ABSTRACT

Results clarified that, prey-type profound effects on measured performance traits. Lowest eggs incubation period recorded for predators fed on A. craccivora nymphs, while highest observed for those fed on P. citri nymphs. Shortest total nymphal developmental period recorded for nymphs fed on A. craccivora nymphs, while longest for those fed on P. citri nymphs. Highest survival rate observed for predator that fed on eggs of E. kuehniella, while shortest recorded for those fed on P. citri nymphs. Daily female ovipositional rate was high in predator culture reared on E. kuehniella eggs comparing with those fed on P. citri nymphs. Fecundity was high for predator fed on E. kuehniella eggs, while low when fed on P. citri nymphs. Adult females and males fed on A. craccivora nymphs had significantly longer life spans compared with those fed on others. Sex-ratio (%female) was significantly high when predator fed on A. craccivora nymphs. During the nymphal period, O. albidipennis consumed significantly more eggs of E. kuehniella than other-types, whereas lowest were P. citri nymphs. Adult females consumed significantly more E. kuehniella eggs than other-types, while Adult males preferred to consume A. craccivora nymphs. Data obtained suggested that O. albidipennis biology and consumption rate influenced by three tested preys. E. kuehniella eggs and A. craccivora nymphs were most favorable diet for predator. Although, P. citri nymphs were less suitable for predator, but O. albidipennis could survive and reproduce feeding on it which considered as an important advantage attributed as a biological control agent.

Keywords: Biological control, consumption rate, Orius albidipennis, Ephesia kuehniella, Aphis craccivora, Planococcus citri.

INTRODUCTION

Insect pest considers one of the main problems causing extent damage to the economy due to its impact on agricultural economic crops, reducing its quantity and quality. When controlling, insecticide control programs could lead to several problems such as, pesticide residual, pest resistance, secondary pest outbreaks. Absence or inefficient natural enemies could be one of the challenges facing the integrated control of insect pests. The predator, Orius albidipennis (Reuter) is a common predator in Mediterranean region which has been shown to have a potential as a biological control agent under field and greenhouse conditions (Dehghani Zahedani et al., 2011). O. albidipennis is an ideal choose for mass rearing for biological control programs in subtropical and tropical zones because of its capability to tolerate high temperatures and the lack of photoperiod-induced diapausas (Sobhy et al., 2010). It could attack eggs and immature stages of various arthropods, or numerous important agricultural pest species (Bush et al., 1993; Riudavets et al., 1995; Lee et al., 1996; Reitz et al., 2006 and Butler & O’Neill, 2007). In Egypt, O. abidipennis is very common throughout much of the country, south to Wadi Halfa, in the desert, and in cultivated areas, especially in corn and cotton fields. It is usually found in flowers of plants infested with thrips, lepidopteran eggs or other small arthropods (Tawfik and Ata 1973 and Zaki, 1989).

However, little is known of the effects of different economical pest prey on the development and reproduction of O. albidipennis compared with other species of Orius. Therefore, the present investigation compared the effects of different insect pest prey on the biological characteristics of O. albidipennis under laboratory conditions. The suitability of different diets for Orius spp. could be evaluated by comparing their development time, survival and fecundity (Safae et al., 2016)

The parameters examined were: eggs incubation period, nymphal period, survival rate (%), ovipositional rate, fecundity, longevity and sex ratio as well as the consumption of the predator stages. The predator reared on three selected economically pest preys, the first prey; eggs of the Mediterranean flour moth, Ephesia kuehniella Zeller (Lepidoptera: Pyralidae) which is a common pest of cereal grains, especially flour. This moth is found throughout the world, especially in countries with warm temperate climates. The flour mills have a particular problem with the Mediterranean flour moth because the caterpillars spin silk that clogs machinery (Wikipedia, 2020).

The second prey, nymphs of the black bean Aphid, Aphis craccivora Koch. (Hemiptera: Aphididae). Aphids are one of the insect groups whose economic importance increases with the development of agriculture. All species of aphids nearly reproduce parthenogenetically. Aphids
damage the plants roughly through; loss of sap by sucking, reaction of plant tissues stimulated by aphid’s saliva, excreting viscous honeydew on them sooty-molds usually develop and finally transmission of viral diseases to plants. Cereal aphids are the serious pests attacking cereal crops, particularly wheat, barley and maize (El-Heneidy and Adly 2012).

