REVIEWS AND ABSTRACTS

THE GROWTH OF *Anopheles sergenti* THEOBALD (DIPTERA, CULICIDAE), WITH SPECIAL REFERENCE TO THE GROWTH OF THE ANAL PAPILLAE IN VARYING SALINITIES. By D. S. Kettle. Ann. Trop. Med. and Parasit. 42(1): 5–29. 1948. Measurements made on a total of 500 laboratory reared larvae of *Anopheles sergenti* Theobald are analyzed in studying the growth of this mosquito. Of these larvae 125 were in each of the 4 larval instars.

Seven measurements were made on each larva: length of head, breadth of head, length of thorax, breadth of thorax, length of second abdominal segment, breadth of second abdominal segment and the length of the dorsal anal papillae.

From the analysis of the data obtained by these measurements several facts were learned. One is, that the head shows discontinuous growth, with a dramatic increase in size at each ecdysis. The growth coefficient between the head breadth and the thorax breadth was found to be 1.0. The thorax undergoes heterogonic growth, undergoes no sudden change at ecdysis but grows continuously throughout larval life, the length increasing more rapidly than the breadth. The second abdominal segment also grows continuously throughout larval life, the growth rates of its breadth and length being the same. The dorsal anal papillae show a mixed pattern of growth, since they not only grow steadily, though slowly, during an instar, but also have a sudden increase at ecdysis.

Various other workers cited in the paper have demonstrated that the lengths of the anal papillae of the larvae of certain species of mosquitoes steadily decrease with increasing salinity. In studying this phenomenon, the author found that the intra-instar growth rates of fourth stage larvae of *A. sergenti* bear no relation to the lengths of the anal papillae. It is suggested that the variation in lengths of the anal papillae of larvae reared in different salinities is determined by the same mechanism as that which controls the chloride content of the haemolymph.

Studies were made of 52 breeding-places of *A. sergenti* in nature and 25 were found to be below 0.1 percent NaCl in the range of salinity where small changes produce large differences in the length of the anal papillae. Although the length of the anal papillae of *A. sergenti* may prove useful as a specific taxonomic character under certain conditions, it is unlikely to be a critical one.

This study dealing with certain growth conditions and physiological reaction of *A. sergenti* provides useful information tending toward a more complete understanding of the bionomics of mosquitoes. The analysis of the data supporting the author's statements is presented in detail in order that the reader may follow the development of the author's investigations and thoughts.—D. C. THURMAN, JR., U.S.P.H.S., Florida State Board of Health, Jacksonville, Florida.

LARGE SCALE INSECT CONTROL PROBLEMS. By F. C. Bishopp. Soap and Sanitary Chemicals, February, 1948. The author, in his usual effective manner, issues a challenge for large scale insect control operations. He evaluates the importance of insect control in this fast moving world of today bringing out the point that the population is increasing, resulting in the need for more food, the depleting of soil fertility is reducing the food supply, and fast transportation is helping to spread insects. These are all factors that have made the insect of increasingly greater importance in recent years. On the brighter side, he indicates that much more effective weapons against the insects are now available, referring, of course, to the new synthetic organic insecticides and new devices for applying them. He enumerates the limitations in residual spraying, bringing out the possibility of toxicity to higher animals, the varying surfaces upon which the residual deposit is being applied, and the recent apparent failures of DDT, which might indicate a resistant insect strain. The latter, of course, may develop into the most important of all. Several other compounds of promise are enumerated with some of the results obtained thus far. The author states that in large scale field operations many complicating factors are certain to be encountered. The effects of long-time residuals may so effectively control one insect that another not affected might become a worse pest. It is generally agreed that when minimum dosages are applied for a specific insect, the general insect population other than the specific insect being fought is knocked down but returns approximately to normal numbers the following year or even sooner. Several large scale operations under government control are discussed in this article, and it is brought out that in these undertakings there has been a considerable element of experimentation. Public interest has been aroused, but campaigns are of little value unless they result in continuing efforts. Cooperation of industry, government, and the general population is needed. The author finishes his article by stressing the need for more research and knowledge in the many fields of insect control and closes by asking two pertinent questions. "Under present conditions, can we afford to let five to ten per cent of our grains go to feed these pests? Are we all doing the best possible job to stop these losses?"—R. E. DORER, Dir., Insect and Rodent Control, Virginia State Health Department.

