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(54) Title: FUNGICIDAL COMBINATIONS

(57) Abstract: The invention relates to active compound combinations, in particular within a fungicide composition, which comprises (A) at least one compound selected from the group of plant defense inducers, (B) at least one compound from the group of fungicidally active compounds consisting of members of the strobilurin group and (C) Tebuconazole.

FUNGICIDAL COMBINATIONS

The invention relates to active compound combinations, in particular within a fungicide composition, which comprises (A) at least one compound selected from the group of plant defense inducers, (B) at least one compound from the group of fungicidally active compounds consisting of members of the strobilurin group and (C) Tebuconazole.

Moreover, the invention relates to a method for curatively or preventively, in particular curatively, controlling the phytopathogenic fungi and bacteria of plants or crops, as well as a method for increasing the yield, to the use of a combination according to the invention for the treatment of seed, to a method for protecting a seed and not at least to the treated seed.

It is already known that the host defense inducers, e.g. Isotianil are highly suitable for protecting plants against attack by undesirable phytopathogenic fungi and microorganisms (WO 99/024 413, WO 2006/098128, JP 2007-84566, WO 96/29871US-A 5,240,951 und JP-A 06-009313). Isotianil according to the invention is suitable both for mobilizing the defenses of the plant against attack by undesirable phytopathogenic fungi and microorganisms and as microbicides for the direct control of phytopathogenic fungi and microorganisms. In addition, Isotianil is also active against pests which damage plants (WO 99/24414). In addition, combinations of Isotianil with selected fungicides have been described in WO 2005/009130 and WO 2010/069489. However, particular in curative applications against phytopathogenic fungi and bacteria, preferably in combination with an increase in yield, a highly efficient active agent or active agent combination is desired.

Since, moreover, the environmental and economic requirements imposed on modern-day fungicides are continually increasing, with regard, for example, to the spectrum of action, toxicity, selectivity, application rate, formation of residues, and favourable preparation ability, and since, furthermore, there may be problems, for example, with resistances, a constant task is to develop new fungicide agents which in some areas at least have advantages over their known counterparts.

The invention provides active compound combinations/compositions which in some aspects at least achieve the stated objectives.

It has now been found, surprisingly, that the combinations according to the invention not only bring about the additive enhancement of the spectrum of action with respect to the phytopathogen to be controlled that was in principle to be expected but also achieves a synergistic effect. Moreover, the combinations according to the instant invention show increased efficacy in curative applications, in particular for foliar applications, against phytopathogenic fungi as well as bacteria. Further, an increase in product quality could be obtained by use of the combinations of the present invention,

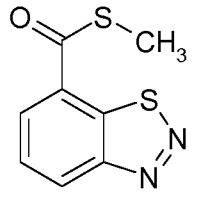
e.g. an enhancement in yield. Preferably an increased yield is achieved in combination with an enhanced efficacy against phytopathogenes, e.g. fungi and bacteria.

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Accordingly, the present invention provides a combination comprising:

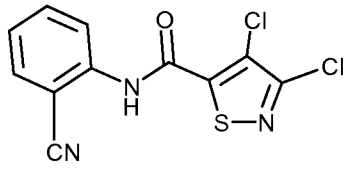
(A) at least one compound selected from the group of host defense inducers comprising

Acibenzolar-S-methyl:



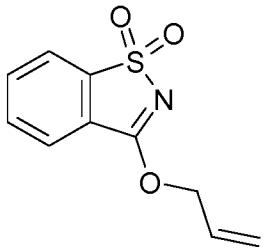
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Isotianil:



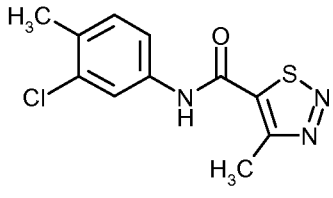
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Probenazole:



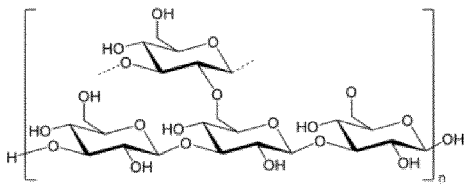
,

Tiadinil:



and

Laminarin:



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Therefrom, Acibenzolar-S-methyl, Isotianil, Probenazole and Tiadinil, or combinations thereof, are preferred; while Isotianil, Probenazole and Tiadinil are more preferred, and the most preferred host defense inducer is Isotianil.

The host defense inducers of the present invention may, if appropriate, be present in the form of mixtures of various isomeric forms which are possible, in particular stereoisomers, such as optical isomers.

(B) and at least one fungicidally active compound (B) selected from the group

comprising members of the strobilurin group as selected from Trifloxystrobin (141517-21-7), Dimoxystrobin (141600-52-4), Fluoxastrobin (361377-29-9), Pyraclostrobin (175013-18-0), Enestroburin (238410-11-2), Picoxystrobin (117428-22-5), Azoxystrobin (131860-33-8) and Mandestrobin (173662-97-0).

The most preferred strobilurin of this group is Trifloxystrobin.

(C) and as further fungicidally active compound (C) Tebuconazole (107534-96-3).

Particularly preferred combinations are listed below:

(A) Isotianil, (B) Trifloxystrobin and (C) Tebuconazole.

(A) Acibenzolar-S-methyl, (B) Trifloxystrobin and (C) Tebuconazole.

(A) Probenazole, (B) Trifloxystrobin and (C) Tebuconazole.

(A) Tiadinil, (B) Trifloxystrobin and (C) Tebuconazole.

The most preferred combination is (A) Isotianil, (B) Trifloxystrobin and (C) Tebuconazole.

In the combinations according to the invention the compounds A, B and C are present in a weight ratio of A:C:B (host defense inducer : azole : strobilurine) - with increasing preference in the order given - in a range of 100:10:1 to 1:10:100, of 50:5:1 to 1:5:50, of 20:3:1 to 1:3:20, of 10:3:1 to 1:3:10, of 5:2.5:1 to 1:2.5:5, of 4:2:1 to 1:2:4, of 4:2:1 to 1:1:1.

Most preferred is the weight ratio of A:C:B in the range of 4:2:1 to 1:1:1, further preferred for the above listed particulary preferred combinations.

Moreover, most preferred is the combination of (A) Isotianil, (C) Tebuconazole and (B) Trifloxystrobin in the weight ratio of A:C:B in the range of 4:2:1 to 1:1:1.

In an alternative embodiment, in the combinations according to the invention the compounds A, B and C are present in a weight ratio of A:C:B (host defense inducer : azole : strobilurine) - with increasing preference in the order given - in a range of 100:10:1 to 1:10:100, of 50:5:1 to 1:5:50, of 20:3:1 to 1:3:20, of 10:3:1 to 1:3:10, of 5:2.5:1 to 1:2.5:5, of 4:2:1 to 1:2:4.

Most preferred in said alternative embodiment is the weight ratio of A:C:B in the range of 4:2:1 to 1:2:4, further preferred for the above listed particulary preferred combinations.

Moreover, most preferred in said alternative embodiment is the combination of (A) Isotianil, (C) Tebuconazole and (B) Trifloxystrobin in the weight ratio of A:C:B in the range of 4:2:1 to 1:2:4.

Where a compound (A) or a compound (B) or compound (C) can be present in tautomeric form, such a compound is understood hereinabove and hereinbelow also to include, where applicable, corresponding tautomeric forms, even when these are not specifically mentioned in each case.

Compounds (A) or compounds (B) or compound (C) having at least one basic centre are capable of forming, for example, acid addition salts, e.g. with strong inorganic acids, such as mineral acids, e.g. perchloric acid, sulfuric acid, nitric acid, nitrous acid, a phosphoric acid or a hydrohalic acid, with strong organic carboxylic acids, such as unsubstituted substituted, e.g. halo-substituted, C_1-C_4 alkanecarboxylic acids, e.g. acetic acid, saturated or unsaturated dicarboxylic acids, e.g. oxalic, malonic, succinic, maleic, fumaric and phthalic acid, hydroxycarboxylic acids, e.g. ascorbic, lactic, malic, tartaric and citric acid, or benzoic acid, or with organic sulfonic acids, such as unsubstituted or substituted, e.g. halo-substituted, C_1-C_4alkane- or aryl-sulfonic acids, e.g. methane- or p-toluene-sulfonic acid. Compounds (A) or compounds (B) having at least one acid group are capable of forming, for example, salts with bases, e.g. metal salts, such as alkali metal or alkaline earth metal salts, e.g. sodium, potassium or magnesium salts, or salts with ammonia or an organic amine, such as morpholine, piperidine, pyrrolidine, a mono-, di- or tri-lower alkylamine, e.g. ethyl-, diethyl-, triethyl- or dimethyl-propyl-amine, or a mono-, di- or tri-hydroxy-lower alkylamine, e.g. mono-, di- or tri-ethanolamine. In addition, corresponding internal salts may optionally be formed. In the context of the invention, preference is given to agrochemically advantageous salts. In view of the close relationship between the compounds (A) or the compounds (B) in free form and in the form of their salts, hereinabove and herein below any reference to the free compounds (A) or free compounds (B) or to their salts should be understood as including also the corresponding salts or the free compounds (A) or free compounds (B), respectively, where appropriate and expedient. The equivalent also applies to tautomers of compounds (A) or compounds (B) and to their salts.

