

## REVIEWS AND ABSTRACTS

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A FIELD GUIDE TO COMMON MOSQUITO-LIKE GNATS OF CALIFORNIA. By the Entomology Committee of the California Mosquito Control Association. Edited by Thomas H. Lauret. Illustrated by Ellen Montgomery. March, 1962. The list of contributors includes: R. M. Bohart, D. H. Ke, J. Fowler, R. F. Frohli, E. E. Kauffman, J. Callars, H. L. Mathis, E. G. Mezger, and M. A. Wood.

This guide was developed as an aid to non-professional workers in recognizing the six families of mosquito-like gnats important as nuisances. It serves its purpose well—from the first page of text where there is a full-page line drawing of a composite gnat with identifying characters clearly labeled, to the final page-and-a-half, where a list of biological terms is simply defined.

There are excellent full-page drawings of each of the six families: Chaoboridae, Chaoborid Gnats of which the Clear Lake Gnat is a notable example; Tipulidae, Crane Flies; Dixidae, Dixidges; Empididae, Dance Flies; Mycetophilidae, Angus Gnats; Chironomidae, Chironomid Midges. Each drawing of an adult is followed by a drawing of a larva. A brief description accompanies each illustration, and a biological sketch of the nymph is added.

The key to adults includes line drawings of the differentiating or comparative features.

This publication, 8 by 11 inches, with attractive cloth cover is very good. It will be appreciated by entomologists in other fields, as well as by non-professional workers.—H. L. T. D.

PROCEEDINGS AND PAPERS OF THE THIRTIETH ANNUAL CONFERENCE OF THE CALIFORNIA MOSQUITO CONTROL ASSOCIATION, INC. Proceedings Committee, W. D. Murray and E. C. Robinson, Editor, J. E. Walker. California Mosquito Control Association, Inc. 1737 West Houston Ave., Visalia, Calif. Oct. 1962. 102 pp. This publication is dedicated to the memory of Dr. Lewis Wendell Hackett, who died in Oakland, April 28, 1962. There is a brief account of Dr. Hackett's life written by Harold Gray, who, on January 30, 1962, at the Conference of the California Mosquito Control Association, had introduced him for the presentation of Honorary Membership in that organization.

The Table of Contents is impressive in its titles and its authors. The two Invitational Papers were by Archie D. Hess, "Some Recent Public Health Service Research on Mosquito Vectors of Malaria," and by Arthur W. Lindquist, "Chemopreventive and Other New Research of Interest to Mosquito Control Workers." Only the latter is mentioned in the "Proceedings," and it is reviewed in some detail as a separate paper.

There are two Interagency Committee Reports, one, "Report of the National Mosquito Control Council and Wildlife Management Coordination Com-

mittee for 1961," the second, "Activities of the Federal Interagency Committee on Water Resources—Subcommittee on Vector Control."

A Symposium on "Vector Control Research in California" lists four papers; and the Symposium on "Outlook for Future Research in California" lists four, also. A panel discussion on "Mosquito Control Operations" and one on "Trustees," list five and four contributions respectively. The Symposium on "Administrative Techniques in Solving Problems of Source Reduction," considers legal and negotiated approaches and equipment policies of several of the abatement districts. The panel, "New Pesticide Materials, Formulations, and Application Techniques," includes: "Mosquito Abatement District Fan Studies: Investigations on the Energy Relations in the Air Pattern from Small Air Carrier Sprayer"; "Mosquito Control with Granular Larvicides"; "Liquid Formulations of Insecticides for Mosquito Control"; "Pesticide Residues and Mosquito Abatement"; and, "Effects of Mosquito Abatement Pesticide Treatment on Honey Bees."

There are eight submitted papers, three on equipment and operation, two on chironomid control, one on mosquito source location, one on bactericidal effects of insecticides and mosquito oviposition, and one on resistance of mosquitoes to insecticides.

"Use of Age Determination Techniques to Locate Sources of *Culex quinquefasciatus*," by Gardner C. McFarland and Harvey I. Magy, is especially interesting in that Bettina Rosay's basic research on age determination of mosquitoes was proved again to be of practical use. The technique includes use of the degree of rotation of the male terminalia, the loss of pupal remnants in the form of muscle tissue in the abdomen, presence of meconium, and the stage in the development of the female ovaries. *Culex quinquefasciatus* had been causing considerable trouble over the years in a residential area near a dairying country. By means of the techniques described above, it was concluded that the infestations stemmed from underground sources recently discovered and not apparent from the usual inspection. The male mosquitoes examined appeared to be less than 48 hours old, and the females, too, indicated that a young group of mosquitoes was emerging from nearby locations.

