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ATTRACTIVENESS AND EFFECTS OF INSECTARY PLANT FLOWERS ON CERTAIN APHIDOPHAGOUS INSECTS AS BIO-AGENTS

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ABSTRACT

The relative attractiveness of flowering plants to some aphidophagous species; predators (*Syrphus corollae* Fabricius, *Chrysoperla carnea* Steph., *Coccinella undecimpunctata* L.and *Paederus alfierii* Koch,and the parasitic wasp *Aphidius* sp. was evaluated under laboratory conditions. Flowers included: coriander (*Coriandrum sativum L) chamomile* , (*Matricaria chamomilla*,) geranium (*Pelargonium graveolens* Ait) and Fennel (*Foeniculum vulgare* .Miller) sweet basil (*Ocimum basillicum*, L,). The obtained results revealed that the tested natural enemies exhibited different degrees of selectivity in response to olfactory stimulant produced by the flowers. Chamomile flowers exhibited higher attractiveness to the hoverflies (S. corollae) than to the other tested predators .*Chry carnea* exposed to different flowers oduor showed the highest attractiveness to fennel followed by coriander with no significant differences. Coriander, chamomile and fennel flowers attracted the highest percentage of *C*. *undecimpunctata* adults with no significant differences. *P alferii* recorded the highest percentage of attractiveness towards sweet basil (*Ocimum basillicum*, L,) flowers .Choise tests illustrated that *Chry. carena,* S. corollae *and* C. *undecimpunctata* exhibited the lowest preferabilty to geranium and sweet basil. On the contrary. *P, alferii* ., showed the highest preferabilty to sweet basil flower. Flower color may influences choice. Yellow and white flowers were particularly attractive Chamomile, fennel, and sweet basil flower colors were preferred by all tested natural enemies. Choice and no choice tests recorded that the aphelinid parasitoid *Aphidius* sp. exhibited the highest percentage of attractiveness and prefferability to flower color of chamomile and coriander . coriander and chamomile flowers increased longevity in *C. undecimpunctata*. Mean longevity was 45.0 ± 8.9 days with only water, 51.0 ± 3.0 days with chamomile flowers and 58.7 ± 6.5 days when given access to coriander flowers. Parasitism percentage by the aphelinid parasitoid, *Aphidius* sp .adult significantly increased when fed on coriander or chamomile in comparison with control. So, Coriander and Chamomile could be a potential insectary plants for enhancing parasitoid fitness and efficacy.

INTRODUCTION

The peach aphid, *Myzus persicae* Sulzen , is a key pest of several crops world-wide (Wu. *et al* , 2004) Parasitoids and predators have not delivered consistently effective control of the peach aphids (Talekar & Shelton ,1993) Some of the natural enemies are known to have greater longevity and fecundity, if they fed on nectar (Idris and Grafius ,1995,1997 and Johanowicz & Mitchell, 2000).

Beneficial insectary planting is a form of conservation biological control that involves introducing flowering plants into agricultural and horticultural systems to increase nectar and pollen resources required by some natural enemies of insect pests. For example, many parasitoid wasps need a source of sugar to realize their maximum longevity and fecundity (Jervis,1996). Habitat management presents an opportunity to enhance the suppression of pests by natural enemies , there by increasing the role of biological control in pest management systems (Landis *et al* ,2000).

Several studies have demonstrated the potential for establishing flowering plants in or around farm fields to attract natural enemies and enhance biological control of crop pests in adjacent fields (White *et.al*.,1995 and Hickman *et al.*, 1996).

However, natural enemies are selective in their feeding and show preferences for certain species (Cowgill *et al.* 1993 and Lunau,1994)

Many species of flowering plants have been documented as being attractive to beneficial insects. However, floral attractiveness is dependent on number of factors including color, pollen, nectar and morphology (Colley & Luna,2000) and there remains a lack of consensus as to which plants are most attractive .

Color is one of the most important cues for insect recognition of flowers (Chittka and Menzel, 1992; Kevan *et al.*, 1996; Menzel and Backhaus, 1991) and is well studied in relation to pollination biology (Heiling *et al.*, 2003; Menzel and Shmida, 1993)

The survival and activity of parasitoids as well as predators is influenced by the availability and quality of water and food (pollen and nectar), habitat requirements and intra – and inter – specific competition (Altieri *et al.*,1993). Information on the range of food that adult parasitoids and predators exploit is limited to a small number despite of the importance of adult nutrition in the ecology of their organisms (Jervis& Kidd, 1999).

