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(54) Title: MIXTURES COMPRISING A TRICHODERMA STRAIN AND A PESTICIDE

(57) Abstract: The present invention relates to mixtures comprising, as active components the Trichoderma harzianum strain SK-55, or a cell-free extract thereof or at least one metabolite thereof having pesticidal activity, and/or a mutant of Trichoderma harzianum SK-55 having pesticidal activity and producing at least one pesticidal metabolite as defined herein, or a pesticidal metabolite or extract of the mutant, and at least pesticide as defined herein, and to compositions comprising these mixtures.

Mixtures comprising a Trichoderma strain and a pesticide

Description

The present invention relates to mixtures comprising, as active components the Trichoderma harzianum strain SK-55, or a cell-free extract thereof or at least one metabolite thereof having pesticidal activity, and/or a mutant of Trichoderma harzianum SK-55 having pesticidal activity and producing at least one pesticidal metabolite as defined herein, or a pesticidal metabolite or extract of the mutant, and a pesticide.

This microorganism Trichoderma harzianum SK-55 was known to have a wide antagonistic spectrum against fungal diseases in plants, in particular against soil soil-borne pathogenic fungi (US 5,422,107). The antagonistic action of above-described Trichoderma harzianum SK-55 strain is to accelerate cytoplasmic aggregation upon contacting with hyphae and coiling thereof, thus killing the disease-causing microorganims. Methods for production of pesticides comprising Trichoderma harzianum SK-55 are described in US 5,422,107 and US 6,955,912, which documents are herewith incorporated by reference. The preparation of extracts and the isolation of specific metabolites having plant activator activity against filamentous fungi and bacteria has been described in US 6,753,295, which document is herewith incorporated by reference.

The Trichoderma harzianum SK-55 microorganism was separated from soil in the Tokachi District in Hokkaido, Japan. Trichoderma harzianum SK-55 (also referred to as SK-5-5) used in this invention has been deposited under deposition number "Bikoken Microbial Deposition No. 13327" with the National Institute of Bioscience and Human-Technology, Agency of Industrial Science and Technology, Japan (address: Azuma 1-1-3, Tsukuba-shi, Ibaraki Pref., Japan) (deposited Dec. 9, 1992, depositor: Hokkaido Green Kosan). The transfer of original deposition to international deposition under the Budapest treaty was requested on Dec. 9, 1992, and said microorganism is given deposition number BP-4346 at the National Institute of Bioscience and Human-Technology (NIBH), Agency of Industrial Science and Technology, Ministry of International Trade and Industry, 1-3, Higashi 1-chome, Tsukuba-shi, Ibaraki-Ken 305, Japan).

A pesticide is generally a chemical or biological agent (such as a virus, bacterium, antimicrobial or disinfectant) that through its effect deters, incapacitates, kills or otherwise discourages pests. Target pests can include insects, plant pathogens, weeds, mollusks, birds, mammals, fish, nematodes (roundworms), and microbes that destroy property, cause nuisance, spread disease or are vectors for disease. The term pesticides includes also plant growth regulators that alter the expected growth, flowering, or reproduction rate of plants; defoliants that cause leaves or other foliage to drop from a plant, usually to facilitate harvest; desiccants that promote drying of living tissues, such as unwanted plant tops; plant activators that activate plant physiology for defense of against certain pests; safeners that reduce unwanted herbicidal action of pesticides on crop plants; and plant growth promoters that affect plant physiology to increase plant growth, biomass, yield or any other quality parameter of the harvestable goods of acrop plant.

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 ectracts from biological or other natural sources).

Biopesticides are typically created by growing and concentrating naturally occurring organisms and/or their metabolites including bacteria and other microbes, fungi, viruses, nematodes, proteins, etc. They are often considered to be important components of integrated pest management (IPM) programmes, and have received much practical attention as substitutes to synthetic chemical plant protection products (PPPs).

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 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.

Examples for biochemical pesticides include, but are not limited to semiochemicals (insect pheromones and kairomones), natural plant and insect regulators, naturally-occurring repellents and attractants, and proteins (e.g. enzymes).

Biopesticides for use against crop diseases have already established themselves on a variety of crops. For example, biopesticides already play an important role in controlling downy mildew diseases. Their benefits include: a 0-Day Pre-Harvest Interval, the ability to use under moderate to severe disease pressure, and the ability to use in mixture or in a rotational program with other registered pesticides.

A major growth area for biopesticides is in the area of seed treatments and soil amendments. Biopesticidal seed treatments are e.g. used to control soil borne fungal pathogens that cause seed rots, damping-off, root rot and seedling blights. They can also be used to control internal seed borne fungal pathogens as well as fungal pathogens that are on the surface of the seed. Many biopesticidal products also show capacities to stimulate plant host defenses and other physiological processes that can make treated crops more resistant to a variety of biotic and abiotic stresses or can regulate plant growth. Many biopesticidal products also show capacities to stimulate plant health, plant growth and/or yield enhancing activity.

The term "plant health" is to be understood to denote a condition of the plant and/or its products which is determined by several indicators alone or in combination with each other such as yield (e. g. increased biomass and/or increased content of valuable ingredients), plant vigor (e. g. improved plant growth and/or greener leaves ("greening effect")), quality (e. g. improved content or composition of certain ingredients) and tolerance to abiotic and/or biotic stress. The above identified indicators for the health condition of a plant may be interdependent, or may result from each other.

However, biopesticides under certain conditions can also have disadvantages such as high specificity: which may require an exact identification of the pest/pathogen and the use of

multiple products to be used, slow speed of action (thus making them unsuitable if a pest outbreak is an immediate threat to a crop), variable efficacy due to the influences of various biotic and abiotic factors (since biopesticides are usually living organisms, which bring about pest/pathogen control by multiplying within the target insect pest/pathogen) and resistance development.

Practical agricultural experience has shown that the repeated and exclusive application of an individual active component in the control of harmful fungi, insects or other pests leads in many cases to a rapid selection of those fungus strains or pest isolates which have developed natural or adapted resistance against the active component in question. Effective control of these fungi, insects or other pests with the active component in question is then no longer possible.

To reduce the risk of the selection of resistant fungus, insect or other pest isolates, mixtures of different active components are nowadays conventionally employed for controlling harmful fungi, insects or other pests. By combining active compounds and/or biopesticides having different mechanisms of action, it is possible to ensure successful control over a relatively long period of time.

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, e.g. both animal pests and pathogenic 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 problem underlying the present invention is the desire for compositions that improve plants, a process which is commonly and hereinafter referred to as "plant health".

It is an object of the present invention overcome the abovementioned disadvantages and to provide, with a view to effective resistance management and effective control of phytopathogenic harmful fungi, insects or other pests or to effective plant growth regulation, at application rates which are as low as possible, compositions which, at a reduced total amount of active compounds applied, have improved activity against the harmful fungi, insects or other pests or improved plant growth regulating activity (synergistic mixtures) and a broadened activity spectrum, in particular for certain indications.

This is particularly visible if application rates for the beforementioned mixtures of pesticides are used where the individual components show no or virtually no activity. The invention can also result in an advantageous behavior during formulation or during use, for example during grinding, sieving, emulsifying, dissolving or dispensing; improved storage stability and light stability, advantageous residue formation, improved toxicological or ecotoxicological behaviour, improved properties of the plant, for example better growth, increased harvest yields, a better developed root system, a larger leaf area, greener leaves, stronger shoots, less seed required, lower phytotoxicity, mobilization of the defense system of the plant, good compatibility with plants. Moreover, even an enhanced systemic action of SK-55 and the pesticides as defined herein and/or a persistency of the fungicidal, insecticidal, acaricidal and/or nematicidal action is expected.

This is particularly visible if application rates for the mixtures of T. harzianum SK-55 with pesticides are defined are used where the applicaton rates of the individual components show no or virtually no activity. The invention can also result in an advantageous behavior during formulation or during use, for example during grinding, sieving, emulsifying, dissolving or dispensing; improved storage stability and light stability, advantageous residue formation, improved toxicological or ecotoxicological behaviour, improved properties of the plant, for example better growth, increased harvest yields, a better developed root system, a larger leaf area, greener leaves, stronger shoots, less seed required, lower phytotoxicity, mobilization of the defense system of the plant, good compatibility with plants. Moreover, even an enhanced systemic action of SK-55 and the pesticides as defined herein and/or a persistency of the fungicidal, insecticidal, acaricidal and/or nematicidal action is expected.

It was therefore also an object of the present invention to provide pesticidal mixtures which solve the problems of reducing the dosage rate and / or enhancing the spectrum of activity and / or combining knock-down activity with prolonged control and / or to resistance management and/or promoting (increasing) the health of plants.

We have accordingly found that this object is achieved by the mixtures and compositions defined herein, comprising the Trichoderma harzianum strain SK-55, or a cell-free extract thereof or at least one metabolite thereof having pesticidal activity, and/or a mutant of Trichoderma harzianum SK-55 having pesticidal activity and producing at least one pesticidal metabolite as defined herein, or a pesticidal metabolite or extract of the mutant.

Thus, the present invention relates to mixtures comprising, as active components

1) Trichoderma harzianum strain SK-55, or a cell-free extract thereof or at least one metabolite thereof having pesticidal activity, and/or a mutant of Trichoderma harzianum SK-55 having pesticidal activity and producing at least one pesticidal metabolite as defined herein, or a pesticidal metabolite or extract of the mutant;

and

2) at least one pesticide II selected from the groups A) to O):

A) Respiration inhibitors

- Inhibitors of complex III at Q_0 site (e.g. strobilurins): azoxystrobin, coumethoxystrobin, coumoxystrobin, dimoxystrobin, enestroburin, fenaminstrobin, fenoxystrobin/flufenoxystrobin, fluoxastrobin, kresoxim-methyl, mandestrobine, metominostrobin, orysastrobin, picoxystrobin, pyraclostrobin, pyrametostrobin, pyraoxystrobin, trifloxystrobin and 2-(2-(3-(2,6-dichlorophenyl)-1-methyl-allylidene-aminooxymethyl)-phenyl)-2-methoxyimino-N-methyl-acetamide, pyribencarb, triclopyricarb/chlorodincarb, famoxadone, fenamidone;
- inhibitors of complex III at Q_i site: cyazofamid, amisulbrom, [(3S,6S,7R,8R)-8-benzyl-3-[(3-acetoxy-4-methoxy-pyridine-2-carbonyl)amino]-6-methyl-4,9-dioxo-1 ,5-dioxonan-7-yl] 2-methylpropanoate, [(3S,6S,7R,8R)-8-benzyl-3-[[3-(acetoxymethoxy)-4-methoxy-

pyridine-2-carbonyl]amino]-6-methyl-4,9-dioxo-1 ,5-dioxonan-7-yl] 2-methylpropanoate, [(3S,6S,7R,8R)-8-benzyl-3-[(3-isobutoxycarbonyloxy-4-methoxy-pyridine-2-carbonyl)amino]-6-methyl-4,9-dioxo-1 ,5-dioxonan-7-yl] 2-methylpropanoate, [(3S,6S,7R,8R)-8-benzyl-3-[[3-(1 ,3-benzodioxol-5-ylmethoxy)-4-methoxy-pyridine-2-carbonyl]amino]-6-methyl-4,9-dioxo-1 ,5-dioxonan-7-yl] 2-methylpropanoate; (3S,6S,7R,8R)-3-[[(3-hydroxy-4-methoxy-2-pyridinyl)carbonyl]amino]-6-methyl-4,9-dioxo-8-(phenylmethyl)-l ,5-dioxonan-7-yl 2-methylpropanoate

- inhibitors of complex II (e. g. carboxamides): benodanil, benzovindiflupyr, bixafen, boscalid, carboxin, fenfuram, fluopyram, flutolanil, fluxapyroxad, furametpyr, isofetamid, isopyrazam, mepronil, oxycarboxin, penflufen, penthiopyrad, sedaxane, tecloftalam, thifluzamide, N-(4'-thfluoromethylthiobiphenyl-2-yl)-3-difluoromethyl-1-methyl-1H-pyrazole-4-carboxamide, N-(2-(1 ,3,3-trimethyl-butyl)-phenyl)-1 ,3-dimethyl-5-fluoro-1H-pyrazole-4-carboxamide, 3-(difluoromethyl)-1-methyl-N-(1 ,1 ,3-trimethylindan-4-yl)pyrazole-4-carboxamide, 3-(trifluoromethyl)-1-methyl-N-(1 ,1 ,3-trimethylindan-4-yl)pyrazole-4-carboxamide, 1,3-dimethyl-N-(1 ,1 ,3-trimethylindan-4-yl)pyrazole-4-carboxamide, 3-(trifluoromethyl)-1 ,5-dimethyl-N-(1 ,1 ,3-trimethylindan-4-yl)pyrazole-4-carboxamide, 1,3,5-trimethyl-N-(1 ,1 ,3-trimethylindan-4-yl)pyrazole-4-carboxamide, N-(7-fluoro-1 ,1 ,3-trimethyl-indan-4-yl)-1 ,3-dimethyl-pyrazole-4-carboxamide, N-[2-(2,4-dichlorophenyl)-2-methoxy-1-methyl-ethyl]-3-(difluoromethyl)-1-methyl-pyrazole-4-carboxamide;
- other respiration inhibitors (e.g. complex I, uncouplers): diflumetorim, (5,8-difluoro-quinazolin-4-yl)-{2-[2-fluoro-4-(4-trifluoromethylpyhdin-2-yloxy)-phenyl]-ethyl}-amine; nitrophenyl derivates: binapacryl, dinobuton, dinocap, fluazinam; ferimzone; organometal compounds: fentin salts, such as fentin-acetate, fentin chloride or fentin hydroxide; ametoctradin; and silthiofam;

B) Sterol biosynthesis inhibitors (SBI fungicides)

- C14 demethylase inhibitors (DMI fungicides): triazoles: azaconazole, bitertanol, bromuconazole, cyproconazole, difenoconazole, diniconazole, diniconazole-M, epoxiconazole, fenbuconazole, fluquinconazole, flusilazole, flutriafol, hexaconazole, imibenconazole, ipconazole, metconazole, myclobutanil, oxpoconazole, paclobutrazole, penconazole, propiconazole, prothioconazole, simeconazole, tebuconazole, tetraconazole, triadimefon, triadimenol, triticonazole, uniconazole, 1-[re/-(2S;3R)-3-(2-chlorophenyl)-2-(2,4-difluorophenyl)-oxiranylmethyl]-5-thiocyanato-1H-[1 ,2,4]triazole, 2-[re/-(2S;3R)-3-(2-chlorophenyl)-2-(2,4-difluorophenyl)-oxiranyl-methyl]-2H-[1 ,2,4]triazole-3-thiol, 2-[2-chloro-4-(4-chlorophenoxy)phenyl]-1-(1 ,2,4-triazol-1-yl)pentan-2-ol, 1-[4-(4-chlorophenoxy)-2-(trifluoromethyl)phenyl]-1 -cyclopropyl-2-(1 ,2,4-triazol-1 -yl)ethanol, 2-[4-(4-chlorophenoxy)-2-(trifluoromethyl)phenyl]-1 -(1 ,2,4-triazol-1 -yl)butan-2-ol, 2-[2-chloro-4-(4-chlorophenoxy)phenyl]-1-(1 ,2,4-triazol-1-yl)butan-2-ol, 2-[4-(4-chlorophenoxy)-2-(trifluoromethyl)phenyl]-3-methyl-1 -(1 ,2,4-triazol-1 -yl)butan-2-ol, 2-[4-(4-chlorophenoxy)-2-(trifluoromethyl)phenyl]-1 -(1 ,2,4-triazol-1 -yl)propan-2-ol, 2-[2-chloro-4-(4-chlorophenoxy)phenyl]-3-methyl-1 -(1 ,2,4-triazol-1 -yl)butan-2-ol, 2-[4-(4-chlorophenoxy)-2-(trifluoromethyl)phenyl]-1 -(1 ,2,4-triazol-1 -yl)pentan-2-ol, 2-[4-(4-fluorophenoxy)-2-(trifluoromethyl)phenyl]-1 -(1 ,2,4-triazol-1 -yl)propan-2-ol; imidazoles:

imazalil, pefurazoate, prochloraz, triflumizol; pyrimidines, pyridines and piperazines: fenarimol, nuarimol, pyrifenox, triforine, [3-(4-chloro-2-fluoro-phenyl)-5-(2,4-difluorophenyl)isoxazol-4-yl]-(3-pyridyl)methanol;

- Delta14-reductase inhibitors: aldimorph, dodemorph, dodemorph-acetate, fenpropimorph, tridemorph, fenpropidin, piperalin, spiroxamine;
- Inhibitors of 3-keto reductase: fenhexamid;

C) Nucleic acid synthesis inhibitors

- phenylamides or acyl amino acid fungicides: benalaxyl, benalaxyl-M, kiralaxyl, metalaxyl, metalaxyl-M (mefenoxam), ofurace, oxadixyl;
- others: hymexazole, octhilinone, oxolinic acid, bupirimate, 5-fluorocytosine, 5-fluoro-2-(p-tolylmethoxy)pyrimidin-4-amine, 5-fluoro-2-(4-fluorophenylmethoxy)pyrimidin-4-amine;

D) Inhibitors of cell division and cytoskeleton

- tubulin inhibitors, such as benzimidazoles, thiophanates: benomyl, carbendazim, fuberidazole, thiabendazole, thiophanate-methyl; triazolopyrimidines: 5-chloro-7-(4-methylpiperidin-1 -yl)-6-(2,4,6-trifluorophenyl)-[1 ,2,4]triazolo[1 ,5-a]pyrimidine
- other cell division inhibitors: diethofencarb, ethaboxam, pencycuron, fluopicolide, zoxamide, metrafenone, pyriofenone;

E) Inhibitors of amino acid and protein synthesis

- methionine synthesis inhibitors (anilino-pyrimidines): cyprodinil, mepanipyrim, pyrimethanil;
- protein synthesis inhibitors: blasticidin-S, kasugamycin, kasugamycin hydrochloride-hydrate, mildiomycin, streptomycin, oxytetracyclin, polyoxine, validamycin A;

F) Signal transduction inhibitors

- MAP / histidine kinase inhibitors: fluoroimid, iprodione, procymidone, vinclozolin, fenpiclonil, fludioxonil;
- G protein inhibitors: quinoxyfen;

G) Lipid and membrane synthesis inhibitors

- Phospholipid biosynthesis inhibitors: edifenphos, iprobenfos, pyrazophos, isoprothiolane;
- lipid peroxidation: dicloran, quintozene, tecnazene, tolclofos-methyl, biphenyl, chloroneb, etridiazole;
- phospholipid biosynthesis and cell wall deposition: dimethomorph, flumorph, mandipropamid, pyrimorph, benthiavalicarb, iprovalicarb, valifenalate and N-(1-(1-(4-cyano-phenyl)ethanesulfonyl)-but-2-yl) carbamic acid-(4-fluorophenyl) ester;
- compounds affecting cell membrane permeability and fatty acides: propamocarb, propamocarb-hydrochlorid
- fatty acid amide hydrolase inhibitors: oxathiapiprolin;

H) Inhibitors with Multi Site Action

- inorganic active substances: Bordeaux mixture, copper acetate, copper hydroxide, copper oxychloride, basic copper sulfate, sulfur;
- thio- and dithiocarbamates: ferbam, mancozeb, maneb, metam, metiram, propineb, thiram, zineb, ziram;
- organochlorine compounds (e.g. phthalimides, sulfamides, chloronitriles): anilazine, chlorothalonil, captafol, captan, folpet, dichlofluanid, dichlorophen, hexachlorobenzene,

pentachlorphenole and its salts, phthalide, tolylfluanid, N-(4-chloro-2-nitro-phenyl)-N-ethyl-4-methyl-benzenesulfonamide;

- guanidines and others: guanidine, dodine, dodine free base, guazatine, guazatine-acetate, iminoctadine, iminoctadine-triacetate, iminoctadine-tris(albesilate), dithianon, 2,6-dimethyl-1 H,5H-[1 ,4]dithiino[2,3-c:5,6-c']dipyrrole-1 ,3,5,7(2H,6H)-tetraone;

I) Cell wall synthesis inhibitors

- inhibitors of glucan synthesis: validamycin, polyoxin B; melanin synthesis inhibitors: pyroquilon, tricyclazole, carpropamid, dicyclomet, fenoxanil;

J) Plant defence inducers

- acibenzolar-S-methyl, probenazole, isotianil, tiadinil, prohexadione-calcium; phosphonates: fosetyl, fosetyl-aluminum, phosphorous acid and its salts;

K) Unknown mode of action

- bronopol, chinomethionat, cyflufenamid, cymoxanil, dazomet, debacarb, diclomezine, difenzoquat, difenzoquat-methylsulfate, diphenylamin, fenpyrazamine, flumetover, flusulfamide, flutianil, methasulfocarb, nitrapyrin, nitrothal-isopropyl, oxathiapiprolin, tolprocarb, 2-[3,5-bis(difluoromethyl)-1 H-pyrazol-1 -yl]-1 -[4-(4-{5-[2-(prop-2-yn-1 -yloxy)phenyl]-4,5-dihydro-1 ,2-oxazol-3-yl}-1 ,3-thiazol-2-yl)piperidin-1-yl]ethanone, 2-[3,5-bis(difluoromethyl)-1 H-pyrazol-1 -yl]-1 -[4-(4-{5-[2-fluoro-6-(prop-2-yn-1 -yloxy)phenyl]-4,5-dihydro-1 ,2-oxazol-3-yl}-1 ,3-thiazol-2-yl)piperidin-1-yl]ethanone, 2-[3,5-bis(difluoromethyl)-1 H-pyrazol-1 -yl]-1 -[4-(4-{5-[2-chloro-6-(prop-2-yn-1 -yloxy)phenyl]-4,5-dihydro-1 ,2-oxazol-3-yl}-1 ,3-thiazol-2-yl)piperidin-1-yl]ethanone, oxin-copper, proquinazid, tebufloquin, tecloftalam, triazoxide, 2-butoxy-6-iodo-3-propylchromen-4-one, N-(cyclopropylmethoxyimino-(6-difluoro-methoxy-2,3-difluoro-phenyl)-methyl)-2-phenyl acetamide, N'-(4-(4-chloro-3-trifluoromethyl-phenoxy)-2,5-dimethyl-phenyl)-N-ethyl-N-methyl formamidine, N'-(4-(4-fluoro-3-trifluoromethyl-phenoxy)-2,5-dimethyl-phenyl)-N-ethyl-N-methyl formamidine, N'-(2-methyl-5-trifluoromethyl-4-(3-trimethylsilanyl-propoxy)-phenyl)-N-ethyl-N-methyl formamidine, N'-(5-difluoromethyl-2-methyl-4-(3-tri-methylsilanyl-propoxy)-phenyl)-N-ethyl-N-methyl formamidine, methoxy-acetic acid 6-tert-butyl-8-fluoro-2,3-dimethyl-quinolin-4-yl ester, 3-[5-(4-methylphenyl)-2,3-dimethyl-isoxazolidin-3-yl]-pyridine, 3-[5-(4-chloro-phenyl)-2,3-dimethyl-isoxazolidin-3-yl]-pyridine (pyrisoxazole),
N-(6-methoxy-pyridin-3-yl) cyclopropanecarboxylic acid amide, 5-chloro-1-(4,6-di-methoxy-pyrimidin-2-yl)-2-methyl-1 H-benzoimidazole, 2-(4-chloro-phenyl)-N-[4-(3,4-dimethoxy-phenyl)-isoxazol-5-yl]-2-prop-2-ynyloxy-acetamide, ethyl (Z)-3-amino-2-cyano-3-phenyl-prop-2-enoate, tert-butyl N-[6-[[(Z)-[(1 -methyltetrazol-5-yl)-phenyl-methylene]amino]oxymethyl]-2-pyridyl]carbamate, pentyl N-[6-[[(Z)-[(1 -methyltetrazol-5-yl)-phenyl-methylene]amino]oxymethyl]-2-pyridyl]carbamate, 2-[2-[(7,8-difluoro-2-methyl-3-quinolyl)oxy]-6-fluoro-phenyl]propan-2-ol, 2-[2-fluoro-6-[(8-fluoro-2-methyl-3-quinolyl)oxy]phenyl]propan-2-ol, 3-(5-fluoro-3,3,4,4-tetramethyl-3,4-dihydroiso-quinolin-1 -yl)quinoline, 3-(4,4-difluoro-3,3-dimethyl-3,4-dihydroisoquinolin-1 -yl)quinoline, 3-(4,4,5-trifluoro-3,3-dimethyl-3,4-dihydroisoquinolin-1-yl)quinoline;

L) Biopesticides

L1) Microbial pesticides with fungicidal, bactericidal, viricidal and/or plant defense

activator activity: Ampelomyces quisqualis, Aspergillus flavus, Aureobasidium pullulans, Bacillus amyloliquefaciens, B. mojavensis, B. pumilus, B. simplex, B. solisalsi, B. subtilis, B. subtilis var. amyloliquefaciens, Candida oleophila, C. saitoana, Clavibacter michiganensis (bacteriophages), Coniothyrium minitans, Cryphonectria parasitica, Cryptococcus albidus, 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 polymyxa, Pantoea vagans, Phlebiopsis gigantea, Pseudomonas sp., Pseudomonas chloraphis, Pseudozyma flocculosa, Pichia anomala, Pythium oligandrum, Sphaerodes mycoparasitica, Streptomyces griseoviridis, S. lydicus, S. violaceusniger, Talaromyces flavus, Trichoderma asperellum, T. atroviride, T. fertile, T. gamsii, T. harmatum; mixture of T. harzianum and T. viride; mixture of T. polysporum and T. harzianum; T. stromaticum, T. virens (also named Gliocladium 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: chitosan (hydrolysate), harpin protein, laminarin, Menhaden fish oil, natamycin, Plum pox virus coat protein, potassium or sodium bicarbonate, Reynoutria sachlinensis extract, salicylic acid, tea tree oil;

L3) Microbial pesticides with insecticidal, acaricidal, molluscidal and/or nematicidal activity: Agrobacterium radiobacter, Bacillus cereus, B. firmus, B. thuringiensis, B. thuringiensis ssp. aizawai, B. t. ssp. israelensis, B. t. ssp. galleriae, B. t. ssp. kurstaki, B. t. ssp. tenebrionis, Beauveria bassiana, B. brongniartii , Burkholderia sp., Chromobacterium subtsugae, Cydia pomonella granulosis virus, Cryptophlebia leucotreta granulovirus (CrleGV), Isaria fumosorosea, Heterorhabditis bacteriophora, Lecanicillium longisporum, L. muscarium (formerly Verticillium lecanii), Metarhizium anisopliae, M. anisopliae var. acridum, Nomuraea rileyi, Paecilomyces fumosoroseus, P. lilacinus, Paenibacillus popilliae, Pasteuria spp., P. nishizawae, P. penetrans, P. ramose, P. reneformis, P. thornea, P. usgae, Pseudomonas fluorescens, Steinernema carpocapsae, S. feltiae, S. kraussei;

