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Effects of Insecticides on Voracity of *Menochilus Sexmaculatus* in a Prey Plant System

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Article Details

ABSTRACT

Keywords: Zigzag Ladybird, *Menochilus* Zigzag ladybird, *Menochilus sexmaculatus* (Coleoptera: Coccinellidae) is a *Sexmaculatus*, Predatory Consumption, common predator that feeds aphids, whiteflies and mealy bugs. Insecticides are the dominant tool to manage the pest population, but they have a negative impact on non-targeted organisms. Thus, present study focused on impact of different insecticides on the predatory consumption of 4th larval instar, male and female of *M. sexmaculatus*, mortality rate of aphids and foraging behavior between predator and prey in a treated plant system. The experiment was set using Completely Randomized Design (CRD) with five replications. There were two insecticides used along with control, i.e., T1: Abamectin (1.0 ml/ 500 ml water), T2: Acetamiprid (1.0 ml/500 ml water) and T3: Control (500 ml water). The results revealed that the maximum mean consumption was recorded in T2 (Acetamiprid) on 4th larval instar (26.2), male (27.4) and female (28.6) stages of *M. sexmaculatus* at 24 Hours After Spray (HAS) followed by T1 (Abamectin), respectively. Similarly, the highest aphid mortality percentage was observed in T1 (Abamectin) during predatory efficiency of 4th larval instar (48%), male (43%) and female (45%) stages of zigzag beetle at 24 HAS as compared to T2 (Acetamiprid), respectively. Furthermore, the maximum mean foraging behavior between predator and prey was observed in T2: Acetamiprid during 24 HAS followed by T1: Abamectin, respectively. In T3 (control), the highest mean predatory consumption, aphid mortality percent and foraging behavior between predator and prey was observed at 24 HAS followed by 2 and 6 HAS, respectively. The analysis of variance showed significant differences ($P < 0.05$) between various treatments and intervals. Overall, the maximum mean consumption and predator prey interaction was recorded in T2 (Acetamiprid), however the highest aphid mortality percentage was seen in T1 (Abamectin), respectively.

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INTRODUCTION

Zigzag ladybird, *Menochilus sexmaculatus* (Coleoptera: Coccinellidae) is a polyphagous predator and commonly found in Asia and Europe continents (Zhao *et al.*, 2015; Bukero *et al.* 2019). The body length of zigzag ladybird is about 3–4 mm with yellow to canary yellow body color and black elytra. They lay their eggs near the colony of their prey in nature, so their offspring get food easily. They voraciously feed on aphids and serve as biological control agents of aphids and othersoft bodied small insects such as whiteflies, mealy bugs, scale insects and psyllids (Nagdev *et al.*, 2022). This beetle is holometabolous and developed through the stages of eggs, grub, pupa and adults. The length of each development stage varies with the change in climatic conditions. Cannibalism of female on eggs or larva is common in this species (Majerus, 2016; Singh *et al.*, 2020). It has the ability to tolerate at high temperatures and makes it a suitable biological agent for agroecosystems with elevated temperatures, particularly in greenhouses (Wang *et al.*, 2013). The ecological significance of this lady beetle lies in its ability to regulate herbivore populations, thereby exerting an indirect influence on plant health and productivity (Patel *et al.*, 2018). The predation rates of lady beetles on herbivorous insects exhibit variability influenced by diverse factors such as herbivore population, density, and environmental conditions (Uiterwaal & DeLong, 2018). Aphids are sucking pests of plants and are termed as plant lice. They feed on food materials prepared by the plant. They simply insert their proboscis in phloem and take the nutrients transported to different parts of the plant (Sanches *et al.*, 2023). Their infestation is responsible for food scarcity in plants and leads to curling of the leaves and stunting of the growth. Aphids produce large amounts of sugary liquid waste called honeydew, which provides favorable environment to facilitate the growth of black sooty moulds. In addition, it also provides place to the virus for secondary infection at the site of insertion of their proboscis and harm the plants indirectly (Chen & Wei, 2020; Gadhave *et al.*, 2020).

Aphis gossypii (Hemiptera: Aphididae) is a polyphagous pest that causes severe damage directly and indirectly to plants by feeding and deforming leaves, twigs and transmitting various viral diseases (Campolo *et al.*, 2014). These aphids are controlled by using various agro-chemicals but on the other hand, they are harmful to the natural enemies and destroy the life stages of different insect predators as well as parasitoids in the field crops (Singh & Sharma, 2009). The components of Integrated Pest Management, i.e., cultural, biological and chemical controls are becoming more popular globally. These components are unique, vast, safe and cost-effective benefits against insect pests as well as weeds (Kilgore & Doult, 1967). The agro-chemicals have

caused serious issues due to their indiscriminate, insufficient and inappropriate usage such as health risks, environmental degradation, advent of secondary pests, death of natural enemies and development of pest resistance (Yadav, 1989). Chemical pesticides have become a dominant tool for managing insect pests over the past few years. However, this approach can have negative impacts on non-target organisms due to both lethal and sub-lethal effects (Biondi *et al.*, 2013).

The efficacy of natural insect pest predators, as well as the ecosystem and non-target creatures, may be disrupted by the excessive use of synthetic pesticides (Afza *et al.*, 2021). The treatments involving EPF can be considered low risk for predators and parasitoids, and they are compatible with them (Ansari *et al.*, 2010). Aphids reach a high population density in a short time. They fail to be adequately controlled by the recommended rate of different chemical insecticides (Wang *et al.*, 2021). The high ability of this pest to develop insecticide resistance and boost attention to environmental impact has spurred the development of alternative control methods (Fanning *et al.*, 2018; Zhang *et al.*, 2018). The agro-chemicals are available in the market according to the activity of insect pests such as stomach or contact poisons, neurotoxins, growth regulators and respiratory inhibitors. Imidacloprid, Pyriproxyfen, Lambda-cyhalothrin, Bifenthrin and Acetamiprid, these are all commonly used against sucking as well as chewing insect pests (Sanchez-Bayo, 2012).

