

## REVIEWS AND ABSTRACTS

STUDIES OF THE BIOLOGY AND CONTROL OF BITING FLIES IN NORTHERN CANADA. By C. R. Twinn. Arctic, 3(1)14-26. 1950. Canadian arctic and subarctic species of mosquitoes, black flies, and Tabanids were studied. Observations were made relative to species association, seasonal development, abundance, and characteristic activities of the individual species. At Fort Churchill, Manitoba, 11 species of *Aedes* and 2 species of *Culiseta* were collected including immature stages of all except *A. spencerii* (Theo.) and *Culiseta impatiens* (Wlk.). Sixteen species of black flies were recorded for this region, the major pest species being *Simulium venustum* Say; also 17 species of tabanids including 10 of *Hybomitra*, 5 of *Chrysops* and 2 of *Atylotus*.

Similar studies were conducted at Goose Bay, Labrador where 15 species of mosquitoes were obtained. These included 10 species of *Aedes*, 2 of *Culiseta*, 1 of *Culex*, 1 of *Wyeomyia*, and 1 of *Anopheles*. Also 12 species of black flies, the dominant species being as follows: *Simulium perissum* D. & S. (49%), *Simulium venustum* (35%), and *Prosimulium hirtipes* Fries (11%). Seventeen species of tabanids were taken in the same region including 9 of *Hybomitra*, 1 of *Atylotus*, and 7 of *Chrysops*. Additional records are cited for Whitehorse, Y.T., Baker Lake, N.W.T., Algonquin Park, Ont., northern British Columbia, and the Yukon.

Chemical control studies indicated the superiority of DDT as a mosquito larvicide—0.2 or 0.25 lb. of DDT in oil constituting a practical dosage for pre-hatch and post-hatch treatments of *Aedes* larvae. Pre-hatch dosages of 0.05 to 0.35 lb. per acre showed little if any residual larvicidal effect after one year. Immature stages of black flies were controlled by a DDT-fuel oil solution at a concentration of 0.1 p.p.m. maintained for 15 minutes at the point of application. Dosages of 0.39 p.p.m. for 24 minutes or 0.113 p.p.m. for 16 minutes proved to be dangerous to fish life when the DDT concentrate was not diluted with oil.

Standard repellents, i.e., dimethyl phthalate, Rutgers 612, and 6:2:2 mixture gave protection for 5 to 6 hours against mosquitoes. As a rule repellents gave longer protection against black flies than against mosquitoes, but none appeared to be effective against tabanids. Wide mesh head-nets impregnated with dimethyl phthalate provided good protection against mosquitoes but were penetrated by black flies. These studies are being continued.—B. I. Gerry, State Reclamation Board, Boston 8, Mass.

THE DURATION OF THE AQUATIC STAGES OF *Anopheles minimus*, THEO., DETERMINED BY A NEW METHOD. By C. R. Ribbands. Bull. Entom. Res. 40:371-377. 1949. In Assam the duration of aquatic stages of *Anopheles minimus* in na-

ture was determined by daily dipping each foot of a 100 foot stretch of stream bank for a two month period. In spite of great variation in the stream level due to monsoon rains, and subsequent variation in the daily totals collected, an analysis of the sequence of peaks of the various instars showed that the duration of larval life was seven days. This is a shorter period than expected, since floating cage experiments had previously indicated a 9-12 day larval life for this species.

The life cycle of *Anopheles minimus*, under monsoon conditions in Assam, probably occupies 14 days; egg 2 days, larva 7 days, pupa 2 days, and adult to first egg laying 3 days.—Harold R. Dodge, Communicable Disease Center, Atlanta, Georgia.

STUDIES ON THE ACTION OF DDT ON ANOPHELINE MOSQUITOES AND HOUSE-FLIES. By A. N. Johnston. Bull. Ent. Res. 40(Pt. 3):447-452. 1949. Experimental results indicated that the mortality rate of Anophelines depends on the time of exposure. No evidence of differential reaction between the various stages of larvae was found.

Definite and positive evidence of the action of DDT on mosquito pupae was obtained.

Laboratory trials indicated that mortality of adult Anophelines following contact with DDT is relatively slow, and the period of exposure required for a lethal dose is approximately 15 minutes.

