Insect Poisons, Allergens, and Other Invertebrate Venoms

Handbook of Natural Toxins volume 2

edited by Anthony T. Tu

Handbook of NATURAL TOXINS

Volume 2

INSECT POISONS, ALLERGENS, AND OTHER INVERTEBRATE VENOMS

Edited by

ANTHONY T. TU

Department of Biochemistry
Colorado State University
Fort Collins, Colorado

MARCEL DEKKER, INC. New York and Basel

Library of Congress Cataloging in Publication Data
Main entry under title:

Insect poisons, allergens, and other invertebrate venoms.

(Handbook of natural toxins ; v. 2)
Includes indexes.
1. Insect venom. 2. Arthropoda, Poisonous--Venom. 3. Allergens. I. Tu, Anthony T., [date]
II. Series. [DNLM: 1. Arthropod Venoms. 2. Insect Bites and Stings. 3. Hypersensitivity. 4. Allergens.
QW 630 H236 1983 v.2]
QP632.I57I57 1984 615.9'4 84-17471
ISBN 0-8247-7207-5

COPYRIGHT © 1984 by MARCEL DEKKER, INC. ALL RIGHTS RESERVED

Neither this book nor any part may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, microfilming, and recording, or by any information storage and retrieval system, without permission in writing.

MARCEL DEKKER, INC.
270 Madison Avenue, New York, New York 10016

Current printing (last digit):
10 9 8 7 6 5 4 3 2 1
PRINTED IN THE UNITED STATES OF AMERICA

Preface to the Handbook

Natural toxins are unique toxins which possess some common properties, whether they are obtained from plants, microorganisms, or animals. One common characteristic is that they exert a pronounced effect on the metabolism and biological functions of the intoxicated animals with just a minute quantity. Since ancient times human beings have pondered the physiological effects of various toxins and venoms. How do these natural poisons work? Despite possessing some common nature, each toxin, however, has its unique mode of action and its own characteristic structure.

Drugs are compounds that have specific beneficial effects with a minute quantity. Usually, natural toxins also have very specific effects. Therefore, it is not suprising that many natural toxins are potentially good drugs.

Heretofore, the study of each field of toxins has been taking an independent pathway. Scientists in a specific toxin field are often unaware of the activity in other toxin fields. It is thus desirable to have a primary source of information on all natural toxins so that scientists in a specific discipline of toxin research can easily obtain useful information from other toxin researchers.

This five-volume handbook of toxins will include the following volumes:

1. *Plant and Fungal Toxins*
2. *Insect Poisons, Allergens, and Other Invertebrate Venoms*
3. *Bacterial Toxins*
4. *Reptile and Amphibian Venoms*
5. *Marine Venoms and Toxins*

The editor expresses sincere thanks to Maurits Dekker, Chairman of the Board of Marcel Dekker, Inc., for initiating this project.

Anthony T. Tu

Preface To Volume 2

The progress of science is phenomenal and the field of animal venoms is no exception. In 1968, three volumes of *Venomous Animals and Their Venoms*, edited by Bucheryl, Buckley, and Deulofen, were published. These books were welcomed by all scientists engaged in venom research. In a short time span of a few years, research in animal venoms has advanced to the extent that a new book is needed to summarize the current status of venom research. For this purpose, the book *Insect Poisons, Allergens and Other Invertebrate Venoms* was written as a second volume in a series of five volumes entitled *Handbook of Natural Toxins*.

Many insects and other invertebrates kill or make a person miserable by injecting venoms. A victim can be poisoned by toxins present in a venom or develop an allergic reaction to venom proteins. In this book a broader view of toxic action is taken and allergies caused by these creatures are included. Some scientists may not consider allergic reaction as a part of the toxic action of venom, but it is the editor's opinion that toxicosis as well as allergic reaction caused by insect and other invertebrate venoms should have equal attention.

This book has attempted to summarize and update venom research information. Most likely the book will be obsolete in another 15-20 years but we would consider that a reason to rejoice as an indication that significant research progress is being made.

