REVIEWS AND ABSTRACTS

MOSQUITO INTERMEDIARY HOSTS OF DISEASE IN AUSTRALIA AND NEW GUINEA by Frank H. Taylor, F.R.E.S., F.Z.S. Service Publication (School of Public Health and Tropical Medicine), Number 4, Commonwealth of Australia Department of Health. June 15, 1943 (154 pp. 75 figs.).

The purpose of this publication as stated by the author is to give a concise description of the essential morphology of the adults, pupae and larvae of the various species of mosquitoes (in the area under consideration) concerned with the transmission of disease together with practical details of control. The author frankly pleads guilty to the crime of piracy. Better than half of the material in the publication is quoted directly. No doubt, as the author states, this procedure saved him "many weary hours of writing." The publication starts out with the essential morphology of Anophelines and the characters used in identification and classification; there follows less than five pages of quoted descriptive material on bionomics and relation to disease based on generalized Indian and European observations; very little that would be helpful to workers in the area under consideration.

Next the publication presents systematic descriptions of species within the Australian and New Guinea area belonging to the various genera, *Anopheles* (5 species), *Taeniorhynchus* (one species), *Aedes* (5 species), *Culex* (3 species). For each species a brief statement is made regarding its relation to diseases, for example. *Anopheles bancrofti*: "No information is available in regard to the ability of this mosquito to transmit malaria in Australia." *A. amictus*: "Evidence is lacking as to the part this species plays in relation to malaria in Australia and New Guinea. It is an efficient intermediary host of *Wuchereria bancrofti*." *A. punctulatus* and its variety *moluccensis* are recorded as efficient intermediary hosts of malaria. Considerable space is devoted to *Aedes aegypti* and *Aedes albopictus* and are both recorded as efficient vectors of dengue. *Culex fatigans* is recorded as occurring throughout Australia and widely distributed in New Guinea and a most efficient intermediary host of *Wuchereria bancrofti*.

The remaining third of the publication is devoted to such items as collecting larvae in the field, determination of intermediary hosts of malaria, dissection technique, distribution of Anopheles and malaria in Australia, range of flight, protection against bites of moquitoes, screening of houses, barracks, etc., mosquito traps, fumigation (about four pages devoted to sulphur dioxide). The last twenty pages are devoted to measures directed against the larvae of mosquitoes. Concise directions are included for mounting and care of mosquitoes. There is a goodly list of references.

W. B. Herms.

A PRACTICAL ENTOMOLOGICAL COURSE FOR STUDENTS OF MALARIOLOGY (Third Edition). Revised and Illustrated by I. M. Puri, M.Sc. (Punjab), Ph.D. (Contab.), F.R.E.S. Entomologist to the Malaria Institute of India. Health Bulletin No. 18, Malaria Bureau No. 9. Published by Government of India Press, Calcutta, 1942, VIII, 189 pp., 168 figs. (Price Re. 1-12 or 2s. 6d.)

As the author points out, this bulletin was first prepared in 1933 by Captain P. J. Barraud especially for use by the malaria classes of the Malaria Institute of India. The second edition was published in 1938. The present edition is arranged in fifteen lectures with practical work outlined for each exercise. The first lecture is concerned with (1) General description of the structure of mosquitoes; (2) The Classification of the Animal Kingdom; (3) How to distinguish male and female mosquitoes. The "practical work" outlines methods and procedures for the examination and observation of laboratory material. Lectures 2 and 3 deal with detailed descriptions of the morphology of the mosquito with appropriate practical work.

Lectures 4, 5, and 6 are concerned with mosquito larvae, their morphology, methods of collecting, et cetera. The practical work comprises field collecting, observations on larval feeding habits, rearing *Anopheles* from eggs, and general characters of pupae.

Lectures 7, 8, 9, 10 and 11 are concerned with the identification and bionomics of adult mosquitoes, particularly anophelines. The practical work consists of collection of adult mosquitoes, their identification and feeding habits, testing blood meals by precipitin tests, etc.

Lectures 12, 13 and 14 give an excellent account of the internal anatomy of adult mosquitoes, particularly *Anopheles,* with special reference to the gut, the salivary glands, and reproductive organs. The several accompanying practical work outlines pertaining to the methods of dissecting out and examination of the salivary glands, mid-gut and reproductive organs are quite comprehensive and most valuable.

The fifteenth and final lecture with practical work gives a good account of the enemies and parasites of mosquitoes. Appendix 1 provides useful information on the classification of the Animal Kingdom, Coelomata, Arthropoda, Insecta, Diptera, and Anophelini together with a list of species and varieties of *Anopheles* found in India and Ceylon. Appendix 2 gives alternative names used by various authors for different parts of the thoracic segments, wing veins and cells. Appendix 3 gives a useful list of references important to malariologists, and Appendix 4 lists equipment supplied to students.

All entomologists engaged in malariological work should be familiar with this very important publication. W. B. Herms.

GLOBAL EPIDEMIOLOGY—A GEOGRAPHY OF DISEASE AND SANITATION by Brigadier General James Stevens, Lt. Colonel Tom F. Whayne, Lt. Colonel Gaylord West Anderson, and Major Harold Maclachlan Horsch. This is a J. B. Lippincott selected professional book and sells for $7.50. Volume one, just published, contains 2 parts; the first on India and the Far East, the second on the Pacific Area.

The authors describe the volume as "an excursion into the unexplored field of geomedicine, bringing together in one place certain data on medical, health, and sanitary conditions of various geographic areas of the world." It's really a "must" reference for entomologists, sanitary engineers, and physicians in Public Health who are responsible for keeping our fighting men fit. No doubt the information contained in this work will be important also to the peaceful, post-war world as well. Surely it represents the first collection of this kind of data between the covers of one book.