Adult flies required a much shorter period of exposure, viz., 30 secs., and the rate of mortality was higher. Evidence of the mechanical interference of DDT by flies is also presented.—Author's summary.

MOSQUITO CONTROL: AN INVESTIGATION OF NATURAL SURFACE FILMS IN RELATION TO THE SPREADING OF LARVICIDAL OILS UPON WATER. By B. A. Toms. Bull. Ent. Res. 40(Pt. 4):503-510. 1950. The first section of this report is given over to discussion of what is expected in the way of spreadability of a larvicidal oil and some of the methods used to determine these factors. He separates surface films into biological or mineral types, depending on the nature of the material, and outlines some of the reasons spreading may be effected by such films. Preliminary measurement is done by measuring "spreading pressure" which is the force in dynes per centimeter that must be opposed to the advance edge of the drop just to prevent it from spreading on a clean water surface. The additional resistance offered by the surface film is given as film pressure, which is a force equal in magnitude to the spreading pressure of an oil which just fails to spread on the contaminated surface. Using the method of N. K. Adams as a basis for study, he prepared known concentra-

tions of oleyl alcohol in purified liquid paraffin, in one series, and terpineol and liquid paraffin in another. These were diluted in such a manner as to give a difference in film pressure of 5 dynes. Using these prepared solutions in the field, a survey was made along the Gold Coast limited by the towns of Sekondi and Axim covering an area of about 15 miles. By making field tests on a representative selection of standing water, he was able to determine the average spreading pressures for the area, and thus determine in advance the best type of oil that would give maximum coverage on all the types of standing water to be treated. This method of predetermining the most satisfactory type of base oil with or without wetting agents seemed to produce excellent results in determining more effective larvicidal solutions.—Franklin C. Nelson, Standard Oil Co., Linden, New Jersey.

PUPAE OF THE NEARCTIC ANOPHELINE MOSQUITOES NORTH OF MEXICO. By George Henry Penn. *Jour. Nat. Mal. Soc.*, 8(1):50-69, 1949.

PUPAE OF THE ANOPHELINE MOSQUITOES OF THE NORTHEASTERN UNITED STATES (DIPTERA CULICIDAE). By Richard F. Darsie, Jr. *Rev. de Entomologia*, 20(1-3):509-530, 1949.

In the first paper, Penn describes and illustrates 14 species of *Anopheles*, including the Mexican *A. aztecus* in view of its close relationship to American forms. The descriptions are concise and easily followed, and a tentative key to the species treated is provided. The system of chaetotaxal nomenclature proposed by Knight and Chamberlain is used throughout.

Darsie in the second paper describes, illustrates and keys out the 7 species of *Anopheles* known to occur in the northeastern portion of the United States. The system of chaetotaxal nomenclature followed is that of Baisas, as modified by Penn.

It seems unfortunate that these two papers should appear at approximately the same time, as all the species treated by Darsie are also described by Penn. To most American workers, Penn's paper probably will prove of greater value because of its wider scope. Darsie's study is not without value, however, for the variations in hair size and branching he records are from different specimens, with a few possible exceptions, than those used by Penn. These observations are given in two tables. While these tables are convenient and well planned, they could be improved by indicating the number of specimens of each species studied. For instance, a range of 6-11 branches of a particular hair in a small series of 3 or 4 specimens lacks the significance of a similar range in a much larger series.

Penn wisely calls his key to species a "tentative" one, for with the limited number of specimens of known identity available at the present time for comparison and study, some of the hair characters used eventually may be shown to be unreliable. He had, for instance, as few as 6 specimens of *A. albimanus* and 3 of *freeborni*. Darsie worked under similar handicaps.

Both Penn and Darsie are to be complimented on their initiative in laying a firm groundwork for future American anopheline pupal study. It is hoped that others will realize the value of pupal characters in mosquito taxonomy, associate pupal exuviae with adult specimens, and put the keys to test. The time is probably not far off when the taxonomist will be able to key out anopheline pupae to species with somewhat the same assurance that he now determines larvae.—Roy W. Chamberlain, U. S. Public Health Service, Montgomery 7, Alabama.

