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## REPORT OF A THREE YEAR LIGHT TRAP SURVEY FOR BITING DIPTERA IN PANAMA

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The purpose of this article is to report on light trap operations conducted by the 25th Medical Detachment (Preventive Medicine Survey), operating from the Surgeon's Office, U. S. Army Caribbean, Fort Clayton, Canal Zone.

Malaria control has been the important mission of this survey unit since its reactivation in Panama. Studies in jungle yellow fever have been next in importance and studies on pests or biting insects the third problem.

On all military installations horse-baited traps have been employed almost exclusively as a means of measuring population densities, thereby giving a constant check on the effectiveness of various control measures being used. Also, larval collections have been made routinely and systematically on and adjacent to all military installations. Horse traps cannot readily be transported to outlying districts and male mosquitoes, which are often needed for taxonomic purposes, very rarely enter such traps. These two factors contribute to the justification for the use of light traps.

This paper deals with light traps, a method of capturing insects which was not used extensively in Panama before the senior author initiated the present reported surveys. The purpose of these surveys was to establish the distribution of insects of medical importance which could be attracted to light. When the surveys were first initiated it was thought that it would be confined to studies on the genus *Anopheles*, the vectors of malaria, but the first surveys were so successful that they were soon expanded to include all biting Diptera, not only in the Canal Zone but also in the interior of Panama.

The present paper is the forerunner of a series of small papers which record the results of the surveys. A great many species taken in these surveys are being described by various workers. It is therefore felt that a short paper which establishes location and dates of surveys may stimulate subsequent workers to expand the survey area and fill in some of the gaps that we were not able to accomplish. In this paper only general remarks are made on the results obtained, since a series of short papers are being prepared to cover the details.

The Republic of Panama lies between Costa Rica and Colombia, at 7°39' North latitude and between 77°15' and 83°30' W. longitude. It has an area of 34,169 square miles ranging in elevation from sea level to over 10,000 feet in the volcanic section near Costa Rica. The Canal Zone is a strip of

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land approximately 10 miles wide reaching from the Atlantic to the Pacific Oceans, a distance of approximately 50 miles. The climate is entirely tropical. The wet season lasts from April to December. Rainfall varies from approximately 155 inches to 85 inches a year, the Pacific side getting the lesser amount. Most of the road system extends from near the Costa Rican border to Chepo on the Pacific side, the Trans-Isthmian Highway and a number of lesser highways.

All military installations are in the Canal Zone. There are two maneuver areas in the Republic of Panama, one near Pacora and the other near Rio Hato.

Most of our surveys have been on the existing road system but several surveys have been made in the Darien Province near the Colombian border. This area was reached by boat through the courtesy of the Inter American Geodetic Survey operating out of Patiño Point. One other large series of surveys was conducted by the Gorgas Memorial Laboratory near Almirante, in the Province of Bocas del Toro. This work was done in connection with the yellow fever studies and most of the surveys were conducted at one station in deep tropical rain forest, at an elevation of approximately 600 feet.

Light traps have been operated at 138 different locations, and a total of 454 nights. Very often as many as three generators and six or more light traps would be operating concurrently within a few miles of a given locality. When the unit was up to strength of eleven enlisted men it was possible to station a crew of two men with each generator but as personnel became scarce, it was necessary for two men to operate a battery of generators, driving all night to service the equipment. By such procedure we were able to cover a great many more ecological habitats in a given area. These surveys represent, by far, the most extensive light trap operation ever conducted in any country. Nevertheless, there is a huge area that has not been properly surveyed. Most of the Darien ranging from sea level to over

7,000 feet has not been touched entomologically. The only area that has been properly surveyed is the Mojinga Swamp, an area of approximately 25 square miles in the Fort Sherman Reservation on the Atlantic side. This area has been very rich in biting Diptera. The Volcan has a most interesting fauna due to the variation in elevation. It has not been properly surveyed. A great deal more work should be done in the Los Santos and Herrera Provinces. Our surveys in the Volcan Area extend from near sea level at David to over 6,000 feet at Cerro Punta.

