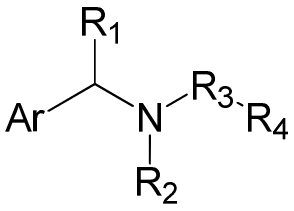
[CLAIMS]

[Claim 1] A pest control agent comprising at least one compound of the following formula (I) or a salt thereof

[Chem. 1]



(I)

(wherein Ar is a phenyl group which may be substituted or a 5- or 6-membered heterocycle which may be substituted;

R_1 is a hydrogen atom or a C_{1-6} alkyl group;

R_2 is a C_{1-6} alkylcarbonyl group in which the alkyl moiety may be substituted with a halogen atom, a C_{1-6} alkyloxycarbonyl group in which the alkyl moiety may be substituted with a halogen atom, a C_{1-6} alkylsulfonyl group in which the alkyl moiety may be substituted with a halogen atom, $CONR_6R_7$, a C_{1-6} O,O'-alkylphosphoryl group in which the alkyl moiety may be substituted with a halogen atom, a cyano group, a formyl group or a nitro group;

R_3 is a C_{1-8} alkylene group which may be substituted with a halogen atom, a C_{2-8} alkenylene group which may be substituted with a halogen atom, a C_{2-8} alkynylene group which may be substituted with a halogen atom, a phenylene group which may be substituted, or a 5- or 6-membered heterocyclic divalent group which may be substituted; and

R_4 is a hydrogen atom, a cyano group, a phenyl group which may be substituted, a 3- to 8-membered cyclic alkyl group which may be substituted, a 3- to 8-membered heterocyclic which may be substituted, a halogen atom, OR_5, $OCOR_5$, $OCOOR_5$, COR_5, $COOR_5$, SR_5, SOR_5, SO_2R_5, N-CO-OR_8, N-CO-SR_8, N-CS-OR_8, N-CS-SR_8, N-O-CO-R_8, O-CO-R_8, O-CO-OR_8, O-CO-SR_8, O-CS-OR_8, O-CS-SR_8, S-CS-OR_8, S-CS-SR_8, S-CO-OR_8, S-CO-SR_8, S-CS-R_8, NR_9R_{10}, O-CO-NR_9R_{10}, O-CS-NR_9R_{10}, S-CO-NR_9R_{10} or S-CS-NR_9R_{10};

wherein R_5 is a C_{1-6} alkyl group which may be substituted with a halogen atom, an aryl group which may be substituted with a halogen atom or an aralkyl group which may be substituted with a halogen atom;

R_6 and R_7 are each independently a hydrogen atom or a C_{1-6} alkyl group which may be substituted with a halogen atom;

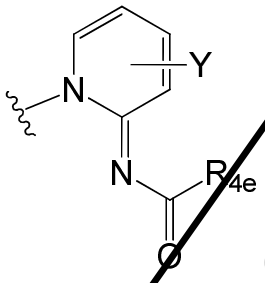
R_8 is a C_{1-6} alkyl group which may be substituted, the substituent which may be substituted being a halogen atom, a C_{1-4} alkyloxycarbonyl group, a C_{1-4} alkylcarbonyl group, a benzoyl group which may be substituted with a halogen atom or a C_{1-4} alkyl group which may be substituted with a halogen atom, a C_{1-4} alkyloxy group or a C_{1-4} alkylthio group;

R_9 and R_{10} are each independently a hydrogen atom, a formyl group, a C_{1-6} alkyl group which may be substituted with a halogen atom, a C_{1-6} alkylcarbonyl group in which the alkyl moiety may be substituted with a halogen atom, a C_{1-6}

alkylcarbonyloxy group in which the alkyl moiety may be substituted with a halogen atom, a phenyl group which may be substituted (the substituent which may be substituted being a halogen atom, a C_{1-4} alkyl group which may be substituted with a halogen atom, or a C_{1-4} alkyloxy group which may be substituted with a halogen atom), or a benzyl group which may be substituted (the substituent which may be substituted being a halogen, a C_{1-4} alkyl group which may be substituted with a halogen or a C_{1-4} alkyloxy group which may be substituted with a halogen), R^9 and R^{10} together form a ring and denote a 3- to 10-membered heterocycloalkyl group containing at least one nitrogen atom, or N, R_9 and R_{10} together form a ring and denote a 5- or 6-membered aromatic heterocycle containing at least one nitrogen atom, and

N, R_2, R_3 and R_4 may together form a group of formula (E)

[Chem. 2]