An outline of chapter 1 will suffice to illustrate the scope and magnitude of this very readable treatise. Each of the geographical divisions is so outlined.

1. Burma
    - Geography and Climate
    - Public Health
        - Health Services
        - Water Supplies
        - Sewage Disposal
        - Insects and Animals
        - Food and Dairy Products
        - Miscellaneous Problems of Sanitation
    - Medical Facilities
        - Hospitals
        - Medical Personnel
        - Medical Institutions
    - Diseases
        - Diseases spread chiefly through intestinal tract
        - Diseases spread chiefly through respiratory tract
        - Disease spread chiefly by contact
        - Diseases spread by arthropods
        - Nutritional diseases
        - Miscellaneous conditions
    - Summary

The sections of greatest interest to medical entomologists and mosquito control workers are those which describe the insects and diseases spread by them. For example, the known vectors of malaria, dengue, yellow fever, and filariasis are given for each of the 34 geographical divisions of India, the Far East, and the Pacific Area. Adequate maps and generous bibliographies also aid in making this book of 504 pages a basic reference in the fields of tropical and preventive medicine.

In subsequent volumes similar data, say the authors, will be made available about Africa, Europe, the Near East and the Western Hemisphere. H. H. Stage.

PROCEEDINGS OF THE THIRTY-FIRST ANNUAL MEETING OF THE NEW JERSEY MOSQUITO EXTERMINATION ASSOCIATION (1944). 198 pp. $1.25.

Several things lift the thirty-first annual proceedings out of the ordinary. One of these is the interesting story of "Thirty-Two Years of Progress" on mosquito extermination prepared by Robert B. Gray, of the Associated Press in Newark, N. J. This article covers the period during which Dr. Thomas J. Headlee was in active leadership of the work.

Worthy of a place in any mosquito fighter's library is the lead article in the proceedings by F. C. Bishopp and H. H. Stage, of the Bureau of Entomology and Plant Quarantine. This article reviews the contributions to the knowledge of mosquitoes made during 1943.

Another interesting paper deals with mosquito-borne diseases already brought into this country from war areas. Written by Dr. Thurlow C. Nelson, professor of zoology at Rutgers University, the paper discusses dengue or "break-bone fever," yellow fever, malaria, and the filariases. The article is interestingly illustrated.

An interesting historical article is the account by Albert W. Lafferty, of 40 years of mosquito control work in Cape May County, New Jersey. The article gives a graphic picture of the trials and tribulations experienced by county mosquito extermination commissions. An accompanying article by O. W. Lafferty, describes how a difficult problem — that of providing a successful outlet for drainage channels through sand beaches — was solved.

Always valuable is the annual summary by Thomas D. Mulhern of mosquito control work in New Jersey. The 1943 summary contains the usual tables reporting the New Jersey survey of adult female mosquitoes.

Mosquito technicians will be interested in articles by members of the Rutgers University staff dealing with "Improved Methods of Rearing *Aedes aegypti* for Use in Repellent Studies," "Methods of Testing the Value of Mosquito Repellents," and a report of the effect of mosquito larvacides on mosquitoes and fish. A number of representatives of mosquito control organizations in various states tell in the proceedings how they managed to conduct their work at a high level of efficiency in spite of wartime shortages of men, materials and machinery.

Throughout the proceedings are found discussions of the danger of malaria outbreaks in this country and the work that is being done to control the vectors of this dreaded disease. A dozen and a half illustrations add to the attractiveness of the book, although wartime shortages made it impossible to print these illustrations on enameled stock.

Sam Reck.

MOSQUITO CONTROL. By Lieutenant Colonel William B. Herms, Professor of Parasitology, University of California, and Harold F. Gray, Consulting Civil Engineer and Lecturer in Public Health, University of California. Published by the Commonwealth Fund, New York, 1944, XIV+419 pp., 86 figs., 9 tables, 11 plates, and 6 special appendices. (Price $3.50.)

Entomologists and Mosquito Control Workers all know and have used the first edition of this indispensable book. To them, the book needs no introduction; but all will welcome this new and enlarged second edition, which was made necessary by the new developments in mosquito control techniques which have come so rapidly in recent years, particularly in response to military needs, both at home and in war areas abroad. In its new form,

MOSQUITO CONTROL is well designed to serve the needs of military forces and rehabilitation agencies in all parts of the world, as well as those of civilian mosquito control workers at home.

The treatment of the subject is admirably comprehensive and well organized. For example, Chapter I is an introductory orientation chapter which first directs attention to the fact that "mosquito abatement is a development mainly of the last forty years," contrasts early attitudes with present attitudes toward such work; then traces ORIGINS OF MOSQUITO CONTROL with examples; discusses MOSQUITO SPECIES briefly in the light of their diversity of life histories and habits, to refute the too common misconception that "mosquito control is simply a matter of squirting a little oil here and there on water"; and finally outlines the GENERAL PRINCIPLES OF MOSQUITO CONTROL, and of MOSQUITO ABATEMENT AND DISEASE PREVENTION.

Chapter II deals with the IMPORTANCE OF MOSQUITOES and of mosquito borne disease, with special reference to the COST OF MALARIA and SUGGESTIONS FOR ESTIMATING ECONOMIC LOSS.

