US011445727B2

(12) **United States Patent**
Fabri et al.

(10) **Patent No.: US 11,445,727 B2**
(45) **Date of Patent: *Sep. 20, 2022**

(54) **FUNGICIDAL COMBINATIONS**

(71) Applicant: **UPL LTD**, Haldia (IN)

(72) Inventors: **Carlos Eduardo Fabri**, Sao Paulo -SP (BR); **Rajju Devidas Shroff**, Maharashtra (IN); **Jaidev Rajnikant Shroff**, Dubai (AE); **Vikram Rajnikant Shroff**, Dubai (AE)

(73) Assignee: **UPL LTD**, West Bengal (IN)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **16/347,283**

(22) PCT Filed: **Oct. 30, 2017**

(86) PCT No.: **PCT/IB2017/056710**
§ 371 (c)(1),
(2) Date: **May 3, 2019**

(87) PCT Pub. No.: **WO2018/083577**
PCT Pub. Date: **May 11, 2018**

(65) **Prior Publication Data**

US 2019/0274307 A1 Sep. 12, 2019

(30) **Foreign Application Priority Data**

Nov. 4, 2016 (IN) 201631037704

(51) **Int. Cl.**

A01N 47/14	(2006.01)
A01N 37/36	(2006.01)
A01N 43/16	(2006.01)
A01N 43/40	(2006.01)
A01N 43/54	(2006.01)
A01N 43/56	(2006.01)
A01N 43/60	(2006.01)
A01N 43/653	(2006.01)
A01N 45/02	(2006.01)

(52) **U.S. Cl.**
CPC ***A01N 47/14*** (2013.01); ***A01N 37/36*** (2013.01); ***A01N 43/16*** (2013.01); ***A01N 43/40*** (2013.01); ***A01N 43/54*** (2013.01); ***A01N 43/56*** (2013.01); ***A01N 43/60*** (2013.01); ***A01N 43/653*** (2013.01); ***A01N 45/02*** (2013.01)

(58) **Field of Classification Search**
CPC A01N 47/14; A01N 37/36; A01N 43/16; A01N 43/40; A01N 43/54; A01N 43/56; A01N 43/60; A01N 43/653; A01N 45/02
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

10,362,782	B2 *	7/2019	Oliveira	A01N 43/653
10,448,636	B2 *	10/2019	Oliveira	A01N 43/40
10,537,101	B2 *	1/2020	Oliveira	A01N 43/653
10,694,744	B2 *	6/2020	Oliveira	A01N 25/00
10,694,745	B2 *	6/2020	Oliveira	A01N 43/653
2008/0113979	A1	5/2008	Foor	
2009/0131462	A1	5/2009	Gewehr et al.	
2010/0216640	A1	8/2010	Tobler et al.	
2015/0181870	A1 *	7/2015	Kemmitt	A01N 37/42 514/229.2
2016/0360751	A1 *	12/2016	Oliveira	A01N 43/54
2020/0170251	A1 *	6/2020	Hermenegildo de Oliveira	A01N 25/00
2021/0007355	A1	1/2021	Gongora et al.	
2021/0022343	A1	1/2021	Gongora et al.	
2021/0106006	A1	4/2021	Fabri et al.	
2021/0127679	A1	5/2021	Fabri et al.	
2021/0137119	A1	5/2021	Fabri et al.	
2022/0039388	A1	2/2022	Fabri et al.	

FOREIGN PATENT DOCUMENTS

CA	2969545	A1	6/2016
CN	101222847	A	7/2008
CN	101677558	A	3/2010
CN	102258039	A	11/2011
CN	102835407	A	12/2012
CN	105744834	A	7/2016
EP	2783569	*	12/2014
WO	2006037632		4/2006
WO	2006037634	A1	4/2006
WO	2008095913	A2	8/2008
WO	2013127818	A1	9/2013
WO	2015079334	A1	6/2015

