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Studies on mango leaf webber, *Orthaga* spp. with special reference to seasonal incidence

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Abstract

“Studies on mango leaf webber, *Orthaga* spp. with special reference to seasonal incidence” was conducted during the year 2015-16 and 2016-17 at the Horticultural orchard of BTC College of Agriculture and Research Station, Bilaspur (C.G). Data on seasonal incidence indicated that minimum larval population of 21.24 larvae/tree was recorded on Himsagar followed by Kurkan, Kesar, Karela, Sunderja, Dilpasand, Dashari, Langra and Alphanzo with 21.83, 23.21, 24.02, 29.43, 30.28, 31.08, 32.19 and 33.16 larvae/tree, respectively. The minimum webbing 12.50 webs/tree was recorded on Himsagar followed by Kurkan, Kesar, Karela, Sunderja, Dilpasand, Dashari, Langra and Alphanzo with 16.38, 17.39, 17.89, 18.13, 19.52, 19.84, 20.10 and 21.80 webs/tree, respectively.

Keywords: Mango leaf webber, seasonal incidence

Introduction

The mango, *Mangifera indica* is popularly known as king of fruits. Mangoes are considered as the apples of tropical regions and one among the most favorite fruit worldwide. Mangoes vary in size, shape, and colours (green, yellow, red or purple) from region to region and from varieties to varieties. The flesh is yellow to orange and when ripe has the texture of peach, the flavour also resembles a peach but with a distinct tropical sweetness. It is an important fruit crop grown extensively under tropical and subtropical climate. Mango belongs to the genus *Mangifera* of the family Anacardiaceae. There are at least 62 species within the genus and 15 of these bear edible fruits. Even though fruits are harvested at its maturity but in case of mango all stages (mature and immature) of fruits are utilized in preparation of various products. The immature fruits are used in the preparation of chutney, pickles and juice and the ripened fruits are utilized in the preparation of several products like squashes, syrups, nectars, jams and jellies. Even at some places mango seeds are consumed. The bark is utilized in tanning leather, while timber is used for boats, flooring, furniture and other applications. The fruit flesh of a ripe mango is very sweet, with a unique taste. Along with a very good taste it's an excellent source of many nutrients. The mango fruits are rich in vitamin A (21%) and C (60%). It also contains about 10.5-32.5% sugars and up to 1-2% protein (Maldonado-Celis M E *et al.*, 2019)^[8]. The raw mango consists of about 81.7% water, 17% carbohydrate, 0.5% protein, 0.3% fat and 0.5% ash. A 100 g serving of raw mango has 65 calories and about half the vitamin C found in oranges (Source: <https://d1iqctulejj45h.cloudfront>). Also the mango kernel contains around 8-10 per cent of fat. The mango consumption helps in fighting against cancer, strengthen the heart, regulates cholesterol, cleanses the skin, mango leaf consumption regulates diabetes.

It's being an important commercial fruit crop of India shows a great potential as an item of export as fresh fruit and processed form. The major mango producing countries in the world are India, China, Pakistan, Mexico, Thailand, Indonesia, Brazil, Philippines, Nigeria and Vietnam. India is the leading producer of mangoes in the world. The area under mango cultivation in India is around 2263 ha, the production is 19687 MT and the productivity is 8.7 MT/ha (2016-17) (Indian horticulture database, 2021). Many states are contributing in the production of mangoes. The leading producers are Uttar Pradesh, Andhra Pradesh and Karnataka of the country. India is the leading exporter of mangoes and the exporting quality of mangoes depends on the freshness and its pulp quality. It's being exported to more than 80 countries with the foreign exchange earning of Rs. 20053.96 million from export of 76460.6 tonnes of fresh fruits and Rs. 7446.1 million from the export of 186197.88 million tons of mango pulp (Anonymous, 2009)^[3].

Chhattisgarh is also an important mango growing state which stands 12th in India with the area of 73.99 ha, production of 437.58 MT and the productivity of 5.9 MT/ha (Indian horticulture database, 2021). Bilaspur is a district of Chhattisgarh occupies 10,094 hectares area with production of 35,046 metric tonnes (Anonymous, 2012-13) [4].

Among the several reasons for low production in mango, infestation by pests is major one. The mango tree is attacked by various pests like scale insect, mealy bug, fruit fly, leaf webber, mango hopper etc. Worldwide the mango plants are attacked by 492 species of insects, 17 species of mites and around 26 species of nematodes. Out of these pests around 188 are reported from India (Tandon and Verghese 1985, Srivastava 1998) [17].

Around 260 species of insects and mite pests attack the tree of different stages (Mari AK., et al., 2020) [9]. The major insect pests of mango are mango hoppers (*Amritodus atkinsoni* Leth, and *Idioscopus* sp.), leaf webber (*Orthaga exvinacea* Saund.), Stem borer (*Batocera rufomaculata* Deg.), mango stone weevil (*Sternochaetus mangiferae* Fab.), defoliator (*Penicillaria jocosatrix* Guenee), blossom webber (*Eublemma versicolor* Walk.), fruitfly (*Bactrocera dorsalis* Hendl), and leaf gall fly (*Procontarinia matteiana* Keiffer and Cocconi) cause considerable damage to mango tree (Pena and Mohyuddin, 1998) [10].

