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INSECTICIDES

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This application is made under the act of March 3, 1883, as amended by the act of April 30, 1928, and the invention herein described, if patented, may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment to us of any royalty thereon.

This invention relates to insecticides and has among its objects the provision of improved insecticidal compositions.

It is known that relatively non-insecticidal materials may enhance the toxicity of an insecticide when applied in admixture with the toxicant. For example, pyrethrins are activated by sesame oil, a natural product having little or no toxicity to insects. Combinations of sesame oil and pyrethrins are far more toxic to flies than the same concentrations of pyrethrins used without sesame oil. Hence, sesame oil is referred to as a "synergistic oil." The term "synergism" has been defined as "a state of action of two materials in which the effect of the combination is greater than the arithmetic sum of the effects of each of the materials used separately and alone."

While it is known also that nicotine compounds when used alone have been successfully employed in the control of economic pests and that 2,2-bis (p-chlorophenyl) 1,1,1-trichloroethane also is a highly effective insecticide when used alone, we have found that combinations of nicotine compounds, such as nicotine alkaloid, nicotine sulfate, nicotine bentonite, cuprous nicotine cyanide, and cupric nicotinammino laurate and 2,2-bis (p-chlorophenyl) 1,1,1-trichloroethane, when incorporated in an inert carrier, such as a dust, etc., are highly effective insecticides because of the synergistic insecticidal action which they exhibit. This synergism is established by the fact that the combination of nicotine compounds with 2,2-bis (p-chlorophenyl) 1,1,1-trichloroethane produce an appreciably higher percentage kill than the arithmetic sum of these individual insecticides would warrant.

The data establishing the synergistic insecticidal action of mixtures comprising nicotine compounds and 2,2-bis (p-chlorophenyl) 1,1,1-trichloroethane are summarized in the following table. The insecticidal evaluations were made against the first instar of the southern armyworm and the fourth instar of the melonworm. Dusted collard leaves were used in the armyworm tests, while the melonworm tests were conducted with dusted pumpkin leaves. A highly absorbent fuller's earth was used as the dust carrier in all dust mixtures shown in the table.

Each mixture of the two insecticides comprised 0.1% of 2,2-bis (p-chlorophenyl) 1,1,1-trichloroethane and 1% of nicotine alkaloid. Whenever a nicotine compound, other than the alkaloid, was employed, it was used in a quantity equivalent to 1% of the free alkaloid.

Two control dusts were employed along with each synergised mixture. One control dust comprised 0.1% of 2,2-bis (p-chlorophenyl) 1,1,1-trichloroethane as its essential active ingredient, and the percent mortalities obtained with this standard are listed in column A of the table. The other control dust comprised 1% nicotine alkaloid, or the appropriate quantity of nicotine compound equivalent to 1% nicotine on a free alkaloid basis, as its essential active ingredient. The percent mortalities observed with these standards are recorded in column B of the table. The column *A+B*, therefore, records the sum of the percent mortalities obtained with A and B individually. The last column of the table records the percent mortality obtained with mixtures of 2,2-bis (p-chlorophenyl) 1,1,1-trichloroethane and various nicotine compounds, including the alkaloid. It will be readily seen that the percent mortality obtained with the mixtures of the two insecticides is greater than the sum of the mortalities obtained with the control dusts in which the toxicants were tested separately.

Synergism between nicotine compounds and 2,2-bis (p-chlorophenyl) 1,1,1-trichloroethane

Example No.	Nicotine compound	Insect	Time, days	Deposit, mg./cm.[3]	Mortalities in per cent			
					A [1]	B [2]	A+B	Mixture of nicotine compound and X [3]
1	Nicotine alkaloid	Melonworm	2	200	88	4	92	100
2	do	do	1	100	5	8	13	25
3	do	do	2	100	36	19	55	88
4	Nicotine sulfate	do	2	100	5	4	9	25
5	do	do	3	100	36	9	45	88
6	do	S. armyworm	3	100	35	26	61	93
7	Cupric, nicotinamino laurate	Melonworm	3	100	36	0	36	96
8	do	S. armyworm	2	100	29	20	49	60
9	Cuprous nicotine cyanide	Melonworm	3	100	36	4	40	100
10	Nicotine bentonite	do	3	100	36	4	40	91
11	do	S. armyworm	2	100	29	10	39	56
12	do	do	3	100	35	13	48	72