The aim of this present work was to evaluate the relative attractiveness of selected flowering plant species (*Coriandrum sativum* L*, Matricaria chamomilla*, *Pelargonium graveolens, Foeniculum vulgare*) to certain aphidophagous predators (*Syrphus corollae, Chrysoperla carnea* Steph, *Coccinella undecimpunctata* L and *Paederus alfierii* Koch and the parasitic wasp *Aphidius* sp.

To identify plant species that was preferred by aphidophagous species. Does the adult predator (*C. undecimpunctata*) and parasitoid (*Aphidus* sp.) agents use floral resources? If so, are then improvements in longevity, fecundity.

MATERIALS AND METHODS

Aphidophagous (predators and parasitoids) behavioral tests in response to floral color and nectars.

Insect and plant sources:

The tested insect predators (*Syrphus corollae*, *Chrysoperla carnea* Steph., *Coccinella undecimpunctata* L.and *Paederus alfierii* Koch and parasitoid (*Aphidus* sp.) were collected from the Experimental Farm, Faculty of Agriculture, Mansora University and kept in laboratory for bioassay. Groups of chamomile seedlings were transferred in pots and kept under laboratory conditions. A set of groups were exposed to colonies of the peach aphid, *Myzus persicae* Suliza , and another set was kept free from aphid infestation .Newly emerged flowers of each tested host plant, coriander

(*Coriandrum sativum* L, chamomile *(Matricaria chamomilla*) geranium *(Plargonium graveolens)* fennel, *(Foeniculum vulgare*) were collected from the Experimental Farm.

Bioassay:

Flower attractiveness

The responses of aphidiphagous predators (adults of *Syrphus corollae* Fabr., *Coccinella undecimpunctata* L *Chrysoperla carnea* Steph and *Paederus alfierii*) to floral nectar of *Coriandrum sativum* L*, Matricaria chamomilla*, *Pelargonium graveolens,* and *Foeniculum vulgare* were evaluated using an experimental Y-tube.(Abd El-Kareim *et al* .,2007) . The experimental Y-tube consists of three dark cylinder arms (3.5 cm diameter x 15 cm highet) attached with an exposure plastic cylinder chamber (6.0 cm in diameter x 5.0 cm highet). Each tube (arm) was closed by black plastic cover. The internal wall of each cover was coated by Tangle foot as a sticky material. The tested predators were introduced inside the exposure chamber which was closed immediately. Flowers of each tested host plant were offered in one odor arm to test predators, while the other two arms of the Y-tube were odorless (control). Flowers of tested plants were immersed in glass tube of water through a pore in the plastic tube cover. Every treatment was repeated five times using five individuals of each species / time for each floral host plant .Counts were done 15 min after exposure of adult .

Response to flower colors

To determine the preferability of a phidophagous species to the of floral colors of the tested host plants, transparent experimental tube was used.

Attractiveness of aphidophagous species was evaluated by using transparent y- tube. The experimental tube consists of three transparent arms (1.5 cm diameter and 5 cm height) attached with an exposure cylinder chamber.

Flowers of each tested host plant were sticked outside the bottom of one arm, while the other two arms of the y- tube were flowerless (control).

Choice test was carried out to assess the preferability of the tested natural enemies by using transparent experiment tube with four arms. Flowers of the four tested host plants were sticked outside the bottom of the five arms (one arm/ flower).

Each experiment was repeated ten times by using five predators or parasitoids/ time. The tested natural enemies were placed at the center of the exposure chamber. Individual which was introduced inside transparent arms (throughout 15 min.) was registered as positive. The number of each species entering each arm was counted and the percentage of attractiveness was calculated .

Influence of insectary plant flowers as food sources for *C. undecimpunctata* and *Aphidus sp.* as aphidophagous natural enemies:

C. undecimpunctata*.*

No choice experiments were conducted in the laboratory to estimate the influence of the tested flowers on the mean longevity and efficiency (predatism%) of *C. undecimpunctata*, against *Myzus persica*e. The flowers and newly infested chamomile shoots with *M. persicae* insects were enclosed in a cylindrical cage (20 cm high and 9 cm in diameter).The Cages consisted of an acetate sheet with fine mesh on the top and foam on the bottom The treatments consisted of coriander, chamomile and water. In water treatment ,50 ml vials with a cotton wick were placed inside the cages. Vials, chamomile and flower shoots were changed every two days. Ten female predators were checked daily to assess longevity and the number of predaceous aphids were counted and recorded.