Chapter III is concerned with LAWS AND AGENCIES FOR MOSQUITO ABATEMENT. Summaries of mosquito control legislation by various states are given and critically analyzed, with comments on defects and possible improvements, particularly with reference to the relative desirability of operation through special improvement districts, or under the administrative or at least the fiscal control of already existing minor civil divisions, such as counties, municipalities and the like.

In this chapter there appears one very natural error. Of the New York law it is said: "Mosquito extermination commissions may be appointed in any county in New York State (not including New York City) . . . " That this is not the case is carefully provided for in the wording of the New York law under which the existing mosquito extermination commissions are organized, beginning: "In a county of the state of New York, adjacent to a county which contains not more than three towns and which is adjacent to a city of the first class, having a population of over three millions, . . . "; these are limiting "weasel words," the significance of which is easily overlooked.

Chapter IV, PRELIMINARIES TO ABATEMENT PROCEDURES, is especially noteworthy for those contemplating new mosquito abatement projects, since it outlines the development of a mosquito abatement district from the PRELIMINARY SURVEY AND REPORT, to sample budgets and specimen report forms appropriate for use by the going project. Especially interesting is the section relating to the duties and compensation of the EXECUTIVE OFFICER, followed by section relating to other personnel including DIVISION FOREMEN, LABORERS, and CLERICAL ASSISTANTS.

Chapter V stresses ways and means for EDUCATION OF THE PUBLIC and the importance of maintaining an understanding public interest in the work.

Though space will not permit their analysis in detail, the remaining chapters are equally well considered, well organized, and pertinent, as their titles indicate:

Chapter VI, FINDING MOSQUITO BREEDING PLACES.

Chapter VII, ABATEMENT METHODS: GENERAL PRINCIPLES. Here careful consideration is given to the problem of co-ordinating sound mosquito abatement procedure with wildlife conservation.

Chapter VIII, DRAINAGE AND RECLAMATION OF FRESH-WATER MARSHES.

Chapter IX, DRAINAGE AND RECLAMATION OF SALT-WATER MARSHES.

Chapter X, FILLING, PUMPING, AND FLUSHING.

Chapter XI, OILS AND LARVACIDES. This chapter contains one of the first, if not the first, published reference to the effectiveness of DDT as a mosquito larvacide; a striking example of the up-to-dateness of the book.

Chapter XII, METHODS OF APPLICATION OF OILS AND LARVICIDES.

Chapter XIII, MOSQUITO CONTROL BY USE OF FISH.

Chapter XIV, SUPPLEMENTARY PROTECTIVE MEASURES.

Chapter XV, SPECIAL FEATURES OF MOSQUITO CONTROL IN URBAN AREAS.

Chapter XVI, SPECIAL FEATURES OF MOSQUITO CONTROL IN RURAL AREAS.
Chapter XVII, SPECIES SANITATION AND NATURALISTIC CONTROL.

The several appendices are a notable feature of the book. Appendix A, Part II, THE PRINCIPAL ANOPHELINES OF THE WORLD, THEIR TYPICAL BREEDING PLACES, AND THE REGIONS WHERE THEY OCCUR, has been enlarged, the latest nomenclature adopted, and rearranged in alphabetical order; and, as Part II, a chart has been added giving THE MOST IMPORTANT *ANOPHELES* MOSQUITOES TRANSMITTING MALARIA IN THE PRINCIPAL REGIONS OF THE WORLD ARRANGED ACCORDING TO THEIR MORE TYPICAL BREEDING PLACES, TOGETHER WITH THE USUALLY APPLICABLE CONTROL MEASURES.

Appendix B gives MOSQUITO VECTORS OF YELLOW FEVER, DENGUE, FILARIASIS, AND EPIDEMIC (VIRUS) ENCEPHALITIS.

Appendix C gives A CLASSIFICATION OF MOSQUITO ABATEMENT METHODS.

Appendix D is IDENTIFICATION OF MOSQUITOES—USE OF KEYS.

Appendix E gives, in addition to the Bibliography at the end of each chapter, a SELECTED LIST OF BOOKS AND ARTICLES ON MOSQUITO SPECIES AND BIOLOGY.

The book is well indexed and, in addition to a very full Table of Contents, is provided with separate indexes to Tables, to Plates, and to Figures.

This book, also, is an admirable example of bookmaking. The excellent halftone illustrations and the large and openly set type (12 point type, 2 point leaded) make the book exceptionally easy to use without fatigue; and many features of the editing could be studied with profit by those with manuscript to prepare. Particularly worthy of study are the use of center heads and side heads, and especially the arrangement of tabular matter. Tables usually have few columns and no vertical rulings. Where vertical lines must be used, the table, specimen forms, and the like are drawn and reproduced as line cuts. Notable, also, is the clear, large, and generously spaced lettering of graphs, diagrams and maps.

It is an extremely useful book that one can own and use with pleasure, satisfaction, and profit.

R. D. Glasgow.

THE MOSQUITOES OF NORTH AMERICA. Their structure and habits, study and identification, how they carry diseases, methods of control. By Robert Matheson, Professor of Entomology, New York State College of Agriculture at Cornell University. Second Edition, Revised and Amplified. Comstock Publishing Company, Ithaca, New York, 1944, VIII+272 pp., 33 plates. (Price $4.00.)

A copy of this valuable "Handbook for Students of Entomology and General Biology, Health Officers and Sanitary Engineers, and Others Interested in Public Health" came to the editor's desk just as copy for the December number of MOSQUITO NEWS was being made ready for mailing to the printer. The importance and timeliness of this completely revised and amplified new edition seem to demand its immediate review; for the many who have used the first edition will wish to know that this long expected new edition is now available.

