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**INSECT PARASITE INTRODUCTION IN PORTO RICO.**

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Because of the difficulty and comparative lack of success in controlling white grubs in Porto Rico by artificial and mechanical means, and the scarcity of any important native parasites and predators on them, one of the first acts of Mr. D. L. Van Dine, the first Entomologist at the Estación Experimental at Río Piedras, was to arrange for the importation of promising parasites of white grubs of other countries into Porto Rico. Mr. C. E. Hood was employed to collect and ship them to Porto Rico, and as the natural enemies of white grubs in the United States had been most thoroughly studied in Illinois by Prof. S. A. Forbes, he made his headquarters in Professor Forbes' laboratory at the University of Illinois.

The most important and abundant parasite of white grubs in the northern United States is an entirely black wasp, covered with grey hairs, *Tiphia inornata* Say., or rather various species of the genus *Tiphia*. (Fig. 1.) The females of this wasp have wings and can fly, but actually spend the greater portion of their time on or in the ground, searching for white grubs on which to lay their eggs. The grub is stung by the wasp so that it will remain temporarily quiet during, and for a short time after, the deposition of the egg on its body. (Fig. 2.) The white maggot of the wasp, which hatches in a few days, grows rapidly, sucking the juices out of the white grub to which it is attached and eventually killing and destroying it, so that nothing is left but the shriveled skin of the body of the grub and its hard legs and head. In the cavity in the soil which was previously occupied by the white grub, the wasp maggot spins its bottle-shaped cocoon of yellowish-brown silk, attaching one end firmly to the side-wall of the cavity in the earth. There may be one or sometimes two generations of the wasps in a year, but the winter is

spent in the cocoon, and it is at this season and in this stage that it could be transported in large numbers alive to a foreign country. In the year that Mr. Hood was employed, he sent 23 cocoons to Porto Rico, from one of which an adult emerged. After Mr. Hood's death, Mr. George N. Wolcott was appointed to continue the work and he collected *Tiphia* cocoons in Illinois for two years, until appointed En-

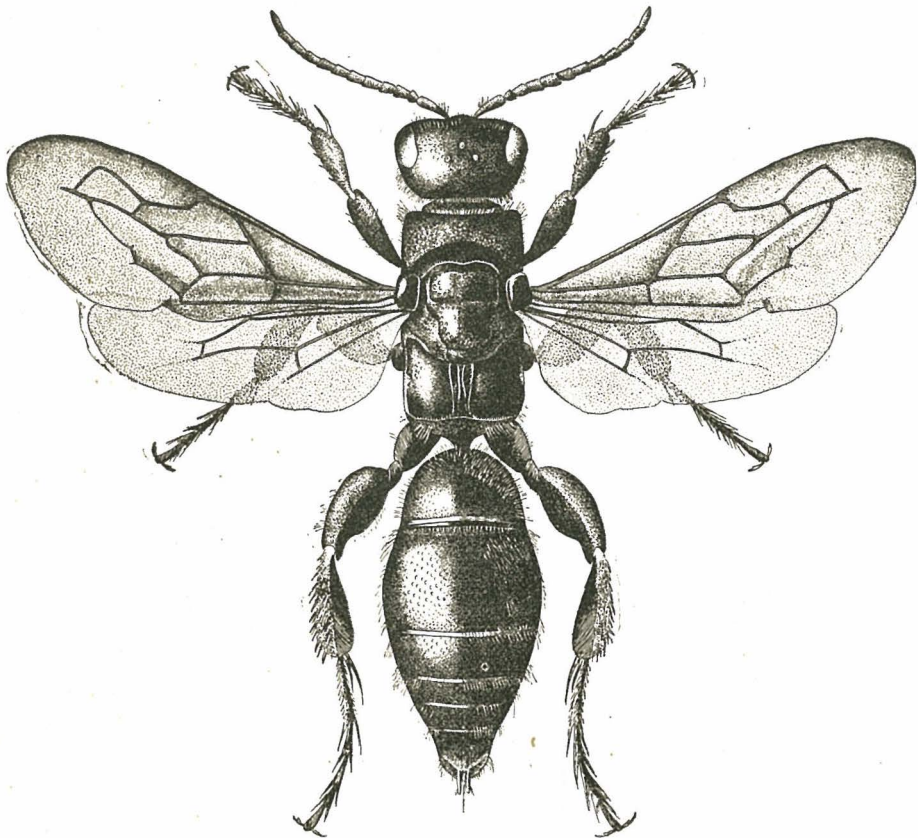


FIG. 1.—Adult female of *Tiphia transversa* Say. (After Davis.)<sup>1</sup>

tomologist at the reorganized Insular Experiment Station in the fall of 1914.

