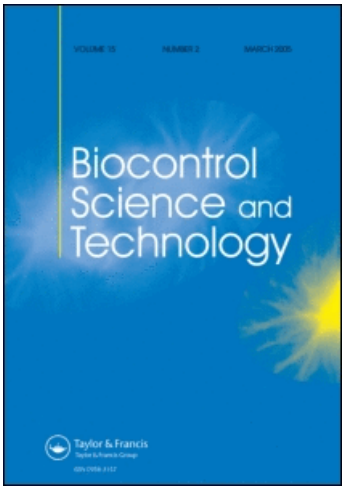

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SHORT COMMUNICATION

Feeding by the coccinellid *Psyllobora rufosignata* (Coleoptera: Coccinellidae) on the Asian grapevine leaf rust fungus *Phakopsora euvitis* (Basidiomycota: Uredinales)

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Feeding by the coccinellid *Psyllobora rufosignata* on the rust fungus *Phakopsora euvitis* was confirmed by observing uredospores of *P. euvitis* in gut contents of *Ps. rufosignata*. This is the first record of *Ps. rufosignata* feeding on *P. euvitis* and the first record of any Halyziini species feeding on any species of Basidiomycota.

Keywords: Coccinellidae: Halyziini; mycophagy; beneficial insect; natural enemy; biological control; biodiversity

Many beetles of the family Coccinellidae are well known as beneficial predators of pest insects. However, mycophagy may be common, though little known or studied, among predatory coccinellids (Triltsch 1999), and coccinellids of the tribe Halyziini are obligate mycophages that have been recorded feeding on a variety of powdery mildew species (Ascomycota: Erysiphales) infecting various species of plants worldwide (Sutherland and Parrella 2009).

In April 2010, large numbers of beetles that appeared to be coccinellids were observed on leaves of grape, *Vitis vinifera* L., infected with the Asian grapevine leaf rust fungus *Phakopsora euvitis* Ono (Basidiomycota: Uredinales) in a vineyard in Santa Teresa, Espírito Santo, Brazil. Therefore this study was conducted to verify the identity of the beetle observed and determine if it was feeding on the rust fungus with which it was associated.

A sample of grape leaves infested with coccinellids and infected with rust fungus was collected on 24 April 2010 from a commercial vineyard (0.6 ha) in the municipality of Santa Teresa, Espírito Santo (19°54′ S, 40°30′ W). The sample consisted of about eight, 20cm long pieces of grape vine with leaves, with coccinellids and rust fungus present on the leaves (53 leaves total), sampled randomly from three locations in the vineyard. The sample was collected near the time of fruit harvest and rust was present on approximately 90% of leaves but powdery mildew and other pests such as aphids did not appear to be present in the vineyard (P.C. Cani, Espírito Santo State Department of Agriculture, personal communication). The sample was

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enclosed in a plastic bag and transported to Vitória to identify and study the insect and fungus. During the initial examination of the sample on 30 April 2010, about 13 adult beetles were removed individually with a forceps from the sample and preserved in 90% ethanol. The remainder of the sample was then stored in a refrigerator (5°C) for approximately 2 weeks until it could be examined completely for additional beetles present, which were also removed (as described above) and stored in ethanol. Three larvae and three adult specimens that had been preserved in ethanol were examined to determine if fungal spores were present in their gut contents. The insects were rinsed in a solution of water and detergent and then dissected in alcohol under a dissecting microscope (Motic SMZ-143) to expose the alimentary canal and other internal organs which were placed in lactic acid on depression slides, and then examined for ingested food remains with a compound microscope (Kyowa 745139) at a magnification of 400×.

A total of 26 coccinellid adults, 15 pupae and 20 larvae were collected from the sample of grape leaves, and few other arthropods were present in the sample (one spider and a scale insect were observed). The coccinellids were identified as *Psyllobora rufosignata* Mulsant and the fungus observed on the grape leaves was identified as *Phakopsora euvitis* based on Ono (2000). Uredospores of *P. euvitis* were observed in gut contents of one larva and all three of the adult *Ps. rufosignata* examined (Figure 1) in masses of approximately 50 to hundreds of spores. Fungal spores and other food remains were not apparent in gut contents of two of the three larvae examined possibly because the larvae were about to moult or stopped feeding while they were stored under refrigerated conditions before they were preserved in ethanol and dissected. No other food remains could be identified in the gut contents of the adults and larvae examined.