One among the major pests of mango is leaf webbers, *Orthaga* sp. which damages mostly old mango trees. The damage caused by caterpillar is very typical; on hatching it feeds on tender leaves nearby and feed gregariously on leaf chlorophyll by scrapping the leaf lamina. In young stages, the caterpillars webs two to three leaves together by feeding on internal portion of the leaves from edges towards the midrib leaving behind the network of veins. In grown up stages, the caterpillar feeds voraciously and web the shoots and leaves together. The leaves loose from their stalks, often detach but remain entangled in webs on the tree. Numerous dried bunches of shoots and leaves are clearly visible from a distance on severely attacked mango tree. The webbed leaves give a small tent-like appearance, so it is also popularly called as the Tent caterpillar. There are many species of leaf webber observed on mango in India of which *Orthaga euadrusalis* (Walker), *Orthaga exvinaceae* (Hampson) and *Orthaga mangiferae* (Mishra, 2001) are considered as major species. Besides these, *Lamida* (*Macalla*) *moncusalis* (Walker), *L. carbonifera* and *L. (Spectrotrota) sordidalis* (Hampson) have also been reported damaging mango tree. Apart from this *O. chilnonalis* and *O. icarusalis* were recorded from Malaysia and Thailand and *Balanotis leucatina* have been reported from Egypt and Srilanka.

Materials and Methods

To study the seasonal incidence of mango leaf webber, *Orthaga* spp.

Four branch of each tree in four different directions (North, South, East and West) were tagged for recording the observations from each previously selected tree and was observed weekly for recording the incidence of leaf webber by counting the No. of webs/tree.

The data thus, obtained was correlated with various abiotic factors such as maximum and minimum temperature, relative humidity, and rainfall were collected from research station and correlated with mango leaf webber to understand the influence on pest damage of mango tree.

1. Seasonal incidence of mango leaf webber, *Orthaga* spp. on mango tree during the year 2015-16 (larva)

In the present piece of investigation in Langra variety highest larval population of leaf webber, *Orthaga* spp. was observed (Table 1 and Fig. 1, 2, 3) during first week of January with (89.0 larva/tree). Least larval population of 1.50 larva/tree was recorded during first week of August. Whereas, in Alphanzo maximum larval population of 83.75 larva/tree was recorded during first week of January and lowest larval population 0.92 larva/tree was recorded during last week of April. Dashari recorded highest larval population of 84.08 larva/tree during second week of January. Minimum number (1.0 larva/tree) was recorded during first week of August. Peak activity of leaf webber was recorded on Sunderja during first week of January with 86.67 larva/tree. Lowest larval population 0.67 larva/tree was recorded during first week of August. In Kesar larval population gradually increased from last week of September and reached its peak on last week of December with 71.08 larva/tree then decreased continuously up to last week of April and recorded least number of larva 0.83 larva/tree. In Kurkan the first appearance of leaf webber was observed on mango during first week of August with (0.42 larva/tree) there was an increase in its population and reached its peak on first week of January with 74.00 larva/tree. In Karela the larval population was gradually increased to 83.67 larva/tree. Minimum larval population was recorded during last week of April with 0.5 larva/tree. In the variety Dilpasand the larval population range (0.67 to 83.58 larva/tree) was recorded during first week of August to last week of April, however, larval population range of 0.0 to 63.67 larva/tree was recorded on Himsagar.

Data on seasonal mean indicated that the minimum larval population of 20.17 larva/tree was recorded on Himsagar followed by Kurkan, Kesar, Karela, Sunderja, Dilpasand, Dashari, Langra and Alphanzo with 20.29, 22.29, 23.61, 29.24, 29.41, 30.04, 31.79 and 32.32 larva/tree, respectively.

Table 1: Seasonal incidence of mango leaf webber, *Orthaga* spp. on mango tree during the year 2015-16

S. N.	SMW	Date of observation	Number of larvae/tree								
			Langra	Alphanzo	Dashari	Sunderja	Kesar	Kurkan	Karela	Dilpasand	Himsagar
1	31	01/08/2015	1.50	1.17	1.00	0.67	1.00	0.42	0.92	0.67	0.67
2	32	08/08/2015	2.00	1.92	1.25	1.83	1.75	1.25	1.58	1.00	1.00
3	33	15/08/2015	2.08	2.33	1.42	1.75	2.25	1.42	2.75	1.42	1.17
4	34	22/08/2015	3.17	2.75	2.25	3.00	2.00	1.50	2.58	2.08	1.75
5	35	29/08/2015	4.17	3.25	2.58	3.17	1.58	2.50	2.25	2.42	2.17
6	36	05/09/2015	4.33	5.58	5.17	5.25	2.17	3.50	2.67	4.50	3.83
7	37	12/09/2015	5.50	3.50	4.58	5.33	2.08	3.58	3.33	5.08	4.67
8	38	19/09/2015	5.92	5.08	5.92	6.00	1.92	5.08	2.17	5.42	4.92
9	39	26/09/2015	7.67	6.08	7.92	7.67	7.42	5.67	7.25	5.92	8.17
10	40	03/10/2015	9.08	9.92	10.42	10.33	10.50	6.42	9.08	7.08	10.00
11	41	10/10/2015	12.25	15.42	12.17	11.67	13.75	8.08	12.42	7.58	10.67
12	42	17/10/2015	16.50	14.58	12.50	14.42	13.67	9.00	12.58	13.25	11.50

