

PCR-based gut content analysis in *Harmonia axyridis*

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Intraguild predation (IGP) among ladybird species has been shown on several occasions (Agarwala and Dixon, 1992; Yasuda and Shinya, 1997). *Harmonia axyridis* is a voracious insect predator capable of devouring other ladybirds in experimental settings such as Petri dish arenas and field cages (Yasuda *et al.*, 2004; Ware and Majerus, 2008). IGP is thus believed to be a key factor in the invasion success of *H. axyridis*. First, *H. axyridis* can eliminate competitors by IGP. Second, the consumption of intraguild species might contribute substantially to the diet for the larvae of *H. axyridis* (Snyder *et al.*, 2004). However, field observations of IGP remain scarce. Qualitative and quantitative data on intra-specific interactions among coccinellids are crucial to assess the importance of IGP in the apparent reduction of native ladybird populations observed in many parts of the world. Ecological data, experimental assays and chemical analyses showed that the species most at risk in Switzerland are *Adalia bipunctata*, *Adalia decempunctata*, *Calvia decemguttata* and *Oenopia conglobata* (Kenis *et al.*, 2010).

Harmonia axyridis, *Adalia bipunctata* and *A. decempunctata* have similar habitat preferences (Adriaens *et al.*, 2007). Laboratory competition experiments have shown that both *Adalia* species rarely survive an encounter with *H. axyridis* in a Petri dish. However, the occurrence of IGP in the field remains to be demonstrated and quantified. Recently, a gut-content analysis technique based on the detection of exogenous alkaloids by GC-MS was developed and used to evaluate IGP of *H. axyridis* (Hautier *et al.*, 2008). The technique was successfully applied to detect IGP in the field (Hautier *et al.*, 2010). However, it failed to distinguish the two congeneric *Adalia* species.

In this study, we are developing molecular tools capable of a) detecting ladybird remains in the gut of *H. axyridis*, b) identifying the ladybird remains to species level and c) evaluating the importance of IGP at the ladybird community level in natural conditions.

We used published cytochrome oxidase I (COI) sequence information of *A. bipunctata*, *A. decempunctata*, and *H. axyridis* to design species –specific primers. The amplified region consists of a short section (ca. 100 bp) of the COI gene. We are developing a series of experiments and tests, confirming specificity, applicability and usefulness of the method. Digestion curves (evolution of detectability over time) will be elaborated for the four endangered species, analyzing the gut content of *H. axyridis* larvae having preyed upon coccinellids at defined time points after ingestion.

We believe that the molecular gut-content barcode system applied to *H. axyridis* will reveal previously unseen aspects of IGP in ladybird communities, shed light on the invasion success of *H. axyridis* and provide valuable information on the potential of such molecular tools for the development of comprehensive environmental risk assessment procedures.

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