*MOSQUITOES FOUND ABOUT GAINESVILLE, FLA.

By U. C. Loftin

PART I. SPECIES, BREEDING PLACES, MOSQUITOES AND DISEASE, NATURAL ENEMIES, PREVENTIVES

Mosquitoes have been known to man since time immemorial, but so far as we know, there has been only one man who was thankful for their existence. In the Old Testament we find that when King Saul was seeking David to slay him, he was asleep in a cave one night when David entered and secured his spear and a bit of his robe. In the Talmud version of this story, we are told that King Saul was guarded by Abner who had stretched himself across the entrance of the cave so that David had to crawl over him to enter. As David was leaving, Abner turned and threw his leg over David's ankle. If David moved, Abner would awaken and kill him; if he waited, day would come and death would follow. The Lord seeing David's predicament, sent a mosquito to bite Abner and cause him to move his foot, thus freeing David who went away thankful and praising God for sending the mosquito. Since that time, man has considered them a nuisance—not only this, but the more recent discoveries have shown them to be transmitters of disease and one of the greatest menaces to public health with which we have to contend.

Mosquitoes are found everywhere, from the frozen arctic regions to the depths of the tropical jungle. When Linnaeus, in 1758, published his catalogue of all the animals then known to exist, he recorded only six species of mosquitoes. Theobald

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PLATE I. Culex quinquefasciatus. (1) Egg rafts (enlarged). (2) Larvae (Wigglers) showing long anal or respiratory tube and oblique angle of suspension from surface of water. (3) Respiratory tube of larvae (greatly enlarged). (4) Head end of Larva (enlarged). (5) Larvae (enlarged). (8) Head of adult male showing plumose antennae and long palpi.

Original numbering of figures has been retained but Figs. 6, 7, 11, 14 and 15 have been omitted.
(1901), in his Monograph of the Culicidae of the World, listed about six hundred species, over sixty of which are recorded from the United States.

Naturally the first question that arises is, "Where do all these pests come from?" "Where do they breed?" It is now known that, with a few possible exceptions that do not occur here, all mosquitoes are aquatic in their younger stages. They live under the surface of the water but are true air-breathers without gills and must come to the surface for air. The air is taken in through the trachael tube which ends in the prolongation of the eighth abdominal segment, called the anal or respiratory tube. This tube is pushed through the surface film and a supply of air drawn in. Later, in the pupal stage, they breathe through two trumpet like tubes arising from the top of the thorax. The food of these larvae consists of bacteria, slimes, and decaying animal and vegetable matter, while a few are carnivorous. Different species breed in different kinds of water. Some will breed only in salt water, others in clean fresh water, while still others prefer polluted sewerage. In studying the mosquito question for extermination, it is important to know where and what kind of breeding places we have to contend with.

The following species have been taken, but there may be others that occur rarely:

Culex quinquefasciatus Say.
Anopheles crucians Wied.
Anopheles quadrimaculatus Say.
Stegomyia calopus Meig.
Psorophora ciliata Fab.
Psorophora floridense D. & K.
Megarhinus sp.?

Following is a brief description of these species:

**CULEX QUINQUEFASCIATUS**

Eggs.—This is the commonest species. The eggs are somewhat conical in shape and are laid on the surface of the water with the large end down. They are placed side by side and stuck together, forming a boat shaped raft (Fig. 1) of six to thirteen rows with forty eggs in a row, each raft containing from one hundred to four hundred eggs, with an average of one hundred and seventy-eight and four-tenths (Davis 1906). They are white when freshly laid, but soon turn grayish brown to black as seen from above, and silvery grayish below, due to a film of air which protects the eggs from the water. They usually hatch in from sixteen to twenty-four hours but they have remained unhatched in the laboratory for ten to twelve days. A few hours desiccation kills them. (Mitchell 1907.)

The eggs are usually laid at night or early morning, but I have observed
a female finishing a raft as late as 9:30 a.m. on a bright day. Males and females bred from larvae in the laboratory, have been confined in a breeding
cage for four weeks with a diet of fresh and dried fruit, but never have any eggs been deposited unless they were fed a meal of blood. Smith (1908) states that blood is the preferred food but is not a necessity and he has had females ovipost on a diet of foul water.

