



E-ISSN: 2320-7078

P-ISSN: 2349-6800

JEZS 2019; 7(2): 513-515

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Received: 22-01-2019

Accepted: 24-02-2019

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Effect of different insecticidal treatments on Aphid (*Aphis craccivora*) infesting groundnut (*Arachis hypogaea*)

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Abstract

The investigations on the field efficacy of some newer pesticide molecules and their combination products against major insect pests of groundnut were undertaken during the pre-summer season of 2016 on groundnut at the agricultural research farm, Institute of Agriculture, Visva-Bharati, Birbhum, West Bengal. The efficacy of seven insecticides viz; Imidacloprid 17.8% SL, Diafenthiuron 50% WP, Diflubenzuron 25% WP, Acephate 50% + imidacloprid 1.8% SP, Lambda Cyhalothrin 5% EC, Quinalphos 25% EC and Chlorpyrifos 20% EC were tested against groundnut aphid. The results of the experiments suggested that all the insecticidal treatments imposed were superior over the untreated check. The infestation of aphid (*Aphis craccivora*) was observed at early growth phase till the flowering phase of the crop growth. Among the seven insecticides tested, Imidacloprid 17.8% SL (0.02% a.i.) and Diafenthiuron 50% WP (600g a.i./ha) were found to be the most effective recording highest per cent reduction in aphid population as 88% and 86% reduction respectively after 10 days of spray. The efficacy of other insecticidal treatments were in the order of Lambda Cyhalothrin 5% EC (@300ml/ha) > Acephate 50% + imidacloprid 1.8% SP (@1000g/ha) > Chlorpyrifos 20% EC > Diflubenzuron 25% WP (@300g/ha) > Quinalphos 25% EC.

Keywords: Aphid, *Aphis craccivora*, groundnut, insecticides

1. Introduction

Groundnut (*Arachis hypogaea* L.) is an important oil seed crop of tropical and sub-tropical regions of the world. India ranks first in groundnut cultivation with an area of 5.53 m ha and occupies second place in production (9.67 million tonnes) with the productivity of 1750 kg ha⁻¹. In India, groundnut is mostly grown in five states viz., Gujarat, Andhra Pradesh, Tamil Nadu, Karnataka and Maharashtra which accounts for 80 per cent of total area and 84 per cent of total production of groundnut. Studies revealed that 15 - 20 per cent of the total oilseed produced is lost directly or indirectly by the attack of insect and mite pests every year. *Aphis craccivora* is the most important pest of groundnuts in the tropics. [5] Yield losses of 16% were recorded in groundnut in India due to a complex of insect pests, the predominant one being *A. craccivora*. Sap removal and physiological reactions of plants to aphid feeding cause direct damage. The removal of sap weakens the plant, causing poor and stunted growth, leaf curling and distorted leaf growth, wilting and reduced resistance to drought conditions, all resulting in yield losses. Damage due to irritants and toxins, produced by aphid feeding on the leaves and growing points, manifests itself in necrosis and other adverse reactions. [9] Direct feeding damage on groundnuts by large numbers of aphids can also result in partial sterility of plants. In Asia, *A. craccivora* appears in groundnut early in the rainy season, when it can cause considerable direct feeding damage. Various methods have been tried for the management of insect-pests of groundnut but use of chemical method has proved to be an important approach for their control because of its quick action, effectiveness and adaptability to various situations. Several insecticides have been recommended and used for the effective management of groundnut insect-pests. But according to several reports many of these label claimed insecticides could not achieve effective results. Hence this experiment has been worked out to evaluate the effect of some new insecticides along with the conventional insecticides against the most dreaded pest of groundnut i.e. aphid.

2. Material and Methods

The field investigation was aimed to evaluate the efficacy of different insecticidal treatments