13	43	24/10/2015	18.75	17.00	17.75	16.75	10.17	9.42	13.25	14.08	10.17
14	44	31/10/2015	21.75	21.25	18.17	18.75	10.58	13.42	14.92	20.75	10.58
15	45	07/11/2015	35.92	40.75	38.17	42.08	55.17	15.58	34.50	38.33	53.42
16	46	14/11/2015	52.00	53.17	48.92	46.17	56.67	19.75	40.42	43.92	51.25
17	47	21/11/2015	56.67	58.83	54.17	52.33	58.42	34.42	48.42	52.17	54.17
18	48	28/11/2015	60.00	68.00	61.50	59.58	65.08	40.25	57.00	62.42	57.33
19	49	05/12/2015	71.42	71.75	64.42	65.67	67.58	44.42	62.67	71.00	60.50
20	50	12/12/2015	73.25	75.08	72.58	78.67	68.33	46.17	69.00	76.08	61.00
21	51	19/12/2015	83.75	78.25	75.08	79.25	69.25	64.67	70.92	79.25	63.67
22	52	26/12/2015	86.50	81.08	76.17	84.17	71.08	69.42	81.08	81.67	61.83
23	01	02/01/2016	89.00	83.75	84.08	86.67	44.33	74.00	83.67	83.58	48.00
24	02	09/01/2016	76.17	73.00	70.08	77.50	41.92	62.08	57.08	68.75	36.17
25	03	16/01/2016	70.42	71.58	66.33	61.58	36.75	46.92	44.25	63.08	21.00
26	04	23/01/2016	78.33	70.17	58.58	59.92	27.17	35.42	40.92	55.67	18.00
27	05	30/01/2016	62.17	64.00	58.17	52.00	24.58	30.25	41.33	52.50	12.33
28	06	06/02/2016	57.67	58.08	48.25	35.42	23.33	28.17	24.92	50.50	25.58
29	07	13/02/2016	51.67	54.33	47.33	40.08	18.08	25.25	21.83	49.42	20.83
30	08	20/02/2016	43.67	51.50	44.00	35.33	16.08	23.67	17.25	46.50	22.17
31	09	27/02/2016	25.75	32.58	33.58	32.25	13.33	17.58	14.25	33.08	19.50
32	10	05/03/2016	22.08	29.17	26.42	17.42	12.33	15.17	10.58	20.25	16.75
33	11	12/03/2016	15.00	18.25	16.50	14.17	10.08	14.00	7.42	16.50	5.25
34	12	19/03/2016	10.50	13.67	12.92	11.17	8.67	10.83	7.08	12.25	5.00
35	13	26/03/2016	10.08	11.42	10.83	8.67	7.17	9.92	7.42	11.25	5.58
36	14	02/04/2016	7.00	7.92	9.67	7.42	6.00	4.75	5.08	7.00	2.42
37	15	09/04/2016	7.08	7.33	9.67	7.00	3.58	3.50	4.25	3.75	1.50
38	16	16/04/2016	4.50	5.25	5.25	4.42	3.00	2.58	3.08	3.33	1.58
39	17	23/04/2016	3.75	3.25	4.25	3.42	1.75	0.92	1.83	1.75	0.58
40	18	30/04/2016	2.67	0.92	1.50	0.75	0.83	0.58	0.50	1.08	0.00
		Seasonal mean	31.79	32.32	30.04	29.24	22.29	20.29	23.61	29.41	20.17

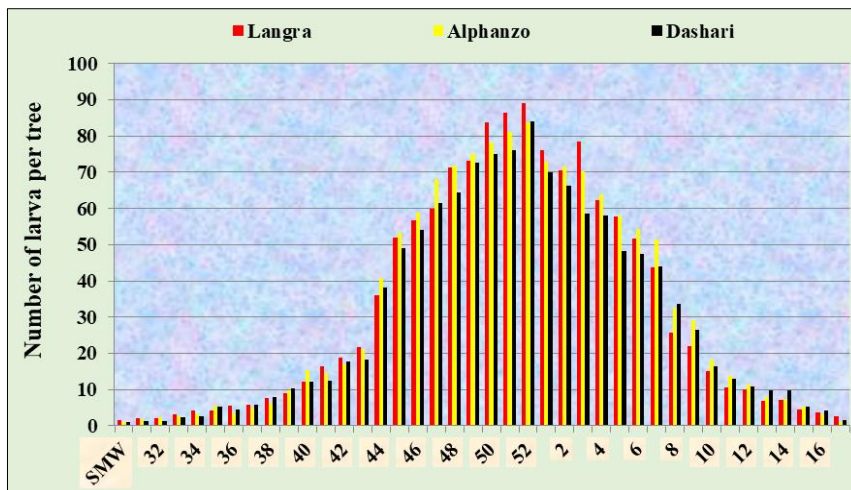


Fig 1: Seasonal incidence of mango leaf webber, *Orthaga* spp. on mango tree (larva) during the year 2015-16 (Langra, Alphanzo, Dashari)

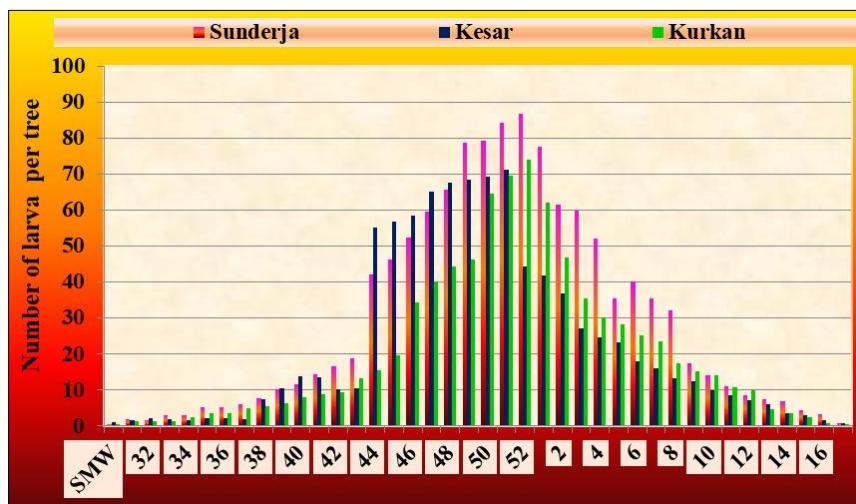


Fig 2: Seasonal incidence of mango leaf webber, *Orthaga* spp. on mango tree (larva) during the year 2015-16 (Sunderja, Kesar, Kurkan)