It was found that the most practical and effective method of collecting *Tiphia* cocoons was by taking advantage of the normal

<sup>1</sup>To Prof. Stephen A. Forbes, Chief of the Illinois State Natural History Survey, the writer is greatly indebted for permission to use the illustrations appearing in this article, which were published in the paper by Mr. John J. Davis "Contributions to a Knowledge of the Natural Enemies of *Phyllophaga*", Art. V, Vol. XIII, Bull. Ill. Nat. Hist. Survey, Feb. 1919.

processes of agriculture, that is, by following the plow in promising fields being plowed, where white grubs were, or rather had been, abundant. The *Tiphia* wasps are such efficient parasites in Illinois that in two or three years after the appearance of the few females in a field heavily infested with grubs, nearly all will have been parasitized, and the next year neither grubs nor live parasites will be present in the soil, only the empty rotten cocoons of *Tiphia*, a relic of their presence and of their having exterminated the white grubs (<sup>1</sup>).<sup>1</sup> Most of the plowing in Illinois is done in the fall and for a short period in the spring and the collection of *Tiphia* cocoons there was confined to these seasons of the year.

Attempts were made to collect *Tiphia* cocoons in Texas and Louisiana in the early winter, but although white grubs were found in abundance, very few cocoons were collected, none in Texas and only 19 in Louisiana in 1912 and none there in 1913.

From the autumn of 1912 to the autumn of 1914, inclusive, a total of 2,560 *Tiphia* cocoons was collected in Illinois and sent to Porto Rico by Mr. Wolcott, as shown in the accompanying table.

TABLE.

	Number of cocoons.	Per cent of adults emerging.	Per cent of live adults released in breeding cages.
<i>Tiphia</i> cocoons collected in Illinois during the fall of 1912	540	38 per cent -----	33 per cent.
Spring of 1913	500	20 per cent -----	15 per cent.
Fall of 1913, sent to Porto Rico fall	101	29 per cent -----	26 per cent.
Sent to Porto Rico spring	855	44 per cent in 11 days	44 per cent.
Spring of 1914	234	27 per cent in 7 days	27 per cent.
Fall of 1914, sent to Porto Rico spring	330	71 per cent in 10 days	79 per cent released in the field, Tablón No. 7, Hda. Sta. Rita.
		79 per cent total.	

The increase in the number of adults emerging and of live adults

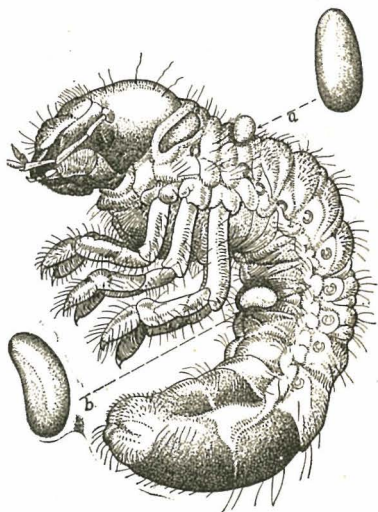


FIG. 2.—White grub showing position of *Tiphia* eggs; a, *Tiphia punctata* Rob.; b, *T. transversa* Say, and eggs much enlarged. (After Davis.)

<sup>1</sup> Numbers refer to "Literature Cited." See p. 19.

available for breeding and release in Porto Rico indicates the perfection of proper methods of shipment and of caring for the cocoons. At first cocoons were packed 25 or 30 together in small tin salve boxes, placed in paper mailing tubes and sent by first-class mail. The cocoons in a box, all of which appeared healthy when shipped, might arrive in Porto Rico covered with the white mycelium of a fungus, *Isaria*, which had killed all the insects inside them, having

