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(54) Titre : DERIVES FONGICIDES PYRIDINYLOXY SUBSTITUES PHENYLAMIDINE
(54) Title: FUNGICIDE PYRIDINYLOXY SUBSTITUTED PHENYLAMIDINE DERIVATIVES

(57) **Abrégé/Abstract:**

The present invention relates to 2,5-di-substituted-4-pyridinyloxy-substituted-phenyl-amidine derivatives, notably to 2,5-dialkyl-4-pyridinyloxy-substituted-phenyl-amidine derivatives, of formula (I) in which the substituents are as in the description, their process of preparation, their use as fungicide active agents, particularly in the form of fungicide compositions, and methods for the control of phytopathogenic fungi, notably of plants, using these compounds or compositions (I).



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(54) **Title:** FUNGICIDE PYRIDINYLOXY SUBSTITUTED PHENYLAMIDINE DERIVATIVES

(57) **Abstract:** The present invention relates to 2,5-di-substituted-4-pyridinyloxy-substituted-phenyl-amidine derivatives, notably to 2,5-dialkyl-4-pyridinyloxy-substituted-phenyl-amidine derivatives, of formula (I) in which the substituents are as in the description, their process of preparation, their use as fungicide active agents, particularly in the form of fungicide compositions, and methods for the control of phytopathogenic fungi, notably of plants, using these compounds or compositions (I).



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FUNGICIDE PYRIDINYLOXY SUBSTITUTED PHENYLAMIDINE DERIVATIVES

DESCRIPTION

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The present invention relates to 2,5-di-substituted-4-pyridinyloxy-substituted-phenyl-amidine derivatives, notably to 2,5-dialkyl-4-pyridinyloxy-substituted-phenyl-amidine derivatives, their process of preparation, their use as fungicide active agents, particularly in the form of fungicide compositions, and methods for the control of phytopathogenic fungi, notably of plants, using

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In international patent application WO-00/46184 certain phenyl-amidine derivatives are disclosed. However, this document does not specifically disclose nor suggest to select such compounds wherein the phenyl ring is substituted according to the invention thus allowing an

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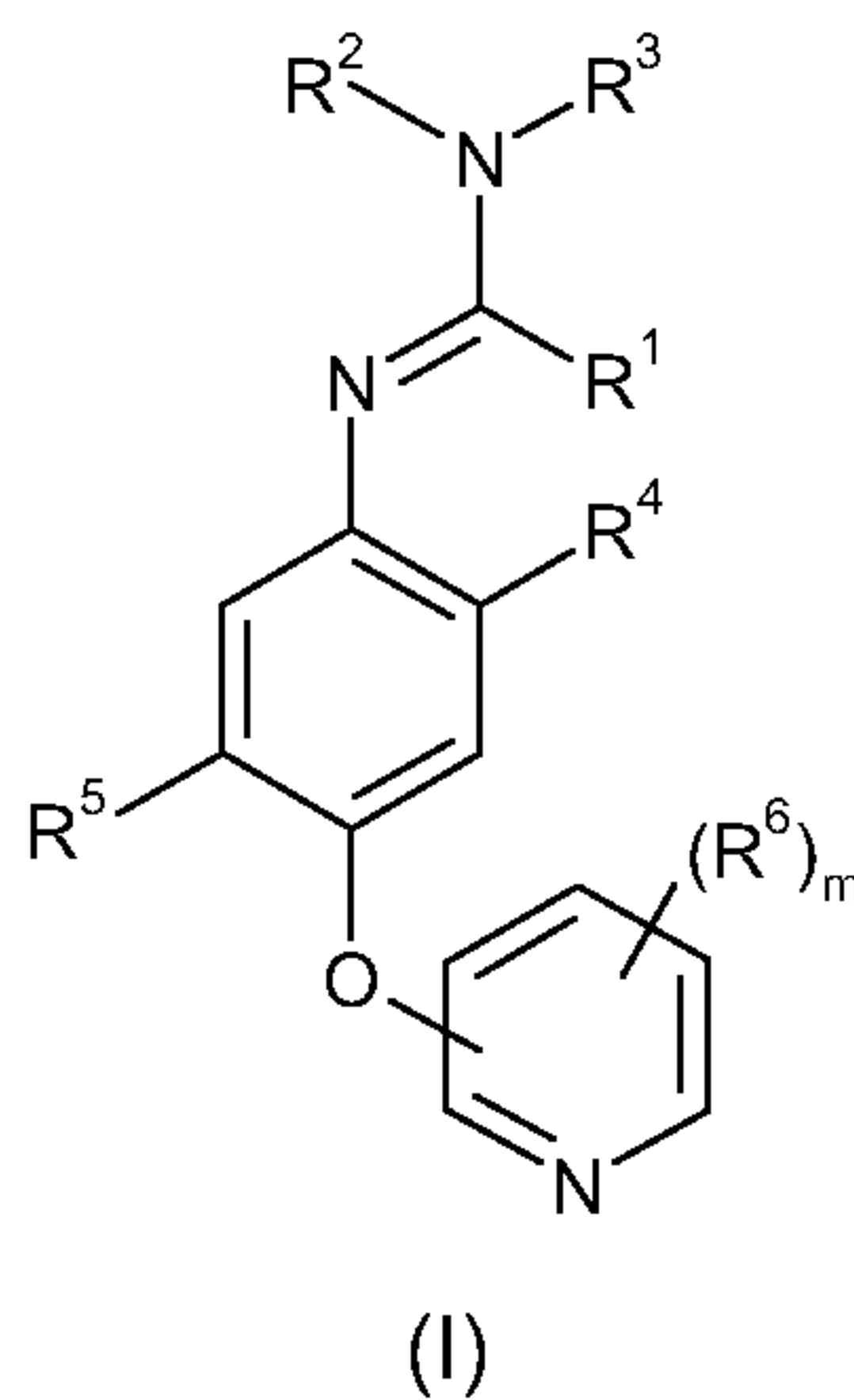
It is always of high-interest in agriculture to use novel pesticide compounds in order to avoid or to control the development of resistant strains to the active ingredients. It is also of high-interest to use novel compounds being more active than those already known, with the aim of

20

We have now found a new family of compounds which possess the above mentioned effects or advantages.

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Accordingly, the present invention provides 2,5-di-substituted-4-pyridinyloxy-substituted-phenyl-amidine derivatives of formula (I) :



30

wherein

- R¹ represents H, a substituted or non substituted C₁-C₁₂-alkyl, a substituted or non substituted C₂-C₁₂-alkenyl, a substituted or non substituted C₂-C₁₂-alkynyl, SH or a substituted or non substituted S-C₁-C₁₂-alkyl;
- R² represents a substituted or non substituted C₁-C₁₂-alkyl;
- 5 • R³ represents a substituted or non substituted C₂-C₁₂-alkyl, substituted or non substituted C₃-C₆-cycloalkyl, substituted or non substituted C₂-C₁₂-alkenyl, substituted or non substituted C₂-C₁₂-alkynyl, halogeno-C₁-C₁₂-alkyl; or
- R¹ and R², R¹ and R³ or R² and R³ can form together a substituted or non substituted 5 to 7-membered heterocycle;
- 10 • R⁴ represents a substituted or non substituted C₁-C₁₂-alkyl, a halogen atom, halogeno-C₁-C₁₂-alkyl, substituted or non substituted O-C₁-C₁₂-alkyl or cyano;
- R⁵ represents H, a substituted or non substituted C₁-C₁₂-alkyl, a halogen atom, halogeno-C₁-C₁₂-alkyl, substituted or non substituted O-C₁-C₁₂-alkyl or cyano;
- m represents 1, 2, 3 or 4;
- 15 • R⁶ represents H, halogen, cyano, substituted or non substituted phenoxy, substituted or non substituted phenyl, substituted or non substituted C₁-C₁₂-alkyl, or halogeno-C₁-C₁₂-alkyl, NR⁷R⁸, OR⁷, SR⁷, trialkysilyl, COOR⁷, C(R⁷)=NOR⁸;
- R⁷, R⁸ represent H, substituted or non substituted C₁-C₁₂-alkyl, aryl;
- R⁷ and R⁸ may form a substituted or non substituted, saturated or non saturated 5 to 7-
- 20 membered heterocycle;

as well as salts; N-oxydes, metallic complexes, metalloidic complexes and optically active or geometric isomers thereof.

Any of the compounds according to the invention can exist in one or more optical or chiral isomer forms depending on the number of asymmetric centres in the compound. The invention thus relates equally to all the optical isomers and to their racemic or scalemic mixtures (the term "scalemic" denotes a mixture of enantiomers in different proportions), and to the mixtures of all the possible stereoisomers, in all proportions. The diastereoisomers and/or the optical isomers can be separated according to the methods which are known *per se* by the man ordinary skilled in the art.

Any of the compounds according to the invention can also exist in one or more geometric isomer forms depending on the number of double bonds in the compound. The invention thus relates equally to all geometric isomers and to all possible mixtures, in all proportions. The geometric isomers can be separated according to general methods, which are known *per se* by the man ordinary skilled in the art.

For the compounds according to the invention, halogen means either one of fluorine, bromine, chlorine or iodine and heteroatom can be nitrogen, oxygen or sulphur.

Preferred compounds of formula (I) according to the invention are those wherein R^1 represents H; C_1 - C_{12} -alkyl, preferably C_1 - C_{12} -alkyl like methyl and ethyl; or SH.

- 5 Other preferred compounds of formula (I) according to the invention are those wherein R^2 represents methyl or ethyl.

Still other preferred compounds of formula (I) according to the invention are those wherein R^3 represents C_2 - C_{12} -alkyl, preferably a non substituted C_2 - C_4 -alkyl like ethyl, n-propyl, i-propyl; C_2 -
10 C_{12} -alkenyl, preferably C_3 - C_4 -alkenyl like propenyl or allyl; C_3 - C_6 -cycloalkyl like cyclopropyl.

Still other preferred compounds of formula (I) according to the invention are those wherein R^2 and R^3 can form together a substituted or non substituted 5 to 7-membered heterocycle, preferably a 6-membered heterocycle, more preferably a piperidinyl or a pyrrolidinyl, even more
15 preferably a bis-alkylated-pyrrolidinyl like a bis-methyl-pyrrolidinyl.

Still other preferred compounds of formula (I) according to the invention are those wherein R^4 represents a C_1 - C_{12} -alkyl, preferably a non substituted C_1 - C_{12} -alkyl like methyl and ethyl; a halogen atom like a chlorine atom.
20

Still other preferred compounds of formula (I) according to the invention are those wherein R^5 represents a C_1 - C_{12} -alkyl, preferably a non substituted C_1 - C_{12} -alkyl like methyl and ethyl; a halogen atom like a chlorine atom.

- 25 Still other preferred compounds of formula (I) according to the invention are those wherein R^6 represents H, halogen, cyano, substituted or non substituted C_1 - C_{12} -alkyl, or halogeno- C_1 - C_{12} -alkyl, NR^7R^8 , OR^7 , SR^7 , $COOR^7$.

Still other preferred compounds of formula (I) according to the invention are those wherein R^7 or
30 R^8 independently represent H, methyl, ethyl, aryl preferably substituted phenyl or may form a substituted or non substituted, saturated or non saturated 5- to 7-membered heterocycle, preferably piperidinyl or morpholinyl.