Aphidius sp.

No – choice experiments were conducted in the laboratory on *Aphidus* sp.. The flowers and plant shoot infested with 20 individuals of *Myzus persica* and natural enemies were enclosed in a cylindrical cage (as previously mentioned).

To asses the influence of insectary plant flowers (chamomile, coriander) on the mean longevity and potential of the hymenopterous parasitoid, *Aphidius* sp, one pair (male and female) of the parasitoid per treatment (10 pairs) was checked daily. A pair of newly emerged adult *Aphidius* sp. was placed in each treatment .The number of days until death of the parasitoid was recorded for both individuals (male and female).

Treatments consisted of chamomile, coriander and water as previously mentioned. Vials, chamomile and flower shoots were changed every three days.

To estimate the parasitism percentage, the parasitoid individuals were counted after death of parasitoid female,.

Statistical analyses:

The data obtained were subjected to regular statistical analysis (one way ANOVA) and mean comparison were carried out using L.S.D. at 5%.

RESULTS AND DISCUSSION

Flower attractiveness.

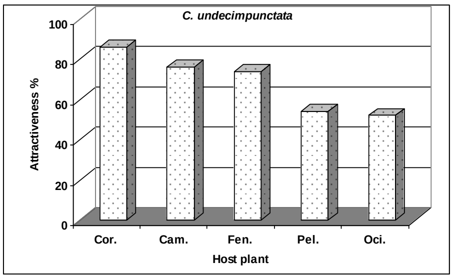
The reactions of aphidophagous predators (*S. corollae, C. undecimpunctata , Chry. carnea,* and *p. alfierii* were observed in response to odour and colour of the tested flowers (*C. sativum, M.chamomilla, p. graveolens, f. vulgare and O. basillicuml*).

In response to flower odour.

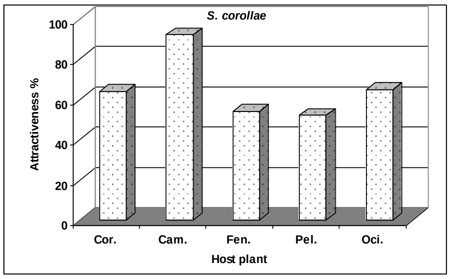
The nectar plant species of *M. chamomilla* , was significantly more attracted to *S. corollae* as compared to the control . The percentages of responses were 92 ± 11.0, 65± 11.4, 64±11.4, 54.0± 11.4 and 52 ±8.4% for *M. chamomilla, O. basillicum* L*, C. sativum F.vulgare and P. graveolens* (Figure 1).

A comparison was also made of the preference when given a choice between three nectar plants. When selecting between *M. chamomilla, C. sativum and Foeniculum vulgare* ., the nectar of *C. sativum* Followed by , *M.chamomilla* attracted the highest percentage (40 ± 14.8 and 36 ± 8.4%) of the test adult flies with no significant deference. *Foeniculum vulgare* was significantly (p= 0.05) less attractive than *M. chamomilla* and *C. sativum* (Figure 2).

Chry. Carnea exhibited the highest attractiveness to fennel (86.0 ± 16.73 %) and coriander nectars (84 ± 16.73 %) with no significant difference. The predator showed significantly low response to chamomile, geranium and Sweet basil with a total percentage of attractiveness 74.0 ± 16.7, 56 ± 11.4 and 56.0± 11.4% respectively (Fig. 1).



