

been extensively used either along or concurrently to elucidate the behaviour patterns of the midges. Much of the work has been carried out with a view to defining the seasonal and diel activity patterns, and the biting activities on man.

The phlebotomines (sandflies) transmit human and animal leishmaniasis and viral infections. Intensive research is carried out in regions where human leishmaniasis is a zoonosis. Host preference tests with rodents are described. Biting habits, resting sites, seasonal abundance with respect to rainfall, type of forest, and vertical distribution were determined (in Panama) mainly by the use of baited traps. Primarily crepuscular and nocturnal biters, phlebotomines are active throughout the year at both ground and canopy levels. Flying and biting activities are more intense in forests, where tree trunks and litter provide the preferred diurnal resting sites. Mark-release-recapture experiments to determine flight patterns in rain forests showed that phlebotomines have a limited range of flight and tend to remain localised. Host range was studied by precipitin tests. The use of standardised sticky paper was the only technique

that could sample sandflies in human settlements and farmsteads; information on seasonal incidence and species composition of phlebotomine populations was so obtained.

References are all given at the end of the book by chapters, except for those on mosquitoes which are obviously grouped together. Only selective and pertinent references of publications up to 1980 are listed. An index to scientific names is also included.

This book is an invaluable tool mainly to field medical and veterinary entomologists and ecologists. It could as well benefit specialists of specific vector pests. Research workers and students freshly embarking on any one of the pests described might be recommended to get initiated by perusing this book, although they would then find certain descriptions insufficient especially with regard to notes on diagrams and figures.

I. Fagoonee

School of Agriculture
University of Mauritius
Réduit, Mauritius

Insect Clocks. Second edition, by D. S. Saunders, 409 pp., ill., index. Pergamon Press, Oxford, 1982.

Few aspects of insect biology are as universally important to a wide spectrum of entomology as rhythmicity. Nearly all behavioral, metabolic, and developmental patterns are regulated by a precise time-keeping mechanism. Thus, the insect clock not only provides a rich and exciting field for basic research, but daily and seasonal rhythms demand the attention of strategists focusing on effective pest management. *Insect Clocks* is an indispensable primer. Only a dedicated clock aficionado will plow through the entire book, but all entomologists should at least spend a few hours absorbing the impact of the insect clock at the organismal and population levels.

Readers of the first edition of David Saunders' book will appreciate the significant update of new material incorporated into this second edition. A new chapter devoted to multioscillators covers this important new concept in time measurement. Other chapters retain the basic flavor of the

first edition, but over 400 new references have been added. Since the clock mechanism is still such a 'black box', the field is plagued with cumbersome jargon and heavy reliance on theoretical models. A glossary and list of symbols help to initiate the reader. The molecular and biochemical events that underlie the time-keeping mechanism remain to be discovered, but it is a bit disappointing that the author has not included at least a few hints suggested by the non-insect literature.

Readers with a tropical orientation will also be disappointed in searching for information on seasonal cycles of development in tropical insects. But, this is not an oversight by the author. There has been very little experimentation in this potentially rich field of investigation.

David L. Denlinger

Department of Entomology
Ohio State University
1735 Neil Avenue
Columbus, Ohio 43210
U.S.A.