



Research Article

STUDIES ON THE SUCCESSION AND INCIDENCE SHOOT GALL MAKER (*Betousa stylophora*) ON AONLA (*Phyllanthus emblica* L.)

DHANOLIYA NEELESH¹, KUMAR DIPESH¹, JATAV RAJESH^{2*}, VASURE NARENDRA² AND RAGHUWANSHI PAWAN¹

¹Department of Entomology, College of Agriculture, Rajmata VijayarajeScindia Agricultural University, Gwalior, Madhya Pradesh, 474002, India

²Department of Horticulture, College of Agriculture, Rajmata VijayarajeScindia Agricultural University, Gwalior, Madhya Pradesh, 474002, India

*Corresponding Author: Email-rajeshjativhorthi@gmail.com

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Abstract- Studies on the succession and incidence of different shoot gall maker (*Betousa stylophora*) on aonla was studied at College of Agriculture, RVSKVV, Gwalior. The observations were recorded at weekly interval in the field conditions starting from the first week of October at different stages of plant growth up to fourth week or last week of May, on the three randomly selected trees, on the incidence of various shoot gall maker (*Betousa stylophora*). The highest number of gall (9.7/plant) and branch infestation (73.4%) due to shoot gall maker was recorded in the 8 standard week (19-25 Feb.) and 14 standard weeks (02-08 April) respectively, when the average minimum and maximum temperature, relative humidity and rainfall observed were 11.7°C to 29.2°C, 40.1°C to 22.8°C, 87.0% to 50.1% and 0.0 - 0.0 mm. respectively. The correlation studies reveal a significant and positive correlation between population of shoot gall maker ($r=0.100$) with average temperature. Whereas, correlation coefficient was found no significant between average relative humidity and populations of shoot gall maker.

Keywords- Shoot gallmaker, Succession, Seasonal incidence, Correlation, Weather factor.

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Introduction

Aonla or Indian gooseberry (*Phyllanthus emblica* L.) or "nelli" also called myrobalan, is an indigenous fruit of Indian subcontinent. Malacca tree or amla is a deciduous tree of the family *Phyllanthaceae*. The aonla owing to hardy nature, suitability to various wastelands is one of the oldest Indian fruit. The aonla fruit has aroused good deal of interest among the scientific workers because it is one of the richest sources of the vitamin "C" and possess high productivity unit area (15 – 20% ha), nutritive and therapeutic value, aonla has become an important fruit. It contains 500-700mg. ascorbic acid per 100g of pulp.

A variety of insect pests, like shoot gall maker (*Betousa stylophora*), bark eating caterpillar (*Inderbela quardinata*) recorded as major pests, whereas, pomegranate butter fly (*Virchola isocrates*), cow bug (*Tricentrus congestus*), leaf roller or leaf rolling caterpillar (*Gacillaria acidula*), hairy caterpillar (*Selepa celtis*), aphids (*Schoutedeni aemblica*) and termite (*Odontotermis obesus*) have been recorded as minor pests on this plant [1,2,4,5,7].

In Madhya Pradesh, the area under aonla cultivation has increased over years and farmers are facing the problem of insect pest.

Materials And Method

To study the succession and incidence of different shoot gall maker (*Betousa stylophora*) on aonla, the observations were recorded at weekly interval in the field conditions starting from the first week of October at different stages of plant growth up to fourth week or last week of May, on the three randomly selected trees, on the incidence of various shoot gall maker (*Betousa stylophora*). The meteorological data of corresponding period of observations was also noted. The studies on correlation with weather parameters were also conducted.

Results

The studies revealed that on the basis of pest populations and infestation level, of shoot gall maker (*Betousa stylophora*) was found to be major pests of aonla in Gwalior.

Seasonal incidence of shoot gall maker (*Betousa stylophora*) [Table-1]

Data recorded on number of galls per plant due to shoot gall maker indicated that the pest appeared on aonla in 40 standard weeks (1-7 October) and remained active up to 22 standard weeks (28 May-03 June). During this period the number of galls ranged from 2.0 to 9.7 galls/ plant. The highest number of gall (9.7 galls/plant) was recorded in the 8 standard weeks (19 -25 February) when the minimum and maximum temperature, average relative humidity and rainfall was 11.7°C, 29.2°C, 87.0% and 000.0 mm, respectively.

