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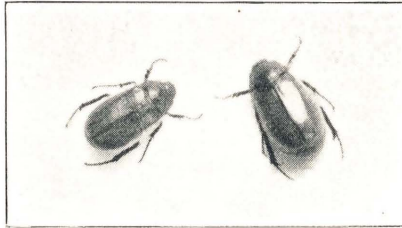
*University of Michigan*

# JUNE BEETLES OR WHITE GRUBS IN MICHIGAN

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By R. H. PETTIT

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AGRICULTURAL EXPERIMENT STATION

MICHIGAN STATE COLLEGE

Of Agriculture and Applied Science

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ENTOMOLOGICAL SECTION

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East Lansing, Michigan

## FOREWORD

White-grubs, the larvae of June-beetles, are steadily becoming more plentiful in Michigan. The present bulletin deals briefly with the life-history of white-grubs and is supplied with maps which enable one to readily determine just when and where to expect serious injury from these pests. Certain palliative control measures are likewise discussed, although much remains to be done toward developing a truly satisfactory and effective means of control. The present bulletin is a contribution toward the final development of a satisfactory control program. It defines the three broods, gives their schedules of appearance in Michigan, and tells what is known about the present distribution of the various broods in order that the growers in each county in the state may have foreknowledge as to when to expect an attack.

R. H. PETTIT,  
Entomologist of Experiment Station.

# June Beetles or White Grubs in Michigan

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R. H. PETTIT

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It is now pretty generally known among agriculturists that the common brown June-beetle, which appears occasionally in such large numbers in May and June, is the parent of the common white-grub which dwells underground and which feeds on the roots of grasses, grains, fruits, and vegetables. Grass sod is particularly attractive to these white grubs, as are also corn, strawberries, potatoes, hops, and young nursery trees. Besides these plants, the grubs also feed on a host of other plants.

The adult beetles range from half an inch up to about an inch in length. After appearing above ground, their chief occupation appears to be that of depositing eggs in suitable locations so that the young white grubs from these eggs will be established among favorable surroundings with plenty of food. After the eggs are once disposed of, the females are readily attracted to bright lights where they may be captured in traps. The doubtful value of traps for the purpose of attracting the beetles becomes apparent at once when we consider that the very great majority of individuals captured are males, while most of the females caught in such traps are "spent" ones which have already laid their eggs.

Very many species of June-beetles are found in the United States; the majority of our Michigan species require three years for the completion of the life-cycle. While this rule does not hold inviolable and without exception, it is nevertheless true that the species of greatest economic importance in Michigan, conform to it. This time is divided over parts of four seasons but the total time required by our most destructive species is three years.

June-beetles are subject to attack by many natural enemies. Two or more fungus diseases carry off numbers of the larvae. One or more protozoan diseases also affect the larvae, and there seems reason to believe that a bacterial disease helps out in the destruction of these pests. Birds dig them up, and skunks feed freely on the larvae. During the seasons of the year when the larvae work near the surface of the ground, shrews undoubtedly secure their quota. The adult beetles are greedily devoured by poultry and by many wild birds. A number of insect parasites and predators regularly deplete their numbers. It naturally follows that the areas infested by any particular brood of June-beetles will constantly change, due to the process of "cleaning up" performed by these various restrictive agencies. Disease epidemics among insects, just as among humans, carry off the greatest numbers in districts where the population of white-grubs is greatest.

In the light of the foregoing discussion, it naturally follows that there will be three general broods of June-beetles, each brood reappearing in the adult condition regularly at intervals of three years each.

