REVIEWS AND ABSTRACTS

HELEN LOUISE DURKEE

Aëdes aegypti (L.) THE YELLOW FEVER OSQUITO. ITS LIFE HISTORY, BIONOMICS AND TRUCTURE. By Sir S. Rickard Christophers. ondon and New York: Cambridge Uni- rsity Press, pp. xii + 739 (86 plates), 1960, 14.50. The most vexing problem of the licidologist today is the enormous literature hich must be comprehended before adequate w research can be undertaken. There are prob- ly over 25,000 more or less important books, ticles and pamphlets which have been devoted the study of mosquitoes and the rate of produc- on of such verbiage appears to be rapidly in- easing. Probably 90 percent or more of what is ritten on the subject today contains little that is ally new but represents confirmation or even discovery of previously published ideas. There an all too prevalent attitude that it is easier to t a needed answer from experimentation than om published literature. This may occasionally sult in a really new approach to a problem but, the vast majority of cases, leads to duplication previous works which as often as not were ore thoroughly done. It is for this reason that mprehensive synthetic works are extremely val- able to the culicidologist. The last decade has en especially fruitful in this regard. The pub- cation of Bates' *Natural History of Mosquitoes* 1949 was an important step toward the syn- esis of biological information on mosquitoes. he publication in 1951 of Muirhead-Thomson's *Mosquito Behavior in Relation to Malaria Trans- ission and Control in the Tropics* was an impor- nt step in the synthesis of information on the havior of mosquitoes. The *Synoptic Catalogue f Mosquitoes of the World* by Stone, Knight and tarcke in 1959 was an important synthesis for ie taxonomist. The last major gap, that of natomy and morphology has been filled by Sir hristophers' book. Culicidologists are indeed in n enviable position. The work of synthesizing ie literature is by no means completed, as a natter of fact it has hardly begun; these four ooks, however, form a good basic library for the ovitiate and an invaluable set of references for ie experienced research worker.

The present volume is first and foremost a udy of the anatomy and morphology of mos- uitoes. This is an area which has required re- iew for many years, the standard references being ie very old studies of Nuttal, Shipley, Imms and ie review by Howard, Dyar and Knab. Last year nodgrass contributed importantly to this field by is publication *The Anatomical Life of the Mos- uito* which, however, is much less detailed than ie present work, as well as having a more re- ricted subject of inquiry. Christophers' volume the most comprehensive work on the structure f mosquitoes which has yet been published.

At first sight the work appears to be a compilation of what is known concerning *Aedes aegypti*. The references appear to number about 2,500; the number cannot be estimated with accuracy because they are scattered throughout the book at the end of each chapter which causes a good deal of duplication although such duplications are noted. The references would be much more useful, at least to this reviewer, if they were combined and placed at the end of the text. The latest references noted are dated 1958 but there are few of more recent vintage than 1955. In reading the text one is frequently impressed with the amount of work which has been done since that time.

Upon looking over the volume more closely one finds that it is much more than just a compilation of the literature. It consists, to a surprising extent, of new and unpublished information. Apparently Sir Christophers found many lacunae in knowledge of this species and tried systematically to fill in the details. The over-all result is a monograph, not limited, incidentally, to *Aedes aegypti,* containing a vast amount of previously unpublished information and constituting the only modern synthesis of work on the structure of mosquitoes.

The book is arranged in 31 chapters, each with its own list of references. The first five chapters constitute an introduction followed by three chapters on eggs, six on larvae, two on pupae and 15 on imagines.