L4) Biochemical pesticides with insecticidal, acaricidal, molluscidal, pheromone and/or nematicidal activity: L-carvone, citral, (E,Z)-7,9-dodecadien-1-yl acetate, ethyl formate, (E,Z)-2,4-ethyl decadienoate (pear ester), (Z,Z,E)-7,1 1,13-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 actanoate, (E,Z,Z)-3,8,1 1-tetradecatrienyl acetate, (Z,E)-9,12-tetradecadien-1-yl acetate, Z-7-tetradecen-2-one, Z-9-tetradecen-1-yl acetate, Z-1 1-tetradecenal, Z-1 1-tetradecen-1-ol, Acacia negra extract, extract of grapefruit seeds and pulp, extract of Chenopodium ambrosiodae, Catnip oil, Neem oil, Quillay extract, Tagetes oil;

L5) Microbial pesticides with plant stress reducing, plant growth regulator, plant growth

promoting and/or yield enhancing activity: Azospirillum amazonense A. brasilense, A. lipoferum, A. irakense, A. halopraeferens, Bradyrhizobium sp., B. elkanii, B. japonicum, B. liaoningense, B. lupini, Delftia acidovorans, Glomus intraradices, Mesorhizobium sp., Paenibacillus alvei, Penicillium bilaiae, Rhizobium leguminosarum bv. phaseolii, R. l. trifolii, R. l. bv. viciae, R. tropici, Sinorhizobium meliloti;

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

M) Growth regulators

abscisic acid, amidochlor, ancymidol, 6-benzylaminopurine, brassinolide, butralin, chlormequat (chlormequat chloride), choline chloride, cyclanilide, daminozide, dikegulac, dimethipin, 2,6-dimethylpuridine, ethephon, flumetralin, flurprimidol, fluthiacet, forchlorfenuron, gibberellic acid, inabenfide, indole-3-acetic acid , maleic hydrazide, mefluidide, mepiquat (mepiquat chloride), naphthaleneacetic acid, N-6-benzyladenine, paclobutrazol, prohexadione (prohexadione-calcium), prohydrojasmon, thidiazuron, triapenthenol, tributyl phosphorotrithioate, 2,3,5-tri-iodobenzoic acid , trinexapac-ethyl and uniconazole;

N) Herbicides

- acetamides: acetochlor, alachlor, butachlor, dimethachlor, dimethenamid, flufenacet, mefenacet, metolachlor, metazachlor, napropamide, naproanilide, pethoxamid, pretilachlor, propachlor, thenylchlor;
- amino acid derivatives: bilanafos, glyphosate, glufosinate, sulfosate;
- aryloxyphenoxypropionates: clodinafop, cyhalofop-butyl, fenoxaprop, fluazifop, haloxyfop, metamifop, propaquizafop, quizalofop, quizalofop-P-tefuryl;
- Bipyridyls: diquat, paraquat;
- (thio)carbamates: asulam, butylate, carbetamide, desmedipham, dimepiperate, eptam (EPTC), esprocarb, molinate, orbencarb, phenmedipham, prosulfocarb, pyributicarb, thiobencarb, triallate;
- cyclohexanediones: butroxydim, clethodim, cycloxydim, profoxydim, sethoxydim, tepraloxydim, tralkoxydim;
- dinitroanilines: benfluralin, ethalfluralin, oryzalin, pendimethalin, prodiamine, trifluralin;
- diphenyl ethers: acifluorfen, aclonifen, bifenox, diclofop, ethoxyfen, fomesafen, lactofen, oxyfluorfen;
- hydroxybenzonitriles: bomoxynil, dichlobenil, ioxynil;
- imidazolinones: imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr;
- phenoxy acetic acids: clomeprop, 2,4-dichlorophenoxyacetic acid (2,4-D), 2,4-DB, dichlorprop, MCPA, MCPA-thioethyl, MCPB, Mecoprop;
- pyrazines: chloridazon, flufenpyr-ethyl, fluthiacet, norflurazon, pyridate;

- pyridines: aminopyralid, clopyralid, diflufenican, dithiopyr, fluridone, fluroxypyr, picloram, picolinafen, thiazopyr;
- sulfonyl ureas: amidosulfuron, azimsulfuron, bensulfuron, chlorimuron-ethyl, chlorsulfuron, cinosulfuron, cyclosulfamuron, ethoxysulfuron, flazasulfuron, flucetosulfuron, flupyrsulfuron, foramsulfuron, halosulfuron, imazosulfuron, iodosulfuron, mesosulfuron, metazosulfuron, metsulfuron-methyl, nicosulfuron, oxasulfuron, primisulfuron, prosulfuron, pyrazosulfuron, rimsulfuron, sulfometuron, sulfosulfuron, thifensulfuron, triasulfuron, tribenuron, trifloxysulfuron, triflusulfuron, tritosulfuron, 1-((2-chloro-6-propyl-imidazo[1 ,2-b]pyridazin-3-yl)sulfonyl)-3-(4,6-dimethoxy-pyrimidin-2-yl)urea;
- triazines: ametryn, atrazine, cyanazine, dimethametryn, ethiozin, hexazinone, metamitron, metribuzin, prometryn, simazine, terbuthylazine, terbutryn, triaziflam;
- ureas: chlorotoluron, daimuron, diuron, fluometuron, isoproturon, linuron, metha-benzthiazuron,tebuthiuron;
- other acetolactate synthase inhibitors: bispyribac-sodium, cloransulam-methyl, diclosulam, florasulam, flucarbazone, flumetsulam, metosulam, ortho-sulfamuron, penoxsulam, propoxycarbazone, pyribambenz-propyl, pyribenzoxim, pyriftalid, pyriminobac-methyl, pyrimisulfan, pyrithiobac, pyroxasulfone, pyroxsulam;
- others: amicarbazone, aminotriazole, anilofos, beflubutamid, benazolin, bencarbazone,benfluresate, benzofenap, bentazone, benzobicyclon, bicyclopyrone, bromacil, bromobutide, butafenacil, butamifos, cafenstrole, carfentrazone, cinidon-ethyl, chlorthal, cinmethylin, clomazone, cumyluron, cyprosulfamide, dicamba, difenzoquat, diflufenzopyr, *Drechslera monoceras,* endothal, ethofumesate, etobenzanid, fenoxasulfone, fentrazamide, flumiclorac-pentyl, flumioxazin, flupoxam, flurochloridone, flurtamone, indanofan, isoxaben, isoxaflutole, lenacil, propanil, propyzamide, quinclorac, quinmerac, mesotrione, methyl arsonic acid, naptalam, oxadiargyl, oxadiazon, oxaziclomefone, pentoxazone, pinoxaden, pyraclonil, pyraflufen-ethyl, pyrasulfotole, pyrazoxyfen, pyrazolynate, quinoclamine, saflufenacil, sulcotrione, sulfentrazone, terbacil, tefuryltrione, tembotrione, thiencarbazone, topramezone, (3-[2-chloro-4-fluoro-5-(3-methyl-2,6-dioxo-4-trifluoromethyl-3,6-dihydro-2H-pyrimidin-1-yl)-phenoxy]-pyridin-2-yloxy)-acetic acid ethyl ester, 6-amino-5-chloro-2-cyclopropyl-pyrimidine-4-carboxylic acid methyl ester, 6-chloro-3-(2-cyclopropyl-6-methyl-phenoxy)-pyridazin-4-ol, 4-amino-3-chloro-6-(4-chloro-phenyl)-5-fluoro-pyridine-2-carboxylic acid, 4-amino-3-chloro-6-(4-chloro-2-fluoro-3-methoxy-phenyl)-pyridine-2-carboxylic acid methyl ester, and 4-amino-3-chloro-6-(4-chloro-3-dimethylamino-2-fluoro-phenyl)-pyridine-2-carboxylic acid methyl ester.

O) Insecticides

- organo(thio)phosphates: acephate, azamethiphos, azinphos-methyl, chlorpyrifos, chlorpyrifos-methyl, chlorfenvinphos, diazinon, dichlorvos, dicrotophos, dimethoate, disulfoton, ethion, fenitrothion, fenthion, isoxathion, malathion, methamidophos, methidathion, methyl-parathion, mevinphos, monocrotophos, oxydemeton-methyl, paraoxon, parathion, phenthoate, phosalone, phosmet, phosphamidon, phorate, phoxim, pirimiphos-methyl, profenofos, prothiofos, sulprophos, tetrachlorvinphos, terbufos,

triazophos, trichlorfon;

- carbamates: alanycarb, aldicarb, bendiocarb, benfuracarb, carbaryl, carbofuran, carbosulfan, fenoxycarb, furathiocarb, methiocarb, methomyl, oxamyl, pirimicarb, propoxur, thiodicarb, triazamate;
- pyrethroids: allethrin, bifenthrin, cyfluthrin, cyhalothrin, cyphenothrin, cypermethrin, alpha-cypermethrin, beta-cypermethrin, zeta-cypermethrin, deltamethrin, esfenvalerate, etofenprox, fenpropathrin, fenvalerate, imiprothrin, lambda-cyhalothrin, permethrin, prallethrin, pyrethrin I and II, resmethrin, silafluofen, tau-fluvalinate, tefluthrin, tetramethrin, tralomethrin, transfluthrin, profluthrin, dimefluthrin;
- insect growth regulators: a) chitin synthesis inhibitors: benzoylureas: chlorfluazuron, cyramazin, diflubenzuron, flucycloxuron, flufenoxuron, hexaflumuron, lufenuron, novaluron, teflubenzuron, triflumuron; buprofezin, diofenolan, hexythiazox, etoxazole, clofentazine; b) ecdysone antagonists: halofenozide, methoxyfenozide, tebufenozide, azadirachtin; c) juvenoids: pyriproxyfen, methoprene, fenoxycarb; d) lipid biosynthesis inhibitors: spirodiclofen, spiromesifen, spirotetramat;
- nicotinic receptor agonists/antagonists compounds: clothianidin, dinotefuran, flupyradifurone, imidacloprid, thiamethoxam, nitenpyram, acetamiprid, thiacloprid, 1-2-chloro-thiazol-5-ylmethyl)-2-nitrimino-3,5-dimethyl-[1 ,3,5]triazinane;
- GABA antagonist compounds: endosulfan, ethiprole, fipronil, vaniliprole, pyrafluprole, pyriprole, 5-amino-1-(2,6-dichloro-4-methyl-phenyl)-4-sulfinamoyl-1 H-pyrazole-3-carbothioic acid amide;
- macrocyclic lactone insecticides: abamectin, emamectin, milbemectin, lepimectin, spinosad, spinetoram;
- mitochondrial electron transport inhibitor (METI) I acaricides: fenazaquin, pyridaben, tebufenpyrad, tolfenpyrad, flufenerim;
- METI II and III compounds: acequinocyl, fluacyprim, hydramethylnon;
- Uncouplers: chlorfenapyr;
- oxidative phosphorylation inhibitors: cyhexatin, diafenthiuron, fenbutatin oxide, propargite;
- moulting disruptor compounds: cryomazine;
- mixed function oxidase inhibitors: piperonyl butoxide;
- sodium channel blockers: indoxacarb, metaflumizone;
- ryanodine receptor inhibitors: chlorantraniliprole, cyantraniliprole, flubendiamide, N-[4,6-dichloro-2-[(diethyl-lambda-4-sulfanylidene)carbamoyl]-phenyl]-2-(3-chloro-2-pyridyl)-5-(trifluoromethyl)pyrazole-3-carboxamide; N-[4-chloro-2-[(diethyl-lambda-4-sulfanylidene)carbamoyl]-6-methyl-phenyl]-2-(3-chloro-2-pyridyl)-5-(trifluoromethyl)pyrazole-3-carboxamide; N-[4-chloro-2-[(di-2-propyl-lambda-4-sulfanylidene)carbamoyl]-6-methyl-phenyl]-2-(3-chloro-2-pyridyl)-5-(trifluoromethyl)pyrazole-3-carboxamide; N-[4,6-dichloro-2-[(di-2-propyl-lambda-4-sulfanylidene)carbamoyl]-phenyl]-2-(3-chloro-2-pyridyl)-5-(trifluoromethyl)pyrazole-3-carboxamide; N-[4,6-dichloro-2-[(diethyl-lambda-4-sulfanylidene)carbamoyl]-phenyl]-2-(3-chloro-2-pyridyl)-5-(difluoromethyl)pyrazole-3-carboxamide; N-[4,6-dibromo-2-[(di-2-propyl-lambda-4-sulfanylidene)carbamoyl]-phenyl]-2-(3-chloro-2-pyridyl)-5-(trifluoromethyl)pyrazole-3-

carboxamide; N-[4-chloro-2-[(di-2-propyl-lambda-4-sulfanylidene)carbamoyl]-6-cyano-phenyl]-2-(3-chloro-2-pyridyl)-5-(trifluoromethyl)pyrazole-3-carboxamide; N-[4,6-dibromo-2-[(diethyl-lambda-4-sulfanylidene)carbamoyl]-phenyl]-2-(3-chloro-2-pyridyl)-5-(tri - fluoromethyl)pyrazole-3-carboxamide;

- others: benclothiaz, bifenazate, cartap, flonicamid, pyridalyl, pymetrozine, sulfur, thiocyclam, cyenopyrafen, flupyrazofos, cyflumetofen, amidoflumet, imicyafos, bistrifluron, pyrifluquinazon and 1,1'-[(3S,4R,4aR,6S,6aS,12R,12aS,12bS)-4-[[(2-cyclopropylacetyl)oxy]methyl]-1 ,3,4,4a, 5,6,6a, 12, 12a, 12b-decahydro-1 2-hydroxy-4,6a, 12b-trimethyl-1 1-oxo-9-(3-pyridinyl)-2H ,11H-naphtho[2, 1-b]pyrano[3,4-e]pyran-3,6-diyl] cyclopropaneacetic acid ester.

According to one embodiment, the mixtures comprise Trichoderma harzianum strain SK-55 (herein also referred to as SK-55), or a cell-free extract thereof or at least one metabolite thereof having pesticidal activity, and/or a mutant of SK-55 having pesticidal activity and producing at least one pesticidal metabolite as defined herein, or a pesticidal metabolite or extract of the mutant, and at least one pesticide II in a synergistically effective amount.

The invention also relates to a method for controlling phytopathogenic harmful fungi using mixtures of SK-55 and and at least one pesticide II and to the use of SK-55 and pesticides II for preparing such mixtures, and to compositions comprising these mixtures and seed comprising these mixtures or coated with this this mixture.

Moreover, we have found that simultaneous, that is joint or separate, application of SK-55 and a pesticide II or successive application of a SK-55 and of a pesticide II allows better control of harmful fungi than is possible with the individual components alone (synergistic mixtures).

Component 1) in the mixtures embraces not only the isolated, pure cultures of Trichoderma harzianum SK-55 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" 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 produced by a microorganism (such as fungi and bacteria, in particular SK-55) 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 a microorganism, here in particular SK-55, 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.

In general, the term "nematode" comprises eggs, larvae, juvenile and mature forms of said

organism. Thus, in one embodiment, said organisms are comprised in form of eggs, larvae, juvenile or mature form in a formulation, e.g., a solo- or combined-formulation.

According to a further embodiment, component 1) is SK-55, and a cell-free extract thereof. According to a further embodiment, component 1) is SK-55 or a mutant thereof having pesticidal activity and producing at least one pesticidal metabolite, preferably selected from metabolites A, B, C and D as defined herein. According to a further embodiment, the mutant of SK-55 is obtained by direct mutant selection optionally after being subjected to mutagens.

According to a further embodiment, component 1) is SK-55. According to a further embodiment, component 1) is SK-55 in a whole browth. According to a further embodiment, component 1) is SK-55 in a dormant form. According to a further embodiment, component 1) is SK-55 in the form of spores. According to a further embodiment, component 1) is SK-55 in the form of condiospores or chlamydospores. According to a further embodiment, component 1) is SK-55.

Chlamydospores are thick-walled big resting spore of several kinds of fungi. It is the life-stage which survives in unfavourable conditions, such as dry or hot seasons, which makes them being a stable and storable dormant life stage an especially suitable use form of the biopesticide SK-55. Conidiospores (also called conidia) are asexual spores that are generated through mitosis.

Trichoderma harzianum SK-55 may be cultivated using media and fermentation techniques known in the art, e.g. in a medium based on glucose, yeast extract and polypepton at 27°C to 29°C for 5 to 15 days (US 6,955,912) or in potato dextrose agar on a petri dish (US 5,422,107). In liquid culture, condiospores and chlamydospores can be produced (e.g. US 6,955,912). In large liquid cultures, aeriation may be necessary. Chlamydospore formation can be facilitated by glucose depletion along with increasing agitation speed (US 6,955,912). The bacterial cells (vegatitive cells and spores) can be washed and concentrated (e.g. by centrifugation at room temperature for about 15 min at 7000 x g). To produce a dry formulation, bacterial cells, preferably spores were suspended in a suitable dry carrier (e.g. clay). To produce a liquid formulation, cells, preferably spores, can be re-suspended in a suitable liquid carrier (e.g. water-based) to the desired spore density. The spore density number of spores per mL can be determined by identifying the number of colony-forming units (CFU) on agar medium e.g. potato dextrose agar after incubation for several days at 28°C. SK-55 is generally active in temperatures between 5°C and 50°C, preferably between 15°C and 35°C. Dry prower containing primarily condiospores of SK-55 can be preared as described in US 5,422,107. Such powder usually contains 10^9 to 10^{10} conidiospores per gram.

Such powder prepared according to US 5,422,107 can be applied at rates 0.5 g to 10 g per m^2 of acreage. When diluted with a solid carrier or auxiliary such as soil or peat, such powder can be applied at rates 0.5 g to 1000 g per m^2 of acreage. When water other liquids are used as a diluent, 0.5 to 10 g of the powder may be diluted at the rate of 0.1 to 10 l per m^2 of acreage, preferably at a rate of 1 to 5 l.

To produce a pesticidal extract, SK-55 may be grown on solid medium such as rice medium composed of rice supplemented with 3% soybean cake and 10% water. Alternatively, SK-55 may be cultivated in liquid medium e.g. comprising 3 to 5% glucose, 0.5% polypeptone, 0.8% NaCl, 0.2% yeast extract and 1% calcium carbonate at 25 to 30°C for 7 to 15 days. The

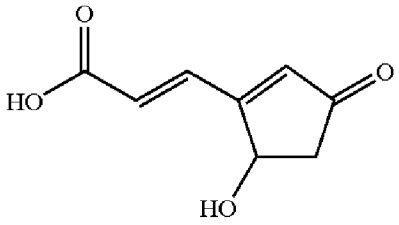
extraction can be carried out with an organic solvent, preferably a water-soluble organic solvent such as an alcohol or ketone, even more preferably with acetone or acetone/water mixtures, which solvent or solvent micture may be removed by distillation and/or drying.

Such extract contains pesticidal metabolites. Peptaibol metabolites that are specific to this strain may be isolated from such organic solvent-based extract according to US 6,753,295, in particular when SK-55 has been cultivated on solid medium.

Peptaibols are biologically active peptides containing between seven and twenty amino acid residues, some of which are non-proteinogenic amino acids, in particular they contain a-aminoisobutyric acid sometimes along with other unusual amino acids such as ethylnorvaline, isovaline and hydroxyproline, the N terminal is acetylated and the C-terminal amino acid is hydroxylation to an acid alcohol.

The pesticidal metabolite from SK-55 or its mutants are preferably selected from the peptaibol metabolites A, B and D wherein Ac is acetyl group at the N-terminus and Aib is a-aminobutyric acid and the C-terminus is an amino alcohol linkage and wherein the sequences below are partial N-terminal sequences of the respective metabolite:
metabolite A of molecular weight of about 1933 +/- 10 and comprising the sequence Ac-Aib-Ala-Aib-Aib-Aib-Aib-Gln-Aib-Aib-,
metabolite B of a molecular weight of 1955 +/-10 and comprising the sequence Ac-Aib-Ala-Aib-Aib-Val-Aib-Gln-Aib-Aib-, and
metabolite D of molecular weight of about 1810 +/- 10 and comprising the sequence Ac-Aib-Ala-Aib-Aib-Aib.

In addition, the pesticidal metabolite of SK-55 or a mutant thereof is preferably the pesticidal metabolite C of formula



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which can be preferably extracted and isolated from liquid cultures of SK-55 and which metabolites may be used for the inventive mixtures and compositions.

The pesticides II of chemical nature described by common names, their preparation and their activity against pests is known (cf.: http://www.alanwood.net/pesticides/); these pesticides are often commercially available.

The pesticides II 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 03/1 1853; 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 11/028657, WO2012/168188, WO 2007/006670, WO 11/77514; WO13/047749, WO 10/069882, WO 13/047441 , WO 03/16303, WO 09/90181 , WO 13/007767, WO 13/010862, WO 13/024009 and WO 13/02401 0).

The biopesticides from group L) of pesticides II, their preparation and their pesticidal activity e.g. against harmful fungi or insects are known (e-Pesticide Manual V 5.2 (ISBN 978 1 901396 85 0) (2008-201 1); http://www.epa.gov/opp00001/biopesticides/, see product lists therein; http://www.omri.org/omri-lists, see lists therein; Bio-Pesticides Database BPDB http://sitem.herts.ac.uk/aeru/bpdb/, see A to Z link therein).

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 are registered and/or are commercially available: aluminium silicate (Screen™ Duo from Certis LLC, USA), Agrobacterium radiobacter K1026 (e.g. NoGall® from Becker Underwood 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 Becker Underwood, South Africa; or Goemar® from Laboratoires Goemar, France), Aspergillus flavus NRRL 21882 isolated from a peanut in Georgia in 1991 by the USDA, National Peanut Research Laboratory (e.g. in Afla-Guard® from Syngenta, CH), mixtures of Aureobasidium pullulans DSM14940 and DSM 14941 (e.g. blastospores in BlossomProtect® from bio-ferm GmbH, Germany), Azospirillum brasilense XOH (e.g. AZOS from Xtreme Gardening, USA or RTI Reforestation Technologies International; USA), Bacillus amyloliquefaciens FZB42 (e.g. in RhizoVital® 42 from AbiTEP GmbH, Berlin, Germany), B. amyloliquefaciens IN937a (J. Microbiol. Biotechnol. 17(2), 280-286, 2007; e.g. in BioYield® from Gustafson LLC, TX, USA), B. amyloliquefaciens IT-45 (CNCM I-3800) (e.g. Rhizocell C from ITHEC, France), B. amyloliquefaciens subsp. plantarum MBI600 (NRRL B-50595, deposited at United States Department of Agriculture) (e.g. Integral®, Subtilex® NG from Becker Underwood, USA), B. cereus CNCM 1-1562 (US 6,406,690), B. firmus CNCM I-1582 (WO 2009/126473, WO 2009/124707, US 6,406,690; Votivo® from Bayer Crop Science LP, USA), B. pumilus GB34 (ATCC 700814; e.g. in YieldShield® from Gustafson LLC, TX, USA), and Bacillus pumilus KFP9F (NRRL B-50754) (e.g. in BAC-UP or FUSION-P from Becker Underwood South Africa), B. pumilus QST 2808 (NRRL B-30087) (e.g. Sonata® and Ballad® Plus from AgraQuest Inc., USA), B. subtilis GB03 (e.g. Kodiak® or BioYield® from Gustafson, Inc., USA; or Companion® from Growth Products, Ltd., White Plains, NY 10603, USA), B. subtilis GB07 (Epic® from Gustafson, Inc., USA), B. subtilis QST-713 (NRRL B-21661 in Rhapsody®, Serenade® MAX and Serenade® ASO from AgraQuest Inc., USA), B. subtilis var. amyloliquefaciens FZB24 (e.g. Taegro® from Novozyme Biologicals, Inc., USA), B. subtilis var.