Table-1 Incidence of Shoot gall maker on aonla and natural enemies

S. N.	Common Name	Scientific Name	Order	Family	Plant part damage	Status	Period of activity
1.	Shoot gall maker	<i>Betousa stylophora</i> Swinhoe	Lepidoptera	Thyrididae	Twigs/ branches	Major	Oct. - May

The branch infestation due to shoot gall maker was first recorded in the 40 standard weeks (1-7 Oct.) and continued to 22 standard weeks (28 May-03 June). During this period the per cent branch infestation ranged from 22.9 to 78.4%. The maximum branch infestation (78.4%) was recorded in the 14 standard weeks (2 to 8 April), when the minimum and maximum temperature, average relative humidity and rainfall were 22.8°C, 40.1°C, 50.1% and 000.0 mm respectively. Whereas the minimum and maximum temperature, relative humidity and rainfall during the pest

activity period i.e. 40 standard weeks (1-7 Oct.) to 22 standard weeks (28 May-03 June) ranged from 3.9°C to 29.6°C, 18.9°C to 44.4°C, 28.8 to 95.0% and 0.00 to 026.0 mm, respectively. With regards to the nature of damage observed the black coloured caterpillars bored into twigs or shoots and reached the pith. The damaged tissues develop into a gall like structure on the stem. Fresh galls when young looked proportionately much longer than broad. Often the galls were distinct from one another but some time two galls were continuous having a narrow constriction in between them. The caterpillar feeds inside the galls on the internal woody tissue and passes out reddish frass through a small hole at one end which was covered by a meshwork of silken threads. The caterpillar comes out of the gall in the beginning of the summer (April-May) by enlarging the entrance hole and prepares a pupal chamber on the leaflets. The caterpillar pupated within the chamber after emergence from the gall.

Correlation studies [Table-2]

The correlation studies revealed that a significant and positive correlation between average temperature (X) and number of gall (Y) was observed with the 'r' value being 0.100.

Table-2 Effect of weather parameters on the population of shoot gall maker.

Weather parameters	Correlation coefficient		
	Cow bug	Shoot gall maker	Bark eating caterpillar
Average temperature	-0.288	0.100*	0.213*
Relative humidity	0.426	-0.007	0.153

* – Significant

NS – Non-significant

Discussion

For developing insect pest management programme for specific agro ecosystem, it is necessary to have the basic information on the incidence of the pest in relation to weather parameters). The meteorological data during the observation are presented in [Table-2]. This helps in determining appropriate time of action and suitable effective methods of control. Therefore the present investigations were carried out with a view of study the effect of different parameters on the incidence of the pest.

In the present studies on the basis of pest load and level of infestation the shoot gall maker (*B. stylophora*) is the major pest of aonla (var. N.A.-7) in Gwalior.

The incidence of shoot gall maker started in 40 standard weeks and continued up to 22 standard weeks, during this period the population of galls ranged from 2.0 to 9.7 per plant. The peak activity of the pest was observed in the 9 standard weeks. Similarly, branch infestation due to shoot gall maker appeared in the 40 standard week and continued up to 22 standard weeks. During this period the branch infestation ranged from 22.9 to 78.4%. The highest branch infestation was recorded in 14 standard weeks when the minimum and maximum temperature, relative humidity and rainfall were 22.8°C, 40.1°C, 50.1% and 000.0 mm, respectively. It was observed that the population of gall remained more or less same throughout the time of observation where as the branch infestation due to shoot gall maker was recorded relatively low in the standard weeks 15 to 22 than rest of the standard weeks i.e. 40 to 10. Whereas, the incidence of insect pest is presented in [Table-1].

Earlier worker's also recorded the damage of shoot gall maker (*B. stylophora*) on aonla crop [1,3,5,7,11,12]. In the present findings the cow bug and shoot gall maker was observed as a major pests of aonla which is in accordance as reported by [1,3,6,7,11,12].

The Nature of damage of shoot gall maker was also studied, which is in conformity with that of [6,7]. Summing up the results obtained on the population load and level of infestation due to shoot gall maker in aonla, the present findings are more or less similar to that of [7].

