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Source: Journal of Orthoptera Research, 14(1) : 119-120

Published By: Orthopterists' Society

URL: https://doi.org/10.1665/1082-6467(2005)14[119:ABRODO]2.0.CO;2

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A Book Review of:

Die ostasiatische Wanderheuschrecke und ihre Bekämpfung unter besonderer Berücksichtigung der Ming- und Qing-Zeit (1368-1911) by Raimund Theodor Kolb, in German

(*The oriental migratory locust and its control with special emphasis on the Ming and Qing dynasties (1368-1911)*).

Würzburger Sinologische Schriften, edition forum, P.O. Box 102103, 69011 Heidelberg, Germany, ISBN 3-927943-14-2, Price: ca. EUR 70.

Reviewed by K. Reinhardt, Department of Animal and Plant Sciences, University of Sheffield, Sheffield S10 2TN, United Kingdom

Treasure hunting can be a difficult business. Sometimes the treasure is impossible to find, and sometimes it is there but not recognized. I believe I have recently unearthed an unrecognized treasure: a book about Orthoptera, published 10 years ago, but seemingly unnoticed by the community of orthopterists.

The book is in 2 main parts: a review of our present knowledge of the biology of the oriental migratory locust, *Locusta migratoria manilensis*, and a review of the historical importance of this species and its control in China. Professor Kolb, a sinologist and not an entomologist, has produced a marvellous book. In the first 50 pages he summarizes our knowledge of the taxonomy, nomenclature, seasonality and habitats of this species. He gives a list of food plants in Chinese, Latin and German, and reviews the development of swarms, their parasites and swarm reproduction.

Kolb deliberately sticks close to Chinese sources, avoiding information from orthopterological handbooks. And in many respects his compilation exceeds the information provided in "The Locust and Grasshopper Agricultural Manual" (Anonymous, 1982): e.g., variation in reproductive output with different food plants. Kolb's analysis is also sometimes at odds with 'Anonymous'. For example, on p. 28 it is mentioned that after being flooded from September until April, eggs still have a hatching rate of 40%, whereas the manual mentions that eggs are totally destroyed if submerged for 6 days. Quantitative data are provided on infestation rates by parasites such as fungi, or egg predators such as *Scelio* and Bombyliidae. Kolb also uses several unpublished sources. For example, it is stated that solitary females can lay up to 180 pods with a total of 16542 eggs per female (Chen Yonglin, unpub. data, p.28 in Kolb).

I must admire non-entomologist Kolb's understanding of the biology of 'our' insects. He makes a valid criticism of autotomy as a locust response to predation (or for that matter predation of grasshoppers in general) by birds (p.53). He says that birds usually take grasshoppers perpendicular to the locust's body axis. Under such a form of attack, leg autotomy by locusts would not seem an effective method of predator avoidance. Given the wide occurrence of "one-legged" grasshoppers, we may have to think more carefully about other important predators of grasshoppers.

Kolb's main interest is the history of pest control and the administrative change in its management. He bases his analysis on previous reviews by Chinese authors, but incorporates primary sources to a remarkable extent. Written documents from 1200 BC already show the popular fear of locusts. From 700 BC to 1936 AD, at least 796 swarms, possibly more than 1330 (Kolb 2004) were recorded. Kolb assumes this is an underestimate -- between 960 and 1936 AD alone, 619 damaging swarms were reported (p. 55). While the Locust and Grasshopper Agricultural Manual" (Anonymous, 1982) (p. 467) mentions "few estimates" of the economic damage done by migratory locusts, Kolb, again, stands out by providing just such data: within the long list on economic damage, the 1933 outbreak resulted in a damage of 15 million Yuan (p. 58).

Among the detailed descriptions of the locust outbreaks and their consequences, some will remain forever in one's mind: those of humans and pigs being eaten (p. 112), those of family members being abandoned or sold because of locust-caused starvation periods, or those recounting the onset of human cannibalism due to repeated destructions of the harvest by locust swarms (p. 130 to 133). I also believe that the list compiled by Kolb, which separately lists locust outbreaks in different regions in China, could be a very valuable time series for spatial ecologists trying to predict future dynamics.

From the 13th century BC, pest control measures were taken: civil servants, specialized in pest insects, existed. However, as in other areas of the world (Europe, Arabia), locust swarms were considered god-sent retribution for the immoral behavior of politicians: "opulent income in the civil servants leads to greed and there are insect plagues" (p. 100-103). Different moral failures were recognized depending on which parts of rice and other plants were attacked by the locusts (p. 103). However, locusts being seen as divine insects sent to punish humans for the failure of the political elite, also meant that control measures were considered "useless" and so biological knowledge hardly accumulated (see also Kolb 2004).

While the difference between winged and nonwinged locusts was known for ca 3500 years (p. 88), only since about 1700 did it become known that the latter are the nymphs of the former. Likewise, it was already known in the Song dynasty (960-1271 AD) that courtship and copulation only take place after wing development, that both are in preparation for oviposition, and that mating takes place on the ground after swarm flights.

Try to get this book! When you read it, have a timetable to hand of the appearances of the different dynasties. If I have to bemoan something, I will mention that biologically trained minds work better with the year adjoining the citation, rather than only in the reference

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list and that the map of the swarming areas and migration routes is not reproduced too well.

The appendix of the book contains the beautiful illustrations and descriptions of locust control methods as depicted in the Buhuang tu shuo. One had to guess that Buhuang tu shuo refers to BHTC and hence the illustrations are from 1759. Finally, one reason alone to buy this book (although for this alone it would be a bit expensive) are its collection of impressive numbers: swarms can consist of 10 billion individuals (p. 50); in 1934 10 million kg of locusts were destroyed plus 1000 kg of egg pods (p. 51); or in 1955 a predator, rarely mentioned in western literature, was used to eliminate hopper bands: 73800 ducks cleared an area of 66,600,000 square meters of locusts.

It was a fascinating experience to read something so profound about an orthopteran species, from an angle I have never thought of before: Chinese history. I suspect that workers in the area of locust control will find this book immensely interesting, and useful for its biological details and its historical approach.

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