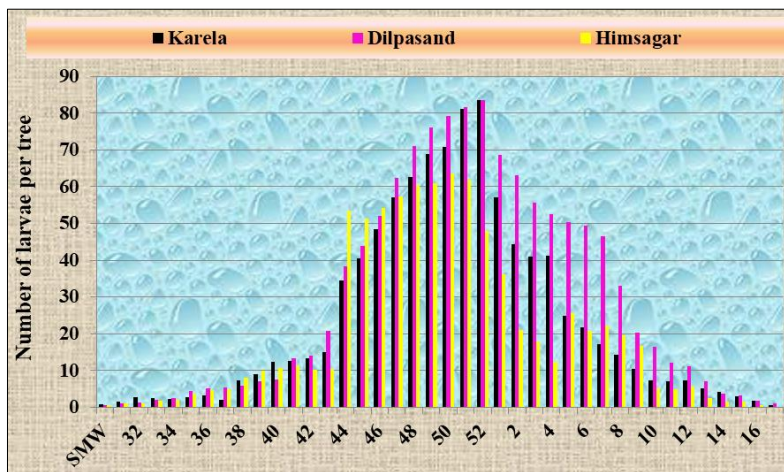


Fig 3: Seasonal incidence of mango leaf webber, *Orthaga* spp. on mango tree (larva) during the year 2015-16 (Karela, Dilpasand, Himsagar)

Table 2: Simple correlation co-efficient (r) between meteorological parameters and mango leaf webber, *Orthaga* spp. (larvae) on mango tree during the year 2015-16

Weather data / Varieties	Temperature (°C)			Relative humidity (%)			Sunshine (Hours)	Rainfall (mm)
	Maximum	Minimum	Average	Morning	Evening	Average		
Langra	-0.789**	-0.865**	-0.935**	0.125	-0.415*	-0.329*	-0.174	-0.304
Alphanzo	-0.811**	-0.806**	-0.907**	0.215	-0.375*	-0.272	-0.141	-0.319*
Dashari	-0.783**	-0.875**	-0.937**	0.106	-0.434**	-0.350*	-0.174	-0.323*
Sunderja	-0.788**	-0.835**	-0.915**	0.163	-0.413*	-0.318*	-0.172	-0.292
Kesar	-0.739**	-0.623**	-0.755**	0.306	-0.393*	-0.266	-0.065	-0.287
Kurkan	-0.755**	-0.830**	-0.895**	0.128	-0.389*	-0.306	-0.199	-0.263
Karela	-0.775**	-0.740**	-0.848**	0.238	-0.369*	-0.262	-0.142	-0.270
Dilpasand	-0.789**	-0.855**	-0.928**	0.132	-0.440**	-0.349*	-0.158	-0.308
Himsagar	-0.739**	-0.595**	-0.737**	0.319*	-0.365*	-0.239	-0.079	-0.282

*: Significant at 5% level, **: Significant at 1% level

Simple correlation co-efficient (r) between meteorological parameters and leaf webber, *Orthaga* spp.

The several weather factors (Table 2) considered for correlation studies with leaf webber, *Orthaga* spp., only the morning relative humidity found to be the most favorable for the leaf webber and positively correlated with larval population. Remaining other weather variables had negatively correlated with larval population.

2. Seasonal incidence of mango leaf webber, *Orthaga* spp. on mango tree during the year 2016-17 (larva)

During the present piece of investigation in Langra variety highest larval population of leaf webber, *Orthaga* spp. was observed (Table 3 and Fig. 4, 5, 6) during first week of January with (82.75 larva/tree). Least larval population of 1.0 larva/tree was recorded during last week of April. Whereas, in Alphanzo maximum larval population of 83.83 larva/tree was recorded during last week of December and lowest larval population 0.92 larva/tree was recorded during last week of April. Dashari recorded highest larval population of 87.92 larva/tree during first week of January. Minimum number

(1.25 larva/tree) was recorded during first week of August. Peak activity of leaf webber was recorded on Sunderja during first week of January with 88.25 larva/tree. Lowest larval population 0.75 larva/tree was recorded during last week of April. In Kesar larval population gradually increased from last week of August and reached its peak on third week of December with 70.58 larva/tree then decreased continuously upto last week of April and recorded least number of larva 0.67 larva/tree. In Kurkan the first appearance of leaf webber was observed on mango during first week of August with (0.83 larva/tree) there was an increase in its population and reached its peak on last week of December with 74.33 larva/tree.

In Karela the larval population was gradually increased and reached its peak on first week of January with 82.67 larva/tree. Minimum larval population was recorded during first week of August with 0.92 larva/tree. In the variety Dilpasand the larval population range (0.75 to 80.42 larva/tree) was recorded during first week of August to last week of April, however, larval population range of 0.92 to 74.33 larva/tree was recorded on Himsagar.

Table 3: Seasonal incidence of mango leaf webber, *Orthaga* spp. on mango tree during the year 2016-17

S. N.	SMW	Date of observation	Number of larvae/tree								
			Langra	Alphanzo	Dashari	Sunderja	Kesar	Kurkan	Karela	Dilpasand	Himsagar
1	31	01/08/2016	3.50	1.33	1.25	0.92	0.67	0.83	0.92	0.75	0.92
2	32	08/08/2016	1.08	1.17	1.67	1.25	2.17	1.58	1.42	1.42	2.25
3	33	15/08/2016	2.17	1.83	2.33	1.08	1.67	2.83	2.08	1.08	2.50
4	34	22/08/2016	1.92	3.33	2.75	2.25	1.42	2.50	1.92	1.92	2.42
5	35	29/08/2016	2.83	3.92	4.25	2.83	2.17	2.33	1.33	2.58	3.42
6	36	05/09/2016	5.25	6.00	3.33	3.92	2.75	3.58	2.17	3.58	4.17
7	37	12/09/2016	5.58	4.33	5.33	5.00	4.33	3.00	3.50	4.00	4.08
8	38	19/09/2016	5.83	5.33	4.75	6.33	7.08	2.92	2.92	5.42	6.08

