International Journal of Fauna and Biological Studies
Available online at www.faunajournal.com

IJFBS
International Journal of Fauna And Biological Studies

ISSN 2347-2677
IJFBS 2017; 4(4): 26-28
Received: 17-05-2017
Accepted: 18-06-2017

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Efficacy of Bio agents against Jassid (*Amrasca biguttula biguttula Ishida*) Population on RCH-134 Bt (BG-II)

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Abstract
In the present study, the bio-efficacy of different bio agents against sucking insect pests Jassid(*Amrasca biguttula biguttula Ishida*) was evaluated. The experiment involved 8 treatments including control. The treatments consist of NSKE 5% (Neem Seed Kernal Extract), Neem Oil + liquid soap, Pest guard 5%, *Fusarium SP, Verticillium lecanii, Beauveria bassiana*, Buprofenzin I.G.R. (Insect Growth Regulator) and Control. Total three sprays of each bio agent were given at 7-10 days' interval to protect the Bt cotton against sucking pests. The following bio agents were used for spraying the crop during crop season. In the result, it was found that maximum reduction in jassid population was offered by NSKE 5% (37.61%) and was superior to rest of the treatments. The treatment of Neem oil +liquid soap (30.22%) and pest guard 5% (25.40%) ranked second in order of efficacy to reduce jassid population and were at par to each other. The treatment of *Fusarium* SP (18.20%), *Verticillium lecanii* (17.46%), Buprofenzin I.G.R. (17.01%) and *Beauveria bassiana* (14.84%) proved to be least effective in reducing the jassid population.

Keywords: Bio agents, Neem oil +liquid soap, Buprofenzin I.G.R, Jassid population.

Introduction
India is the only country in the world that grows not only all the four cultivated species of cotton namely, G. arboretum (Sea Island Cotton), G. herbaceaum (Indian cotton), G. barbadense (Egyptian cotton) and G. hirsutum (American cotton), but also their intra- and inter- specific hybrids on a commercial scale. Area wise, India ranks first in global scenario contributing about 34% of the world cotton area. However, the productivity of cotton in India still is far less than other major cotton growing countries of the world, viz. Australia (1802 kg ha-1), Brazil (1446 kg ha-1), China (1326 kg ha-1), USA (865 kg ha-1), Pakistan (721 kg ha-1) and Uzbekistan (682 kg ha-1) (AICCIP, 2012a).

The insect pests are a major constraint in achieving high productivity. Due to several new technological developments such as transgenic cotton, cotton genomics, molecular breeding, pest and disease resistance, integrated pest management, insect resistance management, integrated nutrient management, and cotton by- products utilization, the cotton scenario in the country is changing much faster than it was anticipated. However, there is a continuous loss, in the productivity of cotton due to many reasons, mainly due to pest attack.

Nataranjan & Sundramurthy (1990) [1] reported that growth & development of whitefly nymphs were suppressed by treatment with neem oil (0.5% and 1.0%) on cotton but remained unaffected by monocrotophos, only 14.3 and 13% of nymphs reached the adult stage with 0.5 and 1% neem oil, respectively, while 84.3% of those treated with monocrotophos became adults. Adults emerging from neem oil treatment showed crippled wings. Shelke *et al*. (1990) [2] and Sidding (1991) [3] reported that two applications of neem seed extract @ 1 kg/40 L water at a 14-day interval starting at the beginning of infestation significantly reduced the population of Bemisia tabaci to less than 50 % of the control. Sohail *et al*. (2015) evaluated the efficacy of botanical chemicals i.e. Neem seed crude extract (2.5%), Turmeric (3.5%), Garlic extract (5%), Henge extract (2.5%) and Thiodan (0.07%) against the insect pests of Okra at the new Developmental farm (NDF) of the University of Agriculture Peshawar, Pakistan. Significant effect was recorded in all the treatments as compared to the control. They found that Thiodan (0.07%) and Neem seed crude extract (2.5%) were the most effective chemicals against the pests of Okra. Lowest mean population of E. insulana, A. devastans and O. leotus were recorded in Thiodan (0.07%) and Neem seed crude extract (2.5%).