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on Aphid (*Aphis craccivora*) infesting groundnut during pre-summer season of 2016 at the Institute of Agriculture (Palli Siksha Bhavana) farm, Visva-Bharati, West Bengal. This farm is situated at 23°39' North latitude and 87°42' East longitude and 58.90m above the main sea level. The soil of the experimental site was sandy loam in texture with a high percent of sand and low percent of clay and dry sub-humid and subtropical climate. The soil was acidic in nature with pH range 5.1- 6.1. The weather conditions during the period of investigation is characterized by the temperature range of maximum 35.31-42.32°C and minimum 20.19-26.42°C and maximum RH 42.42-87.14%, rainfall 0.04-7.22 mm and sunshine hour 4.1 to 9.64 hr during the crop growth period. The experiment was arranged in a randomized completely block design (RCBD) in three replications and eight treatments. An untreated control was maintained as check and sprayed with water. The crop was grown with the spacing of 30cm with the experimental plot of 4m x 3m in size. The observation was started with random selection of ten plants from each plot for analysis of the incidence of insect pest viz. Aphid (*Aphis craccivora*) where the incidence of an insect was assessed in terms of nymph and adult present on apical 10cm portion of the plants in each plot. Treatment imposition on the crop was done twice once at 40 days after sowing and the second at 15 days interval with knapsack sprayer was used for the spraying of insecticides to analyze the efficacy of different insecticides formulations. The different insecticidal treatments comprised of Imidacloprid 17.8% SL, Diafenthiuron 50% WP, Diflubenzuron 25% WP, Acephate 50% + imidacloprid 1.8% SP, Lambda Cyhalothrin 5% EC, Quinalphos 25% EC and Chlorpyrifos 20% EC. The population of aphid (*Aphis craccivora*) were recorded before and 3, 7, and 10 days after treatment imposition. Data thus obtained were analyzed in a computer by using OPSTAT & SPSS package. Transformations of insect data were made where necessary. Population reduction over control was worked by a procedure as laid out by Henderson –Tilton's formula (1955).

$$\text{Corrected \%} = \left(1 - \frac{n \text{ in Co before treatment} * n \text{ in T after treatment}}{n \text{ in Co after treatment} * n \text{ in T before treatment}} \right) * 100$$

Where: n = Insect population, T = treated, Co = control

3. Results and Discussion

3.1 Evaluation of some synthetic insecticide against the pests of groundnut

An investigation was conducted to evaluate the efficacy of a group of synthetic insecticides against the important insect-pests infesting groundnut mainly Aphid (*Aphis craccivora*). The different insecticides evaluated against an untreated control were Imidacloprid 17.8% SL, Diafenthiuron 50% WP,

Diflubenzuron 25% WP, Acephate 50% + imidacloprid 1.8% SP, Lambda Cyhalothrin 5% EC, Quinalphos 25% EC and Chlorpyrifos 20% EC. The outcomes of the experiments are delineated hereunder:

3.2 Effect of different insecticidal treatment on Aphid (*Aphis craccivora*)

The pooled data on mean reduction in the population of aphid at 3, 7 and 10 days after spray have been presented in Table 1 and 2. All the treatments were found significantly superior over untreated control. The data reveals that the highest reduction in the population of aphid was recorded in case of spraying with Imidacloprid 17.8% SL (0.02% a.i.) and Diafenthiuron 50% WP (600g a.i./ha). It was found superior to all the treatments. It showed 4.00 and 3.00 percent reduction in mean population of aphid at 10 days after spraying which gave 81.93% and 79.76% mortality of aphid population over control (Table-2). Rest of the insecticidal treatments were in the order of Lambda Cyhalothrin 5% EC (@300ml/ha) (T5) > Acephate 50% + imidacloprid 1.8% SP (@1000g/ha) and Diflubenzuron 25% WP (300g a.i./ha) gave 75.08 %, 74.38 %, and 61.49 percent population reduction in aphid respectively. Further it is also noticed that Imidacloprid and Diafenthiuron foliar spray persisted for even 10 days after spray and gave better efficiency. Least population reduction was observed in the treatment with Chlorpyrifos 20% EC and Quinalphos 25% EC. Analysis of variance showed significant interaction among the treatment and days after spraying. [2] The bio-efficacy of imidacloprid 200 SL (@ 100, 150, 200 and 250 ml/ha), with dimethoate and methyl-o-demeton @ 500 ml/ha as standards, against thrips (*Scirtothrips dorsalis*), aphids (*Aphis craccivora*) and leafhopper (*Empoasca kerri*) on groundnut was found effective against aphid on groundnut. Imidacloprid @ 100 ml/ha effectively controlled the population of thrips and aphids on groundnut and was superior to the standard chemicals. Further the effect of imidacloprid foliar spray persisted for three weeks and increased pod yield. [8] No population of aphids was observed in the treatments with imidacloprid 17.8 SL @ 0.3ml/l, quinalphos 25 EC @ 2 ml/l, chlorpyrifos 20 EC @ 2 ml/l with 100 percent protection at seven days after spray. [10] Lowest aphid (0.4 tiller-1) and maximum 99% aphid mortality was recorded for Imidacloprid on susceptible against (0.8 tiller-1) and 95% aphids mortality on resistant wheat variety. [6] The effectiveness of different treatment concentration of Imidacloprid treatment at the rate of 400 ml ha⁻¹ was found most effective against wheat aphids at 24 h, 2 days, 7 days and 14 days post spray interval. [7] The foliar application of imidacloprid 200 SL @ 200 ml/ha was highly effective against sucking pests of cotton. [4], [1], [3] the efficacy of Imidacloprid against aphids infesting different crops.

