

Study of fungi-insect relationships may lead to new evolutionary discoveries

May 24 2016

Zombie ants are only one of the fungi-insect relationships studied by a team of Penn State biologists in a newly compiled database of insect fungi interactions.

"I couldn't find a place with broad information about all groups of fungi that infect insects in the same study," said Joao Araujo, [graduate student](#) in biology. "When we organized the information, we started to understand things we wouldn't see before, because the literature was so spread."

From the 150 years of literature, the [researchers](#) found that about 65 percent of insect orders can be infected by fungi and Oomycetes, fungi-like organisms that also infect insects. The results were published in the May issue of *Advances in Genetics*.

Sap-sucking insects, such as cicadas, are the most frequently attacked by fungi. The researchers believe this is because of the way this order of insect evolved. They have specialized mouth parts for sucking sap making them susceptible to fungi that originally infect plants.

"The fungi may have found a good environment inside the insect and then they would have established in the new host by host-jumping from plants to insects," said Araujo.

Host-jumping occurs when the fungi, in this case, are able to infect new groups of hosts like insects, animals or plants and so jump from one

species or groups of hosts to others.

The researchers also discovered that flies are the only order of insects that are infected at all stages of development—from when they are eggs until they are adults. They believe flies are especially susceptible to infection because they are found all over the world and get their food in a wide variety of ways. Their larvae often occupy a wide range of breeding sites, ranging from ponds to tree trunks. This diversity within the order is a potential explanation for the susceptibility to fungal infections in all stages of flies.

The researchers found the order of insect that includes butterflies and the order that includes beetles to be the most likely to be infected when they are larvae.

They believe this is caused by a variety of factors. First, these insects occupy a wide variety of environments as larvae so they are exposed to a wider variety of fungi. Second, they tend to stay close to the breeding site where they were laid as eggs, making it easy for fungi to locate them. Third, in order to grow, they eat a lot of food. This means they become a large reservoir of energy for fungi. Finally, the larvae need to grow rapidly and so do not yet have a hard exoskeleton. Their softer, thinner skin makes them more susceptible to infection.

With this new database on the relationships between fungi and insects, the researchers believe much more research and additional conclusions will be possible, and it may be a useful tool for teaching the diversity of [fungi](#) that infect [insects](#).

Provided by Pennsylvania State University

Citation: Study of fungi-insect relationships may lead to new evolutionary discoveries (2016,

May 24) retrieved 26 April 2024 from <https://phys.org/news/2016-05-fungi-insect-relationships-evolutionary-discoveries.html>

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