Acetamiprid belongs to the neonicotinoid group and these poisons disturb the activity and function of central nervous system of any insect which cause paralysis (Sattar *et al.*, 2018). Insecticide imidacloprid is a systematic poison which is used against aphids, whiteflies, jassids, thrips and minute soil insects. This poison damages neurophysiological activity such as lack of coordination, shocks, locomotion and causes paralysis (Papachristos & Milonas, 2008). This insecticide has complete chances to reduce the insect pest population when it is applied through foliar or treating method (Tan *et al.*, 2012). Another agro-chemical, the pyriproxyfen is an insect growth regulator (IGR) which damages many various insect pests i.e., cockroaches, ticks, ants, carpet beetles and mosquitoes. These insecticides influence their juvenile hormones and restrict the growth that affects the newly emerged adults, larvae and eggs (Hallman *et al.*, 2015). Therefore, the purpose of current work was to determine the impact of different insecticides on predatory consumption of 4th larval instar, male and female of *M. sexmaculatus*, the aphid mortality and foraging behavior between predator prey in treated plant system.

MATERIALS AND METHODS

LOCATION: The current research work was conducted at Bio-control Research Laboratory,

Department of Entomology, Faculty of Crop Protection, Sindh Agriculture University, Tando Jam during the year 2023.

EXPERIMENTAL DESIGN: The Complete Randomized Design (CRD) was used with five replications.

TREATMENTS: Three treatments were used as follows:

T1: Abamectin (1.0 ml/ 500 ml water)

T2: Acetamiprid (1.0 ml/500 ml water)

T3: Control (500 ml water).

PROCEDURE OF EXPERIMENT: Brinjal plants were grown into five plastic pots. The 250 aphids (*Lipaphis erysimi*) were then released on each plant. Foliar applications of each treatment were applied on brinjal plants. After application, each plant was kept 30 minutes for drying and released five each 4th instar larvae, adult male and female of predator, *M. sexmaculatus* for 24 h., and each plant was covered with plastic bag to prevent them from effect and appearance of other insecticides. The data on predation efficiency, mortality and foraging behavior of predator and prey was recorded after 2, 6 and 24 HAS (Hours After Spray). This experiment was designed to determine predation efficiency according to the model given by Soares et al. (2003).

$$(1) \quad V_0 = A - a_2$$

$$(2) \quad V_0 = A - a_6$$

$$(3) \quad V_0 = A - a_{24} \text{ Where:}$$

V_0 = Number of eaten aphids

A = Number of aphids available

a_2, a_6, a_{24} = Number of aphids not consumed (dead or alive) in the system still 24 hrs.

The consumption rate and mortality percentage of aphids were calculated by using the following formula:

$$\text{Consumption rate \%} = \frac{\text{Consumed Aphids} \times 100}{\text{Total Aphids}}$$

$$\text{Mortality \%} = \frac{\text{Dead aphid} \times 100}{\text{Total aphids}}$$

STATISTICAL ANALYSIS: The data were subjected to statistical analysis using Statistix 8.1 computer software (Statistix, 2006). The differences among the treatment's means were compared by the LSD test, where necessary.

RESULTS

The mean consumption rate of 4th larval instar of *Menochilus sexmaculatus* after the application of different insecticides at various intervals were calculated Figure 1. The data displays that the maximum mean aphid consumption was observed 22.0 and 26.2 against T₁ (Abamectin) and T₂ (Acetamiprid) after 24 hours. Similarly, the minimum average consumption was found at the interval of 2 and 6 hrs. (10.4, 14.8 and 16.6, 20.0) against T₁ (Abamectin) and T₂ (Acetamiprid), respectively. In T₃ (control), the highest mean consumption was recorded 48.2 after the spray of 24 hrs., as compared to 2 and 6 hrs. (25.0 and 34.8), respectively. The analysis of variance showed significant difference ($P < 0.05$) between different treatments as well as intervals.

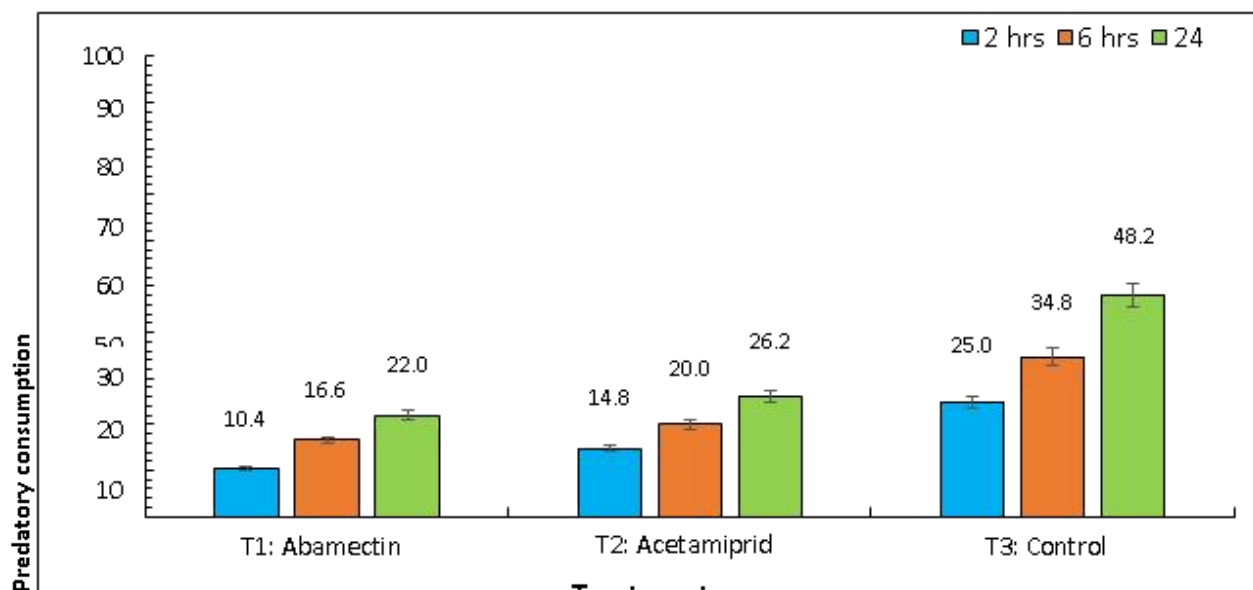


FIGURE 1. Mean consumption of 4th larval instar of *Menochilus sexmaculatus* after the application of different insecticides at various intervals.

