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Behaviour and population dynamics of shoot gall maker (*Betousa stylophora* Swinhoe) on aonla (*Emblica officinalis* Geartn) in south-west Haryana

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ABSTRACT

The study on behaviour and population dynamics of *Betousa stylophora* Swinhoe on aonla was carried out at CCSHAU, Regional Research Station, Bawal for two years 2012-14. The shoot gall maker *Betousa stylophora* (Lepidoptera: Thyrididae) was recorded as an important pest of aonla. The fresh gall formation was observed from July to November. The mean twig infestation was recorded maximum (40.0%) in variety NA-10 followed by Chakaiya (34.0%) during the study period. The minimum twig infestation was recorded (13.5%) in seedling (Desi). Average number of galls were recorded highest in NA-10 (4.6 galls/twig) followed by Chakaiya (4.1 galls/twig) which were significantly higher from all the varieties. The minimum number of galls 2.0 galls/twig were recorded in the seedling. During the study rainfall was found to be the overriding factor in determining the infestation with the highest correlation coefficient (r= 0.645 and r= 0.742). The minimum temperature showed a significant positive correlation (r= 0.563 and r= 0.537) with infestation during 2012-13 and 2013-14 respectively.

Keywords: Population dynamic; *Emblica officinalis*; insect pest; correlation; varieties

INTRODUCTION

Aonla or Indian gooseberry, *Emblica officinalis* Geartn is an important indigenous fruit tree of Indian sub-continent. It has great medicinal and nutritional value. Dried fruits have been reported to be useful in hemorrhages, diarrhoea, dysentery, anemia, jaundice and cough. The fruits are major constituents of Chyavanprash and Trifla. Other uses of fruits are in pickle, Murabba, jam and sauce preparation (Shrivastava 1990). It has aroused good deal of interest among the scientific workers because it is one of the richest natural sources of vitamin C. Besides fruits leaves, bark and even seeds are being used for various purposes (Chadha 2006). Though it is considered to be a hardy fruit crop not less than 30 insect and mite species

have been recorded feeding on the tree from different places mostly from India (Lakra 1996). Aonla trees are attacked by number of insects and pathogens and due to the repeated attack of various insect pests the growth of the plant is stunted (Beeson 1941). Perusal of literature reveal that only few reports are available so far pertaining to the behaviour and population dynamics of shoot gall maker on different aonla cultivars. Therefore the present investigations were carried out to know the behavior and population dynamics of shoot gall maker so that management strategies could be framed accordingly.

MATERIAL and METHODS

The investigations were carried in aonla orchard planted during 2006 at CCSHAU, Regional Research Center Bawal, Haryana. The soil of the region is light textured sand and loamy sand with poor fertility and low water holding capacity. In the present study nine different varieties of *E officinalis* including NA-6, CHES-1, G-1, NA-20, NA-10, Krishana, Chakaiya, BSR-1, NA-7 and seedling (Desi) were raised in 2 ha following randomized block design with three replications and spacing 6 x 6 m. The observations were recorded for two consecutive years (2012-13 and 2013-14). The three plants of each variety and ten twigs of each plant were taken for recording the number of galls/twig in the month of August. The per cent twig infestation was calculated by recording the number of healthy and damaged branches from ten randomly selected branches of each plant (3 plants of each variety) in the month of August. The observations were recorded at fortnightly interval for the assessment of population dynamics of *B stylophora.* Ten trees of Chakaiya variety were randomly selected and kept free from application of any insecticide throughout the study period for recording of observations. Data were recorded and statistically analyzed.

RESULTS and DISCUSSION

It was observed that in south-west Haryana moth of *B stylophora* (Lepidoptera: Thyrididae) commenced its activity from the month of July and laid the eggs on leaves of aonla. The young caterpillars bore into the apical portion of shoot resulting into the gall formation. The apical growth was checked and side shoots developed below the gall and subsequent growth in the coming season was badly hampered. The affected shoot did not grow in the following season. The mean twig infestation (Table 1) was recorded maximum (40.0%) in variety NA-10 followed by Chakaiya (34.0%) in the month of August. The minimum twig infestation was recorded (13.5%) in seedling. Similar studies were also reported by Bharpoda et al (2009). The results revealed that mean number of galls were recorded maximum in NA-10 (4.6 galls/twig) followed by Chakaiya (4.1 galls/twig) which were

