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BIO-MANAGEMENT OF SUGARCANE APHID *MELANAPHIS SACCHARI* (Z.) IN SORGHUM

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Abstract

Sugarcane aphid *Melanaphis sacchari* is a harmful aphid affecting sorghum and causes direct damage by reducing plant vigor, sap sucking and indirect damage by being a vector of various viral diseases. The laboratory experiment was carried out during September 2015 in the laboratory of Amity Institute of Organic Agriculture, Amity University, Noida (Uttar Pradesh), India. The botanical extracts of plants include Neem (*Azadirachta indica*), Jatropa (*Jatropha curcas*), Amla (*Emblica officinalis* L) and Drum stick (*Moringa olifera* L) in a randomized block design (RBD) were tested against aphid of sorghum. From the observation, it was concluded that all the treatments showed repellent characteristics against aphids and prevented them from feeding. After 14 days, it was observed that Amla + Neem oil and Amla+ Neem oil+water revealed the maximum significant increase in reduction of aphid population showing 96.70% mortality rate and minimum mortality rate was recorded in combination with Drumstick + Neem + water showing 65% of mortality rate. In both concentrated and diluted formulations, the highest mortality and control efficiency rate was shown by combination of Amla + Neem application followed by combination of Drumstick + Neem application and the lowest mortality and control efficiency was shown in combination of Amla + Drumstick + Jatropha. Due to lack of organic management practices available, use of natural insecticides have been the objective of research and these extracts have promised a solution.

Key words : Sorghum*, Jatropha curcas, Moringa olifera, Emblica officinalis* L, *Neem,* sugarcane aphid.

Introduction

Sorghum (jowar or jowari) is an important nutrition cereals constituting staple diet in the country (Dayakar *et al*., 2005). India contributes about 16% of the world's sorghum production. It is the fourth most important cereal crop in the country. Every efforts is being made to raise the productivity of these crops by adopting modern agricultural practices such as use of high yielding varieties. Several pests are known to be associated with various phonological stages of Sorghum crops in India. Grain sorghum is relatively tolerant to insect feeding. Several species of aphids can attack sorghum. Aphids are small soft-bodied insect that have sucking mouthparts and feed on plant sap. Damage to sorghum by the sugarcane aphid depends on a number of factors including aphid density and infestation duration. Sorghum is typically infested soon after plant emergence, but significant infestations usually occur during late growth stages and in dry periods (van Rensburg, 1978). Sorghum responses to *M. sacchari* injury include purple leaf discoloration of seedlings followed by chlorosis, necrosis, stunting, delay in flowering, and poor grain fill, including quality and quantity yield losses.

In India, the farmers have heavily relied upon chemical pesticides to overcome the problem of pests. Residues of various pesticides in the soil are left behind on crops, which are then consumed directly causing various food borne. However, some chemicals have posed some serious problems to health and environmental safety, because of their high toxicity and prolonged persistence (Kulkarni and Joshi, 1998). Thus, newer approaches for pest control are continuously being sought. The use of botanical resources for agrochemical purpose is one of the important alternatives. In view of these efforts were carried out to investigate the effect of botanical extracts, such as Jatropa (*Jatropha curcas*), Amla (*Emblica officinalis* L) and Drum stick (*Moringa olifera* L) on

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survival and feeding of corn leaf aphids under laboratory conditions.

Materials and Methodology

Collection of corn leaf aphids

Insects were collected from infested leaves of Sorghum from Organic research field, Amity Institute of Organic Agriculture on September 2015. During the survey some major crop insects were identified such as aphids, *Pyrilla purpusilla*, brown hopper and hudda beetle. Aphids were selected for the experiment on the basis of its life span and high reproductive ability

Preparation of extracts

The lab experiment was conducted from September to December 2015 under specific lab conditions in 2015 at Amity Institute of Organic Agriculture, Amity University, Noida (Uttar Pradesh), India. Leaves of Jatropa (*Jatropha curcas*), Amla (*Emblica Officinalis* L) and drum stick (*Moringa olifera* L) were collected for the leaf extraction. The collected leaves were cleaned, and damaged leaves were excluded and kept for shade drying under lab conditions for 2-3 days. The dried leaves were crushed in methanol and volume raised up to 500ml and it was kept under lab conditions for 2-3 days until all the phytochemicals were extracted from the leaves. The leaf solution was filtered with Whattsman filter paper to filter out the coarse leaf particles. The obtained solution was later concentrated about 30ml with the help of rotary evaporator. Nine concentrations each 10 ml were prepared for treating against aphids (table 1).