OTHER PUBLICATIONS

Brent K. J. et al.; "Fungicide Resistance in Crop Pathogens: How Can It Be Managed?"; 2nd Revised Edition, Fungicide Resistance Action Committee, 2007, ISBN 90-72398-07-6; 60 pages.
International Search Report and Written Opinion; International Application No. PCT/IB2017/056710; International Filing Date Oct. 30, 2017; dated Jan. 12, 2018; 10 pages.
Lalancette, Norman, "New Fungicide for Apple Disease Control" Plant & Pest Advisory, Rutgers Cooperative Extension, Mar. 17, 2016, 2 pages.
Rosenberger, David; "Apple Scab Models & Suggestions for Scab Control in 2015"; 70th North Jersey Commercial Fruit Growers Meeting, Flemington, NJ, Mar. 4, 2015, 31 pages.
Rosenberger Presentation "Fire Blight and NEWA—How to Control Blight in 2015"; 70th North Jersey Commercial Fruit Growers Meeting; Mar. 4, 2015, Flemington, NJ; 43 pages.

* cited by examiner

Primary Examiner — Mina Haghighatian
(74) *Attorney, Agent, or Firm* — Cantor Colburn LLP

(57) **ABSTRACT**

A combination comprising a dithiocarbamate fungicide, a succinate dehydrogenase fungicide and at least one of ergosterol biosynthesis inhibitor fungicide or a quinone outside inhibitor fungicide.

10 Claims, No Drawings

FUNGICIDAL COMBINATIONS

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a National Stage application of PCT/IB2017/056710, filed on Oct. 30, 2017, which claims the benefit of Indian Application No. 201631037704, filed on Nov. 4, 2016, both of which are incorporated by reference in their entirety herein.

TECHNICAL FIELD

The present invention relates to a combination of fungicides. More specifically, the present invention relates to fungicidal combinations comprising succinate dehydrogenase inhibitor fungicides for controlling a broad spectrum of fungal diseases.

BACKGROUND OF THE INVENTION

Fungicides are an integral and important tool yielded by farmers to control diseases, as well as to improve yields and quality of the crops. There are various fungicides that have been developed over the years with many desirable attributes such as specificity, systemicity, curative and eradicant action and high activity at low use rates.

Succinate dehydrogenase inhibitor (SDHI) fungicides are known in the art to be broad spectrum and have a high potency. Pyrazolecarboxamides are a group of active compounds within the SDHI family of fungicides that are known to be more potent than most other SDHI fungicides. These molecules specifically bind to the ubiquinone-binding site (Q-site) of the mitochondrial complex II, thereby inhibiting fungal respiration. These fungicides are known to control a broad spectrum of fungal diseases.

Various other classes of fungicides are also known in the art, such as Quinone outside inhibitors (QoIs), ergosterol-biosynthesis inhibitors, fungicides that act on multiple sites, fungicides that affect mitosis etc. These fungicides have been mixed with SDHI fungicides to achieve a broad spectrum of disease control.

WO2006037632 teaches combinations of SDHI fungicides with a second active compound. WO2013127818 teaches combinations of SDHI fungicides with various herbicides. WO2006037634 teaches methods of controlling fungi using a combination of SDHI fungicide with various fungicides. However, the prior art does not teach the use of ternary or higher combinations of SDHI fungicides.

Dithiocarbamate are known in the art as multi-site fungicides. These fungicides are used for broad-spectrum disease control in more than 70 crops. Mancozeb is especially important for controlling devastating and fast spreading diseases such as Phytophthora infestans, Venturia inaequalis etc. Dithiocarbamate fungicides, especially mancozeb, are particularly useful for disease control because of their broad spectrum of activity, high tolerance by crop plants, and general usefulness for controlling fungal plant diseases not controlled by active compounds that act on only a single target site in the fungus.

Mancozeb has been combined with various SDHI fungicides for disease control. There is a need in the art to improve on the disease spectrum provided by these combinations.

There is therefore a need in the art for combinations of

imposed and resistance being increasingly observed, there is a need for a combination of actives that allows for broader disease control spectrum that combines curative and preventive actives and has a lower dosage.

