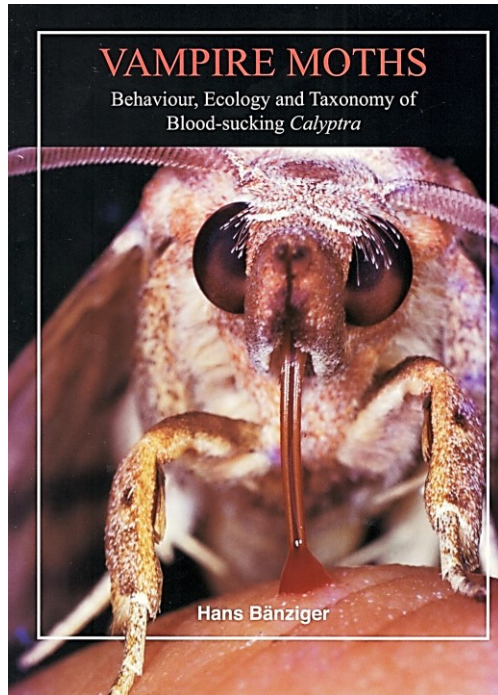


Book Review

Vampire Moths Behaviour, Ecology and Taxonomy of Blood-sucking Calyptra

Hans Bänziger. Natural History Publications (Borneo) Sdn. Bhd., P.O. Box 15566. 88864 Kota Kinabala, Sabah, Malaysia. Colorful laminated boards with dust jacket. 232 pages, 20 color plates, numerous color figures and line drawings. ISBN 10: 9838121991; ISBN 13: 978-9838121996, English. (7.5" = 19 cm x 10.5" = 26.6 cm) from \$70.00 (the publisher) and up at many retail outlets or \$50.00 directly from the author, hans.banziger@cmu.ac.th. Post is extra.



Eric H. Metzler¹

This book is the epitome of the concept of *Life: The Excitement of Biology*. The author spent his life becoming the one and only expert on this fascinating and unusual group of animals that drink blood from other animals. The blood drinkers are moths! The object of my life's work is the study of moths; I feel extremely lucky and excited the author summarized his life's work, not for me, but for the rest of all scientists to peek inside the world of these unusual animals, perhaps the antitheses of moths. He concisely and thoroughly summarizes his previously published works, and he publishes, for the first time, some of the life histories, including the previously unpublished larvae.

I started my study of butterflies and moths as a very young man. I first learned about adult moths that take blood from their hosts in the 1970s when I came across some papers by Hans Bänziger (e.g., Bänziger 1975). Over the years I found his illustrations used in several texts, such as Scoble (1992).

¹ Research Associate, Department of Entomology, National Museum of Natural History, Smithsonian Institution, Post Office Box 45, Alamogordo, New Mexico 88311-0045 USA. E-mail: metzler@si.edu

Recently, Bänziger combined his life's work on these outside-the-norm-lepidopterans. The result is the well written partly autobiographical and wholly scientific, systematic, taxonomic, behavioural, and ecological treatment of these colorful and unorthodox insects.

Chapter 2, Reminiscences, contains a short autobiographical sketch chocked full of details to let the reader understand some of the trials and groundbreaking techniques Dr. Bänziger used to observe the moths as they pierced the skin and took blood from wild animals. Some of the wild animals, the size of which, e.g., elephants, could easily kill the lone observer with any missteps. The photographs and self-portraits are more admirable when I learned Dr. Bänziger (personal communication) designed and built his own cameras requiring that he calculate the correct exposures along with all the details required for skilled nature photography.

The book is Smyth-sewn allowing the signatures lie flat for easy reference of the text; this is a major plus. The font is seraph on glossy white paper and pleasing to the eye. The illustrations are sharp and easy to see and interpret.

The book is divided into several chapters including the traditional Introduction (Chapter 1), Material and methods (Chapter 3), followed by Taxonomy of the genus *Calyptra* (Chapter 4), an important chapter because it outlines the history of the genus and the several species including those included in *Calyptra* and given new combinations in other genera and families. The chapter includes a checklist of *Calyptra* with its subspecies and calls attention to two subspecies of *C. minuticornis* (Guenée), *C. m. minuticornis* (Guenée) and *C. m. novaepommeraniae* (Strand), reinstated in this treatment.

