions, ear tags, bands for fixing at body parts, and adhesive strips and foils.

Generally it is favorable to apply solid formulations which release mixtures of the invention in total amounts of 10 mg/kg to 300 mg/kg, preferably 20 mg/kg to 200 mg/kg, most preferably 25 mg/kg to 160 mg/kg body weight of the treated animal in the course of three weeks.

Examples:

Below are the examples of the present invention .

1. COMPOUND I-R-1 and Velifer (Beauveria bassiana)

1.1. Thrips (Frankliniella occidentalis, FRANOC)

1.1.1. Methodology

Indirect exposure was used for the assay. Six days old cotton plants were dipped into the different treatments and allowed to dry for at least 40 minutes. Five replications per treatment with 30 adults of thrips each were kept in the growth chamber with light cycle of 14/10 and 26ºC for a period of 7 days. Each plant with insects was contained in a 32 OZ cup. Feeding damage was evaluated at day 2, 4 and 7. Treatments: control (water), chemical control (Imidacloprid 23ppm), Velifer 2 X 106 cfu/ml, COMPOUND I-R-1 100 ppm, COMPOUND I-R-1 200 ppm, Velifer 2 X 106 cfu/ml + COMPOUND I-R-1 100 ppm and Velifer 2 X 106 cfu/ml + COMPOUND I-R-1 200 ppm.

1.1.2. Results

	Solo application				Combination		
	COMPOUND I-R-1		Beauveria bassiana		COMPOUND I-R-1 + Beauveria bassiana		
Pest	Use rate (ppm)	% Feeding damage reduction	Use rate (cfu/ml)	% Feeding damage reduction	Use rate (ppm + cfu/ml)	% Feeding damage reduction	COLBY
FRANOC	100	56	2 X106	13.1	100 + 2 X106	64	61
FRANOC	200	69	2 X106	13.1	200 + 2 X106	81	73

The combinations of COMPOUND I-R-1 and Velifer showed a synergistic effect on thrips feeding damage reduction

1.2. Flea beetle (Phyllotreta striolata, PHYEVI)

1.2.1. Methodology

Indirect exposure was used for the assay. Seven days old radish plants were dipped into the different treatments and allowed to dry for at least 40 minutes. Five replications per treatment with 5 adults of flea beetle each were kept in the growth chamber with light cycle of 14/10 and 26ºC for a period of 3 days. Each plant was contained in a 32 OZ cup. Mortality was evaluated at day 1, 2 and 3. Treatments: control (water), chemical control (I-R-1 5ul/100ml rate obtained from ATAC), Velifer 1 X 106 cfu/ml, Velifer 2 X 106 cfu/ml, COMPOUND I-R-1 100ppm, Velifer 1 X 106 cfu/ml + COMPOUND I-R-1 100ppm and Velifer 2 X 106 cfu/ml + COMPOUND I-R-1 100ppm.

1.2.2. Results

	Solo application				Combination		
	COMPOUND I-R-1		Beauveria bassiana		COMPOUND I-R-1 + Beauveria bassiana		
Pest	Use rate (ppm)	% Mortality	Use rate (cfu/ml)	% Mortality	Use rate (ppm + cfu/ml)	% Mortality	COLBY
PHYEVI	100	58	1 X106	16	100 + 1 X106	68	64
PHYEVI	100	58	2 X106	16	100 + 2 X106	68	64

The combination of COMPOUND I-R-1 and Velifer displayed a synergistic effect on flea beetle mortality.

1.3. Stink bug (Nezara viridula, NEZAVI)

1.3.1. Methodology

Indirect exposure was used for the assay. Seven days old lima plants were dipped into the different treatments and allowed to dry for at least 40 minutes. Two leaves were cut from the plant and placed them in a petri dish containing filter paper with 2.5ml of water. Five replications per treatment with 4 second instar insects each were kept in the growth chamber with light cycle of 14/10 and 26°C for a period of 3 days. Mortality was evaluated at day 1, 2 and 3. Treatments: control (water), chemical control (Brigadier 56ppm), Velifer 1 X 106 cfu/ml, COMPOUND I-R-1 5.0ppm, Velifer 1 X 106 cfu/ml + COMPOUND I-R-1 5.0ppm.

