

Foreign Grubs, a Menace of the Future

By B. R. LEACH

Associate Entomologist, U. S. Department of Agriculture and Consulting Entomologist,
U. S. G. A. Green Section

IN last month's article I discussed the marked change in the status of grub control from a minor golf course maintenance problem to that of a major one due to the entrance into this country of three foreign species of turf feeding grubs from Japan. I stressed the fact that, as these three foreign species of grubs gradually spread over the country, they will cause pronounced changes in green-keeping methods and practice and that grub control—instead of being the occasional annoyance caused by our native species of grubs—will be an ever-present, annual concern of all golf clubs situated in the rapidly expanding area infested by these foreign species.

In view of these facts, it would seem logical at this time to give in detail an intimate account of the history and doings of the most prominent of these three insects, namely the Japanese beetle (*Popillia japonica*) during the past six or seven years in its relation to golf courses; and in addition to describe its habits and behavior in fine turf. This discussion should provide a fitting background to subsequent discussion of control measures since the latter are, in a measure, based on the habits of the insects.

The Japanese beetle was first discovered in an ornamental nursery near Riverton, N. J., in 1916. Subsequent investigation pretty clearly demonstrated that it had gained entrance to the United States in the matted roots of *Iris* plants imported from Japan. It could not have been long in the country at that time because only a few specimens were picked up by an entomologist on an insect collecting trip through that section. He was immediately impressed by the unusually bright green and bronze coloring of the beetle and realized that it was not a native species. Identification by expert coleopterists disclosed its real identity, and the state and federal agricultural officials realized they had another unknown quantity to deal with.

During the next two or three years, the insect gradually increased in numbers and

spread out over a few square miles of country in the vicinity of Riverton. At that time and often since that time the technical men stationed on the Japanese beetle project were compelled to listen



The beetle deposits its eggs underground and the larvae, hatching, feed on the roots of the vegetation.

with superficial politeness to the vapid and querulous queries of the chronic neophytes who inquired, with all the sincerity of the mentally thick-headed, why didn't we get busy and wipe out the beetle during those early years when it was present in relatively small numbers and infested only a few square miles of territory. We were even accused of standing by and allowing the beetle to increase from the not disinterested motive of insuring the permanence of our jobs.

We usually silenced these self-appointed critics by asking for suggestions as to the best way of going about this job of wiping out the beetles. One genius advised that we screen all the infested land with fly-screening. Figure this out per square mile at 3 cents a square foot for wire cloth and then try raising, by public subscription, the millions of dollars required.

Another deep thinker advised soaking every foot of the infested area with kero-

land conditions the grubs did no apparent damage to the rough turf when present in numbers as high as three hundred to the square yard. The pasture grasses seemed to be about as presentable looking and thrifty, with all these grubs present, as they would have been with the grubs absent.

No intensive study of the feeding habits of the grub had as yet been made and in view of the apparent immunity of the farm

WHILE the problem of Japanese beetle control is of direct interest principally to eastern clubs, since only they are within the known affected area, the general subject of eliminating grubs from our greens is of interest to all greenmen. Indications point to local grub invasions in the middle west next season.

This is the second of a series of articles GOLFDOM is printing on the subject. Another will follow in an early issue.

sene oil and was quite annoyed when told that the grub of the Japanese beetle liked petroleum with its meals. I am absolutely convinced that Barnum was a keen observer of the human animal.

Jap Beetle Here to Stay

As a matter of fact the extermination of this beetle was a stark impossibility. In the first place, in 1920 there was no method known among entomologists, either in this country or abroad, whereby grubs could be killed in soil on a large scale. Furthermore, even today the methods for killing grubs in soil, as worked out by myself and assistants at the Japanese beetle laboratory will not give in practice a clean cut 100 percent kill of grubs. We are satisfied with 90 to 95 percent, and I seriously doubt whether 100 percent kill can ever be obtained in large scale operations regardless of the method employed. Hence, the unvarnished statement that extermination of the Japanese beetle at any period in its history in this country was an impossibility.

