Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2019; 7(2): 1082-1084

Received: 14-01-2019
Accepted: 18-02-2019

Sabrine Attia
1. LR14AGR02 of Bio-aggressors and Integrated Pest Management in Agriculture. National Institute of Agronomy of Tunisia. 1082 Cité Mahrajène, Carthage University, Tunisia
2. High Agronomic Institute of Chott Mariem. Sousse. Tunisia

Salma Bouker
LR14AGR02 of Bio-Aggressors and Integrated Pest Management in Agriculture. National Institute of Agronomy of Tunisia. 1082 Cité Mahrajène, Carthage University, Tunisia

Kaouthar Grissa Lebdi
Citrus Technical Center, Plant protection service, Beni Khalled, Tunisia

Monia Kamel Ben Halima
LR14AGR02 of Bio-Aggressors and Integrated Pest Management in Agriculture. National Institute of Agronomy of Tunisia. 1082 Cité Mahrajène, Carthage University, Tunisia

Correspondence
Sabrine Attia
1. LR14AGR02 of Bio-aggressors and Integrated Pest Management in Agriculture. National Institute of Agronomy of Tunisia. 1082 Cité Mahrajène, Carthage University, Tunisia
2. High Agronomic Institute of Chott Mariem. Sousse. Tunisia

Behaviour of the aphid parasitoids *Aphidius colemani* and *Lysiphlebus testaceipes* (Hymenoptera: Braconidae) in response to *Aphis gossypii* (Hemiptera: Aphididae)

Sabrine Attia, Salma Bouker, Kaouthar Grissa Lebdi and Monia Kamel Ben Halima

Abstract
The aim of this work was to examine whether the aphid *Aphis gossypii* (Hemiptera: Aphididae) affected the foraging strategy of two insect parasitoids Hymenoptera *Aphidius colemani* and *Lysiphlebus testaceipes* (Hymenoptera: Braconidae) by comparing wasp behaviour in the presence of the same species of aphid.
In this study, the number of antennal contacts and ovipositor insertions on aphids, as well as patch residence time, were recorded. We thus expected that the behaviour of these two parasitoids should be different. Our results showed there is no significant difference in the number of antennal contacts, ovipositor insertions and residence time per aphid between the two species of parasitoids *L. testaceipes* and *A. colemani*. No difference in host selection strategy may be explained primarily by the developmental stage and the detectability of the host associated cues.

Keywords: *Aphidius colemani, Lysiphlebus testaceipes, Aphis gossypii, behavior, residence time*

Introduction
Aphids such as *Aphis gossypii* Glover (Hemiptera: Aphididae) cause yield losses by sucking the sap of vegetable crops. It has a very wide host range, about 700 host plants worldwide [1] including vegetables such as cantaloupe, melon, watermelon, cucumber, pepper, asparagus, eggplant, cotton, citrus and weeds such as milkweed, jimsonweed, pigweed and plantain [2]. Since aphid populations can quickly increase, synthetic pesticides are currently used to control these pests. To date, many synthetic pesticides are effective for control of aphids in vegetable crops such as Malathion, Bifenthrine, Permethrin and Acetamiprid etc. [2]. However, the excessive use of pesticides makes aphids prone to develop resistance towards many active ingredients.
In this way, it is compulsory to find a new alternative method to overcome the negative effect of synthetic pesticides uses against aphids without the use of chemical products. Biological control by the use of natural enemies such as hymenopterous wasps: *Aphidius colemani* and *Lysiphlebus testaceipes* wasps (Hymenoptera: Braconidae) seems to be a good alternative to control pests and play an important role in regulating populations of *A. gossypii.* They have a least harmful effects to beneficial insects, and high selectivity for the target pest [3, 4].
For instance, hymenopterous wasps exploiting host colonies need to decide which colony to exploit, which host to descriminate, and how long to stay in the aphid colony in order to maximize its fitness.
Our aim in this study was to examine whether the aphid *Aphis gossypii* (Homoptera: Aphididae) affected the foraging strategy of *Aphidius colemani* and *Lysiphlebus testaceipes* (Hymenoptera: Braconidae) by comparing the number of antennal contact, oviposition insertion and the patch-leaving decision rules of *L. testaceipes* and *A. colemani* in the aphid colony of *A. gossypii.*

Materials and Methods
Study organisms
All the experiments were performed with *Aphidius colemani* and *Lysiphlebus testaceipes*

wasps (Hymenoptera: Braconidae). These parasitoids were reared on *R. padi*. Strain using synchronized larvae L3.

Colonies of *A. ervi*, *L. testatceipes*, *R. padi* and *A. gossypi* were maintained on cucumber and barley plants at 19.5±0.6 °C, 40-50% RH, under a 16L:8 D photoperiod in the laboratory of Entomology in High Agronomic Institute of Chott Mariem.

