

universal satisfaction and that the few simple implements necessary thereto can always be rigged up by the planters themselves at a moment's notice.

NOTES ON COTTON INSECTS FOUND IN MISSISSIPPI.

By WILLIAM H. ASHMEAD.

(Continued from INSECT LIFE, vol. vii, p. 247.)

ORDER HEMIPTERA.

The strong-nerved plant-bug (*Hymenarcys nervosa* Say). A few specimens seen feeding on the stalk.

The black plant-bug (*Proxys punctulatus* Beauv). Not rare. Feeds on the sap of the cotton plant, although other observers state that it will also attack the cotton-worm and other injurious caterpillars.

The single-spotted soldier-bug (*Euschistus pyrrhocerus* Herr.-Sch.). Not rare. Punctures new shoots and terminal branches.

The green soldier-bug (*Nezara hiliaris* Say). Common on the stalk, sucking its juices. Also said to prey upon the cotton-worm, but I never detected one in the act.

The flat-horned coreid (*Chariesterus antennator* Fabr.). Common in all fields visited. Feeds on juices of the plant and is very active. Its egg is triquetrous, of a golden bronze color, with fine hexagonal reticulations and measures 1^{mm} in length; each side measures 0.6^{mm} in width. The young larvæ escape by gnawing a hole at one end, leaving behind a larval exuvium in making their escape. An egg taken on a cotton leaf August 15, hatched three days later. On account of having all the joints of the antennæ and the legs broadly dilated the larva is quite dissimilar to its parent.

The thick-thighed Metapodius (*Metapodius femoratus* Fabr.). Captured several times puncturing the young bolls, and while not especially numerous does considerable injury.

The egg has not been described, although frequently met with on cotton leaves. In shape it is very similar to that of *Chariesterus antennator* but much larger. It is 3^{mm} long by 2.2^{mm} wide, triquetrous, pale-greenish in color, with a submetallic luster, its surface being finely reticulated, the reticulations forming small hexagons.

The leaf-footed plant-bug (*Leptoglossus phyllopus* Linn.) was of common occurrence. I observed it feeding on the bolls and in and on the blossoms, its preference being for young bolls. Sometimes as many as three or four together were observed feeding on a single boll.

The plain leaf-footed plant bug (*Leptoglossus oppositus* Say) was of rare occurrence on cotton.

The spined Neides (*Neides muticus* Say) is quite frequently met with on cotton leaves. It feeds, apparently, on plant tissues, but is never in sufficient numbers to do any appreciable injury.

The garnished plant-bug (*Geocoris bullatus* Say). Nymph and imago frequently found together feeding upon the tender terminal branches and in the blossoms, although not in great numbers.

The bordered plant-bug (*Largus succinctus* Herr.-Schf.). Numerous specimens of the newly hatched young of this species were taken on the under side of a cotton leaf and along the leaf petioles. They measured 2.5^{mm} in length and were of a blue-black color, smooth and shining, but clothed with a short fine pubescence; the beak, except the last joint, two basal joints and legs, except the last joint of the tarsi, being red.

The swift capsid (*Calocoris rapidus* Say) is exceedingly common on cotton. It feeds in both the nymph and adult stage in the blossoms, upon the petals, and on the corolla.

The false chinch-bug (*Triphleps insidiosus* Say). Common in blossoms, puncturing the stamens.

The crowned soldier-bug (*Sinea diadema* Fabr.) was common in all the cotton fields visited, and does great service in destroying the cotton aphides, small caterpillars, including the cotton-worm, and other injurious species.

The eggs are deposited in clusters to the number of eight, ten, or more, on either the upper or lower surface of the leaf, and are closely held together in a sticky, dark honey-yellow, or reddish-yellow secretion. Each egg measures about 1.2^{mm} in length, or a little more than twice as long as thick, of a cylindrical shape, rounded at bottom and truncate at top. The top is surrounded by a broad, silky, white, marginal fringe, in the center of which is a cone-shaped cap or lid, which is removed when the young nymph makes its exit from the egg. A freshly laid cluster of these eggs, deposited August 7, hatched on the 17th, so that the duration of the egg state, under ordinary circumstances, can not be more than ten or twelve days.

