MOSQUITOES FOUND ABOUT GAINESVILLE, FLA.

By U. C. Loftin

PART II.—TRAPS FOR MOSQUITOES

During the fall and winter of 1912-1913, the writer, at the suggestion of Dr. E. W. Berger, conducted some experiments with traps for adult mosquitoes. These experiments have been recorded in an unpublished thesis, submitted at the University of Florida. The principle results are summarized here. The traps (simplified forms of the one used by Lefroy) were vessels and boxes, dark inside and of several sizes and shapes, placed where the mosquitoes would be likely to use them for hiding places in the early morning. A successful style was a plain earthenware jar, or crock, such as is often used for churns, six to eight inches in diameter, sixteen to eighteen inches high, dark chocolate to black inside (Fig. 27).

*Third and final consecutive installment of Mr. Loftin's paper.
**Dr. Berger first used the traps during June and part of July, and then placed his records at the writer's disposal.

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Another type that gave good results was wooden boxes, seven by seven inches square by thirteen inches deep, painted black or dark green inside, or lined with black or dark green cloth. A joint of six-inch stovepipe was also used with good results. Other sizes, shapes and colors of crocks and boxes were used, but it was found that the traps of small diameter and a depth of twice the diameter gave the largest catches. No noticeable difference was found between the black and the dark green cloth, but the cloth lined boxes gave slightly better results than the painted ones. It is well known that mosquitoes seek a dark place in which to hide during the day and anything that furnishes this condition and is nearly air-tight so that they can be easily killed with a fumigant can be successfully used. Mosquitoes, in common with living things in general, are positively phototactic up to a certain degree of light intensity, and negatively so after this is exceeded. With mosquitoes this optimum, or turning point, is commonly met a little before sunrise.

The traps were placed in various positions and kept uncovered during the night. They were covered from 7:00 to 7:30 in the morning, before the direct rays of the sun reached them. A board or piece of stiff cardboard makes a good cover, but the best and most convenient cover found was a wooden frame covered with wire gauze with a piece of cardboard cut to fit. This cover allows an examination of the contents and the addition of the killing agent without any danger of escape. Gasoline was found to be the cheapest and most effective fumigant. It was added at the rate of $\frac{1}{2}$ teaspoonful per gallon capacity of the crock, and about twice this amount for the boxes, when they were covered in the morning, the amount depending somewhat upon the temperature, more being required on a cold day when vaporization was slower. From fifteen to twenty minutes was found sufficiently long to leave the traps covered. If the specimens are to be kept for future study, no more gasoline than will readily vaporize should be added, for otherwise the specimens will be wet and bedraggled. If they are not to be kept, a pint of boiling water poured into the crock quickly kills them.

The position of the trap is very important and upon it depends its success or failure. Most of the tests were made on porches (Fig. 31) at 208 W. Ninth Street, South, and 2300 W. Hernando Street, Gainesville, Fla., but traps were tried for
short times at several other dwellings in Gainesville, and in
the dormitories and Experiment Station Building of the
University of Florida.

The West Ninth Street house faces west with a porch
extending entirely across the front. The woodwork is painted
dark green and the porch has a solid coping around it and a
wire trellis for vines at either end. There are two double
windows and a door opening on to it. The porch and the
position of the traps are shown in the diagram, Figure 31a.
Traps were placed on the south end of the porch on the east
side next the wall (SE:bc); on the west side next the coping
(SW:bc) and at a point midway between the two. On the
north end they were located on the east side near the wall
(NE:bbb).

The house at 2300 W. Hernando Street is situated about one-
fourth mile northwest of Thomas Hall, University of Florida.
It faces south with a front porch and a side porch part of the
way along the east side. The woodwork is white with a door,
a single window, a double window opening on the front (south)
porch and two single windows on the side (east) porch. There is a corner two feet east of the door that projects outward a couple of feet and a trellis of wisteria shades part of the front and side porches. The traps were located at the right and left of the door (N:rl); at the windows on the front (south) porch (W:bbb); and on the north end of the east porch (N:cb). See diagram, Fig. 31b.

The importance of the position of the traps is strikingly shown in Table I, which gives the records of two similar crocks situated on the south end of the West Ninth Street porch. One was on the east side near the wall (SE:c) and the other not eight feet away on the west side near the coping where it was more exposed to light (SW:c) (see Fig. 31a). The table gives the average number caught per night for a five and six months period, from October to March. (There is no record for the crock near the coping for November, hence this is for a five months period only.)