The third prey; the citrus mealybug, Planococcus citri (Risso) (Hemiptera: Pseudococcidae) is an important pest attacking several crops. Biotic and abiotic factors, as well as the substrate they feed on influence its population (Correa et al., 2008). The citrus mealy bug infested 65 plant species belonging to 56 genera in 36 families and distributed in Egypt. P. citri prefers citrus followed by guava and grape (Ahmed & Abd-Rabou 2010).

The chosen preys consider as important pests for many economical crops, vegetables, fruit trees and cereal grains in Egypt. According to (ScaleNet, 2020) the predator Orius albidipennis never recorded before as a biocontrol agent of the citrus mealybug, Planococcus citri and no data available on its effects on the biology and consumption rate on the studied predator (Amer and Elsahn, 2020).

The aim of this work is to apply rearing of O. albidipennis in biological control programs in Egypt in order to reduce the chemical application which would improve the food safety and reduce the environmental pollution.

MATERIALS AND METHODS

The predatory bug Orius albidipennis (Reuter) (Hemiptera: Anthocoridae) is considered as a biological control agent for many insect pests in Egypt. Effects of different preys on the biology and consumption rate is compared when the predator fed on eggs of Euphemia kuehniella Zeller, nymphs of Aphis craccivora, Koch. and Planococcus citri (Risso). The parameters examined were the predator eggs incubation period, nymphal period, total nymphal development period, survival rate (%), ovipositation rate, fecundity, longevity, sex ratio and prey consumption. All experiments conducted under laboratory conditions of 28 ± 2 °C, 60 ± 5 % RH and L18:D6 photoperiod. Individuals were reared from the neonate stage until death on each one of the three prey types.

Rearing of the predator, Orius albidipennis (Rauter).

The rearing of the predator, O. albidipennis was carried out under laboratory conditions at 28 ± 2 °C, 60 ± 5 % RH and L18:D6 photoperiod. The adults were obtained from unsprayed Alfalfa plants, Medicago sativa (Fabaceae) in Benha region, Qalyubiya governorate, Egypt. Adults and nymphs of O. albidipennis were collected by using insect net and kept in plastic containers of (10 cm x 20 cm) enclosed with muslin. In order to decrease cannibalism between stages, mini foam balls and one gm of frozen Euphemia kuehniella Zeller (Lepidoptera: Pyralidae) eggs were added in each jar. E. kuehniella frozen eggs were obtained from faculty of agriculture, Benha University as a food source to O. albidipennis. In order to allow females of O. albidipennis laying eggs, a piece of small (3cm) bean pod, Phaseolus vulgaris and a piece of cotton soaked in sugar water (1:1) were added in all jars (Isenhor and Yeargan, 1981 a). Bean pods which contains laid eggs were kept in new plastic containers which observed daily until hatching. Newly emerged nymphs were moved to plastic containers feeding by frozen eggs of E. kuehniella. The predator, O. albidipennis had been reared for several generations under laboratory conditions using the methods described by (Isenhor and Yeargan 1981a&b; Alauzet et al., 1994 and Cocuzza et al., 1997).

Rearing of the black bean Aphid, Aphis craccivora Koch. (Hemiptera: Aphididae)

Aphis craccivora Koch., was collected from the broad bean Vicia faba L. (Fabaceae) orchards in Benha district, Qalyubiya governorate, Egypt, which reared on Vicia faba leaves planted from seeds in plastic plates (25 cm * 35 cm *15 cm). After one week from cultivation, the newly broad bean leaves injured to be infest with A. craccivora. The nymphs of A. craccivora used as a prey for the predator, O. albidipennis. A. craccivora colonies were reared under laboratory conditions (28 ± 2 °C and 60% ± 10% RH) on broad beans which described by (Amer et al., 2018).

Rearing of Citrus mealybugs, Planococcus citri (Risso) (Hemiptera: Pseudococcidae). The citrus mealybugs, Planococcus citri was collected from infested pomegranate, Punica granatum L. (Lythraceae) leaves and fruits from an orchard in Nubariya district, Behira governorate, Egypt. The mealybug reared on potato sprouts which described by (Mahmoud, et al., 2017). The crawlers emerged out and started feeding and developed to adults. The small nymphs of the citrus mealybug used as a prey for the predator, O. albidipennis.

