A real-life zombie story in the life of bugs

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Dinocampus coccinellae wasp. Image credit: Misanthrope/Wild About Britain

(PhysOrg.com) -- In a recent study published in *Biology Letters*, a page of science fiction comes to life in a real-life zombie scenario between the ladybug and a parasitical wasp called *Dinocampus coccinellae*.

The study, led by Fanny Maure, a University of Montreal graduate student, looked at exactly what role the ladybug played in the birth and growth of the *D. coccinellae*. The female *D. coccinellae* stings the ladybug and lays her egg within the ladybug host. The larva then hatches and eats its way out of the ladybug and within three weeks has hatched out of the ladybugs abdomen. The ladybug, however, is not dead and still very much alive.

The grub then spins its orange cocoon within the ladybug's legs until it grows into an adult. It was believed that the ladybug served as protection to the cocoon as its colors and erratic twitching scares off predators. However Maure decided to test this theory and exposed the wasp

cocoons to lacewings. What she discovered was that the unprotected cocoons were devoured but so were 85 percent of the ones protected by a dead ladybug. However, when the cocoon was protected by a still alive ladybug in its zombie state, only about one third of them were eaten.

It is still unclear how the ladybug survives and still twitches after the larva has left, but Maure believes that the larva may leave behind some type of venom that enables the twitching within the ladybug. Maure also discovered that the longer the ladybug remains alive, the less beneficial it is for the fertility of the growing wasp.

It is believed that this is because the tiny grub is limited to the amount it can eat. If it consumes the ladybug to the point of death, it eats but is less likely to reach maturity without protection. By eating less and allowing the adult ladybug to survive, the grub keeps its protection and reaches maturity, but its development is affected by the lack of food needed for proper development.

More information: The cost of a bodyguard, *Biol. Lett.* Published online before print June 22, 2011, doi:10.1098/rsbl.2011.0415

Abstract
Host manipulation by parasites not only captures the imagination but has important epidemiological implications. The conventional view is that parasites face a trade-off between the benefits of host manipulation and their costs to fitness-related traits, such as longevity and fecundity. However, this trade-off hypothesis remains to be tested. Dinocampus coccinellae is a common parasitic wasp of the spotted lady beetle Coleomegilla maculata. Females deposit a single egg in the haemocoel of the host, and during larval development the parasitoid feeds on host tissues. At the prepupal stage, the parasitoid egresses from its host by forcing its way through the coccinellid's abdominal segments and begins spinning a cocoon between the ladybird's legs. Remarkably, D.

coccinellae does not kill its host during its development, an atypical feature for parasitoids. We first showed under laboratory conditions that parasitoid cocoons that were attended by a living and manipulated ladybird suffered less predation than did cocoons alone or cocoons under dead ladybirds. We then demonstrated that the length of the manipulation period is negatively correlated with parasitoid fecundity but not with longevity. In addition to documenting an original case of bodyguard manipulation, our study provides the first evidence of a cost required for manipulating host behaviour.