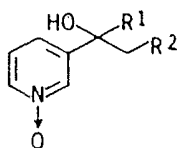


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PYRIDINE-N-OXIDES AND FUNGICIDES CONTAINING THEM
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- (57) Claim

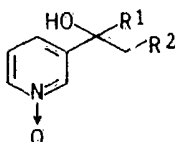
1. A 3-substituted pyridine-N-oxide of the formula



(I),

where R¹ is C₁-C₁₂-alkyl, and R² is phenyl or substituted phenyl bearing from one to three radicals selected from the group consisting of C₁-C₄-alkyl, C₁-C₄-haloalkyl, C₁-C₄-alkoxy, C₁-C₄-haloalkoxy and halogen, and its salts physiologically tolerated by plants.

2. A fungicidal agent containing an inert carrier and a 3-substituted pyridine-N-oxide of the formula



(I),

where R¹ is C₁-C₁₂-alkyl, and R² is phenyl or substituted phenyl bearing from one to three radicals selected from the group consisting of C₁-C₄-alkyl, C₁-C₄-haloalkyl, C₁-C₄-alkoxy, C₁-C₄-haloalkoxy and halogen, or a salt thereof physiologically tolerated by plants.

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612752 Form 1

COMPLETE SPECIFICATION

(ORIGINAL)

Class

Int. Class

Application Number:
Lodged:

Complete Specification Lodged:
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Related Art :

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Complete Specification for the invention entitled:

PYRIDINE-N-OXIDES AND FUNGICIDES CONTAINING THEM

The following statement is a full description of this invention, including the best method of performing it known to us

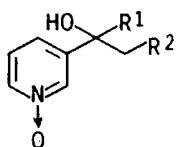
Pyridine-N-oxides and fungicides containing them

The present invention relates to novel pyridine-N-oxides and salts thereof, fungicidal agents containing these compounds, and methods of
5 preparing them.

It has been disclosed (EP 69,330) to use 3-pyridylmethanols as fungicides. However, their fungicidal action is only satisfactory at high application rates.

10

We have now found that novel pyridine-N-oxides of the formula



(I),

where R¹ is C₁-C₁₂-alkyl, and R² is phenyl or substituted phenyl bearing
15 from one to three radicals selected from the group consisting of C₁-C₄-alkyl, C₁-C₄-haloalkyl, C₁-C₄-alkoxy, C₁-C₄-haloalkoxy and halogen, and their salts physiologically tolerated by plants, have a better fungicidal action than the prior art 3-pyridylmethanols and are also much better tolerated by plants.

20

R¹ is C₁-C₁₂-alkyl, and especially C₃-C₈-alkyl, for example methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, tert-butyl, n-pentyl, isopentyl, neopentyl, n-hexyl, neohexyl, n-heptyl, n-octyl, n-nonyl, n-decyl, n-undecyl and n-dodecyl.

25

R² is for example phenyl, mono-, di- or trimethylphenyl, isopropylphenyl, tert-butylphenyl, trifluoromethylphenyl, pentafluoroethylphenyl, mono-, di- or trimethoxyphenyl, tert-butoxyphenyl, tetrafluoroethoxyphenyl, fluorophenyl, chlorofluorophenyl, and mono-, di- or trichlorophenyl.

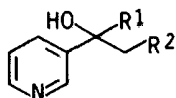
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Examples of salts are acid addition salts, for instance salts of inorganic acids, e.g., hydrochloric acid, hydrobromic acid, sulfuric acid and phosphoric acid, or of organic acids, e.g., C₁-C₄-alkylcarboxylic acids, acetic acid, propionic acid, tolylsulfonic acid and dodecylbenzenesulfonic
35 acid.

The compounds contain at least one asymmetrical carbon atom, and therefore appear in the form of their optical isomers, viz., enantiomers. The present invention embraces both the pure enantiomers and the racemates and diastereomers.

