Journal of Biological Control, 26 (1): 80-83, 2012

Research Note

Utilization of biopesticides in the management of *Apion amplum* (Faust) (Apionidae: Coleoptera) on greengram under organic ecosystem.

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ABSTRACT: An experiment on utilization of biopesticides in the management of *Apion amplum* (Faust) (Apionidae: Coleoptera) was conducted at main research station, University of Agricultural Sciences, Dharwad during 2008–09. The results of present study indicated that among the microbial pesticides, *Bacillus thuringiensis* @ 1 ml/ l performed very well in reducing mean weevil numbers, pod and seed damage to greengram. This was followed by *Beauveria bassiana* 4 g/l and *Metarhizium anisopliae* 4g/l in reducing mean weevil numbers, pod and seed damage to greengram. *B. thuringiensis* treatment recorded highest grain yield 332.00 kg/ ha.

KEY WORDS: Greengram, *Apion amplum*, management, microbial pesticides, botanicals.

Greengram is the third most important pulse crop in India, covering an area of 2.92 million hectares with total production of 1.42 million tonnes. The average productivity is 486 kg per hectare (Anonymous, 2005). In Karnataka, it occupies an area of 3.6 lakh hectares with a total production of 1.6 lakh tonnes. The average productivity is 208 kg per ha which is almost half of the national productivity. The low yield of greengram in Karnataka may be attributed to several factors and among them damage caused by insect pests is of paramount importance. In India, 64 species have been reported attacking greengram right from seedling stage upto pod formation stage (Lal, 1985). Among the insect pests, *Apion amplum* was recorded as a serius pest on greengram and blackgram inflicting damage to the extent of 22 to 49 per cent pod damage (Basavana Goud and Vastrad, 1994). Adults feed on the flower buds and tender pods, make brownish discoloration on tender pods due to their ovipositional behaviour. Grubs feed on the seeds inside the pods, resulting 70 per cent seed damage in greengram in northern transitional belt of Karnataka (Sharanabasappa, 2002).

The detailed studies on this pest and its management aspects were lacking. The objective study of this was to evaluate the efficacy of microbial pesticides for the management of *A.amplum*.

Field collected eggs were surface sterilized with 10 per cent formaldehyde, washed 3-4 times with distilled water to get disease free larvae and kept in Petri plate (5 cm diameter) for hatching on moist filter paper. Freshly hatched larvae were provided with green gram pods in transparent plastic rearing container and covered with muslin cloth. Feed was changed twice a day till the larvae pupated. To facilitate pupation, the grubs were transferred to a container with sterilized saw dust one day prior to pupation. Pupae were segregated from the saw dust and kept in cages for adult emergence. Dilute honey (10%) was provided as adult feed in small vial with cotton wad and greengram plant pods in conical flask containing water were kept inside the cage for egg laying. Adult weevils were used for further laboratory studies.

Each treatment was replicated thrice with 10 adults/ infested pods per replication. Mortality of *A. amplum* adults was recorded at 3 days interval till the death of all adults.

Different microbial pesticides like, *B. bassiana* @ 2 gm/lt, and 4 gm/lt, *M. anisopliae* @ 2 gm/lt, and 4 gm/l, *B. thuringiensis* 1ml/l, and control were studied on adult of *A. amplum* in the laboratory condition. The greengram leaf disc were dipped in desired concentration of treatments for thirty seconds, after drying in shade kept in a container (10 × 6 cm) slantingly on a moistened filter paper at the

Table1: Evaluation of biopesticides against *Apion amplum* in greengram under organic ecosystem

