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Evaluation of cue-lure pheromone for the attraction of Melon fruit fly *Bactrocera cucurbitae* in Bitter gourd vegetable crop

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Abstract

Fruit flies constitute the most important group of pest infesting fruits and cucurbitaceous vegetable crops throughout the universe. Particularly Melon fruit fly has been weighed notorious pest. For the management of this pest, various control measures have been advocated in all over the world. During the performed research work assess the Persistency and Durability of cue-lure sex pheromone and of three different insecticides including Limda, Amida, and Route. Keeping in view sex pheromone was used for the attraction as well trapping of flies under laboratory conditions and the insecticides mixed with cue-lure for the killing of pest inside the traps was observed as triplicate under field conditions. The four different persistency durations such as 15, 25, 35, 45 days were observed in bitter gourd crop. Results revealed that significant higher *Bactrocera cucurbitae* were captured in the fifteen days of replenished which ($41.89 \pm 1.83a$). However, significantly lower ($19.44 \pm 1.46e$) after sixty days of replenished. It was observed that lure might be replenished after every fortnight in the month of May, June and July-2016. Moreover, results also depicted that considerably higher (49.62 ± 1.95) killing of *Bactrocera cucurbitae* were observed in route and lower (38.30 ± 1.92) in Amida. The results of the study would be helpful for the selecting of the insecticide in mixing with cue-lure for the management of the cucurbit flies under field conditions.

Keywords: *Bactrocera cucurbitae*, bitter gourd, pheromone and insecticide

1. Introduction

In South Asia, cucurbitaceous vegetables have great significance. Among these, *Momordica charantia*, *Cucumis sativus*, *Cucumis melo*, *Cucurbita pepo* and also other numerous seasonal vegetables are prominent (Panday *et al.*, 2012) ^[1]. The existence of insect pests is key factors for the depressed yields and pathetic quality of vegetables throughout the globe (Abro *et al.*, 2017) ^[2]. Among them Dipteran insects; family Tephertidae related species Melon fruit fly is one of the most alarming significant pests of fruits along with of cucurbit crops (Shah *et al.*, 1948) ^[3]. Consequently, it is considered as quarantine pest. (Dhillon *et al.* 2005) ^[4] Indicated that India is the origin of Melon fruit fly. Moreover, Bezzi (1913) ^[5] has been published the first report in which 39 species of fruit fly incepted from the Indian region. (Lall and Sinha, 1959; Narayanan and Batra, 1960; Kushwaha *et al.*, 1973) ^[6-8] it has been recorded 41 to 89% infestation in the bitter gourd fruit due to the attack of fruit fly. (Hollingsworth *et al.*, 1997) ^[9] reported that melon fruit fly infested the pumpkin fruits 60 to 87% and snake gourd 90% in the Solomon Islands than the Papua New Guinea islands about 95% was recorded in bitter gourd fruits. In bitter gourd 41 to 89% loss was recorded by the infestation of melon fruit fly (Rabindranath, 1986) ^[10]. The melon fruit fly oviposited eggs nearly 2 to 4 mm deeply inside the fruit pulp and after hatching maggot's larvae they nourish inside the fruit. Therefore it is too challenging to control with pesticides due to internal feeding of maggot larvae (Panday *et al.*, 2012) ^[1]. Hence, various techniques such as different insecticides as well as pheromone traps are widely used to monitoring the fruit crops against the infestation of insect pests. Mostly vegetable growers use randomly dose of toxic pesticides to reduce the fruit fly infestation in Pakistan. Thus Replenish indiscriminate use of pesticide application have direct or indirect impacts on natural environment, water, soil, wildlife and human health (Abro *et al.*, 2017) ^[2]. Many vegetable fruit growers mostly use the insecticides to kill the melon fruit fly which is not easily available in the market. So, this study will be useful to evaluate an insecticide and cue-lure (s) for killing as well attraction persistency to *B. cucurbitae* under field.

2. Materials and Methods

The present study was carried out at Asim Agriculture farm, Tando soomro, District Tando Allahyar from May to July-2016, where bitter gourd vegetable crop was sown at 20 acres area. For the investigation of efficacy and persistency of attractant cu-lure sex pheromone as well as the comparative killing effect of different insecticides persistency against captured melon fruit fly has been used in Plastic traps in this selected field.

