Some caterpillers just don't want to grow up

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For many years, ecologists from the Centre of Environment and Hydrology (CEH) have investigated the ecology of Maculinea rebeli, a Lycaenid butterfly whose caterpillars live as parasites inside colonies of Myrmica ants, where they feed on regurgitations from the nurse ants. One of the peculiar features of this species' ecology is that only about 25% of the caterpillars complete development within one year. The rest are inactive in the first season and mature only after two years.

"The question puzzling us for some time," says Prof. Jeremy Thomas, director of the CEH in Dorset, "was to understand why so many caterpillars waste one year's time by delaying their development. From all what we know, which developmental pathway a caterpillar takes is determined early during the caterpillar's life, presumably by its mother."

An international project on the ecology of Maculinea butterflies has now brought together the CEH team with theoreticians from the universities of Würzburg and Montpellier to investigate this problem. Together they have compiled various potential adaptive explanations for the evolution of such strategies into a general and quantitative model. "The problem was not the lack of, but multitude of alternative mechanisms principally capable to explain the evolution of delayed development," Dr. Thomas Hovestadt, the project leader from Würzburg University, points out.

The scientists conclude that low added mortality and intense competition among caterpillars in the nest are a prerequisite for the evolution of delayed development, but cannot explain it on their own. In contrast, sibling competition and "segregation" – cohorts from both years do not

always compete because infected ant colonies avoid re-infection in the next season – favor evolutionary stable fractions of slow developers up to 50%. However, among all arguments suggested so far, only a "priority effect" – the competitive asymmetry between last year's slow and this year's fast developing caterpillars – can explain why more than 50% of caterpillars mature in their second season.

Yet, according to the currently available data, the effect seems to be too weak to fully explain the large proportion of caterpillars delaying development. Based on a simple model expansion, the scientists predict that added benefits achieved by slow-developers after emergence would also tip the balance in favor of slow development. It is now a matter of further field and lab work to demonstrate that such benefits exist.

Source: University of Chicago