

BOOK REVIEW

LEHANE, M. J. 2005. *The Biology of Blood-sucking Insects*. Cambridge Univ. Press, Cambridge, U.K. 2nd edition, xi + 320 pp. Paperback, ISBN 0-521-54395-9, \$60.00 [Also hardback, ISBN 0-521-83608-5, \$120.00].

The insect fauna adapted to the blood-sucking lifestyle arguably contain the most important arthropods affecting human history. More important than the pain and distress caused by their blood-feeding habits, the disease-causing organisms transmitted to humans or livestock have caused incalculable distress throughout history. Considerable effort is being directed to eliminate many of the most damaging vector-borne diseases and advances in molecular biology may soon allow for this long sought after goal. The development of integrated pest management principles specifically tailored to medical and veterinary entomology will greatly aid in this process. The progress in biology, ecology, behavior, toxicology and a host of other disciplines are melding, thereby creating an opportunity to rid the world of the scourge of human malaria, dengue, onchocerciasis, and perhaps sleeping sickness and nagana. In particular, the opportunity for disease relief and ultimately economic development in Sub-Saharan Africa holds great promise.

In this second edition, Lehane updates his 1991 edition with considerable information on feeding preference, host location, ingestion and management of the blood meal, host insect interactions, and parasite transmission. The greatest change in this version is the incorporation of the tremendous progress resulting from advances in molecular biology.

An effective delivery is provided with a topic-based outline, rather than by a traditional insect classification design. Within these topics, Lehane uses a comparative technique to illustrate the different modifications utilized by insects. Initially, the focus is on the modifications made by the insects to successfully adapt to a blood-sucking lifestyle. These include the blood-feeding habit, mouthpart adaptations, host location, and blood-meal processing, not a simple task. Considerable effort is made to delineate the variety of theories as to how and perhaps why diverse groups of insects made these adaptations independently. Throughout the book the text is enhanced by the addition of useful tables, figures and images to support the author's presentation.

Although our knowledge of the blood feeding insects has expanded considerably, collective knowledge is still greatest for only a few species. In fitting with the presentation-by-topic style, Lehane eases the presentation by discussing the groups of insects by behavioral methodology, including temporary ectoparasites, such as tabanids, mosquitoes and blood-feeding bugs, perma-

nent ectoparasites, such as lice and the sheep ked; and periodic ectoparasites, such as many of the fleas and the Pupipara. This approach has benefits and drawbacks; however, this style fits well into the overall presentation. By the time students would be ready for the information provided in this book, they should already have a firm understanding of the taxonomic relationship, as well as the behavioral reasons for this grouping.

The book opens with a short chapter on the importance of blood-sucking insects, followed by a discussion on the evolution of the blood-sucking habit. Lehane includes a discussion on the theories that best describe the shift to blood-feeding, such as having a close association with a host or having pre-adapted piercing mouthparts. These introductory chapters are supplemented by a presentation on feeding preferences and host location, information that is becoming increasingly important as researchers continue to develop ways to prevent attack, thereby preventing disease transmission. The rationale on host choice and host specificity provides insight as to the eventual vector capabilities of various groups. Behavior associated with appetite driven searching behavior and host finding and orientation techniques is very intriguing.

As is the primary focus of this book, several chapters specific to the handling of the blood meal and the interrelationships of the host, vector, and pathogen follow. The ingestion of the blood meal presents a precarious situation for many insects. The variety of approaches utilized by the insects is presented individually by major taxa. A discussion of the host response to probing and blood feeding, the resultant challenge facing and response utilized by the insects provides a solid understanding of a fascinating but often-overlooked interrelationship. Chapter 6 is one of the most interesting and deals with the management of the blood meal. This chapter approaches the discussion based on the structure (with or without diverticula) and method of blood meal processing (batch or continuous), resulting in four approaches to handling a blood meal. Lehane illustrates the impact the blood meal can have on gonotrophic concordance and nutrition. A discussion of host hormone impacts is highlighted by a description of the rabbit flea, *Spilopsyllus cuniculi* (Dale) feeding on the European rabbit, *Oryctolagus cuniculus*.

A discussion of host-insect interactions covers insect distribution on the host, the morphological specializations developed by insects, host immune responses and salivary contents, host be-

havioral responses, and the impact of insect density on feeding success. This important chapter outlines the adaptations by the lice, fleas, and keds and includes specific discussions of the wingless lifestyle, tarsal and other locomotory changes and adaptations to support physiological processes, such as water loss. The host-based adaptations to avoid or mitigate blood-feeding insects includes sections on responses to insect saliva, such as increased sensitivity as well as behavioral responses including aggregation by cattle, grooming by mice, and defensive movements by birds subjected to mosquito bites.

Certainly the greatest damage caused by blood feeding insects is their capacity to serve as pathogen vectors. This chapter opens with a discussion of transmission routes that students of the science will find invaluable. Included is a table listing many of the important pathogens with their associated major vectors, hosts, and geographic distribution. The discussion on vector-parasite specificity flows well into the section on the origin of vector-parasite relationships. Although this book is written largely from the insect perspective, a discussion is included on the strategies employed by parasites for locating both a vector and a vertebrate host. An often-overlooked component of vector ecology, the parasite impact on the vector, including vector immune mechanisms is presented.

The final chapter of the book encompasses an overview of the major families involved with the blood feeding strategy. This section will be most useful to students, and should be considered a starting point for their understanding of these important groups of insects.

As medical entomologists continue to make progress in utilizing molecular tools to aid in the disruption of pathogen transmission and disease manifestation, the knowledge of the interactions between the host, insect, and pathogen have and will continue to increase. The book contains an extensive citation listing and a highly useful index. Although the book is written in both a clear and concise fashion, students entering the field would have benefited by a glossary.

The book is an invaluable tool for undergraduate and graduate students entering the fields of medical and veterinary entomology, ecology, behavior, epidemiology, human and veterinary medicine, as well as others. I found the up-to-date information very useful, as should others who teach about these highly important pests.

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