MORTALITY PERCENTAGE OF APHIDS IN TREATED PLANTS DURING PREDATORY EFFICIENCY OF 4TH LARVAL INSTAR OF *MENOCILUS SEXMACULATUS*

The death rate percent of aphids in treated plants during predatory efficiency of the 4th instar of *M. sexmaculatus* was studied and results are presented in Figure 2. According to the results, the highest mortality was shown in T₁: Abamectin (48%) and T₂: Acetamiprid (40%) after the spray of 24 hours. Whereas the lowest death rate (mortality) was recorded 18% in T₂ (Acetamiprid)

and 21% in T₁ (Abamectin) after the spray of 2 hours. Furthermore, moderate aphid mortality was observed 27% in T₂ (Acetamiprid) and 33% in T₁ (Abamectin) during 6 hrs. intervals, respectively. In T₃ (control), the maximum mortality was found 7% after 24 hrs. as well as the minimum was shown 2 and 5% at 2 and 6 hrs.spray intervals, respectively. The ANOVA showed a highly significant difference ($P<0.01$) among different treatments as well as intervals.

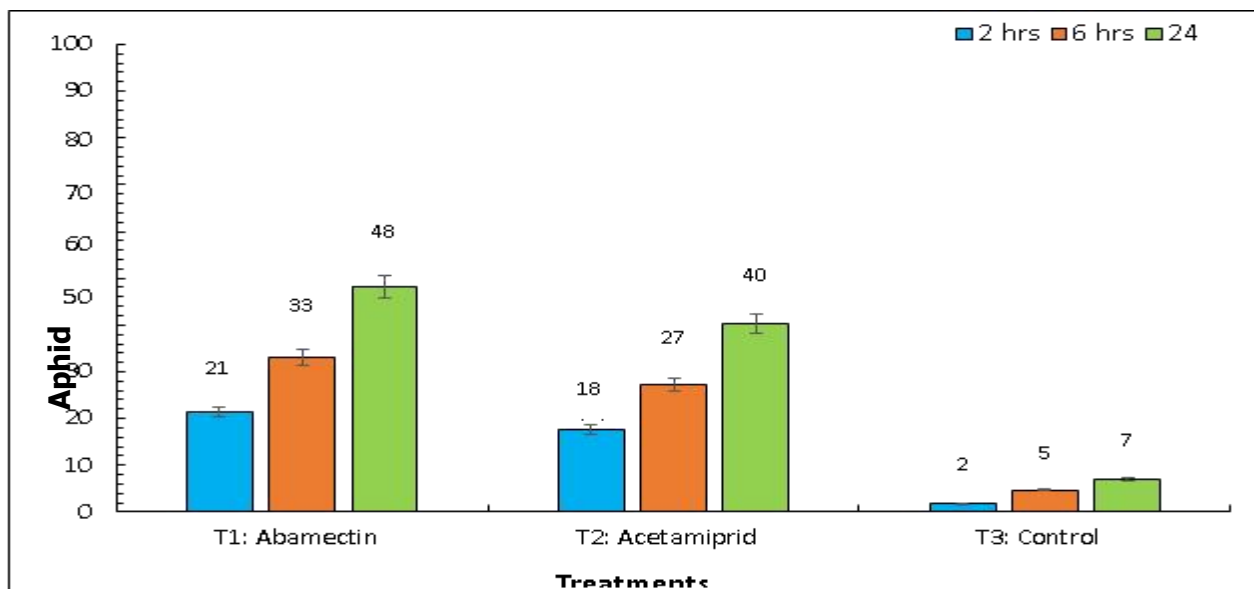


FIGURE 2. Mortality percentage of aphids in treated plants during predatory efficiency of 4th larval instar of *Menochilus sexmaculatus* at various intervals.

FORAGING BEHAVIOR OF 4TH LARVAL INSTARS OF *MENOCHILUS SEXMACULATUS* ON APHIDS IN TREATED PLANT SYSTEM AT DIFFERENT INTERVALS

Figure 3 demonstrates the foraging behavior of 4th larval instar of *M. sexmaculatus* on aphids in treated plants at various intervals. The data depicted shows that the maximum consumption was recorded 14.8, 20.0 and 26.2 in T₂ (Acetamiprid) after 2, 6 and 24 hrs. intervals, whereas the minimum consumption was indicated 10.4, 16.6 and 22.0 against T₁ (Abamectin) during same hrs. intervals, respectively. In T₃ (control), the high consumption was found 48.2 after 24 hrs. followed by 6 hrs.(34.8) and 2 hrs. (25.0), respectively. The ANOVA showed significant difference ($P<0.05$) among different treatments as well as hours.

