

Research Article



The Comparative Toxicity of some Insecticides and Plant Extracts against Cotton Mealy Bug (*Phenacoccus solenopsis*)

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Abstract | Cotton is the major cash crop and is known as white gold. The present study was conducted to evaluate and compare the commercially available pesticides and indigenously available plant extracts. The efficacy of following insecticides and plant extracts viz. *Cascabela thevetia* leaf extract @ 300ml/acre, *Azadirachta indica* @ 300ml/acre, Profenofos @600ml/acre., Crown 70WS @125gm/acre, Match 50EC@250ml/acre, Helmat 40EC@600ml/acre and Confidor 20SL@ 250ml/ acre were evaluated on cotton against 3rd instar cotton mealy bug. Data was collected after 3,6,12,24 and 48 hours. Maximum mortality of cotton mealy bug was recorded in Syngenta 50EC (profenofos) are 42%, 62%, 80%, 88%, 94 % while Match 50EC exhibit minimum percentage of mortality is 22%,34%,48%, 72% and 76% after 3, 6, 12, 24 and 48 hours respectively.

Received | August 11, 2019; **Accepted** | August 19, 2019; **Published** | January 10, 2020

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Citation | Hussain, G., M. Asrar, D. Hussain, K. Zia, A. Rashid, H. Anwar, M. Azeem, S. Hussain and S. Asghar. 2020. The comparative toxicity of some insecticides and plant extracts against cotton mealy bug (*Phenacoccus solenopsis*). *Pakistan Journal of Agricultural Research*, 33(1): 17-21.

DOI | <http://dx.doi.org/10.17582/journal.pjar/2020/33.1.17.21>

Keywords | Cotton, Cotton mealy bug, Plant extract, *Azadirachta indica*, Insecticides

Introduction

Cotton is a major fiber cash crop of Pakistan and it is cultivated on area of 7.86 million acres in 2015-2016. By exporting cotton and its derivatives, we earn 10 % of GDP (Rehman et al., 2016). Area under cultivation since last four years decreased drastically hence the farmers diverted its attentions towards other crops than cotton which is very alarming for Pakistan. Due to this alarming condition of cotton crop in Pakistan both industry and farming communities are facing crisis which shows bad impacts on proper growth and sustainability of a country. In Pakistan cotton crop is often attacked by an insect pest complex which can be controlled by

different management techniques. Pest management is very vital factor regarding cotton yield. In 2005-2006 cotton production was very low than expected target and during this time cotton mealy bug was first time observed as a major crop pest. It was noted in both cotton growing provinces of Pakistan Sindh and Punjab (Zaka et al., 2006). A remarkable reduction in yield of cotton was noticed at that time due to this heavy attack of cotton mealy bug at that time. And attacked plants of cotton dried up entirely they look as that it had been sprayed with a defoliator (Abbas et al., 2007).

Cotton mealy bug is a juice sucking pest of cotton it is a soft bodied insect. The infested plants stop their

growth and become stunted production of flowers and bolls are also affected. Due to sucking of sap leaves become yellowish and distorted then finally drop off. This pest secret honey dew secretion which produces blackish sooty mold this enhance fungal activity and also effect on photosynthetic ability if leaves (Saeed et al., 2007). Cotton mealy bug is serious pest it must be control. Various management methods are used to control it like chemicals, biological and plant extracts etc. Insecticides and plant extracts are most effective control methods (Badshah et al., 2015).

The most insecticides have been used to control cotton mealy bug are i.e. Profenofos 50EC, carbosulfan 20EC, Imidacloprid 20SL, Malathion 57EC, Dimethoate 40EC. Among these, Profenophos and Malathion have shown major effectiveness against cotton mealy bug. Some other insecticides like Commando (97% DF), Lannate (40% SP), Actara (25 WG) and Confidor (20% SL) were also used against cotton mealy bug which especially controlled nymphs of mealy bug (Rasheed et al., 2014). Different plant extracts can also be used against cotton mealy bug and the efficiently kill the pest when applied, both in laboratory and fields condition (Prishanthini and Vinobaba, 2014). The continuous and non-judicious use of insecticides has defiled our ecosystem and has built the resistance in cotton mealy bug.

Use of plant extracts are novel for cotton mealy bug management. It may have the insecticidal and cotton repellent effect. These are cheap, eco-friendly and can be used at very low doses. These are easy to use and have broad spectrum potential. Hence, the present study was aimed to evaluate the comparative efficacy of different plant extracts and insecticides against cotton mealy bug.

Materials and Methods

Field collection

The cotton mealy bug was collected from infested field crops of different localities of district Jhang and Faisalabad. From Faisalabad it was collected from cotton crop Thekri wala, Dagora pind and from district Jhang cotton mealy bug were collected from Hassu Balail and Fateh Pur, tehsil Ahmed Pur Sial Jhang. The collected cotton mealy bug with different instars were taken in experimental lab of Entomological Research Institute Ayub Agricultural Research Institute (AARI) for further study.