According to the invention the expression "combination" stands for the various combinations of compounds (A) (B) and (C), for example in a single "ready-mix" form, in a combined spray

mixture composed from separate formulations of the single active compounds, such as a "tank-mix", and in a combined use of the single active ingredients when applied in a sequential manner, i.e. one after the other with a reasonably short period, such as a few hours or days. Preferably the order of applying the compounds (A) (B) and (C) is not essential for working the present invention.

The compounds (A), (B) and (C) are listed by common names followed by the corresponding CAS-numbers in parenthesis. If no common name was available at the priority date of the application compounds are listed by IUPAC-names followed by the corresponding CAS-numbers in parenthesis or alternatively are given as structures.

In a further aspect there is provided a composition comprising a combination according to this invention. Preferably the composition comprises an agriculturally acceptable support, carrier or filler. Most preferred, the active ingredients of the compositions according to the present invention consist of Isotianil, Trifloxystrobin and Tebuconazole.

According to the invention, the term "support" denotes a natural or synthetic, organic or inorganic compound with which the active compounds of the instant invention are combined or associated to make it easier to apply them, notably to the parts of the plant. This support is thus generally inert and should be agriculturally acceptable. The support may be a solid or a liquid. Examples of suitable supports include clays, natural or synthetic silicates, silica, resins, waxes, solid fertilisers, water, alcohols, in particular butanol, organic solvents, mineral and plant oils and derivatives thereof. Mixtures of such supports may also be used.

The composition according to the invention may also comprise additional components. In particular, the composition may further comprise a surfactant. The surfactant can be an emulsifier, a dispersing agent or a wetting agent of ionic or non-ionic type or a mixture of such surfactants. Mention may be made, for example, of polyacrylic acid salts, lignosulphonic acid salts, phenolsulphonic or naphthalenesulphonic acid salts, polycondensates of ethylene oxide with fatty alcohols or with fatty acids or with fatty amines, substituted phenols (in particular alkylphenols or arylphenols), salts of sulphosuccinic acid esters, taurine derivatives (in particular alkyl taurates), phosphoric esters of polyoxyethylated alcohols or phenols, fatty acid esters of polyols, and derivatives of the present compounds containing sulphate, sulphonate and phosphate functions. The presence of at least one surfactant is generally essential when the active compound and / or the inert support are water-insoluble and when the vector agent for the application is water. Preferably, surfactant content may be comprised from 5% to 40% by weight of the composition.

Colouring agents such as inorganic pigments, for example iron oxide, titanium oxide, ferrocyanblue, and organic pigments such as alizarin, azo and metallophthalocyanine dyes, and

trace elements such as iron, manganese, boron, copper, cobalt, molybdenum and zinc salts can be used.

Optionally, other additional components may also be included, e.g. protective colloids, adhesives, thickeners, thixotropic agents, penetration agents, stabilisers, sequestering agents. More generally, the active compounds can be combined with any solid or liquid additive, which complies with the usual formulation techniques.

In general, the composition according to the invention may contain from 0.05 to 99% by weight of active compounds, preferably from 10 to 70% by weight.

The combination or composition according to the invention can be used as such, in form of their formulations or as the use forms prepared therefrom, such as aerosol dispenser, capsule suspension, cold fogging concentrate, dustable powder, emulsifiable concentrate, emulsion oil in water, emulsion water in oil, encapsulated granule, fine granule, flowable concentrate for seed treatment, gas (under pressure), gas generating product, granule, hot fogging concentrate, macrogranule, microgranule, oil dispersible powder, oil miscible flowable concentrate, oil miscible liquid, paste, plant rodlet, powder for dry seed treatment, seed coated with a pesticide, soluble concentrate, soluble powder, solution for seed treatment, suspension concentrate (flowable concentrate), ultra low volume (ULV) liquid, ultra low volume (ULV) suspension, water dispersible granules or tablets, water dispersible powder for slurry treatment, water soluble granules or tablets, water soluble powder for seed treatment and wettable powder.

The treatment of plants and plant parts with the active compound combination according to the invention is carried out directly or by action on their environment, habitat or storage area by means of the normal treatment methods, for example by watering (drenching), drip irrigation, spraying, atomizing, broadcasting, dusting, foaming, spreading-on, and as a powder for dry seed treatment, a solution for seed treatment, a water-soluble powder for seed treatment, a water-soluble powder for slurry treatment, or by encrusting. Patricular preferred are treatments for foliar applications.

These compositions include not only compositions which are ready to be applied to the plant or seed to be treated by means of a suitable device, such as a spraying or dusting device, but also concentrated commercial compositions which must be diluted before application to the crop.

The active compounds within the composition according to the invention have potent microbicide activity and can be employed for controlling undesired micro-organisms, such as fungi or bacteria, in crop protection or in the protection of materials.

Within the composition according to the invention, fungicide compounds can be employed in crop protection for example for controlling Plasmodiophoromycetes, Oomycetes, Chytridiomycetes, Zygomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes. Preferably, the compositions and combinations of the present invention are used for the control of *Alternaria solani, Sphaerotheca fuliginea* and *Pyricularia Oryzae*.

Particular preferred is the use for controlling *Alternaria solani* in *Solanaceae*, more preferred tomatoes.

Further preferred is the use for controlling *Sphaerotheca fuliginea* in *Cucurbitaceae*, more preferred cucumbers.

Further preferred is the use for controlling *Pyricularia Oryzae* in *Gramineae*, more preferred rice.

Within the composition according to the invention, bactericide compounds can be employed in crop protection for example for controlling Pseudomonadaceae, Xanthomonadaceae, Rhizobiaceae, Enterobacteriaceae, Corynebacteriaceae and Streptomycetaceae. Particular preferred is the use of the instant compositions or combinations for controlling Pseudomonadaceae and Xanthomonadaceae, even more preferred Pseudomonas glumae (Burkholderia glumae) and Xanthomonas campestris pv. Oryzae, wherein most preferred the protected crop are *Gramineae*, in particular rice.

The composition according to the invention can be used to curatively or preventively control the phytopathogenic fungi or bacteria of plants or crops. Thus, according to a further aspect of the invention, there is provided a method for curatively or preventively controlling the phytopathogenic fungi of plants or crops comprising the use of a fungicide composition according to the invention by application to the seed, the plant or to the fruit of the plant or to the soil in which the plant is growing or in which it is desired to grow. In the present invention the curative use is preferred. Further preferred is a curative use in combination with the use to increase the yield.

The composition of the invention is also suitable for the treatment of seeds. A large part of the damage caused by pests on cultigens occurs by infestation of the seed during storage and after sowing the seed in the ground as well as during and after germination of the plants. This phase is especially critical since the roots and shoots of the growing plant are particularly sensitive and even a small amount of damage can lead to withering of the whole plant.

The method of treatment according to the invention may also be useful to treat propagation material such as tubers or rhizomes, but also seeds, seedlings or seedlings pricking out and plants or plants pricking out. This method of treatment can also be useful to treat roots. The method of

treatment according to the invention can also be useful to treat the over-ground parts of the plant such as trunks, stems or stalks, leaves, flowers and fruit of the concerned plant.

Among the plants that can be protected by the method according to the invention, mention may be made of cotton ; flax ; vine ; fruit or vegetable crops such as *Rosaceae sp.* (for instance pip fruit such as apples and pears, but also stone fruit such as apricots, almonds and peaches), *Ribesioidae sp.*, *Juglandaceae sp.*, *Betulaceae sp.*, *Anacardiaceae sp.*, *Fagaceae sp.*, *Moraceae sp.*, *Oleaceae sp.*, *Actinidaceae sp.*, *Lauraceae sp.*, *Musaceae sp.* (for instance banana trees and plantins), *Rubiaceae sp.*, *Theaceae sp.*, *Sterculiceae sp.*, *Rutaceae sp.* (for instance lemons, oranges and grapefruit) ; *Solanaceae sp.* (for instance tomatoes), *Liliaceae sp.*, *Asteraceae sp.* (for instance lettuces), *Umbelliferae sp.*, *Cruciferae sp.*, *Chenopodiaceae sp.*, *Cucurbitaceae sp.*, *Papilionaceae sp.* (for instance peas), *Rosaceae sp.* (for instance strawberries) ; major crops such as *Graminae sp.* (for instance maize, lawn or cereals such as wheat, rye, rice, barley and triticale), *Asteraceae sp.* (for instance sunflower), *Cruciferae sp.* (for instance colza), *Fabacae sp.* (for instance peanuts), *Papilionaceae sp.* (for instance soybean), *Solanaceae sp.* (for instance potatoes), *Chenopodiaceae sp.* (for instance beetroots) ; horticultural and forest crops ; as well as genetically modified homologues of these crops.