1.3.2. Results

	Solo application				Combination		
	COMPOUND I-R-1		Beauveria bassiana		COMPOUND I-R-1 + Beauveria bassiana		
Pest	Use rate (ppm)	% Mortality	Use rate (cfu/ml)	% Mortality	Use rate (ppm + cfu/ml)	% Mortality	COLBY
NEZAVII	5.0	53	1 X106	0	5.0 + 1 X106	68	53

A synergistic effect on stink bug was observed when COMPOUND I-R-1 5.0ppm was applied with Velifer 1 X 106 cfu/ml.

1.4. Diamondback moth (Plutella Xylostella, PLUTMA)

1.4.1. Methodology

Indirect exposure was used for the assay. Seven days old lima plants were dipped into the different treatments and allowed to dry for at least 40 minutes. Two leaves were cut from the plant and placed them in a petri dish containing filter paper with 2.5ml of water. Ten replications per treatment with 2 second instar insects each were kept in the growth chamber with light cycle of 14/10 and 26°C for a period of 3 days. Mortality was evaluated at day 1, 2 and 3. Treatments: control (water), chemical control (Coragen 50ppm), Velifer 4 X 106 cfu/ml, COMPOUND I-R-1 50ppm, COMPOUND I-R-1 70ppm, Velifer 4 X 106 cfu/ml + COMPOUND I-R-1 50ppm and Velifer 4 X 106 cfu/ml + COMPOUND I-R-1 70ppm.

1.4.2. Results

	Solo application	Combination

	COMPOUND I-R-1		Beauveria bassiana		COMPOUND I-R-1 + Beauveria bassiana		
Pest	Use rate (ppm)	% Mortality	Use rate (cfu/ml)	% Mortality	Use rate (ppm + cfu/ml)	% Mortality	COLBY
PLUTMA	50	0	4 X106	30	50 + 4 X106	65	30
PLUTMA	70	0	4X106	30	70 + 4 X106	40	30

A synergistic effect on diamondback moth was observed when COMPOUND I-R-1 50ppm was applied with Velifer 4 X 106 cfu/ml and when COMPOUND I-R-1 70ppm was applied with Velifer 4 X 106 cfu/ml.

1.5. Southern armyworm (Spodoptera eridania, PRODER)

1.5.1. Methodology

Indirect exposure was used for the assay. Seven days old lima plants were dipped into the different treatments and allowed to dry for at least 40 minutes. Two leaves were cut from the plant and placed them in a petri dish containing filter paper with 2.5ml of water. Ten replications per treatment with 2 second instar insects each were kept in the growth chamber with light cycle of 14/10 and 26ºC for a period of 4 days. Mortality was evaluated at day 1, 2, 3 and 4. Treatments: control (water), chemical control (Coragen 50ppm), Velifer 2 X 106 cfu/ml, Velifer 4 X 106 cfu/ml, COMPOUND I-R-1 50ppm, Velifer 2 X 106 cfu/ml + COMPOUND I-R-1 50ppm, Velifer 4 X 106 cfu/ml + COMPOUND I-R-1 50ppm.

1.5.2. Results

	Solo application				Combination		
	COMPOUND I-R-1		Beauveria bassiana		COMPOUND I-R-1 + Beauveria bassiana		
Pest	Use rate (ppm)	% Mortality	Use rate (cfu/ml)	% Mortality	Use rate (ppm + cfu/ml)	% Mortality	COLBY
PRODER	50	40	2 X106	0	50 + 2 X106	50	40
PRODER	50	40	4X106	0	50 + 4 X106	50	40

A synergistic effect was observed in both combinations against PRODER.