L.S.D = 19.03



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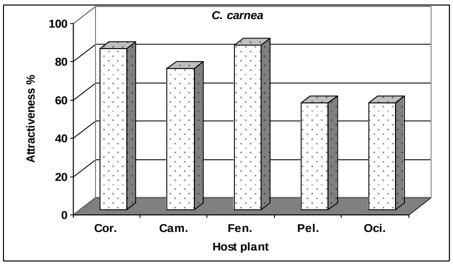

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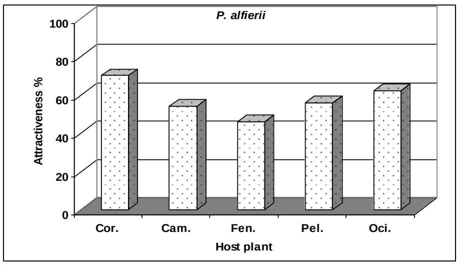


L.S.D = **15.72**

Fig.1: Percentage of attracted aphidophagaus predators (*Syrphus corollae* Fabr, *Chrysoperla carnea* Steph, *Coccinella undecimpunctata* L., *paederus alfierii*,) to flower odours the of tested plants (*Matricaria chamomilla, Coriandrum sativum* L, *Pelargonium graveolens, Foeniculum vulgare* and *Ocimum basillicum L*).

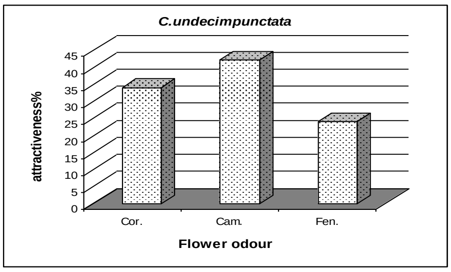
Preferability experiments illustrated that *Chry. carnea* exhibited the highest preferability to coriander (44 ± 5.5%) followed by chamomile (34 ± 11.4) with no significant difference. The lowest preferabilty was recorded toward fennel nectars (22 ± 4.5%), when selecting between coriander, chamomile and fennel nectars (Fig. 2).

Coriander (86.0 ± 13.4), chamomile (76.0 ± 16.71) and fennel nectars, 74.0 ± 19.5 %) were significantly more attractive to the coccinellid predator *C.undecimpuncta* than geranium (54 ± 11.4) and sweet basil 53.0 ± 8.2%) (Fig.1).

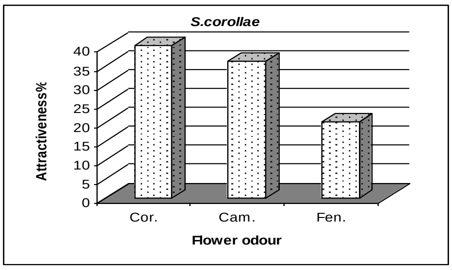
Choice test Indicted that *C .undecimpuncta* showed the highest preferability towards chamomile and coriander nectar with a percentages of attractiveness 42 ± 15.2 % and 34 ± 4.5 % when selecting between chamomile, coriander and fennel nectars (Fig. 2).

The staphelind predator, *P. alferii* adults showed a moderate attractance to the tested flower nectars. The percentage of attractiveness was 70.0 ± 12.2, 62.0 ± 13.0, 56.0 ± 11.4 and 46.0 ± 11.4% in response to coriander, sweet basil, geranium, chamomile and fennel nectars, respectively (Fig. 1)..

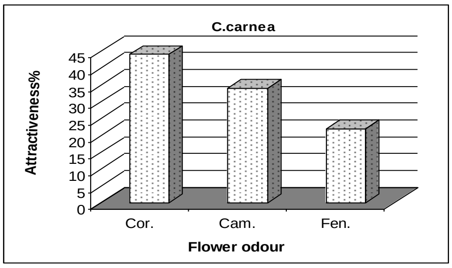
When, *P. alfierii* ,was exposed to coriander, sweet basil and chamomile in choice test showed the highest preferability towards sweet basil (42.0 ± 5.5) followed by coriander 36 ± 6.3 and chamomile 22 ± 5.5 % (Fig. 2)..



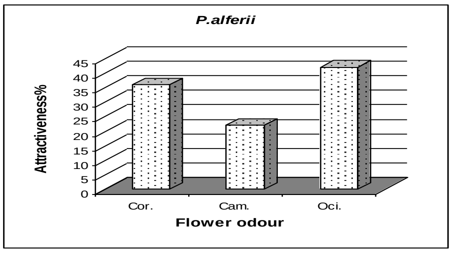
L.S.D **= 9.8**



L.S.D **= 12.6**



L.S.D **= 10.8**



L.S.D **= 11.2**

Fig.2: Preferrability of aphidophagaus predators (*Syrphus corollae* Fabr, *Chrysoperla carnea* Steph, *Coccinella undecimpunctata* L., paederus alferii,) to different flower odours of the tested plants (*Matricaria chamomilla, Coriandrum sativum* L, *Pelargonium graveolens, Foeniculum vulgare* and *Ocimum basillicuml*).