5

The pyridine-N-oxides of the formula I may be produced for example by oxidizing, in conventional manner, a 3-substituted pyridine of the formula



(II)

10 where R¹ and R² have the above meanings. Examples of suitable oxidants are peracids, or peracids formed in situ from hydrogen peroxide and carboxylic anhydrides, hydrogen peroxide or organic derivatives of hydrogen peroxide (cf., for example, R.A. Abramovitch and E.M. Smith, Chemistry of Heterocyclic Compounds, vol. 14, Suppl. 2, p. 1 et seq., John Wiley, New York, 15 1974; A.R. Katritzky, J.M. Lagowski, The Chemistry of Heterocyclic N-Oxides, p. 21 et seq., Academic Press, New York, 1971). A particularly advantageous oxidant for this process is 3-chloroperbenzoic acid (cf. J.C. Craig, K.K. Purnshothaman, J. Org. Chem., 35, 1721, 1970). Examples of diluents when the oxidation is carried out with 3-chloroperbenzoic acid 20 are chlorohydrocarbons, especially dichloromethane and trichloromethane.

3-Pyridylcarbinols of the formula II are known from EP-A-69,330. The manufacturing instructions given there can be applied without any difficulty to other alkyl and aryl radicals.

25

The preparation of the novel pyridine-N-oxides is illustrated by the following examples.

Example 1

30

1-(2,4-Dichlorophenyl)-2-(pyridine-1-oxide-3-yl)-2-decanol

While stirring, a solution of 7.6 g (0.044 mol) of 3-chloroperbenzoic acid in 60 ml of dichloromethane is dripped into a solution of 8.5 g

35 (0.022 mol) of 1-(2,4-dichlorophenyl)-2-(pyridin-3-yl)-2-decanol in 100 ml of dichloromethane. After the reaction solution has been stirred overnight, it is washed twice with 5wt% strength sodium hydroxide solution and

40

once with water, dried over sodium sulfate and evaporated down under reduced pressure. The oily residue is stirred with diisopropyl ether until crystallization occurs. After suction filtration and drying under reduced pressure, there is obtained 6.8 g (78% of theory) of a beige-colored powder having a melting point of 99-102°C (compound no. 1).

Example 2

1-(4-Fluorophenyl)-2-(pyridine-1-oxide-3-yl)-2-decanol

10

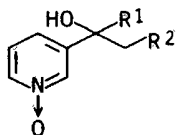
While stirring, a solution of 7.6 g (0.044 mol) of 3-chloroperbenzoic acid in 60 ml of dichloromethane is dripped into a solution of 7.5 g (0.022 mol) of 1-(2,4-dichlorophenyl)-2-(pyridin-3-yl)-2-decanol in 100 ml of dichloromethane. After the reaction solution has been stirred over-

15 night, it is concentrated to about half of its volume and introduced into a column containing about 300 g of basic aluminum oxide (activity stage I). Nonpolar impurities are eluted with dichloromethane, and the pyridine-1-oxide with dichloromethane/methanol (3:1). Concentration under reduced pressure gives 5.5 g (70% of theory) of compound no. 2 as a yellow oil.

20 ¹H-NMR of the pyridine moiety (200 MHz, CDCl₃): δ = 8.30 (2-H), 8.05 (6-H), 7.20 (4-H, 5-H).

The following compounds may be prepared analogously:

25 Table 1



(I)

Compound No.	R ¹	R ²	mp (°C)
30 1	n-octyl	2,4-dichlorophenyl	99-102
2	n-octyl	4-fluorophenyl	oil
3	isopropyl	4-chlorophenyl	
4	isopropyl	2-chlorophenyl	
5	isopropyl	2,4-dichlorophenyl	150-151
35 6	n-Propyl	2,4-Dichlorophenyl	
7	n-Propyl	Phenyl	
8	n-Propyl	4-Methylphenyl	
9	n-Butyl	2,4-Dichlorophenyl	

Table 1 (contd.)

