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PREDOMINANT EFFECTS OF HOST PLANT SPECIES ON *APHIS GOSSYPII* APHID AND *E. PISYRPHUS BALTEATUS* HOVERFLY IN A TRITROPHIC APPROACH

R.N. POLIGUI, E. HAUBRUGE and F. FRANCIS
University of Liege, Gembloux Agro-Bio Tech, Functional and evolutionary Entomology,
Passage de Deportes 2, 5030 Gembloux Belgium

SUMMARY

The aphid *Aphis gossypii* Glover (Homoptera: Aphididae) is known as worldwide important pest. It causes serious injuries to crops, but is also able to feed on various cultivated and wild plants. Some programs are developped to control this aphid. In many studies , hoverfy *Episyrphus balteatus* De Geer (Diptera: Syrphidae) is used as an efficient and aphid specific predator in biological control systems. In this work, we study cotton aphid choice plant discrimination, the effect of host plants on its developpment(fecondity and mortality), and the *E.balteatus* foraging and oviposition behavior according aphid host plants. Biologic parameters were observed using various plant combinations. *E.balteatus* behavioral observations were conducted using the Noldus Observer v.5.0. *A.gossypii* makes discriminant choice of his hosts, with better preference on *Cucurbita pepo* L. (Cucurbitaceae) and *Capsicum annuum* L. (Solanaceae). *Dacryodes edulis* (G. Don) H.J. Lam. (Burseraceae) and *Vicia faba* L. (Fabaceae) are the midle choice while *Hibiscus sabdariffa* L. (Malvaceae) is less chosen. *A.gossypii* develops easily on *C.pepo*, and weakly on *C.anuum*, *H.sabdariffa*,and *V.faba*. *D. edulis* induces very high mortality to *A.gossypii*. According to *E. balteatus* behavior, *A. gossypii* is more attractive when infesting *C .pepo* and *V.faba*, less on *H. sabdariffa*. While non-infested, *V.faba* appeared to be more attractive for the hoverfly, but without significant differnce compared to other plants. Our results highlited the importance of interactions between aphids and their host plants and the prey-host influence on a specific aphid predatory hoverfy. Other ways like melon aphid and its host plant volatils emission ,in correlation with this work, are to investigated to complete this study and perform melon aphid biological control.

Key words: Aphids, Hoverfly, biologic parameters, host plants, prey-host influence, oviposition, biological control.

INTRODUCTION

Aphis gossypii Glover (Homoptera, Aphididae) is a cosmopolitan and polyphagous aphid, commonly called melon or cotton aphid, widely distributed in tropical, subtropical, and temperate regions, except northernmost colder areas (Satar, 1999; Capinera, 2007). In tropical areas A. gossypii occurs in fields, while in temperate zones it attacks vegetables in fields and greenhouses (Blackman *et al*., 1985; Leclant *et al*., 1994). It occurs on a very wide host range that is estimated about 700 throughout the world-wide. It is a serious crops pest on cucurbits, cotton, pepper, Okra, asparagus, hibiscus, citrus and several other plants (Stroyan, 1984). In spite of its wide host range, several studies provided that cotton aphid performance depend of its originating plants and areas (Ekukolé, 1990; Mokhtar and al., 1993; Wool and al., 1997).It is also well provided that distinct genetically forms or host races exist in *A. gossypii*, so that clones from cucumber cannot perform as well on chrysanthemum or in cotton, and vice versa (Guldemand, 1994; Kersting, 1998). The melon aphid damage is induced by sucking nutrients from the host plant. Their feeding can causes direct damage consisting on foliage deformation, chlorosis, and deperishment (Satar, 1999). Indirect dam-