The method of treatment according to the invention is used in the treatment of genetically modified organisms (GMOs), e.g. plants or seeds. Genetically modified plants (or transgenic plants) are plants of which a heterologous gene has been stably integrated into the genome. The expression “heterologous gene” essentially means a gene which is provided or assembled outside the plant and when introduced in the nuclear, chloroplastic or mitochondrial genome gives the transformed plant new or improved agronomic or other properties by expressing a protein or polypeptide of interest or by downregulating or silencing other gene(s) which are present in the plant (using for example, antisense technology, co-suppression technology or RNA interference – RNAi - technology). A heterologous gene that is located in the genome is also called a transgene. A transgene that is defined by its particular location in the plant genome is called a transformation or transgenic event.

Depending on the plant species or plant cultivars, their location and growth conditions (soils, climate, vegetation period, diet), the treatment according to the invention may also result in superadditive (“synergistic”) effects. Thus, for example, reduced application rates and/or a widening of the activity spectrum and/or an increase in the activity of the active compounds and compositions which can be used according to the invention, better plant growth, increased tolerance to high or low temperatures, increased tolerance to drought or to water or soil salt content, increased flowering performance, easier harvesting, accelerated maturation, higher harvest yields, bigger fruits, larger plant height, greener leaf color, earlier flowering, higher quality and/or a higher nutritional value of the harvested products, higher

sugar concentration within the fruits, better storage stability and/or processability of the harvested products are possible, which exceed the effects which were actually to be expected.

Plants and plant cultivars which are preferably to be treated according to the invention include all plants which have genetic material which impart particularly advantageous, useful traits to these plants (whether obtained by breeding and/or biotechnological means).

Plants and plant cultivars which are also preferably to be treated according to the invention are resistant against one or more biotic stresses, i.e. said plants show a better defense against animal and microbial pests, such as against nematodes, insects, mites, phytopathogenic fungi, bacteria, viruses and/or viroids.

Plants and plant cultivars which may also be treated according to the invention are those plants which are resistant to one or more abiotic stresses. Abiotic stress conditions may include, for example, drought, cold temperature exposure, heat exposure, osmotic stress, flooding, increased soil salinity, increased mineral exposure, ozon exposure, high light exposure, limited availability of nitrogen nutrients, limited availability of phosphorus nutrients, shade avoidance.

Plants and plant cultivars which may also be treated according to the invention, are those plants characterized by enhanced yield characteristics. Increased yield in said plants can be the result of, for example, improved plant physiology, growth and development, such as water use efficiency, water retention efficiency, improved nitrogen use, enhanced carbon assimilation, improved photosynthesis, increased germination efficiency and accelerated maturation. Yield can furthermore be affected by improved plant architecture (under stress and non-stress conditions), including but not limited to, early flowering, flowering control for hybrid seed production, seedling vigor, plant size, internode number and distance, root growth, seed size, fruit size, pod size, pod or ear number, seed number per pod or ear, seed mass, enhanced seed filling, reduced seed dispersal, reduced pod dehiscence and lodging resistance. Further yield traits include seed composition, such as carbohydrate content, protein content, oil content and composition, nutritional value, reduction in anti-nutritional compounds, improved processability and better storage stability.

Plants that may be treated according to the invention are hybrid plants that already express the characteristic of heterosis or hybrid vigor which results in generally higher yield, vigor, health and resistance towards biotic and abiotic stress factors. Such plants are typically made by crossing an inbred male-sterile parent line (the female parent) with another inbred male-fertile parent line (the male parent). Hybrid seed is typically harvested from the male sterile plants and sold to growers. Male sterile plants can sometimes (e.g. in corn) be produced by detasseling, i.e. the mechanical removal of the male reproductive organs (or males flowers) but, more typically, male sterility is the result of genetic determinants in the plant genome. In that case, and especially when seed is the desired product to be

harvested from the hybrid plants it is typically useful to ensure that male fertility in the hybrid plants is fully restored. This can be accomplished by ensuring that the male parents have appropriate fertility restorer genes which are capable of restoring the male fertility in hybrid plants that contain the genetic determinants responsible for male-sterility. Genetic determinants for male sterility may be located in the cytoplasm. Examples of cytoplasmic male sterility (CMS) were for instance described in Brassica species. However, genetic determinants for male sterility can also be located in the nuclear genome. Male sterile plants can also be obtained by plant biotechnology methods such as genetic engineering. A particularly useful means of obtaining male-sterile plants is described in WO 89/10396 in which, for example, a ribonuclease such as barnase is selectively expressed in the tapetum cells in the stamens. Fertility can then be restored by expression in the tapetum cells of a ribonuclease inhibitor such as barstar.

Plants or plant cultivars (obtained by plant biotechnology methods such as genetic engineering) which may be treated according to the invention are herbicide-tolerant plants, i.e. plants made tolerant to one or more given herbicides. Such plants can be obtained either by genetic transformation, or by selection of plants containing a mutation imparting such herbicide tolerance.

Herbicide-tolerant plants are for example glyphosate-tolerant plants, i.e. plants made tolerant to the herbicide glyphosate or salts thereof. Plants can be made tolerant to glyphosate through different means. For example, glyphosate-tolerant plants can be obtained by transforming the plant with a gene encoding the enzyme 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS). Examples of such EPSPS genes are the AroA gene (mutant CT7) of the bacterium S*almonella typhimurium*, the CP4 gene of the bacterium *Agrobacterium sp*, the genes encoding a Petunia EPSPS, a Tomato EPSPS, or an Eleusine EPSPS. It can also be a mutated EPSPS. Glyphosate-tolerant plants can also be obtained by expressing a gene that encodes a glyphosate oxido-reductase enzyme. Glyphosate-tolerant plants can also be obtained by expressing a gene that encodes a glyphosate acetyl transferase enzyme. Glyphosate-tolerant plants can also be obtained by selecting plants containing naturally-occurring mutations of the above-mentioned genes.

Other herbicide resistant plants are for example plants that are made tolerant to herbicides inhibiting the enzyme glutamine synthase, such as bialaphos, phosphinothricin or glufosinate. Such plants can be obtained by expressing an enzyme detoxifying the herbicide or a mutant glutamine synthase enzyme that is resistant to inhibition. One such efficient detoxifying enzyme is an enzyme encoding a phosphinothricin acetyltransferase (such as the bar or pat protein from Streptomyces species). Plants expressing an exogenous phosphinothricin acetyltransferase are also described.

Further herbicide-tolerant plants are also plants that are made tolerant to the herbicides inhibiting the enzyme hydroxyphenylpyruvatedioxygenase (HPPD). Hydroxyphenylpyruvatedioxygenases are

enzymes that catalyze the reaction in which para-hydroxyphenylpyruvate (HPP) is transformed into homogentisate. Plants tolerant to HPPD-inhibitors can be transformed with a gene encoding a naturally-occurring resistant HPPD enzyme, or a gene encoding a mutated HPPD enzyme. Tolerance to HPPD-inhibitors can also be obtained by transforming plants with genes encoding certain enzymes enabling the formation of homogentisate despite the inhibition of the native HPPD enzyme by the HPPD-inhibitor. Tolerance of plants to HPPD inhibitors can also be improved by transforming plants with a gene encoding an enzyme prephenate dehydrogenase in addition to a gene encoding an HPPD-tolerant enzyme.

Still further herbicide resistant plants are plants that are made tolerant to acetolactate synthase (ALS) inhibitors. Known ALS-inhibitors include, for example, sulfonylurea, imidazolinone, triazolopyrimidines, pyrimidinyoxy(thio)benzoates, and/or sulfonylaminocarbonyltriazolinone herbicides. Different mutations in the ALS enzyme (also known as acetohydroxyacid synthase, AHAS) are known to confer tolerance to different herbicides and groups of herbicides. The production of sulfonylurea-tolerant plants and imidazolinone-tolerant plants is describe. Other imidazolinone-tolerant plants are also described. Further sulfonylurea- and imidazolinone-tolerant plants are also described in for example WO 2007/024782.

Other plants tolerant to imidazolinone and/or sulfonylurea can be obtained by induced mutagenesis, selection in cell cultures in the presence of the herbicide or mutation breeding as described for example for soybeans, for rice, for sugar beet, for lettuce, or for sunflower.

Plants or plant cultivars (obtained by plant biotechnology methods such as genetic engineering) which may also be treated according to the invention are insect-resistant transgenic plants, i.e. plants made resistant to attack by certain target insects. Such plants can be obtained by genetic transformation, or by selection of plants containing a mutation imparting such insect resistance.

