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SEASONAL INCIDENCE AND ECO FRIENDLY MANAGEMENT OF RED PUMPKIN BEETLE OF BOTTLE GOURD

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ABSTRACT

The investigation was carried out during summer, 2017 at the Horticulture Farm and the laboratory of Department of Entomology, Rajasthan College of Agriculture, Udaipur. The incidence of red pumpkin beetle initiated in the 1st week of June 2017 (16 beetle / 5 plants) (22nd SMW) and reached to the peak (34 beetle / 5plants) in the 26th SMW on 1st July, 2017. The population of red pumpkin beetle evinced significant positive correlation with mean atmospheric temperature. The efficacy of biopesticides evaluated against beetles showed that treatment of spinosad 45 SC @ 1 ml/l was most effective which caused highest mean per cent reduction in population of red pumpkin beetle but the treatment of parthenium leaf extract @ 100 ml/l was least effective against the pest.

Keywords: red pumpkin beetle, bottle gourd, incidence, eco friendly, bio efficacy.

INTRODUCTION

Cucurbits are among the most important and widely grown vegetable crops in the tropical and subtropical countries of the world, mostly cultivated in Africa, Tropical America and Asia. In India the major vegetables grown in summer are cucurbits. According to Renner and Pandey (2013) there are 31 genera and around 94 species of this family in India. Among cucurbits, bottle gourd, [*Lagenaria siceraria* (Molina) Stand.] is a popular vegetable of Cucurbitaceae family grown throughout India. About 80 per cent of edible portion in bottle gourd contains 95 per cent water, 0.65 per cent protein, 0.02 per cent fat, 3.4 per cent carbohydrates, 0.5 per cent fiber and 0.4 per cent ash. It is also rich in minerals, thiamine, niacin and vitamin C (0.02, 0.02, 0.32 and 10.1 mg per 100 g of edible fruit, respectively), (USDA, 2014). In India the total area under this crop was 1.53 lakh hectares with an average production of about 25.29 metric tons (Anonymous, 2016). In Rajasthan the total area under this crop was 4.44 thousand hectares with an average production 15.131 metric tons with average productivity of 34.12 ton/ hectare (Anonymous, 2015-16).

Various factors that cause low yield of bottle gourd are poor quality seeds, insect pest infestation, diseases and adverse climatic conditions. The crop is infested by many insect pests, Important among them are the red pumpkin beetle, *Aulacophora foveicollis* (Lucas), fruit fly, *Dacus cucurbitae* and *Bactrocera* spp. (Coquillett) (Dhandapani *et al.,* 2003 and Gupta 2004).

Red pumpkin beetle, *Aulacophora foveicollis* (Lucas) is a widely distributed polyphagous pest of cucurbit crops in India (Butani and Jotwani 1984). Adults feed on cotyledons, flowers and foliage causing holes when plants are very young and early sown cucurbits are severely damaged and at times require resowing (Atwal and Dhaliwal, 2002). In India, fruit flies are identified as one of the ten most serious problems of entire agriculture and because of the polyphagous nature of their larvae along with many other species cause high economic losses in fruits and vegetables.

To control the pests infesting bottle gourd and other vegetables, farmers generally use conventional pesticides. Excessive and indiscriminate use of the pesticides apart from being expensive lead to many problems like resurgence of the pests, deposition of pesticidal residues in or on the harvested vegetables injuries to natural enemies as well as non-target organisms. To overcome these problems eco-safe pest management technology provides the most effective environmentally sound and socially acceptable method of managing the pests.

MATERIALS AND METHODS

1. Seasonal Incidence :

The seasonal incidence of the major insect pests was recorded under natural conditions of infestation in three

plots each measuring 6 m x 10 m (60 m^2) with row to row and plant to plant distance of 3 m x 1 m respectively. The seasonal incidence of two major insect pests *i.e.*, red pumpkin beetle and cucurbit fruit fly were recorded on "Arka Bahar" variety of Bottle gourd. Five plants per plot were randomly selected and tagged to record the observations throughout the experimental period.

Observations:

Red pumpkin beetle:

Observations for beetle were recorded from the tagged plants starting from initiation of the pest incidence at weekly intervals during early hours of the day (6-8 A.M.) Observations were taken from the whole plant and expressed on per plant basis.

The prevailing abiotic factors (mean atmospheric temp. & RH) of the environment were recorded from the meteorological observatory.

