Effect of aphid species on development and morphometrics of Menochilus sexmaculatus (Fabricius) (Coleoptera: Coccinellidae) under laboratory conditions


Abstract

Menochilus sexmaculatus (Fab.) is a potential biocontrol agent that is commonly used in augmentative release programs and necessitates more ecological and biological data information. The experiment was conducted to determine the consequences of different aphid species (Aphis nerii, Lipaphis erysimi and Bervicoryne brassicae) on development and morphometrics of Menochilus sexmaculatus at the laboratory of Biocontrol, Department of Entomology, Faculty of Crop Protection, Sind Agriculture University Tando Jam, Sindh, Pakistan during 2018. The longest development period Menochilus sexmaculatus female and male were observed on A. nerii 39.00±2.08 and 30.33±1.20 days followed by B. brassicae 38.00±1.53 and 30.33±0.33 days and L. erysimi 34.33±1.20 and 27.33±0.88 days, respectively. The longest length and breadth (mm) of larval instars from 1st to 4th instar were recorded on A. nerii. Where in the pupal stage it was recorded on L. erysimi but in the female and male adult stages of Menochilus sexmaculatus Fab. was recorded on L. erysimi, respectively. The ANOVA showed a significant (P<0.05) difference in metamorphic measurement in length and breadth in all developmental stages.

Keywords: Aphid, Aphis nerii, Lipaphis erysimi and Bervicoryne brassicae, development period, morphometrics, M. sexmaculatus.

Introduction

The family Coccinellidae are a well-known group of dynamic predators that check the aphid population keeps them below the economic injury level, possessing huge economic importance due to its predaceous encounter on aphid in both grubs as well as adult stages [1]. The zigzag beetle belongs Coccinellidae sub-family is a generalist predator that devours on soft-bodied insects comprised of aphids [2]. In Sindh, many aphid species are found serious pests of vegetable crops, i.e. wheat aphid, safflower aphid, mustard aphid, and berseem aphid, etc. These species of aphids are wingless and reproduce parthenogenetically. If the environmental conditions are favorable the population's aphid species may expand very quickly [3]. Predatory zigzag beetle, Menochilus sexmaculatus (Fab.), is well-known ladybird beetle is an entomophilous coccinellid having a wide range of distribution in South-Western Asia, South Africa, Philippines, Indonesia, India, and Pakistan [4]. The adult as well grub of Menochilus sexmaculatus is voraciously fed on prey (aphid) species which is a serious threat to various cereal crops in Pakistan. Rhopalosiphum padi (L) is considered serious pests of wheat in cereals at present. Furthermore, that directly causes losses in yield, because this aphid also acts as the vector of barley yellow dwarf virus [5]. Rose aphid, Macrosiphum rosae, denoted as a serious pest of the rose as well as other crops. Both stages of aphid adults as well as nymphs attack the rose plants and suck the cell sap from tender shoots, buds, and flowers, eventually reduced the value of flowers in the market. About 20-40 % of losses recorded due to the infestation of aphid that declined capacity of flowering in the crop [6]. Aphids are unisexual and multiply on parthenogenesis. Under natural conditions, the aphid population may increase rapidly. Menochilus sexmaculatus is a common insectivorous ladybug that feeds on soft insects including aphids. The adult beetles are about 2 mm in size, bright yellow, and have black vertical uneven lines on the backside of both elytra. Polymorphs of various colors may exist in the species [7].
Keeping in view the above facts so this study was conducted to determine the effect of aphid species on the development and morphometrics of *Menochilus sexmaculatus* on different aphid species under laboratory conditions.

