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Conference Abstract

"The orchids of the animal kingdom": tackling functional anatomy and phenotypic plasticity of ant nest beetles (Carabidae: *Paussus*) using 3D models generated by Micro-Computed Tomography (µ-CT)

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Abstract

The genus *Paussus* is a highly specialized, charismatic group of ground beetles (Carabidae) classified in the subfamily Paussinae. All species of *Paussus* are obligate myrmecophiles (associates of ants). As with many other myrmecophilous or termitophilous beetles, *Paussus* have undergone extreme phenotypic adaptations for life with ants, at the level of head, antennae, and prothorax. Host data suggest that *Paussus* species are likely to be species-specific ant parasites, and the structural modifications of antennae and other body parts are likely under selection by their host ants. Investigating anatomical structures have been fundamental to better understand living organisms, and their interplay with the surrounding environment, which could induce significant morphological variation. In the last few years, bio-imaging techniques paired with geometric morphometrics (GM) overcame the limits of traditional anatomical studies, becoming widely non-invasive and highly informative for both internal and external characters. The use of Computed Tomography (CT) scanners definitively allowed to advance in the knowledge of either known or neglected biological structures. For this project, we used X-ray micro-computed

tomography, in order to acquire 2D serial, cross-sections of various paussines samples, with a resolution between 0.954 and 2.44 micrometers. The 2D images in high resolution are then processed using a high-performance computer system and Thermo Scientific™ Amira™ Software and Thermo Scientific™ Avizo™ Software for the reconstruction of 3D models. With these models, we will be able to conduct a morphological study of the most variable parts in the body of the genus *Paussus* using 3D geometric morphometrics (3D GM), as these integrative techniques allows to describe in a quantitative way even subtle differences between structures, so as to determine whether the striking diversity of phenotypes is caused by the host or by other factors, overlapping the results obtained with the molecular part of phylogeny. These innovative practices help to deepen the meaning of shape in insect biology, from both structural and evolutionary views. They will allow, in particular, to describe the relationship between phylogeny and functional morphology in the extremely variable species of the subfamily Paussinae.

Keywords

Ants; Paussus; Morphology; Micro-CT; Geometric Morphometrics; Carabidae

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