2. Behavioural responses of parasitoids and patch residence time

In this experiment, we investigated the behaviour of two parasitoids Hymenoptera *L. testaceipes* and *A. colemani* in aphid colony of *A. gossypii*. In that purpose, a piece (25 X 25 mm) of cucumber leaf was placed in a 15-cm diameter glass petri dish and a 9-cm diameter circle was drawn with red ink around the cucumber leaf. This was considered the experimental patch limit.

Thirty L3 individuals of *A. gossypii* with the same clone were placed on the cucumber leaf. Assays were conducted separately for each wasp using one fed and mated 24-h-old female parasitoid. The number of antennal contacts and ovipositor insertions on aphids, as well as patch residence time, were recorded.

A parasitoid was considered to have left a patch when it remained outside of the patch limit (the red line) for more than 60 sec [5].

All plants used for rearing insects and experiments were grown in a glasshouse at the high agronomic institute of chott mariem.

3. Statistical analyses

Test-t was used to compare means using Graph Pad Prism v.5.01 for Windows (Graph Pad Software, San Diego, CA, http://www.graphPad.com). All tests were applied under the two-tailed hypothesis, with the level of statistical significance P set at 0.05 and the normality was verified.

Results and Discussion

Behavioural responses of L. testaceipes* and *A. colemani and patch residence time

As shown in figures 1, 2 and 3 there is no significant difference in the number of antennal contacts (P=0.558; U=158.5), ovipositor insertions (P=0.644; F=130) (figure 1), and residence time per aphid (P=0.170; F=130) between the two parasitoids *L. testaceipes* and *A. colemani* exploiting host colonies of *A. gossypii* (figure 2).

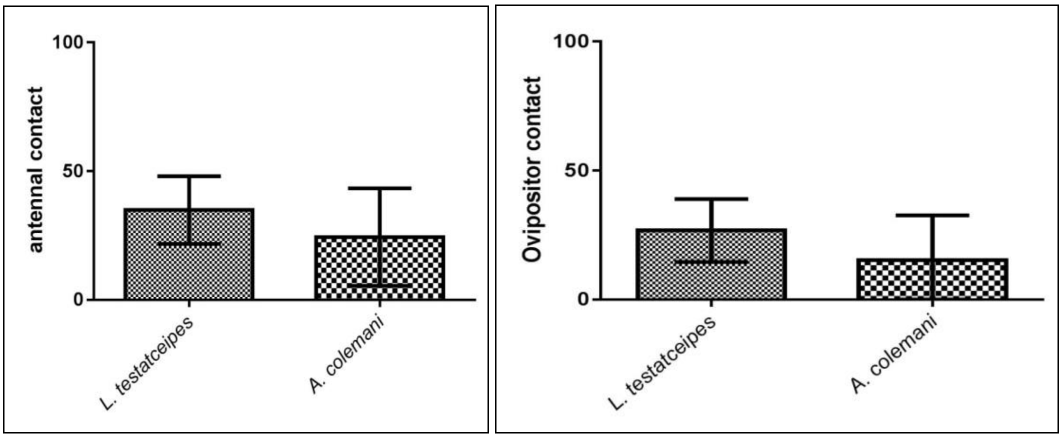

Fig 1: Means (±SEM) of antennal contacts and ovipositor insertions performed by *L. testaceipes* and *A. colemani* on *A. gossypi*

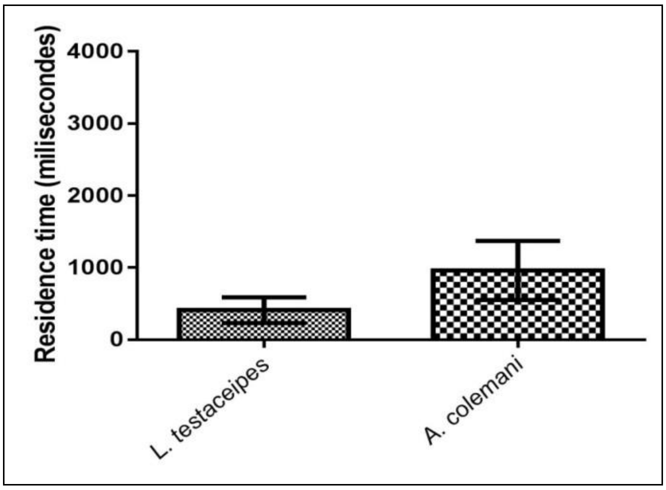

Fig 2: Means (±SEM) of the patch-leaving decision rules of *L. testaceipes* and *A. colemani* on *A. gossypi*

Although more information is now available on how natural enemies makes patch-departure decisions from various types of host patches.

We showed here, that the parasitoids *L. testaceipes* and *A. colemani* appears to detect aphids in the same way. Moreover, an increase in the patch-leaving tendency suggests the parasitoids were capable of assessing a low quality patch.