In the present findings, the branch infestation due to shoot gall maker was observed from 40 standard weeks (1-7 Oct.) and continued upto 22 standard weeks (28 May–03 June), during which period the branch infestation ranged from 19.8 to 90.3%. Whereas, [4] recorded shoot gall maker infestation on aonla during December to January and reported 65-75% infested twigs per plant. However, [7] reported the activity of shoot gall maker on aonla from mid November to mid May,

during this period the number of gall and branch infestation ranged from 2.7 to 9.3/plant and 12.6 to 37.0%, respectively. The peak activity was observed in the 19 standard weeks (7-13 May) and 20 standard weeks (14-20 May) during which the minimum and maximum temperature and relative humidity 25.7 to 27.6°C, 39.82% to 44.1°C and 32.0 to 45.0%, respectively. However, [6] reported the activity of shoot gall maker on aonla from first week November to first week of April, during this period the number of gall and branch infestation ranged from 2.3 to 8.7/plant and 33.0 to 84.8%, respectively. The peak activity was observed in the 14 standard weeks (29 March-4 April) and 46 standard weeks (8-14 Nov.) during which the minimum and maximum temperature and relative humidity 20.5 to 7.5°C, 32.7 to 28.6°C and 31.7 to 48.0%, respectively.

The climatic factors play substantially role in the biology of any pest, of which temperature is the crucial abiotic factor influencing the life economy of any organism. It is rather difficult to find a direct relationship between any single climatic factor and pest activity because the impact of weather elements of pest remained usually confounded [9].

However, the temperature, relative humidity, rainfall are the chief weather parameters that largely direct the activity of a given species of insect. This information is in turn helpful in preparing predictive models for forecasting the pest species. The knowledge of influence of abiotic factors on population build up insect pest of aonla was much wanting. The correlation studies revealed that average temperature showed significantly positive correlation with the population of gall ($r = 0.100$) and population of bark eating caterpillar ($r = 0.213$), whereas it was interesting to observed that the relative humidity was found to have no association with the population of shoot gall maker as the correlation coefficient was found non significant. Earlier [8] reported that among the weather parameters, morning vapour pressure had a direct significant effect of *B. stylophora* in aonla and also a negative association was observed between *B. stylophora* and rainfall, wind velocity, minimum temperature, morning and evening vapour pressure and relative humidity in the morning and evening. The present finding regarding the effect of temperature is in conformity with that of [8] but differ with regards to relative humidity. It was peculiar to note that [7] found that weather factors had no influence on the incidence of shoot gall maker in aonla. Whereas, [6] found that the relative humidity had no influence on the incidence of the pests but the incidence of pest was found positively correlated with the average temperature.

Conclusion

The highest number of gall (9.7/ plant) and branch infestation (78.4%) due to shoot gall maker was recorded in the 8 standard week (19-25 Feb.) and 14 standard weeks (02–08 April) respectively, when the average minimum and maximum temperature, relative humidity and rainfall observed were 11.7°C to 29.2°C, 40.1°C to 22.8°C, 87.0% to 50.1% and 0.0 - 0.0 mm, respectively. Whereas, the peak population of bark eating caterpillar (4.3 galls/plant) and length of frass (10.3 cm/plant) due to bark eating caterpillar was recorded in 11 (12-18 March) and 19 (7-13 May) standard weeks and 11, 19 and 8 standard weeks (12-18 March, 7-13 May and 19-25 February). During which the minimum, maximum temperature, relative humidity and rainfall recorded was 32.1°C, 15.6°C, 76.5% and 0.0 mm, 43.5°C, 35.2°C, 61.8% and 014.6 mm and 29.2°C, 11.7°C, 87.0% and 0.0 mm, respectively. The cow bug population was found negatively correlated with the average temperature, 'r' value being - 0.288. Whereas, correlation coefficient was found non-significant between relative humidity and the population of cow bug ($r = 0.426$). The correlation studies revealed a significant and positive correlation between population of shoot gall maker ($r=0.100$) and bark eating caterpillar ($r=0.213$) with average temperature. Whereas, correlation coefficient was found non-significant between average relative humidity and populations of shoot gall maker and bark eating caterpillar.

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Abbreviations

r = regression coefficient

cm= Centimeter

mm= Millimeter

⁰C= degree centigrade

RH= relative humidity

Feb.= February

var. = Variety

Nov. = November

ha = hectare

Oct. = October

Conflict of Interest: None declared

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