Table1. Per cent twig infestation and number of galls/twig caused by *B stylophora*

Variety	Twig infestation (%)			Average # galls/twig		
	2012-13	2013-14	Mean	2012-13	2013-14	Mean
BSR-1	19.0	22.0	20.5	2.3	2.4	2.3
CHES-1	22.0	25.0	23.5	2.5	2.3	2.4
NA-10	38.0	42.0	40.0	4.7	4.6	4.6
G1	25.0	27.0	26.0	3.2	2.8	3.0
NA-6	30.0	27.0	28.6	3.3	3.2	3.2
Chakaiya	32.0	36.0	34.0	4.0	4.2	4.1
Krishna	28.0	25.0	26.5	3.2	3.2	3.2
NA-20	20.0	18.0	19.0	3.0	3.1	3.0
NA-7	22.0	25.0	23.5	2.5	2.6	2.5
Desi (seedling)	15.0	12.0	13.5	1.9	2.2	2.0
$CD_{0.05}$	2.5	3.2		0.4	0.6	

significantly higher from all the varieties. The NA-20 (3.0 galls/twig), NA-7 (2.5 galls/twig), CHES-1(2.4 galls/twig) and BSR-1 (2.3 galls/twig) were found statistically at par with each other in gall formation. The minimum number of galls (2.0 galls/twig) were recorded in seedling. Patel et al (1996) reported that out of fourteen varieties of *E officinalis* Faizabad and Kanchan were found less susceptible to *B stylophora* than local varieties Amla-1 and Anand-1.

The study on population dynamics of *B stylophora* revealed that the infestation to twig/branch due to this pest started from 1st week of July that continued till the end of November. The Table 2 indicates that infestation gradually increased and reached to its peak 32.0 per cent in 2nd week of August 2012 and 36.0 per cent in 3 rd week of August 2013 which subsequently decreased towards the end of November. The damage in Chakaiya variety ranged from 10.0 to 32.0 per cent in 2012-13 and 6.0 to 36.0 per cent in 2013-14. These results are in general agreement with the work of Jhala et al (2005) who made observations on the activity of *B stylophora* during May to January at Anand (Gujarat) during 1993-94 to 1995-96.

Correlation of *B stylophora* infestation with weather parameters showed a significant and positive correlation. Rainfall was found to be the overriding factor in determining the infestation with the highest correlation coefficient (r= 0.645 and r= 0.742). The minimum temperature (r= 0.563) and (r= 0.537) showed a significant positive correlated with infestation during 2012-13 and 2013-14 respectively. Evening relative humidity (r= 636 and r=

Table 2. Influence of temperature, relative humidity and rainfall on the infestation of *B stylophora* during 2012-13

Month	Fortnight	% twig infestation	Temperature (°C)		Relative humidity (%)		Rainfall (mm)
			Max	Min	M	E	
June	I	0.0	43.0	33.0	60.0	40.0	0.0
	II	0.0	41.0	31.0	56.0	38.0	0.0
July	I	10.0	38.1	27.2	69.0	43.0	39.0
	II	16.0	37.9	26.7	67.5	41.0	30.0
Aug	I	26.0	33.8	25.5	77.0	54.0	83.0
	II	32.0	31.2	25.4	89.3	66.3	350.8
Sep	I	30.0	32.5	24.3	85.0	63.0	67.9
	II	18.0	33.6	20.7	81.0	41.0	28.6
Oct	I	7.0	35.2	16.4	69.5	30.0	0.0
	II	5.0	31.7	14.2	75.5	21.0	0.0
Nov	I	2.0	29.6	9.8	80.7	28.3	0.0
	II	1.0	26.7	6.3	87.6	30.6	0.0
Dec	I	0.0	25.2	6.9	87.3	37.5	2.5
	II	0.0	18.9	3.9	90.9	50.4	0.0
Jan	I	0.0	17.3	2.2	92.2	56.4	0.0
	II	0.0	20.4	3.7	88.0	35.4	35.5
Feb	I	0.0	22.9	6.3	86.9	36.5	73.0
	II	0.0	20.7	6.0	86.3	48.3	90.0
March	I	0.0	29.1	8.2	81.5	25.2	0.0
	II	0.0	31.8	13.5	74.0	26.0	0.0