During the study, single dose of cu-lure with 5 treatment persistency (15, 25, 35, 45 and 60 days of interval) along with three different types of insecticides (Limda, Amida and Route) each of which 5% mixed with similar 4ml dose of cu-lure with respect to 4 treatment (15, 25, 35 and 45 days of interval) in separate plastic traps (20×12cm diameter) and cotton wick throughout the experimental time period were used.

2.1 Experimental procedure

A long rope which was tightly binded between each adjacent pair of bitter gourd branches where Plastic traps were hung with the support of iron hook nearly at three meter height above the ground level. These traps had two holes on each side which allowed the flies for entrance inside the trap. After that taken a similar dose of each insecticide including 5% Limda, 5% Amida and 5% Route were mixed with 4ml of cue-lure which was applied through syringe impregnated in the cotton wick into separate traps. Single cu-lure as well as mixed with in three different separate insecticide persistency were checked during fruiting season of the crop. The data on metrological parameters were correlated with each treatment and the observation as well as killing efficacy was taken on a weekly basis. All the treatment of single cu-lure after every 15, 25, 35, 45 and 60 days of interval and mixed with in three separate insecticides replenished after every 15, 25, 35 and 45 days of interval besides this each treatment were replicated as thrice time.

2.2 Statistical analysis

All the analysis were done with the help of statistix® version 8.1, in which data were tabulated with the use of ANOVA (Analysis of variance) and Tukey's Honest significant difference (HSD) test.



Fig 1: Showing Field view of bitter gourd vegetable crop.



Fig 2: Showing Replenishing of insecticide through a syringe.



Fig 3: Showing hanging of traps in field of Bitter gourd vegetable.

3. Results and Discussion

Results revealed that significantly higher ($P < 0.05$) *B. cucurbitae* were captured in the (T1) on 15 days of replenished which was (41.89±1.83) followed by (T2) 25 days of replenished (36.48±1.68). However, lower number of melon flies (19.44±1.46) were caught in the traps (T5) which were replenished after 60 days (Table, 1). It was observed that lure might be replenished after every fortnight during fruiting of the crop.

Table 1: Showing (Mean±SE) Persistency of Cue-lure in capturing *B. cucurbitae* in bitter gourd crop on weekly basis under field conditions.

Experimental Dates	Persistency duration (Days)				
	15 days (T1)	25 days (T2)	35 days (T3)	45 days (T4)	60 days (T5)
19-5-2016	44.33±1.85 ab	43.67±1.76 a	41.33±2.40 a	45.67±2.02 a	44.67±1.76 a
26-5-2016	42.33±1.76 ab	40.67±1.85 ab	44.33±1.45 a	41.33±1.76 ab	43.67±2.02 a
2-6-2016	40.33±1.45 ab	32.67±1.76 bc	34.67±2.33 ab	27.67±1.76 c	33.33±1.67 b
9-6-2016	42.33±2.33 ab	41.67±2.73 ab	24.67±2.40 bc	15.67±1.45 d	19.67±1.85 c
16-6-2016	38.33±1.76 b	39.33±2.60 ab	14.67±2.40 cd	11.67±0.88 d	13.33±0.88 cd
23-6-2016	37.67±2.33 b	27.67±1.45 c	39.67±0.88 a	8.33±1.20 d	7.67±1.20 de
30-6-2016	41.33±1.76 ab	17.67±0.33 d	38.67±1.45 a	38.33±1.45 ab	5.67±0.88 e
7-7-2016	41.67±1.45 ab	43.67±1.45 a	24.33±3.17 cd	34.67±0.88 bc	3.67±1.20 e
14-7-2016	48.67±1.76 a	41.33±1.20 ab	14.33±0.67 d	15.67±1.33 d	3.33±0.88 e
Over all fruit fly catches	41.89±1.83 a	36.48±1.68 b	30.74±1.90 c	26.55±1.41 d	19.44±1.46 e

Values with different letters show significantly differ at 5% according to Tukey's Honest Significant Difference (HSD) test.

