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Comparative thermoregulation between different species of dung beetles (Coleoptera: Geotrupinae)

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Abstract

Insects can use thermoregulation to keep their body temperatures within a certain range in response to thermal stress situations. The mechanisms to regulate internal temperature depend on whether species are endothermic or ectothermic species, i.e., if the heat source is internal and/or external. In this study, the thermal stress response due to excess heat was examined in individuals belonging to different species of the Geotrupinae subfamily by using a standardized protocol based on infrared thermography. All the measured heat stress variables allow discrimination among the considered species to a greater or lesser extent. The body heating rate in the heat stress range, the critical thermal maximum and the stress start temperature were the most important variables in discriminating between apterous and winged individuals (R^2 = 52.5%, 51.1% and 50.0%, respectively). Examining the degree of association between the physiological similarity of individuals and some species traits suggest that flying capability and daily activity are related with different thermal responses. Based on the obtained results, the Geotrupinae subfamily can be divided into three ecophysiological groups: good, medium and non-thermoregulators. Within these groups, apterism appears mainly in those species with the ability to actively decrease