ON ANTHOMYIIDÆ.

Pachyneuron anthomyiæ Howard. From puparium of an anthomyiid, larva feeding on *Aphis citrulli;* reared by H. G. Hubbard, Crescent City, Fla.

ON SYRPHIDÆ.

Pachyneuron sp. From syrphid feeding on *Myzus ribis;* reared by Webster, at Lafayette, Ind.

Pachyneuron sp. From syrphid feeding on *Aphis brassicæ;* reared by Koebele, at Alameda, Cal.

Pachyneuron sp. From syrphus puparium; B. D. Eastman; *loc. ?*

Pachyneuron syrphi Ashm. From syrphid puparium; reared by Ashmead, at Jacksonville, Fla.

Pachyneuron allograptæ Ashmead. From puparia of *Allograpta obliqua*, larvæ of which had been feeding on *Aphis brassicæ;* reared by Ashmead, at Jacksonville, Fla.

Pachyneuron sp. From puparia of *Baccha babista*, larvæ of which had been feeding on *Aphis citrulli;* reared by Hubbard, at Crescent City, Fla.

Pachyneuron sp. From puparia of *Mesograpta polita*, larvæ of which had been feeding on corn pollen; reared at Washington from specimens received from New Jersey; also reared by Ashmead, at Jacksonville, Fla.

Pachyneuron sp. From puparia of *Baccha?* sp., larvæ of which had been feeding on *Aphis gossypii;* reared by Hubbard, at Centreville, Florida.

Thus we have records of twenty distinct rearings of species of this genus, and find that it is an enemy of such well-known pests as the grapevine Phylloxera, the grain plant-louse and the cabbage plant-louse, so that the Dr. Jekyll side of its two-faced character is extremely philanthropic. In addition to placing on record the anomalous features of the habits of the insects of this genus of parasites, the short historical summary of my own impressions will serve to point the old, old warning as to the danger of attempting a generalization without broad foundations and extended material.

Mr. Schwarz read the following paper:

CONTRIBUTION TO THE LIFE-HISTORY OF CORTHYLUS PUNCTATISSIMUS, AND DESCRIPTION OF C. SPINIFER N. SP.

BY E. A. SCHWARZ.

The food-habits of *Corthylus punctatissimus* remained unknown until, in the fall of 1882, Dr. C. Hart Merriam discov-

ered that in northeastern New York it lives in the subterranean part of the stems of young Sugar Maple saplings, and that this hitherto supposed rare Scolytid is, at least in northeastern New York, greatly injurious to that valuable tree. This discovery was certainly a most interesting one, but did not fully settle the question of food-plants, for I knew that specimens had been captured in places where there are no Sugar Maples; and this tree does also not grow in the vicinity of Columbia, S. C., where Dr. Zimmermann in all probability found the original specimens. It was to be suspected that this Scolytid had another food-plant, and this was unexpectedly discovered toward the end of September almost within the city limits of Washington, where the beetle was found in abundance in the roots of the common Huckleberry. The fact that it is the first Coleopteron known to affect the Huckleberry, and that it is one of the few Scolytids known to live in plants which are not tree-like, induced me to spend some Sunday's excursions during October to study the habits of this *Corthylus*. The observations are of course only fragmentary so far, since they were made at a season when the insect is already in its winter rest and in its winter quarters.

From Dr. Merriam's excellent account and figures (Amer. Nat., 17, 1883, pp. 84–86) it can be seen that the beetle, after entering the stem just at or very near to the surface of the ground, constructs a circular burrow within the wood close to the bark, but so that the furthest end of the burrow is always a little above or below the entrance hole. From this circular burrow a varying number of straight, short galleries lead off perpendicularly either upward or downward. Sometimes the beetle uses the bottom of one of these shorter galleries to dig deeper down in the stem, and to construct then a second circular gallery parallel with the upper one and possessing also the vertical shorter galleries. In rare instances Dr. Merriam observed also a third story of galleries. The vertical galleries are also excavated by the parent beetle, and are the larval cradles; one egg is laid in each, and the larva remains stationary, does not enlarge the cradle, and is a sap-feeder.

The work of the beetle in the roots, or rather subterranean stems, of the Huckleberry differs but slightly from that in Sugar Maple. The largest root of Huckleberry which I found to be infested measured not quite 10 mm. in thickness, and the smallest but little over 3 mm. It is, indeed, quite astonishing to see how this comparatively large beetle manages to make its circular burrow in such a narrow space; but I have also found infested stems where the beetle, after entering the stem, found it too thin, and left it on the shortest way, viz: by eat-

ing its way out just opposite the entrance hole. Most infested roots measure from 4 to 6 mm. in thickness. In this narrow space it is impossible for the beetle to make the circular gallery as nearly in the same plane as in the thicker Sugar Maple saplings, and the gallery is constructed in a more descending or ascending way along the axis of the root. It thus resembles usually the windings of a corkscrew, and is sometimes quite steep. The arrangement of the short vertical galleries or cradles in the Huckleberry is much less regular than in the Sugar Maple; the whole interior of the infested portion of the root appears to be honeycombed with them. A second or third story of galleries occur also in Huckleberries, but not often, and they are usually much less plain than in Dr. Merriam's figures. Since the Huckleberry roots are rarely vertical, but either more or less arched or crooked in various ways or horizontal for a long distance, and since the burrows of the beetle may occur in any part of the root (except in the thinner tip), from near to the surface of the soil to five or six inches beneath it, the galleries are directed sometimes upward, sometimes downward, and sometimes they are horizontal, but usually they run from the entrance hole in the direction of the tip of the root.