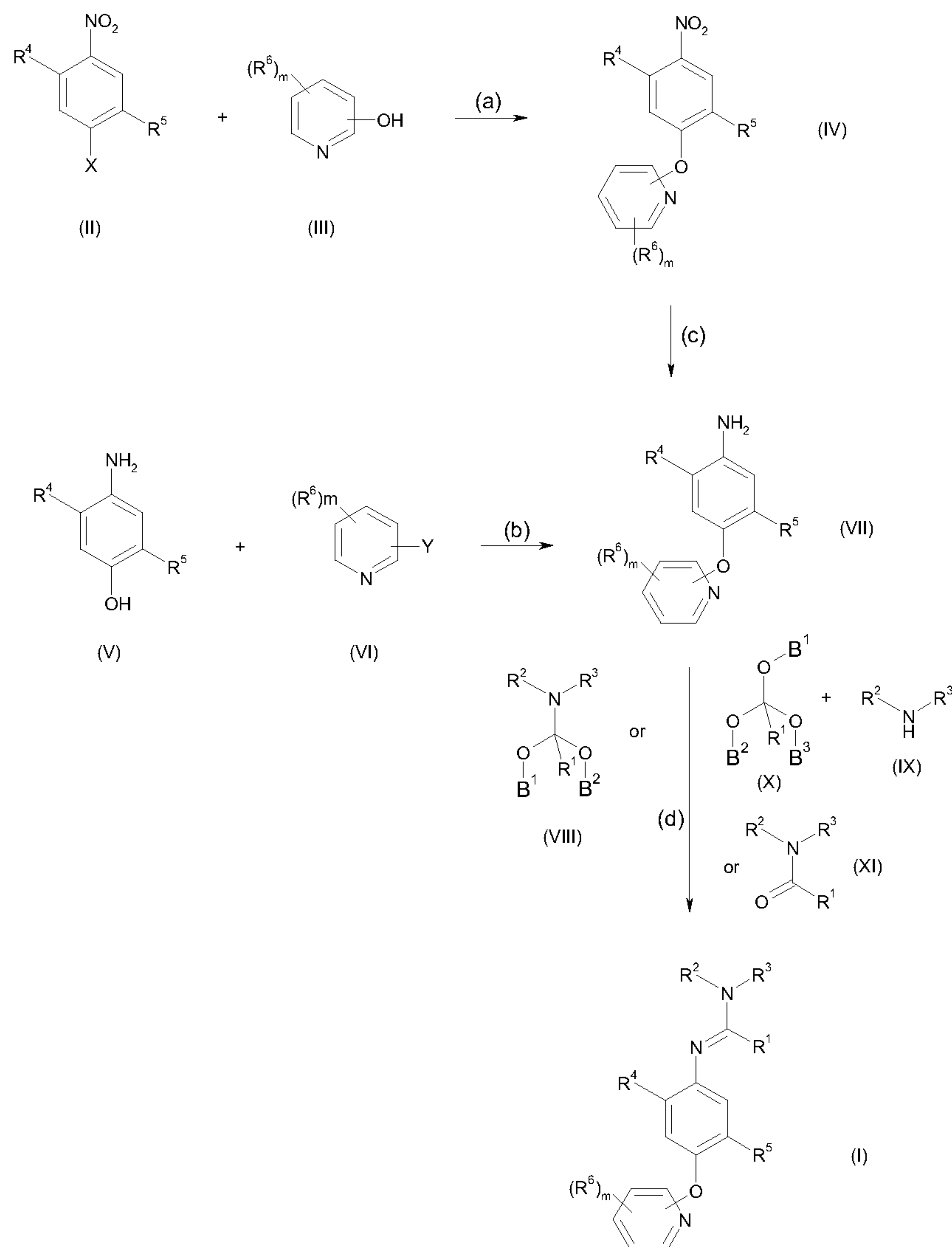
The above mentioned preferences with regard to the substituents of the compounds according
35 to the invention can be combined in various manners. These combinations of preferred features thus provide sub-classes of compounds according to the invention. Examples of such sub-classes of preferred compounds according to the invention can combine:

- preferred features of R^1 with preferred features of R^2 to R^8 ;
- preferred features of R^2 with preferred features of R^1 to R^8 ;

- preferred features of R^3 with preferred features of R^1 to R^8 ;
- preferred features of R^4 with preferred features of R^1 to R^8 ;
- preferred features of R^5 with preferred features of R^1 to R^8 ;
- preferred features of R^6 with preferred features of R^1 to R^8 ;
- 5 - preferred features of R^7 with preferred features of R^1 to R^8 .

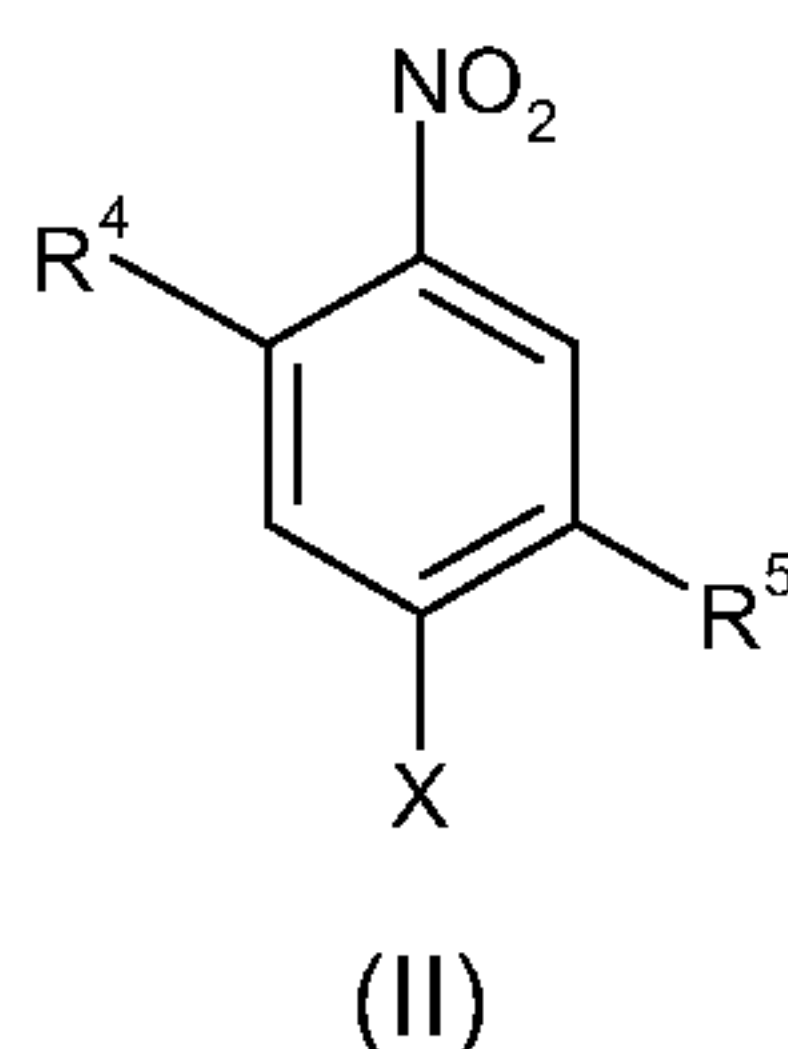
In these combinations of preferred features of the substituents of the compounds according to the invention, the said preferred features can also be selected among the more preferred features of each of R^1 to R^6 so as to form most preferred subclasses of compounds according to the invention.

The present invention also relates to a process for the preparation of compounds of formula (I). Generally, the preparation of compound of formula (I) according to the invention can be carried out as illustrated by scheme 1.



Scheme 1

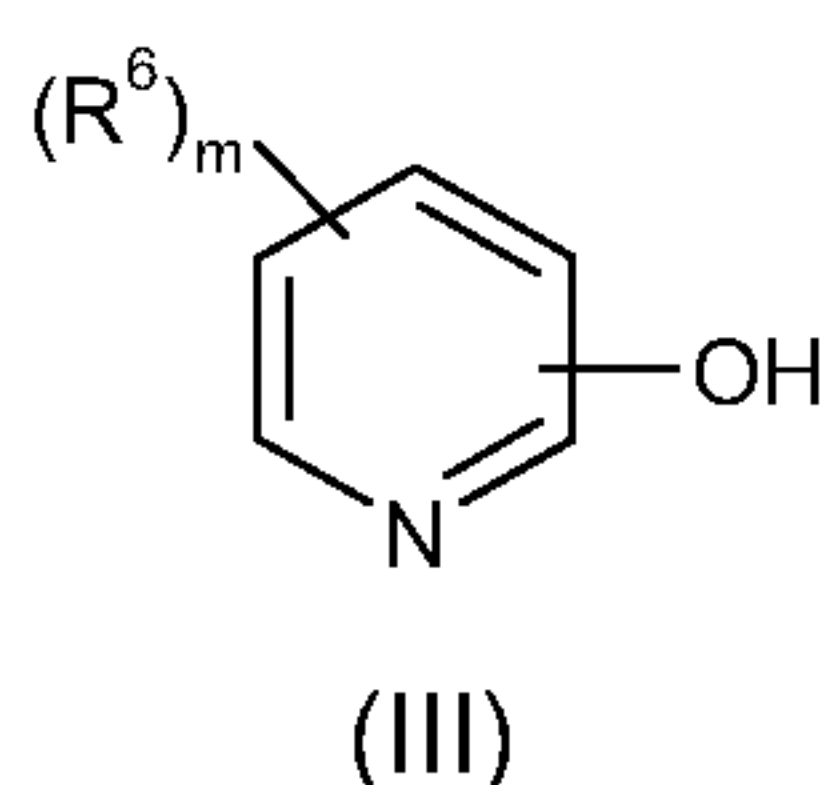
Nitrophenylether derivatives of formula (IV) can be obtained according to process (a) by reacting nitrobenzene derivatives of formula (II)



wherein

- R⁴ and R⁵ are as herein-defined ;
- X represents halogen, triflate, SOMe, mesylate or tosylate ;

with hydroxypyridine derivatives of formula (III)



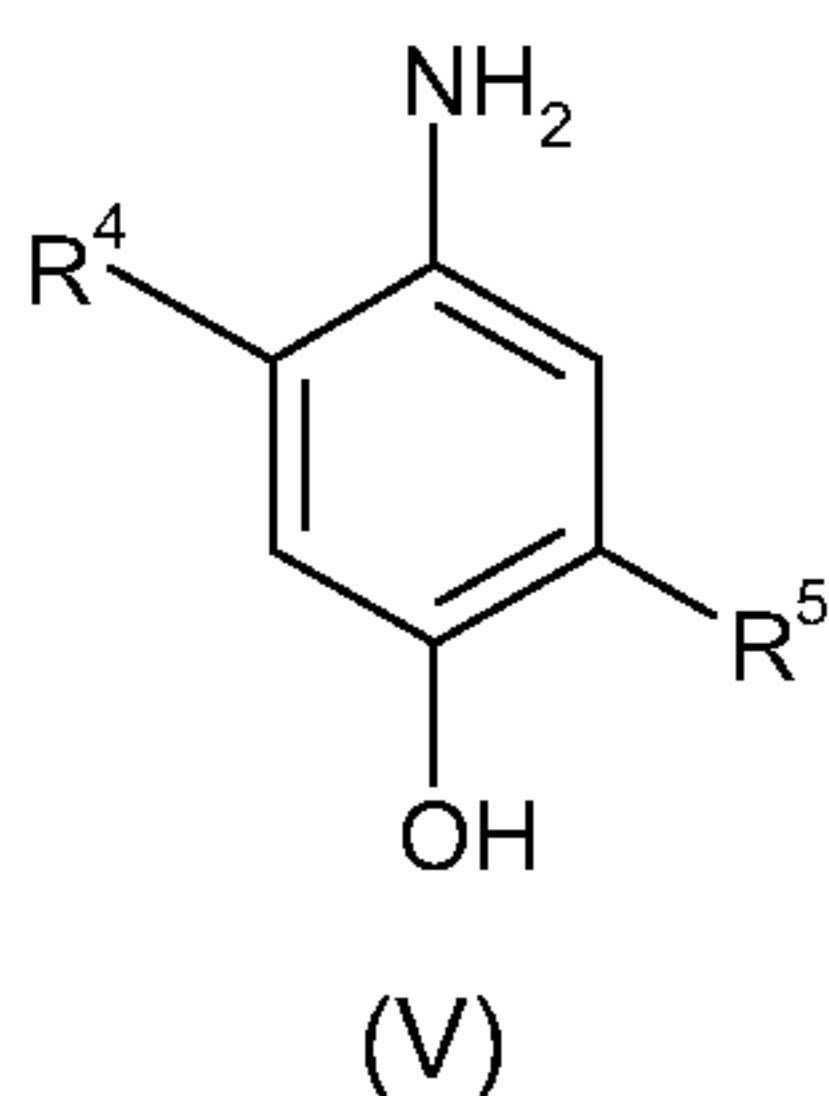
wherein

- R⁶ and m are as herein-defined.

Process (a) according to the invention can further comprise one or more of the following characteristics:

- presence of a base;
- presence of a diluent;
- presence of a catalyst.

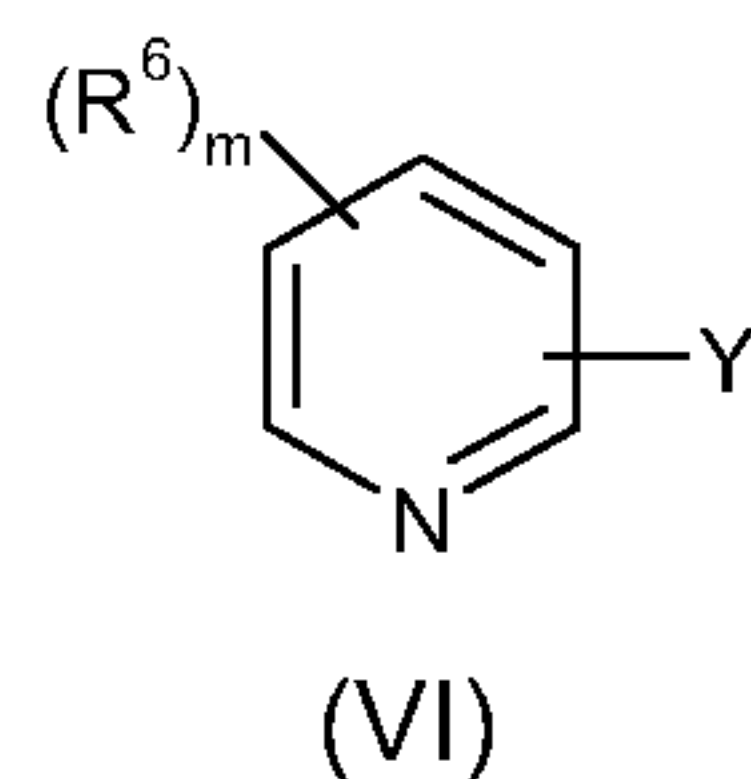
Aniline derivatives of formula (VII) can be obtained according to process (b) by reacting aniline derivatives of formula (V)



wherein

- R⁴ and R⁵ are as herein-defined ;

with pyridine derivatives of formula (VI)



