

it consumes plants faster than they can grow. A small amount of pruning is no doubt good for the plants, and if the feeding which takes place in two weeks could be distributed through three months it might be very advantageous. Mr. H. S. Smith, who studied the insect in Italy, was of the opinion that that was one of the principal factors in producing the condition in Italy along the seacoast, where the weevil is always present in considerable numbers, but is of no consequence as a pest. Its feeding is distributed through many months instead of a few weeks.

PRESIDENT C. GORDON HEWITT: I will now call for a paper by Mr. A. F. Burgess and Mr. E. L. Griffin.

A NEW TREE BANDING MATERIAL FOR THE CONTROL OF THE GIPSY MOTH

By A. F. BURGESS and E. L. GRIFFIN.¹

About the year 1896, when the gipsy moth work in Massachusetts was in charge of the State Board of Agriculture, a small quantity of a product known as Raupenleim was imported from Germany to use for banding tree trunks to prevent caterpillars from reaching the foliage. The results with this material proved to be of enough value so that an attempt was made during the following year to manufacture it in a small way in this country. The material was of a greasy nature and was applied to the tree trunk with a trowel, the upper part of the band being thinner than the lower edge. The results with the substitute which was prepared in this country were not very satisfactory, particularly because the object of the work at that time was the extermination of the moth, and although banding was not very expensive, it was found that more caterpillars could be destroyed in a given area by using burlap and crushing the caterpillars that congregated beneath it.

When the gipsy moth work was resumed by the State of Massachusetts in 1905, the question of banding trees was a very important one. By that time tree tanglefoot had come into use and it was adopted as a satisfactory material for banding purposes and has since been used in large quantities throughout the infested area.

In 1909, Dr. L. O. Howard, while in Europe, secured a small order of Raupenleim from a German factory and shipped it to this country.

¹ The testing of the material was carried out by the Gipsy Moth Laboratory and field force of the Bureau of Entomology, while the analyses were made and material prepared at the Insecticide Laboratory, Bureau of Chemistry, U. S. Department of Agriculture.

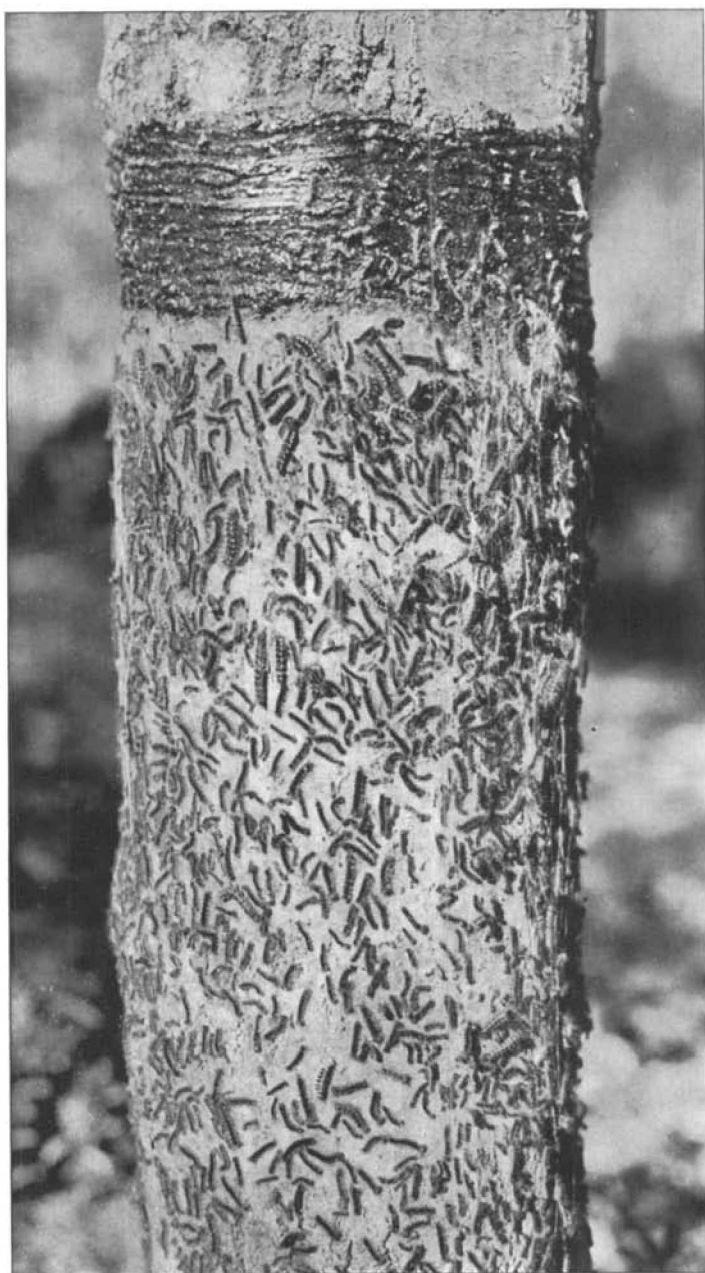
It was applied to several species of trees by men working under the direction of Mr. D. M. Rogers. Bands about three inches wide were placed on the trees by using a wooden paddle similar to that with which tanglefoot is applied. The material did not give satisfaction, as it dried out in some parts of the band, and there was a decided tendency for it to run down the tree trunk when exposed to high temperature. It is probable that the difficulty experienced with this material was due to the method of application, but as it did not look promising further experiments were not continued.