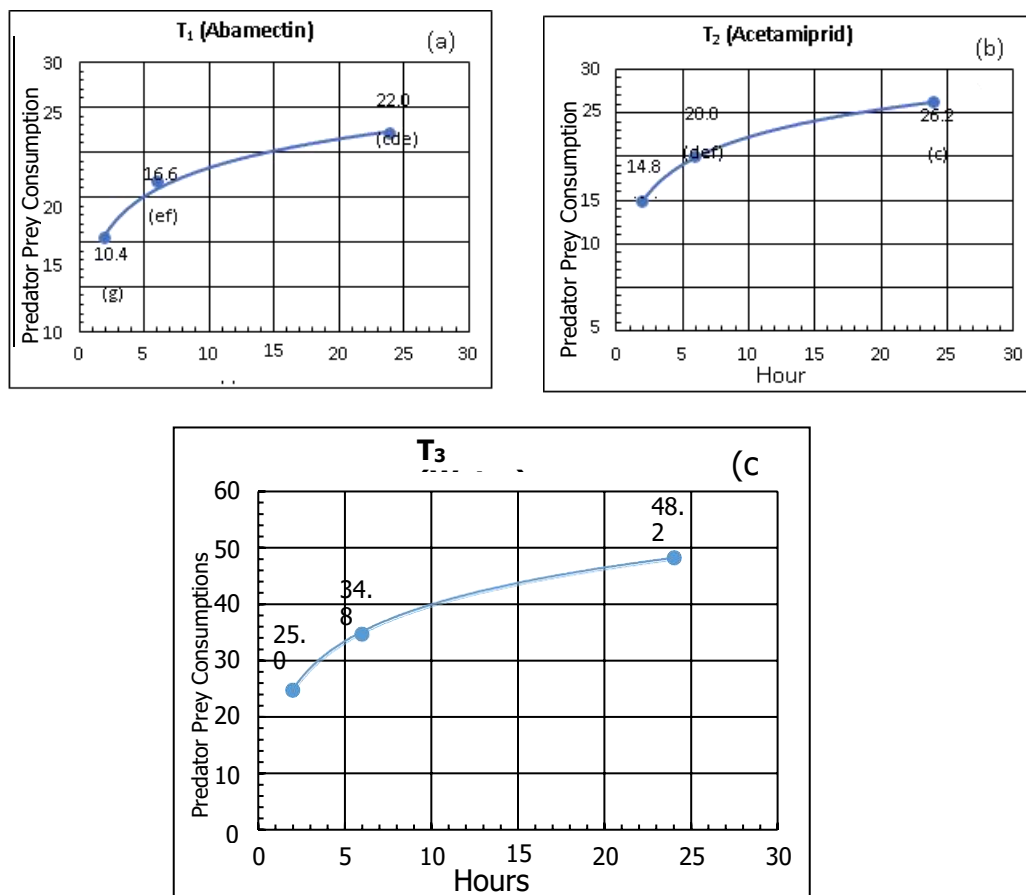


FIGURE 3. Foraging behavior of 4th larval instars of *Menochilus sexmaculatus* on aphids in treated plant system at different intervals.

MEAN CONSUMPTION RATE OF *MENOCILUS SEXMACULATUS* MALES AFTER THE APPLICATION OF DIFFERENT INSECTICIDES AT VARIOUS INTERVALS

The average consumption of *M. sexmaculatus* adults (male) at various intervals is shown in Figure 4. The result shows that the highest average consumption was recorded 24.8 and 27.4 in T₁ (Abamectin) and T₂ (Acetamiprid) after the spray of 24 hours. However, the lowest mean consumption by males were indicated in T₁: Abamectin (13.2 and 19.0) and T₂: Acetamiprid (16.6 and 21.0) during 2 and 6 hrs. intervals, respectively. In T₃ (control), the maximum average consumption was 51.0 after 24 hrs., while the minimum was found after 2 and 6 hrs. (28.4 and 35.8), respectively. The ANOVA displayed significant difference ($P < 0.05$) among various treatments and hours.

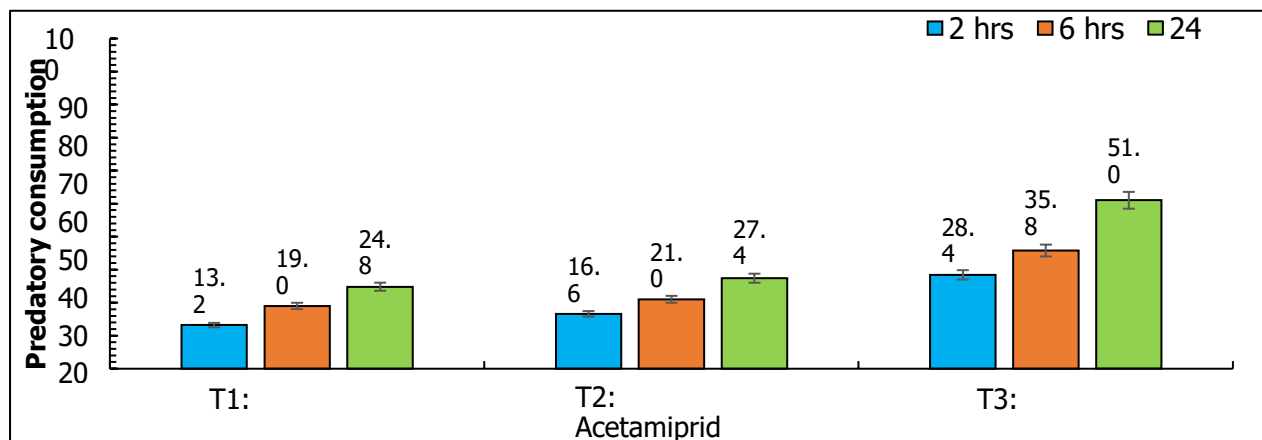


FIGURE 4. Mean consumption of *Menochilus sexmaculatus* males after the application of different insecticides at various intervals.

MORTALITY PERCENTAGE OF APHIDS IN TREATED PLANTS DURING PREDATORY EFFICIENCY OF *MENOCHILUS SEXMACULATUS* MALES

Figure 5 displays the mortality percentage of aphids in treated plants during predatory efficiency of male stage. The graph shows that the maximum aphid mortality was observed to be 43% in T1 (Abamectin) and 38% in T2 (Acetamiprid) at 24 HAS. Therefore, the minimum mortality was found in T2: Acetamiprid (19%) and T1: Abamectin (24%) at 2 HAS, while the moderate death rate was showed 26% in T2 (Acetamiprid) and 30% in T1 (Abamectin) during 6 hrs. intervals, respectively. In T3 (control), the highest death rate was showed 6% during 24 hrs. whereas the lowest was recorded 2 and 4% at 2 and 6 HAS, respectively. The analysis of variance displayed a highly significant difference ($P < 0.01$) between various treatments and intervals.