Therefore, embodiments of the present invention may ameliorate one or more of the above mentioned problems:

Therefore, embodiments of the present invention may provide combinations of fungicides that possess an enhanced efficacy over the individual fungicides used in isolation.

Another object of the present invention is to provide a fungicidal combination that causes an enhanced greening of the crops to which it is administered.

Another object of the present invention is to provide a fungicidal combination that causes late senescence to the crop to which it is applied thereby resulting into an increasing yield of the crop.

Yet another object of the present invention is to provide a fungicidal combination that results into reduced fungal disease incidence in the crops to which it is applied.

Another object of the present invention is to provide a fungicidal combination that achieves increased yield in the crops to which it is applied.

Some or all these and other objects of the invention are can be achieved by way of the invention described hereinafter.

SUMMARY OF THE INVENTION

Thus, an aspect of the present invention can provide a fungicidal combination comprising at least one succinate dehydrogenase inhibitor fungicide, at least one dithiocarbamate fungicide, and at least another fungicide.

Another aspect of the present invention can provide a fungicidal combination comprising at least one succinate dehydrogenase inhibitor fungicide, at least one dithiocarbamate fungicide and at least two other fungicides.

Another aspect of the present invention can provide synergistic compositions comprising at least one succinate dehydrogenase inhibitor fungicide, at least one dithiocarbamate fungicide, and at least one other fungicide.

Another aspect of the present invention can provide synergistic compositions comprising at least one succinate dehydrogenase inhibitor fungicide, at least one dithiocarbamate fungicide and at least two other fungicides.

DETAILED DESCRIPTION

The term 'disease control' as used herein denotes control and prevention of a disease. Controlling effects include all deviation from natural development, for example: killing, retardation, decrease of the fugal disease. The term 'plants' refers to all physical parts of a plant, including seeds, seedlings, saplings, roots, tubers, stems, stalks, foliage and fruits. The term locus: of a plant as used herein is intended to embrace the place on which the plants are growing, where the plant propagation materials of the plants are sown or where the plant propagation materials of the plants will be placed into the soil. The term plant propagation material: is understood to denote generative parts of a plant, such as seeds, vegetative material such as cuttings or tubers, roots, fruits, tubers, bulbs, rhizomes and parts of plants, germinated plants and young plants which are to be transplanted after germination or after emergence from the soil. These young plants may be protected before transplantation by a

an active that kills or inhibits the plant disease for which control is desired, in an amount not significantly toxic to the plant being treated.

Succinate dehydrogenase inhibitor (SDHI) fungicides play an important role in plant protection against many phytopathogenic fungi. These molecules specifically bind to the ubiquinone-binding site (Q-site) of the mitochondrial complex II, thereby inhibiting fungal respiration. Dithiocarbamate are multi-site contact fungicides. These molecules attack multiple sites within the fugal cells.

It has surprisingly been found that the addition of a dithiocarbamate fungicide to the combinations of succinate dehydrogenase inhibitors with at least another fungicide selected from an ergosterol biosynthesis inhibitors or Quinone outside inhibitors or a combination thereof, resulted in surprising and unexpected advantages. It was surprising that the addition of a dithiocarbamate fungicide to the combination of a succinate dehydrogenase inhibitor with at least another fungicide selected from an ergosterol biosynthesis inhibitors and/or Quinone outside inhibitors or a combination thereof resulted in an enhancement of the efficacy, and a surprising reduction in fungal disease incidence, seen only with the combination of succinate dehydrogenase inhibitors with at least another fungicide selected from an ergosterol biosynthesis inhibitors or Quinone outside inhibitors or a combination thereof. It has further been found that the addition of a dithiocarbamate fungicide to these combinations and application of these combinations during the flowering stage of the crop delayed the senescence in the crop to which they were applied, which led to better greening in the crop thereby increasing the level of photosynthesis occurring within the plant, thereby leading to a greater yield from the crop to which they were applied.