age is about photosynthesis hindering, yield alteration and virus transmission. *A. gossypii* secretes honeydew which serves as substrate for sooty mold growth. This dark fungal layer hind photosynthetic capacity of foliage so that the plant provides poorly its fundamental functions, withers or deperishes. In addition, cotton aphid is a vector of 76 virus diseases in a very large range of its host plants (Chan and al., 1991). It is well known to transmit effectively potyviruses like Cucumber mosaic virus (CMV), watermelon mosaic virus 2 (WMV2) and Citrus tristeza virus (CTV) (Blancard and al., 1991; Ahlawat and al., 1988). Furthermore, non-colonizing melon aphids can transmit viruses to non-host crops; so that insecticides have little effect on virus transmission. According to this pest status, investigations on its natural enemies showed that melon aphid is attacked by ladybirds (Coleoptera: Coccinellidae), syrphids((Diptera: Syrphidae) and braconid wasps (Hymenoptera: Braconidae). *Lysiphlebus testaceips* (Cress) (Hymenoptera: Braconidae) is known to induce up to 99% parasitism (Capinera, 2007). *A. gossypii* colonies are often tended by ants that collect honeydew and eventually protect them from other insects. Management of melon aphids takes in account insecticides use and cultural practices. Because of leaf distortions provide shelter for insects, systemic insecticides are useful, but excessive and unnecessary use of insecticides have both induced elimination of beneficial insects and melon aphid resistance to chlorinated hydrocarbon, organophosphate and pyrethroid insecticides. Cultural practices are focused on destroying overwintering weeds infested and crops after harvest. Time of planting is also of some influence on the potential population of *A. gossypii*. From present knowledge, further and alternative scientific investigations should be made to perform the understanding of relationship between *Aphis gossypii*, its host plants and some natural enemies. In our work, *Cucurbita pepo* L. (Cucurbitaceae), *Capsicum annuum* L. (Solanaceae), *Dacryodes edulis* (G. Don) H.J. Lam. (Burseraceae), *Hibiscus sabdariffa* L. (Malvaceae) and *Vicia faba* L. (Fabaceae) and the aphidophagous hoverfly *Episyrphus balteatus* De Geer (Diptera : Syrphidae) were used to study in more detail their relationship on a tritrophic approach. Thus, the aim of the present study was to determine first the suitability of five distinct host plants species for the choice and the development of *A. gossypii* population, and secondly their effects to the hoverfly foraging behaviour, under constant conditions in the laboratory.

MATERIAL AND METHODS

Plants and insects rearing

Cucurbita pepo L. (Cucurbitaceae), *Capsicum annuum* L. (Solanaceae), (Burseraceae), *Hibiscus sabdariffa* L. (Malvaceae) and *Vicia faba* L. (Fabaceae) were grown in 30 x 20 x 5 cm plastic trays, and *Dacryodes edulis* (G. Don) H.J. Lam on 30 x 20 x 10 ones. Broad beans (*V. faba*) plastic trays were filled with a mix of perlite and vermiculite (1/1), while those of the other plants were filled with a mix of compost, perlite and vermiculite (3:1:1). All plants were maintained in controlled environment growth rooms (16:8 Light:dark; 20 ± 1°C). Melon aphids were provided by INRA Avignon Research Unit for Genetics and Improvement of Fruit and Vegetables (France). *Aphis gossypii* were reared on *Cucurbita pepo* in separate controlled room under same above laboratory conditions. The hoverfly *Episyrphus balteatus* was provided from mass rearings of the Functional and evolutionary Entomology laboratory. The main experiments were on the study of some biological parameters of *A. gossypii*, and the *E. balteatus* foraging behaviour.

Melon aphid experimental observations

Melon aphid host plants choice: In a two-choice experiment, 10 apterous melon aphids were deposited on a plastic disc system placed between two leaves of the different host plants. Ten combinations of host plant couples were tested and repeated three times. The melon aphid's choice was recorded during ten minutes and plant preference was determined.

Melon aphid fecundity and survivorship: Under young leaves of each host plant, ten individuals' melon aphids were studied during fifteen days. Each apterous aphid was confined in leaf cage system so that its offspring and survival time are observed daily. This experiment is repeated three times with distinct host plant samples each time.