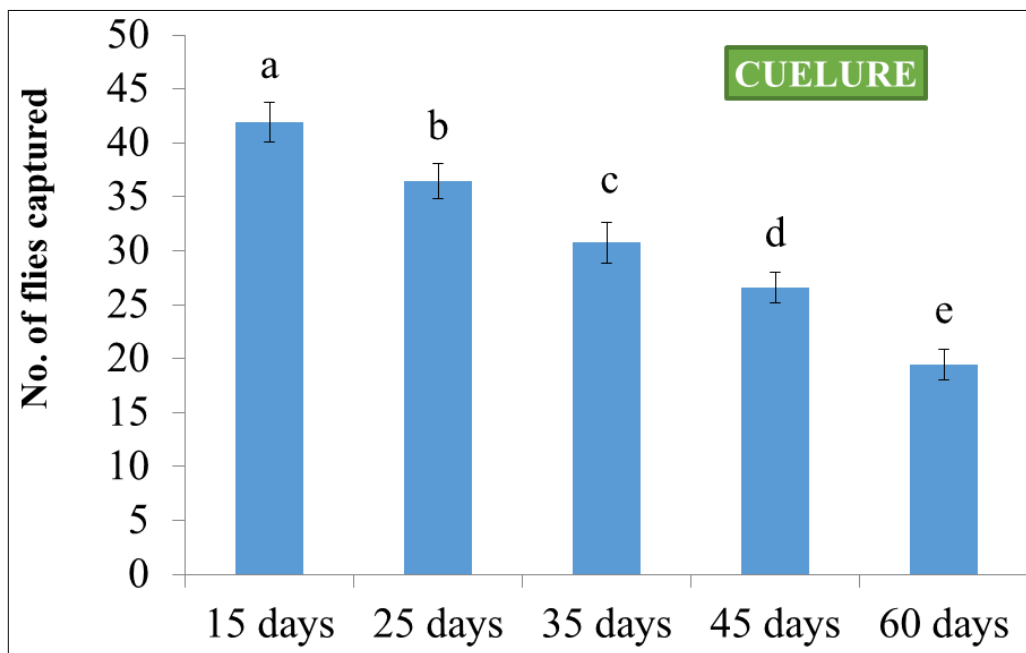


Fig 4: Over all persistency of Cue-lure in capturing *B. cucurbitae* in bitter gourd crop under field conditions.

The result presented in (Table.2) revealed that the highest number of *B. cucurbitae* (60.03±2.01) were caught in (T6) 15 days of replenish followed by (T7) at 25 days of replenish of

cue lure along with insecticide route. (53.85±1.96). Whereas, lowest flies (37.44±1.58) were recorded when the traps were replenished with Route (T9) after every 45 days (Fig.5).

Table 2: Effect of insecticide (Route) on the persistency and killing of *B. cucurbitae* in bitter gourd crop under field conditions.

Experimental Dates	Persistency duration (Days)			
	15 days (T6)	25 days (T7)	35 days (T8)	45 days (T9)
19-5-2016	63.67±2.72a	62.67±2.40 a	60.33±2.33 ab	57.33±1.20 a
26-5-2016	60.67±0.88 a	60.67±2.60 a	63.33±2.02 a	56.33±1.20 a
2-6-2016	59.33±1.85 a	50.33±1.20 bc	50.67±1.76 bc	44.33±3.48 b
9-6-2016	63.67±1.76 a	60.67±1.45 a	38.33±2.18 cd	25.33±0.67 c
16-6-2016	57.33±1.45 a	57.67±0.88 ab	26.67±1.20 e	12.33±1.45 d
23-6-2016	55.33±2.40 a	46.67±1.76 c	58.67±2.72 ab	6.33±0.88 d
30-6-2016	58.33±2.60 a	34.33±2.96 d	54.67±4.33 ab	54.33±1.45 a
7-7-2016	56.33±1.45 a	56.33±1.20 ab	40.33±2.02 cd	52.33±1.85 ab
14-7-2016	65.67±2.96 a	56.33±2.33 ab	30.67±2.02 de	28.33±2.02 c
Over all fruit fly catches	60.03±2.01 a	53.85±1.96 b	47.11±2.28 c	37.44±1.58 d

