Predators As biological control agents against *Myzus persicae* in tomato crop

Abdel-Raheem MA and Abdel-Rahman IE

Abstract

The results obtained that, the % reduction of *Myzus persicae* population by releasing *Coccinella undecimpunctata* and *Chrysoperla carnea* (Stephens) on tomato plants in green house in Faculty of Agriculture, Al-Azhar University. Predators releasing caused % reduction on *M. persicae* population compared with control treatments. The suppression of *M. persicae* population by three treatments of predators released (C. undecimpunctata and C. carnea), C. carnea and C. undecimpunctata on tomato plants were (85, 83, 80 and 84, 82, 79%) on 7th days after releasing with three treated for the first experiment and second experiment, respectively. After two weeks, from predators released the % reduction reached to (90.5, 89 and 85%) and (90, 89% and 83%) for three treated during the two experiments respectively.

Keywords: *Coccinella undecimpunctata*, *Chrysoperla carnea*, *Myzus persicae*, tomato

Introduction

Tomatoes may lose their commercial value when severely attacked *Myzus persicae* and *Tauta absoluta* it’s become a pests of tomatoes in both field and greenhouses [1-3] Its major host is *Solanum lycopersicum* (tomato), [4] other hosts also exist Such as *Capsicum* spp. (Pepper), [5-8] Aphid parasites (Hymenoptera: Braconidae and Aphelinidae) have been used in biological control and integrated pest management (IPM) programs much more often than other aphid natural enemies. They have the advantage of preying exclusively on aphids, although many will attack a wide range of species. Several of natural enemies are produced commercially in large numbers, particularly for use in glasshouses, where some important aphid species have developed resistance to chemical insecticides. In addition, several parasitoid species have been moved around the world and used in classical introductions to combat major aphid pests of outdoor crops, [9-11] Coccinellidae predators are tolerant to many insecticides which is an advantage over other predators. It is the most important beneficial insect of cotton pests, with its immature and mature stages as voracious feeder of all the species of aphids, [4, 12-16].

There are some pests which cause a great damage of the vegetable productions such as cabbage aphid, *Brevicoryne brassica* (L.), cotton Aphid *Aphis gossypii*, (Hemiptera: Aphididae), these pests controlled by predators such as ladybirds, Aphid lion and parasites such as parasitic wasps, [17-20].

These Insect predators belong to family *Coccinellidae* and *Chrysopidae*, these feed during the larval and adult stages on different sap-sucking pests including aphids, [21, 22]. Several studies have been carried out in different parts of the world concerning the predation activity of many predator species such as *Chrysoperla undecimpunctata* and *Chrysoperla carnea*. Among those who contributed much to these studies are [23, 24]. The neuropteran predator’s *C. carnea* and *C. septempunctata* (Wesm) have attracted considerable attention as a biological agent to control important agricultural pests, [25].

Many attempts have been made by releasing some bio-control agents, particularly common *Coccinellid* and *Chrysopidae* species for controlling aphid species, [26]. The green lacewings, *Chrysoperla carnea* (Stephens) is a polyphagous predator, commonly found in agricultural systems. It has been recorded as an effective generalist predator of aphids, [27-29]. The aim of this study to evaluated the efficiency of *Coccinella undecimpunctata* and *Chrysoperla carnea* against *Myzus persicae* on tomato plants.
Materials and Methods
Evaluate the efficiency of 2nd instar larvae of *Chrysoperla carnea* (Four larvae /plant) and adult of *Coccinella undecimpunctata* (Four adults/ plant) as biological control agents of *Myzus persicae* on tomato plants under green house of 300 m² in Faculty of Agriculture, Al-Azhar University. The area was divided into 12 replicates (5x 5 m²) as treated by the two predators *Chrysoperla carnea* and *Coccinella undecimpunctata* (three replicates); for each one and three replicates as control. A plastic sheet was fixed between each replicate. Randomized samples of 10 leaves /replicate were taken just before the predator release as pre-count and then samples picked up weekly intervals as post-counts. The samples were put in paper bags, directly transferred to laboratory. Immature and adults of *M. persicae* were counted with aid of a stereomicroscope, after 3, 7 and 14 days.

