

## Preface to the First Edition

This publication was conceived by Harold D. Chapman in 1975 while he was serving as President of the American Mosquito Control Association. Since that time it has been supported by Presidents D. Bruce Francy, Lewis T. Nielsen, Paul A. Hunt, Glenn W. Stokes and Robert K. Washino, their respective Boards of Directors, the publication committees and Executive Directors Thomas A. Mulhern and W. Donald Murray. The publication Editorial Board was composed of William E. Bickley, John D. Edman, Lewis T. Nielsen and the authors.

We are greatly indebted to the Department of Entomology, U.S. National Museum, Smithsonian Institution, its head, Don R. Davis and Oliver S. Flint, Jr., the principal investigator of the Medical Entomology Project, for granting the use of the national collection and space in which to work during the development and illustration of the keys. Many others have provided specimens to be used in preparing illustrations. Especially do we thank the late John N. Belkin, Harold D. Chapman, Lewis T. Nielsen, Sunthorn Sirivanakarn, Stephen M. Smith, and Thomas J. Zavortink.

The following persons kindly shared with us unpublished records on the occurrence of mosquito species in their political units: Peter Belton (BC), Richard L. Berry (OH), John F. Burger (NH), Charles F. Burr (VA), Robert J. Dicke (WI), James S. Haeger (FL), Fred W. Knapp (KY), Robert W. Lake (DE), Harold D. Newson (MI), Margaret A. Parsons (OH), Aileen Pucat (ALTA ) and William Wills (PA). California records were provided by Gail Grodhaus. D. M. Wood allowed us to see parts of his unpublished manuscript on the mosquitoes of Canada. For this we give him thanks.

We are particularly grateful to those who have participated in the review process and contributed their expertise to improve the various sections of the publication. We especially wish to thank the late John N. Belkin, Michael E. Faran, Ralph E. Harbach, Bruce A. Harrison, Lewis T. Nielsen, Charles H. Porter, Sunthorn Sirivanakarn and D. M. Wood.

The respective agencies to which we belong are due our gratitude for their support in many ways without which the project could never have been completed. In this regard special thanks go to the late Robert L. Kaiser and Ladene Newton of the Bureau of Tropical Diseases, Center for Disease Control, to the several directors of the Central America Research Station, San Salvador, El Salvador, Central America, where the senior author was stationed during much of the preparation and to Marta Ambrogi, who was responsible for typing most of the manuscript. The Walter Reed Army Institute of Research permitted the junior author to devote considerable time during a two year period for this work with the necessary facilities provided by the Smithsonian Institution.

We would like to acknowledge the assistance of the Defense Pest Management Information and Analysis Center which readily supplied literature references needed for the bibliography.

High praise must go to the artist, Chien C. Chang, for her superior quality work in preparing the

illustrations at considerable sacrifice, and to the Department of Entomology, Kansas State University, its former chairman, Richard J. Sauer and staff members Herbert C. Knutson and H. Derrick Blocker, for their support of the art work by providing space, instruments, technical assistance, use of their reproduction equipment and mailing facilities. We also are deeply indebted to the late Kenneth L. Knight who arranged for the artist to work at Kansas State University and who has helped sustain this project in many ways. We also thank him for permission to use the illustrations on Plates 2, 3, 4, 5, 7, 8.

Thanks need also to be extended to Mr. and Mrs. George L. Gattoni who gave refuge to the senior author during his several visits to the U.S. National Museum and offered assistance and counsel during the publication's production.

## Preface to the Second Edition

The revised edition was prepared at the behest of many officials and members of the American Mosquito Control Association. Support was provided from two sources, the first a loan from the Florida Mosquito Control Association through the American Mosquito Control Association, and two additional grants from the latter. Preparation of this edition would not have been possible without the support and cooperation of the Florida Medical Entomology Laboratory, Institute of Food and Agricultural Sciences, University of Florida, and its directors Richard H. Baker and Walter J. Tabachnick. They provided office and laboratory space for the senior author and the office facilities and supplies so necessary for a project like this.