(E)

wherein Y is a hydrogen atom, a halogen atom, a hydroxyl group, a C_{1-6} alkyl group which may be substituted with a halogen, a C_{1-6} alkyloxy group which may be substituted with a halogen, a cyano group, a formyl group or a nitro group,

and R_{4e} is a C_{1-6} alkyl group substituted with a halogen or a C_{1-6} alkyloxy group which may be substituted with a halogen;

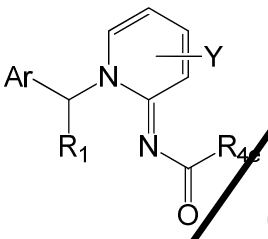
with the proviso that if Ar is a 2,6-dichloro-4-pyridyl group, then R_2 is not a C_{1-6} alkyloxycarbonyl group in which the alkyl moiety may be substituted with a halogen atom).

[Claim 2] The pest control agent according to claim 1, wherein Ar in formula (I) is a 6-chloro-3-pyridyl group or a 5-chloro-3-thiazolyl group.

[Claim 3] The pest control agent according to claim 1 or 2, wherein R_2 in formula (I) is a C_{1-6} alkylcarbonyl group in which the alkyl moiety may be substituted with a halogen atom, a C_{1-6} alkylsulfonyl group in which the alkyl moiety may be substituted with a halogen atom, or a cyano group.

[Claim 4] The pest control agent according to claim 1, wherein the compound of formula (I) is a compound of formula (Ie) below.

[Chem. 3]



(Ie)

[Claim 5] The pest control agent according to claim 4, wherein R_{4e} in formula (Ie) is a C_{1-6} alkyl group substituted with a halogen atom.

[Claim 6] The pest control agent according to claim 4, wherein Y in formula (Ie) is a hydrogen atom or a halogen atom.

[Claim 7] The pest control agent according to claim 4, wherein R_{4e} in formula (Ie) is a C_{1-6} alkyl group substituted with a halogen atom, and Y is a hydrogen atom or a halogen atom.

[Claim 8] The pest control agent according to claim 4, wherein the compound of formula (Ie) is a compound selected from the group consisting of N-[1-((6-chloropyridin-3-yl)methyl)pyridin-2(1H)-ylidene]-2,2,2-trifluoroacetamide, N-[1-((6-chloro-5-fluoropyridin-3-yl)methyl)pyridin-2(1H)-ylidine]-2,2,2-trifluoroacetamide, N-[1-((6-fluoropyridin-3-yl)methyl)pyridin-2(1H)-ylidene]-2,2,2-trifluoroacetamide, N-[1-((6-bromopyridin-3-yl)methyl)pyridin-2(1H)-ylidene]-2,2,2-trifluoroacetamide, N-[1-(1-(6-chloropyridin-3-yl)ethyl)pyridin-2(1H)-ylidene]-2,2,2-trifluoroacetamide, N-[1-((6-chloropyridin-3-yl)methyl)pyridin-2(1H)-ylidene]-2,2-difluoroacetamide, 2-chloro-N-[1-((6-chloropyridin-3-yl)methyl)pyridin-2(1H)-ylidene]-2,2-difluoroacetamide, N-[1-((2-chloropyrimidin-5-yl)methyl)pyridin-2(1H)-ylidene]-2,2,2-trifluoroacetamide and N-[1-((6-chloropyridin-3-yl)methyl)pyridin-2(1H)-ylidene]-2,2,3,3,3-pentafluoropropanamide.

[Claim 9] The pest control agent according to any one of claims 1 to 8, which has a pest control activity on at least

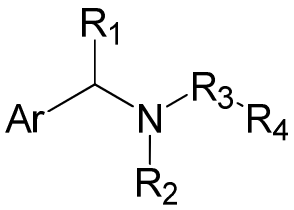
one type of pest selected from the group consisting of lepidopterous pests, hemipterous pests, thysanopterous pests, dipterous pests, coleopterous pests, animal parasitic fleas and ticks, and canine heartworms.

[Claim 10] The pest control agent according to any one of claims 1 to 9, wherein the pest is an agricultural/horticultural pest or an animal parasitic pest.

[Claim 11] The pest control agent according to any one of claims 1 to 9, wherein the pest is a pesticide-resistant pest.