Compound No.	R ¹	R ²	mp (°C)
5			
10	n-butyl	4-chlorophenyl	
11	isobutyl	2,4-dichlorophenyl	161
12	isobutyl	4-chlorophenyl	
13	isobutyl	4-fluorophenyl	
10 14	isobutyl	3-trifluoromethylphenyl	
15	isobutyl	2-chlorophenyl	
16	n-pentyl	4-chlorophenyl	
17	n-pentyl	2,4-dichlorophenyl	
18	n-pentyl	2-chlorophenyl	
15 19	neo-hexyl	2-chlorophenyl	
20	neo-hexyl	4-chlorophenyl	
21	neo-hexyl	2,4-dichlorophenyl	150-153
22	neo-hexyl	4-trifluoromethylphenyl	
23	neo-hexyl	3-trifluoromethylphenyl	
20 24	neo-hexyl	4-fluorophenyl	
25	neo-hexyl	4-tert-butylphenyl	
26	neo-hexyl	4-chloro-3-trifluoromethylphenyl	
27	n-hexyl	2,4-dichlorophenyl	
28	n-heptyl	2,4-dichlorophenyl	
25 29	n-octyl	2-chlorophenyl	65-67
30	n-octyl	4-chlorophenyl	oil
31	n-octyl	3-trifluoromethylphenyl	oil
32	n-nonyl	2,4-dichlorophenyl	
33	n-decyl	2,4-dichlorophenyl	
30 34	n-undecyl	2,4-dichlorophenyl	
35	n-dodecyl	2,4-dichlorophenyl	
36	n-dodecyl	4-chlorophenyl	
37	n-dodecyl	2-chlorophenyl	57-64
38	n-dodecyl	4-fluorophenyl	73-76
35 39	neo-pentyl	2,4-dichlorophenyl	
40	neo-pentyl	4-chlorophenyl	
41	neo-pentyl	2-chlorophenyl	
42	neo-pentyl	4-fluorophenyl	
43	neo-pentyl	2-fluorophenyl	
40 44	neo-pentyl	4-trifluoromethylphenyl	
45	neo-pentyl	3-trifluoromethylphenyl	
46	neo-pentyl	4-(4-tert-butylphenyl)	

Compound NMR data and IR values
No.

2	$^1\text{H-NMR}$ (CDCl_3): δ = 8.30 (s, 2'-H), 8.05 (s, 6'-H), 7.20 (br.m, 4'-H, 5'-H), 7.10 (dd, 2H_O), 6.85 (dd, 2H_m), 4.75 (br.s, OH), 3.03 (dd, 1- CH_2), 1.80 (br.m, 3- CH_2), 1.20 (br.m, 4- bis 9- CH_2), 0.85 (t, 10- CH_3).
5	IR (film): ν = 2953, 2927, 2855, 1601, 1509, 1426, 1298, 1261, 1223, 1158, 1015 cm^{-1} .
10	
30	$^1\text{H-NMR}$ (CDCl_3): δ = 8.30 (s, 2'-H), 8.05 (s, 6'-H), 7.20 (br.m, 4'-H, 5'-H), 7.15 (d, 2H_O), 6.95 (d, 2H_m), 4.25 (br.s, OH), 3.00 (dd, 1- CH_2), 1.78 (br.m, 3- CH_2), 1.20 (br.m, 4- bis 9- CH_2), 0.85 (t, 10- CH_3).
15	IR (film): ν = 3223, 2927, 2854, 1602, 1490, 1467, 1428, 1258, 1149, 1093, 1016 cm^{-1} .
31	$^1\text{H-NMR}$ (CDCl_3): δ = 8.30 (s, 2'-H), 8.05 (s, 6'-H), 7.40 bis 7.15 (m, 4'-H, 5'-H, 2H_O , H_m , H_p), 4.65 (br.s, OH), 3.10 (dd, 1- CH_2), 1.80 (br.m, 3- CH_2), 1.20 (br.m, 4- to 9- CH_2), 0.85 (t, 10- CH_3).
20	IR (film): ν = 3220, 2928, 2856, 1602, 1428, 1333, 1259, 1204, 1163, 1124, 1096, 1075 cm^{-1} .