Statistical analysis:

The population data of major insect pests were correlated with average temperature and relative humidity with following formula as suggested by Fowler, *et al.* (1998).

$$r_{xy} = \frac{\Sigma XY - \frac{(\Sigma X)(\Sigma Y)}{n}}{\sqrt{\left[\Sigma X^2 - \frac{(\Sigma X)^2}{n}\right]\left[\Sigma Y^2 - \frac{(\Sigma Y)^2}{n}\right]}}$$

Where,

r = simple correlation coefficient

X = Independent variable *i.e.* abiotic component average temperature and relative humidity

Y = Dependent variable *i.e.* mean number of insect pests / per cent infestation

n = Number of paired observations

To find out the significance of correlation coefficient by following formula was used:

$$t = \frac{1}{\sqrt{1 - r^2}} \times \sqrt{n - 2} \sim t_{n-2} \text{ d.f.}$$

2. Evaluation of eco-friendly pesticides against major insect pests of bottle gourd:

A field experiment was carried out at the Horticulture Farm, Rajasthan College of Agriculture, Udaipur (Rajasthan) during summer 2017 to bio-efficacy of different eco-friendly pesticides against red pumpkin beetle. The experiment was laid out in a Randomized Block Design with seven treatments including the control with three replications. The each plot measured 6.0 x 10 m. The bottle gourd variety Arka Bahar was used for experiment and all the recommended horticultural practices were adopted except insecticidal spray.

Table 1. Details of botanicals / insecticide used

S. No.	Treatments	Dosages a.i.
T1	*Azadirachta indica* oil (2%)	20 ml /l
T2	*Pongamia pinnata (L.)* oil (2%)	20 ml /l
T3	Neem leaf extracts (10%)	100 ml /l
T4	NSKE (5%)	50 ml/l
T5	*Parthenium* leaf extract (10%)	100 ml /l
T6	Spinosad 45 SC	1 ml/l
T7	Control	-

The first spray was given on appearance of insect pests and subsequent sprays were done at 15 day intervals.

Observations:

The observation on populations of the red pumpkin beetle and fruit fly infestation were recorded one day before spray and the post treatment observation after 1st, 3rd, and 7th days after each spray.

Statistical analysis:

Efficacy of different treatments against major insects pests was analyzed by using standard statistical procedures. The data were subjected to the population reduction percentage values as given by Henderson and Tilton (1955).

$$\text{Population Reduction \%} = 100 \times \left[1 - \frac{T_a \times C_b}{T_b \times C_a}\right]$$

Where,

Ta = Number of insects after treatment

Tb = Number of insects before treatment

Ca = Number of insects in untreated check after treatment

Cb = Number of insects in untreated check before treatment

RESULTS AND DISCUSSION

1. Seasonal incidence of red pumpkin beetle :

The results presented in the Table 2 clearly reveals that red pumpkin beetle *Aulacophora foveicollis* (Lucas) incidence was initiated in the 22nd standard meteorological week with a mean population 16 beetles per five plants. The population extended gradually and reached to its peak (34 beetles/5 plants) during 26th standard meteorological week thereafter, leaning trend was observed till the crop maturity when population of

pest was 10 beetles per five plants. The population of red pumpkin beetle showed (Table 3) significant positive correlation with mean atmospheric temperature (0.630*) while negative significant correlation with mean relative humidity (-0.693*).The results attained in this investigation are thus adjacent concurrence of prior narration of Dangi (2006) and Khan *et al.* (2015) who also reported the peak infestation of beetle in month of May. The infestation of *A. foveicollis* on bottle gourd crop started when the mean atmospheric temperature was 32.20°C and mean relative humidity 52.80 per cent. The beetle population reached its peak when the temperature stepped up to 31.40°C and 48.30 per cent mean relative humidity. Contradictory results were documented by Rajak (2000) who found maximum population of beetles at average temperature of 28.8°C. The population of red pumpkin beetle had significant positive correlation with mean atmospheric temperature and significant negative correlation with mean relative humidity. The work of studies on correlation of population of red pumpkin beetle with the weather parameters are similar to the findings of Dangi (2006), Gathala and Bajpai (2007), Rathod and Borad (2010), Khan *et al.* (2012) and Kumar (2012) who reported that red pumpkin beetle had significant positive correlation with mean atmospheric temperature, while significant negative correlation with mean relative humidity.

