Bio-efficacy of newer insecticides and biopesticides against sucking insect pest aphid (Aphis craccivora Koch) of groundnut

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Abstract
To evaluate efficacy of newer insecticides and biopesticide against aphid, Aphis craccivora Koch experiment were carried out during Kharif 2018 at Agronomy farm, S.K.N. College of Agriculture, Jobner (Rajasthan). The experiment was laid out in Randomized Block Design (RBD) with nine treatments including untreated control on groundnut variety KG-382. All the insecticidal treatments were found significantly superior over the untreated control in aphid population in both the sprays. On the basis of mean per cent reduction in aphid population in two successive sprays the treatment of imidacloprid (81.94%) was found most effective against aphids, followed by thimethoxam (79.87%) and acetamiprid (77.99%). The methyl demeton (72.79%), fipronil (70.54%) and acephate (68.60%) falls under moderately effective group and were differed significantly to each other. Biopesticides Metarhizium anisopliae (32.56%) and NSKE (47.97%) were proved least effective.

Keywords: Aphid, bio-efficacy, biopesticide, groundnut, insecticide, sucking insect pest

Introduction
Groundnut, Arachis hypogaea L. is grown on large scale in almost all the tropical and subtropical countries of the world. The major groundnut producing countries are India, China, Nigeria, U.S.A., Taiwan, Indonesia, Senegal, Ghana, Argentina and Brazil. Total cultivated area of groundnut in India is 49.70 lakh hectares with an annual production of 71.00 lakh tonnes and productivity of 1429 kg/ha [2]. India occupies the first place in regard to acreage and second in production. Groundnut is important oilseed crop also known as peanut, earthnut, monkey nut, goober, pinda and manilla nut. Its oil primarily used in the manufacturing of vegetable oil (vanaspati ghee). Groundnut seed contains about 45 per cent oil and 26 per cent protein. Groundnut kernel as a whole is highly digestible. It is, in the first place about as concentrated a food as money can buy, one gram supplies 5.8 food calories. The biological value of groundnut protein is highest among the vegetable proteins and equals that of casein. Groundnuts are a good source of all B vitamins except B12. They are a rich source of thiamin, riboflavin, nicotinic acid and vitamin E [12]. With regard to minerals, phosphorus, calcium and iron are present in significant amount. The kernels are consumed either roasted or fried and salted.

The number of factors responsible for low productivity of groundnut includes adverse climatic conditions, poor quality seeds, diseases and insects which significantly affect both the quality and production of groundnut. Among these, insect pests are major limiting factor to reduce pod yield. As many as 52 species of insects and two species of mites have been recorded infecting the groundnut crop in India [14]. The sucking insect pests viz., aphid, A. craccivora, leafhoppers, E. kerri, whiteflies, B. tabaci and thrips, T. dorsalis are most important [3]. They suck the sap from tender parts of the plants, as a result plants wilted and dry up. Most of the species of sucking insects are also known to be vectors of diseases of groundnut. The Aphid, A. craccivora is a vector of groundnut rosette virus, peanut mottle virus and peanut stripe virus, cause yield losses up to 40 per cent [3]. The damage is severe in drought situation when the crop is young. Both nymphs and adults pierce plant tissues to feed on sap. The damage done by aphid, leafhopper and thrips at these stages showed maximum reduction in potential yield of the crop. Therefore, the crop should be protected at proper stage from these pests [13].
Insecticides are used widely to control the insect pests of groundnut because of easy adoption, effectiveness and immediate control. But their indiscriminate and irrational use creates resurgence, resistance and residual problems. Hence in the present study some new insecticides and biopesticides were evaluated against one of the major sucking insect pest aphid, A. craccivora of groundnut.

