

**FEEDING PREFERENCES OF APHIDOPHAGOUS COCCINELLIDS (COLEOPTERA:
COCCINELLIDAE) BY ALFALFA APHIDS (HEMIPTERA: APHIDIDAE) IN
LABORATORY**

Suzan Beatriz Zambon da Cunha¹, Carlos Roberto Sousa e Silva¹

¹Universidade Federal de São Carlos, São Carlos, SP, Brasil. E-mail: suzanbio@yahoo.com.br, dcrs@ufscar.br

ABSTRACT

This paper deals with the feeding preferences of *Cycloneda sanguinea*, *Harmonia axyridis* and *Hippodamia convergens* (Coleoptera: Coccinellidae) by the alfalfa aphids *Acyrtosiphon pisum*, *Aphis craccivora* and *Therioaphis maculata*, in laboratory. One observed that the predators selected the prey for they did not consume the first aphid species found. The results of the Ivlev Electivity Index indicated that most of the coccinellids showed a preference for *Aphis craccivora*.

Keywords: *Medicago sativa*, ladybugs, predators

**SELETIVIDADE ALIMENTAR DE COCCINELÍDEOS (COLEOPTERA:
COCCINELLIDAE) POR AFÍDEOS (HEMIPTERA: APHIDOIDEA) PRAGAS DA
ALFAFA**

RESUMO

Verificou-se em laboratório se há seletividade alimentar das espécies *Cycloneda sanguinea*, *Harmonia axyridis* e *Hippodamia convergens* pelos afídeos *Acyrtosiphum. pisum*, *Aphis craccivora* e *Therioaphis maculata*, pragas da cultura de alfafa. Observou-se que os predadores selecionaram a presa, não consumindo a primeira espécie de afídeo encontrada. Os resultados dos cálculos do Índice de Eletividade de Ivlev, revelaram que a maioria dos coccinélídeos testados demonstrou preferência por *Aphis craccivora*.

Palavras-chave: *Medicago sativa*, joaninhas, predadores

INTRODUCTION

The aphids (Hemiptera: Aphidoidea) are considered the most important economic pests of alfalfa (*Medicago sativa* L.) crops, for they generally occur in high population levels. They have direct action, by sucking the plant sap, and indirect action by inoculating virus into de alfalfa plants. Associated to the aphid colonies one finds many predator species namely the coccinellids. Although there is no exclusively aphidophagous species among the Coccinellidae (SARAN et al 2007), some species present a high preference for aphids, such as *Cycloneda*, *Harmonia* and *Hippodamia* (GIORGI et al., 2009). Because *Hippodamia convergens* maintains the aphid population under control in California, this motivates its introduction in many countries, including Brazil, to be used in programs of biological control (KATO et al., 1999). This species is also referred in Argentina as an efficient agent of aphid control in alfalfa crops (ARAGON, 1990 according to SOUSA-SILVA et al., 1998). *Harmonia axyridis* is an Asian species, introduced in Brazil in 2002, in the state of Paraná, where it was observed feeding on aphid pests of *Pinus*. This species is considered a predator of aphids, psyllids and coccids and worldly used in biological control programs (ALMEIDA & SILVA, 2002). In Japan, the species is one of the main aphid predators in alfalfa crops (RAKSHANI et al., 2009). Although the introduction of *H. axyridis* is registered for more than 10 years ago, there are few information about its biology and feeding preference (SANTOS et al., 2009). *Cycloneda sanguinea*, *Harmonia axyridis* and *Hippodamia convergens* are species commonly found in high numbers in alfalfa crops. In São Carlos, State of São Paulo, they are easily collected in alfalfa fields, preying the aphids *Acyrtosiphon pisum*, *Aphis craccivora* and *Therioaphis maculata* (SOUSA- SILVA et al., 1998). Therefore, the objective of this research was to verify, in laboratory, if there is any feeding selectivity of the species *Cycloneda. sanguinea*, *Harmonia axyridis* and *Hippodamia. convergens* concerning the aphids *Acyrtosiphum pisum*, *Aphis. craccivora* and *Therioaphis maculata*.

MATERIAL AND METHODS

Coccinellids and aphids used in the feeding selectivity tests were collected in alfalfa fields, cultivar Crioula, in the “Unidade da Embrapa Pecuária Sudeste – CPPSE”, in the region of São Carlos, State of São Paulo, Brazil.

The experiment was carried out at the Laboratory of Applied Entomology, Department of Ecology and Evolutive Biology, University of São Carlos, in São Carlos, State of São Paulo, Brazil, at room temperature (27° C), 65% of relative humidity and 12-hours photophase.

The tests were done with chance of choice in a completely randomized experimental design with three treatments and 50 replications per treatment. In each treatment, one species of coccinellid and four adults of each aphid species, totalizing 12 aphids, were used. The coccinellids were kept in fasting for 48 hours before beginning the tests and the parameters used for observation, analysis and interpretation of the obtained data were: searching for the prey, species initially consumed and total number of specimens of each prey species consumed. In petri dish containing only one coccinellid one added 12 adult aphids, being four of each aphid species. Two hours after the beginning of the tests the remaining food material was registered and afterwards one calculated the Ivlev Electivity Index (KREBS, 1989) to see if there was or there was not preference for the offered material.