The final paper, Ralph Barr's, "Resistance of Mosquitoes to Insecticides in California," is a 14½-page review (31 tables, 36 bibliographical references); it is well-organized and well-documented. It is a compilation of reports and surveys by the California Mosquito Abatement Districts and makes use of available published data, as well as some unpublished material of L. L. Lewallen. The author was assisted in the compilation by L. L. Lewallen, D. C. Mengle, and C. M. Gjullin. Testing for resistance was done chiefly by the

University of California at Davis, the United States Department of Agriculture, California State Bureau of Vector Control, and the Kern Mosquito Abatement District. Eighteen of 35 Mosquito Abatement Districts reported resistance of mosquitoes to insecticides. LC<sub>50</sub>'s are tabulated for DDT, malathion, parathion, toxaphene, lindane, aldrin, and heptachlor against *Aedes nigromaculis*, *A. melanimon*, *Culex tarsalis*, *C. pipiens* subsp., and *Culiseta incidens*. In California, the principal insecticides have been DDT, malathion, and parathion. Resistance to these insecticides has appeared in *Aedes nigromaculis*, *Culex tarsalis*, and probably *C. pipiens* (mostly subspecies *quinquefasciatus*). Resistance was shown also to the less frequently used toxaphene, lindane, aldrin, and heptachlor.—H. L. T. D.

CHEMOSTERILANT AND OTHER NEW RESEARCH OF INTEREST TO MOSQUITO CONTROL WORKERS. By A. W. Lindquist. Proceedings and Papers of the Thirtieth Annual Conference of the California Mosquito Control Association, Inc. Visalia, Calif. 1962. 5 pp., 14 refs. This paper is a digest of the pertinent outstanding research contributions, published and unpublished, of the projects in progress, and of the thinking in the Entomology Research Division of the Agricultural Research Service of the United States Department of Agriculture.

In his Introduction, Dr. Lindquist calls attention to the efficiency and economy of insecticides such as DDT, dieldrin, and lindane, developed in the mid-1940's, and of the resultant benefits to mankind. Disease-bearing and annoying insects, as well as those affecting animal and food crops, had had an increasingly marked influence on the health, social and economic welfare. He cites as an example, that, of the one-and-a-quarter billion persons in areas subject to malaria, almost one-fourth, or 280,000,000 now live in areas where malaria has been eradicated by means of such residual sprays.

As the use of these insecticides increased, difficulties arose, such as resistance of the insects, hazards of residual sprays on foods, in milk, and in meat of animals sprayed, and of deleterious effects on fish and wildlife when spraying was not carefully done.

In outlining the Entomology Research Division's approaches and attitudes to this problem, the author divides the subject matter into three main groups. The first, "Control of Insect Reproduction," points out that the sterile-male technique is the most efficient single means of reaching and destroying all of the insects in a normal native population.

Gamma radiation of reared male screw-worm flies resulted in sterile males which, when released in greater numbers than those occurring in nature, caused the eventual elimination of *Cochliomyia hominivorax* (Coq.) from the Island of Curaçao and from the southeastern United States. A ratio of released males to native males

of 10:1 sought out and mated with female flies and reproduction then ceased in females so mated.

A search for chemicals to be used as chemosterilants stemmed from Gamma radiation disadvantages (difficulty in handling and rearing, detrimental effect on male vigor, and cost) and from the advantage that a lure or bait would sterilize attracted females as well as males. The sterilized females and males would then be added to the females sterilized by mating with the male, thus providing a potential 99 percent control of reproduction as opposed to a 90 percent control with insecticides.

In addition to the lure or bait, the chemosterilant might be applied as an insecticide, or in combination with a residual insecticide. A discussion of various facets of these possibilities is most fascinating.

Recent chemosterilant research is making use of materials selected in a screening program which has been underway for several years. Compounds found effective in sterilizing both sexes of house flies, mosquitoes, and stable flies, are aphoxide, aphomide, and apholate. (These are unofficial common names. Chemical names are listed in the paper.) Both sexes of *Aedes aegypti* (Linn.) and *Anopheles quadrimaculatus* Say were sterilized by combining either aphoxide or apholate with food or by placing it in the water in which the larvae were reared.

In selecting a chemosterilant, permanency of sterilization as well as the age of the insect relative to exposure to the chemical is important. Of utmost importance, also, is the effect of chemosterilant on the vigor of the insects. Gamma radiation tends to weaken. This was indicated in preliminary tests when irradiated male *Aed. aegypti* were placed in a cage with females the same time that apholate-treated males were placed in another cage with females. In the latter cage, there was a greater reduction in the number of viable eggs. The apholate-sterilized males lived longer, also.