<table>
<thead>
<tr>
<th>Position of Crock (c)</th>
<th>Months Recorded</th>
<th>Average No. Per Night</th>
</tr>
</thead>
<tbody>
<tr>
<td>W. 9th St. at SE:c (1)</td>
<td>6</td>
<td>21.2</td>
</tr>
<tr>
<td>W. 9th St. at SW:c</td>
<td>5</td>
<td>11.3</td>
</tr>
</tbody>
</table>

(1) See Fig. 31.

This large difference is explained as follows: As day approaches the outer edge of the porch becomes light first and the mosquitoes move towards the darker side, next the green wall, and eventually settle in the traps. The house also breaks the wind on this side and the air is calmer. This tendency to go toward the darker side is also shown near the door at 2300 W. Hernando Street (Fig. 31b). A crock was placed on one side of the door and a joint of stovepipe on the other throughout the winter. Records for an average of ten nights in March show that when the crock was on the right it caught 1.56 times as many as the stovepipe on the left and that when the stovepipe was on the right it caught 1.47 times as many as the crock. This is in spite of the fact that a flower stand and a box for rubbers, etc., was always on the right and a considerable number always settled here. The conditions here are somewhat similar to those at West Ninth Street. The projecting wall shuts off the early light from the east and the wisteria vines, which end about opposite the trap, shut off the light from the front, leaving this a darkened corner. The effect of a large dark place where the mosquitoes can hide was
shown at another house. The back porch is latticed, but not screened, and mosquitoes are plentiful. A crock set in various places on and about the porch gave almost negative results, as most of the mosquitoes settled in a large dark cupboard in a corner of the porch. This being larger and equally as dark as the jar seemed more attractive. In a bedroom at 203 West Ninth Street, where the furniture and walls are light colored, four or five, and at once time a dozen mosquitoes were caught when they were not numerous enough to be troublesome, while in the dormitory, where the woodwork is dark and there are closets and bookcases for them to hide in, never more than three or four, and often none, would be caught, even when they were too numerous for comfort.

No data were secured on the relation of the direction of the wind to the number caught, but the catch was always greater on a still than on a windy night. But as a high wind was usually accompanied by a drop in temperature, this may account for most of the difference. The effect of temperature was noticed throughout the winter, a high catch always coming with a rise in temperature. The curve in Figure 32 shows the temperature recorded and the number caught in a green cloth-lined box on the porch at 2300 West Hernando Street during February, and the close correlation between the two. The temperature of February was the coldest and most variable of any month of the year.

Various substances such as apples, bananas, guavas, raw beef, urine, water, banana oil, etc., were placed in the traps as attractions, but none caused any appreciable increase in the number caught. Very definite results were secured, however, with repellants. The method employed was to place a small vial, or to pour a little of the substance to be tested in the bottom of the trap, and to have a similar trap about a foot away for a control, or check. The percentage of efficiency, as repellants, of three proprietary compounds, Bombay Vapor, oil of citronella and oil of tar, varied from 92.8% to 82% in the order named. Traps of this nature should prove useful in testing the efficiency of repellants because of the ease in which a control can be secured.

A daily record was kept of the position and the catch of the individual traps and the mosquitoes placed in vials or pill boxes for future study. Some of the specimens were destroyed by breakage, loss, destruction by ants, etc., but during the
year 20,449 individual mosquitoes were caught and identified.

Table II gives the number of males and females, the percent of females, the number of females with blood in the abdomen, the number of females with well developed ovaries,

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Plate VI. Fig. 31. (a) Smaller figure, diagram of porch at 203 W. Ninth Street South. Size of porch 9x26 ft. (b) Larger, L-shaped figure, diagram of porch at 2300 W. Hernando Street. Size 7 and 9 ft. by 26 and 15 ft. (b, e, r, l, stand for box trap, crock, traps right and left of door, respectively.)
the total number and the per cent of each species caught during the year.

<table>
<thead>
<tr>
<th>Species Caught</th>
<th>Males</th>
<th>Females</th>
<th>Per cent females</th>
<th>Females with blood in abdomen</th>
<th>Females with well developed ovaries</th>
<th>Total number</th>
<th>Per cent of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Culex quinquefasciatus Say.</td>
<td>11723</td>
<td>8363</td>
<td>41+</td>
<td>839</td>
<td>1022</td>
<td>20086</td>
<td>98.30+</td>
</tr>
<tr>
<td>Anopheles quadrimaculatus Say.</td>
<td>26</td>
<td>171</td>
<td>86.8</td>
<td>11</td>
<td>18</td>
<td>197</td>
<td>.96+</td>
</tr>
<tr>
<td>Anopheles crucians Wied.</td>
<td>87</td>
<td>124</td>
<td>77+</td>
<td>8</td>
<td>12</td>
<td>101</td>
<td>.78-</td>
</tr>
<tr>
<td>Psorophora ciliata Fab...</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stegomyia calopus Meig...</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>11786</td>
<td>8658</td>
<td>42.33</td>
<td>858</td>
<td>1052</td>
<td>20449</td>
<td>100.06</td>
</tr>
</tbody>
</table>