In response to flower colours.

Predators

As seen in Figure (3), the experimental tube indicated that the tested five predators exhibited different degrees of attractiveness in response to flower colours of the tested plants.

The obtained results revealed that *Chry. Carnea, S. corollae* and *C. undecimpunctata* were significantly attracted to chamomile, fennel and sweet basil flower colours. The percentage of attractiveness for *Chry. Carnea,* were 92 ± 8.4, 82.0 ± 8.1 and 68 ± 8.4 towards chamomile, fennel, and sweet basil, respectively (Fig. 3).

S. corollae showed 90 ± 7.1, 86 ± 8.9 and 70.0 ± 7.1 % positive response to chamomile, fennel and sweet basil, respectively. Also, C . *undecimpunctata* showed similar response to chamomile (94.0 ± 8.9), fennel (86 ± 8.9) and sweet basil (36.0 ± 1.4%). On the countraly, *P. alfierii* exhibited the highest response towards chamomile (84 ± 11.40) followed by coriander flower (80 ± 15.8), and geranium, (54 ± 5.5%) (Fig. 3).

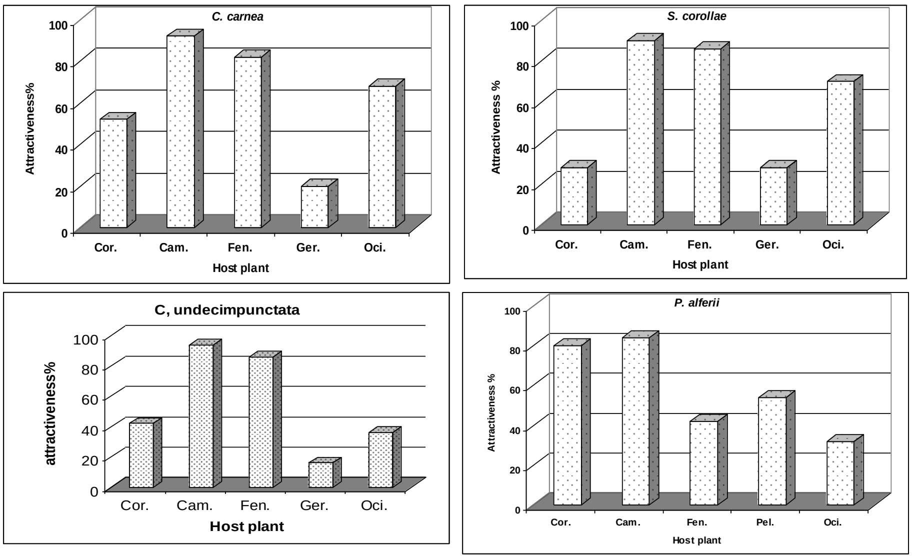


Fig.3: Percentage of attracted aphidophagaus predators (*Syrphus corollae* Fabr, *Chrysoperla carnea* Steph, *Coccinella undecimpunctata* L., and *paederus alfierii*,) to different flower colours of tested plants (*Matricaria chamomilla*, *Coriandrum sativum* L, *Pelargonium graveolens*, *Foeniculum vulgare* and *Ocimum basillicum* L).