9	39	26/09/2016	5.75	6.42	6.92	8.67	7.67	6.83	7.08	7.67	5.92
10	40	03/10/2016	7.33	10.00	8.00	10.33	10.00	11.17	11.67	10.75	6.92
11	41	10/10/2016	7.83	14.58	11.50	13.42	10.67	18.08	13.50	13.17	8.58
12	42	17/10/2016	14.75	16.33	16.08	16.00	15.50	16.08	15.25	11.50	11.00
13	43	24/10/2016	17.50	18.33	19.83	17.58	17.17	11.42	15.50	16.25	10.83
14	44	31/10/2016	21.42	22.50	24.17	18.83	23.75	14.25	17.33	17.75	12.08
15	45	07/11/2016	37.58	45.00	31.75	35.08	37.33	47.25	41.33	47.50	27.67
16	46	14/11/2016	46.67	55.08	42.17	44.75	52.08	47.25	44.25	52.25	25.75
17	47	21/11/2016	54.33	64.25	46.42	53.25	53.50	59.25	46.75	55.83	34.17
18	48	28/11/2016	62.33	79.25	60.08	58.33	59.92	62.42	55.75	65.58	44.83
19	49	05/12/2016	68.08	78.42	72.58	72.92	63.83	71.75	65.17	65.25	46.08
20	50	12/12/2016	78.92	76.00	72.50	79.00	66.25	70.42	71.42	73.08	44.00
21	51	19/12/2016	78.17	80.08	82.33	80.75	70.58	72.17	68.33	73.25	64.92
22	52	26/12/2016	79.92	83.83	82.83	84.33	67.25	74.33	80.00	75.67	74.33
23	01	02/01/2017	82.75	83.42	87.92	88.25	58.75	50.50	82.67	80.42	70.08
24	02	09/01/2017	70.83	76.75	78.67	79.00	52.75	45.67	54.33	72.42	65.25
25	03	16/01/2017	68.17	75.33	76.08	63.00	47.33	40.17	45.83	66.33	51.25
26	04	23/01/2017	64.50	72.17	77.67	58.67	42.83	33.25	41.67	61.25	44.50
27	05	30/01/2017	61.50	65.17	67.42	49.50	35.67	29.25	43.58	61.42	37.00
28	06	06/02/2017	59.25	60.58	63.83	33.00	39.92	27.42	31.67	54.50	29.67
29	07	13/02/2017	65.75	56.25	55.08	38.92	22.83	20.08	28.83	51.50	25.42
30	08	20/02/2017	53.75	58.33	49.75	37.25	21.83	17.17	17.42	46.50	25.83
31	09	27/02/2017	47.58	41.67	32.00	37.50	16.75	13.50	12.75	36.08	24.33
32	10	05/03/2017	30.67	24.25	22.42	17.92	11.67	12.42	11.75	27.33	20.58
33	11	12/03/2017	34.75	22.25	16.75	15.50	10.42	10.42	7.50	21.75	15.67
34	12	19/03/2017	17.58	13.50	15.08	13.58	8.00	8.83	7.00	22.08	12.83
35	13	26/03/2017	17.50	10.42	10.33	14.00	7.33	7.00	6.33	9.17	8.75
36	14	02/04/2017	7.83	6.83	9.08	5.92	3.42	6.25	4.92	9.17	6.42
37	15	09/04/2017	5.33	7.00	6.83	7.92	3.67	4.33	3.67	8.83	4.83
38	16	16/04/2017	3.58	4.92	5.08	3.50	2.67	3.17	3.58	4.83	4.58
39	17	23/04/2017	2.08	2.83	4.50	3.58	1.00	2.08	2.25	4.17	1.42
40	18	30/04/2017	1.00	0.92	3.25	0.75	0.75	0.83	1.58	2.00	1.17
		Seasonal mean	32.58	34.00	32.11	29.61	24.13	23.36	24.42	31.15	22.31

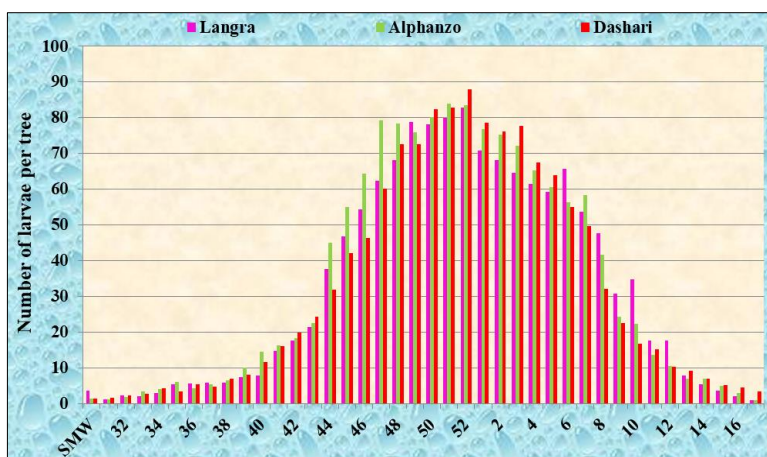


Fig 4: Seasonal incidence of mango leaf webber, *Orthaga* spp. on mango tree (larva) during the year 2016-17 (Langra, Alphanzo, Dashari)

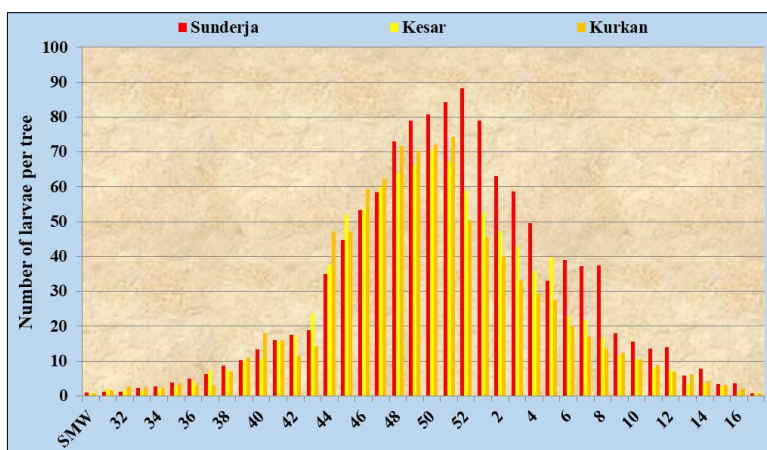


Fig 5: Seasonal incidence of mango leaf webber, *Orthaga* spp. on mango tree (larva) during the year 2016-17 (Sunderja, Kesar, Kurkan)

