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Evaluation of Different Bio Pesticides Against the Aphid in Okra at Bhubaneswar

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Abstract: Aphid population ranged from 2.01-2.21 in the beginning of *Kharif* 2013 and 3.87 to 4.21 in summer 2013-14 after the application of biopesticides and bioagents at 40 DAG aphid infestation during 2013 was found to be 0.36/plant in acetamiprid treatment (T_7) but bioagent *C. zastrowi sillemi* also reduced the population substantially recording 1.0 and 1.09 aphid/ plant at 40 DAG. The reduction was 96.54% in insecticide were as it was 90.41% in *C. zastrowi sillemi* @ 1 lakh / ha and 89.54% in *C. zastrowi sillemi* @ 75,000 / ha indicating the effectiveness of *C.zastrowi sillemi* in the control of sucking pest similarly corresponding incidence in summer was 0.96, 1.28 and 1.31 aphids/ plant and 92.29 and 86.32 and 85.74% reduction respectively. The biopesticides were also effective for control of aphid the most effective being *V. lecanii* which recorded 1.86 and 2.06 aphids/plant and 82.16 and 82.92% reduction of aphid population during *Kharif* and summer respectively. The other biopesticides in order of effectiveness were *M. anisopliae*, Neemazol and *B. bassiana* recording (3.02 and 3.10,4.01 and 3.92,3.96 and 4.08 aphid/plant) during *Kharif* and summer respectively. It was observed that over the two seasons, the aphid population ranged between 0.77 in acetamiprid treatment to 3.69 in *B. bassiana* treatment among the bioagent and biopesticides where as in controlled plot it was 8.34 aphid/plant correspondingly the population reduction was also highest in T_7 (80.21%) followed by T_3 (79.46%), T_5 (77.57%), T_2 (67.86%), T_4 (60.67%) and T_1 (55.75%) indicating that *C.zastrowi sillemi* and *V.lecanii* were most effective bioagents against aphids.

Key word: Evaluation · Aphid · Okra

INTRODUCTION

Okra is ravaged by as many as 45 species of insect-pests throughout its growth period (Rawat and Sahu, 1973) [1]. Among these, the aphid, *Aphis gossypii* is a polyphagous sucking pest and also found damaging okra all over India. It also acts as vector of virus and transmits mosaic, leaf curl etc. (Butani and Verma, 1976) [2]. The indiscriminate use of pesticides has caused toxicity to non-target beneficial organisms resulting in development of pest resistance to the chemical pesticides and resurgence of pest due to pyrethorids (Basha *et al.* 1982) [3]. Adoptions of IPM strategies ensure safety of environment. In this regard encouragement of natural enemies occupies a central position in integrated pest management because biological control of pests and weeds through natural enemies is eco-friendly (Shivalingaswamy *et al.,* 2002 [4]; Telang *et al.,* 2004; Sardana *et al.,* 2005 [5]). The effectiveness of bio pesticides like *Beauveria bassiana*, *Verticillum lecanii* and *Metarhizium anisopliae* against okra aphid *Aphis gossypii* has been reported by Harischandra Naik and Shekharappa (2008) whereas that of the neem pesticides has been elaborated by Dhanalakashmi and Mallapur (2011) [6]. The chrysopid predator, *C. carnea* has also successfully controlled okra aphid (Puri, 1992). Keeping all these in view, a field experiments were taken up at the Orissa University of Agriculture and Technology, Bhubaneswar to evaluate bio pesticides against the okra aphid.

MATERIALS AND METHODS

The field experiments were taken up in the Central Research Station of Orissa University of Agriculture and Technology (OUAT), Bhubaneswar during *Kharif* 2013 and Summer 2013-14. The okra variety Utkal Gaurav was sown in well prepared land and the crop was grown

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following all standard package of practices. The experiments were laid in Randomized Block Design (RBD) with three replications and eight treatments. The plot size was 5m x 5m. Treatment schedule was as follows:

T_1- Application of *Beauveria bassiana* @ 1x 10^8 cfu/g at 15 and 30 DAG (Days after Germination)

T_2- Application of *Metarrhizium anisopliae*@ 1x 10^8 cfu/g as in T_1

T_3- Application of *Verticillium lecanii* @ 1x 10^8 cfu/g as in T_1.

T_4- Application of Neemazal 4% as in T_1.