Melon aphid population development: Ten apterous melon aphids were infested on each host plant, in a separate rearing net cage. The final aphids' population number was counted fifteen days later. The experiment was repeated three times with new distinct host plants.
Melon aphid adaptation: Aphis gossypii population was placed separately on *Cucurbita pepo*, *Capsicum annuum*, *Hibiscus sabdariffa* and *Vicia faba* for two days of adaptation before their transfer to host plants exposed to the aphidophagous hoverfly *Episyrphus balteatus.*

Hoverfly foraging behaviour

Aphid host plant preference: In a single choice experiment, two to three weeks old females of *Episyrphus balteatus* were placed individually in net cages (30x30x60 cm) with one host plant infested with 100 *A. gossypii* 2 hours before. The experiment was repeated ten times by each *A. gossypii*/host plant combination. The same experiment was carried out with non-infested host plants (control) to compare the melon aphid influence to *E. balteatus*. The hoverfly foraging behaviour was then recorded for 10min using the Observer® software (Noldus information Technology, version 5.0, Wageningen, The Netherlands). Descriptions of four observed behavioural subdivisions are presented in table 1.

Table 1. Description of foraging events of the aphidophagous hoverfly *Episyrphus balteatus* exposed to infested or safe host plants.

Observed behavior	Events	Foraging description
Immobility	Immobility/cage	Predator Immobilized on the cage
Searching	Fly/cage	Predator fly in the cage
	Fly/plant	Predator fly near the plant
Acceptance of host plant	Immobile/plant	Predator landing on the plant
	Walking/plant	Predator moving on the plant
	Dragging proboscis/plant	Predator extends it proboscis on the plant
Oviposition	Immobile abdomen/plant	Predator curve it abdomen without laying
	Dragging abdomen/plant	Predator exhibits an abdominal protraction
	Egg laying	Predator lays eggs on the plant

Statistical analysis

Means were compared using one-way analysis of variance (Anova) and Tukey's test, conducted with Minitab (version 15.2, Minitab® Inc, State College, PA, USA). Observed frequen-

cies related to the apterous aphids' choice were compared and corresponding host plant preference were evaluated using χ^2.

RESULTS

Melon aphid experimental observations

Melon aphid host plants choice

Aphis gossypii was found to make four tendencies on it choice even if no significant difference (p≥0,12) was observed between five host plant dual choice combinations which are *Capsicum annuum/Cucurbita pepo, C. annuum/Vicia faba, Dacryodes edulis/V. faba, D. edulis/Hibiscus sabdariffa* and *H. sabdariffa/C. pepo* (Table 2). The choice was significant (p=0,04) between *D. edulis/C. annuum*, very significant (p=0,01) between *H. sabdariffa/V. faba*, and highly significant (p≤0, 01) for *C. annuum/H. sabdariffa, C. pepo/V. faba* and *D. edulis/C. pepo*.

Table 2. The choice of the melon aphid according to host plants tested

Host plants combinations	Aphids choice by host plant	$\chi 2$	df	p
Capsicum annuum / Cucurbita pepo	13/17	1.07	1	0.30
Capsicum annuum / Vicia faba	17/13	1.07	1	0.30
Dacryodes edulis / Hibiscus sabdariffa	13/17	1.07	1	0.30
Dacryodes edulis / Vicia faba	16/14	0.27	1	0.61
Hibiscus sabdariffa / Cucurbita pepo	12/18	2.40	1	0.12
Dacryodes edulis/ Capsicum annuum	11/19	4.27	1	0.04
Hibiscus sabdariffa/ Vicia faba	10/20	6.67	1	0.01
Capsicum annuum / Hibiscus sabdariffa	25/5	26.70	1	0.00
Cucurbita pepo/ Vicia faba	24/6	21.60	1	0.00
Dacryodes edulis / Cucurbita pepo	8/22	13.07	1	0.00

Compared to individual host plants (figure 1), the melon aphid choice was preferentially high on both *Cucurbita pepo* and *Capsicum annuum*, for respectively 67,5% and 61,67%. Their third better choice was on *Vicia faba* (44, 17%), while *Dacryodes edulis* and *Hibiscus sabdariffa* were both the less preferred, respectively 40,00% and 36,67%.

