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Comparison of two botanical extracts with Imidacloprid in suppressing cotton whitefly, *Bemisia tabaci* Gennadius (Hemiptera: Aleyrodidae)

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Abstract

An experiment on the efficacy of botanical extracts in comparison with a synthetic insecticide against whitefly on cotton crop was conducted at New Developmental Farm, The University of Agriculture, Peshawar, Pakistan during 2013. Two botanical extracts *Datura alba* 5% and *Parthenium hysterophorus* 5% were applied in comparison with imidacloprid (250 g/acre i.e.). Minimum number of whitefly/leaf/plant (0.38), (1.25), (1.35), (1.49), (1.75) and (1.84) was recorded after 24hrs, 48hrs, 72hrs, 7 days, 10 days and 15 days respectively in plots treated with imidacloprid followed by *D. alba* and *P. hysterophorus*. Maximum number (4.00), (5.32), (5.87), (6.24), (6.75) and (6.94) of whitefly/leaf/plot was recorded in control plot. The study recommends the use of *D. alba* and *P. hysterophorus* extracts for the effective management of whitefly in cotton crop.

Keywords: Whitefly, *Datura alba*, *Parthenium hysterophorus*, Imidacloprid

1. Introduction

Cotton (*Gossypium hirsutum* L.) known as “white gold” is the key cash and fiber crop of Pakistan. The average production of cotton is about 570.99 kg/ha, which is low as compared to other cotton growing area of the world [1]. The low productivity of cotton is caused by various reasons, but the most serious one is the intensity of insect pests attack. Among sucking insect pests, whitefly, jassid and thrips are vital in Pakistan and cause significant yield reduction [2, 3]. These are very critical pests during seedling and vegetative stage of cotton as they suck the plant sap, make it fragile and in case of rigorous infestation wilting and shedding of leaves occur [4].

Among the sucking insects cotton whitefly (*Bemisia tabaci* Genn.) is one of the most important cotton pest in the Middle East, Europe, North and central America [5]. In Pakistan Whitefly infestation is recorded from 104 plants belonging to 24 families. It has 12 generations and remains active throughout the year. A single female carrying virus can infest many plants [6]. The cotton whitefly damages the plants in different ways i.e. nymphal and adults of the insect suck the cell sap from the leaves. Sooty mold develops on the sticky material secreted by the insect which disturbs the photosynthesis of the plants. They also act as a vector of causal organisms of about 38 plant diseases [6]. The whitefly transmitted geminiviruses have been reported to cause 40 diseases of vegetables and fibre crops worldwide [7].

The cotton insect pest management in Pakistan is mainly dominated by the use of broad-spectrum insecticides. Foliar application of insecticides at early stages can destroy natural enemies. One option to reduce the insecticide use on cotton is the exploitation of transgenic Bt cotton as a component of integrated pest management [8]. As Bt cotton is effective only against lepidopterous insect pests, therefore a number of synthetic chemicals are used to control whitefly infestation, which are injurious not only to non target organisms but also pose threats to the environment and human beings.

Based on the above mentioned importance of the pest there is a dire need to manage this insect in a way that is environmentally friendly and economically feasible. The present study was therefore carried out to evaluate the efficacy of botanical extracts (*Datura alba* 5% and *Parthenium hysterophorus* 5%) in comparison with a synthetic insecticide (Imidacloprid) for the control of cotton whitefly.

2. Materials and Methods

An experiment on the efficacy of different botanical extracts against cotton whitefly was conducted at the New Developmental Farm, The University of Agriculture Peshawar during cotton season, 2013. There were four treatments including control. Each treatment was replicated three times. The experiment was designed as Randomized Complete Block Design (RCBD).

2.1 Preparation of field lay out

Cotton field was selected in the New Developmental Farm at the University of Agriculture, Peshawar. Bt Cotton variety MNH-886 was used in the trial. A plot of area (15 x 20) meters square was divided into 12 sub-plots. Each sub-plot size was (4 x 4) meter squares and among each sub-plot a buffer zone of 1 meter was kept. There were four rows in each sub-plot.

Table 1: Insecticides and botanical extracts used in the study with their respective doses.

S. No	Treatment	Dose/acre
1	Imidacloprid 25% WP	250g/acre
2	<i>Parthenium hystopporous</i> Extract	5kg/acre
3	<i>Datura alba</i> Extract	5kg/acre
4	Control	No application

2.2 Preparation of treatments

Imidacloprid 25% WP was purchased from local market, whereas, *P. hystopporous* and *D. alba* were provided by Agriculture Research Institute (ARI), Tarnab, Peshawar. The extracts were prepared in laboratory by the following procedure.

Five liter water was boiled to which 10g detergent was added. Half Kg of *P. hystopporous* and *D. alba* in powdered form was taken in muslin cloth and was kept in the water for 24 hours to make 10% solution of *P. hystopporous* and *D. alba* extracts. Later on 5% extract was prepared for field application [9].

These chemicals were applied when whitefly reached its economic threshold level leaving one check (no treatment application) in each replication. All the treatments were applied at once. Pretreatment data on whitefly population were recorded one day before spray while post treatment data after

24hr, 48hr, 72hr, 7 days, 10 days and 15 days. Data on number of whiteflies/leaf/plant was recorded from top, middle and bottom leaves on the middle two rows by selecting five plants randomly.

