



Caterpillar seed predators mediate shifts in selection on flowering phenology in their host plant

Journal:	<i>Bulletin of the Ecological Society of America</i>
Manuscript ID	Draft
Wiley - Manuscript type:	Photo Gallery
Date Submitted by the Author:	n/a
Complete List of Authors:	Valdés, Alicia; Stockholms Universitet, Department of Ecology, Environment and Plant Sciences Ehrlén, Johan; Stockholm University, Department of Ecology, Environment and Plant Sciences
Substantive Area:	
Organism:	
Habitat:	
Geographic Area:	
Additional Keywords:	
Abstract:	

Title: Caterpillar seed predators mediate shifts in selection on flowering phenology in their host plant

Authors: Valdés, Alicia and Ehrlén, Johan

Author affiliation: Department of Ecology, Environment and Plant Sciences, Stockholm University, SE-106 91 Stockholm, Sweden

ESA manuscript number: ECY16-0167.R3

Accepted manuscript online: 27 October 2016 (unknown volume and date of publication), DOI: 10.1002/ecy.1633

Description of the related study:

Variation in selection among populations and years has important implications for evolutionary trajectories of populations. Yet, the agents of selection causing this variation have rarely been identified. Selection on the time of reproduction within a season in plants might differ both among populations and among years, and selection can be mediated by both mutualists and antagonists. We investigated if differences in the direction of phenotypic selection on flowering phenology among 20 populations of *Gentiana pneumonanthe* during two years were related to the presence of the butterfly seed predator *Phengaris alcon*, and if butterfly incidence was associated with the abundance of the butterfly's second host, *Myrmica* ants. In plant populations without the butterfly, phenotypic selection favored earlier flowering. In populations where the butterfly was present, caterpillars preferentially attacked early-flowering individuals, shifting the direction of selection to favoring later flowering. Butterfly incidence in plant populations increased with ant abundance. Our results demonstrate that antagonistic interactions can shift the direction of selection on flowering phenology, and suggest that such shifts might be associated with differences in the community context.

Photo 1: The marsh gentian (*Gentiana pneumonanthe*) is the host plant of the Lycaenid butterfly *Phengaris alcon*, whose caterpillars act as predispersal seed predators, feeding into the developing fruits during their first larval instars. This seed predator contributes to shift the direction of selection on flowering phenology in its host plant. As butterflies prefer ovipositing in early-flowering individuals, selection favors late flowering in plant populations where butterflies are present, while the contrary is true in plant populations where butterflies are absent. Photo by Alicia Valdés.

Photo 2: We collected data on *Gentiana pneumonanthe* reproductive traits and fitness and on intensity of seed predation by *Phengaris alcon* in 100 marked individuals in each of 20 study populations during 2010 and 2011. The butterfly seed predator *P. alcon* was present in 11 of the study populations and absent from 9. The study populations were located in bogs, pastures, lake shores and wet meadows in the county of Västra Götaland (SW Sweden). We present here an overview of 4 of the study populations: Högsjön (top left), Tånga hed (top right), Remmene skjutfält (bottom left) and Kalvsjön (bottom right). Photos by Alicia Valdés.

Photo 3: The Lycaenid butterfly *Phengaris alcon* (top right) and its two hosts: the marsh gentian (*Gentiana pneumonanthe*, left), which feeds caterpillars until their fourth instar, and *Myrmica* ants (bottom right), which adopt caterpillars into their nests, where they complete their development and pupate. Adult females of *P. alcon* fly on July-August and lay eggs on young buds of the marsh gentian (visible as white dots). We used the number of eggs per plant as a measure of the intensity of seed predation. We estimated ant abundance in each study population using transects of sugar-cube baits, and found that the probability of *P. alcon* presence increased with increasing abundance of *Myrmica* ants in the population. Photos by Alicia Valdés.



Photo 1: The marsh gentian (*Gentiana pneumonanthe*) is the host plant of the Lycaenid butterfly *Phengaris alcon*, whose caterpillars act as predispersal seed predators, feeding into the developing fruits during their first larval instars. This seed predator contributes to shift the direction of selection on flowering phenology in its host plant. As butterflies prefer ovipositing in early-flowering individuals, selection favors late flowering in plant populations where butterflies are present, while the contrary is true in plant populations where butterflies are absent. Photo by Alicia Valdés.

128x85mm (300 x 300 DPI)



Photo 2: We collected data on *Gentiana pneumonanthe* reproductive traits and fitness and on intensity of seed predation by *Phengaris alcon* in 100 marked individuals in each of 20 study populations during 2010 and 2011. The butterfly seed predator *P. alcon* was present in 11 of the study populations and absent from 9. The study populations were located in bogs, pastures, lake shores and wet meadows in the county of Västra Götaland (SW Sweden). We present here an overview of 4 of the study populations: Högsjön (top left), Tånga hed (top right), Remmene skjutfält (bottom left) and Kalvsjön (bottom right). Photos by Alicia Valdés.

162x112mm (300 x 300 DPI)



Photo 3: The Lycaenid butterfly *Phengaris alcon* (top right) and its two hosts: the marsh gentian (*Gentiana pneumonanthe*, left), which feeds caterpillars until their fourth instar, and *Myrmica* ants (bottom right), which adopt caterpillars into their nests, where they complete their development and pupate. Adult females of *P. alcon* fly on July-August and lay eggs on young buds of the marsh gentian (visible as white dots). We used the number of eggs per plant as a measure of the intensity of seed predation. We estimated ant abundance in each study population using transects of sugar-cube baits, and found that the probability of *P. alcon* presence increased with increasing abundance of *Myrmica* ants in the population. Photos by Alicia Valdés.

193x151mm (300 x 300 DPI)