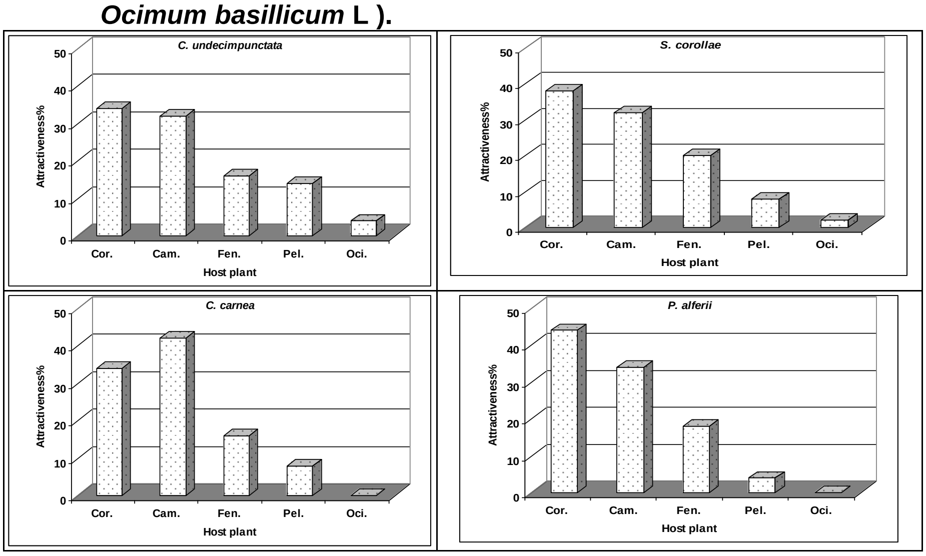


Fig.4: Preferrability of aphidophagaus predators (*Syrphus corollae* Fabr, *Chrysoperla carnea* Steph, *Coccinella undecimpunctata* L., *paederus alferii*) in response to different flower colours (*Matricaria chamomilla, Coriandrum sativum L, Pelargonium graveolens, Foeniculum vulgare* and *Ocimum basillicuml*).

Preferability experiments illustrated that all tested predators exhibited the highest preferebility to yellow flower colors (fennel and chamomile) followed by while colors (sweet basil). The tested aphidophagous predators showed the lowest preferability toward coriander and geranium flower colours (rose and pink colours) when selecting between flower colours (Fig. 4).

Parasitoid*, Aphidius* sp.

The reactions of the aphelind parasitoid, *Aphidius* sp were observed in response to colour of the tested flowers (Figure 5)

The obtained results obviously indicated that *Aphidius* sp adult females exhibited the highest attractiveness toward chamomile (92 ± 11.0) and fennel (88± 11.0) plants (with no significant differences, followed by coriander flowers (72.0 ± 10.9) geranium and Sweet basil were significantly less attractive to *Aphidius* females (56 ± 16.7 and 52 ± 10.9 %.

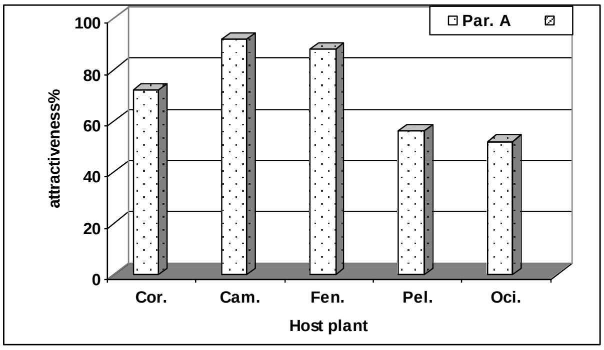


Fig. 5: Reaction behavior of the hymenopterous parasitoid *Ahidius* sp in response to flower colours of *Matricaria chamomilla, Coriandrum sativum* L, *Pelargonium graveolens, Foeniculum vulgare* and *Ocimum basillicum*.

Effects of floral resources on fitness of *C. undecimpunctata* and *Aphidius sp*.

Effect of food sources on predatism% and mean longivity.

Data presented in Table (1) indicated the mean longevity for *C. undecimpunctata* feeding on coriander (*Coriandrum sativum* L.) and chamomile (*M.chamomilla*) flowers were 58.7 ±6.5 and 51.0 ± 6.0 days,while the mean longevity of individuals fed on water (control) was 45.0 ± 8.9 days.

There was a significant effect of the feeding treatment (P= 0.05), Within treatment, there was a significant differences in longevity between water and chamomile flowers (Table 1).

Predatism data show that coriander and chamomile could be a potential plant for enhancing efficacy of the coccinellid predator, *C. undecimpunctata* .

Flowers increased feeding capacity in *C. undecimpunctata*. Mean predatism percentage was 45.0 ± 11.7 with only water, 88 ± 9.4 % with chamomile and 92 ± 9.18 when given access to coriander flowers.

Table 1: Predatism percentage and mean longevity of *Coccinella undecimpunctata* L adult females with different food resources

Food sources	Predatism %	Mean longevity (day)
Coriandrum sativum L.,	92 ± 9.18 (a)	58.7 ± 6.5 a
Matricaria chamomilla,	88 ± 9.4 (a)	51.0 ± 3.0 b
Control (water)	45 ± 11.7(b)	45.0 ±8.9 c
L. S. D. (p = 5 %)	9.82	4.65

Effect of food sources on parasitism % and mean longivity.