They reported that farmers can utilize Neem seed crude extract for the effective control of Okra pests in field as having low cost and less environmental hazard. In the present study, the bio-efficacy of different bio agents against sucking insect pest Jassid (*Amrasca biguttula biguttula Ishida*) Population on RCH-134 Bt (BG-II)was evaluated.

Material & Method

The experiment involved 8 treatments including control. The treatments consist of NSKE 5% (Neem Seed Kernal Extract), Neem Oil + liquid soap, Pest guard 5%, *Fusarium SP*, *Verticillium lecanii*, *Beauveria bassiana*, Buprofenzin I.G.R. (Insect Growth Regulator) and Control. Total three sprays of each bio agent were given at 7-10 days' interval to protect the Bt cotton against sucking pests. The following bio agents were used for spraying the crop during crop season. The treatments were imposed as and when the population of jassid reached Economic Threshold Level (ETL). The Population of sucking pest were recorded on the crop, 24 hours before spray and 2-4 days after each spray of the treatment. Population counts of jassids was made on the lower surface of three leaves (one each from upper, middle and lower plant canopy) of each of the five randomly selected plants per plot. Later the population was averaged to present as number per three leaves. The average seasonal means were considered for pooled analysis of two years. The observations on the surviving insects after each treatment at definite time intervals were recorded and percent reduction in population was calculated.

Result & Discussion

In the present study, the bio-efficacy of different bio agents against sucking insect pest, Jassid, Amrasca biguttula biguttula Ishida, was evaluated. Total three sprays of each bio agent were done to protect Bt cotton variety RCH-134 Bt (BG-II) from the infestation of sucking pests. The observations on percent reduction of sucking pests population were recorded 24 hours before spray and 2-4 days after each spray of the treatment.

The data presented in Table 1 and 2 for the years of 2012-13 and 2013-14, respectively and pooled data in Table 3 for percent reduction in jassid population indicated that all the bio agents treatments reduced the jassid population significantly over the control. However, significant differences existed among the treatments. On the basis of pooled data presented in Table 3 revealed that, during 2012-13, maximum reduction in jassid population was offered by NSKE 5% (39.34%) and was superior over the other treatments. The treatment of Neem oil + liquid soap (31.86%), Pest guard 5% (25.63%) formed the next best group of treatments to reduce jassid population. The treatment *Verticillium lecanii* (17.55%), *Fusarium SP* (17.37%), Buprofenzin I.G.R (15.63%) and *Beauveria bassiana* (12.89%) formed the next group of bioagents and were less effective to reduce jassid population and were statistically at par to each other.

During 2013-14, maximum reduction in jassid population was offered by NSKE 5% (35.88%) and was superior over the other treatments. The treatment of Neem oil + liquid soap (28.59%) and Pest guard 5% (25.16%) ranked second in order of efficacy to reduce jassid population and were at par to each other. The treatment of *Fusarium SP* (19.02%), Buprofenzin I.G.R (18.40%), *Verticillium lecanii* (17.38%) and *Beauveria bassiana* (16.79%) were proved less effective in order of efficacy and were at par to each other (Table 3). The pooled mean as depicted in Table 3 regarding reduction in jassid population revealed that the maximum reduction in jassid population was offered by NSKE 5% (37.61%) and was superior over the other treatments. The treatment of Neem oil + liquid soap (30.22%) and Pest guard 5% (25.40%) ranked second in order of efficacy to reduce jassid population and were at par to each other. The treatment of *Fusarium SP* (18.20%), *Verticillium lecanii* (17.46%), Buprofenzin I.G.R (17.01%) and *Beauveria bassiana* (14.84%) were proved less effective to reduce jassid population and were at par to each other. It was concluded that bio agents were effective against the pest population compared to control.

