

# Insects Infesting Golf Courses and Lawns

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Proportioning machine in operation

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## FOREWORD

The many calls that come in asking for information about the control of insects on golf links have inspired the writing of this bulletin. Only the more common pests of golf links have been included, and an attempt has been made to make the discussions brief and to the point. It is hoped that the bulletin will prove useful to the many keepers of golf links and to the owners of lawns attacked by insects.

R. H. PETTIT.

## INTRODUCTION

The same insects that infest golf courses are also found in lawns. The arrival of several new pests in the East, among which the Japanese beetle occupies a prominent place, has led to the development of new methods of control for sod-inhabiting insects. Notable among these new methods are the use of arsenate of lead worked into the surface of the soil, and the use of carbon disulphide emulsion. Both these methods are comparatively little known in Michigan at the present time, as well as the use of the proportioning machine for making the application of carbon disulphide emulsion.

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## WEBWORMS

Small moths, or millers, from one-half to three-quarters of an inch in length, and with the wings curved and rolled around the body in a cylindrical fashion, are usually plentiful in summer and in early fall around window screens and in the vicinity of bright lights. They usually alight head downward and sit quietly between flights. They are the adults of sod webworms (*Crambus*), of which there are several species common in Michigan.

The larvae are usually pink or brown, marked with comparatively dark spots, each one of which bears a bristle and they live in silk-lined burrows in the sod of golf links and in lawns where they feed on the grass roots. Often, enormous

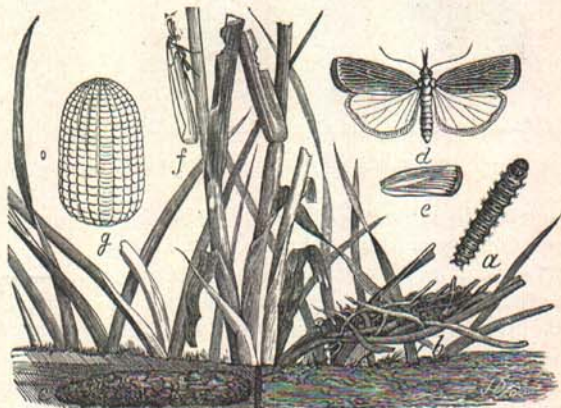


Fig. 1.—Vagabond crambus or sod webworms. From U. S. D. A. Bureau of Entomology.

numbers of these creatures collect in a comparatively small space and kill so much of the grass as to create conspicuous spots.

As before stated, there are several species which vary in habits so that a succession of different species and different generations of the same species is likely to be found all summer. These webworms belonging to the genus *Crambus* are also found in old pastures and in meadows, where they are usually easy to control by fall-plowing. However, in the case of golf links and lawns where grass is grown continuously over a long period, fall-plowing is taboo and other methods of control must be substituted for it. As stated there are two or more generations in most cases.

In case a golf green or lawn becomes infested with these webworms and it is desirable to kill them off immediately, they may be controlled by an application of carbon disulphide emulsion (see p. 9) or with a spray of one of the pyrethrum extracts (see page 11). These materials are marketed under various names and are readily obtainable in

most cities. However, a more permanent treatment is one by which arsenate of lead is worked into the soil, usually at the rate of five pounds to 1,000 square feet of lawn surface (see p. 9). This will not kill half or full-grown worms, but will kill the small worms just after hatching. It is, therefore, to be recommended for a more or less permanent treatment.

## JUNE BEETLES

The larvae of June-beetles are the well-known white grubs which work under the surface of the soil and eat off the roots of grasses and other plants. There are quite



Fig. 2.—June-beetle (*Phyllophaga fusca*).

a number of different species of June-beetles present in Michigan, most of which require three years underground for development before becoming adult beetles. Thus, every third year there is a time during May and June when June-beetles are very prevalent, and when they lay the eggs which will hatch into tiny white grubs that will make a vigorous attack the year following the flight of the June bugs. The third year is of less consequence than the second year, because the larvae usually stop work in the middle of the summer and retire down deep to pupate; and, late in the fall, they change into adults in the ground. It will be seen from the foregoing that every third year is the flight year of the beetles, that the year following will be one devoted to destruction by the larvae, and the third year will be devoted also to a similar larval attack, only one of short duration. For a rather full discussion of the habits of white grubs, see Circular Bulletin No. 132.

work under the surface of the soil and eat off the roots of grasses and other plants. There are quite a number of different species of June-beetles present in Michigan, most of which require three years underground for development before becoming adult beetles. Thus, every third year there is a time during May and June when June-beetles are very prevalent, and when they lay the eggs which will hatch into tiny white grubs that will make a vigorous attack the year following the flight of the June bugs. The third year is of less



Fig. 3.—Larva of June-beetle.