It is seen from the table that *Culex quinquefasciatus* is the dominant species but the percentage given is probably higher than is usually found. The relative abundance of the different species varies from time to time, but *Culex quinquefasciatus* usually comprises from 80 to 85% of those seen. During December very few *Culex quinquefasciatus* were seen at the Experiment Station, while *Anopheles* were common. *Anopheles* comprised from 15 to 20% and sometimes more of those collected by hand in the dormitories during October and November. No *Anopheles* were found resting on the window screens at 2300 West Hernando Street with the *Culex* until about December 1st. From December 1st until February 1st both species of *Anopheles* were found, but usually more *Anopheles quadrimaculatus*. Then *Anopheles crucians* became more abundant, comprising about 10% and sometimes more of all those seen. On March 29th, twenty-five *Anopheles crucians* and only two *Culex* were counted on the screen. Only an occasional individual was seen on the screens at 203 West Ninth Street, while they were always thick on the screens on the front porch at 2300 West Hernando Street, often as many as a hundred individuals being counted in the morning before they were disturbed. The wisteria vines shade the screens at the latter place while there is no such protection at the former.

Stegomyia was occasionally seen in considerable numbers about the building, but only three were taken throughout the

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year in the traps. Psorophora were usually rare, but comprised about 75% of a lot collected by hand or found dead on the window sills of the Agricultural Building. They were sometimes troublesome at night during May in Science Hall. Two or three specimens of Megarhinus were collected, but were never taken from traps.

The percentage of females caught in traps is much lower for Culex than for Anopheles. Smith (1) has pointed out that male mosquitoes do not fly as far as females and that more females than males enter the house. He collected some outside and some inside the house, a total of 1,350, representing several species. Of these taken outside, only a small percentage (10-23%) of those breeding considerable distances away were males, while 60% of the Culex pipiens, which were breeding locally, were males. Of a total of 318 individuals taken within the house, Smith did not find a single male. Lefroy (2) caught an average of 21.8% females in a similar trap set inside the house.

Culex were found breeding closer to both houses than Anopheles.

TABLE III.—Average Number Caught Per Month in Similar Crocks at Both Stations

<table>
<thead>
<tr>
<th>Month</th>
<th>Average Number Caught Per Night</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>203 W. Ninth St. S.</td>
</tr>
<tr>
<td>September, 1912</td>
<td>21.0</td>
</tr>
<tr>
<td>October</td>
<td>44.2</td>
</tr>
<tr>
<td>November</td>
<td>14.3</td>
</tr>
<tr>
<td>December</td>
<td>14.2</td>
</tr>
<tr>
<td>January, 1913</td>
<td>12.0</td>
</tr>
<tr>
<td>February</td>
<td>14.5</td>
</tr>
<tr>
<td>March</td>
<td>31.1</td>
</tr>
<tr>
<td>April</td>
<td>12.2</td>
</tr>
<tr>
<td>May</td>
<td>10.5</td>
</tr>
<tr>
<td>Average per year</td>
<td>19.3</td>
</tr>
</tbody>
</table>

The number given as having blood in the abdomen included only those in which the blood was undigested and could be seen through the abdominal walls as a dark clot. All of those with the abdomen plump and distended, where no blood could be seen, were counted as having well developed ovaries, though some of them were probably distended with other food.

(2). See "Literature Cited".
Plate VII. Fig. 32. Curves showing correlation between temperature and the number of mosquitoes caught per night during February, 1913. Figures at left and dotted line denote temperature, degrees F.; figures at bottom denote days of the month; figures at right and solid line denote the number caught. Porch, 2300 Hernando Street, corner Waukulla Avenue, Lot 1, Block 5, College Park Plat, Gainesville, Fla. Trap, a box (see Fig. 27) lined with dark green cloth.
In twenty-five dissections, however, all contained well developed eggs, the number varying from 30 to 130, depending upon the size of the specimens, with an average of 80.5 eggs.

In Table III is given the monthly average number caught per night in similar crocks situated on the southeast end of the porch at 203 West Ninth Street (Fig. 31a SE:c), and on the right side of the door at 2300 West Hernando Street (Fig. 31 b:r).

