

## PATENT SPECIFICATION

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(54) AGENTS FOR THE CONTROL OF INSECTS, MITES, LEPORINE ANIMALS AND RODENTS

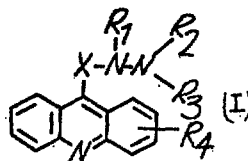
(71) We, FARBENFABRIKEN BAYER AKTIENGESELLSCHAFT, a body corporate organised under the laws of Germany, of Leverkusen, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 The present invention relates to the use as agents for the control of insects, mites, leporine animals and rodents of certain acridine derivatives, some of which are known.

15 It is known to use heterocyclic compounds for the control of insects and mites, for example 1 - isopropyl - 3 - methyl - 5 - pyrazolyl - N,N - dimethylcarbamate (see Swiss Patent Specification 282,655).

20 Furthermore, it is known to use, for the control of destructive rodents, rodenticides such as zinc phosphide, alphanaphthylthiourea and 5 - ( $\alpha$  - hydroxy -  $\alpha$  - 2 - pyridylbenzyl) - 7 - ( $\alpha$  - 2 - pyridylbenzylidene) - 5 - norbornene - 2,3 - dicarboximide. These active compounds are of considerable importance in practice.

30 The present invention provides a composition for the control of insects, mites, leporine animals and rodents containing as active ingredient an acridine derivative of the formula



in which

X stands for a direct bond or the grouping —NH—CS—, 35

R<sub>1</sub> stands for hydrogen, alkyl or substituted alkyl,

R<sub>2</sub> and R<sub>3</sub> individually stand for hydrogen, alkyl, substituted alkyl or acyl, or

R<sub>2</sub> and R<sub>3</sub> together stand for an alkylidene group, or, with the nitrogen atom, for a heterocyclic radical and 40

R<sub>4</sub> stands for hydrogen, alkyl or halogen as the free base or in the form of a salt in admixture with a solid diluent or carrier or in admixture with a liquid diluent or carrier containing a surface-active agent. 45

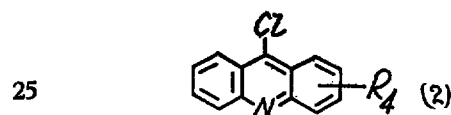
The compounds of the formula (I) exhibit strong insecticidal, acaricidal and rodenticidal properties. 50

In the general formula (I), R<sub>1</sub> stands preferably for hydrogen and alkyl with 1 to 4 carbon atoms which may be substituted by halogen or hydroxy. Preferably, R<sub>2</sub> and R<sub>3</sub> stand individually for hydrogen, alkyl with 1 55

- to 4 carbon atoms which may be substituted by halogen, such as Cl, Br and F, as well as for acyl, particularly derived from carboxylic acids, for example with 2 to 18 carbon atoms, which may be substituted, carbonic acid esters and sulphonic acids.  $R_2$  and  $R_3$  together with the nitrogen atom may stand for a saturated heterocyclic radical with 5 or 6 ring members, such as morpholyl and piperidyl. These radicals may contain a second hetero atom, such as O, N and S.  $R_2$  and  $R_3$  further stand preferably for alkylidene with 2 to 8 carbon atoms. Finally,  $R_4$  stands preferably for hydrogen, alkyl with 1 to 4 carbon atoms and halogen, such as chlorine, bromine and fluorine.

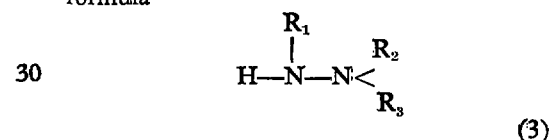
A number of the substances according to the invention are already known (cf. C.A. 62, 517 (1965), J. Chem. Soc. 1965, 4653).

- The other active compounds are new. They can be prepared in a simple manner according to known processes. The compounds of the general formula (1), in which X represents a direct bond, may be prepared by reacting a 9-chloroacridine of the general formula



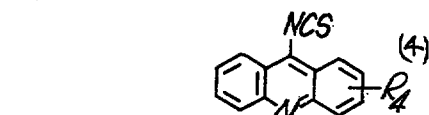
in which

$R_4$  has the meaning stated above with a hydrazine derivative of the general formula



- in excess phenol as reaction medium at a temperature between 80° and 120°C. From the reaction mixture the product of the general formula (1) can be precipitated in the form of the hydrochloride with ether.

The compounds of the general formula (1) in which X stands for the grouping  $\text{—NH—CS—}$  may be obtained by reacting 9-acridinylisothiocyanate of the formula



with a hydrazine derivative of the general formula (3) in an inert solvent, for example ethanol or benzene.

- 45 The acridine derivatives may be used as free bases or as salts of inorganic acids, such as hydrochloric acid, methylsulphuric acid, sulphuric acid and phosphoric acid, or organic acids, such as acetic acid, chloroacetic

acid or toluenesulphonic acid. In the salts it is the acridine derivative moiety, not the acid, which determines the pesticidal effectiveness.

The active compounds according to the invention exhibit strong insecticidal and acaricidal effects, with low phytotoxicity. The effects set in rapidly and are long-lasting. The active compounds can therefore be used with good results for the control of noxious sucking and biting insects, Diptera and mites (*Acarina*).