Effects of different prey on the biological characteristics of O. albidipennis.

In order to study effects of the different selected prey on the biological characteristics of O. albidipennis, the parameters examined were: eggs incubation period, nymphal period, total nymphal development period, survival rate (%), ovipositation rate, fecundity, longevity and Sex ratio. Experiments were conducted using three types of prey: non hatched eggs of E. kuehniella, nymphs of A. craccivora and of P. citri. A total of 10 replicates per treatment (type of prey) were placed in order to study its effect on the studied biological characteristics of O. albidipennis. Eggs of E. kuehniella replicates were put in Petri dishes which placed inside plastic jars with a piece of cotton moister with honey water (1:1) placed in small glass flask (5 mL). Nymphs of A. craccivora and P. citri as treatments were presented to the predator on small leaf discs of broad bean leaves. Each replicates were observed daily using the stereoscopic binocular microscope. In order to study the developing of the predator’s immature stage. New prey was daily provided until the predator completed its growth or died (Sobhy et al., 2006). In the experiments to study ovipositional rate, fecundity, longevity and sex ratio of the predator, newly emerged adults of O. albidipennis (one female and one male) were replicated 10 times and exposed to the different preys. Treatments were separated in Petri dishes (9 cm (diameter) * 1.5 cm (height)) for mating. To stimulate mating, no prey was added at this time. Twelve hours later, males were removed and separated to other Petri dishes to determine the adults prey consumption. The females were daily
provided with nymphs of *A. craccivora* and *P. citri* on broad bean leaves and paper discs for *E. kuehniella* as well as bean pods to lay eggs until death. Adult males were provided with new preys as mentioned with adult females. The numbers of consumed preys were counted every day by using a binocular microscope. After adult eclosion, the sex ratio of the predator was determined and Consumption of different stages of *O. albipennis* reared on the three selected preys.

In order to study the consumption of prey (eggs of *E. kuehniella* and nymphs of *A. craccivora* and *P. citri*) for the nymphal instar of the predator, *O. albipennis*, each treatment was examined with 10 replicates of the above preys. Observation were made daily, counting the Daily and total Prey consumption of the 4th and 5th nymphal instar as well as males and females by adding fresh preys (treatments) retrieved from the rearing prey stocks (Sobhy et al., 2010).

### Statistical Analysis

Significance of the impact of various preys on developing of immature stages and adults as well as, prey consumption was determined by one – way ANOVA (analysis of variance). The mean values were compared using Tukey’s test at the ($P < 0.05$, LSD) level of significance. Adult prey consumption and adult longevity were analyzed by two-way ANOVA. Statistical analyses were run in SPSS for Windows version 16.

## RESULTS AND DISCUSSIONS

### 1- Effects of different prey on the biological characteristics of *O. albipennis*.

Data presented in (Table1) showed that the predator, *O. albipennis* was capable to complete its nymphal instar feeding in all different prey (*E. kuehniella* eggs and nymphs of *A. craccivora* and *P. citri*). Type of prey had a different effect on the developmental time of eggs embryonic (incubation) period, the nymphal instars period, the total nymphal developmental time and the survival rate (%) of the predator.

#### a. Effect of different prey on the embryonic (incubation) period of the predator, *O. albipennis*.

Data obtained and arranged in (Table1) suggested that the type of prey had profound effects on the duration of the embryonic period of *O. albipennis*. Total embryonic time was significantly faster for *O. albipennis*

Table 1. Effect of three different preys on embryonic stages of *O. albipennis*.