25

In general terms, the novel compounds are extremely effective on a broad spectrum of phytopathogenic fungi, in particular those from the class consisting of the Ascomycetes and Basidiomycetes. Some of them have a systemic action and can be used as foliar and soil fungicides.

30

The fungicidal compounds are of particular interest for controlling a large number of fungi in various crops or their seeds, especially wheat, rye, barley, oats, rice, Indian corn, lawns, cotton, soybeans, coffee, sugar cane, fruit and ornamentals in horticulture and viticulture, and in

35 vegetables such as cucumbers, beans and cucurbits.

The novel compounds are particularly useful for controlling the following plant diseases:

40 *Erysiphe graminis* in cereals,

Erysiphe cichoracearum and *Sphaerotheca fuliginea* in cucurbits,

Podosphaera leucotricha in apples,

Uncinula necator in vines,

Puccinia species in cereals,
Rhizoctonia solani in cotton,
Ustilago species in cereals and sugar cane,
Venturia inaequalis (scab) in apples,
5 Helminthosporium species in cereals,
Septoria nodorum in wheat,
Botrytis cinerea (gray mold) in strawberries and grapes,
Cercospora arachidicola in groundnuts,
Pseudocercospora herpotrichoides in wheat and barley,

10 Pyricularia oryzae in rice,
Phytophthora infestans in potatoes and tomatoes,
Fusarium and Verticillium species in various plants,
Plasmopara viticola in grapes,
Alternaria species in fruit and vegetables.

15

The compounds are applied by spraying or dusting the plants with the active ingredients, or treating the seeds of the plants with the active ingredients. They may be applied before or after infection of the plants or seeds by the fungi.

20

The novel substances can be converted into conventional formulations such as solutions, emulsions, suspensions, dusts, powders, pastes and granules. The application forms depend entirely on the purposes for which they are intended; they should at all events ensure a fine and uniform distribution

25

of the active ingredient. The formulations are produced in known manner, for example by extending the active ingredient with solvents and/or carriers, with or without the use of emulsifiers and dispersants; if water is used as solvent, it is also possible to employ other organic solvents as auxiliary solvents. Suitable auxiliaries for this purpose are solvents

30

such as aromatics (e.g., xylene), chlorinated aromatics (e.g., chlorobenzenes), paraffins (e.g., crude oil fractions), alcohols (e.g., methanol, butanol), ketones (e.g., cyclohexanone), amines (e.g., ethanolamine, dimethylformamide), and water; carriers such as ground natural minerals (e.g., kaolins, aluminas, talc and chalk) and ground

35

synthetic minerals (e.g., highly disperse silica and silicates); emulsifiers such as nonionic and anionic emulsifiers (e.g., polyoxyethylene fatty alcohol ethers, alkyl sulfonates and aryl sulfonates); and dispersants such as lignin, sulfite waste liquors and methylcellulose.

40 The fungicides generally contain from 0.1 to 95, and preferably from 0.5 to 90, wt% of active ingredient. The application rates are from 0.02 to 3 kg or more of active ingredient per hectare, depending on the type of effect desired. The novel compounds may also be used for protecting materials, e.g., on Paecilomyces variotii.

The agents and the ready-to-use formulations prepared from them, such as solutions, emulsions, suspensions, powders, dusts, pastes and granules, are applied in conventional manner, for example by spraying, atomizing, dusting, scattering, dressing or watering.

5

Examples of formulations are given below.

I. 90 parts by weight of compound no. 5 is mixed with 10 parts by weight of N-methyl- α -pyrrolidone. A mixture is obtained which is suitable for application in the form of very fine drops.

II. 20 parts by weight of compound no. 5 is dissolved in a mixture consisting of 80 parts by weight of xylene, 10 parts by weight of the adduct of 8 to 10 moles of ethylene oxide and 1 mole of oleic acid-N-monoethanolamide, 5 parts by weight of the calcium salt of dodecylbenzene-sulfonic acid, and 5 parts by weight of the adduct of 40 moles of ethylene oxide and 1 mole of castor oil. By pouring the solution into water and uniformly distributing it therein, an aqueous dispersion is obtained.