[Claim 12] An amine derivative of the following formula (I) or a salt thereof

[Chem. 4]



(I)

(wherein Ar is a phenyl group which may be substituted or a 5- or 6-membered heterocycle which may be substituted;

R_1 is a hydrogen atom or a C_{1-6} alkyl group;

R_2 is a C_{1-6} alkylcarbonyl group in which the alkyl moiety may be substituted with a halogen atom, a C_{1-6} alkyloxycarbonyl group in which the alkyl moiety may be substituted with a halogen atom, a C_{1-6} alkylsulfonyl group in which the alkyl moiety may be substituted with a halogen atom, $CONR_6R_7$, a C_{1-6} O,O'-alkylphosphoryl group in which the

alkyl moiety may be substituted with a halogen atom, a cyano group, a formyl group or a nitro group;

R_3 is a C_{1-8} alkylene group which may be substituted with a halogen atom, a C_{2-8} alkenylene group which may be substituted with a halogen atom, a C_{2-8} alkynylene group which may be substituted with a halogen atom, a phenylene group which may be substituted, or a 5- or 6-membered heterocyclic divalent group which may be substituted; and

R_4 is a hydrogen atom, a cyano group, a phenyl group which may be substituted, a 3- to 8-membered cyclic alkyl group which may be substituted, a 3- to 8-membered heterocyclic which may be substituted, a halogen atom, OR_5, $OCOR_5$, $OCOOR_5$, COR_5, $COOR_5$, SR_5, SOR_5, SO_2R_5, N-CO-OR_8, N-CO-SR_8, N-CS-OR_8, N-CS-SR_8, N-O-CO-R_8, O-CO-R_8, O-CO-OR_8, O-CO-SR_8, O-CS-OR_8, O-CS-SR_8, S-CS-OR_8, S-CS-SR_8, S-CO-OR_8, S-CO-SR_8, S-CS-R_8, NR_9R_{10}, O-CO-NR_9R_{10}, O-CS-NR_9R_{10}, S-CO-NR_9R_{10} or S-CS-NR_9R_{10};

wherein R_5 is a C_{1-6} alkyl group which may be substituted with a halogen atom, an aryl group which may be substituted with a halogen atom or an aralkyl group which may be substituted with a halogen atom;

R_6 and R_7 are each independently a hydrogen atom or a C_{1-6} alkyl group which may be substituted with a halogen atom;

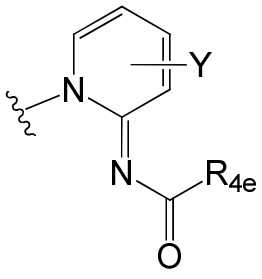
R_8 is a C_{1-6} alkyl group which may be substituted, the substituent which may be substituted being a halogen atom, a

C_{1-4} alkyloxycarbonyl group, a C_{1-4} alkylcarbonyl group, a benzoyl group which may be substituted with a halogen atom or a C_{1-4} alkyl group which may be substituted with a halogen atom, a C_{1-4} alkyloxy group or a C_{1-4} alkylthio group;

R_9 and R_{10} are each independently a hydrogen atom, a formyl group, a C_{1-6} alkyl group which may be substituted with a halogen atom, a C_{1-6} alkylcarbonyl group in which the alkyl moiety may be substituted with a halogen atom, a C_{1-6} alkylcarbonyloxy group in which the alkyl moiety may be substituted with a halogen atom, a phenyl group which may be substituted (the substituent which may be substituted being a halogen atom, a C_{1-4} alkyl group which may be substituted with a halogen atom, or a C_{1-4} alkyloxy group which may be substituted with a halogen atom), or a benzyl group which may be substituted (the substituent which may be substituted being a halogen, a C_{1-4} alkyl group which may be substituted with a halogen or a C_{1-4} alkyloxy group which may be substituted with a halogen), R^9 and R^{10} together form a ring and denote a 3- to 10-membered heterocycloalkyl group containing at least one nitrogen atom, or N, R_9 and R_{10} together form a ring and denote a 5- or 6-membered aromatic heterocycle containing at least one nitrogen atom; and

if Ar is a pyridyl group which may be substituted or a pyrimidyl group which may be substituted, N, R_2, R_3 and R_4 may together form a group of formula (E)

[Chem. 5]



(E)

wherein Y is a hydrogen atom, a halogen atom, a hydroxyl group, a C_{1-6} alkyl group which may be substituted with a halogen atom, a C_{1-6} alkyloxy group which may be substituted with a halogen atom, a cyano group, a formyl group or a nitro group, and R_{4e} is a C_{1-6} alkyl group which may be substituted with a halogen or a C_{1-6} alkyloxy group which may be substituted with a halogen;

with the proviso that if Ar is a 2,6-dichloro-4-pyridyl group, then R_2 is not a C_{1-6} alkyloxycarbonyl group in which the alkyl moiety may be substituted with a halogen atom, and if Ar is a 6-chloro-3-pyridyl group, then R_1 is not a hydrogen atom, Y is not a 5-methyl group and R_{4e} is not a trifluoromethyl group).

