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INSECTICIDAL EFFICACY ON *BACTROCERA CUCURBITAE* (COQUILLETT) INFESTATION IN BITTER GOURD

Qaisar Hamd[1], *Mir Afzal Shah[2], Asad Ullah[1], Urooj Shah[3], Ehtisham Ul Haq[3], Shahid Yar[3], Abdur Rahman[3], Muhammad Salman[4], Arsalan Ali[5], Muhammad Hassan[3], Shahbaz Khan[3]

1 Department of Entomology, The University of Agriculture Peshawar. Pakistan

2 Department of Entomology, Gomal University Dera Ismail Khan, Pakistan

3 Department of Plant Protection, The University of Agriculture Peshawar, Pakistan

4 Sericulture Branch, NTFP Division, Pakistan Forest Department, Peshawar, KPK

5 Directorate of NTFP, Forest Department, Peshawar, Khyber Pakhtunkhwa

Corresponding Author: Mir Afzal Shah*

Abstract

The study was performed at the Agriculture Research Institute Tarnab, Peshawar, Pakistan during 2018 to assess the effectiveness of selected insecticides against the melon fruit fly, *Bactrocera cucurbitae*, in bitter gourd crops. The results revealed that Deltamethrin 2.8 EC + jaggery bait exhibited the highest efficacy. This treatment resulted in minimal fruit infestation rates (13.13%, 8.63%) and the lowest number of maggots per fruit (12.50, 9.57). Following closely, deltamethrin 2.8 EC (0.0028%), azadirachtin 1 EC (0.005%), and malathion 50 EC (0.1%) treatments showed comparable effectiveness in reducing fruit infestation. However, the number of maggots per infested fruit was significantly lower in the deltamethrin and azadirachtin treatments compared to malathion. On the other hand, dichlorovos 76 SC (0.152%) were found to be less effective, showing relatively lower reductions in fruit infestation and the number of maggots per infested fruit compared to other treatments, except the control treatment.

Keywords: *Bactrocera cucurbitae*, jaggery, *Momordica charantia*, synthetic insecticides

Introduction

Fruit flies are significant pests that commonly infest cucurbitaceous vegetables, notably bitter gourd (*Momordica charantia* L.), where their damage poses a substantial constraint on fruit quality and yield. The severity of damage caused by *Bactrocera cucurbitae* ranges from 30 to 100 percent, depending on the specific cucurbit species and prevailing season (Dhillon *et al*., 2005). Historical control efforts against fruit flies primarily employed full cover sprays, initially utilizing inorganic insecticides like lead arsenate in the early 1900s, transitioning over the century to synthetic alternatives such as chlorinated hydrocarbons, organophosphates, and synthetic pyrethroids. These insecticidal cover sprays offer affordability, convenience, and consistent protection against fruit fly infestation (Allwood, 1997). However, given concerns regarding the environmental impact and residual issues associated with chemical applications, there is a growing imperative to explore alternative management strategies. Consequently, this study focuses on investigating and highlighting options for effectively managing melon fruit fly infestations in bitter gourd using selected insecticides while minimizing residual problems.

Material and Methods

Field experiments were conducted on bitter gourd during 2018 at the Agriculture Research Institute Tarnab Peshawar, Pakistan. The bitter gourd variety was sowed in plastic trays filled with coconut husk, and seedlings were nurtured under greenhouse conditions. Transplanting of seedlings took place in the field during the second week of March (Rabi Season) and October (Kharif Season) 2018. The experimental design followed a Randomized Complete Block Design, with a plot size of 3.5 m x 3 m, maintaining row-to-row and plant-to-plant distances of 1.0 m x 60 cm, respectively. Standard fertilizers were applied as recommended, and manual weeding was performed as necessary to control weeds. The treatments were consistent across experiments during both seasons, including:

- T1: spray of deltamethrin + jaggery bait @ 0.0028 + 0.015%

- T2: malathion @ 0.1%

- T3: dichlorvos @ 0.152%

- T4: azadirachtin @ 0.005%

- T5: deltamethrin @ 0.0028%

- T6: control

Each treatment was replicated thrice. The first foliar spray of each treatment was administered at the fruit setting stage of bitter gourd, followed by three additional sprays at 10-day intervals. At each fruit harvesting, healthy and infested fruits were segregated, and data on fruit infestation percentage were recorded. Cumulative fruit infestation percentage for each treatment throughout the cropping season was analyzed. Additionally, data on the number of maggots per infested fruit in each treatment were recorded by dissecting five fruits per plot (i.e., totaling 15 fruits per treatment) to assess the treatment's impact on the maggot population per fruit. The data were subject for the analysis of variance to determine the treatments' effects on fruit fly damage percentage.