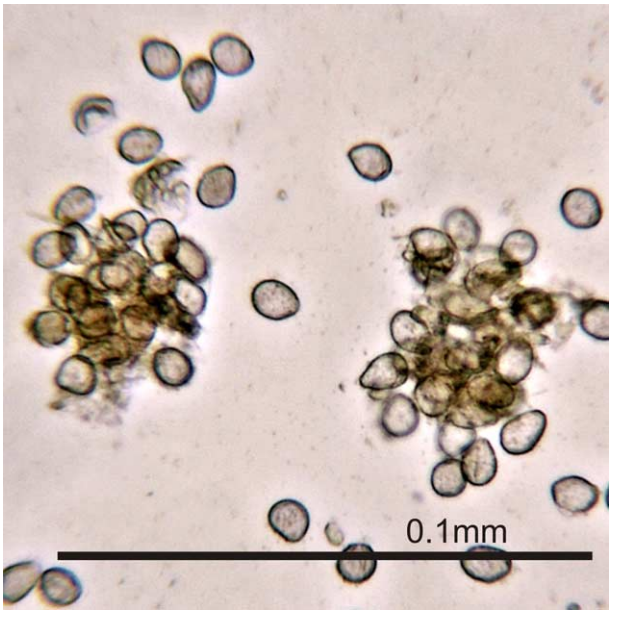

Figure 1. *Phakopsora euvitis* uredospores from the gut of a *Psyllobora rufosignata* adult collected from a grape leaf infected with the Asian grapevine leaf rust fungus.

Psyllobora rufosignata belongs to the tribe Halyziini, members of which have been considered to be obligate mycophages specializing on powdery mildew fungi, and which until recently, have not been reported to feed on fungi from any order other than Erysiphales (Sutherland and Parrella 2009). Recently however, Kumar, Mittal, Patankar, and Ramamurthy (2010) reported that *Ps. bisoctonotata* feeds on Capnodiales and Pleosporales species in addition to Erysiphales.

This is the first record of *Ps. rufosignata* feeding on *P. euvitis*, and as such, it is also the first record of any species of Halyziini feeding on any species of Basidiomycota. Results of this study are also of significance because they indicate that *Ps. rufosignata* may influence plant pathogen dynamics and biological control of *P. euvitis*.

Although feeding by Halyziini on rust fungi has not previously been reported, other coccinellid species are known to feed on various types of fungi. Observations that *Coccinella septempunctata* L., a well known aphid predator, feeds on uredospores of *Puccinia* spp. were reported by Triltsch (1999), who also noted the lack of knowledge of the food relations of coccinellids and the need for additional research to better understand the importance of such feeding. Observations of Ricci and Ponti (2005) also indicate that feeding by predatory coccinellids on fungi may be common.

Ps. rufosignata and other *Psyllobora* Chevrolat species are widespread in Brazil (Almeida 1987) and Halyziini occur world-wide, but knowledge of the biology of this group is limited to about 26 studies published in the past 117 years (Sutherland and Parrella 2009). The genus *Psyllobora* is important in natural and managed systems and may be useful for biological control of powdery mildew (Cruz, Gonzalez-Avila, and Soto 1989; Almeida and Milleo, 1998; Cividanes, Cividanes, and Matos 2007). Because *P. euvitis* is a serious pest of grapes (Chatasiri and Ono 2008) and other rusts are major crop pests throughout the world, and because information on fungal feeding by coccinellids is lacking, results of this study confirm that additional research to determine the impact of *Ps. rufosignata* and other coccinellids on plant pathogenic fungi is warranted to better understand the ecological significance and biological control potential of these insects.

Sutherland and Parrella (2009) noted that the lack of research on coccinellids of the tribe Halyziini is especially difficult to explain because it is a cosmopolitan taxon whose members are obligate mycophages that feed on highly visible and important plant pathogens. However, such research is likely to depend greatly on interdisciplinary cooperation and collaboration (between entomologists, phytopathologists, and taxonomists, etc.), and a better understanding of Halyziini and similar species (i.e., much of the rest of the worlds largely unknown biological diversity) may best be obtained by greater recognition of the importance of such cooperation and collaboration, as well as support to enable it.

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