Table 1 : Ratios of concentrated formulations made.

S. no.	Formulations	Components	Ratio
1.	T_1	Neem Oil	-
2.	T_2	Amla + Neem	1:1
3.	T_3	Amla+Neem	2:1
4.	T_4	Drumstick+Neem	1:1
5.	T_5	Drumstick+Neem	2:1
6.	T_6	Jatropha+Neem	1:1
7.	T_7	Jatropha+Neem	2:1
8.	T_8	Amla+Drumstick+Jatropha	1:1:1
9.	T_9	Amla+Drumstick+Jatropha +Neem	1:1:1:1

For the preparation of diluted formulations , the replica of concentrated formulations were diluted with water in the ratio of 1:9 to get a solution of 100ml.

S. no.	Formulations	Components	Ratio
1.	T_1	Neem Oil+water	-
2.	T_2	(Amla + Neem)+water	1:9
3.	T_3	(Amla+Neem)+water	2:1
4.	T_4	(Drumstick+Neem)+water	1:1
5.	T_5	(Drumstick+Neem)+water	2:1
6.	T_6	(Jatropha+Neem)+water	1:1
7.	T_7	(Jatropha+Neem)+water	2:1
8.	T_8	(Amla+Drumstick+Jatropha) +water	1:1:1
9.	T_9	(Amla+Drumstick+Jatropha +Neem)+water	1:1:1:1

The prepared formulations were then stored in refrigerated condition.

Inoculation of aphids& applications of plant extracts

The aphids were collected from the crop. About 600 aphids were used per treatment to check the insecticidal quality as well as its influence on neem efficiency . Sterilized petri plates were taken and water soaked cotton was used for the moisture availability. Sorghum leaves were then kept in the petri plates as a source of feed. The prepared formulations were then sprayed on the leaves and about 20 aphids per petri plate were introduced. Water was used as a control in the experiment as T_{10}. Each treatment was replicated thrice to avoid the errors. The results were observed within a time limit of 24 hrs.

Recording observations

Effect of formulation on the aphids

Effects of formulations on aphids were calculated on the basis of mortality rate and the reproductive. Mortality and reproductive rate determines the control efficiency of the formulations. The activity of these formulations depends on the type of phyto-chemicals present in them. The percent mortality of aphids was calculated by the Abbott's formula after, 14, 21, 28 and 35 days and calculated :

$$\text{Mortality rate} = \frac{\text{No. of adults dead}}{\text{No. of aphids inoculated}} \times 100$$

$$\text{Control efficiency} = \frac{\text{Total no. of aphids}}{\text{No. of aphids in control}} \times 100$$

Reproductive rate was obtained by plotting a graph on the number of nymphs produced.

Results and Conclusion

From the observation, it was concluded that all the treatments showed repellent characteristics against aphids and prevented them from feeding. After 14 days, it was observed that T_1 (Amla + Neem oil) and T_3 (Amla+ Neem oil+water) revealed the maximum significant increase in reduction of aphid population showing 96.70% mortality rate and minimum mortality rate was recorded in T_5 (Drumstick+Neem + water) showing 65% of mortality rate. In both concentrated and diluted formulations the highest mortality and control efficiency rate was shown by T_1 application followed by T_2 application and the lowest mortality was shown by T_5 and the lowest control efficiency was shown in treatment T_8 (Amla+Drumstick+Jatropha) (table 2). The findings of the present study are almost similar to the findings of several authors like Gurunath *et al*. (2012). This observation is similar to the verified by Tang *et al*. (2002), that the mortality of nymphs and adults of *T. citricida* on citrus treated with Neemix was dependent upon rate, and to results by Lowery *et al*. (1993), who found a positive correlation between aphid mortality and neem extract rates.

