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Research Article

Efficacy of Protein Bait Sprays in Controlling Melon Fruit Fly [*Bactrocera Cucurbitae* (Coquillett)] in Vegetable Agro-ecosystems

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Abstract: Melon fruit fly [*Bactrocera cucurbitae* (Coquillett)] is an injurious pest of vegetables and fruits throughout the cosmos. Vegetables are key source of proteins, minerals and vitamins for human nutrition. However, a number of factors, such as Tephritid flies, confine production of vegetables. Among them, *B. cucurbitae* is most deleterious pests of the vegetables. In the present investigation, conducted at two field locations of district, Hyderabad during 2016, efficacy of various bait sprays was evaluated in controlling *Bactrocera cucurbitae* (Coquillett) infestation. The field locations were Jeay Shah and Dehli farm and the cucurbit vegetable crops were bottle gourd (*Lagenaria siceraria*) and bitter gourd (*Momordica charantia*). For this purpose, three food attractants such as Nu-lure, Protein hydrolysate and Prima were sprayed on one meter square per field area, as spot treatment. Significantly higher reductions in *B. cucurbitae* infestations (24.80±2.63, 21.20±2.75) were recorded with Protein hydrolysate followed by Nu-lure (27.80±3.26, 24.20±3.57), as compared with untreated plots, at both field locations ($P<0.05$). Moreover, higher number of pupae were recovered (121.40±13.81, 115.00±14.17) and higher number of flies and trap catches were observed in control ($P<0.05$). This study established that Protein hydrolysate is an effective food attractant for reducing *B. cucurbitae* in all the tested cucurbits. Results of the present investigation would be useful in developing a sustainable pest management strategy in the cucurbit agro-ecosystem.

Keywords: *Bactrocera cucurbitae,* Protein hydrolysate, bottle gourd, bait sprays

1. INTRODUCTION

Insect pests are the most important factors responsible for low yield and poor quality of vegetables around the world. Cucurbit vegetables are predominantly attacked by melon fruit fly [*Bactrocera cucurbitae* (Coquillett)] [1]. In Pakistan vegetable growers randomly use a mixture of toxins/ pesticides on to suppress fruit fly infestations. However, repeated and indiscriminate application of pesticides leads to havoc on human health, environment, soil, water and wildlife. In addition to direct losses, such incidences could reduce the product value and export opportunities due to strict quarantine regulations [3]. Different protein food attractants were testified against melon flies in Hawaii, such as GF-120 Fruit Fly Bait (Dow Agro Sciences, LLC, www.dowagro.com) and Fruit Fly Bait (GF-120 NF Naturalyte®); both are effectuated primarily with organic formulations certified by the Organic Materials Review Institute and are confirmed as effective bait sprays [7]. The traps baited with food attractants enticed fruit flies from moderately short expanses. The protein baited traps designed to imply a good assessment and management of fruit flies populations existing in the locale. Population of *Bactrocera cucurbitae* controlled using commercial formulation of Neem & Neem leaf dust instead of using insecticidal sprays [2]. The bait sprays (3 component fruit fly food lures), such as MultiLure® and Biolure® against male and female *C. capitata, B. dorsalis and B. cucurbitae.* The baits were applied as spot treatment on the host plants and on foliage adjacent to the host plants and proved highly effective in reducing fruit flies incursion [8]. The continuous practice of food attractants on weekly basis proved

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effective against fruit flies infestation. The 800 ml (56.5 liters) amount of Nulure and Prima were sprayed on cucurbit crops suggested wise use of food attractants mixed with insecticides needed as conferred by connoisseurs [5]. The appreciable efficacy of botanicals (Eucalyptus & Parthenium) in controlling *B. cucurbitae* on *M. charantia* and *L. acutangula* were observed as compared with insecticides. The reduced damage percentage was recorded on *M. charantia* and *L. acutangula* plots when treated with Eucalyptus (43.75%, 40.00%) as compared with Parthenium (45.92%, 41.12 %). Whereas, maximum infestation were recorded in the check plots on both crops [4]. The objective of this study was to determine efficacy of the bait sprays in controlling *B. cucurbitae* in vegetable agro-ecosystem of district Hyderabad in Sindh province of Pakistan.

2. MATERIALS AND METHODS

The bait application experiment was conducted for the management of melon fruit fly in cucurbit agro-ecosystems of district Hyderabad under field conditions. The studies were carried out on different cucurbit crops at Jeay Shah and Dehli farm where bottle gourd (*Lagenaria siceraria*) and bitter gourd (*Momordica charantia*) were sown. The experiment was performed in Randomized Complete Design (RCD) having four treatments and five replications.