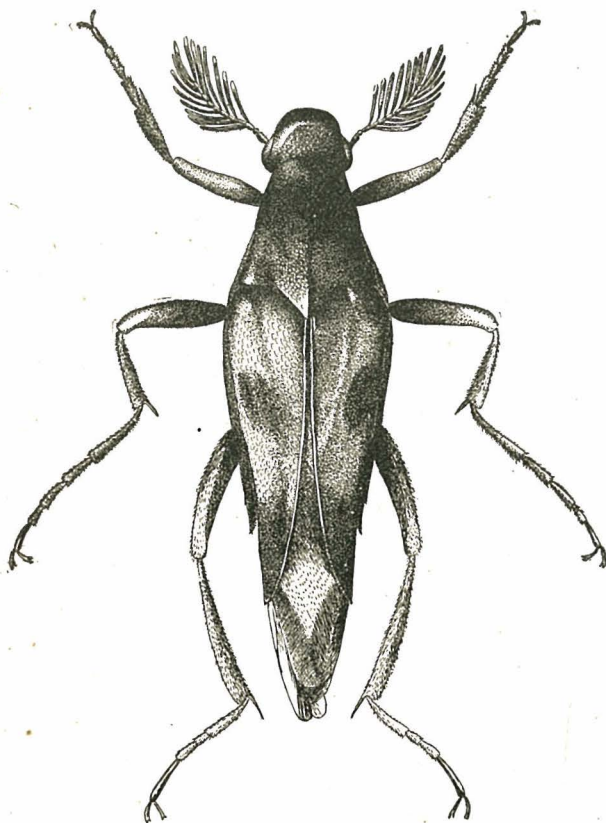


FIG. 3.—Adult of *Macroisiagon* (*Rhipiphorus*) *pectinatus* Fabr., a parasite of *Tiphia*. (After Davis.)

spread from one infested cocoon. Placing each cocoon in a separate, cork or cotton stoppered glass vial, or in a gelatine capsule, confined the fungus to the cocoon where it occurred.

This fungus also caused heavy mortality in Porto Rico until the most satisfactory method of keeping the cocoons for the emergence of the adults was learned from Mr. S. A. Rohwer, Curator of Hymenoptera, U. S. National Museum. This was by putting the cocoons in sterilized

glass tubes, the bottoms of which were plugged with plaster of Paris, which allowed sufficient moisture to come up from the moist sand on which they were placed. Adults emerging in such tubes would be immediately observed and removed to the breeding cages. The emergence of parasites of the wasps would also be observed and these removed and killed. Some of the beetles, *Rhipiphorus pectinatus* Fabr., recorded by Dr. Riley (<sup>2</sup>) from Missouri, were

found in the cocoons sent to Porto Rico (Fig. 3.) and two more species of Bombyliid flies emerged, in addition to the *Exoprosopa fascipennis* Say. recorded by Dr. Forbes (<sup>3</sup>). These have been determined by Mr. C. T. Greene as *Exoprosopa fasciata* Macq. and *Anthrax fulvohirta* Wied.

At first cocoons were sent to Porto Rico as soon as collected. From those collected in the fall, some wasps would be stimulated by the tropical warmth to emerge in November, while those that had not transformed from the larval or pupal stage before leaving the States might not emerge till January or February. The results was that at no time during the winters of 1912-13 and 1913-14 was any large number of wasps alive and active, but their emergence was scattered over a period of three or four months. Despite this discouraging scattering emergence, when often only adults of one sex might be alive, some Illinois *Tiphia* female wasps, from cocoons collected in the first autumn (1912) did oviposit on Porto Rico white grubs (*Lachnosterna vandinei* Smyth, from Hacienda Santa Rita) in the large (3 ft.  $\times$  3 ft.  $\times$  6 ft.) breeding cage in the insectary at Río Piedras, under the care of Mr. Thos. H. Jones. On two grubs the eggs hatched and the maggots increased perceptibly in size, but when next observed the maggots had been rubbed off, only a brown scar on the back showing where they had been, and these white grubs developed normally to beetles. Occasionally grubs showing similar scars were observed in the course of the collecting in Illinois, and indicate that the wasp did not sting the grub sufficiently, or that she had chosen a species of grub that was larger or more active than the one ordinarily parasitized by that species of *Tiphia*. Mr. Jones was of the opinion that the disturbance of the grubs incident to digging them up to find if any were parasitized and placing them in smaller cans for observation might have caused the wasp maggot to loose its hold, and thereafter the soil in the breeding cages was never disturbed by looking to see whether the wasps were successful in parasitizing the grubs.

In the spring of 1913 the breeding work with the wasps was transferred to the South Coast Laboratory at Hacienda Santa Rita (Guánica, near Yauco), of which Mr. E. G. Smyth was in charge, where they were released in a large (6 ft. wide, 10 ft. long and 3 ft. high) outdoor cage on the ground, abundantly supplied with growing sugar-cane and white grubs in the soil. Some live wasps which had emerged at Río Piedras were put in these cages, but most of them were from cocoons shipped direct from Illinois.

In the fall of 1913, only a small portion of the cocoons collected were sent at once to Porto Rico, but about nine-tenths of them, after being put in individual capsules or glass vials, were packed in two 2-quart tin pails and put into cold storage for the winter in a commercial cold-storage plant where the University of Illinois had a large cabinet for the reception of hibernating insects. Late in the next spring, these two pails were packed in an ice-cream tub and sent by insured express to the New York office of Guánica Centrale, which transferred them to the ship's refrigerator, from which they were not removed until reaching Ensenada harbor at Guánica. Thus these cocoons were in cold storage from late fall till June 1st, when they arrived within a few miles of the laboratory in Porto Rico. From the 855 cocoons,

6 live wasps emerged June 1,  
 75 on June 2d,  
 82 on June 3d,  
 97 on June 4th,  
 68 on June 6th and 7th,  
 35 on June 8th and 9th, and the final  
 16 on June 10th and 11th, making a total of

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379, or 44 per cent of the wasps emerging in 11 days,

very much the best record, both for percentage of emergence and for the short time in which it occurred.