In this revised edition, PART I, MOSQUITOES: A COMPREHENSIVE SURVEY, as in the first edition, comprises

Chapter I. CHARACTERISTICS OF MOSQUITOES.
Chapter II. THE BIOLOGY OF MOSQUITOES.
Chapter III. MOSQUITOES IN RELATION TO HUMAN WELFARE.
Chapter IV. THE PROBLEM OF MOSQUITO REDUCTION; and
Chapter V. HOW TO STUDY, COLLECT, REAR, AND PRESERVE MOSQUITOES.

This part of the revised edition, however, though somewhat condensed, contains much new material, both new data and new illustrations, bringing this part of the book up to date with reference to recent work on yellow fever, encephalitis, mosquito control work in the Tennessee Valley, the introduction and eradication of *Anopheles gambiae* in Brazil, and the like.

PART II, A SYSTEMATIC ACCOUNT OF NORTH AMERICAN MOSQUITOES, comprises the mosquito species of North America north of Mexico, for which new keys to the genera and species have been prepared, and which are described, as far as practicable, with notes on their life histories, habits, and distribution. A new section on the *Chaoborinae* (*Corethrinae*) has been added. This new edition contains a much expanded bibliography; and to the plates, a new series showing the male genitalia of the species of *Chaoborinae* has been added. The book should be even more useful and popular than its predecessor.

R. D. G.

TRENCHING MACHINES MARK NEW ERA IN LAND DRAINAGE IN BRITAIN. By E. A. G. Johnson, Land Drainage Division, British Ministry of Agriculture. CONSTRUCTION METHODS, McGraw Hill, New York 26 (1944), 7 (July); 58-61, 142, 144, 146, 148 and 150.

I don't know how other people first look through a new magazine; but I read all the illustrations first, cover to cover. So in the July issue of "Construction Methods" I thought I was "reading" an article on mosquito control in England.

The story proved to be "Trenching Machines Mark New Era of Land Drainage in Britain," by E. A. G. Johnson, Land Drainage Division, British Ministry of Agriculture.

Mr. Johnson's problems brought back memories of the past thirty years, during which time much effort has been spent in developing machines that could dig ditches for drainage purposes in the many acres of salt marsh in New Jersey. Of course this was for mosquito breeding control, and we are still striving for that perfect machine that will dig ten thousand or more feet of 10 x 24-inch ditch per day. We have dug ten thousand feet in one day, but could not maintain that average. We still have hopes.

I note that one of the machines described by Mr. Johnson appears to be cutting sod in the form of a ribbon, but apparently this is a trench in which tiles are laid and the main trench was dug by hand. We in New Jersey have gone further than that. We dig a ditch ten inches wide and as deep as thirty inches with a special plow that cuts the entire ditch in one cut and lays the sod on the bank in one or two pieces or ribbons, and at a rate of thirty-five feet per minute.

We are now getting away from the ribbon idea and are concentrating on the endless chain and bucket, mounted on specially built caterpillar chasis. This forms a unit that both cuts new ditches and cleans old ones. We feel that we have the right idea, and with its perfecting will be very well prepared for mosquito breeding control on our salt marshes.

Mr. Johnson's report on the mole plow is something to make us mosquito fighters sit up and take notice. We have done a lot of talking about this method of drainage, but have done very little about it. Mr. Sammis of the Suffolk County, Long Island, Mosquito Commission has been using the mole plow for over ten years and has found it very satisfactory. Most of the drains have been working for the entire time and still seem to be in good condition. Some men have tried it in New Jersey, but did not find it very satisfactory. This might be due to the very small tidal range. I feel that experiments with this type of drainage should be continued.

Our problem of upland drainage differs greatly from that of Mr. Johnson. Mr. Johnson's ditches seem to have one or both banks clear of trees and bushes, while our drains may run through forest or swamp. This lack of obstructions makes such work comparatively simple and there are many machines that will do this work.

In Britain the object was to get the job done and apparently labor was available and price not the object. This is illustrated by Mr. Johnson's description of the Kerry-Pratt all steel ditch cutter. This machine cuts sides and bottom of the ditch, but the spoil has to be removed by hand labor. This must be very expensive; too expensive for mosquito control work in New Jersey.

The Buckeye Ditcher to my mind is the best ditch digger on the market were it not for the fact that it digs ditches with parallel perpendicular banks. This type is all right for tile, but not for open ditch. We use very little tile in New Jersey.

The Henderson ditcher is an interesting development of the endless chain and bucket. The spoil is lifted from the ditch by spade-like blades mounted on a wheel. Of course the spoil only comes to the surface and it pushed from the bank by two mold boards.

As Mr. Johnson points out, the average ditch in England is about three feet deep, eighteen inches wide at the bottom and five feet wide at the top. Some ditch. The work on these ditches was done by the Priestman dragline excavator with a side arm attachment. By the use of this side arm the bucket can be pulled on the line of ditch. The bucket is built to conform to the shape of the desired ditch. Also the tractor can be run on one bank far enough from the ditch that there is no danger of cave ins.

This idea of ditch digging and cleaning will probably appeal to at least one of New Jersey's mosquito men. He has the problem of cleaning ditches on his salt marsh that are too wide to straddle with the present cleaning machine and cannot be reached from a distance from the ditch bank.

While the idea may appeal, the strain caused by the side arm will require a very heavy tractor rig. Much too heavy to travel on the salt marshes. Also of no use in swamps and forests.

