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PARASITE CONTROL

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The present invention relates to parasite control.

An object of the invention is to provide a parasiticide containing as an active ingredient a toxic partial lauric acid ester of one of a class of polyhydroxylic compounds.

Another object is to control infestation of insects, by applying to the infested plants an aqueous spray containing such a partial ester as a toxic ingredient.

The above and other objects will become apparent from the following specification and claims.

This application is a continuation-in-part of my pending application Serial Number 374,474, filed January 15, 1941, which claims a synergistic combination of various known parasiticidal agents with a series of esters some of which belong to the class herein defined.

In my application Serial Number 310,351, filed December 21, 1939, I have described and claimed a series of hexitan and hexide partial laurate esters as parasiticidal agents. In another application Serial Number 375,930, filed January 25, 1941, I have described and claimed synergistic combinations of said esters and various known parasiticidal agents.

The present invention relates to parasiticides containing as an active ingredient a water-dispersible composition of a partial lauric acid ester of a low molecular weight aliphatic polyhydroxylic compound of the type of polyhydric alcohols, for example, ethylene glycol, glycerol, erythritol, pentaerythritol, hexitols, inositol; di- and poly-condensation products of polyhydric alcohols, for example, diethylene glycol, diglycerol and polyglycerols; and carbohydrates, for example, mono- and oligo-saccharides. By "low molecular weight" as used to define the polyhydroxylic compounds described herein, I intend to exclude polyhydroxylic materials of molecular weights higher than those of the oligosaccharides.

By di- and poly-condensation products I mean not only the straight external ethers, such as diglycerol, but also mixed external ethers, such as mannitol glycerol ethylene glycol ether, obtainable for example by successive condensation of mannitol with 1 mol of glycidol and 1 mol of ethylene oxide.

The preferred compounds in the group described above are those in which the polyhydric residue is derived from a polyhydroxylic compound with not more than 3 carbon atoms for each hydroxyl group, and in which the compounds (esters) have at east 1 hydroxyl group for each fatty acid radical. These characteristics may be stated as:

$$\frac{\text{carbon atom}}{\text{hydroxyl}}$$

of the polyhydroxylic compound not over 3, and

$$\frac{\text{fatty acid}}{\text{hydroxyl}}$$

of the ester not over 1. The compounds which meet these requirements are, in general, readily dispersible in their technical state of purity, and have high insecticidal value coupled with minimum plant injury. In the preferred class the monoesters have been found most efficient. Examples of compounds meeting these requirements are:

Compound	$\frac{\text{Carbon atoms}}{\text{Hydroxyl}}$ of polyhydroxylic compound	$\frac{\text{Fatty acid}}{\text{Hydroxyl}}$ of ester
Ethylene glycol monolaurate	$\frac{2}{2}=1$	$\frac{1}{1}=1$
Glycerol monolaurate	$\frac{3}{3}=1$	$\frac{1}{2}=0.5$
Polyglycerol (containing largely tri- and tetra-glycerol) monolaurate	$\frac{9}{5}=1.8$ and $\frac{12}{6}=2$	$\frac{1}{4}=0.25$ and $\frac{1}{5}=0.2$
Diethylene glycol monolaurate	$\frac{4}{2}=2$	$\frac{1}{1}=1$
Pentaerythritol monolaurate	$\frac{5}{4}=1.25$	$\frac{1}{3}=0.33$
Mannitol dilaurate	$\frac{6}{6}=1$	$\frac{2}{4}=0.5$

The pure esters are generally difficult to disperse in water, and, probably for this reason, have inferior parasiticidal properties by comparison with mixed compositions. The mixtures may consist of different lauric acid esters such as the technical reaction products resulting from a direct esterification of the polyhydroxylic compound and lauric acid. Very desirable complexity of product can be obtained by employing in the esterification reaction a fatty acid mixture which has a major proportion of lauric acid and in addition substantial proportions of other fatty acids. A useful commercial source of such mixed acids is to be found in the mixed fatty acids derivable by hydrolysis of coconut oil. The preferred product for my purpose is, however, obtained by employing an alcoholysis reaction of the polyhydroxylic compound and a natural fat or oil, with a high content of combined lauric acid, to produce the partial lauric esters. Compositions prepared by alcoholysis of coconut oil are the best from the

standpoints of ease of dispersion in water and toxicity.

