DEVICES FOR CHARTING AND OBTAINING NATURALLY EMERGED CATTLE WARBLES (Diptera: Oestridae)[1]

J. D. Gregson and G. P. Holland
Livestock Insect Laboratory, Kamloops, B. C.

With the increased attention now being paid to the problem of cattle warbles, and the need for economy in the use of derris and other rotenone-containing roots, which provide the only known practical means of control, it has been considered necessary to reconsider the life-history and ecology of these insects in order to fill certain gaps in our knowledge.

Numerous questions have been asked: What is the average length of time involved from the first appearance of the grubs in the backs of cattle to their natural emergence? Will grubs that emerge in the very early spring survive frosts? How many degrees of frost will they tolerate? If only one treatment can be given when is the optimum time? What proportion of normally emerging grubs matures to flies under natural conditions? Grubs may emerge while cattle are in the barn, while the animals are in the pasture, in a muddy lane, in sunny or shady spots, on dry hard ground, etc.; what are their chances of survival under these various circumstances? Is the puparium subject to mould and parasites? Are mice or birds factors in control? How long will warble flies live? How far can they fly? How good a cattle-finding sense do they possess? These are only some of the questions that require answers.

In attempting to find the solutions to these problems, certain difficulties have been encountered. To overcome some of these, two simple pieces of apparatus have been devised, and are here described.

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(1) A Method of Charting Warbles (Fig. 1).

Most of our studies are conducted on local dairy herds. A row of cows is chosen for warble development studies and at intervals of a week or so, each animal is checked to see how the grubs are progressing, and whether any new ones have appeared. As there may be as many as 70 grubs in the back of a single beast it was found difficult to locate a particular warble on successive visits.

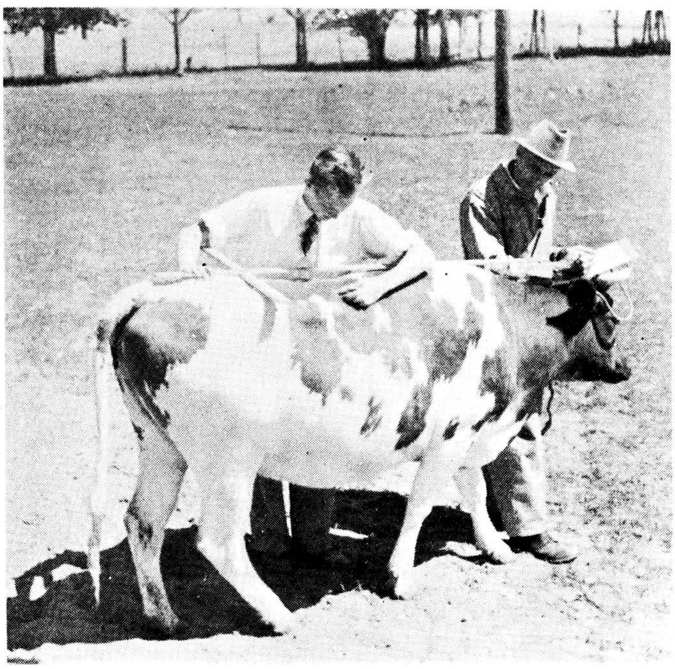
Fig. 1.—Warble Charter in Use.

To obviate this, a measuring stick was made. This consists of a piece of thin wood five feet long, with a cross bar two feet long fastened one foot from the end. The long stick is marked at two-

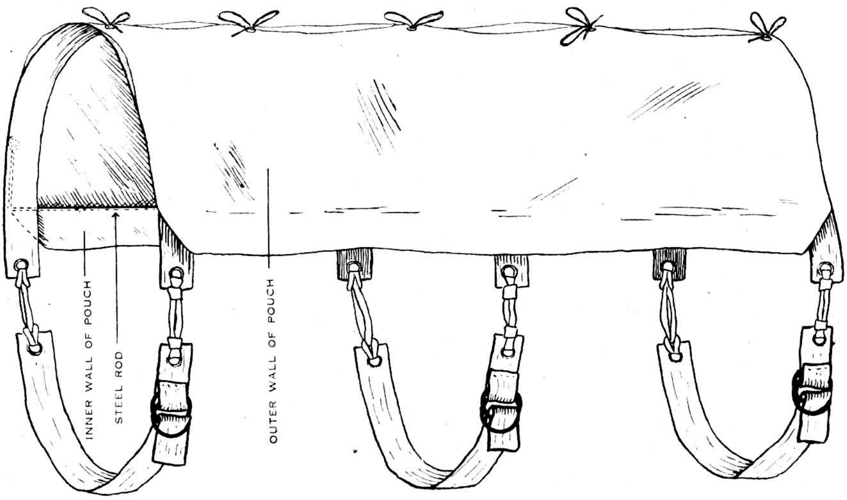

Fig. 2.—Device for Obtaining Emerged Warbles.

inch intervals with numbers from 1 to 30. The cross bar is similarly marked but the divisions are lettered A, B, C, D, etc., on each arm.