Many of the islands on both the Atlantic and Pacific sides are unsurveyed and the entire Atlantic Coast from Almirante, near the Costa Rican border to the Colombian border is untouched by light trap surveys. Many of the larger rivers offer unlimited material for study if these areas could only be explored. Another weakness in our work is the lack of surveys at different seasons of the year. In the tropics one finds peak seasons of populations just as in the north but not so pronounced. Certain species may be common one month and almost entirely absent the remainder of the year.

**EQUIPMENT:** The standard New Jersey type light trap has been employed extensively throughout our surveys. The power for these traps was generated by portable gasoline driven generators. In addition to these traps the Shannon trap has been operated in some areas. This trap is a tent-like affair made of cheese cloth or mosquito netting. This tent is hung up from the four corners by tying cord or rope to a limb or tree at a height that will permit approximately two feet clearance at the bottom of the tent. A light is hung inside and near the top of the tent. This light attracts the insects to the tent and once inside they are captured from the walls and sides of the tent with a suction tube or other appropriate equipment. In most instances reported here a gasoline lantern was used but an electric light of 100 to 200 watts gave about the same results.

**METHODS:** In all our surveys at least one or more traps have been used at each location. In many instances four traps have been operated from one generator and at the same time a Shannon trap has been operated nearby. In addition to this, various colored bulbs have been used ranging up to 100 watts. Also, a series of tests have been run comparing the effect of different colored paint on the top of the traps. These results will be published in subsequent papers. Specimens were brought into the laboratory, identified and preserved.

It might be well to mention here that collecting in the tropics was a constant battle. While in the field, humidity and dampness, which accelerates growth of mold is probably one of the worst hazards. Ants will also steal specimens from under the microscope while one is studying the specimens unless ant protection is provided. Psocids will completely ruin Diptera in a very short time.

The writers poured melted paradichlorobenzene in the bottom of powder boxes and layered the specimens in padded cotton cut to fit the boxes. Specimens were placed in cabinets equipped with heat units as soon as they were brought to the laboratory. They were separated as fast as possible but the laboratory was usually a few months behind.

All specimens of medical importance were picked out and the residue which we labeled "Trash" was repacked in powder boxes and sent to Washington where specialists of the Bureau of Entomology and Plant Quarantine picked out the things that were useful to the national collection. This often provided many species new to the collection and some that were new to science.

Specimens that we consider of medical importance were divided as follows: All mosquitoes were kept for taxonomic studies by the present authors, with Dr. Pedro Galindo of the Gorgas Memorial Laboratory directing these studies. *Phlebotomus* were turned over to Drs. Alexander Graham Bell Fairchild and Marshall

Hertig. Tabanids were sent to Dr. Fairchild. After tentative identification, *Culicoides* were transmitted to Dr. Willis Wirth of the U. S. National Museum. Dr. Wirth and the senior writer are preparing a monograph of the *Culicoides* of Panama, and three papers describing thirteen new *Culicoides* have already appeared.

**GROSS RESULTS:** Notes on distribution of the various species will be treated in a series of short papers. It should be remembered that certain genera of mosquitoes are diurnal and are not readily attracted to light. The following short table presents a general idea of the enormous quantities of mosquitoes, *Culicoides* and *Phlebotomus* collected during these surveys in Panama. A great many species, many of which are new to Panama and some new to science, have been found in these surveys.

	1951	1952	1953 (Through Aug.)
Mosquitoes	73,615	70,867	96,091
<i>Culicoides</i>	105,586	235,555	84,000
<i>Phlebotomus</i>	6,114	31,417	1,492

In addition to these surveys a number of light traps were operated during June of 1952 in Puerto Rico, the results of which will be published later.

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also Hector Baxter, Luis Pinzon, Louis Palma and Wilbur Lowe of the Malaria Control Force.

**SUMMARY:** The 25th Medical Detachment has conducted light trap surveys in Panama since 1951. A total of almost 150 localities have been surveyed one or more times using New Jersey-type mosquito light traps and the Shannon trap. In

addition some traps have been operated in Puerto Rico. During this time approximately 240,573 mosquitoes, 425,141 *Culicoides*, and 39,023 *Phlebotomus* have been collected. A series of short papers will be published later giving the distribution of mosquitoes. Also, much of this material is being used in taxonomic studies by the writers.