Rearing of cotton mealy bug in lab conditions

The collected sample were kept in cages and their rearing was carried out. Pumpkin was used as a food material for cotton mealy bug. Optimize conditions for rearing of cotton mealy bug were maintained with 23.3 ± 5 °C temperature and $40 \% \leq RH$ during the month of August, September and October.

Evaluation of plant extracts and chemicals against cotton mealy bug

Leaves of *Azadirachta indica* and *Cascabela thevetia* were taken, thoroughly washed with tap water and dried in the sun. Giving brittle appearance, leaves were grinded by electric grinder. Twenty-five-gram powder of each extract was taken dissolves in 100 ml of acetone solvent. Extracts were mixed thoroughly by electric stirrer. The aliquot was poured in to plastic tubes and centrifuged at 6000rpm for 5 minutes. After centrifugation, extract was taken out by the help of pipette and solution was passed through Whatman No. 1 filter paper. The resultant was considered as standard.

Two plant extracts (*Azadirachta indica* and *Cascabela thevetia*) at standard doses and five chemicals i.e. Profenofos @600ml/acre., Crown 70WS @125gm/acre, Match 50EC@250ml/acre, Helmat 40EC@600ml/acre and Confidor 20SL@ 250ml/acre were evaluated against cotton mealy bug. The solutions of all pesticide were prepared in 500 ml of water and then applied by leaf dip method. The leaves were observed for mortality of the adults after 3, 6, 12, 24 and 48 hours of treatment. The percentage mortality was calculated in each treatment by sticking with a formula.

$$\text{Percent Mortality} = \frac{\text{Number of insects died}}{\text{Total number of insect present}} \times 100$$

Statistical analysis

Recorded data was analyzed through Analysis of Variance (ANOVA) and treatments means were compared by Fisher's Least Significant Difference (LSD) test. Data was processed statistically through SAS (9.3) software (Inc., 2011-2012) and was represented by Microsoft Excel (2019).

Results and Discussion

Application of Profenofos shown major effectiveness against cotton mealy bug as it gave least population

Table 1: *Comparative toxicity (Means±SE) recorded during 3, 6, 12, 24 and 48 hours in various treatments.*

Treatments	3 hours observation Mean ±SE	6 hours observation Mean ±SE	12 hours observation Mean ±SE	24 hours observation Mean ±SE	48 hours Observation Mean ±SE
Control	9.80±0.7a	9.60±1.55a	9.40±0.94a	9.40±0.60a	9.20±0.90a
Cascabela thevetia leaf extract @ 300ml/acre	7.60±0.86bcd	6.60±0.60b	5.00±0.30bc	3.40±0.96bc	3.20±0.62b
Azadirachta indica @ 300ml/acre	7.00±0.76cd	5.80±0.64bc	4.00±0.94de	2.80±0.52cd	2.40±1.02cde
Profenofos @600ml/acre	5.20±0.91e	3.80±1.84d	2.00±0.57f	1.20±0.49e	0.60±0.03f
Crown 70WS @125gm/acre	6.80±1.28d	5.40±0.98c	3.80±0.60f	2.20±0.72d	1.80±0.63e
Match 50EC@250ml/acre	7.80±0.86bc	6.60±1.22b	5.20±1.16b	3.40±0.56bc	2.80±0.79bc
Helmat 40EC@600ml/acre	8.00±0.71b	6.40±0.86b	4.80±0.29cd	3.60±0.87b	2.60±0.19d
Confidor 20SL@ 250ml/	7.00±1.17cd	5.80±0.44bc	4.20±0.16cde	2.80±0.42cd	2.0±0.60e
LSD at 0.05%	2.037	2.045	2.086	3.012	3.018

Values sharing similar letters do not differ significantly.

mean 5.2 and 48 % mortality in treatment. While other treatments viz. knair seed oil, neem seed oil, imidacloprid, match, chlorpyrifos, confidor and control showed 7.6, 7, 6.8, 7.8, 8, 7, 9.8 mean value respectively with 25%, 30%, 32%, 22%, 20% and 30% mortality (Table 1).

In 2nd observation (after 6 hours) mean values application of knair seed oil, neem seed oil, Profenofos, imidacloprid, match, chlorpyrifos, confidor and control showed 6.60, 5.80, 3.80, 5.40, 6.60, 6.40, 5.80 and 9.6 respectively with 31%, 42%, 62%, 42%, 34%, 36%, and 44% mortality rate. Hence Minimum mean value of population 3.80 and 62% mortality rate was observed where Propenepos was applied.

In 3rd observation (After 12 hours) mean values application of knair seed oil, neem seed oil, Profenofos, imidacloprid, match, chlorpyrifos, confidor and control showed 5, 4, 2, 3.8, 5.2, 4.8, 4.2 and 9.respectively with 49%, 56%, 80%, 62%, 48%, 53%, and 64% mortality rate. Hence Minimum mean value of population 2 and 80% mortality rate was observed where Propenepos was applied.