Material and Methods
The present investigations were conducted at the Agronomy farm of S.K.N. College of Agriculture, Jobner (S.K.N. Agriculture University, Jobner) during Kharif, 2018. Total nine treatments viz. Imidacloprid 17.8 SL (0.005%), Thiamethoxam 25 WG (0.005%), Acephate 75 SP (0.05%), Fipronil 5 SC (0.01%), Acetamiprid 20 SP (0.004%), Neem Seed Kernel Extract-NSKE (5.00%), Metarhizium anisopliae 1.15 WP (1 g/ml), Methyl demeton 25 EC (0.025%) and untreated control were used over groundnut variety RG-382. Each treatment was replicated three in Randomized Block Design (RBD). The plot size was 2.4 x 3.0 m², row to row and plant to plant distance were of 40 cm and 15 cm, respectively.

Application of insecticides
All the insecticides were applied as a foliar spray using knap sack sprayer in two intervals. The first spray was done at economic threshold level on 66 days after sowing and second sprays after 20 days of first spray when leafhopper population rebuilt. Utmost care was taken to check the drift of insecticides by putting polythene check screen around each plot at the time of spraying. The quantity of spray solution was 600 liters per hectare in each spray application.

Observations
The population of aphid on groundnut crop was recorded early in morning hours on three leaves per plant from five randomly selected and tagged plants in each plot. The mean percent reduction in the population of leafhopper obtained one day before and one, three, seven and ten days after spray were taken into consideration to calculate the per cent reduction in the population which was done by applying Abbott’s formula [1];

\[
\text{Per cent control (Reduction)} = \frac{(X - Y)}{X} \times 100
\]

Where,
X = Number living in the check
Y = Number living in the treated
X – Y = Number killed by the treatment

The data were then statistically analyzed by transforming the percentage data into angular transformation values [4].

Results and Discussion
In order to evaluate the bio-efficacy of newer insecticides and biopesticides for the control of insect pests on a specific crop, different criteria could be used. In the present investigation, the insecticides and biopesticides against aphid, A. craccivora were evaluated on the basis of mean population reduction at one, three, seven and ten days after two successive sprays (table-1). Comparative effects of all these insecticides at different intervals over aphids population also represented in the figure 1.

Percent population reduction of aphid, Aphis craccivora Koch
All the insecticidal treatments were found significantly superior over the untreated control in aphid population in both the sprays however, considerable difference were existed among them. The treatment imidacloprid 17.8 SL (81.94%) was found most effective followed by thiamethoxam 25 WG (79.87%) and acetamiprid 20 SP (77.99%) in both the spray and statistically were at par with each other in their efficacy. These results corroborate with that of Yadav et al. (2015) [15], reported that imidacloprid (0.005%) and thiamethoxam (0.005%) were effective against sucking insect pests, aphid, leafhopper and whitefly in cluster bean. The results were further conformity with those of Mutkule et al. (2018) [9] and Nigude et al. (2018) [9] who found that imidacloprid 17.8 SL was most effective for controlling of sucking insect pests on groundnut. Similarly, Pawar et al. (2016) [10] found imidacloprid, thiamethoxam and acetamiprid most effective against aphids, jassids and whitefly. Kolhe et al. (2016) [6] found imidacloprid (0.003%) and dimethoate (0.004%) significantly superior for controlling sucking insect pests of groundnut also support the present finding. The next effective treatment was methyl demeton 25 EC (72.79%) followed by fipronil 5 EC (70.54%) and acephate 75 SP (68.60%) which ranked in middle order of efficacy and were statistically found at par with each other however, methyl demeton also comparable with acetamiprid. Yadav et al. (2015) [15] found acephate (0.037%), profenophos (0.05%) and delta-cyanothrin (0.008%) moderately effective against sucking insect pests, support the present results. In chilli, fipronil 5 SC was superior for controlling thrips, aphid and whitefly reported by Shinde et al. (2017) [11]. The bio-pesticides Metarhizium anisopliae 1.15 WP (32.56%) and neem seed kernel extract-NSKE (47.97%) proved to be least effective against aphid and were differed significantly with each other in their efficacy. The present investigation were in fully conformity with that of Yadav et al. (2015) [15] while partially corroborate with that of Krishna et al. (2015) [7] who reported bio-pesticide, NSKE (5%) was effective against thrips and leafhopper, however, it could not compete with synthetic insecticides.