Treatment	Mean number of adults per plant after 1st spray					Mean number of adults per plant after 2nd spray			
	1DBS	3DAS	5DAS	7DAS	Mean	3DAS	5DAS	7DAS	Mean
Bt @1 ml/l	4.00a (2.24)	2.67b (1.91)	2.40b (1.84)	2.53b (1.88)	2.90d (1.97)	2.20 b (1.79)	1.93 b (1.71)	2.07 c (1.75)	2.07 e (1.75)
Metarhizium anisopliae @ 2gm/l	4.93a (2.44)	3.53b (2.13)	3.27b (2.07)	3.67b (2.16)	3.85b (2.20)	3.47 b (2.11)	3.20 b (2.05)	3.33 b (2.08)	3.33 b (2.08)
Metarhizium anisopliae @ 4g/l	4.20a (2.28)	3.00b (2.00)	2.80b (1.95)	3.07b (2.02)	3.27bcd (2.07)	2.80b (1.95)	2.47b (1.86)	2.67bc (1.91)	2.64 cd (1.91)
Beauveria bassiana @ 2g/l	4.67a (2.38)	3.40b (2.10)	3.13b (2.03)	3.53b (2.13)	3.68bc (2.16)	3.27b (2.07)	3.00b (2.00)	3.20bc (2.05)	3.16 bc (2.04)
Beauveria bassiana @ 4g/l	4.00a (2.38)	2.87b (1.97)	2.67b (1.91)	2.93b (1.98)	3.12cd (2.03)	2.40b (1.84)	2.07b (1.75)	2.20bc (1.79)	2.22 de (1.80)
Control	5.20a (2.49)	5.53a (2.56)	5.60a (2.57)	5.73a (2.59)	5.52a (2.55)	5.93 a (2.63)	6.10 a (2.66)	6.33 a (2.71)	6.12 a (2.67)
SEM ±	0.08	0.10	0.12	0.10	0.05	0.09	0.10	0.07	0.05
CD 5%	N.S.	0.30	0.37	0.32	0.14	0.27	0.31	0.22	0.15

Figure in the parenthesis are √ x + 1 transformed values
Means followed by same letters in the column are not statistically different by DMRT (p = 0.05)
DBS= Day before spraying DAS = Day after spraying

Table 2: Effect of Biopesticides on grain yield and economics of greengram under organic ecosystem

Treatment	Per cent pod damage	Per cent reduction over control	Per cent seed damage	Per cent reduction over control	Yield (kg/ha)	Increase over control (%)	Gross income (Rs/ha)	Cost of plant protection (Rs/ha)	Net return (Rs/ha)	I:B:C ratio
Bt @1 ml/l	36.50 d (37.12)	43.93	34.95 e (36.21)	47.94	332.00 a	870.58	8300.00	1265	7035.00	6.56
Metarhizium anisopliae @ 2gm/l	52.78 b (46.57)	18.92	54.75 b (47.71)	18.46	103.33 c	202.94	2583.33	740	1843.33	3.49
Metarhizium anisopliae @ 4g/l	44.96 bc (42.08)	30.93	46.44 cd (42.94)	30.84	275.00 b	708.82	6875.00	1340	5535.00	5.13
Beauveria bassiana @ 2g/l	50.00 b (44.98)	23.19	51.74 bc (45.98)	22.95	127.33 c	273.52	3183.33	740	2443.33	4.30
Beauveria bassiana @ 4g/l	41.17 cd (39.87)	36.76	43.44 d (41.21)	35.30	304.67 ab	797.05	7616.67	1340	6276.67	5.68
Control	65.10 a (53.78)		67.15 a (55.02)		33.78 d		844.44		844.44	
SEM ±	1.43		1.15		0.10					
CD 5%	4.42		3.53		0.31					
CV %	5.63		4.43		8.91					

Means followed by same letters in the column are not statistically different by DMRT (P= 0.05)
Figure in the parenthesis are angular transformed values
Metarhizium anisopliae= 200/kg
Beauveria bassiana = 200/kg
Price of produce: 2500 q/ ha

bottom to prevent drying up of leaves. The adults starved for 6 hours were released on the treated leaves @ 10 per treatment with three replications. The container was covered with muslin cloth and fastened by rubber band. Leaf discs dipped in sterile distilled water were used as control. The treated leaf discs were changed on successive days till the termination of experiment.

Mass multiplication of *M. anisopliae* was done on a potato dextrose agar medium (PDA) consisting of 200 g potato, 20 g Dextrose and 20 gm Agar mixed in 1l of distilled water. The was inoculated on the PDA medium in sterile conditions and conidia was counted using haemeocytometer.

Mass multiplication of *B. bassiana* was done on broken rice. Fifty gram of broken rice, soaked in water overnight was taken in saline glass bottle (360ml) and 50 ml of 1% yeast was added and extracted in distilled water. The extract was sterilized under autoclave at 15 PSI for 30 min and allowed to cool. The cooled extract was inoculated with 2 ml spore suspension containing 10^6 conidia/ml under a laminar airflow and incubated at room temperature (25 ± 1° C and RH >80%) condition for 20 days. Afterwards the spores were harvested and air dried and the conidial count per gram was taken using haemeocytometer.