An “insect-resistant transgenic plant”, as used herein, includes any plant containing at least one transgene comprising a coding sequence encoding:

1) an insecticidal crystal protein from *Bacillus thuringiensis* or an insecticidal portion thereof, such as the insecticidal crystal proteins listed by Crickmore et al., Microbiology and Molecular Biology Reviews (1998), 62, 807-813, updated by Crickmore et al. (2005) at the *Bacillus thuringiensis* toxin nomenclature, online at: http://www.lifesci.sussex.ac.uk/Home/Neil_Crickmore/Bt/), or insecticidal portions thereof, e.g., proteins of the Cry protein classes Cry1Ab, Cry1Ac, Cry1F, Cry2Ab, Cry3Aa, or Cry3Bb or insecticidal portions thereof; or

2) a crystal protein from *Bacillus thuringiensis* or a portion thereof which is insecticidal in the presence of a second other crystal protein from *Bacillus thuringiensis* or a portion thereof, such as the binary toxin made up of the Cry34 and Cry35 crystal proteins; or

3) a hybrid insecticidal protein comprising parts of different insecticidal crystal proteins from *Bacillus thuringiensis,* such as a hybrid of the proteins of 1) above or a hybrid of the proteins of 2) above, e.g., the Cry1A.105 protein produced by corn event MON98034; or

4) a protein of any one of 1) to 3) above wherein some, particularly 1 to 10, amino acids have been replaced by another amino acid to obtain a higher insecticidal activity to a target insect species, and/or to expand the range of target insect species affected, and/or because of changes introduced into the encoding DNA during cloning or transformation, such as the Cry3Bb1 protein in corn events MON863 or MON88017, or the Cry3A protein in corn event MIR604;

5) an insecticidal secreted protein from *Bacillus thuringiensis* or *Bacillus cereus*, or an insecticidal portion thereof, such as the vegetative insecticidal (VIP) proteins listed at:

http://www.lifesci.sussex.ac.uk/home/Neil_Crickmore/Bt/vip.html, e.g., proteins from the VIP3Aa protein class; or

6) secreted protein from *Bacillus thuringiensis* or *Bacillus cereus* which is insecticidal in the presence of a second secreted protein from *Bacillus thuringiensis* or *B. cereus*, such as the binary toxin made up of the VIP1A and VIP2A proteins; or

7) hybrid insecticidal protein comprising parts from different secreted proteins from *Bacillus thuringiensis* or *Bacillus cereus,* such as a hybrid of the proteins in 1) above or a hybrid of the proteins in 2) above; or

8) protein of any one of 1) to 3) above wherein some, particularly 1 to 10, amino acids have been replaced by another amino acid to obtain a higher insecticidal activity to a target insect species, and/or to expand the range of target insect species affected, and/or because of changes introduced into the encoding DNA during cloning or transformation (while still encoding an insecticidal protein), such as the VIP3Aa protein in cotton event COT102.

Of course, an insect-resistant transgenic plant, as used herein, also includes any plant comprising a combination of genes encoding the proteins of any one of the above classes 1 to 8. In one embodiment, an insect-resistant plant contains more than one transgene encoding a protein of any one of the above classes 1 to 8, to expand the range of target insect species affected when using different proteins directed at different target insect species, or to delay insect resistance development to the plants by using

different proteins insecticidal to the same target insect species but having a different mode of action, such as binding to different receptor binding sites in the insect.

Plants or plant cultivars (obtained by plant biotechnology methods such as genetic engineering) which may also be treated according to the invention are tolerant to abiotic stresses. Such plants can be obtained by genetic transformation, or by selection of plants containing a mutation imparting such stress resistance. Particularly useful stress tolerance plants include:

a. plants which contain a transgene capable of reducing the expression and/or the activity of poly(ADP-ribose)polymerase (PARP) gene in the plant cells or plants

b. plants which contain a stress tolerance enhancing transgene capable of reducing the expression and/or the activity of the PARG encoding genes of the plants or plants cells.

c. plants which contain a stress tolerance enhancing transgene coding for a plant-functional enzyme of the nicotinamide adenine dinucleotide salvage synthesis pathway including nicotinamidase, nicotinate phosphoribosyltransferase, nicotinic acid mononucleotide adenyl transferase, nicotinamide adenine dinucleotide synthetase or nicotine amide phosphorybosyltransferase.

Examples of plants with the above-mentioned traits are non-exhaustively listed in Table A.

Table A

No.	Effected target or expressed principle(s)	Crop phenotype/Tolerance to
A-1	Acetolactate synthase (ALS)	Sulfonylureas, Imidazolinones, Triazolopyrimidines, Pyrimidyloxybenzoates, Phtalides
A-2	AcetylCoA Carboxylase (ACCase)	Aryloxyphenoxyalkanecarboxylic acids, cyclohexanediones
A-3	Hydroxyphenylpyruvate dioxygenase (HPPD)	Isoxazoles such as Isoxaflutol or Isoxachlortol, Triones such as mesotrione or sulcotrione
A-4	Phosphinothricin acetyltransferase	Phosphinothricin
A-5	O-Methyl transferase	altered lignin levels
A-6	Glutamine synthetase	Glufosinate, Bialaphos
A-7	Adenylosuccinate Lyase (ADSL)	Inhibitors of IMP and AMP synthesis
A-8	Adenylosuccinate Synthase	Inhibitors of adenylosuccinate synthesis
A-9	Anthranilate Synthase	Inhibitors of tryptophan synthesis and catabolism
A-10	Nitrilase	3,5-dihalo-4-hydroxy-benzonitriles such as Bromoxynil and Ioxinyl
A-11	5-Enolpyruvyl-3phosphoshikimate Synthase (EPSPS)	Glyphosate or sulfosate
A-12	Glyphosate oxidoreductase	Glyphosate or sulfosate
A-13	Protoporphyrinogen oxidase (PROTOX)	Diphenylethers, cyclic imides, phenylpyrazoles, pyridin derivatives, phenopylate, oxadiazoles, etc.
A-14	Cytochrome P450 eg. P450 SU1	Xenobiotics and herbicides such as Sulfonylureas

No.	Effected target or expressed principle(s)	Crop phenotype/Tolerance to
A-15	Dimboa biosynthesis (Bxl gene)	*Helminthosporium turcicum, Rhopalosiphum maydis, Diplodia maydis, Ostrinia nubilalis, lepidoptera sp.*
A-16	CMIII (small basic maize seed peptide)	plant pathogenes eg. *fusarium, alternaria, sclerotina*
A-17	Corn-SAFP (zeamatin)	plant pathogenes eg. *fusarium, alternaria, sclerotina, rhizoctonia, chaetomium, phycomyces*
A-18	Hml gene	Cochliobulus
A-19	Chitinases	plant pathogenes
A-20	Glucanases	plant pathogenes
A-21	Coat proteins	viruses such as maize dwarf mosaic virus, maize chlorotic dwarf virus
A-22	*Bacillus thuringiensis toxins, VIP 3, Bacillus cereus toxins, Photorabdus and Xenorhabdus toxins*	*lepidoptera, coleoptera, diptera,* nematodes, eg. *ostrinia nubilalis*, *heliothis zea*, armyworms eg. *Spodoptera frugiperda*, corn rootworms, *sesamia sp.*,black cutworm, asian corn borer, weevils
A-23	3-Hydroxysteroid oxidase	*lepidoptera, coleoptera, diptera,* nematodes, eg. *ostrinia nubilalis*, *heliothis zea*, armyworms eg. *Spodoptera frugiperda*, corn rootworms, *sesamia sp.*,black cutworm, asian corn borer, weevils
A-24	Peroxidase	*lepidoptera, coleoptera, diptera,* nematodes, eg. *ostrinia nubilalis*, *heliothis zea*, armyworms eg. *spodoptera frugiperda*, corn rootworms, *sesamia sp.*,black cutworm, asian corn borer, weevils
A-25	Aminopeptidase inhibitors eg. Leucine aminopeptidase inhibitor (LAPI)	*lepidoptera, coleoptera, diptera, nematodes, eg. ostrinia nubilalis, heliothis zea, armyworms eg. spodoptera* frugiperda, corn rootworms, sesamia sp., black cutworm,

No.	Effected target or expressed principle(s)	Crop phenotype/Tolerance to
		asian corn borer, weevils
A-26	Limonene synthase	corn rootworms
A-27	Lectines	*lepidoptera, coleoptera, diptera,* nematodes, eg. *ostrinia nubilalis, heliothis zea*,armyworms eg. *spodoptera frugiperda*, corn rootworms, *sesamia sp.*,black cutworm, asian corn borer, weevils
A-28	Protease Inhibitors eg. cystatin, patatin, virgiferin, CPTI	weevils, corn rootworm
A-29	ribosome inactivating protein	*lepidoptera, coleoptera, diptera,* nematodes, eg. *ostrinia nubilalis, heliothis zea*,armyworms eg. *spodoptera frugiperda*, corn rootworms, *sesamia sp.*,black cutworm, asian corn borer, weevils
A-30	maize 5C9 polypeptide	*lepidoptera, coleoptera, diptera,* nematodes, eg. *ostrinia nubilalis, heliothis zea*,armyworms eg. *spodoptera frugiperda*, corn rootworms, *sesamia sp.*,black cutworm, asian corn borer, weevils
A-31	HMG-CoA reductase	*lepidoptera, coleoptera, diptera,* nematodes, eg. *ostrinia nubilalis, heliothis zea*,armyworms eg. *spodoptera frugiperda*, corn rootworms, *sesamia sp.*,black cutworm, asian corn borer, weevils
A-32	Inhibition of protein synthesis	Chloroactanilides such as Alachlor, Acetochlor, Dimethenamid
A-33	Hormone mimic	2,4-D, Mecoprop-P

Plants or plant cultivars (obtained by plant biotechnology methods such as genetic engineering) which may also be treated according to the invention show altered quantity, quality and/or storage-stability of the harvested product and/or altered properties of specific ingredients of the harvested product such as :

1) transgenic plants which synthesize a modified starch, which in its physical-chemical characteristics, in particular the amylose content or the amylose/amylopectin ratio, the degree of branching, the average chain length, the side chain distribution, the viscosity behaviour, the gelling strength, the starch grain size and/or the starch grain morphology, is changed in comparison with the synthesised starch in wild type plant cells or plants, so that this is better suited for special applications.

