Drafting Insect "Soldiers" To War On Plant Parasites[1]

How Parasites of the Sweet Clover Weevil and European Corn Borer Are Being Established in North Dakota

By J. A. Munro[2]

The battle against insect pests is much like other types of warfare—to be most successful it must be waged on all fronts. Possibly the most common method of controlling insects is by chemical means, using insecticides. This method, while highly useful, must be supplemented wherever practicable by other methods including cultural and biological control.

Cultural control relates largely to soil cultivation, crop rotation and common farm practices which destroy injurious insects particularly in their early stages of development, or which otherwise result in crop protection.

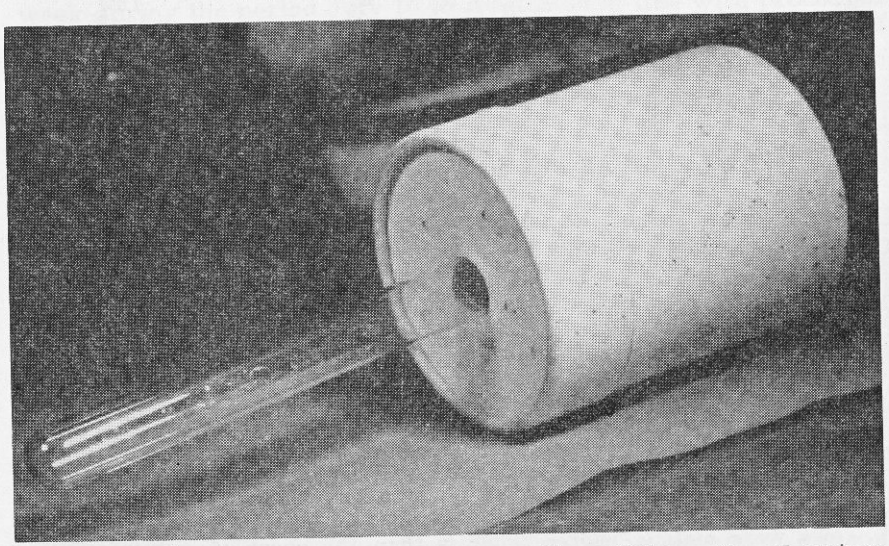

Fig. 1—The plant parasites are contained in these little cardboard cartons into which a glass tube is placed. As the insects come toward the light, out into the tube, they can be carefully "screened" to determine if they are the right species, and the degree of livability after their long journey.

[1] Based on progress reports on Bankhead-Jones 28 and Bankhead-Jones-Offset 98 projects of the North Dakota Agricultural Experiment Station.

[2] Entomologist.

Biological control of insects is obtained largely by the introduction and establishment of insect parasites to prey upon the injurious species. Many examples of successfully established parasites could be cited.

In general, the parasites must be obtained from the same continent from which their host species originated. Since the sweet clover weevil, *Sitona cylindricollis*, and the European corn borer, *Pyrausta nubilalis*, both widespread in this country, came from Europe, a special effort is being made through cooperation with the Bureau of Entomology and Plant Quarantine of the U.S. Department of Agriculture to establish their insect parasites in this country.

Sweet Clover Weevil Parasites

Introduction of insect parasites to aid in control of the sweet clover weevil in North Dakota began in 1948. They have been released annually in the Fargo area by the North Dakota Agricultural Experiment Station as shown in Table I.

TABLE 1. INSECT PARASITES RELEASED TO AID IN CONTROL OF SWEET CLOVER WEEVIL

Year	Number of Parasite Species Released*	
	Microctonus aethiops	Campogaster exigua
1948	427	1,052
1949	19	17
1950	78	279
	524	1,348

*No common names. M. aethiops is a small hymenopterous species and C. exigua is a small dark-colored fly.

WEEVIL LARVAE PREY ON SWEET CLOVER ROOTLETS

By J. A. Munro[1], Roy E. Bry[2], and R. L. Stephenson[2]

To what extent the larvae of the sweet clover weevil hinders development of the plants by feeding on the rootlets was indicated in a recent experiment conducted by the North Dakota Experiment Station. Heretofore, only the damage to foliage caused by the adult weevils was recognized.