The five chapter introduction is devoted to historical, systematic, ecological and medical aspects of *Aedes aegypti* and ends with a chapter on technique. This section is unevenly done. It contains a charming account of the evolution of common names of mosquitoes and a valuable survey of early writings concerning these insects. It also gives a more or less detailed account of the names which have been used for *Aedes aegypti* which could well have been omitted. There is a section on the identification of the species which would be more at home in a manual of identification than in the present work. There is a consideration of the geographical diversity and climatic requirements of the species which suggest having been written by a person more at home in the laboratory than in the field. There are short treatises on sex mosaics, fossil mosquitoes and parasites, which have little to do with *Aedes aegypti* although they may be useful, especially the last of the three. The section on predators is less complete and, surprisingly enough, fails to mention *Gambusia affinis* although the genus is mentioned. The chapter on medical aspects detracts from the quality of the book ("Japanese B. —and St. Louis encephalitis have also been considered possibly mosquito-borne (Marks, 1954)")

and would better have been omitted. The section on control is sketchy, outdated, and occasionally inaccurate ("An analogue of DDT, namely dieldrin . . ."); the section on repellents fails to mention diethyl-toluamide. The chapter on technique will be read avidly by the novitiate and expert alike since everyone seeks better ways of doing things. It contains a great deal of material on equipment and methods for rearing, mounting, dissecting and even sectioning mosquitoes, as well as various other kinds of techniques.

The three chapters on eggs are devoted to structure and biology, hatching and embryology. The anatomical discussions contain much new material as do the sections on size, growth changes, specific gravity, volume, and surface area of eggs. These sections were apparently finished before the recent works of Horsfall and his students were published and the section on waterproofing contains no reference to the work of Beckel. In this section as well as in the rest of the book Sir Christophers shows a weakness in knowledge of American works as Americans customarily have for English works or as either usually has for publications in other languages. The chapter on embryology seems to be the first detailed study of the embryology of mosquitoes which has been published; it applies to autogenous *Culex pipiens* rather than *Aedes aegypti*. In this, as in other sections of the book it is unfortunate that drawings are labelled with abbreviations since in most cases there is adequate space for the complete name of each structure.

The six chapters on larvae give detailed accounts of the morphology and anatomy of larvae and a consideration of instar differences. There are extensive accounts of the mouth parts, nervous system and tracheal system as well as the more familiar material. There is included a chapter on ecology and one on growth of larvae. Here, as elsewhere, the emphasis is on structure; function is less extensively considered. The two chapters on pupae concern anatomy and physical characteristics and contain a small amount on behavior.

The 15 chapters on the imago include one on physical characteristics, two on external anatomy and five on internal anatomy. Of the other seven chapters there are two on feeding and others on mating and oviposition, flight, special senses, environment and longevity, and physiological miscellany. Most of this work is written from an anatomical or grossly descriptive point of view. Again one notices the advances which have been made in study of the female reproductive system, humoral mechanisms and other topics since this work was written. There is no reference to the work of Boettiger and Furshpan on the mechanism of insect flight nor is there reference to Pringle's 1957 book on the subject.

Although the reviewer cannot qualify as an authority on the morphology of mosquitoes, many of Sir Christophers' interpretations appear to be doubtful. Much of the recent work in this field has been omitted completely. There is, for example, no mention of the studies of Cook or DuPorte of the morphology of larvae. Similarl the newer interpretation of the adult thorax l Cook is not mentioned. These morphologic problems appear to be handled with a great amount of awareness in the recent monograph l Snodgrass.

The taxonomic practices used in this work al leave much to be desired. There are references *Culex solliciians, Culex nemorosus,* and to th "genera" *Lutzia, Mucidus, Lestiocampa* (*Goeldia* and *"Taeniorhynchus"* (several times). Th members of the *Culex pipiens* complex are give as *C. pipiens, C. fatiguns, C. quinquefasciatus,* & *pipiens* var. *pallens,* and *C. molestus.* It woul appear that the time has come to discontinu using not only *Taeniorhynchus* but also *Megu hinus* and *Theobaldia.*

The criticisms of this work offered by the r viewer should not be taken as deprecation. In work of this magnitude it is inevitable that ther will be some faults. The book should be judge for what it is, the most extensive account of th structure of mosquitoes which has yet been pul lished. It will be invaluable to all culicidologist no matter what their interests, and will stimula much new work to fill in the gaps which S Christophers has brought to life. The book is fine monument to a lifetime of industry by one our most eminent co-workers.—A. Ralph Bar California State Department of Public Health.

STUDIES ON THE *Culex pipiens* GROUP OF JAPA 5. Morphological studies on the Nagasaki *molestu* By Kamura, T. Endemic Dis. Bul. (Nagasak Univ.) 1(2):176–185. 1959. 31 refs. En summary.