Research problems and the hazards of chemosterilants are discussed at length. Migration of insects and the particular problems peculiar to each species must be recognized and taken into account. The chemosterilants now effective experimentally are considered hazardous and are being used only to demonstrate the practicability of such measures.

"Genetics, Cytology, and Physiology," is the second main grouping and incorporates discussion of the inheritance of resistance and susceptibility in insect strains, and of the physiological responses to insecticides.

"Synergists," heads the third and final group. There is a brief consideration of the synergists that increase effectiveness of insecticides against resistant insects. Triphenyl phosphate, tributyl phosphorotrithioate, and tributyl phosphorotrithioate are inhibitors of alisterase activity in flies and mosquitoes, both *in vivo* and *in vitro*. The combination of these chemicals with malathion

ratios 1:1 and 10:1, easily killed malathion-resistant mosquitoes.

The facts presented in this paper are thought-provoking; and each reader, depending on his own field of investigation and interest, will recognize the challenge.—H. L. T. D.

**INSECT CONTROL IN PUBLIC HEALTH.** By C. B. Symes, R. C. Muirhead Thompson, and J. R. Busine. Elsevier Publishing Co. Inc. Amsterdam and New York. 52 Vanderbilt Ave., New York 7, N. Y. 1962. 227 pp. 19 illus. 15 tables. \$11.00. These three authors combine their varied and wide experience in research and practical control problems to condense into one small volume a lot of good information. The detailed discussions of modern insecticides and their uses against arthropods causing disease throughout the world, and the brief accounts of the diseases, themselves, serve to orient the public health worker and give him practical assistance in control projects.

Nine of the book's eighteen chapters deal briefly with the major arthropod-borne diseases of the world: malaria, yellow fever, filariasis, plague, murine typhus, scrub typhus, Chagas' disease, fly-borne dysenteries, leish-maniasis and sand-fly fever, mouse-borne typhus and relapsing fever, onchocerciasis, and trypanosomiasis. There are brief notes on the vectors, distribution and epidemiology, and control measures.

By far, most of the book is taken up with control, with emphasis on the role of insecticides. Seven chapters deal with insecticides and equipment. Chapter 1 describes the origin, properties, uses, and toxicity of modern insecticides. Pyrethrins and the chlorinated hydrocarbons, DDT, methoxychlor, benzene hexachloride and its gamma isomer, lindane, chlordane, heptachlor, and aldrin are discussed at length. The organic phosphates, parathion, malathion, diazinon, are treated in detail, while chlorthion, "Ronnel," and "Dipterex" with their chemical formulas are touched upon only briefly. Larvicidal petroleum oils are included in this chapter but in less detail than the chlorinated and phosphorus compounds.

Chapter 2, on formulations, is comprehensive, devoting seven pages to water dispersible (wettable) powders, emulsifiable concentrates, solutions, dusts or powders, particle sizes, insecticidal surface coatings, and bricketts, pellets, granules and other formulations. Chapter 3 on space sprays, such as aerosols, fogs, and smoke, is followed by one on residual sprays.

In chapter 5 on equipment, there are given descriptions of and directions for the use of hand sprayers, stirrup pumps, knapsack sprayers, compression or pneumatic sprayers, larvicide applicators, liquefied gas generators, power-operated compressors, mechanical generators, thermal generators, insecticidal smokes, and dusting equipment. A brief note follows on the care and maintenance of this equipment.

Chapter 7 lists the basic requirements and costs of a malaria control campaign based on residual spraying. Chapter 17 summarizes the status of insect resistance to insecticides, and chapter 18 deals briefly with toxicities of modern insecticides and recommended precautionary measures to be taken by those handling them.

Appendices A through I (pp. 156-207) guide the worker through the actual procedures of survey, field and laboratory methods. Appendix A furnishes a one-page description of the characters of the mosquito genera *Anopheles*, *Culex*, and *Aedes*. Appendix D is a 3½-page explanation of the preparation of insecticidal formulations and determination of the rates of application, while "F" gives instructions for the determination of resistance to insecticides of adult and larval mosquitoes. A 15-page Appendix H furnishes a most helpful table outlining the problems for which various formulations are being used.

A selected bibliography of 8½-pages furnishes references to material which will answer questions not supplied in the text. In conclusion, there is a 9-page topical index. The recommendations and tables of other authors, especially those from WHO, are freely used and credited.

This compact volume (size 6 x 9 inches) is printed clearly, bound well, and will be a useful reference for the bookcase or the briefcase.—H. L. T. D.