**Control**—It is a notable fact that golf greens treated with arsenate of lead at the rate of five pounds to 1,000 square feet of surface are never badly affected by white grubs. It would appear that while the treatment may not entirely eradicate the grubs, still it cares for so many of them that the attack is usually quite light in greens that have been treated. This is also true in the case of lawns. For a description of the treatment, see p. 9.

### WIREWORMS

Wireworms are the larvae, or immature stage, of click-beetles, snapping-bugs. They delight to work in sod land, and prefer acid land to that which is neutral or alkaline. They require from one to six years underground to get their growth. Wireworms are small, underground, hard-bodied creatures that measure from half an inch to an inch in length. They are very firm-bodied and require several years for their underground existence, after which they change into snapping beetles, click-beetles, which lay the eggs for the next generation in sod land.

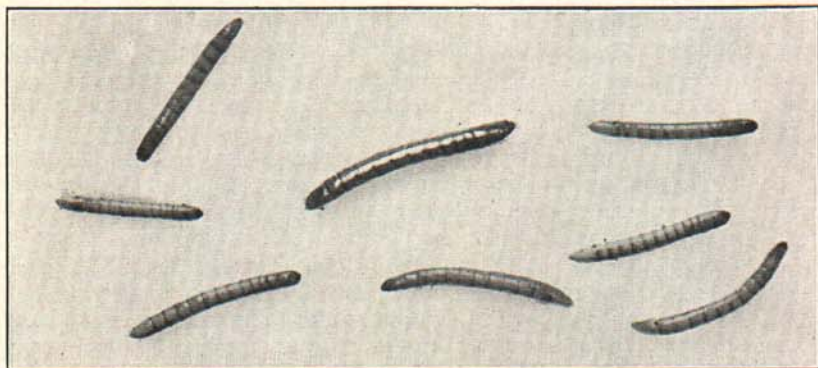


Fig. 4.—Wireworms.



Fig. 5.—Adult click-beetle.

They are extremely difficult to control even on a farm, where rotation can be practiced and where liming the soil may do away with the acid condition. On land that is maintained for many years in grass, and especially land which is kept somewhat sour in order to reduce the weed content, it is almost impossible to get rid of wireworms without great expense. To be sure, the carbon disulphide emulsion treatment of the soil is effective and may be used about the greens and other places in a limited way. However, it is too expensive to use extensively except under very unusual conditions. Liming the soil is helpful, especially if the lime is worked down into the soil, but such a practice usually brings on a large number of weeds and is to be avoided for this reason.

Under conditions where the expense is justified, it will be found practical to keep the greens free from wireworms by the use of a carbon disulphide emulsion. The treatment with arsenate of lead is also helpful to a degree. The whole links should be kept in a vigorous condition by the use of fertilizers, and perhaps touched up here and there where the numbers of wireworms appear to be excessive.

## ANTS

Probably no other insects are more annoying or more prevalent in golf links than ants. Several species are involved, most of which feed on sweets by preference. Such ants can be controlled by the persistent use of brown sugar and paris-green, mixed at the rate of one ounce of paris-green to one pound of the brown sugar. Granulated sugar is useless in this connection because it has no odor and is not attractive to ants. Stir the paris-green and brown sugar together very carefully and then sprinkle lightly where the ants are working. The ants will pick up particles of this poisoned sugar and carry it down into their galleries where it will be fed to the young, and in a month or so the ants will disappear.