We have had running through out mind a machine for cutting or cleaning upland ditches. Crazy perhaps, but runs somewhat as follows:

A caterpillar of say eighteen-inch wide tread. This to be run on line of or in the ditch. The main caterpillar to be balanced by smaller caterpillars or wheels to run both sides of the ditch and so controlled that the main caterpillar is always kept in balance. The drive to be on the main caterpillar. These of course would be connected to a chassis that would carry the engine, gears, etc., and either a power shovel or endless chain buckets. Hydraulic power could be employed for most of the movements.

This is but a dream; but as I look back most of our equipment started as a dream, and lots of it remained dreams that never came true.

However, I still think that some of our mosquito fighters with lots of upland drainage should put more thought to developing a good machine for a very necessary work.

There, New Jersey mosquito fighters, is one right in your laps, and don't try passing it back to the writer. He is having his own particular headache with equipment for the salt marsh.

Fred A. Reiley.

PATHOLOGY OF EXPERIMENTAL POISONING IN CATS, RABBITS, AND RATS WITH 2, 2 BIS-PARACHLORPHENYL 1, 1, 1 TRICHLORETHANE. By R. D. Lillie, Senior Surgeon, and M. I. Smith, Chief Pathologist, United States Public Health Service. Public Health Reports, 59 (July 28, 1944): 979-984.

THE PHARMACOLOGIC ACTION OF 2, 2 BIS (P-CHLORO-PHENYL) 1, 1, 1 TRICHLORETHANE AND ITS ESTIMATION IN THE TISSUES AND BODY FLUIDS. By M. I. Smith, Chief Pharmacologist, and E. F. Stohlman, Associate Pharmacologist, United States Public Health Service. Public Health Reports, 59 (July 28, 1944): 984-993.

HISTOPATHOLOGICAL CHANGES FOLLOWING ADMINISTRATION OF DDT TO SEVERAL SPECIES OF ANIMALS. By Arthur A. Nelson, John H. Draize, Geoffrey Woodward, O. Garth Fitzhugh, R. Blackwell Smith, Jr., and Herbert O. Calvery, Division of Pharmacology, Food and Drug Administration.

These three papers are of interest to mosquito control workers in common with workers in other fields of pest control, because their significance seems to have been misinterpreted, with the result that they have been cited as a source of alarm concerning DDT as a possible health hazard, which might delay its full use as an insecticide.

DDT undoubtedly has remarkable insecticide properties. Its value as a delousing agent is now well known. Herms and Gray (Mosquito Control, 1944 Edition) indicate an apparently effective toxicity for mosquito larvae in phenomenally high dilutions. Others have reported similar results. It is true, however, that when administered in sufficient quantities DDT is a poison, just as are all other insecticide materials.

Irresponsible publicity concerning the insecticide possibilities of DDT has too often lacked proper scientific reservation; and, as a result, popular interest has acquired an urgence far outrunning the seemingly plodding, step-by-step advance permitted by scientific caution. Normal scientific caution is indispensable to the sound advance of scientific knowledge; but it is just as important to avoid unwarranted, delaying overapprehensiveness such as a misinterpretation of the papers cited seems here and there to have engendered, as it is important to avoid heedless overenthusiasm and the errors and resulting hazards to which that may lead.

The three admirable papers in question are based upon thoroughly scientific studies, the chief objectives of which, however, appear to have been concerned with the pharmacological properties of DDT as a drug or poison when administered to laboratory animals in relatively heavy doses; with changes in the tissues and organs by which DDT poisoning may be recognized; and with the development of techniques for identifying the presence of the chemical in cases of DDT poisoning, and for measuring the quantities of the chemical in the organs and tissues in such cases.

A detailed review of these (for their own special field) important papers would be interesting and much worth while in its proper place; but for MOSQUITO NEWS it is sufficient to consider their validity as a basis for alarm concerning the health hazards (if any) which may attend the normal use of DDT as an insecticide.

The technical description given in these papers of the damage to organs and tissues which may result from poisoning by massive doses of DDT do have a gruesome connotation for the layman; but before we translate them directly into hazards which may attend the use of DDT as an insecticide, we should carefully take stock of the problem as a whole.

The doses administered were on the order of 50 to 1500 milligrams per kilogram of body weight for the animals used. Translated into everyday language, these doses would be approximately comparable to doses ranging from a rounded teaspoonful (about one-sixth of an ounce) to more than a quarter of a pound for a 200-pound man. In the experiments described, the DDT was administered in several ways.

With one series of animals (rats), DDT was injected directly into the abdominal cavity of each experimental animal as a single dose, in a quantity that would be equivalent to *more than a quarter of a pound* of the chemical introduced into the abdominal cavity of a 200-pound man.

When these animals were killed and examined at the end of 6 days, the "Significant Pathological Changes" reported for the three animals were: "Slight, slight to moderate, and moderate to marked central necrosis, and slight hydropic degeneration of the liver, slight focal necrosis of leg muscles, and slight focal ulceration of gastric mucosa."

With another series of experimental animals (rabbits) DDT was administered by mouth daily until the animal died or was near death, in quantities (50 milligrams per kilogram of body weight) equivalent to a rounded teaspoonful (one sixth of an ounce) daily for a 200-pound man. The animals lived 15, 18, 23, and 25 days. The total amount of DDT necessary to cause death when administered in this manner being respectively equivalent to 10 ounces, 12 ounces, 15 ounces, and 18 ounces for a 200-pound man. The damage found on post mortem examination was reported respectively as: "Liver necrosis," "Coagulation necrosis of the liver," and "Coagulation necrosis and hyaline degeneration of the liver."

Obviously, the quantities used have little practical relation to the relatively infinitestimal intake that might be involved where DDT is used properly as an insecticide.