2. COMPOUND I-R-1 and Nemasys (Steinernema feltia)

2.1. Diamondback moth (Plutella Xylostella, PLUTMA)

2.1.1. Methodology

Indirect exposure was used for the assay. Seven days old lima plants were dipped into the different treatments and allowed to dry for at least 40 minutes and the nematodes were sprayed in solution after that. Two leaves were cut from the plant and placed them in a petri dish containing filter paper with 2.5 ml of water. Ten replications per treatment with 2 second instar insects each were kept in the growth chamber with light cycle of 14/10 and 26ºC for a period of 2 days. Mortality was evaluated at day 1 and 2. Treatments: control (water), chemical control (Coragen 50ppm), Nemasys 2.5 million/gal of water, Nemasys 5 million/gal of water, COMPOUND I-R-1 50ppm, COMPOUND I-R-1 70ppm, Nemasys 2.5 million

nematodes/gal of water + COMPOUND I-R-1 50ppm, Nemasys 2.5 million nematodes/gal of water + COMPOUND I-R-1 70ppm, Nemasys 5.0 million nematodes/gal of water + COMPOUND I-R-1 50ppm and Nemasys 5 million nematodes/gal water + COMPOUND I-R-1 70ppm.

2.1.2. Results

	Solo application				Combination		
	COMPOUND I-R-1		Steinernema feltia		COMPOUND I-R-1 + Steinernema feltia		
Pest	Use rate (ppm)	% Mortality	Use rate (million nematodes/gal water)	% Mortality	Use rate (ppm + million nematodes/ gal water)	% Mortality	COLBY
PLUTMA	50	0	2.5	37	50 + 2.5	84	37
PLUTMA	50	0	5.0	74	50 + 5.0	100	74
PLUTMA	70	16	2.5	37	70 + 2.5	89	47
PLUTMA	70	16	5.0	74	70 + 5.0	100	78

A synergistic effect was observed in all combinations of COMPOUND I-R-1 and Nemasys against PLUTMA.

2.2. Southern army worm (Spodoptera eridania, PRODER)

2.2.1. Methodology

Indirect exposure was used for the assay. Seven days old lima plants were dipped into the different treatments and allowed to dry for at least 40 minutes and the nematodes were sprayed in solution after that. Two leaves were cut from the plant and placed them in a petri dish containing filter paper with 2.5 ml of water. Ten replications per treatment with 2 second instar insects each were kept in the growth chamber with light cycle of 14/10 and 26°C for a period of 2 days. Mortality was evaluated at day 1 and 2. Treatments: control (water), chemical control (Coragen 50ppm), Nemasys 2.50 million/gal of water, Nemasys 5 million/gal of water, COMPOUND I-R-1 50ppm, Nemasys 2.5 million nematodes/gal of water + COMPOUND I-R-1 50ppm, and Nemasys 5 million nematodes/gal water + COMPOUND I-R-1 50ppm.

2.2.2. Results

	Solo application				Combination		
	COMPOUND I-R-1		Steinernema feltia		COMPOUND I-R-1 + Steinernema feltia		
Pest	Use rate (ppm)	% Mortality	Use rate (million nematodes/gal water)	% Mortality	Use rate (ppm + million nematodes / gal water)	% Mortality	COLBY

PRODER	50	60	2.5	45	50 + 2.5	100	78
PRODER	50	60	5.0	60	50 + 5.0	100	84

A synergistic effect was observed for both combinations (i.e., Nemasys 2.5 million nematodes/gal of water + COMPOUND I-R-1 50ppm and Nemasys 5 million nematodes/gal water + COMPOUND I-R-1 50ppm) against PRODER.

Reference: Colby's formula: $E = (X+Y) - (X * Y) / 100$

E expected efficacy, expressed in % of the untreated control, when using the mixture of the active compounds A (e.g. compound IA, IB or IC) and B (e.g. compound II) at the concentrations a and b.

x efficacy, expressed in % of the untreated control, when using the active compound, A at the concentration a,

y efficacy, expressed in % of the untreated control, when using the active compound B at the concentration b.