Table 1: Evaluation of some insecticidal molecules against groundnut Aphid (*Aphis craccivora*) for 1st spray (Pooled data of two sprays)

Treatment	Incidence of aphid (no. of aphids from apical 10 cm portion/plant) in different days of observation			
	Pre treatment	3 DAS	7 DAS	10 DAS
Imidacloprid 17.8% SL (0.02% a.i.)	21.00 (4.63)	10.33 (3.29)	7.00 (2.73)	4.5 (2.23)
Diafenthiuron 50% WP (600g a.i./ha)	23.33 (4.88)	14.00 (3.80)	9.00 (3.08)	5.6 (2.46)
Diflubenzuron 25% WP (300g a.i./ha)	27.00 (5.24)	13.00 (3.67)	11.23 (3.42)	12.33 (3.58)
Acephate 50% + imidacloprid 1.8% SP(500g a.i./ha)	26.33 (5.17)	12.10 (3.54)	10.78 (3.04)	8.00 (2.91)
Lambda Cyhalothrin 5% EC	22.00 (4.74)	13.21 (3.70)	8.00 (2.91)	6.5 (2.64)
Quinalphos 25% EC	29.00 (5.43)	16.11 (4.07)	11.00 (3.39)	13.4 (3.72)
Chlorpyrifos 20% EC	26.23 (5.17)	17.00 (4.18)	12.32 (3.58)	13.7 (3.76)

Control (Water Spray)	25.30 (5.07)	27.50 (5.29)	28.41 (5.37)	30.00 (5.52)
CD (5%)	NS	1.662	0.284	1.134
Se(m)	-	0.543	0.093	0.370
CV	-	6.307	4.786	9.519

Table 2: Percent reduction of Aphid (*Aphis craccivora*) after spraying of some insecticidal molecules (Pooled data of two sprays)

Treatment	Dose	Pre count insects/10 plant	Population at 10 DAS	Mean population reduction	% population reduction at 10 DAS
Imidacloprid 17.8% SL (0.02% a.i.)	125 ml	21.00 (4.63)	4.5 (2.23)	7.27	81.93
Diafenthiuron 50% WP (600g a.i./ha)	600 g	23.33 (4.88)	5.6 (2.46)	9.53	79.76
Diflubenzuron 25% WP (300g a.i./ha)	300 g	27.00 (5.24)	12.33 (3.58)	12.18	61.49
Acephate 50% + imidacloprid 1.8% SP(500g a.i./ha)	1000 g	26.33 (5.17)	8.00 (2.91)	10.29	74.38
Lambda Cyhalothrin 5% EC	300 ml	22.00 (4.74)	6.5 (2.64)	9.23	75.08
Quinalphos 25%EC	1250 ml	29.00 (5.43)	13.4 (3.72)	13.50	61.03
Chlorpyrifos 20% EC	1000 ml	26.23 (5.17)	13.7 (3.76)	14.34	55.95
Control (Water Spray)	-	25.30 (5.07)	30.00 (5.52)	28.63	-

4. Conclusion

The present investigation brought out the significant difference among the insecticidal treatments against aphids infesting groundnut. Among different insecticides, Imidacloprid 17.8% SL (0.02% a.i.) and Diafenthiuron 50%WP (600g a.i. /ha) exhibited the highest efficacy against the aphids after 10 days of spraying for both the treatment impositions. Further it can also be concluded that the efficacy of both the insecticides persisted with days of treatment imposition.

5. Acknowledgements

The authors would like to dedicate special thanks to the Agricultural Research Farm, Palli Siksha Bhavana (Institute of Agriculture) Visva-Bharati, Birbhum for providing the practical assistance. We owe our deepest thanks to the Department of Plant Protection, Palli Siksha Bhavana, Visva-Bharati University, Sriniketan, West Bengal for providing all the necessary facilities throughout my research work.

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