wherein

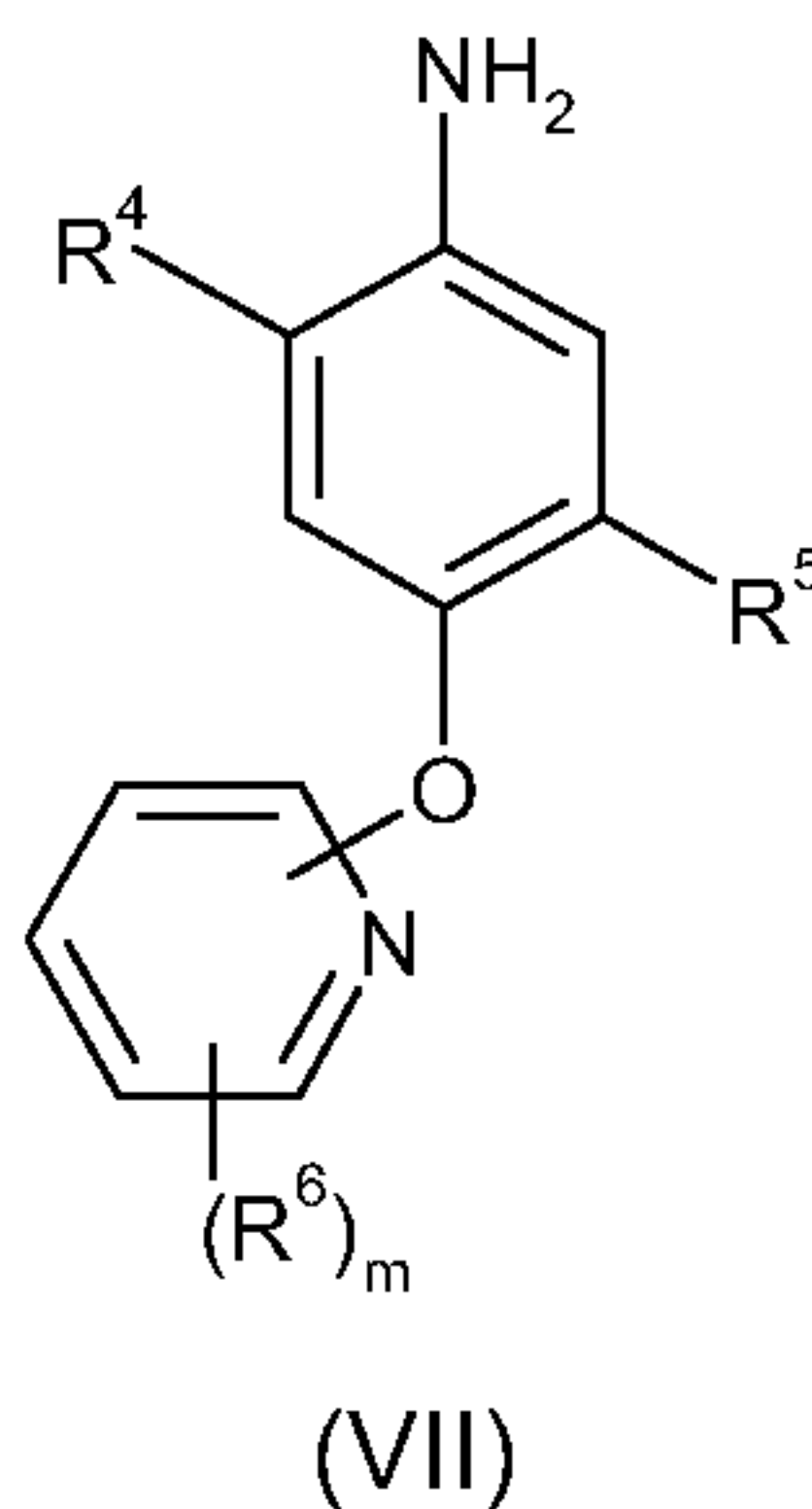
- R^6 and m as herein-defined ;
- Y represents halogen, triflate, SOMe, mesylate or tosylate.

Process (b) according to the invention can further comprise one or more of the following characteristics:

- presence of a base;
- presence of a diluent;
- presence of a catalyst.

Process (b) is then followed by (c) the reduction of nitrophenylether derivatives of formula (IV). Preferably, the reduction reaction is carried out in presence of stannous chloride in concentrated hydrochloric acid.

Amidine derivatives of formula (I) can be obtained according to process (d) by reacting aniline derivatives of formula (VII)

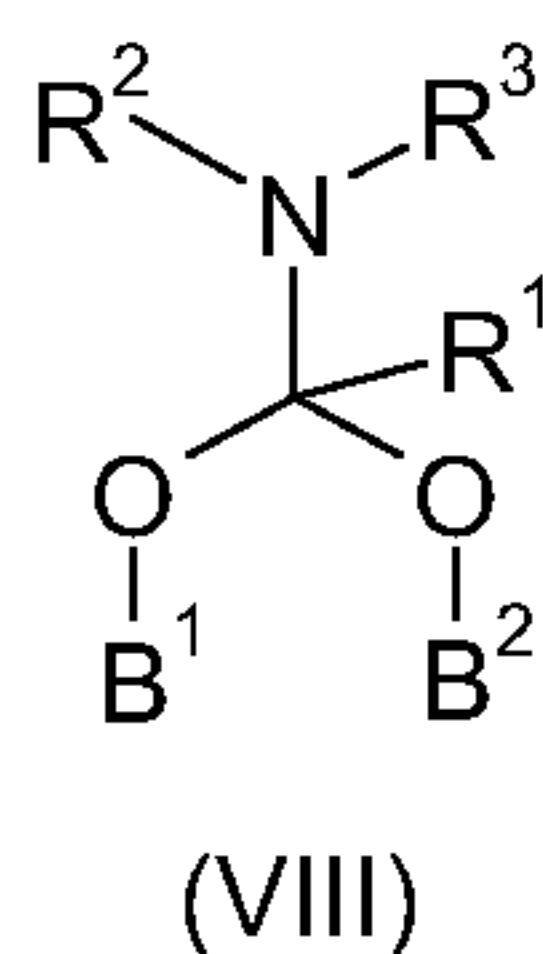


wherein R^4 , R^5 , R^6 and m are as defined above.

Various alternatives of process (d) according to the invention can be considered, they are defined as process (d1), process (d2) and process (d3) according to the invention.

Process (d) according to the invention comprises reacting aniline derivatives of formulae (VII) with different reagents thus defining processes (d1), (d2) and (d3) respectively

Process (d1) is carried out further using amino-acetal derivatives of formula (VIII)



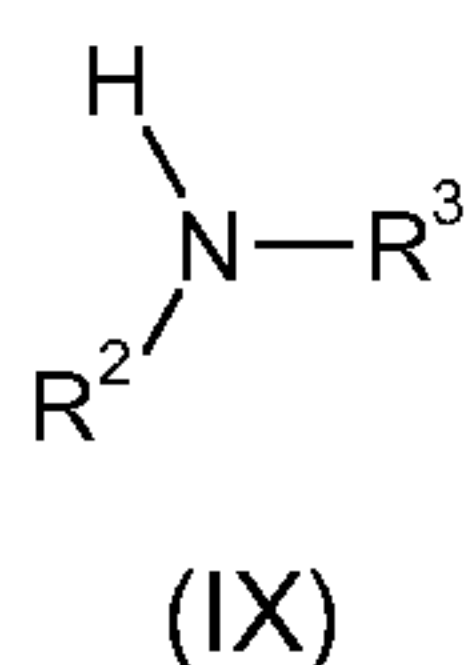
wherein

- R^1 , R^2 , R^3 are as herein-defined ;
- B^1 and B^2 represent each alkyl or together cycloalkyl.

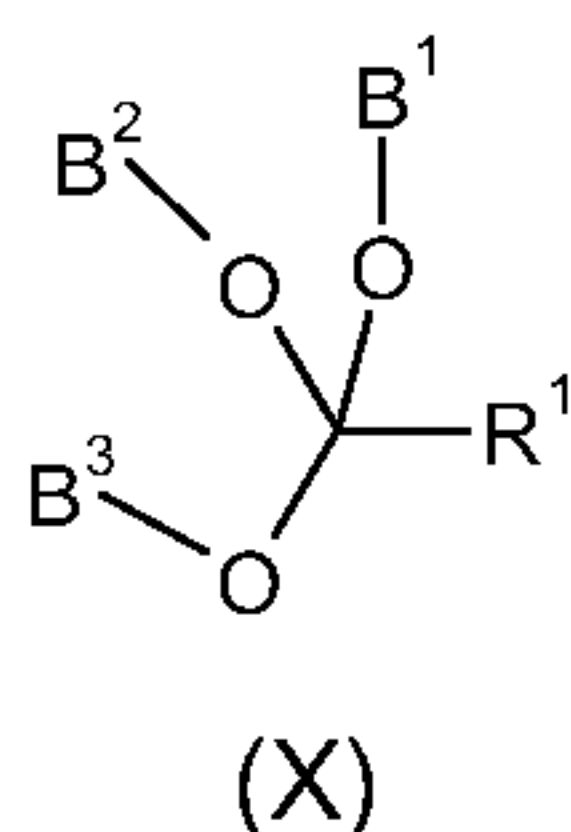
Process (d1) according to the invention can further comprise one or more of the following characteristics:

- presence of an acid or a base;
- presence of a diluent.

Process (d2) is carried out further using amine derivatives of formula (IX)



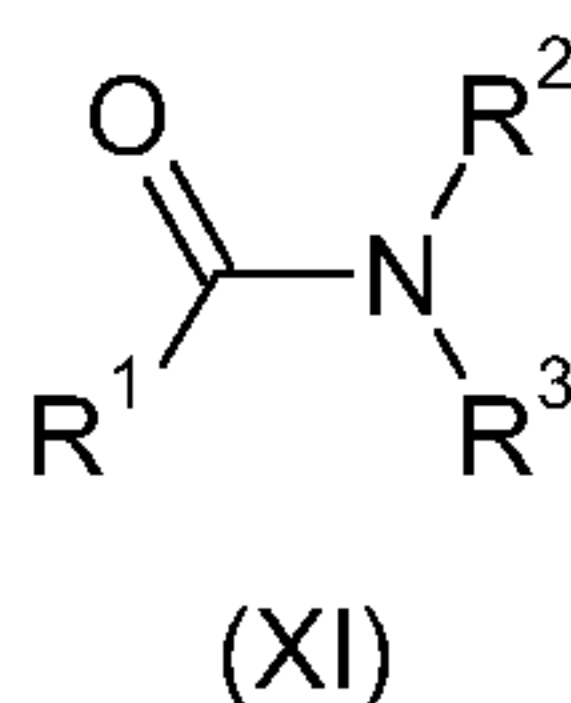
wherein R^2 and R^3 are as herein-defined ; in the presence of orthoester derivatives of formula (X)



wherein

- R^1 is as herein-defined ;
- B^1 , B^2 and B^3 represent each alkyl.

Process (d3) is carried out further using amide derivatives of formula (XI)



wherein R^1 , R^2 , R^3 are as herein-defined.

Process (d3) according to the invention can further comprise one or more of the following characteristics:

- presence of a halogenation agent, like PCl_5 , PCl_3 , POCl_3 , SOCl_2 ;
- presence of a diluent.

Suitable diluents for carrying out the processes (a), (b) and (c) according to the invention are all customary inert organic solvents. Preference is given to using aliphatic, alicyclic or aromatic hydrocarbons, such as petroleum ether, hexane, heptane, cyclohexane, methylcyclohexane, benzene, toluene, xylene or decalin; halogenated hydrocarbons, such as chlorobenzene,

dichlorobenzene, dichloromethane, chloroform, carbon tetrachloride, dichloroethane or trichloroethane; ethers, such as diethyl ether, diisopropyl ether, methyl tert-butyl ether, methyl tert-amyl ether, dioxane, tetrahydrofuran, 1,2-dimethoxyethane, 1,2-diethoxyethane or anisole; nitriles, such as acetonitrile, propionitrile, n- or iso-butyronitrile or benzonitrile; amides, such as N,N-dimethylformamide, N,N-dimethylacetamide, N-methylformanilide, N-methylpyrrolidone or hexamethylphosphoric triamide; mixtures thereof with water or pure water.

Suitable diluents for carrying out the processes (d1), (d2) and (d3) according to the invention are in each case all customary inert organic solvents. Preference is given to using aliphatic, alicyclic or aromatic hydrocarbons, such as petroleum ether, hexane, heptane, cyclohexane, methylcyclohexane, benzene, toluene, xylene or decalin; ethers, such as diethyl ether, diisopropyl ether, methyl tert-butyl ether, methyl tert-amyl ether, dioxane, tetrahydrofuran, 1,2-dimethoxyethane, 1,2-diethoxyethane or anisole; nitriles, such as acetonitrile, propionitrile, n- or iso-butyronitrile or benzonitrile; amides, such as N,N-dimethylformamide, N,N-dimethylacetamide, N-methylformanilide, N-methylpyrrolidone or hexamethylphosphoric triamide; esters, such as methyl acetate or ethyl acetate; sulphoxides, such as dimethylsulphoxide; or sulphones, such as sulfolane; alcohols, such as methanol, ethanol, n- or iso-propanol, n-, iso-, sec- or tert-butanol, ethanediol, propane-1,2-diol, ethoxyethanol, methoxyethanol, diethylene-glycolmonomethylether, diethyleneglycolmonoethylether; mixtures thereof with water or pure water.