The index was calculated according to the model:

$$IEI = (ri - ni) / (ri + ni) \text{ where:}$$

EI = electivity index for the prey I

ri = relative abundance of each item consumed

ni = relative abundance of each item in the environment

The values of the index may vary between 0 and +1.0 conditioning prey preference or positive selection, and between -1.0 and 00 conditioning prey rejection or absence of selection. Results of 0 value condition neutrality.

RESULTS AND DISCUSSION

The evaluations to determine which aphid species was firstly consumed by the predators indicated that most of the three coccinellids species selected *A.craccivora*

From the tested coccinellids, 56.7% of *C.sanguinea*, 61.8% of *Harmonia axyridis*, and 50.1% of *Hippodamia convergens* firstly consumed *A.craccivora*, while *A.pisum* was firstly consumed by 25% of *C.sanguinea*, 16.6% of *H.axyridis*, and 33,3% of *H.convergens*. On the other hand, *T.trifolli* was first consumed by only 18.3% of *C.sanguinea*, 21.6% of *H.axyridis*, and 16.6% of *H.convergens*.

**FEEDING PREFERENCES OF APHIDOPHAGOUS COCCINELLIDS (COLEOPTERA:
COCCINELLIDAE) BY ALFALFA APHIDS (HEMIPTERA: APHIDIDAE) IN LABORATORY**

The results of the Ivlev Electivity Index for the 50 specimens of each coccinellid species indicated that: for *C.sanguinea* seven were neutral, one preferred *T.trifolii*, and 42 preferred *A.craccivora*; for *H.axyridis*, five were neutral, one preferred *A.pisum*, and 44 preferred *A.craccivora*; for *H.convergens*, five were neutral, one preferred preferred, *T.trifolii* and 44 preferred *A.craccivora*. One calculated the mean of the Ivlev Electivity Index for the preys *A.craccivora*, *A.pisum* and *T.trifolii* (Table 1).

Table 1. Mean of the Ivlev Electivity Index for the preys *A.craccivora*, *A.pisum* and *T.trifolii* consumed in laboratory by *C. sanguinea*, *H. axyridis* and *H. convergens*. Positive values condition preference or positive selection, while negative values condition rejection or absence of prey selection by the predator

Predator	Mean of the Ivlev Electivity Index of the preys		
	<i>A. craccivora</i>	<i>A. pisum</i>	<i>T. trifolii</i>
<i>C. sanguinea</i>	+ 0,22	- 0,35	- 0,17
<i>H. axyridis</i>	+ 0,22	- 0,35	- 0,25
<i>H. convergens</i>	+ 0,20	- 0,33	- 0,15

CONCLUSION

The coccinellids *C. sanguinea*, *H. axyridis* and *H. convergens* showed preference for *A. craccivora* when one considers the other alfalfa aphids.

ACKNOWLEDGEMENT

To the “Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq)” for the financial support.

REFERENCES

- ALMEIDA, L.M.; SILVA, V.B. 2002. Primeiro registro de *Harmonia axyridis* (Pallas) (Coleoptera: Coccinellidae): um coccinélídeo originário da região paleártica. **Revista Brasileira de Zoologia**, Curitiba, v.19, n.3, p. 941-944.
- GIORGI, J.A.; VANDENBERG, N.J.; MCHUNG, J.V.; FORRESTER, J.A.; SLIPINSKI, A.; MILLER, K.B.; SHAPIRO, L.R.; WHITING, M.F. 2009. The evolution of food preferences in coccinellidae. **Biological Control**, Netherlands, v.51, p. 215-231.
- KATO, C. M.; BUENO, V. H. P.; MORAIS, J. C.; AUAD, A. M. 1999. Criação de *Hippodamia convergens* Guérin-meneville (Coleoptera: Coccinellidae) em ovos de *Anagasta kuehniella* (Zeller) (Lepidoptera: Pyralidae). **Anais da Sociedade Entomológica do Brasil**, Londrina, v. 28, n. 3, p. 455-459.
- KREBS, C. J. 1989. **Ecological Methodology**. New York, Harper Collins Publishers. 654p.

- RAKSHANI, H.; EBADI, R.; MAHAMMADI, A. A. 2009. Population dynamics of alfalfa aphids and their natural enemies, Isfahan, Iran. **Journal of Agricultural Science and Technology**, Tehran v.11, p. 505-520.
- SARAN, E.D.; THOMAZONI, D.; SERRA, A.P.; DEGRANDE, P. 2007. **Manual dos insetos benéficos do algodoeiro**. FMC- Química do Brasil- Campinas, v.1, 227p.
- SANTOS, N.R.P; SANTOS-CIVIDANES, T.M.; CIVIDANES F.J.; ANJOS, A.C.R; OLIVEIRA, L.V.L. 2009. Aspectos biológicos de *Harmonia axyridis* alimentada com duas espécies de presas e predação intraguildd com *Eriopis connexa*. **Pesquisa Agropecuária Brasileira**, Brasília, v. 44, n.6, p 554-560.
- SOUSA-SILVA, C. R.; PACHECO, J. M.; RASSINI, J. B.; ILHARCO, F. A. 1998. Afídeos da alfafa no Brasil (Homoptera, Aphidoidea). **Revista Brasileira de Entomologia**, Curitiba, v.41, n.2-4 p. 285-288.

Recebido em: 14/01/2016
Aceito para publicação em: 8/5/2017