

## BOOK REVIEWS

**THE ANOPHELINES OF INDIA.** Revised edition. T. Ramachandra Rao. 1984. Malaria Research Centre, Indian Council of Medical Research, 22, Sham Nath Marg, Delhi-110054, India. xvi + 518 pp.; 2 unnumbered pages of Errata. Price: Rs. 150.00 or U.S. \$45.00.

This book is an amazingly comprehensive compilation of the published knowledge about the anophelines of India, that was accrued during the lifetime of Dr. T. Ramachandra Rao, one of the foremost Indian entomologists. Dr. Ramachandra Rao's entomological career spanned the period from the 1930s to November 1984, during which he witnessed a major resurgence of malaria in India after the national malaria eradication program had supposedly controlled this disease.

In the preface to the first edition of this book the author stated "This monograph has been prepared with the object of providing malaria workers in India with accurate and up-to-date information on the distribution, ecology, relation to disease and control of the anophelines of India." In fact, *The Anophelines of India* was intended as an update of the book, *The Vectors of Malaria in India* (1961 edition), with increased emphasis on the biology, ecology and behavior of the vectors.

The book is well printed on fairly good quality paper, has hard covers of unknown durability, and an attractive brown and yellow jacket. It is divided into 2 major sections, general and special, plus the appendices, references and indices. The general section is 225 pages and includes 12 chapters. Although its emphasis is on the Indian subregion, this section offers general background knowledge on topics that every good field entomologist/epidemiologist/public health officer working on malaria should know about vectors, such as: the name; systematics and classification; geographic distribution; biology; and speciation, genetics and cytogenetics. Other topics in this section were designed specifically for Indian workers, but are also useful for workers interested in malaria on a worldwide basis. These topics include: anophelines as vectors of human and animal disease; the vector density factor in malaria epidemiology; landmarks in control of anophelines as a means of malaria control in India; resistance to insecticides; some long term changes in *Anopheles* populations as a result of the use of residual insecticides; and surveys of anophelines from the 9 zones in India. The only remaining topic in this section, "Anophelines of Neighbouring Countries" will be very useful to Indian workers concerned with faunal relationships, imports, keys and the possibility of new species. However, all persons using this chapter should be aware that many of the references are old and the species lists often include outdated names that should not have been repeated in this book.

Most of the chapters in the general section are packed with a wealth of information that previously has not been assembled into one reference. The chapter on geographical distribution clearly defines and maps 9 distinct zones in India based on physiography, climate and hydrology, and is enhanced by the chapter on the anophelines found in those zones. Another lengthy chapter presents the basic biology of the anophelines in India and those behavioral and ecological aspects which impact on their ability to vector malaria parasites.

The chapter on vector density factors in malaria epidemiology has an interesting approach that stresses vector density rather than vector survival and longevity. I feel certain that the author's interest in this topic came about during his work on *An. culicifacies sensu lato*, with the late Dr. Paul Russell in the late 1930s-early 1940s. *Anopheles culicifacies s.l.*, is very zoophilic, yet it is recognized as one of the primary vectors of human malaria parasites in India because it occurs in such vast numbers that a significant number will feed on humans. Otherwise, most primary vector species are anthropophilic and their survival-longevity is usually considered more important than density for making epidemiological calculations. The chapter on landmarks in the control of anophelines in India is well done and documents many successful urban and rural control programs, as well as shortcomings and reversals in control programs.

The species section is a single chapter of 197 pages. It covers the 51 species and their subspecies and varieties that occur in India, a dramatic improvement over the second edition (1961) of *The Vectors of Malaria in India*, which only treated 10 species. The species discussions are filled with valuable references, particularly those applicable to India. Generally, the information provided for each species includes: type locality; type disposition; distinguishing characters; distribution; larval ecology; adult bionomics; relation to disease; and control (if applicable). Between 10 and 42 pages of valuable information are provided for each of the major vectors in India, i.e., *An. culicifacies*, *An. fluviatilis*, *An. minimus*, *An. dirus* (as *balabacensis*), *An. sundaicus* and *An. stephensi*.

The final 84 pages of the book consist of appendices, references and indices. The 5 appendices include: keys, entomological techniques, changes in names of places, designation of types and conversion tables. The reference section is a treasury of hard-to-find references. Of 957 references, approximately 70% are directly about the mosquitoes of the Indian subregion. In addition to a general index, an index of mosquito names is included.

Although the author stressed the value of taxonomy and included many of the major taxonomic advances that have occurred since the publication of Christophers (1933), he stated in the preface of the first edition that he did not feel equal to revising that classic taxonomic volume. It is my impression that the author's reliance on this and other outdated taxonomic publications has created the weakest component of the book. It is most unfortunate that Dr. Ramachandra Rao did not spend more time reviewing the taxonomic literature for corrections and changes that had direct application to the Indian *Anopheles* fauna. As a result, he has ignored "last revisers" in many instances and has perpetuated the use of outdated species names and concepts throughout the book. Workers without a taxonomic background, or those using this book as their only source of information will almost certainly be confused by the mixture of outdated and valid names. The general keys in Appendix 1 are another potential area of confusion. These often stop at the

group or complex level and the reader must refer to other areas of the text to find keys to the species in a particular group or complex. A much more practical approach would have had all of the keys together. Other examples that indicate the limited amount of time spent on taxonomic considerations are: numerous misspellings of taxonomic names throughout the text; listing *Culicoides* in the family Chironomidae and *Zeugomyia* in the tribe Culicini; use of the name *subpictus* var. *vadahadiensis* Doraisamy 1963, on several pages, when this name is not available (see Article 16, International Code of Zoological Nomenclature, 1961, 1964 and 1985 editions); a gross *lapsus calami* on p. 214 where *hackeri* is spelled "bakeri"; misrepresentation of the concept of "polymorphic species" in that it was not delimited by noncontinuous variations; incorrect use of the term "form" to include sibling species; and wrongly citing Bryan as working on the *punctipennis* complex, instead of the *punctulatus* complex.

Despite taxonomic shortcomings, "The Anophelines of India" is a long overdue treatise on the vectors of human malaria in India, and a wealth of information that should be required reading for every worker in India involved in control or research on malaria vectors. Students in medical entomology will also find that this book presents the study of malaria vectors in a more complex and challenging manner than usually encountered in text books. In addition, this will be a very useful source book for public health officials, entomologists and vector control specialists around the world. This book will obviously remain a standard reference for the Indian subregion for years.

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