The newly hatched larva may be described as follows:

Length 1.8^{mm}, and of a piceous or shining black color; the antennæ, except at extreme base, the apical half of middle and posterior tibiæ and all tarsi being brownish-yellow, while the middle and hind legs, except as already noted, are dark piceous. The antennæ are cylindrical, 4-jointed, as long as the body, the first and last joints being nearly equal in length, while the second and third united are a little shorter than the first; the head is large, oblong and smooth, widest anteriorly, and as long as the thorax; the beak is stout, extending to between the middle coxæ; the thorax is divided into two lobes, each of which bears a pair of spines; abdomen short and not longer than the hind lobe of thorax; the anterior femora are longer and much stouter than the others and armed with strong spines above and beneath, their tibiæ shorter and slenderer, pilose and with three spines beneath; while the middle and hind legs are shorter and more slender, without spines, although, more or less pilose.

The clubbed soldier-bug (*Heza clavata* Guer.). Much rarer than the preceding and observed feeding upon the cotton aphid.

The bull-horned soldier-bug (*Repipta taurus* Fabr.). The sanguineous color, the two long horns on the head, and the smooth slender legs

readily distinguish this species from all others found on cotton. Not rare. Observed feeding on the cotton aphid and the cotton Aleyrodes. In Florida I have seen it feed upon various aphides, and scale insects of the genus Lecanium.

The two-spined green soldier-bug (*Diplodus luridus* Stal.) is similar in its habits to those just mentioned; both the nymph and imago were found on cotton.

The social soldier-bug (*Diplodus socius* Uhl.). Rare. Habits are the same as allied species.

The mosquito-shaped soldier bug (*Stenopoda culiciformis* Fabr.) bears a superficial resemblance to some of the above species, but is very much larger and differs in many respects. It does much good in destroying various caterpillars, impaling them upon its short stout beak and sucking them dry.

The white Ormenis (*Ormenis* sp.) was seen upon cotton but twice, and is mentioned here only as an occasional cotton insect.

The common Lamenia (*Lamenia vulgaris* Fitch). Not uncommon on cotton, always sucking the juices from the stem. It is a small insect and the injury it does is slight and not apparent to the naked eye.

The grooved-legged Scolops (*Scolops sulcipes* Say). Only occasionally found on cotton, its food plant being usually coarse grasses, and the injury from the punctures of its beak is but slight.

The notch-backed tree-hopper (*Entilia sinuata* Fabr.). I was surprised to find this well-known membracid, distinguished at once by the deep notch or excavation on the middle of the back, occurring in numbers on the terminal shoots and newly-formed leaves of cotton. It seems thoroughly established on the cotton, and I observed it puncturing and feeding on the sap. The form was slightly smaller and darker colored than that found near Washington, but otherwise appeared identical. While I did not succeed in finding the eggs, I have no doubt that they are deposited under the epidermis of the young shoots and the whole transformation from egg to imago takes place on the plant. No appreciable injury from their attacks was observed, as they occurred only on plants of vigorous growth.

The white-margined sharpshooter (*Oncometopia costalis* Fabr.), an elongate black and white tree-hopper, was not uncommon on the stalk, puncturing and sucking its juices.

The wave-mark sharpshooter (*Oncometopia undata* Fabr.) is much more frequently met with than *O. costalis*.

The glassy-winged sharpshooter (*Homalodisca coagulata* Say) can always be found in plenty feeding on the stalk or a branch of the cotton. It invariably clings to the stalk with the head pointed downward and when disturbed flies off with a whirring noise. An account of its life-history by Riley and Howard is given in INSECT LIFE (vol. v, p. 150).

The yellow-headed tree-hopper (*Diedrocephala flaviceps* Riley) is better known as a wheat insect. I took several specimens feeding on cotton.

The crafty tree-hopper (*Diedrocephala versuta* Say) is widely distributed throughout the United States and has many food-plants. I found it very common on cotton in Mississippi, its preference being for the terminal sprouts and tender, newly-formed leaves. Although quite numerous no serious injury seemed to follow its punctures.

The irrorated sharpshooter (*Aulacizes irrorata* Fabr.). Frequently found associated with *Homalodisca coagulata*, which it somewhat resembles in appearance and in its habits.

The garnished jassid (*Phlepsius excultus* Uhl.) is common all over the South, and its natural food plant is evidently some native grass. It was only occasionally observed on cotton.

The half-clothed jassid (*Eutettix seminudus* Say) was often taken on the stalk of the cotton, and was observed to feed upon the juices of the plant. It is an omnivorous feeder, and will probably never become so numerous on any one plant as to be considered a serious pest.

In addition to the above, I took feeding on cotton, *Cicadula 4-lineata* Forbes, *C. 6-punctata* Fabr., and *Chloroneura* sp.