Values with different letters show significantly differ at 5% according to Tukey's Honest Significant Difference (HSD) test)

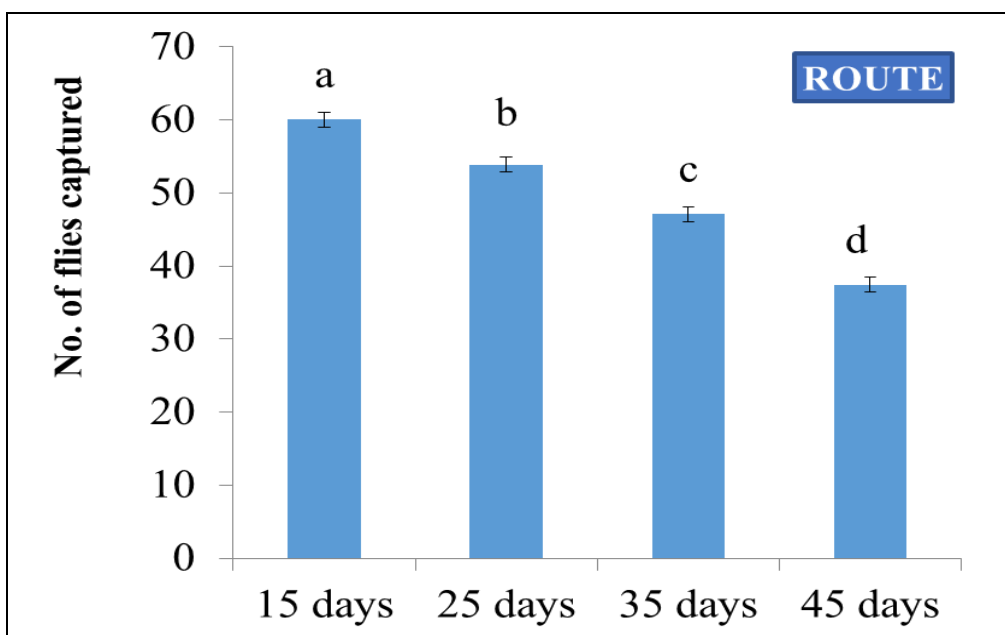


Fig 5: Overall effect of insecticide (Route) on the persistency and killing of *B. cucurbitae* in bitter gourd crop under field conditions.

The Table. 3 showed that significantly highest fruit flies were killed in (T10) at interval of 15 days of replenishing of cue lure along with Limda insecticide (50.25±1.99) followed by (T11) 25 days replenished (44.62±2.08). The Lowest melon

flies were killed in (T13) observed after 45 days of replenishing (34.62±1.72) (Fig. 6). Its means fortnight replenishing of lure was most effectible persistence for the killing of flies.

Table 3: Effect of insecticide (Limda) on the persistency and killing of *B. cucubita* in bitter gourd crop under field conditions.

Experimental Dates	Persistency duration (Days)			
	15 days (T10)	25 days (T11)	35 days (T12)	45 days (T13)
19-5-2016	53.33±1.76 a	51.33±2.02 a	53.33±1.45 a	54.33±1.76 a
26-5-2016	51.33±3.71 a	50.33±1.76 a	49.33±1.20 a	52.33±1.85 a
2-6-2016	48.33±2.02 a	38.33±2.02 ab	36.67±1.76 bc	39.33±1.20 b
9-6-2016	49.67±1.45 a	52.67±1.76 a	29.67±1.76 cd	23.33±2.72 cd
16-6-2016	48.33±1.45 a	51.33±2.33 a	22.33±1.45 d	15.33±1.20 de
23-6-2016	46.67±2.02 a	38.33±1.85 b	46.67±3.17 a	9.67±1.45 e
30-6-2016	48.33±2.33 a	21.33±2.33 c	45.33±1.45 ab	47.33±1.85 ab
7-7-2016	53.67±1.45 a	50.67±2.40 a	32.33±2.90 cd	42.33±2.02 b
14-7-2016	52.67±1.76 a	47.33±2.33 ab	25.33±2.40 d	27.67±1.45 c
Over all fruit fly catches	50.25±1.99 a	44.62±2.088 b	37.88±1.94 c	34.62±1.72 d

Values with different letters show significantly differ at 5% according to Tukey's Honest Significant Difference (HSD) test).

