Optimal foraging at small scales: deciphering the intra-plant foraging pattern of an herbivorous insect

Gaëtan Seimandi Corda , Kathleen Menacer , David Renaud , Marie Trabalon , Guillaume Audo , Eloïse Couthouis , Jérôme Ollivier , Sébastien Faure , Anne Marie Cortesero , and Maxime Hervé*†[1]

[1]Institut de Génétique, Environnement et Protection des Plantes (IGEPP) – Institut National de la Recherche Agronomique : UMR1349, Universite de Rennes 1 : UMR1349 – Domaine de la Motte au Vicomte BP 3532735653 Le Rheu, France

Abstract

According to the optimal foraging theory, diet selection by herbivorous insects should result from a trade-off between costs and benefits associated with feeding. Costs include energy loss during resource location and handling, as well as negative effects due to plant defenses. Benefits are nutrient and energy gains. Optimization of food choice by balancing nutrient intake while minimizing toxicity from defense compounds has been studied for many years, especially in the framework of diet mixing between different plant species. However, both nutrients, defenses and morphological characteristics are known to vary also within a plant, for example, depending on organ age. The optimal foraging theory is then as much relevant to understand intra-plant foraging strategies of herbivorous insects. We applied these concepts to the pollen beetle (*Brassicogethes aeneus*), a florivorous insect that feeds on pollen of many plant species including oilseed rape (*Brassica napus*). Prior to blossoming when pollen is only accessible by piercing flower buds, this insect shows a stereotypic intra-inflorescence pattern of resource exploitation. Indeed, the youngest (i.e., smallest) buds are almost systematically preferred over older buds. We tried to decipher the bases of such foraging behavior in a series of experiments focusing each on an important variable predicted by the optimal foraging theory: resource availability, resource accessibility, nutrient content, defense level and energy gain. Our results show interesting interactions between these variables.

*Speaker

†Corresponding author: maxime.herve@univ-rennes1.fr