To the sucking insects there belong, in the main, aphids, such as the green peach aphid (*Myzus persicae*), the bean aphid (*Doralis fabae*); scales, such as *Aspidiotus hederae*, *Lecanium hesperidum*, *Pseudococcus maritimus*; Thysanoptera, such as *Hercinotrips femoralis*; and bugs, such as the beet bug (*Piesma quadrata*) and the bed bug (*Cimex lectularius*).

With the biting insects, there are classed, in the main, butterfly caterpillars, such as *Plutella maculipennis*, *Lymantria dispar*; beetles, such as granary weevils (*Sitophilus granarius*), the Colorado beetle (*Leptinotarsa decemlineata*), but also species living in the soil, such as the wireworms (*Agriotes sp.*) and larvae of the cockchafer (*Melolontha melolontha*); cockroaches, such as the German cockroach (*Blattella germanica*); Orthoptera, such as the house cricket (*Gryllus domesticus*); termites, such as *Reticulitermes*; Hymenoptera, such as ants.

The Diptera comprise, in particular, the flies, such as the vinegar fly (*Drosophila melanogaster*), the Mediterranean fruit fly (*Ceratitis capitata*), the house fly (*Musca domestica*), and mosquitoes, such as the yellow fever mosquito (*Aedes aegypti*).

In the case of the mites, particularly important are the spider mites (*Tetranychidae*) such as the two-spotted spider mite (*Tetranychus urticae*), the European red mite (*Panonychus ulmi*); gall mites, such as the currant gall mite (*Eriophyes ribis*) and tarsonemids, such as *Tarsonemus pallidus*, and ticks.

The active compounds according to the invention also exhibit rodenticidal properties and are therefore suitable for the control of leporine animals (*Lagomorpha*) and rodents (*Rodentia*), such as squirrel-like animals (*Sciuroidea*), gophers (*Geomysidae*) and mouse-like animals (*Muroidea*) with which there are classed essentially the dormouse-like animals (*Muscardinidae*) and the mice (*Muridae*).

The leporine animals include essentially the Leporidae, such as the rabbit (*Oryctolagus cuniculus*), the squirrel-like animals, for example the European souslik (*Citellus citellus*) and the ground squirrel (*Citellus lateralis*), and the gophers include for example the

mountain pocket gopher (*Thomomys talpoides*).

With the dormouse-like animals there is classed for example the fat dormouse (*Glis glis*).

The mice comprise, for example, in the group of the long-tailed mice (*Murinae*), the rats (*Rattus spec.*), such as the black rat (*Rattus rattus*) and the Norway rat (*Rattus norvegicus*); the house mice (*Mus spec.*), such as *Mus musculus*; in the group of the hamster-like animals (*Cricetinae*) the European hamster (*Cricetus cricetus*) and in the group of the short-tailed mice (*Microtinae*) the common vole (*Microtus arvalis*) the field vole (*Microtus agrestis*) and the water vole (*Arvicola terrestris*).

The active compounds according to the present invention can be converted into the usual formulations, such as solutions, emulsions, suspensions, powders, pastes and granulates. These may be produced in known manner, for example by mixing the active compounds with extenders, that is, liquid or solid diluents or carriers, optionally with the use of surface-active agents, that is, emulsifying agents and/or dispersing agents. In the case of the use of water as an extender, organic solvents can, for example, also be used as auxiliary solvents.

As liquid diluents or carriers, there are preferably used aromatic hydrocarbons, such as xylenes or benzene, chlorinated aromatic hydrocarbons, such as chlorobenzenes, paraffins, such as mineral oil fractions, alcohols, such as methanol or butanol, or strongly polar solvents, such as dimethyl formamide or dimethyl sulphoxide, as well as water.

As solid diluents or carriers, there are preferably used ground natural minerals, such as kaolins, clays, talc or chalk, or ground synthetic minerals, such as highly-dispersed silicic acid or silicates.

Preferred examples of emulsifying agents include non-ionic and anionic emulsifiers, such as polyoxyethylene-fatty acid esters, polyoxyethylene-fatty alcohol ethers, for example alkylaryl polyglycol ethers, alkyl sulphonates and aryl sulphonates; and preferred examples of dispersing agents include lignin, sulphite waste liquors and methyl cellulose.

The active compounds may be mixed with suitable bait materials of animal or vegetable origin, for example ground cereal products, meat meal and fish meal.

The active compounds according to the invention may be present in the formulations in admixture with other known active compounds.

The formulations contain, in general, from 0.1 to 95, preferably from 0.5 to 90, per cent by weight of active compound.

The active compounds may be used as such, in the form of their formulations or of the application forms prepared therefrom, such as

ready-to-use solutions, emulsions, suspensions, powders, pastes and granulates. Application takes place in the usual manner, for example by spraying, squirting, watering, dusting and scattering, poisoning of drinking water or by laying, above ground and below ground, food baits and playbaits into which the active compounds are incorporated; further, by fumigation in rooms or subterranean burrows.