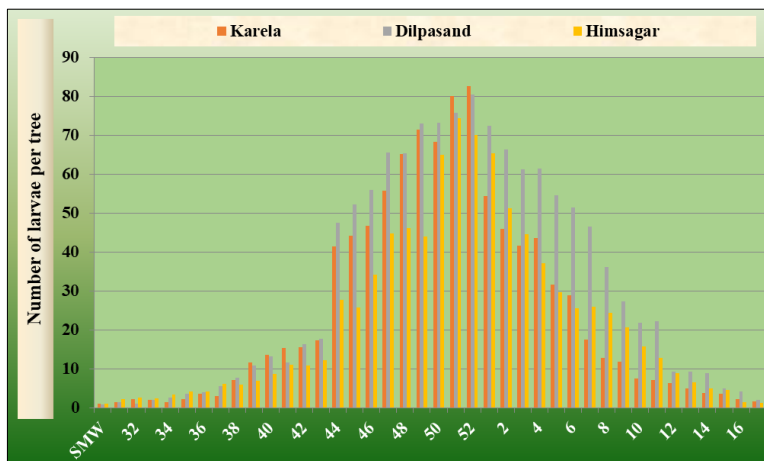


Fig 6: Seasonal incidence of mango leaf webber, *Orthaga* spp. on mango tree (larva) during the year 2016-17 (Karela, Dilpasand, Himsagar)

Table 4: Simple correlation co-efficient (r) between meteorological parameters and mango leaf webber, *Orthaga* spp. (larvae) on mango tree during the year 2016-17

Weather data	Varieties	Temperature (°C)			Relative humidity (%)			Sunshine (Hours)	Rainfall (mm)
		Maximum	Minimum	Average	Morning	Evening	Average		
	Langra	-0.593**	-0.941**	-0.886**	0.145	-0.450**	-0.210	-0.127	-0.475**
	Alphanzo	-0.613**	-0.939**	-0.894**	0.196	-0.416**	-0.166	-0.162	-0.458**
	Dashari	-0.601**	-0.917**	-0.875**	0.181	-0.405**	-0.166	-0.166	-0.450**
	Sunderja	-0.616**	-0.915**	-0.881**	0.207	-0.382*	-0.140	-0.203	-0.436**
	Kesar	-0.638**	-0.904**	-0.886**	0.266	-0.340*	-0.088	-0.223	-0.422**
	Kurkan	-0.603**	-0.860**	-0.841**	0.255	-0.326*	-0.085	-0.246	-0.398*
	Karela	-0.627**	-0.875**	-0.863**	0.260	-0.321*	-0.079	-0.257	-0.403*
	Dilpasand	-0.601**	-0.944**	-0.891**	0.168	-0.439**	-0.193	-0.172	-0.473**
	Himsagar	-0.612**	-0.897**	-0.868**	0.194	-0.373*	-0.141	-0.196	-0.416**

*: Significant at 5% level, **: Significant at 1% level

Data on seasonal mean indicated that the minimum larval population of 22.31 larva/tree was recorded on Himsagar followed by Kurkan, Kesar, Karela, Sunderja, Dilpasand, Dashari, Langra and Alphanzo with 23.36, 24.13, 24.42, 29.61, 31.15, 32.11, 32.58 and 34.0 larva/tree, respectively.

Simple correlation co-efficient (r) between meteorological parameters and leaf webber, *Orthaga* spp.

The several weather factors (Table 4) considered for correlation studies with leaf webber, *Orthaga* spp., only the morning relative humidity found to be the most favorable for the leaf webber and positively correlated with larval population. Remaining other weather variables had negatively correlated with larval population.

3. Seasonal incidence of mango leaf webber, *Orthaga* spp. on mango tree during the year 2015-16 and 2016-17 (larva) pooled

During the present piece of investigation in Langra highest larval population of leaf webber, *Orthaga* spp. was observed (Table 5 and Fig. 7, 8, 9) during first week of January with (85.88 larva/tree). Least larval population of 1.54 larva/tree was recorded during second week of August. Whereas, in Alphanzo maximum larval population of 83.59 larva/tree was

recorded during first week of January and lowest larval population 0.92 larva/tree was recorded during last week of April. Dashari recorded highest larval population of 86.0 larva/tree during first week of January. Minimum number (1.13 larva/tree) was recorded during first week of August. Peak activity of leaf webber was recorded on Sunderja during first week of January with 87.46 larva/tree. Lowest larval population 0.75 larva/tree was recorded during last week of April. In Kesar larval population gradually increased from last week of August and reached its peak on third week of December with 69.92 larva/tree then decreased continuously upto last week of April and recorded least number of larva 0.79 larva/tree. In Kurkan the first appearance of leaf webber was observed on mango during first week of August with (0.63 larva/tree) there was an increase in its population and reached its peak on last week of December with 71.88 larva/tree. In Karela the larval population was gradually increased and reached its peak on first week of January with 83.17 larva/tree. Minimum larval population was recorded during first week of August with 0.92 larva/tree. In the variety Dilpasand the larval population range (0.71 to 82.0 larva/tree) was recorded during first week of August to last week of April, however, larval population range of 0.59 to 68.08 larva/tree was recorded on Himsagar.

