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(54) Title: METHOD OF DETERRING BIRDS FROM GRASSY TURF

(57) Abstract

The invention is directed to a method and compositions for deterring birds from feeding on areas of grassy turf comprising applying to the blades of grass a particulated coating of solid particles of specially defined polycyclic quinones.

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TITLE

METHOD OF DETERRING BIRDS FROM GRASSY TURF

CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of copending U.S. patent application S.N. 08/633,878, filed April 10, 1996.

FIELD OF THE INVENTION

The invention is directed to a method for deterring birds from feeding on areas of grassy turf and compositions therefor. In particular, the invention is directed to such deterrent method by which the birds are not harmed.

BACKGROUND OF THE INVENTION

The present invention relates to deterring birds from feeding on areas of grassy turf, such as golf courses, campuses, cemeteries and airports, and to reduce public nuisances and potential public health and safety problems associated with roosting birds.

Birds can frequently become a nuisance and cause substantial damage to pedestrian traveled areas such as golf courses, cemeteries and campuses. These areas, which require substantial upkeep, especially golf courses, suffer much due to birds feeding, nesting and gathering on them. For example, the birds eat seed which is spread for upkeep of the turf. They can also become a distraction because of the noise a flock can generate. Birds also become a nuisance because of the fecal deposits they leave. The fecal deposits are not only a nuisance due to the mess they cause, but also a public health concern due to the parasites and/or the disease that live in and spread from the droppings.

Another area of major concern is roosting birds near the end of runways at commercial and military airports. Roosting birds can cause "bird strikes" whereby many birds take flight near aircraft that are taking off or landing, which

results in birds colliding with the aircraft or being sucked into the engines. This causes damage to the aircraft by damaging the canopy or the wings and engines. In some instances, birds have caused aircraft engines to fail completely and crash, which results in complete loss of the aircraft and in some instances has resulted in loss of human life. The Federal Aviation Administration receives approximately 2000 reports of bird strikes each year. Major airlines report they sustain over $12 million of damage per year. Roosting birds like the open spaces around the runways. Due to this fact, approximately ninety percent of the bird strike damages occur around airports. Statistics show that bird strikes are worsening due to (1) the increase in the bird population, (2) more birds are nesting in urban areas, (3) birds have fewer natural predators, and (4) birds are only marginally affected by common harassment techniques. Bird strikes therefore remain a very dangerous and costly problem.

Current repellency and harassment techniques have included such techniques as noisemaking, firearms and chemical repellents. Noisemaking and firearms have had only limited success and are of concern to surrounding communities. Many of the chemical repellents are toxic to birds, and other animals, and have resulted in the repellents being withdrawn due to environmental concerns. In the case of bird strikes, the same techniques are similarly unsuccessful. Researchers are investigating ways to reduce the number of bird strikes by bombarding birds with sound waves to scare them away, modifying aircraft radar to monitor birds around runways, improving windshields and canopies to offer greater protection against birds and building engines that can survive the impact of larger birds. These methods will be very costly.

Therefore, the present invention is directed to a method for deterring birds from grassy areas in a manner that is not only effective, but also does not harm the birds or other animals that may come into contact with the treated areas.

SUMMARY OF THE INVENTION

In its broadest aspect, the invention is directed to a method for deterring birds from feeding on areas of grassy turf comprising applying to the blades of grass a particulated coating of solid particles of specially defined polycyclic quinones. More particularly, the invention is also directed to four methods by which the polycyclic quinones can be applied to grassy turf to bring about the deterrent effect, as follows:

(1) Finely divided solid particles of polycyclic quinone are applied to the grass in dry form;

(2) Finely divided solid particles of polycyclic quinone are applied to the grass as an aqueous suspension;

(3) A soluble precursor of solid polycyclic quinone is dissolved in an aqueous medium and applied to the grass surface. Upon drying, the polycyclic quinone is converted to the solid active form; and

(4) Solid, water-soluble particles of an agriculturally active coadjuvant are coated with a discontinuous particulated layer of particles of polycyclic quinone and applied to the grass.

BRIEF DESCRIPTION OF THE DRAWING

The Drawing consists of two sheets. The first sheet contains Figures 1(a) through 1(e), in which various particulated forms of polycyclic quinone are depicted schematically. The second sheet contains Figure 2, which is a graphical representation of the data obtained in Example 2.