The concentrations of active compound can be varied within a fairly wide range. In general, concentrations of active compound of 0.001 to 20 per cent by weight, preferably of 0.005 to 5%, are used. In the case of certain modes of application, concentrated preparations of active compound may also be used, for example with 5 to 60 per cent by weight of active compound.

The present invention further provides a method of combating insects, mites, leporine animals and rodents which comprises applying to the insects, mites, leporine animals or rodents or a habitat thereof an acridine derivative of the formula (1) above or in the form of a composition containing as active ingredient an acridine derivative of the formula (1) in admixture with a solid or liquid diluent or carrier.

The present invention also provides crops protected from damage by insects, mites, leporine animals or rodents by being grown in areas in which immediately prior to and/or during the time of the growing an acridine derivative of the formula (1) was applied alone or in admixture with a solid or liquid diluent or carrier.

The invention is illustrated in and by the following Examples.

#### EXAMPLE A

Plutella test

Solvent: 3 parts by weight dimethyl formamide

Emulsifier: 1 part by weight alkylaryl polyglycol ether

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

Cabbage leaves (*Brassica oleracea*) are sprayed with the preparation of the active compound until dew moist and are then infested with caterpillars of the diamond-back moth (*Plutella maculipennis*).

After the specified periods of time, the degree of destruction is determined as a percentage: 100% means that all the caterpillars are killed whereas 0% means that none of the caterpillars are killed.

The active compounds, the concentrations of the active compounds, the evaluation times and the results can be seen from the following Table:

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(10)

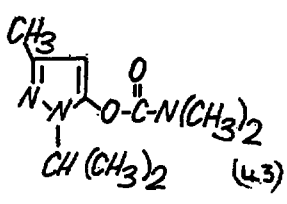
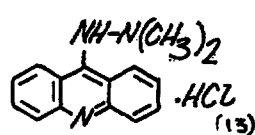
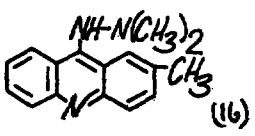
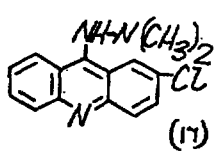
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TABLE A  
(plant-damaging insects)

*Plutella test*

| Active compounds                                                                             | Concentration of active compound in % | Degree of destruction in % after 3 days |
|----------------------------------------------------------------------------------------------|---------------------------------------|-----------------------------------------|
| <br>(known) | 0.2                                   | 90                                      |
| <br>(13)   | 0.2<br>0.02                           | 100<br>100                              |
| <br>(16)  | 0.2<br>0.02                           | 100<br>100                              |
| <br>(17)  | 0.2<br>0.02                           | 100<br>100                              |

Example B

Tetranychus test

Solvent: 3 parts by weight dimethyl formamide.  
Emulsifier: 1 part by weight alkylaryl polyglycol ether.

To produce a suitable preparation of active compound, 1 part by weight of the active compound is mixed with the stated amount of solvent containing the stated amount of emulsifier and the concentrate so obtained is diluted with water to the desired concentration.

5 Bean plants (*Phaseolus vulgaris*), which  
10 have a height of approximately 10—30 cm.,  
are sprayed with the preparation of the active  
compound until dripping wet. These bean  
plants are heavily infested with spider mites  
15 (*Tetranychus urticae*) in all stages of develop-  
ment.

After the specified periods of time, the effectiveness of the preparation of active compound is determined by counting the dead mites. The degree of destruction thus obtained is expressed as a percentage: 100% means that all the spider mites are killed whereas 0% means that none of the spider mites are killed.

The active compounds, the concentrations of the active compounds, the evaluation times and the results can be seen from the following Table:

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TABLE B  
(plant-damaging mites)

*Tetranychus test*

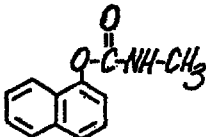
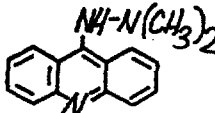
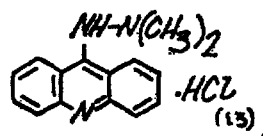
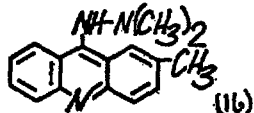
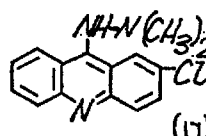
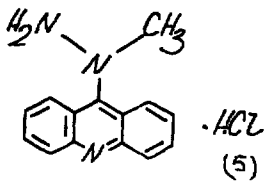
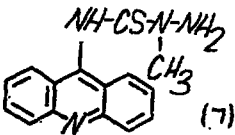
| Active compounds                                                                             | Concentration of<br>active compound<br>in % | Degree of<br>destruction in %<br>after 48 hours |
|----------------------------------------------------------------------------------------------|---------------------------------------------|-------------------------------------------------|
| <br>(known) | 0.2                                         | 0                                               |
| <br>(8)    | 0.2<br>0.02                                 | 100<br>100                                      |
| <br>(13)  | 0.2<br>0.02                                 | 99<br>60                                        |
| <br>(16)  | 0.2<br>0.02                                 | 100<br>95                                       |
| <br>(17)  | 0.2<br>0.02<br>0.002                        | 100<br>99<br>99                                 |