III. 20 parts by weight of compound no. 5 is dissolved in a mixture consisting of 40 parts by weight of cyclohexanone, 30 parts by weight of isobutanol, 20 parts by weight of the adduct of 40 moles of ethylene oxide and 1 mole of castor oil. By pouring the solution into water and finely distributing it therein, an aqueous dispersion is obtained.

25

IV. 20 parts by weight of compound no. 5 is dissolved in a mixture consisting of 25 parts by weight of cyclohexanol, 65 parts by weight of a mineral oil fraction having a boiling point between 210 and 280°C, and 10 parts by weight of the adduct of 40 moles of ethylene oxide and 1 mole of castor oil. By pouring the solution into water and uniformly distributing it therein, an aqueous dispersion is obtained.

V. 80 parts by weight of compound no. 5 is well mixed with 3 parts by weight of the sodium salt of diisobutyl-naphthalene- α -sulfonic acid, 10 parts by weight of the sodium salt of a lignin-sulfonic acid obtained from a sulfite waste liquor, and 7 parts by weight of powdered silica gel, and triturated in a hammer mill. By uniformly distributing the mixture in water, a spray liquor is obtained.

VI. 3 parts by weight of compound no. 5 is intimately mixed with 97 parts by weight of particulate kaolin. A dust is obtained containing 3% by weight of the active ingredient.

VII. 30 parts by weight of compound no. 5 is intimately mixed with a mixture consisting of 92 parts by weight of powdered silica gel and 8 parts by weight of paraffin oil which has been sprayed onto the surface of this silica gel. A formulation of the active ingredient is obtained 5 having good adherence.

VIII. 40 parts by weight of compound no. 5 is intimately mixed with 10 parts of the sodium salt of a phenolsulfonic acid-urea-formaldehyde condensate, 2 parts of silica gel and 48 parts of water to give a stable 10 aqueous dispersion. Dilution in water gives an aqueous dispersion.

IX. 20 parts by weight of compound no. 5 is intimately mixed with 2 parts by weight of the calcium salt of dodecylbenzenesulfonic acid, 8 parts by weight of a fatty alcohol polyglycol ether, 2 parts by weight of the 15 sodium salt of a phenolsulfonic acid-urea-formaldehyde condensate and 68 parts by weight of a paraffinic mineral oil. A stable oily dispersion is obtained.

In these application forms, the agents according to the invention may also 20 be present together with other active ingredients, for example herbicides, insecticides, growth regulators, and fungicides, and may furthermore be mixed and applied together with fertilizers. Admixture with other fungicides frequently results in a greater fungicidal action spectrum.

••••• The following list of fungicides with which the novel compounds may be 25 combined is intended to illustrate possible combinations but not to impose any restrictions.

••••• Examples of fungicides which may be combined with the novel compounds are:

30 sulfur,

••••• dithiocarbamates and their derivatives, such as
••••• ferric dimethyldithiocarbamate,
••••• zinc dimethyldithiocarbamate,
••••• zinc ethylenebisdithiocarbamate,

35 manganese ethylenebisdithiocarbamate,

manganese zinc ethylenediaminebisdithiocarbamate,
tetramethylthiuram disulfides,

ammonia complex of zinc N,N'-ethylenebisdithiocarbamate,

ammonia complex of zinc N,N'-propylenebisdithiocarbamate,

40 zinc N,N'-propylenebisdithiocarbamate and

N,N'-polypropylenebis(thiocarbamyl) disulfide;

nitro derivatives, such as
 dinitro(1-methylheptyl)-phenyl crotonate,
 2-sec-butyl-4,6-dinitrophenyl 3,3-dimethylacrylate,
 2-sec-butyl-4,6-dinitrophenyl isopropylcarbonate and
 5 diisopropyl 5-nitroisophthalate;