amyloliquefaciens D747 (e.g. Double Nickel 55 from Certis LLC, USA), B. thuringiensis ssp. aizawai ABTS-1857 (e.g. in XenTari® from BioFa AG, Munsingen, Germany), B. t. ssp. aizawai SAN 401 I, ABG-6305 and ABG-6346, Bacillus t. ssp. israelensis AM65-52 (e.g. in VectoBac® from Valent Biosciences, IL, USA), Bacillus thuringiensis ssp. kurstaki SB4 (NRRL B-50753; e.g. Beta Pro® from Becker Underwood, South Africa), B. t. ssp. kurstaki ABTS-351 identical to HD-1 (ATCC SD-1275; e.g. in Dipel® DF from Valent Biosciences, IL, USA), B. t. ssp. kurstaki EG 2348 (e.g. in Lepinox® or Rapax® from CBC (Europe) S.r.l., Italy), B. t. ssp. tenebrionis DSM 2803 (EP 0 585 215 B1; identical to NRRL B-15939; Mycogen Corp.), B. t. ssp. tenebrionis NB-125 (DSM 5526; EP 0 585 215 B1; also referred to as SAN 418 I or ABG-6479; 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 (DSM 5480; EP 585 215 B1; Novodor® from Valent Biosciences, Switzerland), Beauveria bassiana ATCC 74040 (e.g. in Naturalis® from CBC (Europe) S.r.l., Italy), B. bassiana DSM 12256 (US 200020031495; e.g. BioExpert® SC from Live Sytems Technology S.A., Colombia), B. bassiana GHA (BotaniGard® 22WGP from Laverlam Int. Corp., USA), B. bassiana PPRI 5339 (ARSEF number 5339 in the USDA ARS collection of entomopathogenic fungal cultures; NRRL 50757) (e.g. BroadBand® from Becker Underwood, South Africa), B. brongniartii (e.g. in Melocont® from Agrifutur, Agrianello, Italy, for control of cockchafer; J. Appl. Microbiol. 100(5), 1063-72, 2006), Bradyrhizobium sp. (e.g. Vault® from Becker Underwood, USA), B. japonicum (e.g. VAULT® from Becker Underwood, USA), Candida oleophila 1-182 (NRRL Y-18846; e.g. Aspire® from Ecogen Inc., USA, Phytoparasitica 23(3), 231-234, 1995), 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. catenulata, also named Gliocladium catenulatum (e.g. isolate J 1446: 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 (e.g. in GRANDEVO from Marrone Bio Innovations, USA), Coniothyrium minitans CON/M/91-08 (e.g. Contans® WG from Prophyta, Germany), Cryphonectria parasitica (e.g. Endothia parasitica from CNICM, France), Cryptococcus albidus (e.g. YIELD PLUS® from Anchor Bio-Technologies, South Africa), Cryptophlebia leucotreta granulovirus (CrleGV) (e.g. in CRYPTEX from Adermatt Biocontrol, Switzerland), Cydia pomonella granulovirus (CpGV) V03 (DSM GV-0006; e.g. in MADEX Max from Andermatt Biocontrol, Switzerland), CpGV V22 (DSM GV-0014; e.g. in MADEX Twin from Adermatt Biocontrol, Switzerland), Delftia acidovorans RAY209 (ATCC PTA-4249; WO 2003/57861 ; e.g. in BIOBOOST from Brett Young, Winnipeg, Canada), Dilophosphora alopecuri (Twist Fungus from Becker Underwood, Australia), Ecklonia maxima (kelp) extract (e.g. KELPAK SL from Kelp Products Ltd, South Africa), formononetin (e.g. in MYCONATE from Plant Health Care pic, U.K.), Fusarium oxysporum (e.g. BIOFOX® from S.I.A.P.A., Italy, FUSACLEAN® from Natural Plant Protection, France), 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 (e.g. MESSENGER or HARP-N-Tek from Plant Health Care pic, U.K.; Science 257, 1-132, 1992), Heterorhabditis

bacteriophaga (e.g. Nemasys® G from Becker Underwood Ltd., UK), Isaria fumosorosea Apopka-97 (ATCC 20874) (PFR-97™ from Certis LLC, USA), cis-jasmone (US 8,221,736), laminarin (e.g. in VACCIPLANT from Laboratoires Goemar, St. Malo, France or Stahler SA, Switzerland), Lecanicillium longisporum KV42 and KV71 (e.g. VERTALEC® from Koppert BV, Netherlands), L. muscarium KV01 (formerly Verticillium lecanii) (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, 107-1 15; Biological Control 31(2), 145-154, 2004), Metarhizium anisopliae var. acridum IMI 330189 (isolated from Ornithacris cavroisi in Niger; also NRRL 50758) (e.g. GREEN MUSCLE® from Becker Underwood, South Africa), M. a. var. acridum FI-985 (e.g. GREEN GUARD® SC from Becker Underwood Pty Ltd, Australia), M. anisopliae FI-1045 (e.g. BIOCANE® from Becker Underwood Pty Ltd, Australia), M. anisopliae F52 (DSM 3884, ATCC 90448; e.g. MET52® Novozymes Biologicals BioAg Group, Canada), M. anisopliae ICIPE 69 (e.g. METATHRI POL from ICIPE, Nairobe, Kenya), Metschnikowia fructicola (NRRL Y-30752; e.g. SHEMER® from Agrogreen, Israel, now distributed by Bayer CropSciences, Germany; US 6,994,849), Microdochium dimerum (e.g. ANTIBOT® from Agrauxine, France), Microsphaeropsis ochracea P130A (ATCC 74412 isolated from apple leaves from an abandoned orchard, St-Joseph-du-Lac, Quebec, Canada in 1993; Mycologia 94(2), 297-301, 2002), Muscodor albus QST 20799 originally isolated from the bark of a cinnamon tree in Honduras (e.g. in development products Muscudor™ or QRD300 from AgraQuest, USA), Neem oil (e.g. TRILOGY®, TRIACT® 70 EC from Certis LLC, USA), Nomuraea rileyi strains SA86101, GU87401, SR86151, CG128 and VA9101, Paecilomyces fumosoroseus FE 9901 (e.g. NO FLY™ from Natural Industries, Inc., USA), P. lilacinus 251 (e.g. in BioAct®/MeloCon® from Prophyta, Germany; Crop Protection 27, 352-361, 2008; originally isolated from infected nematode eggs in the Philippines), P. lilacinus DSM 15169 (e.g. NEMATA® SC from Live Systems Technology S.A., Colombia), P. lilacinus BCP2 (NRRL 50756; e.g. PL GOLD from Becker Underwood BioAg SA Ltd, South Africa), mixture of Paenibacillus alvei NAS6G6 (NRRL B-50755), Pantoea vagans (formerly agglomerans) C9-1 (originally isolated in 1994 from apple stem tissue; BlightBan C9-1® from NuFrams America Inc., USA, for control of fire blight in apple; J. Bacteriol. 192(24) 6486-6487, 2010), Pasteuria spp. ATCC PTA-9643 (WO 2010/085795), Pasteuria spp. ATCC SD-5832 (WO 2012/064527), P. nishizawae (WO 2010/80169), P. penetrans (US 5,248,500), P. ramose (WO 2010/80619), P. thornea (WO 2010/80169), P. usgae (WO 2010/80169), Penicillium bilaiae (e.g. Jump Start® from Novozymes Biologicals BioAg Group, Canada, originally isolated from soil in southern Alberta; Fertilizer Res. 39, 97-103, 1994), Phlebiopsis gigantea (e.g. RotStop® from Verdera Oy, Finland), Pichia anomala WRL-076 (NRRL Y-30842; US 8,206,972), potassium bicarbonate (e.g. Amicarb® fromm Stahler SA, Switzerland), potassium silicate (e.g. Sil-MATRIX™ from Certis LLC, USA), Pseudozyma flocculosa PF-A22 UL (e.g. Sporodex® from Plant Products Co. Ltd., Canada), Pseudomonas sp. DSM 13134 (WO 2001/40441, e.g. in PRORADIX from Sourcon Padena GmbH & Co. KG, Hechinger Str. 262, 72072 Tubingen, Germany), P. chloraphis MA 342 (e.g. in CERALL or CEDEMON from BioAgri AB, Uppsala, Sweden), P. fluorescens CL 145A (e.g. in ZEQUANOX from Marrone BioInnovations, Davis, CA, USA; J. Invertebr. Pathol. 113(1):104-14, 2013), Pythium oligandrum DV 74 (ATCC 38472; e.g.

POLYVERSUM® from Remeslo SSRO, Biopreparaty, Czech Rep. and GOWAN, USA; US 2013/0035230), Reynoutria sachlinensis extract (e.g. REGALIA® SC from Marrone BioInnovations, Davis, CA, USA), Rhizobium leguminosarum bv. phaseolii (e.g. RHIZO-STICK from Becker Underwood, USA), R. l. trifolii RP1 13-7 (e.g. DORMAL from Becker Underwood, USA; Appl. Environ. Microbiol. 44(5), 1096-1 101), R. l. bv. viciae P1NP3Cst (also referred to as 1435; New Phytol 179(1), 224-235, 2008; e.g. in NODULATOR PL Peat Granule from Becker Underwood, USA; or in NODULATOR XL PL bfrom Becker Underwood, Canada), R. l. bv. viciae SU303 (e.g. NODULAID Group E from Becker Underwood, Australia), R. l. bv. viciae WSM1455 (e.g. NODULAID Group F from Becker Underwood, Australia), R. tropici SEMIA 4080 (identical to PRF 81; Soil Biology & Biochemistry 39, 867-876, 2007), Sinorhizobium meliloti MSDJ0848 (INRA, France) also referred to as strain 201 1 or RCR201 1 (Mol Gen Genomics (2004) 272: 1-17; e.g. DORMAL ALFALFA from Becker Underwood, USA; NITRAGIN® Gold from Novozymes Biologicals BioAg Group, Canada), Sphaerodes mycoparasitica IDAC 301008-01 (WO 201 1/022809), Steinernema carpocapsae (e.g. MILLENIUM® from Becker Underwood Ltd., UK), S. feltiae (NEMASHIELD® from BioWorks, Inc., USA; NEMASYS® from Becker Underwood Ltd., UK), S. kraussei L137 (NEMASYS® L from Becker Underwood Ltd., UK), Streptomyces griseoviridis K61 (e.g. MYCOSTOP® from Verdera Oy, Espoo, Finland; Crop Protection 25, 468-475, 2006), S. lydicus WYEC 108 (e.g. Actinovate® from Natural Industries, Inc., USA, US 5,403,584), S. violaceusniger YCED-9 (e.g. DT-9® from Natural Industries, Inc., USA, US 5,968,503), Talaromyces flavus V117b (e.g. PROTUS® from Prophyta, Germany), Trichoderma asperellum SKT-1 (e.g. ECO-HOPE® from Kumiai Chemical Industry Co., Ltd., Japan), T. asperellum ICC 012 (e.g. in TENET WP, REMDIER WP, BIOTEN WP from Isagro NC, USA, BIO-TAM from AgraQuest, USA), T. atroviride LC52 (e.g. SENTINEL® from Agrimm Technologies Ltd, NZ), T. atroviride CNCM I-1237 (e.g. in Esquive WG from Agrauxine S.A., France, e.g. against pruning wound diseases on vine and plant root pathogens), T. fertile JM41 R (NRRL 50759; e.g. RICHPLUS™ from Becker Underwood Bio Ag SA Ltd, South Africa), T. gamsii ICC 080 (e.g. in TENET WP, REMDIER WP, BIOTEN WP from Isagro NC, USA, BIO-TAM from AgraQuest, USA), T. harzianum T-22 (e.g. PLANTSHIELD® der Firma BioWorks Inc., USA), T. harzianum TH 35 (e.g. ROOT PRO® from Mycontrol Ltd., Israel), T. harzianum T-39 (e.g. TRICHODEX® and TRICHODERMA 2000® from Mycontrol Ltd., Israel and Makhteshim Ltd., Israel), T. harzianum and T. viride (e.g. TRICHOPEL from Agrimm Technologies Ltd, NZ), T. harzianum ICC012 and T. viride ICC080 (e.g. REMEDIER® WP from Isagro Ricerca, Italy), T. polysporum and T. harzianum (e.g. BINAB® from BINAB Bio-Innovation AB, Sweden), T. stromaticum (e.g. TRICOVAB® from C.E.P.L.A.C., Brazil), T. virens GL-21 (also named Gliocladium virens) (e.g. SOILGARD® from Certis LLC, USA), T. viride (e.g. TRIECO® from Ecosense Labs. (India) Pvt. Ltd., Indien, BIO-CURE® F from T. Stanes & Co. Ltd., Indien), T. viride TV1 (e.g. T. viride TV1 from Agribiotec srl, Italy) and Ulocladium oudemansii HRU3 (e.g. in BOTRY-ZEN® from Botry-Zen Ltd, NZ).

Strains can be sourced from genetic resource and deposition centers: American Type Culture Collection, 10801 University Blvd., Manassas, VA 201 10-2209, USA (strains with ATCC prefic); CABI Europe - International Mycological Institute, Bakeham Lane, Egham, Surrey, TW20 9TYNRRL, UK (strains with prefices CABI and IMI); Centraalbureau voor Schimmelcultures, Fungal Biodiversity Centre, Uppsalaan 8, PO Box 851 67, 3508 AD Utrecht,

Netherlands (strains with prefic CBS); Division of Plant Industry, CSIRO, Canberra, Australia (strains with prefix CC); Collection Nationale de Cultures de Microorganismes, Institut Pasteur, 25 rue du Docteur Roux, F-75724 PARIS Cedex 15 (strains with prefix CNCM); Leibniz-Institut DSMZ-Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH, InhoffenstraBe 7 B, 38124 Braunschweig, Germany (strains with prefix DSM); International Depositary Authority of Canada Collection, Canada (strains with prefix IDAC); Interntional Collection of Micro-orgniasms from Plants, Landcare Research, Private Bag 92170, Auckland Mail Centre, Auckland 1142, New Zealand (strans with prefix ICMP); IITA, PMB 5320, Ibadan, Nigeria (straisn with prefix IITA); The National Collections of Industrial and Marine Bacteria Ltd., Torry Research Station, P.O. Box 31, 135 Abbey Road, Aberdeen, AB9 8DG, Scotland (strains with prefix NCIMB); 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 (strains with prefix NRRL); Department of Scientific and Industrial Research Culture Collection, Applied Biochemistry Division, Palmerston North, New Zealand (strains with prefix NZP); FEPAGRO-Fundaçao Estadual de Pesquisa Agropecuaria, Rua Gonçalves Dias, 570, Bairro Menino Deus, Porto Alegre/RS, Brazil (strains with prefix SEMIA); SARDI, Adelaide, South Australia (strains with prefix SRDI); U.S. Department of Agriculture, Agricultural Research Service, Soybean and Alfalfa Research Laboratory, BARC-West, 10300 Baltimore Boulevard, Building 011, Room 19-9, Beltsville, MD 20705, USA (strains with prefix USDA: Beltsville Rhizobium Culture Collection Catalog March 1987 USDA-ARS ARS-30: http://pdf.usaid.gov/pdf_docs/PNAAW891 .pdf); and Murdoch University, Perth, Western Australia (strains with prefix WSM). Further strains may be found at the Global catalogue of Microorganisms: http://gcm.wfcc.info/ and http://www.landcareresearch.co.nz/resources/collections/icmp and further references to strain collections and their prefixes at http://refs.wdcm.org/collections.htm.

Bacillus amyloliquefaciens subsp. plantarum MBI600 (NRRL B-50595) is deposited under accession number NRRL B-50595 with the strain designation Bacillus subtilis 1430 (and identical to NCIMB 1237). Recently, MBI 600 has been re-classified as Bacillus amyloliquefaciens subsp. plantarum based on polyphasic testing which combines classical microbiological methods relying on a mixture of traditional tools (such as culture-based methods) and molecular tools (such as genotyping and fatty acids analysis). Thus, Bacillus subtilis MBI600 (or MBI 600 or MBI-600) is identical to Bacillus amyloliquefaciens subsp. plantarum MBI600, formerly Bacillus subtilis MBI600. Bacillus amyloliquefaciens MBI600 is known as plant growth-promoting rice seed treatment from Int. J. Microbiol. Res. 3(2) (2011), 120-130 and further described e.g. in US 2012/0149571 A1. This strain MBI600 is e.g. commercially available as liquid formulation product INTEGRAL® (Becker-Underwood Inc., USA).

Bacillus subtilis strain FB17 was originally isolated from red beet roots in North America (System Appl. Microbiol 27 (2004) 372-379). This B. subtilis strain promotes plant health (US 2010/0260735 A1; WO 2011/109395 A2). B. subtilis FB17 has also been deposited at ATCC under number PTA-11857 on April 26, 2011. Bacillus subtilis strain FB17 may be referred elsewhere to as UD1022 or UD10-22.

Bacillus amyloliquefaciens AP-136 (NRRL B-50614), B. amyloliquefaciens AP-188 (NRRL B-

50615), B. amyloliquefaciens AP-218 (NRRL B-50618), B. amyloliquefaciens AP-219 (NRRL B-50619), B. amyloliquefaciens AP-295 (NRRL B-50620), B. japonicum SEMIA 5079 (e.g. Gelfix 5 or Adhere 60 from Nitral Urbana Laoboratories, Brazil, a BASF Company), B. japonicum SEMIA 5080 (e.g. GELFIX 5 or ADHERE 60 from Nitral Urbana Laoboratories, Brazil, a BASF Company), B. mojavensis AP-209 (NRRL B-50616), B. solisalsi AP-217 (NRRL B-50617), B. pumilus strain INR-7 (otherwise referred to as BU-F22 (NRRL B-50153) and BU-F33 (NRRL B-50185)), B. simplex ABU 288 (NRRL B-50340) and B. amyloliquefaciens subsp. plantarum MBI600 (NRRL B-50595) have been mentioned i.a. in US patent appl. 20120149571 , US 8,445,255, WO 2012/079073. Bradyrhizobium japonicum USDA 3 is known from US patent 7,262,151 .

Jasmonic acid or salts (jasmonates) or derivatives include without limitation potassium jasmonate, sodium jasmonate, lithium jasmonate, ammonium jasmonate, dimethylammonium jasmonate, isopropylammonium jasmonate, diolammonium jasmonate, diethtriethanolammonium jasmonate, 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, coronafacoyl-L-serine, coronafacoyl-L-threonine, methyl esters of 1-oxo-indanoyl-isoleucine, methyl esters of 1-oxo-indanoyl-leucine, coronalon (2-[(6-ethyl-l-oxo-indane-4-carbonyl) -amino]-3-methyl -pentanoic acid methyl ester), linoleic acid or derivatives thereof and cis-jasmone, or 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 the invention, the pesticide II may not be T. harzianum SK-55, preferably not Trichaoderma harzianum, even more preferably pesticide II is not any of Trichoderma asperellum, T. atroviride, T. fertile, T. gamsii, T. harmatum; mixture of T. harzianum and T. viride; mixture of T. polysporum and T. harzianum; T. stromaticum, T. virens (also named Gliocladium virens) or T. viride.

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

L1) Microbial pesticides with fungicidal, bactericidal, viricidal and/or plant defense activator activity: Ampelomyces quisqualis M-10, Aspergillus flavus NRRL 21882, Aureobasidium pullulans DSM 14940, A. pullulans DSM 14941 , Bacillus amyloliquefaciens AP-136 (NRRL B-50614), B. amyloliquefaciens AP-188 (NRRL B-50615), B. amyloliquefaciens AP-218 (NRRL B-50618), B. amyloliquefaciens AP-219 (NRRL B-50619), B. amyloliquefaciens AP-295 (NRRL B-50620), B. amyloliquefaciens FZB42, B. amyloliquefaciens IN937a, B. amyloliquefaciens IT-45 (CNCM I-3800), B. amyloliquefaciens subsp. plantarum MBI600 (NRRL B-50595), B. mojavensis AP-209 (NRRL B-50616), B. pumilus INR-7 (otherwise referred to as BU-F22 (NRRL B-50153) and BU-F33 (NRRL B-50185)), B. pumilus KFP9F, B. pumilus QST 2808 (NRRL B-30087), B. pumilus GHA 181 , B. simplex ABU 288 (NRRL B-50340), B. solisalsi AP-217

(NRRL B-50617), B. subtilis CX-9060, B. subtilis GB03, B. subtilis GB07, B. subtilis QST-713 (NRRL B-21661), B. subtilis var. amyloliquefaciens FZB24, B. subtilis var. amyloliquefaciens D747, Candida oleophila I-82, C. oleophila O, C. saitoana, Clavibacter michiganensis (bacteriophages), Coniothyrium minitans CON/M/91-08, Cryphonectria parasitica, Cryptococcus albidus, Dilophosphora alopecuri, Fusarium oxysporum, Clonostachys rosea f. catenulata J1446 (also named Gliocladium catenulatum), Gliocladium roseum 321 U, Metschnikowia fructicola NRRL Y-30752, Microdochium dimerum, Microsphaeropsis ochracea P130A, Muscodor albus QST 20799, Paenibacillus polymyxa PKB1 (ATCC 202127), Pantoea vagans C9-1 , Phlebiopsis gigantea, Pichia anomala WRL-76, Pseudozyma flocculosa PF-A22 UL, Pythium oligandrum DV 74, Sphaerodes mycoparasitica IDAC 301008-01 , Streptomyces griseoviridis K61 , S. lydicus WYEC 108, S. violaceusniger XL-2, S. violaceusniger YCED-9, Talaromyces flavus V 117b, Trichoderma asperellum T34, T. asperellum SKT-1 , T. asperellum ICC 012, T. atroviride LC52, T. atroviride CNCM 1-1237, T. fertile JM41 R, T. gamsii ICC 080, T. harmatum TH 382, T. harzianum TH-35, T. harzianum T-22, T. harzianum T-39, ; mixture of T. harzianum ICC012 and T. viride ICC080; mixture of T. polysporum and T. harzianum; T. stromaticum, T. virens (also named Gliocladium virens) GL-21 , T. virens G41 , T. viride TV1 , Typhula phacorrhiza 94671 , Ulocladium oudemansii HRU3, Verticillium dahlia, zucchini yellow mosaic virus (avirulent strain);

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

L3) Microbial pesticides with insecticidal, acaricidal, molluscidal and/or nematicidal activity: Agrobacterium radiobacter K1026, A radiobacter K84, Bacillus firmus 1-1582, B. thuringiensis ssp. aizawai strains ABTS-1857, SAN 401 I, ABG-6305 and ABG-6346, B. t. ssp. israelensis AM65-52, B. t. ssp. israelensis SUM-6218, B. t. ssp. galleriae SDS-502, B. t. ssp. kurstaki EG 2348, B. t. ssp. kurstaki SB4, B. t. ssp. kurstaki ABTS-351 (HD-1), Beauveha bassiana ATCC 74040, B. bassiana GHA, B. bassiana H123, B. bassiana DSM 12256, B. bassiana PPRI 5339, B. brongniartii, Burkholderia sp. A396, Chromobacterium subtsugae PRAA4-1 , Cydia pomonella granulosis virus V22, Cydia pomonella granulosis virus V 1, Isaria fumosorosea Apopka-97, Lecanicillium longisporum KV42, L. longisporum KV71 , L. muscarium (formerly Verticillium lecanii) KV01 , Metarhizium anisopliae FI-985, M. anisopliae FI-1045, M. anisopliae F52, M. anisopliae ICIPE 69, M. anisopliae var. acridum IMI 330189, Nomuraea rileyi strains SA86101, GU87401 , SR86151, CG128 and VA9101 , Paecilomyces fumosoroseus FE 9901 , P. lilacinus 251 , P. lilacinus DSM 15169, P. lilacinus BCP2, Paenibacillus popilliae Dutky-1940 (NRRL B-2309 = ATCC 14706), P. popilliae KLN 3, P. popilliae Dutky 1, Pasteuria spp. Ph3, Pasteuria spp. ATCC PTA-9643, Pasteuria spp. ATCC SD-5832, P. nishizawae PN-1 , P. penetrans, P. ramose, P. reneformis Pr-3, P. thornea, P. usgae, Pseudomonas fluorescens CL 145A, Steinernema carpocapsae, S. feltiae, S. kraussei L137;

L4) Biochemical pesticides with insecticidal, acaricidal, molluscidal, pheromone and/or nematicidal activity: L-carvone, citral, (E,Z)-7,9-dodecadien-1-yl acetate, ethyl formate,

(E,Z)-2,4-ethyl decadienoate (pear ester), (Z,Z,E)-7,1 1,13-hexadecatrienal, heptyl butyrate, isopropyl myristate, cis-jasmone, lavanulyl senecioate, 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 actanoate, (E,Z,Z)-3,8,1 1-tetradecatrienyl acetate, (Z,E)-9,12-tetradecadien-1-yl acetate, Z-7-tetradecen-2-one, Z-9-tetradecen-1 -yl acetate, Z-1 1-tetradecenal, Z-1 1-tetradecen-1-ol, Acacia negra extract, extract of grapefruit seeds and pulp, extract of Chenopodium ambrosiodae, Catnip oil, Neem oil, Quillay extract, Tagetes oil;

L5) Microbial pesticides with plant stress reducing, plant growth regulator, plant growth promoting and/or yield enhancing activity: Azospirillum amazonense BR 11140 (SpY2T), A. brasilense AZ39, A. brasilense XOH, A. brasilense BR 11005 (Sp245), A. brasilense BR 11002, A. lipoferum BR 11646 (Sp31), A. irakense, A. halopraeferens, Bradyrhizobium sp. PNL01 , B. sp. (Arachis) CB1015, B. sp. (Arachis) USDA 3446, B. sp. (Arachis) SEMIA 6144, B. sp. (Arachis) SEMIA 6462, B. sp. (Arachis) SEMIA 6464, B. sp. (Vigna), B. elkanii SEMIA 587, B. elkanii SEMIA 5019, B. elkanii U-1301 , B. elkanii U-1302, B. elkanii USDA 74, B. elkanii USDA 76, B. elkanii USDA 94, B. elkanii USDA 3254, B. japonicum 532c, B. japonicum CPAC 15, B. japonicum E-109, B. japonicum G49, B. japonicum TA-11, B. japonicum USDA 3, B. japonicum USDA 3 1, B. japonicum USDA 76, B. japonicum USDA 110, B. japonicum USDA 121 , B. japonicum USDA 123, B. japonicum USDA 136, B. japonicum SEMIA 566, B. japonicum SEMIA 5079, B. japonicum SEMIA 5080, B. japonicum WB74, B. liaoningense, B. lupini LL13, B. lupini WU425, B. lupini WSM471 , B. lupini WSM4024, Glomus intraradices RTI-801 , Mesorhizobium sp. WSM1271 , M. sp. WSM1497, M. ciceri CC1 192, M. huakii, M. loti CC829, M. loti SU343, Paenibacillus alvei NAS6G6, Penicillium bilaiae, Rhizobium leguminosarum bv. phaseolii, R. I. trifolii RP1 13-7, R. I. bv. viciae SU303, R. I. bv. viciae WSM1455, R. I. bv. viciae P1NP3Cst, R. tropici SEMIA 4088, Sinorhizobium meliloti MSDJ0848;

L6) Biochemical pesticides with plant stress reducing, plant growth regulator and/or plant yield enhancing activity: abscisic acid, aluminium silicate (kaolin), 3-decen-2-one, formononectin, genistein, hesperetin, homobrassinlide, humates, methyl jasmonate, cis-jasmone, lysophosphatidyl ethanlamine, naringenin, polymeric polyhydroxy acid, salicylic acid, Ascophyllum nodosum (Norwegian kelp, Brown kelp) extract and Ecklonia maxima (kelp) extract.

The present invention furthermore relates to agrochemical compositions comprising a mixture of T. harzianum SK-55 (component 1) and at least one biopesticide selected from the group L) (component 2), in particular at least one further fungicidal biopesticide selected from the groups L1) and L2), as described above, and if desired at least one suitable auxiliary.

Preference is also given to mixtures comprising as pesticide II (component 2) a biopesticide from group L1), preferably selected from Bacillus amyloliquefaciens AP-136 (NRRL B-50614 and B-50330), B. amyloliquefaciens AP-188 (NRRL B-50615 and B-50331), B. amyloliquefaciens AP-218 (NRRL B-50618), B. amyloliquefaciens AP-219 (NRRL B-50619 and B-50332), B. amyloliquefaciens AP-295 (NRRL B-50620 and B-50333), B. amyloliquefaciens IT-45 (CNCM

1-3800), B. amyloliquefaciens subsp. plantarum MBI600 (NRRL B-50595), B. mojavensis AP-209 (NRRL B-50616), B. pumilus INR-7 (otherwise referred to as BU-F22 (NRRL B-50153) and BU-F33 (NRRL B-50185)), B. pumilus KFP9F, B. pumilus QST 2808 (NRRL B-30087), B. pumilus GHA 181 , B. simplex ABU 288 (NRRL B-50340), B. solisaisi AP-217 (NRRL B-50617), B. subtilis CX-9060, B. subtilis GB03, B. subtilis GB07, B. subtilis QST-713 (NRRL B-21661), B. subtilis var. amyloliquefaciens FZB24, B. subtilis var. amyloliquefaciens D747, Paenibacillus alvei NAS6G6, Paenibacillus polymyxa PKB1 (ATCC 202127), Sphaerodes mycoparasitica IDAC 301008-01 and Trichoderma fertile JM41 R, even more preferably from Bacillus amyloliquefaciens AP-136 (NRRL B-50614), B. amyloliquefaciens AP-188 (NRRL B-50615), B. amyloliquefaciens AP-218 (NRRL B-50618), B. amyloliquefaciens AP-219 (NRRL B-50619), B. amyloliquefaciens AP-295 (NRRL B-50620), B. amyloliquefaciens IT-45 (CNCM I-3800), B. mojavensis AP-209 (NRRL B-50616), B. pumilus INR-7 (otherwise referred to as BU-F22 (NRRL B-50153) and BU-F33 (NRRL B-50185)), B. pumilus QST 2808 (NRRL B-30087), B. simplex ABU 288 (NRRL B-50340), B. subtilis QST-713 (NRRL B-21661), B. subtilis MBI600 (NRRL B-50595), Paenibacillus alvei NAS6G6, Sphaerodes mycoparasitica IDAC 301008-01 and Trichoderma fertile JM41 R.