TABLE B (continued)

(plant-damaging mites)

*Tetranychus test*

| Active compounds                                                                   | Concentration of active compound in % | Degree of destruction in % after 48 hours |
|------------------------------------------------------------------------------------|---------------------------------------|-------------------------------------------|
|   | 0.2<br>0.02                           | 100<br>100                                |
|  | 0.2                                   | 99                                        |

Example C

Food test/albino rat

Test animal: albino rat (*Rattus norvegicus*)

- 5 To produce a suitable preparation of active compound, 3 parts by weight of the active compound are mixed with 2.8 parts by weight of highly dispersed silicic acid and 4.2 parts by weight of talc. This concentrate containing 30 per cent by weight of active compound is extended with a powdered, commercially-available standard rat diet to the desired concentration of active compound in each case.
- 10 In each case 50 grams of the poisoned bait thus prepared are placed, in an automatic feeding device, before albino rats kept separately. No untreated food is available to the animals; they receive water freely. The restriction test proceeds for 72 hours; the ensuing observation period, with normal feeding with untreated standard rat diet, is of 7 days,
- 15

calculated from the end of the restriction test. The mortality observed in this test is valid as measure of the effectiveness.

The dosage of the active compound is, taking into account the previously determined LD<sub>100</sub> (dose of active compound with which 100% of the treated rats are killed), so effected that there is contained in 4 grams of bait the amount of poison certain to be lethal to a rat weighing 200 grams. In this way, adaptation is made to the natural feeding behaviour of the rats.

The active compounds, LD<sub>100</sub> values, concentrations of active compound in the bait and the kill attained can be seen from the following Table.

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(13)

TABLE C  
Food test/albino rat

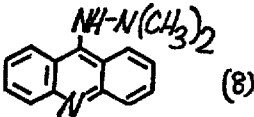
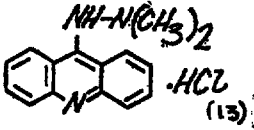
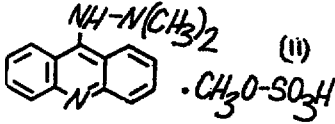
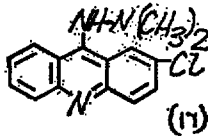
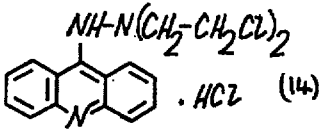
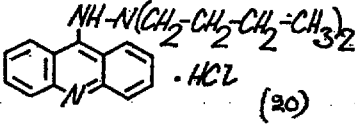
| Active compound                                                                                                                       | LD <sub>100</sub><br>mg/kg<br>(rat) | Concentration<br>of active<br>compound in<br>bait % | Number of<br>rats<br>dead/used |
|---------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-----------------------------------------------------|--------------------------------|
| Zinc phosphide<br>(known)                                                                                                             | 75                                  | 0.375                                               | 0/2                            |
| Alphanaphthylthiourea<br>(known)                                                                                                      | 10                                  | 0.05                                                | 0/2                            |
| 5-( $\alpha$ -hydroxy- $\alpha$ -2-pyridyl-benzyl)-7-( $\alpha$ -2-pyridyl-<br>benzylidene)-5-norbornene-2,3-dicarboximide<br>(known) | 30                                  | 0.15                                                | 0/2                            |
|  (8)                                                 | 2.5                                 | 0.0125                                              | 4/4                            |
|  (13)                                              | 5                                   | 0.025                                               | 4/4                            |
|  (11)                                              | 5                                   | 0.025                                               | 4/4                            |
|  (17)                                              | 5                                   | 0.025                                               | 1/2                            |
|  (14)                                              | 10                                  | 0.05                                                | 4/4                            |
|  (20)                                              | 25                                  | 0.125                                               | 1/2                            |

TABLE C (continued)