In order to clear the morphological differenc between Nagasaki *molestus* and Isahaya *palle* and also Saporo *pallens* and Taihoku *fatigan* examinations were made on the larval character Cell/Stem values of wing vein II of adults, an characters of genitalia of both sexes. Nagasak *molestus* refers to *Culex pipiens molestus* foun in old wells in Nagasaki city (Omori *et al.* 195 Kamura 1959); Isahaya *pallens* to *C. p. palle* widely and most commonly distributed in Nag saki area; Sapporo *pallens* to the *pallens* sent fro Sapporo, Hokkaido, northernmost part of Japa Taihoku *fatigans* to the *fatigans* from Taihok Formosa.

The results of examinations are summarized a follows:

(1) In the branching of hair No. 1 of larv abdominal seg. III and IV and in the number c pecten teeth: Nagasaki *molestus* is similar to Sa poro *pallens* but considerably differs from Isahay *pallens* and Taihoku *fatigans.*

(2) Between the means of Cell/Stem values c wing vein II of Nagasaki *molestus* and the othe three strains, significant differences are found i both sexes, but the ranges of individual variation overlap widely with Sapporo *pallens* and Isahay *pallens* or a little with *fatigans.*

(3) The number of hairs on post-genital pla and insula of female hypopygium is nearly th

me in the four strains, while the number of airs on ninth tergite is peculiar in order of finity, differing markedly in means in the number between Nagasaki *molestus* and Sapporo *allens*. The ranges of individual variation, however, overlap rather widely with each other among e four strains.

(4) Nagasaki *molestus* clearly differs not only om *fatigans* but also from Isahaya *pallens* in at the DV/D values of male genitalia are extremely small, and the tip of the dorsal arm of e phallasome is flatly cut off and the ventral m is narrowest and shortest, reaching only out the middle of the width of the dorsal arm. he *molestus* differs roughly from Sapporo *pallens* because in the latter strain the DV/D value larger, the tip of the dorsal arm is rather vollen toward the middle of the cut off tip and e ventral arm is wider and its tip is rather nger.—Author's summary.

SUPPLEMENTS TO THE FINDINGS ON THE SUSEPTIBILITY OF JAPANESE MOSQUITOES TO *Wuchereria bancrofti*. 2. On the susceptibility of *Anopheles hyrcanus sinensis* and *Culex tritaeniorhynchus*. y Fujisaki, T. Endemic Dis. Bul. (Nagasaki niv.) 1(3):278–287. 1959. 26 refs. Eng. immary.

Studies on the susceptibility of *A. hyrcanus nensis* and *Culex tritaeniorhynchus* to *Wuchereria bancrofti* were carried out from 1955 to 957. These mosquitoes are feeding in the fields nd drains in the fields and are widely distributed ut not so abundant in the filariasis endemic disicts in Western Kyushu, being hilly or rather cky in topography.

The results of experimental infections with ese mosquito species are summarized as follows:

(1) Within the body of *A. h. sinensis*. filaria rvae are killed mostly in 1b stage or in a very uch earlier substage of the 1st stage. A very igh percentage of these killed are chitinized. A nall number of larvae reach the II stage but can arcely reach the III stage. Throughout the exeriments, on the 15th day after the infective eal, only one out of 339 females was found arboring 3 active IIc larvae of a substage just rior to the 2nd ecdysis.

The above results coincide well with those obined by Mochizuki (1911) in Fukuoka, Kyushu, ut differ considerably from those of Yamada 1927). The latter confirmed in Tokyo that rvae could reach maturity in 3 out of 16 inected females. The fact that filaria larvae cannot each maturity in this mosquito in Kyushu sugests that the mosquito is not important in nature the transmission of filariasis, at least in Kyushu, he most serious endemic district of the disease in apan.

