NEW YORK'S FOOD AND LIFE SCIENCES BULLETIN NO. 79, MAY 1979

PLANT SCIENCES
ENTOMOLOGY (GENEVA) • 17

NEW YORK STATE AGRICULTURAL EXPERIMENT STATION, GENEVA, A DIVISION OF THE NEW YORK STATE COLLEGE OF AGRICULTURE AND LIFE SCIENCES, A STATUTORY COLLEGE OF THE STATE UNIVERSITY, CORNELL UNIVERSITY, ITHACA

The onion maggot and its control in New York

P. R. Ellis and C. J. Eckenrode

INTRODUCTION

The onion maggot, *Hylemya antiqua* (Meigen), is the most important insect pest of onions in Canada and in the northeastern and northcentral United States. This pest first reached North America from Europe in 1841, and since that time it has frequently devastated onion crops. It is particularly severe in New York where crops can be destroyed completely if no steps are taken to protect them. The insect can develop resistance to insecticides very quickly; many compounds recommended in the past had to be abandoned because they ceased to be effective against the pest. Also, there is evidence that the onion maggot is beginning to develop low but significant levels of resistance to several of the currently used insecticides. The insect's ability to develop resistance to insecticides threatens the production of onions grown commercially in New York and other states. Since very few new compounds are becoming available, there is an urgent need to use every possible practice that might help to alleviate the problem and to develop alternative control measures which can be integrated with the still effective chemicals.

LIFE HISTORY

The onion maggot is a pest only of crops in the onion family (Alliaceae); its hosts include onions (the most preferred crop), bunching onions, garlic, leek, shallots, and chives. Onions grown from sets and transplants, as well as from seed, are attacked. There is very little evidence to suggest that the pest is capable of maintaining high populations on the wild relatives of onions which may be pre-l.sent in some areas.

Adults.—The adults are flies which are somewhat smaller than houseflies but closely resemble them in general appearance (Fig. 1). They are greyish-black in color; they have brown stripes on the thorax, dark triangular marks on the abdomen, and are approximately 6 mm (1/4 in.) long. Three distinct broods, which may overlap slightly in some years, occur during the New York growing season (Fig. 2), but the appearance of the fly peaks is influenced by the weather. Flies which emerge in the spring are usually the most damaging, partly because of their high numbers and also because the plants are more vulnerable to attack during the seedling stage. Flies live for 2-4 weeks in the field and are capable of migrating several miles in search of onion crops. A week to 10 days after emergence and following mating, the female flies lay their eggs on the young leaves or necks of the onion plant or in the soil near the plants. If enough food is. available, each female is capable of laying several hundred eggs. There is much speculation concerning the adult's source of food. Although flies have been observed feeding on wild flowers in hedgerows, banks, and ditches, it is believed that many flies obtain their sugars and proteins from other as yet unidentified sources near the crop.

Eggs.—The eggs (Fig. 1) are white, elongated, and about 1.25 mm (1/25 in.) in length. The outer casing is ridged, has a faint hexagonal pattern, and there is a shallow depression down one side extending for about a third of the length. In the field, hatching usually occurs in 2-3 days.

Maggots.—The legless larvae or maggots (Fig. 1) which grow to a length of 8 mm (1/3 in.) are tapered and creamy-white in color. They usually enter at the base of the onion plant and commence feeding on the tissues using their hooked mouth parts. Typical maggot damage to young