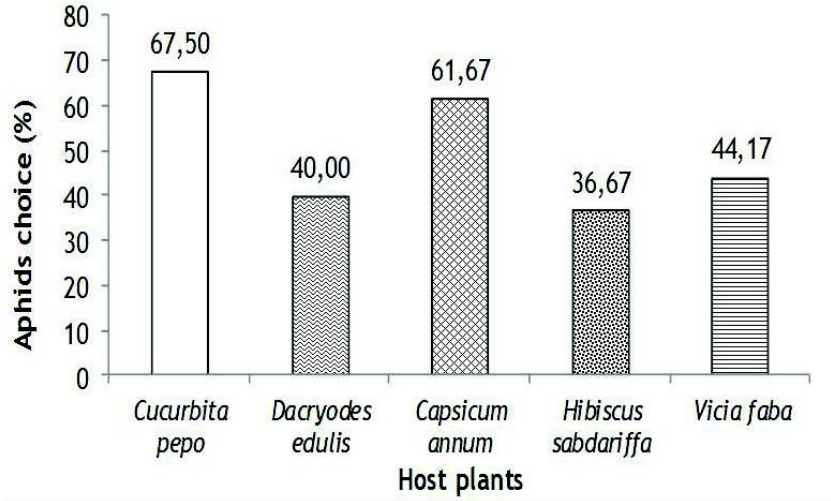

Figure 1. choice and preference of host ants by Aphis gossypii

Melon aphid fecundity and survivorship

Both fecundity and survivorship of the melon aphid were different according to their host plant (Figure 3). The fecundity was higher on *C. pepo* (3,24) and very weak (0,4 to 0,72) on all the other host plants. The survivorship was high on *C. pepo* (12,1), but very weak (1,3 to 2,5) on all the other host plants, with *D. edulis (*1,3) as the host plant inducing fast lethal effect. According to the mortality, *C. pepo* was the only host plant who keeps 60% of living aphids infested 15 days earlier. Three days after host plants infestation, the mortality was at it maximum level (100%) on *D. edulis, C. annuum, H. sabdariffa,* and *V. faba.*

Table 3. Melon aphid fecundity, survivorship and mortality according to host plant species

Host plants	n	Fecundity (offspring/aphid/day)	Survivorship (/15 days)	Mortality (after 15 days)
Cucurbita pepo	10	$3.24^{a}\pm0.30$	$12.1^{a}\pm1.48$	40 %
Dacryodes edulis	10	$0.40^{b}\pm0.40$	$1.30^{b}\pm0.30$	100 %
Capsicum annuum	10	$0.50^{b}\pm0.22$	$2.50^{b}\pm0.43$	100 %
Hibiscus sabdariffa	10	$0.35^{b}\pm0.11$	$2.10^{b}\pm0.10$	100 %
Vicia faba	10	$0.72^{b}\pm0.23$	$2.30^{b}\pm0.45$	100 %

n*: number of aphids tested by repetition (there were 3 repetitions)
ab*: means with different superscriptions in the same column are significantly different($p \geq 0.05$).

Melon aphid population development

As for the choice, the fecundity and the survivorship, after 15 days of simultaneous and separated development was recorded from the obvious infested host plants. *Aphis gossypii* perform very well on *C. pepo*, followed by *H. sabdariffa* and *C. annuum*. *V. faba* does not allow good development and *D. edulis* is the less suitable host plant for having induced the lowest population development of the melon aphids (figure 2).