T_5- Release of *Chrysoperla zastrowi sillemi* @ 75000 1st instar larvae/ha at 15 and 30 DAG

T_6- Release of *Chrysoperla zastrowi sillemi* @ 100,000 1st instar larvae /ha at 15 and 30 DAG

T_7- Application of acetamiprid 0.025% at 15 and 30 DAG

T_8- Untreated control

Fifteen days after germination (DAG) the first application of biopesticides were done. Before that, as the 14th DAG, the population of pests were recorded before application of the treatments (DBA). Thus for each treatment pest population were recorded 1 day before application (DBT) and then 3 day after treatment (DAT) and 10 DAT. The population of pests was recorded from 10 randomly selected plants in each subplot after the first application of biopesticides and bioagents. Observations were taken from 3 leaves *i.e.*, from top, middle and lower portion of the plant for sucking pests. Data so obtained during *Kharif* 2013 and summer 2013-14 were statistically analysed after suitable transformation and the inferences were drawn basing on the results.

RESULTS AND DISCUSSION

During *Kharif* 2013, the population of aphids in okra ranged from 2.01 in T_1 to 2.22 in T_7. Fifteen days after germination (DAG) when the 1st observation was taken the difference between treatments in respect of aphid population was non-significant. After 3 days of applying treatments *i.e.* 18 DAG, the population of aphid ranged between 0.63 in T_7 to 3.80 in T_8. The aphid population was lowest in (0.63/plant) in T_7 i.e. application of acetamiprid which was at par will the application of *Verticillum lecanii* (T_3) having 1.36 aphids/plant [8].

The treatments with *Beauveria bassiana, Metarhizium anisopliae* and Neemazol recorded 2.12, 2.09 and 2.03 aphids/plant which were at par with each other. The bioagent *Chrysoperla zastrowi sillemii* when released @ 1,00,000/ha was as effective as the application of acetamiprid, but when released at the rate of 50,000/ha the predator as effective as the but the biopesticide *Verticillum lecanii*.

The treatment reduced the pest population in the range of 87.71% in T_7 to 42.16 in T_1 during *Kharif* 2013 (Table 1). This observation corroborate with the finding of Nirmala *et al*. (2006) have recorded similar effectiveness of *V. lecanii*. After 30 DAG similar trend was observed in the aphid population. Days before application (DBA) aphids ranged from 1.02 in T_7 to 5.81 in T_8 when the observations was taken. The difference between treatments in respect of aphid population was significant. After 33 DAG 2nd application was done in the same dose. After 3 days of applying treatment *i.e.* at the 33 DAG the population and aphid ranged between in T_7 0.61 to 7.29 in T_8. The aphid population was lowest (0.61/plant) in T_7 *i.e.* application of acetamiprid which was at par with application of *C. zastrowi sillemii* in T_6 having 1.12 aphids/plant. Control plots recorded the highest population of aphid at 3.80 aphids/plant [9].

V. lecanii and *C. zastrowi sillemii* in T_8 *i.e.* @ 75,000/ha recorded 1.98 and 1.43 aphids/plant which were statistically at par with each other. *B. bassiana*, *M. anisopliae* and Neemazol were recorded 4.67, 3.33 and 4.07 which were statistically similar will each other [10].

During summer 2013-14 (Table 2), the population of aphid in okra ranged from 9.2-3.75 at 15 days after germination when the 1st observation was taken. The differences between treatments in respect of aphid population was non-significant. After 3 days of applying treatments i.e. 18 DAG the population of aphid ranged between 2.00 in T_3 to 5.32 in T_8. The aphid population was lowest (2.00/plant) in T_8 *i.e.* application of acetamiprid which was at par with the application of *V. lecanii* (T_3) having 2.02 aphids/plant. The biopesticides. *B. bassiana, V. lecanii* and Neemazol recorded 4.19, 3.21 and 3.12 aphids per plant which were statistically at par will each other. The bioagent *C.zastrowi sillemii* when released at the rate of 1,00,000/ha was as effective as the application of acetamiprid, but when released at the rate of 50,000/ha the predator was as effective as the best biopesticide *V. lecanii*. Control plots recorded the highest population of aphid at 5.32 aphids per plant [11].