The plants used in the experiment were grown in four rows, from seed sown on May 5 in a large outdoor cage covered with screen to exclude weevils and other insects. Eggs collected from caged weevils were scattered along two of the rows and barriers of tarpaper extending about six inches into the soil were laid down to keep the resulting larvae from moving to adjoining rows. The only further care given the plants was occasional watering and elimination of any weeds.

As the season advanced, it became apparent that the infested rows were making poorer progress than the check or non-infested rows. A checkup on July 27 showed the plants from the infested rows to average 35¾ inches in height and 1½ ounces in weight; while the plants from the check rows (non-infested) averaged 50 inches in height and 3½ ounces in weight. The results, although of preliminary nature, are fairly conclusive evidence of the harmful effect of the larvae upon the plants.

[1] Entomologist
[2] Student assistant

In all instances the parasites arrived by air mail and were promptly released to infested plots, following the necessary precautions of screening to insure that only the beneficial parasites were released.

Recent developments on establishing parasites of the sweet clover weevil are summarized as follows: Of chief concern was the scarcity of sweet clover to provide for the work, especially the plantings in waste places which would not be plowed. To remedy the situation a series of small seedings was made in waste places at distances ranging up to approximately half a mile from the insectary plots where the parasites were released, the object being that the seedings serve as "catch basins" or lodging places for parasites which might disperse from where they were released.

Some of the earlier seedings were completely destroyed because of weevil damage, but were subsequently reseeded. The later seedings developed satisfactorily and probably contributed an important environmental aid in establishing the parasites. These plots remained as undisturbed as possible to provide a normal environment for both host and parasites.

To determine if the parasites had become established, sweepings with an insect net were made over the plots. Ten sweeps were made each time at intervals ranging from a few days to a week during the period July 10 to August 30 in line with procedure suggested in a letter from Paul A. Berry of the U. S. Bureau of Entomology Parasite Laboratory in France.

Fig. 2—Here Norman McCalley, student assistant in entomology, releases corn borer parasites at the edge of a cornfield on the Russell Olson farm in Richland county.

His letter states in part, "Regarding procedure to check on establishment of *Campogaster exigua*. I would suggest that you try sweeping for adult flies about a month after releases are made. These sweepings should be repeated from time to time for a period of about two weeks after they are started. The flies pass through a generation in four to six weeks when temperatures are favorable." His letter also suggested dissection of samples of adult weevils. The pressure of work, however, did not allow time for the dissections.

From these sweepings a total of three *C. exigua* were captured—two on July 10 and one on August 20. Identification was confirmed by C. W. Sabrosky in a letter received from C. F. W. Muesebeck, in charge, Division of Insect Identification, Bureau of Entomology and Plant Quarantine, USDA. No *M. aethiops* were recovered in 1950 although empty cocoons of this parasite found in 1949 indicated it to be established.

H. L. Parker, who supervised collecting of the parasites, reported to the writer that he had observed from 20 per cent to 50 per cent of the weevils collected in France in 1948 to be destroyed by *C. exigua* as contrasted with about four per cent by *M. aethiops*. From this it is evident that *C. exigua* is by far the more valuable of the parasites so far introduced.

Insect Parasites of the European Corn Borer

Collections of European corn borer larvae taken from 10 well distributed points throughout North Dakota in 1949 showed no parasitism present. It was therefore decided to introduce the more important species of parasites in the hope of getting them established to aid in borer control.

The Bureau of Entomology and Plant Quarantine, USDA, cooperated both by examining the collections for indications of parasitism, and also by supplying parasites for release in North Dakota. This work was begun in 1950.

Search for a suitable location for release of the insect parasites was confined largely to Richland county because of the more severe borer infestations, the more advanced seasonal conditions and the leading position it holds in corn production. With the aid of County Agent Al Strong, a corn planting on the farm of Russell Olson, Galchutt, Richland county, was selected for release of the parasites. This planting was about two acres in size and almost surrounded by a protective shelterbelt of trees which insured favorable ecological conditions. The corn plants were nearly 100 per cent borer infested, with the stalks averaging about 10 larvae each. However, as the season advanced the number decreased due to various causes to show an average of four per stalk at the close of the season.