(2) Within the body of *Culex tritaeniorhynchus* nany filaria larvae can reach 1d substage or a tage just before the 1st ecdysis when many of hem are killed, but some can reach II stage and few of them reach maturity. It is of interest that none of the larvae killed in the younger larval stage are chitinized. The percentage of matured larvae found in 128 females (the author) 20 females (Yamada, 1927) and 59 females (Mochizuki, 1911) are 4.7, 9.8, and 9.4 percent respectively. Thus the mosquito species is proved to have a low susceptibility but is rather zoophilus in feeding habits; and, consequently, it appears that the mosquito is of little importance in the transmission of filariasis in Japan.—Author's summary.

SOME NOTES ON MOSQUITOES COLLECTED ON FREDERIK HENDRIK ISLAND, (NETHERLANDS NEW GUINEA). By Assem, J. van den. Trop. geogr. Med. (Netherlands) 11(2):140–146. 1959. Twenty-five species of mosquitoes were collected in a two-week period (during the wet season) on this small island, about half the size of the Netherlands. Species collected were:

1. *Aedes funereus* (Theo.). Adults. Females biting.
2. *Aedes kochi* (Donitz). Adults. Females biting. Larvae.
3. *Aedes wallacei* (Edw.). Adults. Females biting.
4. *Aedes* (*Finlaya*) *sp. nov.* Discovered by Dr. E. N. Marks in *wallacei* material; to be described by her.
5. *Aedomyia catastucta* (Knab). Larvae.
6. *Anopheles b. bancrofti* (Giles). Blood-fed females. Larvae.
7. *Anopheles farauti* (Lav.). Stages not given.
8. *Culex annulirostris* (Skuse). Adults. Females biting. Larvae.
9. *Culex bitaeniorhynchus* (Giles). Larvae.
10. *Culex pullus* (Theo.). Larvae.
11. *Culex* (*Culiciomyia*) sp. Probably new species. Larvae.
12. *Culex fraudatrix* (Theo.). Adult female, bred from pupa, could not be positively identified because of lack of male.
13. *Ficalbia elegans* (Taylor). Larvae. Adults bred.
14. *Ficalbia metallica* (Leic.). Larvae and pupae. Adults bred.
15. *Ficalbia minima* (Theo.). Larvae.
16. *Hodgesia spoliata* (Edw.). Female biting.
17. *Mansonia bonnewepsterae* (v. d. Assem). Females biting.
18. *Mansonia ochracea* (Theo.). Female biting.
19. *Mansonia papuensis* (Taylor). Adults. Females biting.
20. *Mansonia uniformis* (Theo.). Adults. Females biting. Larvae.
21. *Mansonia xanthogaster* (Edw.). Females biting.
22. *Tripteroides quasiornata* (Taylor). Female biting.
23. *Uranotaenia albescens* (Taylor). Larvae.
24. *Uranotaenia papua* (Brug). Larvae.
25. *Anopheles amictus hilli*. Identified by author but not collected by him. Stages not given.

The author points out that this list does not represent the total number of species occurring on the island, nor does it indicate the changes that occur during the dry season. He discusses in some detail the habits and habitats of many of the species, and he devotes several paragraphs to a consideration of the almost total lack of mosquito-borne diseases. *Mansonia uniformis,* a vector of *Wuchereria bancrofti,* is present in numbers, but filariasis is unknown on the island; and *Anopheles bancrofti* and *A. farauti* are present and potential vectors of the parasite, but malaria is ALMOST NON-EXISTENT. —H. L. Trembley Durkee.

CHANGING CONCEPT OF *Wuchereria bancrofti* TRANSMISSION IN NETHERLANDS NEW GUINEA. By Rook, H. de, and Dijk, W. J. O. M. van. Trop. geogr. Med. 11(1):57–60. 1959. 12 refs. There is enough evidence to incriminate the anophelines of the *punctulatus* group—*A. farauti, A. punctulatus,* and *A. koliensis*—as vectors of nocturnal *W. bancrofti* filariasis in Melanesia. Of these, *A. farauti* is probably the most important vector. In New Guinea *A. bancrofti* and possibly *A. karwari,* also play an additional part in the transmission.

The suggestion that anophelines play the major —if not the only—part in filariasis transmission in New Guinea has been found to need revision, as in Netherlands New Guinea natural infection with full-grown bancroftian larvae has been encountered in 5 non-anopheline species, while experimental infection with full development of the larvae into the infective stage was observed in 2 other species.