Most of the adults from the cocoons collected in the spring also emerged within a short period (7 days) in mid-May, and the outdoor breeding cage at Santa Rita was well supplied with both sexes of several species of *Tiphia* wasps at this time. When the ground under the cage was dug up later in the year, none of the grubs showed signs of being parasitized, nor were any *Tiphia* cocoons found. Thus this attempt to breed a second generation of Illinois *Tiphia* on Porto Rican white grubs in a cage, under supposedly the most favorable conditions, was an absolute failure. For a period of about three hours on June 6th, 8th, 10th and 12th, the door of the cage had been left open, so that fertilized females might search for grubs in the field, if the environment in the cage had not proved favorable, but it is doubtful if many did escape from the cage, at least none were seen in the yard surrounded by high masonry walls back of the Casa Grande where the cage was located.

Thus despite the careful working out of methods of collection and shipment of *Tiphia* cocoons, so as to have large numbers of

adults alive at one time for breeding or release in the field, the parasite introduction had failed in that not a single wasp maggot had been able to complete its development on a Porto Rican white grub in captivity.

In the fall of 1914, a final collection of *Tiphia* cocoons was made in Illinois, and left there in cold storage, to be sent to Porto Rico the following spring. Dr. Robert H. Glasgow of the University of Illinois, who took charge of starting them from Illinois, placed them in a pail with a friction-top, waterproof cover for shipment in the ice-cream tub. They arrived in Porto Rico in much better condition than the shipment of the year before which had been made in a pail with an insecurely fitting cover that had permitted the water to leak in. This is reflected in the 71 per cent of emergence of adults within ten days after receipt, and a total emergence of 79 per cent. No attempt was made to breed a second generation in confinement, but all adults were released on the date of emergence in Tablón No. 7, Hacienda Santa Rita, where the cane was about two feet high at the time. The white grubs in this field averaged about one per square foot, 4,735 per acre in February–March 1915 and 3,605 in February–March 1916, so there was an abundance of possible hosts present. This field was carefully examined by William Hanson, Jr., when next plowed (February–March 1916) after the release of the wasps, but no *Tiphia* cocoons nor parasitized white grubs were found, either by him or by the laborers collecting the grubs, and it is unlikely that the parasite had become established there.

One other factor contributing to the failure of the parasite introduction was the difficulty of determining the species of *Tiphia* being introduced. It was at first thought that all were of the species *Tiphia inornata* Say., but at least four species occur in central Illinois. The cocoons of *Tiphia illinoiensis* Rob. are small, but those of the commonest species collected, *Tiphia vulgaris* Rob., are indistinguishable from these of the less common *Tiphia clypeata* Rob. and *Tiphia tarda* Say. (Determinations by Mr. S. A. Rohwer.) Nor was it in practise possible to distinguish the species when the adults emerged, as the specific characters, even of dead specimens, are not readily observable, and it was desired to keep all individuals alive and vigorous for breeding or release in the field.

In the summer of 1921, Mr. E. H. Barrow, in charge of the experimental work of Russel & Co., cane growers for Guánica Centrale at Hacienda Santa Rita, found several small black wasps feeding on the secretions of a scale, *Pulvinaria psidii* Mask., on the leaves

of a bush of *palo de muñeca*, *Rauwolfia nitida*, which were sent to Mr. Rohwer for determination. He wrote to Mr. Barrow (letter of October 21, 1921):

“I have examined them and believe they represent a new species of the genus *Tiphia*. This new species is very similar in many ways to some of the species which Mr. Wolcott introduced into Porto Rico years ago but I believe it is specifically distinct.”