Insect parasites of the European corn borer were received by this station during the week of July 17 and released in the Olson planting with the least delay possible. The shipments came by air mail and consisted of three of the more important insect parasites of the borer. The species and number released are as follows: the dipterous parasite *Lydella stabulans grisescens* (46); an inchnuemon parasite, *Horogenes punctorius* (38); and a braconid parasite, *Macrocentrus gifuensis* (638).

The weather and other conditions were considered ideal at the time of releasing these parasites in the infested planting, and the corn borers ranged largely from second to third instar larvae.

In addition to making the planting available, Mr. Olson cooperated further by not using insecticide because such use might also destroy the parasites. He also allowed the old stalks to remain standing well into the 1951 crop season to permit normal escape of the parasites.

During the latter part of October, 1950, corn borer larvae were collected from the Olson planting and sent to the Bureau of Entomology and Plant Quarantine, USDA, (European Corn Borer Research Laboratory) to determine to what extent the parasites might be established.

Fig. 3 At left, Russell Olson, in the cornfield where "plantings" of borer parasites were successfully made; at right, a much magnified picture of *Campogaster exigua*, fly which preys on the sweet clover weevil. In actual size, the fly is about one-third the size of the ordinary housefly. More than five separate shipments of *Campogaster exigua*, shipped by air, were received at Fargo. They were sent from France, and despite a long air journey the rate of survival was astonishingly good.

A letter from K. D. Arbuthnot, entomologist of the bureau, written June 5, 1951, states that 4.1 per cent of the larvae in the collection were parasitized with *Horogenes punctorius*. No other species was recovered. He states, "We were pleasantly surprised that this species was taken since very few adults were released."

It is particularly encouraging that *H. punctorius* has been established in this Richland county location. Further efforts directed towards widening its range of activity in North Dakota will be continued. Regarding the importance of this species in control of the European corn borer, Baker, Bradley and Clark[3] state *"Horogenes punctorius* is one of the most valuable of the introduced parasites."

It is planned to release further shipments of parasites until such parasitism becomes a more important part of nature's control of the European corn borer in this area. The same program also holds for introduction of parasites of the sweet clover weevil.

Special appreciation is expressed to Curtis P. Clausen and William G. Bradley of the Bureau of Entomology and Plant Quarantine, USDA, for furnishing the insect parasites; and to R. L. Post, associate entomologist, Robert D. Aanestad, Gordon W. Badger, Normal F. McCalley and Donald B. Nelson, North Dakota Agricultural College students who assisted in the work.

FEDERAL SEED ACT

The Federal Seed Act makes it unlawful for anyone to sell, offer for sale, or ship in interstate commerce any imported seed stained under the act, when mixed with seed of the same kind produced in the U. S., or to ship falsely labeled seed in interstate commerce. It was announced May 22 that during this season eight shipments of alfalfa seed had been seized under the act and action taken under Federal court decrees because of false representation as to origin. In most instances the presence of weed and crop seeds not ordinarily found in alfalfa seed grown in the Northern States indicated that the shipments consisted wholly or in part of seed from the southwestern U. S., though not so represented.

In two cases seed represented to be of Canadian origin and found to be mixed with domestic seed was ordered exported with as nearly correct labeling as to origin as possible. In two cases seed falsely represented to be of Canadian origin was ordered correctly labeled and also to be stained 10 per cent red to indicate it was unadapted to general agricultural use. Such staining would have been required had it been imported as of mixed Canadian and domestic origin. In other cases still seed falsely represented to be of domestic origin was ordered to be correctly labeled to comply with the Federal Seed Act. The Production and Marketing Administration enforces the Federal Seed Act, which became law August 9, 1939. This law also requires that imported seed meet certain quality standards and that seed in interstate commerce be completely and truthfully labeled, while it prohibits all false advertising of seed in interstate commerce.—USDA.

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[3] Baker, W. A., W. G. Bradley and C. A. Clark. Biological Control of the European Corn Borer in the United States. USDA Tech. Bull. 983. 1949.