According to one embodiment of the inventive mixtures, the at least one pesticide II is Bacillus amyloliquefaciens subsp. plantarum MBI600. These mixtures are particularly suitable in soybean.

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

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

According to one embodiment of the inventive mixtures, the at least one pesticide 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 FZB42, B. amyloliquefaciens IN937a, B. amyloliquefaciens IT-45, B. amyloliquefaciens subsp. plantarum MBI600, B. mojavensis AP-209, B. pumilus GB34, B. pumilus INR-7, B. pumilus KFP9F, B. pumilus QST 2808, B. pumilus GHA 181 , B. simplex ABU 288, B. solisaisi AP-217, B. subtilis CX-9060, B. subtilis GB03, B. subtilis GB07, B. subtilis QST-713, B. subtilis var. amyloliquefaciens FZB24 and B. subtilis var. amyloliquefaciens D747. These mixtures are particularly suitable in 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 a further embodiment, the at least one pesticide II is Sphaerodes mycoparasitica, preferably Sphaerodes mycoparasitica strain IDAC 301008-01 (also referred to as strain SMCD2220-01). These mixtures are particularly suitable in soybean, cereals and corn, in particular corn especially to combat Fusarium head blight.

The present invention also relates to mixtures wherein the at least one pesticide II is selected from the following yests and fungi: Ampelomyces quisqualis, in particular strain AQ 10, Aureobasidium pullulans, in particular blastospores of strain DSM 14940 or blastospores of

strain DSM 14941 or mixtures thereof; Candida oleophila, in particular strains 1-182 and O, Coniothyrium minitans, in particular strain CON/M/91-8; Dilophosphora alopecuri which reduces annual ryegrass toxicity (ARGT), a disease of livestock resulting from the ingestion of annual ryegrass seed-heads that have been infected by the toxin producing bacterium Rathayibacter toxicus; Gliocladium catenulatum, in particular strain J 1446; Metschnikovia fructicola, in particular strain NRRL Y-30752, Microsphaeropsis ochracea, in particular strain P130A for control of apple scab; (2.13) Muscodor albus, in particular strain QST 20799, Pichia anomala, in particular strain WRL-076, Pseudozyma flocculosa, in particular strain PF-A22 UL; Pythium oligandrum, in particular strain DV74;

The present invention also relates to mixtures wherein the at least one pesticide II is selected from the fungal genus Trichoderma, preferably from the strains Trichoderma asperellum T34, T. asperellum SKT-1 , T. asperellum ICC 012, T. atroviride LC52, T. atroviride CNCM 1-1237, T. fertile JM41 R, T. gamsii ICC 080, T. harmatum TH 382, T. harzianum TH-35, T. harzianum T-22, T. harzianum T-39, ; mixture of T. harzianum ICC012 and T. viride ICC080; mixture of T. polysporum and T. harzianum; T. stromaticum, T. virens GL-21 , T. virens G41 and T. viride TV1 ; in particular T. fertile JM41 R.

The present invention also relates to mixtures wherein the at least one pesticide II is selected from the fungal genus Ulocladium, in particular U. oudemansii HRU3.

Preference is also given to mixtures comprising as pesticide II (component 2) a biopesticide from group L2), preferably selected from chitosan (hydrolysate), methyl-jasmonate, cis-jasmone, laminarin, Reynoutria sachlinensis extract and tea tree oil; even more preferable from methyl jasmonate and laminarin.

Preference is also given to mixtures comprising as pesticide II (component 2) a biopesticide from group L3), preferably selected from Agrobacterium radiobacter K1026, Bacillus firmus I-1582, Bacillus thuringiensis ssp. kurstaki SB4, Beauveria bassiana GHA, B. bassiana H123, B. bassiana DSM 12256, B. bassiana PPRI 5339, Metarhizium anisopliae var. acridum IMI 330189, M. anisopliae FI-985, M. anisopliae FI-1045, M. anisopliae F52, M. anisopliae ICIPE 69, Paecilomyces lilacinus DSM 15169, P. lilacinus BCP2, Paenibacillus popilliae Dutky-1940 (NRRL B-2309 = ATCC 14706), P. popilliae KLN 3 and P. popilliae Dutky 1, even more preferably from Bacillus thuringiensis ssp. kurstaki SB4, 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, Paenibacillus popilliae Dutky-1940 (NRRL B-2309 = ATCC 14706), P. popilliae KLN 3 and P. popilliae Dutky 1.

According to a further embodiment, the at least one pesticide II is Beauveria bassiana, preferably selected from Beauveria bassiana ATCC 74040, B. bassiana GHA, B. bassiana H123, B. bassiana DSM 12256 and B. bassiana PPRI 5339, in particular Beauveria bassiana strain PPRI 5339. These mixtures are particularly suitable for wide range of arthropod pests, such as white flies, thrips, mites, aphids, tingids and all their developmental stages (eggs, immature stages, and adults) infesting numerous crops (vegetables, cucurbits, solanaceous fruits, strawberry, flowers and ornamentals, grapevine, citrus, pome, stone fruits, etc.). Recent

studies have shown that these antagonistic fungal strains can effectively control also nut-weevils, wireworms (Agriotes spp.), and Tephritid flies, such as the Mediterranean fruit fly, Ceratitis capitata, the cherry fruit fly, Rhagoletis cerasi, and the olive fly, Bactrocera oleae. They are also useful in soybean and corn.

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

According to a further embodiment, the at least one pesticide 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 soybean and corn.

According to a further embodiment, the at least one pesticide II is Lecanicillium sp., preferably selected from Lecanicillium longisporum KV42, L. longisporum KV71 and L. muscarium (formerly Verticillium lecanii) KV01 .

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

According to a further embodiment, the at least one pesticide 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 pesticide II is Bacillus firmus, preferably spores of strain CNCM 1-1 582, preferable for seed treatment of soybean and corn against nematodes and insects.

According to a further embodiment, the at least one pesticide II is B. cereus preferably spores of CNCM 1-1562, preferable for seed treatment of soybean and corn against nematodes and insects.

According to a further embodiment, the at least one pesticide II is a mixture of spores of B. firmus and B. cereus, preferably mixtures spores of strains CNCM 1-1582 and CNCM 1-1562, preferable for seed treatment of soybean and corn against nematodes and insects.

According to a further embodiment, the at least one pesticide II is selected from Bacillus thuringiensis, preferably B. thuringiensis ssp. aizawai, in particular B. t. ssp. aizawai strains ABTS-18, SAN 401 I, ABG-6305 and ABG-6346, which are effective against different lepidopteran species including also noctuidae.

According to a further embodiment, the at least one pesticide II is selected from Bacillus t. ssp. israelensis, preferably AM65-52, SAN 402 I and ABG-6164, which are applied against larvae of various dipteran pests, e.g. mosquitoes and nematoceres.

According to a further embodiment, the at least one pesticide II is selected from Bacillus t. ssp. kurstaki preferably from strains EG 2348, SB4 and ABTS-351 (HD-1), in particular B. thuringiensis ssp. kurstaki SB4. These strains are used for control of lepidopteran larvae, but without noctuidae.

According to a further embodiment, the at least one pesticide II is selected from Bacillus thuringiensis subsp. tenebrionis, preferably the strains DSM 2803, NB-125 and NB-176, in particular NB-176, which all protect plants e.g. against leaf beetle larvae.

Preference is also given to mixtures comprising as pesticide II (component 2) a biopesticide

from group L4), preferably selected from methyl jasmonate, Acacia negra extract, extract of grapefruit seeds and pulp, Catnip oil, Neem oil, Quillay extract and Tagetes oil, in particular methyl jasmonate or water-based Quillay extract.

Preference is also given to mixtures comprising as pesticide II (component 2) a biopesticide from group L5), preferably selected from Azospirillum amazonense BR 11140 (SpY2T), A. brasilense XOH, A. brasilense BR 11005 (Sp245), A. brasilense BR 11002, A. lipoferum BR 11646 (Sp31), A. irakense, A. halopraeferens, Bacillus amyloliquefaciens AP-136 (NRRL B-50614), Bradyrhizobium sp. (Vigna), B. japonicum USDA 3, B. japonicum USDA 31, B. japonicum USDA 76, B. japonicum USDA 110, B. japonicum USDA 121, Glomus intraradices RTI-801, Paenibacillus alvei NAS6G6, Penicillium bilaiae, Rhizobium leguminosarum bv. phaseolii, R. l. trifolii, R. l. bv. viciae, and Sinorhizobium meliloti, more preferably selected from Azospirillum brasilense BR 11005 (Sp245), Bradyrhizobium sp. (Vigna), B. japonicum USDA 3, B. japonicum USDA 31, B. japonicum USDA 76, B. japonicum USDA 110, B. japonicum USDA 121, Rhizobium leguminosarum bv. phaseolii, R. l. trifolii, R. l. bv. viciae SU303, R. l. bv. viciae WSM1455, R. tropici SEMIA 4088 and Sinorhizobium meliloti MSDJ0848.

According to another embodiment of the inventive mixtures, Bradyrhizobium sp. (meaning any Bradyrhizobium species and/or strain) as pesticide II is Bradyrhizobium japonicum (B. japonicum). These mixtures are particularly suitable in soybean. B. japonicum strains were cultivated using media and fermentation techniques known in the art, e.g. in yeast extract-mannitol broth (YEM) at 27°C for about 5 days.

The present invention also relates to mixtures, wherein the at least one pesticide II is selected from Bradyrhizobium japonicum (B. japonicum) and further comprisies a compound III, wherein compound III is selected from jasmonic acid or salts or derivatives thereof including cis-jasmone, preferably methyl-jasmonate or cis-jasmone.

References for various B. japonicum strains are given e.g. in US 7,262,151 (B. japonicum strains USDA 110 (= IITA 2121, SEMIA 5032, RCR 3427, ARS 1-110, Nitragin 61A89; isolated from Glycine max in Florida in 1959, Serogroup 110; Appl Environ Microbiol 60, 940-94, 1994), USDA 31 (= Nitragin 61A164; isolated from Glycine max in Wisoconsin in 1941, USA, Serogroup 31), USDA 76 (plant passage of strain USDA 74 which has been isolated from Glycine max in California, USA, in 1956, Serogroup 76), USDA 121 (isolated from Glycine max in Ohio, USA, in 1965), USDA 3 (isolated from Glycine max in Virginia, USA, in 1914, Serogroup 6), USDA 121 (Crop Science 26(5), 911-916, 1986) and USDA 136 (= CB 1809, SEMIA 586, Nitragin 61A136, RCR 3407; isolated from Glycine max in Beltsville, Maryland in 1961; Appl Environ Microbiol 60, 940-94, 1994). Further suitable B. japonicum strain G49 (INRA, Angers, France) is described in Fernandez-Flouret, D. & Cleyet-Marel, J. C. (1987) C R Acad Agric Fr 73, 163-171), especially for soybean grown in Europe, in particular in France. Further suitable B. japonicum strain TA-11 (TA11 NOD$^+$) (NRRL B-18466) is i.a. described in US 5,021,076; Appl Environ Microbiol (1990) 56, 2399-2403 and commercially available as liquid inoculant for soybean (VAULT® NP, Becker Underwood, USA). Further B. japonicum strains as example for pesticide II are described in US2012/0252672A. Further suitable and especially in Canada commercially available strain 532c (The Nitragin Company, Milwaukee, Wisconsin, USA, field isolate from Wisconsin; Nitragin strain collection No. 61A152; Can J Plant

Sci 70 (1990), 661-666) (e.g. in RHIZOFLO, HISTICK, HICOAT Super from Becker Underwood, Canada). Preferably, B. japonicum is selected from strains TA-1 1 and 532c, more preferably a mixture of B. japonicum strains TA-1 1 and 532c.

Other suitable and commercially available B. japonicum strains (see e.g. Appl Environ Microbiol 2007, 73(8), 2635) are SEMIA 566 (isolated from North American inoculant in 1966 and used in Brazilian commercial inoculants from 1966 to 1978), SEMIA 586 (= CB 1809; originally isolated in Maryland, USA but received from Austrailia in 1966 and used in Brazilian inoculants in 1977), CPAC 15 (= SEMIA 5079; a natural varaiant of SEMIA 566 used in commercial inoculants since 1992) and CPAC 7 (= SEMIA 5080; a natural variant of SEMIA 586 used in commercial inoculants since 1992). These strains are especially suitable for soybean grown in Australia or South America, in particular in Brazil. In particular, mixtures of B. japonicum SEMIA 5079 and SEMIA 5080 are suitable. Some of the abovementioned strains have been re-classified as a novel species Bradyrhizobium elkanii, e.g. strain USDA 76 (Can. J. Microbiol., 1992, 38, 501-505).

Another suitable and commercially available B. japonicum strain is E-1 09 (variant of strain USDA 138, see e.g. Eur. J. Soil Biol. 45 (2009) 28-35; Biol Fertil Soils (201 1) 47:81-89, deposited at Agriculture Collection Laboratory of the Instituto de Microbiologia y Zoologia Agncola (IMYZA), Instituto Nacional de Tecnologi ́a Agropecuaria (INTA), Castelar, Argentina). This strain is especially suitable for soybean grown in South America, in particular in Argentina.

Another suitable and commercially available B. japonicum strain are WB74 or WB74-1 (e.g. from Stimuplant CC, South Africa or from SoyGro Bio-Fertilizer Ltd, South Africa). These strains are especially suitable for soybean grown in South America and Africa, in particular in South Africa.

The present invention also relates to mixtures, wherein the at least one pesticide II is selected from Bradyrhizobium elkanii and Bradyrhizobium liaoningense (B. elkanii and B. liaoningense), more preferably from B. elkanii. These mixtures are particularly suitable in soybean. B. elkanii and liaoningense were cultivated using media and fermentation techniques known in the art, e.g. in yeast extract-mannitol broth (YEM) at 27°C for about 5 days.

The present invention also relates to mixtures wherein the at least one pesticide II is selected from selected from B. elkanii and B. liaoningense and further comprises a compound III, wherein compound III is selected from jasmonic acid or salts or derivatives thereof including cis-jasmone, preferably methyl-jasmonate or cis-jasmone.

Suitable and commercially available B. elkanii strains are SEMIA 587 and SEMIA 5019 (=29W) (see e.g. Appl Environ Microbiol 2007, 73(8), 2635) and USDA 3254 and USDA 76 and USDA 94. Preferably, mixtures of B. elkanii strains SEMIA 587 and SEMIA 5019 are useful (e.g. in Gelfix 5 from Nitral Urbana Laboratories, Brazil, a BASF Company). Further commercially available B. elkanii strains are U-1301 and U-1302 (e.g. product Nitroagin® Optimize from Novozymes Bio As S.A., Brazil or NITRASEC for soybean from LAGE y Cia, Brazil). These strains are especially suitable for soybean grown in Australia or South America, in particular in Brazil.

The present invention also relates to mixtures, wherein pesticide II is selected from Bradyrhizobium sp. (Arachis) (B. sp. Arachis) which shall describe the cowpea miscellany cross-inoculation group which includes inter alia indigenous cowpea bradyrhizobia on cowpea (Vigna

unguiculata), siratro (Macroptilium atropurpureum), lima bean (Phaseolus lunatus), and peanut (Arachis hypogaea). This mixture comprising as pesticide II B. sp. Arachis is especially suitable for use in peanut, Cowpea, Mung bean, Moth bean, Dune bean, Rice bean, Snake bean and Creeping vigna, in particular peanut.

The present invention also relates to mixtures wherein the at least one pesticide II is selected from B. sp. (Arachis) and further comprises a compound III, wherein compound III is selected from jasmonic acid or salts or derivatives thereof including cis-jasmone, preferably methyl-jasmonate or cis-jasmone.

Suitable and commercially available B. sp. (Arachis) strain is CB1015 (= IITA 1006, USDA 3446 presumably originally collected in India; from Australian Inoculants Research Group; see e.g. http://www.qaseeds.com.au/inoculant_applic.php). These strains are especially suitable for peanut grown in Australia, North America or South America, in particular in Brazil. Further suitable strain is Bradyrhizobium sp. PNL01 (Becker Underwood, ; Bisson and Mason, April 29, 2010, Project report, Worcester Polytechnic Institute, Worcester, MA, USA: http://www.wpi.edu/Pubs/E-project/Available/E-project-04281 0-1 6361 4/).

Suitable and commercially available Bradyrhizobium sp. (Arachis) strains especially for cowpea and peanut but also for soybean are Bradyrhizobium SEMIA 6144, SEMIA 6462 (= BR 3267) and SEMIA 6464 (= BR 3262; see e.g. FEMS Microbiology Letters (2010) 303(2), 123-131 ; Revista Brasileira de Ciencia do Solo (201 1) 35(3);739-742, ISSN 0100-0683).

The present invention also relates to mixtures, wherein the at least one pesticide II is selected from Bradyrhizobium sp. (Lupine) (also called B. lupini, B. lupines or Rhizobium lupini). This mixture is especially suitable for use in dry beans and lupins.

The present invention also relates to mixtures wherein the at least one pesticide II is selected from Bradyrhizobium sp. (Lupine) (B. lupini) and further comprises a compound III, wherein compound III is selected from jasmonic acid or salts or derivatives thereof including cis-jasmone, preferably methyl-jasmonate or cis-jasmone.

Suitable and commercially available B. lupini strain is LL13 (isolated from Lupinus iuteus nodules from French soils; deposited at INRA, Dijon and Angers, France; http://agriculture.gouv.fr/IMG/pdf/ch20060216.pdf). This strain is especially suitable for lupins grown in Australia, North America or Europe, in particular in Europe.

Further suitable and commercially available B. lupini strains WU425 (isolated in Esperance, Western Australia from a non-Australian legume Ornthopus compressus), WSM4024 (isolated from lupins in Australia by CRS during a 2005 survey) and WSM471 (isolated from Ornithopus pinnatus in Oyster Harbour, Western Australia) are described e.g. in Palta J.A. and Berger J.B. (eds), 2008, Proceedings 12th International Lupin Conference, 14-18 Sept. 2008, Fremantle, Western Australia. International Lupin Association, Canterbury, New Zealand, 47-50, ISBN 0-86476-153-8: http://www.lupins.org/pdf/conference/2008/Agronomy%20and%20Production/John%20Howieson%20and%20G%20OHara.pdf; Appl. Environ. Microbiol. 7 1, 7041-7052, 2005; Australian J. Exp. Agricult. 36(1), 63-70, 1996.

The present invention also relates to mixtures, wherein the at least one pesticide II is selected from Mesorhizobium sp. (meaning any Mesorhizobium species and/or strain), more preferably Mesorhizobium ciceri. These mixtures are particularly suitable in cowpea.

The present invention also relates to mixtures wherein the at least one pesticide II is selected from Mesorhizobium sp. and further comprises a compound III, wherein compound III is selected from jasmonic acid or salts or derivatives thereof including cis-jasmone, preferably methyl-jasmonate or cis-jasmone.

Suitable and commercially available Mesorhizobium sp. strains are e.g. M. ciceri CC1 192 (=UPM 848, CECT 5549; from Horticultural Research Station, Gosford, Australia; collected in Israel from Cicer arietinum nodules; Can J Microbial (2002) 48, 279-284) and Mesorhizobium sp. strains WSM1271 (collected in Sardinia, Italy, from plant host Biserrula pelecinus), WSM 1497 (collected in Mykonos, Greece, from plant host Biserrula pelecinus), M. loti strains CC829 (commerical inoculant for Lotus pedunculatus and L. ulginosus in Australia, isolated from L. ulginosus nodules in USA; NZP 2012), M. loti SU343 (a commercial inoculant for Lotus corniculatus in Australia; isolated from host nodules in USA). For references see e.g. Soil Biol Biochem (2004) 36(8), 1309-1317; Plant and Soil (201 1) 348(1-2), 231-243).

Suitable and commercially available M. loti strains are e.g. M. loti CC829 for Lotus pedunculatus.

The present invention also relates to mixtures wherein the at least one pesticide II is selected from Mesorhizobium huakuii, also referred to as Rhizobium huakuii (see e.g. Appl. Environ. Microbiol. 201 1, 77(15), 5513-5516). These mixtures are particularly suitable in Astralagus, e.g. Astalagus sinicus (Chinese milkwetch), Thermopsis, e.g. Thermopsis luinoides (Goldenbanner) and alike.

The present invention also relates to mixtures wherein the at least one pesticide II is selected from Mesorhizobium huakuii and further comprises a compound III, wherein compound III is selected from jasmonic acid or salts or derivatives thereof including cis-jasmone, preferably methyl-jasmonate or cis-jasmone.

Suitable and commercially available M. huakuii strain is HN3015 which was isolated from Astralagus sinicus in a rice-growing field of Southern China (see e.g. World J. Microbiol. Biotechn. (2007) 23(6), 845-851 , ISSN 0959-3993).

The present invention also relates to mixtures, wherein the at least one pesticide II is selected from Azospirillum amazonense, A. brasilense, A. lipoferum, A. irakense and A. halopraeferens, more preferably from A. brasilense, in particular selected from A. brasilense strains BR 11005 (Sp245) and AZ39 which are both commercially used in Brazil and are obtainable from EMBRAPA-Agribiologia, Brazil. These mixtures are particularly suitable in soybean.

The present invention also relates to mixtures wherein the at least one pesticide II is selected from A. amazonense, A. brasilense, A. lipoferum, A. irakense and A. halopraeferens, more preferably A. brasilense, and further comprises a compound III, wherein compound III is selected from jasmonic acid or salts or derivatives thereof including cis-jasmone, preferably methyl-jasmonate or cis-jasmone.

The present invention also relates to mixtures wherein the at least one pesticide II is selected from Rhizobium leguminosarum bv. phaseolii; R. l. trifolii, especially strain RP1 13-7 thereof, R. l. bv. viciae, in particular strains SU303, WSM1455 and P 1NP3Cst thereof; R. tropici, especially strain SEMIA 4088 thereof; and Sinorhizobium meliloti, especially strain MSDJ0848 thereof. Sinorhizobium meliloti is commercially available from Becker Underwood as product Dormal®

Alfalfa & Luzerne. Rhizobium leguminosarum bv. phaseoli is commercially available from Becker Underwood as product Rhizo Stick. These strains are particulyrly suitable as inoculants for various legumes such as alfalfa, clover, peas, beans, lentils, soybeans, peanuts and others.

The present invention also relates to mixtures wherein the at least one pesticide II is selected from R. leguminosarum bv. phaseolii, R. i. trifolii, R. i. bv. viciae, R. tropici and Sinorhizobium meliloti, and further comprises a compound III, wherein compound III is selected from jasmonic acid or salts or derivatives thereof including cis-jasmone, preferably methyl-jasmonate or cis-jasmone.

According to a further embodiment, the at least one pesticide II is selected from Delftia acidovorans, in particular strain RAY209, especially in soybean and canola.

According to a further embodiment, the at least one pesticide II is selected from Lysobacter spp., preferably selected from L.antibioticus, in particular strains 13-1 and HS124, preferably in rice or pepper for control of Phytophthora or bacterial leaf blight. According to a further embodiment, the at least one pesticide II is selected from L. enzymogenes, in particular strain 3.1T8.

According to a further embodiment, the at least one pesticide II is selected from Lysobacter spp., preferably selected from Pseudomonas spp., in particular strain MA 342 and Pseudomonas sp. DSM 13134.

According to a further embodiment, the at least one pesticide II is selected from Penicillium bilaiae.

Preference is also given to mixtures comprise as pesticide II (component 2) a biopesticide from group L6), preferably selected from abscisic acid, aluminium silicate (kaolin), humates, Ascophyllum nodosum (Norwegian kelp, Brown kelp) extract and Ecklonia maxima (kelp) extract.

Preference is also given to mixtures comprise as pesticide II a biopesticide selected from the isoflavones formonennitin, hesperetin and naringenin.

Preference is also given to mixtures comprising as component 2) at least one active substance selected from group A) and particularly selected from azoxystrobin, dimoxystrobin, fluoxastrobin, kresoxim-methyl, orysastrobin, picoxystrobin, pyraclostrobin, trifloxystrobin; famoxadone, fenamidone; benzovindiflupyr, bixafen, boscalid, fluopyram, fluxapyroxad, isopyrazam, penflufen, penthiopyrad, sedaxane; ametoctradin, cyazofamid, fluazinam and fentin salts, such as fentin acetate.

Preference is given to mixtures comprising as component 2) at least one active substance selected from group B) and particularly selected from cyproconazole, difenoconazole, epoxiconazole, fluquinconazole, flusilazole, flutriafol, metconazole, myclobutanil, penconazole, propiconazole, prothioconazole, triadimefon, triadimenol, tebuconazole, tetraconazole, triticonazole, prochloraz, fenarimol, triforine; dodemorph, fenpropimorph, tridemorph, fenpropidin, spiroxamine; and fenhexamid.

Preference is given to mixtures comprising as component 2) at least one active substance selected from group C) and particularly selected from metalaxyl, (metalaxyl-M) mefenoxam and ofurace.

Preference is given to mixtures comprising as component 2) at least one active substance selected from group D) and particularly selected from benomyl, carbendazim, thiophanate-methyl, ethaboxam, fluopicolide, zoxamide, metrafenone, pyriofenone.

Preference is also given to mixtures comprising as component 2) at least one active substance selected from group E) and particularly selected from cyprodinil, mepanipyrim, pyrimethanil.

Preference is also given to mixtures comprising as component 2) at least one active substance selected from group F) and particularly selected from iprodione, fludioxonil, vinclozolin and quinoxyfen.

Preference is also given to mixtures comprising as component 2) at least one active substance selected from group G) and particularly selected from dimethomorph, flumorph, iprovalicarb, benthiavalicarb, mandipropamid and propamocarb.