DETAILED DESCRIPTION OF THE INVENTION

A. Polycyclic Quinones:

1. Composition: A wide variety of polycyclic quinones can be used in the invention. As used herein, the term "polycyclic quinone" refers to bicyclic, tricyclic and tetracyclic condensed ring quinones and hydroquinones, as well as precursors thereof. On the whole, the non-ionic polycyclic quinones and polycyclic hydroquinones (herein referred to collectively as PCQs) have very low solubility in water at ambient temperatures. For use in the invention, it is

preferred that such PCQs have a water solubility no higher than about 1,000 ppm, by weight.

However, as noted above, certain precursors of such PCQs can also be used in the invention either combined with the relatively insoluble PCQs or by themselves. Such precursors are anionic salts of PCQs which are water soluble under alkaline anaerobic conditions. However, these materials are not stable and are easily converted to the insoluble quinone form upon exposure to air. Thus, when anionic PCQs are applied to grass and exposed to air, they are quickly changed to the water soluble, more active quinone form.

Among the water-insoluble PCQs which can be used in the invention are anthraquinone, naphthoquinone, anthrone(9,10-dihydro-9-oxo-anthracene), 10-methylene-anthrone, phenanthrenequinone and the alkyl, alkoxy and amino derivatives of such quinones, 6,11-dioxo-1H-anthra[1,2-c]pyrazole, anthraquinone-1,2-naphthacridone, 7,12-dioxo-7,12-dihydroanthra[1,2-b]pyrazine, 1,2-benzanthraquinone, 2,7-dimethylanthraquinone, 2-methylanthraquinone, 3-methylanthraquinone, 2-aminoanthraquinone and 1-methoxyanthraquinone. Of the foregoing cyclic ketones, anthraquinone and methylanthraquinone are preferred because they appear to be more effective. Naturally occurring anthraquinones can be used as well as synthetic anthraquinones.

Other PCQs which can be used include insoluble anthraquinone compounds such as 1,8-dihydroxy-anthraquinone, 1-amino-anthraquinone, 1-chloro-anthraquinone, 2-chloro-anthraquinone, 2-chloro-3-carboxyl-anthraquinone, 1-hydroxy-anthraquinone and unsubstituted anthraquinone. Various ionic derivatives of these materials can be prepared by catalytic reduction in aqueous alkali.

In addition, a wide variety of anthrahydroquinone compounds can be used in the method of the invention. As used herein, the term "anthrahydroquinone compound" refers to compounds comprising the basic tricyclic structure such as tetrahydroanthrahydroquinone. Anthrahydroquinone itself is 9,10-dihydroxyanthracene.

More particularly, both water-insoluble and water-soluble forms of PCQs can be used. The non-ionic compounds are largely insoluble in aqueous systems, while ionic derivatives, such as di-alkali metal salts, are largely soluble in water. The water soluble forms are stable only in high pH anaerobic fluids. Low pH fluids (pH less than about 9-10) will result in the formation of the insoluble molecular anthrahydroquinone. Aerobic solutions will incur oxidation of the anthrahydroquinones to anthraquinone. Thus, anthrahydroquinones will not exist

for long periods of time in an aerated environment such as that which is experienced by spraying. For these reasons, anthrahydroquinone treatments are usually implemented with the soluble ionic form in a caustic solution. Sodium hydroxide solutions are preferred over the hydroxides of other alkali metals for economic reasons.

2. Configuration: It is known that the sensory organs of some birds are capable of more than one sensing function. For this reason, it is not known with certainty whether the PCQs used in the invention are detected by the bird through its sense of taste or sight or smell. In fact, two or more senses may be involved. Nevertheless because of the vary small size of the sensory organs of birds, it is preferred that the PCQ used be in physical form small enough to be touched by the sensory organs of the bird. That is, if the particles are too large, the taste sensors may pick up the taste poorly, if at all. Thus, for the PCQ to be more effective as a repellent, it is preferred to be of sufficiently small particle size that its taste can be sensed by birds. Thus, the more effective quantity of PCQ repellents in any application is that which is in a form accessible to the bird's tongue; that is, it should be of sufficiently small size that it can be tasted by the bird.

