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INSECTICIDE AND REPELLENT

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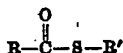
This invention relates to insecticides and particularly relates to those insecticides which contain an acyl sulfide grouping and which have both a killing and repelling effect on insects.

It has now been discovered that acyl sulfides are particularly good fly repellents and that they may also be used as repellents towards other insects such as gnats, mosquitos, etc.

The compounds of the present invention all contain the grouping



and the type formula of these compounds is



in which R and R' may be hydrogen atoms or similar or dissimilar organic radicals such as: alkyl as methyl-, ethyl-, propyl, isopropyl, normal butyl, isobutyl, secondary butyl, tertiary butyl, normal pentyl, isopentyl, secondary pentyl, tertiary pentyl, etc.; alkenyl as vinyl, allyl, methallyl, crotyl, etc.; aryl as phenyl, naphthenyl, etc.; aralkyl as tolyl, xylyl, secondary butyl-naphthyl, dipropyl-naphthyl, benzyl, naphthyl-butyl, etc.; aralkenyl as vinyl-phenyl, crotonyl-naphthyl, methallyl-phenyl, triallyl-naphthyl, naphthyl-allyl, etc.; cycloparaffinic as cyclopentyl, ethyl-cyclohexyl, tributyl-cyclohexyl, etc.; cyclo-olefinic as cyclopentenyl, cyclohexenyl, etc.; heterocyclic as thienyl, pyrrolyl, furyl, etc. Further, these radicals may have one or more of their hydrogen atoms substituted with other elements or groups as halogen, hydroxyl, nitro, sulfo, etc. To illustrate, but not in any way to limit the scope of my invention, a few representative compounds that may be used are as follows: ethyl acetyl sulfide, isopropyl acetyl sulfide, secondary butyl acetyl sulfide, propyl propionyl sulfide, vinyl acetyl sulfide, methallyl acetyl sulfide, butyl methacryl sulfide, tolyl acetyl sulfide, phenyl propionyl sulfide, ethyl-phenyl valeryl sulfide, propyl toluyl sulfide, methallyl benzoyl sulfide, vinyl-phenyl acetyl sulfide, tertiary butyl-phenyl isobutyryl sulfide, phenyl-ethyl acetyl sulfide, cyclopentyl acetyl sulfide, cyclohexyl acryl sulfide, methyl-cyclohexyl acetyl sulfide, propyl naphthenyl sulfide, methallyl naphthenyl sulfide, methyl-cyclohexenyl acetyl sulfide, thienyl acetyl sulfide, furyl acetyl sulfide, brombutyl propionyl sulfide, hydroxyethyl acetyl sulfide, nitroethyl acetyl sulfide, sulfoethyl acetyl sulfide, etc.

The acyl sulfides may be applied either alone

or they may be diluted and applied in various ways. For instance they may be dissolved in solvents and sprayed or brushed over the surfaces to be treated or they may be emulsified either before or after they have been dissolved in solvents. It is also possible to combine the acyl sulfides with an inert finely divided carrier such as clay or carbon black so that they can be used for dusting. The preferred manner of application is by spraying, since one of the most important uses of these compounds is to protect animals from attacks by flies. For spraying it has been found that both emulsions and solutions are effective. Emulsions of the acyl sulfides may be prepared by the use of any known emulsifying agent such as ordinary soaps, salts or esters of sulfates and sulfonated animal, vegetable or mineral oils, caseinates, resins, amine salts of higher fatty acids and sulfuric acid esters etc.

The acyl sulfides may be used either alone or in combination with known insecticides such as pyrethrum, rotenone, nicotine, ammonium polysulfides, lime-sulfur, Bordeaux, organic thiocyanates and isothiocyanates and the like. Besides being useful in protecting animals the acyl sulfides may be used for the protection of silk, cotton, jute, burlap, strawboard and the like substances which are subject to attack by insects.

The acyl sulfides of the present invention may be prepared by reacting a mercaptan with a carboxylic acid or carboxylic acid anhydride under conditions wherein one of the reaction products is separated from the reaction mixture by a method such as fractional distillation, azeotropic distillation, extraction, stratification or centrifugation. The methods of preparation are set out in detail in my copending patent application Ser. No. 247,950, filed December 27, 1938.

In order to test the repellency of the acyl sulfides, an olfactometer was used. The olfactometer is described in detail in the Journal of Economic Entomology 28, 1029-1036 (1934). Briefly, it consists of a light-tight box in which insects are placed. Two circles of screen wire at one end of the box are illuminated to attract the insects and a stream of air containing the substance to be tested for repellency is forced through one of the illuminated screen circles while a stream of pure air is forced through the other screen. In this way the distribution of the flies on the two illuminated areas can be observed and the repellency, if any, noted. The repellency index is the percentage of flies which alight on the illuminated circle through which

the repellent material is forced. Thus an index of 50 would indicate no repellency, and smaller numbers indicate increasing degrees of repellency.

In the following experiments, the effect on the flesh fly *Lucilia sericata* was tested, since this fly is one of the most serious pests causing severe damage to cattle and sheep.

The following data are given as illustrative examples of the effectiveness of the acetyl sulfides as repellents and it is not intended that the present invention be limited thereby.

Acyl sulfide	Partial pressure of acyl sulfide in air, mm. of Hg	Repellency index
Ethyl acetyl sulfide.....	0.12	42.5
	0.16	37.5
	0.18	45.0
	0.313	25.0
Methallyl acetyl sulfide.....	0.035	45.0
	0.06	37.5
	0.07	25.
	0.10	17.5
Tertiary butyl acetyl sulfide.....	0.05	40.0
	0.008	25.0
	0.1	15.0
	0.15	10.0

It can be seen from the above that the acetyl

sulfides are effective as repellents even when used in very small concentrations. This is very important, since repellents are ordinarily sprayed on animals and normally evaporate, and therefore if they are to serve their purpose their effect must still be apparent when they are in minute concentrations.

I claim as my invention:

1. An insecticidal and fumigating composition containing as an active constituent an alkenyl acyl sulfide.

2. An insecticidal and fumigating composition containing as an active constituent an organic compound comprising an alkyl acyl sulfide group to which is linked an allyl group.

3. An insecticidal and fumigating composition containing as an active constituent a methallyl alkyl acyl sulfide.

4. An insecticidal and fumigating composition containing as an active constituent methallyl acetyl sulfide.

5. An insect repellent composition containing as an active constituent an acyl sulfide.

6. An insect repellent composition containing as an active constituent an organic compound comprising an acyl sulfide group to which is linked at least one hydrocarbon radical.

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