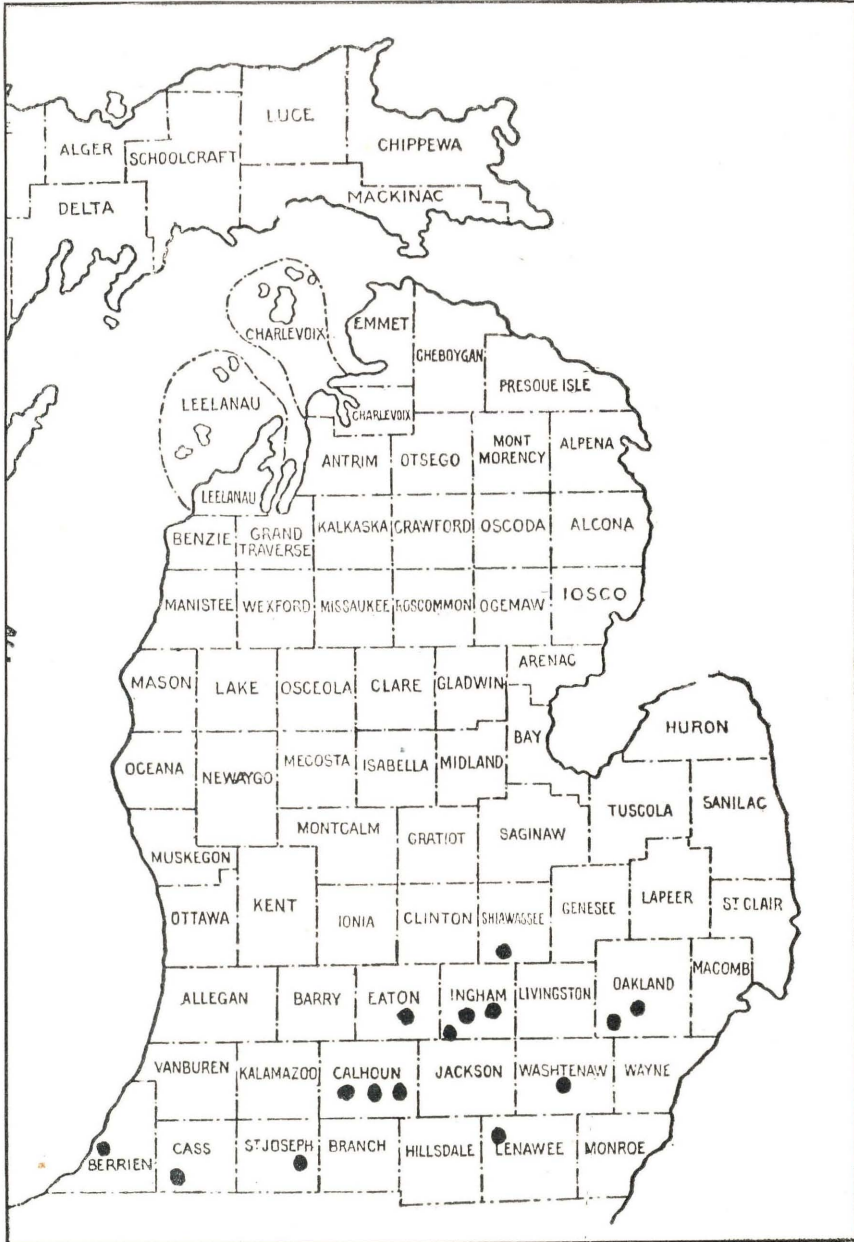


Fig. 1.—Known localities where brood C of June-beetle occurs.

Thus, brood A appeared in the adult condition in the Spring of 1929. Brood B will appear in the adult condition in 1930 and Brood C in 1931. Furthermore, these three several broods do not infest the same areas