Specific examples of partial esters and compositions useful in practising my invention are ethylene glycol monolaurate, alcoholysis product of coconut oil and ethylene glycol, glycerol monolaurate, polyglycerol-coconut oil alcoholysis product, diethylene glycol monolaurate, diethylene glycol-coconut oil alcoholysis product, pentaerythritol monolaurate, pentaerythritol-coconut oil alcoholysis product, and ester compositions prepared from the mixed fatty acids derivable from coconut oil and the polyhydroxylic compounds listed.

Of the specific partial lauric esters described the preferred ones are the pentaerythritol monoesters especially the ones produced by direct esterification of pentaerythritol with mixed coconut oil fatty acids, and those made by alcoholysis of coconut oil with pentaerythritol.

These products can be prepared by procedures which are well known or obvious to the art. Alcoholysis reactions can be performed with heat stable polyhydroxylic compounds at elevated temperatures using a catalyst such as sodium hydroxide. The degree of esterification of the product is controllable by the ratio of fat or oil to polyhydroxylic compound. Monoesters are preferable for my purpose, hence a ratio of about 1 mol fat or oil to 2 mols polyhydroxylic material is recommended. Direct esterifications can be performed at high temperature if the reactants are heat stable. Cold reactions such as those involving acid chlorides and the polyhydroxylic compound can be used where necessary or desirable.

Whenever I refer to a "water-dispersible composition" throughout this specification and claims it is intended that the partial lauric esters are water-dispersible either as such or by virtue of admixture with other esters, and/or unreacted materials, produced in the course of making the product or added at a later time for the purpose of imparting water-dispersibility.

The invention is to be distinguished from the use of small quantities of partial esters as spreading and wetting agents for other toxic materials. I have discovered that these partial lauric esters are themselves toxic to parasites, particularly as contact poisons to soft-bodied insects, when used in the form of aqueous dispersions. Dilutions of the ester materials for use as the toxic agents in sprays will rarely run over 1 part ester to 1000 or 1200 parts water and more usual dilutions will be 1:400 or less. The dilution that can be used in a particular case depends on the ester used, the parasite to be controlled, manner of spraying, etc., as will be understood by the art.

Many parasites are killed by the lauric esters of the invention. Among the parasites controlled by the invention are soft-bodied sucking insects such as aphids, mites, cabbage loopers, the young and larvae of many hard-bodied insects, mosquito larvae, and many other parasites. Being contact poisons, the partial lauric esters of the invention must be applied to the insects themselves. Control is achieved by spraying an aqueous dispersion of the esters on the plants infested with the insects using care to wet the insects as thoroughly as possible. The lauric esters can be applied to most plants without injury at the dilution used. They are innocuous to warm blooded animals.

One highly practical use of the lauric esters of the invention is in the control of the red spider mite (*Tetranychus telarius*) on greenhouse plants.

The following examples give data on the behavior of some of the esters of the invention in controlling the red spider mite.

Example 1

Comparative tests were run on active stages of red spider mite (*Tetranychus telarius*) on bean leaves by precision spraying with the following compositions, the results being as indicated:

Ester	Dilution in water	Percent mortality
Ethylene glycol monolaurate [1]	1:200	49.6
Glycerol monolaurate [1]	1:400	70.8
Do	1:200	90.2
Polyglycerol monolaurate	1:400	62.2
Do	1:200	72.0
Do [1]	1:400	65.4
Do [1]	1:200	89.3
Diethylene glycol monolaurate	1:400	66.4
Do	1:200	83.7
Do [1]	1:400	71.1
Do [1]	1:200	92.0
Pentaerythritol monolaurate	1:400	86.7
Do	1:200	98.3
Do [1]	1:400	88.8
Do [1]	1:200	98.4
Water		0.0

[1] Alcoholysis product of coconut oil.

Example 2

In addition to killing the active stages of red spider mite these compounds prevent the eggs from hatching. Eggs deposited by red spider mite on bean leaves were sprayed with the following compositions, hatchings were observed and the results were as set out:

Ester	Dilution in water	Percent not hatching
Polyglycerol monolaurate	1:400	47.5
Do [1]	1:400	41.4
Pentaerythritol monolaurate	1:400	67.2
Do [1]	1:400	67.3

[1] Alcoholysis product of coconut oil.

The usual spraying equipment and methods can be used for greenhouse and agricultural practice of the invention. The sprays can be made up as needed by dispersing the ester in water in accordance with usual practice.

