Research Article

Management of Bitter Gourd Whitefly *Bemisia tabaci* (Genn) (Hemiptera: Aleyrodidae) Under Field Condition

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Abstract | Bitter gourd (*Momordica charantia* L.) is one of the most important vegetable crop of warm season. Various number of insect pests attack on this crop but whitefly (*Bemisia tabaci* Genn.) is one of them. An investigation was carried out at farmar's field in Malam jaba Swat during Kharif crop 2018 to evaluate the effectiveness of synthetic and botanical insecticides against insect pests of bitter gourd i.e Whitefly Significant differences were observed among all the treatments as compared to untreated plot. Results revealed that Flonicamid 50WG (0.3g/l) was significantly better in minimizing the whitefly population, followed by Diafenthiuron 50WP (0.6g/l), Diptrex (Trichlorofom) 80-SP at 1250 gm/ha, Thiamethoxam 25 WG (0.2g/l), Chinaberry (200g/l), Garlic (20g/l), and Neem oil (2% cont). Similarly, highest yield (1556.38 kg/ha) and cost benefit ratio (1:9) was observed in Flonicamid 50WG (0.3g/l) treated plots. From the above study, it is concluded that all the insecticides reduce the population whitefly and increases net production of the crop. But chemical insecticide Flonicamid 50WG (0.3g/l) is recommended against various sucking insect pests.

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Introduction

Bitter gourd (*Momordica charantia* L.) is the most important vegetable crops used in pickles, fresh and dry food. It contains 32% oil in its seed and is rich sources of protein, vitamins and minerals (Tindall, 1978). It is mostly effective in controlling diabetes (Yuwai *et al*., 1991). Many insect pest attacks on bittergourd i.e melon fruit fly (*Bactrocera cucurbitae*), widly spread in South Asian countries and causes highly economic losses. Whitefly *Bemisia tabaci* Genn. (Hemiptera: Aleyrodidae) is another major insect pest of bitter gourd which suck the cell sap from the leaves, secrete honey dew and serves as medium for sooty mold fungus (Mustafa, 1995). It slows down the processes of photosynthesis (Berlinger *et al*., 2002) and hence it effects the market value of the crop. It is the most destructive pest of vegetables, fruits, fibers,

ornamental crops and plantation crops in tropical and subtropical regions of the world (Oliveira *et al*., 2001).

Whitefly can cause several plant viral diseases as the resultof severe yield losses. Severe infestation may lead to complete destruction of the crop (Berlinger, 2002). Exessive use of pesticides showed resistance in insect pests (Mahrotra and Phokela, 1992) which became a serious threat to the agriculture. In current situation it is crucial to develop an eco-friendly and effective IPM stragegy to manage the whitefly infestation (Zhu *et al*., 2016). Botanical extracts are eco-friendly as compared to chemical insecticides (Hussain *et al*., 2022a). Plant extracts proved as a better alternative to synthetic insecticides (Sithisut *et al*., 2011). The comparative study of botanical and chemical insecticides is very important to minimize the indiscriminated used of chemical insecticides. Thus, the current study was carried out to evaluate the effectiveness of botanical and chemical insecticides against whitefly on bitter gourd crop under field condition.

Materials and Methods

The experiment was conducted in the farmar's field at Malam Jaba Swat during kharif crop 2018 to test the efficacy synthetic and botanical insecticides against insect pest of bittergourd.

The experiment was laid out in a Randomized Complete Bblock design (RCBD) having eight treatments including control and replicated three times. Insecticides viz Diptrex (trichlorfom) 80-SP (1250 gm/ha), Diafenthiuron 50WP (0.6g/l), Flonicamid 50WG (0.3g/l), Thiamethoxam 25 WG (0.2g/l) and Neem oil were purchased from local market. Extract of Garlic bulbs were obtained from field by crushing 20g garlic bulbs. The crushed garlic bulbs were then added to 1 liter of water with minute quantity of detergent and kept for 24 hours to get 2% solution (Khan *et al*., 2022; Ali *et al*., 2022). The chinaberry extracts were obtained by crushing 200gm of dry fruit and mixed with 1 liter of water at room temperature for 48 hrs. The solution was then filtered for field application (Hussain *et al*., 2022a, b, d).

Field application

The insecticides were applied with 10 days intervals by using knapsack hand sprayer. The data were recorded from reandomly selected 5 plants. In each plant, 6 leaves (top, mid and bottom) were randomly selected. The data were recorded before and after 24, 48, 72 and 1 week interval. Mean pest populations data were calculated by the following formula.

$$\text{Mean insect population} = \text{sum of } X/n$$

Where X is sum of valve, n is number of values.

Yield (kg/ha)

The Healthy fruits weight in each picking was noted individually and the yield was calculated which was then converted into per hectare with the following formula.

$$yield\ kg\ per\ ha = \frac{Fruit\ weight\ (kg)}{Area\ harvested\ (\mathrm{m2})}\ x\ 10000$$

Cost benefit ratio (CBR)

The cost benefit ratio for finding best treatment was obtained by the method used by Hussain *et al*. (2022a).

$$C.B.R = \frac{estimated\ net\ benefit}{total\ expenditure}$$

Statistical analysis

All the data were subjected to statistical analysis of variance after appropriate transformation given by Gomez and Gomez (1976).