2) transgenic plants which synthesize non starch carbohydrate polymers or which synthesize non starch carbohydrate polymers with altered properties in comparison to wild type plants without genetic modification. Examples are plants producing polyfructose, especially of the inulin and levan-type, plants producing alpha 1,4 glucans, plants producing alpha-1,6 branched alpha-1,4-glucans, plants producing alternan,

3) transgenic plants which produce hyaluronan.

Particularly useful transgenic plants which may be treated according to the invention are plants containing transformation events, or combination of transformation events, that are the subject of petitions for non-regulated status, in the United States of America, to the Animal and Plant Health Inspection Service (APHIS) of the United States Department of Agriculture (USDA) whether such petitions are granted or are still pending. At any time this information is readily available from APHIS (4700 River Road Riverdale, MD 20737, USA), for instance on its internet site (URL http://www.aphis.usda.gov/brs/not_reg.html). On the filing date of this application the petitions for nonregulated status that were pending with APHIS or granted by APHIS were those listed in table B which contains the following information:

A further aspect of the instant invention is a method of protecting natural substances of vegetable or animal origin or their processed forms, which have been taken from the natural life cycle, which comprises applying to said natural substances of vegetable or animal origin or their processed forms a combination of compounds (A), (B) and (C) in an effective amount, preferably in a synergistically effective amount.

A preferred embodiment is a method of protecting natural substances of vegetable origin or their processed forms, which have been taken from the natural life cycle, which comprises applying to said natural substances of vegetable origin or their processed forms a combination of compounds (A), (B) and (C) in an effective amount, preferably in a synergistically effective amount.

A further preferred embodiment is a method of protecting fruit, preferably pomes, stone fruits, soft fruits and citrus fruits, or their processed forms, which have been taken from the natural life cycle, which comprises applying to said natural substances of vegetable origin or their processed forms a combination of compounds (A), (B) and (C), in an effective amount, preferably in a synergistically effective amount.

The combinations of the present invention may also be used in the field of protecting technical material against attack of fungi. According to the instant invention, the term "technical material" includes paper; carpets; constructions; cooling and heating systems; wall-boards; ventilation and air conditioning systems and the like. The combinations according the present invention can prevent disadvantageous effects such as decay, discoloration or mold. Preferably "storage goods" is understood to denote wall-boards.

The method of treatment according to the invention can also be used in the field of protecting storage goods against attack of fungi. According to the instant invention, the term "storage goods" is understood to denote natural substances of vegetable or animal origin and their processed forms, which have been taken from the natural life cycle and for which long-term protection is desired. Storage goods of vegetable 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. Also falling under the definition of storage goods 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. Storage goods 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 "storage goods" is understood to denote natural substances of vegetable 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.

In another preferred embodiment of the invention "storage goods" is understood to denote wood. The fungicide combination or composition according to the invention may also be used against fungal diseases liable to grow on or inside timber. The term “timber” means all types of species of wood, and all types of working of this wood intended for construction, for example solid wood, high-density wood, laminated wood, and plywood. The method for treating timber according to the invention mainly consists in contacting one or more compounds according to the invention, or a composition according to the invention; this includes for example direct application, spraying, dipping, injection or any other suitable means.

Among the diseases of plants or crops that can be controlled by the method according to the invention, mention may be made of:

Powdery Mildew Diseases such as

Blumeria diseases caused for example by Blumeria graminis

Podosphaera diseases caused for example by Podosphaera leucotricha

Sphaerotheca diseases caused for example by Sphaerotheca fuliginea

Uncinula diseases caused for example by Uncinula necator

Rust Diseases such as

Gymnosporangium diseases caused for example by Gymnosporangium sabinae

Hemileia diseases caused for example by Hemileia vastatrix

Phakopsora diseases caused for example by Phakopsora pachyrhizi and Phakopsora meibomiae

Puccinia diseases caused for example by Puccinia recondite, and Puccinia triticina;

Uromyces diseases caused for example by Uromyces appendiculatus

Oomycete Diseases such as

Bremia diseases caused for example by Bremia lactucae

Peronospora diseases caused for example by Peronospora pisi and Peronospora brassicae

Phytophthora diseases caused for example by Phytophthora infestans

Plasmopara diseases caused for example by Plasmopara viticola

Pseudoperonospora diseases caused for example by Pseudoperonospora humuli and Pseudoperonospora cubensis

Pythium diseases caused for example by Pythium ultimum

Grainspot, Leafspot, Leaf blotch and Leaf Blight Diseases such as

Alternaria diseases caused for example by Alternaria solani

Cercospora diseases caused for example by Cercospora beticola

Cladiosporium diseases caused for example by Cladiosporium cucumerinum

Cochliobolus diseases caused for example by Cochliobolus sativus and Cochliobolus miyabeanus.;

Curvularia diseases; Fusarium diseases, Microdochium diseases, for example Microdochium oryzae; and Sarocladium diseases, for example Sarocladium oryzae.

(Conidiaform: Drechslera, Syn: Helminthosporium);

Colletotrichum diseases caused for example by Colletotrichum lindemuthianum

Cycloconium diseases caused for example by Cycloconium oleaginum

Diaporthe diseases caused for example by Diaporthe citri

Elsinoe diseases caused for example by Elsinoe fawcettii

Gloeosporium diseases caused for example by Gloeosporium laeticolor

Glomerella diseases caused for example by Glomerella cingulata

Guignardia diseases caused for example by Guignardia bidwellii

Leptosphaeria diseases caused for example by Leptosphaeria maculans

Magnaporthe diseases caused for example by Magnaporthe grisea (Pyricularia oryzae)

Mycosphaerella diseases caused for example by Mycosphaerella graminicola and Mycosphaerella fijiensis

Phaeosphaeria diseases caused for example by Phaeosphaeria nodorum

Pyrenophora diseases caused for example by Pyrenophora teres

Ramularia diseases caused for example by Ramularia collo-cygni

Rhynchosporium diseases caused for example by Rhynchosporium secalis

Septoria diseases caused for example by Septoria apii;

Typhula diseases caused for example by Thyphula incarnata

Venturia diseases caused for example by Venturia inaequalis

Root- and Stem Diseases such as

Corticium diseases caused for example by Corticium graminearum

Fusarium diseases caused for example by Fusarium oxysporum

Gaeumannomyces diseases caused for example by Gaeumannomyces graminis

Rhizoctonia diseases caused for example by Rhizoctonia solani

Oculimacula (Tapesia) diseases caused for example by Oculimacula Tapesia acuformis

Thielaviopsis diseases caused for example by Thielaviopsis basicola

Ear and Panicle Diseases including Maize cob such as

Alternaria diseases caused for example by Alternaria spp.

Aspergillus diseases caused for example by Aspergillus flavus

Cladosporium diseases caused for example by Cladiosporium cladosporioides

Claviceps diseases caused for example by Claviceps purpurea

Fusarium diseases caused for example by Fusarium culmorum

Gibberella diseases caused for example by Gibberella zeae

Monographella diseases caused for example by Monographella nivalis

Smut- and Bunt Diseases such as

Sphacelotheca diseases caused for example by Sphacelotheca reiliana

Tilletia diseases caused for example by Tilletia caries

Urocystis diseases Urocystis occulta

Ustilago diseases caused for example by Ustilago nuda;

Fruit Rot and Mould Diseases such as

Aspergillus diseases caused for example by Aspergillus flavus

Botrytis diseases caused for example by Botrytis cinerea

Penicillium diseases caused for example by Penicillium expansum and Penicillium purpurogenum

Sclerotinia diseases caused for example by Sclerotinia sclerotiorum;

Verticillium diseases caused for example by Verticillium alboatrum

Seed- and Soilborne Decay, Mould, Wilt, Rot and Damping-off diseases

Fusarium diseases caused for example by Fusarium culmorum

Phytophthora diseases caused for example by Phytophthora cactorum

Pythium diseases caused for example by Pythium ultimum

Rhizoctonia diseases caused for example by Rhizoctonia solani

Sclerotium diseases caused for example by Sclerotium rolfsii

Canker, Broom and Dieback Diseases such as

Nectria diseases caused for example by Nectria galligena

Blight Diseases such as

Monilinia diseases caused for example by Monilinia laxa

Leaf Blister or Leaf Curl Diseases including deformation of blooms and fruits such as

Taphrina diseases caused for example by Taphrina deformans

Decline Diseases of Wooden Plants such as

Esca disease caused for example by Phaeomoniella clamydospora and Phaeoacremonium aleophilum and Fomitiporia mediterranea

Diseases of Flowers and Seeds such as

Botrytis diseases caused for example by Botrytis cinerea

Diseases of Tubers such as

Rhizoctonia diseases caused for example by Rhizoctonia solani

Helminthosporium diseases caused for example by Helminthosporium solani

Diseases caused by Bacterial Organisms such as

Xanthomanas species for example Xanthomonas campestris pv. Oryzae

Pseudomonas species for example Pseudomonas syringae pv. Lachrymans

Erwinia species for example Erwinia amylovora.