2.1 Bottle Gourd (*L. siceraria*)

The experiments on *L. siceraria* were conducted at Jeay Shah Farm where each replicate comprised of five plots (9 m x 6 m) for each treatment with plant spacing (hill x row) of 0.5 m x 2 m. The different food attractants such as Prima bait, Nu-lure bait and Protein hydrolysate bait were sprayed at weekly intervals using Prima bait (200 ml /L), Nu-lure bait (200 mL /L) and Protein hydrolysate bait (200 mL/L) mixed with Proclaim (25 mL/L). The mixture was applied using a power knapsack sprayer. First application of baits was made at fruit setting and consecutive applications were made until the plants died. The control plots were 200 m away from the plots treated with Protein bait sprays and no insecticide spray was sprayed around the control plots. Cue-lure baited traps were deployed at respective plots for adult fruit fly capture.

2.2 Bitter Gourd (*M. charantia*)

The experiments on *M. charantia* were conducted at Dehli Farm where each replicate comprised of five plots (9 m x 6m) for each treatment with plant spacing (hill x row) of (0.5 m x 2 m). Different food attractants such as Prima bait, Nu-lure bait and Protein hydrolysate bait were sprayed at weekly intervals using Prima bait (200 mL/L), Nu-lure bait (200 mL /L) and Protein hydrolysate bait (200 mL/L) mixed with Proclaim (25 mL/L). The mixture was applied using a power knapsack sprayer. The first application of baits was made at fruit setting and consecutive applications were made until the plants died. The control plots were 200 m away from plots treated with Protein bait sprays and no insecticide spray was sprayed around control plots. Cue-lure baited traps were deployed at respective plots for adult fruit fly capture.

The infested fruits were collected from respective plots of distinct locations at weekly intervals and brought to the laboratory, placed on sterilized sand moistened with distilled water in wooden trays covered with fine wire mesh for pupation. The number of infested fruits, number of flies collected from cue-lure traps were recorded.

3. RESULTS

The results of the present study confirmed that *Bactrocera cucurbitae* was the only species that infested fruits of both crops (*M. charantia* and *L. siceraria*) treated with and without different bait sprays. However, significantly lower number of infested vegetables (24.80 ± 2.63, 21.20 ± 2.75) and number of pupae (70.40 ± 11.45, 68.80 ± 3.44) were recovered from both crops at discrete locations when treated with protein hydrolysate bait spray followed by Nu-lure and Prima bait sprays (Table 1). Similarly, minimum number of male and female emerged from the pupae recovered from infested vegetables in the plots treated with protein hydrolysate (Table 2). Likewise reduced number of males and females was recorded from plots sprayed with protein hydrolysate bait spray, compared with control. Moreover, the plots sprayed with protein hydrolysate bait spray were significantly decreased the adult male captures using cue-lure followed by the plots sprayed with Nu-lure and Prima bait

Table 1. Number of infested vegetables and number of pupae recovered from the treated & untreated plots.

Location and Crop	Treatment	No. of Infested Vegetables	No. of Pupae Recovered
Dehli Farm *M. charantia*	Protein hydrolysate bait spray	24.80±2.63 d*	70.40±11.45 b
	Nu-lure bait spray	27.80±3.26 c	74.80±2.42 b
	Prima bait spray	31.60±3.67 b	78.40±5.48 b
	Control	48.00±3.96 a	121.40±13.81 a
Jeay Shah *L. siceraria*	Protein hydrolysate bait spray	21.20±2.75 c	68.80±3.44 b
	Nu-lure bait spray	24.20±3.57 bc	71.20±8.51 b
	Prima bait spray	28.40±3.66 b	74.40±4.75 b
	Control	44.40±4.50 a	115.00±14.17 a

*Values within a column followed by different letters are significantly different according to Fisher's Least Significant Difference (LSD) at $P < 0.05$.

Table 2. Adult emergence of *B. cucurbitae* from infested vegetables in treated and untreated plots.