Results and Discussion

Mean density of whitefly leaf^{-1}

The current study was carried out in bitter gourd to evaluate the effectiveness of different botanical and chemical insecticides against whitefly at District Swat, Khyber Pakhtunkhwa. Before spray application the population of whitefly was nonsignificant. After spary application the chemical Ulala 50WG (flonicamid) was most effective in all the applied insecticides. The current results revealed that Ulala (flonicamid) remains active for 3 weeks. Morita *et al*. (2014) also observed the long-lasting efficiency of flonicamid in field. The chemical insecticide flonicamid gave better result in all spray applications against whitefly. This finding is similar to the finding of Hussain *et al*. (2022b).

After 1st spray application (Table 1) minimum mean density was observed in plot treated with Flonicamid and Diafenthiuron i.e., 1.92 Whitefly/leaf and 2.07 Whitefly/leaf, while highest (3.89 Whitefly/leaf)

mean density was observed in control plot.

Table 1: *Means density of whitefly population on Bittergourd after each spray sapplications.*

Treatments	1st Application	2nd Application	3rd Application	Over all means
Neem oil	2.83b	2.33b	1.31b	2.16b
Garlic	2.69bc	2.25b	0.62cd	1.85c
Flonicamid	1.92d	1.22d	0.39d	1.17e
Chinaberry	2.73b	1.93bc	0.73c	1.80c
Thiamethoxam	2.28bcd	1.86bc	0.73c	1.62cd
Diafenthiuron	2.07cd	1.57cd	0.76c	1.47de
Diptrex	2.35bcd	1.65cd	0.67c	1.56cd
Control	3.89a	4.16a	3.11a	3.72a
LSD	0.16	0.23	0.44	0.20

Means followed by same letters within a column are nonsignificant at 5% level of significance (LSD test).

After 2nd spray application the minimum mean desnsity was observed in plot treated with Flonicamid and Diafenthiuron i.e., 1.22 Whitefly/leaf and 1.57 Whitefly/leaf, while the highest mean density was observed in control.

After 3rd spray application, minimum mean desnsity was observed in plot treated with Flonicamid and Garlic i.e., 0.39 Whitefly/leaf and 0.62 Whitefly/leaf, while the highest (3.11 Whitefly/leaf) mean density was recorded in control plot.

Minimum mean density of whitefly in all three applications was observed in plot treated with Flonicamid (1.17) followed by Diafenthiuron (1.47) while highest means denity of whityfly was recorded in control plot (3.72). In current study, the comparative efficacy of synthetic and botanical insecticides clearly indicated that Flonicamid gave better result as compared to other insecticides. These agreements are close to Zia *et al.* (2022), Ihsan *et al.* (2022), Hussain *et al.* (2022b) and Hussain *et al.* (2022c) findings for controlling whiteflies.

Yield and cost benefit ratios (CBR)

Table 2 showed that, Significant difference was recorded in all the treatments as compare to control plot. Flonicamid treated plot showed maximum yield (1556.38 kg/ha), followed by Garlic (1388 kg/ha), Neem oil (1385 kg/ha), Chinaberry (1353.05 kg/ha), Thiamethoxam (1330.83 kg/ha), Diafenthiuron (1320.27 kg/ha), Diptrex (1309.72 kg/ha) and the lowest yield was recorded in untreated plot (908 kg/ha) respectively. The study supported that maximum popution of whitefly gave minimum production and vice versa. Current results are like the results of Mehra *et al.* (2018) and Zia *et al.* (2022). Highest (CBR) was recorded in plot treated with Flonicamid (1:9) followed by Chinaberry (1:8.04), Garlic (1:7.32), Diptrex (1:7.04), Diafenthiuron (1:6.79), Thiamethoxam (1:6.03) while the lowest CBR was noted in Neem oil (1:5.15). CBR and yield were recorded higher in synthetic insecticides as compare to botanicals. The current findings cannot be associated with the results of former investigators, as the commudity cost of control is fluctuating from region to region.

Conclusions and Recommendations

It was concluded from the study that the botanical extracts are less effective as compared to synthetic insecticides in controlling whitefly infestation. Therefore, it is recommended that chemicals insecticides are better to control against sucking insect pests. However, synthetic insecticides are hazardous to environment. Therefore, botanical insecticides are recommended for future study with different concentration.

Table 2: *Cost benefit ratio of different synthetic and botanical insecticides against whitefly of bitter gourd.*

Treatments	Yield (kg/ha)	Grass income	Cost of control	Return over control	Estimated benefit E= (D-C)	C:B (F=E/C)
Neem oil	1385	210500	8200.12	50400	42199.88	5.15
Garlic	1388	235500	9060.23	75400	66339.77	7.32
Flonicamid	1556.38	245800	8170.12	85700	77529.88	9.49
Chinaberry	1353.05	236000	8400.45	75900	67499.55	8.04
Thiamethoxam	1330.83	223540	9030.01	63440	54409.99	6.03
Diafenthiuron	1320.27	227510	8653.34	67410	58756.66	6.79
Diptrex	1309.72	227200	8345.34	67100	58754.66	7.04
Control	908	160100	--	--	--	--

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Novelty Statement

This study is novel in describing the use of different concentration of plant extracts as a substitute for conventional insecticides.

Author's Contribution

All authors listed, have made substantial, direct, and intellectual contribution to the work, and approved it for publication.

Conflict of interest
The authors have declared no conflict of interest.

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