2. Evaluation eco-friendly pesticides against red pumpkin beetle :

A field trial was conducted during summer, 2017 to evaluate the bio-efficacy of eco-friendly pesticide against pest and economically suitable for farmers. There were 7 treatments including control replicated thrice for red pumpkin beetle. The trend of effectiveness of different pesticides has been presented below:

First spray

The data presented in table 4 reveal that all the treatments were significantly superior over control in terms of population reduction of the beetle. One day after spray spinosad 45 SC (1 ml/liter) was observed most effective which caused the maximum mean

Table 2. Effect of abiotic factors on the incidence of red pumpkin beetle on bottle gourd during summer, 2017

SMW	Observation date	Mean Temperature (°C)	Mean Relative Humidity (%)	Mean Population of beetles/ 5 plants
22	03/06/2017	32.20	52.80	16
23	10/06/2017	31.30	61.15	23
24	17/06/2017	31.55	57.80	28
25	24/06/2017	29.00	69.50	27
26	01/07/2017	31.40	48.30	34
27	08/07/2017	31.30	51.75	33
28	15/07/2017	26.65	82.65	24
29	22/07/2017	26.60	87.50	20
30	29/07/2017	24.45	91.35	16
31	05/08/2017	26.10	85.15	11
32	12/08/2017	26.00	85.95	10
Seasonal Mean		28.78	70.35	22

Table 3. Correlation matrix depicting correlation coefficient between selected variables

Correlation	Temperature	Relative humidity	Beetle population
Temperature	1		
Relative humidity	-0.973**	1	
Beetle population	0.630*	-0.693*	1
Fruit fly infestation	-0.660*	0.659*	-0.461*
No. of flies trapped	-0.551*	0.559*	-0.311

SMW- Standard Meteorological Week; * Significant at 5 per cent level of significance; ** Significant at 1 per cent level of significance

Table 4. Bio-efficacy of different botanicals / insecticide against red pumpkin beetle on bottle gourd during summer, 2017

Treatments	Dose (ml/litre)	PTP	Mean population reduction (%) - I spray			PTP	Mean population reduction (%) - II spray			PTP	Mean population reduction (%) - III spray		
			1DAS	3DAS	7DAS		1DAS	3DAS	7DAS		1DAS	3DAS	7DAS
A. indica oil 2% 20	24.00	46.77	50.75	50.24	30.00	45.14	52.05	51.00	27.67	43.13	51.60	50.45	
		[4.95]	(43.15)	(45.43)	(45.14)	[5.52]	(42.21)	(46.18)	(45.57)	[5.31]	(41.05)	(45.92)	(45.26)
P. pinnata oil 2%20	24.33	40.94	47.59	45.93	29.33	40.17	48.35	47.41	27.33	41.20	48.70	46.57	
		[4.98]	(39.78)	(43.62)	(42.67)	[5.46]	(39.33)	(44.05)	(43.51)	[5.28]	(39.93)	(44.25)	(43.03)
Neem leaf extract 10%	100	23.67	31.16	39.55	38.09	29.00	33.24	40.50	40.00	28.00	34.81	41.30	39.33
		(4.91)	(33.93)	(38.97)	(38.11)	[5.43]	(35.21)	(39.52)	(39.23)	[5.34]	(36.15)	(39.99)	(38.84)
NSKE 5%	50	23.33	32.94	44.02	42.33	30.67	35.81	44.94	43.26	28.67	37.83	44.79	41.50
		[4.88]	(35.02)	(41.56)	(40.59)	[5.58]	(36.76)	(42.10)	(41.13)	[5.40]	(37.96)	(42.01)	(40.11)
Parthenium leaf extract 10%	100	23.00	27.80	37.80	36.30	30.33	24.79	38.15	37.69	28.33	32.25	37.70	36.89
		[4.84]	(31.82)	(37.94)	(37.05)	[5.55]	(29.84)	(38.14)	(37.87)	[5.37]	(34.60)	(37.88)	(37.40)
Spinosad 45 SC	1	24.00	56.09	65.09	63.87	29.33	56.00	65.84	65.20	28.00	58.41	67.39	65.44
		[4.95]	(48.50)	(53.79)	(53.08)	[5.46]	(48.45)	(54.24)	(53.85)	[5.34]	(49.84)	(55.18)	(54.00)
Control	-	23.33	-	-	-	30.33	[5.55]	-	-	-	28.33	-	-
		[4.88]									[5.37]		
SEm±		0.913	0.365	0.503	0.689	0.711	0.512	0.447	0.454	0.626	0.405	0.509	0.495
C.D. (P = 0.05)		2.813	1.124	1.551	2.124	2.190	1.577	1.379	1.399	1.928	1.247	1.568	1.527