Table 5: Seasonal incidence of mango leaf webber, *Orthaga* spp. on mango tree during the year 2015-16 and 2016-17 (pooled)

S. N.	SMW	Date of observation	Number of larvae/tree								
			Langra	Alphanzo	Dashari	Sunderja	Kesar	Kurkan	Karela	Dilpasand	Himsagar
1	31	01/08/2016	2.50	1.25	1.13	0.80	0.84	0.63	0.92	0.71	0.80
2	32	08/08/2016	1.54	1.55	1.46	1.54	1.96	1.42	1.50	1.21	1.63
3	33	15/08/2016	2.13	2.08	1.88	1.42	1.96	2.13	2.42	1.25	1.84
4	34	22/08/2016	2.55	3.04	2.50	2.63	1.71	2.00	2.25	2.00	2.09
5	35	29/08/2016	3.50	3.59	3.42	3.00	1.88	2.42	1.79	2.50	2.80
6	36	05/09/2016	4.79	5.79	4.25	4.59	2.46	3.54	2.42	4.04	4.00

7	37	12/09/2016	5.54	3.92	4.96	5.17	3.21	3.29	3.42	4.54	4.38
8	38	19/09/2016	5.88	5.21	5.34	6.17	4.50	4.00	2.55	5.42	5.50
9	39	26/09/2016	6.71	6.25	7.42	8.17	7.55	6.25	7.17	6.80	7.05
10	40	03/10/2016	8.21	9.96	9.21	10.33	10.25	8.80	10.38	8.92	8.46
11	41	10/10/2016	10.04	15.00	11.84	12.55	12.21	13.08	12.96	10.38	9.63
12	42	17/10/2016	15.63	15.46	14.29	15.21	14.59	12.54	13.92	12.38	11.25
13	43	24/10/2016	18.13	17.67	18.79	17.17	13.67	10.42	14.38	15.17	10.50
14	44	31/10/2016	21.59	21.88	21.17	18.79	17.17	13.84	16.13	19.25	11.33
15	45	07/11/2016	36.75	42.88	34.96	38.58	46.25	31.42	37.92	42.92	40.55
16	46	14/11/2016	49.34	54.13	45.55	45.46	54.38	33.50	42.34	48.09	38.50
17	47	21/11/2016	55.50	61.54	50.30	52.79	55.96	46.84	47.59	54.00	44.17
18	48	28/11/2016	61.17	73.63	60.79	58.96	62.50	51.34	56.38	64.00	51.08
19	49	05/12/2016	69.75	75.09	68.50	69.30	65.71	58.09	63.92	68.13	53.29
20	50	12/12/2016	76.09	75.54	72.54	78.84	67.29	58.30	70.21	74.58	52.50
21	51	19/12/2016	80.96	79.17	78.71	80.00	69.92	68.42	69.63	76.25	64.30
22	52	26/12/2016	83.21	82.46	79.50	84.25	69.17	71.88	80.54	78.67	68.08
23	01	02/01/2017	85.88	83.59	86.00	87.46	51.54	62.25	83.17	82.00	59.04
24	02	09/01/2017	73.50	74.88	74.38	78.25	47.34	53.88	55.71	70.59	50.71
25	03	16/01/2017	69.30	73.46	71.21	62.29	42.04	43.55	45.04	64.71	36.13
26	04	23/01/2017	71.42	71.17	68.13	59.30	35.00	34.34	41.30	58.46	31.25
27	05	30/01/2017	61.84	64.59	62.80	50.75	30.13	29.75	42.46	56.96	24.67
28	06	06/02/2017	58.46	59.33	56.04	34.21	31.63	27.80	28.30	52.50	27.63
29	07	13/02/2017	58.71	55.29	51.21	39.50	20.46	22.67	25.33	50.46	23.13
30	08	20/02/2017	48.71	54.92	46.88	36.29	18.96	20.42	17.34	46.50	24.00
31	09	27/02/2017	36.67	37.13	32.79	34.88	15.04	15.54	13.50	34.58	21.92
32	10	05/03/2017	26.38	26.71	24.42	17.67	12.00	13.80	11.17	23.79	18.67
33	11	12/03/2017	24.88	20.25	16.63	14.84	10.25	12.21	7.46	19.13	10.46
34	12	19/03/2017	14.04	13.59	14.00	12.38	8.34	9.83	7.04	17.17	8.92
35	13	26/03/2017	13.79	10.92	10.58	11.34	7.25	8.46	6.88	10.21	7.17
36	14	02/04/2017	7.42	7.38	9.38	6.67	4.71	5.50	5.00	8.09	4.42
37	15	09/04/2017	6.21	7.17	8.25	7.46	3.63	3.92	3.96	6.29	3.17
38	16	16/04/2017	4.04	5.09	5.17	3.96	2.84	2.88	3.33	4.08	3.08
39	17	23/04/2017	2.92	3.04	4.38	3.50	1.38	1.50	2.04	2.96	1.00
40	18	30/04/2017	1.84	0.92	2.38	0.75	0.79	0.71	1.04	1.54	0.59
Seasonal mean			32.19	33.16	31.08	29.43	23.21	21.83	24.02	30.28	21.24

Table 6: Simple correlation co-efficient (r) between meteorological parameters and mango leaf webber, *Orthaga* spp. (larvae) on mango tree during the year 2015-16 and 2016-17 (Pooled)

