Cocooned wasp larvae jump to shaded areas to improve their survival

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Jumping is not about fun and games for insect larvae. They must do it to survive. This manoeuvre is all about finding a shady spot to develop in, according to researchers from Kyushu University in Japan, who led research into the jumping behavior of a minute parasitic wasp, published in Springer's journal *The Science of Nature*.

The use of jumping as a means of movement has only been observed in a few species of parasitic wasp larvae, suggesting that this behavior does not easily evolve. One such wasp is the three millimeter long Bathyplectes anurus. This parasite is used as a form of biological pest control against alfalfa weevil (*Hypera postica*), a destructive agricultural pest that attacks legumes.

Adult *Bathyplectes anurus* wasps lay their eggs in alfalfa weevil larvae. When the wasp larva develops, it crawls out from inside its host and promptly feeds on it. It then spends ten months in a self-spun cocoon inside the cocoon of the alfalfa weevil larva it has eaten, before developing into a pupa. During this time, the wasp larva performs whip-like twitches against the interior of the cocoon causing the entire structure to move approximately five centimeters at a time.

Lead researcher, Yoriko Saeki, and her team conducted a series of experiments on 100 Bathyplectes anurus larvae to understand if this behavior is a survival technique, and whether it comes at a cost to the insects. They examined the effects of different light intensities, temperatures, as well as levels of humidity under different laboratory

and field conditions.

The *Bathyplectes anurus* cocoons exposed to light jumped nearly three times more often than those kept in darkness. Jumping activity increased during rapid temperature increases, and was 60 percent higher at conditions of low humidity. When the cocoons were allowed to jump freely in an area of gradient light going from dark to bright, more cocoons ended up in shady areas. Cocoons in the shady area were more likely to survive, compared to the cocoons left out in brighter light.

The cocoons jumped and moved about 83 percent more when they were placed near Japanese giant ants, known predators of this type of larvae, compared to when there were no danger elements in the vicinity. The frequency of movements decreased once the predators made direct contact with the cocoons.

The results suggest that the larvae respond to environmental stresses by jumping to more favorable habitats that allow them to develop unrestrictedly. The body mass of the individuals that jumped was lower compared to those that did not. The researchers suggest that this is because jumping behavior comes at a cost as it requires more energy use.

Further studies of cocoon structures and the physical mechanisms that allow for such jumping in related species will help entomologists to fully understand the evolution of this behavior.

More information: Yoriko Saeki et al. Costs and benefits of larval jumping behaviour of Bathyplectes anurus, *The Science of Nature* (2015). DOI: 10.1007/s00114-015-1324-1