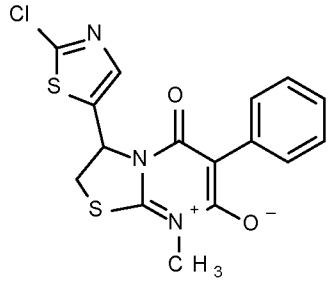
Synergy ratio (S): $S = (XY)/E$

XY Efficacy of the combination

Claims

1. Pesticidal mixtures comprising as active components

1) the compound of formula I



(I)

or the tautomers, enantiomers, diastereomers or salts thereof;

and

2) at least one biopesticide II selected from the groups L1 to L6:

L1) Microbial pesticides with fungicidal, bactericidal, viricidal and/or plant defense activator activity: *Ampelomyces quisqualis*, *Aspergillus flavus*, *Aureobasidium pullulans*, *Bacillus altitudinis, B. amyloliquefaciens*, *B. megaterium*, *B. mojavensis*, *B. mycoides*, *B. pumilus*, *B. simplex*, *B. solisalsi*, *B. subtilis*, *B. subtilis* var. *amyloliquefaciens*, *Candida oleophila*, *C. saitoana*, *Clavibacter michiganensis* (bacteriophages), *Coniothyrium minitans*, *Cryphonectria parasitica*, *Dilophosphora alopecuri*, *Fusarium oxysporum*, *Clonostachys rosea* f. *catenulate* (also named *Gliocladium catenulatum*), *Gliocladium roseum*, *Lysobacter antibioticus*, *L. enzymogenes*, *Metschnikowia fructicola*, *Microdochium dimerum*, *Microsphaeropsis ochracea*, *Muscodor albus*, *Paenibacillus alvei*, *Paenibacillus epiphyticus*, *P. polymyxa*, *P. agglomerans*, *Pantoea vagans*, *Penicillium bilaiae*, *Phlebiopsis gigantea*, *Pseudomonas* sp., *Pseudomonas chloraphis*, *Pseudozyma flocculosa*, *P. fluorescens*, *P. putida*, *Pichia anomala*, *Pythium oligandrum*, *Sphaerodes mycoparasitica*, *Streptomyces griseoviridis*, *S. lydicus*, *S. violaceusniger*, *Talaromyces flavus*, *Trichoderma asperelloides, T. asperellum*, *T. atroviride*, *T. fertile*, *T. gamsii*, *T. harmatum*, *T. harzianum*, *T. polysporum*, *T. stromaticum*, *T. virens*, *T. viride*, *Typhula phacorrhiza*, *Ulocladium oudemansii*, *Verticillium dahlia*, zucchini yellow mosaic virus (avirulent strain);

L2) Biochemical pesticides with fungicidal, bactericidal, viricidal and/or plant defense activator activity selected from: chitosan (hydrolysate), harpin protein, laminarin, Menhaden fish oil, natamycin, Plum pox virus coat protein, potassium or sodium bicarbonate, *Reynoutria sachalinensis* extract, salicylic acid, tea tree oil;

L3) Microbial pesticides with insecticidal, acaricidal, molluscidal and/or nematicidal activity selected from: *Agrobacterium radiobacter*, *Bacillus cereus*, *B. firmus*, *B. thuringiensis*, *B. thuringiensis* ssp. *aizawai*, mixture of strain *B. firmus* CNCM I-1582 and strain *B. thuringiensis* EX297512, *B. t.* ssp. *israelensis*, *B. t.* ssp. *galleriae*, *B. t.* ssp. *kurstaki*, *B. t.* ssp. *tenebrionis*, *Beauveria bassiana*, *B. brongniartii*, *Burkholderia* spp., *Chromobacterium subtsugae*, *Cydia pomonella* granulovirus (CpGV), *Cryptophlebia leucotreta* granulovirus (CrleGV), *Flavobacterium* spp., *Helicoverpa armigera* nucleopolyhedrovirus (HearNPV), *Helicoverpa zea* nucleopolyhedrovirus

(HzNPV), *Helicoverpa zea* single capsid nucleopolyhedrovirus (HzSNPV), *Heterorhabditis bacteriophora*, *Isaria fumosorosea*, *Lecanicillium longisporum*, *L. muscarium*, *Metarhizium anisopliae*, *Metarhizium anisopliae* var. *anisopliae*, *M. anisopliae* var. *acridum*, *Nomuraea rileyi*, *Paecilomyces fumosoroseus, P. lilacinus*, *Paenibacillus popilliae*, *Pasteuria* spp., *P. nishizawae*, *P. penetrans*, *P. ramosa*, *P. thornea*, *P. usgae*, *Pseudomonas fluorescens*, *Spodoptera littoralis* nucleopolyhedrovirus (SpliNPV), *Steinernema carpocapsae*, *S. feltiae*, *S. kraussei, Streptomyces galbus*, *S. microflavus*;

