Avian Malaria Parasites and Other Haemosporidia

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Source: Journal of Wildlife Diseases, 43(2) : 322-324

Published By: Wildlife Disease Association

URL: https://doi.org/10.7589/0090-3558-43.2.322

BOOK REVIEW

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Journal of Wildlife Diseases, 43(2), 2007, pp. 322–324

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Avian Malaria Parasites and Other Haemosporidia. By Gediminas Valkiunas, CRC Press, 2000 NW Corporate Blvd., Boca Raton, Florida, 33431 USA. 2005. 932 pp. ISBN 0-415-30097-5. US $179.95 (hardback).

Review by Jos. J.

In 1826 a sailing ship visiting the Hawaiian Islands put ashore a party to recharge the crew's water casks. This was the first of two apparently minor events that spun into an ecological catastrophe. When flushing the casks, the visitors inoculated the islands with the mosquito *Culex quinquefasciatus*. A century later a bird, either brought by humans to "improve" the environment, or a natural migrant, arrived infected with the malaria parasite *Plasmodium relictum*. The result has been the devastation of the native Hawaiian avifauna, with numbers of species driven to extinction, and many others greatly reduced in range (Scott et al., 1986).

The history of these events was unraveled through elegant detective work by R. E. Warner (Warner, 1968) and Charles van Riper III and colleagues (van Riper III et al., 1986), followed by a recent monumental team effort led by Robert Fleischer, Carter Atkinson, and Jon Beadell. The recent evidence (Beadell et al., 2006) indicates that a large number of *P. relictum* genotypes occur worldwide. Many strains must have come to the islands, yet only one (GRW4) was deadly for the local birds. This single genotype is also implicated in the destruction of the endemic bird community of Bermuda. (GRW4 should be renamed the "Shiva" strain for the Hindu god of destruction, who was also blamed in the ancient Vedic medical texts for human malaria.)

The Hawaiian bird malaria story is well known to readers *of Journal of Wildlife Diseases*; indeed, Hawaiian avian malaria could stand as the poster parasite for the dangers of emerging infectious diseases of wildlife, especially for isolated complex island communities. But *P. relictum* is but one of hundreds of described species of avian haematozoan parasites, and Staffan Bensch, Robert Ricklefs, and their coworkers propose that there is even a vast cryptic diversity of the parasites, perhaps thousands of reproductively isolated species. A growing body of literature uses this diversity of avian parasites for important studies on host range, opportunity and frequency of host switching, and community ecology of blood parasites (Fallon et al., 2006).

The diversity of avian malaria parasites is an intriguing and useful system for study by specialists, but pity any wildlife disease researcher, zoo veterinarian, or ornithologist who must identify blood parasites in the order Haemosporidia. Checklists of species organized by Gordon Bennett (Bennett et al., 1982) have long been a good starting resource, but are now seriously out of date.

Anyone interested in wildlife diseases should, therefore, welcome publication of *Avian Malaria Parasites and Other Haemosporidia* by Gediminas Valkiunas. This is an updated English edition of his 1997 monograph published in Russian by the Vilnius University Institute of Ecology. Professor Valkiunas has produced a magisterial work, one of both broad and deep scholarship. He has digested an enormous world literature in many languages to summarize just about everything known about bird parasites in the order Haemosporidia (primarily the genera *Plasmodium*, *Haemoproteus*, and *Leucocytozoon*). The author graciously gifted our laboratory with a copy of the earlier Russian version, which was avidly studied (albeit slowly) by graduate and undergraduate students. Copies of the English edition are now in our laboratory, festooned with tags for quick reference. That will be the likely fate of copies in laboratories worldwide—to be marked up, highlighted, and stained with microscope immersion oil.

The monograph opens with 231 pages of clear summaries on life cycle, structure, pathology, geographic and host distribution, immunity, ecology, evolution, and laboratory and field techniques. Professor Valkiunas has strong opinions on every issue, but also presents counterviews, with many references. No student will be misled, and those of us with sometimes contrary opinions will be informed

rather than slighted. These 231 pages can stand as one of the finest summaries of the biology of malaria parasites available for perusal by students and even specialists. Of course, the meat of any monograph must be the species accounts, and these consume approximately 600 pages. Many taxonomic decisions were made (the lumping vs. splitting conflict), but full information is provided to alert readers to any controversy. The author casts an especially cautious eye on species erected based only on host record. Excellent drawings of all species are presented, usually with multiple images to show the variation seen on stained blood smears.

Students and researchers in wildlife disease will, of course, be most interested in using the monograph for species identification. The good news is that the book is easy to use, with clear descriptions linked to the drawings. The bad news is the parasites refuse to cooperate by evolving clear morphological distinctions among species. Many species are very similar under the microscope, and the author often reminds readers to study the variation among the cells seen in a blood smear, and to use a process of elimination when comparing similar species. The effort would be valuable. Like Darwin with his barnacles, any researcher will grow to appreciate the importance of within-species variation vs. among-species differences. Identification with confidence is revealed to be difficult, but not impossible.

Avian Malaria Parasites was originally published just at the advent of molecular sequencing methods in the study of the parasites' diversity. In the English edition, Professor Valkiunas does not take us into those results. What is the relationship between morphological species and recent results from molecular studies, and will *Avian Malaria Parasites* have much of a shelf life when the molecular data increase in volume and sophistication?

My colleague Ellen Martinsen (2006, 2007) has organized studies resulting in the first marriage of morphologic and molecular identifications of species of all three genera, as well as a study of the subgenera of *Plasmodium* (using the Valkiunas volume as a confident guide to identification). The result is a mixed bag, with diagnoses based on morphology sometimes supported, other times not. For example, *Plasmodium juxtanucleare*, a nasty parasite of chickens in Southeast Asia, to the novice is not particularly striking in morphology, but was placed into a new subgenus (Bennettinia) by Valkiunas. The molecular phylogeny demonstrates it is indeed a divergent taxon. The subgenus Haemamoeba includes *P. relictum*, and was found to be a well-supported clade. Researchers can, therefore, confidently begin identification of parasites with the distinctive Haemamoeba morphology by going directly to that section of the monograph.

We can conclude that claims of the demise of morphology for study of avian malaria parasites are greatly exaggerated. Indeed, any conflicts between taxa defined by morphology and results of molecular studies are themselves intriguing. Why should morphologic traits converge in different systematic clades, and why should other closely related species diverge in morphology? Thus, this monograph deserves to be close at hand in any molecular laboratory.

Avian Malaria Parasites and Other Haemosporidia is an expensive volume, but worth every penny. It is well constructed and clearly printed. Oddly, the only picture of a bird, which is shown on the cover, is a cormorant. Perhaps this is a visual joke because cormorants are among the very few taxa of birds that are not exploited by haemosporidians! Only three pages of photographs of the parasites are included, but photographs are often less useful in identification of malaria parasites than fine drawings. Professor Valkiunas opens his volume by modestly offering it as a continuation of the scholarship of the luminaries of parasitology. In fact, this is a work that is a new landmark in systematic parasitology and deserves to take a place as an equal next to Garnham's classic work on malaria parasites (Garnham, 1966). For generations to come it will be a standard reference for any student of malaria parasites and anyone remotely interested in avian health. In the future, as avian malaria parasites are transported over the globe, the malaria parasites are likely to cause more problems for isolated bird communities, and wildlife disease researchers should then turn first to *Avian Malaria Parasites and Other Haemosporidia*.

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