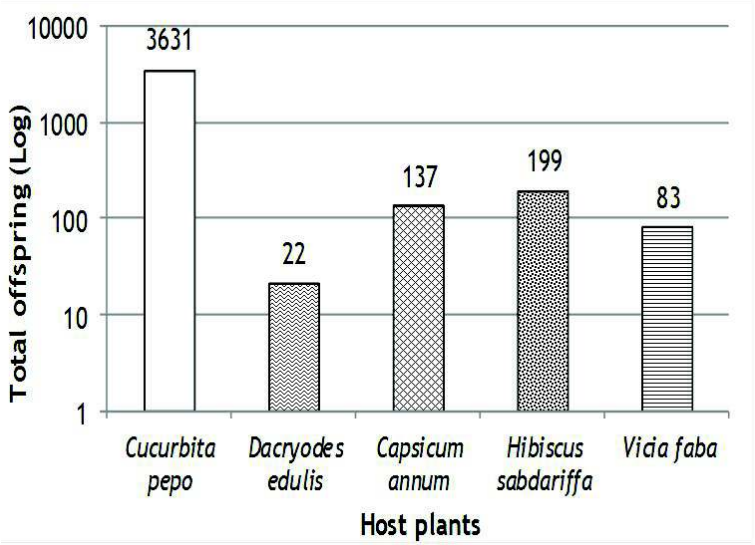

Figure 2. Development of *Aphis gossypii* population according to host plants

Hoverfly foraging behaviour

The above results show that *Dacryodes edulis* was the less suitable for melon aphids. Thus, this host plant was retried and not involved in the study of foraging behaviour of aphidophagous hoverfly. So, face to the four host plants infested by melon aphids, *Episyrphus balteatus* foraging differ according host plants exposed to it.

The foraging behaviour of *E. balteatus* females was clearly influenced by the presence of melon aphids on host plants. In all observed events, the aphidophagous hoverfly displayed significant difference of foraging. It was more active face to the infested plants than to the safe plants (Table 4, figure 3). Face to non-infested host plants, females spent less time in activity so that during 85 to 95% of their foraging potential time, they were in rest position.

Table 4. Mean (±SE) frequencies events of the hoverfly *Episyrphus balteatus* according infested and non-infested host plants.

		Capsicum annuum	*Cucurbita pepo*	*Hibiscus sabdariffa*	*Vicia faba*
Immobility	Infested plants	5.45±2.52	24.20±3.70	50.89±10.95	6.84±4.18
	Safe plants	85.27±5.43	92.13±3.76	88.69±6.86	95.34±1.01
Search	Infested plants	13.46±3.65	53.60±9.00	13.29±4.18	10.84±3.07
	Safe plants	7.9±2.79	7.17±3.52	7.37±3.03	4.66±1.14
Acceptance	Infested plants	57.46±5.68	5.30±1.60	32.40±11.27	58.64±6.50
	Safe plants	4.83±2.94	0.08±0.06	3.56±3.56	0.0±0.00
Oviposition	Infested plants	9.12±2.41	16.90±9.00	3.42±4.18	23.68±6.17
	Safe plants	2.0±1.96	0.08±0.06	0.38±0.38	0.0±0.00

Foraging according infested host plants

The aphidophagous hoverfly immobility in cage

Immobility in cage (figure 3) was highly significant according host infested (F=8.85, p=<0,001). The immobility of hoverflies exposed to the infested *H. sabdariffa* was significantly longer (Tukey's test: t= -3.75, p=0.001) than face to infested *C. pepo* . Compared to it resting time face to infested *C. pepo*, inactivity of *E. balteatus* was greatly significant face to *C. annuum* (Tukey's test: t= -3.30, p=0.011) and face to *Vicia faba* (Tukey's test: t= -3.60, p=0,005). Immobility face to *H. sabdariffa* was greatly significant compared to *C. annuum* (Tukey's test: t= -3.66, p=0.004) and face to *V. faba* (Tukey's test: t= -3.96, p=0,002). There was no significant difference (Tukey's test: t= -0.30, p=0,991) of immobility in cage when the aphidophagous hoverfly is exposed respectively to *C. annuum* and to *V. faba* .