There were significant differences in parasitism rate between the three feeding treatments. Parasitism rate was significantly (p= 0.05) higher in the coriander treatment (mean = 93.0 ± 8.2%) compared to the control (48.9 ± 11.6 %). Chamomile (80.0 ± 15.6%) also enhanced parasitism rate compared with the control (Table 2).

The water-only treatment resulted in the shortest longevity of both female and male of *Aphidius sp*. and was significantly lower than all other treatments (Table 2).

Survival on coriander treatment for both female and male *Aphidius* sp. was significantly greater than on chamomile treatments.

Table 2: Mean longevity (day) for male and female *Aphidius* sp. Fed on food sources in the laboratory at 28 ± 2.5 Cº.

Floral treatment	Parasitism%	Longevity (days)	
		Female	Male
Coriander	93.0 ± 8.2 a	9.2 ± 3.1 a	7.4 ± 2.5 a
Chamomile	80.0 ± 15.6 a	7.8 ± 1.9 a	5.6 ± 2.4 a
Water (control)	48.9 ± 11.6 b	4.2 ± 3.1 b	3.8 ± 1.3 ab
L. S. D. (p= 5 %)	10.78	3.23	2.82

Discussion

The results obtained showed that the tested aphidophagous species (*Syrphus corollae* Fabr, *Chrysoperla carnea* Steph, *Coccinella undecimpunctata* L.,and *paederus alfierii*,) varied in their innate response to nectars based on odours and flower colours.

Aphidogous predators (*Chry. Carnae, S. corollae* and *C . undecimpunctata*) exhibited a relatively higher preference for coriander nectar flowers followed by chamomile and fennel. According to Colley and Luna (2000), hoverflies (syrphidae) are selective in their flower feeding and show preferences to certain plant species. They added that hoverflies exhibited the highest response to coriander and fennel. In a similar study (Lovei *et al.*(1993), showed that coriander was most preferred over other flowers .

Flower colours may influence choice. (Cowgill (1989)) surveyed wild plants in farmlands and noted that yellow and white flowers were particularly attractive. (Lunau and Wacht (1994)) indicated that feeding behavior is stimulated in the laboratory by yellow colour. Coriander, buckwheat, alyssum and fennel were all attractive and have white or yellow flowers (Colley and Luna, 2000).In the current study, chamomile, fennel and sweet basil also, have yellow and white colours were exhibited attractiveness to all tested natural enemies.

Many insects have an innate visual preference for yellow (Wäckers, 1994), which is a common flower color. Jönsson *et al.* (2005) found two pollen beetle parasitoids (*Phradis interstitialis* and *Tersilochus heterocerus*) to be significantly attracted to yellow, when given a choice between yellow and green. When combined with flower odours from oilseed rape, *Brassica napus*, the attraction was even more pronounced for *T. heterocerus*, a species preferring older larvae occurring in flowering rape. In contrast, Idris & Grafius (1997) did not observe colour preference in flower choice by *Diadegma insulare* offering choice between several yellow flowers, including *B. napus*, and white flowers.

Hymenopteran parasitoids usually require a carbohydrate energy source during their adult stage, such as floral nectar, to increase longevity (Idris & Grafius, 1995; Baggen & Gurr, 1998; Vattala *et al.*, 2006), fecundity (Idris & Grafius, 1995; Baggen & Gurr, 1998; Winkler *et al.*, 2006) and motivation to seek hosts (Wäckers, 1994; Winkler *et al.*, 2006). Consequently, provision of nectar plants in the agroecosystems can increase the effectiveness of biological control programs. Nevertheless, not all nectar plants are appropriate for hymenopteran parasitoids (Wäckers & Steppuhn, 2003; Wäckers, 2005)

Floral nectar is mainly composed of carbohydrates, amino acids, proteins, lipids, vitamins and secondary plant metabolites (Wäckers, 2005). The composition determines the nutritional suitability (Hausmann, *et al.*, 2005; Vattala *et al.*, 2006), feeding stimulation (Romeis & Wäckers, 2000) and gustatory response (Wäckers, 1999). The sugar concentration ranges commonly between 20 and 40%. Carbohydrates common in floral nectars include sucrose, fructose and glucose, and in lower amounts raffinose, galactose, mannose and xylose. The preference for the different sugars can vary between insect groups (Schoonhoven *et al.*, 2005b; Wäckers, 2005).