<table>
<thead>
<tr>
<th>Preys</th>
<th>No. of replicates</th>
<th>Eggs incubation (Days)</th>
<th>Nymphal period (days) Mean ± SE</th>
<th>Total nymphal stages in (Days)</th>
<th>Survival rate (%) Mean ± SE</th>
<th>F-value</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>A. craccivora</em></td>
<td>10</td>
<td>2.30 ± 0.89 a</td>
<td>1.46 ± 0.27 b</td>
<td>1.58 ± 0.22 c</td>
<td>11.98 ± 0.64 a</td>
<td>60.74 ± 0.08 a</td>
<td>22.56 &lt; 0.001</td>
</tr>
<tr>
<td><em>E. kuehniella</em></td>
<td>10</td>
<td>2.76 ± 0.04 a</td>
<td>2.14 ± 0.55 b</td>
<td>2.28 ± 0.35 c</td>
<td>15.28 ± 0.12 c</td>
<td>72.36 ± 0.09 a</td>
<td>7.85 &lt; 0.001</td>
</tr>
<tr>
<td><em>P. citri</em></td>
<td>10</td>
<td>6.12 ± 0.11 b</td>
<td>3.51 ± 0.42 b</td>
<td>3.48 ± 0.35 c</td>
<td>18.45 ± 0.54 c</td>
<td>50.90 ± 0.12 c</td>
<td>12.26 &lt; 0.001</td>
</tr>
</tbody>
</table>

*The means followed by same letters in each column are not significantly different based on Tukey’s test with ($P < 0.05$, LSD).

Concerning the total developmental nymphal instars period of the predator, *O. albipennis* data obtained reviled that, it was significantly shorter in the case of feeding on *A. craccivora* nymphs 11.98±0.64 compared to insects allowed to feed on *E. kuehniella* eggs 15.28±0.85 that fed on *E. kuehniella* eggs or *A. craccivora* nymphs compared with those fed on nymphs of the citrus mealybug, *P. citri*. It was 2.30±0.89, 2.76±1.21 days in the case of *E. kuehniella* eggs or *A. craccivora* nymphs respectively without any significance different between them. While Total embryonic time was significantly slower in case of feeding the predator on nymphs of the citrus mealybug, *P. citri* which reached 6.12±1.44 days. (Table1). Data obtained agree with (Cocuzza et al., 1997) who concluded that Diet also strongly affected the length of ovipositional period in *O. albipennis*.

### b. Effect of different prey on the development of nymphal stages period and total nymphal instars period of the predator, *O. albipennis*.

It appeared that in the predator 1st nymphal instar the developmental time was significantly shorter in the case of feeding on *A. craccivora* nymphs 2.12±0.04 compared to insects allowed to feed on *E. kuehniella* eggs 3.04±0.19 or *P. citri* nymphs 3.51±0.45 with significant difference between all treatment. (Table1).

For the 2nd nymphal instar the developmental time was significantly shorter in the case of feeding on *A. craccivora* nymphs 1.46±0.77 and *E. kuehniella* eggs 2.14±0.27 without any significant different between them compared to insects allowed to feed on *P. citri* nymphs the developmental period increased to 3.96±1.18 (Table1).

Data obtained for the 3rd nymphal instar developmental time showed that it was significantly shorter in the case of feeding on *A. craccivora* nymphs 2.06±0.27 compared to insects allowed to feed on *E. kuehniella* eggs 2.66±0.32 or *P. citri* nymphs 3.48±0.46 with significant difference between all treatment.

For the 4th nymphal instar the developmental time was significantly shorter in the case of feeding on *A. craccivora* nymphs 1.58±1.10 and *E. kuehniella* eggs 2.28±1.27 without any significant different between them compared to insects allowed to feed on *P. citri* nymphs the developmental period increased to 3.94±1.36 (Table1).

In the predator 5th nymphal instar the developmental time was significantly shorter in the case of feeding on *A. craccivora* nymphs 2.46±0.21 compared to insects allowed to feed on *E. kuehniella* eggs 2.40±0.35 or *P. citri* nymphs 3.56±0.54 with significant difference between all treatments (Table1).
albidipennis that fed on E. kuehniella eggs or Gynaikothrips ficorum larvae compared with the other investigated prey.

Safaei et al., 2016, concluded that Nymphal developmental time of the bug on different diets varied because of different preys. They mentioned that, the best diet which shorten the nymphal developmental time was the diet of E. kuehniella + sunflower pollen Which could of great benefit in mass rearing for the predator.

c. Effect of different prey on the survival rate (%) of the predator, O. albidipennis.

Results clarified that, the lowest overall survival rates to adulthood were recorded for nymphs that fed on P. citri 50.90±0.12 while the highest survival rate 72.36±0.09 was recorded for those fed on E. kuehniella eggs. Intermediate rates for survivorship were reported for those fed on A. craccivora nymphs 60.74±0.08 with significant different between all preys. (Table1). Data agreed with that obtained by (Sobhy et al., 2010) which concluded that the highest survival rate of the predator O. albidipennis was recorded for those fed on E. kuehniella eggs. (87.75%) comparing with those fed on Gynaikothrips ficorum (72.91%), Trialeurodes vaporariorum eggs (51.06%) and Tetranychus urticae eggs (59.57%).

