

Controlling Symphylids

H. E. MORRISON



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H. E. Morrison

Associate Entomologist

SYMPHYLIDS are small, pearly white, centipede-like animals which feed on a wide variety of host plants. In some areas, they limit production of vegetables, mint, small fruits, nursery, and specialty crops.

The eggs, nymphs, and adults can be found during any month of the year. They become active in the spring, and can be seen in increasing numbers in the upper 6 to 8 inches of soil during July and August. They remain active in the upper soil until cold, rainy fall weather drives them deeper.

Length of life of a symphylid has not been determined. Adults kept in

captivity for over five years were capable of reproducing during the entire period. The number of generations each year has not been determined because of overlapping in development of various stages. There is at least one generation each season and ample time for two complete broods.

Because they can move deep into the soil, symphylids are difficult to control. Parathion and certain soil fumigants have given satisfactory results. The following suggestions, based on research* at Oregon State College, may be of value to growers.

Control in Annual Crops

Parathion

Parathion, a useful but hazardous insecticide, is now registered by the U. S. Department of Agriculture for symphylid control. Many growers have been satisfied with its performance. Although it will kill symphylids, it is short-lived in the soil and will protect crops for less than three months. In many instances, this is sufficient time for plants to establish good root systems and later produce normal yields.

It may not, however, be sufficient time to prevent severe cullage of root crops sold on the fresh market.

In some fields after use for three successive years, parathion has not measurably reduced symphylid numbers. Growers having a serious sym-

* Cooperation of A. J. Howitt, Western Washington Experiment Station, Puyallup; R. M. Bullock, Southwest Washington Experiment Station, Vancouver; and many growers is acknowledged.

phyllid problem and choosing to use parathion must use it each season to obtain adequate crop protection.

Formulations

Parathion can be obtained in various formulations. Wettable powders and emulsifiable concentrates are designed for use in spray machinery. Granular materials and fertilizer mixtures are prepared for application by fertilizer spreaders. A low percentage (1 to 2) of parathion in the granular formulation or fertilizer mixture will make it easier to apply the material evenly over the field.

Dosage

Any of the formulations available can be used. Spread the material evenly over the soil surface at the rate of 5 pounds actual toxicant per acre. Mix immediately (within 30 minutes) in the top 4 to 6 inches of soil. Since parathion provides a short period of protection, apply the toxicant shortly (within 48 hours) before planting.

Precautions

Growers who use parathion for symphyllid control must recognize the

potential hazards involved. Failure to follow proper precautions may result in a serious accident. Symphyllid control involves using parathion at strong concentrations. By comparison, it is approximately 40 times the concentration orchardists use. Some suggestions:

¶ Wear protective, waterproof clothing while spraying. Change or launder clothing and bathe daily. Wear rubber gloves at all times when handling parathion.

¶ When using parathion, wear a respirator approved by the U. S. Department of Agriculture for protection against parathion dust and vapor. With high exposures use a full face, canister-type mask. Heed the manufacturer's warnings regarding protective limits of respirators.

¶ Do not eat, smoke, or chew while mixing or applying organic phosphorus insecticides such as parathion.

¶ Never measure nor leave mixtures of these insecticides in beverage bottles or in labeled cans or boxes which have formerly contained food products.

¶ Bury spilled insecticide, and



Symphylids reduced growth of above cabbage plants. Because they can move deep in the soil, symphyllids are difficult to control. Parathion and certain soil fumigants promise control.

clean contaminated area with a weak lye solution.

¶ Burn or bury empty insecticide bags or other containers. Never reuse them.

¶ Always store all insecticides out of reach of children—best in locked premises.

¶ Cover crops treated with these insecticides should not be used as pasture until 21 days after treatment.

Suggestions for parathion use*

Before using organic phosphorus insecticides, get in touch with your physician. He will be in a better position to deal with a sudden illness if he is told of probable spraying dates and other details. He may wish you to have a supply of 1/100 gr. atropine tablets for use in an emergency. This drug should never be used before exposure to organic phosphorus insecticides, for it may hide important warning symptoms. Use 1 or 2 tablets as directed by your physician and only after definite symptoms occur. Never take atropine without calling your physician at once. Any person who is ill enough to receive a single dose of atropine should remain under medical observation for at least 24 hours, because the atropine may produce only a temporary relief of symptoms in what may prove to be a serious case of poisoning.

Watch for these symptoms*

Organic phosphorus insecticides easily enter the body through contact with the skin, through the mucous membrane of eyes, nose, mouth, and throat, and through breathing. Repeated exposures to these insecticides may, even without symptoms, increase susceptibility to poisoning. After several days or weeks of exposure without difficulties, a relatively moderate exposure

may suddenly produce serious poisoning symptoms.

Initial symptoms are giddiness, headache, nausea, vomiting, excessive sweating, and tightness of the chest. These are followed by or accompanied with blurring of vision, diarrhea, excessive saliva, watering of the eyes, and twitching of muscles. One of the most characteristic signs is constriction of the pupils but this may be preceded by dilation. Later signs are fluid in the chest, convulsions, respiratory failure, coma, and loss of urinary or bowel control.