Food test/albino rat

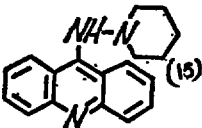
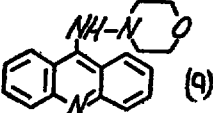
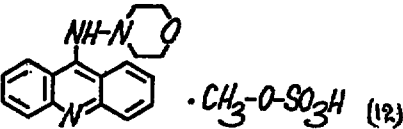
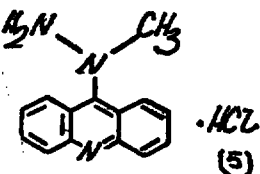
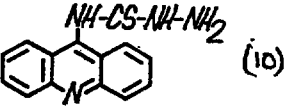
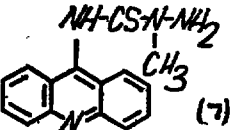
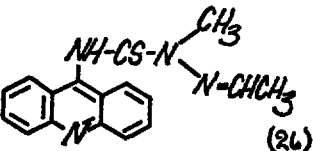
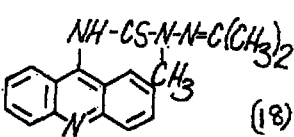
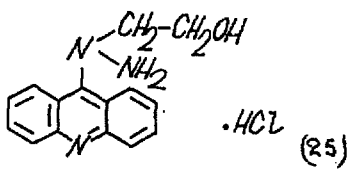
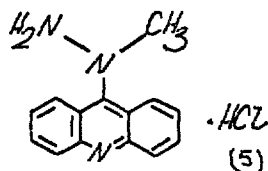
| Active compound                                                                          | LD <sub>100</sub><br>mg/kg<br>(rat) | Concentration<br>of active<br>compound in<br>bait % | Number of<br>rats<br>dead/used |
|------------------------------------------------------------------------------------------|-------------------------------------|-----------------------------------------------------|--------------------------------|
|  (15)   | 5                                   | 0.025                                               | 4/4                            |
|  (9)    | 10                                  | 0.05                                                | 4/4                            |
|  (12)  | 20                                  | 0.1                                                 | 4/4                            |
|  (5)  | 5                                   | 0.025                                               | 4/4                            |
|  (10) | 50                                  | 0.25                                                | 4/4                            |
|  (7)  | 5                                   | 0.025                                               | 4/4                            |
|  (26) | 20                                  | 0.1                                                 | 1/2                            |

TABLE C (continued)

Food test/albino rat

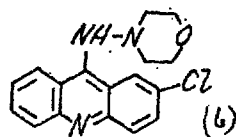
| Active compound                                                                            | LD <sub>100</sub><br>mg/kg<br>(rat) | Concentration<br>of active<br>compound in<br>bait % | Number of<br>rats<br>dead/used |
|--------------------------------------------------------------------------------------------|-------------------------------------|-----------------------------------------------------|--------------------------------|
| <br>(18)  | 20                                  | 0.1                                                 | 4/4                            |
| <br>(25) | 10                                  | 0.05                                                | 4/4                            |

## EXAMPLE 1



0.1 mole (21.4 g) 9-chloroacridine is dissolved, with heating to 100°C, in 80 g phenol, and 0.1 mole (4.6 g) monomethylhydrazine are added dropwise, with stirring. Heating to 100°C is effected for one hour, followed by cooling, and the hydrochloride is precipitated with ether. After recrystallisation from methanol, 18 g (70% of the theory) of 9 - (1 - methylhydrazino) - acridine hydrochloride are obtained. Yellow crystals, m.p. 227°C decomp.

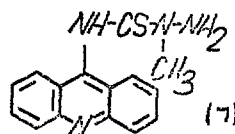
## EXAMPLE 2



0.05 mole (12.4 g) of 2,9-dichloroacridine is heated with 40 g phenol and 0.05 mole (5.1 g) N-aminomorpholine to 100°C for 1 hour. After cooling, the hydrochloride is pre-

cipitated with ether. The hydrochloride is suspended hot in 100 ml ethanol, and the base is liberated by dropwise addition of concentrated ammonia solution and water. After cooling, the base is filtered off with suction and recrystallised from benzene. 12 g (76% of the theory) of 2 - chloro - 9 - (N - aminomorpholino) - acridine are obtained, m.p. 224—226°C.

## EXAMPLE 3



0.06 mole (2.7 g) monomethylhydrazine are added at 50°C to a solution of 0.05 mole (11.8 g) 9-acridinylisothiocyanate in 120 ml benzene. After subsidence of the exothermal reaction, stirring is continued for some time at room temperature. The product precipitates, is filtered off with suction and washed with benzene. 12 g (85% of the theory) of 1 - (9 - acridinyl) - 3 - methylthiosemicarbamide are obtained, m.p. 198°C (decomp.) (Recrystallised from isobutanol).

In manner the same in principle as stated in the Examples, the compounds of the Formula (I) compiled in the following Table 1 can be prepared:

TABLE 1

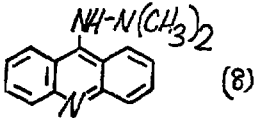
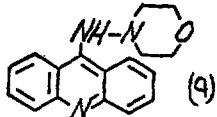
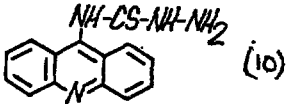
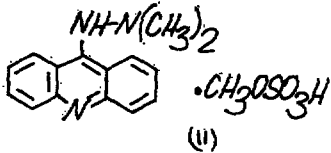
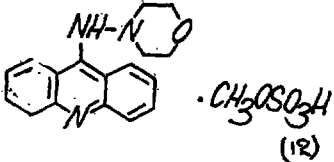
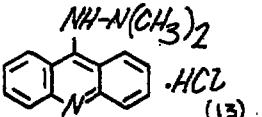
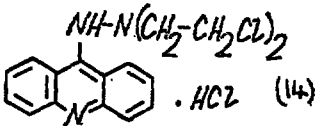
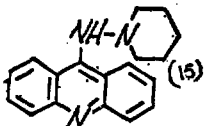
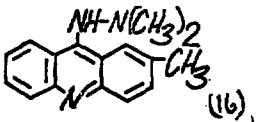
|                                                                                             | m.p. (°C)    |
|---------------------------------------------------------------------------------------------|--------------|
| <br>(8)    | 158°—160°    |
| <br>(9)    | 243° decomp. |
| <br>(10)   | 214° decomp. |
| <br>(11)  | 169°—170°    |
| <br>(12) | 228°—230°    |
| <br>(13) | 242° decomp. |
| <br>(14) | 252° decomp. |
| <br>(15) | 188—189°     |
| <br>(16) | 185—186°     |