L4) Biochemical pesticides with insecticidal, acaricidal, molluscidal, pheromone and/or nematicidal activity selected from: L-carvone, citral, (E,Z)-7,9-dodecadien-1-yl acetate, ethyl formate, (E,Z)-2,4-ethyl decadienoate (pear ester), (Z,Z,E)-7,11,13-hexadecatrienal, heptyl butyrate, isopropyl myristate, lavanulyl senecioate, cis-jasmone, 2-methyl 1-butanol, methyl eugenol, methyl jasmonate, (E,Z)-2,13-octadecadien-1-ol, (E,Z)-2,13-octadecadien-1-ol acetate, (E,Z)-3,13-octadecadien-1-ol, R-1-octen-3-ol, pentatermanone, potassium silicate, sorbitol octanoate, (E,Z,Z)-3,8,11-tetradecatrienyl acetate, (Z,E)-9,12-tetradecadien-1-yl acetate, Z-7-tetradecen-2-one, Z-9-tetradecen-1-yl acetate, Z-11-tetradecenal, Z-11-tetradecen-1-ol, Acacia negra extract, extract of grapefruit seeds and pulp, extract of *Chenopodium ambrosioides*, Catnip oil, Tagetes oil, alpha-terpinene, p-cymene, limonene;

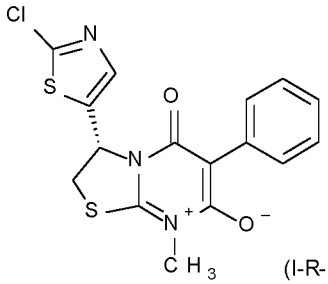
L5) Microbial pesticides with plant stress reducing, plant growth regulator, plant growth promoting and/or yield enhancing activity selected from: *A. lipoferum*, *A. irakense*, *A. halopraeferens*, *Bradyrhizobium* spp., *B. elkanii*, *B. japonicum*, *B. liaoningense*, *B. lupini*, *Delftia acidovorans*, *Glomus intraradices*, *Mesorhizobium* spp., *Rhizobium leguminosarum* bv. *phaseoli*, *R. l.* bv. *trifolii*, *R. l.* bv. *viciae*, *Sinorhizobium meliloti*;

L6) Biochemical pesticides with plant stress reducing, plant growth regulator and/or plant yield enhancing activity selected from: abscisic acid, aluminium silicate (kaolin), 3-decen-2-one, formononetin, genistein, hesperetin, homobrassinolide, humates, jasmonic acid and its salts or derivatives thereof, lysophosphatidyl ethanolamine, naringenin, polymeric polyhydroxy acid and *Ascophyllum nodosum* (Norwegian kelp, Brown kelp) extract;

in synergistically effective amounts.

2. The mixtures according to any of claim 1, wherein the compound of formula I is non-racemic.

3. The mixtures according to any of claims 1 or 2, wherein the compound of formula I is with enantiomeric excess of the compound I-R-1.



(I-R-1)

4. The mixtures according to any of claims 1 to 3, wherein the compound of formula I is with at least 90% enantiomeric excess of the compound I-R-1.

5. The mixtures according to claim 3, wherein the compound of formula I is the compound I-R-1.

6. The mixtures according to any of claims 1 to 5, wherein component 1) and component 2) are present in a total weight ratio of from 1:10000 to 10000:1 wherein the total weight of component 2) is based on the amount of the solid material (dry matter) of component 2).