TOXICITY OF DDT RESIDUES. By R. W. Fay, E. I. Cole and S. W. Simmons, Soap and Sanitary Chemicals, 24, 6:130–133, June 1948.

Factors influencing the residual toxicity of DDT-Xylene emulsions, DDT-kerosene sprays, and suspensions of water wettable DDT on various surfaces were laboratory tested to determine (1) the relative effectiveness of DDT-Xylene emulsions on specified surfaces; (2) the comparative effectiveness of DDT deposits from emulsion, solution and suspension applications on specified surfaces; and (3) the effect of cleaning operations on the residual toxicity of DDT deposits.

Samples containing twenty-five, 4 day old *Anopheles quadrimaculatus* females were used in the cage tests on the many surfaces tested. Exposures of 60 minute intervals were used. Immediate knock-down and 24 hour mortality intervals were recorded. Experimental techniques used are described in full. Results obtained are tabulated in full accompanied with narrative descriptions of the results obtained.

Deposits of 200 mg. DDT per square foot of 5 percent DDT-Xylene emulsion gave satisfactory results for 6 months on dry bamboo, bark, and rusty sheet metal. One to 2 month effectiveness was obtained on new sheet metal, glass, tile, palmetto thatch, and new metal screen. Unsatisfactory results were obtained using plexiglass, shellacked wood, cement, and waxed wood. DDT-kerosene deposits on the same surfaces gave a somewhat lower level of effectiveness than DDT-Xylene emulsion while the water-wettable DDT deposits were generally better than DDT-Xylene or DDT-kerosene on most surfaces; superior on cement but nearly non-effective on adobe.

Effects of house-cleaning and maintenance operations on residual DDT deposits were studied showing that dry cleaning rapidly reduced effectiveness on clothing as did the use of a hot iron. Waxed and shellacked floors treated gave very low residual effectiveness. The use of a vacuum cleaner reduced the residual toxicity markedly.—G. EDWIN WASHBURN, Manager, Turlock Mosquito Abatement District, Turlock, California.

CONTROL OF MOSQUITO BREEDING BY THE USE OF DDT SOLUTION ABSORBED ON BRIQUETTES. By W. C. D. Lovett, The East African Med. Journ., 24(5): 196–198. 1947. In this preliminary article the author discusses the need for mosquito control in British Somaliland, where mosquito-breeding is largely in uncovered wells. For example, one square mile alone contains approximately 300 wells. Experimental work was carried out in Haraf, a village with six wells. Each well is uncovered, about 20 ft. deep, 3 to 4 ft. in diameter, and lined with logs and brushwood. The reaction of Culicine larvae only is recorded since they were the only mosquitoes found upon sampling.

Briquettes (about one inch cube), prepared from a mixture of sawdust and plaster of paris (2:1), were soaked in a 5 per cent solution of DDT in diesoline for 48 hours and then stored in tins containing a slight excess of the oil. By dropping one or more impregnated briquettes (each cube gives control of 4 square yards of water surface) into a well, mosquito-breeding was prevented for a month. The treatment apparently had no deleterious effect on the water or at least there were no complaints from the villagers who were using it for all purposes. This control work can be carried out by an unskilled person which is one of the main points of the author's experiment.—LOUISE GOODE, National Institutes of Health, Bethesda 14, Md.

MICRO-ORGANISMS AS ENEMIES OF MOSQUITO LARVAE. (MIKROBIEN ALS FEINDE VON STECHMÜCKENLARVEN.) By H. M. v. Jettmar. Acta Tropica 4(3):193–208. 1947. Article in German, with English and French summaries.

A severe invasion of the larvae of the species of *Culex fatigans* by streptobacilli was observed in summer 1946 in Shanghai. All these infected larvae were secondarily invaded by vorticella to such an extremely high degree that the outer surface of the larvae was covered by a thick mossy-looking layer of these protozoa. The invasion by these streptobacilli, which developed especially in the 3rd and 4th larval stage, was fatal to the larvae in all cases, as they could never hatch into pupae. The *lethality* was therefore exactly 100 per cent and with it the *mortality* as well, as *all larvae* of this species living in the infected pond became invaded.