The field experiment was conducted during Kharif season using chinamung variety of greengram. The crop was raised by following package of practices except plant protection measures. Randomized block design was adopted with three replications with an individual plot size of 5m × 3m for each treatment. The *B. bassiana* @ 2 gm/ litre and 4 gm/ litre, *M. anisopliae* @ 2 gm/ litre and 4 gm/ litre, *B. thuringiensis* (Sandiego) 1ml/ litre, control, were imposed by using knapsack sprayer. Two sprayings were taken up, one at 50% flowering and second at 7 days after pod setting. The observation on number of grubs of *A. amplum* per plant was recorded on ten randomly selected plants in each treatment on a day before and 3, 5, and 7 days after spray. The per cent values were transformed in to angular transformation before the data was subjected to statistical analysis. The data on grain weight was recorded at harvest was statistically analysed by Duncans Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

After 1st and 2nd spray, significantly lowest numbers of grubs and adults were recoded in *B. thuringiensis* 1 ml/l (2.90 and 2.07 weevils/ plant) than other treatments. This was followed by *B. bassiana* @ 4 gm/l (3.12 and 2.22 weevils/ plant) and *M. anisopliae* @ 4gm/l (3.27 and 2.64 weevils/ plant) which are at par with each other. *B. bassiana* @ 2 gm/l (3.68 and 3.16 weevils/ plant) and *M. anisopliae* @ 2 gm/l (3.85 and 3.33 weevils/ plant) were less effective in reducing the weevil population compared with higher doses. However, they were superior over untreated control recording 5.52 and 6.12 weevils per plant compared to all other treatments (Table 1).

Observations on pod and seed damage were made following the application of microbial pesticides (Table 2). The results revealed that among the microbial pesticides, *B. thuringiensis* application proved more effective (36.50% and 34.95%) (Table 2) than others. This treatment was followed by *B. bassiana* @ 4 g/l (41.16% and 43.44%) and *M. anisopliae* @ 4g/l (44.96% and 46.14%). *B. bassiana* @ 2 g/l (50.00% and 51.74%) and *M. anisopliae* @ 2 g/l (52.78% and 54.75%) were less effective than their higher doses. However, significantly highest pod damage was noticed from untreated control (65.10%).

Among the various microbial pesticide treatments *B. thuringiensis* recorded significantly highest yield of 332 kg per ha compared to others. This was followed by *B. bassiana* @ 4 g/l (304 kg/ ha) and *M. anisopliae* @ 4g/l (275 kg/ ha). Whereas less grain yield was recorded in *B. bassiana* @ 2 g/l (127.33 kg/ ha) and *M. anisopliae* @ 2 g/l (103.33 kg/ ha). Untreated control recorded only 33.78 kg per ha yield which was significantly inferior over all other treatments (Table-2). Among all biopesticides, *B. thuringiensis* recorded highest gross and net income of (Rs 8300 and 7035 ha followed by *B. bassiana* @ 4 g/l (Rs 7616 and 6276.67 ha) and *M. anisopliae* @ 4g/l (Rs 6875 and 5535 ha). Whereas, *B. bassiana* @ 2 gm/l (Rs 3183.33 and 2443.33 ha) and *M. anisopliae* 2 gm/l (Rs 2583.33 and 1843.33 ha) recorded lowest gross income compared to other treatments.

Among the different microbial pesticides, highest Benefit: Cost of 6.56 was obtained in *B. thuringiensis* followed by *B. bassiana* @ 4 g/l (5.68) and *M. anisopliae* @ 4g/l (5.13). Whereas, *B. bassiana* @ 2 g/l (4.30) and *M. anisopliae* @ 2 g/l (4.39) recorded lowest B: C ratio compared to other microbial pesticide treatments (Table 2).

Studies on the efficacy of biopesticides indicated that, *B. thuringiensis* (36.50% and 34.95%) was more effective in reducing the pod and seed damage as compared to other biopesticides. This was followed by *B. bassiana* @ 4 g/l and *M. anisopliae* @ 4g/l. Work done by the earlier workers on pigeon pea (Thakre *et al*, 2003), (Paras Nath *et al.*, 2007) also showed the superiority of *B. thuringiensis* in reducing the pod damage by borers.

The yield result are in agreement with the results of (Mandal *et al.*, 2003) and (Singh and Yadav, 2007) who found that among various bio-pesticides tested against pod borer *Helicoverpa armigera* on chickpea *B. thuringiensis* gave the highest benefit:cost ratio.

ACKNOWLEDGMENTS

I would like to thank and extend my heartfelt gratitude to my chairman Dr. R.K. Patil for his vital encouragement and support who has made the completion of this research.

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