Mass rearing of *Coccinella undecimpunctata* (L.)
When the population of *Myzus persicae*, increased and reached to suitable density individuals (approximately 100 individuals /plant) on tomato plants, these plants were inoculated with *Coccinella undecimpunctata*. The stock culture of ladybird was obtained from infested plants and transferred to laboratory. Only 10 adults♂ + 10 adults♀ of ladybird (to prevent larval cannibalism) were transferred to rearing cages (30 cm diameter X 50 cm high) and kept in wooden cages (100X150X150 cm) with nylon gauze sides. To maintain the predator culture, a suitable number of the prey daily offered to the predator.

Mass rearing of *Chrysoperla carnea*
Five pairs of the green lacewings *Chrysoperla carnea* adults were confined in the glass chimney (6cm x10cm) was placed in the Petri dish (10 cm). Another small petri dish (5 cm. diameter) was placed in the bigger Petri dish for holding cotton soaked in distilled water to maintain moisture. The upper open end of glass chimney was covered with black muslin cloth and was tightened with rubber band. The diet (sugar: yeast extract: honey: distilled water: casein 3g: 2.5gm: 2.5gm: 10 ml: 2 gm) provided with intervals of 24 hours. Eggs laid by female green lacewing on the walls of chimney and muslin cloth were harvested. After hatching the newly hatched larvae were fed on frozen eggs of *Sitotroga cerealella*. The process continued until the formation of cocoons. The cocoons formed were removed gently with camel hair brush to other empty glass chimneys to observe and record the emergence of adults.

Statistical analysis
The % Reduction of infestation was calculated according to the equation of [30], (ANOVA) of the obtained data were performed by using SAS program, [31].

Results and discussion
Table 1 & 2: showed that the interaction of *Coccinella undecimpunctata* and *Chrysoperla carnea* caused insignificant suppressed of *Myzus persicae* population on tomato plants.
The results obtained that aphid population before released were (145, 140, 142 and 137, 135, 140 individuals/plant) while it recorded on control (133, 125, 121 and121, 122, 120 individuals /plant) for the three treatments during two season respectively. Predators releasing caused reduction percentages on *M. persicae* population compared with control during two successive seasons. During first season, *M. persicae* population achieved (11, 9 and 6 individuals /plant) after *C. undecimpunctata* and *C. carnea* released on 3rd, 7th and 14th days. While aphid population recorded (20, 17 and 10 individuals /plant) after releasing of *C. undecimpunctata* on 3rd, 7th and 14th days, and releasing *C. carnea* reduced the aphid population to reach (21, 15 and 9 individuals /plant) on 3rd, 7th and 14th days after predator releasing. In addition, the reduction of *M. persicae* population continuing to second season compared with control which recorded (10, 9 and 6 individuals /plant) after releasing *C. undecimpunctata* and *C. carnea* on 3rd, 7th and 14th days respectively. Also, in case of releasing *C. undecimpunctata* the aphid insects population achieved (25, 15, 9individuals /plant) on 3rd, 7th and 14th days respectively.

The suppression percentages of *M. persicae* individuals were (86.3, 83, 83.5 and 86, 84.2, 84%) on 3rd days after releasing with three treatments for the first and second seasons respectively. Then after 7 days of predators releasing the suppression percentage of *M. persicae* individuals were (89, 86, 88 and 86.7, 88.2, 92%) with three treatments for the first and second seasons respectively. At the end of the experiment, after two weeks of predators released, the reduction percentages reach its maximum (91.7, 91 and 95%) and (90, 88.5% and 92%) for the three treatments during two seasons, respectively. Generally in all cases, the numbers of consumption aphids had been eaten did not differ between three different treatments. These results agree with [32] who investigated the efficiency of the ladybirds *Hippodamia variegata* (Goeze) and *C. carnea* (Stephens) as biological control agents of the cotton aphid *A. gossypii*. The predator: prey ratios of 1:30 and 1:90 significantly reduced the population of *A. gossypii*. At 1:30 and 1:90 there was no difference in efficiency between the uses of the predators alone or in combination. Also, [33] tested two antagonist combinations, the parasitoid *Aphidius colemani* (Viereck) with the predator species *C. carnea* (Stephens) against *Myzus persicae* (Sulz.) on sweet pepper plants. They reported cleared aphid insects population achieved (11, 9 and 6 individuals /plant) after releasing 3rd days after releasing *C. carnea* the aphid insects population achieved (20, 17 and 10 individuals /plant) on 3rd, 7th and 14th days respectively.

