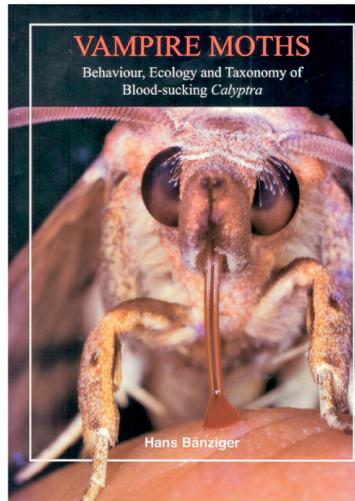


Vampire Moths: Behaviour, Ecology and Taxonomy of Blood-sucking *Calyptra* by Hans Bänziger. Natural History Publications (Borneo), Kota Kinabalu, Malaysia; printed in Taiwan, 2021. 232 pp. ISBN 978-983-812-199-6. Price 50 US\$ (can be ordered also from the author: e-mail: hans.banziger@cmu.ac.th)



Vampire moths! Who would have thought that among moths, known for their important role as pollinators, food for bats or pests for forestry and agriculture, there is a group of species that can sting and suck blood, even of humans? While professional entomologists might be familiar with this phenomenon from the many publications of Hans Bänziger, the amateur may not at all be aware of this surprising fact.

Hans Bänziger discovered these moths, members of the erebid (previously noctuid) genus *Calyptra*, already in the late 1960s and has since investigated them during his whole life. He has now compiled his extraordinary findings and his sound knowledge in a beautifully illustrated, comprehensively updated, fascinating, excellent book.

The book begins with a summary, continues with seven chapters and ends with an afterword, acknowledgements, references, two appendices, and an index. Chapter 1 briefly introduces the history of the term “vampire moths”. This term, albeit catchy as shown by the title of the book, was first not applied by Hans Bänziger for biological reasons—the mechanism by which vampire bats consume blood is distinctly different from the stinging, blood sucking mechanism of the moths. However, the term “vampire moths” had become more and more established in the scientific literature after their discovery and was finally also adopted by Hans Bänziger—not to the disadvantage of his spectacular discovery.

In Chapter 2 the author describes touching “Reminiscences”, personal experiences, among which the exciting description of the author’s discovery of blood sucking *Calyptra*, impressive encounters with wild Indian rhinos in Nepal in the Royal Chitwan National Park, the author’s first attack by a vampire moth under natural conditions and, interestingly enough, his passion for the pollination of Venus slipper orchids and Rafflesiaceae.

Applied methods in the field and in the lab are clearly outlined in Chapter 3. Whereas most scientists working on nocturnal Lepidoptera use artificial light such as mercury vapor lamps to attract the moths, the author had to work in the dark, only equipped with a dimmed torch, to inspect potential host animals for blood sucking moths. Host animals were mainly water buffaloes, zebu cattle, horses, mules, pigs, but also work elephants and wild animals such as rhinos—the latter were mostly inspected in zoos, however notwithstanding the author's necessity to here and there climb the fence holding the caged animals for close inspection or catching a *Calyptra* moth. Altogether, the author made observations on a total of 545 nights.

Chapter 4 presents an updated, comprehensive and thorough taxonomical analysis of the genus *Calyptra*, including a redescription of the genus. All currently known 17 *Calyptra* species, i.e., blood suckers, fruit piercers and species with so far unknown or only partly known feeding habits, are analysed and presented in beautiful, instructive color plates. Eight species are confirmed to suck blood by a piercing act under natural conditions in the wild. Whereas the Eurasian *C. thalictri* has been shown to suck blood when constrained in experiments, so far there are no reports of attacks in nature across its wide distribution from W. Europe through to Japan, although the species has been known for more than two centuries. A detailed characterization of all *Calyptra* species and subspecies is given, including careful drawings, made by the author, of the male genitalia of all species. Furthermore, an identification key and 4 tables compiling external characters facilitate identification of the different species.

Chapter 5 forms the heart of the book. Here the author presents a wealth of findings on the biology, ethology, and ecology of *Calyptra* moths, based on an enormous amount of field work. It would go beyond the scope of a book review to mention all the fascinating and carefully presented details of the natural history of the moths in this chapter. I just mention a few highlights: The author presents not only a detailed description and explanation of the complex piercing mechanism by the proboscis, unique among insects, but also illustrates it with a most instructive, beautiful drawing of the tip of the proboscis of *Calyptra eustrigata*, explanatory schematic sketches, and an impressive series of photographs of a self-experiment (!). The feeding behavior of all eight blood sucking *Calyptra* species and their preferred hosts and feeding spots are discussed in detail and field observations are listed in substantial, comprehensive tables. Particular attention is given to the relatively few attacks on humans under natural conditions. Although blood sucking is evidently important for the eight *Calyptra* species showing this feeding behavior, piercing fruits and feeding on them is indispensable for all *Calyptra* species. Interestingly, only males of *Calyptra* are blood sucking, in contrast to mosquitoes in which only females are blood sucking, using blood proteins for egg production; male mosquitoes feed on nectar! This counterintuitive finding is also discussed; *Calyptra* males lack proteinases and cannot digest erythrocytes, but obviously profit from salts (NaCl), amino acids, and potentially also from other compounds or required precursors needed by them.

A further highlight of the book is the part on immature stages with excellent photographs of caterpillars and their larval host plants. The author's experience in searching for and inspecting potential larval hosts of *Calyptra* caterpillars led him to discover new plant species (e.g., *Cissampelos hispida*, Menispermaceae, moonseed family).

Chapter 6 is a brief but sound contribution about the potential of *Calyptra* moths to transmit pathogens. While this potential is most likely small due to the general rarity of the moths, it should nevertheless not be dismissed a priori as insignificant.

Chapter 7 contains a conclusive account of the evolution of blood sucking behavior of *Calyptra* moths. Contrary to prevailing opinion that the blood sucking habit in *Calyptra* has evolved from settling at eyes and imbibing tears (lachryphagy), the morphology of the piercing proboscis (among other arguments) strongly suggests that blood sucking in *Calyptra* has evolved from their fruit-piercing habit, widespread in the genus. Finally, a thoughtful and touching Afterword closes this book.

The two Appendices deal with systematic issues. Appendix 1 argues that morphologically the North American *Pericalpe canadensis* is not a member of the genus *Calyptra*. Appendix 2 provides convincing evidence for maintaining two subspecies of *Calyptra minuticornis*, i. e. *C. minuticornis minuticornis* and *C. minuticornis novaepommeraniae*, based on their distinct wing and genitalia morphology, allopatry, and different larval coloration.

In conclusion, “Vampire Moths” is indispensable for all entomologists working with *Calyptra* moths and/or related fields, it is highly recommended for professional entomologists also outside the research area of blood sucking insects, and last but not least it is also a wonderful read for the interested amateur, not only for its sound scientific value, but also as a beautifully illustrated documentary of—sadly enough—past (lost?) times in tropical areas of Southeast Asia.

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