**Practical Use of Traps**

Traps of this nature may not rid a place of mosquitoes, nor even reduce the number enough to make them unobjectionable. But in favorable positions, they will catch large numbers and certainly could be used as a controlling factor. The average number caught throughout the year (September to May) by a single crock at 2300 West Hernando Street, was 33.9 per night. This would give a total of over twelve thousand for the year. Suppose one thousand houses in Gainesville should run two of the traps, one on the front porch and one on the back porch, for a year. This would rid the city of twenty-four million pests—I dare say more than have ever been killed by artificial means within the city in the last ten years. Certainly they are not so plentiful in Gainesville that these twenty-four million would not be missed. But even this is not all; each female caught during the winter and spring is cut off from becoming the progenitor of at least a thousand others during the summer. If every home would cooperate by running one or two of these traps, at least during the winter and early spring, the number of mosquitoes present would probably be greatly reduced.

Such traps also afford a very convenient means for testing the efficiency of repellants and determining the relative abundance of mosquitoes at different seasons.

**Summary**

1. All of the mosquitoes found at the University breed locally, but the breeding areas are small and could be drained with the expenditure of a small amount of money.

2. Traps used for adults, when favorably located on porches, have caught an average of thirty-three mosquitoes per night for nine months.

3. Crockes and boxes, black inside or lined with dark cloth,
have given the best results. They should be rather narrow and deep.

4. The success or failure of traps depends on the location. They should be placed in a well lighted room or porch, which is free from dark cupboards, closets, etc. The best position is determined by experiments.

5. High winds affect the number caught, but temperature is the most important factor. The largest numbers caught were on warm still nights.

6. Not all species are equally attracted to the traps. *Culex quinquefasciatus* is attracted more than Anopheles or Stegomyia.

7. These traps are not recommended to rid a place of mosquitoes, but if used with judgment they will reduce the number present in the house or outside. Such traps are also useful for collecting mosquitoes for specimens, demonstration or class uses, or for testing repellants.

**Literature Cited**

Berkley, W. N., 1902, Laboratory Work With Mosquitoes.

Darling, Samuel T., 1910, Studies in Relation to Malaria. Publication of the Isthmian Canal Commission, Laboratory of the Board of Health, Department of Sanitation.


Francis, 1906, Public Health Notes, Vol., No. 26, June, 1900.


Herrick, Glen, W., 1903, The Relation of Malaria to Agriculture and Other Industries of the South. Popular Science Monthly, April, 1903.


KEY TO NORTH AMERICAN SPECIES OF PHYSTHRIPS

(Continued from page 32)

The genus Physothrips is part of the old genus Euthrips which name Karny (1909) has shown should be applied to the genus Anaphothrips. The species formerly included under Euthrips are now divided between four genera which may be separated by the following key:

1. Tibia with a strong, curved spine on the end..........Odontothrips Serville
2. Tibia without such a spine.
   a. Wings with transverse bands..........................Taeniothrips Serville
   aa. Wings without transverse bands.
      b. Bristles on the fore angles of the prothorax conspicuous. Frankiniella Karny
      bb. Bristles on the fore angles of the prothorax not conspicuous. Physothrips Karny

KEY TO THE NORTH AMERICAN SPECIES OF PHYSTHRIPS

(Adapted from Jones, 1912)

1. General color white to light yellow or orange. Head noticeably wider than long.
   a. Last two segments of antennae rather long and slender, and together about 2-3 as long as segment 6. Wings shaded brown except near base and apex.........................................................P. orchardii (Moulton)
   aa. Last two segments of antennae not long and slender, about ½ as long as segment 6. Wings not shaded brown.
      b. Ring vein and longitudinal veins conspicuous. Wings dilute yellow .........................................................P. costalis (Jones)
      bb. Ring and longitudinal veins not conspicuous. Wings white.
          P. albus (Moulton)

2. General color brown.
   a. Head nearly as long as wide; no prominent bristles in front of posterior ocelli..........................P. longirostrum (Jones)
   aa. Head noticeably wider than long; a prominent spine in front of each posterior ocellus.
      b. Eyes not pilose; postocular bristles present; antennal segments 3 and 4 not pedicellate; posterior longitudinal vein of fore wings with 13 spines.................................................P. ehrhornii (Moulton)
      bb. Eyes sparsely pilose; post-ocular bristles absent; antennal segments 3 and 4 pedicellate; posterior longitudinal vein with 11 or 12 spines.................................................P. blacki n. sp.
"Here's to the chigger
That isn't any bigger
Than the point of a very small pin,
But the lump he raises,
Itches like blazes
And there's where the rub comes in."

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