Table 1: Effect of different bioagents on the aphid population in okra during *Kharif* 2013

Treatment	1st application			Reduction over control (%)	2nd Application			Reduction over control (%)
	DBA	18 DAG	25 DAG		DBA	33 DAG	40 DAG	
T_1	2.01(1.41)	2.12(1.45)	2.73(1.65)	42.16	4.81(2.19)	4.67(2.16)	3.96(1.98)	62.02
T_2	2.13(1.45)	2.09(1.44)	1.65(1.28)	65.05	4.00(2.0)	3.33(1.82)	3.02(1.73)	71.01
T_3	2.11(1.45)	1.36(1.16)	1.06(1.02)	77.54	2.91(1.70)	1.98(1.40)	1.86(1.36)	82.16
T_4	2.21(1.48)	2.03(1.42)	2.00(1.41)	57.64	4.42(2.10)	4.07(2.01)	4.01(2.00)	61.54
T_5	2.09(1.44)	1.80(1.34)	1.73(1.38)	59.12	1.32(1.14)	1.43(1.19)	1.09(1.04)	89.54
T_6	2.13(1.45)	1.65(1.28)	1.53(1.23)	67.59	1.28(1.13)	1.121.05)	1.00(1.00)	90.41
T_7	2.22(1.48)	0.63(0.79)	0.58(0.76)	87.71	1.02(1.00)	0.61(0.78)	0.36(0.60)	96.54
T_8	2.20(1.48)	3.80(1.94)	4.72(2.17)	-	5.81(2.41)	7.29(2.7)	10.42(3.22)	-
SE(m)$\pm$	NS	0.27	0.32		NS	0.38	0.64	
CD(0.05)	NS	0.81	0.96		NS	1.13	1.92	

Figures in parentheses are values

Table 2: Effect of different bioagents on the aphid population in okra during *Summer* 2013-14

Treatment	1st Application			Reduction over control(%)	2nd Application			Reduction over control (%)
	DBA	18 DAG	25 DAG		DBA	33 DAG	40 DAG	
T_1	4.20(2.04)	4.19(2.04)	4.03(2.00)	34.79	5.12(2.26)	4.36(2.08)	4.08(2.01)	66.17
T_2	3.78(1.99)	3.21(1.79)	2.97(1.72)	51.94	3.39(1.84)	3.16(1.77)	3.10(1.76)	74.30
T_3	3.75(1.93)	2.02(1.42)	1.86(1.36)	69.90	2.98(1.72)	2.12(1.45)	2.06(1.43)	82.92
T_4	4.21(2.05)	3.71(1.92)	3.22(1.79)	47.73	4.86(2.20)	4.43(2.10)	3.92(1.97)	67.50
T_5	4.08(2.01)	3.12(1.76)	2.96(1.72)	52.10	2.14(1.46)	1.88(1.37)	1.72(1.31)	85.74
T_6	4.11(2.02)	3.01(1.73)	2.43(1.55)	60.68	2.08(1.44)	1.70(1.37)	1.65(1.28)	86.32
T_7	3.87(1.96)	2.00(1.41)	1.23(1.10)	80.09	2.42(1.55)	1.10(1.04)	0.93(0.96)	92.29
T_8	4.01(2.00)	5.32(2.30)	6.18(2.48)	-	6.82(2.61)	8.91(2.98)	12.06(3.47)	-
SE (m) $\pm$	NS	0.11	0.19		0.14	0.17	0.28	
CD(0.05)	NS	0.32	0.58		0.42	0.52	0.85	

Figures in parentheses are values

Table 3: Effect of different biopesticides on the aphid population in okra (pooled over *Kharif* 2013 and summer 2013-14)

Treatment	DBA	18 DAG	25 DAG	(%)Reductionover control
T_1	4.03(2.00)	3.83(1.95)	3.69(1.92)	55.75
T_2	3.33(1.82)	2.94(1.71)	2.68(1.63)	67.86
T_3	2.93(1.71)	1.87(1.37)	1.71(1.30)	79.49
T_4	3.92(1.96)	3.56(1.88)	3.28(1.81)	60.67
T_5	4.81(2.19)	2.05(1.43)	1.87(1.36)	77.57
T_6	2.39(1.54)	1.91(1.38)	1.65(1.28)	80.21
T_7	2.38(1.54)	1.08(1.03)	0.77(0.88)	90.76
T_8	4.70(2.16)	6.32(2.51)	8.34(2.88)	-
SE (m) $\pm$	NS	0.22	0.19	
CD(0.05)	NS	0.68	0.59	