Figures in parenthesis are angular transformed values; Figures in square bracts are square root transformed value

reduction (56.09%) followed by neem oil (20 ml/l) with mean reduction of 46.77 per cent and karanj oil (20 ml/l) with 40.94 per cent reduction. Spray of NSKE (50ml/l) and neem leaf extract (100 ml/l) caused 32.94 and 31.16 per cent population reduction and was moderately effective. The lowest efficacy (27.80%) was recorded in case of parthenium leaf extract (100 ml/l). After 3rd day of spray, spinosad 45 SC (1 ml/l) was most effective (65.09% population reduction of beetle). Neem oil (20 ml/l), karanj oil (20 ml/l), NSKE (50 ml/l) and neem leaf extract (100 ml/l) were next in order of efficacy and significantly different to each other. Among all the treatments, parthenium leaf extract (100 ml/l) was least effective (37.80%). The data on population reduction of beetle after seven days of spray presented in Table (4) depict that spinosad 45 SC (1 ml/l) (63.87%) and neem oil (20 ml/liter) (50.24%) were significantly superior in terms of their effectiveness than rest of the treatments. The treatment of parthenium leaf extract (100 ml/l) was least effective with 36.30 per cent mean population reduction.

Second spray

It can be observed from table- 4 that the maximum reduction (56.00%) in beetle population 1st day after spray was recorded in spinosad 45 SC (1 ml/l). Among the tested biopesticides / insecticides spinosad was most effective followed by neem oil @ 20 ml/l (45.14%), karanj oil @ 20 ml/l (40.17%), NSKE @ 50 ml/l (35.81%) and neem leaf extract @ 100 ml/liter (33.24%) which were significantly different with spinosad 45 SC. The minimum (24.79%) population reduction was recorded in parthenium leaf extract @ 100 ml/l. After 3rd day the maximum reduction in beetle population was obtained in spinosad 45 SC @ 1 ml/l (65.84%) being significantly different with neem oil @ 20 ml/l (52.05%), karanj oil @ 20 ml/l (48.35%), NSKE @ 50 ml/l (44.94%) and neem leaf extract @ 100 ml/l (40.50%). Among the treatments parthenium leaf extract was least effective with 38.15 per cent reduction of beetle population. A similar pattern was noted 7th day after spray with maximum reduction of beetle population under spinosad 45 SC @ 1 ml/l (65.20%) treatment. Among the other pesticides the descending order of efficacy was neem oil @ 20 ml/l (51.00), karanj oil @ 20 ml/ l(47.41%), NSKE @ 50 ml/l (43.26%) and neem leaf extract @ 100 ml/l (40.00%) reduction. Parthenium leaf extract showed lowest (37.69%) population reduction.

Third spray

The data presented in Table-4 reveal that all the treatments lowered down the population of red pumpkin beetle in comparison to control. The maximum reduction (58.41%) in beetle population one day after spray was recorded in spinosad 45 SC and minimum reduction of in parthenium leaf extract (32.20%). After 3rd day all the treatments were statistically different and superior over the control. Maximum reduction of population was recorded in the treatment of spinosad 45 SC (67.39%) followed by neem oil 20 ml/l (51.60%), karanj oil 20 ml/l (48.70%), NSKE @ 50 ml/liter (44.79%) and neem leaf extract @ 100 ml/l (41.30%). Parthenium leaf extract caused lowest reduction (37.70%). Almost similar observations were recorded after 7th day of third spray with decrease in population reduction in all the treatments. Maximum reduction 65.44 per cent was observed in spinosad 45 SC @ 1 ml/l followed by neem oil @ 20 ml/l (50.45%), karanj oil @ 20 ml/l (46.57%), NSKE @ 50 ml/ l (41.50%), neem leaf extract @ 100 ml/l (39.33%) and parthenium leaf extract 36.89 per cent in decreasing order of bio-efficacy.

The findings get support from Dangi *et al.* (2006) who found that spinosad significantly effective against *Aulacophora foveicollis* on ridge gourd. Rathod *et al.* (2009) conducted an experiment and recorded maximum mortality in neem based commercial formulation gronim (49.89) and neem-azal-F (44.86%) against red pumpkin beetle. Neupane *et al.* (2016) reported that 5ml/l concentration of multi-neem formulation gave the highest reduction of beetle population (100%) on pumpkin followed by 4ml/l (91.5%), 3ml/l (63%) and 2 ml/l (37.9%), respectively. Hussain *et al.* (2011) evaluated the efficacy of different botanicals /plant extracts against red pumpkin beetle (*Aulacophora foveicollis Lucas*). Among the treatments methomyl and *Parthenium hysterophorus* extract showed significant results against *Aulacophora foveicollis*.

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