Table 1: Efficacy of different bio agents against jassid population on RCH-134 Bt (BG-II) during Kharif 2012-13

Treatment	Doses/lit. of water	Mean (%) reduction of jassid/3leaves after 1st spray	Mean (%) reduction of jassid/3leaves after 2nd spray	Mean (%) reduction of jassid/3leaves after 3rd spray
NSKE 5%	5 ml	38.80# (38.51)*	41.77# (40.21)*	37.46# (37.71)*
Neem oil + liquid soap	3 ml + 1 ml	33.60 (35.35)	31.11 (33.85)	30.86 (33.72)
Pest guard 5%	4 ml	24.60 (29.73)	28.17 (29.73)	24.13 (29.35)
Fusarium SP	2 g	16.16 (23.65)	17.17 (24.42)	18.79 (25.50)
Verticillium lecanii	3 g	17.26 (24.44)	16.77 (24.04)	18.62 (25.49)
Beauveria bassiana	3 g	11.47 (19.77)	13.87 (21.81)	13.34 (21.30)
Buprofenzin I.G.R.	2 ml	14.81 (22.51)	15.46 (23.07)	16.60 (24.00)
Control		3.903 (11.22)	3.41 (10.58)	3.37 (10.52)
SEM±		1.11	1.08	1.46
CD (5%)		3.38	3.28	4.43
CV%		7.52	7.22	9.75

Mean of three replications

* Values in parenthesis are transformed angular values

Table 02: Efficacy of different bioagents against jassid population on RCH-134 Bt (BG-II) during Kharif 2013-14.

Treatment	Doses/lit. of water	Mean (%) reduction of jassid/3leaves after 1st spray	Mean (%) reduction of jassid/3leaves after 2nd spray	Mean (%) reduction of jassid/3leaves after 3rd spray
NSKE 5%	5 ml	35.94# (36.79)*	38.37# (38.24)*	33.33# (35.23)*
Neem oil + liquid soap	3 ml + 1 ml	30.82 (33.68)	29.53 (32.86)	25.42 (30.18)
Pest guard 5%	4 ml	29.14 (32.62)	24.60 (29.68)	21.75 (27.78)
Fusarium SP	2 g	20.02 (26.56)	17.78 (24.88)	19.25 (25.96)
Verticillium lecanii	3 g	18.84 (25.68)	13.93 (22.96)	19.36 (26.00)
Beauveria bassiana	3 g	13.97 (21.73)	18.80 (25.61)	17.60 (24.76)
Buprofenzin I.G.R.	2 ml	15.32 (22.89)	19.13 (25.84)	20.74 (27.01)
Control		3.09 (10.08)	3.53 (10.73)	3.34 (10.47)
SEM±		1.41	1.18	1.23
CD (5%)		4.28	3.58	3.73
CV%		9.31	7.76	8.23

Mean of three replications
* Values in parenthesis are transformed angular values

Table 3: Efficacy of different bioagents against jassid population on RCH-134 Bt (BG-II) during Kharif 2012-13 and 2013-14 (Pooled data of Two years).

Treatment	Doses/lit. of water	2012-13	2013-14	Pooled mean
		Mean (%) reduction of jassid/3leaves after spray	Mean (%) reduction of jassid/3leaves after spray	Mean (%) reduction of jassid/3leaves after spray
NSKE 5%	5 ml	39.34# (38.81)*	35.88# (36.75)*	37.61## (37.78)*
Neem oil + liquid soap	3 ml + 1 ml	31.86 (34.61)	28.59 (32.24)	30.22 (33.27)
Pest guard 5%	4 ml	25.63 (29.6)	25.16 (30.02)	25.40 (29.81)
Fusarium SP	2 g	17.37 (24.52)	19.02 (25.8)	18.20 (25.16)
Verticillium lecanii	3 g	17.55 (24.66)	17.38 (24.88)	17.46 (24.77)
Beauveria bassiana	3 g	12.89 (20.96)	16.79 (24.03)	14.84 (22.5)
Buprofenzin I.G.R.	2 ml	15.63 (23.2)	18.40 (25.25)	17.01 (24.22)
Control		3.56 (10.77)	3.32 (10.43)	3.44 (10.6)
SEM±		1.22	1.27	1.25
CD (5%)		3.70	3.86	3.78
CV%		8.17	8.43	8.30

Pooled mean of two years
Mean of three sprays
* Values in parenthesis are transformed angular values

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