TABLE 1 (Continued)

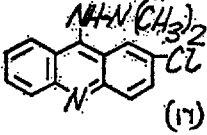
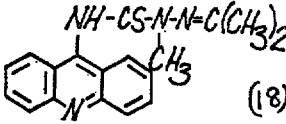
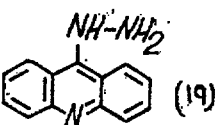
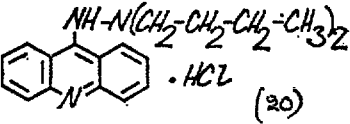
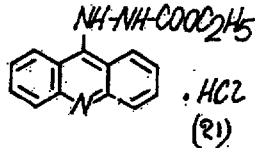
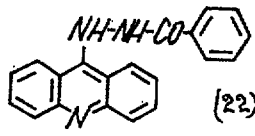
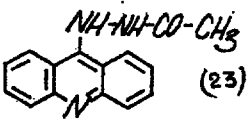
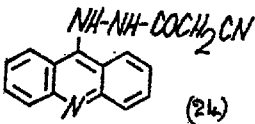
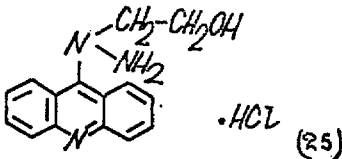
|                                                                                             | m.p. (°C).       |
|---------------------------------------------------------------------------------------------|------------------|
| <br>(17)   | 157—158°         |
| <br>(18)   | 180° decomp.     |
| <br>(19)   | 168—169°         |
| <br>(20)   | 184—185°         |
| <br>(21) | 249° decomp.     |
| <br>(22) | 240—242° decomp. |
| <br>(23) | 253° decomp.     |
| <br>(24) | 328—330° decomp. |
| <br>(25) | 195—197° decomp. |

TABLE 1 (Continued)

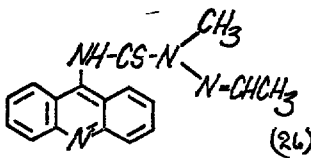
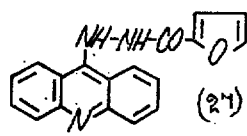
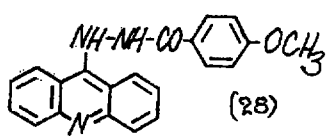
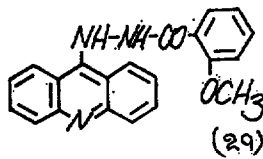
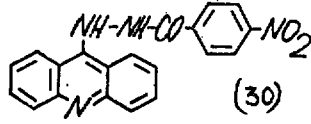
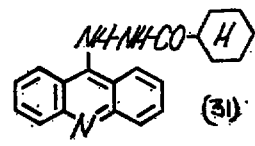
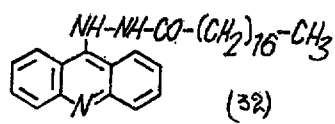
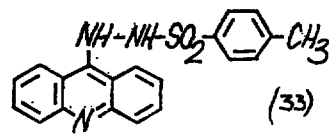
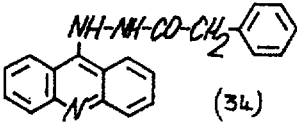
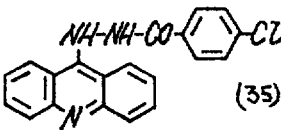
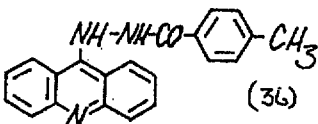
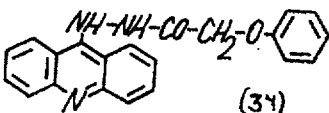
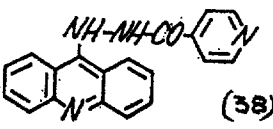
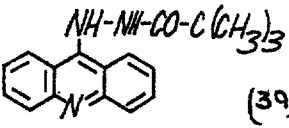
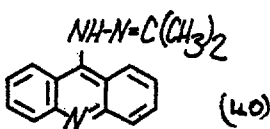
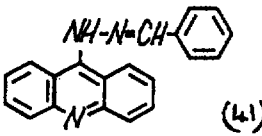
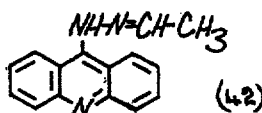
|                                                                                                 | m.p. (°C).   |
|-------------------------------------------------------------------------------------------------|--------------|
|  <p>(26)</p>   | 158°         |
|  <p>(27)</p>   | 274° decomp. |
|  <p>(28)</p>   | 277° decomp. |
|  <p>(29)</p>  | 286° decomp. |
|  <p>(30)</p> | 310° decomp. |
|  <p>(31)</p> | 198—199°     |
|  <p>(32)</p> | 116—118°     |
|  <p>(33)</p> | 161° decomp. |