In 1912, Mr. L. H. Worthley, while employed by the Bureau in making gipsy moth investigations in Europe, observed the successful use of Raupenleim in the German forests. He obtained a barrel of the material and had it shipped to the Bureau at Melrose Highlands, Mass. He also secured a sample of the gun used in applying the bands to the trees. This instrument consists of a tin cylinder, in one end of which is a small, somewhat rectangular orifice. Into the cylinder is fitted a plunger which can be forced forward in such a way as to slowly press the banding material through the orifice. To apply the banding material to a tree, it is simply necessary to place the orifice against the tree trunk, gradually forcing the material through while the operator moves slowly around the tree until he has encircled it. Experiments conducted by Mr. Worthley with this material during the summers of 1913 and 1914 indicated that it was very effective in preventing caterpillars from ascending the trees and that no injury was caused to the bark. Since the time these experiments were concluded, it has been impossible to obtain more of the German product.

An attempt was made in the winter of 1915 to procure a similar product in this country. Samples were sent to the Federal Insecticide Board and through the courtesy of Dr. J. K. Heywood, chairman of the board, the matter was investigated by Mr. C. C. McDonnell who detailed Mr. E. L. Griffin, one of his assistants in the Insecticide and Fungicide Laboratory, to make a special study of the material. At our suggestion, several samples were prepared having slightly different consistencies and these were tested during the winter in a chamber especially designed for the purpose, where different temperatures were maintained in order to determine whether the samples would remain intact if subjected to high temperature. The two best samples were selected and a quantity of the material was prepared for use in the field during the summer of 1915. Good results were secured, and at our request two tons each of the two samples were prepared and applied in the field during the spring of 1916. The purpose of using so large an amount was to make the test extensive enough so that definite conclusions could be drawn. The material was used in New Hampshire,



Applying tree banding material.



Gipsy moth caterpillars under tanglefoot band.

Massachusetts, and Connecticut on all kinds of trees and no injury to the trees resulted, and excellent results were secured. Many tests were also made by Mr. C. W. Collins and C. E. Hood of the Gipsy Moth Laboratory to determine the effect of using bands of different widths and thicknesses as well as to compare the results of these substances with other banding materials. One sample, however, proved better than the other on account of its being a little softer, which made it easier to handle in the guns when the temperature was low.

In gipsy moth work, banding is usually begun in April and many days the weather is rather cold. The sample which gave the best results contained the following materials.

(a) A high boiling neutral coal tar oil having a density of about 1.15 at 20°C.

(b) A soft coal tar pitch.

(c) Rosin oil of the grade known as first run "Kidney" oil.

(d) Ordinary commercial quick lime.

A stock mixture was first made up in large quantities as follows: A weighed quantity of the coal tar pitch was transferred to a ten-gallon steam jacketed kettle, which was equipped with a stirring arrangement operated by a motor, and heated until thin enough to run. Then twice its weight of the coal tar neutral oil was run in and the mixture well stirred, thus giving a product which could be poured and worked after it had cooled off. This will be referred to as the "Pitch-neutral oil mixture."

The quick lime was slaked with a small amount of water, so that the resultant product would be a dry powder. This was passed through a sieve having ten meshes to the inch.

The tree banding material was mixed as follows: 5 lbs. of the "pitch-neutral oil mixture," 16 lbs. of the coal tar neutral oil and 4 lbs. of slaked lime were weighed into the mixing kettle previously referred to, and the stirrer started working. When the contents had become of a uniform consistency, 20 lbs. of rosin oil were added and about ten minutes later 10 lbs. more of the coal tar neutral oil. At the end of twenty-five minutes from the time the rosin oil was added, the stirring was stopped and the material dumped into tubs. It was now rather thin and was allowed to stand for two days by which time it had set into a semi-solid cake. Two pounds of the coal tar neutral oil were stirred into each 50 lbs. of this mixture in order to give it the desired oily surface. The product was now ready for use.