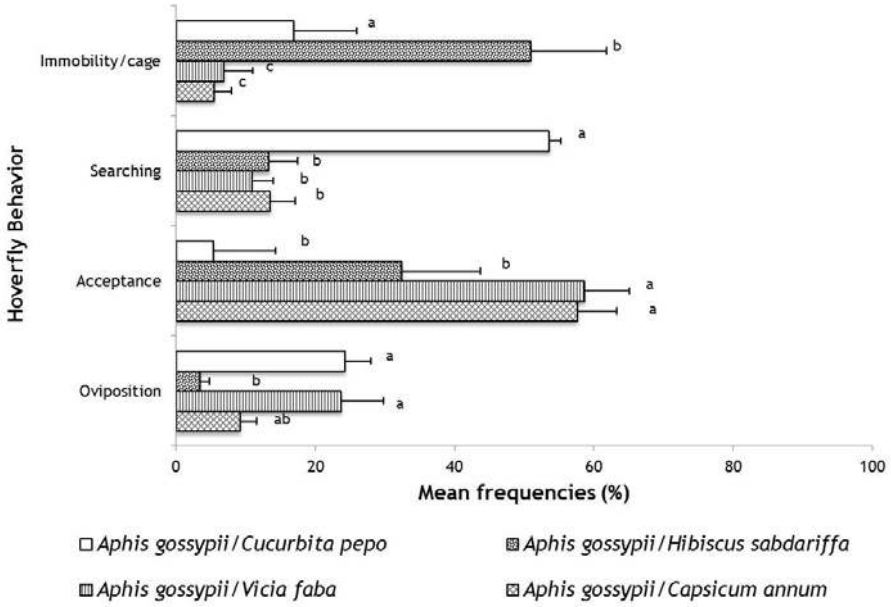

Figure 3. Foraging behaviour of *Episyrphus balteatus* according host plants infested by *Aphis gossypii*. The data with different letters differ significantly (p≤0.05).

The aphidophagous hoverfly searching

Searching was highly significant (figure 3) according host infested (F=6.99, p=0.001). Searching of hoverflies exposed to the infested *C. pepo* was greatly significant compared to *C. annuum* (Tukey's test: t= -3.42, p=0.008), *V. faba* (Tukey's test: t= -3.97, p=0.002), and *H. sabdariffa* (Tukey's test: t= -3.75, p=0.003). There was no significant difference of searching between *H. sabdariffa* compared to *C. annuum* (Tukey's test: t= 0.34, p=0.99) and *V. faba* (Tukey's test: t= -0.21, p=0.99). There was no significant difference of searching (Tukey's test: t= -0.55, p=0.94) between *C. annuum* and *V. faba*.

The aphidophagous hoverfly acceptance of plants

Acceptance was highly significant (figure 3) according host infested (F=14.30, p<0.001). Then, *C. pepo* was highly less preferred to *C. annuum* (Tukey's test: t= 5.45, p<0.001), *V. faba* (Tukey's test: t= 5.45, p<0.001), and *H. sabdariffa* (Tukey's test: t= 3.55, p<0.001). Likely, *H. sabdariffa* was significantly less preferred to *C. annuum* (Tukey's test: t= 3.30, p=0.011) and *V. faba* (Tukey's test: t= 3.30, p=0.011). There was no significant difference of acceptance (Tukey's test: t= -0.003, p=1.000) between *C. annuum* and *V. faba*.

The aphidophagous hoverfly oviposition

Oviposition was significant (figure 3) according to aphid infested host plant species (F=4.77, p=0.007). On *C. pepo* the hoverfly lays significantly more eggs than on *H. sabdariffa* (Tukey's test: t= 3.30, p=0.023). There was no significant difference of oviposition between aphid infested *C. pepo* and both *C. annuum* (Tukey's test: t= 1.64, p=0.367) and *V. faba* (Tukey's test: t= -0.30, p=0.99). Oviposition on aphid infested *H. sabdariffa* was not significant compared to rate on infested *C. annuum* (Tukey's test: t= 1.94, p=0.23), but was highly less significant compared to rate on *V. faba* (Tukey's test: t= 3.32, p=0.010).Oviposition was not significant (Tukey's test: t= 1.38, p=0.52) between aphid infested *C. annuum* and *V. faba*.

Foraging according non-infested host plants

The comparison of non-infested plants (figure 4) showed no significant difference of *E. balteatus* foraging (p≥0,05). Immobility (F=0.74, p=0.53), searching (F=0.14, p=0.94), acceptance (F=1.84, p=0.16) and oviposition (F=0.76, p=0.52) show any preference for all host plants (figure 4). However, females spent more time in activity. The major time (85 to 95%), the hoverflies were almost in rest position, and there was very weak oviposition.

