A special issue of the Journal of Orthoptera Research devoted to Body Size in Orthoptera

Authors: Whitman, Douglas W., and Vincent, Shawn

Source: Journal of Orthoptera Research, 17(2) : 113-114

Published By: Orthopterists' Society

URL: https://doi.org/10.1665/1082-6467-17.2.113

A special issue of the Journal of Orthoptera Research devoted to

Body Size in Orthoptera

Preface

EDITED BY DOUGLAS W. WHITMAN AND SHAWN VINCENT

[DWW] 4120 Department of Biological Sciences, Illinois State University, Normal, Illinois, 61790, USA. Email: dwwhitm@ilstu.edu
[SEV] Department of Natural, Information, and Mathematical Sciences, Indiana University, Kokomo, Indiana, 46902, USA. Email: sevince1@hotmail.com

Size is perhaps the most conspicuous feature of an organism, and has profound effects on nearly every aspect of organismal design, behavior, and function (Peters 1983, Schmidt-Nielsen 1984, Brown & West 2000, Dial *et al*. 2008). Across the tree of life, organisms span an impressive 21 orders of magnitude in size, ranging from mycoplasmas (10^{-13} g) to blue whales (10^{8} g) (Schimidt-Nielsen 1984). In particular, Orthoptera (crickets, katydids, locusts, grasshoppers and wetas) and Phasmatodea (walkingsticks) display some of the most striking variation in size among terrestrial animals, from tiny 2-mm long ant-crickets to giant 357-mm long Malaysian walkingsticks (Otte & Alexander 1983; Wetterer & Hugel 2008; Natural History Museum, London). As evinced by the impressive array of subjects in this special issue on "*Body size in Orthoptera*", orthopterans are model organisms in which to study the ecological and evolutionary significance of size.

At present count, there are ~ 24,300 known orthopteran species and ~ 3,500 known phasmatids (Orthoptera Species File, Phasmida Species File), with many more species likely to be unearthed with the continued progression of molecular phylogenetic studies in coming years. Thus far, phylogenetic studies generally support a monophyletic hypothesis for the Orthoptera (Gorochov 1995, Storozhenko 1997, Flook *et al*. 1999), although much work using modern molecular and statistical approaches remains to be done to resolve the higher-level relationships. The first known orthopteran fossil dates back to the upper Carboniferous period (~ 299 mya, Chopard 1920, Storozhenko 1997, Gorochov 2001), making orthopterans one of the most ancient of insect lineages. And recently, an entirely new order of orthopteroid-like insects, the Mantophasmatodea, was discovered (Klass *et al*. 2002, Terry & Whiting 2005), suggesting we still have much to learn about this diverse group. These remarkable animals also inhabit virtually every terrestrial biome type, where they are often highly abundant, sometimes spectacularly so, with up to 30,000 individuals per square meter in the case of locust hoppers (Uvarov 1977). Because of their high densities, orthopterans frequently play critical roles in terrestrial food webs as both herbivores (Schmitz 2005) and prey (see Whitman & Vincent 2008), and cause serious economic damage to crops and rangeland (Metcalf *et al*. 1962, Joern & Gaines 1990, Krall 1994). Understanding the adaptive nature of size variation in this diverse group of insects may not only shed significant light on a number of unresolved issues in ecological and evolutionary biology, but has practical value as well in pest management.

This special issue of JOR on "*Body size in Orthoptera*", brings together a diverse array of 32 articles with this lofty goal in mind. The papers explore the full range of size-related topics, from understanding environmental and genetic control of size, to its geographic and sexual expression, to its fitness consequences and evolution, to its role in the conservation of endangered Orthoptera. It addresses how body size is influenced by nearly every aspect of the environment, and in turn influences nearly every conceivable aspect of orthopteran biology, from morphology and physiology to feeding, dispersal, defense, to mating, fecundity, and life-history strategies, and ultimately to fitness itself. We hope that the wide-reaching nature of these papers will help to guide the various avenues of research being explored on size in the Orthoptera, and to integrate these disparate topics into a more cohesive whole.

References

Brown J.H., West G.B. (Eds) 2000. Scaling in Biology. Oxford University Press, Oxford.

Chopard L. 1920. Recherches sur la conformation et la développement des derniers segmentes abdominaux des Orthoptères. Thèse, Faculté des Sciences de Paris, Oberthur, Rennes.

Dial K.P., Green E., Irschick D.J. 2008. Allometry of Behavior. Trends in Ecology and Evolution 23: 394-401.

Flook P.K., Klee S., Rowell C.H.F. 1999. Combined molecular phylogenetic analysis of the Orthoptera (Arthropoda, Insecta) and implications for their higher systematics. Systematic Biology 48: 233-253.

Gorochov A.V. 1995. System and evolution of the suborder Ensifera (Orthoptera) (in 2 books). Proceedings of the Zoological Institute Russian Academy of Sciences 260. 224 + 212 pp. [In Russian]

Gorochov A.V. 2001. The most interesting finds of orthopteroid insects at the end of the 20th century and a new recent genus and species. Journal of Orthoptera Research 10: 353-367.

Joern A., Gaines S.B. 1990. Population dynamics and regulation in grasshoppers, pp. 415-482. In: Chapman R.F., Joern A. (Eds) Biology of Grasshoppers. Wiley, New York.

Klass K.-D., Zompro O., Kristensen N.P., Adis J. 2002. Mantophasmatodea: a new insect order with extant members in the Afrotropics. Science 296: 1456-1459.

Krall S. 1994. Importance of locusts and grasshoppers for African agriculture and methods for determining crop losses, pp. 7-22. In: Krall S., Wilps H. (Eds) New Trends in Locust Control. Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), Eschborn Germany.

Metcalf C.L., Flint W.P., Metcalf R.L. 1962. Destructive and Useful Insects. McGraw-Hill, New York.
Natural History Museum, London. World's longest insect revealed. http://www.nhm.ac.uk/about-us/news/2008/october/worlds-longest-insect-revealed.html
Orthoptera Species File. http://orthoptera.speciesfile.org/HomePage.aspx
Otte D., Alexander R.D. 1983. The Australian crickets (Orthoptera: Gryllidae). Academy of Natural Sciences of Philadelphia Monograph 22: 1-477.
Peters R.H. 1983. The Ecological Implications of Body Size. Cambridge University Press, Cambridge.
Phasmida Species File. http://phasmida.orthoptera.org/HomePage.aspx
Schmidt-Nielsen K. 1984. Scaling: Why is Animal Size so Important? Cambridge University Press, Cambridge.
Schmitz O.J. 2005. Scaling from plot experiments to landscapes: studying grasshoppers to inform forest ecosystem management. Oecologia 145: 225-234.
Storozhenko S.Y. 1997. Fossil history and phylogeny of orthopteroid insects, pp. 59-82. In: Gangwere S.K., Muralirangan M.C., Muralirangan M. (Eds) The Bionomics of Grasshoppers, Katydids and their Kin. CAB International, Wallingford, UK.
Terry M.D., Whiting M.F. 2005. Mantophasmatodea and phylogeny of the lower neopterous insects. Cladistics 21: 240-257.
Uvarov B. 1977. Grasshoppers and Locusts Vol. II. Centre for Overseas Pest Research, London.
Wetterer J.K., Hugel S. 2008. Worldwide spread of the ant cricket, *Myrmecophilus americanus*, a symbiont of the longhorn crazy ant P*aratrechina longicornis*. Sociobiology 52: 157-165.
Whitman D.W., Vincent S. 2008. Large size as an anti-predator defense in an insect. Journal of Orthoptera Research 17: 353-371.