These surprising advantages of the combinations of the invention were not observed when the dithiocarbamate fungicide was not present in the combination. Therefore, these unexpected advantages of the combination of the present invention could be attributed to the inclusion of a dithiocarbamate fungicide to the combination of a succinate dehydrogenase inhibitor with at least another fungicide selected from an ergosterol biosynthesis inhibitors and/or Quinone outside inhibitors or a combination thereof.

Thus, in an aspect, the present invention provides a fungicidal combination comprising:

(a) at least one dithiocarbamate fungicide;

(b) at least one succinate dehydrogenase inhibitor fungicide; and

(c) at least another fungicide selected from an ergosterol biosynthesis inhibitors and/or Quinone outside inhibitors.

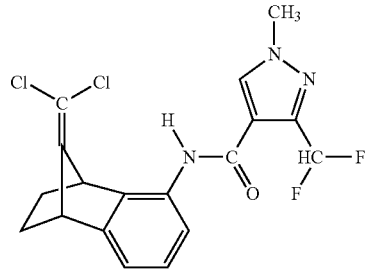
In an embodiment, the dithiocarbamate fungicide is selected from the group consisting of amobam, asomate, azithiram, carbamorph, cufraneb, cuprobam, disulfiram, ferbam, metam, nabam, tecoram, thiram, urbacide, ziram, dazomet, etem, milneb, mancopper, mancozeb, maneb, metiram, polycarbamate, propineb and zineb.

In an embodiment, the preferred dithiocarbamate fungicide is mancozeb.

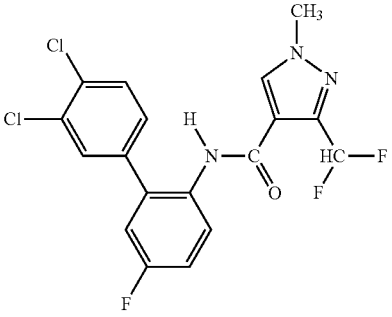
In an embodiment, the succinate dehydrogenase inhibitor is selected from pyrazole carboxamide class of succinate dehydrogenase inhibitor fungicides. However, it should be understood that the choice of succinate dehydrogenase inhibitors is not understood to be limited to these pyrazole carboxamide fungicides alone.

In an embodiment, the pyrazole carboxamide class of succinate dehydrogenase inhibitor fungicide may be selected from benzovindiflupyr, bixafen, fluxapyroxad, furametpyr, isopyrazam, penflufen, penthiopyrad, and sedaxane.

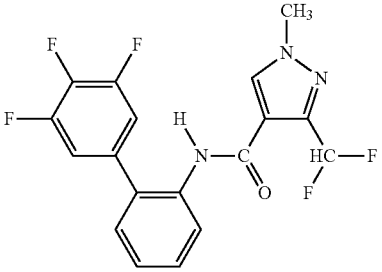
aphthalen-5-yl]-3-(difluoromethyl)-1-methylpyrazole-4-carboxamide and has the structure:



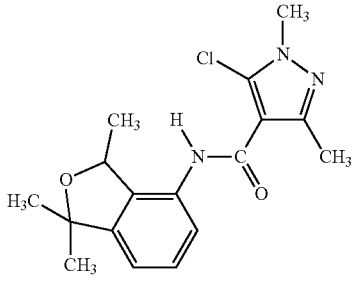
Bixafen has the chemical name N-(3',4'-dichloro-5-fluorobiphenyl-2-yl)-3-(difluoromethyl)-1-methylpyrazole-4-carboxamide and the structure:



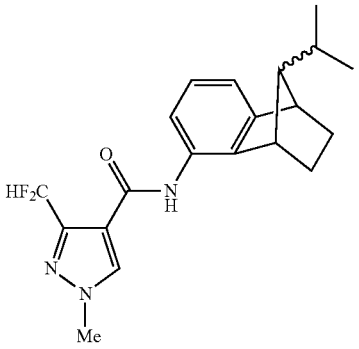
Fluxapyroxad has the chemical name 3-(difluoromethyl)-1-methyl-N-(3',4',5'-trifluorobiphenyl-2-yl)pyrazole-4-carboxamide and has the structure:



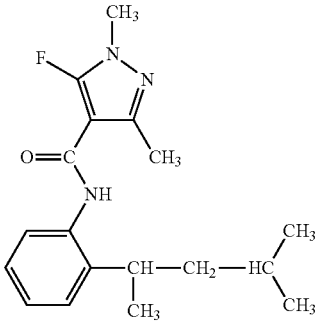
Furametpyr has the chemical name (RS)-5-chloro-N-(1,3-dihydro-1,1,3-trimethylisobenzofuran-4-yl)-1,3-dimethylpyrazole-4-carboxamide and has the structure:



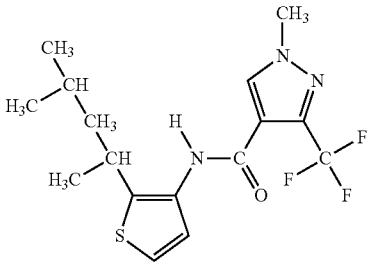
Isopyrazam is a mixture of 2 isomers 3-(difluoromethyl)-1-methyl-N-[(1RS,4SR,9RS)-1,2,3,4-tetrahydro-9-isopropyl-1,4-methanonaphthalen-5-yl]pyrazole-4-carboxamide and 2 aisomers 3-(difluoromethyl)-1-methyl-N-[(1RS,4SR,9SR)-1,2,3,4-tetrahydro-9-isopropyl-1,4-methanonaphthalen-5-yl]pyrazole-4-carboxamide and its tautomer's have the structure:



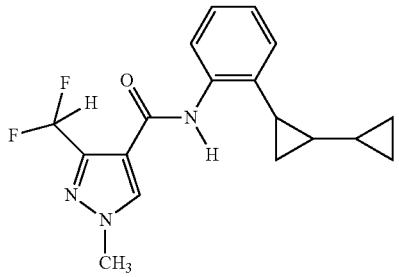
Penflufen has the chemical name N-[2-(1,3-dimethylbutyl)phenyl]-5-fluoro-1,3-dimethyl-1H-pyrazole-4-carboxamide, and has the following structure:



Penthiopyrad has the chemical name (RS)—N-[2-(1,3-dimethylbutyl)-3-thienyl]-1-methyl-3-(trifluoromethyl) pyrazole-4-carboxamide, and has the following structure:



Sedaxane is a mixture of 2 cis-isomers 2'-[(1RS,2RS)-1,1'-bicycloprop-2-yl]-3-(difluoromethyl)-1-methylpyrazole-4-carboxanilide and 2 trans-isomers 2'-[(1RS,2SR)-1,1'-bicyclopropr-2-yll-3-(difluoromethyl)-1-methylpyrazole-4-



In an embodiment, the succinate dehydrogenase inhibitor fungicide may be selected from the group consisting of benodanil, flutolanil, mepronil, isofetamid, fluopyram, fenfuram, carboxin, oxycarboxin, thifluzamide, boscalid and IR9792.

In an embodiment, the third and/or fourth fungicides in the combinations of the present invention may be selected from ergosterol biosynthesis inhibitors, and/or Quinone outside (Qo) inhibitors or mixtures thereof.

Thus in an embodiment, the ergosterol biosynthesis inhibitors may be selected from the group consisting of azaconazole, bitertanol, bromuconazole, cyproconazole, difenoconazole, diniconazole, epoxiconazole, etaconazole, fenbuconazole, fluquinconazole, flusilazole, flutriafol, hexaconazole, imibenconazole, Ipconazole, metconazole, myclobutanil, penconazole, Propiconazole, simeconazole, tebuconazole, tetraconazole, triadimefon, triadimenol, triticonazole, prothioconazole, imazalil, oxpoconazole, pefurazoate, prochloraz, triflumizole, fenarimol, nuarimol, pyrifenox, pyrisoxazole, triforine and mixtures thereof.

In another embodiment, the ergosterol biosynthesis inhibitors may be selected from prothioconazole, tebuconazole, hexaconazole, cyroconazole or epoxiconazole.