Preference is also given to mixtures comprising as component 2) at least one active substance selected from group H) and particularly selected from copper acetate, copper hydroxide, copper oxychloride, copper sulfate, sulfur, mancozeb, metiram, propineb, thiram, captafol, folpet, chlorothalonil, dichlofluanid, dithianon.

Preference is also given to mixtures comprising as component 2) at least one active substance selected from group I) and particularly selected from carpropamid and fenoxanil.

Preference is also given to mixtures comprising as component 2) at least one active substance selected from group J) and particularly selected from acibenzolar-S-methyl, probenazole, tiadinil, fosetyl, fosetyl-aluminium and H_3PO_3 and salts thereof.

Preference is also given to mixtures comprising as component 2) least one active substance selected from group K) and particularly selected from cymoxanil, proquinazid and /V-methyl-2-{1-[(5-methyl-3-trifluoromethyl-1 H-pyrazol-1-yl)-acetyl]-piperidin-4-yl}-/V-[(1 R)-1 ,2,3,4-tetrahydro-naphthalen-1-yl]-4-thiazolecarboxamide.

The inventive mixtures comprising SK-55 and/or as pesticide II a microbial pesticide from groups L1), L3) and L5) may be formulated as an inoculant for a plant. The term "inoculant" means a preparation that includes an isolated culture of a microbial pesticide and optionally a carrier, which may include a biologically acceptable medium.

According to one embodiment, the microbial pesticides selected from groups L1), L3) and L5) embrace not only the isolated, pure cultures of the respective micro-organism as defined herein, but also its cell-free 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.

According to a further embodiment, the microbial pesticides selected from groups L1), L3 and L5) embraces not only the isolated, pure cultures of the respective micro-organism as defined herein, but also a cell-free extract thereof or at least one metabolite thereof, and/or a mutant of the respective micro-organism having all the identifying characteristics thereof and also a cell-free extract or at least one metabolite of the mutant.

The abovementioned microbial pesticides from groups L1), L3) and L5) and T. harzianum SK-55 may be isolated or substantially purified. The terms "isolated" or "substantially purified" refers to microbial pesticides that have been removed from a natural environment and have

been isolated or separated, and are at least 60% free, preferably at least 75% free, and more preferably at least 90% free, even more preferably at least 95% free, and most preferably at least 100% free from other components with which they were naturally associated. An "isolated culture" or "substaintially purified culture" refers to a culture of the microbial pesticides that does not include significant amounts of other materials such as other materials which normally are found in natural habitat in which the microbial pesticides grows and/or from which the microbial pesticides normally may be obtained. An "isolated culture" may be a culture that does not include any other biological, microorganism, and/or bacterial species in quantities sufficient to interfere with the replication of the isolated culture. Isolated cultures of microbial pesticides may, however, be combined to prepare a mixed culture of microbial pesticides.

Herein, microbial pesticides may be supplied in any physiological state such as active or dormant. Dormant microbial pesticides may be supplied for example frozen, dried, or lyophilized or partly desiccated (procedures to produce partly desiccated organisms are given in WO 2008/002371) or in form of spores.

Microbial pesticides II selected from groups L1), L3) and L5) and the T. harzianum SK-55 strain used as organism in an active state can be delivered in a growth medium without any additional additives or materials or in combination with suitable nutrient mixtures.

T. harzianum SK-55 is preferably delivered and formulated in a dormant stage, more preferably in form of spores, even more preferably in form of chlamydospores.

The mixtures and compositions thereof according to the invention can, in the use form as pesticides, fungicides and/or insecticides, also be present together with further pesticides, e. g. with herbicides, insecticides, growth regulators, fungicides; or else with fertilizers, as pre-mix or, if appropriate, not until immeadiately prior to use (tank mix).

Mixing SK-55 and one pesticide II and the compositions comprising them, respectively, in the use form as fungicide with further fungicides results in many cases in an expansion of the fungicidal spectrum of activity or in a prevention of fungicide resistance development. Furthermore, in many cases, synergistic effects are obtained.

Mixing SK-55 and one pesticide II and the compositions comprising them, respectively, in the use form as insecticide with further insecticides results in many cases in an expansion of the insecticidal spectrum of activity or in a prevention of insecticide resistance development. Furthermore, in many cases, synergistic effects are obtained.

The mixtures and compositions according to the invention are suitable as fungicides. They are distinguished by an outstanding effectiveness against a broad spectrum of phytopathogenic fungi, including soil-borne fungi, which derive especially from the classes of the Plasmodiophoromycetes, Peronosporomycetes (syn. Oomycetes), Chytridiomycetes, Zygomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes (syn. Fungi imperfecti). Some are systemically effective and they can be used in crop protection as foliar fungicides, fungicides for seed dressing and soil fungicides. Moreover, they are suitable for controlling harmful fungi, which inter alia occur in wood or roots of plants.

The mixtures and compositions according to the invention are particularly important in the control of a multitude of phytopathogenic fungi on various cultivated plants, such as cereals, e.

g. wheat, rye, barley, triticale, oats or rice; beet, e. g. sugar beet or fodder beet; fruits, such as pomes, stone fruits or soft fruits, e. g. apples, pears, plums, peaches, almonds, cherries, strawberries, raspberries, blackberries or gooseberries; leguminous plants, such as lentils, peas, alfalfa or soybeans; oil plants, such as rape, mustard, olives, sunflowers, coconut, cocoa beans, castor oil plants, oil palms, ground nuts or soybeans; cucurbits, such as squashes, cucumber or melons; fiber plants, such as cotton, flax, hemp or jute; citrus fruit, such as oranges, lemons, grapefruits or mandarins; vegetables, such as spinach, lettuce, asparagus, cabbages, carrots, onions, tomatoes, potatoes, cucurbits or paprika; lauraceous plants, such as avocados, cinnamon or camphor; energy and raw material plants, such as corn, soybean, rape, sugar cane or oil palm; corn; tobacco; nuts; coffee; tea; bananas; vines (table grapes and grape juice grape vines); hop; turf; natural rubber plants or ornamental and forestry plants, such as flowers, shrubs, broad-leaved trees or evergreens, e. g. conifers; and on the plant propagation material, such as seeds, and the crop material of these plants.

Preferably the inventive mixtures and compositions are used for controlling a multitude of fungi on field crops, such as potatoes sugar beets, tobacco, wheat, rye, barley, oats, rice, corn, cotton, soybeans, rape, legumes, sunflowers, coffee or sugar cane; fruits; vines; ornamentals; or vegetables, such as cucumbers, tomatoes, beans or squashes.

The term "plant propagation material" is to be understood to denote 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, including seedlings and young plants, which are to be transplanted after germination or after emergence from soil. These young plants may also be protected before transplantation by a total or partial treatment by immersion or pouring.

Preferably, treatment of plant propagation materials with the inventive mixtures and compositions thereof, respectively, is used for controlling a multitude of fungi on cereals, such as wheat, rye, barley and oats; rice, corn, cotton and soybeans.

The term "cultivated plants" is to be understood as including plants which have been modified by breeding, mutagenesis or genetic engineering including but not limiting to agricultural biotech products on the market or in development (cf. http://cera-gmc.org/, see GM crop database therein). Genetically modified plants are plants, which genetic material has been so modified by the use of recombinant DNA techniques that under natural circumstances cannot readily be obtained by cross breeding, mutations or natural recombination. Typically, one or more genes have been integrated into the genetic material of a genetically modified plant in order to improve certain properties of the plant. Such genetic modifications also include but are not limited to targeted post-transtional modification of protein(s), oligo- or polypeptides e. g. by glycosylation or polymer additions such as prenylated, acetylated or farnesylated moieties or PEG moieties.

The inventive mixtures and compositions 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

alternate), tomatoes (e. g. *A. solanior 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.) on corn (e. g. *D. maydis),* cereals (e. g. *B. sorokiniana:* spot blotch), rice (e. g. *B. oryzae)* 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, 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),* 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 (£. *pyri),* soft fruits (£. *veneta:* anthracnose) and vines (£. *ampelina:* anthracnose); *Entyloma oryzae* (leaf smut) on rice; *Epicoccum* spp. (black mold) on wheat; *Erysiphe* spp. (powdery mildew) on sugar beets (£. *betae),* vegetables (e. g. £. *pisi),* such as cucurbits (e. g. £. *cichoracearum),* cabbages, rape (e. g. £. *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. £. *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* 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; *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 s*pp. 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, and asparagus (e. g. *P. asparagi); 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 s*pp., 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. *miliaria:* 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.

In particular, the mixtures and compositions of the present invention are effective against plant pathogens in speciality crops such as vine, fruits, hop, vegetables and tabacco.

Bacteria pathogenic for plants are responsible for devastating losses in agriculture. The use of antibiotics to control such infections is restricted in many countries due to worries over the evolution and transmission of antibiotic resistance.

The mixtures and compositions according to the invention are also suitable as bactericides. They are distinguished by an outstanding effectiveness against a broad spectrum of phytopathogenic bacteria, including soil-borne bacteria, which derive especially from the genera of Agrobacterium, Clavibacter, Corynebacterium, Erwinia, Leifsonia, Pectobacterium, Pseudomonas, Ralstonia, Xanthomonas (e.g. Xanthomonas oryzae causing bacterial blight on rice) and Xylella; preferably Erwinia; even more preferably Erwinia amylovora causing fire blight on apples, pears and other memb er of the family Rosaceae.

The mixtures according to the present invention and compositions thereof, respectively, are also suitable for controlling harmful fungi in the protection of stored products or harvest and in the protection of materials. The term "protection of materials" is to be understood to denote the protection of technical and non-living materials, such as adhesives, glues, wood, paper and paperboard, textiles, leather, paint dispersions, plastics, colling lubricants, fiber or fabrics, against the infestation and destruction by harmful microorganisms, such as fungi and bacteria. As to the protection of wood and other materials, the particular attention is paid to the following harmful fungi: Ascomycetes such as *Ophiostoma* spp., *Ceratocystis* spp., *Aureobasidium pullulans, Sclerophoma spp., Chaetomium* spp., *Humicola* spp., *Petriella spp., Trichurus spp.;* Basidiomycetes such as *Coniophora* spp., *Coriolus* spp., *Gloeophyllum* spp., *Lentinus* spp., *Pleurotus spp., Poria spp., Serpula* spp. and *Tyromyces* spp., Deuteromycetes such as *Aspergillus* spp., *Cladosporium* spp., *Penicillium* spp., *Trichorma* spp., *Alternaria* spp., *Paecilomyces* spp. and Zygomycetes such as *Mucor* spp., and in addition in the protection of

stored products and harvest the following yeast fungi are worthy of note: *Candida* spp. and *Saccharomyces cerevisae.*

The method of treatment according to the invention can also be used in the field of protecting stored products or harvest against attack of fungi and microorganisms. According to the present invention, the term "stored products" is understood to denote natural substances of plant or animal origin and their processed forms, which have been taken from the natural life cycle and for which long-term protection is desired. Stored products of crop plant origin, such as plants or parts thereof, for example stalks, leafs, tubers, seeds, fruits or grains, can be protected in the freshly harvested state or in processed form, such as pre-dried, moistened, comminuted, ground, pressed or roasted, which process is also known as post-harvest treatment. Also falling under the definition of stored products is timber, whether in the form of crude timber, such as construction timber, electricity pylons and barriers, or in the form of finished articles, such as furniture or objects made from wood. Stored products of animal origin are hides, leather, furs, hairs and the like. The combinations according the present invention can prevent disadvantageous effects such as decay, discoloration or mold. Preferably "stored products" is understood to denote natural substances of plant origin and their processed forms, more preferably fruits and their processed forms, such as pomes, stone fruits, soft fruits and citrus fruits and their processed forms.

The mixtures and compositions according to the invention are particularly important in the control of a multitude of phytopathogenic insects or other pests (e.g. lepidopterans, beetles, dipterans, thrips, heteropterans, hemiptera, homoptera, termites, orthopterans, arachnids, and nematodes) on various cultivated plants, such as cereals, e. g. wheat, rye, barley, triticale, oats or rice; beet, e. g. sugar beet or fodder beet; fruits, such as pomes, stone fruits or soft fruits, e. g. apples, pears, plums, peaches, almonds, cherries, strawberries, raspberries, blackberries or gooseberries; leguminous plants, such as lentils, peas, alfalfa or soybeans; oil plants, such as rape, mustard, olives, sunflowers, coconut, cocoa beans, castor oil plants, oil palms, ground nuts or soybeans; cucurbits, such as squashes, cucumber or melons; fiber plants, such as cotton, flax, hemp or jute; citrus fruit, such as oranges, lemons, grapefruits or mandarins; vegetables, such as spinach, lettuce, asparagus, cabbages, carrots, onions, tomatoes, potatoes, cucurbits or paprika; lauraceous plants, such as avocados, cinnamon or camphor; energy and raw material plants, such as corn, soybean, rape, sugar cane or oil palm; corn; tobacco; nuts; coffee; tea; bananas; vines (table grapes and grape juice grape vines); hop; turf; natural rubber plants or ornamental and forestry plants, such as flowers, shrubs, broad-leaved trees or evergreens, e. g. conifers; and on the plant propagation material, such as seeds, and the crop material of these plants.

Preferably the inventive mixtures and compositions are used for controlling a multitude of pests on field crops, such as potatoes sugar beets, tobacco, wheat, rye, barley, oats, rice, corn, cotton, soybeans, rape, legumes, sunflowers, coffee or sugar cane; fruits; vines; ornamentals; or vegetables, such as cucumbers, tomatoes, beans or squashes.

The inventive mixtures and the compositions thereof, respectively, are particularly suitable for controlling the following harmful insects from the order of the

lepidopterans (Lepidoptera), for example *Agrotis ypsilon, Agrotis segetum, Alabama argillacea, Anticarsia gemmatalis, Argyresthia conjugella, Autographa gamma, Bupalus*

piniarius, Cacoecia murinana, Capua reticulana, Cheimatobia brumata, Choristoneura fumiferana, Choristoneura occidentalis, Cirphis unipuncta, Cydia pomonella, Dendrolimus pini, Diaphania nitidalis, Diatraea grandiosella, Earias insulana, Elasmopalpus lignosellus, Eupoecilia ambiguella, Evetria bouliana, Feltia subterranea, Galleria mellonella, Grapholitha funebrana, Grapholitha molesta, Heliothis armigera, Heliothis virescens, Heliothis zea, Hellula undalis, Hibernia defoliaria, Hyphantria cunea, Hyponomeuta malinellus, Keiferia lycopersicella, Lambdina fiscellaria, Laphygma exigua, Leucoptera coffeella, Leucoptera scitella, Lithocolletis blancardella, Lobesia botrana, Loxostege sticticalis, Lymantria dispar, Lymantria monacha, Lyonetia clerkella, Malacosoma neustria, Mamestra brassicae, Orgyia pseudotsugata, Ostrinia nubilalis, Panolis flammea, Pectinophora gossypiella, Peridroma saucia, Phalera bucephala, Phthorimaea operculella, Phyllocnistis citrella, Pieris brassicae, Plathypena scabra, Plutella xylostella, Pseudoplusia includens, Rhyacionia frustrana, Scrobipalpula absoluta, Sitotroga cerealella, Sparganothis pilleriana, Spodoptera frugiperda, Spodoptera littoralis, Spodoptera litura, Thaumatopoea pityocampa, Tortrix viridana, Trichoplusia ni and *Zeiraphera canadensis,*

beetles (Coleoptera), for example *Agrilus sinuatus, Agriotes lineatus, Agriotes obscurus, Amphimallus solstitialis, Anisandrus dispar, Anthonomus grandis, Anthonomus pomorum, Atomaria linearis, Blastophagus piniperda, Blitophaga undata, Bruchus rufimanus, Bruchus pisorum, Bruchus lentis, Byctiscus betulae, Cassida nebulosa, Cerotoma trifurcata, Ceuthorrhynchus assimilis, Ceuthorrhynchus napi, Chaetocnema tibialis, Conoderus vespertinus, Crioceris asparagi, Diabrotica longicornis, Diabrotica speciosa, Diabrotica 12-punctata, Diabrotica virgifera, Diloboderus abderus, Epilachna varivestis, Epitrix hirtipennis, Eutinobothrus brasiliensis, Hylobius abietis, Hypera brunneipennis, Hypera postica, Ips typographus, Lema bilineata, Lema melanopus, Leptinotarsa decemlineata, Limonius californicus, Lissorhoptrus oryzophilus, Melanotus communis, Meligethes aeneus, Melolontha hippocastani, Melolontha melolontha, Oulema oryzae, Ortiorrhynchus sulcatus, Oryazophagus oryzae, Otiorrhynchus ovatus, Phaedon cochleariae, Phyllotreta chrysocephala, Phyllophaga sp., Phyllophaga cuyabana, Phyllophaga triticophaga, Phyllopertha horticola, Phyllotreta nemorum, Phyllotreta striolata, Popillia japonica, Sitona lineatus* and *Sitophilus granaria,*

dipterans (Diptera), for example *Aedes aegypti, Aedes vexans, Anastrepha ludens, Anopheles maculipennis, Ceratitis capitata, Chrysomya bezziana, Chrysomya hominivorax, Chrysomya macellaria, Contarinia sorghicola, Cordylobia anthropophaga, Culex pipiens, Dacus cucurbitae, Dacus oleae, Dasineura brassicae, Fannia canicularis, Gasterophilus intestinalis, Glossina morsitans, Haematobia irritans, Haplodiplosis equestris, Hylemyia platura, Hypoderma lineata, Liriomyza sativae, Liriomyza trifolii, Lucilia caprina, Lucilia cuprina, Lucilia sericata, Lycoria pectoralis, Mayetiola destructor, Musca domestica, Muscina stabulans, Oestrus ovis, Oscinella frit, Pegomya hysocyami, Phorbia antique, Phorbia brassicae, Phorbia coarctata, Rhagoletis cerasi, Rhagoletis pomonella, Tabanus bovinus, Tipula oleracea* and *Tipula paludosa,*

thrips (Thysanoptera), e.g. *Frankliniella fusca, Frankliniella occidentalis, Frankliniella tritici, Scirtothrips citri, Thrips oryzae, Thrips palmi* and *Thrips tabaci,*

hymenopterans (Hymenoptera), e.g. *Acromyrmex ambuguus, Acromyrmex crassispinus, Acromyrmex heiery, Acromyrmex landolti, Acromyrmex subterraneus, Athalia rosae, Atta capiguara, Atta cephalotes, Atta laevigata, Atta robusta, Atta sexdens, Atta texana,*

Hoplocampa minuta, Hoplocampa testudinea, Monomorium pharaonis, Solenopsis geminata and *Solenopsis invicta,*

heteropterans (Heteroptera), e.g. *Acrosternum hilare, Blissus leucopterus, Cyrtopeltis notatus, Dichelops furcatus, Dysdercus cingulatus, Dysdercus intermedius, Euchistos hems, Eurygaster integriceps, Euschistus impictiventris, Leptoglossus phyllopus, Lygus lineolaris, Lygus pratensis, Nezara viridula, Piesma quadrata, Piezodorus guildini, Solubea insularis* and *Thyanta perditor,*

Hemiptera and Homoptera, e.g. *Acrosternum hilare, Blissus leucopterus, Cyrtopeltis notatus, Diaphorina citri, Dysdercus cingulatus, Dysdercus intermedius, Eurygaster integriceps, Euschistus impictiventris, Leptoglossus phyllopus, Lygus lineolaris, Lygus pratensis, Nezara viridula, Piesma quadrata, Solubea insularis , Thyanta perditor, Acyrthosiphon onobrychis, Adelges laricis, Aphidula nasturtii, Aphis fabae, Aphis forbesi, Aphis pomi, Aphis gossypii, Aphis grossulariae, Aphis schneideri, Aphis spiraecola, Aphis sambuci, Acyrthosiphon pisum, Aulacorthum solani, Brachycaudus cardui, Brachycaudus helichrysi, Brachycaudus persicae, Brachycaudus prunicola, Brevicoryne brassicae, Capitophorus horni, Cerosipha gossypii, Chaetosiphon fragaefolii, Cryptomyzus ribis, Dreyfusia nordmannianae, Dreyfusia piceae, Dysaphis radicola, Dysaulacorthum pseudosolani, Dysaphis plantaginea, Dysaphis pyri, Empoasca fabae, Hyalopterus pruni, Hyperomyzus lactucae, Macrosiphum avenae, Macrosiphum euphorbiae, Macrosiphon rosae, Megoura viciae, Melanaphis pyrarius, Metopolophium dirhodum, Myzodes persicae, Myzus ascalonicus, Myzus cerasi, Myzus varians, Nasonovia ribis-nigri, Nilaparvata lugens, Pemphigus bursarius, Perkinsiella saccharicida, Phorodon humuli, Psylla mall, Psylla piri, Rhopalomyzus ascalonicus, Rhopalosiphum maidis, Rhopalosiphum padi, Rhopalosiphum insertum, Sappaphis mala, Sappaphis mall, Schizaphis graminum, Schizoneura lanuginosa, Sitobion avenae, Trialeurodes vaporariorum, Toxoptera aurantiiand, Viteus vitifolii, Cimex lectularius, Cimex hemipterus, Reduvius senilis, Triatoma spp., and Aril us critatus,*

termites (Isoptera), *e.g. Calotermes flavicollis, Cornitermes cumulans, Heterotermes tenuis, Leucotermes flavipes, Neocapritemes opacus, Procornitermes triacifer; Reticulitermes lucifugus, Syntermes molestus, and Termes natalensis,*

orthopterans (Orthoptera), e.g. *Acheta domestica, Blatta orientalis, Blattella germanica, Forficula auricularia, Gryllotalpa gryllotalpa, Locusta migratoria, Melanoplus bivittatus, Melanoplus femur-rubrum, Melanoplus mexicanus, Melanoplus sanguinipes, Melanoplus spretus, Nomadacris septemfasciata, Periplaneta americana, Schistocerca americana, Schistocerca peregrina, Stauronotus maroccanus* and *Tachycines asynamorus,*

Arachnoidea, such as arachnids, e.g. of the families Argasidae, Ixodidae and Sarcoptidae, such as *Amblyomma americanum, Amblyomma variegatum, Argas persicus, Boophilus annulatus, Boophilus decoloratus, Boophilus microplus, Dermacentor silvarum, Hyalomma truncatum, Ixodes ricinus, Ixodes rubicundus, Ornithodorus moubata, Otobius megnini, Dermanyssus gallinae, Psoroptes ovis, Rhipicephalus appendiculatus, Rhipicephalus evertsi, Sarcoptes scabiei,* and *Eriophyidae spp.* such as *Aculus schlechtendali, Phyllocoptrata oleivora* and *Eriophyes sheldoni; Tarsonemidae spp.* such as *Phytonemus pallidus* and *Polyphagotarsonemus latus; Tenuipalpidae spp.* such as *Brevipalpus phoenicis; Tetranychidae spp.* such as *Tetranychus cinnabarinus, Tetranychus kanzawai, Tetranychus pacificus,*

Tetranychus telarius and *Tetranychus urticae, Panonychus ulmi, Panonychus citri,* and *Oligonychus pratensis.*

In particular, the inventive mixtures are suitable for combating pests of the orders Coleoptera, Lepidoptera, Thysanoptera, Homoptera, Isoptera, and Orthoptera.

They are also suitable for controlling the following plant parasitic nematodes such as root-knot nematodes, *Meloidogyne arenaria, Meloidogyne chitwoodi, Meloidogyne exigua, Meloidogyne hapla, Meloidogyne incognita, Meloidogyne javanica* and other *Meloidogyne species;* cyst nematodes, *Globodera rostochiensis, Globodera pallida, Globodera tabacum* and other *Globodera species, Heterodera avenae, Heterodera glycines, Heterodera schachtii, Heterodera trifolii,* and other *Heterodera species;* seed gall nematodes, *Anguina funesta, Anguina tritici* and other *Anguina species;* stem and foliar nematodes, *Aphelenchoides besseyi, Aphelenchoides fragariae, Aphelenchoides ritzemabosi* and other *Aphelenchoides species;* sting nematodes, *Belonolaimus longicaudatus* and other *Belonolaimus species;* pine nematodes, *Bursaphelenchus xylophilus* and other *Bursaphelenchus species;* ring nematodes, *Criconema species, Criconemella species, Criconemoides species,* and *Mesocriconema species;* stem and bulb nematodes, *Ditylenchus destructor, Ditylenchus dipsaci, Ditylenchus myceliophagus* and other *Ditylenchus species;* awl nematodes, *Dolichodorus species;* spiral nematodes, *Helicotylenchus dihystera, Helicotylenchus multicinctus* and other *Helicotylenchus species, Rotylenchus robustus* and other *Rotylenchus species;* sheath nematodes, *Hemicycliophora species* and *Hemicriconemoides species; Hirshmanniella species;* lance nematodes, *Hoplolaimus columbus, Hoplolaimus galeatus* and other *Hoplolaimus species;* false root-knot nematodes, *Nacobbus aberrans* and other *Nacobbus species;* needle nematodes, *Longidorus elongates* and other *Longidorus species;* pin nematodes, *Paratylenchus species;* lesion nematodes, *Pratylenchus brachyurus, Pratylenchus coffeae, Pratylenchus curvitatus, Pratylenchus goodeyi, Pratylencus neglectus, Pratylenchus penetrans, Pratylenchus scribneri, Pratylenchus vulnus, Pratylenchus zeae* and other *Pratylenchus species; Radinaphelenchus cocophilus* and other *Radinaphelenchus species;* burrowing nematodes, *Radopholus similis* and other *Radopholus species;* reniform nematodes, *Rotylenchulus reniformis* and other *Rotylenchulus species; Scutellonema species;* stubby root nematodes, *Trichodorus primitivus* and other *Trichodorus species; Paratrichodorus minor* and *other Paratrichodorus species;* stunt nematodes, *Tylenchorhynchus claytoni, Tylenchorhynchus dubius* and other *Tylenchorhynchus species* and *Merlinius species;* citrus nematodes, *Tylenchulus semipenetrans* and other *Tylenchulus species;* dagger nematodes, *Xiphinema americanum, Xiphinema index, Xiphinema diversicaudatum* and other *Xiphinema species;* and other plant parasitic nematode species

Plant propagation materials may be treated with the mixtures and compositions of the invention prophylactically either at or before planting or transplanting.

In particular, the present invention relates to a method for protection of plant propagation material from pests, wherein the plant propagation material is treated with an effective amount of an inventive mixture.

In a preferred embodiment, the present invention relates to a method for protection of plant propagation material from animal pests (insects, acarids or nematodes), wherein the plant propagation material are treated with an effective amount of an inventive mixture.

In an equally preferred embodiment, the present invention relates to a method for protection

of plant propagation material from harmful fungi, wherein the plant propagation material is treated with an effective amount of an inventive mixture.