Larvae.—The larvae issue from the under side of the eggs. They have a long anal tube and float below the surface at an oblique angle (Fig. 2). The anal tube is about five times as long as wide, tapering rapidly toward the last half and bears four tufts (Fig. 3). The antenal tufts are set in a notch on the apical half, and are never over half the length of the antennae (Fig. 4).

The larvae (Fig. 5) vary in color from light, almost colorless, to greenish, and nearly black, depending upon the food. Larvae that have had scant food supply and developed slowly seem to be lighter colored than those that developed quickly. The larval stage lasts from seven days (Howard 1902) to several months. Smith (1908) has found the time in New Jersey to vary from one to three weeks depending upon the temperature and the food supply. The time required here was about two weeks in September and October, but was probably longer during the winter. In one instance, in May, they required only seven days to pupate while they have been kept in the laboratory from October twenty-first to February third and then died before pupating. The usual time required in the laboratory was four or five weeks.

The food consists of minute algae, bacteria, and decaying vegetable material. They browse over the vegetable material and eat the bacteria, slime, etc., that accumulates there, as well as some cellular tissue, but no animal tissue has been found in the stomachs examined (Johnson 1902). They have frequently been observed nibbling over the bodies of the larvae that had died, and in one instance the larvae of Citheronia regalis*, but they may have been eating only the bacteria.

Pupae.—The pupae are easily distinguished from the larvae by their enlarged head and thorax. The trumpet like breathing tubes which are over six times as long as wide (Mitchell 1907), arise from the dorsum of the thorax. The pupal stage lasts from two to several days.

Adults.—The adults are small to medium sized individuals, usually light brown in color, though varying from light green to almost black. The abdominal segments are banded basally with white, usually conspicuous, but sometimes indistinct. They rest upon the wall in a horizontal position, with the head upward, and the body held parallel to the wall.

The scutellum is three lobed with the posterior end of the thorax bare. The palpi in the males are as long as the proboscis, but in the females less than one-half as long. The antennae of the males (Fig. 8) are thickly covered with hairs, but in the females, sparsely covered (Fig. 9). The front claws of the males are toothed, but single in the females with the tarsi uniformly blackish. The veins of the wings (Fig. 10) are uniformly covered with narrow scales. The petiole of the first submarginal cell is about one-fourth the length of the cell. They do not fly far, but several hundred yards may be covered when seeking for food or breeding place. (Smith 1908.)

The length of life of the adult is very variable. In the north the im-

*The Regal Moth.
pregnated females hibernate over winter and then may live several weeks and lay two or three times. They have lived for five weeks in confinement in breeding cages (during April and May) on a ration of dried fruits.
Breeding Places

Larvae have been taken in holes, puddles, wells, buckets, barrels, stump holes, basements of buildings, wagon ruts, marshes, ditches, cess-pools, and dishes inside or outside of buildings.

Anopheles

Eggs.—The eggs are boat shaped, one side being flatter than the other, and are covered with a fine reticulated membrane. They are not stuck together in rafts, but float singly or in groups upon the surface of the water. They usually hatch in thirty-six to forty-eight hours, but they may remain viable for several months (Mitchell 1907). They have remained unhatched for fifteen days in the laboratory.

Larvae.—The larvae are easily distinguished by their resting position in the water (Fig. 12). They have a very short anal tube and the body is always held parallel to and touching the surface, and are supported by the anal tube and the racemose hairs (Fig. 13) along the sides of the body indenting the surface film. (Berkley 1902.)

The color varies from very light green to dark brown, almost black. There are often whitish markings on the thorax and abdomen, but these are very variable and often entirely lacking. The length of the larval stage under favorable conditions, may be as short as six days (Howard 1902), but is often much longer. Anopheles quadrimaculatus has remained in this stage for two months in the laboratory.

The larvae feed at the surface and will swallow any minute floating particle.

Pupae.—The pupae resemble Culex very much, but they have shorter and broader respiratory tubes which are placed near the middle of the thorax. The length of the pupal stage is longer than for Culex, varying from five to ten days (Howard 1902).

The eggs, larvae, and pupae of the two species we have are very much alike, and are not easily distinguished.