Taxonomy (Chapter 4) is a comprehensive treatment containing a key to the species and subspecies of *Calyptra*, followed by a characterization of the species and subspecies currently placed in the genus *Calyptra*, with detailed species accounts and complete synonymies. The detailed species accounts integrate diagnoses, descriptions, including references to illustrations in the text along with an account of the material examined. Each species account is as complete as an original description. The line drawings of the genitalia are exquisite. The color plates of the adults are crystal clear and clarify any confusion when combined with the comprehensive text. Tables 1–4 further elucidate each species with the following diagnostic characteristics detailed for side by side comparisons: length of the wingspan for each sex; size of male antennae with the measurements of the rami in mm; descriptive overall color of the forewing and hindwing; descriptions of the elements of wing patterns such as specifications of the diagonal lines, oblique lines, and shape of the hook of the tornus of the forewing; reniform; white spots in antemarginal areas; fringes; androtheca on the male tibia II; presence or absence of hair tufts on the male femur I; and other remarks.

Chapter 5: Biology, ethology and Ecology. This chapter competes with Taxonomy as the heart and soul of the book. The author discusses the confirmed skin-piercing blood-sucking habits of *Calyptra*. The reader learns about the fruit-piercing species of *Calyptra* and explores the haematophagous habits of *C. thalictri* (Borkhausen, 1790) under a variety of conditions demonstrating this species adaptability. The chapter examines the piercing mechanism and feeding acts the action of the proboscis and how it might relate to transmission of pathogens. The chapter details the mechanism with exquisite drawings (Figure 1) and photographs. Details of how the adult moth finds the proper location to pierce the skin along with the mechanics of the piercing activities are explored in depth with excellent line drawings.

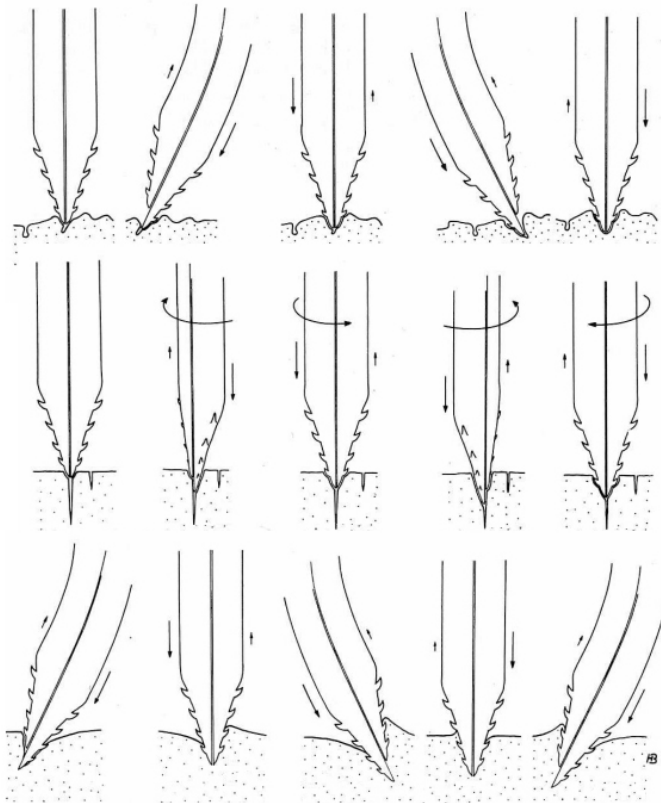
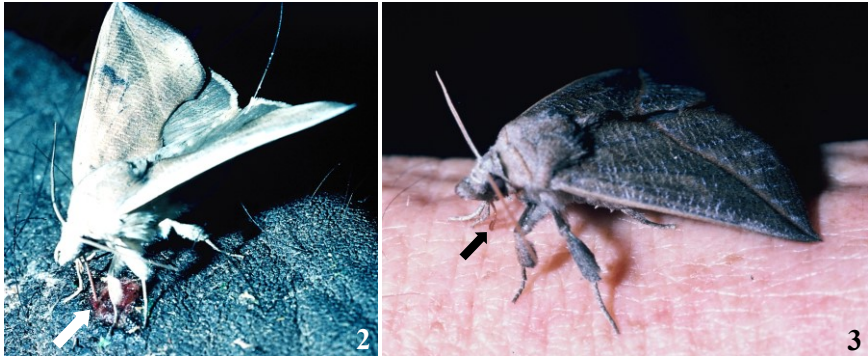


Figure 1. ‘Left’ and ‘right’ sides of *Calyptra* proboscis alternatively pushed into the epidermis. Note that the proboscis rotates and bends while entering the epidermis.

Color photographs by the author (Figures 2 and 3) illustrate the preceding drawings to show exactly how the moth pierces the skin and withdraws blood. All

the photographs of the moth sitting on the author's skin and withdrew the author's blood were taken by the author. The author himself photographically records the moths taking his blood. Just amazing!!



