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INSECTICIDAL COMPOSITION

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This invention relates to a new insecticidal oil composition and more particularly to a new form in which it has been found highly advantageous to apply the known insecticidal mineral oils to parasite infested vegetation.

The insecticidal value of various distillates from petroleum and coal tar oils has long been recognized and many methods have hitherto been proposed for utilizing this inherent value. Oils generally have been applied in one or other of two forms, either as such and substantially undiluted or as dilute emulsions of oil-in-water.

The surfaces of both the insects and the plant tissues which they infest are usually more readily wet by oil than by water so that the obvious method of securing a complete coverage of the host surfaces and effective contact with the insect was to apply the oil as such. This is however usually undesirable in at least two major respects.

The amount of oil theoretically necessary to produce an adequate coverage is very small and, so far as I am aware, but a single entirely practical means, copending application Serial No. 635,861, of distributing such a small bulk of material uniformly over a large area extended in three dimensions has yet been devised. When a bulk of oil which could be uniformly distributed by ordinary spray methods over such an area has been employed it has been both uneconomical and in most cases decidedly detrimental to the vegetation treated.

In order to escape these difficulties recourse was had to the use of dilute emulsions of oil-in-water in which the oil constituted from about 1 to 5 percent of the total volume. Thus a bulk of material sufficient to permit of uniform distribution was provided but by a means which was completely illogical in at least one other essential respect. Apparently the only reason that it has endured as long as it has and has received the wide adoption that it has is because there appeared no other possible way of economically realizing even a part of the insecticidal value of mineral oils.

The shortcomings of an oil-in-water emulsion insecticide are now so well known as to need scarcely more than mention. Such emulsions having an aqueous continuous phase are of necessity "water wetting" and thus instead of contributing to the insecticidal power of the oil actually protect the insects from the oil by first drenching them with a layer of water so that the dispersed oil droplets easily run off and are either lost in the drip from the leaves or when retained at all do not give a complete, insect impervious,

covering. While a slight increase in economy and utility has been realized through decreasing the stability of the emulsions until they approach the point of being no longer applicable due to breaking and stratification during the process of application the undesirable features inherent in an aqueous continuous phase have not been eliminated or even substantially mitigated.

It is the main object of this invention to provide a form in which mineral oils may be applied as insecticides with the substantial elimination of the foregoing disadvantages which attend the application of oil in either of the two previously used forms.

It is a further object of my invention to provide means whereby oil may be rendered in a form which is economical and practical as an insecticide and easily possible of application by known methods.

Broadly I have discovered that oil in a third, and, so far as I am aware, new form, as far as insecticidal work is concerned, is realized in a water-in-oil emulsion. Such an emulsion, in which the continuous phase is oil, is of necessity "oil wetting" and is thus the complete equal in this desirable characteristic of undiluted oil. The extent to which water may be dispersed in oil and hence the extent to which oil may thereby be increased in bulk for ease of uniform distribution is limited only by the efficiency of the water-in-oil producing emulsifiers which are available.

Water-in-oil emulsions have not heretofore received considerable application in any branch of industry and consequently but little is known concerning their preparation and properties and that little is of a purely theoretical or academic nature. I have found, however, that even with the limited knowledge and range of materials available perfectly uniform and stable dispersions of water in oil may be prepared containing 75% or more water. The increase in bulk thus effected is entirely adequate to make even the minimum theoretically necessary quantities of oil applicable without difficulty and without resort to the doubly objectionable increase in oil formerly required.

I have found that the polyvalent metal soaps of the ordinary fatty acids such as oleic, stearic, palmitic, etc., are effective in producing stable water-in-oil emulsions when water is introduced into an oil solution of about 1 to 5% of the emulsifier just as oil is introduced into the aqueous phase in the preparation of conventional oil-in-water emulsions.

As disclosed in my copending application Serial No. 741,722, certain of these same soaps dissolved

in oil are highly effective in preventing the oil from being absorbed by growing vegetation and thus make possible the remarkably complete elimination of the customary oil damage to foliage and fruit. When these same jell-forming soaps are employed as water-in-oil emulsifiers in the present invention they may thus serve the double purpose of also rendering the oil relatively non-absorbable by living plant tissues.

It has been found that in general the amount of such a soap which is necessary to render a given oil incipiently jell-forming will be more than enough to give any desired amount of water dispersion in the same oil. It may however sometimes be necessary to use slightly more soap to effect both results in the same composition.

The physical form which is taken by a water dispersion in such a jell-forming oil composition when atomized and applied by the process of my copending application Serial No. 635,861 or an equivalent method is so far as both the host plant and the insects are concerned, identical with that which is formed by the jell-forming oil alone. That is, a uniform coating of fine, discrete, more or less spherical oil "jelly-balls" so close together as to constitute complete coverage from insects but so far apart as to permit of free respiration by the plant tissue is deposited. The only difference is that the center one-half to four-fifths of each jelly ball is water and not oil. Assuming the same size and number of particles per unit of surface an identical coverage can thus be effected with an expenditure of but one-half to one-fifth the amount of oil.