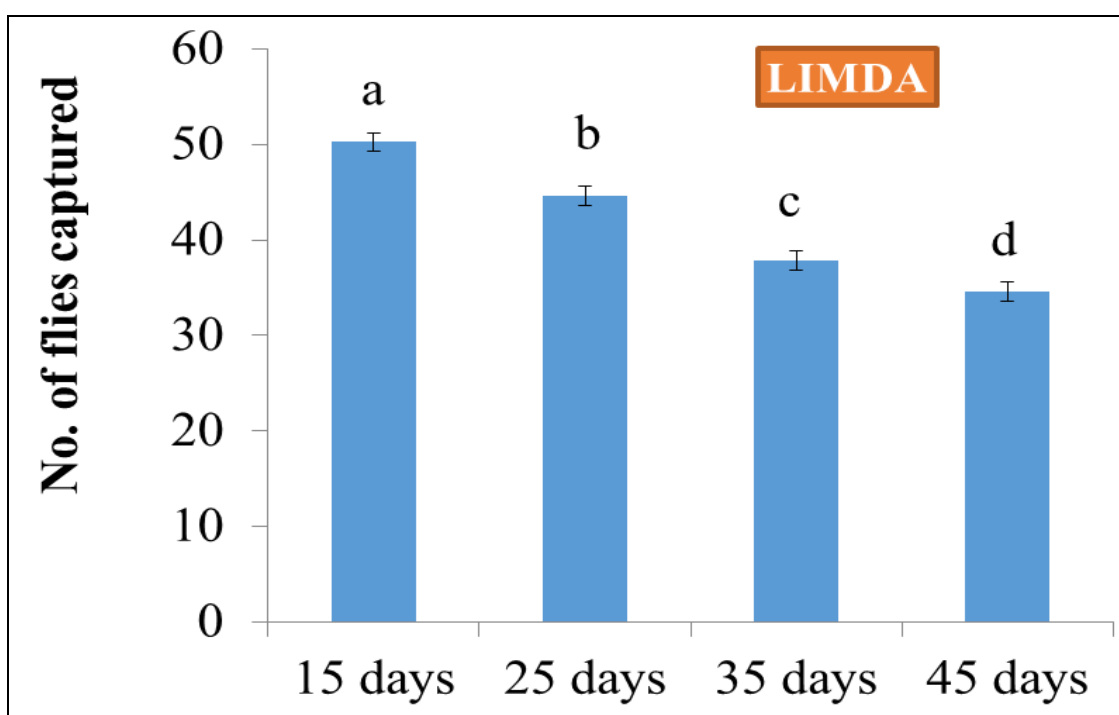


Fig 6: Overall effect of insecticide (Limda) on the persistency and killing of *B. cucubita* in bitter gourd crop under field conditions.

Furthermore results revealed that significantly highest number of melon flies were killed in (T14) after 15 days interval (47.85±1.83) followed by 25 days replenished (40.52±2.02).

Whereas, lowest mean number of flies were killed in (T17) interval of 45 days replenish. (Fig.7).

Table 4: Effect of insecticide (Amida) on the persistency and killing of *B. cucubita* in bitter gourd crop under field conditions.

Experimental Dates	Persistency duration (Days)			
	15 days (T14)	25 days (T15)	35 days (T16)	45 days (T17)
19-5-2016	48.33±2.33 ab	46.33±3.28 a	45.67±0.67 a	47.67±3.17 a
26-5-2016	47.33±2.60 ab	44.67±1.85 ab	44.67±1.45 a	44.33±1.76 a
2-6-2016	47.33±1.76 ab	33.67±1.45 bc	36.67±1.20 ab	29.33±1.20 ab
9-6-2016	50.67±0.88 ab	47.67±2.40 a	25.67±4.25 bc	20.67±1.85 cd
16-6-2016	43.33±2.40 b	44.67±2.72 a	19.33±2.02 c	14.33±1.20 de
23-6-2016	43.33±1.76 b	35.67±1.85 bc	45.33±2.02 a	8.67±0.88 e
30-6-2016	49.33±1.85 ab	22.67±2.60 d	44.67±1.45 a	42.33±2.33 a
7-7-2016	48.33±1.76 ab	44.67±1.20 ab	34.67±2.33 ab	39.33±2.40 a
14-7-2016	52.67±1.20 a	44.67±0.88 ab	20.33±1.76 c	22.33±2.60 bc
Over all fruit fly catches	47.85±1.83a	40.52±2.02 b	35.22±1.90 c	29.89±1.93 d

Values with different letters show significantly differ at 5% according to Tukey's Honest Significant Difference (HSD) test).