Burkholderia species for example Burkholderia glumae in particular in rice;

as well as Acholeplasmatales species.

The compounds releated to this invention are preferably used to control the following diseases:

Fungal Diseases of the Foliage, Upper Stems, Pods and Seeds for example

Alternaria leaf spot (Alternaria spec. atrans tenuissima), Anthracnose (Colletotrichum gloeosporoides dematium var. truncatum), Brown spot (Septoria glycines), Cercospora leaf spot and blight (Cercospora kikuchii), Choanephora leaf blight (Choanephora infundibulifera trispora (Syn.)), Dactuliophora leaf spot (Dactuliophora glycines), Downy Mildew (Peronospora manshurica), Drechslera blight (Drechslera glycini), Frogeye Leaf spot (Cercospora sojina), Leptosphaerulina Leaf Spot (Leptosphaerulina trifolii), Phyllostica Leaf Spot (Phyllosticta sojaecola), Pod and Stem Blight (Phomopsis sojae), Powdery Mildew (Microsphaera diffusa), Pyrenochaeta Leaf Spot (Pyrenochaeta glycines), Rhizoctonia Aerial, Foliage, and Web Blight (Rhizoctonia solani), Rust (Phakopsora pachyrhizi, Phakopsora meibomiae), Scab (Sphaceloma glycines), Stemphylium Leaf Blight (Stemphylium botryosum), Target Spot (Corynespora cassiicola), Leaf Blast (Pyricularia oryzae), Bacterial Panicle Blight (Burkholderia glumae).

Fungal Disease of the Roots and Lower Stems for example

Black Root Rot (Calonectria crotalariae), Charcoal Rot (Macrophomina phaseolina), Fusarium Blight or Wilt, Root Rot, and Pod and Collar Rot (Fusarium oxysporum, Fusarium orthoceras, Fusarium semitectum, Fusarium equiseti), Mycoleptodiscus Root Rot (Mycoleptodiscus terrestris), Neocosmospora (Neocosmopspora vasinfecta), Pod and Stem Blight (Diaporthe phaseolorum), Stem Canker (Diaporthe phaseolorum var. caulivora), Phytophthora Rot (Phytophthora

megasperma), Brown Stem Rot (Phialophora gregata), Pythium Rot (Pythium aphanidermatum, Pythium irregulare, Pythium debaryanum, Pythium myriotylum, Pythium ultimum), Rhizoctonia Root Rot, Stem Decay, and Damping-Off (Rhizoctonia solani), Sclerotinia Stem Decay (Sclerotinia sclerotiorum), Sclerotinia Southern Blight (Sclerotinia rolfsii), Thielaviopsis Root Rot (Thielaviopsis basicola).

The method of treatment according to the invention also provides the use of compounds (A), (B) and (C) in a simultaneous, separate or sequential manner.

The dose of active compound (sum of (A), (B) and (C)) usually applied in the method of treatment according to the invention is generally and advantageously

- for foliar treatments: from 0.1 to 10,000 g/ha, preferably from 10 to 1,000 g/ha, more preferably from 50 to 500 g/ha; most preferred from 150 to 300 g/ha, in case of drench or drip application, the dose can even be reduced, especially while using inert substrates like rockwool or perlite;

- for seed treatment: from 0,1 to 200 g per 100 kilogram of seed, preferably from 0,2 to 150 g per 100 kilogram of seed, most preferably from 0,5 to 100 g per 100 kilogram of seed;

- for soil treatment: from 0.1 to 10,000 g/ha, preferably from 1 to 5,000 g/ha.

The doses herein indicated are given as illustrative examples of the method according to the invention. A person skilled in the art will know how to adapt the application doses, notably according to the nature of the plant or crop to be treated.

The compounds or mixtures according to the invention may also be used for the preparation of composition useful to curatively or preventively treat human or animal fungal diseases such as, for example, mycoses, dermatoses, trichophyton diseases and candidiases or diseases caused by *Aspergillus spp.*, for example *Aspergillus fumigatus*.

Mycotoxins

Furthermore compounds or mixtures according to the invention may also be used to reduce the contents of mycotoxins in the harvested crops and therefore in foods and animal feed stuff made therefrom.

Especially but not exclusively the following mycotoxins can be specified:

Deoxynivalenole (DON), Nivalenole, 15-Ac-DON, 3-Ac-DON, T2- und HT2- Toxins, Fumonisines, Zearalenone Moniliformine, Fusarine, Diaceotoxyscirpenole (DAS), Beauvericine, Enniatine,

Fusaroproliferine, Fusarenole, Ochratoxines, Patuline, Ergotalcaloides und Aflatoxines, which are caused for example by the following fungal diseases: Fusarium spec., like Fusarium acuminatum, F. avenaceum, F. crookwellense, F. culmorum, F. graminearum (Gibberella zeae), F. equiseti, F. fujikoroi, F. musarum, F. oxysporum, F. proliferatum, F. poae, F. pseudograminearum, F. sambucinum, F. scirpi, F. semitectum, F. solani, F. sporotrichoides, F. langsethiae, F. subglutinans, F. tricinctum, F. verticillioides and others but also by Aspergillus spec., Penicillium spec., Claviceps purpurea, Stachybotrys spec. and others.

Treatment of seeds

The invention comprises a procedure in which the seed is treated at the same time with a compound of Group (A) and a compound selected from group (B). It further comprises a method in which the seed is treated with compound of Group (A) and a compound selected from group (B) separately.

The invention comprises a procedure in which the seed is treated at the same time with a compound of Group (A), a compound selected from group (B) and a compound selected from group (C). It further comprises a method in which the seed is treated with compound of Group (A), a compound selected from group (B) and a compound selected from group (c) separately.

The invention also comprises a seed, which has been treated with a compound of Group (A) and a compound selected from group (B) at the same time. The invention also comprises a seed, which has been treated with a compound of Group (A) and a compound selected from group (B) separately. For the latter seed, the active ingredients can be applied in separate layers. These layers can optionally be separated by an additional layer that may or may not contain an active ingredient.

The invention also comprises a seed, which has been treated with a compound of Group (A), a compound selected from group (B) and a compound of Group (C) at the same time. The invention also comprises a seed, which has been treated with a compound of Group (A), a compound selected from group (B) and a compound of Group (C) separately. For the latter seed, the active ingredients can be applied in separate layers. These layers can optionally be separated by an additional layer that may or may not contain an active ingredient.

The combination/ compositions of the invention can be applied directly, that is without containing additional components and without being diluted. It is normally preferred to apply the combination/ composition to the seed in the form of a suitable formulation. Suitable formulations and methods for seed treatment are known to the person skilled in the art and are described, for example, in the following documents: US 4,272,417 A, US 4,245,432 A, US 4,808,430 A, US 5,876,739 A, US 2003/0176428 A1, WO 2002/080675 A1, WO 2002/028186 A2.

According to another aspect of the present invention, in the combination or composition according to the invention, the compound ratio A/B/C may be advantageously chosen so as to produce a synergistic effect. The term synergistic effect is understood to mean in particular that defined by Colby in an article entitled "Calculation of the synergistic and antagonistic responses of herbicide combinations" Weeds, (1967), 15, pages 20-22.

The advanced fungicidal activity of the active compound combinations according to the invention as well as the increase in yield is evident from the example below. While the individual active compounds exhibit weaknesses with regard to the fungicidal activity, the combinations have an activity which exceeds a simple addition of activities.

A synergistic effect of fungicides is always present when the fungicidal activity of the active compound combinations exceeds the total of the activities of the active compounds when applied individually. The expected activity for a given combination of two active compounds can be calculated as follows (cf. Colby, S.R., "Calculating Synergistic and Antagonistic Responses of Herbicide Combinations", *Weeds* **1967**, *15*, 20-22):

If

X is the efficacy when active compound A is applied at an application rate of m ppm (or g/ha),

Y is the efficacy when active compound B is applied at an application rate of n ppm (or g/ha),

Z is the efficacy when active compound B is applied at an application rate of r ppm (or g/ha),

E_1 is the efficacy when the active compounds A and B are applied at application rates of m and n ppm (or g/ha), respectively, and

E_2 is the efficacy when the active compounds A, B and C are applied at application rates of m, n and r ppm (or g/ha), respectively, and

then

$$E_1 = X + Y - \frac{X \cdot Y}{100}$$

and for a ternary mixture:

$$E_2 = X + Y + Z - \left(\frac{X \cdot Y + X \cdot Z + Y \cdot Z}{100} \right) + \frac{X \cdot Y \cdot Z}{10000}$$

The degree of efficacy, expressed in % is denoted. 0 % means an efficacy which corresponds to that of the control while an efficacy of 100 % means that no disease is observed.

If the actual fungicidal activity exceeds the calculated value, then the activity of the combination is superadditive, i.e. a synergistic effect exists. In this case, the efficacy which was actually observed must be greater than the value for the expected efficacy (E) calculated from the abovementioned formula.