In general, "pesticidally effective amount" means the amount of the inventive mixtures or of compositions comprising the mixtures 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 used in the invention. A pesticidally effective amount of the mixtures / 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 an equally preferred embodiment, the present invention relates to a method for improving the health of plants, wherein the plants are treated with a plant health effective amount of an inventive mixture.

The term "plant health effective amount" denotes an amount of the inventive mixtures, which is sufficient for achieving plant health effects as defined herein below. More exemplary information about amounts, ways of application and suitable ratios to be used is given below. Anyway, the skilled artisan is well aware of the fact that such an amount can vary in a broad range and is dependent on various factors, e.g. the treated cultivated plant or material and the climatic conditions.

Healthier plants are desirable since they result among others in better yields and/or a better quality of the plants or crops, specifically better quality of the harvested plant parts. Healthier plants also better resist to biotic and/or abiotic stress. A high resistance against biotic stresses in turn allows the person skilled in the art to reduce the quantity of pesticides applied and consequently to slow down the development of resistances against the respective pesticides.

It has to be emphasized that the above mentioned effects of the inventive mixtures, i.e. enhanced health of the plant, are also present when the plant is not under biotic stress and in particular when the plant is not under pest pressure.

For example, for seed treatment and soil applications, it is evident that a plant suffering from fungal or insecticidal attack shows reduced germination and emergence leading to poorer plant or crop establishment and vigor, and consequently, to a reduced yield as compared to a plant propagation material which has been subjected to curative or preventive treatment against the relevant pest and which can grow without the damage caused by the biotic stress factor. However, the methods according to the invention lead to an enhanced plant health even in the absence of any biotic stress. This means that the positive effects of the mixtures of the invention cannot be explained just by the pesticidal activities of SK-55 and pesticides II, but are based on further activity profiles. Accordingly, the application of the inventive mixtures can also be carried out in the absence of pest pressure.

In an equally preferred embodiment, the present invention relates to a method for improving the health of plants grown from said plant propagation material, wherein the plant propagation material is treated with an effective amount of an inventive mixture.

Each plant health indicator listed below, which is selected from the groups consisting of yield, plant vigor, quality and tolerance of the plant to abiotic and/or biotic stress, is to be

understood as a preferred embodiment of the present invention either each on its own or preferably in combination with each other.

According to the present invention, "increased yield" of a plant means that the yield of a product of the respective plant is increased by a measurable amount over the yield of the same product of the plant produced under the same conditions, but without the application of the inventive mixture.

For seed treatment e.g. as inoculant and/or foliar application forms, increased yield can be characterized, among others, by the following improved properties of the plant: increased plant weight; and/or increased plant height; and/or increased biomass such as higher overall fresh weight (FW); and/or increased number of flowers per plant; and/or higher grain and/or fruit yield ; and/or more tillers or side shoots (branches); and/or larger leaves; and/or increased shoot growth; and/or increased protein content; and/or increased oil content; and/or increased starch content; and/or increased pigment content; and/or increased chlorophyll content (chlorophyll content has a positive correlation with the plant's photosynthesis rate and accordingly, the higher the chlorophyll content the higher the yield of a plant) and/or increased quality of a plant.

"Grain" and "fruit" are to be understood as any plant product which is further utilized after harvesting, e.g. fruits in the proper sense, vegetables, nuts, grains, seeds, wood (e.g. in the case of silviculture plants), flowers (e.g. in the case of gardening plants, ornamentals) etc., that is anything of economic value that is produced by the plant.

According to the present invention, the yield is increased by at least 4%. In general, the yield increase may even be higher, for example 5 to 10 %, more preferable by 10 to 20 %, or even 20 to 30 %

According to the present invention, the yield - if measured in the absence of pest pressure - is increased by at least 2 % In general, the yield increase may even be higher, for example until 4% to 5% or even more.

Another indicator for the condition of the plant is the plant vigor. The plant vigor becomes manifest in several aspects such as the general visual appearance.

For foliar applications, improved plant vigor can be characterized, among others, by the following improved properties of the plant: improved vitality of the plant; and/or improved plant growth; and/or improved plant development; and/or improved visual appearance; and/or improved plant stand (less plant verse/lodging and/or bigger leaf blade; and/or bigger size; and/or increased plant height; and/or increased tiller number; and/or increased number of side shoots; and/or increased number of flowers per plant; and/or increased shoot growth; and/or enhanced photosynthetic activity (e.g. based on increased stomatal conductance and/or increased CO_2 assimilation rate)); and/or earlier flowering; and/or earlier fruiting;; and/or earlier grain maturity; and/or less non-productive tillers; and/or less dead basal leaves; and/or less input needed (such as fertilizers or water); and/or greener leaves; and/or complete maturation under shortened vegetation periods; and/or easier harvesting; and/or faster and more uniform ripening; and/or longer shelf-life; and/or longer panicles; and/or delay of senescence ; and/or stronger and/or more productive tillers; and/or better extractability of ingredients; and/or improved quality of seeds (for being seeded in the following seasons for seed production); and/or reduced production of ethylene and/or the inhibition of its reception by the plant.

Another indicator for the condition of the plant is the "quality" of a plant and/or its products.

According to the present invention, enhanced quality means that certain plant characteristics such as the content or composition of certain ingredients are increased or improved by a measurable or noticeable amount over the same factor of the plant produced under the same conditions, but without the application of the mixtures of the present invention. Enhanced quality can be characterized, among others, by following improved properties of the plant or its product: increased nutrient content; and/or increased protein content; and/or increased oil content; and/or increased starch content; and/or increased content of fatty acids; and/or increased metabolite content; and/or increased carotenoid content; and/or increased sugar content; and/or increased amount of essential amino acids; and/or improved nutrient composition; and/or improved protein composition; and/or improved composition of fatty acids; and/or improved metabolite composition; and/or improved carotenoid composition; and/or improved sugar composition; and/or improved amino acids composition ; and/or improved or optimal fruit color; and/or improved leaf color; and/or higher storage capacity; and/or better processability of the harvested products.

Another indicator for the condition of the plant is the plant's tolerance or resistance to biotic and/or abiotic stress factors. Biotic and abiotic stress, especially over longer terms, can have harmful effects on plants.

Biotic stress is caused by living organisms while abiotic stress is caused for example by environmental extremes. According to the present invention, "enhanced tolerance or resistance to biotic and/or abiotic stress factors" means (1.) that certain negative factors caused by biotic and/or abiotic stress are diminished in a measurable or noticeable amount as compared to plants exposed to the same conditions, but without being treated with an inventive mixture and (2.) that the negative effects are not diminished by a direct action of the inventive mixture on the stress factors, e.g. by its fungicidal or insecticidal action which directly destroys the microorganisms or pests, but rather by a stimulation of the plants' own defensive reactions against said stress factors.

Negative factors caused by biotic stress such as pathogens and pests are widely known and are caused by living organisms, such as competing plants (for example weeds), microorganisms (such as phythopathogenic fungi and/or bacteria) and/or viruses.

Negative factors caused by abiotic stress are also well-known and can often be observed as reduced plant vigor (see above), for example:

less yield and/or less vigor, for both effects examples can be burned leaves, less flowers, pre-mature ripening, later crop maturity, reduced nutritional value amongst others.

Abiotic stress can be caused for example by: extremes in temperature such as heat or cold (heat stress / cold stress); and/or strong variations in temperature; and/or temperatures unusual for the specific season; and/or drought (drought stress); and/or extreme wetness; and/or high salinity (salt stress); and/or radiation (for example by increased UV radiation due to the decreasing ozone layer); and/or increased ozone levels (ozone stress); and/or organic pollution (for example by phythotoxic amounts of pesticides); and/or inorganic pollution (for example by heavy metal contaminants).

As a result of biotic and/or abiotic stress factors, the quantity and the quality of the stressed plants decrease. As far as quality (as defined above) is concerned, reproductive development is usually severely affected with consequences on the crops which are important for fruits or

seeds. Synthesis, accumulation and storage of proteins are mostly affected by temperature; growth is slowed by almost all types of stress; polysaccharide synthesis, both structural and storage is reduced or modified: these effects result in a decrease in biomass (yield) and in changes in the nutritional value of the product.

As pointed out above, the above identified indicators for the health condition of a plant may be interdependent and may result from each other. For example, an increased resistance to biotic and/or abiotic stress may lead to a better plant vigor, e.g. to better and bigger crops, and thus to an increased yield. Inversely, a more developed root system may result in an increased resistance to biotic and/or abiotic stress. However, these interdependencies and interactions are neither all known nor fully understood and therefore the different indicators are described separately.

In one embodiment the inventive mixtures effectuate an increased yield of a plant or its product. In another embodiment the inventive mixtures effectuate an increased vigor of a plant or its product. In another embodiment the inventive mixtures effectuate in an increased quality of a plant or its product. In yet another embodiment the inventive mixtures effectuate an increased tolerance and/or resistance of a plant or its product against biotic stress. In yet another embodiment the inventive mixtures effectuate an increased tolerance and/or resistance of a plant or its product against abiotic stress.

The invention also relates to agrochemical compositions comprising an auxiliary and T. harzianum strain SK-55, or a cell-free extract thereof or at least one metabolite thereof having pesticidal activity, and/or a mutant of T. harzianum SK-55 having pesticidal activity and producing at least one pesticidal metabolite as defined herein, or a pesticidal metabolite or extract of the mutant, and at least one pesticide II according to the invention.

An agrochemical composition comprises a fungicidally or insecticidally effective amount of T. harzianum strain SK-55, or a cell-free extract thereof or at least one metabolite thereof having pesticidal activity, and/or a mutant of T. harzianum SK-55 having pesticidal activity and producing at least one pesticidal metabolite as defined herein, or a pesticidal metabolite or extract of the mutant, and at least one pesticide II. Such an amount can vary in a broad range and is dependent on various factors, such as the fungal or pest species to be controlled, the treated cultivated plant or material, the climatic conditions.

In the case of mixtures comprising microbial pesticides II selected from groups L1), L3) and L5), the microorganisms as used according to the invention can be cultivated continuously or discontinuously in the batch process or in the fed batch or repeated fed batch process. A review of known methods of cultivation will be found in the textbook by Chmiel (Bioprozesstechnik 1. Einfuhrung in die Bioverfahrenstechnik (Gustav Fischer Verlag, Stuttgart, 1991)) or in the textbook by Storhas (Bioreaktoren und periphere Einrichtungen (Vieweg Verlag, Braunschweig/Wiesbaden, 1994)). The culture medium that is to be used must satisfy the requirements of the particular strains in an appropriate manner. Descriptions of culture media for various microorganisms are given in the handbook "Manual of Methods for General Bacteriology" of the American Society for Bacteriology (Washington D. C , USA, 1981). These culture media that can be used according to the invention generally comprise one or more sources of carbon, sources of nitrogen, inorganic salts, vitamins and/or trace elements.

Preferred sources of carbon are sugars, such as mono-, di- or polysaccharides. Very good sources of carbon are for example glucose, fructose, mannose, galactose, ribose, sorbose, ribulose, lactose, maltose, sucrose, raffinose, starch or cellulose. Sugars can also be added to the media via complex compounds, such as molasses, or other by-products from sugar refining. It may also be advantageous to add mixtures of various sources of carbon. Other possible sources of carbon are oils and fats such as soybean oil, sunflower oil, peanut oil and coconut oil, fatty acids such as palmitic acid, stearic acid or linoleic acid, alcohols such as glycerol, methanol or ethanol and organic acids such as acetic acid or lactic acid. Sources of nitrogen are usually organic or inorganic nitrogen compounds or materials containing these compounds. Examples of sources of nitrogen include ammonia gas or ammonium salts, such as ammonium sulfate, ammonium chloride, ammonium phosphate, ammonium carbonate or ammonium nitrate, nitrates, urea, amino acids or complex sources of nitrogen, such as corn-steep liquor, soybean flour, soybean protein, yeast extract, meat extract and others. The sources of nitrogen can be used separately or as a mixture. Inorganic salt compounds that may be present in the media comprise the chloride, phosphate or sulfate salts of calcium, magnesium, sodium, cobalt, molybdenum, potassium, manganese, zinc, copper and iron. Inorganic sulfur-containing compounds, for example sulfates, sulfites, dithionites, tetrathionates, thiosulfates, sulfides, but also organic sulfur compounds, such as mercaptans and thiols, can be used as sources of sulfur. Phosphoric acid, potassium dihydrogenphosphate or dipotassium hydrogenphosphate or the corresponding sodium-containing salts can be used as sources of phosphorus. Chelating agents can be added to the medium, in order to keep the metal ions in solution. Especially suitable chelating agents comprise dihydroxyphenols, such as catechol or protocatechuate, or organic acids, such as citric acid. The culture media used may also contain other growth factors, such as vitamins or growth promoters, which include for example biotin, riboflavin, thiamine, folic acid, nicotinic acid, pantothenate and pyridoxine. Growth factors and salts often come from complex components of the media, such as yeast extract, molasses, corn-steep liquor and the like. In addition, suitable precursors can be added to the culture medium. The precise composition of the compounds in the medium is strongly dependent on the particular experiment and must be decided individually for each specific case. Information on media optimization can be found in the textbook "Applied Microbiol. Physiology, A Practical Approach" (Publ. P.M. Rhodes, P.F. Stanbury, IRL Press (1997) p. 53-73, ISBN 0 19 963577 3). Growing media can also be obtained from commercial suppliers, such as Standard 1 (Merck) or BHI (Brain heart infusion, DIFCO) etc. All components of the medium are sterilized, either by heating (20 min at 2.0 bar and 121°C) or by sterile filtration. The components can be sterilized either together, or if necessary separately. All the components of the medium can be present at the start of growing, or optionally can be added continuously or by batch feed. The temperature of the culture of the respective microorganism is normally between 15°C and 45°C, preferably 25°C to 40°C and can be kept constant or can be varied during the experiment. The pH value of the medium should be in the range from 5 to 8.5, preferably around 7.0. The pH value for growing can be controlled during growing by adding basic compounds such as sodium hydroxide, potassium hydroxide, ammonia or ammonia water or acid compounds such as phosphoric acid or sulfuric acid. Antifoaming agents, e.g. fatty acid polyglycol esters, can be used for controlling foaming. To maintain the stability of plasmids, suitable substances with

selective action, e.g. antibiotics, can be added to the medium. Oxygen or oxygen-containing gas mixtures, e.g. the ambient air, are fed into the culture in order to maintain aerobic conditions. The temperature of the culture is normally from 20°C to 45°C. Culture is continued until a maximum of the desired product has formed. This is normally achieved within 10 hours to 160 hours. To obtain cell-free extracts, the cells can be disrupted optionally by high-frequency ultrasound, by high pressure, e.g. in a French pressure cell, by osmolysis, by the action of detergents, lytic enzymes or organic solvents, by means of homogenizers or by a combination of several of the methods listed. The methodology of the present invention can further include a step of recovering individual compositions such as cell-free extracts, supernatants, metabolites or alike. The term "recovering" includes extracting, harvesting, isolating or purifying of an extract, supernatant or metabolite e.g. from whole culture broth. Recovering can be performed according to any conventional isolation or purification methodology known in the art including, but not limited to, treatment with a conventional resin (e.g., anion or cation exchange resin, non-ionic adsorption resin, etc.), treatment with a conventional adsorbent (e.g., activated charcoal, silicic acid, silica gel, cellulose, alumina, etc.), alteration of pH, solvent extraction (e.g., with a conventional solvent such as an alcohol, ethyl acetate, hexane and the like), distillation, dialysis, filtration, concentration, crystallization, recrystallization, pH adjustment, lyophilization and the like. For example the agent can be recovered from culture media by first removing the microorganisms. The remaining broth is then passed through or over a cation exchange resin to remove unwanted cations and then through or over an anion exchange resin to remove unwanted inorganic anions and organic acids.

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 T. harzianum SK-55 and pesticides II from groups L1), L3) and L5), form part of such kit, it must be taken care that choice and amounts of the other parts of the kit (e.g. chemcial pesticidal agents) 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 compring a) a composition comprising component 1) 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.

The at least one pesticide II can be converted into customary types of agrochemical 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 Monograph 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.

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, cyclohexanol; 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; polysaccharides, 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 alkylarylsulfonates, 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 alkylnaphthalenes, sulfosuccinates or sulfosuccinamates. Examples of sulfates are sulfates of fatty acids and oils, of ethoxylated alkylphenols, of alcohols, of ethoxylated alcohols, or of fatty acid esters. Examples of phosphates are phosphate esters. Examples of carboxylates are alkyl carboxylates, and carboxylated alcohol or alkylphenol ethoxylates.

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 home- 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 compound I 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 alkyliso-thiazolinones 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.

When living microorganisms, such as T. harzianum SK-55 and pesticides II from groups L1), L3) and L5), form part of the compositions, such compositions can be prepared as compositions comprising besides the active ingredients at least one auxiliary (inert ingredient) by usual means (see e.g. H.D. Burges: Formulation of Micobial Biopestcides, Springer, 1998). Suitable customary types of such compositions are suspensions, dusts, powders, pastes, granules, pressings, capsules, and mixtures thereof. Examples for composition types are suspensions (e.g. SC, OD, FS), 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). Herein, it has to be taken into account that each formulation type or choice of auxiliary should not influence the viability of the microorganism during storage of thecomposition and when finally applied to the soil, plant or plant propagation material.

Suitable formulations are e.g. mentioned in WO 2008/002371 , US 6955,912, US 5,422,107.

Examples for suitable auxiliaries are those mentioned earlier herein, wherein it must be taken care that choice and amounts of such auxiliaries should not influence the viability of the microbial pesticides in the composition. Especially for bactericides and solvents, compatibility with the respective microorganism of the respective microbial pesticide has to be taken into account. In addition, compositions with microbial pesticides may further contain stabilizers or nutrients and UV protectants. Suitable stabilzers or nutrients are e.g. alpha-tocopherol, trehalose, glutamate, potassium sorbate, various sugars like glucose, sucrose, lactose and maltodextrine (H.D. Burges: Formulation of Micobial Biopestcides, Springer, 1998). Suitable UV protectants are e.g. inorganic compouns like titan dioxide, zinc oxide and iron oxide pigments or organic compounds like benzophenones, benzotriazoles and phenyltriazines. The compositions may in addition to auxiliaries mentioned for compositions comprising compounds I herein optionally comprise 0.1 - 80% stabilizers or nutrients and 0.1-10% UV protectants.

Examples for composition types and their preparation are:

i) Water-soluble concentrates (SL, LS)

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

ii) Dispersible concentrates (DC)

5-25 wt% of a compound I and 1-10 wt% dispersant (e. g. polyvinylpyrrolidone) are dissolved in organic solvent (e.g. cyclohexanone) ad 100 wt%. Dilution with water gives a dispersion.

iii) Emulsifiable concentrates (EC)

15-70 wt% of a compound I and 5-10 wt% emulsifiers (e.g. calcium dodecylbenzenesulfonate and castor oil ethoxylate) are dissolved in water-insoluble organic solvent (e.g. aromatic hydrocarbon) ad 100 wt%. Dilution with water gives an emulsion.

iv) Emulsions (EW, EO, ES)

5-40 wt% of a compound I 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 water ad 100 wt% 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 a compound I 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 water ad 100 wt% 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 a compound I are ground finely with addition of dispersants and wetting agents (e.g. sodium lignosulfonate and alcohol ethoxylate) ad 100 wt% 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 a compound I 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 solid carrier (e.g. silica gel) ad 100 wt%. 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 a compound I are comminuted with addition of 3-10 wt% dispersants (e.g. sodium lignosulfonate), 1-5 wt% thickener (e.g. carboxymethylcellulose) and water ad 100 wt% 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 a compound I are added to 5-30 wt% organic solvent blend (e.g. fatty acid dimethylamide and cyclohexanone), 10-25 wt% surfactant blend (e.g. alcohol ethoxylate and arylphenol ethoxylate), and water ad 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 a compound I, 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 radical initiator results in the formation of poly(meth)acrylate microcapsules. Alternatively, an oil phase comprising 5-50 wt% of a compound I according to the invention, 0-40 wt% water insoluble organic solvent (e.g. aromatic hydrocarbon), and an isocyanate monomer (e.g. diphenylmethene-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 formation of polyurea microcapsules. 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 compound I are ground finely and mixed intimately with solid carrier (e.g. finely divided kaolin) ad 100 wt%.

xii) Granules (GR, FG)

0.5-30 wt% of a compound I is ground finely and associated with solid carrier (e.g. silicate) ad 100 wt%. Granulation is achieved by extrusion, spray-drying or fluidized bed.

xiii) Ultra-low volume liquids (UL)

1-50 wt% of a compound I are dissolved in organic solvent (e.g. aromatic hydrocarbon) ad 100 wt%.

The compositions types i) to xiii) 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 compositions types i) to vii) 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, 0.1 - 80% stabilizers or nutrients, 0.1-10% UV protectants and 0,1-1 wt% colorants.

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 are characterized in that they contain an effective quantity of the active components as defined above. Generally, they contain between 0.01 and 95%, preferably between 0.1 and 90%, and in particular between 0.5 and 75%, by weight of active components, in particular active substances.

According to one embodiment, the compositions contain microbial pesticides such as SK-55 and pesticides II from groups L1), L3) and L5) in an amount from 1×10^5 to 1×10^{12} CFU, preferably from 1×10^7 CFU to 1×10^{12} CFU, more preferably from 1×10^9 CFU to 1×10^{12} CFU per gram total weight of the composition.

Solutions for seed treatment (LS), suspoemulsions (SE), flowable concentrates (FS), powders for dry treatment (DS), water-dispersible powders for slurry treatment (WS), water-soluble powders (SS), emulsions (ES), emulsifiable concentrates (EC) and gels (GF) are usually employed for the purposes of treatment of plant propagation materials, particularly seeds.

Preferred examples of seed treatment formulation types or soil application for pre-mix compositions are of WS, LS, ES, FS, WG or CS-type.

The compositions in question give, after two-to-tenfold dilution, active components concentrations of from 0.01 to 60% by weight, preferably from 0.1 to 40%, in the ready-to-use preparations. Application can be carried out before or during sowing. Methods for applying or treating compound I and compound II and compositions thereof, respectively, on to plant propagation material, especially seeds include dressing, coating, pelleting, dusting, soaking and in-furrow application methods of the propagation material. Preferably, compound I and compound II or the compositions thereof, respectively, are applied on to the plant propagation material by a method such that germination is not induced, e.g. by seed dressing, pelleting, coating and dusting.

Typically, a pre-mix formulation for seed treatment application comprises 0.5 to 99.9 percent, especially 1 to 95 percent, of the desired ingredients, and 99.5 to 0.1 percent, especially 99 to 5 percent, of a solid or liquid adjuvant (including, for example, a solvent such as water), where the auxiliaries can be a surfactant in an amount of 0 to 50 percent, especially 0.5 to 40 percent, based on the pre-mix formulation. Whereas commercial products will preferably be formulated as concentrates (e.g., pre- mix composition (formulation)), the end user will normally employ dilute formulations (e.g., tank mix composition).

Seed treatment methods for applying or treating inventive mixtures and compositions thereof to plant propagation material, especially seeds, are known in the art, and include dressing, coating, filmcoating, pelleting and soaking application methods of the propagation material. Such methods are also applicable to the combinations according to the invention. In a preferred embodiment, the inventive mixture is applied or treated on to the plant propagation material by a method such that the germination is not negatively impacted. Accordingly, examples of suitable methods for applying (or treating) a plant propagation material, such as a seed, is seed dressing, seed coating or seed pelleting and alike.

It is preferred that the plant propagation material is a seed, seed piece (i.e. stalk) or seed bulb.

Although it is believed that the present method can be applied to a seed in any physiological state, it is preferred that the seed be in a sufficiently durable state that it incurs no damage during the treatment process. Typically, the seed would be a seed that had been harvested from the field; removed from the plant; and separated from any cob, stalk, outer husk, and surrounding pulp or other non-seed plant material. The seed would preferably also be biologically stable to the extent that the treatment would cause no biological damage to the seed. It is believed that the treatment can be applied to the seed at any time between harvest of the seed and sowing of the seed or during the sowing process (seed directed applications). The seed may also be primed either before or after the treatment.

Even distribution of the ingredients in inventive mixtures and adherence thereof to the seeds is desired during propagation material treatment. Treatment could vary from a thin film (dressing) of the formulation containing the combination, for example, a mixture of active ingredient(s), on a plant propagation material, such as a seed, where the original size and/or shape are recognizable to an intermediary state (such as a coating) and then to a thicker film (such as pelleting with many layers of different materials (such as carriers, for example, clays; different formulations, such as of other active ingredients; polymers; and colourants) where the original shape and/or size of the seed is no longer recognizable.

An aspect of the present invention includes application of the inventive mixtures onto the plant propagation material in a targeted fashion, including positioning the ingredients in the combination onto the entire plant propagation material or on only parts thereof, including on only a single side or a portion of a single side. One of ordinary skill in the art would understand these application methods from the description provided in EP954213B1 and WO06/1 12700.

The inventive mixtures can also be used in form of a "pill" or "pellet" or a suitable substrate and placing, or sowing, the treated pill, or substrate, next to a plant propagation material. Such techniques are known in the art, particularly in EP1 124414, WO07/67042, and WO07/67044. Application of the combinations described herein onto plant propagation material also includes protecting the plant propagation material treated with the combination of the present invention by placing one or more pesticide-containing particles next to a pesticide-treated seed, wherein the amount of pesticide is such that the pesticide-treated seed and the pesticide- containing particles together contain an Effective Dose of the pesticide and the pesticide dose contained in the pesticide-treated seed is less than or equal to the Maximal Non-Phytotoxic Dose of the pesticide. Such techniques are known in the art, particularly in WO2005/1 20226.

Application of the combinations onto the seed also includes controlled release coatings on the seeds, wherein the ingredients of the combinations are incorporated into materials that release the ingredients over time. Examples of controlled release seed treatment technologies are generally known in the art and include polymer films, waxes, or other seed coatings, wherein the ingredients may be incorporated into the controlled release material or applied between layers of materials, or both.

Seed can be treated by applying thereto the compound s present in the inventive mixtures in any desired sequence or simultaneously.

The seed treatment occurs to an unsown seed, and the term "unsown seed" is meant to include seed at any period between the harvest of the seed and the sowing of the seed in the ground for the purpose of germination and growth of the plant.

Treatment to an unsown seed is not meant to include those practices in which the active ingredient is applied to the soil but would include any application practice that would target the seed during the planting process.

Preferably, the treatment occurs before sowing of the seed so that the sown seed has been pre-treated with the combination. In particular, seed coating or seed pelleting are preferred in the treatment of the combinations according to the invention. As a result of the treatment, the ingredients in each combination are adhered on to the seed and therefore available for pest control.