In an embodiment, the third fungicide may be a Quinone outside (Qo) inhibitor fungicide selected from azoxystrobin, coumoxystrobin, enoxastrobin, flufenoxystrobin, picoxystrobin, pyraoxystrobin, mandestrobin, pyraclostrobin, pyrametostrobin, triclopyricarb, kresoxim-methyl, dimoxystrobin, fenaminostrobin, metominostrobin, trifloxystrobin, famoxadone, fluoxastrobin, fenamidone, pyribencarb and mixtures thereof.

In an embodiment, the Quinone outside (Qo) inhibitor fungicide may be selected from azoxystrobin, picoxystrobin, kresoxim-methyl, pyraclostrobin and trifloxystrobin.

In an embodiment of the combinations of the present invention, the preferred succinate dehydrogenase inhibitor fungicide is isopyrazam.

In an embodiment, the combinations of the present invention include the following preferred combinations:

S No.	I	II	III	IV
1	Mancozeb	Isopyrazam	Cyproconazole	—
2	Mancozeb	Isopyrazam	Difenoconazole	—
3	Mancozeb	Isopyrazam	Epoxiconazole	—
4	Mancozeb	Isopyrazam	Hexaconazole	—
5	Mancozeb	Isopyrazam	Tebuconazole	—
6	Mancozeb	Isopyrazam	Tetraconazole	—
7	Mancozeb	Isopyrazam	Prothioconazole	—
8	Mancozeb	Isopyrazam	—	Azoxystrobin
9	Mancozeb	Isopyrazam	—	Picoxystrobin
10	Mancozeb	Isopyrazam	—	Pyraclostrobin
11	Mancozeb	Isopyrazam	—	Kresoxim-

-continued

S No.	I	II	III	IV
12	Mancozeb	Isopyrazam	—	Trifloxystrobin
13	Mancozeb	Isopyrazam	Cyproconazole	Azoxystrobin
14	Mancozeb	Isopyrazam	Cyproconazole	Picoxystrobin
15	Mancozeb	Isopyrazam	Cyproconazole	Pyraclostrobin
16	Mancozeb	Isopyrazam	Cyproconazole	Kresoxim-methyl
17	Mancozeb	Isopyrazam	Cyproconazole	Trifloxystrobin
18	Mancozeb	Isopyrazam	Difenoconazole	Azoxystrobin
19	Mancozeb	Isopyrazam	Difenoconazole	Picoxystrobin
20	Mancozeb	Isopyrazam	Difenoconazole	Pyraclostrobin
21	Mancozeb	Isopyrazam	Difenoconazole	Kresoxim-methyl
22	Mancozeb	Isopyrazam	Difenoconazole	Trifloxystrobin
23	Mancozeb	Isopyrazam	Epoxiconazole	Azoxystrobin
24	Mancozeb	Isopyrazam	Epoxiconazole	Picoxystrobin
25	Mancozeb	Isopyrazam	Epoxiconazole	Pyraclostrobin
26	Mancozeb	Isopyrazam	Epoxiconazole	Kresoxim-methyl
27	Mancozeb	Isopyrazam	Epoxiconazole	Trifloxystrobin
28	Mancozeb	Isopyrazam	Hexaconazole	Azoxystrobin
29	Mancozeb	Isopyrazam	Hexaconazole	Picoxystrobin
30	Mancozeb	Isopyrazam	Hexaconazole	Pyraclostrobin
31	Mancozeb	Isopyrazam	Hexaconazole	Kresoxim-methyl
32	Mancozeb	Isopyrazam	Hexaconazole	Trifloxystrobin
33	Mancozeb	Isopyrazam	Tebuconazole	Azoxystrobin
34	Mancozeb	Isopyrazam	Tebuconazole	Picoxystrobin
35	Mancozeb	Isopyrazam	Tebuconazole	Pyraclostrobin
36	Mancozeb	Isopyrazam	Tebuconazole	Kresoxim-methyl
37	Mancozeb	Isopyrazam	Tebuconazole	Trifloxystrobin
38	Mancozeb	Isopyrazam	Tetraconazole	Azoxystrobin
39	Mancozeb	Isopyrazam	Tetraconazole	Picoxystrobin
40	Mancozeb	Isopyrazam	Tetraconazole	Pyraclostrobin
41	Mancozeb	Isopyrazam	Tetraconazole	Kresoxim-methyl
42	Mancozeb	Isopyrazam	Tetraconazole	Trifloxystrobin
43	Mancozeb	Isopyrazam	Prothioconazole	Azoxystrobin
44	Mancozeb	Isopyrazam	Prothioconazole	Picoxystrobin
45	Mancozeb	Isopyrazam	Prothioconazole	Pyraclostrobin
46	Mancozeb	Isopyrazam	Prothioconazole	Kresoxim-methyl
47	Mancozeb	Isopyrazam	Prothioconazole	Trifloxystrobin