Anthony T. Tu

此为试读,需要完整PDF请访问: www.ertongbook.com

Contributors

ROGER D. AKRE *Department of Entomology, Washington State University, Pullman, Washington*

PATRICIA I. ARNOLD *Division of Allergy and Immunology, Department of Medicine, University of Miami School of Medicine, Miami, Florida*

MURRAY S. BLUM *Department of Entomology, University of Georgia, Athens, Georgia*

FRANCOIS COURAUD *INSERM U172, Laboratoire de Biochemie, Faculté de Médecine, Secteur Nord, Marseille, France*

PIERRE DELORI *INSERM U172, Laboratoire de Biochemie, Faculté de Médecine, Secteur Nord, Marseille, France*

LEO W. DUCHEN *Department of Neuropathology, Institute of Neuropathology, and National Hospital for Nervous Diseases, London, England*

FARID EL-ASMAR *Department of Biochemistry, Faculty of Medicine, Ain Shams University, Cairo, Egypt*

MOHAMED EL AYEB *INSERM U172, Laboratoire de Biochemie, Faculté de Médecine, Secteur Nord, Marseille, France*

COLLIS R. GEREN *Department of Chemistry, University of Arkansas, Fayetteville, Arkansas*

STEPHEN GOMEZ* *Department of Neuropathology, Institute of Neurology, and the National Hospital for Nervous Diseases, London, England*

MOSCHE GUERON *Soroka Medical Center, Faculty of Health Sciences, Ben-Gurion University of the Negev, Beersheva, Israel*

FATMA HASSAN *Egyptian Organization for Biologicals and Vaccines, Agouza, Cairo, Egypt*

*Present affiliation: Department of Physiology, Royal Free Hospital School of Medicine, London, England

DONALD R. HOFFMAN *Department of Pathology, East Carolina University School of Medicine, Greenville, North Carolina*

BHUPENDRA SINGH JANGI *Periodicals Department, Publications and Information Directorate, Council of Scientific and Industrial Research, New Delhi, India*

EMMANUEL JOVER *INSERM U172, Laboratoire de Biochemie, Faculté de Médecine, Secteur Nord, Marseille, France*

FUMIHIKO KAWAMOTO *Department of Medical Zoology, Nagoya University School of Medicine, Showa-ku, Nagoya, Japan*

NOBUO KUMADA *Department of Medical Zoology, Nagoya University School of Medicine, Showa-ku, Japan*

IRA W. LEVIN *National Institute of Arthritis, Diabetes, and Digestive and Kidney Diseases, National Institutes of Health, Bethesda, Maryland*

TERUMI NAKAJIMA* *Division of Molecular Biology, Institute for Medical and Dental Engineering, Tokyo Medical and Dental University, Tokyo, Japan*

GEORGE V. ODELL *Department of Biochemistry, Oklahoma State University, Stillwater, Oklahoma*

MASAHISA ORI† *Institute of Medical Sciences, University of Tokyo, Tokyo, Japan*

ILYA OVSYSHCHER *Soroka Medical Center, Faculty of Health Sciences, Ben-Gurion University of the Negev, Beersheva, Israel*

TOM PIEK *Pharmacology Laboratory, University of Amsterdam, Amsterdam, The Netherlands*

LOURIVAL D. POSSANI *Departamento de Biologia Molecular, Instituto de Investigaciones Biomédicas, Universidad Nacional Autónoma de México, México, México*

HAL C. REED‡ *Department of Entomology, Washington State University, Pullman, Washington*

Present affiliations:
*Department of Analytical Chemistry, Faculty of Pharmaceutical Sciences, University of Tokyo, Tokyo, Japan
†Natural Nakano Chest Hospital, Nakano, Tokyo, Japan
‡Natural Science Department, Oral Roberts University, Tulsa, Oklahoma

DUANE R. SCHULTZ *Division of Allergy and Immunology, Department of Medicine, University of Miami School of Medicine, Miami, Florida*

RUDOLF A. SHIPOLINI *Department of Biochemistry, Imperial College of Science and Technology, University of London, London, England*

STEPHEN K. WIKEL* *Department of Microbiology and Immunology, School of Medicine, University of South Dakota, Vermillion, South Dakota*

*Present affiliation: Department of Microbiology and Immunology, School of Medicine, University of North Dakota, Grand Forks, North Dakota