A novel feature in the knowledge of our Scolytid burrows is exhibited in a long, straight gallery through the core of the root, beginning at the top of the honeycombed portion and extending always upward, sometimes even above the surface of the soil. This gallery is never coated with the black substance seen in the regular galleries, and in it from three to six or even more beetles, one close behind the other, are met with. I have called it the hibernating gallery, for it is evident that it is made (of course only by the foremost beetle, the others can only help by pushing the sawdust behind themselves) solely for the purpose of having dry winter quarters remote from the regular galleries, where the wood becomes rotten and damp. This hibernating gallery occurs, however, not in all infested roots.

In the course of my observations I examined the roots and subterranean stems of all sorts of plants growing among the huckleberry bushes but without finding hitherto any other food-plant. The beetle appears to live only in the common Huckleberry of our markets, *Gaylussacia resinosa*, and I failed to find it even in two allied species, *Vaccinium stamineum* and *V. corymbosum*. It occurs, however, by no means wherever the *Gaylussacia* grows, but there are here and there infested areas of plants of larger or smaller extent, more especially in shady places, where the plants grow on a decayed log or

where the soil is covered with a thick layer of old leaves. On such places infested roots are by no means rare: every fourth or fifth will be found either to contain the beetles or to have been infested by a previous generation. The beetle is common in the localities thus far visited by me, viz: the hills along the Eastern Branch of the Potomac near Benning's Station, and along Rock Creek, and I have no doubt that it will be found equally abundant in other localities around Washington and elsewhere. In view of this fact it is strange that neither Mr. Ulke, in his thirty years' assiduous collecting near Washington, nor myself have ever found before a single specimen of the beetle here. The only explanation for this is, in my opinion, that the beetle is strictly subterraneous; that it appears only rarely above ground and rarely makes use of its wings, although both sexes are provided with such. The beetle seems to be perfectly at home in the soil and digs through the same with astonishing rapidity, while specimens which I took from their burrows and placed in a pill-box were all dead after less than twenty-four hours. Both sexes appear to be nearly equally represented: of fifty-six specimens, twenty-five were males and thirty-one females.

Although quite abundant the beetles are by no means easily found. The best way is to carefully inspect a patch of huckleberry bushes in places indicated above, and if there are dead plants or plants with wilted leaves they are sure to be infested by the insect. No attempt should be made to pull out such plants for they break off invariably just at the top of the infested portion, and it is then usually very difficult to find, among the tangle of other roots, the underground continuation of the plant containing the burrows and the beetles. The earth should be carefully removed from the suspected plants, and the infested part of the root will at once be recognizable from some yellow sawdust adhering to it.

From the observation made thus far but little can be said regarding the annual life-cycle of this species. The perfect beetles hybernate either in the larval cradles or in special hybernating galleries. Among the many specimens I found during October there were only two larvæ and three pupæ, and these would no doubt have changed to imagos before the beginning of the winter. In early spring the beetles will no doubt emerge from the plants, copulation taking place outside of the burrows because there is no room therefor within. The female beetle will then bore into fresh plants and commence to lay one egg in each of the larval cradles excavated by herself. If the plant is thin only three or four cradles are excavated, and the beetle probably attacks a second or even a third plant.

In larger plants more cradles are usually made, and the largest number I found in a single plant was fifteen, but it is of course impossible to say whether this corresponds with the largest number of eggs which a single female is capable of laying. The beetle dies within its galleries, and her dead body can still be found when the next generation of beetles has undergone their transformation. Whether there is one or two annual generations can only be determined by future observations.

That this insect is a formidable enemy to the Sugar Maple is evident from Dr. Merriam's account. He says "in Lewis county [N. Y.] alone hundreds of thousands of young sugar maples perished from the ravages of this Scolytid during the summer of 1882." As to its injury to the Huckleberry but little observation is necessary to find that every gallery is fatal to the plant above the infested place. In view of its abundance the beetle would seem, therefore, to act as a serious check to the growth of the plant, but the latter is so exceedingly common and the vitality of the root so indestructible as to fully counterbalance the loss suffered. For while digging in the ground and examining every stock it will be found that the root itself is never killed by the work of the beetle; the plant above the ground dies but the root below the infested part sends forth one or two new shoots.