Suitable acid binders for carrying out the processes (a), (b) and (c) according to the invention are all inorganic and organic bases customary for such reactions. Preference is given to using alkaline earth metal or alkali metal hydrides, hydroxides, amides, alcoholates, acetates, carbonates or hydrogen carbonates, such as sodium hydride, sodium amide, lithium diisopropylamide, sodium methanolate, sodium ethanolate, potassium tert-butanolate, sodium acetate, potassium acetate, calcium acetate, sodium hydroxide, potassium hydroxide, sodium carbonate, potassium carbonate, potassium bicarbonate, sodium bicarbonate, or ammonium carbonate; and also tertiary amines, such as trimethylamine, triethylamine, tributylamine, N,N-dimethylaniline, N,N-dimethyl-benzylamine pyridine, N-methylpiperidine, N-methylmorpholine, N,N-dimethylaminopyridine, diazabicyclooctane (DABCO), diazabicyclononene (DBN) or di-aza-bicycloundecene (DBU).

Suitable acid binders for carrying out the processes (b), (c), (d) according to the invention are in each case all inorganic and organic bases customary for such reactions. Preference is given to using alkaline earth metal or alkali metal hydrides, hydroxides, amides, alcoholates, acetates, fluorides, phosphates, carbonates or hydrogen carbonates, such as sodium hydride, sodium - amide, lithium diisopropylamide, sodium methanolate, sodium ethanolate, potassium tert-butanolate, sodium hydroxide, potassium hydroxide, sodium acetate, sodium phosphate, potas-

sium phosphate, potassium fluoride, caesium fluoride, sodium carbonate, potassium carbonate, potassium hydrogencarbonate, sodium hydrogencarbonate or caesium carbonate; and also tertiary amines, such as trimethylamine, triethylamine, tributylamine, N,N-dimethylaniline, N,N-dimethyl-benzylamine, pyridine, N-methylpiperidine, N-methylmorpholine, N,N-dimethylamino-
5 pyridine, diazabicyclooctane (DABCO), diazabicyclononene (DBN) or diazabicycloundecene (DBU).

Suitable acids for carrying out the process (d1) according to the invention are all inorganic and organic acids customary for such reactions. Preference is given to using para-toluene sulfonic
10 acid, methane sulfonic acid, hydrochloric acid (gas, aqueous or organic solution) or sulphuric acid.

Suitable condensing agents for carrying out the process (d3) according to the invention are all condensing agents customary for such amidation reactions. Preference is given to using acid
15 halide former, such as phosgene, phosphorous tribromide, phosphorous trichloride, phosphorous pentachloride, phosphorous trichloride oxide or thionyl chloride; anhydride former, such as ethyl chloroformate, methyl chloroformate, isopropyl chloroformate, isobutyl chloroformate or methanesulfonyl chloride; carbodiimides, such as N,N'-dicyclohexylcarbodiimide (DCC) or other customary condensing agents, such as phosphorous
20 pentoxide, polyphosphoric acid, N,N'-carbonyldiimidazole, 2-ethoxy-N-ethoxycarbonyl-1,2-dihydroquinoline (EEDQ), triphenylphosphine/tetrachloromethane or bromo-tripyrrolidino-phosphonium-hexafluorophosphate.

Compounds of formula (I) according to the invention can be prepared according to the herein
25 described processes. It will nevertheless be understood that, on the basis of his general knowledge and of available publications, the skilled worker will be able to adapt these processes according to the specifics of each of the compounds which it is desired to synthesise.

In a further aspect, the present invention also relates to a fungicide composition comprising an
30 effective and non-phytotoxic amount of an active compound of formula (I).

The expression "effective and non-phytotoxic amount" means an amount of composition according to the invention which is sufficient to control or destroy the fungi present or liable to appear on the crops, and which does not entail any appreciable symptom of phytotoxicity for the said crops. Such an amount can vary within a wide range depending on the fungus to be controlled, the type of crop,
35 the climatic conditions and the compounds included in the fungicide composition according to the invention.

This amount can be determined by systematic field trials, which are within the capabilities of a person skilled in the art.

Thus, according to the invention, there is provided a fungicide composition comprising, as an active ingredient, an effective amount of a compound of formula (I) as herein-defined and an agriculturally acceptable support, carrier or filler.

According to the invention, the term "support" denotes a natural or synthetic, organic or inorganic compound with which the active compound of formula (I) is combined or associated to make it easier to apply, 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.

Optionally, 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 compound, preferably 10 to 70% by weight.

Compositions according to the invention can be used in various forms 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.

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 compounds according to the invention can also be mixed with one or more insecticide, fungicide, bactericide, attractant, acaricide or pheromone active substance or other compounds with biological activity. The mixtures thus obtained have a broadened spectrum of activity.

The mixtures with other fungicide compounds are particularly advantageous. Examples of suitable fungicide mixing partners may be selected in the following lists :

B1) a compound capable to inhibit the nucleic acid synthesis like benalaxyl, benalaxyl-M, bupirimate, chiralaxyl, clozylacon, dimethirimol, ethirimol, furalaxyl, hymexazol, metalaxyl, metalaxyl-M, ofurace, oxadixyl, oxolinic acid ;

B2) a compound capable to inhibit the mitosis and cell division like benomyl, carbendazim, diethofencarb, fuberidazole, pencycuron, thiabendazole thiophanate-methyl, zoxamide ;

B3) a compound capable to inhibit the respiration for example

as CI-respiration inhibitor like diflumetorim ;

as CII-respiration inhibitor like boscalid, carboxin, fenfuram, flutolanil, furametpyr, mepronil, oxycarboxine, penthiopyrad, thifluzamide ;

as CIII-respiration inhibitor like azoxystrobin, cyazofamid, dimoxystrobin, enestrobin, famoxadone, fenamidone, fluoxastrobin, kresoxim-methyl, metominostrobin, orysastrobin, pyraclostrobin, picoxystrobin, trifloxystrobin ;

B4) a compound capable of to act as an uncoupler like dinocap, fluazinam ;

B5) a compound capable to inhibit ATP production like fentin acetate, fentin chloride, fentin hydroxide, silthiofam ;

B6) a compound capable to inhibit AA and protein biosynthesis like andoprim, blasticidin-S, cyprodinil, kasugamycin, kasugamycin hydrochloride hydrate, mepanipyrin, pyrimethanil ;

B7) a compound capable to inhibit the signal transduction like fempiclonil, fludioxonil, quinoxifen ;

B8) a compound capable to inhibit lipid and membrane synthesis like chlozolate, iprodione, procymidone, vinclozolin, pyrazophos, edifenphos, iprobenfos (IBP), isoprothiolane, tolclofos-methyl, biphenyl, iodocarb, propamocarb, propamocarb-hydrochloride ;

B9) a compound capable to inhibit ergosterol biosynthesis like fenhexamid,
 5 azaconazole, bitertanol, bromuconazole, cyproconazole, diclobutrazole, difenoconazole, diniconazole, diniconazole-M, epoxiconazole, etaconazole, fenbuconazole, fluquinconazole, flusilazole, flutriafol, furconazole, furconazole-cis, hexaconazole, imibenconazole, ipconazole, metconazole, myclobutanil, paclobutrazol, penconazole, propiconazole, prothioconazole, simeconazole, tebuconazole, tetraconazole, triadimefon, triadimenol, triticonazole, uniconazole,
 10 voriconazole, imazalil, imazalil sulfate, oxpoconazole, fenarimol, flurprimidol, nuarimol, pyrifenoxy, triforine, pefurazoate, prochloraz, triflumizole, viniconazole, aldimorph, dodemorph, dodemorph acetate, fenpropimorph, tridemorph, fenpropidin, spiroxamine, naftifine, pyributicarb, terbinafine ;

B10) a compound capable to inhibit cell wall synthesis like bentiavalicarb, bialaphos,
 15 dimethomorph, flumorph, iprovalicarb, polyoxins, polyoxorim, validamycin A ;

B11) a compound capable to inhibit melanine biosynthesis like carpropamid, diclocymet, fenoxanil, phthalide, pyroquilon, tricyclazole ;

B12) a compound capable to induce a host defence like acibenzolar-S-methyl, probenazole, tiadinil ;

B13) a compound capable to have a multisite action like captan, chlorothalonil, copper preparations such as copper hydroxide, copper naphthenate, copper oxychloride, copper sulphate, copper oxide, oxine-copper and Bordeaux mixture, dichlofluanid, dithianon, dodine, dodine free base, ferbam, fluorofolpet, folpet, guazatine, guazatine acetate, iminoctadine, iminoctadine albesilate, iminoctadine triacetate, mancozeb, maneb,
 20 metiram, metiram zinc, propineb, sulphur and sulphur preparations including calcium polysulphide, thiram, tolylfluanid, zineb, ziram ;

B14) a compound selected in the following list: amibromdole, benthiazole, bethoxazin, capsimycin, carvone, chinomethionat, chloropicrin, cufraneb, cyflufenamid, cymoxanil, dazomet, debacarb, diclomezine, dichlorophen, dicloran, difenzoquat, difenzoquat methylsulphate,
 30 diphenylamine, ethaboxam, ferimzone, flumetover, flusulfamide, fosetyl-aluminium, fosetyl-calcium, fosetyl-sodium, fluopicolide, fluoroimide, hexachlorobenzene, 8-hydroxyquinoline sulfate, irumamycin, methasulphocarb, metrafenone, methyl isothiocyanate, mildiomyacin, natamycin, nickel dimethyldithiocarbamate, nitrothal-isopropyl, octhilinone, oxamocarb, oxyfenthiin, pentachlorophenol and salts, 2-phenylphenol and salts, phosphorous acid and its
 35 salts, piperalin, propanosine-sodium, proquinazid, pyrrolnitrine, quintozone, tecloftalam,

tecnazene, triazoxide, trichlamide, zarilamid and 2,3,5,6-tetrachloro-4-(methylsulfonyl)-pyridine, N-(4-Chloro-2-nitrophenyl)-N-ethyl-4-methyl-benzenesulfonamide, 2-amino-4-methyl-N-phenyl-5-thiazolecarboxamide, 2-chloro-N-(2,3-dihydro-1,1,3-trimethyl-1H-inden-4-yl)-3-pyridincarboxamide, 3-[5-(4-chlorophenyl)-2,3-dimethylisoxazolidin-3-yl]pyridine, cis-1-(4-chlorophenyl)-2-(1H-1,2,4-triazole-1-yl)-cycloheptanol, methyl 1-(2,3-dihydro-2,2-dimethyl-1H-inden-1-yl)-1H-imidazole-5-carboxylate, 3,4,5-trichloro-2,6-pyridinedicarbonitrile, Methyl 2-[[[cyclopropyl[(4-methoxyphenyl)imino]methyl]thio]methyl]-.alpha.-(methoxymethylene)-benzeneacetate, 4-Chloro-alpha-propynyloxy-N-[2-[3-methoxy-4-(2-propynyloxy)phenyl]ethyl]-benzeneacetamide, (2S)-N-[2-[4-[[3-(4-chlorophenyl)-2-propynyl]oxy]-3-methoxyphenyl]ethyl]-3-methyl-2-[(methylsulfonyl)amino]-butanamide, 5-chloro-7-(4-methylpiperidin-1-yl)-6-(2,4,6-trifluorophenyl)[1,2,4]triazolo[1,5-a]pyrimidine, 5-chloro-6-(2,4,6-trifluorophenyl)-N-[(1R)-1,2,2-trimethylpropyl][1,2,4]triazolo[1,5-a]pyrimidin-7-amine, 5-chloro-N-[(1R)-1,2-dimethylpropyl]-6-(2,4,6-trifluorophenyl)[1,2,4]triazolo[1,5-a]pyrimidin-7-amine, N-[1-(5-bromo-3-chloropyridin-2-yl)ethyl]-2,4-dichloronicotinamide, N-(5-bromo-3-chloropyridin-2-yl)methyl-2,4-dichloronicotinamide, 2-butoxy-6-iodo-3-propyl-benzopyranon-4-one, N-{(Z)-[(cyclopropylmethoxy)imino][6-(difluoromethoxy)-2,3-difluorophenyl]methyl}-2-phenylacetamide, N-(3-ethyl-3,5,5-trimethyl-cyclohexyl)-3-formylamino-2-hydroxy-benzamide, 2-[[[1-[3(1Fluoro-2-phenylethyl)oxy]phenyl]ethylidene]amino]oxy]methyl]-alpha-(methoxyimino)-N-methyl-alphaE-benzeneacetamide, N-{2-[3-chloro-5-(trifluoromethyl)pyridin-2-yl]ethyl}-2-(trifluoromethyl)benzamide, N-(3',4'-dichloro-5-fluorobiphenyl-2-yl)-3-(difluoromethyl)-1-methyl-1H-pyrazole-4-carboxamide, 2-(2-{[6-(3-chloro-2-methylphenoxy)-5-fluoropyrimidin-4-yl]oxy}phenyl)-2-(methoxyimino)-N-methylacetamide, 1-[(4-methoxyphenoxy)methyl]-2,2-dimethylpropyl-1H-imidazole-1-carboxylic acid, O-[1-[(4-methoxyphenoxy)methyl]-2,2-dimethylpropyl]-1H-imidazole-1-carbothioic acid.