The pond, where this fatal disease among the larvae occurred proved to be an excellent trap for the female mosquitoes of the species, which proceeded to deposit their eggs there, from which the hatched larvae were doomed to certain premature death.

Observations made during this invasion are described, the histology of the invaded larvae is given and illustrated by photomicrographs. In connection with the description of this outbreak the other hitherto undescribed micro-organisms which are pathogenic to the mosquito-larvae are discussed.—Author's summary.

CALIFORNIA MOSQUITO CONTROL ASSOCIATION OPERATIONS MANUAL. Issued by California Mosquito Control Association, Post Office Box 649, Berkeley 1, California, 1947. $6.00, including additional data sheets to be supplied as issued.

This new manual should be very helpful to the mosquito workers in California, and elsewhere. Sections are specifically designated "Administration," "Operations," "Engineering," "Entomology," and "Miscellaneous," and are so indicated by tabs at the edge of the pages. Provision is made for many types of information, ranging from a guide as to how a meeting of the governing board of a mosquito district should be conducted, through laws and legal responsibilities, biological information, data on insecticides, methods and forms for estimating and recording costs, tables useful in making dilutions of insecticides, etc.

Made up in the form of a loose leaf, mimeographed book with a hard cover, the manual can be easily kept up to date by inserting replacement or additional pages as they are provided by the California Association. The Executive Committee of that organization states that technical memoranda will be issued as information of general value is developed, each memorandum being labeled to indicate the section of the manual in which it should be inserted.

We should like to see more subject headings, or subdivisions of the present broad headings, and should particularly like to see a section of "Definitions." For convenience in making revisions, each might carry a running head showing the date prepared, the section in which it belongs, and a page number. An index, revised annually, could then be issued and would be helpful in using the manual.

The obvious objective of this handbook is to make readily and promptly available to those on the "firing-line" of mosquito control the authoritative information-ammunition which they need to actually control the mosquitoes, and at the same time to promote coordination of the efforts of the several agencies represented in the California Association. We are informed by officials of the California Association, that each of the California Districts is urged to contribute their novel mosquito control observations, findings, and developments for possible use in the manual. They give full credit to the Bureau of Vector Control of the California State Department of Health, for that body is bearing the greater share of the labor of preparation, editing, printing and mailing the technical material. The idea was developed by the Association, and it also furnished the funds for covers and for separators, etc.

The California Association is to be complimented for undertaking this thoroughly worthwhile project.—THOMAS D. MULHERN, Sec.-Treas., AMCA.

DDT AND *Aedes aegypti* CONTROL IN BRITISH GUIANA. By P. F. De Caires. Puerto Rico Jour. Pub. Health and Trop. Med., 22(4):405–415. 1947.

Emanating from the British Guiana Yellow Fever Service, which derives its funds from the Government of British Guiana and the Rockefeller Foundation, this paper chalks up another point for DDT in its contest with the traditional forms of mosquito control. Here again we find an author who is willing to stake all on spraying of houses, for he has found that "this method of *Aedes* control proved more effective and cheaper than routine anti-*Aedes* control measures, even when carried out with inferior spraying equipment." (Administrators, take note of everything except the last phrase!)

The experiment, which began in August, 1945, was undertaken in villages near Georgetown. Part of the houses were subjected to 5 per cent DDT (in kerosene) spraying, part to 2½ per cent DDT, and part to routine anti-*Aedes* control measures, while no work was done in a check area. From an initial index of 26 (percentage of houses with *aegypti* breeding) the 5 per cent DDT area attained an index of 0 in 13 weeks; but the 2½ per cent DDT area and the routine measures area did not reach that low index, even after 35 weeks. A single treatment of 5 per cent DDT spraying remained effective for 10 months. The 2½ per cent DDT treatment was not regarded as being superior to the routine measures. For control of *Aedes aegypti* in large areas the author recommends 5 per cent DDT spraying of houses rather than the usual measures on the basis of greater effectiveness and lesser costs.