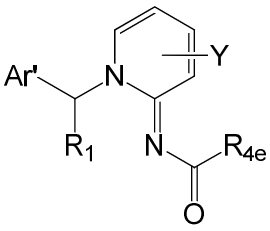
[Claim 13] The amine derivative or a salt thereof according to claim 12, wherein Ar in formula (I) is a 6-chloro-3-pyridyl group or a 5-chloro-3-thiazolyl group.

[Claim 14] The amine derivative or a salt thereof according to claim 12 or 13, wherein R_2 in formula (I) is a C_{1-6} alkylcarbonyl group in which the alkyl moiety may be substituted with a halogen atom, a C_{1-6} alkylsulfonyl group

in which the alkyl moiety may be substituted with a halogen atom, or a cyano group.

[Claim 15] The amine derivative or a salt thereof according to claim 12, wherein the compound of formula (I) is a compound of formula (Ie') below.

[Chem. 6]



(Ie')

(wherein Ar' is a pyridyl group which may be substituted or a pyrimidyl group which may be substituted; Y is a hydrogen atom, a halogen atom, a hydroxyl group, a C_{1-6} alkyl group which may be substituted with a halogen atom, a C_{1-6} alkyloxy group which may be substituted with a halogen atom, a cyano group, a formyl group or a nitro group; and R_{4e} is a C_{1-6} alkyl group substituted with a halogen or a C_{1-6} alkyloxy group which may be substituted with a halogen;

with the proviso that if Ar' is a 6-chloro-3-pyridyl group, then R_1 is not a hydrogen atom, Y is not a 5-methyl group and R_{4e} is not a trifluoromethyl group).

[Claim 16] The amine derivative or a salt thereof according to claim 15, wherein R_{4e} in formula (Ie') is a C_{1-6} alkyl group substituted with a halogen atom.

[Claim 17] The amine derivative or a salt thereof according to claim 15, wherein Y in formula (Ie') is a hydrogen atom or a halogen atom.

[Claim 18] The amine derivative or a salt thereof according to claim 15, wherein R_{4e} in formula (Ie') is a C_{1-6} alkyl group substituted with a halogen atom and Y is a hydrogen atom or a halogen atom.

[Claim 19] The amine derivative or a salt thereof according to claim 15, wherein the compound of formula (Ie') is a compound selected from the group consisting of N-[1-((6-chloropyridin-3-yl)methyl)pyridin-2(1H)-ylidene]-2,2,2-trifluoroacetamide, N-[1-((6-chloro-5-fluoropyridin-3-yl)methyl)pyridin-2(1H)-ylidine]-2,2,2-trifluoroacetamide, N-[1-((6-fluoropyridin-3-yl)methyl)pyridin-2(1H)-ylidene]-2,2,2-trifluoroacetamide, N-[1-((6-bromopyridin-3-yl)methyl)pyridin-2(1H)-ylidene]-2,2,2-trifluoroacetamide, N-[1-(1-(6-chloropyridin-3-yl)ethyl)pyridin-2(1H)-ylidene]-2,2,2-trifluoroacetamide, N-[1-((6-chloropyridin-3-yl)methyl)pyridin-2(1H)-ylidene]-2,2-difluoroacetamide, 2-chloro-N-[1-((6-chloropyridin-3-yl)methyl)pyridin-2(1H)-ylidene]-2,2-difluoroacetamide, N-[1-((2-chloropyrimidin-5-yl)methyl)pyridin-2(1H)-ylidene]-2,2,2-trifluoroacetamide and N-[1-((6-chloropyridin-3-yl)methyl)pyridin-2(1H)-ylidene]-2,2,3,3,3-pentafluoropropanamide.

[Claim 20] The amine derivative or a salt thereof according to any one of claims 12 to 19, which has a pest control

activity on at least one type of pest selected from the group consisting of lepidopterous pests, hemipterous pests, thysanopterous pests, dipterous pests, coleopterous pests, animal parasitic fleas and ticks, and canine heartworms.

[Claim 21] A method for controlling pests, comprising the step of using the pest control agent according to any one of claims 1 to 9 or the amine derivative or a salt thereof according to any one of claims 12 to 20.

[Claim 22] A method for controlling agricultural/horticultural pests, comprising the step of treating plant seeds, roots, tubers, bulbs, rhizomes, soil, a nutrient solution in nutriculture, a solid culture medium in nutriculture, or a carrier for growing plants, with the pest control agent according to any one of claims 1 to 9 or the amine derivative or a salt thereof according to any one of claims 12 to 20, thereby inducing the compound to penetrate and translocate into the plants.