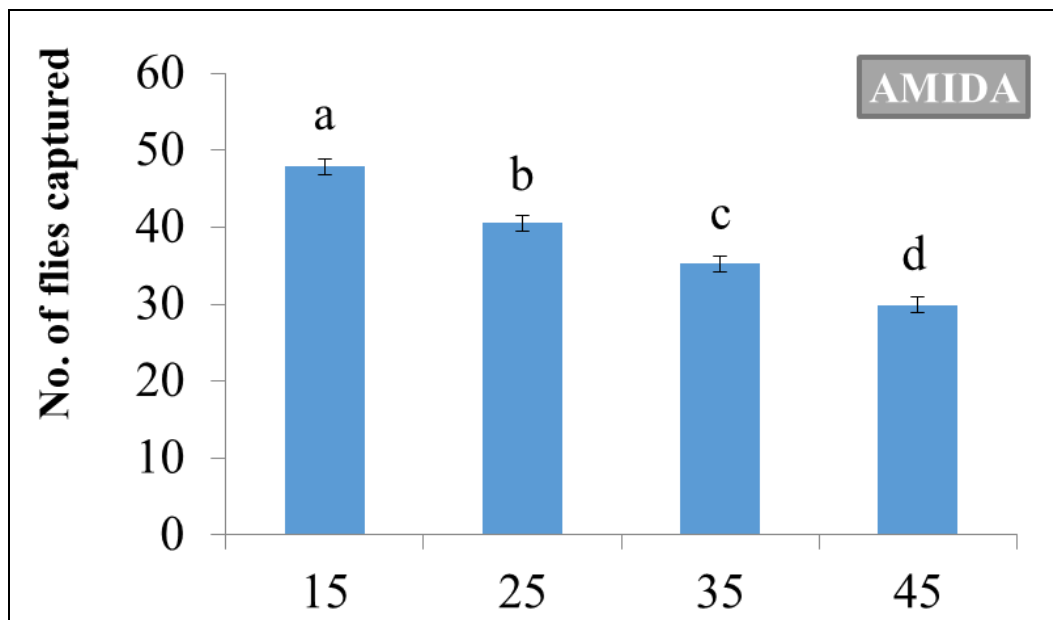


Fig 7: Overall effect of insecticide (Amida) on the persistency and killing of *B. cucurbitae* in bitter gourd crop under field conditions.

Moreover, research revealed that highest melon flies were captured and killed after 15 days of replenish (60.03±2.01) followed by 25 days interval of replenish (53.85±1.96) in

Route. The persistency and killing were recorded lowest in Amida (29.89±1.93) after 45 days of replenished interval (Fig 8).

Table 5: Effect of different insecticide with a different interval of persistency and killing of *B. cucurbitae* in bitter gourd crop under field conditions.

Insecticide	Persistency duration (Days)			
	15 days	25 day	35 days	45 days
Route	60.03±2.01 a	53.85±1.96 b	47.11±2.28 c	37.44±1.58 d
Limda	50.25±1.99 a	44.62±2.08 b	37.88±1.94 c	34.62±1.72 d
Amida	47.85±1.83 a	40.52±2.02 b	35.22±1.90 c	29.89±1.93 d

Values with different letters show significantly differ at 5% according to Tukey's Honest Significant Difference (HSD) test.