[1] Percent mortality using a dust comprising 1% of 2,2-bis (p-chlorophenyl) 1,1,1-trichloroethane as the only active insecticidal ingredient.

[2] Per cent mortality using a dust comprising 1% of nicotine alkaloid or using a dust comprising a nicotine compound in a quantity equivalent to 1% of the free alkaloid as the only active insecticidal ingredient.

[3] 2,2-bis (p-chlorophenyl) 1,1,1-trichloroethane.

In view of the fact that since the concentration of toxicant necessary to kill 95% of a given insect infestation is disproportionately greater than that required to kill 50% of a comparable infestation, it appears that the magnitude of synergistic action may be even greater than herein indicated. In fact, the mixtures are in general several times as effective as would be expected from the insecticides when used alone.

The ratios of nicotine to 2,2-bis (p-chlorophenyl) 1,1,1-trichloroethane shown herein are illustrative only. The invention is not limited to any particular ratio of the two toxicants, since the synergistic effect may be retained in mixtures having widely varying ratios. The most desirable ratio will be dependent upon the particular application. The species of insects, climatic conditions, habitat of pest, nature of carrier, use of adjuncts, such as spreaders and stickers, and other factors will influence the ratio and concentration of toxicants to be employed.

Having thus described our invention, what is claimed is:

1. An insecticidal composition comprising 2,2-bis (p-chlorophenyl) 1,1,1-trichloroethane and a nicotine compound as its essential active ingredients.

2. An insecticidal composition comprising 2,2-bis (p-chlorophenyl) 1,1,1-trichloroethane and a nicotine compound incorporated in an inert carrier.

3. An insecticidal composition comprising 2,2-bis (p-chlorophenyl) 1,1,1-trichloroethane and a nicotine compound incorporated in a dust.

4. An insecticidal composition comprising 2,2-bis (p-chlorophenyl) 1,1,1-trichloroethane and nicotine alkaloid as its essential active ingredients.

5. An insecticidal composition comprising 2,2-bis (p-chlorophenyl) 1,1,1-trichloroethane and nicotine sulfate as its essential active ingredients.

6. An insecticidal composition comprising 2,2-bis (p-chlorophenyl) 1,1,1-trichloroethane and nicotine bentonite as its essential active ingredients.

7. An insecticidal composition comprising 2,2-bis (p-chlorophenyl) 1,1,1-trichloroethane and cuprous nicotine cyanide as its essential active ingredients.

8. An insecticidal composition comprising 2,2-bis (p-chlorophenyl) 1,1,1-trichloroethane and cupric nicotinammino laurate as its essential active ingredients.

9. The process of killing insects comprising applying to the habitat of the insects an insecticidal composition containing 2,2-bis (p-chlorophenyl) 1,1,1-trichloroethane and a nicotine compound as its essential active ingredients.

10. The process of killing insects comprising applying to the habitat of the insects an insecticidal composition containing 2,2-bis (p-chlorophenyl) 1,1,1-trichloroethane and nicotine alkaloid as its essential active ingredients.

11. The process of killing insects comprising applying to the habitat of the insects an insecticidal composition containing 2,2-bis (p-chlorophenyl) 1,1,1-trichloroethane and nicotine sulfate as its essential active ingredients.

12. The process of killing insects comprising applying to the habitat of the insects an insecticidal composition containing 2,2-bis (p-chlorophenyl) 1,1,1-trichloroethane and nicotine bentonite as its essential active ingredients.

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