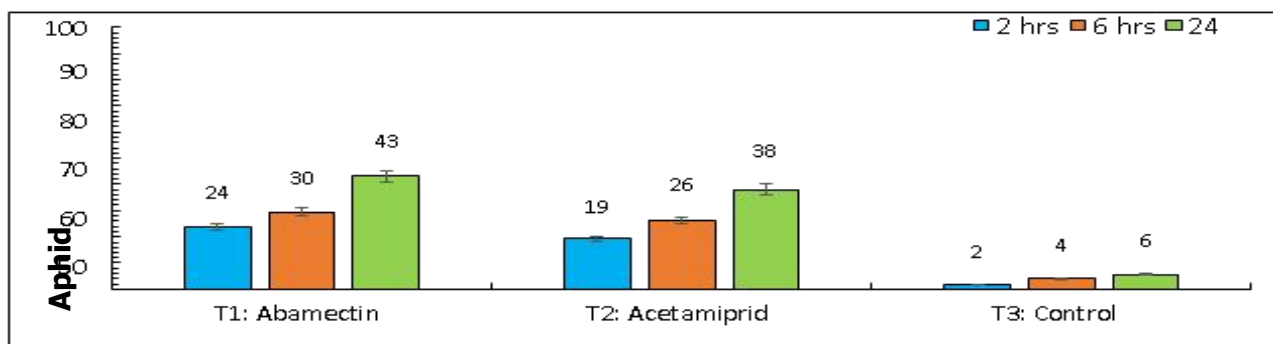


FIGURE 5. Mortality percentage of aphids in treated plants during predatory efficiency of *Menochilus sexmaculatus* males at various intervals.

FORAGING BEHAVIOR OF PREDATORY BEETLE *MENOCHILUS SEXMACULATUS* MALES ON APHIDS IN TREATED PLANT SYSTEM AT

DIFFERENT INTERVALS

The foraging behavior of predatory beetle *M. sexmaculatus* males on aphids in treated plant at different hours is presented in figure 6. According to the data, the highest average male consumption was showed 16.6, 21.0 and 27.4 after 2, 6 and 24 hrs. intervals in T₂: Acetamiprid, whereas the minimum mean consumption was found in T₁: Abamectin (13.2, 19.0 and 24.8) after the same hrs. intervals, respectively. In T₃ (control), the maximum mean predator prey consumption was indicated after 24 hrs. (51.0) as compared to 6 hrs. (35.8) and 2 hrs. (28.4), respectively. The analysis of variance displayed significant differences ($P<0.05$) between various treatments and intervals.

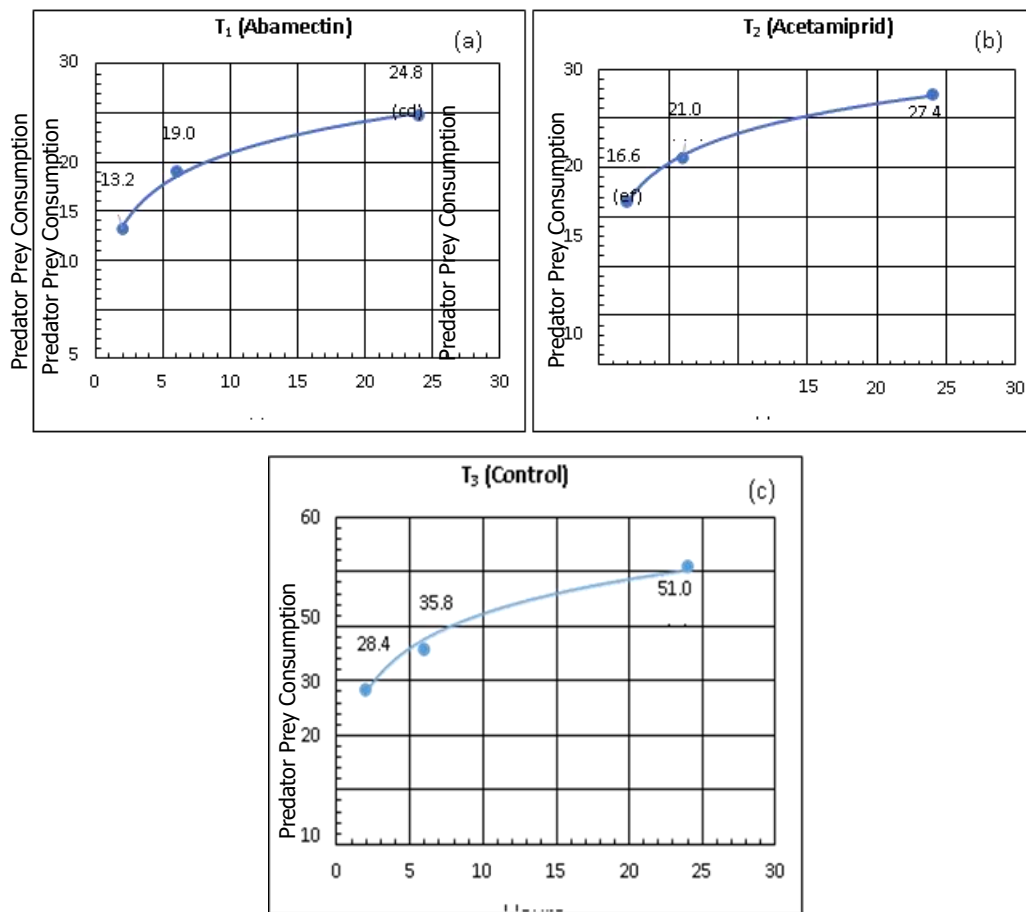


FIGURE 6. Foraging behavior of predatory beetle *Menochilus sexmaculatus* males on aphids in treated plant system at different intervals

MEAN CONSUMPTION RATE OF *MENOCHILUS SEXMACULATUS* FEMALES AFTER THE APPLICATION OF DIFFERENT INSECTICIDES AT VARIOUS INTERVALS

The mean consumption of *M. sexmaculatus* females at different spray intervals is described in Figure 7. According to the data, the maximum mean predatory consumption was found 25.0 and 28.6 on T1 (Abamectin) and T2 (Acetamiprid) after 24 hours spray interval. Whereas the minimum average consumption was showed 14.8, 17.0, 21.2 and 23.8 against T1 (Abamectin) and T2 (Acetamiprid) after 2 and 6 hrs. intervals, respectively. In T3 (control), the highest mean consumption was observed 55.2 after 24 hrs. interval as compared to 2 and 6 hrs. intervals (30.4 and 37.0), respectively. The analysis of variance showed significant difference ($P<0.05$) between different treatments as well as intervals.