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The composition according to the invention comprising a mixture of a compound of formula (I) with a bactericide compound may also be particularly advantageous. Examples of suitable bactericide mixing partners may be selected in the following list : bronopol, dichlorophen, nitrapyrin, nickel dimethyldithiocarbamate, kasugamycin, octhillinone, furancarboxylic acid, oxytetracycline, probenazole, streptomycin, tecloftalam, copper sulphate and other copper preparations.

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The compound of formula (I) and the fungicide composition according to the invention can be used to curatively or preventively control the phytopathogenic fungi 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 characterised in that a compound of formula (I) or a fungicide composition according to the invention is applied to the seed, the plant or to the fruit of the plant or to the soil wherein the plant is growing or wherein it is desired to grow.

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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 overground parts
 5 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), *Ribesioideae* sp., *Juglandaceae* sp., *Betulaceae* sp., *Anacardiaceae* sp., *Fagaceae* sp.,
 10 *Moraceae* sp., *Oleaceae* sp., *Actinidaceae* sp., *Lauraceae* sp., *Musaceae* sp. (for instance banana trees and plantains), *Rubiaceae* sp., *Theaceae* sp., *Sterculiaceae* 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
 15 strawberries) ; major crops such as *Graminae* sp. (for instance maize, lawn or cereals such as wheat, rice, barley and triticales), *Asteraceae* sp. (for instance sunflower), *Cruciferae* sp. (for instance colza), *Fabaceae* 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.

20 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* ;

25 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* ;

30 Hemileia diseases, caused for example by *Hemileia vastatrix* ;

Phakopsora diseases, caused for example by *Phakopsora pachyrhizi* or *Phakopsora meibomia* ;

Puccinia diseases, caused for example by *Puccinia recondita* ;

Uromyces diseases, caused for example by *Uromyces appendiculatus* ;

35 Oomycete diseases such as :

Bremia diseases, caused for example by *Bremia lactucae* ;

Peronospora diseases, caused for example by *Peronospora pisi* or *P. 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* or *Pseudoperonospora cubensis* ;

Pythium diseases, caused for example by *Pythium ultimum* ;

Leafspot, leaf blotch and leaf blight diseases such as :

- 5 Alternaria diseases, caused for example by *Alternaria solani* ;
- Cercospora diseases, caused for example by *Cercospora beticola* ;
- Cladosporium diseases, caused for example by *Cladosporium cucumerinum* ;
- Cochliobolus diseases, caused for example by *Cochliobolus sativus* ;
- Colletotrichum diseases, caused for example by *Colletotrichum lindemuthianum* ;
- 10 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* ;
- 15 Guignardia diseases, caused for example by *Guignardia bidwelli* ;
- Leptosphaeria diseases, caused for example by *Leptosphaeria maculans* ; *Leptosphaeria nodorum* ;
- Magnaporthe diseases, caused for example by *Magnaporthe grisea* ;
- Mycosphaerella diseases, caused for example by *Mycosphaerella graminicola* ;
- 20 *Mycosphaerella arachidicola* ; *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* ;
- 25 Septoria diseases, caused for example by *Septoria apii* or *Septoria lycopersici* ;
- Typhula diseases, caused for example by *Typhula incarnata* ;
- Venturia diseases, caused for example by *Venturia inaequalis* ;
- Root and stem diseases such as :
- Corticium diseases, caused for example by *Corticium graminearum* ;
- 30 Fusarium diseases, caused for example by *Fusarium oxysporum* ;
- Gaeumannomyces diseases, caused for example by *Gaeumannomyces graminis* ;
- Rhizoctonia diseases, caused for example by *Rhizoctonia solani* ;
- Tapesia diseases, caused for example by *Tapesia acuformis* ;
- Thielaviopsis diseases, caused for example by *Thielaviopsis basicola* ;
- 35 Ear and panicle diseases such as :
- Alternaria diseases, caused for example by *Alternaria spp.* ;
- Aspergillus diseases, caused for example by *Aspergillus flavus* ;
- Cladosporium diseases, caused for example by *Cladosporium spp.* ;
- 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 :

5 Sphacelotheca diseases, caused for example by *Sphacelotheca reiliana* ;

Tilletia diseases, caused for example by *Tilletia caries* ;

Urocystis diseases, caused for example by *Urocystis occulta* ;

Ustilago diseases, caused for example by *Ustilago nuda* ;

Fruit rot and mould diseases such as :

10 Aspergillus diseases, caused for example by *Aspergillus flavus* ;

Botrytis diseases, caused for example by *Botrytis cinerea* ;

Penicillium diseases, caused for example by *Penicillium expansum* ;

Sclerotinia diseases, caused for example by *Sclerotinia sclerotiorum* ;

Verticillium diseases, caused for example by *Verticillium alboatrum* ;

15 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* ;

20 Sclerotium diseases, caused for example by *Sclerotium rolfsii* ;

Microdochium diseases, caused for example by *Microdochium nivale* ;

Canker, broom and dieback diseases such as :

Nectria diseases, caused for example by *Nectria galligena* ;

Blight diseases such as :

25 Monilinia diseases, caused for example by *Monilinia laxa* ;

Leaf blister or leaf curl diseases such as :

Taphrina diseases, caused for example by *Taphrina deformans* ;

Decline diseases of wooden plants such as :

Esca diseases, caused for example by *Phaemoniella clamydospora* ;

30 Eutypa dieback, caused for example by *Eutypa lata* ;

Dutch elm disease, caused for example by *Ceratocystis ulmi* ;

Diseases of flowers and Seeds such as :

Botrytis diseases, caused for example by *Botrytis cinerea* ;

Diseases of tubers such as :

35 Rhizoctonia diseases, caused for example by *Rhizoctonia solani*.

The fungicide 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.

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The dose of active compound usually applied in the method of treatment according to the invention is generally and advantageously from 10 to 800 g/ha, preferably from 50 to 300 g/ha for applications in foliar treatment. The dose of active substance applied is generally and advantageously from 2 to 200 g per 100 kg of seed, preferably from 3 to 150 g per 100 kg of seed

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in the case of seed treatment.

It is clearly understood that the doses indicated herein 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.

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The fungicide composition according to the invention may also be used in the treatment of genetically modified organisms with the compounds according to the invention or the agrochemical compositions according to the invention. Genetically modified plants are plants into genome of which a heterologous gene encoding a protein of interest has been stably integrated. The expression "heterologous gene encoding a protein of interest" essentially means

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genes which give the transformed plant new agronomic properties, or genes for improving the agronomic quality of the modified plant.

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,

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for example, mycoses, dermatoses, trichophyton diseases and candidiases or diseases caused by *Aspergillus spp.*, for example *Aspergillus fumigatus*.

The various aspects of the invention will now be illustrated with reference to the following tables of compounds and examples. The following tables illustrate in a non-limiting manner examples

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of compounds according to the invention.

In the following examples, M+1 (or M-1) means the molecular ion peak, plus or minus 1 a.m.u. (atomic mass unit) respectively, as observed in mass spectroscopy and M (Apcl+) means the molecular ion peak as it was found via positive atmospheric pressure chemical ionisation in

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mass spectroscopy.

In the following examples, the logP values were determined in accordance with EEC Directive 79/831 Annex V.A8 by HPLC (High Performance Liquid Chromatography) on a reversed-phase column (C 18), using the method described below :

Temperature: 40°C ; Mobile phases : 0.1% aqueous formic acid and acetonitrile ; linear gradient from 10% acetonitrile to 90% acetonitrile.

Calibration was carried out using unbranched alkan-2-ones (comprising 3 to 16 carbon atoms) with known logP values (determination of the logP values by the retention times using linear interpolation between two successive alkanones).

The lambda max values were determined in the maxima of the chromatographic signals using the UV spectra from 190nm to 400nm.

Preparation example 1: N-Ethyl-N-methyl-N'-[4-(2-chlor-4-trifluormethylpyridyl-6-oxy)-2,5-xylyl]form-amidine - compound of formula (I)

0.25 g (0.79 mmol) of 4-(2-chlor-4-trifluormethylpyridyl-6-oxy)-2,5-xylidine were dissolved in 10 ml of methanol and treated with 0.25 g of a solution of N-ethyl-N-methylformamiddimethylacetal in methanol (60%). The reaction mixture was stirred at 45°C for 12 h before the solvent was removed in vacuo to yield 200 mg (60% yield, 92% purity) of product; log P (pH 2.3) = 2.39

¹H NMR δ(ppm) 1.01 (t, ³J_{HH} = 7 Hz, 3H, CH₃), 1.92 (s, 3H, CH₃), 2.02 (s, 3H, CH₃), 3.21 (s, 3H, NCH₃), 4.01 (q, ³J_{HH} = 7 Hz, 2H, NCH₂), 6.71 (s, 1H, aryl-H), 6.86 (s, 1H, aryl-H), 7.29 (s, 1H, aryl-H), 7.61 (s, 1H, aryl-H), 7.65 (b, 1H, amidine-H).

Preparation of starting material:

4-(2-chlor-4-trifluormethylpyridyl-6-oxy)-2,5-xylidine - compound of formula (VII)

1.76 g (12.86 mmol) of 4-amino-2,5-dimethylphenol, 2.50 g (11.56 mmol) of 2,6-dichloro-4-trifluoromethylpyridine and 1.95 g (14.14 mmol) of potassium carbonate were suspended in 50 ml of DMSO under argon atmosphere. The reaction mixture was stirred at 120°C for 6h, cooled down to room temperature, treated with 150 ml of water and 50 ml of a 2N solution of sodium hydroxide in water and extracted with dichloromethane (2x 100 ml). The combined organic extracts were dried (MgSO₄), filtered and evaporated to dryness. The crude product was purified by silica gel chromatography eluting with cyclohexane/ethyl acetate to yield the title compound in 64% yield (2.6 g, 92% purity); log P (pH 2.3) = 2.77.

¹H NMR δ(ppm) 1.92 (s, 3H, CH₃), 2.02 (s, 3H, CH₃), 4.73 (s, 2H, NH₂), 6.52 (s, 1H, aryl-H), 6.70 (s, 1H, aryl-H), 7.20 (s, 1H, aryl-H), 7.58 (s, 1H, aryl-H).

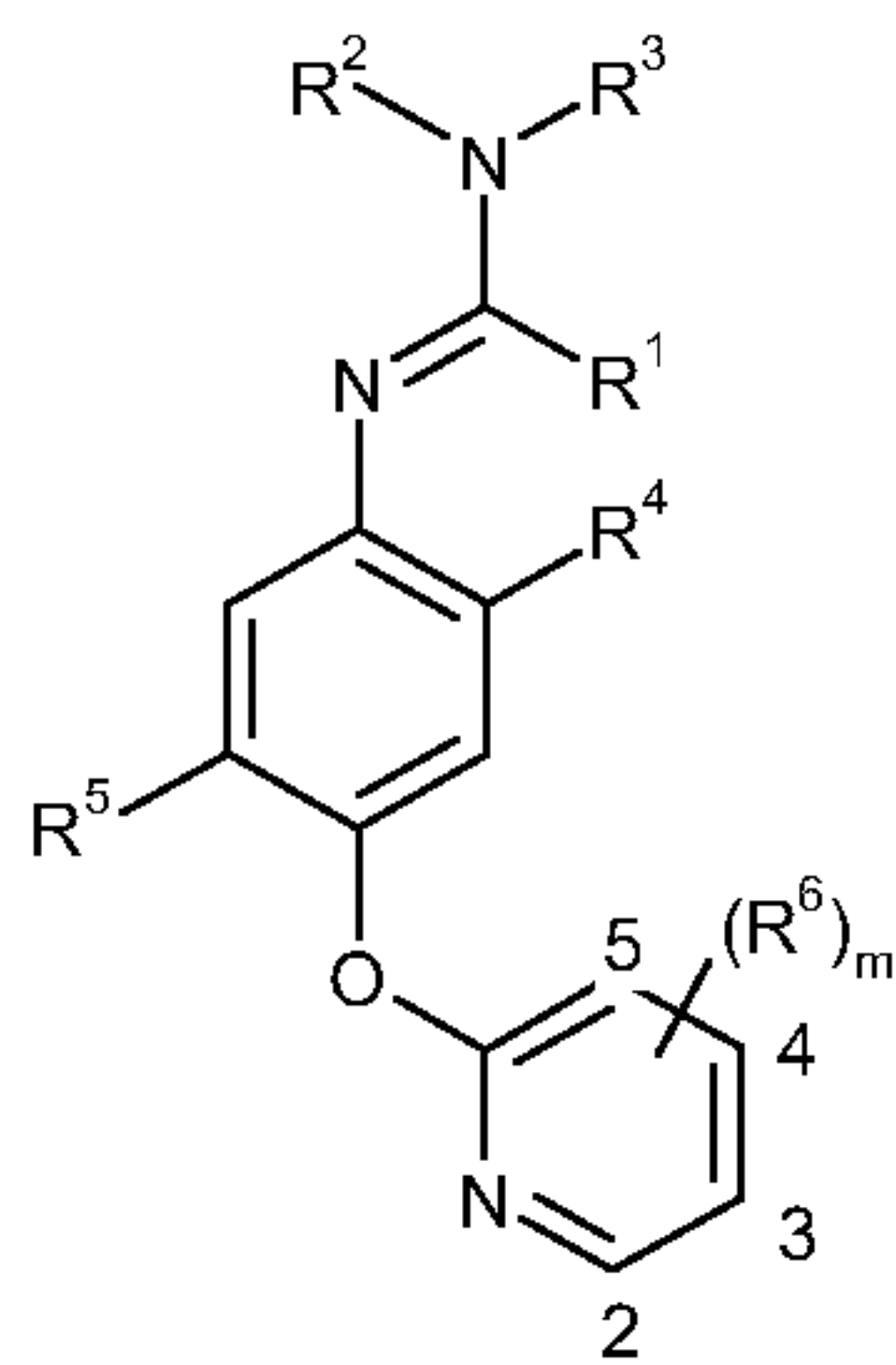


Table 1 :