The physical properties of the material can be varied through quite a large range by varying the proportions of coal tar neutral oil and "pitch-neutral oil mixture," and also by varying the amount of rosin oil and lime. The addition of more coal tar neutral oil makes the

material softer and more oily. Too much of it, however, gives a product which will not stand up under summer heat. A harder product can be made by the addition of more pitch or larger quantities of rosin oil and slaked lime.

The cost of the materials used (prices paid by the Department of Agriculture in the Spring of 1916) were as follows:—The high boiling coal tar neutral oil, 45¢ per gallon (about 4.7¢ per pound) and the coal tar pitch, 11¢ per gallon (about 1.1¢ per pound). They were both obtained from the Barrett Manufacturing Company, Philadelphia, Pa. The rosin oil ("Kidney" oil) was furnished by the John A. Casey Company of New York at 36¢ per gallon (about 4.32¢ per pound). The quick lime cost 65¢ per barrel of 200 lbs. (about 0.33¢ per pound). Based upon these figures the tree banding material cost 4.14¢ per pound distributed as follows: Pitch 0.03¢, Rosin oil 1.49¢, Coal tar neutral oil 2.60¢, and Lime 0.02¢. These prices do not include containers. Metal containers with bail and cover, holding 25 pounds and strong enough to bear shipment without crating will cost about 25¢ each. If the material were packed in barrels the additional cost per pound would be very small.

It is possible that a cheaper commercial coal tar distillate, such as road oil, might be substituted for the comparatively expensive coal tar neutral oil, thus bringing the cost of the material even lower.

It is evident that this material is considerably cheaper than any successful banding material that is now on the market. Pound for pound, the tree banding material will cover about two-thirds as many lineal feet as tree tanglefoot, but as the trees do not have to be scraped before applying the former band, the labor is reduced so that a large saving is made by using this material. The bands remain on the trees during the winter and can be moistened with turpentine in the spring so that they will be effective for two seasons.

PRESIDENT C. GORDON HEWITT: The paper is now open for discussion.

MR. W. E. HINDS: I would like to ask whether on highways where dust is abundant the effectiveness of the bands is reduced?

MR. A. F. BURGESS: The effectiveness of these bands is not reduced as much as in the case of tanglefoot bands, but they require more attention when there is an abundance of dust.

MR. P. J. PARROTT: I would like to ask if any allowance has to be made for high temperature as summer advances, or for excessive precipitation.

MR. A. F. BURGESS: No.

MR. P. J. PARROTT: We have been working on a preparation manufactured in this country for the purpose of preventing ants from carrying aphids on apple trees. One of the great defects in the material is that during seasons when rainfall is heavy, as in 1916, the ants were able to cross the bands after heavy rains.

MR. A. F. BURGESS: It is very difficult to secure a banding material which will not run when exposed to high temperature or harden after a rain. We have not had these difficulties with this material. It is more greasy than sticky.

PRESIDENT C. GORDON HEWITT: I will now call on Mr. E. D. Ball to present his paper.

EFFICIENCY AND ECONOMY IN GRASSHOPPER CONTROL

By E. D. BALL, *State Entomologist, Madison, Wis.*

That grasshopper outbreaks can be successfully controlled is a definitely established fact. That they will ordinarily be controlled under every day farm conditions is still very doubtful.

Where organized campaigns are waged against large outbreaks, public sentiment aroused, poisonous material supplied in carload lots, and distributed to those needing it, it will always be easy to obtain a high percentage of effort and a still higher percentage of efficiency. Whether the material is sold or furnished free makes little difference, so long as it is readily available and sufficient publicity has been given to arouse interest to the point of action.

Under ordinary farm conditions the handling of an outbreak is quite a different matter. The danger of damage is often realized, but the material for destruction is not at hand and often difficult to procure. The writer has several times been in communities in which it was found practically impossible to procure any strong smelling molasses,—either West India or Sugar Beet, without which the effectiveness of the poison bait is much reduced.

The Hopperdozer as usually built and operated is not very efficient and requires tar or crude oil, neither of which may be available, though kerosene may be used as an expensive substitute. Its operation in any case is disagreeable and a constant expense, and the machine is so offensive that it is almost always left outside to rust or rot.

The grasshopper catching machine is the easiest solution of many of these problems. It is efficient, inexpensive and when once built is always ready for immediate use. Communities that have once been supplied with grasshopper machines rarely call for additional help.