Finally, on the basis of mean population reduction of aphid after first and second sprays the descending order of effectiveness of insecticides and bio-pesticides were as Imidacloprid 17.8 SL (0.005%) > Thiamethoxam 25 WG (0.005%) > Acephate 20 SP (0.004%) > Methyl demeton 25 EC (0.025%) > Fipronil 5 SC (0.01%) > Acephate 75 SP (0.05%) > NSKE (5.0%) > Metarhizium anisopliae 1.15 WP (1 g/l).
### Table 1: Bio-efficacy of different insecticides and biopesticides against aphid, *Aphis craccivora* Koch on groundnut

| S. No. | Insecticides           | Concentration (%) / dose | Per cent reduction of Aphid population days after spray |
|--------|------------------------|--------------------------|--------------------------------------------------------|
|        |                        |                          | First Spray                                            | Second Spray                                          |
|        |                        |                          | One  Three    Seven    Ten   Mean                        | One  Three    Seven    Ten   Mean                        |
| 1.     | Imidacloprid 17.8 SL   | 0.005                     | 82.54 (65.31)  86.35 (68.66)  83.15 (66.08)  74.48 (59.68)  81.63 (64.99) | 80.10 (63.54)  85.16 (67.37)  87.50 (69.34)  76.20 (60.82)  82.24 (65.10) |
| 2.     | Thiamethoxam 25 WG     | 0.005                     | 80.20 (63.68)  84.43 (67.14)  81.48 (64.95)  72.23 (58.23)  79.59 (63.22) | 78.77 (62.59)  83.52 (66.09)  85.27 (67.45)  73.00 (63.45)  70.14 (63.83) |
| 3.     | Acephate 75 SP         | 0.05                      | 68.35 (55.78)  74.10 (59.34)  72.74 (57.37)  61.73 (51.80)  68.73 (56.00) | 66.46 (54.61)  72.76 (58.56)  74.36 (59.62)  60.30 (50.95)  68.47 (55.96) |
| 4.     | Fipronil 5 SC          | 0.01                      | 71.30 (57.61)  76.42 (61.24)  72.20 (58.22)  63.27 (52.70)  70.80 (57.33) | 68.35 (55.78)  74.60 (59.34)  76.12 (63.45)  62.00 (51.95)  70.54 (57.15) |
| 5.     | Acetamiprid 20 SP      | 0.004                     | 77.26 (61.58)  82.12 (65.27)  80.53 (63.87)  70.42 (57.11)  77.58 (61.76) | 76.50 (61.12)  81.46 (64.73)  83.67 (66.39)  71.92 (60.05)  78.39 (62.32) |
| 6.     | NSKE                   | 5.0                       | 43.78 (41.42)  55.67 (48.26)  49.32 (44.61)  40.37 (39.44)  47.29 (43.45) | 44.57 (41.87)  52.00 (46.15)  58.20 (49.72)  39.80 (39.11)  48.64 (44.21) |
| 7.     | Metarhizium anisopliae| 1.15 WP                   | 27.43 (31.54)  35.26 (36.43)  39.16 (38.74)  30.98 (30.98)  32.09 (34.50) | 28.60 (32.29)  36.39 (37.10)  39.45 (38.90)  27.66 (31.70)  33.03 (35.07) |
| 8.     | Methyl demeton 25 EC   | 0.025                     | 73.56 (59.13)  78.44 (62.65)  74.66 (59.36)  65.88 (54.28)  73.14 (58.81) | 70.22 (56.97)  79.90 (61.29)  78.38 (62.30)  64.24 (53.31)  72.44 (58.37) |
| 9.     | Untreated              | -                         | 0.000 (0.00)   0.000 (0.00)   0.000 (0.00)   0.000 (0.00)   0.000 (0.00) | 0.000 (0.00)   0.000 (0.00)   0.000 (0.00)   0.000 (0.00)   0.000 (0.00) |

*Figures in parentheses are angular transformation values*

**Fig 1**: Comparative efficacy of different treatments against aphid, *Aphis craccivora* Koch on groundnut

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