In 1920, the beetles were injuring the foliage of trees and shrubs to some extent by their feeding, and the grubs could be found in fair numbers in some of the pastures and other grasslands in the center of the infested area.

Up to this time, no golf course had experience of the grubs in their greens or fairways and the only indication of the grub's capacity to destroy fine turf was gained by observing their work in the rough grass of farmlands. Under the farm-

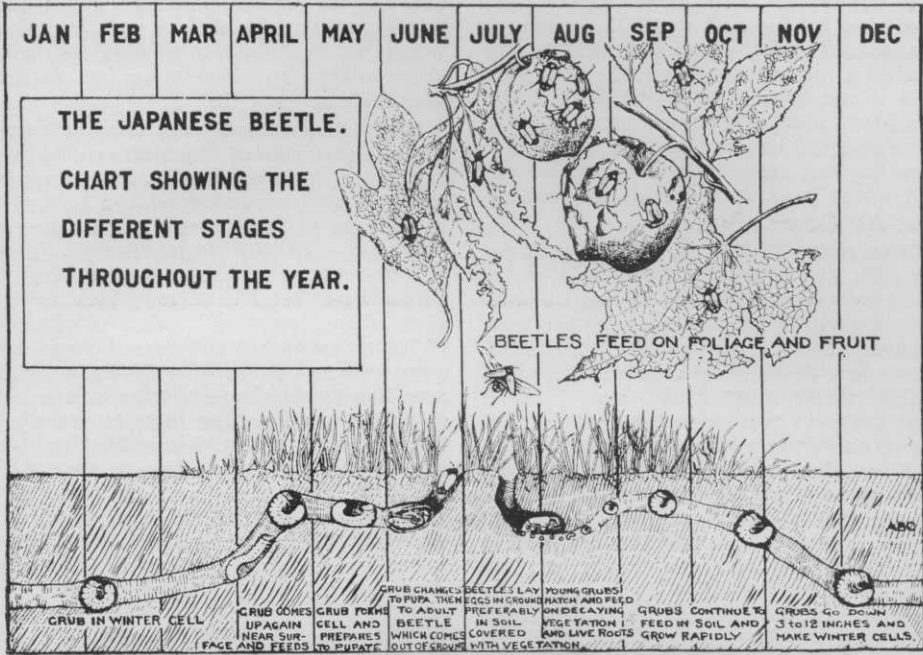
pastures, the entomologist jumped to the premature conclusion that the grubs fed only on decayed vegetable matter in the soil and did not eat the living roots of grasses and other vegetation. It was therefore felt, with considerable confidence, that the grub stage of this insect would not prove destructive to agriculture and that the beetle proper, with its foliage destroying tendencies, was the only phase of the Japanese beetle problem to be concerned about.

That this idea of the grub's innocuity to turf was premature and unfounded was shown by more detailed study of the grubs feeding habits conducted in 1921. These biological studies showed conclusively that the grub fed on decayed organic matter in the soil only for a very few weeks after hatching from the egg and that, during the later two-thirds of its life as a grub, the main diet was the living roots of grasses and other plants.

Country Clubs Become Alarmed

Thereupon, the golf clubs on the edge of the then infested area began to prick up their ears and to wonder just what they were to be confronted with in preserving the turf on their courses from the ravages of this grub. The golf clubs asked for assistance and I was detailed to find a method of killing the grubs in the greens.

It was intensely interesting to watch the steps in the gradual infestation of the Riverton Country club, the first golf course in this country to feel the weight of the



Japanese beetle. In 1921 the beetles were flying around the course during July and August in fair numbers and in the fall some slight injury was noted to the turf on the edges of several of the greens. In the spring of the following year, some turf injury showed up in spots on the approaches and fairways, but nothing of an alarmingly serious nature.