A further way of demonstrating a synergistic effect is the method of Tammes (cf. "Isoboles, a graphic representation of synergism in pesticides" in *Neth. J. Plant Path.*, **1964**, *70*, 73-80).

The invention is illustrated by the following examples. However the invention is not limited to the examples.

Example A: *in vivo* preventive test on *Alternaria* test (tomatoes)

Solvent:	24.5	parts by weight of acetone
	24.5	parts by weight of dimethylacetamide
Emulsifier:	1	part by weight of alkylaryl polyglycol ether

To produce a suitable preparation of active compound, 1 part by weight of active compound is mixed with the stated amounts of solvent and emulsifier, and the concentrate is diluted with water to the desired concentration. To test for preventive activity, young plants are sprayed with the preparation of active compound at the stated rate of application. After the spray coating has dried on, the plants are inoculated with an aqueous spore suspension of ***Alternaria solani***. The plants are then placed in an incubation cabinet at approximately 20°C and a relative atmospheric humidity of 100%. The test is evaluated 3 days after the inoculation. 0% means an efficacy which corresponds to that of the untreated control while an efficacy of 100% means that no disease is observed.

The table below clearly shows that the observed activity of the active compound combination according to the invention is greater than the calculated activity, i.e. a synergistic effect is present.

Table A: *in vivo* preventive test on *Alternaria* test (tomatoes)

Active compounds		Application rate of active compound in ppm a.i.	Efficacy in %	
			found*	calc.**
trifloxystrobin (TFS)		2.5 1.25	50 30	
tebuconazole (TBZ)		5 2.5	55 8	
isotianil (IST)		7.5 3.75	0 0	
(TFS) + (TBZ) + (IST)	1:2:3	2.5 + 5 + 7.5	84	78
(TFS) + (TBZ) + (IST)	1:2:3	1.25 + 2.5 + 3.75	70	35

* found = activity found
** calc. = activity calculated using Colby's formula

Example B: *in vivo* preventive test on *Sphaerotheca* test (cucumbers)

Solvent:	24.5	parts by weight of acetone
	24.5	parts by weight of dimethylacetamide
Emulsifier:	1	part by weight of alkylaryl polyglycol ether

To produce a suitable preparation of active compound, 1 part by weight of active compound is mixed with the stated amounts of solvent and emulsifier, and the concentrate is diluted with water to the desired concentration. To test for preventive activity, young plants are sprayed with the preparation of active compound at the stated rate of application. After the spray coating has dried on, the plants are inoculated with an aqueous spore suspension of ***Sphaerotheca fuliginea***. The plants are then placed in a greenhouse at approximately 23°C and a relative atmospheric humidity of approximately 70%. The test is evaluated 7 days after the inoculation. 0% means an efficacy which corresponds to that of the untreated control, while an efficacy of 100% means that no disease is observed.

The table below clearly shows that the observed activity of the active compound combination according to the invention is greater than the calculated activity, i.e. a synergistic effect is present.

Table B: *in vivo* preventive test on *Sphaerotheca* test (cucumbers)

Active compounds	Application rate of active compound in ppm a.i.	Efficacy in %	
		found*	calc.**
trifloxystrobin (TFS)	2.5	0	
tebuconazole (TBZ)	5	58	
isotianil (IST)	7.5	0	
(TFS) + (TBZ) + (IST) 1:2:3	2.5 + 5 + 7.5	72	58

* found = activity found
** calc. = activity calculated using Colby's formula

Efficacy of Combinations according to the Invention against Rice Diseases (Foliar and Panicle Applications)

In a several field trials the efficacy of straight Nativo and Nativo – Isotianil Combinations were tested to find out the efficacy against various rice diseases when sprayed on leaves or panicles.

These tests were run in different countries against several bacterial and fungal rice diseases.

The field trials were completely randomized, had 3 – 4 replicates and plot size was 10 – 20 m². Fertilization, herbicide- and insecticide applications were carried out according to the local agricultural practice.

The following test compounds were applied straight or in tank mixtures:

Isotianil (IST), Trifloxystrobine (TFS) and Tebuconazole (TBZ)

Example 1:
Xanthomonas campestris pv. Oryzae , Bacterial Leaf Blight, Columbia

In 2014 rice in growth stage EC 45 was treated with a foliar application and one week later the efficacy of the products against Bacterial Leaf Blight was visually assessed as incidence of infested leaves per plot (in %). Then the incidence was converted into control (% Abbott).

The values can be found in table 1.

Table.1 Impact of TFS/TBZ and TFS/TBZ/ISTCombinations on the control of Bacterial Leaf Blight in Rice (Foliar Application).

						Xanthomonas	
						LEAF	
	Rate (g a.i./ha)					Incidence (%)	Abbott (%)
Treatment	TBZ	TFS	IST	Difenconazole	Azoxystrobine	7 days after application	
UNTREATED						73	-
TFS/TBZ	60	30	-	-	-	65	11
TFS/TBZ	80	40	-	-	-	64	12
TFS/TBZ	100	50	-	-	-	60	18
TFS/TBZ/IST	60	30	75	-	-	53	28
TFS/TBZ/IST	60	30	100	-	-	45	38
TFS/TBZ/IST	80	40	75	-	-	43	42
TFS/TBZ/IST	80	40	100	-	-	40	45
TFS/TBZ/IST	100	50	75	-	-	45	38
TFS/TBZ/IST	100	50	100	-	-	30	59
AMISTAR TOP	-	-	-	50	80	58	21

Based on this trial we can conclude that the combination of IST/TFS/TBZ in tank mixture combinations increases the control of bacteria leaf blight compared to straight TFS/TBZ .

Example 2:
Pseudomonas glumae (Burkholderia glumae), Panicle Blight, Costa Rica

In 2014 rice in the growth stages EC 45 and EC 57 was treated with foliar and panicle applications and about two weeks after the second application the efficacy of the products against the bacterial pathogen Panicle Blight was visually assessed as severity of infested necks per plot (in %). Then the severity was converted into control (% Abbott).

The values can be found in table 2.

Table.2 Impact of Straight TFS/TBZ and TFS/TBZ/ISTl Combinations on the control of Bacterial Panicle Blight in Rice (Foliar and Panicle Applications).

	Rate (g a.i./ha)					Pseudomonas glumae neck severity (%)	Abbott (%)
Treatment	TBZ	TFS	IST	Oxytetracycline + Streptomycine	Epoxiconazole + Kresoxim Methyl	15 days after 2nd application	
UNTREATED						9	0
TFS/TBZ	60	30	-	-	-	5	41
TFS/TBZ	80	40	-	-	-	4	53
TFS/TBZ	100	50	-	-	-	2	82
TFS/TBZ/IST	60	30	75	-	-	1	87
TFS/TBZ/IST	60	30	100	-	-	1	86
TFS/TBZ/IST	80	40	75	-	-	1	89
TFS/TBZ/IST	80	40	100	-	-	1	85
TFS/TBZ/IST	100	50	75	-	-	1	94
TFS/TBZ/IST	100	50	100	-	-	2	80
Agrimycine Juwel	-	-	-	67	200	3	63

Based on this trial we can conclude that the combination of IST/TFS/TBZ in tank mixture combinations increases the control of neck bacterial panicle blight of straight TFS/TBZ .

Table.2 continued: Impact of Straight TFS/TBZ and TFS/TBZ/ISTl Combinations on Yield

	Rate (g a.i./ha)					Yield (kg/ha)	(%)
Treatment	TBZ	TFS	IST				
UNTREATED						719	100
TFS/TBZ	60	30	-			779	108
TFS/TBZ	80	40	-			775	108
TFS/TBZ	100	50	-			731	102
TFS/TBZ/IST	60	30	75			817	114
TFS/TBZ/IST	60	30	100			-	-
TFS/TBZ/IST	80	40	75			838	117
TFS/TBZ/IST	80	40	100			-	-
TFS/TBZ/IST	100	50	75			820	114
TFS/TBZ/IST	100	50	100			-	-

Based on this trial we can conclude that the application of the combinations of the present invention increases the control of neck bacterial panicle blight and yield.

Example 3:
Pyricularia Oryzae (Magnaporthe grisea), Leaf and Panicle Blast, Columbia

In 2014 rice in the growth stages EC 45 and EC 58 was treated with foliar and panicle applications. Four weeks after the second application the efficacy of the products against the fungal pathogen leaf and panicle blast was visually assessed as severity of infested panicles per plot (in %). Then the severity was converted into control (% Abbott).

The values can be found in table 3.

Table.3 Impact of Straight TFS/TBZ and TFS/TBZ – Isotianil Combinations on the control of Blast in Rice (Foliar and Panicle Applications).

						Pyricularia oryzae	
						PANICLE	
	Rate (g a.i./ha)					Severity (%)	Abbott (%)
Treatment	TBZ	TFS	IST	Difenconazole	Azoxystrobine	28 days after 2nd application	
UNTREATED						77	0
TFS/TBZ	80	40	-	-	-	30	61
TFS/TBZ	100	50	-	-	-	26	66
TFS/TBZ/IST	80	40	75	-	-	24	69
TFS/TBZ/IST	80	40	100	-	-	25	68
TFS/TBZ/IST	100	50	75	-	-	18	77
TFS/TBZ/IST	100	50	100	-	-	14	82
AMISTAR TOP	-	-	-	50	80	14	82

Based on this trial we can that conclude the combination of IST/TFS/TBZ in tank mixture combinations increases the control of panicle blast compared to straight TFS/TBZ .