Experiments conducted on a full commercial scale have demonstrated the entire practicability and desirability of this new type insecticide. It possesses a combination of safety to plants, efficiency in oil utilization, low overall cost, ease of preparation and efficacy in high percentage insect kill not approached by any other sort of mineral oil insecticide preparation of which I am aware.

The large number of possible variations and extensions of the basic principle of this invention will be readily apparent to one skilled in the art. Oil soluble toxic materials such as rotenone and pyrethrum may be added to the oil phase, water soluble toxic materials such as nicotine and other alkaloid salts, lime sulfur, etc., may be included in the water, water insoluble but suspendable materials such as lead arsenate, Bordeaux mixture or the newer copper silicate gel fungicides may be suspended in either the aqueous or oil phase, or soaps of the fungicidally active metals such as copper, lead, mercury or zinc may be incorporated in the oil. In general it will be found possible to construct combination parasitocides with my water-in-oil emulsions just as has in the past been possible with the oil-in-water type of emulsions, regard being had of course to the inherently different properties of the reverse type emulsions.

The range of insecticidal oils which may be employed in my water-in-jell-forming oil emulsions is the same as in the jell-forming oils alone and includes not only the usually accepted oils but also more volatile oils due to the reduction in vapor pressure occasioned by the jell and also less highly refined oils due to the substantial elimination of oil absorption by the vegetation likewise brought about by the jelling action.

One improvement on the simple water-in-oil emulsions as such has been found to consist in the addition of thickening or bodying agents to

the aqueous phase. This permits the aqueous core of the oil droplets deposited to help in supporting and maintaining the droplets as such and when an insoluble agent is suspended in the aqueous phase the bodying agent will prevent its being prematurely squeezed out with consequent disruption of a considerable part of the emulsion. Such highly hydrophyllic colloids as starch, glue, gelatine, waste sulfite liquor residues, etc. have been found suitable for this use.

Having now disclosed my invention to be an insecticidal mineral oil having an aqueous phase dispersed therein, preferably through the use of an oil soluble polyvalent metal soap emulsifier which tends to render the continuous oil phase jell-forming, and having taught how it may be used and the advantages to be gained thereby, what I claim is:

1. An insecticide comprising a mineral oil continuous phase having an aqueous phase dispersed therein.

2. An insecticidal composition comprising a mineral oil continuous phase, an emulsifier adapted to the formation of a water-in-oil type of emulsion and an aqueous phase dispersed in said oil.

3. An insecticidal composition comprising a mineral oil continuous phase, a polyvalent metal soap and a dispersed aqueous phase.

4. An insecticidal composition as in claim 3 wherein the polyvalent metal soap is incorporated in the continuous oil phase and is of the type which tends to render said oil phase jell-forming.

5. An insecticidal composition as in claim 3 wherein the polyvalent metal soap is aluminum stearate.

6. An insecticidal composition consisting of a mineral oil continuous phase having a polyvalent metal soap incorporated therein in an amount resulting in incipient jell-formation and having an aqueous phase dispersed therein.

7. An insecticidal composition as in claim 6 in which the polyvalent metal soap is aluminum stearate.

8. An insecticidal oil emulsion composition in which a refined mineral oil constitutes the continuous phase and an aqueous liquid the discontinuous phase, the volume ratio of oil to aqueous phase being at least one to four.

9. An insecticidal oil emulsion composition comprising a refined mineral oil as the continuous phase, an emulsifier adapted to the formation of a water-in-oil type of emulsion and an aqueous discontinuous phase dispersed in the oil, the volume ratio of oil to aqueous phase being at least about one to four and the dispersion being sufficiently stable to persist as such until deposited on a parasite infested host.

10. An insecticidal oil emulsion composition as in claim 9 wherein the emulsifier is a polyvalent metal soap.

11. An insecticidal oil emulsion composition as in claim 9 wherein the emulsifier is a polyvalent metal soap dissolved in the oil in quantity to produce incipient jell formation.

12. An insecticidal oil emulsion composition as in claim 9 wherein the emulsifier is aluminum stearate dissolved in the oil in such quantity as to produce incipient jelling of the oil.

13. An insecticidal oil emulsion composition as in claim 9 wherein the emulsifier is aluminum stearate dissolved in the oil in quantity to produce incipient jelling of the same and the aqueous phase contains a thickening agent.

14. An insecticidal spray comprising a mineral

oil external phase having an aqueous phase enclosed therein.

15. The method of increasing the bulk of a mineral oil insecticide for more effective spraying and at the same time of retarding the absorption of said oil when applied to vegetation which comprises dispersing an aqueous phase in said oil with the aid of a polyvalent metal soap emulsifier of a type which tends to produce jelling of the oil.

16. The method of increasing the bulk of a mineral oil insecticide for more effective spraying and at the same time of retarding the absorption of said oil when applied to vegetation which comprises dispersing an aqueous phase containing a thickening agent in said oil with the aid of a polyvalent metal soap emulsifier of a type which tends to produce jelling of the oil.

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