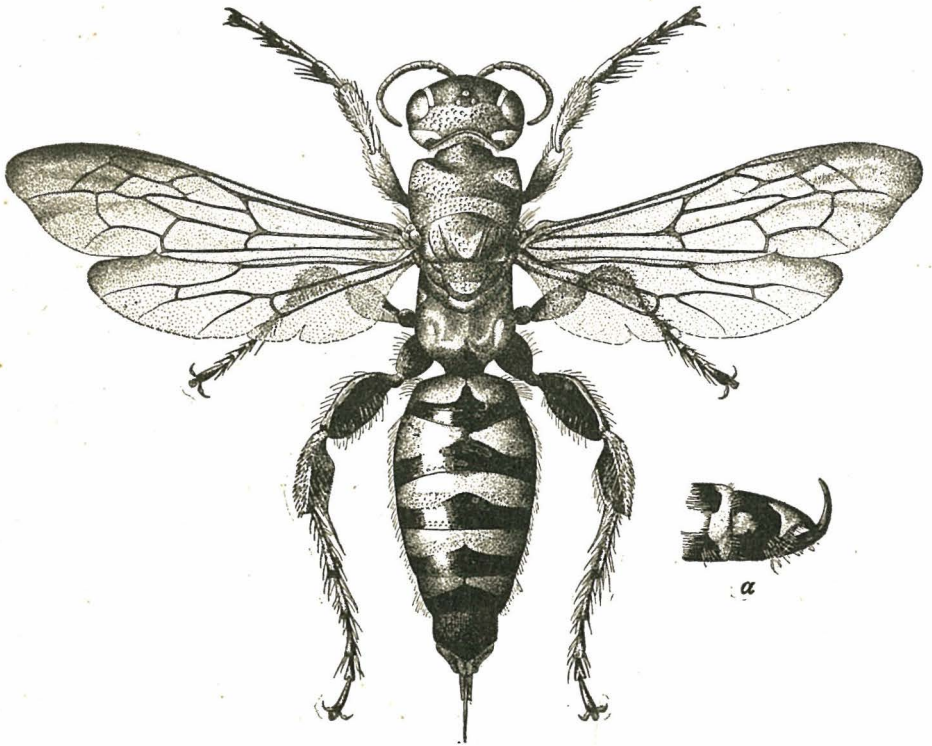


FIG. 4.—Adult female of *Elis atriventris* Gahan, a parasite of white grubs. (After Davis.)

Whether these wasps really represent a native species not before collected, or whether they are the descendants of an introduced species, which has varied because of a changed host and environment, and whether they are parasitic on *Lachnosterna* white grubs, and of how great importance they are now, or may become, can only be determined by further study.

In addition to attempting to introduce species of *Tiphia* from the United States, arrangements were made in 1913 for Mr. William Newell, Entomologist in Barbados, to have cocoons of *Tiphia parallela*



Smith collected and sent to Porto Rico. The actual work of collection was done under the supervision of Mr. A. A. Evelyn, who was already having dug up on his estate the cocoons of this wasp for introduction into Mauritius, where the small white grubs of *Phytalus smithi* Arrow, accidentally introduced from Barbados in the soil about potted cane plants, had become a serious pest (<sup>4</sup>). One hundred cocoons were sent in April 1913, arriving a month later, but only ten adults emerged. No special arrangements had been made

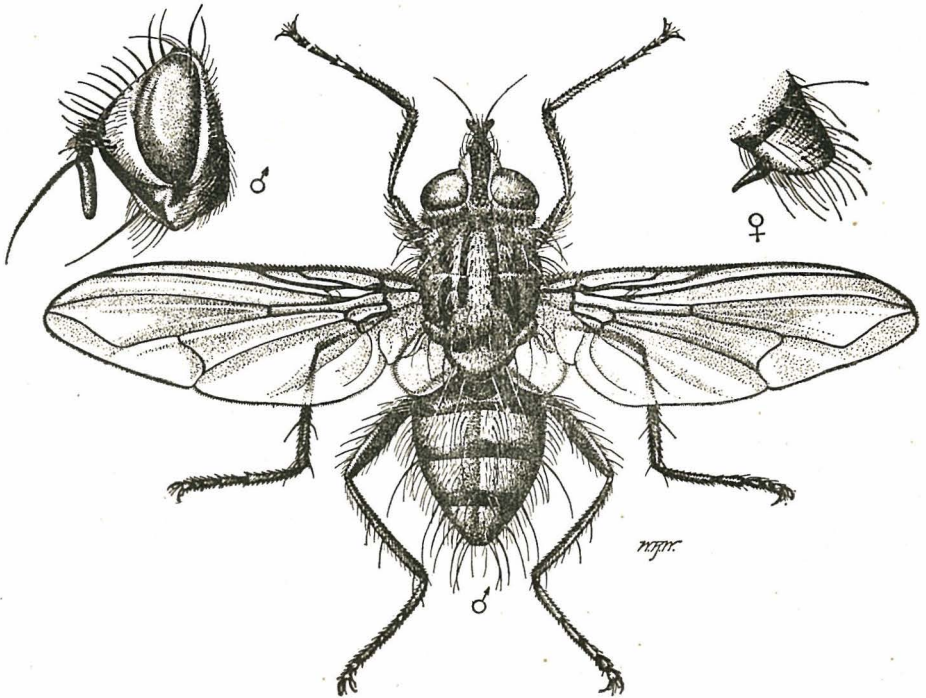


FIG. 5.—Adult male of *Cryptomeigenia aurifacies* Walt., a native Porto Rican parasite of *Lachnosterna* beetles. (After Walton.)

for attempting to have these breed on the grubs of *Phytalus insularis* Smyth, the most nearly related Porto Rican species of grub, and the females did not oviposit on the larger *Lachnosterna* grubs.