Generally, because of these criteria, particles larger than about 50 micrometers cannot be adequately sensed. Particles no larger than 30 micrometers are preferred. Similarly, smooth continuous surfaces of PCQ cannot be adequately sensed; and, of course, if the PCQ is coated with anything which is non-repellent to the bird or to which the bird is taste insensitive, the PCQ is ineffective. Though, strictly speaking, for the PCQ to be effective as a repellent, it does not have to be in the form of discrete particles, nevertheless, the particles must be of sufficient size or have a contour that contains areas that are taste-accessible. This criterion is illustrated in the Drawing.

The particle in Figure 1(a) would be accessible because it is sufficiently small. The particle in Figure 1(b) would be less effective because it is too large to be sensed effectively. The smooth continuous coating in Figure 1(c) would create little or no taste sensation because the large continuous surface would not have adequate access to the bird's taste sensors. On the other hand, the continuous coating shown in Figure 1(d) would create at least moderate taste sensation because the protrusions are sufficiently small to be tasted. In this situation, the PCQ in the protrusions would be effective, but the PCQ in the main body of the coating would be less so, if at all. When the particles are portrayed as stacks of

particles, as in Figure 1(e), it can be seen that some of the particles in the upper layers would be accessible and therefore would be effective; but those particles in the lower layer would be less accessible and therefore less effective. The foregoing analysis shows clearly that the efficacy of the repellent is a function of both its configuration and accessibility. In turn, it can be seen that these variables are in large part dependent on the method of application.

When the PCQ is applied directly in particulate form, the size of the particles can be readily controlled. When such particles are applied as a single layer of particles, substantially all of the PCQ would be effective. However, if the particles are applied as a multiple of particle layers, essentially only the top layer would be effective. An important aspect of this analysis is that it is not important that the PCQ be applied as continuous covering. To the contrary, it is better that the coating of PCQ particles be discontinuous, at least on a micro scale, to enable functional exposure of the stomata of the foliage. Thus, the particles to be effective must be "particulated" in the sense that they contain areas which are accessible to the bird's taste apparatus.

3. Physical Properties---Volatility, Water Solubility: It is important to the effectiveness of the invention that the PCQ, in whatever physical form it is applied, be persistent. That is, the applied active material must be able to resist erosion by wind and rain and other environmental forces to which the treated plant is exposed. For this reason, it is preferred (1) that the active form of the PCQ have a relatively low solubility in water so that it is not easily washed off the treated plant surfaces, and (2) that it have a relatively high melting temperature so that it does not undergo excessive evaporation from the treated plant surfaces during exposure to high ambient temperatures. For these reasons, it is preferred that the active PCQ material has a solubility in water under ambient temperature conditions of no more than about 1000 ppm and preferably in the range of 200-1000 ppm. The melting temperature of the active PCQ component should be at least about 150C and preferably at least 200C.

Even when the active PCQ material possesses the above-described preferred physical properties, the material may have poor persistence because it does not adhere well to the plant surface to which it is applied. This is a function of the different surface properties of the foliage and the PCQ material. When this problem occurs, it is further preferred that the formulation contain a "sticking agent," i.e., a material which itself has good adhesion to the substrate and when

mixed with the active material causes the PCQ to adhere to the substrate more firmly. Preferred sticking agents are aqueous polymer latices, which upon evaporation of the water therefrom, form a polymeric mass which is highly adhesive to the plant surface and holds particles of the active material firmly on the plant surface. Such latex sticking agents typically contain a small amount of surfactant dissolved in the aqueous phase.

A distinct advantage of the PCQ compounds which have been tested for use in the invention is that they are essentially non-toxic, i.e, they have an LD_{50} of at least 2,000 mg/kg in rats and preferably an LD_{50} in rats of 5,000 mg/kg or higher. (Acute oral toxicity, 5 male and 5 female Wistar rats, single dose, 50% solution in corn, 5,000 mg/kg body weight.) Because of this low toxicity of PCQs, they are not toxic to most insects or to birds, animals and humans. Moreover, the toxicity level is sufficiently low that any active material that becomes leached into the soil will not be detrimental to the normal constituents of fertile soil layers.

B. Methods of Application:

A clear advantage of the invention is that it can be applied to growing plants in a number of different forms and methods of application. For example, the PCQ active material can be formulated in the form of powdery solids which can be applied by conventional spreaders, e.g., trough spreaders, such as those used for planting grass seed, and by centrifugal (spinning disk) spreaders. Still in powder form, the PCQs can be sprayed as powders, either neat or in combination with solid powder extenders and/or various coadjuvants.