Results and Discussion

The findings of the current study regarding the efficacy of selected insecticides against the melon fruit fly in bitter gourd crops demonstrated varying effectiveness in reducing fruit infestation and maggot density compared to the untreated control during both the kharif and rabi seasons (see Table 1). Notably, among the treatments, the application of deltamethrin + jaggery bait showed high efficacy against the melon fruit fly, resulting in significantly lower fruit infestation rates (13.13%, 8.63%) and fewer maggots per infested fruit (12.50, 9.57) compared to other treatments. These results align with previous findings by Ranganath *et al*. (2015), who reported that a spray containing deltamethrin @ 1ml/l + jaggery bait @ 15g/l, along with sanitation and cue lure traps, resulted in reduced fruit damage. The bait spray (deltamethrin + jaggery) is applied to broad-leafed plants, serving as refugia for melon fruit fly adults (Ronald and Jayma, 2007), encouraging adult feeding on the spray residue and providing effective kill rates. The next most effective treatments in this study were deltamethrin (22.50%, 15.64%), azadirachtin (22.94%, 16.02%), and malathion (24.02%, 18.68%), which showed comparable efficacy in reducing fruit infestation. However, deltamethrin (19.00, 17.41) and azadirachtin (23.55, 22.76) recorded fewer maggots per fruit compared to malathion (29.24, 26.55). In a study conducted in Pakistan, Khan *et al*. (1992)

observed that the application of deltamethrin 2.5 EC and malathion 57% EC at 10-day intervals (four sprays in total) significantly reduced *B. cucurbitae* infestation on melons compared to the untreated control. The efficacy of deltamethrin was also supported by the findings of Doharey (1983), reporting 100 percent mortality of *B. cucurbitae* at a concentration of 0.003 percent deltamethrin within 96 hours. Hassan (1998) found effective reduction of fruit damage by *B. cucurbitae* in bitter gourd up to 16 days after fruiting and the second spray of deltamethrin (15 g a.i/ha) compared to malathion (500 g a.i/ha). Moreover, Ranganath *et al*. (1997) reported the efficacy of neem-based biopesticides against fruit flies in terms of reducing fruit infestation and antioviposition effects. Additionally, Sharma and Sinha (2009) found "neem ban" to be more effective against *B. cucurbitae* in bitter gourd than endosulfan. Hassan (1998) tested neem seed kernel extract on persimmon and found it to be most effective against first and second instar larvae of the Queensland fruit fly. Furthermore, dichlorvos also exhibited considerable effectiveness in reducing fruit infestation and the number of maggots per fruit in both seasons compared to the untreated control.

Table 1: Efficacy of different synthetic insecticides against the *Bactrocera* infestation in bitter gourd during 2018.

Insecticides	Fruit infestation (%)		No. of maggots fruit^{-1}	
	Rabi	Kharif	Rabi	Kharif
Deltamethrin + jaggery bait	13.13 a	8.63 a	12.50 a	9.57 a
Malathion	24.02 b	18.68 bc	29.24 cd	26.55 cd
Dichlorvos	31.09 c	24.96 d	36.30 e	33.15 ef
Azadirachtin	22.94 b	16.02 abc	23.55 bc	22.76 bc
Deltamethrin	22.50 b	15.64 ab	19.00 b	17.41 b
Control	40.54 d	30.35 e	46.25 f	38.13 g
LSD (0.05)	3.68	2.80	5.59	4.00

Mean in columns followed by the same letters are non-significant 5 % level of probability

Conclusions and Recommendations

The study concluded that among all the tested treatments Deltamethrin 2.8 EC + jaggery bait exhibited the highest efficacy at all the observation period and it is recommend for the field use of end users of Peshawar area.

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