example	R ¹	R ²	R ³	R ⁴	R ⁵	R ⁶		logP _a
2	H	Me	Et	Me	H	3-CF ₃	5-Cl	2.21
3	H	Me	Et	Me	H	4-Cl		1.50
4	H	Me	Et	Me	H	2-Cl	4-CF ₃	2.20
5	H	Me	Et	Me	H	3-Cl		1.58
6	H	Me	Et	Me	Me	2-Cl	3-CF ₃	2.36
7	H	Me	iPr	Me	H	2-Cl	4-CF ₃	2.22
8	H	Me	Et	Me	Me	3-Cl		1.84
9	H	Me	Et	Me	H	3-CF ₃		1.79
10	H	Me	Et	Me	Me	3-CF ₃		1.86
11	H	Me	Et	Me	Me	2-Cl	3-CF ₃	2.11
12	H	Me	iPr	Me	Me	2-Cl	4-CF ₃	2.52
13	H	Me	iPr	Me	Me	2-Cl	3-CF ₃	2.51
14	H	Me	Et	Me	Me	3-I		2.10
15	H	Me	Et	Me	Me	3-Me	4-(2-Cl-Ph)	2.58
16	H	Me	Et	Me	H	3-Me	4-(2-Cl-Ph)	2.39
17	H	Me	Et	Me	H	3-I		1.87
18	H	Et	Et	Me	Me	2-Cl	4-CF ₃	2.59
19	H	Me	nPr	Me	Me	2-Cl	4-CF ₃	2.66
20	H	Me	iPr	Me	tBu	2-Cl	4-CF ₃	3.17
21	H	Me	iPr	Me	iPr	2-Cl	4-CF ₃	2.97
22	H	Me	Et	Me	tBu	2-Cl	4-CF ₃	2.83
23	H	Me	Et	Me	Me	2-Me	4-Cl	1.58
24	H	Me	Et	Me	iPr	2-Cl	4-CF ₃	2.87
25	H	Me	Et	Me	Me	2-Me	4-CF ₃	2.19
26	H	Me	Et	Me	Me	2-Cl		1.78
27	H	Me	Et	Me	Me	4-CF ₃		1.96
28	H	Me	Et	Me	Me	3-Cl	5-Cl	2.00
29	H	Me	nPr	Me	Me	3-Cl	5-Cl	2.22

30	H	Me	Et	Me	Me	2-nPr	4-nPr	2.97
31	H	Me	Et	Me	Me	4-CN		1.42
32	H	Me	iPr	Me	Me	3-Cl	5-Cl	2.24
33	H	Me	Et	Me	Me	2-iPr	4-Cl	2.18
34	H	Me	iPr	Me	Me	2-iPr	4-Cl	2.34
35	H	Me	Et	Me	Me	3-CN		1.47
36	H	Me	nPr	Me	Me	3-CN		1.63
37	H	Me	Allyl	Me	Me	3-CN		1.56
38	H	-(CH ₂) ₅ -		Me	Me	3-CN		1.58
39	H	-(CH ₂) ₄ -		Me	Me	3-CN		1.46
40	H	-(CH ₂) ₅ -		Me	Me	2-Et	4-Cl	2.04
41	H	-(CH ₂) ₄ -		Me	Me	2-Et	4-Cl	1.95
42	H	Me	nPr	Me	Me	2-Et	4-Cl	2.00
43	H	Me	iPr	Me	Me	3-CF ₃	5-Cl	2.29
44	H	Me	Et	Me	Me	3-CF ₃	5-Cl	2.15
45	H	Me	Et	Me	Me	2-(4-Cl-Ph)		2.66
46	H	-(CH ₂) ₄ -		Me	Me	2-Cl		1.81
47	H	-(CH ₂) ₅ -		Me	Me	2-Cl		1.96
48	H	Me	Et	Me	Me	2-Et	4-Cl	1.98
49	H	Me	Et	Me	Me	2-Cl	3-Me	2.01
50	H	-(CH ₂) ₅ -		Me	Me	2-Cl	3-Me	2.21
51	H	Me	nPr	Me	Me	2-Cl	3-Me	2.17
52	H	-(CH ₂) ₄ -		Me	Me	2-Cl	3-Me	2.05
53	H	-(CH ₂) ₅ -		Me	Me	2-iPr	4-Cl	2.34
54	H	Me	nPr	Me	Me	2-iPr	4-Cl	2.35
55	H	-(CH ₂) ₄ -		Me	Me	2-iPr	4-Cl	2.22
56	H	Me	Et	Me	Me	4-Cl		1.75
57	H	Me	Et	Me	Me	2-Br		1.89
58	H	Me	nPr	Me	Me	2-Br		2.04
59	H	-(CH ₂) ₅ -		Me	Me	2-Br		2.06
60	H	-(CH ₂) ₄ -		Me	Me	2-Br		1.90
61	H	Me	Et	Me	Me	2-CF ₃		1.98
62	H	Me	Et	Me	Me	2,3-F ₂ -4-CF ₃		2.31
63	H	Me	nPr	Me	Me	2,3-F ₂ -4-CF ₃		2.48

Preparation example 64: N-Ethyl-N-methyl-N'-[4-(3-chlorpyridyl-5-oxy)-2,5-xylyl]formamidine - compound of formula (I)

0.50 g (2.19 mmol) of 4-(3-chlorpyridyl-5-oxy)-2,5-xylidine were dissolved in 10 ml of methanol and treated with 0.53 g of a solution of N-ethyl-N-methylformamiddimethylacetal in methanol (77%). The reaction mixture was stirred at 45°C for 12 h before the solvent was removed in vacuo to yield 620 mg (95% yield, 99% purity) of product; log P (pH 2.3) = 1.70.

¹H NMR δ(ppm) 1.19 (t, ³J_{HH} = 7 Hz, 3H, CH₃), 2.10 (s, 3H, CH₃), 2.12 (s, 3H, CH₃), 2.48 (s, 3H, CH₃), 3.04 (s, 3H, NCH₃), 3.29 (q, ³J_{HH} = 7 Hz, 2H, NCH₂), 6.77 (s, 1H, aryl-H), 7.14 (m, 1H, aryl-H), 7.21 (m, 1H, aryl-H), 7.94 (s, 1H, aryl-H), 8.12 (s, 1H, aryl-H), amidine-H not detected.

Preparation of starting material:

4-(3-chlorpyridyl-5-oxy)-2,5-xylidine - compound of formula (VII)

2.7 g (10.45 mmol) of 4-(3-chlorpyridyl-5-oxy)-2,5-dimethylnitrobenzene were dissolved in 10 ml of methanol and 10 ml of concentrated hydrochloric acid before 7.01 g (31.36 mmol) of stannous chloride were added. The reaction mixture was refluxed for 4 h, cooled to room temperature and extracted with dichloromethane (2 x 50 ml). The combined organic layers were dried (MgSO₄), filtered and evaporated to dryness to yield 2.2 g of pure product (92%); log P (pH 2.3) = 1.83.

¹H NMR δ(ppm) 2.15 (s, 3H, CH₃), 2.27 (s, 3H, CH₃), 2.58 (s, 3H, CH₃), 4.5 (b, 2H, NH₂), 6.90 (m, 1H, aryl-H), 7.32 (m, 1H, aryl-H), 7.49 (m, 1H, aryl-H), 7.55 (m, 1H, aryl-H), 8.27 (m, 1H, aryl-H).

4-(3-chlorpyridyl-5-oxy)-2,5-dimethylnitrobenzene - compound of formula (IV)

2.00 g (10.78 mmol) of 4-chloro-2,5-dimethylnitrobenzene, 1.29 g (11.86 mmol) of 3-hydroxy-6-methylpyridine and 1.93 g (14.01 mmol) of potassium carbonate were suspended in 10 ml of DMF. The reaction mixture was refluxed for 2h, cooled down to room temperature, treated with 100 ml of water and 50 ml of a 2N solution of sodium hydroxide in water and extracted with dichloromethane (2x 100 ml). The combined organic extracts were dried (MgSO₄), filtered and evaporated to dryness. The crude product was purified by silica gel chromatography eluting with cyclohexane/ethyl acetate to yield the title compound in 94% yield (2.9, 95% purity); log P (pH 2.3) = 3.61.

¹H NMR δ(ppm) 2.30 (s, 3H, CH₃), 2.42 (s, 3H, CH₃), 2.58 (s, 3H, CH₃), 6.79 (m, 1H, aryl-H), 7.32 (m, 1H, aryl-H), 7.43 (m, 1H, aryl-H), 8.04 (m, 1H, aryl-H), 8.29 (m, 1H, aryl-H),

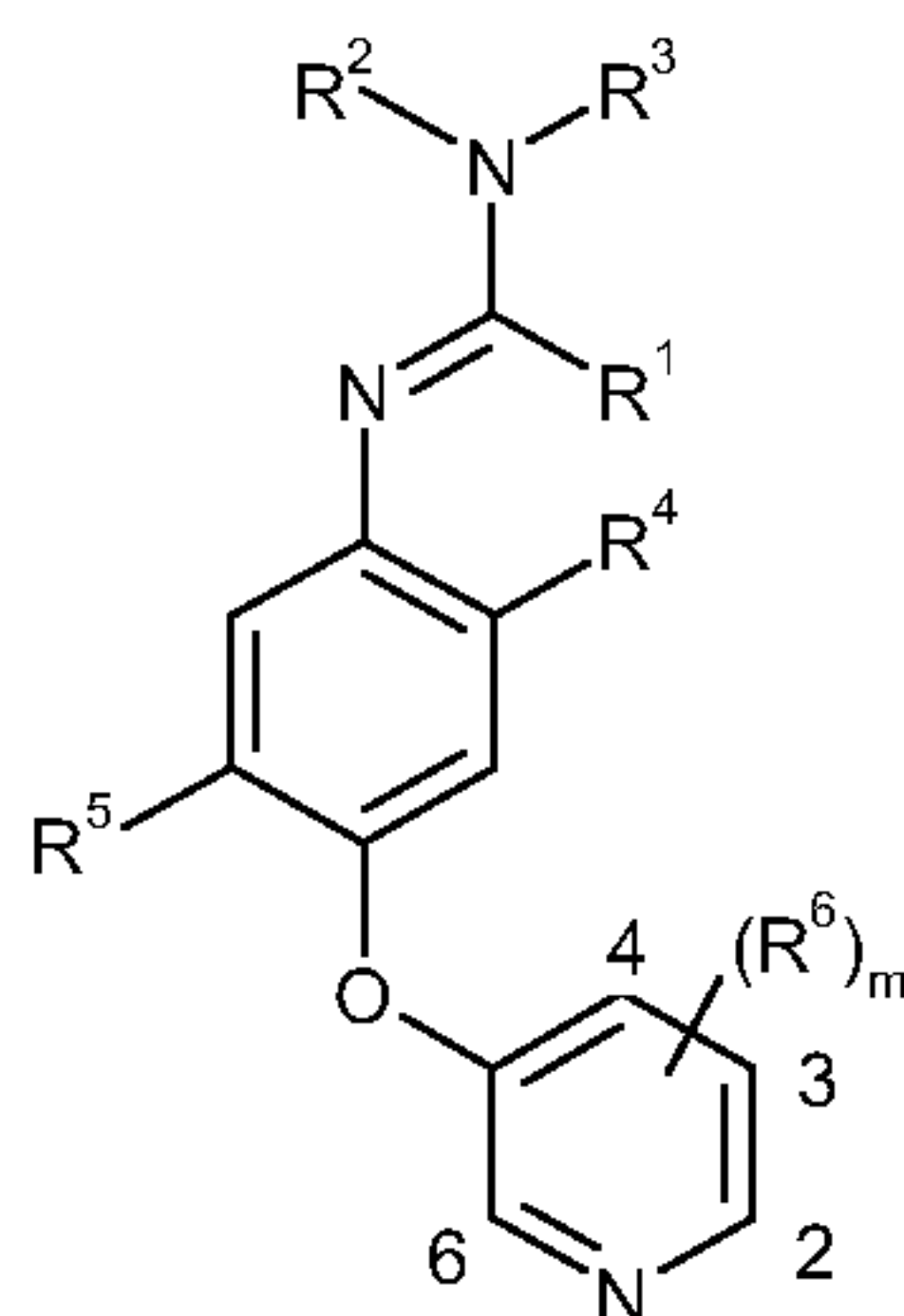


Table 2 :

N°	R¹	R²	R³	R⁴	R⁵	R⁶	logP _a
65	H	Me	Et	Me	Me	2-Me	0.60
66	H	Me	Et	Me	Me	6-Me	1.56
67	H	Me	Et	Me	Me	3-Cl	1.82

5 Preparation example 68: N-Ethyl-N-methyl-N'-[4-(2-ethyl-3-chloropyridyl-4-oxy)-2,5-xylyl]form-
amidine - compound of formula (I)

0.20 g (0.72 mmol) of 4-(2-ethyl-3-chloropyridyl-4-oxy)-2,5-xylidine and 5 mg of p-toluene
sulfonic acid were refluxed in 20 ml of trimethylformate for 3 h. The reaction mixture was cooled
to room temperature and the solvent was removed in vacuo. The residue was dissolved in 50 ml
10 of dichloromethane and subsequently treated with 0.09 g (1.45 mmol) of N-ethyl-N-
methylamine. After stirring at room temperature for 16 h the solvent and unreacted amine was
removed in vacuo to give the product in excellent yield (240 mg, 99%) and purity (98%); log P
(pH 2.3) = 1.47.