7. The mixtures according to any one of claims 1 to 6, wherein component 2) is selected from

L1) Microbial pesticides with fungicidal, bactericidal, viricidal and/or plant defense activator activity: *Ampelomyces quisqualis*, *Aspergillus flavus*, *Aureobasidium pullulans*, *Bacillus altitudinis, B. amyloliquefaciens*, *B. megaterium*, *B. mojavensis*, *B. mycoides*, *B. pumilus*, *B. simplex*, *B. solisalsi*, *B. subtilis*, *B. subtilis* var. *amyloliquefaciens*, *Candida oleophila*, *C. saitoana*, *Coniothyrium minitans*, *Cryphonectria parasitica*, *Dilophosphora alopecuri*, *Fusarium oxysporum*, *Clonostachys rosea* f. *catenulate* (also named *Gliocladium catenulatum*), *Lysobacter antibioticus*, *L. enzymogenes*, *Metschnikowia fructicola*, *Microdochium dimerum*, *Microsphaeropsis ochracea*, *Muscodor albus*, *P. polymyxa*, *P. agglomerans*, *Pantoea vagans*, *Phlebiopsis gigantea*, *Pseudomonas* sp., *Pseudomonas chloraphis*, *P. fluorescens*, *P. putida*, *Pythium oligandrum*, *Sphaerodes mycoparasitica*, *Streptomyces griseoviridis*, *S. lydicus*, *S. violaceusniger*, *Talaromyces flavus*, *Trichoderma asperelloides, Ulocladium oudemansii*;

L2) Biochemical pesticides with fungicidal, bactericidal, viricidal and/or plant defense activator activity selected from: chitosan (hydrolysate), laminarin, *Reynoutria sachalinensis* extract;

L3) Microbial pesticides with insecticidal, acaricidal, molluscidal and/or nematicidal activity selected from: *Agrobacterium radiobacter*, *Bacillus cereus*, *B. firmus*, *B. thuringiensis*, *B. thuringiensis* ssp. *aizawai*, mixture of strain *B. firmus* CNCM I-1582 and strain *B. thuringiensis* EX297512, *B. t.* ssp. *israelensis*, *B. t.* ssp. *kurstaki*, *B. t.* ssp. *tenebrionis*, *Beauveria bassiana*, *B. brongniartii*, *Burkholderia* spp., *Chromobacterium subtsugae*, *Cydia pomonella* granulovirus (CpGV), *Cryptophlebia leucotreta* granulovirus (CrleGV), *Flavobacterium* spp., *Helicoverpa armigera* nucleopolyhedrovirus (HearNPV), *Heterorhabditis bacteriophora*, *Isaria fumosorosea*,

Lecanicillium longisporum, *L. muscarium*, *Metarhizium anisopliae*, *Metarhizium anisopliae* var. *anisopliae*, *Nomuraea rileyi*, *P. lilacinus*, *Pasteuria* spp., *P. nishizawae*, *P. penetrans*, *P. ramosa*, *P. thornea*, *P. usgae*, *Pseudomonas fluorescens*, *Spodoptera littoralis* nucleopolyhedrovirus (SpliNPV), *Steinernema carpocapsae*, *S. feltiae*, *S. kraussei, Streptomyces galbus*;

L4) Biochemical pesticides with insecticidal, acaricidal, molluscidal, pheromone and/or nematicidal activity selected from: cis-jasmone, potassium silicate, extract of grapefruit seeds and pulp;

L5) Microbial pesticides with plant stress reducing, plant growth regulator, plant growth promoting and/or yield enhancing activity selected from: *A. lipoferum*, *Bradyrhizobium* spp., *B. elkanii*, *B. japonicum*, *B. lupini*, *Delftia acidovorans*, *Glomus intraradices*, *Mesorhizobium* spp., *Rhizobium leguminosarum* bv. *phaseoli*, *R. l.* bv. *trifolii*, *R. l.* bv. *viciae*, *Sinorhizobium meliloti*;

L6) Biochemical pesticides with plant stress reducing, plant growth regulator and/or plant yield enhancing activity selected from: aluminium silicate (kaolin), formononetin, *Ascophyllum nodosum* (Norwegian kelp, Brown kelp) extract;

