Released 2/28/07

NEW STUDY REWRITES EVOLUTIONARY HISTORY OF VESPID WASPS

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CHAMPAIGN, Ill. — Scientists at the University of Illinois have conducted a genetic analysis of vespid wasps that revises the vespid family tree and challenges long-held views about how the wasps' social behaviors evolved. In the study, published in the February 21 Proceedings of the National Academy of Sciences, the researchers found genetic evidence that eusociality (the reproductive specialization seen in some insects and other animals) evolved independently in two groups of vespid wasps.

These findings contradict an earlier model of vespid wasp evolution, which placed the groups together in a single lineage with a common ancestor.

Eusocial behavior generally involves the breeding of different reproductive classes within a colony. The sterile members of the group perform tasks that support their fertile counterparts. Eusociality occurs in some species of insects, rodents, crustaceans and arthropods.

The evolution of eusociality in wasps has long been a source of debate, said U. of I. entomology professor Sydney Cameron, who is principal investigator of the study. A prior model of vespid wasp evolution placed three subfamilies of wasps – the Polistinae, Vespinae and Stenogastrinae – together in a single evolutionary group with a common ancestor. This model did not rely on a genetic analysis of the wasps, but instead classified them according to physical traits.

Cameron's team included University of Missouri biology professor James H. Hunt, an expert on the evolution of social behavior in the vespid wasps. Hunt had observed that many behavioral characteristics of the vespid wasps contradicted this model of the vespid family tree. His observations, along with those of other behavioral experts in the field, prompted the new analysis.

(MORE – Wasps)

Instead of affirming a linear, step-wise evolution of social behaviors from solitary to highly social, Cameron said, her team's analysis shows that the Polistinae and Vespinae wasp subfamilies evolved their eusocial characteristics separately from the eusocial Stenogastrinae subfamily of vespid wasps.

Experts on vespid wasp behavior have long noted the significant behavioral differences between the Stenogastrinae subfamily and the group that includes Polistinae and Vespidae. And others have tried, unsuccessfully, to challenge the earlier model of vespid wasp evolution. In 1998, German researchers J. Schmitz and Robin Moritz also used a genetic analysis to propose that the subfamily Stenogastrine was evolutionarily distinct from the Polistinae and Vespinae subfamilies.

Proponents of the earlier model criticized their work, however, because it relied on an analysis of less than 600 base pairs in two genes (one ribosomal RNA, the other mitochondrial DNA).

The new study examined variations in fragments of four genes across 30 species of vespid wasps. Four independent statistical analyses tested the reliability of the pattern of relationships that emerged from the data.

This work confirms the ideas of Schmitz and Moritz, said Cameron, by adding to the weight of evidence that their hypothesis was accurate.

The fact that eusociality evolved independently in two groups of vespid wasps also sheds light on the complexity of evolutionary processes, Cameron said.

"Sometimes scientists want to make generalizations and simplify the world. But the world isn't simple and evolution isn't simple. This finding points to the complexity of life."

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