Data obtained by (Safaei et al., 2016) showed that, the nymph and adult survival and consumption rate were not significantly affected by the dietary treatments. Because of a more rapid development with food containing eggs of E. kuehniella, they are the best nymphal diets for mass rearing of O. albidipennis.

d. Effect of different prey on the female ovipositional rate (%) per day of the predator, O. albidipennis.

Data obtained in Table 2, cleared that, most females were able to continue laying egg until death. Highest daily ovipositional rate occurred for females fed on E. kuehniella eggs, these females laying a total mean of 8.18±0.08 eggs per day. Females fed on A. craccivora and P. citri nymphs laid a total of 5.24±1.10 and 3.06±0.06 eggs daily per female respectively with a significant different between the three preys.

Table 2. Effect of three different preys on longevity and female fecundity of O. albidipennis.

<table>
<thead>
<tr>
<th>Prey</th>
<th>No. of replicates</th>
<th>Ovipositional rate (eggs/female/day)</th>
<th>Fecundity (eggs/female)</th>
<th>Longevity (Days) Mean ± SE</th>
<th>Sex ratio (% female)</th>
<th>F-value</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Female</td>
<td>Male</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. craccivora</td>
<td>10</td>
<td>5.24±1</td>
<td>1.09b</td>
<td>25.98±1</td>
<td>63.15±2</td>
<td>28.43</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>E. khanellia</td>
<td>10</td>
<td>8.18±1</td>
<td>1.10a</td>
<td>25.0±1</td>
<td>65.6±1</td>
<td>21.80</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>P. citri</td>
<td>10</td>
<td>3.06±1</td>
<td>0.08a</td>
<td>16.55±1</td>
<td>61.7±1</td>
<td>13.56</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

*eThe means followed by same letters in each column are not significantly different based on Tukey’s test with (P < 0.05, LSD).

e. Effect of different prey on the fecundity of the predator, O. albidipennis.

Results showed that, prey species had a significant effect on the fecundity of the predator, O. albidipennis. The highest lifetime fecundity 112.7±1.45 eggs/female were recorded for females fed E. kuehniella eggs (Table 2) without any significant different of those fed on A. craccivora nymphs 96.04±1.09. When females fed on P. citri nymphs, fecundity dropped significantly to 55.42±2.18 eggs/female.

f. Effect of different prey on the longevity of the predator, O. albidipennis males and females.

Data illustrated in (Table 2) showed that, the longevity of O. insidiosus females and males fed on A. craccivora nymphs 25.98±0.05 and 16.55±0.15 respectively, was larger than that when the predator were fed on eggs E. kuehniella 20.50±0.09 and 7.11±0.28 respectively, without any significant different between them. While the predator male and female longevity terns short 15.8±0.05 and 5.01±0.36 days when it fed on P. citri nymphs.  

g. Effect of different prey on the sex ratio(%female) of the predator, O. albidipennis.

The obtained results revealed that after the predator adult eclosion the sex ratio were varied depending on the three prey types. Sex ratio was determined and expressed as a percentage of females were 63.15±1.02 in predators reared on A. craccivora nymphs while it was 56.2±0.08 and 41.57±1.31 in the culture of the predator reared on E. kuehniella eggs and P. citri nymphs respectively with significant differences between all treatments (Table2).

The above mentioned results agree with (Sobhy et al., 2010) who said that, Orius albidipennis females showed the highest fecundity when fed on E. kuehniella eggs, and the lowest when fed on Trialeurodes vaporariorum eggs. Adult females and males that fed on Gynaikothrips ficorum larvae had significantly longer life spans compared with those fed other prey. Because of their relatively rapid development and high fecundity, O. albidipennis fed E. kuehniella eggs had a significantly higher reproductive rate and intrinsic rate of increase than O. albidipennis fed other prey types. He also concluded that, longevity of adult O. albidipennis was dependent on both prey type and predator sex, with females living considerably longer than males. There was a significant interaction between prey type and predator sex.