In case large hills are found, then half a teacupful of the mixture should be placed in a cavity opened in the hill, after which the dirt should be replaced and the hill should be allowed to remain undisturbed for several weeks. It will be necessary in most cases to repeat this treatment from time to time during the entire summer. At least, after each rain or heavy sprinkling the treatment should be repeated. It is, of course necessary that precautions be taken to avoid accidents, since dogs and children might get some of the poisoned sugar if it were carelessly applied. All lumps should be discarded and the poison should be sifted on very lightly wherever the ants are at work. The reserve stock should be kept in a tightly-closed container, well-labeled, and preferably hidden away where it is inaccessible to irresponsible individuals. Of course, a larger amount can be prepared in the same proportions, using one part of paris-green to sixteen of brown sugar.

The writer likes to keep this poisoned sugar bait in a two-quart Mason fruit jar with the cover screwed down and a label pasted on the jar. This jar is then hidden away in the basement where it is unlikely to be found by children or to be broken and the contents spilled on the floor.

## EARTHWORMS

Earthworms are undesirable in golf greens and to a lesser degree in lawns. They occasionally occur in objectionable numbers. Earthworms may be controlled by a thorough drenching with a solution of mercuric chloride or corrosive sublimate, applied at the rate of three ounces of the crystals in 50 gallons of water. This should be sufficient to treat 1,000 square feet of greens. Before and after the application has been made the ground should be thoroughly sprinkled, in order to bring the worms to the surface and to wash down the chemical into the soil. It is also stated by W. R. Walton in *Farmers' Bulletin No. 169*, page 12, that corrosive sublimate may be used in the dry form for the same purpose. Mr. Walton recommends that two or three ounces of the crystals in a finely divided condition be mixed into two cubic feet of dry sand, and that the mixture be scattered evenly over 1,000 square feet of green. These applications should be followed by liberal watering.

In preparing and applying this mixture, the solution should never



be allowed to come in contact with metals. Either wooden barrels should be used or, if metal containers are used at all, they should be liberally coated on the inside with asphaltum paint or some other material that will prevent the liquid from coming in contact with the metal container. In making an application of mercuric chloride, the soil should be slightly moistened in order that water will soak in quickly and so that the worms will be attracted to the surfare. It should not be loaded with water, however.

Mercuric chloride in solution immediately amalgamates with most metals, ruining the solution and the container, as well. Mercuric chloride is a violent poison, sometimes known as corrosive sublimate, and is dangerous to all who handle it. It should not be allowed to come in contact with the hands or the clothing, and, *if by any chance poisoning occurs, the treatment is to first send for a physician and then induce vomiting, giving whites of eggs and milk.*

Where the soil receives the regulation arsenical treatment (see p. 9) the problem of controlling earthworms does not arise.

### ARSENATE OF LEAD TREATMENT

Five pounds of dry powdered arsenate of lead is thoroughly and evenly mixed with a bushel of sand, and then broadcast over 1,000 square feet of space and raked in so that it is finally worked into about the top half-inch of soil. This will not kill the half-grown or full-grown larvae of the sod webworm or of white grubs. Therefore, it is useless for immediate results. However, if the application is made before the attack begins, such treated spaces are usually found to be free from attack. It would seem that the very small worms take in a little of the soil in their feeding on the roots of the grass, and that the eating of this poisoned soil usually results in their deaths. Therefore, it is recommended that each golf green be treated in this way as a permanent protection against the sod webworm. Each year after the first heavy treatment there should be a repetition of the treatment, using two pounds of arsenate of lead in place of the five pounds originally prescribed.

### CARBON DISULPHIDE EMULSION

A soil treatment that is coming into use more and more each year consists in putting a dilute carbon disulphide emulsion on the roots of grasses by means of a proportioning machine. Carbon disulphide emulsion is made by mixing carbon disulphide with an emulsifier, usually solutized castor oil, and diluting this with water.

A 50 per cent miscible carbon disulphide emulsion can be made by mixing carbon disulphide with an equal quantity of solutized castor oil. This is 50 per cent carbon disulphide, with which the tank of the proportioning machine is filled. Commercially prepared miscible carbon disulphide is for sale by various firms and is used in the same way.