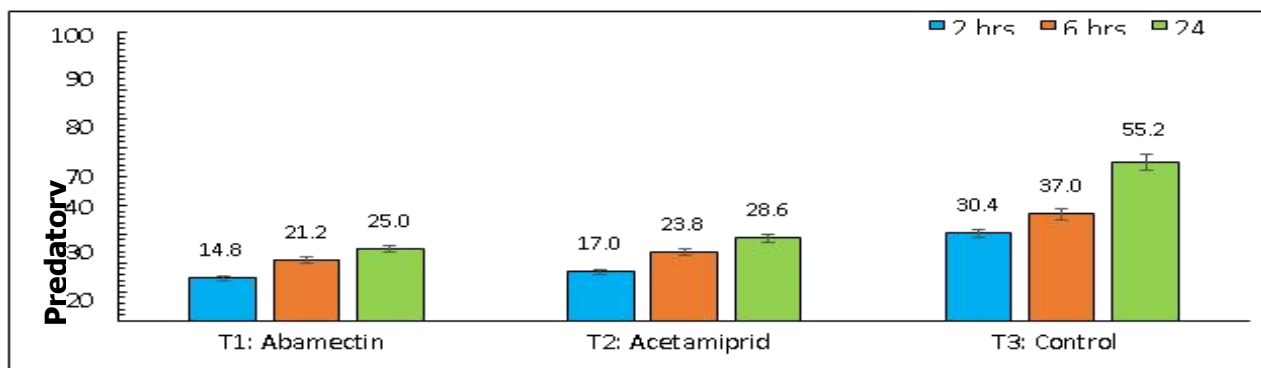


FIGURE 7. Mean consumption of *Menochilus sexmaculatus* females after the application of different insecticides at various intervals.

MORTALITY PERCENTAGE OF APHIDS IN TREATED PLANTS DURING PREDATORY EFFICIENCY OF *MENOCHILUS SEXMACULATUS* FEMALES

The mortality percentage of aphids in treated plants during predatory efficiency of the female stage is shown in Figure 8. According to the graph, the highest mortality was shown 45 and 41% after 24 hrs. intervals when the plant was treated with T1: Abamectin and T2: Acetamiprid. However, the lowest death rate was recorded 21 and 28% against T2: Acetamiprid and 27 and 32% against T1: Abamectin after 2 and 6 hrs. intervals, respectively. In T3 (control), the maximum mortality was displayed 9% after 24 hrs., while the minimum was showed 3 and 5% at 2 and 6 hrs. The ANOVA showed a highly significant difference ($P<0.01$) among various treatments and intervals.

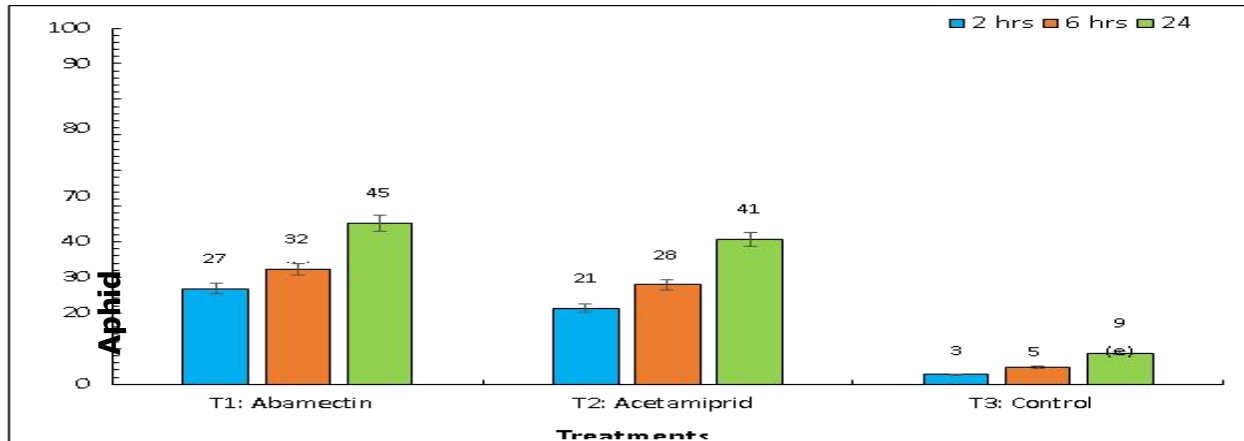


FIGURE 8. Mortality percentage of aphids in treated plants during predatory efficiency of *Menochilus sexmaculatus* females at various intervals.

FORAGING BEHAVIOR OF PREDATORY BEETLE *MENOCILUS SEXMACULATUS* FEMALES ON APHIDS INTREATED PLANT SYSTEM AT DIFFERENT INTERVALS

The foraging behavior of predatory beetle *M. sexmaculatus* females on aphids in treated plant at different hours is shown in Figure 9. The graph shows that the maximum mean predator prey consumption was observed 17.0, 23.8 and 28.6 in T2: Acetamiprid after 2, 6 and 24 hrs. intervals. Therefore, the minimum average consumption was found 14.8, 21.2 and 25.0 in T1: Abamectin during the same hrs. intervals, respectively. In T3 (control), the maximum average consumption was observed 55.2 after 24 hrs. as compared to 6 hrs. (37.0) and 2 hrs. (30.4), respectively. The ANOVA showed significant difference ($P < 0.01$) among different treatments as well as various intervals.