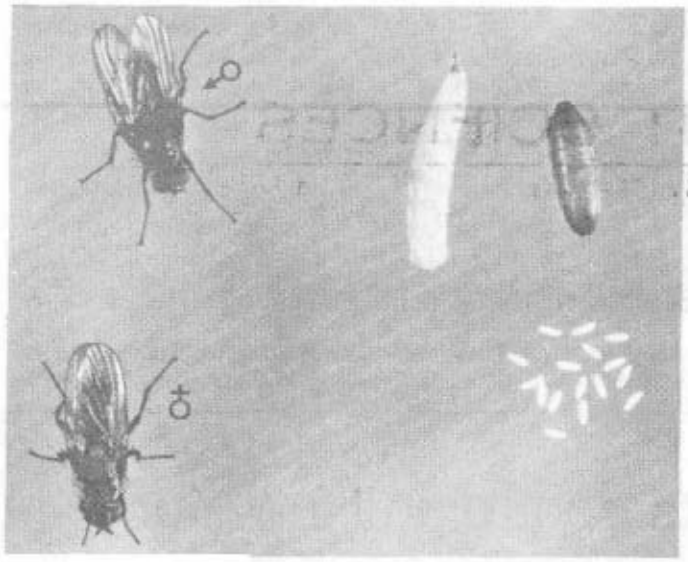

Figure 1.—Life stages of the onion maggot, Hylemya antiqua *(Meigen).*

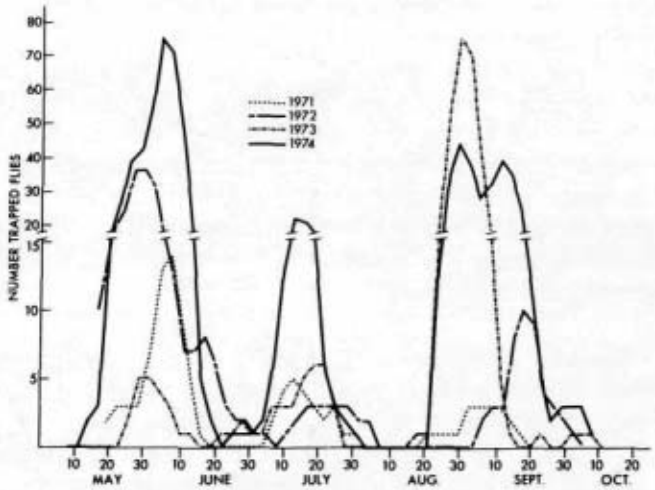

Figure 2.—Numbers of onion maggot adults collected from field traps at Elba, NY.

onion plants is illustrated in Figure 3. If seedlings are killed, the maggots migrate to other plants in search of food; more than 20 small seedlings may be killed by a single maggot. There are three larval stages, the total development taking 2-4 weeks depending on temperature. When fully grown, the maggots leave the onion plants and enter the soil to pupate at a depth of 5-15 cm (1/5-3/5 in.).

Pupae.—The chestnut brown pupae (Fig. 1) are 4-7 mm (1/6-1/3 in.) long. The insect overwinters as a pupa, and at other times in the season spends 2-4 weeks in this stage of its life cycle.

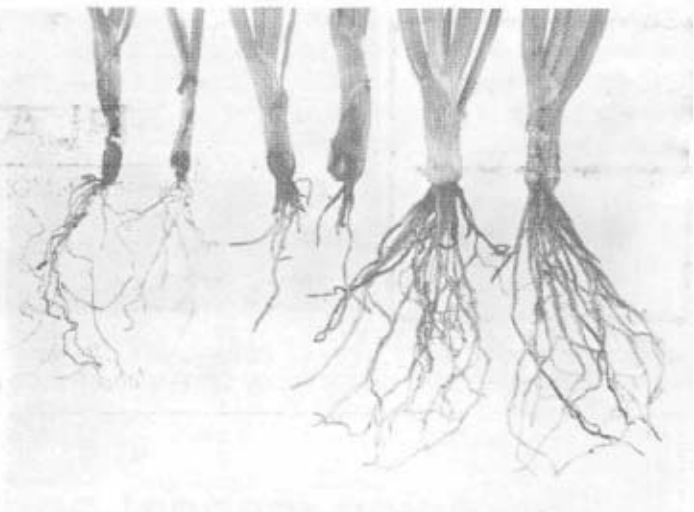

Figure 3.—Onion maggot injury on seedling onions. The two plants on the right are not damaged.

DAMAGE TO CROPS

The first sign of onion maggot injury is the wilting of foliage. The whole plant becomes flaccid and then collapses. This damage is particularly noticeable when the plants are seedlings (Fig. 4), the maggots frequently destroying groups of plants which leads to a patchy crop. Larger onions survive the attack but distorted growth accompanied by rotting of the tissues makes them unmarketable. Although the worst damage is usually noticed in the spring, considerable losses of bulbs at harvest have been reported in several states because of maggot feeding during September and October (Fig. 5). In addition to the direct damage resulting from maggot feeding, this insect is important because it can introduce and spread certain fungal and bacterial rots to onions.

CONTROL MEASURES

Insecticides.—Effective control of onion maggot at present relies entirely on the proper application of insecticides.

Figure 4.—Infested onion seedlings in the field.

This situation is likely to continue until some alternative measures are developed which can be used to supplement chemicals. In addition, precise monitoring of adult fly numbers will most certainly help to direct control measures toward peak onion maggot activity.