Best results from the use of carbon disulphide have been obtained by

following the formulae and methods developed by the Japanese Beetle Laboratory, U. S. D. A. Department of Entomology, Moorestown, New Jersey. The dilutions, or in other words the amount of emulsion fed into the stream depend on the minimum temperature of the soil at a depth of six inches. If the soil is from 40 to 50 degrees F., 68 cc. are fed into 10 gallons of water. If the soil is 50 to 60 degrees F., 57 cc. are used. If the soil is 60 to 70 degrees F., then 45 cc. are sufficient for 10 gallons of water. The concentration of the emulsion should not be greater than is necessary, as too strong concentrations may injure the grass.

In making the application, about two and one-half gallons of dilute emulsion are required for each square foot of grass surface. Carbon disulphide emulsion is effective against all forms of insect life in the top six inches of the soil when applied in the manner described. It acts also somewhat as a fertilizer, since it stimulates the growth of grasses and other vegetation. Its fumes are explosive and inflammable, of course, in the concentrated form, and no fire should be brought near it, nor should the fumes from it be breathed more than is necessary.

### THE PROPORTIONING MACHINE

The proportioning machine is a piece of apparatus designed for adding chemical solutions to a stream of water in definite ratio. It consists of a short length of inlet hose, a pressure reducing and regulating valve, a water meter, a pressure gauge, and a proportioning jet to which it attached a suction pipe and strainer, all mounted on a chemical container. It is used in applying insecticides on a large scale where a one-inch discharge hose is used. Such materials as miscible carbon disulphide or carbon disulphide emulsion may be distributed by this means in a highly dilute condition to the grass, where it soaks down into the soil and kills the insects. In use, the container is filled with carbon disulphide emulsion, properly reduced or diluted and the inlet hose is connected to a hydrant. The outlet is connected to a long line of hose, which may be carried from place to place to reach all points where the treatment is to be made. The water, in passing through the apparatus, is constantly receiving material from the tank or, in other words, a small amount is constantly added to the stream of water passing through the apparatus. The machine may be used for distributing fertilizers or chemicals or carbon disulphide emulsion intended to kill insects in the soil.

### ARSENICAL SPRAY

The standard arsenical spray used against chewing insects is arsenate of lead used at the rate of three pounds to 100 gallons of water, with or without a little flour used as a sticker. This is useful only for insects that chew their food, and, of course it can be made up in smaller quantities by reducing the amounts while preserving the proportions, thus four and one-half level teaspoonfuls of arsenate of lead to a gallon of water would be sufficient.

### NICOTINE SPRAY

The standard spray for sucking insects affecting shrubbery and other plants which are used to beautify golf grounds and lawns is nicotine. It is now sold as 40 per cent nicotine sulphate. The ordinary strength recommended when used in the orchard or when applied with high pressure by a spraying machine is one pint to 100 gallons of water with three or four pounds of cheap soap added. This is, however, much too weak when the application is made with a hand atomizer, because of the lack of power in the latter case. A spray applied with 200 or 300 pounds pressure is much more effective than one applied with only 10 or 15 pounds pressure, and in the latter case it is necessary to make up for the lack of pressure with a stronger solution. The strength recommended for use in a hand atomizer is one tablespoonful of nicotine to one quart of strong soapsuds. Cheap soap is better than an expensive soap, because of the presence of an alkaline in the former which is required to liberate the nicotine in its volatile condition. When applied at this latter strength, the mixture will kill all the insects that are hit, not only sucking insects but chewing insects as well, and with safety to most plants.

### PYRETHRUM EXTRACTS

Pyrethrum is a non-poisonous powder made from the pyrethrum plant and one which paralyzes all insects with which it comes in contact. It is a contact insecticide, therefore, and also one that kills very quickly. Various standardized extracts of pyrethrum are now on the market and can be purchased locally in most cities in Michigan. These extracts, when diluted with water and sprayed on a golf green, cause the insects to come to the surface and to wriggle about in a very lively way. After they have thus been brought to the surface, they can be killed by a second spray applied 15 or 20 minutes afterward.

It happens that there are now a number of pyrethrum extracts on the market, of various strengths and characteristics, so that no table of dilutions can be provided. A little experimenting with the particular brand that one happens to get will quickly settle the strength required.