Adults.—The adults of this genus are easily recognized by the position in which the body is held when at rest. It is held at an angle to the surface, which gives them the appearance of standing on their heads. The body of A. crucians is usually held at an angle of sixty to seventy degrees, while A. Quadrimaculatus usually forms an angle of forty-five to fifty degrees. When there is a breeze blowing, they have been observed clinging to the window screens in the position assumed by Culex, and once or twice when the wind was blowing hard, the body was pressed against the screen. When resting, the hind feet usually point backward and are held a little below the level of the body.

The scutellum is convex behind and the proboscis is straight. The palpi are as long as the proboscis (Figs. 16 and 17) and the claws simple in both sexes. The wings are spotted with white and black scales, but the front margin is wholly black scaled.

Anopheles crucians can be distinguished from Anopheles quadrimaculatus by the spots on the wings. In A. crucians (Fig. 18) the last vein is white scaled and marked with three black spots; while in A. quadrimaculatus (Fig. 19) the last vein is wholly black scaled.

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The length of life of the adult is variable. They must live for at least a week after biting before they can transmit malaria. In the north, they hibernate as adults in cellars, barns, etc. (Howard 1911). They fly only short distances. In the work at Panama, three hundred yards from the breeding points has proved to be safe.

PLATE IV. (23) Warmouth Bass (Chaenobryttus gulosus).

Anopheles usually bite only at night and this point has been emphasized in protection from malaria, but both A. crucians and A. quadrimaculatus have bitten in the late morning in the Experiment Station toilet.

BREEDING PLACES

Larvae have been taken in the edge of marshes, in road ditches, basements, pools, and several other places that were a mile or more from the University. They have been several times taken with Culex larvae.

STEGOMYIA

Eggs.—The eggs are laid singly as with Anopheles. They are black in color, conically elongated, and are covered with a reticulated membrane which collects air and gives them buoyancy (Berkley 1902, Art. by Dr. Agromonte). They usually hatch in from fifteen hours to three days, but will stand desiccation for a day or two and remain viable for at least a month (loc. cit.).

Larvae.—The larvae closely resemble those of Culex, but are larger, less active, and remain below the surface much longer. The anal tube is somewhat shorter and thicker than Culex, being about three times as long as wide, and tapers regularly. The anal tube bears but one pair of tufts and has the teeth of the pecten evenly spaced. The antennae do not taper apically and the tuft is placed at or before the middle. The length of the larval stage varies from eight to twenty days.
Pupae.—The pupae (Fig. 20) resemble Culex, but are larger. They remain as pupae two or three days.

Adults.—The adults are easily recognized. They have the legs and abdomen conspicuously banded with white and the dorsum of the thorax bears a lyre-shaped area of white, though this is sometimes inconspicuous. They fly and bite only during the day.

BREEDING PLACES

The larvae of this species have been found in an old pot, tin cans, and in pans in the laboratory.

PSOROPHORA

The eggs are large, spined, and laid singly. The larvae are much like Culex, but can soon be distinguished by their large size, being over one-half of an inch when full grown. They are cannibalistic and feed upon larvae of Culex, Anopheles, and the smaller ones of their own species. (Berkley 1902.) The adult of *P. ciliata* is easily recognized by its large size and the bands of erect scales on the legs. *P. Floridense* looks very much like Stegomyia, but so far as I have observed, they fly and bite only at night. Neither species are ordinarily troublesome here. No local breeding places have been found.

(To be continued in Nos. 3 and 4. No. 3 will contain Mosquitoes and Disease, Natural Enemies, and Preventives; No. 4, Part II, Traps for Mosquitoes.)

PERSONALS

Announcements of the marriage of Mr. A. C. Mason of the U. S. Ent. Laboratory at Miami to Miss Mary McConchie, at Paris, Ill., have been received.

Mr. C. A. Bennett has established his laboratory for the camphor thrips work at Satsuma. With J. R. Watson of the Fla. Exp. Station, who has been made colaborator in the Bureau on this project, he has recently made a trip to Macclenny, Glen St. Mary, and Monticello.

Mr. K. E. Bragdon is at present supervising the inauguration of a general survey of the peninsular section of Florida for the purpose of finding whether or not the sweet potato weevil has become established at interior points.

Mr. W. R. Briggs has recently been appointed County Agent for Manatee County, with headquarters at Bradentown.

Mr. A. C. Brown recently participated in the boll weevil investigations conducted by the State Plant Board in the northern part of the state.