The invention is not to be taken as limited to the details and examples set out above except as defined in the following claims. Many examples of insecticidal efficiency could be presented but it is believed that the foregoing specification will be sufficient to indicate to those skilled in this art the type of uses that can be made of my invention, bearing in mind that many other types of insects can be controlled through the use of my parasiticides.

I claim:

1. A process for controlling insects which comprises applying to the insects an insecticide containing as an active ingredient a water-dispersible composition comprising a partial lauric acid ester of a low molecular weight aliphatic polyhydroxylic compound selected from the class consisting of polyhydric alcohols, di- and poly-condensation products of polyhydric alcohols, and carbohydrates.

2. A process for controlling insects as in claim 1 wherein the said polyhydroxylic compound has a ratio of carbon atoms to hydroxyl groups not greater than 3 and wherein the said ester has a ratio of fatty acid residue to hydroxyl groups not greater than 1.

3. A process for controlling insects as in claim

1 wherein the said partial lauric acid ester is a monoester and wherein the said polyhydroxylic compound has a ratio of carbon atoms to hydroxyl groups not greater than 3.

4. A process for controlling insects which comprises applying to the insects an aqueous insecticidal dispersion containing as an active ingredient a water dispersible composition comprising a partial lauric acid ester of a low molecular weight aliphatic polyhydroxylic compound selected from the class consisting of polyhydric alcohols and di- and poly-condensation products of polyhydric alcohols, and the other products produced in the reaction of the mixed fatty acids derivable by hydrolysis of coconut oil and said polyhydroxylic compound.

5. A process for controlling insects which comprises applying to the insects an insecticide comprising the monolaurate of a low molecular weight aliphatic polyhydroxylic compound selected from the class consisting of polyhydric alcohols and di- and poly-condensation products of polyhydric alcohols, and the other products of the reaction of about 1 mol of the mixed fatty acids derivable by hydrolysis of coconut oil and 1 mol of the said polyhydroxylic compound.

6. A process for controlling insects which comprises applying to the insects an insecticide containing as an active ingredient a water-dispersible composition comprising a partial lauric acid ester of a low molecular weight aliphatic polyhydroxylic compound selected from the class consisting of polyhydric alcohols and di- and poly-condensation products of polyhydric alcohols and the other products of the alcoholysis reaction of coconut oil with the said polyhydroxylic compound.

7. A process for controlling insects which comprises applying to the insects an aqueous insecticidal dispersion containing as an active ingredient a water-dispersible composition comprising the monolaurate of a low molecular weight aliphatic polyhydroxylic compound selected from the class consisting of polyhydric alcohols and di- and poly-condensation products of polyhydric alcohols, and the other products of the alcoholysis reaction of about 1 mol of coconut oil and 2 mols of the said polyhydroxylic compound.

8. A process for controlling insects comprising applying to the insects an insecticide containing as an active ingredient a water-dispersible composition comprising a partial lauric acid ester of pentaerythritol.

9. A process for controlling insects comprising applying to the insects an insecticide containing as an active ingredient a water-dispersible composition comprising pentaerythritol monolaurate.

10. A process for controlling insects comprising applying to the insects an aqueous insecticidal dispersion containing as an active ingredient a water-dispersible composition comprising pentaerythritol monolaurate and the other products of the reaction of the mixed fatty acids derivable by hydrolysis of coconut oil and pentaerythritol in mol-for-mol proportions.

11. A process for controlling insects comprising applying to the insects an aqueous insecticidal dispersion containing as an active ingredient a water-dispersible composition comprising pentaerythritol monolaurate and the other products of the alcoholysis reaction of about 1 mol of coconut oil with 2 mols of pentaerythritol.

12. A process for controlling insect infestations on plants which comprises applying to the infested plants an aqueous insecticidal spray containing as an active ingredient a water-dispersible composition comprising a partial lauric acid ester of a low molecular weight aliphatic polyhydroxylic compound selected from the class consisting of polyhydric alcohols, and di- and poly-condensation products of polyhydric alcohols, together with the other products of the reaction of the mixed fatty acids obtainable by hydrolysis of coconut oil and the said polyhydroxylic compound.

13. A process for controlling insect infestations on plants which comprises applying to the infested plants an aqueous insecticidal spray containing as an active ingredient a water-dispersible composition comprising a partial lauric acid ester of a low molecular weight aliphatic polyhydroxylic compound selected from the class consisting of polyhydric alcohols, and di- and poly-condensation products of polyhydric alcohols, and the other products of the alcoholysis reaction of coconut oil with the said polyhydroxylic compound.

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