Press release

Aquatic Insects – a tremendous potential for research on diversification

Frankfurt, February 5, 2014. Inland waters cover less than 1% of the Earth's surface yet harbor 10% of all known animal species, 60% of them being aquatic insects. Nearly 100,000 species from 12 orders spend one or more life stages in freshwater. Still today, little is known on how this remarkable diversity arose. Scientists of the Biodiversity and Climate Research Centre (BiK-F), the Naturalis Biodiversity Center in Leiden and the Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB) in Berlin therefore investigated the potential of aquatic insects for research on diversification. The results have now been published in the renowned *Annual Review for Entomology*.

Freshwaters cover less than 1% of the Earth's surface, but harbour 10% of all animal. Six out of ten of currently known species are insects. In a recently published review an international team of researchers from the Biodiversity and Climate Research Centre (BiK-F), the Biodiversity Center in Leiden, and the Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB) in Berlin analyzed how studying the vast diversity of aquatic insects may contribute to a better understanding of diversification processes. „Analyzing the reasons behind the disproportionately high degree of aquatic insect diversity relative to the little area covered by freshwaters may help us to better understand species diversification", specifies Dr. Steffen Pauls, leader of a junior research group at the BiK-F and one of the authors of the review. All aquatic insect groups are the result of the invasion of freshwaters by terrestrial groups: „Although belonging to only 12 orders, aquatic insects may represent more than 50 separate invasions", explains co-author Dr. Klaas-Douwe Dijkstra from the Naturalis Biodiversity Center Leiden. The ecology and habitat preferences of many aquatic insect groups have been intensively studied, due to their roles as disease vectors or bioindicators for water quality. But as this research is mostly done in a purely ecological context, these species are underrepresented in evolutionary studies. „And even inside the entomological community, there is often a lack of communication between experts on different groups of insects. So we hope this review will stimulate more exchange and promote interdisciplinary research ", Dijkstra points out.

He who lives in a safe home, doesn't need to move

Ecological diversity results from a complex set of environmental influences. One important factor affecting diversification is habitat stability. The researchers present a model that explores the correlation of habitat stability, speciation and spreading rates under environmental change of aquatic insects. These processes strongly affect and are intricately linked with the life cycles of aquatic insects, as one and the same species may switch between a non-flying, aquatic immature life stage, and a flying terrestrial adult stage.

February 5, 2014

For further informationplease contact:

Dr. Steffen Pauls
LOEWE Biodiversität und Klima Forschungszentrum (BiK-F)
Tel. +49 (0)69 7542 1884
steffen.pauls@senckenberg.de

or

Dr. Julia Krohmer
LOEWE Biodiversität und Klima Forschungszentrum (BiK-F), Transferstelle
Tel. +49 (0)69 7542 1837
julia.krohmer@senckenberg.de

Publication:
Dijkstra, KDB, Monaghan, MT & **SU Pauls** (2014): Freshwater Biodiversity and Aquatic Insect Diversification. – In: Annual Review of Entomology, Vol. 59, DOI: 10.1146/annurev-ento-011613-161958

Press photos:

A typical karst spring and stream in the western Balkan Peninsula that is home to a microendemic caddisfly species of the genus *Drusus*.
© Ana Previsic
Download in 300 dpi

Co-author Dr. Michael T. Monaghan, Leibniz-Institute of Freshwater Ecology and Inland Fisheries in Berlin, sums up: „Our model demonstrates a non-linear relationship between habitat stability and dispersal ability of species. Standing waters harbor a larger proportion of species that appear to have evolved the propensity to move to another habitat if conditions change. This can result in the emergence of new species based on geographical diversification. Organisms in running water disperse less, therefore must adapt to changing environmental conditions, which may be another important speciation mechanism. It makes the mixture of habitats an ideal place to study ecological diversification."

Overview of the research potential of different aquatic insects

The authors summarize and highlight the value of major aquatic insect lineages for biodiversity research.

The diversification of the caddisfly genus *Drusus* is well suited to investigate speciation taking place at the interface of geographical and ecological diversification. „In the streams and springs of the western Balkan Mountains you can find a whole range of *Drusus* species. Across the whole mountain range different microendemic species have evolved in every valley– right down to Greece", says Pauls. „The trigger might be geographical diversification, as waters are isolated by the progressing karst formation", the entomologist suggests. Different temperature preferences of individual species however, highlight that ecological diversification also plays an important role in the process.

Temperature adaptation is another focus of research interest, e.g. in non-biting midges (Chironomidae). These highly adaptive midges with their plumose antennae comprise tropical and antarctic species and occur in altitudes from 6000 above sea level to 1000 below sea level (even in marine environments). They tolerate temperatures from -20° until +40° Celsius, and their lifecycles last from seven days to seven years.

The review outlines new perspectives in biodiversity research: The combination of phylogenetic methods with the extensive ecological data provides a promising avenue for future research, making aquatic insects highly suitable models for the study of ecological diversification and opening up new paths in science. Pauls concludes: „If we understand the origin of the enormous species richness of aquatic insects, we will be able to better infer how other animal and plant species diversified and hopefully be able to put this knowledge to good use in species conservation".

Dragonflies live in both standing and running waters and presents a good model for studying the effects of diversification in the context of habitat stability. Pictured is the dragonfly *Trithemis hartwigi.*
© Nicolas Meziere
Download in 300 dpi

The dragonfly *Platycypha rufitibia*.
© Nicolas Meziere
Download in 300 dpi

For further information please contact:

Dr. Steffen Pauls
LOEWE Biodiversität und Klima Forschungszentrum (BiK-F)
Tel. +49 (0)69 7542 1884
steffen.pauls@senckenberg.de

or

Dr. Julia Krohmer
LOEWE Biodiversität und Klima Forschungszentrum (BiK-F),
Transferstelle
Tel. +49 (0)69 7542 1837
julia.krohmer@senckenberg.de

Publication:
Dijkstra, KDB, Monaghan, MT & **SU Pauls** (2014): Freshwater Biodiversity and Aquatic Insect Diversification. – In: Annual Review of Entomology, Vol. 59, DOI: 10.1146/annurev-ento-011613-161958

Press photos:

A typical karst spring and stream in the western Balkan Peninsula that is home to a microendemic caddisfly species of the genus *Drusus*.
© Ana Previsic
Download in 300 dpi

Dragonflies live in both standing and running waters and presents a good model for studying the effects of diversification in the context of habitat stability. Pictured is the dragonfly *Trithemis hartwigi.*© Nicolas Meziere
Download in 300 dpi

The dragonfly *Platycypha rufitibia*.
© Nicolas Meziere
Download in 300 dpi

The press photos are also available at
www.bik-f.de/root/index.php?page_id=32&ID=684&year=0

LOEWE Biodiversität und Klima Forschungszentrum, Frankfurt am Main

With the objective of analysis the complex interactions between biodiversity and climate through a wide range of methods, the **Bi**odiversität und **K**lima **F**orschungszentrum [Biodiversity and Climate Research Centre] (BiK-F) has been funded since 2008 within the context of the **L**andes-**O**ffensive zur **E**ntwicklung **W**issenschaftlichökonomischer **E**xzellenz (LOEWE) of the Land of Hessen. The Senckenberg Gesellschaft für Naturforschung and Goethe University in Frankfurt as well as other, directly involved partners, co-operate closely with regional, national and international institutions in the fields of science, resource and environmental management, in order to develop projections for the future and scientific recommendations for sustainable action. For further details, please visit www.bik-f.de .