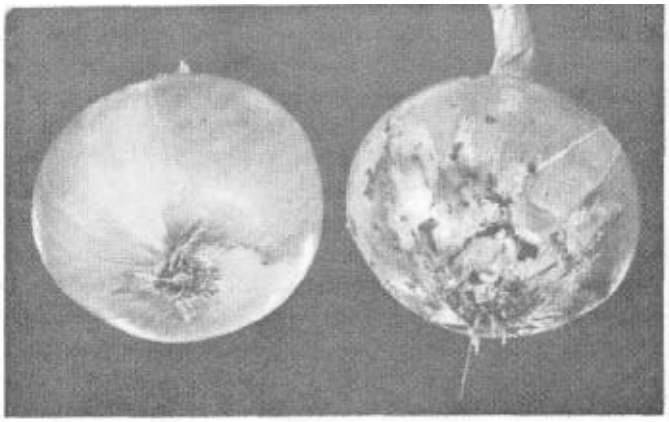

Figure 5.—Onion maggot injury on mature bulb. The injured bulb is on the right.

Insecticides are applied to the crop in a variety of ways: (1) as a seed furrow application in the form of a drench or granules (usually in combination with a fungicide). Furrow treatments with today's chemicals lack the persistence required to control mid- and late-season maggots and therefore, additional treatments may be necessary to supplement the furrow application; (2) for spring fly control, sprays are applied at 3-5 day intervals, starting in early May in Orange County and mid-May in upstate areas; and (3) for fall fly control to prevent maggots from invading the mature bulbs, sprays are applied at 3-5 day intervals beginning the second or third week of September, and, in Orange County at the beginning of September. The time to begin spraying may vary somewhat from year to year.

The recommended chemicals and their rates are listed in *Cornell Recommends.*

Very few new compounds are likely to be registered for use in New York State in the near future and therefore, ways of prolonging the useful life of existing compounds and ways of making them more effective are being investigated. Some of these ways of improving their effectiveness are discussed below.

Cultural Methods.—When possible, crop rotation of 2 or more years and isolation of onion fields from one another can reduce maggot populations considerably. Growing onions one year in every two significantly reduces the devastation that onion maggot can inflict when the crop is grown continuously. In the past, it was believed that piles of rotting onions and trash at the sides of onion fields were highly attractive to adult females for egg-laying, thus harboring large populations of the insect. Several recent studies show that onion maggots do not breed in large numbers in old cull piles. Nevertheless, strict attention to good husbandry should include the destruction of volunteer and cull onions and also the burning of debris from onion stores as it eliminates possible sources of onion maggot infestation.

Natural Enemies.—The onion maggot has many natural enemies which can help control its population in the field. Certain predatory beetles eat onion maggot eggs and larvae. Predatory flies and insectivorous birds consume the adults. Larvae and pupae are parasitized by various wasps and nematodes, and adults are commonly attacked by a parasitic fungus when conditions are cool and wet. Methods of rearing and releasing these biological control agents are being investigated in the hope of utilizing them for onion maggot control. At present, however, since all insecticide applications may reduce natural enemies of the onion maggot, foliar sprays should be applied only when adult maggot populations are present, thus minimizing destruction of natural enemies.

Plant Resistance.—The use of resistant crop varieties to control pests is an attractive idea. There is no costly equipment involved and no toxic or environmental hazards such as those frequently associated with the use of insecticides. In New York, bulbing onion varieties differ little in their susceptibility to onion maggot attack. However, certain Japanese bunching onions appear to resist attack of the maggots under some conditions. The potential of selecting for resistance and breeding with promising material is being investigated. Even a moderate degree of resistance to onion maggot could reduce the amount of insecticide required to give an adequate level of control and may help delay the onset of resistance to insecticides which are still effective.

Genetic Control.—In Canada and the Netherlands, much interest is being shown in the use of sterilized onion maggots in control programs; field experiments have already given encouraging results. In this approach, onion maggots are reared in large numbers in the laboratory and then sterilized chemically or by irradiation from a radioactive source. Sterilized flies are released into onion fields where they mate with fertile wild flies. No viable eggs are produced from these pairings. If sufficient sterilized flies are released into the area, the possibility of a wild female mating with a wild male is lowered to such an extent that there is a reduction in the number of fertile eggs produced. Repeated releases may lower the population to acceptable levels. The possibility of rearing and releasing flies which are genetically dissimilar to wild flies, and which lead to population decline, is also being studied.

Clearly, certain of the control measures described above are at an experimental stage. Others are of more immediate value. However, they all contribute information about the onion maggot, and it is only through comprehensive knowledge of the pest that we can make maximum use of the few insecticides that are presently available, and hope to reduce populations to reasonable levels.