¹H NMR δ(ppm) 1.16 (t, ³J_{HH} = 7 Hz, 3H, CH₃), 1.26 (t, ³J_{HH} = 7 Hz, 3H, CH₃), 2.01 (s, 3H, CH₃),
15 2.17 (s, 3H, CH₃), 2.93 (q, ³J_{HH} = 7 Hz, 2H, CH₂), 2.99 (s, 3H, NCH₃), 3.42 (q, ³J_{HH} = 7 Hz, 2H,
NCH₂), 6.40 (m, 1H, pyridine-H), 6.81 (s, 1H, Ph-H), 6.83 (s, 1H, Ph-H), 7.71 (s, 1H, amidine-H),
8.22 (m, 1H, pyridine-H).

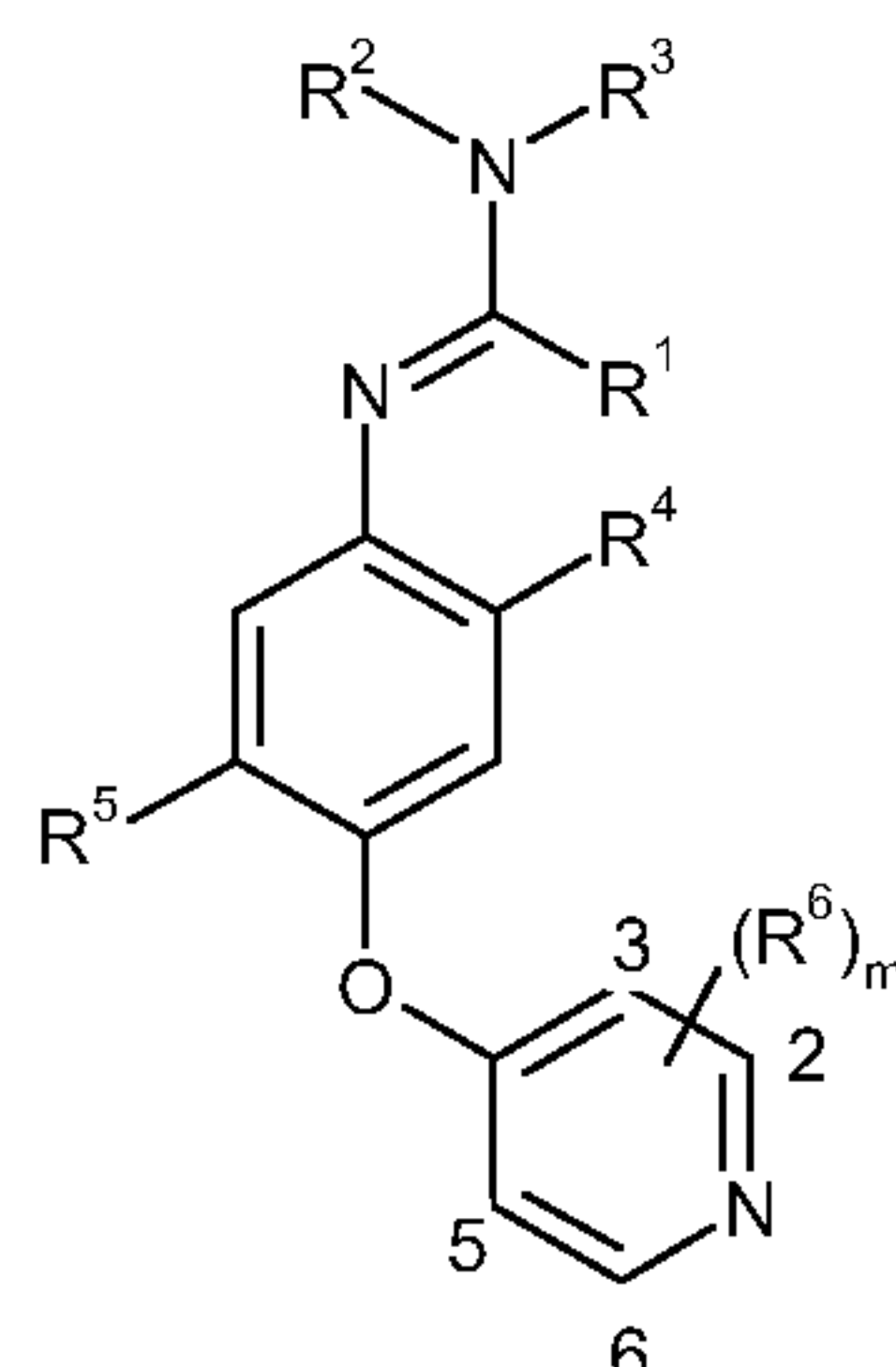
Preparation of starting material:

20 4-(2-Ethyl-3-chloropyridyl-4-oxy)-2,5-xylidine - compound of formula (VII)

3.11 g (22.72 mmol) of 4-amino-2,5-dimethylphenol, 4.00 g (22.72 mmol) of 3,4-dichloro-2-
ethylpyridine and 5.02 g (36.05 mmol) of potassium carbonate were suspended in 50 ml of
DMSO under argon atmosphere. The reaction mixture was stirred at 120°C for 6h, cooled
down to room temperature, treated with 150 ml of water and 50 ml of a 2N solution of
25 sodium hydroxide in water and extracted with dichloromethane (2x 100 ml). The combined
organic extracts were dried (MgSO₄), filtered and evaporated to dryness. The crude product

was purified by silica gel chromatography eluting with cyclohexane/ethyl acetate to yield the title compound in 59% yield (3.7 g, 97% purity); log P (pH 2.3) = 1.66.

^1H NMR δ (ppm) 1.25 (t, $^3J_{\text{HH}} = 7$ Hz, 3H, CH₃), 1.92 (s, 3H, CH₃), 2.03 (s, 3H, CH₃), 2.91 (q, $^3J_{\text{HH}} = 7$ Hz, 2H, CH₂), 4.64 (s, 2H, NH₂), 6.37 (m, 1H, pyridine-H), 6.57 (s, 1H, Ph-H), 6.68 (s, 1H, Ph-H), 8.17 (m, 1H, pyridine-H).



10 Table 3 :

N°	R ¹	R ²	R ³	R ⁴	R ⁵	R ⁶		logP _a
69	H	Me	Et	Me	Me	2-Cl		1.45
70	H	-(CH ₂) ₅ -		Me	Me	2-Cl		1.66
71	H	-(CH ₂) ₄ -		Me	Me	2-Cl		1.52
72	H	Me	nPr	Me	Me	2-Cl		1.56
73	H	Me	Allyl	Me	Me	2-Et	3-Cl	1.51
74	H	Me	nPr	Me	Me	2-Et	3-Cl	1.59
75	H	-(CH ₂) ₅ -		Me	Me	2-Et	3-Cl	1.56
76	H	-(CH ₂) ₄ -		Me	Me	2-Et	3-Cl	1.43
77	H	Me	Et	Me	Me	2-CF ₃		1.75
78	H	Me	nPr	Me	Me	2-CF ₃		1.75
79	H	-(CH ₂) ₅ -		Me	Me	2-CF ₃		1.78
80	H	-(CH ₂) ₄ -		Me	Me	2-CF ₃		1.69
81	H	Me	Allyl	Me	Me	2-Cl		1.74

Efficacy example A : *in vivo* preventive test on *Puccinia recondita f. Sp. tritici* (wheat brown rust).

15 Solvent: 50 parts by weight of n,n-dimethylacetamid
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.

- 5 To test for preventive activity, young plants are inoculated with a spore suspension of *Puccinia recondita* in a 0.1% strength aqueous agar solution. After the spray coating has dried on, the plants are sprayed with the preparation of active compound at the stated rate of application. The plants remain for 24 hours in an incubation cabinet at 20°C and a relative atmospheric humidity of 100%.
- 10 The plants are placed in a greenhouse at a temperature of approximately 20°C and a relative atmospheric humidity of approximately 80% to promote the development of rust pustules.

The test is evaluated 10 days after the inoculation. 0% means an efficacy which corresponds to that of the control, while an efficacy of 100% means that no disease is observed.

- 15 In this test the following compounds according to the invention showed an efficacy of 70% or even higher at a concentration of 1000ppm of active ingredient : 1 ; 3 ; 4 ; 5 ; 6 ; 7 ; 9 ; 10 ; 11 ; 12 ; 13 ; 14 ; 18 ; 19 ; 23 ; 26 ; 27 ; 28 ; 29 ; 32 ; 33 ; 34 ; 35 ; 42 ; 43 ; 44 ; 47 ; 50 ; 57 ; 58 ; 59 ; 60 ; 61 ; 64 ; 66 ; 68 ; 69 ; 70 ; 71 ; 74 ; 75 ; 76 ; 81.

20 Efficacy example B : *in vivo* preventive test on *Erysiphe graminis* (Powdery mildew on Barley)

Solvent: 50 parts by weight of n,n-dimethylacetamid

Emulsifier: 1 part by weight of alkylaryl polyglycol ether

- 25 To produce a suitable preparation of active compound, 1 part by weight of active compound or active compound combination is mixed with the stated amounts of solvent and emulsifier, and the concentrate is diluted with water to the desired concentration.

- 30 To test for preventive activity, young plants are sprayed with the preparation of active compound or active compound combination at the stated rate of application.

After the spray coating has dried on, the plants are dusted with spores of *Erysiphe graminis f.sp. hordei*.

The plants are placed in a greenhouse at a temperature of approximately 20°C and a relative atmospheric humidity of approximately 80% to promote the development of mildew pustules.

35

The test is evaluated 7 days after the inoculation. 0% means an efficacy which corresponds to that of the control, while an efficacy of 100% means that no disease is observed.

In this test the following compounds according to the invention showed an efficacy of 70% or even higher at a concentration of 1000ppm of active ingredient : 1 ; 3 ; 4 ; 6 ; 7 ; 10 ; 11 ; 12 ; 14

; 18 ; 19 ; 23 , 26 ; 27 ; 28 ; 29 ; 33 ; 34 ; 35 ; 42 ; 43 ; 44 ; 47 ; 64 ; 66 ; 68 ; 69 ; 70 ; 72 ; 74 ; 75 ; 76.

Efficacy example C : *in vivo* protective test on *Alternaria solani* (Leaf spot of tomato)

- 5 Solvent: 49 parts by weight of N, N-dimethylformamide
Emulsifier: 1 part by weight of alkylaryl polyglycoether

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
10 water to the desired concentration.

To test for protective 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 remain for one day in an
15 incubation cabinet at approximately 20°C and a relative atmospheric humidity of 100%. Then the plants are placed in an incubation cabinet at approximately 20°C and a relative atmospheric humidity of 96%.

The test is evaluated 7 days after the inoculation. 0% means an efficacy which corresponds to
20 that of the control while an efficacy of 100% means that no disease is observed..

In this test, invention related compounds of the following formula revealed an efficacy of 70% or higher at a concentration of 500 ppm of active ingredient : 1 ; 6 ; 12 ; 23 ; 48 ; 69.

Efficacy example D : *in vivo* protective test on *Podosphaera leucotricha* (apples).

- 25 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
30 mixed with the stated amounts of solvent and emulsifier, and the concentrate is diluted with water to the desired concentration.

To test for protective 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
35 with an aqueous spore suspension of the causal agent of apple mildew (*Podosphaera leucotricha*). The plants are then placed in a greenhouse at approximately 23°C and a relative atmospheric humidity of approximately 70%.

The test is evaluated 10 days after the inoculation. 0% means an efficacy which corresponds to that of the control, while an efficacy of 100% means that no disease is observed.

In this test the compounds according to the invention of the following structures showed efficacy of 70% or even higher at a concentration of 100ppm of active ingredient : 1 ; 6 ; 12 ; 13 ; 23 ; 28 ; 34 ; 66 ; 69 ; 73 ; 74.

Efficacy example E : *in vivo* protective test on *Sphaerotheca fuliginea* (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 protect 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 control, while an efficacy of 100% means that no disease is observed.