Likewise, when the PCQs are in powder form, they can be dispersed in a liquid media, especially water, and sprayed as a liquid suspension. On the other hand, when water-soluble precursors of the PCQs are used, they can be dissolved in water for dilution and then applied by spraying in the usual manner. The aeration, which occurs during spraying is sufficient to convert the soluble salt to the more active water-insoluble form. In both of these techniques either solid or liquid coadjuvants can be used. For example, water-soluble coadjuvants can be dissolved in the liquid medium or water-insoluble coadjuvant particles can be suspended in the liquid medium along with PCQ and/or PCQ precursor. Nevertheless, it will ordinarily be necessary to spray new plant growth to avoid reinfestation by whatever birds are being encountered.

It will be recognized by those skilled in the formulation of agricultural chemicals that dispersion media other than water can be used. For example, safe, degradable oils, such as vegetable oils, can be used. However, from the standpoint of safety and environmental health, it is much preferred to use water.

The method of the invention is suitable for application to all common forms of grass. In particular, the invention can be utilized to deter birds from feeding on all of the Species of the following listed Genus: Agropyron, Agrostis, Axonopus, Bouteloua, Buchloe, Cynodobn, Eremochloa, Festuca, Lolium, Paspalum, Poa, Stenotaphrum, and Zoysia.

EXAMPLE

Example 1:

A formulation containing 50% wt., basis total formulation, of 9,10-anthraquinone dispersed in water with a small amount of surfactant and thickener was prepared and sprayed onto untreated grassy turf in an area where geese normally feed. One-third acre of turf was treated with areas of untreated turf bordering on both sides of the treated area. The dispersed anthraquinone particles were applied at a rate of 1 pint/acre (approximately 50 mg/m^2) on the treated area. The test areas were observed for approximately four weeks to determine the effects of the treated versus the untreated areas. The differences in the effects of the treated area versus the untreated area were easily noted. Geese feeding in the untreated areas were unaffected and exhibited normal behavior as they fed and were not repelled. Geese that entered the treated area began to feed, but immediately ceased eating, exited the treated area, entered a nearby pond and began to wash or rinse themselves. After this exhibited behavior, none of the geese feeding on the untreated areas entered the treated areas. The geese were repelled from the treated area for approximately two weeks until the turf was cut. After cutting, another treatment was applied. The dispersed anthraquinone particles were applied at a rate of 1/2 pint/acre (approximately 25 mg/m^2) in the same manner of treating one strip of turf bordered by untreated turf. The same repellency was exhibited. The test was continued for approximately two weeks. The test was concluded due to snow.

Example 2:

A grassy test site having an area of 6.2 acres was selected within the grounds of a large campus style research complex having a substantial flock of geese in residence, which numbers 250-300 geese during the day and as many as 500 geese

in the evening hours. In order to determine when daily observations should be made, the site was observed beforehand to determine the times during which the maximum number of geese were on the test site. Observations were conducted at the same time(s) each day in such manner that the behavior of the geese could be observed without disturbance. In addition, the number of droppings in selected areas of the site were counted each day, recorded and then removed from the test area by raking.

Following 10 days observation of the untreated test site, the above-described goose repellent composition was sprayed on the test area using a calibrated spray tank and a fan-shaped head sprayer. The liquid spray contained one gallon of repellent per 140 gallons of water and the rate of application was 2.77 pounds per acre of the mixture. In the absence of rain, the applied composition fully dried on the blades of grass within 24 hours.

During the week before application of the repellent composition, the goose counts taken in the afternoon were from about 45 to 305 geese with an average of about 150 geese. Following application of the bird repellent composition, the goose count was about 110 the following day, but dropped to zero a day later. More complete test data are given in Figure 3 of the Drawing.

Turning now to Figure 3 of the Drawing, it can be seen that between days 1 and 3, the number of geese in the test area dropped substantially from over 200 to 48. This drop in the number of geese appears to have resulted from the departure of a migrant flock from the test area. However, the number of geese began to grow in day 5 and reached a maximum of over 300 by day 10 of the test. After making the count on day 10, the test area was treated with PCQ's in the manner described above.

