Rotoita and *Oodera* - the stories of two extraordinary chalcidoid wasps

Ralph S. Peters[1]*, John Heraty[2], James B. Woolley[3] & Lars Krogmann[4]

[1]Zoologisches Forschungsmuseum Alexander Koenig, Bonn, Germany
[2]University of California, Riverside, CA, USA
[3]Texas A&M University, College Station, TX, USA
[4]State Museum of Natural History Stuttgart, Germany
*E-Mail: r.peters@leibniz-zfmk.de

The megadiverse superfamily Chalcidoidea is rich in extraordinary, sometimes weird taxa, and taxa being key for our understanding of certain evolutionary innovations. Two of these taxa, the genera *Rotoita* and *Oodera*, will be presented here in more detail, including their morphology, biology, phylogenetic placement and classification.

Rotoita is an enigmatic genus of small chalcidoid wasps endemic to New Zealand. It is classified in the family Rotoitidae, which includes only two genera, *Rotoita* from New Zealand and *Chiloe* from Chile, suggesting a relict Gondwanan distribution of the group. We present new findings on the placement of *Rotoita* in the chalcidoid tree of life as well as the state of knowledge on this genus, based on recent collections during a trip to New Zealand.

Oodera is another rarely collected genus of comparatively large-sized wasps, currently classified in the family Pteromalidae and the subfamily Cleonyminae. All species of the genus have remarkably enlarged fore femora and a variety of characters unique or very unusual among chalcidoid wasps. The genus has been notoriously difficult to place in the Chalcidoidea tree, and had never been taxonomically revised. We present new data that allow for the first time reliable phylogenetic placement, and present the results from recent taxonomic revision, including some observations and speculations on the species' biology and the use of the exceptional and striking morphological modifications.

New kid on the block – a new addition to the ranks of CI-inducing bacteria promotes speciation in a parasitic wasp

Marie Pollmann[1], Elena Krimmer[2], Yuval Gottlieb[3] & Johannes L.M. Steidle[1]*

[1]Universität Hohenheim, Institut für Zoologie, Fachgebiet Tierökologie, Stuttgart
[2]Universität Würzburg, Abteilung Tierökologie und Tropenbiologie, Würzburg
[3]Hebrew University, Koret School of Veterinary Medicine, Rehovot, Israel
*E-Mail: jsteidle@uni-hohenheim.de

The process of speciation has been the subject of many studies, one of the first scientists addressing this topic being Darwin in 1859 who called it the "mystery of mysteries" (Coyne 1992). By now, many isolating barriers causing and promoting speciation have been identified, with the final step of the speciation process always being the establishment of reproductive isolation (Dobzhansky 1937, Coyne 1992).

Bacterial endosymbionts have been shown to employ mechanisms to manipulate the reproduction of their hosts that act as isolating barriers and are assumed to promote speciation processes in the hosts (Coyne 1992, Werren 1998). The most common of these mechanisms, cytoplasmic incompatibility, prevents the formation of a diploid zygote. While this is lethal in diploid organisms for both male and female offspring, in haplodiploid organisms like pteromalid wasps only diploid females die while haploid males emerge (Bordenstein 2003, Breeuwer & Werren 1990). CI occurs in crosses between males infected with the bacteria and uninfected females.

The pteromalid wasp *Lariophagus distinguendus* (Förster 1841) is a parasite of enclosed beetle larvae. Previous studies revealed two distinct ecotypes based on different host preferences (König et al. 2015). The discovery of further differences between the ecotypes, including different chromosome numbers, asymmetric sexual isolation, a significant genetic difference, and almost complete reproductive isolation resulted in the conclusion that the two lineages are true species, tentatively named granary weevil species (gw-species) and drugstore beetle species (db-species) based on their preferred hosts, the granary weevil *Sitophilus granarius* (Coleoptera: Dryophtoridae) (Hase 1919) and the drugstore beetle *Stegobium paniceum* (Coleoptera: Ptinidae) (Linnaeus 1761) (König et al. 2015).

Fecundity experiments with crosses from strains of both species were conducted to investigate the reproductive isolation between and within species. The absence of female offspring indicated the occurrence of cytoplasmic incompatibility in some of the crosses. Female offspring were restored in these crosses by means of a tetracycline treatment eliminating all bacteria potentially occurring in the parental generation and interfering in the reproduction. In order to identify the bacteria responsible for the observed CI, they were thoroughly investigated by subjecting them to multiple analyses.

References:

Bordenstein, S.R. 2003, Symbiosis and the origin of species, in: Bourtzis, K. & Miller, T. (eds) *Insect Symbiosis*, CRC Press, New York, NY, USA, pp. 283-304.

Breeuwer, J.A.J. & Werren, J.H. 1990, Microorganisms associated with chromosome destruction and reproductive isolation between two insect species, *Nature*, vol. 346, no. 6284, pp. 558-560.

Coyne, J.A. 1992, Genetics and speciation, *Nature*, vol. 355, no. 6360, pp. 511-515.

Dobzhansky, T. 1937, Genetic Nature of Species Differences, *Am Nat*, vol. 71, no. 735, pp. 404-420.

Duron, O., Bouchon, D., Boutin, S., Bellamy, L., Zhou, L., Engelstädter, J. & Hurst, G.D. 2008, The diversity of reproductive parasites among arthropods: *Wolbachia* do not walk alone, *BMC Biology*, vol. 6, no. 27.

Engelstädter, J. & Hurst, G.D.D. 2009, The Ecology and Evolution of Microbes that Manipulate Host Reproduction, *Annu Rev Ecol Evol S*, vol. 40, no. 1, pp. 127-149.

König, K., Krimmer, E., Brose, S., Gantert, C., Buschlueter, I., König, C., Klopfstein, S., Wendt, I., Baur, H., Krogmann, L. & Steidle, J.L.M. 2015, Does early learning drive ecological divergence during speciation processes in parasitoid wasps?, *Proc R Soc B*, vol. 282, no. 1799.

Werren, J.H. 1998, Wolbachia and speciation, In: Howard, D.J. & Berlocher, S. H.: *Endless forms: species and speciation*, Oxford University Press, New York, NY, USA, pp. 245-260.