Pollen is primarily a source of amino acids and proteins, with protein levels ranging from 2.5 to 61% (Wäckers, 2005). Direct pollen-feeding by hymenopteran parasitoids is not common, although records occur. Jervis *et al.* (1993) found no proof of pollen feeding when dissecting flower-visiting wasps. However, there are parasitoid wasps that show specialization for pollen-feeding (Jervis, 1998).

Attraction to as host plant from a distance often appears to involve both olfactory and visual elements of behavior (Wackers, 2005). The factory signal is the indicator of an appropriate host, causing the insect to take off and more towards the source of the odour. But the olfactory system will rarely act alone, a response to odour will be combined with a visual response. It is probably true that colour is important in the final stage of attraction of many days. Flying insect to their hosts, the colour affects both the number of runs a female makes on a plant and the number of probing,. and reproduce in flowers are often attracted to blue. Also, ichneumonid parasitoids visited white flowers (Idris and Grafius, 1997).

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تأثير بعض النباتات الزهريه الآويه للحشرات على بعض الحشرات المتغذية على المن كعوامل حيويه

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فى هذه الدراسه تم تقييم القدره النسبيه لبعض النباتات الزهريه على بعض أنواع المفترسات المتغذيه على المن وهى *Sysphus corollae* Fab ، *Paedeus alfierii* vad ، *Coccinella undecimpunctata* L *Cheysoperla carnea* Step علاوه على نوع من الطفيليات وهو Aphidius وذلك تحت الظروف المعمليه.

والأزهار خاصه بالنباتات التاليه:- الكزبره Cariander - شيح البابونج Chamomile العتر Geranium الشمر Fennel – الريحان Sweet lasil .

وأوضحت النتائج المتحصل عليها أن الأعداء الحيويه المختبره قد أظهرت درجات مختلفه من الإختياريه Selectivity تجاه المنبهات السميه الناتجه عن الأزهار .

وأزهار شيح البابونج كانت أكثر جذبا بالنسبه *S. corollae* عن باقى المفترسات.

كما أن المفترس *Chry. Carnea* كان الأكثر انجذابا لأزهار الشمر تلاه أزهار الكزبره وذلك بلا فروق معنويه.

كما أن أزهارالكزبره وشيح البابونج والشمر قد جذبت أعلى نسبه مئويه من المفترس أبو العيد ذو 11 نقطه وأيضاً بلا فروق معنويه.

أما الحشره الرواغه *P. alfienii* فقد سجلت أعلى نسبه مئويه للإنجذاب تجاه أزهار الريحان.

كذلك اختبارات التفضيل (الاختيار Choice test) أوضحت أن *Chry. Carnea* & *C. undecimpunetats* & S. corollae أقل تفضيل تجاه أزهار العتر والريحان.

وعلى العكس من ذلك فالمفترس P. alfieni كان الأعلى انجذاباً تجاه أزهار الريحان.

أيضاً لون الأزهار قد يؤثر على هذه الصفه (التفضيل). فالون الأصفر والأبيض لأزهار شيح البابونج والشمر والريحان كان هما المفضلان لكل الأعداء الحيويه المختبره.

أيضاً باستخدام Choice test و.No choice t فاتضح أن الطفيل .Aphidius Sp قد أظهر أعلى نسبه مئويه للإنجذاب والتفضيل للون أزهار شيح البابونج والكزبره.

أيضاً اتضح أن الكزبره وشيح البابونج قد زاد فتره الحياه Longevity للمفترس أبو العيد ذو 11 نقطه حيث كانت هذه الفتره 45 + 8.9 يوم مع الماء فقط (كنترول) و 51± 3 يوم مع شيح البابونج ، 58.7 ± 6.5 يوم عندما تعرضت لأزهار الكزبره.والنسبه المئويه للطفيل بواسطه .Aphidius Sp قد زات بشكل معنوى عند التغذيه على الكزبره وشيح البابونج.

وعلى ذلك فان نبات الكزبره وشيح البابونج من الممكن استخدامها كنباتات آويه لهذا الطفيل بما يزيد من كفاءته.

قام بتحكيم البحث

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