By day 11, the number of geese dropped to 109 and on day 12 the number of geese was reduced to zero. During days 12-23, only a few geese were observed from time-to-time. On day 18, several geese (18) were observed in the test area;

but, as indicated by the very low quantity of droppings, it is apparent that the flock, which was probably migratory, was repelled from the test area before the next day. Following a heavy rain, on day 23, the goose count rose to 27 and the number of droppings rose to 13. This minor increase in the number of geese appeared to result from some of the treating material's being washed off the grass. After treatment of the test area, large numbers of birds were observed milling around, but not entering the treated area.

Since completion of the tests carried out in Example 2, it has been noted that the number of geese in the treated area, as compared to the number in the surrounding untreated areas, remained quite low for a period more than 3 months following the treatment. This phenomenon was quite unexpected in view of the fact that the treating material in the test area had been largely dissipated by heavy rains. Such prolonged deterrent effect is believed to be a result of memory by the geese who had initially been exposed to the polycyclic quinone treating material.

CLAIMS

What is claimed is:

1. A method for deterring birds from feeding on areas of grassy turf comprising applying to the blades of grass a particulated coating of solid particles of polycyclic quinones, the average size of which particles is less than 50 micrometers.

2. The method of Claim 1 in which the polycyclic quinones have a solubility of no more than 1000 ppm.

3. The method of Claim 1 in which the polycyclic quinones have a melting temperature of at least 150C.

4. The method of Claim 1 in which the polycyclic quinones have an LD_{50} of at least 2000 mg/kg in rats.

5. The method of Claim 1 in which the polycyclic quinones are particulate in form and the particles have an average size less than 50 micrometers.

6. The method of Claim 1 in which the polycyclic quinone is an anthraquinone.

7. The method of Claim 6 in which the polycyclic quinone is 9,10 anthraquinone.

8. The method of Claim 6 in which the polycyclic quinone is 2-methylanthraquinone.

9. The method of Claim 1 in which the average particle size is less than 30 micrometers with no more than 10% of the particles larger than 50 micrometers.

10. The method of Claim 1 in which the effective particles of polycyclic quinone are applied at a level of at least 25 mg/m^2.

11. The method of Claim 1 in which the polycyclic quinone particles are applied in dry form.

12. The method of Claim 11 in which the polycyclic quinone solid particles are admixed with inert solid extender particles.

13. The method of Claim 11 in which the polycyclic quinone solid particles are admixed with solid particles of at least one coadjuvant selected from the group consisting of fertilizers, growth regulators, pesticides, herbicides and mixtures thereof.

14. The method of Claim 1 in which the polycyclic quinone particles are applied in the form of an aqueous suspension of a polycyclic quinone precursor.

15. The method of Claim 14 in which the aqueous suspension is applied by spraying.

16. The method of Claim 14 in which the aqueous suspension contains a sticking agent.

17. The method of Claim 14 in which the aqueous suspension has dispersed therein at least one coadjuvant selected from the group consisting of fertilizers, growth regulators, pesticides, herbicides and mixtures thereof.

18. The method of Claim 14 in which the coadjuvants are dissolved in the aqueous medium.

19. The method of Claim 14 in which the coadjuvants are solids dispersed in the aqueous medium.

20. The method of Claim 14 in which the aqueous dispersion contains an odorant dissolved in the aqueous medium.

21. The method of Claim 1 in which the polycyclic quinone is a soluble liquid precursor.

22. The method of Claim 21 in which the polycyclic quinone is applied to the blades of grass in an organic solvent solution by spraying.

23. The method of Claim 21 in which the solution contains a dissolved sticking agent.

24. The method of Claim 21 in which the solution contains a defoaming agent.

25. The method of Claim 21 in which the solution contains a penetrant.

26. The method of Claim 21 in which the solution contains a surfactant.

27. The method of Claim 21 in which the polycyclic quinone is a dihydroxyanthraquinone.

28. The method of Claim 21 in which at least one coadjuvant selected from the group consisting of fertilizers, growth regulators, pesticides, herbicides and mixtures thereof is dissolved in the solvent.

29. The method of Claim 21 in which solid particles of at least one coadjuvant selected from the group consisting of fertilizers, growth regulators, pesticides, herbicides and mixtures thereof are suspended in the solvent.

30. The method of Claim 21 in which the solution contains a dissolved odorant.

31. An encapsulated agriculturally active composition comprising particles of solid, water-soluble, agriculturally active coadjuvant discontinuously coated with particles of water-insoluble polycyclic quinone having a particle size no greater than 50 micrometers.