During the summer of 1922, the beetles were decidedly more numerous on the course than during the previous year. In the fall, careful examination of the turf on greens and fairways showed a grub population as high as 200 grubs per square yard in certain parts and a general average of about 100 grubs to the square yard. During that season the grubs took some toll on the turf of the greens and fairways, but by careful rolling and top-dressing, and decidedly more than the usual amount of watering, the greens were carried thru the year in fair playing condition but not in as good shape as they would ordinarily have been had the grubs been absent.

In 1923, the beetles were overwhelmingly apparent during June, July and August and the trees surrounding the course were almost defoliated. By the middle of August it was apparent, as a result of numerous examinations, that the greens, approaches and portions of the

fairways were perfectly lousy with grubs. As high as 1,000 grubs to the square yard, more than 100 to the square foot, were found in some of the greens and it can be safely said that the greens infested averaged 500 grubs per square yard.

Putting Turf Affected

The turf would not have lasted very long under the onslaught of this army of root devourers. However, by that time I had worked out the carbon disulfide emulsion method of treating turf for the control of grubs, and all but one green on the course was treated by this method before the end of August, with the result that 90 to 95 percent of the grubs were killed, the grass came back vigorously and play was not materially interfered with.

The number 5 green, which did not receive the carbon disulfide emulsion treatment, was an interesting object of study during the remainder of the year. The grub infestation in this green ran about 500 to the square yard and by September 10th the grass was dead. The green was torn up, harrowed, smoothed and seeded. Thousands of grubs were exposed as soon as the soil was disturbed, but they simply dug in again after the harrowing was completed. The grass seed germinated nicely and the green had the velvety appearance of newly seeded turf. Within

two weeks this new grass was in turn dead due to the feeding of the grubs on the roots and the green remained in that condition (out of play) until the next year. Had it not been for the carbon disulfide emulsion method, three-fourths of the greens on the Riverton course would have been in the same ruined condition and golf would have been out of the question.

Not All Greens Suffer

Observation of the greens of the Riverton club, and other clubs, during a period of six or seven years, has shown some interesting traits of the Japanese beetle in connection with its egg laying habits. There are some greens on the Riverton course which have never been infested with grubs to any appreciable extent during all those years. Numbers 8, 13 and 14, in or on the edge of the woods, have always escaped grub injury, accountable in all probability to the fact that the beetle is not a shade loving species and prefers to lay its eggs in open, sunny ground. Number 17, on the other hand, entirely in the open sun, has never to my knowledge

had any real grub infestation and I have spent a great deal of time and thought in trying to figure out why that particular green always proved immune but with no tangible results.

I have just recently examined a course on the north side of Philadelphia and grub conditions there today are the same as the Riverton club contended with in 1923. The greens are in good shape due to the use of arsenate of lead during the past year, but the fairways and tees, totaling 60 acres, have been shot to pieces by the grub of the Japanese beetle. It will cost \$6,000 to grubproof and reseed these fairways. One golf course in the Philadelphia area has to date used 18 tons of arsenate of lead in grubproofing their fairways and the turf is in splendid condition in spite of a heavy beetle population in that vicinity.

In next month's article I propose to discuss the habits of the grub in turf and to begin describing the carbon disulfide emulsion method of controlling grubs in fine turf.



Lightning Strikes Again —No Permanent Damage

IN THE October GOLFDOM there appeared an illustration of a green hit by lightning. Now another case is brought to our attention. The picture given here shows the fourth green on the Homestead course at Virginia Hot Springs which was struck by a bolt of lightning quite recently. The marks, which extended some 20

feet from the center, disappeared in ten days with no apparent permanent damage to the affected turf.

"The extraordinary thing to me," writes Fay Ingalls, president of the Virginia Hot Springs Company, "is that I have always heard that lightning would strike a tree or any elevated object. You will note that this damage occurred approximately 12 or 15 feet from the cup in which the standard was at the time of the storm. This is quite a large green, about 9,000 square feet."