**Materials and Methods**

The experiment was conducted in the laboratory of the Entomology Department, Sindh Agriculture University, Tando Jam. The adult of zigzag beetle was collected from different crops and rear on natural hosts in the laboratory. The aphid species (Akke, Mustard, and Cabbage) were collected from respective crops. The prey species were provided to the predator larva and adult beetle to determine the development period and morphometrics of different larval instars of under laboratory conditions. The temperature was maintained between 26±2°C and Relative humidity 60±5%. The experimental design was Complete Randomized Design (CRD) with five replications. There were three treatments i.e. T1= *Aphis nerii*, T2= *Lipaphis erysimi*, and T3= *Bervicoryne brassicae*. Ten eggs of *Menochilus sexmaculatus* were shifted in each Petri dish for the experiment. After hatching, grubs were fed on aphid species on the leaves of respective crops. The observation was taken daily to determine the developmental time and morphometric was measured of each life stage daily with the help of a magnifying glass scale. The newly emerging adults were fed with the same aphid species.

The collected data were subjected to statistical analysis and statistical differences existed between data set (P<0.05), Fisher’s Least Significant Differences (LSD) was used to separate the differing means.

**Results**

**Development period of *Menochilus sexmaculatus* on different aphid species**

The result in table 1 indicates that the development of 1st instar of *Menochilus sexmaculatus* took maximum days (2.67±0.33 days) on *Aphis nerii* than *Bervicoryne brassicae* (2.33±0.33 days) and *Lipaphis erysimi* (2.67±0.03 days). Maximum days (2.67±0.33) for development of 2nd instar of *Menochilus sexmaculatus* were recorded for *Bervicoryne brassicae* than *Lipaphis erysimi* (2.00±0.58 days) and *Aphis nerii* (1.67±0.03 days). Maximum days (2.67±0.33) for the development of the 3rd instar of *Menochilus sexmaculatus* were recorded for *Lipaphis erysimi* than *Bervicoryne brassicae* (2.00±0.58 days) and *Aphis nerii* (1.67±0.03 days). Maximum days (2.33±0.33) for the development of the 4th instar of *Menochilus sexmaculatus* were recorded for *Lipaphis erysimi* than *Aphis nerii* (1.33±0.33 days) and *Bervicoryne brassicae* (1.33±0.33 days). Maximum days (4.67±0.33) for the development of pupa of *Menochilus sexmaculatus* were recorded for *Bervicoryne brassicae* than *Lipaphis erysimi* (3.67±0.33 days) and *Aphis nerii* (3.33±0.33 days). Maximum days (39.00±2.08) for the development of females of *Menochilus sexmaculatus* were recorded for *Aphis nerii* than *Bervicoryne brassicae* (38.00±1.53 days) and *Lipaphis erysimi* (34.33±1.20 days). Maximum days (30.33±1.20) for the development of males of *Menochilus sexmaculatus* were recorded for *Aphis nerii* than *Bervicoryne brassicae* (30.33±0.33 days) and *Lipaphis erysimi* (27.33±0.88 days).

**Table 1: Development period of *Menochilus sexmaculatus* on different aphid species under laboratory conditions**

<table>
<thead>
<tr>
<th>Life stages</th>
<th><em>Aphis nerii</em> (T1)</th>
<th><em>Lipaphis erysimi</em> (T2)</th>
<th><em>Bervicoryne brassicae</em> (T3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st instar</td>
<td>2.67±0.33</td>
<td>2.33±0.33</td>
<td>2.67±0.33</td>
</tr>
<tr>
<td>2nd instar</td>
<td>1.67±0.33</td>
<td>2.00±0.58</td>
<td>2.67±0.33</td>
</tr>
<tr>
<td>3rd instar</td>
<td>1.67±0.33</td>
<td>2.67±0.33</td>
<td>2.00±0.58</td>
</tr>
<tr>
<td>4th instar</td>
<td>1.33±0.33</td>
<td>2.33±0.33</td>
<td>1.33±0.33</td>
</tr>
<tr>
<td>Pupa</td>
<td>3.33±0.33</td>
<td>3.67±0.33</td>
<td>4.67±0.33</td>
</tr>
<tr>
<td>Female</td>
<td>39.00±2.08</td>
<td>34.33±1.20</td>
<td>38.00±1.53</td>
</tr>
<tr>
<td>Male</td>
<td>30.33±1.20</td>
<td>27.33±0.88</td>
<td>30.33±0.33</td>
</tr>
</tbody>
</table>