ALTURA DE POUSO DAS FÊMÉAS DE ANOPHELES DARLINGI E DE ANOPHELES AQUASALIS NAS PAREDES INTERNAS DAS CASAS. L. M. Deane and R. G. Damasceno. *Revista do Serviço Especial de Saúde Pública* 11(2):503-506, 1948. 1. In order to verify the vertical distribution of the resting females of *Anopheles darlingi* and *Anopheles aquasalis*—the main vectors of malaria in the Amazon—on the inside walls of dwellings, night captures were made between April 1947 and October 1948 in several types of rural houses in Belém, Maracana, and Capanema, State of Pará, Brazil. The walls of these houses were ruled off in horizontal divisions one meter wide from the ground up.

2. It was found that the females of both species are distributed in decreasing numbers from the lowest to the highest levels, that the majority are found on the two lowest divisions, and that few specimens are encountered above three meters—1.4% of 7,151 *darlingi* and 2.1% of 3,137 *aquasalis* in the observations herein reported. It was also found that the engorged females show a tendency to rest at a lower level than the unfed females.

3. It is concluded that in the control of malaria by indoor spraying with DDT in areas where the vectors are *darlingi* and *aquasalis*, it is sufficient to apply the insecticide up to 3 meters, disregarding the higher portions of walls and ceiling, thus saving considerable material and working time.—Authors' summary.

FURTHER STUDIES ON THE LOSS OF INSECTICIDES BY ABSORPTION INTO THE MUD AND VEGETATION. By A. B. Hadaway and F. Barlow. *Bull. Ent. Res.* 40(Pt. 3):323-343, 1949. (Colonial Insecticide Research, Uganda, Africa.) Formulations of DDT have been applied to standard mud blocks. Toxicities to *Glossina palpalis* and *Aedes aegypti*, and the proportions of insecticide recovered from an outer layer of approximately 0.1 mms. thickness have been compared.

Absorption of DDT in oil solutions was considerable and amounts recovered from the outer layer were only from 8-10% of the total dosage applied. Adsorption of the insecticide from the oil on to mud occurred. There was some correlation between the capillary rise of the solvent and the extent of absorption. Toxicities of the blocks to test insects were low.

Using concentrations of 2%, 5%, and 10% in

power kerosene, there was no increase in the proportion held on the surface. Application of excessively heavy dosages increased the amounts in the outer layers but there was a trend towards greater absorption, and therefore to greater waste, at the high dosages. Repeated applications similarly built up a larger dosage in the outer layer but did not increase the proportion there.

Emulsions were intermediate between solutions and wettable powders as regards absorption and toxicity.

Up to 77% of the insecticides applied as wettable powders was recovered from the outer layer, and toxicities were correspondingly high. When benzene hexachloride wettable powder was used there was rapid loss of benzene hexachloride from the surface by volatilisation. After 15 days the dosage had decreased considerably and the percentage in the outer layer had fallen from over 70% to 20%.

Loss of DDT by penetration of the carrier oil through the leaf cuticle may occur when an oil solution is sprayed on to vegetation. The extent of penetration varies with different plants.

There is an indication that small amounts of DDT are transferred from the inside of treated leaves to other untreated parts of young coffee and avocado pear plants.

Deposits of DDT on leaves exposed to ordinary climatic conditions remained toxic to tsetse flies for a longer period when applied as an emulsion than as an oil solution. Deposits from a water suspension of a wettable powder were washed off readily by rain.

There is some evidence that continuous exposure to sunlight produced some chemical change in, and reduced the toxicity of, DDT deposits applied to glass plates as a solution in kerosene. —Authors' summary.