32. An encapsulated agriculturally active composition comprising particles of solid adsorbent having adsorbed therein liquid agriculturally active material, the particles being discontinuously coated with particles of water-insoluble polycyclic quinone having a particle size no larger than 50 micrometers.

33. The composition of Claim 32 in which the adsorbed liquid material is water-soluble.

34. The composition of Claim 32 in which the adsorbed liquid material is water-insoluble.

35. The method of deterring birds from feeding on grassy turf areas comprising applying to the blades of grass the composition of Claim 33 or Claim 34.

36. A composition for deterring birds from feeding on areas of grassy turf comprising finely divided particles of polycyclic quinone having a solubility in water of no more than 1000 ppm, melting temperature of at least 150C, and an average particle size of no larger than 50 micrometers.

37. The composition of Claim 36 in which the particles of polycyclic quinone are suspended in an aqueous medium.

38. The composition of Claim 37 in which the aqueous medium also has suspended therein finely divided particles of at least one coadjuvant selected from the group consisting of fertilizers, fungicides, growth regulators, pesticides, herbicides and mixtures thereof.

39. The composition of Claim 38 which also contains an effective amount of a sticking agent.

40. The composition of Claim 37 in which at least one coadjuvant selected from the group consisting of fertilizers, fungicides, growth regulators, pesticides, herbicides and mixtures thereof dissolved in the aqueous medium.

41. A composition for deterring birds from feeding on areas of grassy turf comprising an aqueous solution of polycyclic quinone precursor which upon drying is converted to solid particles of polycyclic quinone.

42. The composition of Claim 41 in which the aqueous solution also contains dissolved therein at least one coadjuvant selected from the group consisting of fertilizers, fungicides, growth regulators, pesticides, herbicides and mixtures thereof.

43. The composition of Claim 41 in which the aqueous solution also contains suspended therein finely divided solid particles of at least one coadjuvant selected from the group consisting of fertilizers, fungicides, growth regulators, pesticides, herbicides and mixtures thereof.