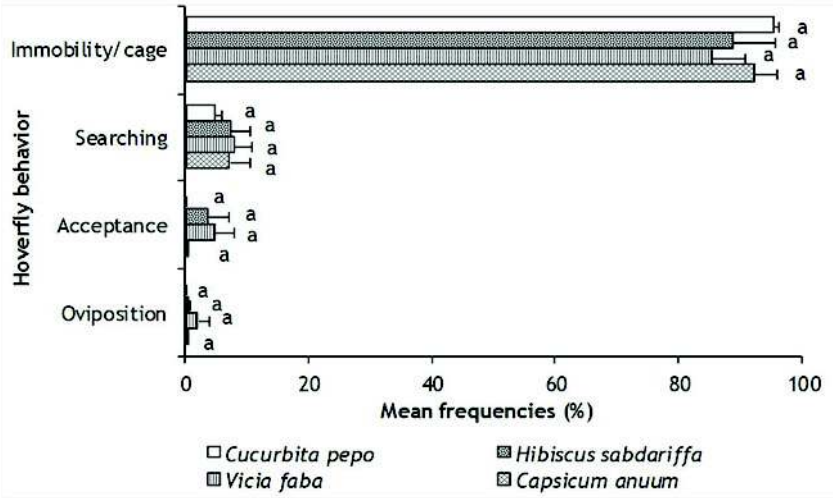

Figure 4. Foraging behavior of *Episyrphus balteatus* according to non-infested host plants
The data with the same letter do not differ significantly (p≥0.05).

DISCUSSION

This study highlight significant host plants preference by the melon aphid. As demonstrated by Guldmond *et al*. (1994), we observe that performance of *A. gossypii* depend on its host plants. Among ten combinations of couples from the five host plants studied, the preference of choice was clearly made on *C. pepo*. *C. annum* was the second better choice, while *V. faba* the third. *Dacryodes edulis* and *H. sabdariffa* were less preferred. To verify that this significance of choice does not depend on random, the fecundity, the survivorship and the development of the melon aphid were determined. Our results showed that fecundity rate (3.24 larvae per day) on *C. pepo* was higher than on the other plants (0.35 to 0.72 larvae per day). The fecundity related to *C. pepo* is below normal rate that is about 4.3 offspring per day (Capinera, 2000), but it is clearly four to ten times the value of the fecundity induced by the other host plants. The survivorship was also high (12.1/15 days) on *C. pepo* only. By the way, the mortality was the less on this host plant. According the experiment studying the free development of *A. gossypii,* the higher population, was recorded on *C. pepo*. That is to confirm the suitability of *C. pepo* for *A. gossypii*. It's known that melon aphid is polyphagous, but the fact of being more efficient on one crop among five plants tested in this study is the evidence that this melon aphid is a cucumber race which might probably developed genetic adaptation restricted to cucurbits, as to confirm Ekukolé (1990) works. All the biologic parameters highlight the close relationship between *C. pepo* and *A. gossypii*, to indicate that the effects of host plant to the melon aphid are correlated to the original rearing plant. So, the origin and the nature of host plant have an evident influence on *A. gossypii* (Ekukolé, 1990). Furthermore, some specific parameters like plant colour, leaves pubescence and age, and chemical cues (Ninkovic *et al*., 1985) are to explain the success of the melon aphid performance. It's worth underlining the relative better development recorded both on *H. sabdariffa* (malvaceae) and *C. annuum* (solanaceae), because of *A. gossypii* is frequently reported to occur on its (Autrique and Ntahimpera, 1994). This aphid has a close adaptive capacity to survive on those crops (Vayssières and al., 2000). Otherwise, *V. faba* and *D. edulis*

were found to be the less suitable host plant. This plant is a tropical fruit tree which pests are not much studied, but Pauly and al. (1988) have recorded the presence of *Aphis citricola* (van der Goot) on it in Gabon. According to Hill (1983), *A. gossypii* can develop well on Fabaceae and on fruit trees as *Persea americana* (Lauraceae) and *Citrus spp*. (Rutaceae).Thus, the weak success of all biological parameters observed on *D. edulis* could then depend on this aphid strain inability to perform on this plant, but also due to the phenology of tested plant. Indeed, this pant was less turgid than the others. Because of the growth of *D. edulis* renews any leaf during the experiment, all the leaves were to become quickly old with more resin production and fibres that do not allow aphid feeding, while in better host plants case, leaves were quit tender.