A REVIEW OF THE SPECIES OF CULEX OF THE SUBGENUS MELANOCONION (DIPTERA, CULICIDAE). By Lloyd E. Rozeboom and William H. W. Komp. Ann. Ent. Soc. America 43(1):75-114, pls. I-XV, 1950. The purpose of this paper is to make possible the determination of members of this subgenus, which, as treated by these authors, includes both *Melanoconion* and *Mochlostyrax*. Since this determination must be entirely dependent, for most species, on details of the male terminalia, the keys and figures are confined to this group of structures. Ninety-one species are keyed and figured and eleven other species listed but not treated further because of insufficient knowledge. An alphabetical list is given of the keyed species with the original literature references, type localities, notes on types with certain lectotype designations, and recent and new synonymy. The authors discuss the necessity for dissecting the terminalia in order to study it properly and the difficulties involved in the study of types not properly prepared. Using the key and the excellent illustrations together and using proper techniques in preparing the material, one should have little difficulty

in recognizing the described species. Some difficulty may be experienced in interpreting the shape of the clasper. To the reviewer it seems rather unfortunate that a better term could not be found than "snout-shaped" in describing the clasper in the section *Choeroporpa*. Snouts are of such varied shapes that it brings nothing very definite to mind, and the clasper of *aikenii* seems fully as "snout-shaped" as that of *paracrybda* or *intrincatus*, while that of *elephas* seems simple. If the clasper of *latisquama* is considered simple then that of *elephas* should be, the former appearing considerably more modified than the latter. One might also think that the clasper of *zeteki* had a distal portion expanded. It is to be hoped that when the immature stages and the biologies of the species become better known a more satisfactory grouping of species can be found than this based upon the shape of the male claspers. The paper is an excellent one, however, and should greatly aid the study of this interesting but difficult group.—Alan Stone, Div. of Insect Identification, B.E.P.Q., U.S. Dept. Agriculture, Washington 25, D.C.

OBSERVATIONS OF THE PERSISTENCE OF PLASMODIUM INFECTIONS IN ANOPHELES MOSQUITOES IN AN AREA OF LOW OBSERVED HUMAN MALARIA PARASITEMIA IN SOUTH CAROLINA. By Wm. C. Frohne, Albert A. Weathersbee, Giles M. Williams, and John W. Hart, Journ. Nat. Mal. Soc. 9(1):10-24, 1950. 1. Data are presented on malaria incidence as determined by monthly blood films for a period of 51 months in a Negro population of about 600. The parasitemia rate dropped from 38.2 per cent in October 1944 to 0.0 per cent in 1946, and has remained low during 1947 and 1948.

2. The results of dissection of 33,593 *A. quadrimaculatus* in 1945 and 1946 and of 10,589 in 1947 and 1948 show a generally parallel drop in the annual sporozoite (gland-positive) rates. Rates of the 4 successive years are: 0.17, 0.07, 0.09, and 0.04 per cent, respectively.

3. Similarly, the sporozoite rates of 5,138 *A. crucians* dissected in 1947 and of 8,384 in 1948 were 0.14 and 0.06 per cent, respectively.

4. Densities for both species of *Anopheles* were determined from weekly averages of dissection station counts. There were low densities in 1947, but *A. crucians* densities were not so greatly depressed as those of *A. quadrimaculatus*.

5. During 1947 and 1948 when human parasitemia rates were insignificant, 4 individual stations yielded 5 sporozoite-positive *quadrimaculatus*, and 9 stations furnished 12 infected *crucians*. In 4 instances gland-positive mosquitoes of both species came from the same stations. Positive *crucians* were found in all *quadrimaculatus*-positive stations except one vacant house from which less than 200 *crucians* were dissected in 2 years.

6. A formerly malarious neighborhood of 4 dissection stations produced the 2 infective *quadrimaculatus* of 1947 and 3 of the 7 infective

*crucians*. In 1948 the same small neighborhood without any demonstrable human parasitemia during all 12 months, nevertheless furnished 50 per cent of the infective *Anopheles* found, though only 12.6 per cent of the mosquitoes dissected came from there.

7. In the study area the residual spraying of dwellings with DDT was carried on from 1945 through 1948. During that period human malaria parasitemia decreased in the ratio of 318 to 1. In spite of this remarkable reduction in parasitemia, and doubt regarding any recent new infections, the conclusion is reached that a minor amount of malaria transmission may be occurring in the study area for the following reasons: (1) Sporozoite-positive anophelines were present at specific locations in association with human parasitemia. Further investigations to determine the nature of these sporozoite infections is necessary before the definite conclusion can be drawn that they are not of human origin. (2) *P. falciparum* infections in the human host are atypical. These usually are asymptomatic, persist for long periods, and are highly infective to *Anopheles* even when gametocyte rates are extremely low. Thus, it is possible that a higher percentage of the human population is infective to *Anopheles* than is indicated by the monthly human parasitemia rates.—Authors' summary and conclusions.