The treated seeds can be stored, handled, sowed and tilled in the same manner as any other active ingredient treated seed.

In particular, the present invention relates to a method for protection of plant propagation material from pests and/or improving the health of plants grown from said plant propagation material, wherein the soil, wherein plant propagation material is sown, is treated with an effective amount of an inventive mixture.

In particular, the present invention relates to a method for protection of plant propagation material from pests, wherein the soil, wherein plant propagation material is sown, is treated with an effective amount of an inventive mixture.

In particular, the present invention relates to a method for protection of plant propagation material from harmful fungi, wherein the soil, wherein plant propagation material is sown, is treated with an effective amount of an inventive mixture.

In particular, the present invention relates to a method for protection of plant propagation material from animal pests (insects, acarids or nematodes), wherein the soil, wherein plant propagation material is sown, is treated with an effective amount of an inventive mixture.

When employed in plant protection, the total amounts of active components applied are, depending on the kind of effect desired, from 0.001 to 10 kg per ha, preferably from 0.005 to 2 kg per ha, more preferably from 0.05 to 0.9 kg per ha, in particular from 0.1 to 0.75 kg per ha. In the case of T. harzianum SK-55 and microbial pesticides II, the application rates preferably range from about 1×10^6 to 5×10^{15} (or more) CFU/ha. Preferably, the spore concentration is about 1×10^7 to about 1×10^{12} CFU/ha. In the case of (entomopathogenic) nematodes as microbial pesticides (e.g. Steinernema feltiae), the application rates preferably range inform about 1×10^5 to 1×10^{12} (or more), more preferably from 1×10^8 to 1×10^{11}, even more preferably from 5×10^8 to 1×10^{10} individuals (e.g. in the form of eggs, juvenile or any other live stages, preferably in an infetive juvenile stage) per ha.

When employed in plant protection by seed treatment, the amount of the inventive mixtures (based on total weight of active components) is in the range from 0.01 - 10 kg, preferably from 0.1-1000 g, more preferably from 1-100 g per 100 kilogram of plant propagation material (preferably seeds). In the case of T. harzianum SK-55 and microbial pesticides II, the application rates with respect to plant propagation material preferably range from about 1×10^6 to 1×10^{12} (or more) CFU/seed. Preferably, the concentration is about 1×10^6 to about 1×10^{11} CFU/seed. In the case of T. harzianum SK-55 and microbial pesticides II, the application rates with respect to plant propagation material also preferably range from about 1×10^7 to 1×10^{14} (or more) CFU per 100 kg of seed, preferably from 1×10^9 to about 1×10^{12} CFU per 100 kg of

seed.

When used in the protection of materials or stored products, the amount of active components applied depends on the kind of application area and on the desired effect. Amounts customarily applied in the protection of materials are 0.001 g to 2 kg, preferably 0.005 g to 1 kg, of active components per cubic meter of treated material.

Various types of oils, wetters, adjuvants, fertilizer, or micronutrients, and further pesticides (e.g. herbicides, insecticides, fungicides, growth regulators, safeners) may be added to the mictures or the compositions comprising 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 .

These further useful active compounds can be fertilizers or micronutrient donors (such as Mo, Zn and / or Co), especially when applied to plant propagation materials.

According to one embodiment, a polyether polymethylsiloxane copolymer may be added to the composition accoding to the invention, preferably in a weight ratio of 1:100 to 100:1 , more preferably in a weight ratio of 1:10 to 10:1 , in particular in a weight ratio of 1:5 to 5:1 based on the total weight of the component 1) and component 2).

According to a further embodiment, a mineral oil or a vegetable oil may be added to the composition according to the invention, preferably in a weight ratio of 1:100 to 100:1 , more preferably in a weight ratio of 1:10 to 10:1 , in particular in a weight ratio of 1:5 to 5:1 based on the total weight of component 1) and component 2).

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.

In the mixtures and compositions, the compound ratios are advantageously chosen so as to produce a synergistic effect.

The term "synergstic effect" is understood to refer in particular to that defined by Colby's formula (Colby, S. R., "Calculating synergistic and antagonistic responses of herbicide combinations", Weeds, 15, pp. 20-22, 1967).

The term "synergistic effect" is also understood to refer to that defined by application of the Tammes method, (Tammes, P. M. L , "Isoboles, a graphic representation of synergism in pesticides", Netherl. J. Plant Pathol. 70, 1964).

According to the invention, the solid material (dry matter) of the biopesticides (with the exception of oils such as Neem oil, Tagetes oil, etc.) are considered as active components (e.g. to be obtained after drying or evaporation of the extraction medium or the 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 1×10^{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.

In the binary mixtures and compositions according to the invention the weight ratio of the component 1) and the component 2) generally depends from the properties of the active components 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 , 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 a further embodiments of the binary mixtures and compositions, the weight ratio of the component 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 a further embodiments of the binary mixtures and compositions, the weight ratio of the component 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) and the component 2) usually is in the range of from 20,000:1 to 1:1,000, often in the range of from 10,000:1 to 1:100, regularly in the range of from 5,000:1 to 1:1 , 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 .

In the ternary mixtures, i.e. compositions according to the invention comprising the component 1) and component 2) and a compound III (component 3), the weight ratio of component 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) 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).

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

We claim:

1. A mixture comprising, as active components:

1) Trichoderma harzianum strain SK-55, or a cell-free extract thereof or at least one metabolite thereof having pesticidal activity, and/or a mutant of Trichoderma harzianum SK-55 having pesticidal activity and producing at least one pesticidal metabolite, or a pesticidal metabolite or extract of the mutant;

and

2) at least one pesticide II selected from the groups A) to O):

A) Respiration inhibitors

- Inhibitors of complex III at Q_0 site (e.g. strobilurins): azoxystrobin, coumethoxystrobin, coumoxystrobin, dimoxystrobin, enestroburin, fenaminstrobin, fenoxystrobin/flufenoxystrobin, fluoxastrobin, kresoxim-methyl, mandestrobine, metominostrobin, orysastrobin, picoxystrobin, pyraclostrobin, pyrametostrobin, pyraoxystrobin, trifloxystrobin and 2-(2-(3-(2,6-dichlorophenyl)-1-methyl-allylidene-aminooxymethyl)-phenyl)-2-methoxyimino-N-methyl-acetamide, pyribencarb, triclopyricarb/chlorodincarb, famoxadone, fenamidone;
- inhibitors of complex III at Q_i site: cyazofamid, amisulbrom, [(3S,6S,7R,8R)-8-benzyl-3-[(3-acetoxy-4-methoxy-pyridine-2-carbonyl)amino]-6-methyl-4,9-dioxo-1,5-dioxonan-7-yl] 2-methylpropanoate, [(3S,6S,7R,8R)-8-benzyl-3-[[3-(acetoxymethoxy)-4-methoxy-pyridine-2-carbonyl]amino]-6-methyl-4,9-dioxo-1,5-dioxonan-7-yl] 2-methylpropanoate, [(3S,6S,7R,8R)-8-benzyl-3-[(3-isobutoxycarbonyloxy-4-methoxy-pyridine-2-carbonyl)amino]-6-methyl-4,9-dioxo-1,5-dioxonan-7-yl] 2-methylpropanoate, [(3S,6S,7R,8R)-8-benzyl-3-[[3-(1,3-benzodioxol-5-ylmethoxy)-4-methoxy-pyridine-2-carbonyl]amino]-6-methyl-4,9-dioxo-1,5-dioxonan-7-yl] 2-methylpropanoate; (3S,6S,7R,8R)-3-[[(3-hydroxy-4-methoxy-2-pyridinyl)carbonyl]amino]-6-methyl-4,9-dioxo-8-(phenylmethyl)-1,5-dioxonan-7-yl 2-methylpropanoate
- inhibitors of complex II (e.g. carboxamides): benodanil, benzovindiflupyr, bixafen, boscalid, carboxin, fenfuram, fluopyram, flutolanil, fluxapyroxad, furametpyr, isofetamid, isopyrazam, mepronil, oxycarboxin, penflufen, penthiopyrad, sedaxane, tecloftalam, thifluzamide, N-(4'-trifluoromethylthiobiphenyl-2-yl)-3-difluoromethyl-1-methyl-1 H-pyrazole-4-carboxamide, N-(2-(1,3,3-trimethyl-butyl)-phenyl)-1,3-dimethyl-5-fluoro-1 H-pyrazole-4-carboxamide, 3-(difluoromethyl)-1-methyl-N-(1,1,3-trimethylindan-4-yl)pyrazole-4-carboxamide, 3-(trifluoromethyl)-1-methyl-N-(1,1,3-trimethylindan-4-yl)pyrazole-4-carboxamide, 1,3-dimethyl-N-(1,1,3-trimethylindan-4-yl)pyrazole-4-carboxamide, 3-(trifluoromethyl)-1,5-dimethyl-N-(1,1,3-trimethylindan-4-yl)pyrazole-4-carboxamide, 1,3,5-trimethyl-N-(1,1,3-trimethylindan-4-yl)pyrazole-4-carboxamide, N-(7-fluoro-1,1,3-trimethyl-indan-4-yl)-1,3-dimethyl-pyrazole-4-carboxamide, N-[2-(2,4-dichlorophenyl)-2-methoxy-1-methyl-ethyl]-3-(difluoromethyl)-1-methyl-pyrazole-4-carboxamide;

- other respiration inhibitors (e.g. complex I, uncouplers): diflumetorim, (5,8-difluoroquinazolin-4-yl)-{2-[2-fluoro-4-(4-trifluoromethylpyridin-2-yloxy)-phenyl]-ethyl}-amine; nitrophenyl derivates: binapacryl, dinobuton, dinocap, fluazinam; ferimzone; organometal compounds: fentin salts, such as fentin-acetate, fentin chloride or fentin hydroxide; ametoctradin; and silthiofam;

B) Sterol biosynthesis inhibitors (SBI fungicides)

- C14 demethylase inhibitors (DMI fungicides): triazoles: azaconazole, bitertanol, bromuconazole, cyproconazole, difenoconazole, diniconazole, diniconazole-M, epoxiconazole, fenbuconazole, fluquinconazole, flusilazole, flutriafol, hexaconazole, imibenconazole, ipconazole, metconazole, myclobutanil, oxpoconazole, paclobutrazole, penconazole, propiconazole, prothioconazole, simeconazole, tebuconazole, tetraconazole, triadimefon, triadimenol, triticonazole, uniconazole, 1-[re/-(2S;3R)-3-(2-chlorophenyl)-2-(2,4-difluorophenyl)-oxiranylmethyl]-5-thiocyanato-1H-[1,2,4]triazole, 2-[re/-(2S;3R)-3-(2-chlorophenyl)-2-(2,4-difluorophenyl)-oxiranylmethyl]-2H-[1,2,4]triazole-3-thiol, 2-[2-chloro-4-(4-chlorophenoxy)phenyl]-1-(1,2,4-triazol-1-yl)pentan-2-ol, 1-[4-(4-chlorophenoxy)-2-(trifluoromethyl)phenyl]-1-cyclopropyl-2-(1,2,4-triazol-1-yl)ethanol, 2-[4-(4-chlorophenoxy)-2-(trifluoromethyl)phenyl]-1-(1,2,4-triazol-1-yl)butan-2-ol, 2-[2-chloro-4-(4-chlorophenoxy)phenyl]-1-(1,2,4-triazol-1-yl)butan-2-ol, 2-[4-(4-chlorophenoxy)-2-(trifluoromethyl)phenyl]-3-methyl-1-(1,2,4-triazol-1-yl)butan-2-ol, 2-[4-(4-chlorophenoxy)-2-(trifluoromethyl)-phenyl]-1-(1,2,4-triazol-1-yl)propan-2-ol, 2-[2-chloro-4-(4-chlorophenoxy)phenyl]-3-methyl-1-(1,2,4-triazol-1-yl)butan-2-ol, 2-[4-(4-chlorophenoxy)-2-(trifluoromethyl)-phenyl]-1-(1,2,4-triazol-1-yl)pentan-2-ol, 2-[4-(4-fluorophenoxy)-2-(trifluoromethyl)-phenyl]-1-(1,2,4-triazol-1-yl)propan-2-ol; imidazoles: imazalil, pefurazoate, prochloraz, triflumizol; pyrimidines, pyridines and piperazines: fenarimol, nuarimol, pyrifenox, triforine, [3-(4-chloro-2-fluoro-phenyl)-5-(2,4-difluorophenyl)isoxazol-4-yl]-(3-pyridyl)methanol;
- Delta14-reductase inhibitors: aldimorph, dodemorph, dodemorph-acetate, fenpropimorph, tridemorph, fenpropidin, piperalin, spiroxamine;
- Inhibitors of 3-keto reductase: fenhexamid;

C) Nucleic acid synthesis inhibitors

- phenylamides or acyl amino acid fungicides: benalaxyl, benalaxyl-M, kiralaxyl, metalaxyl, metalaxyl-M (mefenoxam), ofurace, oxadixyl;
- others: hymexazole, octhilinone, oxolinic acid, bupirimate, 5-fluorocytosine, 5-fluoro-2-(p-tolylmethoxy)pyrimidin-4-amine, 5-fluoro-2-(4-fluoro-phenylmethoxy)pyrimidin-4-amine;

D) Inhibitors of cell division and cytoskeleton

- tubulin inhibitors, such as benzimidazoles, thiophanates: benomyl, carbendazim, fuberidazole, thiabendazole, thiophanate-methyl; triazolopyrimidines: 5-chloro-7-(4-methylpiperidin-1-yl)-6-(2,4,6-trifluorophenyl)-[1,2,4]triazolo[1,5-a]pyrimidine
- other cell division inhibitors: diethofencarb, ethaboxam, pencycuron, fluopicolide, zoxamide, metrafenone, pyriofenone;

E) Inhibitors of amino acid and protein synthesis

- methionine synthesis inhibitors (anilino-pyrimidines): cyprodinil, mepanipyrim, pyrimethanil;
- protein synthesis inhibitors: blasticidin-S, kasugamycin, kasugamycin hydrochloride-hydrate, mildiomycin, streptomycin, oxytetracyclin, polyoxine, validamycin A;

F) Signal transduction inhibitors

- MAP / histidine kinase inhibitors: fluoroimid, iprodione, procymidone, vinclozolin, fenpiclonil, fludioxonil;
- G protein inhibitors: quinoxyfen;

G) Lipid and membrane synthesis inhibitors

- Phospholipid biosynthesis inhibitors: edifenphos, iprobenfos, pyrazophos, isoprothiolane;
- lipid peroxidation: dicloran, quintozene, tecnazene, tolclofos-methyl, biphenyl, chloroneb, etridiazole;
- phospholipid biosynthesis and cell wall deposition: dimethomorph, flumorph, mandipropamid, pyrimorph, benthiavalicarb, iprovalicarb, valifenalate and N-(1-(1-(4-cyano-phenyl)ethanesulfonyl)-but-2-yl) carbamic acid-(4-fluorophenyl) ester;
- compounds affecting cell membrane permeability and fatty acides: propamocarb, propamocarb-hydrochlorid
- fatty acid amide hydrolase inhibitors: oxathiapiprolin;

H) Inhibitors with Multi Site Action

- inorganic active substances: Bordeaux mixture, copper acetate, copper hydroxide, copper oxychloride, basic copper sulfate, sulfur;
- thio- and dithiocarbamates: ferbam, mancozeb, maneb, metam, metiram, propineb, thiram, zineb, ziram;
- organochlorine compounds (e.g. phthalimides, sulfamides, chloronitriles): anilazine, chlorothalonil, captafol, captan, folpet, dichlofluanid, dichlorophen, hexachlorobenzene, pentachlorphenole and its salts, phthalide, tolylfluanid, N-(4-chloro-2-nitro-phenyl)-N-ethyl-4-methyl-benzenesulfonamide;
- guanidines and others: guanidine, dodine, dodine free base, guazatine, guazatine-acetate, iminoctadine, iminoctadine-triacetate, iminoctadine-tris(albesilate), dithianon, 2,6-dimethyl-1 H,5H-[1 ,4]dithiino[2,3-c:5,6-c']dipyrrole-1 ,3,5,7(2H,6H)-tetraone;

I) Cell wall synthesis inhibitors

- inhibitors of glucan synthesis: validamycin, polyoxin B; melanin synthesis inhibitors: pyroquilon, tricyclazole, carpropamid, dicyclomet, fenoxanil;

J) Plant defence inducers

- acibenzolar-S-methyl, probenazole, isotianil, tiadinil, prohexadione-calcium; phosphonates: fosetyl, fosetyl-aluminum, phosphorous acid and its salts;

K) Unknown mode of action

- bronopol, chinomethionat, cyflufenamid, cymoxanil, dazomet, debacarb, diclomezine, difenzoquat, difenzoquat-methylsulfate, diphenylamin, fenpyrazamine, flumetover, flusulfamide, flutianil, methasulfocarb, nitrapyrin, nitrothal-isopropyl, oxathiapiprolin, tolprocarb, 2-[3,5-bis(difluoromethyl)-1 H-pyrazol-1-yl]-1-[4-(4-{5-[2-

(prop-2-yn-1 -yloxy)phenyl]-4,5-dihydro-1 ,2-oxazol-3-yl}-1 ,3-thiazol-2-yl)piperidin-1 -yl]ethanone, 2-[3,5-bis(difluoromethyl)-1 H-pyrazol-1 -yl]-1 -[4-(4-{5-[2-fluoro-6-(prop-2-yn-1 -yloxy)phenyl]-4,5-dihydro-1 ,2-oxazol-3-yl}-1 ,3-thiazol-2-yl)piperidin-1 -yl]ethanone, 2-[3,5-bis(difluoromethyl)-1 H-pyrazol-1 -yl]-1 -[4-(4-{5-[2-chloro-6-(prop -2-yn-1 -yloxy)phenyl]-4,5-dihydro-1 ,2-oxazol-3-yl}-1 ,3-thiazol-2-yl)piperidin-1 -yl]ethanone, oxin-copper, proquinazid, tebufloquin, tecloftalam, triazoxide, 2-butoxy-6-iodo-3-propylchromen-4-one, N-(cyclopropylmethoxyimino-(6-difluoro-methoxy-2,3-difluoro-phenyl)-methyl)-2-phenyl acetamide, N'-(4-(4-chloro-3-trifluoromethyl-phenoxy)-2,5-dimethyl-phenyl)-N-ethyl-N-methyl formamidine, N'-(4-(4-fluoro-3-trifluoromethyl-phenoxy)-2,5-dimethyl-phenyl)-N-ethyl-N-methyl formamidine, N'-(2-methyl-5-trifluoromethyl-4-(3-trimethylsilanyl-propoxy)-phenyl)-N-ethyl-N-methyl formamidine, N'-(5-difluoromethyl-2-methyl-4-(3-trimethylsilanyl-propoxy)-phenyl)-N-ethyl-N-methyl formamidine, methoxy-acetic acid 6-tert-butyl-8 -fluoro-2,3-dimethyl-quinolin-4-yl ester, 3-[5-(4-methylphenyl)-2,3-dimethyl-isoxazolidin-3-yl]-pyridine, 3-[5-(4-chloro-phenyl)-2,3-dimethyl-isoxazolidin-3-yl]-pyridine (pyrisoxazole), N-(6-methoxy-pyridin-3-yl) cyclopropanecarboxylic acid amide, 5-chloro-1-(4,6-dimethoxy-pyrimidin-2-yl)-2-methyl-1 H-benzoimidazole, 2-(4-chloro-phenyl)-N-[4-(3,4-dimethoxy-phenyl)-isoxazol-5-yl]-2-prop-2-ynyloxy-acetamide, ethyl (Z)-3-amino-2-cyano-3-phenyl-prop-2-enoate, tert-butyl N-[6-[[(Z)-[(1-methyltetrazol-5-yl)-phenyl-methylene]amino]oxymethyl]-2-pyridyl]carbamate, pentyl N-[6-[[(Z)-[(1-methyltetrazol-5-yl)-phenyl-methylene]amino]oxymethyl]-2-pyridyl]carbamate, 2-[2-[(7,8-difluoro-2-methyl-3-quinolyl)oxy]-6-fluoro-phenyl]-propan-2-ol, 2-[2-fluoro-6-[(8-fluoro-2-methyl-3-quinolyl)oxy]phenyl]propan-2-ol, 3-(5-fluoro-3,3,4,4-tetramethyl-3,4-dihydroisoquinolin-1-yl)quinoline, 3-(4,4-difluoro-3.3-dimethyl-3,4-dihydroisoquinolin-1-yl)quinoline, 3-(4,4,5-trifluoro-3,3-dimethyl-3.4-dihydroisoquinolin-1-yl)quinoline;

L) Biopesticides

L1) Microbial pesticides with fungicidal, bactericidal, viricidal and/or plant defense activator activity: Ampelomyces quisqualis, Aspergillus flavus, Aureobasidium pullulans, Bacillus amyloliquefaciens, B. mojavensis, B. pumilus, B. simplex, B. solisalsi, B. subtilis, B. subtilis var. amyloliquefaciens, Candida oleophila, C. saitoana, Clavibacter michiganensis (bacteriophages), Coniothyrium minitans, Cryphonectria parasitica, Cryptococcus albidus, 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 polymyxa, Pantoea vagans, Phlebiopsis gigantea, Pseudomonas sp., Pseudomonas chloraphis, Pseudozyma flocculosa, Pichia anomala, Pythium oligandrum, Sphaerodes mycoparasitica, Streptomyces griseoviridis, S. lydicus, S. violaceusniger, Talaromyces flavus, Trichoderma asperellum, T. atroviride, T. fertile, T. gamsii, T. harmatum; mixture of T. harzianum and T. viride; mixture of T. polysporum and T. harzianum; T. stromaticum, T. virens (also named Gliocladium 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: chitosan (hydrolysate), harpin protein, laminarin, Menhaden fish oil, natamycin, Plum pox virus coat protein, potassium or sodium bicarbonate, Reynoutria sachlinensis extract, salicylic acid, tea tree oil;

L3) Microbial pesticides with insecticidal, acaricidal, molluscidal and/or nematicidal activity: Agrobacterium radiobacter, Bacillus cereus, B. firmus, B. thuringiensis, B. thuringiensis ssp. aizawai, B. t. ssp. israelensis, B. t. ssp. galleriae, B. t. ssp. kurstaki, B. t. ssp. tenebrionis, Beauveria bassiana, B. brongniartii , Burkholderia sp., Chromobacterium subtsugae, Cydia pomonella granulosis virus, Cryptophlebia leucotreta granulovirus (CrleGV), Isaria fumosorosea, Heterorhabditis bacteriophora, Lecanicillium longisporum, L. muscarium (formerly Verticillium lecanii), Metarhizium anisopliae, M. anisopliae var. acridum, Nomuraea rileyi, Paecilomyces fumosoroseus, P. lilacinus, Paenibacillus popilliae, Pasteuria spp., P. nishizawae, P. penetrans, P. ramose, P. reneformis, P. thornea, P. usgae, Pseudomonas fluorescens, Steinernema carpocapsae, S. feltiae, S. kraussei;

L4) Biochemical pesticides with insecticidal, acaricidal, molluscidal, pheromone and/or nematicidal activity: L-carvone, citral, (E,Z)-7,9-dodecadien-1-yl acetate, ethyl formate, (E,Z)-2,4-ethyl decadienoate (pear ester), (Z,Z,E)-7,1 1,13-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 actanoate, (E,Z,Z)-3,8,1 1-tetradecatrienyl acetate, (Z,E)-9,12-tetradecadien-1-yl acetate, Z-7-tetradecen-2-one, Z-9-tetradecen-1 -yl acetate, Z-1 1-tetradecenal, Z-1 1-tetradecen-1-ol, Acacia negra extract, extract of grapefruit seeds and pulp, extract of Chenopodium ambrosiodae, Catnip oil, Neem oil, Quillay extract, Tagetes oil;

L5) Microbial pesticides with plant stress reducing, plant growth regulator, plant growth promoting and/or yield enhancing activity: Azospirillum amazonense A. brasilense, A. lipoferum, A. irakense, A. halopraeferens, Bradyrhizobium sp., B. elkanii, B. japonicum, B. liaoningense, B. lupini, Delftia acidovorans, Glomus intraradices, Mesorhizobium sp., Paenibacillus alvei, Penicillium bilaiae, Rhizobium leguminosarum bv. phaseolii, R. I. trifolii, R. I. bv. viciae, R. tropici, Sinorhizobium meliloti;

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

M) Growth regulators

abscisic acid, amidochlor, ancymidol, 6-benzylaminopurine, brassinolide, butralin, chlormequat (chlormequat chloride), choline chloride, cyclanilide, daminozide, dikegulac, dimethipin, 2,6-dimethylpuridine, ethephon, flumetralin, flurprimidol, fluthiacet, forchlorfenuron, gibberellic acid, inabenfide, indole-3-acetic acid , maleic hydrazide, mefluidide, mepiquat (mepiquat chloride), naphthaleneacetic acid, N-6-benzyladenine, paclobutrazol, prohexadione (prohexadione-calcium), prohydrojasmon, thidiazuron, triapenthenol, tributyl phosphorotrithioate, 2,3,5-tri-iodobenzoic acid , trinexapac-ethyl and uniconazole;