In this test the compounds according to the invention of the following structures showed efficacy of 70% or even higher at a concentration of 100ppm of active ingredient : 1 ; 6 ; 12 ; 13 ; 21 ; 22 ; 23 ; 26 ; 28 ; 33 ; 34 ; 42 ; 48 ; 54 ; 55 ; 57 ; 66 ; 68 ; 69 ; 73 ; 74 ; 75.

Efficacy example F : *in vivo* protective test on *Uromyces appendiculatus* (beans)

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 protective 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 the causal agent of bean rust (*Uromyces appendiculatus*)

and then remain for 1 day in an incubation cabinet at approximately 20°C and a relative atmospheric humidity of 100 %.

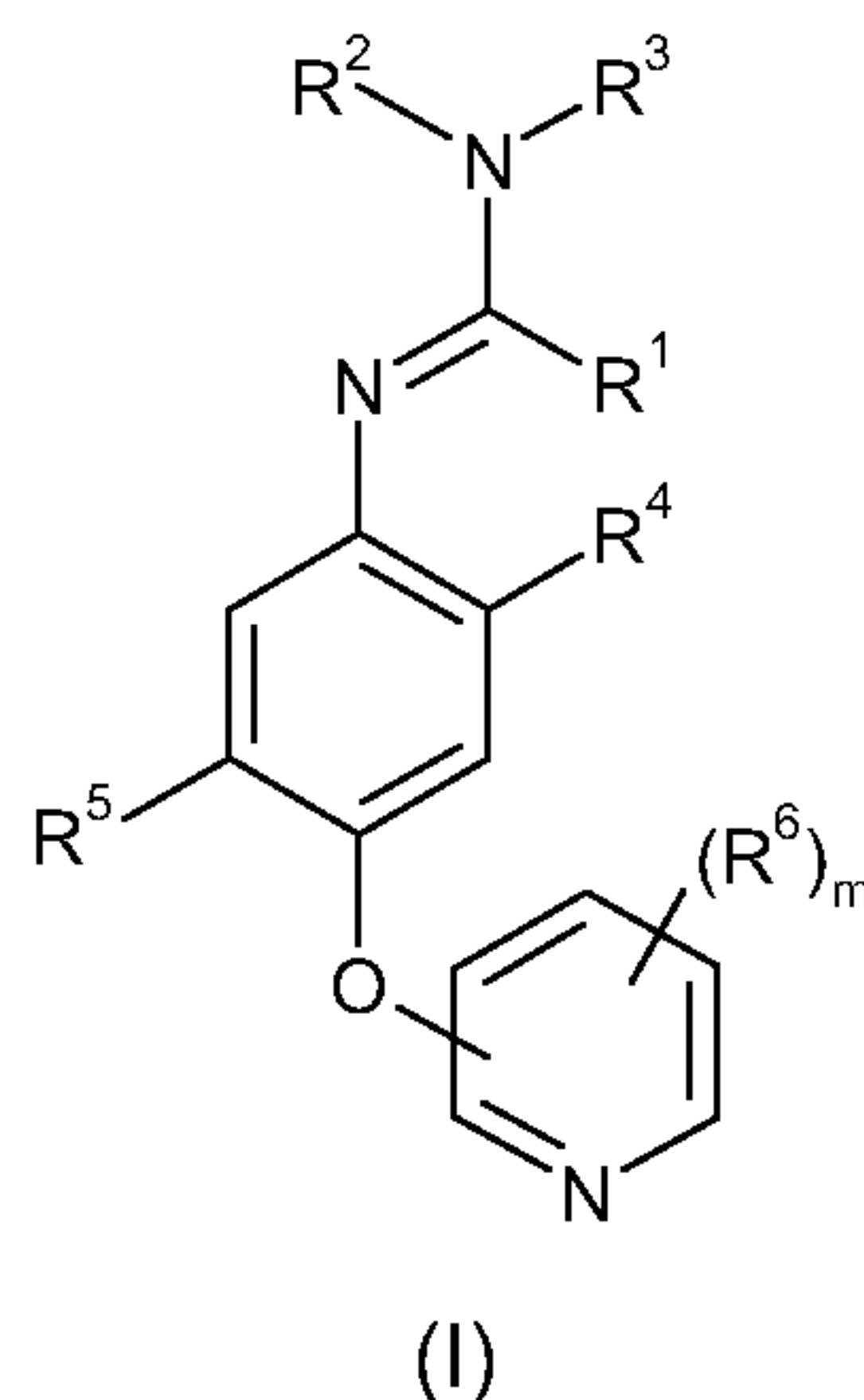
5 The plants are then placed in a greenhouse at approximately 21°C and a relative atmospheric humidity of approximately 90 %.

The test is evaluated 10 days after the inoculation. 0% means an efficacy which corresponds to that of the control, while an efficacy of 100% means that no disease is observed.

In this test the compounds according to the invention of the following structures showed efficacy of 70% or even higher at a concentration of 10ppm of active ingredient : 48 ; 50 ; 54 ; 55 ; 57

CLAIMS

1. A phenyl-amidine derivative of formula (I) :



wherein

- R¹ represents H, a substituted or non substituted C₁-C₁₂-alkyl, a substituted or non substituted C₂-C₁₂-alkenyl, a substituted or non substituted C₂-C₁₂-alkynyl, SH or a substituted or non substituted S-C₁-C₁₂-alkyl;
- R² represents a substituted or non substituted C₁-C₁₂-alkyl;
- R³ represents a substituted or non substituted C₂-C₁₂-alkyl, substituted or non substituted C₃-C₆-cycloalkyl, substituted or non substituted C₂-C₁₂-alkenyl, substituted or non substituted C₂-C₁₂-alkynyl, halogeno-C₁-C₁₂-alkyl; or
- R¹ and R², R¹ and R³ or R² and R³ can form together a substituted or non substituted 5 to 7-membered heterocycle;
- R⁴ represents a substituted or non substituted C₁-C₁₂-alkyl, a halogen atom, halogeno-C₁-C₁₂-alkyl, substituted or non substituted O-C₁-C₁₂-alkyl or cyano;
- R⁵ represents H, a substituted or non substituted C₁-C₁₂-alkyl, a halogen atom, halogeno-C₁-C₁₂-alkyl, substituted or non substituted O-C₁-C₁₂-alkyl or cyano;
- m represents 1, 2, 3 or 4;
- R⁶ represents H, halogen, cyano, substituted or non substituted phenoxy, substituted or non substituted phenyl, substituted or non substituted C₁-C₁₂-alkyl, or halogeno-C₁-C₁₂-alkyl, NR⁷R⁸, OR⁷, SR⁷, trialkysilyl, COOR⁷, C(R⁷)=NOR⁸;
- R⁷, R⁸ represent H, substituted or non substituted C₁-C₁₂-alkyl, aryl;
- R⁷ and R⁸ may form a substituted or non substituted, saturated or non saturated 5- to 7-membered heterocycle;

as well as salts; N-oxydes, metallic complexes, metalloidic complexes and optically active or geometric isomers thereof.

2. A compound of formula (I) according to claim 1 wherein

- R¹ represents H, C₁-C₁₂-alkyl or SH ; or
- R² represents methyl or ethyl ; or
- R³ represents C₂-C₁₂-alkyl, C₂-C₁₂-alkenyl or C₃-C₆-cycloalkyl ; or
- 5 • R² and R³ can form together a substituted or non substituted 5- to 7-membered heterocycle ; or
- R⁴ represents C₁-C₁₂-alkyl or a halogen atom ; or
- R⁵ represents a C₁-C₁₂-alkyl or a halogen atom; or
- R⁶ represents H, a halogen atom, cyano, substituted or non substituted C₁-C₁₂-alkyl, or
- 10 halogeno-C₁-C₁₂-alkyl, NR⁷R⁸, OR⁷, SR⁷, COOR⁷; or
- R⁷ and R⁸ independently represent H, methyl, ethyl, substituted phenyl ; or
- R⁷ and R⁸ may form a substituted or non substituted, saturated or non saturated 5- to 7-membered heterocycle.

15 3. A compound of formula (I) according to claims 1 or 2 wherein

- R¹ represents C₁-C₁₂-alkyl ; or
- R³ represents a non substituted C₂-C₄-alkyl, C₃-C₄-alkenyl or cyclopropyl ; or
- R² and R³ can form together a 6-membered heterocycle ; or
- R⁴ represents a non substituted C₁-C₁₂-alkyl or a chlorine atom ; or
- 20 • R⁵ represents a non substituted C₁-C₁₂-alkyl or a chlorine atom ; or
- R⁷ and R⁸ may form a piperidinyl or a morpholinyl.

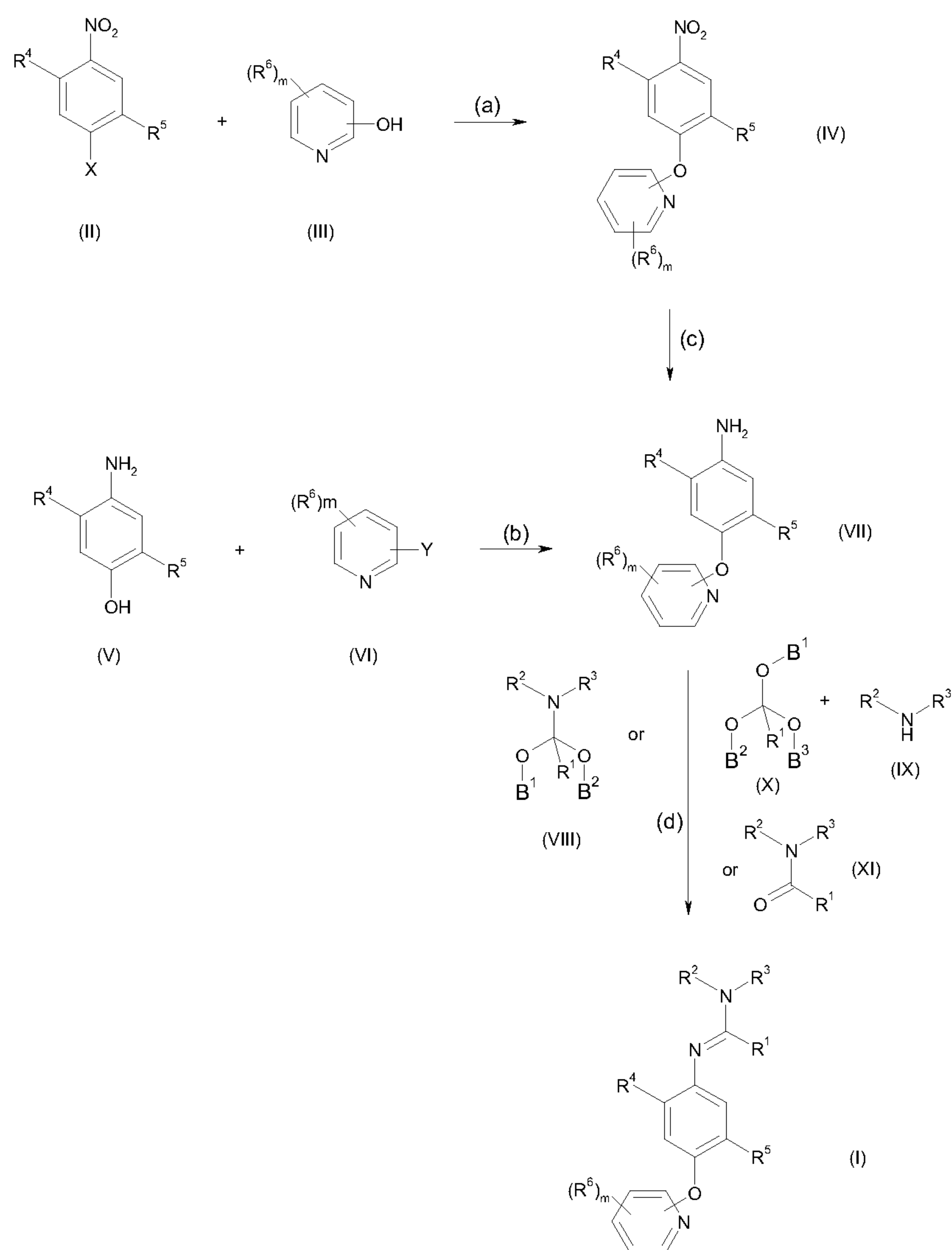
4. A compound of formula (I) according to claims 1 to 3 wherein

- R¹ represents methyl or ethyl ; or
- 25 • R³ represents ethyl, n-propyl, i-propyl, propenyl or allyl ; or
- R² and R³ can form together a piperidinyl or a pyrrolidinyl ; or
- R⁴ represents methyl or ethyl ; or
- R⁵ represents methyl or ethyl.

30 5. A compound of formula (I) according to claims 1 to 4 wherein R² and R³ form together a bis-alkylated-pyrrolidinyl.

6. A compound of formula (I) according to claim 5 wherein R² and R³ form together a bis-methyl-pyrrolidinyl.

35 7. A process for the preparation of a compound of formula (I) according to claims 1 to 6 comprising the following steps:



8. A method for controlling phytopathogenic fungi of crops, characterized in that an agronomically effective and substantially non-phytotoxic quantity of a compound according to claims 1 to 6 is applied to the soil where plants grow or are capable of growing, to the leaves and/or the fruit of plants or to the seeds of plants.