- heterocyclic substances, such as
 2-heptadecylimidazol-2-yl acetate,
 2,4-dichloro-6-(o-chloroanilino)-s-triazine,
 10 0,0-diethyl phthalimidophosphonothioate,
 5-amino-1-[-bis-(dimethylamino)-phosphinyl]-3-phenyl-1,2,4-triazole,
 2,3-dicyano-1,4-dithioanthraquinone,
 2-thio-1,3-dithio[4,5-b]quinoxaline,
 methyl 1-(butylcarbamy)-2-benzimidazolecarbamate,
 15 2-methoxycarbonylamino benzimidazole,
 2-(fur-2-yl)-benzimidazole,
 2-(thiazol-4-yl)benzimidazole,
 N-(1,1,2,2-tetrachloroethylthio)-tetrahydrophthalimide,
 N-trichloromethylthiotetrahydrophthalimide,
 20 N-trichloromethylthiophthalimide,
 N-dichlorofluoromethylthio-N',N'-dimethyl-N-phenylsulfuric acid diamide,
 5-ethoxy-3-trichloromethyl-1,2,3-thiadiazole,
 2-thiocyanatomethylthiobenzothiazole,
 25 1,4-dichloro-2,5-dimethoxybenzene,
 4-(2-chlorophenylhydrazono)-3-methyl-5-isoxazolone,
 2-thiopyridine 1-oxide,
 8-hydroxyquinoline and its copper salt,
 2,3-dihydro-5-carboxanilido-6-methyl-1,4-oxathiine,
 30 2,3-dihydro-5-carboxanilido-6-methyl-1,4-oxathiine 4,4-dioxide,
 2-methyl-5,6-dihydro-4H-pyran-3-carboxanilide,
 2-methylfuran-3-carboxanilide,
 2,5-dimethylfuran-3-carboxanilide,
 2,4,5-trimethylfuran-3-carboxanilide,
 35 2,5-dimethyl-N-cyclohexylfuran-3-carboxamide,
 N-cyclohexyl-N-methoxy-2,5-diethylfuran-3-carboxamide,
 2-methylbenzanilide,
 2-iodobenzanilide,
 N-formyl-N-morpholine-2,2,2-trichloroethylacetal,
 40 piperazine-1,4-diylbis-(1-(2,2,2-trichloroethyl)-formamide),
 1-(3,4-dichloroanilino)-1-formylamino-2,2,2-trichloroethane,
 2,6-dimethyl-N-tridecylmorpholine and its salts,
 2,6-dimethyl-N-cyclododecylmorpholine and its salts,