The cotton aphid (*Aphis gossypii* Glover) was exceedingly common, but was prevented from increasing too rapidly by its natural parasite, *Lysiphlebus testaceipes* Cr., many of which were bred from it, and by numerous predaceous insects belonging to the families Coccinellidæ, Chrysopidæ, Hemerobiidæ, and Syrphidæ.

The cotton Aleyrodes (*A. gossypii* Fitch). I see no valid reason for believing this insect anything else than the species described by Fitch under the name of *Aspidiotus gossypii*, he evidently having mistaken a dried pupa of an Aleyrodes, attached to a leaf of cotton, for a coccid belonging to the genus *Aspidiotus*.

This species lives on the leaves, and toward the latter part of July and to the middle of August becomes exceedingly numerous, many hundreds occurring on a single plant, and when disturbed they fly up in powdery clouds.

The eggs, from fifty to a hundred or more, are laid on the under side of a leaf, without any regard to order, resembling those of the orange Aleyrodes, only somewhat smaller, with a shorter pedicel, paler color, and with the surface perfectly smooth and shining. These hatch in from four to five days, and the young larvæ attach themselves to the leaf and begin feeding on its juices.

Although occurring by the thousands, I could detect but slight injury caused by these insects.

ORDER LEPIDOPTERA.

The most serious insect enemies to cotton are found in this order. Many insects belonging to other orders live and feed upon cotton, but as may be seen by these brief notes, these do not as a rule become serious pests, and while it is important that they should be destroyed whenever practicable, no apprehension should be felt on their appearing occasionally in the cotton fields.

No caterpillar of any butterfly, except *Thecla pæas* so far as I am aware, feeds upon cotton, although several species of butterflies are found in numbers flying through the cotton fields, alighting ever and anon upon the cotton blossoms to feed upon their sweets.

Three butterflies, *Callidryas eubule* Linn., *Terias nicippe* Cram., and *Euptoieta claudia* Cram., are so frequently seen in cotton fields throughout the whole cotton belt that it is but natural for the cotton grower to suspect them to be genuine cotton insects. They are mentioned here as of special interest on account of a remarkable theory in regard to one of them, originating and held by Mr. John W. Brown, the planter with whom I was staying, namely, that *Callidryas eubule*, which he called the "vandal fly," produces the boll-worm (*Heliothis armiger*). Notwithstanding I explained to Mr. Brown the utter impossibility of such widely separated species originating from one another, the first belonging to the section Rhopalocera, or butterflies, and the second to the section Heterocera, or moths, he most strenuously held to his theory, and claimed to have proven it by a series of experiments carried on for a period of three years.

It is scarcely necessary to state that at no time did I believe such a remarkable theory. Mr. Brown, however, was so positive in his statements about rearing his "vandal-fly" that I, for a time, thought it quite probable the caterpillar might feed on cotton, and my experiments with it, therefore, were conducted more toward proving or disproving its food-habits.

I shall enter into no details respecting my experiments. Suffice to say, several efforts were made to induce the butterflies to oviposit on cotton, but all proved unsuccessful, the "vandal-fly" again and again refusing to lay its eggs on cotton. I ascertained that its food-plant was Cassia and allied species; and, on procuring some wild coffee (*Cassia occidentalis*), had no difficulty in getting it to oviposit. I inclosed the butterfly in a gauze net with this food plant, and from the eggs thus obtained succeeded in hatching the young larvæ.

It is in the section Heterocera, or moths, that we find the most serious pests of the cotton plant, but only three species cause the planter any serious apprehension, and when they appear he should at once resort to the best remedies known for their destruction, or he will run the risk of losing his crop. These are the larvæ or caterpillars of three nocturnal moths, namely, the boll-worm (*Heliothis armiger* Hübn.), the cotton-worm or cotton leaf-worm (*Aletia argillacea* Hübn.), and the cotton cut-worm (*Prodenia lineatella* Harvey). The habits and destructiveness of the first two have been the subject of such thorough investigation by this Department and the U. S. Entomological Commission that very little remains to be discovered respecting them, and they, therefore, need not be mentioned here.