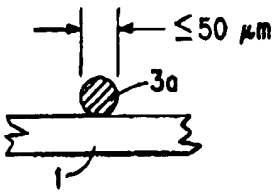


FIG.1a

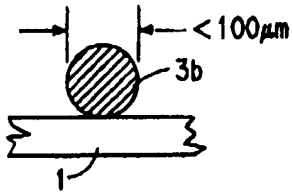


FIG.1b

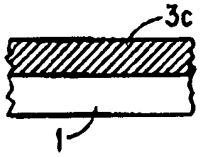


FIG.1c

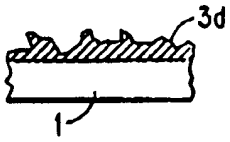


FIG.1d

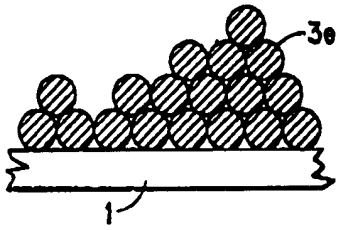
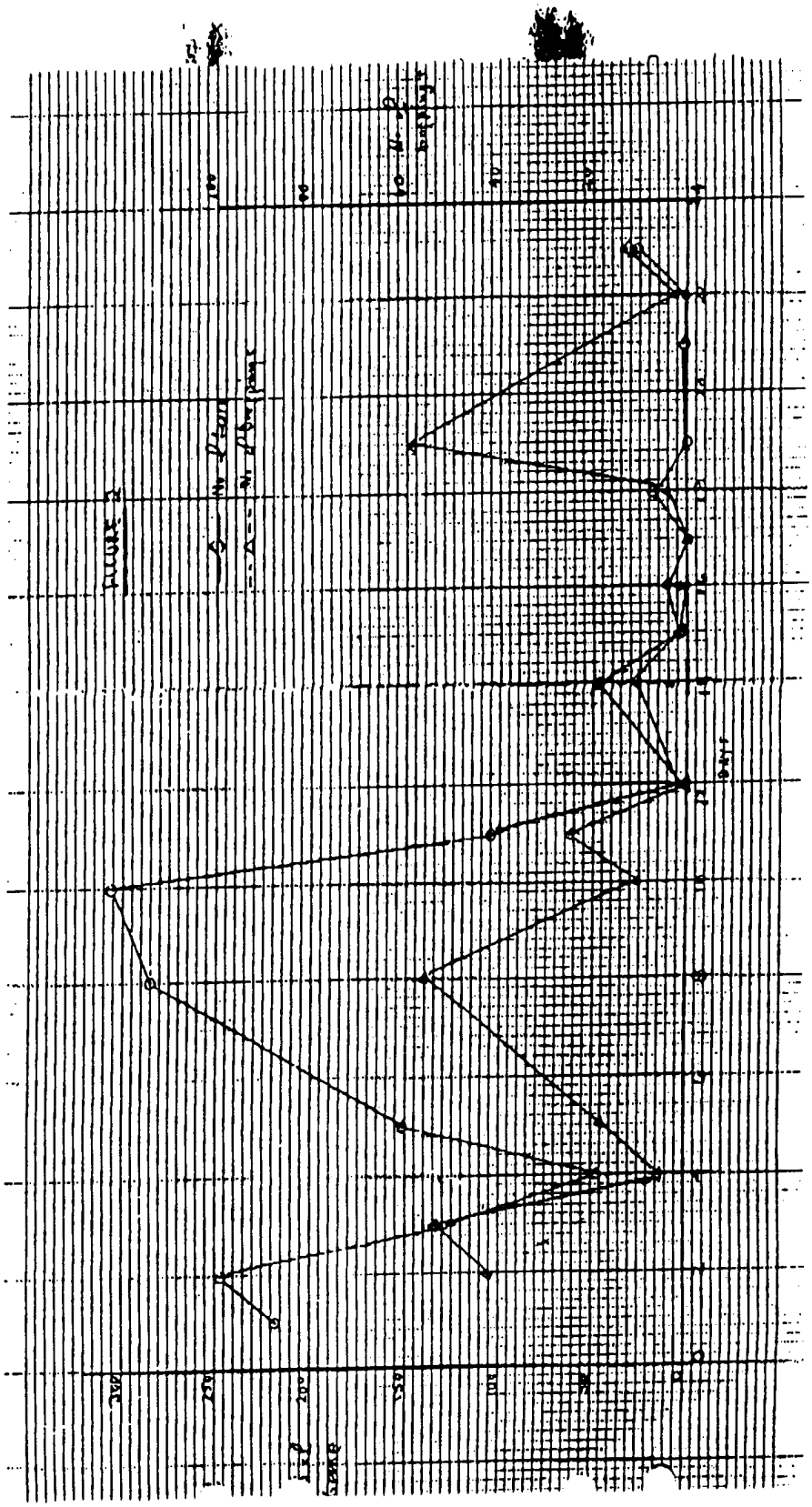


FIG.1e



INTERNATIONAL SEARCH REPORT

Int: :ional Application No
PCT/US 99/09449

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A01N35/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category ³	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 97 37540 A (BIO-TECHNICAL RESOURCES) 16 October 1997 (1997-10-16) * see the whole document* ---	1-43
X	TOMLIN C: "THE PESTICIDE MANUAL" , PESTICIDE MANUAL,GB,FARNHAM, BCPC, VOL. ED. 10, PAGE(S) 45-46-46 XP002035598ISBN: 0-948404-79-5 the whole document ---	1-43
X	WEGLER R: "CHEMIE DER PFLANZENSCHUTZ- UND SCHAEDLINGSBEKAEMPFUNGSMITTEL, PASSAGE" , CHEMIE DER PFLANZENSCHUTZ- UND SCHADLINGS-BEKAMPFUNGSMITTEL,DE,BERL IN, SPRINGER, VOL. BAND 1, PAGE(S) 587-588,593-597 XP002035599 page 587 -page 588 --- -/--	1-43

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 December 1999	22/12/1999

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

Inte ional Application No
PCT/US 99/09449

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
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X	DE 28 04 563 A (KOENIG GUENTER DIPL CHEM DR) 9 August 1979 (1979-08-09) page 4, paragraph 3 examples ---	1-43
X	DE 743 517 C (I.G. FARBENINDUSTRIE A.G.) page 1, line 33 -page 2, line 2 ---	1-43
X	GB 1 601 226 A (FISONS LTD) 28 October 1981 (1981-10-28) claims 1,3 page 2, line 61 - line 85 -----	1-43

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Int tional Application No
PCT/US 99/09449

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