Another source of alarm concerning the health hazard which might attend the use of DDT as an insecticide, which has likewise been cited, appears to be the report that DDT is toxic for fish at a dilution of one part in ten million parts of water (1 to 10,000,000).

This, however, is not necessarily an index to any potential health hazard when used as an insecticide.

Cresylic acid is a standard ingredient in sheep and cattle dips, and in repellent fly sprays designed for use about dairy barns and the like; yet M. M. Ellis reports that cresylic

acid at a dilution of 1 to 10,000,000 killed goldfish in 5 days, and at a dilution of 1 to 1,000,000 in 6 to 24 hours.

Also, *chloramine* is used in large quantities in the treatment of city water supplies; yet Coventry, Shelford and Miller report that chloramine at a dilution of 1 to 3,000,000 killed trout fry at once, and at a dilution of 1 to 16,000,000 in 48 hours; and that it killed sunfish and bullheads at a dilution of 1 to 2,500,000.

Many thousands of men have been using a 10 per cent DDT louse powder dusted inside their clothes. It would be strange if, when used in this manner, appreciable quantities of DDT should not be either inhaled, or taken internally with food, the occasional contamination of which by DDT could scarcely be avoided. We should know by now if any ill effects are likely to result from this relatively heavy external application of DDT and from its probable occasional attendant intake.

Much work still remains to be done, of course, before we know just where and how DDT may be best and most safely used; but the writer can remember the similar reaction to the possible horrors which might result from the "indiscriminate" use of Derris when it was being introduced some twenty odd years ago. One of the leading importers and millers of pyrethrum then told me substantially "We won't touch it! The health hazard for our employees is too great; and we can't take the chance of suits for damages which might be filed by users of the stuff."

DDT seems to have immense promise as an insecticide. We should keep our feet on the ground, and strive to avoid any delaying over-apprehensiveness, quite as much as any over-enthusiasm until we learn how best to use it. With DDT, as with other insecticide poisons, our real problem is to find the ranges within which it may be used with safety, or how to use it and at the same time exclude it from that part of the protected product which will eventually be consumed.

It seems doubtful whether any health hazard to the operator would attend the use of DDT as a Culicide; and in the quantities required, whether it would constitute a hazard for livestock.

MORE DDT FINDINGS. NEW INSECTIDE IS APPARENTLY SAFE TO USE WHEN DUSTED DRY ON THE SKIN AND WHEN BREATHED IN AIR INTO WHICH IT HAS BEEN SPRAYED, RESULTS OF TWO SERIES OF EXPERIMENTS SHOW. Anonymous. Science News Letter for Nov. 11, 1944, p. 310.

Since the preceding special review of three articles in "Public Health Reports" was written, the article cited here has appeared. It seems that Dr. Paul A. Neal of the National Institute of Health, and Dr. Herbert O. Calvery of the U. S. Food and Drug Administration, the latter a joint author of one of the three papers reviewed above, had recently reported "before an audience of entomologists in Washington," "results of — experiments supporting" the conclusion set forth in the subtitle of this item in "Science News Letter."

Dr. Calvery's summation is quoted as: "In solid form DDT applied topically to the skin is nonirritating, nonsensitizing and not appreciably absorbed. In solution, either in oil or in organic solvent, it does readily penetrate the skin, is very mildly irritating and a very mild sensitizing agents."

Dr. Neal is reported as having "corroborated his colleague's verdict so far as safety in use as a dry delousing powder is concerned, and added that the spray or aerosol solutions containing 1 per cent of DDT were breathed for long periods by rabbits without any tangible ill effects."

Dr. Neal is directly quoted as having added: "In a clinical and laboratory study of three men who had had several months' continuous occupational exposure to DDT in its various forms as an insecticide, an evaluation of the results failed to indicate any definite toxic effects."

This item, based as indicated upon results apparently still unpublished, seems to bear out the point of view outlined in the foregoing review. It should be repeated, however, that

DDT probably should never be applied to products like cauliflower, broccoli, lettuce, celery and the like from which residues can not be removed before consumption, nor to other products likely to carry an appreciable residue until it can be fully established by the agencies referred to, what limit of tolerance for such residues may be entirely safe. But any probable use of DDT for the control of mosquitoes appears unlikely to carry any hazard for the operator; and, as with pyrethrum, ways will doubtless soon be found to increase materially the present rather narrow margin between the upper limit of its effectiveness as a mosquito larvicide and the limit beyond which it is no longer toxic for fish. R. D. G.

A CRITICAL REVIEW OF THE LITERATURE RELATING TO THE FLIGHT AND DISPERSION HABITS OF ANOPHELINE MOSQUITOES. By Don E. Eyled. Division of Infectious Diseases, National Institute of Health, U. S. Public Health Service, Bulletin No. 287 (1944), 39 pp.

Study of flight habits is of paramount importance. Inflexible limits have too often been set. In this country a 1-mile limit is most often set as a radius for operations against *A. quadrimaculatus*. This limit has usually given good results; but it has been shown on several occasions that this mosquito can fly greater distances.

The following factors may cause excessive dispersal: 1. Prolific breeding outside the set limits of control. 2. Absence of adequate blood sources nearer the breeding places than are afforded within the protected area. 3. Winds favorable to dispersion. 4. Artificial means of dispersal, such as carriages, automobiles, trains, ships, airplanes and the like. Such passive transportation for more than 100 miles has been recorded, and it is supposed that *A. gambiae* was thus introduced into Brazil.

