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INSECTICIDES.

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INSECTICIDES.

For some time letters of inquiry regarding the best means of fighting insects have been received at this station. These inquiries have led me to believe that a bulletin treating of some of the principal substances used as insecticides would be gratefully received and might prove of some benefit to those desiring information.

ARSENITES.

Among the substances most universally used are the *Arsenites*, Paris green and London purple. These substances have been used with success against most *mandibulate* insects—insects with biting mouth parts. Paris green is a combination of arsenous acid and copper. It is practically insoluble in water and when used upon fruit and shade trees should be continually stirred so that the small particles of poison may be more easily held in suspension. The various manufacturers of spraying apparatus recognize this fact and have attached to their pumps a return pipe which forces the water into the vessel and thus constantly stirs it. London purple consists principally of the Arsenite of lime and is more readily soluble in water. From the fact that it is much cheaper than Paris green it is very desirable as an insecticide, and it does its work as well. These substances should be used in the proportion of one pound of the poison to 200 gallons of water. If there is any injury to the foliage a small quantity of slacked lime may be added to the mixture, which will prevent the burning of the leaves. A spray pump is the best means of applying the liquid. Care should be taken that the application be made thorough and all portions of the tree wetted, or the beneficial results

will not be as great as was expected. If a single application is not sufficient to destroy the pest, a second application may be made in a week or ten days.

Last spring and summer the shade trees and the fruit trees were severely injured by leaf rollers. In Colorado the injury was much greater than in Wyoming. The arsenites were used against these pests with success. We may expect a repetition of the attack this season and a careful watch should be kept. All insects that eat the foliage of plants, such as the potato beetle, the tent caterpillar, whose webs are seen on almost every currant bush, and the fall web worm, may be easily held in check or destroyed by a timely application of Paris green or London purple.

For potato beetles, the poison may be mixed with land plaster or air slacked lime, one pound of the poison to seventy-five of the plaster or lime, and then dusted on the plants. A cheese cloth bag or finely perforated tin can will answer the purpose admirably. London purple and Paris green are deadly poison and should be kept from children and irresponsible persons.

KEROSENE EMULSION, OR COAL OIL EMULSION.

Another preparation of great importance as an insecticide is *Kerosene emulsion*, or *Kerosene and soap mixture*. Within the last twelve months much controversy concerning the best methods and proportions to be used in making the preparation has been going on. The different formulae are those of Prof. A. J. Cook of Michigan and Dr. C. V. Riley of the Department of Agriculture at Washington. With Prof. Cook's formula a pint of kerosene oil is thoroughly mixed and stirred, even churned, with two quarts of water in which has been dissolved a quart of soft soap or one-fourth pound of hard soap. These, when thoroughly mixed with a force pump or syringe, will form a thick, creamy mass capable of being diluted with either

hard or soft water. In preparing the emulsion it is better and more quickly done if the water is warm. This mixture should be diluted so that only one-fifteenth of the mixture is kerosene oil; i. e., add to the mixture ten pints of water.

The Riley preparation is made as follows: Dissolve one-half pound of hard soap in a gallon of hot water, then add two gallons of kerosene oil and stir thoroughly by means of a force pump, pumping the mixture into the vessel. The mixture is more easily prepared if the oil is warmed. This mixture may be diluted to any desired proportion; one-ninth kerosene is the usual strength.

My experience has been that the Cook formula is preferable. It is more easily prepared and no free oil is found when diluted. This can not be said of the Riley preparation. The former is more permanent and will not separate upon long standing. In this country, where soft water and soft soap are an impossibility, I should earnestly recommend the Cook formula. The Riley emulsion, if prepared and diluted with soft water, does very well, and the amount of free oil is comparatively small. I have experienced no failures with the Cook formula, but with the Riley formula have.

Plant lice, ticks, bugs and all sucking insects, or those which must be killed by an external application of some insecticide, are readily destroyed by this emulsion. When too much kerosene is present the foliage becomes blackened and soon dries up. A weaker preparation will not injure and may be used with success. In applying the emulsion some form of spraying apparatus is necessary, and thoroughness, above everything else, is essential. Plant lice often puncture the leaves, so that they curl, thus protecting the insects. In cases of this kind every portion of the plant should be thoroughly treated. Kerosene emulsion may also be used as a sheep dip and for cattle lice and ticks. It makes the skin soft and smooth, rendering it free from dirt and destroys the eggs of these external parasites. When used for this purpose during cold weath-

er it is best to give the animals some form of shelter until they become dry.