Cocoons of *Elis collaris* Say, another wasp parasite of white grubs (Fig. 4.), were collected in considerable abundance in northern Illinois, especially along the Illinois River and near Galesburg, and a few were collected at Plaquemine, La. Few adults emerged from these cocoons in Porto Rico, possibly because they are much more

sensitive to the disturbance by plowing of the soil which closely surrounds them.

There are already present in Porto Rico and native to the Island, two common species of wasps parasitic on white grubs, *Campsomeris dorsata* Fabr. and *Elis haemorrhoidalis* Fabr., and at least four other less common species, *Elis (xanthonotus Rohwer) erhippum* Fabr., *Campsomeris atrata* Fabr., *C. pyrura* Roh. and *C. trifasciata* Fabr.

The host of the first of these is known to be the comparatively non-harmful grubs of *Ligyris tumulosus* Burm., which feed on decaying vegetation in the soil and never on live cane roots, as parasitized grubs of this species collected at Santa Rita produced adults of *Campsomeris dorsata*. The females are large black wasps with two broad, dark reddish-yellow bands on the abdomen, which spend most of their time in the soil and are seldom seen, but the males, which are smaller and less black, having yellow eyes, three narrow yellow bands on the thorax and four large ones on the abdomen,

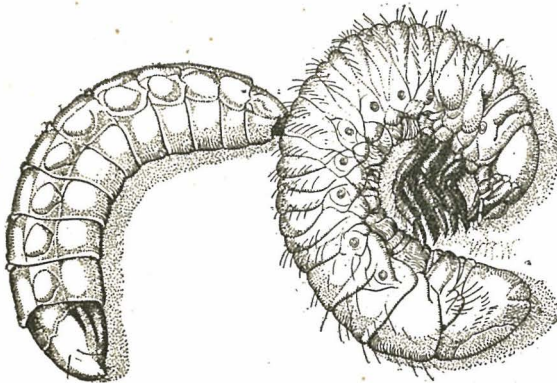


FIG. 6.—Maggot of *Promachus vertebratus* Say, attacking a white grub. (After Davis.)

are often seen flying about close to the ground in sandy places, especially in soils where the grubs of *Ligyris tumulosus* and the pursuing female wasps are present.

The host of the second common species, a slender, small black-and-yellow wasp with six narrow bands of yellow on the abdomen, *Elis haemorrhoidalis*, is *Lachnosterna (Phytalus) insularis* Smyth, the smallest and least injurious of the *Lachnosterna* group of white grubs, which is found in abundance in sandy soil near the beach, where the very slender male wasps are often seen flying about, or late in the afternoon, resting in clusters of several hundreds on the vegetation. Cocoons of this wasp, with the mandibles of a third-instar grub of *L. insularis* entangled in its outer threads, have been found in a field where no undestroyed grubs of this species were present, but grubs of all instars of *L. citri* were present in abundance and unparasitized.

The wasps of *Elis ephippium* are all black except for a large nearly square reddish-yellow spot on the thorax between the wings. Those of *Campsomeris trifasciata* have, as the specific name implies, three yellow bands on the abdomen and those of *C. pyrura* are larger and have the three abdominal bands more broken. The wasps of *C. atrata* are very large, nearly two inches in length, so large indeed that the white grubs of the Rhinoceros beetles, *Strataegus* spp., seem to be the only host grubs of sufficient size for their complete development, but nothing is known of the life history and host of any of these less common wasps. If any of them are parasitic on the eco-

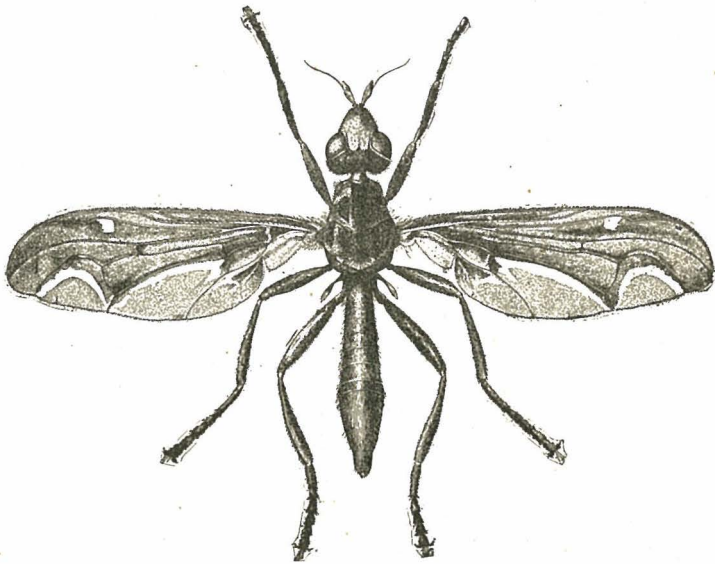


FIG. 7.—Adult female of *Pyrgota undata* Weid., a parasite of *Lachnosterna* beetles. (After Davis.)

