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Population dynamics of leaf roller of aonla in relation to abiotic factors

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Abstract
Study on 'Population dynamics of leaf miner in relation to abiotic factors was conducted at two locations *i.e*., Dryland Research Station (DRS), Dhiansar, and RHRSS, Raya *i.e*., of Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu for two consecutive year during. 2016 and 2017. The major constraint in aonla fruit production is ravages caused by the insects, disease and some physiological problems throughout the world. Among the insect pests, the aonla shoot gall maker (*Betousa stylophora*), leaf rolling caterpillar (*Gacillaria acidula*), bark eating caterpillar (*Inderbela quardinatata*), fruit borer (*Dueodorix isocrates*), fruit moths (*Otheris fullonica*, *O. materna*) and mealy bug have been reported to be of major importance. The observations on natural infestation or population dynamics of leaf roller on aonla revealed that the peak population of leaf roller infestation on 30 cm twig was recorded as 46.60 in the last week of September i.e., 39th SW. The leaf roller population dynamic was observed at RHRSS, Raya at 22nd SW and reached at peak population density rather late i.e., in 41 SW with (39.78/ 30 cm twigs). The leaf roller population attained the peak activity in 42nd SW at DRS, Dhiansar (43.75/ 30 cm twig) and RHRSS, Raya (37.00/30 cm twig), respectively during 2017. During 2017, weather parameters were found to be highly significant in determining the leaf roller pest fluctuation with 72.10 and 92.00 percent at DRS, Dhiansar and RHRSS, Raya, respectively. The results obtained showed that the peak population of leaf roller infestation on 30 cm twig was recorded as 46.60 in the last week of September i.e., 39th SW. The leaf roller population dynamic was observed at RHRSS, Raya at 22nd SW and reached at peak population density rather late i.e., in 41 SW with (39.78/ 30 cm twigs). The leaf roller population attained the peak activity in 42nd SW at DRS, Dhiansar (43.75/ 30 cm twig) and RHRSS, Raya (37.00/30 cm twig), respectively during 2017. Thereafter, the population of leaf rollers started declining up to December with bit fluctuations due to abiotic factors in both the locations.

Keywords: Aonla, population dynamics and Leaf roller

1. Introduction
Aonla (*Emblica officinalis Gaertn syn. Phyllanthus emblica* L.), the king of arid fruits also known as Indian gooseberry, is one of the traditional fruits to India belongs to family Euphorbiaceae. It is indigenous to India and has great medicinal and nutritional value which is gaining popularity among farmers and consumers having immense potential of cultivation in arid and wastelands [1]. Though, considered to be a hardy fruit crop, not less than 30 insect and mite species have been recorded feeding on this scared tree from different places, mostly from India [2]. The major constraint in aonla fruit production is ravages caused by the insects, disease and some physiological problems throughout the world. Among the insect pests, the aonla shoot gall maker (Betousa stylophora), leaf rolling caterpillar (*Gacillaria acidula*), bark *eating caterpillar* (*Inderbela quardinatata*), *fruit borer* (*Dueodorix isocrates*), fruit moths (*Otheris fullonica, O. materna*) and mealy bug have been reported to be of major importance [3-5]. Since the incidence and development of all the insect pests are very much dependent upon the prevailing weather conditions, such as temperature, relative humidity, and precipitation [6], it is therefore imperative to generate a baseline data and to fill the existing information gaps.

2. Materials and Methods
The present study was conducted at RHRSS, Raya and Dryland Research Station, Dhiansar, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu. The details of materials used, experimental procedures followed and techniques adopted for the present investigations on Management of major insect pests in Aonla (*Emblica officinalis* Gaertn.). Observations on the seasonal incidence of leaf roller on aonla were recorded on five plants of aonla about eight years old and of equal vigour and size.

For recording the population dynamics of aonla leaf roller, the terminal branches measuring 30 cm from all four directions were marked and number of leaf roller per tree were recorded. All the agronomic practices recommended by Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu for raising the crop was followed. Weekly records of leaf roller were made on the 5 randomly selected tagged plants. The observations were recorded when the first leaf roller appeared in the field. Weekly data on temperature (maximum / minimum °C), relative humidity (morning and evening percent), and rainfall (mm) was obtained from the Agro meteorological section, Division of Agronomy, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu. These data were subjected to analysis with various abiotic factors of the environment and the statistical analysis was worked out. The data were analyzed with the help of a statistical package SPSS-16.0 version.

2.1 Regression model

The effect of various environmental factors under study on population of leaf roller and borers were estimated by using multiple linear regression analyses with the prediction equations given as: Est. $Y_1 = a + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5$

Where, Y_1 represent leaf roller population on aonla, 'a' is the constant (intercept) and b_1 to b_5 are the estimated regression coefficient associated with X_1 to X_5, respectively.