Contents of Volume 1

PART VII. TOXINS IN EVOLUTION AND SPECIES INTERACTION

PART VIII. TOXINS USEFUL IN MEDICINE

此为试读,需要完整PDF请访问: www.ertongbook.com

Contents

INSECTA

1

Biology and Distribution of Social Hymenoptera

Roger D. Akre and Hal C. Reed*

Washington State University, Pullman, Washington

I. INTRODUCTION

Among the most beneficial of all insects to humans are aculeate or stinging Hymenoptera: the bees, wasps, and ants. About 50,000 species of aculeates in several families pollinate our crops, aerate and till our soil, collect nectar to produce and store honey, are responsible for other useful products, such as beeswax, and are voracious predators of insects attacking crop plants and forests. In the latter context, ants and wasps are undoubtedly among the most important predators attacking insects damaging forest trees, especially defoliators.

*Present affiliation: Oral Roberts University, Tulsa, Oklahoma

Most aculeates are solitary, nonaggressive species that use their stings primarily to subdue prey or as a defensive weapon against predators. The venoms of those using their stings against prey are specialized for this purpose and cause little discomfort to vertebrates. Many others, even though they use their stings for defense, are so small that the sting is rarely able to penetrate human skin. Therefore, with few exceptions [i.e., a few solitary wasps (Ebeling, 1975) and solitary bees (Michener, 1974)], most stings of concern to humans are inflicted by social Hymenoptera. All use the sting primarily as a defensive weapon, and the venoms contain materials that cause intense pain in vertebrates. Perhaps more importantly, social Hymenoptera live in colonies comprised of 30-100,000 or more individuals. Their social organization ensures rapid and effective communication of disturbances throughout the colony, and stings resulting from colony disturbances are frequently multiple, and consequently serious.

Bees are one of the most abundant and conspicuous groups of insects. Many are brightly colored in yellows, oranges, greens, or shiny black, and all are highly visible as they visit flowers for pollen and nectar. Included are minute individuals of 2 mm or less, to robust giants of nearly 40 mm (Michener, 1974). Behavior is also extremely variable among the many species and ranges from strictly solitary to highly eusocial. The latter not only exhibit a reproductive division of labor between the fertile queen and the relatively sterile worker caste, but a division of colony labor also exists among the workers.

Bees, including the familiar honey bee, evolved from sphecoid wasps (Michener, 1974). These modified wasps, about 100 million years ago, abandoned the habit of provisioning their nests with arthropod prey, and instead visited flowers to collect pollen and nectar to feed their larvae. Morphological adaptations to this habit include modifications of the mouth parts for nectar collection and branched or spiral hairs on their bodies or legs that retain pollen as they visit flowers. These hairs are sometimes present in very dense, localized patches and form a distinct pollen collection apparatus, or scopa, particularly on the hind legs (plasterer bees, mining bees, sweat bees) or on the underside of the abdomen (leafcutting bees). Similarly, bumble bees and honey bees have special pollen baskets, or corbiculae, on the tibiae of the hind legs. The legs are used to brush the pollen from the body hairs into compact masses onto these baskets for transport back to the nest.

Social wasps also include a number of species that are brightly colored, probably serving as an easily recognized warning signal to potential predators and nest destroyers that they are capable of inflicting pain. Social wasps prey upon other animals, primarily arthropods. A few species also scavenge flesh from dead animals. All species feed on nectar from flowers, and some store honey in their nests, like bees, as a food reserve during times of scarcity.

Size of individuals also varies greatly from very slender, delicate workers of ~7-8 mm to robust, heavy-bodied individuals of more than 40 mm. This size is generally reflected in the prey attacked, as larger species kill larger prey. Colonies also vary greatly in size, from 30 to more than 100,000 individuals, and in general, larger colony species exhibit more complex social behavior. Like the social systems in the bees, wasp societies vary greatly. Some species have small colonies with only a slight distinction between the reproductive(s) and the workers; others have a clear behavioral-morphological dichotomy between the queen and the workers.

Ants, like the bees, evolved from a primitive wasp ancestor (Wilson, 1971) to become the most abundant, widely distributed, and successful of all the social insects. Some ants still superficially resemble wasps, but all are

此为试读,需要完整PDF请访问: www.ertongbook.com