**Morphometric measurements of *Menochilus sexmaculatus* on different aphid species**

The data in table 2 depicted that the maximum length of 1st instar of *Menochilus sexmaculatus* (2.27±0.17 mm) was recorded for *Aphis nerii* followed by *Lipaphis erysimi* (2.0±0.06 mm) and *Bervicoryne brassicae* (1.87±0.15 mm), respectively. The maximum length of 2nd instar of *Menochilus sexmaculatus* (3.53±0.15 mm) was recorded for *Aphis nerii* followed by *Lipaphis erysimi* (3.33±0.24 mm) and *Bervicoryne brassicae* (2.93±0.07 mm), respectively. The maximum length of the 3rd instar of *Menochilus sexmaculatus* (6.05±0.35 mm) was recorded for *Aphis nerii* followed by *Lipaphis erysimi* (5.89±0.06 mm) and *Bervicoryne brassicae* (5.30±0.21 mm), respectively. The maximum length of the 4th instar of *Menochilus sexmaculatus* (7.17±0.17 mm) was recorded for *Aphis nerii* followed by *Bervicoryne brassicae* (7.07±0.22 mm) and *Lipaphis erysimi* (7.00±0.04 mm), respectively. The maximum length of the pupa of *Menochilus sexmaculatus* (4.33±0.33 mm) was recorded for *Aphis nerii* followed by *Lipaphis erysimi* (5.17±0.93 mm) and *Bervicoryne brassicae* (4.87±0.19 mm), respectively. The maximum length of females of *Menochilus sexmaculatus* (5.33±0.33 mm) was recorded for *Aphis nerii* followed by *Lipaphis erysimi* (5.67±0.17 mm) and *Bervicoryne brassicae* (5.50±0.29 mm), respectively. The maximum length of males of *Menochilus sexmaculatus* (4.70±0.07 mm) was recorded for *Aphis nerii* followed by *Lipaphis erysimi* (4.03±0.03 mm) and *Bervicoryne brassicae* (4.03±0.09 mm), respectively. The results further revealed in table-2 that maximum breadth of 1st instar of *Menochilus sexmaculatus* (1.14±0.06 mm) was recorded for *Bervicoryne brassicae* followed by *Lipaphis erysimi* (1.06±0.06 mm) and *Aphis nerii* (1.03±0.03 mm), respectively. Maximum breadth of 2nd instar of *Menochilus sexmaculatus* (1.67±0.09 mm) was recorded for *Aphis nerii* followed by *Lipaphis erysimi* (1.60±0.10 mm) and *Bervicoryne brassicae* (1.40±0.06 mm), respectively. Maximum breadth of 3rd instar of *Menochilus sexmaculatus* (3.08±0.08 mm) was recorded for *Aphis nerii* followed by *Lipaphis erysimi* (2.50±0.10 mm) and *Bervicoryne brassicae* (2.42±0.08 mm), respectively. Maximum breadth of 4th instar of *Menochilus sexmaculatus* (3.67±0.17 mm) was recorded for *Aphis nerii* followed by *Lipaphis erysimi* (3.25±0.14 mm) and *Bervicoryne brassicae* (3.00±0.05 mm), respectively. The maximum breadth of the pupa of *Menochilus sexmaculatus* (3.50±0.01 mm) was recorded on *Lipaphis erysimi* followed by *Aphis nerii* (3.33±0.17 mm) and *Bervicoryne brassicae*...
The current results have partial agreements with those of Lipaphis erysimi followed by Aphis neri and B. brassicae as compared to L. erysimi. The average maximum length and breadth in larval instars were recorded on A. neri followed by L. erysimi and B. brassicae, respectively. However, the maximum length and breadth were observed in pupae and adults (female and male) on L. erysimi, B. brassicae, and A. neri, respectively.

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References