(Mendes et al., 2002) stated that, fecundity of adult O. insidiosus was increased with the consumption of eggs of A. kuehniella when compared to feeding on the other prey.

2- Consumption of O. albidipennis stages reared on the three selected preys.

The type of prey had a significant effect on the number of prey daily and total mean consumed by the predator, O. albidipennis 4th, 5th nymphal instar, females and males (Table 3).

For the predator 4th and 5th nymphal instar the daily consumption was significantly high when it fed on the prey E. kuehniella eggs reached 6.87±0.98 daily consumption, decreased to 5.78±1.19 and 3.99±1.27 when it fed on A. craccivora and P. citri nymphs respectively. Data in (Table 3) also revealed that the total mean consumption increased to 60.61±0.71 and 55.06±0.53 in the culture reared on the
prey *E. kuehniella* eggs and *A. craccivora* nymphs respectively without any significant different between them. While the total mean consumption decreased in the prey culture fed on *P. citri* nymphs reached 41.47±1.01. Concerning the predator adult females and males number of prey daily and total mean consumption, data obtained suggested that the predator adult females recorded high daily and total fed consuming comparing with adult males on the three diets treatments. The greatest total females prey consumption was 166.51±0.06 eggs of *E. kuehniella* followed by nymphs of *A. craccivora* 134.2±0.09 while the lowest was 85.35±0.18 nymphs of *P. citri*.

### Table 3. Consumption of different developmental stages of *O. albidipennis* reared on three preys.

<table>
<thead>
<tr>
<th>Preys</th>
<th>4th and 5th Nymphal instars</th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daily prey consumption</td>
<td>Mean Prey consumption</td>
<td>Mean Prey consumption</td>
</tr>
<tr>
<td><em>A. craccivora</em></td>
<td>5.78±1.19b</td>
<td>55.06±0.53a</td>
<td>12.42±1.24b</td>
</tr>
<tr>
<td><em>E. kuehniella</em></td>
<td>6.87±0.99a</td>
<td>60.61±0.71a</td>
<td>17.73±1.03a</td>
</tr>
<tr>
<td><em>P. citri</em></td>
<td>3.99±1.27c</td>
<td>41.47±1.01b</td>
<td>6.56±1.58c</td>
</tr>
</tbody>
</table>

*The means followed by same letters in each column are not significantly different based on Tukey’s test with (P < 0.05, LSD).*

While the greatest total males prey consumption was 70.74±2.54 nymphs of *A. craccivora* followed by eggs of *E. kuehniella* 63.57±1.54 while the lowest was 46.16±3.06 nymphs of *P. citri* (Table 3). Daily predation of female rates (prey/day) were higher with the *E. kuehniella* eggs 17.73±1.03 as the prey than for the other types of prey. *O. albidipennis* males daily prey consumption ranged from 8.17±0.11 feeding on *E. kuehniella* eggs, 7.41±0.24 on the culture of *A. craccivora* nymphs and ending with a lost mean daily consumption of 5.01±0.33 of the prey *P. citri* nymphs. It could be concluded that, the prey consumption increased notably in *O. albidipennis* adult females comparing with adult males as well as in adult stages generally comparing with the predator 4th and 5th nymphal instars (Table 3).

Sobhy et al., 2010, stated that, prey type had a significant effect on prey consumption by *O. albidipennis* adults. There was a significant prey type by predator sex interaction for total prey consumption, but overall, female predators did consume significantly more total prey than male predators. Part of this difference is attributable to differences in longevity between males and females. Although females did consume more eggs of *E. kuehniella* comparing with other tested preys.

## CONCLUSION

It could be concluded that, *O. albidipennis* biology and consumption rate influences by the three tested preys. Eggs of *E. kuehniella* and *A. craccivora* nymphs were the most suitable diet for the predator. Although, *P. citri* nymphs were less suitable for the predator, but it could survive and reproduce feeding on which is conceded as an important advantage as a biological control agent. The present work could be applied for mass rearing of *O. albidipennis* in biological control programs in Egypt in order to reduce the chemical application which would improve the food safety and reduce the environmental pollution.

## REFERENCES


Treaty Impact on Biological Control of Insects


target the crop

\textit{Orius albidipennis} (Reuter) (Hemiptera: Anthocoridae)

\begin{itemize}
\end{itemize}