Table.3 continued: Impact of Straight TFS/TBZ and TFS/TBZ – Isotianil Combinations on yield

	Rate (g a.i./ha)					Yield (dt/ha) (%)	(%)
Treatment	TBZ	TFS	IST				
UNTREATED						55	100
TFS/TBZ	80	40	-			68	123
TFS/TBZ	100	50	-			71	128
TFS/TBZ/IST	80	40	75			73	132
TFS/TBZ/IST	80	40	100			74	135
TFS/TBZ/IST	100	50	75			75	136
TFS/TBZ/IST	100	50	100			75	136

Based on this trial we can conclude that the application of the combinations of the present invention increases the control of panicle blight and yield.

Example 4:
Pyricularia Oryzae (Magnaporthe grisea), Leaf Blast, Indonesia

In 2014 rice in the growth stages EC 29 and EC 45 was treated with two subsequent foliar applications. 25 days after the second application the efficacy of the products against the fungal pathogen leaf blast was visually assessed as severity of infested leaves in the plot (in %). Then the severity was converted into control (% Abbott).

The values can be found in table 4.

Table.4 Impact of Straight TFS/TBZ and TFS/TBZ – Isotianil Combinations on the control of Leaf Blast in Rice (Foliar Applications).

						Pyricularia oryzae leaves severity (%)	Abbott (%)
	Rate (g a.i./ha)						
Treatment	TBZ	TFS	IST	Difenconazole	Azoxystrobine	25 days after 2nd application	
UNTREATED						47	0
TFS/TBZ	60	30	-	-	-	45	4
TFS/TBZ	120	60	-	-	-	25	46
TFS/TBZ	150	75	-	-	-	19	59
Isotianil			90	-	-	38	18
TFS/TBZ/IST	60	30	45	-	-	25	46
TFS/TBZ/IST	120	60	90	-	-	18	61
TFS/TBZ/IST	150	75	112,5	-	-	5	89
AMISTAR TOP	-	-	-	37,5	60	23	51

Based on this trial we can conclude that the Combination of IST/TFS/TBZ in tank mixture combinations increases the control of leaf blast compared to straight TFS/TBZ.

Example 5:
Panicle Disease Complex (mixed fungal and bacterial pathogens), China

In 2014 rice in the growth stages EC 29, EC 47 and EC 58 was treated with foliar and panicle applications. About 4 weeks after the third application the efficacy of the products against the mixed panicle disease complex was visually assessed as severity of infested panicles (in %). Then the severity was converted into control (% Abbott).

The values can be found in table 5.

Table.5 Impact of Straight TFS/TBZ and TFS/TBZ/IST Combinations on the control of mixed panicle disease complex Rice (Foliar and Panicle Applications).

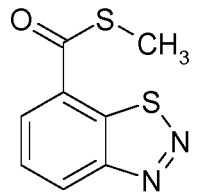
					Mixed bacterial and fungal infection	
					panicle	
	Rate (g a.i./ha)				severity (%)	Abbott (%)
Treatment	TBZ	TFS	IST	Thiodiazole ZN	4 weeks after 3rd application	
UNTREATED					4	-
TFS/TBZ	60	30	-	-	2	37
TFS/TBZ	120	60	-	-	2	42
TFS/TBZ	150	75	-	-	2	47
Isotianil	-	-	90	-	3	34
TFS/TBZ/IST	60	30	45	-	2	40
TFS/TBZ/IST	120	60	90	-	2	55
TFS/TBZ/IST	150	75	112,5	-	2	61
THIODIAZOLE-ZN	-	-	-	375	2	42

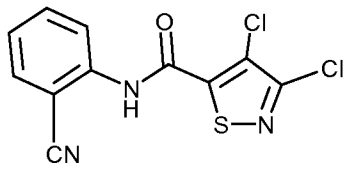
Based on this trial we can conclude that the combination of IST/TFS/TBZ in tank mixture combinations increases the control of Panicle Disease Complex compared to straight TFS/TBZ .

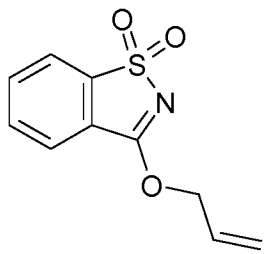
Claims

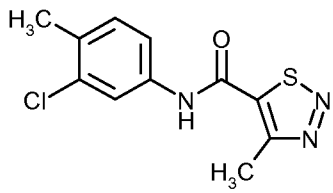
1. A combination consisting of:

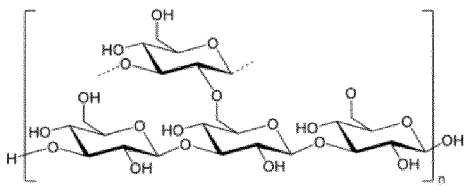
(A) at least one compound selected from the group of host defense inducers comprising

Acibenzolar-S-methyl: ,

Isotianil: ,

Probenazole: ,

Tiadinil:  and

Laminarin: .

and

(B) at least one fungicidally active compound selected from the group consisting of members of the strobilurin group selected from Trifloxystrobin, Dimoxystrobin, Fluoxastrobin,

Pyraclostrobin, Enestroburin, Picoxystrobin, Azoxystrobin and Mandestrobin, and

(C) as further fungicidally active compound Tebuconazole.

2. Combination according to claim 1 wherein mixing partners are (A) Isotianil, (B) Trifloxystrobin and (C) Tebuconazole.

3. Combination according to claims 1 or 2 comprising mixing partners (A):(C):(B) in a weight ratio of 100:10:1 to 1:10:100.

4. Combination according to claims 1 or 2 comprising mixing partners (A):(C):(B) in a weight ratio of 4:2:1 to 1:1:1.

5. A composition comprising a combination according to claims 1 to 4.

6. A composition according to claim 5 further comprising adjuvants, solvents, carrier, surfactants or extenders.

7. A method for curatively controlling the phytopathogenic fungi and bacteria of plants or crops comprising the use of a composition according to claims 5 and 6 by application to the seed, the plant or to the fruit of the plant or to the soil in which the plant is growing or in which it is desired to grow.

8. The method according to claim 7 for controlling *Alternaria solani, Sphaerotheca fuliginea* and *Pyricularia Oryzae.*

9. The method according to claim 8 for controlling *Alternaria solani* in *Solanaceae, Sphaerotheca fuliginea* in *Cucurbitaceae* and *Pyricularia Oryzae* in *Gramineae.*

10. The method according to claim 7 for controlling *Pseudomonadaceae* and *Xanthomonadaceae.*

11. The method accordig to claim 10 for controlling *Pseudomonadaceae* and *Xanthomonadaceae* in *Gramineae.*

12. The method according to claims 7 or 11 wherein the amount of the combination of claims 1 to 6 is from 150 g/ha to 300 g/ha for foliar treatment.

13. The method according to any of claims 7 to 12 wherein additional to the control of phytopathogenic fungi and bacteria of plants or crops yield is increased.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/058504

A. CLASSIFICATION OF SUBJECT MATTER
INV. A01N35/06 A01N37/50 A01N43/40 A01N43/54 A01N43/653
A01N43/80 A01N43/82 A01N43/88 A01N47/12 A01N47/24
A01P1/00 A01P3/00

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, CHEM ABS Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2015/181877 A1 (SWART GINA MERCIA [CH] ET AL) 2 July 2015 (2015-07-02)	1-13
Y	the claims; paragraphs 37-43 and table B42	1-13

X	US 2011/251062 A1 (SCHUETZ BURKHARD [DE] ET AL) 13 October 2011 (2011-10-13)	1-13
Y	the claims; page 20 and paragraphs 79-81, 126, 185 and 349	1-13

X	US 2011/281816 A1 (DAHMEN PETER [DE] ET AL) 17 November 2011 (2011-11-17)	1-13
Y	the claims; paragraphs 5-7, 41, 58 and 85 and table 2	1-13

X	US 6 335 355 B1 (RUESS WILHELM [CH] ET AL) 1 January 2002 (2002-01-01)	1-13
Y	the claims and examples B5, B9(a) and B9(b)	1-13

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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

"E" earlier application or patent but published on or after the international filing date

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

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

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

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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
6 June 2017	22/06/2017

Name and mailing address of the ISA/	Authorized officer
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2

Form PCT/ISA/210 (second sheet) (April 2005)

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 103 250 707 B (SHAANXI MEIBANG PESTICIDES CO) 17 February 2016 (2016-02-17)	1-13
Y	the claims and the examples	1-13

X	CN 103 416 425 B (SHAANXI WEIERQI CROP PROT CO) 17 February 2016 (2016-02-17)	1-13
Y	the claims and the examples	1-13

X	EP 2 936 981 A1 (SUMITOMO CHEMICAL CO [JP]) 28 October 2015 (2015-10-28)	1-13
Y	the claims; the abstract; paragraph 3 and the examples	1-13

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2017/058504

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