What to do for poisoning*

1. In severe cases of poisoning, breathing may stop. In such a situation artificial respiration is the most important first aid until breathing has resumed.

2. Get the patient to a hospital or physician as soon as possible. Give artificial respiration on the way if the patient turns blue or stops breathing. Take along a label from one of the insecticide containers for the doctor's information.

3. Never try to give anything by mouth to an unconscious patient.

4. INTERNAL—If the insecticide has been swallowed and vomiting has not resulted, induce vomiting by giving a strong soap solution or 1 tablespoon of salt dissolved in $\frac{1}{2}$ glass of water. Give some neutral material such as milk or water then induce vomiting again.

5. SKIN—Where the insecticide has come into contact with the skin, immediately remove all clothing and bathe the patient with generous

* These sections were prepared by the Oregon State Board of Health and the U. S. Public Health Service.

amounts of soap and water, rinsing thoroughly. If washing soda or baking soda is available use it also in decontaminating the skin.

6. EYES—If spray gets into the eyes, wash them immediately with flowing water.

7. The patient should lie down and be kept warm.

Emergency consultation*

Physicians or hospital representatives may obtain emergency consultation by calling:

1. Oregon State Board of Health, Portland, Oregon
Phone—CApitol 6-2161
Phone (after hours including Sundays or holidays)—CApitol 2-1500
2. University of Oregon Medical School, Department of Pharmacology, Portland, Oregon
Phone—CApitol 8-9181
3. U. S. Public Health Service, Wenatchee, Washington
Phone—Normandy 2-5506
For night or holidays call Griff Quinby, M.D., Normandy 3-2944; Bill Upholt, Normandy 3-4845; Ken Walker, Normandy 2-2091.

Soil Fumigants

Fumigants which have given satisfactory symphyliid control are:

¶ D-D Mixture at 30 to 35 gallons per acre.

¶ Vapam 40 pounds (10 gallons 31% material) per acre.

¶ Nemagon 35 pounds (4 gallons 50% material) per acre.

¶ Ethylene dibromide (10 gallons 85% material) per acre.

When properly timed and applied, certain soil fumigants have given satis-

factory symphyliid control. Although fumigants do not have residual properties, one application has reduced and held symphyliid populations to a low level for three or more years. Fumigants are expensive and their use requires hard work and careful planning. Do not fumigate without adequate equipment. The following considerations may assist growers who contemplate the use of soil fumigants.

Timing of application

Best results have been obtained when the fumigants are applied from mid-July through August. Soil temperatures are high at this time and symphyliids are normally in the upper 6 to 8 inches of soil, within reach of the fumigant.

Equipment

Special equipment is needed to apply soil fumigants and two types are commonly used. These are the blade applicator and the chisel applicator. They are described in Oregon State College Station Bulletin 555, *Soil Fumigation Equipment for Nematode Control*. Both pieces of equipment have been satisfactorily used for symphyliid control. If the chisel applicator is used, chisel spacings should not exceed 8 to 9 inches.

It is important to apply the fumigant below the level of symphyliid concentration to prevent them from moving away from the fumigant. Generally, an application of 7 to 8 inches deep is enough.

Seedbed preparation

Soil should be in fine tilth with a complete absence of clods. Fumigants follow the path of least resistance and do not penetrate clods. It is also difficult to hold fumigants any length of time when the soil is cloddy. If the

soil is too wet, fumigants will not diffuse through it properly. If too dry, symphyllids will not be in the upper soil where the fumigant can reach them. Soil must be friable, moist, and in the best seedbed condition possible.

Planning for soil fumigation

It is frequently necessary to plan months in advance. Satisfactory soil fumigation cannot be carried on while crops are growing.

In some instances, only parts of a field may require fumigation and the center of symphyllids (target area) is well defined by sparse vegetation or plants with stunted growth. However, symphyllids may extend for a considerable distance beyond these target areas and plants may appear to have normal vigor.

Locate these outer limits by digging at various intervals until only 2 or 3 or no symphyllids are found. Late June through July is good for carrying on surveys of this kind, provided soil moisture in the upper soil is good and soil has not been stirred recently.

Square off the outer limits of the infestation so the fumigant can be accurately applied, and identity of the treated area can be determined and maintained.

Crop residues obstruct the movement of fumigation equipment through the soil and may also absorb some of the fumigant. To prevent this, shred or beat the cover crop prior to disking or plowing. Do this early in the season so crop residues will have broken down by July or August. Before applying the fumigant, firm the seedbed to provide adequate tractor traction. With poor traction, it is difficult to pull the applicator through the soil at the depth necessary for good fumigation.

Location of symphyllid populations

Before applying fumigants, determine the depth at which symphyllids are located. If the majority are concentrated in the top 6 to 8 inches of soil, the fumigant can be applied.

If the soil has become dry, and symphyllids are below 8 inches, give the soil a heavy sprinkler irrigation (2 to 3 inches of water). After 7 to 10 days, when the soil is again in a good workable condition, symphyllids move to the upper soil and the fumigant can be applied. It is best to recheck, however.