Location and Crop	Treatment	Sex Ratio	
		Male	Female
Dehli Farm *M. charantia*	Protein hydrolysate bait spray	32.00±4.15 b	42.00±7.54b
	Nu-lure bait spray	34.20±0.86 b*	39.80±4.71 b
	Prima bait spray	38.00±3.94 ab	40.60±2.16 b
	Control	48.00±5.39 a	72.80±7.66 a
Jeay Shah *L. siceraria*	Protein hydrolysate bait spray	28.80±1.98 b	38.40±3.47 b
	Nu-lure bait spray	32.40±4.27 ab	38.60±1.29 b
	Prima bait spray	31.00±2.39 ab	39.80±2.73 b
	Control	40.00±5.48 a	75.00±10.49 a

*Values within a column followed by different letters are significantly different according to Fisher's Least Significant Difference (LSD) at $P < 0.05$.

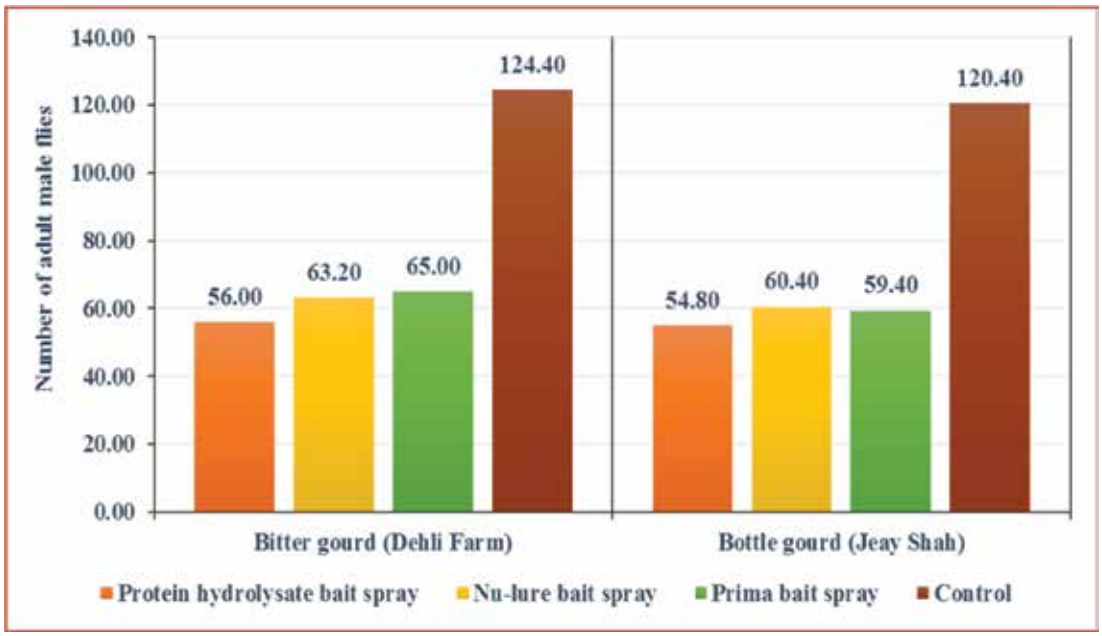

Fig. 1. Adult male melon flies captured using cue-lure baited traps from treated and untreated plots.

sprays from the selected vegetable crops at separate locations (Fig. 1).

4. DISSCUSSION

The present study aimed at observing efficacy of proteinaceous bait sprays against melon fruit fly infestation in vegetable agro-ecosystems of district Hyderabad. The low number of infested vegetable plants was observed in plots treated with protein hydrolysate followed by nue-lure bait spray. However, Qureshi et al. [9] reported significantly lower number of larval infestation on cucurbit vegetables treated with Nu-lure. Furthermore, in this experiment significantly less pupae harboured when *L. siceraria* and *M. charantia* grown plots were treated with protein hydrolysate. The results observed are in agreement with those of Khoo and Tan [10] who also observed lowest pupal recovery from the plots sprayed with protein hydrolysate. The maximum number of adult male melon flies was captured using cue-lure baited traps from untreated plots as compared both treated trials with proteinaceous sprays. Similarly, smith and Yeast [11] observed higher number of adult *B. cucurbitae* in th control angled luffa plots compared with the plot treated with Pinnacle. Further, our results indicated that protein hydrolysate bait spray was comparatively more effective in reducing larval infestation and adult *B. cucurbitae* population. The results of our study are also partially in line with those of Vargas et al. [12] who observed that bait spray (protein hydrolysate + 500 g of molasses/ jiggery) applied with 20 liters of water per acre against *B. cucurbitae* in cucurbit crops proved effective under field conditions. Based on results of this study, it is recommended that in case of severe infestation bait foliar sprays must be repeated at weekly intervals. Installation parapheromone traps with food attractants is recommended for better results against this notorious pest.