The cotton cut-worm (*Prodenia lineatella* Harvey) is not mentioned among cotton insects by either Comstock or Riley, although in reading

through the correspondence of the Department, as published in their reports, frequent allusions to its ravages can be found. Mr. F. W. Mally (*see* Bull. 24, Div. Ent., U. S. Dept. Agr., p. 24) appears to have been the first to notice its occurrence on cotton, but describes neither the worm nor the moth. He says: "This fleshy worm was observed entering into nearly grown bolls and feeding on their contents. Its ravages are exactly like those of a nearly grown boll-worm, and the two can not be distinguished." This statement is scarcely correct, as in its earlier stage it is totally dissimilar to the boll-worm, and in its final larval stage there is only the most superficial resemblance. It is not as a destroyer of the boll, however, that it is to be feared, but rather as a cut-worm on young plants in early spring. In the latter capacity, should climatic and other conditions favor its increase, it may yet become a most destructive pest. I first met with it July 26, in the young larval stage, feeding in the newly forming boll. It had not only eaten irregular holes through the outer sheaths of the boll and the petals of the flower, but had also gnawed sufficiently into the corolla to destroy it.

Mr. J. W. Brown recognized this cut-worm and stated that at this season it was rare. They were quite numerous earlier in the season and very destructive, attacking young cotton-plants as they appeared above ground, acres being sometimes destroyed and having to be reset to secure a good crop.

It was successfully bred to the imago. In one case the larva pupated August 4, the moth issuing on the 16th; in another the pupa stage was reached August 6, the moth appearing on the 19th, thus giving twelve and thirteen days, respectively, as the duration for the pupa state.

One of the larvæ, after the last molt, measured 1.25 inch in length. It had a dirty white or yellowish white dorsal lateral line, with two sub-triangular or semilunate velvety black spots on dorsal segments 2 to 11, a V-shaped mark on cervical shield, and a large black spot over the fifth spiracle; there is a pale indistinct median dorsal line that becomes entirely obliterated on segments 3 and 4, and distinct brownish stigmal lines; laterally, below the stigmata, are numerous granulated white spots; the labrum is broader than long and triangularly emarginated; while the legs are green, immaculate, with black claws.

The larvæ of three or four species of geometrid moths, termed "measuring worm," were also taken on cotton, but were rare and did but slight injury to the plant.

ORDER DIPTERA.

The species in the family Asilidæ are predaceous on other insects, seizing them upon the wing and alighting and sucking their juices. Many of them are large and powerful and sting quite severely with their strong, piercing proboscis. The majority of the species appear

devoid of fear, and will attack a bee or wasp as readily as a moth or fly. An asilid in capturing a bee or wasp seizes it immediately back of the head so that the abdomen is extended forward and it can make no defense with its sting in its effort to escape.

The Germans call these insects "robber-flies," and several species are common in the cotton fields. I have observed them seizing moths, beetles, dragon-flies, bees, etc. The following species were taken on the Brown plantation: *Diogmites platypterus* Loew, *Erax lateralis* Macq., *Erax ? bastardi*, *Atomosia puella* Wied., *A. rufipes* Macq., and *Holcocephala abdominalis* Say.

The habits of the Syrphidæ are varied, although many of them in the larva state are beneficial, as they feed upon destructive aphides. The following were observed on cotton: *Mesograpta polita* Say, *Eristalis vinetorum* Fabr., and *Baccha fuscipennis* Say, all on the blossoms feeding upon pollen, while the larva of the last-mentioned was feeding upon the cotton aphis.

The larva of *Mesograpta polita* Say was also common on corn, feeding on the pollen and juices of the plant. The blades of the corn were covered with its puparia. From these I bred two parasites, a cynipid (*Solenaspis hyalinus* Ashm.) and a chalcidid (*Encyrtus mesograptae* Ashm.).

Pipunculus subvirescens Loew. was found associating with certain jasids affecting cotton, and I believe it to be parasitic on *Diedrocephala versuta* Say.

Several distinct species of Tachinidæ were captured on cotton, but as none were bred, no effort has been made to identify them.

Phora aletia Comst., formerly supposed to be a true parasite of the cotton-worm, was common in all the fields, and lives in almost any decaying animal or vegetable substance, the frass and excreta of the boll-worm being a favorite place in which it deposits its eggs. I bred many specimens from such places, as well as from nothing but decomposing cotton leaves, the excremental pellets of various larvæ, and from decomposing insects. It is certainly only a scavenger, and not a true parasite.

ON THE DISTRIBUTION OF CERTAIN IMPORTED BEETLES.

By F. H. CHITTENDEN.

In the list of Coleoptera collected by the writer in the foreign agricultural exhibits at the World's Columbian Exposition, and published by Professor Riley in *INSECT LIFE* (vol. VI, pp. 218-221), several species were only partially identified. Since the publication of this list the doubtful forms have been given further study, and it is now possible to furnish the names of some of the more important species, as well as some information regarding their synonymy and geographic and economic status. At the same time I have thought it well to include in this