Marking techniques used by various investigators are discussed, and comprise: 1. Liberating adults which had been sprayed with aqueous solutions of aniline dyes. 2. Dusting mosquitoes to be liberated with dry powdered aniline dyes. 3. Dusting with metallic bronzing powders. Methods of recognition when captured are adapted to the marking technique employed.

Annotated lists of species review the work of various investigators, and a tabular summary, brings together in compact form the data available on the flight range of the important anopheline vectors.

A very comprehensive bibliography of work in this field is given.

DENGUE FEVER EPIDEMIC. Anonymous. The Hawaii Health Messenger, Volume IV, August, 1944: 2-3.

This article gives a very full account of measures taken and progress attained in suppressing the recent epidemic of dengue fever in Hawaii. "Two commercial airline pilots arrived in Honolulu on July 19, 1943, one in the fourth day after onset, the other apparently ill with dengue in the incubation stage." These cases were hospitalized; the first at once, the second on the fifth day after onset. An August 5th, and subsequently, cases began to appear in the Waikiki district.

There was a previous widespread epidemic of dengue in the Hawaiian Islands in 1903, and a lesser outbreak in 1912. "The vectors of dengue in the Hawaiian Islands are: *Aedes aegypti* Linnaeus, which breeds in artificial containers such as bottles, tin cans and tanks, and *Aedes allopictus* Skuse, which breeds in artificial containers, and also in natural containers, such as tree and rock holes, and water holding plants.

The Public Health and Military Authorities at once began a vigorous campaign to prevent an explosive epidemic. Inspectors of the Rat and Mosquito Control Squad of the Honolulu Chamber of Commerce were immediately augmented by many additional new inspectors, including military personnel.

Extensive *Aedes* mosquito control work was undertaken, including a campaign for public cooperation, stimulated by newspaper publicity and the distribution of printed information and instructions.

Most areas responded well; but one large business firm in the Kakaako District failed

to cooperate, with the result that as many as 70 employees of this firm were incapacitated by dengue at one time, and a total of 400 cases were reported from that district.

Many interesting details of the campaign are given in this report, and in the "Health Report" in another column it is stated: "At the end of July (1944) the *Aedes* breeding index for Honolulu was 0.7 per cent, which is the lowest index reported for the city since the start of the program."

After the first year, it became evident that the dengue problem might become Territory-wide, not because of the local situation, but due to increasing importation of dengue cases from the Southwest Pacific. The logical solution has been to extend *Aedes* mosquito control immediately to all areas where necessary for protection of the war effort. R. D. G.

ENTOMOLOGICAL PHASES OF THE RECENT DENGUE EPIDEMIC IN HONOLULU. By Robert L. Usinger, Passed Assistant Sanitarian (R), U. S. Public Health Service. Public Health Reports, 59 (1944): 423-430.

This article and the reprot on the same epidemic, published in Hawaii Health Messenger for August, 1944, Volume IV, No. 2, should be considered together by anyone interested in this mosquito borne disease.

Hawaii was mosquito free until 1826, when the arrival of *Aedes* (*Culex*) *quinquefasciatus* (Say) was definitely recorded. *Aedes aegypti* (Linn.) arrived later, and was abundant and widespread in 1892. At that time, *Aedes allopictus* (Skuse) had not been reported in collections; whereas it was reported "very numerous and conspicuous" in 1902. Only these three species are known to occur in Hawaii, where no species of *Anopheles* has yet become established.

The author states that the outbreak is of doubtful origin; but repeats the current story of the two commercial flyers introducting the infection from the Fiji Islands, where an epidemic was in progress. The disease was fairly typical, but less severe than in some epidemics. The three mosquito species are discussed at some length, with special reference to their habits, distribution, and relative abundance in Hawaii. Very curiously, the numbers of cases were in nearly inverse proportion to the general mosquito breeding index. This apparent anomaly is analyzed and tentatively explained. Dengue epidemics may be ended in three ways: 1. When frost occurs, this may kill adult mosquitoes and stop the epidemic. 2. When most of the population has had the disease and has acquired immunity. 3. The epidemic will disappear when the mosquito carriers are reduced in numbers below the threshold of sanitary importance. It was important for military reasons that a general epidemic involving the whole population be avoided; so the third, and physically most difficult, course has been employed in the present epidemic. R. D. G.

ANOPHELES MOSQUITO SURVEY IN CANADA. By C. R. Twinn, Dominion Department of Agriculture, Ottawa, Division of Entomology, Science Service, Contribution No. 11 (Multilith), June 20, 1944, 13 pp.

This neatly reproduced and well illustrated little pamphlet, of which a copy has just come to the editor's desk, is designed to reassure those of whom it is said: "Some concern has been expressed regarding the possible danger of malaria transmission occurring in Canada as a result of the presence in this country of prisoners of war and the return of members of the armed forces from war theatres where this disease is prevalent." It is pointed out that, while a few species of *Anopheles* mosquitoes "are rather widely distributed in Canada, they are not generally abundant, and represent only a small percentage of the mosquito population except, perhaps, in restricted localities."

Brief descriptions, tables and figures provide a guide to the life histories, habits and identification of the Canadian Anophelines, with directions for their detection, collection, and study, and for enlisting official assistance in the appraisal of any potential local malaria hazard. R. D. G.

ANOPHELES GAMBIAE IN BRAZIL, 1930 TO 1940. By F. L. Soper and D. Bruce Wilson. pp. xviii 262. 75 figs., 49 tables. The Rockefeller Foundation, 1943.