The stick is placed with the long member running along the animal's vertebral column, and with the cross piece exactly even with the projecting pelvis (hook) bones. The location of any grub may then be expressed by a number and a letter—on the right side or the left—as 8A, 10C, 17D, and so on. Furthermore, an arbitrary series of numbers from one to five indicates the relative development of the grubs as follows:

Size 1—barely perceptible to small
2—small to medium
3—half to three-quarter grown
4—mature and ready to emerge
5—empty cysts.

Cards have been printed on which to record these data. On one side is a square chart representing the cow's back, lettered and numbered in the same manner as the stick. On the other side there is space for the date, locality, name of herd, row and stall of the particular animal, its breed, colour, age and other pertinent details.

Thus a complete seasonal record may be kept for each animal, and the development of each grub traced from first appearance to maturity.

(2) A DEVICE FOR SECURING NATURALLY EMERGED GRUBS (Fig. 2).

In experiments using adult flies, or in determining the normal pupal period, it is necessary to have numbers of naturally emerged grubs. In 1943 rearing experiments were conducted with mature grubs that had been squeezed out very carefully and gently by hand. Due to the unavoidable mechanical injury these grubs did not survive. As it is impractical to follow a cow around, waiting for a grub to fall out of its back, some means of obtaining uninjured grubs in fair numbers had to be invented.

Officers of the United States Department of Agriculture overcame the difficulty by enveloping the body of the animals with bagging; others have applied capsules over individual warble cysts (Bishopp et al., 1926). The first method is awkward, and the capsules are apt to be scratched off.

Our apparatus consists of two canvas pouches, twenty-four inches long and three inches deep, one on each side of the animal. The inner margins of the pouches—those against the sides of the cow—are reinforced by one-eighth inch spring steel rods: the type used by upholsterers for spring work was found to be most satisfactory. At the ends of the pouches these rods are turned up at right angles for about three inches, then terminated in small loops to prevent them tearing out of the canvas into which they are sewn.

The outer walls of the pouches continue up as flaps, and are tied together over the animal's back. These canvas pockets are kept in place and are tightly compressed against the animal to which they are shaped by three webbing girdles, which are cinched around the belly. Each of these straps has an elastic insert on each side to accommodate the cow's size before and after feeding. The girdles are adjusted by double ring buckles. As the warbles emerge, they roll down from the back and are caught in the pockets, from which they may be removed daily, and set aside for rearing.

Heavily infested, long-haired beef yearlings proved ideal for our use; as many as thirty-five grubs were collected from five animals in one day under these circumstances. Tame animals are a great asset to success, for under the best of conditions the harness receives rough treatment. For this reason it should be constructed strongly, and sewn with linen thread.

LITERATURE CITED

Bishopp, F. C., E. W. Laake, H. M. Brundrett, and R. W. Wills. The Cattle Grubs or Ox Warbles, their Biologies and Suggestions for Control. U. S. Dept. Agric. Bul. 1369, April 1926.

THE EUROPEAN RED MITE IN THE OKANAGAN VALLEY OF BRITISH COLUMBIA (Acarina)[1]

E. P. VENABLES
Dominion Entomological Laboratory, Vernon, B. C.

This paper records certain observations regarding the economic importance of the European red mite *Paratetranychus pilosus* (C. & F.) and the effect that control measures may have upon the development of infestations in the Okanagan Valley of southern central British Columbia.

The potential importance of the European red mite has frequently been stated in terms of devitalization of the foliage resulting in loss of leaves, reduction in size and colour of the fruit, and failure on the part of the tree to produce fruit buds. The extent to which the entomologist is justified in leading the orchardist to expect such cumulative injury, should depend upon observations made in his own particular district over a period of years, rather than upon reports from other parts of the country or from obsolete literature.

In infested irrigated orchards of the Okanagan Valley, it is very doubtful if defoliation ever occurs, although yellowing and bronzing of the leaves is commonly observed where the mites are numerous. Trees in this condition may lose many of their leaves following the application of summer oil. In non-irrigated orchards on the other hand, defoliation may be of common occurrence as noted by Newcomer (1941) in Washington State. Infestations in Eastern Canada and the United States, where irrigation is not usual, are also accompanied by loss of leaves and other resulting symptoms. It is well known that the development of many orchard insects is profoundly influenced by cultural practices and there can be little doubt that irrigation has an important bearing upon injuries resulting from the attack of mites and scale insects.

The effect of foliage injury upon fruit bud formation would depend upon the stage of bud development when the mite population reaches its height. In the Okanagan Valley, the fruit buds are usually well developed by late June or early July. Heavy mite infestations during May and June would therefore be more liable to reduce bud vitality than later infestations

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