2.3 Statistical Analysis

The data was analyzed, using the statistical package, Statistix 8.1 [10]. DMR test was applied for mean separation.

3. Results

The results in table (2) revealed that the effect of all the treatments (Imidacloprid, *D. alba* and *P. hystopporous*) on the number of whitefly were non-significant among each other ($P < 0.05$) after 24 hrs application but significantly different from control plot, however the lowest number of whitefly (0.38) was found in the plot treated with Imidacloprid followed by *P. hystopporous* (0.42), *D. alba* (0.45), and the highest number of whitefly was found (4.00) in control plot.

After 48 hours of spray application the lowest number of whitefly (1.25) was found in the plot treated with Imidacloprid followed by *D. alba* (1.26), *P. hystopporou* (1.38) and highest number (5.32) of whitefly was found in control plot.

The data after 72 hrs revealed that the lowest number of whitefly (1.35) was found in the plot treated with Imidacloprid followed by *D. alba* (1.41), *P. hystopporous* (1.32) and the highest number of whitefly was found (5.87) in control plot.

It was observed that on 7th day of spray application the lowest number of whitefly (1.49) was found in the plot treated with insecticide Imidacloprid followed by *D. alba* (1.53), *P. hystopporous* (1.52) and the highest number of whitefly (6.24) was found in control plot.

The population of whitefly after 10 days of spray application depicted that the lowest number of whitefly (1.75) was found in a plot treated with insecticide followed by *D. alba* (1.83), *P. hystopporous* (1.89) and highest number of whitefly (6.75) was found in control plot.

The data recorded on 15 days of spray application showed that the lowest number of whitefly (1.84) was found in the plot treated with insecticide followed by *D. alba* (1.92), *P. hystopporous* (1.98) and highest number of whitefly (6.94) was found in the control plot.

Table 2: Effect of the tested chemicals on mean number of whiteflies per leaf in cotton crop

S.NO	Treatment Name	Dose/acre	Pre-Spray Data	24hr	48hr	72hr	7 days	10 days	15 days
1	Imidacloprid 25% WP	250 gm	3.48	0.38 b	1.25 b	1.35 b	1.49 b	1.75 b	1.84 b
2	<i>Datura alba</i> Extract	5 kg	3.83	0.45 b	1.26 b	1.41 b	1.53 b	1.83 b	1.92 b
3	<i>Parthenium hystopporous</i> Extract	5 kg	3.75	0.42 b	1.38 b	1.32 b	1.52 b	1.89 b	1.98 b
4	Control	-----	3.72	4.00 a	5.32 a	5.87 a	6.24 a	6.75 a	6.94 a
	LSD			2.32	2.35	3.23	2.54	2.45	2.86

Means followed by the same letter(s) in columns are significant at 5% level of probability.

4. Discussion

The findings of this study exposed that both extracts of *D. alba* and *P. hystopporous* pose real threat to whitefly population. This indicates the presence of certain chemical molecules which are potent in causing mortality of the pest and needs further exploration to find out more facts. These extracts had been investigated by a number of researchers and our results are in conformity with the previous investigators Khan *et al.* (2013) who reported significant effect of different plant extracts (Neem oil, Garlic, Eucalyptus and *Datura*) on the population of sucking pests in cotton under field conditions after 24, 72, 168 and 240 hours of application [9]. Nimbalkar *et al.* (1993) in a study on botanical insecticides i.e., neem seed extract and neem oil against whitefly found considerable

reductions of adult and nymph population [11]. Our study indicated similar effects of botanical and synthetic insecticide which is against the observations of Rashid *et al.* (2012) who compared the effect of neem oil at 1%, 1.5% and 2% and neem seed water extract at 1%, 2% and 3% concentration with that of synthetic insecticide (Polytrin C@ 440 EC) against *Bemisia tabaci*. Neem oil at 2% and neem seed water extract at 3% significantly reduced the whitefly population while synthetic insecticide proved to be more toxic against whitefly [12]. The results of synthetic insecticide (Imidacloprid) are in line with the previous scientists Khan (2011) who reported different cotton varieties and efficacy of Acetamiprid 20 SP, Imidacloprid 25% WP, Bifenthrin 10 EC, Cypermethrin 10 EC, Triazophos 40 EC, Lambda Cyhalothrin 2.5 EC, Rani 20

SL against whitefly. Among insecticides, Rani 20 SL and Acetamiprid 20 SP were more effective against whitefly and in increasing seed cotton yield as compared to the other tested insecticides [13]. Similarly, Amjad *et al.* (2009) studied seven insecticides at their field recommended doses for their efficacy against whitefly on cotton and noted that the most effective insecticides for whitefly, up to seven days were Megamos and Confidor (Imidacloprid) [14].

5. Conclusion

The overall results revealed that botanical extracts were similar in efficacy as compared to the synthetic insecticide used. Based on the expected lower toxicity of the botanical extracts towards the environment, human beings and biological control agents, this study recommends the use of *D. alba* and *P. hystoporous* extracts for the effective management of cotton whitefly. However in depth research is needed to explore all the aspects of these botanical extracts to be used in an IPM program for controlling whitefly in cotton crop.

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6.1 Competing Interest

The authors declare that they have no competing interests.

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