TABLE 1 (Continued)

|                                                                                             | m.p. (°C).       |
|---------------------------------------------------------------------------------------------|------------------|
| <br>(34)   | 227—228° decomp. |
| <br>(35)   | 282° decomp.     |
| <br>(36)   | 226—227°         |
| <br>(37)  | 217—219°         |
| <br>(38) | 287—292° decomp. |
| <br>(39) | 201—203°         |
| <br>(40) | 145—146°         |
| <br>(41) | 112—114°         |
| <br>(42) | 145—146°         |

22



\* C L M S \*

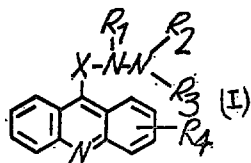
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14

WHAT WE CLAIM IS:—

1. A composition for the control of insects, mites, leporine animals and rodents containing as active ingredient an acridine derivative of the formula

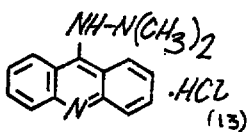


in which

- X stands for a direct bond or the grouping —NH—CS—,  
 10  $R_1$  stands for hydrogen, alkyl or substituted alkyl,  
 $R_2$  and  $R_3$  individually stand for hydrogen, alkyl, substituted alkyl or acyl, or  
 $R_2$  and  $R_3$  together stand for an alkylidene group, or, with the nitrogen atom, for a heterocyclic radical, and  
 15  $R_4$  stands for hydrogen, alkyl or halogen, as the free base or in the form of a salt, in admixture with a solid diluent or carrier or in admixture with a liquid diluent or carrier containing a surface-active agent.

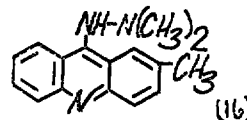
2. A composition for the control of insects, mites, leporine animals and rodents containing as active ingredient an acridine derivative of the formula in Claim 1, in which  
 25  $R_1$  stands for hydrogen or alkyl with 1 to 4 carbon atoms,  $R_2$  and  $R_3$  stand individually for hydrogen or alkyl with 1 to 4 carbon atoms, which may be substituted by chlorine, bromine, iodine or acyl derived from carboxylic acids with 2 to 18 carbon atoms, carbonic acid esters or sulphonic acids, or  $R_2$  and  $R_3$  together with the nitrogen atom stand for a saturated heterocyclic radical of 5 or 6 members, optionally containing a second hetero atom or  $R_1$  and  $R_2$  stand for an alkylidene radical with 2 to 8 carbon atoms, and  $R_4$   
 30 stands for hydrogen, alkyl with 1 to 4 carbon atoms, chlorine, bromine or fluorine, in admixture with a solid diluent or carrier or in admixture with a liquid diluent or carrier containing a surface-active agent.

3. A composition for the control of insects, mites leporine animals and rodents in which the active ingredient is an acridine derivative of the formula



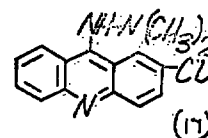
- in admixture with a solid diluent or carrier or in admixture with a liquid diluent or carrier containing a surface-active agent.

4. A composition for the control of insects, mites leporine animals and rodents in which the active ingredient is an acridine derivative of the formula



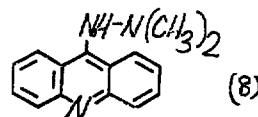
- in admixture with a solid diluent or carrier or in admixture with a liquid diluent or carrier containing a surface-active agent.

5. A composition for the control of insects, mites leporine animals and rodents in which the active ingredient is an acridine derivative of the formula



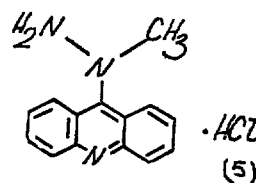
- in admixture with a solid diluent or carrier or in admixture with a liquid diluent or carrier containing a surface-active agent.

6. A composition for the control of insects, mites leporine animals and rodents in which the active ingredient is an acridine derivative of the formula



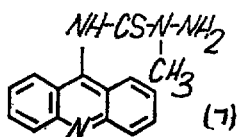
- in admixture with a solid diluent or carrier or in admixture with a liquid diluent or carrier containing a surface-active agent.

7. A composition for the control of insects, mites leporine animals and rodents in which the active ingredient is an acridine derivative of the formula



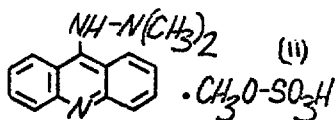
- in admixture with a solid diluent or carrier or in admixture with a liquid diluent or carrier containing a surface-active agent.

8. A composition for the control of insects, mites leporine animals and rodents in which the active ingredient is an acridine derivative of the formula



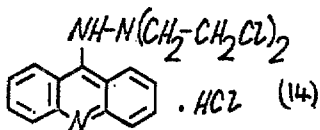
in admixture with a solid diluent or carrier or in admixture with a liquid diluent or carrier containing a surface-active agent.