In 4th observation (after 24 hours) mean values application of knair seed oil, neem seed oil, Profenofos, imidacloprid, match, chlorpyrifos, confidor and control showed 3.40, 2.80, 1.2, 2.20, 3.4, 3.6, 2.8 and 9.4. respectively with 63%, 72%, 88%, 78%, 72%, 66%, and 78% mortality rate. Hence Minimum mean value of population 1.20 and 88% mortality rate was observed where Propenepos was applied.

In 5th observation (after 48 hours) mean values application of knair seed oil, neem seed oil, Profenofos,

imidacloprid, match, chlorpyrifos, confidor and control showed 3.20, 2.40, 0.60, 1.80, 2.80, 2.60, 2.00 and 9.20. Respectively with 65%, 76%, 94%, 82%, 76%, 76%, and 81% mortality rate. Hence minimum mean value of population 0.60 and 94% mortality rate was observed where Propenepos was applied (Figure 1).

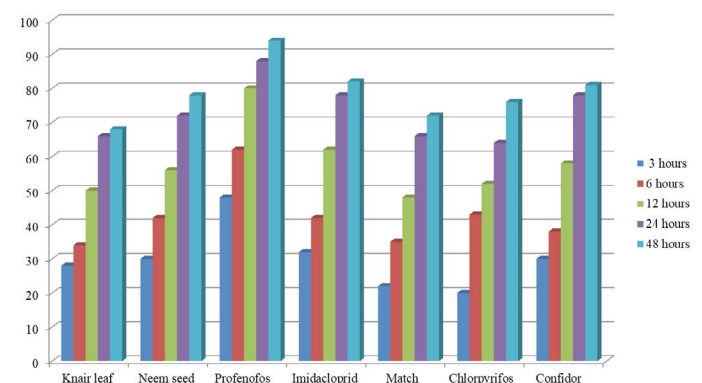


Figure 1: *Percent mortality of Cotton mealy bug 3, 6, 12, 24 and 48 hours after spray.*

The best insecticide which caused the major mortality was Profenophos Sanghi et al. (2015) checked the mortality of some commonly used pesticide including Profenophos and their results showed that the Profenophos was seem to be most effective against cotton mealy bug. These results were similar as the results of this experiment.

Same results were obtained by Saeed et al. (2007), Ali et al. (2014). Their results showed that Profenophos the was the best insecticide which caused the highest mortality. Saeed et al. (2007) performed research work to check out the efficacy of different pesticide against cotton mealy bug (*Phenacoccus gossypiphilous*). Their results showed that the applications of

chlorpyrifos were reasonably. In the lab Profenofos and Chlorpyrifos turned out to be the best bug sprays for mealy bug control, in view of their vulnerability with the leaf plunge technique for their LC 50. Our results were incompatible with the findings of above work due to experimental conditions. According to our result Chlorpyrifos shown percentage mortality of 76% after 48 hour of application. Prishanthini and Vinobaba (2014) also used Chlorpyrifos against cotton mealy bug and their result can be compared with our work. Aslam et al. (2004) also observed similar results.

Confidor (20SL) shown moderate toxicity against cotton mealy under lab condition (Rashid et al., 2011). Confidor also was tested against cotton mealy bug in lab and it shown moderate toxicity by Ibrahim et al. (2015). But they cannot compare due to differences in experimental condition. Similarly, Ali et al. (2014) reported by his research work among different pesticide tested against cotton mealy bug, Imidacloprid considerable toxicity. They observed efficacy of treatments after different intervals after 24, 48, 72 hours, 7th and 10th days. Imidacloprid showed effect after 7 days of spray. But present work cannot be compared with that due to experimental incompatible. In the present study, the application of imidacloprid resulted in 82% mortality of 3rd instar of cotton mealy. The present finding cannot be compared with those Ali et al. (2014), Saeed et al. (2018), Rasheed et al. (2014). In present study use of plant extract like Neem seed oil and Knair extract was used against cotton mealy bug. Neem derivatives shown mortality of 78% after 48 hour of exposure time Zafar et al. (1997), Rasheed et al. (2014). Prishanthini and Prishanthini M and M. Vinobaba (2014) investigated the efficacy of different botanical extract against cotton mealy bug under laboratory conditions. Our result can be compared with their work at low concentration but at 2% solution it shown mortality of 72%.

Author's Contribution

Ghulam Hussain: Overall Management of the article.

Muhammad Asrar : Data collection.

Dilber Hussain: Data entry in SPSS and analysis.

Khurum Zia: Introduction.

Abdul Rashid: References.

Hina Anwar: Wrote abstract.

Muhammad Azeem: Results and discussion.

Saddam Hussain: Results and discussion.

Sabeen Asghar: Technical Input at every step.

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