Supposing that *Corthylus punctatissimus* has no other food-plants besides the Sugar Maple and the Huckleberry, the question arises which of the two is its original food-plant and which represents an acquired habit? A satisfactory answer cannot be given as long as we are ignorant of the food-habits of the beetle in the more southern localities, and more especially whether or not it feeds on the Sugar Maple in South Carolina and further south. The great damage to Sugar Maples in northeastern New York, as reported by Dr. Merriam, has every appearance of resulting from one of those sudden invasions or irruptions which we are accustomed to see in recently introduced insects. Had this beetle been living in the Sugar Maples of New York for many years, its ravages could hardly have failed to attract the attention of the resident entomologists. The species is evidently an immigrant from the south; it belongs to a genus of tropical origin. Five species have been described from South America; others will no doubt be found in the Antillean region; and one, presently to be described, occurs in semi-tropical Florida. *C. punctatissimus* is the only one which extends into the boreal region of North America, and I fully believe that the food-plant

which enabled it to reach the Sugar Maple district of New York is the common Huckleberry.

Upon careful comparison I fail to find the slightest difference between specimens breeding in Huckleberry and others sent by Dr. Merriam, but I take this opportunity to describe another species of *Corthylus* which occurs within the political boundaries of the United States, but which evidently belongs to the colony of West Indian species in southern Florida.

Corthylus spinifer n. sp.—Form oblong, robust; color piceous or reddish-brown; legs and antennæ pale-reddish. Eyes large, transverse, deeply emarginate in front, antennæ inserted in front of the emargination. Thorax and elytra glabrous excepting a few hairs on the front margin of the former. Thorax slightly longer at middle than wide, anteriorly much rounded; sides parallel when viewed from above; basal marginal line well marked and forming an obtuse angle with the lateral line, which nearly reaches the front margin; asperities smaller than in *C. punctatissimus* and indistinctly arranged in concentric rows; posterior half of thorax smooth and tolerably shining. Scutellum semicircular, smooth. Elytra barely as wide as and but little longer than the thorax, cylindrical, broadly rounded at tip, surface shining, finely and rather sparsely punctulate, the punctures irregular except on the disc, where they are distinctly seriate; declivity nearly vertical, slightly retuse, irregularly punctulate, on each side with a longitudinal series of three small cusps, and margined on each side at its apical third by a rather well-defined smooth ridge; suture elevated on the declivity; sutural space not perceptibly excavated and densely punctured. Front tibiæ nearly linear, straight, outer edge finely serrulate and with two larger teeth near the tip, terminal uncus rather blunt and curving outwardly. Abdomen rather densely punctured and hairy. Length, 2 mm.

Male: Surface of head flattened and depressed, the depression rather deep in front, gradually shallowing posteriorly and covered with rather dense yellowish, but not very long, pubescence, sculpture concealed by the pubescence on the anterior part of the depression, posterior portion moderately shining and finely punctulate. Antennal scape greatly dilated toward the tip, triangular, apical edge straight; funicular joint very small, transverse; club very large, nearly circular in outline, densely punctulate and hairy and with three distinct sutures, of which the basal one is nearly straight but distinctly angulated near the anterior end, the two outer sutures decidedly, almost semicircularly, arched; from the base of the inner surface of the club arises a slender spine which, following at first the curvature of the posterior edge of the club, projects above the club and curves inwardly, the projecting portion of the spine being as long as or longer than the whole antenna. If the antennæ are applied to the sides of the head the tips of the two spines overlap each other.

Female: Unknown.

Described from two specimens found by myself on April 19th, in the semi-tropical hammock of the island of Key West, Fla.; precise food-plant unknown.

In the female of *C. punctatissimus* the antennal scape is much more slender than in the male, not dilated, and with the terminal edge rounded; the club is smaller, longer than wide, and more regularly oval. The female of *C. spinifer* will presumably participate in these characters, and further differ from the male in the sculpture and vestiture of the head and in the absence of the antennal spine. Aside from the difference in size and sculpture the two species of *Corthylus* may be distinguished as follows:

Elytral declivity simple; antennal club with two straight sutures, and unarmed in both sexes..... ....*punctatissimus*

Elytral declivity retuse, margined at apical third, and provided each side with three small tubercles; antennal club with three sutures (the two outer ones curved), and armed, in the male, with a long, curved spine .....*spinifer*

Mr. Marlatt presented the following paper:

THE FINAL MOLTING OF TENTHREDINID LARVÆ.

By C. L. Marlatt.

In my experience in rearing the larvæ of various Saw-flies, I have been repeatedly struck with the surprising and apparently anomalous change, just before spinning up or entering the ground to pupate, in coloration only in the case of the smooth-bodied forms, and with spiny larvæ in the loss of the spines, accompanied with similar colorational changes. The variation of larvæ in this particular was so marked that it was difficult to believe that one was dealing with the same species. The larvæ of totally distinct species could not present more decided differences.

At first the nature of this change was not comprehended, but later it was found that after full growth is reached and the usual four moltings are undergone, what I have termed the final molting takes place. This molting is as complete as any of the others—the entire skin being shed, including that of the head and thoracic feet—and I believe has no counterpart in any other family of insects. In Lepidoptera the hairs in many species, or fleshy appendages, as in certain of the