A FIELD STUDY ON "GAMMEXANE" AND MALARIA CONTROL IN THE BELGIAN CONGO. II. THE EFFECT OF THE SPRAYING OF HOUSES WITH "GAMMEXANE" ON THE MOSQUITO POPULATION AND ON THE MALARIA INCIDENCE IN CHILDREN. By G. Davidson. Ann. Trop. Med. and Parasitol. 44(1): 1-26. 1950. "Gammexane" deposits applied in commercial water dispersible formulations at rate of 10 mg. gamma isomer per square foot retained toxicity against *Anopheles moucheti* for three months. Dwellings sprayed were mudwalled, often whitewashed, with roofs of corrugated metal, cement tiles or leaves.

The density of *Anopheles gambiae*, though low in the area was thought to have remained low during flood conditions due to spraying.

Untreated houses within a treated village harbored large numbers of *A. moucheti* after most of houses had been treated, emphasizing importance of treating every house. Complete spraying of isolated villages failed to effect local eradication.

Stomach and ovary dissections showed that over-all age level of *A. moucheti* was reduced, with a corresponding reduction in biting rate and egg laying. On basis of salivary gland examinations, malaria transmission was judged to have ceased.

"Gammexane" treatment described was ineffective against *Taeniorhynchus (Mansonioides) africanus*.

Blood film examinations of children 9 months and one year after beginning of spraying did not reduce rate of parasitemia but intensity of infections decreased. Parasite rates and intensities

increased among children in untreated villages during a corresponding one year period. Infant infection rates were similar in treated and untreated villages. Population movements tend to nullify effect of treatment on malaria incidence in particular parts of the area.—Robert H. McCauley, Jr., U. S. Public Health Service, Manning, S. C.

BIOLOGICAL AND CROSSBREEDING STUDIES ON *Aedes hebrideus* AND *Aedes pernotatus*. By Wm. J. Perry. Ann. Ent. Soc. Amer. 43(1):123-136. 1950. Almost all culicidologists who have been concerned with control or taxonomic aspects of mosquitoes in the Pacific Basin have an appreciation of certain group complexes which have until recently been confused. During World War II certain Culicid species known to be efficient disease vectors were erroneously reported from localities where the distribution of the species does not extend. Medically, species differentiation of some of the "groups" is extremely important. *Aedes pseudoscutellaris* collected in nature in Samoa (Byrd and St. Arnant 1945) exhibited a 9.9 percent larvae *W. bancrofti* infectivity rate. *Aedes hebrideus*, which had been previously determined as *A. pseudoscutellaris* epidemiologically is not responsible for the transmission of this disease.

Biological and crossbreeding studies made on two closely related forms of the *scutellaris* group from the New Hebrides Islands, *Aedes hebrideus* and *Aedes pernotatus*, led the author to the conclusion that both are true morphological species. Ability to hybridize only with extreme difficulty under laboratory conditions, and morphological differences in the larval, pupal and adult stages, including distinct hypopygial features, support this belief. No apparent intergrades have been found in nature even though on Esperitú Santo, in the New Hebrides, both occur together.

No ova were produced in crossbreeding experiments between female *A. pernotatus* and male *A. hebrideus*. Fertile ova were produced with the reverse sex combination. Intergrading characters were produced in larvae of the first generation with the progeny exhibiting features tending toward the maternal type, *A. hebrideus*. Larvae showed greatest variation in the sclerotic plate of the fourth instar. Second generation progeny showed greater alteration of structure of the sclerotic plate. Four males with a terminal pattern similar to *A. pernotatus* and a single imperfectly developed female was obtained in this group.

The medical importance of the two species in these Islands is not significant.

Biological accounts are given for the two species which include clear tables with reference to aquatic development. Six excellent plates adequately illustrate the critical larval, pupal, adult, and male terminalia of the two species and also contrast selected variations in larvae and adults of the first and second generation progeny.—Theodore Aarons, Alameda County Mosquito Abatement District, Oakland, California.