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Book Review: Die Widderchen des Iran [The burnet moths of Iran]

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T. Keil 2014: Die Widderchen des Iran. 17. Beiheft der Entomologischen Nachrichten und Berichte. 461 pp. ISSN: 0232-55535. Price: €238.

The first research on the zygaenid fauna of Iran goes back to the first half of the 19th century with the description of the two taxa, *Zygaena cuvieri* Boisduval (1828) and *Z. haematina* Kollar, 1849. Only a short time later new material came to Europe which had been collected by Joseph Haberhauer and Hugo Christoph under partly very adventurous circumstances during their expeditions to Iran. This led to the description of another five taxa. Just before the Second World War, Fred Brandt brought spectacular material to Europe. He had travelled alone in 1936 through the northern Iran (Elburz, Kuh-e Binaloud) and in 1937 and 1938 to then hitherto unknown regions of southern and eastern Iran as far as the Afghan and Pakistan borders where he collected exceptional material that included many new species. Although the interest in the zygaenid fauna of Iran increased after the Second World War and also the habitats and the biology and ecology of some species were described, it was not until about 20 years ago that a new area of research on the Iranian Zygaenidae began. Axel Hofmann, Bernard Mollet, Clas Naumann, Gerhard Tarmann, W. Gerald Tremewan and Thomas Keil are the most important contributors to this new development of research. Thomas Keil visited Iran alone more than 30 times during the last 17 years. Consequently, the number of relevant publications increased significantly. Most papers were published in various journals. Except for contributions by Axel Hofmann and W. Gerald Tremewan as well as the papers by Mohmoud Karami, Clas Naumann and W. Gerald Tremewan on the genus *Zygaena* Fabricius, 1775, there was no comprehensive work available, especially not for the subfamily Procridinae. This gap has now been closed by Thomas Keil's book "Die Widderchen des Iran".

This book is impressive by its size alone and by its generously designed binding in a linen hard cover. That the text is published in two languages is not a great novelty. However, that the German text is completely translated into Farsi by Maryam and Hossein Rajaei and that also the book is published completely in Roman letters (German text) and in Farsi calligraphy (Iranian text) is exceptional. It is an acknowledgement to the hospitality of Iran's people and shows respect to Iran's environment. Moreover, Iranian scientists can now rely on a profound standard work on Zygaenidae which documents in an impressive way the diversity and unique status of the Iranian zygaenid fauna. It is to be hoped that this work will influence future decisions on preserving the environment of Iran.

The book begins with a general part that contains information about the geography of Iran, its climate and its biotopes. This is followed by an attempt to associate the different Zygaenidae species to faunistic subunits, followed by comments on endangered taxa and a list of the terminology of morphological characters mentioned in the book. In an annotated list of species, 25 Procridinae

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(22 of them confirmed for Iran) and 42 Zygaenidae (41 of them confirmed for Iran) are mentioned. The remaining four species (not yet confirmed for Iran) can be found most probably also in Iran based on the present knowledge of their distribution. Not only the high number of taxa but also the high number of 30 endemic species shows the exceptional character of Iran's zygaenid fauna.

In the systematic part 67 species are mentioned. The text is presented in a concise form and gives information about the distribution of each species (global and in Iran), the morphology (descriptions of imagines and early stages), and the ecology (habitats, larval host-plants, habits). The text is accompanied by colour plates of aesthetically superb quality which also include the imagines as for the early stages (in most cases). Some of the larvae are figured several times in different instars and colour variations. The selected format of the images with 8.5 × 12.5 cm allows the recognition of even the smallest details. Some of the magnifications in large format are exceptional, e.g. *Zygaenoprocris* (*Keilia*) *minna* (Efetov, 1991) on p. 105, *Zygaena* (*Mesembrynus*) *nocturna nocturna* Ebert, 1974, on p. 161. The author of this review had the opportunity to collaborate in the ongoing Swiss book series 'Schmetterlinge und ihre Lebensräume'. He therefore knows very well what an enormous amount of work with lots of associated frustration is required to produce such a documentation of pre-imaginal stages, especially of the Zygaenidae. This group has especially complicated diapause rhythms that are a real challenge for anyone who tries to rear species from egg to imago. It is amazing to note how great Thomas Keil's tolerance against such frustrations must have been to be able to achieve such an impressive result.

The following chapter is devoted to the genitalia structures. These are essential especially for the identification of the Procridinae. The genitalia of males and females are figured in black and white photography. The size of the figures is well chosen and allows recognition of the relevant characters clearly. Only in a few cases in the male genitalia (e.g. *Zygaenoprocris rjabovi* (Alberti, 1928) on p. 340 and *Z. khorassana* (Alberti, 1939) on p. 341) will the reader have some difficulties to recognise the form of the cornuti on the vesica in the phallus. The main reason for this seems to be the fact that the sclerotisation of the phallus is of very different intensity. Perhaps in such cases line drawings could have given a better result. The female genitalia are well recognisable. However, in some cases it could have helped to figure them in different views (dorsal, lateral, ventral).

Another highlight of this book are the aquarelle paintings produced by Anja Spindler. These are of superb quality and can be compared with those of František Gregor (e.g. in Tarmann, G. M., Zygaenid Moths of Australia) or Peter Wymann (e.g. in Lepidopteren-Arbeitsgruppe, Schmetterlinge und ihre Lebensräume, vols 1–3). The work contains 31 colour plates with these paintings illustrating 186 specimens that are reproduced three times their natural size. This allows an impressive overview and is an aesthetic highlight.

The next chapter deals with the distribution. For 66 species distribution maps are provided. The localities are listed under 'Verbreitung im Iran' with the treatment of the respective species in the systematic part.

Under the headline 'Nahrungspflanzen der Raupen' there follows on 16 colour plates that are a compendium of larval host-plants. The whole of the information is based on personal research by Thomas Keil. We can see that although many larval host-plants can be already identified to species level there is still a significant number left where only the genus is known. There is still a lot research to do. This chapter is followed by a comprehensive picture gallery of Iranian habitats for zygaenids. It is almost a dream for a European entomologist to see these exceptional habitats in Iran.

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Last but not least an extensive list of literature and the contents list are provided. Moreover, a summary of Thomas Keil's scientific activities that were often accompanied by his wife Christine Keil provides the book with a nice ending.

Some small recommendations for additions should a second edition ever be published are: mention the sexual dimorphism in some species; introduce a paragraph dealing with 'similar species' for easier identification; give chorological data; explain genitalia characters for a differential diagnosis (especially for Procridinae).

This work is the result of extraordinary dedication and is a milestone in Zygaenidology. It will be a solid base for any future research.

(Translated from German by Gerhard Tarmann.)

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