In regards of the study of the melon aphid choice, fecundity, survivorship and population development, our results showed clearly that *C. pepo* was the preferred host plant. That was to confirm it natural occurrence on this plant, while *D. edulis* was not suitable. Thus, investigating the influence of host plants and *A. gossypii* combinations on *E. balteatus* foraging do not take in count *D. edulis*, but was focused on other four host plants. It's known that *E. balteatus* females are able to select their oviposition site by means of recognizing host plant characteristics and aphids species (Chandler, 1968). Several studies have shown that *E. balteatus* oviposition is conducted by best potential fitness appreciation (Sadeghi and Gilbert, 2000).

In this study, we have also shown that they are able to make significant preference among plants infested by *Aphis gossypii*. The hoverfly host plants preference consist on less time in immobility in the cage, good searching, high acceptance and oviposition .Then, our results showed that *Cucurbita pepo* was the first suitable aphid host plant preferred by *E. balteatus*. This is conform to previous results according *Aphis gossypii* preference to its host plants. This preference is certainly due to the fact that melon aphids on *Cucurbita pepo* are big and darker than on other plants. So, *Episyrphus balteatus* is able to make preference throughout visual or chemical prey parameters (Vanhaelen, 2005). Acceptance was lower on this plant because of it hairy leaf surface who do not allow the hoverfly walking or dragging proboscis. The hoverfly prefer *C. annuum* as well as *V. faba* because of their aphids were with medium size and their leaves and stems were glabrous so that the hoverfly can land on it easily. The prey was greatly visible and walking or dragging proboscis was easy. *H. sabdariffa* was less preferred, certainly because of its aphids were with very small size and pale morphs. The red color of the stem could also have been a non-attractant factor for *E. balteatus*.

E. balteatus foraging behaviour has no significant difference face to all non-infested plants. However, females spent more time in activity, because *E. balteatus* foraging depends to the presence of aphids. So to lay eggs, *E. balteatus* might consider if the aphid size and the host plant nature are able to ensure it offspring success.

In conclusion, the results of this work indicate clearly that *A. gossypii* made a significant difference of choice of its host plants. Fecundity, survivorship and development of melon aphid population depend greatly to its hosts. These effects have been observed in several studies on many phytophagous, predacious and parasitoids insects' species (Ekukloé, 1990; Guldemond 1990; Almohamad and al., 2007). *Cucurbita pepo* was the suitable host for *A. gossypii*, because of it was the origin plant used for rearing melon aphids, but also because it is a natural host for this aphid (Capinera,2007). *Dacryodes edulis* was not suitable for *A. gossypii*. This plant is a tropical fruit tree which pests are not much studied, but Pauly and al.(1988) have recorded the presence of *Aphis citricola* (van der Goot) on it in Gabon. The lack of suitability for melon aphid could be due to *D. edulis* phenology. The guinea rosella *H. sabdariffa*, in spite of being closed to cotton (*Gossypium sp*.), allow small size of *Aphis goss-*

ypii offspring. *Vicia faba* and C*. annuum* have similar little effect on melon aphid because choice, fecundity, survivorship and development were of weak level. Thus, if the nature and the plant from which the rearing begin have effects on *Aphis gossypii*, the probable speciation of this race on cucumber is to explain these aphids and host plants relationship. It's well known that host plant nutritional value has a certain influence on biological parameters of phytophagous species like aphids (Satar and al., 1998). In the other hand, host plants are known to use their secondary metabolites for inducting insects' specific behaviour (Wink, 1999). Insects are also able to adapt specific response to plants reaction (Francis and al., 2001). As to confirm this knowledge, our study showed that the *E. balteatus* significantly prefers infested plants to non-infested plants. The good foraging behaviour was observed on *C. pepo* infested with *A. gossypii*, compared to other infested plants. Aphid infested *H. sabdariffa* was less preferred. This preference is explained by the aphids' better size and also it host plant colour. Physical parameters were showed to influence the tritrophic relationship between *A. gossypii,* host plants and *E. balteatus*. In regards of these results, this study is to perform with semiochemicals investigations to determine which volatiles could be produced by *A. gossypii* and host plant and be attractive for the hoverfly *E. balteatus*.

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