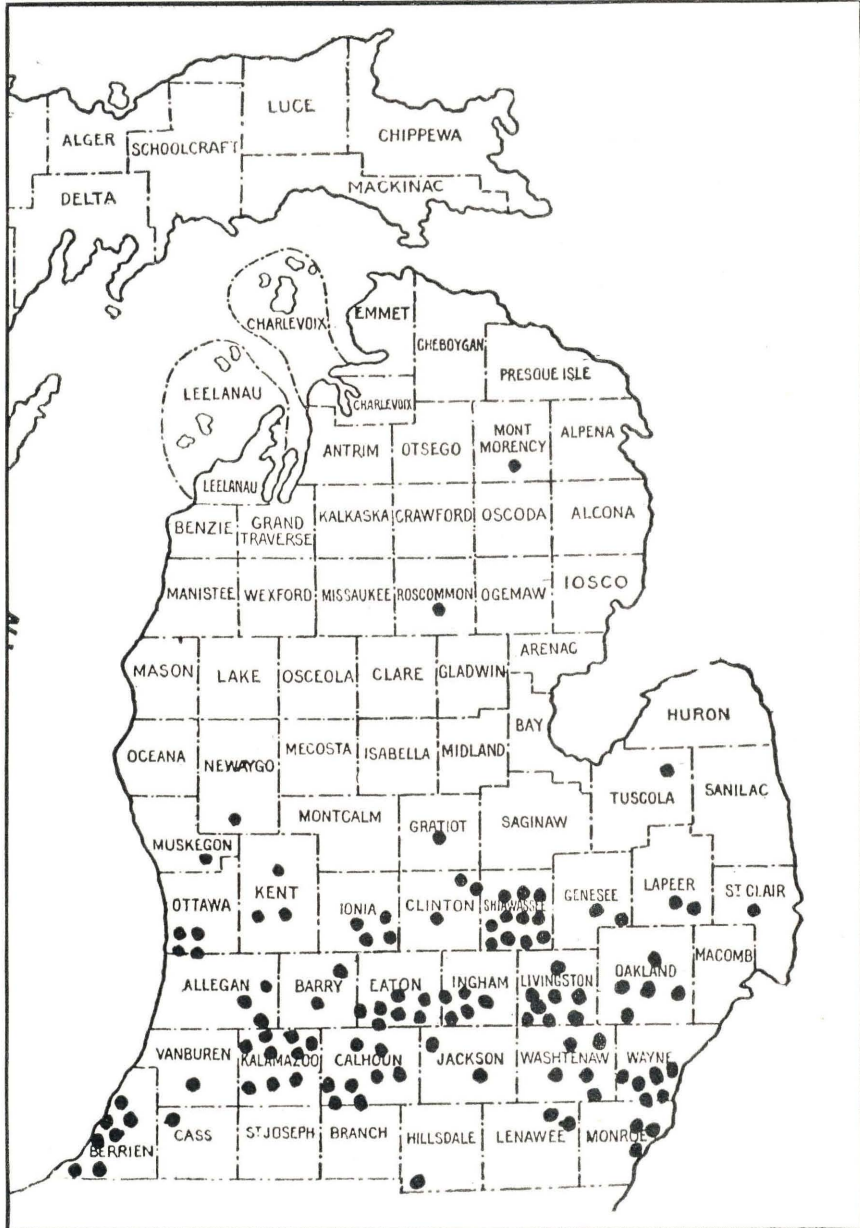


Fig. 2.—Known localities where brood A of June-beetle occurs.

by any means, although broods C and A overlap. It is intended in this bulletin to designate such areas as are at present known to be occupied by each of the several broods A, B, and C. The accompanying map of brood A shows the areas of infestation so far as we have been able to obtain them. Each dot shows a location where numbers of June-beetles have been reported in the adult condition in 1929. So far as these records are correct, one may expect serious infestations of white grubs in the same areas during 1930, at which time the larvae from the eggs laid in 1929 will have produced half grown larvae which will feed on the roots of vegetation and be especially troublesome in land that was in grass sod during 1929. During 1931, the same districts may expect to be called on to endure a shorter attack, one which will end by mid-summer and which will be brought about by the larvae of 1930 completing their growth before tunneling down deeply and changing to pupae. These pupae of brood A will in turn emerge as adult beetles in 1932 and every third year thereafter, until such time as their numbers are reduced to insignificance by their natural enemies or by man's efforts.

The map on page 4 shows the distribution of brood C so far as at present known. In brood C, the adults are due in 1931 and an attack by the nearly developed larvae is due to occur in the areas indicated by the map during the first half of the summer of 1930.

Brood B, due to appear in the adult condition during 1930, would appear to be of comparatively little importance in Michigan. Our records thus far show its presence in only two widely separated counties.

As stated elsewhere, the areas occupied by the several broods of June-beetles are constantly changing, the beetles disappearing from one area and appearing in destructive numbers in new districts. Then, too, there are undoubtedly small areas scattered all over the state where white-grubs are established locally. It is earnestly desired that word of both local and widespread outbreaks be reported to the Department of Entomology in order that maps may be kept up to date and their accuracy constantly improved. The facts desired are: the occurrence of June-beetles in large numbers, the month and the year of appearance, the presence of large numbers of white-grubs in the field, whether they are young or full grown, and whether they continue to work through the entire season or work only for the first half of the summer.

### **AGRICULTURAL PRACTICES UNFAVORABLE TO THE GRUBS**

Wherever it is practicable to pasture badly infested fields with unringed hogs, during the summer, it is possible to clean up the land very effectually. Hogs are fond of white grubs and will root them out when given the opportunity. To be sure, this method cannot be employed very generally but, whenever it can, it offers a cheap, effective means of temporarily clearing the land of the larvae. Another practice unfavorable to June beetles is that of fall plowing.\* It would

\*J. J. Davis, Farmers Bulletin No. 940, U. S. Dept. of Agriculture.

appear that about the first of October of the season marked by the flight of the adult beetles, the larvae descend deeply, usually below the plough line. This is also true during the second season of their existence and, therefore during these two seasons, plowing, in order to be effective must be done before the grubs descend too deeply, in other words, during the latter half of September or the very first part of October. During the third season, however, when the larvae descend for the third time and just prior to pupation and the change to the adult condition, they do not burrow so deeply and many of them can be turned up at this time by the plow. It follows that plowing, in order to be effective against white grubs, should be completed by the first part of October during the first two years of the development of the grub, or at any time during the third year, which is the one preceding the appearance of the beetles in the adult winged form. Plowing, accomplished at the proper time, turns up many of the larvae to the surface where they can be reached by birds, shrews, skunks, and other natural enemies, and some are crushed by the plowing itself. White-grub larvae are rather tender creatures and do not stand rough handling at all well. For these reasons plowing kills many of them and is, to say the least, very helpful in reducing their numbers.