2.2 Screening of aonla cultivars against leaf roller

In recent years, the practical significance of varietal resistance to leaf roller and borers of aonla has become increasingly important as being the most desirable major component in pest management programme. The experiment conducted to screen aonla cultivars leaf roller was conducted at Dryland Research Station (DRS), Dhiansar and RHRSS, Raya, SKUAST-Jammu under pesticide free condition. For this, field experiment was laid out during 2016 and 2017 with 07 different aonla cultivars such as NA-6 (Narendra Aonla-6), NA-10 (Narendra Aonla-10), NA-7 (Narendra Aonla-7), Chakaiya, Banarasi, Local Deshi and Francis for their response against against borers and leaf roller. Observations on pest incidence were recorded in terms of percent leaf and fruit at weekly interval. In every observation, 4 plants were selected randomly and tagged. In case of fruit infestation by fruit borer, observations were made at each picking. Total number of healthy and infested fruits were counted and also weighed separately. Hence, infestation (%) both on number and weight basis was worked out. The leaf infestation by leaf roller (%) was recorded from three branches each from the selected plant, in each replication by counting total number of healthy and infested leaves from the time when the initial attack was started till no further incidence on leaves. Rests of agronomical practices were followed as per package of practices of SKUAST, Jammu. No plant protection measures were given for recording the varietal screening.

2.2.1 Varieties observed

1. NA-6 (Narendra Aonla-6),
2. NA-10 (Narendra Aonla-10),
3. NA-7 (Narendra Aonla-7),
4. Chakaiya,
5. Banarasi,
6. Local Deshi, and
7. Francis

Number of plants per variety: 4

Percent incidence was calculated as per the following formula:

$$\text{Incidence (\%)} = \frac{\text{No. of fruits infested}}{\text{No. of fruits examined}} \times 100$$

Scale was chalked out for the screening of leaf roller infestation, as the compound leaflets were very important components in photosynthesis process and formation of fruits on aonla. Scales for determining the resistance reaction against leaf roller percent incidence is as follows-

Grade	% incidence	Resistance reaction
0	No damage	Immune
1	0 – 10.0	Resistant (R)
2	10.1 – 20.0	Moderately Resistant (MR)
3	20.1– 30.0	Moderately Susceptible (MS)
4	30.1– 40.0	Susceptible (S)
5	>40.0	Highly Susceptible (HS)

3. Results

Population dynamics of leaf roller on aonla per 30 cm twig at different locations of Jammu during 2016. The results obtained showed that leaf roller was first observed in 24th SW at DRS, Dhiansar and RHRSS, Raya and remained active on aonla plants up to end of the year i.e., 52nd SW. The peak population of leaf roller infestation on 30 cm twig was recorded as 46.60 in the last week of September i.e., 39th SW. The leaf roller population dynamic was observed at RHRSS, Raya at 22nd SW and reached at peak population density rather late i.e., in 41 SW with (39.78/ 30 cm twigs) and remained up to the shedding of leaves or end of the financial years up to 52nd SW. Thereafter, the population started declining up to December in both the locations. The population trend showed the variation in population fluctuations due to the variations in weather or abiotic factors More or less some similar trends were also observed during the second years experimentation i.e., during 2017 on population dynamics of leaf roller on aonla. The mean leaf roller larval population per 30 cm twig aonla ranged from 0.25 to 43.75. The leaf roller population attained the peak activity in 42nd SW at DRS, Dhiansar (43.75/ 30 cm twig) and RHRSS, Raya (37.00/30 cm twig), respectively during 2017. Thereafter, the population of leaf rollers started declining up to December with bit fluctuations due to abiotic factors in both the locations. The relationship of population dynamics of leaf roller on aonla host crop with mean temperature and relative humidity at different experimental sites (DRS, Dhiansar and RHRSS, Raya) during 2016 and 2017. A non-significant negative correlation existed between weekly minimum mean temperature and relative humidity morning with leaf roller larval density at DRS, Dhiansar and RHRSS, Raya, and highly significant negative correlation with relative humidity evening and rainfall at DRS, Dhiansar and RHRSS, Raya, respectively during 2016. Similar trend were also observed during 2017 except positive and highly significant correlation was existed with maximum temperature (0.692**) and relative humidity evening (0.734**) at RHRSS, Raya (0.692**). Other weather factors like rainfall, relative humidity morning (–0.881**) and minimum temperature had negative and highly significant correlation on leaf roller population geared up RHRSS, Raya. The value of linear regression equations for the leaf roller were calculated to be Y= –23.793