In an embodiment of the combinations of the present invention, the preferred succinate dehydrogenase inhibitor fungicide is Benzovindiflupyr.

In an embodiment, the combinations of the present invention include the following preferred combinations:

S No.	I	II	III	IV
48	Mancozeb	Benzovindiflupyr	Cyproconazole	—
49	Mancozeb	Benzovindiflupyr	Difenoconazole	—
50	Mancozeb	Benzovindiflupyr	Epoxiconazole	—
51	Mancozeb	Benzovindiflupyr	Hexaconazole	—
52	Mancozeb	Benzovindiflupyr	Tebuconazole	—
53	Mancozeb	Benzovindiflupyr	Tetraconazole	—
54	Mancozeb	Benzovindiflupyr	Prothioconazole	—
55	Mancozeb	Benzovindiflupyr	—	Azoxystrobin
56	Mancozeb	Benzovindiflupyr	—	Picoxystrobin
57	Mancozeb	Benzovindiflupyr	—	Pyraclostrobin
58	Mancozeb	Benzovindiflupyr	—	Kresoxim-methyl
59	Mancozeb	Benzovindiflupyr	—	Trifloxystrobin
60	Mancozeb	Benzovindiflupyr	Cyproconazole	Azoxystrobin
61	Mancozeb	Benzovindiflupyr	Cyproconazole	Picoxystrobin
62	Mancozeb	Benzovindiflupyr	Cyproconazole	Pyraclostrobin
63	Mancozeb	Benzovindiflupyr	Cyproconazole	Kresoxim-methyl
64	Mancozeb	Benzovindiflupyr	Cyproconazole	Trifloxystrobin
65	Mancozeb	Benzovindiflupyr	Difenoconazole	Azoxystrobin
66	Mancozeb	Benzovindiflupyr	Difenoconazole	Picoxystrobin
67	Mancozeb	Benzovindiflupyr	Difenoconazole	Pyraclostrobin
68	Mancozeb	Benzovindiflupyr	Difenoconazole	Kresoxim-methyl
69	Mancozeb	Benzovindiflupyr	Difenoconazole	Trifloxystrobin
70	Mancozeb	Benzovindiflupyr	Epoxiconazole	Azoxystrobin
71	Mancozeb	Benzovindiflupyr	Epoxiconazole	Picoxystrobin
72	Mancozeb	Benzovindiflupyr	Epoxiconazole	Pyraclostrobin
73	Mancozeb	Benzovindiflupyr	Epoxiconazole	Kresoxim-methyl
74	Mancozeb	Benzovindiflupyr	Epoxiconazole	Trifloxystrobin
75	Mancozeb	Benzovindiflupyr	Hexaconazole	Azoxystrobin
76	Mancozeb	Benzovindiflupyr	Hexaconazole	Picoxystrobin
77	Mancozeb	Benzovindiflupyr	Hexaconazole	Pyraclostrobin
78	Mancozeb	Benzovindiflupyr	Hexaconazole	Kresoxim-methyl
79	Mancozeb	Benzovindiflupyr	Hexaconazole	Trifloxystrobin
80	Mancozeb	Benzovindiflupyr	Tebuconazole	Azoxystrobin
81	Mancozeb	Benzovindiflupyr	Tebuconazole	Picoxystrobin
82	Mancozeb	Benzovindiflupyr	Tebuconazole	Pyraclostrobin
83	Mancozeb	Benzovindiflupyr	Tebuconazole	Kresoxim-methyl
84	Mancozeb	Benzovindiflupyr	Tebuconazole	Trifloxystrobin
85	Mancozeb	Benzovindiflupyr	Tetraconazole	Azoxystrobin
86	Mancozeb	Benzovindiflupyr	Tetraconazole	Picoxystrobin
87	Mancozeb	Benzovindiflupyr	Tetraconazole	Pyraclostrobin
88	Mancozeb	Benzovindiflupyr	Tetraconazole	Kresoxim-methyl
89	Mancozeb	Benzovindiflupyr	Tetraconazole	Trifloxystrobin
90	Mancozeb	Benzovindiflupyr	Prothioconazole	Azoxystrobin
91	Mancozeb	Benzovindiflupyr	Prothioconazole	Picoxystrobin
92	Mancozeb	Benzovindiflupyr	Prothioconazole	Pyraclostrobin
93	Mancozeb	Benzovindiflupyr	Prothioconazole	Kresoxim-methyl
94	Mancozeb	Benzovindiflupyr	Prothioconazole	Trifloxystrobin