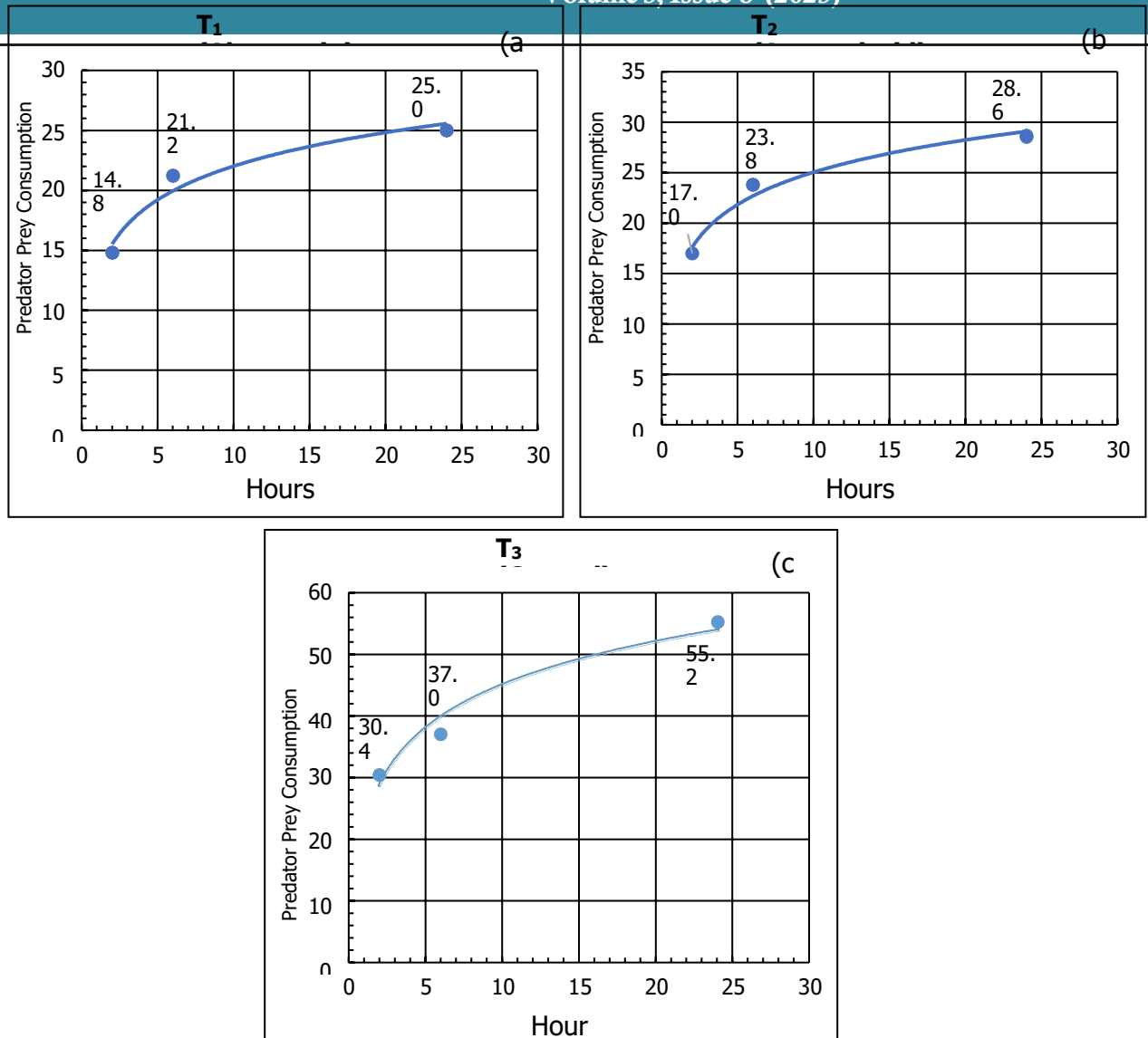


FIGURE 9. Foraging behavior of predatory beetle *Menochilus sexmaculatus* females on aphids in treated plant system at different intervals

DISCUSSION

The biocontrol agents feed the contaminated prey when applied the different insecticides against the pests in the field and their body has produced the resistance against the exposure (Desneux *et al.*, 2005). Sattar et al. (2018) reported that the effect of insecticides i.e., acetamiprid, dimethoate, deltamethrin, pyriproxyfen and lambda-cyhalothrin were highly reduced the activity of neurophysiological and behavioral responses, leading to paralysis, loss of coordination, and reduced fertility, lifespan, and growth of *C. septempunctata*. Solangi et al. (2007) observed that the dose of confider, Telstar and polo insecticides showed highest mortality against 4th larval instar at 96 hrs. While danitol showed 72% mortality at the interval of one week. Therefore, the insecticide Tracer was harmless and showed 30% mortality, respectively. Olszak et al. (2004)

reported that aphids were contaminated with pirimicarb, pyriproxyfen and fenpyroximate insecticides and provided to life stages of two-spot and Seven-spot ladybird beetle and did not show the toxic impact on the longevity period as well as fecundity rate of females. Azod et al. (2016) reported that the sub-lethal field recommended doses of abamectin insecticide decreased the egg laying capacity of zigzag beetle (*M. sexmaculatus*). Furthermore, Haramboure (2017) explained that the sublethal concentrations of pyrethroids showed toxic effects on oviposition, egg hatchability and larval stage of green lacewing.