nomie species of white grubs, they are so rare as to be of negligible importance.

Besides the *Scoliid* wasps parasitic on white grubs, there are several other parasites of *Lachnosterna*. A few puparia of an undetermined Tachinid fly, were collected inside dead beetles in plowed fields in Illinois, but no adults emerged from those sent to Porto Rico. There are already present in Porto Rico two species of Tachinid flies, *Cryptomeigenia aurifacies* Walton (Fig. 5.) and *Eutrixoides jonesii* Walton, which are parasitic on the native *Lachnosterna* beetles (<sup>5</sup>). These flies were first bred from beetles which they had parasitized

and killed, collected near Añasco, but later were found to be moderately abundant thruout the moister portion of the Island. They are not found in the dry sections on the south side where white grubs have caused the greatest damage, and attempts to artificially introduce and propagate them there have been unsuccessful.

Several times, large *Asilid* or robber-fly maggots were found in the plowed fields in Illinois near partly devoured white grubs, for the destruction of which they were apparently responsible. (Fig. 6.) A considerable number of such maggots and puparia were sent to Porto Rico, but as the adult robber flies have the reputation of chasing and killing honey-bees, those emerging were not liberated. They have been identified by Mr. Knab as *Promachus vetehratus* Say. Seven species of *Asilid* flies are reported as occurring in Porto Rico and one species, *Proctacanthus rufiventris* Macq., is quite common.

In some years, large numbers of *Lachnosterna* beetles in Illinois are parasitized by a fly, *Pyrgota undata* Wied. (Fig. 7.), of extraordinary appearance and habits, the females of which lay eggs in the beetles, attacking them when they are flying at night and the ovipositor can be inserted through the unprotected tender skin of the upper part of the abdomen. During the summers of 1913 and 1914, when large numbers of beetles were collected, this fly was comparatively rare and only an occasional parasitized beetle was found. A few flies, all males, were found under electric lights. Several fly puparia inside dead beetles were collected in plowed fields and sent to Porto Rico, but no adults emerged.

The introduction of parasites of *Lachnosterna* had been undertaken so soon after the founding of the "Estación Experimental de la Asociación de Productores de Azúcar de Puerto Rico," because the serious damage caused by the grubs in the cane fields of the south coast, especially near Guánica, demanded prompt action, and as known parasites were supposedly common and had been studied in Illinois, their introduction seemed to promise immediate success. But it was only part of the general plan of Mr. Van Dine that, following the preliminary survey of the sugar cane insect pests of the Island and determining their relative importance, possible methods of artificial control and control by native parasites, the introduction from nearby countries of parasites of all those of economic importance should be undertaken. Trips were made to various sugar cane growing countries, to Mexico in 1912 by Mr. Hood (<sup>5</sup>), to Demerara, Trinidad

and Barbados in 1913 (<sup>6</sup>, <sup>7</sup>, <sup>8</sup>) and Cuba and Jamaica in 1914 by Mr. Wolcott (<sup>9</sup>), to investigate the presence and abundance of all parasites of insect pests of sugar cane and the possibility of importing the parasites into Porto Rico.

One insect which is nearly always present on sugar cane, and sometimes occurs in very great abundance, is the mealybug, *Pseudococcus calceolariae* Mask. and *P. sacchari* Ckll. It undoubtedly does cause some stunting of the growth of the cane and a resulting loss in tonnage, although its injuries are ordinarily inappreciable, even when the mealybugs are present in such large masses as to prevent the leaf-sheaths trashing off normally. A lady-beetle, *Cryptolaemus montrouzieri* Muls., the larvae of which feed on mealybugs, had been successfully introduced from Australia into Hawaii to prey upon destructive mealybugs, and from there had been successfully introduced and colonized in California. Three shipments of these lady-beetles were made from California to Porto Rico (<sup>10</sup>), and large numbers of them were bred in cages at Río Piedras, Guánica, Fajardo and Mayagüez, feeding them with mealybugs collected from sugar cane. Beetles were released in cane fields at several localities, but none were ever collected in cane fields later. The introduction of this beetle was not a failure, however, except from the standpoint of the cane grower, as the beetles and their larvae have been found feeding on mealybugs and fleshy scales on other plants and trees, and the species is now firmly established in Porto Rico. Mealybugs on sugar cane live under the leaf-sheaths which wrap closely around the cane stalk and protect them from harm and especially from the introduced lady-beetle larvae which are unable to get under the leaf-sheaths, but mealybugs which live on the leaves and branches of other plants are not thus protected and fall an easy prey to *Cryptolaemus*.