Pack soil after fumigation

Compress the soil with a float or roller immediately after the fumigant has been applied. Following this, a light sprinkler irrigation (about $\frac{1}{2}$ inch) prevents rapid escape of the fumigant. Failure to follow this procedure may result in a control failure.

Replanting

Soil fumigants kill plants. Do not apply fumigants closer than the drip line to established trees, bushes, or shrubs. The toxicity of fumigants varies according to dosage used, material, crop susceptibility, soil temperatures, etc. For this reason no definite rules governing a safe time interval before replanting can be given. Generally, a 2- to 3-week period is sufficient, providing soil has dried. A thorough disking of the fumigated soil before replanting will help release any fumigant which may have remained in the soil.

In areas which overflow, it may be necessary to plant a cover crop 2 to 3 days after the fumigants have been applied. It has been observed that ryegrass is resistant to the toxic effects of most fumigants and can be used for

this purpose. Vetch and other legumes have been susceptible.

Precautions

Depending on the chemical, soil fumigants may be corrosive, caustic, skin irritating, and toxic if taken in-

ternally. Flush equipment with fuel oil immediately after use to keep it in good condition. Precautions are always given on the manufacturer's label.

Control in Established Plantings

Efforts to control symphylids in established plantings have met with varying degrees of success. In some instances temporary relief has been obtained. This may or may not be satisfactory, depending on the crop and degree of infestation.

Side Dressings

As yet, no satisfactory method has been devised for fumigating soils in established plantings. Attempts have been made by the Oregon Agricultural Experiment Station to apply the fumigants and other materials as side dressings on one or both sides of the row. These control measures have been unsuccessful, probably because of the compact nature of the soil in the row.

Drenches

In several instances, an aldrin drench has prevented symphylids from destroying planted strawberries. In one instance, 8 pounds of aldrin (25 per cent wettable powder) per 100 gallons of water was mixed in the spray tank and metered out to individual plants at the rate of 1 pint per plant. In another instance, this rate was reduced to $\frac{1}{2}$ pint per plant by the use of an injection nozzle on the spray hose. In this way, the liquid was forced into the soil under pressure.

Emulsifiable concentrate formulations used as a drench caused serious

plant injury. It is important that the material be applied after harvest or, if applied before harvest, the crop should not be harvested because of harmful residue. With a treatment of this kind applied before harvest, it would not be possible to keep the crop within the established residue tolerance of 0.1 ppm.

Application Through Sprinkler Irrigation Systems

This has serious limitations. Even on calm days, distribution of material over the soil surface is uneven. If applied through a sprinkler system, material should be metered into the irrigation line in a minimum time of 30 minutes. Use only water-soluble toxicants or emulsifiable concentrates, and apply only on days when the temperature during application is not above 80° F.

Soil is an excellent filtering agent and little of the toxicant will penetrate below a depth of 1 to 2 inches. Depth of penetration will vary with conditions of the seedbed at the time of application.

Here are some materials which might work best:

Vapam

This water-soluble material lends itself to application by sprinkler irrigation systems. Many failures in controlling symphylids have been ob-

served, however, when Vapam was applied to established crops such as strawberries, mint, etc. These failures have been associated with the compacted soil when the material was applied. Results with Vapam have been generally favorable when the soil was in a good seedbed condition.

Parathion

The emulsifiable concentrate form has been applied to established crops with varying degrees of success. In general, plants tend to recover from symphyliid damage rapidly. But on pole beans, the growing season was not long enough for the plants to develop a root system with adequate vigor for normal production.

In some instances, parathion ap-

plied in this manner may provide the added spark necessary for the establishment of young strawberry plantings. Strawberries generally tend to maintain themselves in symphyliid-infested soil if they can survive the first season. Some varietal differences have been observed. Marshalls are more resistant to symphyliid damage than Northwests.

If parathion is applied through sprinkler irrigation systems, 21 days should elapse before crops are harvested. In addition, field workers must stay out of the treated area for 7 to 10 days unless they wear protective clothing. Livestock (sheep, geese, etc.) should not be allowed in the treated area for 21 days.

Control in Home Gardens

Because of the many and varied kinds of plantings commonly found in home gardens, no specific recommendations are made for symphyliid control. Home gardeners should not use parathion because of the extreme hazards involved. Soil fumigants, depending on the crop planted, could be tried but materials of this kind must be ap-

plied only by experienced individuals.

In many instances, thorough stirring of the soil immediately before planting or use of rotary tillers in seedbed preparation will scatter symphyliids and make it possible to grow normal crops. Practices of this kind have no permanent value, but make it possible to live with symphyliids.

Control in Greenhouses

Under greenhouse conditions, symphyliids reverse their seasonal history and become troublesome in the late fall and winter. In most instances, the difficulty is encountered in ground benches.

Parathion, if applied by experienced personnel at the rate of 5 pounds toxicant per acre (1.8 ounces per 1,000 square feet), is reported to

have given good crop protection. Danger encountered in handling and applying it are intensified under the closed greenhouse conditions.

Experience is lacking in the use of the newer fumigants in greenhouses. Although symphyliids may be satisfactorily controlled, escaping fumigants may kill some plants within the greenhouses or even in adjoining ranges.