- N-[3-(p-tert.-butylphenyl)-2-methylpropyl]-cis-2,6-dimethylmorpholine,
 N-[3-(p-tert.-butylphenyl)-2-methylpropyl]-piperidine,
 1-[2-(2,4-dichlorophenyl)-4-ethyl-1,3-dioxolan-2-ylethyl]-1H-1,2,4-
 -triazole,
 5 1-[2-(2,4-dichlorophenyl)-4-n-propyl-1,3-dioxolan-2-ylethyl]-1H-1,2,4-
 -triazole,
 N-(n-propyl)-N-(2,4,6-trichlorophenoxyethyl)-N'-imidazolyl-urea,
 1-(4-chlorophenoxy)-3,3-dimethyl-1-(1H-1,2,4-triazol-1-yl)-butan-2-one,
 1-(4-chlorophenoxy)-3,3-dimethyl-1-(1H-1,2,4-triazol-1-yl)-butan-2-ol,
 10 1-(4-phenylphenoxy)-3,3-dimethyl-1-(1H-1,2,4-triazol-1-yl)-2-butanol,
 α -(2-chlorophenyl)- α -(4-chlorophenyl)-5-pyrimidinemethanol,
 5-butyl-(2-dimethylamino-4-hydroxy-6-methylpyrimidine,
 bis-(p-chlorophenyl)-3-pyridinemethanol,
 1,2-bis-(3-ethoxycarbonyl-2-thioureido)-benzene,
 15 1,2-bis-(3-methoxycarbonyl-2-thioureido)-benzene,
 and various fungicides, such as
 dodecylguanidine acetate,
 3-[3-(3,5-dimethyl-2-oxycyclohexyl)-2-hydroxyethyl]-glutaramide,
 hexachlorobenzene,
 20 DL-methyl-N-(2,6-dimethylphenyl)-N-fur-2-yl alanate,
 methyl DL-N-(2,6-dimethylphenyl)-N-(2'-methoxyacetyl)-alanate,
 N-(2,6-dimethylphenyl)-N-chloroacetyl-DL-2-aminobutyrolactone,
 methyl DL-N-(2,6-dimethylphenyl)-N-(phenylacetyl)-alanate,
 5-methyl-5-vinyl-3-(3,5-dichlorophenyl)-2,4-dioxo-1,3-oxazolidine,
 25 3-[3,5-dichlorophenyl]-5-methyl-5-methoxymethyl-1,3-oxazolidine-2,4-dione,
 3-(3,5-dichlorophenyl)-1-isopropylcarbamyldantoin,
 N-(3,5-dichlorophenyl)-1,2-dimethylcyclopropane-1,2-dicarboximide,
 2-cyano-[N-(ethylaminocarbonyl)-2-methoximino]-acetamide,
 1-[2-(2,4-dichlorophenyl)-pentyl]-1H-1,2,4-triazole,
 30 2,4-difluoro- α -(1H-1,2,4-triazol-1-ylmethyl)-benzhydryl alcohol,
 N-(3-chloro-2,6-dinitro-4-trifluoromethylphenyl)-5-trifluoromethyl-3-
 chloro-2-aminopyridine, and
 1-[(bis-(4-fluorophenyl)-methylsilyl)-methyl]-1H-1,2,4-triazole.

35 In the use example below, 1-(2,4-dichlorophenyl)-2-(pyridin-3-yl)-3-methyl-2-butanol (A) disclosed in EP 69,330 was used as comparative agent.

Use example

40 Action on Botrytis cinerea

In the open, small plots of strawberry plants of the Senga-Sengana variety were sprayed to runoff in the main blossom period with an aqueous suspension consisting (dry basis) of 80wt% of active ingredient and 20% of

dispersant. After two days, all the plots were inoculated with a spore suspension of Botrytis cinerea. This treatment was repeated after a further 5 days. 38 days later, the ripe fruit was checked for Botrytis attack.

5

compound number 5 of Table 1

The results show that ~~active ingredient 5~~, applied at a rate of 2 kg/ha, had a better fungicidal action (75%) than prior art active ingredient A (18%).

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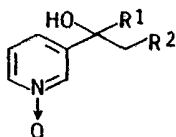
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THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

~~XXXXXXXXXX~~

1. A 3-substituted pyridine-N-oxide of the formula



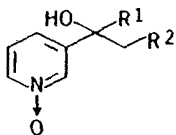
(I),

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where R¹ is C₁-C₁₂-alkyl, and R² is phenyl or substituted phenyl bearing from one to three radicals selected from the group consisting of C₁-C₄-alkyl, C₁-C₄-haloalkyl, C₁-C₄-alkoxy, C₁-C₄-haloalkoxy and halogen, and its salts physiologically tolerated by plants.

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2. A fungicidal agent containing an inert carrier and a 3-substituted pyridine-N-oxide of the formula



(I),

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where R¹ is C₁-C₁₂-alkyl, and R² is phenyl or substituted phenyl bearing from one to three radicals selected from the group consisting of C₁-C₄-alkyl, C₁-C₄-haloalkyl, C₁-C₄-alkoxy, C₁-C₄-haloalkoxy and halogen, or a salt thereof physiologically tolerated by plants.

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3. A compound as set forth in claim 1, where R¹ is isopropyl and R² is 2,4-dichlorophenyl.

4. A compound as set forth in claim 1, where R¹ is isobutyl and R² is 2,4-dichlorophenyl.

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DATED this 29th day of December 1988.

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