+ $3.602X_1 – 2.888X_2 –0.271X_3 + 0.227X_4 – 0.060X_5$ and Y= – $16.317 + 3.037X_1 – 2.365X_2– 0.109X_3 – 0. 141X_4 – 0.016X_5$ at different experimental sites of DRS, Dhiansar and RHRSS, Raya, respectively. The corresponding correlation co-efficient values worked out to be 0.695 and 0.764 which showed that the values were found statistically significant at 5% level of significance. The co-efficient of determination (R^2) values were found to be 0.483 and 0.583 which was the indicative that the overall abiotic factors were responsible to regulate the leaf roller population by 48.30 and 58.30 percent at DRS, Dhiansar and RHRSS, Raya, respectively. During 2017, weather parameters were found to be highly significant in determining the leaf roller pest fluctuation with 72.10 and 92.00 percent at DRS, Dhiansar and RHRSS, Raya, respectively.

Table 1: Population dynamics of leaf roller on aonla per 30 cm twig at different locations of Jammu during 2016

St. Weeks	Time of the month and year	Locations		Weather parameters				
		DRS, Dhiansar	RHRSS, Raya	Max. Temp.	Min. Temp.	RH Morn	RH Even	Rain fall
22	28-3 Jun	0.00	0.00	37.2	28.1	68	54	19
23	4-10	0.00	0.00	34.6	25.2	80	64	16.6
24	11-17	0.41	0.52	34.7	25.8	79	60	69.4
25	18-24	0.93	0.86	34.1	24.9	81	62	19.8
26.	25-1 July	1.75	0.93	32.8	23.9	86	73	192.6
27.	2-8	3.25	1.67	34.0	25.2	83	65	165.2
28.	9-15	11.27	4.45	30.6	24.6	87	77	193.3
29.	16-22	15.89	7.58	35.2	25.0	80	58	18.8
30.	23-29	17.60	10.57	33.5	25.4	81	64	5.4
31.	30-5 Aug	19.21	13.98	33.2	23.6	82	61	77.4
32.	6-12	25.36	16.63	35.0	24.4	72	56	3
33.	13-19	28.15	17.10	33.9	23.4	80	54	23.2
34.	20-26	33.50	19.11	34.1	24.6	75	60	21.5
35.	27-2 Sep	36.57	23.20	32.9	23.9	85	65	13.4
36.	3-9	38.15	21.18	34.2	23.5	79	63	1.2
37.	10-16	40.05	28.10	32.7	18.0	75	57	0
38.	17-23	42.69	30.12	32.0	16.1	78	43	0
39.	24-30	46.60	32.20	31.4	13.8	76	39	0
40.	1-7 Oct	40.93	36.20	28.6	12.6	80	53	0
41.	8-14	37.85	39.78	28.1	10.0	87	39	0
42.	15-21	32.13	37.12	24.7	8.4	79	43	0
43.	22-28	30.87	30.18	24.8	9.2	90	45	0
44.	29-4 Nov	28.85	27.11	26.1	8.2	92	41	0
45	5-11	25.42	19.17	23.8	6.9	94	51	0
46.	12-18	21.86	14.26	21.9	7.4	92	62	0
47.	19-25	18.38	12.10	22.7	3.6	92	51	0
48.	26-2 Dec	16.17	7.40	22.0	5.7	90	54	0
49.	3-9	13.05	4.15	19.7	8.6	92	59	33.2
50.	10-16	11.62	2.11	16.9	2.4	90	53	10
51.	17- 23	9.19	1.60	16.7	5.2	87	61	21.2
52.	24-31	6.66	0.80	18.1	9.4	93	79	69.2

Table 2: Population dynamics of leaf roller on Aonla per 30 cm twig at different locations of Jammu during 2017

St. Weeks	Time of the month and year	2017						
		Locations		Weather parameters				
		DRS, Dhiansar	RHRSS, Raya	Max. Temp	Min. Temp	RH Morn	RH Even	Rainfall
22	28-3 Jun	0.00	0.25	37.6	22	58	32	7.6
23	4-10	0.00	0.25	39.9	23.9	65	29	18.6
24	11-17	0.50	0.25	37.2	22.9	59	31	2.6
25	18-24	0.75	0.25	33.6	23.2	80	61	68
26.	25-1 July	1.25	0.5	34	25.8	77	62	147.2
27.	2-8	0.50	0.75	36.3	24.8	78	57	13
28.	9-15	1.25	1.25	34.5	25.5	83	67	33.2
29.	16-22	2.75	1.75	33.9	24.9	82	66	71.4
30.	23-29	3.50	2.5	34.2	25	86	64	137.8
31.	30-5 Aug	8.25	2.75	32.1	25.6	91	78	110.6
32.	6-12	12.50	2	34.5	24.9	90	67	57.4
33.	13-19	17.25	4.75	34.4	26.1	85	61	14
34.	20-26	16.75	7.25	33.3	23.8	84	62	21.4
35.	27-2 Sep	20.50	5.75	31.6	23.8	89	70	50
36.	3-9	26.75	12.75	33.5	23.4	87	61	1.5
37.	10-16	28.75	13.75	34.3	22.5	84	52	0
38.	17-23	29.50	16.50	34.8	21.6	80	48	0