Our faith in DDT suffers, however, when it comes to *Culex quinquefasciatus*. "Quinque" was found to be rather resistant to DDT, and the number of breeding places of the larvae was not reduced by house spraying; indeed, routine larval control measures were more effective for this species.

This is a very good paper and in reading it one wishes to compliment the author particularly on the attention he has paid to practical detail—such as personnel, equipment and costs. In this connection, the reviewer would have liked a little more prominence given to the matter of transportation, for according to his own modest experience in government and military insect and rodent control projects, this item is not adequately considered; maybe if enough of the workers mention it in their publications, administrators will give transportation well deserved importance.—IRVING FOX, Department of Medical Zoology, School of Tropical Medicine, San Juan, Puerto Rico.

MALARIA CONTROL ON IMPOUNDED WATERS. Federal Security Agency, United States Public Health Service, and Tennessee Valley Authority, Health and Safety Department, 1947, 422 pages.

Prepared jointly by staff members of their respective agencies, under the guidance of Dr. E. L. Bishop, Director, Health and Safety Department, Tennessee Valley Authority, and of Mr. M. E. Hollis, Sanitary Engineer, Director, in charge of malaria control for the United States Public Health Service. The organization and editorial treatment was under the direction of Mr. C. I. Mansur.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

As the title implies, this attractively cloth-bound volume is a manual presenting the basic principles and modern practices of malaria control in the neighborhood of impounded waters.

Impoundage of the water in any part of an open drainage system profoundly alters the general biologic balance of the affected area; the resulting changes depending upon the physical and biological characteristics of the environment, and the nature and extent of the operation.

Notable among these changes may be a vast increase in the malaria hazard arising from the attendant increase in potential anopheline breeding water.

A program of regional development, based primarily on water control like that undertaken in 1933 by the Tennessee Valley Authority, therefore, has both demanded, and afforded a unique opportunity for the study and application of malaria control measures on an unprecedented scale. Such work on the more than 10,000 miles of newly created reservoir shore line in a region of widely varying topography, has provided malaria control experience on a scale, and under a variety of conditions never before provided by any single project. The experience of the U. S. Public Health Service has been acquired over a much broader geographic and ecologic range.

Therefore, the manual produced in collaboration by the two agencies combines the experience gained by intensive work on a regional basis with that gained by extensive operations on a national scale, and such a pooling of knowledge, experience, and research effort, together with consultation from other competent authorities has contributed to bring about a sustained increase in the efficiency and economy of control practices as applied in the work of the TVA, and as described in this manual.

In sixteen chapters, this manual covers very comprehensively the various problems and techniques of malaria control in relation to impounded waters with special emphasis on control of the vector Anopheline mosquitoes, as follows:

I. Malaria and Its Relation to Impounded Water.
II. Planning Malaria Control.
III. Reservoir Preparation.
IV. Permanent Marginal Measures.
V. Water Level Management.
VI. Shore-Line Maintenance.
VII. Larviciding.
VIII. Mosquito Proofing.
IX. House Spraying.
X. Facilities and Operation Procedures.
XI. Malaria Mosquitoes.
XII. Malariology.
XIII. The Relation of Plants to Mosquito Control.
XIV. Interrelationships of Malaria Control and Wildlife Conservation.
XV. Personnel Training and Public Relations.
XVI. Small Reservoirs.

Following these sixteen chapters are eight Appendices:

Appendix A. Summary of State Laws and Regulations Pertaining to Malaria Control.
Appendix B. Example of Hydraulic Analysis for Prediction of the Frequency and Duration of Flooding in a Flood Control Storage Reservoir.
Appendix C. Chemicals Employed in Malaria Control.
Appendix D. Equipment, Tools, and Supplies.
Appendix E. Design of Airplane Larviciding Equipment.
Appendix F. Methods of Determining the Recovery of Larvicides on a Water Surface.
Appendix G. The More Important Anopheles Mosquitoes Transmitting Malaria in the Principal Regions of the World with Typical Breeding Places and Usually Applicable Control Measures.
Appendix H. Malaria Survey Diagnostic Technique.