Figures in parentheses are values

During summer 2013-14 (Table 2), the population of aphid in okra ranged from 9.2-3.75 at 15 days after germination when the 1st observation was taken. The differences between treatments in respect of aphid population was non-significant. After 3 days of applying treatments *i.e.* 18 DAG the population of aphid ranged between 2.00 in T_3 to 5.32 in T_8. The aphid population was lowest (2.00/plant) in T_8 *i.e.* application of acetamiprid which was at par with the application of *V. lecanii* (T_3) having 2.02 aphids/plant. The biopesticides. *B. bassiana, V. lecanii* and Neemazol recorded 4.19, 3.21 and 3.12 aphids per plant which were statistically at par will each other. The bioagent *C.zastrowi sillemii* when released at the rate of 1,00,000/ha was as effective as the application of acetamiprid, but when released at the rate of 50,000/ha the predator was as effective as the best biopesticide *V. lecanii*. Control plots recorded the highest population of aphid at 5.32 aphids per plant.

The treatments reduced the pest population in the range of 34.79% (T_1) to 80.09% (T_7) during summer 2013-14. This observation is in agreement with the findings of Yokomi and Gottwald (1998) who have recorded similar effectiveness of *V. lecanii* against *A. gossypii*.

After 30 DAG, similar trend was observed in the aphid population. DBA, it ranged from 2.42 in T_7 to 6.82 in T_8 when the observation were taken. The difference between treatments in respect of aphid population was significant. After 3 days *i.e.* 33 DAG again the 2nd spraying was done. The aphid population varied from 1.10 in T_7 to 8.91 in T_8 aphid/plant showing acetamiprid as most effective treatment with 92.29% population reduction followed by *C. zastrowi sillemii* @ 1 lakh/ha and 75,000/ha resulting in 86.32% and 85.74 % reduction in aphid population respectively. Next best treatment was *V. lecanii* showing 82.92 % reduction, *M. anisopliae* showing 74.30 % reduction, Neemazol showing 67.50 % reduction and *Bt* showing 66.17 % reduction in aphid population. The effectiveness of *V. lecanii and C.zastrowi sillemi* in controlling aphids has been reported by Khalil *et al.* (1983) [7], Yokomi [8] and Gottwald (1998), Ramarethinam *et al.* (2005) [9] and Nirmala *et al.,* (2006) [10] earlier and the present study also confirmed their findings.

The pooled data (Table 3) of both the seasons revealed that the DBA, the aphid population ranged from 2.93 / plant in T_3 *i.e. V. lecanii* to 4.70 in untreated control. The lowest population in T_3 is due to application of *V. lecanii*. The plots treated with insecticide acetamiprid registered, recorded lowest population of 2.38 aphids/ plant where as the biopesticide recorded 3.33,3.92 and 4.03 aphids / plant in respect of *M. anisopliae*, Neemazol and *B. bassaina* application [12].

18 DAG and 25 DAG the population of aphid ranged from 1.08/ plant in T_7 to 6.32/plant and 0.77 to 8.34/ plant respectively, acetamiprid being the most effective treatment recording both the lowest population. The biopesticides were also found effective in controlling the aphid population. The most effective one was *V.lecanii* recording 1.87 and 1.71 aphids/ plants respectively the corresponding aphid population in respect of *M. anisopliae* Neemazol and *B. bassiana* were 2.94 and 2.68, 3.56 and 3.28, 3.83 and 3.69 aphids / plant respectively. Acetamiprid recorded the highest reduction in population of aphid (90.76%) followed by *C. zastrowi sillemii* @ 1 lakh / ha (80.21%), *V. lecanii* (79.49%) in *C. zastrowi sillemii @75,000/ha* (77.57%), *M. anisopliae* (67.86%), Neemazol (60.67%) and *B. bassiana* (55.75%).

The effectiveness of *Chrysoperla* in reducing the sucking as well as borer pest of different crops has been demonstrated by Balakrishnan *et. al.* (2004) [11], Inayatullah (2007) in tomato, Pathan *et.al,* in okra (2010) [12]. The present findings are in agreement with the above authors.

CONCLUSION

It was observed that over the two seasons, the aphid population ranged between 0.77 in acetamiprid treatment to 3.69 in *B. bassiana* treatment among the bioagent and biopesticides where as in controlled plot it was 8.34 aphid/plant correspondingly the population reduction was also highest in T_7 (80.21%) followed by T_3 (79.46%), T_5 (77.57%), T_2 (67.86%), T_4 (60.67%) and T_1 (55.75%) indicating that *C.zastrowi sillemi* and *V. lecanii* were most effective bioagents against aphids.

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