39.	24-30	33.00	22.75	34.4	23.3	86	52	0
40.	1-7 Oct	35.75	28.75	34.4	20.6	87	46	0
41.	8-14	41.25	33.25	34.1	18.2	82	43	0
42.	15-21	43.75	37.00	33.8	14.6	80	37	0
43.	22-28	39.25	22.50	31	13.4	82	35	0
44.	29-4 Nov	32.50	15.75	27.6	12.8	90	49	0
45	5-11	26.00	12.75	27.1	10.8	95	48	0
46.	12-18	22.50	7.75	23.7	9.3	92	49	0
47.	19-25	17.50	3.75	33.9	6.3	94	40	0
48.	26-2 Dec	13.25	2.75	24.1	6.4	93	40	0
49.	3-9	7.00	1.25	23.0	4.6	91.6	41.1	0.00
50.	10-16	4.75	0.5	16.8	8.5	94.9	76.1	51.2
51.	17- 23	3.00	0.25	23.1	6.1	87.6	46.4	0.0
52.	24-31	0.50	0	22.7	3.6	92.4	50.6	0.0

4. Discussion

The present findings are in conformity with the findings obtained by [7, 4, 5]. who observed that the leaf roller is a major insect pest of aonla and remained active from second fortnight of May to the end of February with infestation ranging from 0.08 to 11.63%. Initially, the incidence was very low but then gradually increased and reached to its peak (11.63%) during first fortnight of August. Later on, it showed decreasing trend and disappeared from the aonla orchards during the end of February. However, the late appearance (mid June) of the leaf roller in Jammu conditions could be due to aberration in climatic variability.

4. Conclusion

The results obtained showed that the peak population of leaf roller infestation on 30 cm twig was recorded as 46.60 in the last week of September i.e., 39th SW. The leaf roller population dynamic was observed at RHRSS, Raya at 22nd SW and reached at peak population density rather late i.e., in 41 SW with (39.78/ 30 cm twigs). The leaf roller population attained the peak activity in 42nd SW at DRS, Dhiansar (43.75/ 30 cm twig) and RHRSS, Raya (37.00/30 cm twig), respectively during 2017. Thereafter, the population of leaf rollers started declining up to December with bit fluctuations due to abiotic factors in both the locations. A highly significant negative correlation with evening relative humidity and rainfall at DRS, Dhiansar and RHRSS, Raya were existed during 2016. Similar trend were also observed during 2017 except positive and highly significant correlation was existed with maximum temperature (0.692**) and relative humidity evening (0.734**) at RHRSS, Raya (0.692**). During 2017, weather parameters were found to be highly significant in determining the leaf roller pest fluctuation with 72.10 and 92.00 percent at DRS, Dhiansar and RHRSS, Raya, respectively.

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6. References

1. Hiwale S. Aonla (Indian gooseberry). In: Sustainable Horticulture in Semiarid Dry Lands, (Hiwale, S. ed.) Springer, India, 2015.
2. Lakra RK. Some important pests of fruit crops of arid regions and their management. Proc. Natln. Symp. Arid Horticulture, Horticulture Society of Haryana, CCSHAU, Hisar, 1996, 144-147.
3. Chadha KL. Handbook of Horticulture, ICAR Publication, New Delhi, 2003, 747.
4. FAO. Proceedings of Promotion of Medicinal and Aromatic Plants in the Asia-Pacific Region, Bangkok, Thailand, 2-3 December, 2013. Paroda, R., Dasgupta, S., Mal, B., Ghosh, S. P. and Pareek, S. K. (eds.). 2013, 282.
5. Satyagopal K. AESA based IPM package for Amla. 2014, 32.
6. Aheer GM, Ahmed KJ, Ali A. Role of weather in fluctuating aphid density in wheat crop. J Agric. Res. 1994; 32:295-301.
7. Bharpoda TM, Koshiya DJ, Korat DM. Seasonal occurrence of insect-pests on aonla (*Emblica officinalis* Geartn) and their natural enemies. Karnataka Journal of Agricultural Sciences. 2009; 22(2):314-318.