8. The mixtures according to any one of claims 1 to 7, wherein component 2) is selected from *Agrobacterium radiobacter*, *Bacillus cereus*, *B. firmus*, *B. thuringiensis*, *B. thuringiensis* ssp. *aizawai*, mixture of strain *B. firmus* CNCM I-1582 and strain *B. thuringiensis* EX297512, *B. t.* ssp. *israelensis*, *B. t.* ssp. *kurstaki*, *B. t.* ssp. *tenebrionis*, *Beauveria bassiana*, *B. brongniartii*, *Burkholderia* spp., *Chromobacterium subtsugae*, *Cydia pomonella* granulovirus (CpGV), *Cryptophlebia leucotreta* granulovirus (CrleGV), *Flavobacterium* spp., *Helicoverpa armigera* nucleopolyhedrovirus (HearNPV), *Heterorhabditis bacteriophora*, *Isaria fumosorosea*, *Lecanicillium longisporum*, *L. muscarium*, *Metarhizium anisopliae*, *Metarhizium anisopliae* var. *anisopliae*, *Nomuraea rileyi*, *P. lilacinus*, *Pasteuria* spp., *P. nishizawae*, *P. penetrans*, *P. ramosa*, *P. thornea*, *P. usgae*, *Pseudomonas fluorescens*, *Spodoptera littoralis* nucleopolyhedrovirus (SpliNPV), *Steinernema carpocapsae*, *S. feltiae*, *S. kraussei, Streptomyces galbus*.

9. The mixtures according to any one of claims 1 to 8, wherein component 2) is *Beauveria bassiana* or *S. feltiae*.

10. The mixtures according to any of the claims 1 to 9, further comprising as active component 3) a further active compound III, which is selected from known pesticides.

11. A seed treatment composition comprising an auxiliary and a mixture as defined in any one of claims 1 to 10, wherein the auxiliary is preferably selected from the group consisting of surfactants, antifreezing agents, binders, and pigments, and is particularly preferably a surfactant or a binder.

12. The seed treatment composition according to claim 11, which is in the form of a flowable concentrate FS, a solution LS, a powder for dry treatment DS, a water dispersible powder

for slurry treatment WS, a water-soluble powder SS, an emulsion ES or EC, or a gel formulation, and is preferably in the form of a flowable concentrate.

13. Use of a mixture as defined in any one of claims 1 to 10 or a seed treatment composition as defined in claim 11 or 12, for protecting a plant, plant propagation material, or soil or water, in which the plants are growing, against the attack or infestation by invertebrate pests.

14. A method for controlling invertebrate pests, which method comprises contacting the plant or the plant propagation material or the soil; the pests or their food supply, habitat or breeding grounds, with a pesticidally effective amount of a mixture as defined in any one of claims 1 to 10 or with a seed treatment composition as defined in claim 11 or 12.

15. A method for controlling nematodes, which method comprises contacting the plant or the plant propagation material or the soil; the pests or their food supply, habitat or breeding grounds, with a pesticidally effective amount of a mixture as defined in any one of claims 1 to 10 or with a seed treatment composition as defined in claim 11 or 12.

16. Seeds comprising the mixture as defined in any one of claims 1 to 10 or the seed treatment composition as defined in claim 11 or 12 in an amount of from 0.01 g to 10000 g per 100 kg of seeds.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2019/075103

A. CLASSIFICATION OF SUBJECT MATTER
INV. A01N43/90
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)
A01N

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, CHEM ABS Data, 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,P	WO 2018/177970 A1 (BASF SE [DE]) 4 October 2018 (2018-10-04) page 1, line 10 - page 2, line 9 page 2, line 18 - page 3, line 40 page 14, line 11 - line 23 page 16, line 11 page 21, line 35 - page 24, line 24 page 31, line 37 - page 32, line 5 page 36; table M page 75, line 35 - page 86, line 15 ----- -/--	1-7, 11-16

X Further documents are listed in the continuation of Box C.

X See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
16 October 2019	29/10/2019

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Zanobini, Alessandra

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2019/075103

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2014/167084 A1 (BASF SE [DE]) 16 October 2014 (2014-10-16) cited in the application page 1, line 10 - line 13 page 5, line 5 - page 6, line 12 page 27, line 5 - line 10 page 43, line 20 - page 47, line 33 page 53, line 14 - line 22 page 65, line 6 - page 66, line 7 Compound C-38; page 90 page 92 - page 94 -----	1-16

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2019/075103

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