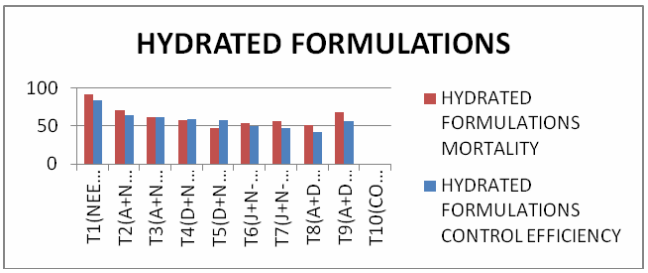

Fig. 1 : Effect of various hydrated formulations on the mortality of aphids.

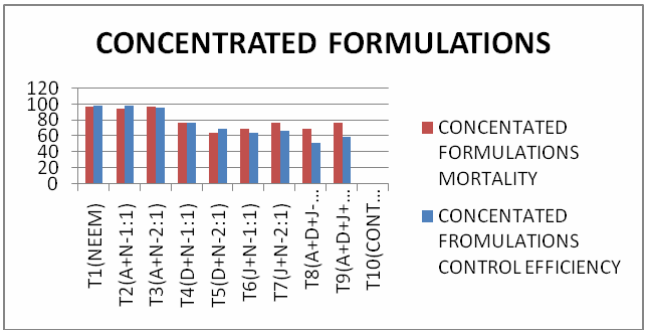

Fig. 2 : Effect of various concentrated formulations on the mortality of aphids.

Table 2 : Effect of various treatments on Percent mortality and control efficiency.

Treatment	Initial reading	Day 14 reading	Total population	Mortality	Control efficiency
T_1	20	1.66	9.99	91.70	84.80
T_2	20	5.66	23.66	71.70	64.10
T_3	20	7.6	24.93	62.00	62.20
T_4	20	8.33	26.99	58.35	59.10
T_5	20	10.66	27.32	47.00	58.50
T_6	20	9.33	33.33	53.30	49.50
T_7	20	8.66	34.66	56.70	47.40
T_8	20	9.66	34.99	51.70	41.90
T_9	20	6.33	18.66	68.35	56.57
T_{10}	20	20	46.00	00.00	00.00

Similar result was obtained in the mustard aphid, *Lipaphis erysimi* (Kalt.)which is a major pest of *Brassica* crops (Bakhetia & Ghorbandi, 1987; Bakhetia & Sekhon, 1989). Good control of mustard aphid were obtained by spraying traditional organic insecticides (Bakhetia, 1984 and Khurana *et al*., 1989). Spraying extracts of leaves and kernels of *Vinca rosea*, *Pongamia pinnata*, *Azadirachta indica* and *Vitex negundo* took 10 days to cause mortality of aphids: Dimethoate, chlorpyriphos, endosulfan, alfamectin and malathion not only reduced aphid populations but promoted grain and fodder yields, besides increase in kernel weight (Balikai, 2001).

Nagia DK *et al*. (1990) tested the efficiency of 9 insecticides against larvae of *Spilosoma oblique*, of Cabbage leaves (*Brassica oleracea*) treated with Neem, Sarifa, *Beauveria bassiana* and Cypermethrin.

Effect of botanical extracts, biological and chemical control against *Spilosoma oblique* on cabbage (*Brassica oleracea*) was reported by Hussein and Abed (2015).

The botanical extract reduced comparatively low aphid population than chemical insecticides, but it is not toxic like chemical insecticides. It is safe for honeybee and other pollinators and also conserve natural enemies in the mustard fields. Figs. 1 & 2 shows a reduction in aphid population by using neem extract over control. Biswas (2008) reported that neem extract and neem oil

reduced 73-83% aphid population in mustard crop in Bangladesh. Similar results were obtained by Prasad (1997) in India. Morde and Blackwell (1993) reported that anti feedant, repellent, and insect growth regulatory effects are present in neem product which can be used for insect management in crop production. Similar finding was also reported by Saha *et al.* (2006).

Therefore, results from this study will help in understanding that biological control and botanical pesticides can be combined to control aphids on sorghum plant. It is hoped that the results will be used to aid the small-scale rural farmers, through the enhancement of biological control and a reduction in the use of chemical pesticides.

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