The Manual is well illustrated with tables, graphs, charts, drawings, maps, photographs and aerial views, many of the photographs and aerial views reproduced in color; and the examples of record maps and forms employed for the report of current operations should be useful or suggestive to mosquito control operators everywhere.

It is a book that should be in the library of every mosquito control agency; and, indeed, in the library of every mosquito control worker, as well as in public libraries wherever malaria control or even general mosquito control is an object. —R. D. G.

MALARIA CONTROL PLANS BY THE WORLD HEALTH ORGANIZATION. The report of the Expert Committee on Malaria of the World Health Organization, the 2nd session of which was held in the Pan American Sanitary Bureau Building following the 4th International Congresses of Tropical Medicine and Malaria, Washington, D. C., May 19–25, 1948 has just been distributed (dated June 8, 1948, mimeographed).

The following members of the Committee were present, including Secretary Pampana, W.H.O.: Dr. Arnaldo Gabaldon, Venezuela, Chairman, Major General Sir Gordon Covell, U.K.; Dr. Paul F. Russell, U.S.A.; Med. General Marcel Vaucel, France; Dr. D. K. Viswanathan, India; co-opted members: Lt. Col. M. K. Afridi, Pakistan; Dr. J. W. Field, Malaya; Dr. D. Bagster Wilson, Tanganyika; FAO representative: Dr. Wallace R. Aykroyd; Pan American Malaria Commission Observers: Dr. Carlos A. Alvarado, Argentina; Dr. Paulo C. A. Antunes, Brazil; Dr. Luis Vargas, Mexico; consultants: Dr. G. Robert Coatney, U.S.A.; Dr. Clay G. Huff, U.S.A.; Dr. Fred L. Soper, U.S.A. and Mr. H. H. Stage, U.S.A.

The 50-page mimeographed report is divided into the following ten sections: I. Introduction; II. World Needs; III. WHO Malaria Policy; IV. Agriculture and Malaria; V. Use of Insecticides; VI. Chemotherapeutics in Malaria Control; VII. Research; VIII. Quarantine; IX. Recommended Resolutions; X. Conclusions and Recommendations.

The objectives are well summarized in the Committee's statement "the fundamental purpose of the WHO malaria policy should be to assist

governments to accomplish effective malaria control along modern scientific lines. The Committee believes that this should be done through WHO regional organizations and that it involves practical assistance in formulating programmes and in setting up adequate governmental machinery for malaria control, in training skilled personnel, in disseminating relevant information, in developing uniform international procedure and nomenclature, and in promoting measures to protect countries against the introduction of anophelines from the outside."

Overall original plans for carrying forward malaria control programs are outlined using the malaria organizations in India, Venezuela, and other countries as examples. Methods of training effective workers, demonstrating procedures and conducting public education are outlined.

The cooperative attitude of the FAO is included in a memorandum prepared by that group. They point out that "From the point of view of agriculture, malaria creates two separate types of problems. The first is the case where malaria is endemic in a thickly populated area already under agricultural occupation, where the effect of the malaria is to sap the energy of the working population, and to increase, often at critical periods, the number of working days on which the worker is incapacitated by ill-health. The second is where malaria is preventing the development of an area otherwise suitable for agricultural development." Also "To assess the effect of malaria control, economic surveys should be made in rural areas selected for demonstration malaria control projects. Such surveys should be made before the initiation of control measures and again at a later date when they have taken effect."

The use of insecticides in malaria control, their application, production, availability and cost are discussed in Chapter V. In Chapter VI modern therapeutics for malaria are treated. The situations in which drugs have a place are pointed out and the importance of antimosquito measures are stressed as indicated by the statement, *"The Committee,* considering that there would be general agreement that the primary consideration in the communal control of malaria is the interruption of transmission at the mosquito level, recommends that measures so directed should be given priority by health authorities wherever possible."

In section VII research fields which urgently require attention are well presented including experiments in species eradication.

The importance of preventing spread of malaria carriers and procedures to be followed are presented in Chapter VIII, and the final section deals with conclusions and recommendations regarding the whole malaria situation and the part WHO may play in its improvement.—F. C. BISHOPP.