PYRETHRUM OR BUHACH

is a substance which has gained favor among entomologists as an insecticide. This is a yellowish powder obtained by grinding the flowers and stems of several plants belonging to the genus *pyrethrum*. The active principle is thought to be a volatile oil which prostrates the insects when it comes in contact with them. It is used as a powder by simply dusting it upon the affected plants, or it may be stirred into water and applied in the form of a spray. A tablespoonfull to two gallons of water will form a mixture of sufficient strength for all purposes. The powder should always be fresh, as it loses strength on long standing or when exposed to the air.

When pyrethrum is mixed with water it is an excellent remedy for plant lice. I have used this preparation in greenhouses and in the field and have never experienced any failures. Those who have used it for this purpose have reported favorable results and think it much better for greenhouses than tobacco smoke. Buhach is also an excellent remedy for house flies. If all the rooms are darkened with one exception the flies will congregate in the lighted room. If a small quantity of powder is dusted in the room the flies will drop to the floor where they may be swept up and burned. Pyrethrum is not poisonous to man and the lower animals, hence there is no danger or risk in using it. The fresh article may be obtained of the Buhach Manufacturing Co., Stockton, Cal., or any reliable druggist.

TOBACCO DECOCTION.

This is an important insecticide and is prepared by boiling tobacco or the stems of refuse tobacco, using one pound of tobacco to two gallons of water. The stems and loose material may be removed by straining through a cloth.

The tobacco decoction is an excellent dip for sheep, as well as an important wash to rid cattle of vermin. It

is often necessary to make two applications, as it does not kill or destroy the eggs that may be present during the first application.

Beets, turnips and potatoes are often attacked by small beetles, which jump upon the least alarm. These beetles are termed flea beetles. They eat small holes into the leaves and lessen the vitality of the plants. This tobacco decoction has given excellent satisfaction as a remedy for these little beetles.

BISULPHIDE OF CARBON

is undoubtedly one of the best insecticides known. It is a highly inflammable material when mixed in the right proportions with air. A careless person should never attempt to use it, although when in careful hands it is perfectly harmless. It readily evaporates when exposed to the air. For "buggy peas" and grain insects there is nothing that will answer the purpose of an insecticide so well. The infested grain should be placed in a tight box or bin and a quantity of the bisulphide introduced and the box closed tightly. The liquid may be thrown upon the grain or introduced through a gas pipe. The box should remain closed for two or three days when it may be opened for ventilation. Fire should be kept away from the box or building, as an explosion might be the result.

Experiments will be carried on at this station during the present season to determine the value of bisulphide of carbon for killing gophers. The results of such experiments will be published in a future bulletin. Those who wish to conduct similar experiments may obtain the material direct from the manufacturer, Edward R. Taylor, Cleveland, Ohio, at a cost not to exceed ten cents per pound. It is hoped that those who try this remedy will report to this station.

In conclusion, I wish to say that it is important that in the application of any insecticide, thoroughness is necessary to insure success. Many fail because of lack of this, while others using the same remedies, are always attended with beneficial results.

[NOTE.—The Entomologist of the Wyoming Agricultural Experiment Station will be pleased to receive insects from the residents of the state, and will endeavor to answer any inquiries concerning their life history or the best means of destroying them if injurious. Insects can be sent by mail for one cent per ounce. If the specimens are dead they should be packed in cotton or wool to insure safe transportation, and enclosed in a tight wooden or tin box. NEVER SEND INSECTS IN A LETTER, as they will be crushed beyond recognition. Whenever it is possible live insects should be sent. Caterpillars, grubs, maggots, etc., should be supplied with enough of their food plant to last them until they have reached their destination. It is unnecessary to cut airholes in the boxes, as the amount of air required by insects is very small. When sending insects the name of the sender should be written on the package. Anyone sending specimens for identification will confer a favor by giving as full particulars as possible concerning their habits; for example, what plant it infests; whether it infests the roots, stems, twigs, buds or leaves; how long you have known it to be injurious, and what amount of damage it has done. The Director on his recent tour through the State, arranged for collections of insects to be made by the Superintendents of the Experiment Farms at Lander, Saratoga, Sheridan, Sundance and Wheatland. Insects may be sent through those gentlemen. All packages and communications should be addressed to F. J. NISWANDER, Entomologist, Agricultural Experiment Station, Laramie, Wyo.]