- 5 9. A composition for the control of insects, mites leporine animals and rodents in which the active ingredient is an acridine derivative of the formula



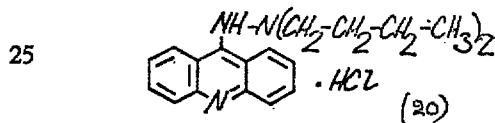
- 10 in admixture with a solid diluent or carrier or in admixture with a liquid diluent or carrier containing a surface-active agent.

- 15 10. A composition for the control of insects, mites leporine animals and rodents in which the active ingredient is an acridine derivative of the formula



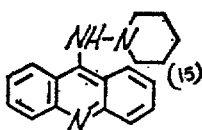
- 20 in admixture with a solid diluent or carrier or in admixture with a liquid diluent or carrier containing a surface-active agent.

11. A composition for the control of insects, mites leporine animals and rodents in which the active ingredient is an acridine derivative of the formula



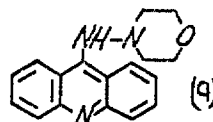
- 25 in admixture with a solid diluent or carrier or in admixture with a liquid diluent or carrier containing a surface-active agent.

- 30 12. A composition for the control of insects, mites leporine animals and rodents in which the active ingredient is an acridine derivative of the formula



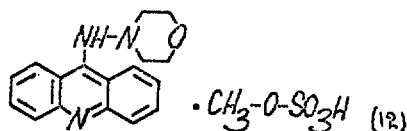
- in admixture with a solid diluent or carrier or in admixture with a liquid diluent or carrier containing a surface-active agent. 35

13. A composition for the control of insects, mites leporine animals and rodents in which the active ingredient is an acridine derivative of the formula 40



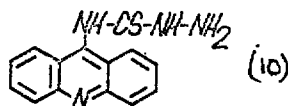
- in admixture with a solid diluent or carrier or in admixture with a liquid diluent or carrier containing a surface-active agent. 45

14. A composition for the control of insects, mites leporine animals and rodents in which the active ingredient is an acridine derivative of the formula



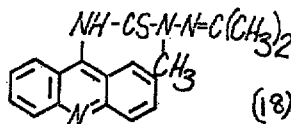
- in admixture with a solid diluent or carrier or in admixture with a liquid diluent or carrier containing a surface-active agent.

15. A composition for the control of insects, mites leporine animals and rodents in which the active ingredient is an acridine derivative of the formula 55



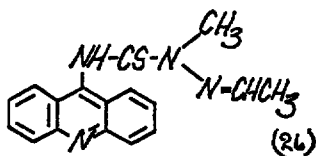
- in admixture with a solid diluent or carrier or in admixture with a liquid diluent or carrier containing a surface-active agent. 60

16. A composition for the control of insects, mites leporine animals and rodents in which the active ingredient is an acridine derivative of the formula 65



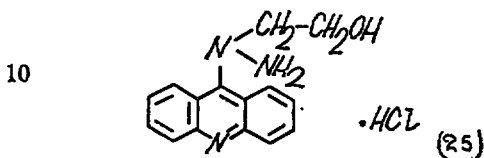
- in admixture with a solid diluent or carrier or in admixture with a liquid diluent or carrier containing a surface-active agent.

17. A composition for the control of insects, mites leporine animals and rodents in which the active ingredient is an acridine derivative of the formula 70



- 5 in admixture with a solid diluent or carrier or in admixture with a liquid diluent or carrier containing a surface-active agent.

18. A composition for the control of insects, mites leporine animals and rodents in which the active ingredient is an acridine derivative of the formula



10 in admixture with a solid diluent or carrier or in admixture with a liquid diluent or carrier containing a surface-active agent.

- 15 19. A composition for the control of insects, mites, leporine animals and rodents in which the active ingredient is any of the acridine derivatives specifically mentioned in Examples 1 to 3 and Table 1 in admixture with a solid diluent or carrier or in admixture with a liquid diluent or carrier containing a surface-active agent.

20 20. A composition according to any of claims 1 to 19 containing from 0.1 to 95% of the active compound, by weight.

- 25 21. A composition according to claim 20 containing from 0.5 to 90% of the active compound, by weight.

22. A method of combating insects, mites, leporine animals and rodents which comprises applying to the insects, mites, leporine animals or rodents or a habitat thereof an acridine derivative of the formula given in any of claims 1 to 18 alone or in the form of a composition containing as active ingredient an acridine derivative of the formula given in any of claims 1 to 18 in admixture with a solid or liquid diluent or carrier.

23. A method according to claim 22 in which a composition is used containing from 0.001 to 20% of the active compound, by weight.

24. A method according to claim 23 in which a composition is used containing from 0.005 to 5% of the active compound, by weight.

25. A method according to claim 22 in which a composition is used containing from 5 to 60% of the active compound, by weight.

26. A method according to any of claims 22 to 25 in which the acridine derivative is one of those hereinbefore mentioned in any of Examples A to C.

27. Crops protected from damage by insects, mites, leporine animals or rodents by being grown in areas in which immediately prior to and/or during the time of the growing an acridine derivative of the formula given in any of claims 1 to 18 was applied alone or in admixture with a solid or liquid diluent or carrier.

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