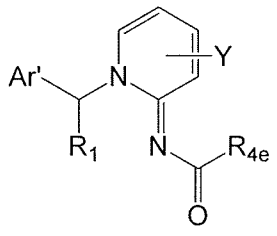
[Claim 23] The method according to claim 21, wherein the pest is an agricultural/horticultural pest or an animal parasitic pest.

[Claim 24] The method according to claim 21, wherein the pest is a pesticide-resistant pest.

CLAIMS

[Claim 1] An amine derivative of the following formula (Ie') or a salt thereof.

[Chem. 1]



(Ie')

(wherein Ar' is a pyridyl group which may be substituted with halogen atoms, C_{1-4} alkyl groups which may be substituted with halogen atoms, alkyloxy groups which may be substituted with halogen atoms, hydroxyl groups, cyano groups or nitro groups, or a pyrimidyl group which may be substituted with halogen atoms, C_{1-4} alkyl groups which may be substituted with halogen atoms, alkyloxy groups which may be substituted with halogen atoms, hydroxyl groups, cyano groups or nitro groups; R_1 is a hydrogen atom or a C_{1-6} alkyl group; Y is a hydrogen atom, a halogen atom, a hydroxyl group, a C_{1-6} alkyl group which may be substituted with a halogen atom, a C_{1-6} alkyloxy group which may be substituted with a halogen atom, a cyano group, a formyl group or a nitro group; and R_{4e} is a C_{1-6} alkyl group substituted with a halogen;

with the proviso that if Ar' is a 6-chloro-3-pyridyl group, then R_1 is not a hydrogen atom, Y is not a 5-methyl group and R_{4e} is not a trifluoromethyl group).

[Claim 2] The amine derivative or a salt thereof according to claim 1, wherein Y in formula (Ie') is a hydrogen atom or a halogen atom.

[Claim 3] The amine derivative or a salt thereof according to claim 1, wherein the compound of formula (Ie') is a compound selected from the group consisting of N-[1-((6-chloropyridin-3-yl)methyl)pyridin-2(1H)-ylidene]-2,2,2-trifluoroacetamide, N-[1-((6-chloro-5-fluoropyridin-3-yl)methyl)pyridin-2(1H)-ylidine]-2,2,2-trifluoroacetamide, N-[1-((6-fluoropyridin-3-yl)methyl)pyridin-2(1H)-ylidene]-2,2,2-trifluoroacetamide, N-[1-((6-bromopyridin-3-yl)methyl)pyridin-2(1H)-ylidene]-2,2,2-trifluoroacetamide, N-[1-(1-(6-chloropyridin-3-yl)ethyl)pyridin-2(1H)-ylidene]-2,2,2-trifluoroacetamide, N-[1-((6-chloropyridin-3-yl)methyl)pyridin-2(1H)-ylidene]-2,2-difluoroacetamide, 2-chloro-N-[1-((6-chloropyridin-3-yl)methyl)pyridin-2(1H)-ylidene]-2,2-difluoroacetamide, N-[1-((2-chloropyrimidin-5-yl)methyl)pyridin-2(1H)-ylidene]-2,2,2-trifluoroacetamide and N-[1-((6-chloropyridin-3-yl)methyl)pyridin-2(1H)-ylidene]-2,2,3,3,3-pentafluoropropanamide.

[Claim 4] The amine derivative or a salt thereof according to any one of claims 1 to 3, which has a pest control activity on at least one type of pest selected from the

group consisting of lepidopterous pests, hemipterous pests, thysanopterous pests, dipterous pests, coleopterous pests, animal parasitic fleas and ticks, and canine heartworms.

[Claim 5] A pest control agent comprising at least one amine derivative or a salt thereof according to any one of claims 1 to 4.

[Claim 6] A method for controlling pests in a non-human subject, comprising the step of using the amine derivative or a salt thereof according to any one of claims 1 to 4 or the pest control agent according to claim 5.

[Claim 7] The method according to claim 6, comprising the step of treating plant seeds, roots, tubers, bulbs, rhizomes, soil, a nutrient solution in nutriculture, a solid culture medium in nutriculture, or a carrier for growing plants, with the amine derivative or a salt thereof according to any one of claims 1 to 4 or the pest control agent according to claims 5, thereby inducing the compound to penetrate and translocate into the plants.

[Claim 8] The method according to claim 6 or 7, wherein the pest is an agricultural/horticultural pest or an animal parasitic pest.

[Claim 9] The method according to any one of claims 6 to 8, wherein the pest is a pesticide-resistant pest.