Dipping of lacewing, *Chrysoperla externa* in acetamiprid showed adverse impact on the fecundity rate as well as 1st larval instar, whereas the same insecticide increased the larval duration of predatory mite, *Amblyseius cucumeris* (Rimoldi et al., 2017; Cheng et al., 2018). Bass et al. (2015) and Margaritopoulos et al. (2020) reported that whitefly (*B. tabaci*), cotton aphid (*A. gossypii*), brown planthopper (*Nilaparvata lugens*) and mustard aphid (*M. persicae*) produced the resistant against neonicotinoid insecticides. Jiang et al. (2018) showed the impact of clothianidin solution and found that the duration was increased of 2nd, 3rd larval instars as well as pupal stage of *C. septempunctata*. Claver et al. (2003) observed that cypermethrin insecticide decreased the feeding potential of seven spot beetle when provided the treated assassin bug (*Acanthaspis pedestris*). Azadirachtin (0.03%) displayed 1.17% death rate of assassin bug sp. (*Rhynocoris marginatus*) when treated with contact method (Sahayaraj & Selvaraj, 2003). Baloch et al. (2023), they reported that the highest decreasing rates of banana aphid (*Pentalonia nigronervosa*) was showed 70-91% when sprayed with Spinetoram as compared to Methoxyfenozide (68-85%), Spinosad (67-73%), Chlorantraniliprole (28-72%) and Flubendamide (20-48%), respectively. Ataide et al. (2024) observed that chlorfenapyr, sulfoxaflor-spinetoram and spinosad highly affected the life stages of tobacco thrips (*Thrips parvispinus*) by direct and residue toxicity assays, while acetamiprid, acephate, abamectin and imidacloprid showed moderate mortality, respectively. Nur et al. (2020) found that spinosad, emamectin benzoate and neem oil had exerted the lowest aphid population and resulted in significantly higher marketable yield on Hyacinth bean (*Lablab purpureus*).

Arya et al. (2014) found the valuable effectiveness of castor bean oil (*Ricinus communis*) against mustard aphid (*L. erysimi*). Furthermore, the maximum death rate of green citrus aphid (*Aphis spiraecola*) was found 58% on Tondexir (3 ml) + Bartar soaps (1 ml), whereas the minimum was seen 18% on Palizin (2 ml), respectively (Imani and Toorani, 2016). Sabry et al. (2014) found

the highest impact on the larval stage of green lacewing (*Chrysoperla carnea*) when treated with chlorantaraniliprole in the laboratory conditions. Planes et al. (2013) applied direct method of spirotetramat and did not show the residual impact on the eggs hatching, larval growth, survival, development and reproduction rates of females against the predator (*C. montrouzieri*). Halappa et al. (2013) determined that imidacloprid and acetamiprid insecticides proved slightly toxic against the immature as well as mature stages of mealybug destroyer (*Cryptolaemus montrouzeiri*). Patel et al. (2015), they examined that the spray of emamectin benzoate displayed highest mortality and showed least damage of sucking insect pests on eggplant. Mandi et al. (2020) determined that the lowest population of leafhoppers (0.79), thrips (0.46) and aphids (2.75) was seen when sprayed with combined insecticides (Spinetoram + Sulfoxaflor). The infestation of black citrus aphid (*Toxoptera aurantia*) completely decreased (100%) when sprayed the dose of botanical pesticide Dayabon, 10% SL (Toorani et al., 2016). The maximum death rate of Australian mealybug (*Icerya purchasi*) was found 93-100% on botanical pesticides i.e., Dayabon and Tondexir + Bartar Soap, respectively (Kazem & El-Shereif, 2010).

Heydari et al. (2016), they observed that the maximum death rate of apple aphid (*Aphis nerii*) was indicated 94.46% in Tondexir + Bartar soap followed by Dayabon (89.70%) and acetamiprid (90.17%). Various botanical pesticides such as Palizin (2.5 ml) + Citrol oil (5 ml) and Tondexir (3 ml) + Bartar soap (1 ml) were highly effective in reducing the damage of cotton aphids, respectively (Baniameri, 2008). Dhingra (1999) reported that the adults of seven spot beetles showed the least tolerance when applied the dose of deltamethrin (LC₅₀ 0.0021%). Sterk et al. (1999) found heptenophos was moderate effective and showed 51 to 75% death rate against the adults of *C. septempunctata* in the field condition. Ibrahim & Yee (2000), Nadimi et al. (2009), Biondi et al. (2013) reported that egg laying capacity and total life duration of phytoseiid mites and parasitoid wasps females were highly damaged by the spray of abamectin insecticide. Nasreen et al. (2003), Bueno & Freitas (2004), Moura et al. (2012) explained that abamectin insecticide showed the highest death rate of green lacewing at the highest dose.

Jiang et al. (2019) observed that the larval stage and lifespan was reduced (18.76 and 24.46%) when applied the concentration of thiamethoxam (LC₁₀). However, the fecundity (33.74 and 46.56%) and oviposition period (19.67 and 25.01%) were also reduced at the same concentration, respectively. El-Sherbeni et al. (2019) observed that profenofos displayed 100% mortality of *A. gossypii* followed by lambda-cyhalothrin insecticides. Khalequzzaman and Nahar

(2008) observed that the solution of *Azadirachta indica* was highly effective as compared to imidacloprid, malathion and carbosulfan against cowpea aphid, cotton aphid, green peach aphid and mustard aphid, respectively.

CONCLUSIONS AND RECOMMENDATIONS

- The maximum mean predatory consumption of 4th larval instar, male and female of *M. sexmaculatus* was observed in T₂ (Acetamiprid) followed by T₁ (Abamectin) at 24 HAS.
- Similarly, the highest aphid mortality percent in treated plants during predatory efficiency of 4th larval instar, male and female of *M. sexmaculatus* was showed in T₁ (Abamectin) as compared to T₂ (Acetamiprid) at the same interval, respectively.
- Furthermore, the highest average predator prey consumption was recorded in T₂ (Acetamiprid) at 6 and 24 HAS, whereas the lowest consumption was seen in T₁ (Abamectin) at 2 HAS, respectively.
- Both insecticides such as abamectin and acetamiprid were proved as highly toxic and showed the highest mortality of aphids during the experiment, but both are very dangerous to zigzag beetles.
- Therefore, these poisons should be avoided when natural enemies interact with prey in the field crops.

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