In an embodiment of the combinations of the present invention, the preferred succinate dehydrogenase inhibitor fungicide is Penthiopyrad.

In an embodiment, the combinations of the present invention include the following preferred combinations:

S No.	I	II	III	IV
95	Mancozeb	Penthiopyrad	Cyproconazole	—
96	Mancozeb	Penthiopyrad	Difenoconazole	—
97	Mancozeb	Penthiopyrad	Epoxiconazole	—
98	Mancozeb	Penthiopyrad	Hexaconazole	—
99	Mancozeb	Penthiopyrad	Tebuconazole	—
100	Mancozeb	Penthiopyrad	Tetraconazole	—
101	Mancozeb	Penthiopyrad	Prothioconazole	—
102	Mancozeb	Penthiopyrad	—	Azoxystrobin
103	Mancozeb	Penthiopyrad	—	Picoxystrobin
104	Mancozeb	Penthiopyrad	—	Pyraclostrobin
105	Mancozeb	Penthiopyrad	—	Kresoxim-methyl
106	Mancozeb	Penthiopyrad	—	Trifloxystrobin
107	Mancozeb	Penthiopyrad	Cyproconazole	Azoxystrobin
108	Mancozeb	Penthiopyrad	Cyproconazole	Picoxystrobin
109	Mancozeb	Penthiopyrad	Cyproconazole	Pyraclostrobin
110	Mancozeb	Penthiopyrad	Cyproconazole	Kresoxim-methyl
111	Mancozeb	Penthiopyrad	Cyproconazole	Trifloxystrobin
112	Mancozeb	Penthiopyrad	Difenoconazole	Azoxystrobin
113	Mancozeb	Penthiopyrad	Difenoconazole	Picoxystrobin
114	Mancozeb	Penthiopyrad	Difenoconazole	Pyraclostrobin
115	Mancozeb	Penthiopyrad	Difenoconazole	Kresoxim-methyl
116	Mancozeb	Penthiopyrad	Difenoconazole	Trifloxystrobin
117	Mancozeb	Penthiopyrad	Epoxiconazole	Azoxystrobin
118	Mancozeb	Penthiopyrad	Epoxiconazole	Picoxystrobin
119	Mancozeb	Penthiopyrad	Epoxiconazole	Pyraclostrobin
120	Mancozeb	Penthiopyrad	Epoxiconazole	Kresoxim-methyl
121	Mancozeb	Penthiopyrad	Epoxiconazole	Trifloxystrobin

DOCKET ALARM

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts

Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research

With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips

Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS
Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS
Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS
Sync your system to PACER to automate legal marketing.