Figures 2 and 3. *Calyptra* adults can feed on blood. 2. Proboscis (arrowhead), seen between the front legs, of *Calyptra fasciata* (Moore, 1883) piercing a newly healed sore on the skin of an elephant. Photo taken in northern Thailand, 28 November 1980. 3. *Calyptra parva* Bänziger, 1979 on the Bänziger's wrist after piercing five holes in Bänziger's skin. The proboscis can be seen at the tip of the black arrow.

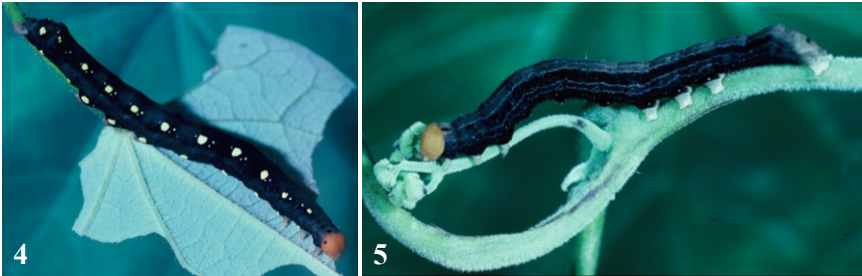
Chapter 5 continues with the various moths extracting blood from other animals. The color photographs of the different species of moths on the various animals including black rhinoceros, Indian rhinoceros, elephants at close range, sambar deer, Malayan tapir, a mule, zebu (large humped cattle), etc. are sensational. In all cases the photographs are crystal clear, and the proboscis is easily seen leading from the underside of each moth's head to the skin of the host animal.

More tables are used to detail the author's precise observations defining and clarifying the moths' interactions with the host animals including the number of times the moth circled the host, the number of landing attempts, the moth's briefly settling on the host, the piercing attempts, and the number of successful pierces, along with comments. Detailed observations on the preferred host and feeding spots on the hosts; persistence, length of time the moths spent on each host are included. A separate table is provided for each species of moth for which observations were made. The text discusses different piercing habits in various species of moths including detailed photographs taken by the author. In all photographs the proboscis is clearly seen; the artistry, inclusive depths of focus, and detail of the photographs is an astounding accomplishment. These transcribed field notes and photographs are a model for any biologist.

The nutrient needs of the moths are discussed and well-illustrated as the moths settle on mud, tethering ropes of livestock, dung, etc. Digestion and sequestration of the compounds taken up by the moths are discussed with an

analytical table showing feeding time, the sodium content of donor blood, sodium intake from other sources, and sodium content of secretions with total amount sequestered. The quantitative analysis is astonishing.

Much of the newest knowledge presented in the book are details regarding the immature stages, including the larval hosts. Color images of ova, several larval instars including the ultimate instar and pupa are presented. Several complete life histories are published for the first time. Habitat photos of the living larval host plants are included along with foliage (Figures 4 and 5), inflorescences, and fruits. Special attention is paid to the chemical compounds the larvae can sequester from the plant species.



Figures 4 and 5. *Calyptra* larvae are herbivores. 4. Last instar of *Calyptra minuticornis minuticornis* caterpillar feeding on *Stephania japonica* (Thunberg) Miers (Menispermaceae). 5. Last instar of *Calyptra multicornis novaepommeraniae* on the larval host, *S. japonica*.

Chapter 6: Potential pathogen transmission. The author suggests the recent evolution of the skin-piercing blood-sucking behaviour of the moths probably precludes any important function in the complex life cycles of most blood borne pathogens. He suggests that pathogens transmitted mechanically have a higher probability of being vectored by the moths, however given that the mouthparts of the moths differ considerably from the mouthparts of skin-piercing blood-sucking Diptera, the moths are less likely to transmit pathogens. Citations for the author’s comments are provided indicating another well researched part of the book.

Chapter 7 discusses the evolution of the moths’ behaviour with observations of butterflies being attracted to the sprinkle of the blood from freshly killed animals in 1884. The author notes, “Essentially those are anecdotal observations.” The author’s detailed observations give credible quantitative evidence to the peculiar habit of this anomalous group of moths.

Literature Cited

Bänziger, H. 1975. Skin-piercing blood-sucking moths I: Ecological and ethological studies on *Calpe eustrigata* (Lepid., Noctuidae). *Acta Tropica* 32 (2):125–144.
 Scoble, M. J. 1992. *The Lepidoptera, Form, Function and Diversity*. Oxford University Press. Oxford, England. 402 pp.