The eradication of *Anopheles gambiae* Giles from Brazil is one of the great achievements of mankind in the prevention of disease. *Anopheles gambiae* was first discovered "in a small over-flowed grassy field" near Natal, Brazil, in March 1930. It probably arrived several months before by boat from Dakar, West Africa. Two explosive outbreaks of malaria occurred in Natal during 1930 and 1931 and stimulated a local control program. Thereafter the situation was quiescent for seven years, during which time *gambiae* became firmly entrenched and slowly spread through relatively unfavorable territory. Then, in 1938, *gambiae* invaded the river valleys of the States of Ceara and Rio Grande do Norte. The Assu, Apodi, and Jaguaribe river valleys "were the scene of epidemic malaria equal in severity, if not in extent, to that of the worst outbreaks described in the literature of this disease . . . Entire families were laid low at one time. Often none were spared to cook the little food available or to seek more; none were able to go for medicine, even had there been money with which to buy it . . . Not only was everyone ill, but the mortality was appalling."

To cope with this situation, the Malaria Service of the Northeast was organized, drawing heavily on personnel from the highly effective Yellow Fever Service and supported by the Ministry of Health of Brazil and the International Health Division of the Rockefeller Foundation. It was decided to attempt complete eradication since *gambiae* is probably the most domestic of all anophelines and breeds most effectively in small shallow, sunlit pools of fresh water without vegetation.

The control program was based to a large extent on paris green applied wet or dry. It was applied in dry form by mixing "approximately one kilogram of dry earth, dust, or fine gravel with ten grams of paris green and then repeating the operation until 5 kilograms had been mixed." In most of the work this mixture was dispersed by hand but chronic arsenic poisoning was a serious disadvantage to this method of application. In this connection it is reported that "an overzealous inspector, who eventually recovered, suffered severely from a public demonstration of the nontoxicity of paris green in which he added a goodly portion of it to his beer."

Great emphasis was placed on adult control measures or "disinsectization," although the authors "secured ample proof that anti-larval work (paris green) alone is able to eliminate *gambiae*, whereas anti-imaginal measures alone were never shown to be effective." As in the South American *aegypti* eradication program, the adult survey method proved to be the most sensitive and was indispensable in the final stages of eradication.

Three significant points emerge out of the *gambiae* situation in Brazil. First, the incidence and severity of malaria in a region depends very largely upon the habits of the vector, the domesticated *gambiae* causing a catastrophic epidemic in an area where local anophelines had supported endemic malaria at a low level for centuries. Second, mosquito control measures have now been perfected to a point where spectacular results may be achieved by concentrating on the objective. Third, the danger of importing foreign vectors is a very real one and must be squarely faced by a civilization on the threshold of an era of international air transport.—(From Monthly Report, March, 1944, Office of Malaria Control in War Areas, Atlanta, Ga.) R. L. Usinger, P.A. Sanitarian (R).

INSECT REPELLENT COMPOSITION PATENTED. U. S. Patent 2,356,801, issued August 29, 1944, to Bernard V. Travis and Howard A. Jones, Orlando, Florida, assignors to the United States of America as represented by Claude R. Wickard, Secretary of Agriculture, and his successors in office.

This invention relates to an improved insect repellent composition. The materials comprising this composition are dimethyl phthalate 60 per cent, 2-ethyl-1, 3-hexanediol 20 per

cent, and n-Butyl mesityl oxide oxalate 20 per cent. In more familiar terms, this is three parts of dimethyl phthalate, to one part of Rutgers 612, and one part of Indalone.

The relative effectiveness of this 60-20-20 mixture in comparison with each of these now well known repellents used alone, are given in tabular form as follows:

EFFECTIVENESS AS MEASURED BY THE AVERAGE REPELLENT TIME IN MINUTES

SPECIES AND TYPE OF TEST	DIMETHYL PHTHALATE	2-ETHYL-1, 3-HEXANEDIOL	N-BUTYL MESITYL OXIDE OXALATE	60-20-20 MIXTURE
Anopheles quadrimaculatus (laboratory)	206	78	30	257
Aedes aegypti (laboratory)	234	363	160	321
Aedes taeniorhynchus (field)	153	276	164	212
Stomoxys calcitrans (laboratory)	47	101	171	189

The unusual increase in repellent time obtained by combining the three components appears to result from a synergistic effect, whereby one increases the repellent effect of another.

This insect repellent composition may cause a slight, temporary stinging sensation when applied undiluted to the more sensitive areas of the skin; but extensive tests over long periods of time have shown it to be toxicologically safe for repeated application to the human skin. R. D. G.

ANNOUNCEMENTS

ANNUAL MEETING, AMERICAN MOSQUITO CONTROL ASSOCIATION. The 1945 Annual Business Meeting will be held at the Hotel Claridge, Atlantic City, N. J. on the evening of March 29, 1945. Details will be sent to the membership by mail, previous to the meeting. T.D.M.

NEW JERSEY MOSQUITO EXTERMINATION ASSOCIATION. The 1945 Annual Meeting will be held at the Hotel Claridge, Atlantic City, N. J. on March 28, 29, and 30, 1945.

Proceedings of the thirty-first annual meeting (1944) are now available on order from the Secretary of the N. J. Association. See review by Sam Reck in this number of MOSQUITO NEWS. T. D. MULHERN.

WANTED

BACK NUMBERS OF MOSQUITO NEWS WANTED. In order to complete sets of back numbers of MOSQUITO NEWS for sale to libraries, etc., the Secretary needs copies of the following numbers: Volume 1, No. 1 and 2 (combined), and Volume 3, No. 1. If you have copies that you do not need, please send them to the Secretary, who will pay for them at the regular price of seventy-five (75¢) cents per copy. T.D.M.