Taking into account the hospitability, spread, abundance, longevity, biting habits, and the distance between human dwellings and the breeding sites of these non-anopheline vectors, evidence is growing that some of these species really compete with anophelines in efficiency to transmit *W. bancrofti* filariasis in New Guinea.

It will be clear that all this influences filariasis control. Indoor spraying with residual insecticides, primarily directed against malaria, would also automatically eradicate anopheline-borne filariasis. However, *Mansonia uniformis* which in some places bites rather often out-of-doors, and DDT-resistant *C. fatigans* require other measures— Author's summary and excerpt from text.

GRAU DE SUSCEPTIBILIDADE DO *Anopheles* (*Nyssorhynchus*) *darlingi* AO DDT EM DUAS LOCALIDADES DO ESTADO DE MINAS GERAIS (BRASIL). By Rachou, R. G., Moura Lima, M., Machado Leal, J. Rev. Bras. Malariol. D. Trop. 11(1):67–68. 1959. In March-April, 1958, the susceptibility of *Anopheles darlingi* to DDT was tested in two localities of the State of Minas Gerais, Pedra Maria da Cruz and Fazenda Curral das Varas, both in the Municipio of Januária, in the São Francisco valley. The Busvine and Nash technique was followed. The mosquitoes exposed to the insecticide were caught with human bait. In both localities *Anopheles darlingi* revealed high susceptibility; the L. C. 50 in Pedra Maria da Cruz was 0.26 percent ±0.01, and in Fazenda Curral das Varas 0.37 percent ±0.03. The houses in both localities were sprayed at least three times when the tests were made.—Authors' summary.

CYTOLOGICAL AND ECOLOGICAL RESEARCHES ON BRAZILIAN ANOPHELIDS. By Schreiber, G. and Guedes, A. S. Rev. Bras. Malariol. D. Trop. 11(1):97–98. 1959. (In English) This is a brief but stimulating account by the authors (of the University of Minas Gerais, and Departmento Nacional de Endemias Rurais, Belo Horizonte, Brasil) of research completed and in progress at Belo Horizonte.

The caryotypes have been determined of *A. argyritarsis, A. strodei, A. darlingi, A. noroestensis,* and *A. homunculus.* Salivary gland chromosome maps of the same species are being prepared. The map of *A. argyritarsis* is completed as well as the map of the X chromosome of *A. strodei.* These two species have been studied with a view to establishing a possible relationship between their ecological distribution and chromosome polymorphism. There have been variations in behavior of some female *A. darlingi* in areas treated with insecticides. Larvae have been reared from these females and their chromosome structure studied. These investigations are being made in an effort to establish the relation between chromosome polymorphism and insecticide resistance, or variation in ecological distribution and behavior after insecticide application. In addition, a special study is being made of *A. strodei's* egg shell structure and chromosome polymorphism.—H. L. T. D.

THE EFFECT OF TEMPERATURE AND ILLUMINATION ON MATING OF *Culex pipiens pipiens* L. AND *C. p. fatigans* WIED. By Parker, Anne C. M. and Rozeboom, L. E. Amer. Jour. trop. Med. Hyg. 9(3):331–335. 1960. 10 tables. Mating experiments with several strains of *C. p. pipiens* and *C. p. fatigans* at different temperatures showed that *fatigans* was more active at all temperatures, but was less inhibited than *pipiens* at the highest temperature. With decreasing intensity of illumination, *fatigans* began swarming sooner than did *pipiens,* but ceased shortly after complete darkness was attained, whereas *pipiens* continued to swarm in the dark.

It is concluded that *fatigans* does not exhibit a specific temperature adaptation for mating, but that the higher insemination rates at all temperatures were the result of an inherent sexual aggressiveness. However, such differential activity could be a means of limiting the establishment of *pipiens* in warmer areas, where it would have to compete with the more active *fatigans.* Furthermore, these differences in response to temperature and changes in illumination could be a mechanism for keeping the population segregated in some areas where they coexist.—Authors' summary.