N) Herbicides

- acetamides: acetochlor, alachlor, butachlor, dimethachlor, dimethenamid, flufenacet, mefenacet, metolachlor, metazachlor, napropamide, naproanilide, pethoxamid, pretilachlor, propachlor, thenylchlor;
- amino acid derivatives: bilanafos, glyphosate, glufosinate, sulfosate;
- aryloxyphenoxypropionates: clodinafop, cyhalofop-butyl, fenoxaprop, fluazifop, haloxyfop, metamifop, propaquizafop, quizalofop, quizalofop-P-tefuryl;
- Bipyridyls: diquat, paraquat;
- (thio)carbamates: asulam, butylate, carbetamide, desmedipham, dimepiperate, eptam (EPTC), esprocarb, molinate, orbencarb, phenmedipham, prosulfocarb, pyributicarb, thiobencarb, triallate;
- cyclohexanediones: butroxydim, clethodim, cycloxydim, profoxydim, sethoxydim, tepraloxydim, tralkoxydim;
- dinitroanilines: benfluralin, ethalfluralin, oryzalin, pendimethalin, prodiamine, trifluralin;
- diphenyl ethers: acifluorfen, aclonifen, bifenox, diclofop, ethoxyfen, fomesafen, lactofen, oxyfluorfen;
- hydroxybenzonitriles: bomoxynil, dichlobenil, ioxynil;
- imidazolinones: imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr;
- phenoxy acetic acids: clomeprop, 2,4-dichlorophenoxyacetic acid (2,4-D), 2,4-DB, dichlorprop, MCPA, MCPA-thioethyl, MCPB, Mecoprop;
- pyrazines: chloridazon, flufenpyr-ethyl, fluthiacet, norflurazon, pyridate;
- pyridines: aminopyralid, clopyralid, diflufenican, dithiopyr, fluridone, fluroxypyr, picloram, picolinafen, thiazopyr;
- sulfonyl ureas: amidosulfuron, azimsulfuron, bensulfuron, chlorimuron-ethyl, chlorsulfuron, cinosulfuron, cyclosulfamuron, ethoxysulfuron, flazasulfuron, flucetosulfuron, flupyrsulfuron, foramsulfuron, halosulfuron, imazosulfuron, iodosulfuron, mesosulfuron, metazosulfuron, metsulfuron-methyl, nicosulfuron, oxasulfuron, primisulfuron, prosulfuron, pyrazosulfuron, rimsulfuron, sulfometuron, sulfosulfuron, thifensulfuron, triasulfuron, tribenuron, trifloxysulfuron, triflusulfuron, tritosulfuron, 1-((2-chloro-6-propyl-imidazo[1 ,2-b]pyridazin-3-yl)sulfonyl)-3-(4,6-dimethoxypyrimidin-2-yl)urea;
- triazines: ametryn, atrazine, cyanazine, dimethametryn, ethiozin, hexazinone, met-

amitron, metribuzin, prometryn, simazine, terbuthylazine, terbutryn, triaziflam;

- ureas: chlorotoluron, daimuron, diuron, fluometuron, isoproturon, linuron, methabenzthiazuron,tebuthiuron;
- other acetolactate synthase inhibitors: bispyribac-sodium, cloransulam-methyl, diclosulam, florasulam, flucarbazone, flumetsulam, metosulam, ortho-sulfamuron, penoxsulam, propoxycarbazone, pyribambenz-propyl, pyribenzoxim, pyriftalid, pyriminobac-methyl, pyrimisulfan, pyrithiobac, pyroxasulfone, pyroxsulam;
- others: amicarbazone, aminotriazole, anilofos, beflubutamid, benazolin, bencarbazone,benfluresate, benzofenap, bentazone, benzobicyclon, bicyclopyrone, bromacil, bromobutide, butafenacil, butamifos, cafenstrole, carfentrazone, cinidon-ethyl, chlorthal, cinmethylin, clomazone, cumyluron, cyprosulfamide, dicamba, difenzoquat, diflufenzopyr, *Drechslera monoceras,* endothal, ethofumesate, etobenzanid, fenoxasulfone, fentrazamide, flumiclorac-pentyl, flumioxazin, flupoxam, flurochloridone, flurtamone, indanofan, isoxaben, isoxaflutole, lenacil, propanil, propyzamide, quinclorac, quinmerac, mesotrione, methyl arsonic acid, naptalam, oxadiargyl, oxadiazon, oxaziclomefone, pentoxazone, pinoxaden, pyraclonil, pyraflufen-ethyl, pyrasulfotole, pyrazoxyfen, pyrazolynate, quinoclamine, saflufenacil, sulcotrione, sulfentrazone, terbacil, tefuryltrione, tembotrione, thiencarbazone, topramezone, (3-[2-chloro-4-fluoro-5-(3-methyl-2,6-dioxo-4-trifluoromethyl-3,6-dihydro-2H-pyrimidin-1-yl)-phenoxy]-pyridin-2-yloxy)-acetic acid ethyl ester, 6-amino-5-chloro-2-cyclopropyl-pyrimidine-4-carboxylic acid methyl ester, 6-chloro-3-(2-cyclopropyl-6-methyl-phenoxy)-pyridazin-4-ol, 4-amino-3-chloro-6-(4-chlorophenyl)-5-fluoro-pyridine-2-carboxylic acid, 4-amino-3-chloro-6-(4-chloro-2-fluoro-3-methoxy-phenyl)-pyridine-2-carboxylic acid methyl ester, and 4-amino-3-chloro-6-(4-chloro-3-dimethylamino-2-fluoro-phenyl)-pyridine-2-carboxylic acid methyl ester.

O) Insecticides

- organo(thio)phosphates: acephate, azamethiphos, azinphos-methyl, chlorpyrifos, chlorpyrifos-methyl, chlorfenvinphos, diazinon, dichlorvos, dicrotophos, dimethoate, disulfoton, ethion, fenitrothion, fenthion, isoxathion, malathion, methamidophos, methidathion, methyl-parathion, mevinphos, monocrotophos, oxydemeton-methyl, paraoxon, parathion, phenthoate, phosalone, phosmet, phosphamidon, phorate, phoxim, pirimiphos-methyl, profenofos, prothiofos, sulprophos, tetrachlorvinphos, terbufos, triazophos, trichlorfon;
- carbamates: alanycarb, aldicarb, bendiocarb, benfuracarb, carbaryl, carbofuran, carbosulfan, fenoxycarb, furathiocarb, methiocarb, methomyl, oxamyl, pirimicarb, propoxur, thiodicarb, triazamate;
- pyrethroids: allethrin, bifenthrin, cyfluthhn, cyhalothhn, cyphenothrin, cypermethhn, alpha-cypermethrin, beta-cypermethrin, zeta-cypermethrin, deltamethrin, esfenvalerate, etofenprox, fenpropathrin, fenvalerate, imiprothrin, lambda-cyhalothrin, permethrin, prallethrin, pyrethrin I and II, resmethrin, silafluofen, tau-fluvalinate, tefluthrin, tetramethrin, tralomethrin, transfluthrin, profluthrin, dimefluthrin;
- insect growth regulators: a) chitin synthesis inhibitors: benzoylureas:

chlorfluazuron, cyramazin, diflubenzuron, flucycloxuron, flufenoxuron, hexaflumuron, lufenuron, novaluron, teflubenzuron, triflumuron; buprofezin, diofenolan, hexythiazox, etoxazole, clofentazine; b) ecdysone antagonists: halofenozide, methoxyfenozide, tebufenozide, azadirachtin; c) juvenoids: pyriproxyfen, methoprene, fenoxycarb; d) lipid biosynthesis inhibitors: spirodiclofen, spiromesifen, spirotetramat;

- nicotinic receptor agonists/antagonists compounds: clothianidin, dinotefuran, flupyradifurone, imidacloprid, thiamethoxam, nitenpyram, acetamiprid, thiacloprid, 1-2-chloro-thiazol-5-ylmethyl)-2-nitrimino-3,5-dimethyl-[1 ,3,5]triazinane;
- GABA antagonist compounds: endosulfan, ethiprole, fipronil, vaniliprole, pyrafluprole, pyriprole, 5-amino-1 -(2,6-dichloro-4-methyl-phenyl)-4-sulfinamoyl-1H-pyrazole-3-carbothioic acid amide;
- macrocyclic lactone insecticides: abamectin, emamectin, milbemectin, lepimectin, spinosad, spinetoram;
- mitochondrial electron transport inhibitor (METI) I acaricides: fenazaquin, pyridaben, tebufenpyrad, tolfenpyrad, flufenerim;
- METI II and III compounds: acequinocyl, fluacyprim, hydramethylnon;
- Uncouplers: chlorfenapyr;
- oxidative phosphorylation inhibitors: cyhexatin, diafenthiuron, fenbutatin oxide, propargite;
- moulting disruptor compounds: cryomazine;
- mixed function oxidase inhibitors: piperonyl butoxide;
- sodium channel blockers: indoxacarb, metaflumizone;
- ryanodine receptor inhibitors: chlorantraniliprole, cyantraniliprole, flubendiamide, N-[4,6-dichloro-2-[(diethyl-lambda-4-sulfanylidene)carbamoyl]-phenyl]-2-(3-chloro-2-pyridyl)-5-(trifluoromethyl)pyrazole-3-carboxamide; N-[4-chloro-2-[(diethyl-lambda-4-sulfanylidene)carbamoyl]-6-methyl-phenyl]-2-(3-chloro-2-pyridyl)-5-(trifluoromethyl)pyrazole-3-carboxamide; N-[4-chloro-2-[(di-2-propyl-lambda-4-sulfanylidene)carbamoyl]-6-methyl-phenyl]-2-(3-chloro-2-pyridyl)-5-(trifluoromethyl)pyrazole-3-carboxamide; N-[4,6-dichloro-2-[(di-2-propyl-lambda-4-sulfanylidene)carbamoyl]-phenyl]-2-(3-chloro-2-pyridyl)-5-(trifluoromethyl)pyrazole-3-carboxamide; N-[4,6-dichloro-2-[(diethyl-lambda-4-sulfanylidene)carbamoyl]-phenyl]-2-(3-chloro-2-pyridyl)-5-(difluoromethyl)pyrazole-3-carboxamide; N-[4,6-dibromo-2-[(di-2-propyl-lambda-4-sulfanylidene)carbamoyl]-phenyl]-2-(3-chloro-2-pyridyl)-5-(trifluoromethyl)pyrazole-3-carboxamide; N-[4-chloro-2-[(di-2-propyl-lambda-4-sulfanylidene)carbamoyl]-6-cyano-phenyl]-2-(3-chloro-2-pyridyl)-5-(trifluoromethyl)pyrazole-3-carboxamide; N-[4,6-dibromo-2-[(diethyl-lambda-4-sulfanylidene)carbamoyl]-phenyl]-2-(3-chloro-2-pyridyl)-5-(trifluoromethyl)pyrazole-3-carboxamide;
- others: benclothiaz, bifenazate, cartap, flonicamid, pyridalyl, pymetrozine, sulfur, thiocyclam, cyenopyrafen, flupyrazofos, cyflumetofen, amidoflumet, imicyafos, bistrifluron, pyrifluquinazon and 1,1'-[(3S,4R,4aR,6S,6aS,12R,12aS,12bS)-4-[[(2-cyclopropylacetyl)oxy]methyl]-1 ,3,4,4a, 5,6,6a, 12, 12a, 12b-decahydro-1 2-hydroxy-

4,6a,12b-trimethyl-1 1-oxo-9-(3-pyridinyl)-2H ,11H-naphtho[2, 1-b]pyrano[3,4-e]pyran-3,6-diyl] cyclopropaneacetic acid ester.

2. The mixture according to claim 1, wherein component 1) and component 2) are present in a synergistically effective amount.

3. The mixture according to any of the claims 1 to 2, wherein component 1) and component 2) are present in a total weight ratio of from 10,000:1 to 1:100, wherein the total weight of component 1) is calculated on the basis of of the amount of CFU of component 1), wherein 1×10^{10} CFU equals one gram of total weight of component 1).

4. The mixture according to any of the claims 1 to 3, wherein component 1) is Trichoderma harzianum SK-55.

5. The mixture according to any of the claims 1 to 4, wherein component 1) is in a whole broth.

6. The mixture according to any of the claims 1 to 5, wherein component 1) is in a dormant form.

7. The mixture according to any of the claims 1 to 6, wherein component 1) is in the form of spores.

8. The mixture according to any of the claims 1 to 7, wherein component 1) is a metabolite selected from:
the peptaibol metabolites A, B and D wherein Ac is acetyl group at the N-terminus and Aib is a-aminobutyric acid and the C-terminus is an amino alcohol linkage and wherein the sequences below are partial N-terminal sequences of the respective metabolite:

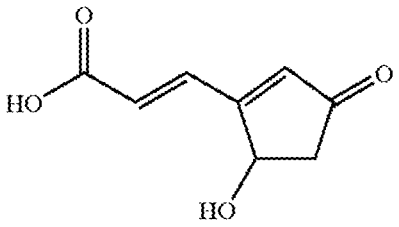
metabolite A of molecular weight of about 1933 +/- 10 and comprising the sequence Ac-Aib-Ala-Aib-Aib-Aib-Aib-Gln-Aib-Aib-,

metabolite B of a molecular weight of 1955 +/-10 and comprising the sequence Ac-Aib-Ala-Aib-Aib-Val-Aib-Gln-Aib-Aib-, and

metabolite D of molecular weight of about 1810 +/- 10 and comprising the sequence Ac-Aib-Ala-Aib-Aib-Aib

and

metabolite C of formula



.

9. The mixture according to any of the claims 1 to 8, wherein component 2) is selected from the groups L1) to L6):

L1) Microbial pesticides with fungicidal, bactericidal, viricidal and/or plant defense activator activity: Ampelomyces quisqualis M-10, Aspergillus flavus NRRL 21882, Aureobasidium pullulans DSM 14940, A. pullulans DSM 14941, Bacillus amyloliquefaciens AP-136 (NRRL B-50614), B. amyloliquefaciens AP-188 (NRRL B-50615), B. amyloliquefaciens AP-218 (NRRL B-50618), B. amyloliquefaciens AP-219 (NRRL B-50619), B. amyloliquefaciens AP-295 (NRRL B-50620), B. amyloliquefaciens FZB42, B. amyloliquefaciens IN937a, B. amyloliquefaciens IT-45 (CNCM I-3800), B. amyloliquefaciens subsp. plantarum MBI600 (NRRL B-50595), B. mojavensis AP-209 (NRRL B-50616), B. pumilus INR-7 (otherwise referred to as BU-F22 (NRRL B-50153) and BU-F33 (NRRL B-50185)), B. pumilus KFP9F, B. pumilus QST 2808 (NRRL B-30087), B. pumilus GHA 181, B. simplex ABU 288 (NRRL B-50340), B. solisalsi AP-217 (NRRL B-50617), B. subtilis CX-9060, B. subtilis GB03, B. subtilis GB07, B. subtilis QST-713 (NRRL B-21661), B. subtilis var. amyloliquefaciens FZB24, B. subtilis var. amyloliquefaciens D747, Candida oleophila I-82, C. oleophila O, C. saitoana, Clavibacter michiganensis (bacteriophages), Coniothyrium minitans CON/M/91-08, Cryphonectria parasitica, Cryptococcus albidus, Dilophosphora alopecuri, Fusarium oxysporum, Clonostachys rosea f. catenulata J1446 (also named Gliocladium catenulatum), Gliocladium roseum 321 U, Metschnikowia fructicola NRRL Y-30752, Microdochium dimerum, Microsphaeropsis ochracea P130A, Muscodor albus QST 20799, Paenibacillus polymyxa PKB1 (ATCC 202127), Pantoea vagans C9-1, Phlebiopsis gigantea, Pichia anomala WRL-76, Pseudozyma flocculosa PF-A22 UL, Pythium oligandrum DV 74, Sphaerodes mycoparasitica IDAC 301008-01, Streptomyces griseoviridis K61, S. lydicus WYEC 108, S. violaceusniger XL-2, S. violaceusniger YCED-9, Talaromyces flavus V117b, Trichoderma asperellum T34, T. asperellum SKT-1, T. asperellum ICC 012, T. atroviride LC52, T. atroviride CNCM 1-1237, T. fertile JM41 R, T. gamsii ICC 080, T. harmatum TH 382, T. harzianum TH-35, T. harzianum T-22, T. harzianum T-39, ; mixture of T. harzianum ICC012 and T. viride ICC080; mixture of T. polysporum and T. harzianum; T. stromaticum, T. virens (also named Gliocladium virens) GL-21, T. virens G41, T. viride TV1, Typhula phacorrhiza 94671, Ulocladium oudemansii HRU3, Verticillium dahlia, zucchini yellow mosaic virus (avirulent strain);

L2) Biochemical pesticides with fungicidal, bactericidal, viricidal and/or plant defense activator activity: chitosan (hydrolysate), harpin protein, laminarin, Menhaden fish oil, natamycin, Plum pox virus coat protein, potassium bicarbonate, Reynoutria sach-

linensis extract, salicylic acid, sodium bicarbonate, tea tree oil;

L3) Microbial pesticides with insecticidal, acaricidal, molluscidal and/or nematicidal activity: Agrobacterium radiobacter K1026, A radiobacter K84, Bacillus firmus 1-1582, B. thuringiensis ssp. aizawai strains ABTS-1857, SAN 401 I, ABG-6305 and ABG-6346, B. t. ssp. israelensis AM65-52, B. t. ssp. israelensis SUM-6218, B. t. ssp. galleriae SDS-502, B. t. ssp. kurstaki EG 2348, B. t. ssp. kurstaki SB4, B. t. ssp. kurstaki ABTS-351 (HD-1), Beauveria bassiana ATCC 74040, B. bassiana GHA, B. bassiana H123, B. bassiana DSM 12256, B. bassiana PPRI 5339, B. brongniartii, Burkholderia sp. A396, Chromobacterium subtsugae PRAA4-1 , Cydia pomonella granulosis virus V22, Cydia pomonella granulosis virus V 1, Isaria fumosorosea Apopka-97, Lecanicillium longisporum KV42, L. longisporum KV71 , L. muscarium (formerly Verticillium lecanii) KV01 , Metarhizium anisopliae FI-985, M. anisopliae FI-1045, M. anisopliae F52, M. anisopliae ICIPE 69, M. anisopliae var. acridum IMI 330189, Nomuraea rileyi strains SA86101, GU87401 , SR86151, CG128 and VA9101 , Paecilomyces fumosoroseus FE 9901 , P. lilacinus 251 , P. lilacinus DSM 15169, P. lilacinus BCP2, Paenibacillus popilliae Dutky-1940 (NRRL B-2309 = ATCC 14706), P. popilliae KLN 3, P. popilliae Dutky 1, Pasteuria spp. Ph3, Pasteuria spp. ATCC PTA-9643, Pasteuria spp. ATCC SD-5832, P. nishizawae PN-1 , P. penetrans, P. ramose, P. reneformis Pr-3, P. thornea, P. usgae, Pseudomonas fluorescens CL 145A, Steinernema carpocapsae, S. feltiae, S. kraussei L137;

L4) Biochemical pesticides with insecticidal, acaricidal, molluscidal, pheromone and/or nematicidal activity: L-carvone, citral, (E,Z)-7,9-dodecadien-1-yl acetate, ethyl formate, (E,Z)-2,4-ethyl decadienoate (pear ester), (Z,Z,E)-7,1 1,13-hexadecatrienal, heptyl butyrate, isopropyl myristate, cis-jasmone, lavanulyl senecioate, 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 actanoate, (E,Z,Z)-3,8,1 1-tetradecatrienyl acetate, (Z,E)-9,12-tetradecadien-1-yl acetate, Z-7-tetradecen-2-one, Z-9-tetradecen-1 -yl acetate, Z-1 1-tetradecenal, Z-1 1-tetradecen-1-ol, Acacia negra extract, extract of grapefruit seeds and pulp, extract of Chenopodium ambrosiodae, Catnip oil, Neem oil, Quillay extract, Tagetes oil;

L5) Microbial pesticides with plant stress reducing, plant growth regulator, plant growth promoting and/or yield enhancing activity: Azospirillum amazonense BR 11140 (SpY2T), A. brasilense AZ39, A. brasilense XOH, A. brasilense BR 11005 (Sp245), A. brasilense BR 11002, A. lipoferum BR 11646 (Sp31), A. irakense, A. halopraeferens, Bradyrhizobium sp. PNL01 , B. sp. (Arachis) CB1015, B. sp. (Arachis) USDA 3446, B. sp. (Arachis) SEMIA 6144, B. sp. (Arachis) SEMIA 6462, B. sp. (Arachis) SEMIA 6464, B. sp. (Vigna), B. elkanii SEMIA 587, B. elkanii SEMIA 5019, B. elkanii U-1301 , B. elkanii U-1302, B. elkanii USDA 74, B. elkanii USDA 76, B. elkanii USDA 94, B. elkanii USDA 3254, B. japonicum 532c, B. japonicum CPAC 15, B. japonicum E-109, B. japonicum G49, B. japonicum TA-1 1, B. japonicum USDA 3, B. japonicum USDA 31, B. japonicum USDA 76, B. japonicum USDA 110, B. japonicum USDA 121 , B. japonicum USDA 123, B. japonicum USDA 136, B. japonicum SEMIA 566,

B. japonicum SEMIA 5079, B. japonicum SEMIA 5080, B. japonicum WB74, B. liaoningense, B. lupini LL13, B. lupini WU425, B. lupini WSM471 , B. lupini WSM4024, Glomus intraradices RTI-801 , Mesorhizobium sp. WSM1271 , M. sp. WSM1497, M. ciceri CC1 192, M. huakii, M. loti CC829, M. loti SU343, Paenibacillus alvei NAS6G6, Penicillium bilaiae, Rhizobium leguminosarum bv. phaseolii, R. l. trifolii RP1 13-7, R. l. bv. viciae SU303, R. l. bv. viciae WSM1455, R. l. bv. viciae P1NP3Cst, R. tropici SEMIA 4088, Sinorhizobium meliloti MSDJ0848;

L6) Biochemical pesticides with plant stress reducing, plant growth regulator and/or plant yield enhancing activity: abscisic acid, aluminium silicate (kaolin), 3-decen-2-one, formononectin, genistein, hesperetin, homobrassinlide, humates, methyl jasmonate, cis-jasmone, lysophosphatidyl ethanlamine, naringenin, polymeric polyhydroxy acid, salicylic acid, Ascophyllum nodosum (Norwegian kelp, Brown kelp) extract and Ecklonia maxima (kelp) extract.

10. An agrochemical composition, comprising an auxiliary and a mixture as defined in any one of claims 1 to 9.

11. The agrochemical composition according to claim 10, further comprising as active component 3) a further pesticide.

12. A kit for preparing a usable pesticidal composition, the kit compring
a) a composition comprising component 1) as defined in any of the claims 1 to 9 and at least one auxiliary; and
b) a composition comprising component 2) as defined in any of the claims 1, 2, 3 and 9 and at least one auxiliary.

13. A method for controlling phytopathogenic fungi, insects or other pests and/or improving the health of plants and/or regulating plant growth, comprising treating the plants, the plant seed or the soil with an effective amount of the mixture as defined in any one of claims 1 to 9 or of the composition as defined in any of the claims 10 to 11 or of the kit as defined in claim 12.

14. A method for protection of plant propagation material from pests and/or improving the health of plants grown from said plant propagation material, wherein the plant propagation material are treated with a effective amount of the mixture as defined in any of claims 1 to 9 or of the compositions as defined in any of the claims 10 to 11 or of the kit as defined in claim 12.

15. A plant propagation material, comprising the mixture as defined in any one of claims 1 to 9 or the composition as defined in any of the claims 10 to 11 in an amount of from 0.01 g to 10000 g per 100 kg of plant propagation material.

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2014/063184

A. CLASSIFICATION OF SUBJECT MATTER
INV. A01N63/04 A01N37/42 A01N37/46 A01P3/00 A01P5/00
A01P7/00 A01P21/00
ADD.
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A01N

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal , WPI Data, BIOSIS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2000 093167 A (OUBI KEN KK; SASAKI YASUHARU) 4 April 2000 (2000-04-04) abstract ----	1-15
X	EP 1 180 523 A1 (HOKKAIDO GREEN K0SAN INC [JP]; SASAKI YASUHARU [JP]) 20 February 2002 (2002-02-20) cited in the application paragraphs [0001], [0008], [0014], [0020], [0022], [0025] - [0028], [0037], [0039], [0043], [0044], [0079], [0083] - [0085], [0091], [0093] paragraphs [0117] - [0119] -----	1-15

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

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"L" documentwhich may throw doubts on priority claim(s) orwhich is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 October 2014	20/10/2014

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	Klaver, Jos

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2014/063184

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 422 107 A (KUBOTA TERUMASA [JP]) 6 June 1995 (1995-06-06) cited in the application column 1, lines 8-15 ,28-55 column 2, lines 13-15 ,32-42 column 3, lines 1-13 column 5, lines 6-10 Embodiments 1 - 3	1-15
Y	WO 2009/060012 A2 (BASF SE [DE] ; V0ESTE DIRK [DE] ; BRAHM LUTZ [DE] ; WUTS MATHIJS [DE] ; HA) 14 May 2009 (2009-05-14) page 1, lines 6-12 page 7, lines 14-22 page 10, lines 9-22 page 11, lines 7-10,23-27 page 12, line 16 - page 17, line 33 page 28, line 37 - page 29, line 2	1-15
X	DATABASE BI0SIS [Online] BIOSCIENCES INFORMATION SERVICE, PHILADELPHIA, PA, US; April 2010 (2010-04) , EL-KATATNY M0MEIN H: "Enzyme Production and Nitrogen Fixation by Free, Immobilized and Coimmobi1ized Inoculants of Trichoderma harzianum and Azospirillurn brasilense and Their Possible Role in Growth Promotion of Tomato" , XP002717909 , Database accession no. PREV201000406163	1-3 ,5, 9-15
Y	abstract & EL-KATATNY M0MEIN H: "Enzyme Production and Nitrogen Fixation by Free, Immobilized and Coimmobi1ized Inoculants of Trichoderma harzianum and Azospirillurn brasilense and Their Possible Role in Growth Promotion of Tomato" , FOOD TECHNOLOGY AND BIOTECHNOLOGY, vol . 48, no. 2, April 2010 (2010-04) , pages 161-174, ISSN : 1330-9862	4-8
Y	W0 2010/009241 A2 (BI0W0RKS INC [US] ; MARTIN WILLIAM RANDOLPH JR [US] ; HAYES CHRISTOPHER) 21 January 2010 (2010-01-21) paragraphs [0002] , [0019] - [0023] , [0027] , [0029] - [0032] , [0040] , [0041] Examples 1-8 and experiments 1 & 2	1-15

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INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2014/063184

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	NI RANJAN RAJ S ET AL: "Synergi sti c effects of Tri choshi eld on enhancement of growth and resi stance to downy mi ldew in pearl mi llet" , BI0C0NTR0L, KLUWER ACADEMIC PUBLISHERS, DO, vol . 50, no. 3, 1 June 2005 (2005-06-01) , pages 493-509 , XP019230663 , ISSN : 1573-8248, D0I : 10. 1007/S10526-004-0460-X page 494, paragraph 2-3 page 495, paragraph 5 - page 496, paragraph 1 figures 1-4; tabl es 1,2 page 504, paragraph 1 - page 506, paragraph 3 ----	1-15
Y	M. S. JISHA ET AL: "Nutri ent uptake and yield of sorghum (Sorghum bicol or L. Moench) inocul ated wi th phosphate sol ubi l izing bacteri a and cel lulolyti c fungus in a cotton stal k amended verti sol ", MICROBIOL. RESEARCH , vol . 151, no. 2, 1 January 1996 (1996-01-01) , pages 213-217 , XP055093196, page 214, col umn 1, paragraph 4 page 214, col umn 2, paragraph 4-5 tabl es 1-3 page 216, col umn 1, paragraph 3 - page 217, col umn 1, paragraph 1 ----	1-15

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INTERNATIONAL SEARCH REPORT

International application No
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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