The introduction of *Eretmocerus eremicus* (Rose and Zolnerowich) and *Dicyphus hesperus* (Knight) had the positive effect in whitefly on tomato plants in greenhouse using *Encarsia formosa* (Gahan) only was not effective in winter season. The addition of *Eretmocerus eremicus* (Rose and Zolnerowich) and *Dicyphus hesperus* (Knight) had the positive effect in several cropping systems; *D. hesperus* was the effective predator of all stages of whitefly. Also, [35] evaluated the prey preference of the omnivorous bug *Dicyphus tamaninii* (Wagner) (Heteroptera: Miridae) among 5 different prey species, and its interaction between three different natural enemies *Amblyseius cucumeris* (Oudemans) *Phytoseiulus persimilis* (Athias-Henriot) and *Aphidius colemani* (Viereck) commonly used in greenhouses. The results demonstrated that *A. cucumeris*, *P. persimilis*, and *A. colemani* individuals were attacked by *D. tamaninii* in absent of unparasitized *A. gossypii*. 
Table 1: Interaction between *Coccinella undecimpunctata* (L.) and *Chrysoperla carnea* (Stephens) against *Myzus persicae* (Sulzer) infesting tomato plants in the first Season.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>No. of <em>Myzus persicae</em>/ plant before release</th>
<th>No. of <em>Myzus persicae</em>/ plant after release (%)</th>
<th>3rd day</th>
<th>7th day</th>
<th>14th day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>% No.</td>
<td>%</td>
<td>% No.</td>
<td>% No.</td>
</tr>
<tr>
<td><em>C. undecimpunctata</em></td>
<td>145</td>
<td>21 86.3</td>
<td>15 89</td>
<td>9 91.7</td>
<td></td>
</tr>
<tr>
<td>control</td>
<td>133</td>
<td>120 -----</td>
<td>93 -----</td>
<td>75 -----</td>
<td></td>
</tr>
<tr>
<td><em>C. carnea</em></td>
<td>140</td>
<td>21 83</td>
<td>15 86</td>
<td>9 91</td>
<td></td>
</tr>
<tr>
<td>control</td>
<td>125</td>
<td>120 -----</td>
<td>87 -----</td>
<td>80 -----</td>
<td></td>
</tr>
<tr>
<td><em>C. undecimpunctata + C. carnea</em></td>
<td>142</td>
<td>9 83.5</td>
<td>9 88</td>
<td>6 95</td>
<td></td>
</tr>
<tr>
<td>control</td>
<td>121</td>
<td>100 -----</td>
<td>90 -----</td>
<td>88 -----</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Interaction between *Coccinella undecimpunctata* (L.) and *Chrysoperla carnea* (Stephens) against *Myzus persicae* (Sulzer) infesting tomato plants in the second Season.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>No. of <em>Myzus persicae</em>/ plant before release</th>
<th>No. of <em>Myzus persicae</em>/ plant after release (%)</th>
<th>3rd day</th>
<th>7th day</th>
<th>14th day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>% No.</td>
<td>%</td>
<td>% No.</td>
<td>% No.</td>
</tr>
<tr>
<td><em>C. undecimpunctata</em></td>
<td>137</td>
<td>25 86</td>
<td>15 86.7</td>
<td>9 90</td>
<td></td>
</tr>
<tr>
<td>control</td>
<td>121</td>
<td>115 -----</td>
<td>100 -----</td>
<td>80 -----</td>
<td></td>
</tr>
<tr>
<td><em>C. carnea</em></td>
<td>135</td>
<td>20 84.2</td>
<td>15 88.2</td>
<td>10 88.5</td>
<td></td>
</tr>
<tr>
<td>control</td>
<td>122</td>
<td>91 -----</td>
<td>86 -----</td>
<td>79 -----</td>
<td></td>
</tr>
<tr>
<td><em>C. undecimpunctata + C. carnea</em></td>
<td>140</td>
<td>10 84</td>
<td>9 92</td>
<td>6 92</td>
<td></td>
</tr>
<tr>
<td>control</td>
<td>120</td>
<td>89 -----</td>
<td>86 -----</td>
<td>79 -----</td>
<td></td>
</tr>
</tbody>
</table>

Conclusion

The interaction of *Coccinella undecimpunctata* and *Chrysoperla carnea* caused significant suppressed of *Myzus persicae* population on tomato plants. *Coccinella undecimpunctata* and *Chrysoperla carnea* releasing caused reduction percentages on *M. persicae* population compared with control as combination or alone. Using of combination from *Coccinella undecimpunctata* and *Chrysoperla carnea* against *Myzus persicae* is prefer than using both alone.

Reference