5. CONCLUSIONS

Our results revealed that protein hydrolysate bait spray proved effective against *B. cucurbitae* infestation in *M. charantia* and *L. siceraria* than Nu-lure and Prima bait sprays. It is recommended that if we spray protein hydrolysate bait properly and at appropriate time, when crop starts fruiting, it is possible to obtain good control of *B. cucurbitae* in cucurbits. It is also suggested that bait application techniques (BAT) along with spray followed by male annihilation technique (MAT) for adult flies capture could be more effective.

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7. REFERENCES

1. Khan, L., M. Haq, C. Inayatullah, & A. Mohsan. Biology and behavior of melon fruit fly, *Dacus cucurbitae* Coquillett. (Diptera: Tephritidae). *Pakistan Journal of Zoology* 25 (3): 203-208 (1993).
2. Mahfuza, K., M.H. Aftab, & M.I. Saidul. Effect of Neem leaf dust and commercial formulation of a Neem compound on the longevity, fecundity and ovarian development of melon fly, *Bactrocera cucurbitae* (Coquillett) and oriental fruit fly, *Bactrocera dorsalis* (Hendel) (Diptera: Tephritidae). *Pakistan Journal of Biological Sciences* 10(20): 3656-3661 (2007).
3. Mahmood, T., S.I. Hussain, K.M. Khokhar, & M.A. Hidayatullah. Studies on methyl eugenol as a sex attractant for fruit fly, *Dacus zonatus* (Saund) in relation to abiotic factors in peach orchard. *Asian Journal of Plant Sciences* 4: 401-402 (2002).
4. Klungness, L.M., E.B. Jang, R.F.L. Mau, R.I. Vargas, J.S. Sugano, & E. Fujitani. Sanitation techniques for controlling tephritid fruit flies (Diptera: Tephritidae) in Hawaii. *Journal of Applied Science & Environmental Management* 9: 5-14 (2005).
5. Hasyim, A., S. Maryati, & W.J. Kogel. Population fluctuation of adult males of the fruit fly, *Bactrocera tau* walker (Diptera: Tephritidae) in passion fruit orchards in relation to abiotic factors and sanitation. *Indonesia Journal of Agricultural Science* 9: 29–33 (2008).
6. Koyama, J., J.H. Kakinohana, & T. Miyatake. Eradication of the melon fly, *Bactrocera cucurbitae,* in Japan: Importance of Behavior, Ecology, Genetics, and Evolution. *Annual Review of Entomology* 49: 331-349 (2004).
7. Peck, S.L., & G.T. McQuate. Field tests of environmentally friendly Malathion replacements to suppress wild Mediterranean fruit fly (Diptera:

Tephritidae) populations. *Journal of Economic Entomology* 93: 280-289 (2000).

8. Pinero, J.C., R.F.L. Mau, & R.I. Vargas. Managing oriental fruit fly, *Bactrocera dorsalis* (Diptera: Tephritidae), through spinosad-based protein bait sprays and sanitation in papaya orchards in Hawaii. *Journal of Economic Entomology* 102: 1123-1132 (2009).
9. Qureshi, M.Z., S. Hussain, L. Khan, & M.K. Khattak. Varietal resistance and the effect of number of sprays of Dipterex 80sp against fruit fly complex on cucumber (*Cucumis sativus*). *Pakistan Journal of Biological Sciences* 3: 1919–1920 (2000).
10. Khoo, C.C.H., & K.H. Tan. Attraction of both sexes of melon fly, *Bactrocera cucurbitae* to conspecific males a comparison after pharmacophagy of cue-lure and a new attractant Zinger one. *Entomologia Experimentalis et Applicata* 97: 317-320 (2000).
11. Smith, D., & L. Nannan. Yeast autolysate bait sprays for control of Queensland fruit fly on passion fruit in Queens land. *Queensland Journal of Agriculture and Animal Science* 45(2): 169-177 (1988).
12. Vargas, R.I., N.W. Miller, & J.D. Stark. Field trials of spinosad as a replacement for naled ddvp, and malathion in methyl eugenol and cue-lure bucket traps to attract and kill male oriental fruit flies and melon flies (Diptera: Tephritidae) in Hawaii. *Journal of Economic Entomology* 96: 1780-1785 (2003).