M= morning, E= evening

Table 3. Correlation matrix between infestation caused by *B stylophora* and abiotic variable during 2012-13

		% twig infestation	Temperature (°C)		RH (%)		Rainfall (mm)
			Max	Min	M	E	
% twig infestation		1					
Temperature (°C)	Max	0.340^{NS}	1				
	Min	0.563**	0.917**	1			
RH (%)	M	0.047^{NS}	-0. 883**	-0.753**	1		
	E	0.636**	-0.127^{NS}	0.254^{NS}	0.317^{NS}	1	
Rainfall (mm)		0.645**	-0.030^{NS}	0.236^{NS}	0.294^{NS}	0.630**	1

M= morning, E= evening, **Significant at 1 per cent, NS= non-significant

Table 4. Influence of temperature, relative humidity and rainfall on the infestation of *B stylophora* during 2013-14

Month	Fortnight infestation	% twig	Temperature (°C)		Relative humidity (%)		Rainfall (mm)
			Max	Min	M	E	
June	I	0.0	42.0	32.0	65.5	45.5	0.0
	II	0.0	40.5	30.0	62.5	42.5	0.0
July	I	6.0	35.4	25.4	82.7	54.4	91.8
	II	11.0	34.3	25.1	87.4	62.7	71.5
Aug	I	36.0	32.4	24.4	90.4	67.4	185.7
	II	34.0	33.0	23.9	86.4	60.4	84.7
Sep	I	30.0	36.3	22.5	76.5	37.4	3.5
	II	28.0	33.0	22.3	82.4	44.2	125.2
Oct	I	25.0	31.0	23.2	80.0	54.5	99.3
	II	3.0	32.3	15.9	81.5	32.0	0.0
Nov	I	2.0	26.2	9.9	77.4	25.4	0.0
	II	1.0	27.2	7.2	77.2	27.8	0
Dec	I	0.0	26.7	6.4	87	26	0
	II	0.0	18.9	5	90.9	49.4	6
Jan	I	0.0	17.9	2	90.3	50.8	0
	II	0.0	18.15	5.3	90.6	59.8	8
Feb	I	0.0	20.92	5.5	89.7	49.7	12.5
	II	0.0	22.14	5.7	88.7	30.8	3.2
March	I	0.0	24.8	7.9	90.2	46.7	57.3
	II	0.0	29.3	11.7	86.9	33.6	33.6

M = morning, E = evening

Table 5. Correlation matrix between infestation caused by *B stylophora* and abiotic variable during 2013-14

		% twig infestation	Temperature (°C)		RH (%)		Rainfall (mm)
			Max	Min	M	E	
% twig infestation		1					
Temperature (°C)	Max	0.396^{NS}	1				
	Min	0.537*	0.940**	1			
RH (%)	M	0.040^{NS}	-0.734**	-0.615**	1		
	E	0.450*	-0.055^{NS}	0.354^{NS}	0.310^{NS}	1	
Rainfall (mm)		0.742**	-0.284^{NS}	0.469*	0.257^{NS}	0.629**	1

M= morning, E= evening, *Significant at 5 per cent, **Significant at 1 per cent,
NS= non-significant

450) was also found to be an important abiotic factor exerting influence on the infestation of aonla plant due to *B stylophora* (Tables 3 & 5). The results are in accordance with the findings of Yadav et al (2014) who reported that afternoon relative humidity played important role in green semi-looper activity in soybean crop. Sharma et al (2013) also observed that weather parameters significantly influenced the population of major insect pests of tomato. Kumar et al (2007) reported that the activity of pest population was guided by weather conditions. Ahmed et al (2010) worked out the correlation coefficient for beetle and weather parameters and pointed out that some of the climatic factors imparted crucial role in pest population development.

CONCLUSION

On the basis of results it was found that the infestation by *B stylophora* was started in the month of July and the infestation showed significant positive correlation with rainfall, evening relative humidity and minimum temperature. The aonla field can be sprayed with insecticides in the month of July and August for effective and economic management of *B stylophora*. It can be concluded that varieties such as NA-7, NA-20, CHES-1 and BSR-1 were least preferred by *B stylophora* under climatic conditions of south-west Haryana. Therefore it is suggested that these varieties may be used for further plantation to avoid the damage of shoot gall maker in the region.

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