Of all land which is likely to harbor white-grubs during years immediately following those of June-beetle flights, grass land is to be regarded with most suspicion. Strawberry fields are also likely to harbor these grubs. Pure stands of clover or alfalfa and fields free from grass or weeds are far less likely to harbor the grubs, and, for this reason, corn planted in such fields is more likely to escape injury than corn following grassy fields.

White-grubs, once they become established in certain fields, are not good travelers and do not spread or migrate to other fields with any degree of facility. The spreading to and the invasion of new areas takes place at times when the adult June-beetles are on the wing.

Our Michigan practice of seeding clover and timothy with small grains, thus securing clover and timothy followed by timothy, is a practice which does not lend itself well to the control of white-grubs since such clover and timothy fields are very likely to be selected by the beetles at egg-laying time.

Once it is established that a given piece of land is infested with white-grubs, the question immediately arises as to what can be planted there with a fair chance of escaping the ravages of the grubs. Of course, corn should never be used under such conditions. Potatoes are likewise taboo. Strawberries suffer severely but legumes probably escape with less injury than most other crops.

### WHITE-GRUBS IN LAWNS AND IN GOLF LINKS

Neither golf links nor lawns, grassy parks nor boulevards are immune to the attacks of white-grubs. However, the owners of such grassy areas usually feel justified in expending more effort and expense in controlling the pest than does the farmer in growing crops in large fields.



Dr. B. R. Leech of the National Bureau of Entomology, has demonstrated the value of arsenate of lead used as a soil dressing in the control of the Japanese beetle, a pest that has somewhat similar feeding habits to those of our common white-grubs. The treatment consists in broadcasting five pounds of ordinary dry, powdered arsenate of lead mixed thoroughly with a bushel of slightly moistened sand over each thousand square feet of sod to be protected. If this dressing can be applied before the grass is grown and at a time when the poison can be raked down into the soil to a depth of about half an inch, the results are even more gratifying. However, the mere broadcasting of this poison on the surface, from whence it may be washed down into the top layer of soil, is said to be fairly effective. Dr. Leech issues a warning that sod so treated must not be fertilized with anything other than plain barnyard manure or ammonium sulphate, other commercial fertilizers seem to interfere with the efficiency of the treat-



Fig. 3.—Larva of June-beetle.

ment. Furthermore, recent tests would appear to have developed the fact that such a treatment applied to soils more than slightly acid in reaction or those containing a heavy content of organic matter, is likely to prove fatal to vegetation. Our own tests with various arsenicals used in this way have not yet progressed far enough to warrant recommending them unreservedly. However, thus far, our tests, mostly made in nurseries, appear to give promise of bringing about a control.

### CONTROL OF ADULT JUNE-BEETLE

Besides the injury done by the white-grubs, it often happens that the June-beetles themselves become so numerous that they strip the foliage from trees and sometimes even kill trees outright. The majority of the beetles, during the egg laying period, remain in the ground during the day time but leave the soil at night and often fly to oaks, maples, and other trees in the vicinity, where they feed until nearly dawn. Sometime before sunrise they cease feeding on the trees and hurry back to the soil, bury themselves once more, and resume the

duty of placing their eggs. Trees which are attacked by the beetles may be protected by the application of an arsenical spray or dust applied as in orchard spraying or dusting. Use three or four pounds of dry powdered arsenate of lead to each 100 gallons of water if a spray is applied. The application should be made, if possible, with a power rig using a high pressure. If a dust is to be employed, use 10 pounds of dry powdered arsenate of lead with 90 pounds of hydrated lime and apply in the ordinary manner.

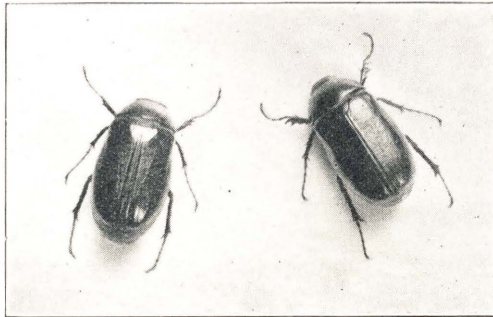


Fig. 4.—June-beetle (*Phyllophaga fusca*).

**CALENDAR**

	<b>Brood A</b>	<b>Brood B</b>	<b>Brood C</b>
1929	adults		full season larval attack
1930	full season larval attack	adults	short season larval attack
1931	short season larval attack		adults
1932	adults		full season larval attack
1933	full season larval attack	adults	short season larval attack
1934	short season larval attack		adults
1935	adults		full season larval attack
1936	full season larval attack	adults	short season larval attack

The department earnestly solicits records of the occurrence of either June-beetles or white-grubs found in any part of the state and at any time. Send such reports to the Department of Entomology and if possible send a tin box or can containing samples, always stating just how plentiful the insects are and the exact location of their occurrence. Such reports will be used as a basis for perfecting our survey and keeping the maps up to date.

Address letters and packages to

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