Recently, Moiroux *et al*. [6] showed that the residence time of *A. colemani* depend on temperature and patch composition. In onother study, Lombaert [7] showed that the exploitation of aphid colonies by the parasitoid *L. testaceipes* depend on host species and its age. In the same type of idea, Boivin *et al*. showed that the residence time of female parasitoid *Anaphes victus* (Hymenoptera: Mymaridae) varies according, the aphid species, the age of the host, the parasitism status and the time spent in travel between colonies [8].

L. testaceipes and *A. colemani* were shown to adjust their patch residence time according to the quality and aphid species.

These results indicate that aphid species may play an important role in mediating interactions between *A. gossypii* and their natural enemies *L. testaceipes* and *A. colemani*. Wasps recognize aphids after antennal contact. Infact, the sensorial organs used by wasps to locate their hosts are present on their antennae where chemosensory, mechanosensory and thermo-hygroreceptive sensilla have been studied by Quicke (1997) [9] and Van Baaren *et al*. [10]. These authors underlined that the variety of these olfactory based on the life history of both the wasp and the aphid [10].

This is mediated by aphids producing a contact pheromone. Some authors reported that parasitoids use aphid semiochemicals to discriminate between different aphid species [11]. So, we conclude that semiochemicals are probably the key stimulus inducing oviposition behavior in our study. However, composition of these molecules vary depend on aphid species and quality of the host plant [12]. Many studies showed that aphids engage in intimate interactions with endosymbionts that range in type of association [13]. However, there is a lack of knowledge about strategies used by parasitoids at the patch level when faced with some hosts harbouring bacteria [13-15]. Further studies must be done in order to examine the presence of these bacteria in aphids and especially in *A. gossypii* and understand if these symbionts could affected the foraging strategy of *A. colemani* and *L. testaceipes* wasps (Hymenoptera: Braconidae).

References

1. Capinera JL. Handbook of Vegetable Pests. Academic Press, San Diego, 2001, 729.
2. Cannon C, Bunn B, Petrizzo E, Alston D, Murray M. Aphid Pests on Vegetables. UPPDL, 5305 Old Main Hill, Logan UT 84322, utahpests.usu.edu. 2017, 9.
3. Ganyo KK, Tounou AK, Agboton C, Dannon EA, Pittendrigh BR, Tamo M. Interaction between the aphid parasitoid *Lysiphlebus testaceipes* (Hymenoptera: Aphidiidae) and its hyperparasitoid *Syrphophagus africanus* (Hymenoptera: Encyrtidae). International Journal of Tropical Insect Science. 2012; 32(1):45-55.
4. Zamora-Mejías D, Hanson P. Trophic Relationships of Aphid Hyperparasitoids (Hymenoptera) in Costa Rica. Journal of entomological research society. 2016; 18(3):35-44.
5. Wajnberg E, Rosi MC, Colazza S. Genetic variation in patch time allocation in a parasitic wasp. Journal of Animal Ecology. 1999; 68(1):121-133.
6. Moiroux J, Abram PK, Louâpre P, Barrette M, Brodeur J, Boivin G. Influence of temperature on patch residence time in parasitoids: physiological and behavioral mechanisms. Naturwissenschaften. 2016; 103(3, 4):32.
7. Lombaert E. Mémoire de stage Exploitation des patchs d'hôtes par les parasitoïdes : apprentissage des signaux émis par les plants. Institut de la Recherche Agronomique d'Antibes, 2001.
8. Boivin G, Fauvergue X, Wajnberg Eric. Optimal patch residence time in egg parasitoids: innate versus learned estimate of patch quality. 2003. Oecologia. 2004; 138: 640-647.
9. Quicke DLJ. Parasitic wasps. London: Chapman & Hall. 1997, 470.
10. Joan van Baaren, Guy Boivin, Delphine Bourdais, Olivier Roux. Antennal sensilla of hymenopteran parasitic wasps: variations linked to host exploitation behavior. Modern Research and Educational Topics in Microscopy. A. Méndez-Vilas and J Díaz (Eds.), 2007. ©FORMATEX 2007
11. Muratori F, Hance T, Lognay G. Chemical characterization of cuticular extracts of *Sitobion avenae* (Hemiptera: Aphididae). Physiology Biochemistry and Toxicology. 2008; 101(3):598-603
12. Verheggen FJ, Haubruge E, De Moraes CM, Mescher MC. Social enviroment influences aphid production of alarm pheromone. Behaviour Ecology. 2009; 20(2, 1):283-288.
13. Oliver KM, Noge K, Huang EM, Campos JM, Becerra J X, Hunter MS. Parasitic wasp responses to symbiont-based defense in aphids. BMC Biology, 2012, 10-11.
14. Schmid M, Sieber R, Zimmermann YS, Vorburger C. Development, specificity and sublethal effects of symbiont-conferred resistance to parasitoids in aphids. Functional Ecology. 2012; 26:207-215.
15. Łukasik P, Dawid M, Ferrari J, Godfray HCJ. The diversity and fitness effects of infection with facultative endosymbionts in the grain aphid, *Sitobion avenae*. Oecologia. 2013; 173:985-996.