The authors are indebted to Taina Litwak for preparing illustrations for the twelve species added to the book since the first edition and to James M. Newman, graphic artist at the Florida Medical Entomology Laboratory, for preparing the thirty-one map plates and injecting his ideas for improving them over those in the first edition. Also thanks to the supervisor of the Graphics Laboratory, C. C. Lord, and to J. F. Day for their support of the project, and to L. P. Lounibos, B. F. Eldridge, and D. Strickman for reviewing the manuscript.

## Introduction

In 1955 Carpenter and LaCasse published a monograph titled *Mosquitoes of North America North of Mexico* (146). They included 143 species and subspecies in 11 genera and 19 subgenera, identification keys to genera and species, and descriptions of the known adult female, male, and larval stages. Their distribution information consists of lists of states of the United States and provinces of Canada in which each taxon was collected, with substantiating references.

There are now 174 known species and subspecies in 14 genera and 29 subgenera. The additions and changes in the names of the North American mosquito fauna have been reviewed by Carpenter (131, 135, 144), Darsie (204, 206), Darsie and Ward (217), and Reinert (599, 802).

The principal objective of this volume is to revise the identification keys to adult female and larval stages in order to incorporate all 174 taxa. Each key is preceded by a detailed description of the morphology of the stage, which is needed to use the key successfully. In addition, every couplet in the two keys is illustrated, to assist the user in interpreting the characters employed.

A second purpose is to present up-to-date information on the geographical distribution of the mosquito taxa. We are continuing the arrangement used by Carpenter and LaCasse (146), listing the states and provinces from which each species has been reported with confirming references. In addition, we are depicting the distribution on maps (plates 9–42); plate captions contain the specific states/provinces in which each taxon is found. Using Carpenter and LaCasse (146) as a starting point and listing the state/province data given by them, we are adding a total of 556 new records that encompass the twelve species added since 1955. Detailed also are the fifteen instances in which species once reported as occurring in particular states/provinces have been deleted.

The morphological terms employed in this volume are substantially changed from those used by Carpenter and LaCasse (146). Harbach and Knight (308) published *Taxonomists' Glossary of Mosquito Anatomy* in 1980, and the morphological terms proposed by them and used in this volume take into consideration homology and phylogeny and use of those terms generally in the field of dipterous insects.

Another modification from the 1955 monograph is the adoption of the chaetotaxical nomenclature espoused by John N. Belkin (1950, 1952, 1953, 1954, 1960, 1962) and the abbreviations he used to designate parts of the body and setae borne on them, especially in the immature stages (e.g., T for metathorax and 6-T for seta 6 on that segment). This practice has been used by Belkin and his associates (1, 10, 11, 13, 42, 469, 511, 514) and by many other taxonomists (250, 258, 647, 778).

Let us reiterate that the user should study the applicable sections on morphology before starting to identify specimens. Wherever possible we have used adult characters that are the least disturbed by the mechanical light trapping process, but in some couplets, especially in the genus *Ochlerotatus*, the use of traits disrupted by trapping was unavoidable. The user should be familiar with the proper method

of preserving mosquito larvae because the presence of a full complement of the appendages and setae is essential for their identification in the larval keys. We also tried to quantify insofar as practicable all characters, to reduce the guesswork in dealing with relative terms.

Beside each species named in the keys is a plate number where its distribution is shown. The user can immediately ascertain if an identified species has been reported from the locality where it was collected.

References cited by year are found in the Selected Bibliography of Mosquito Morphology and those cited by number are found in the Bibliography of Mosquito Taxonomy and Geographical Distribution, both at the end of this volume. Abbreviations of generic and subgeneric names used throughout the work follow Reinert (812).

An appendix provides locality data for the voucher specimens selected for illustration in the keys. These mosquitoes are located by figure number. Most are from the Walter Reed Biosystematics Unit, U.S. National Museum, Smithsonian Institution mosquito collection.