EUROPEAN JOURNAL OF ENTOMOLOGY
ISSN (online): 1802-8829
http://www.eje.cz
Eur. J. Entomol. **122**: 147–148, 2025
doi: 10.14411/eje.2025.018
BOOK REVIEW

RÜPPELL G. & HILFERT-RÜPPELL D. 2024: DRAGONFLY BEHAVIOR: DISCOVERING THE DYNAMIC LIFE OF AN ANCIENT ORDER OF INSECTS. Springer-Verlag GmbH, Berlin, Heidelberg, xx + 229 pp., 290 colour photos, 30 black-and-white illustrations. ISBN 978-3-662-70233-8 (hardback), 978-3-662-70234-5 (e-book). Hardcover price EUR 28.07.

Georg Rüppell, a former professor at the Zoological Institute of the Technical University of Braunschweig, Germany, has dedicated his professional life to the study of flight. After an initial focus on bird flight, he transitioned to studying odonates. Many of his 75+ publications are co-authored by Dr. Dagmar Hilfert-Rüppell, whose doctoral research focused on damselflies. She currently works at the Institute for the Didactics of Natural Science at the Technical University of Braunschweig. Their latest book is the culmination of 30 years of research and filming of odonates and highlights 25 European and five non-European species.

Dragonfly Behavior (Fig. 1) is an exceptional book, offering both experts and interested individuals a unique perspective on observing nature's aerial acrobats. Dragonflies are among the fastest insects on the planet, and the intricacies of their interactions with mates, competitors, and predators often occur too quickly for the human eye to detect. Through their slow-motion filming techniques, the authors reveal remarkable behaviours that were previously unknown, shattering many preconceived assumptions, particularly regarding sexual conflict and male-male competition. For example, females perform a variety of behaviours, such as playing dead, to successfully evade harassing males, while both sexes bite to fend off attacks. Unlike typical scientific texts, the authors convey most of their story using photographs and sketches, enabling non-specialists to easily grasp the salient points. Some images are clever composites of multiple photos, with arrows or numbers showing the sequence of events. For example, an arrow shows how a male locks onto a female's prothorax to take her tandem, while a numbered sequence shows how a female breaks tandem to escape while the male continues to engage with the attacking rival.

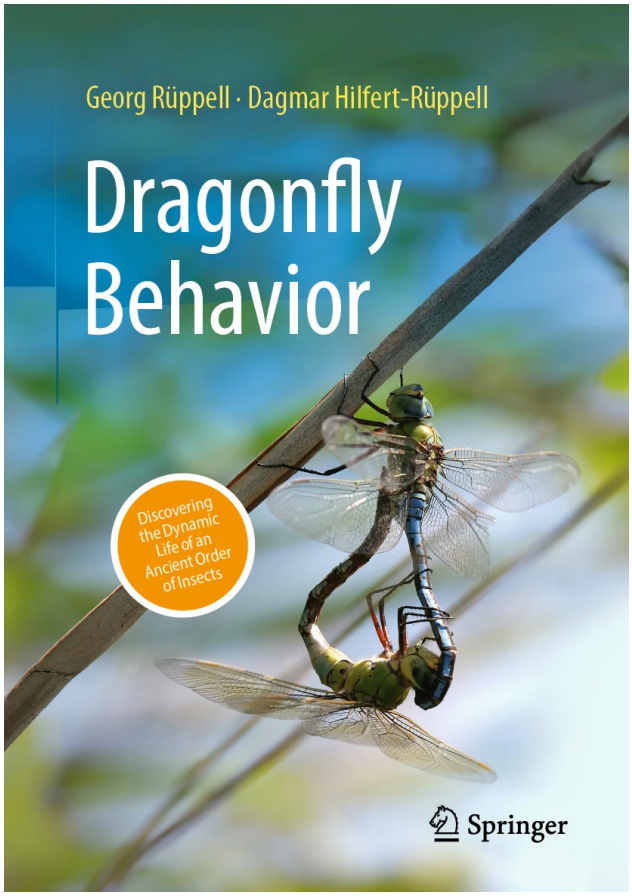

Fig. 1. Front cover of Rüppell & Hilfert-Rüppell, 2024.

The book first covers dragonfly anatomy of body, eyes, and wings and the various types of flight. It then moves on to examine behaviours such as prey capture, drinking, fighting, male courtship, female defence against males, mating, egg-laying, larval behaviour and emergence. To elucidate the behaviour of adults and larvae, as well as underwater oviposition by females of some species, the authors filmed both above and below the water's surface. Their extraordinary patience and persistence paid off in documenting exceedingly rare events, such as males using their wings to create circular waves during courtship flights and the alternative, non-territorial reproductive behaviour employed by *Calopteryx* demoiselles. I was especially impressed by their exquisite footage of bird predation on odonates. The text concludes with sections on dragonfly swarms, migration and the ecological consequences of their behaviour. Useful references, organised by chapter, are included in the bibliography only, so as not to interrupt the text.

Specialists will appreciate the latest research on wing construction and its effect on flight, as well as the flight mechanisms such as vortex patterns that facilitate flight manoeuvres. The text contains many fascinating facts and comparisons, such as the similarity between the inverted flight of odonates and that of birds of prey like kites. Particular attention is paid to species with sexually dimorphic coloured wings, whose males perform specific flight manoeuvres to display their condition to potential mates and rivals. Dark-winged species appear to be at greater risk of overheating, which suggests a potential method of tracking the impact of rising temperatures on populations. Are coloured-winged odonates at greater risk of extinction than clear-winged ones? Is the liquid expelled by a tandem female during flight the sperm of previous mates? Such questions remain for the next generation to explore, as with any area of research. In the concluding section, Anecdotes, the authors share their research adventures around the world, offering refreshing insights into how science is actually conducted in practice. Their work has indeed been a family affair, illustrating how even a teenager with drone expertise can contribute to serious scientific research.

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The book is well worth the price, especially given the 13 short film sequences, each one- to two-minutes long, which are included via online links (just a click away in the e-book version). These slow-motion films offer an intimate view of nature's daily dramas, which will hopefully be preserved for future generations in a public depository. Having watched the films with a four-year-old dragonfly enthusiast, I was impressed by the questions they prompted, particularly those relating to female underwater egg-laying, the labial masks of larvae capturing mosquito prey, and the remarkable tongue of a frog predator. *Dragonfly Behavior* is thus an excellent example of how scientists can communicate effectively with the general public. By producing a book explicitly for both colleagues and non-specialists, the authors are making a significant contribution to public education. In particular, citizen scientists who provide species counts and data on seasonality may now pay more attention to behavioural diversity, which they may previously have overlooked. Dragonflies are among the most easily viewed insects and are conspicuous in urban parks with water features or, during their dispersal stage, even in home gardens lacking water. The slow-motion filming techniques used on dragonflies can be applied to any insect group. In our increasingly virtual age, taking the time to observe nature provides a relaxing balm in troubled times and strengthens our desire to preserve the natural world. I expect this book will inspire other entomologists to share their research with both their peers and the wider public in such an engaging way.

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