In Trinidad there is a lady-beetle, the larvae of which are quite common under sugar cane leaf-sheaths feeding on mealybugs. A small collection of live lady-beetle larvae was sent from there by Mr. Wolcott in 1913, but only one beetle reached Porto Rico alive, as the package was nearly a month in transit. No further efforts were made to introduce it because of the lack of quick and rapid means of transportation.

In Barbados and Demerara the sugar cane mealybugs are preyed upon by the larvae of a lady-beetle, *Hyperaspis trilineata* Muls. (<sup>8</sup>);

which also might be advantageously introduced if the delays of transportation could be overcome. Mr. Bodkin has more recently reported two other species of *Hyperaspis* from Demerara as predaceous on the mealybugs of sugar cane, *H. festiva* Muls. and *H. orthopustulata* Muls. (or *octopustulata* F.) (<sup>11</sup>).

About fifteen years ago the horn fly, *Haematobia serrata* Desv., became established in Porto Rico, and although now found in all parts of the Island, it becomes most injuriously abundant only in the southern or dryer sections of the Island at the times when there is considerable rainfall. Apparently the abundant rainfall on the north side of the Island renders fresh manure too wet for breeding, and during the periods of least rainfall on the south side the beetles *Aphodius lividus* Oliv. and *Ataenius stercorator* Fabr. become very abundant, and by feeding on and tunneling through the fresh manure change it to a dusty, felty mass of undigested fibers which is also unfavorable for the development of the horn fly maggots. Mr. J. D. Mitchell (<sup>12</sup>) has observed that in south Texas during very dry weather, "the manure dries before the larvae can pupate, and when the manure is thin, the intense heat cooks the larvae outright."

There are two minute hymenopterous parasites of horn-fly larvae in Porto Rico, a species of *Spalangia* and *Xyalosema bifoveolata* Cress. (determined by Mr. J. C. Crawford) and a small staphylinid beetle *Aleochara (anthomyiae or nitida)* (determined by Dr. E. A. Schwarz), which is predaceous on them, each of which exerts some influence in reducing the numbers of these flies. During the seasons when the fly is abundant, however, it is a very serious pest of cattle, especially of the bulls and oxen used in plowing and with the cane carts, and arrangements were made by Mr. Van Dine to introduce several species of "tumble-bugs" from various sources to further reduce the amount of manure suitable for the development of the fly maggots. The Egyptian scarab is the prototype of the tumble-bugs, of which a pair, male and female, detach a bit of manure from a fresh mass, form it into a ball which they roll along the ground and in which the female deposits an egg after they have buried it.

Mr. J. D. Mitchell of Victoria, Texas, sent 275 adult beetles, of which 146 arrived in Porto Rico alive, of three species, *Canthon ebenus* Say., *Canthon laevis* Drury and *Choeridium lecontei* Harold (determined by Dr. W. D. Pierce). About a hundred beetles of *Canthon*

*violaceus* Oliv. were brought from Santo Domingo by G. B. Merrill (<sup>13</sup>) and 8 adults of *Copris carolina* Linn. were sent by the writer from Randolph, Illinois. These beetles were kept in large outdoor screen cages at Guánica, supplied with fresh cow dung daily and they multiplied rapidly in confinement. When the cages became crowded, a liberation of 100 adults at a time would be made. Although the conditions seemed favorable for these beetles, especially those from south Texas and southern Santo Domingo, yet none were noticed in the field after their release, and it is doubtful if any became permanently established in Porto Rico.

The small success achieved in artificially establishing beneficial insects in Porto Rico has fortunately been paralleled by the difficulty that one serious pest of cattle, the oxwarble, *Hypoderma lineata* DeVill., finds in becoming established here, despite its repeated accidental introduction. Many of these flies have unintentionally been brought in as larvae in the body of the host, their presence unsuspected when the cattle were purchased, but later causing considerable apprehension when the swellings which the maggots cause, appeared on the backs of the cows. No adult flies have been collected, no infested native cattle noted and introduced cattle remain free after the infestation at the time of their importation has been eliminated, indicating a failure of the oxwarble in adjusting itself to the changed environments in Porto Rico and becoming acclimated here.

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