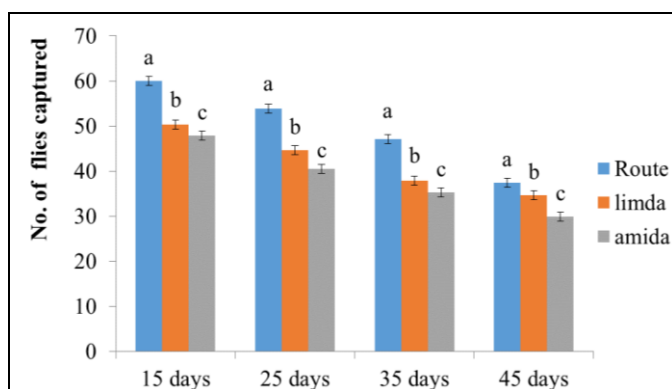


Fig 8: Overall effect of different insecticides on the persistency and killing of *B. cucurbitae* in bitter gourd crop at different time intervals under field conditions.

The highest killing effects of insecticide i.e. Route were observed (49.60±1.96). Followed by Limda and Amida. (Table, 6).

Table 6: Over all efficacy of different insecticide captured and killed (*B. cucurbitae*) in bitter gourd under field condition.

Route	Limda	Amida
49.60±1.96 a	41.84±1.93 b	38.37±1.92 b

Values with different letters show significantly differ at 5% according to Tukey's Honest Significant Difference (HSD) test.

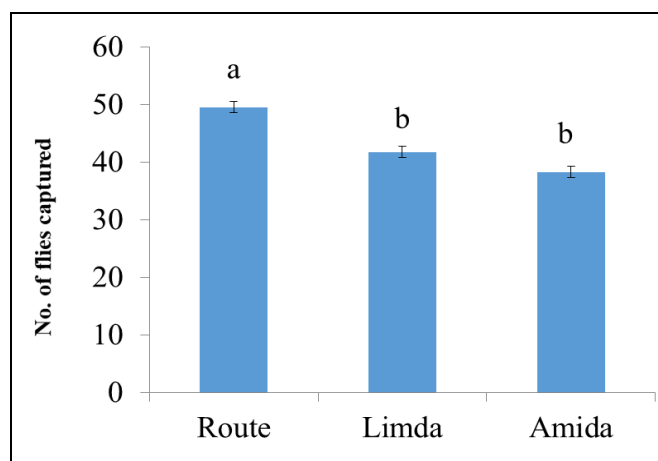


Fig 9: Over all efficacy of different insecticide captured and killed (*B. cucurbitae*) in bitter gourd under field condition

The present studies was analysed to investigate the killing efficacy of insecticide including Limda, Amida, Route, and Cue-lure attraction persistency as well as capturing melon fruit fly under field conditions on bitter gourd crop. Maximum count of *B. cucurbitae* was captured in the after 15 days of replenishing while the minimum melon flies were captured after 60 days of replenish. In addition, the killing of *B. cucurbitae* was more observed in Route and lower in Amida respectively. Current results were compared with the findings of Khan *et al.* 2010 [11] who observed attractive efficacy of

cue-lure and Methyl Eugenol pheromone for the trapping of fruit flies during the field work on bitter gourd in district Sahiwal and Faisalabad, in which higher population of male trapped was seen through cue-lure in compare to effect of Methyl Eugenol. It is noted that in this experiment cue-lure trap was a more effective treatment with respect to Methyl Eugenol. Furthermore, our results partially touched the observations of Jiji *et al.* 2009 ^[12] who has been largely focused on persistency of different chemicals in the food traps for the attraction of *B.cucurbitae* in Cucumber. Moreover, Paramita *et al.* (2014) ^[13] conducted field trials to obtain the efficacy of certain insecticide treatments against *Bactrocera cucurbitae* on *Momordica charantia* in India. Our results are inlined with the above performed work. Our results are partially in connection with Mahmood (1995) ^[14] who indicated that when Malathion chemical mix with in bait trap the *B. dorsalis* population reduced.

4. Conclusion

From the overall assess findings of durability and persistency of the Cue-lure attraction as well as killing of trapped flies concluded that more effective application was seen in a mixture of Cue-lure + Insecticide in compare to separately Cue-lure pheromone application. During the comparative effect of three insecticides, more susceptibility was seen in Route whereas, the less Susceptibility was noticed in Amida insecticide. The results of the study would be helpful for selecting the insecticide in mixing with cue-lure for the management of the cucurbit flies under field conditions.

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