Weather data	Varieties	Temperature (°C)			Relative humidity (%)			Sunshine (Hours)	Rainfall (mm)
		Maximum	Minimum	Average	Morning	Evening	Average		
Langra		-0.719**	-0.944**	-0.942**	0.153	-0.481**	-0.286	-0.235	-0.481**
Alphanzo		-0.725**	-0.937**	-0.941**	0.172	-0.470**	-0.271	-0.227	-0.479**
Dashari		-0.713**	-0.940**	-0.937**	0.157	-0.476**	-0.281	-0.240	-0.477**
Sunderja		-0.726**	-0.906**	-0.922**	0.201	-0.449**	-0.245	-0.263	-0.451**
Kesar		-0.715**	-0.810**	-0.857**	0.276	-0.414*	-0.192	-0.229	-0.432**
Kurkan		-0.725**	-0.858**	-0.892**	0.241	-0.424**	-0.213	-0.251	-0.427**
Karela		-0.723**	-0.835**	-0.877**	0.260	-0.390*	-0.181	-0.260	-0.415*
Dilpasand		-0.718**	-0.936**	-0.937**	0.166	-0.483**	-0.283	-0.223	-0.481**
Himsagar		-0.727**	-0.856**	-0.891**	0.242	-0.422**	-0.211	-0.250	-0.434**

*: Significant at 5% level, **: Significant at 1% level

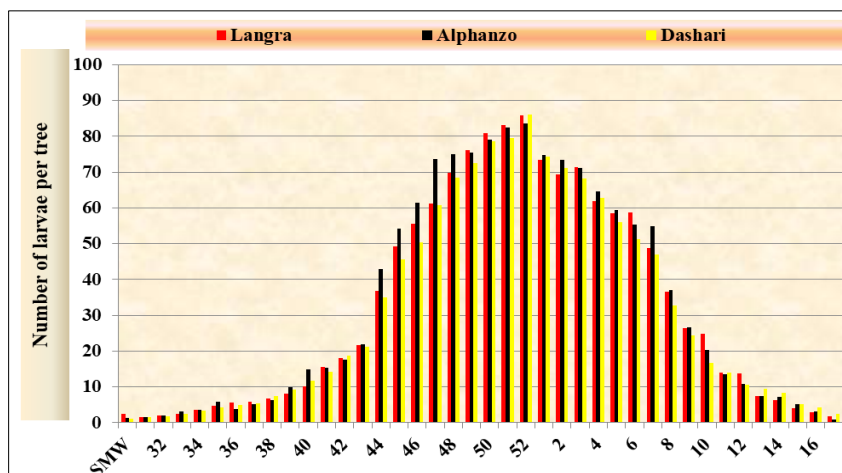


Fig 7: Seasonal incidence of mango leaf webber, *Orthaga* spp. on mango tree (larva) during the year 2015 and 2016 (Pooled) (Langra, Alphanzo, Dashari)

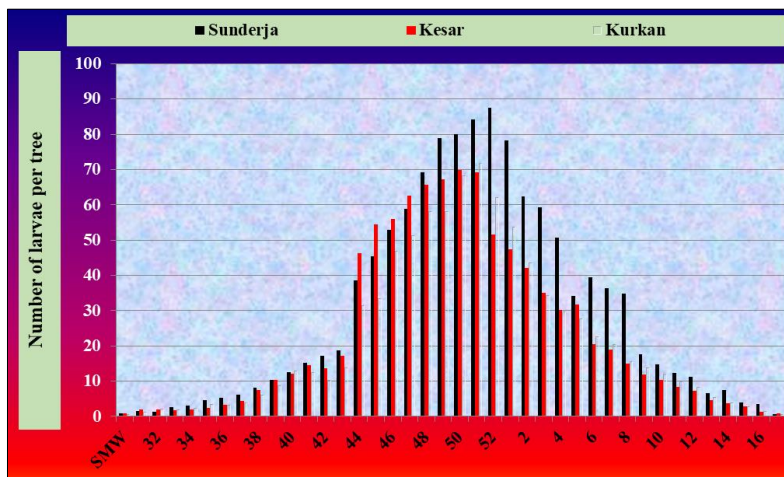


Fig 8: Seasonal incidence of mango leaf webber, *Orthaga* spp. on mango tree (larva) during the year 2015 and 2016 (Pooled) (Sunderja, Kesar, Kurkan)

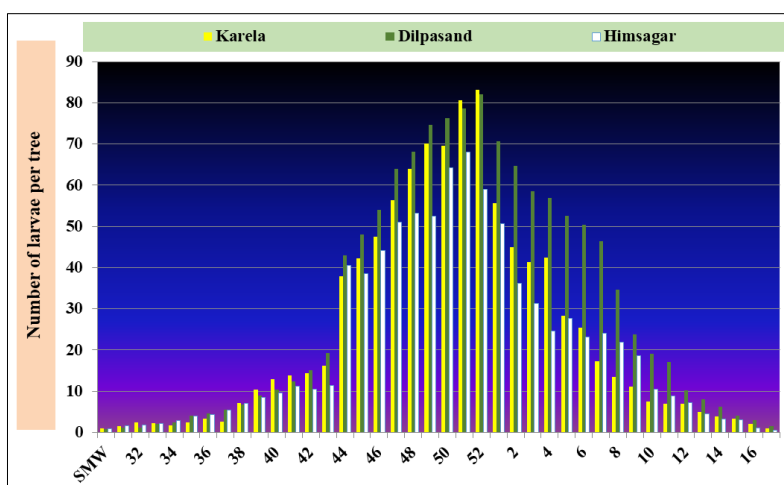


Fig 9: Seasonal incidence of mango leaf webber, *Orthaga* spp. on mango tree (larva) during the year 2015 and 2016 (Pooled) (Karela, Dilpasand, Himsagar)

Data on seasonal mean indicated that the minimum larval population of 21.24 larva/tree was recorded on Himsagar followed by Kurkan, Kesar, Karela, Sunderja, Dilpasand, Dashari, Langra and Alphanzo with 21.83, 23.21, 24.02, 29.43, 30.28, 31.08, 32.19 and 33.16 larva/tree, respectively.

Simple correlation co-efficient (r) between meteorological parameters and leaf webber, *Orthaga* spp.

The several weather factors (Table 6) considered for correlation studies with leaf webber, *Orthaga* spp., only the morning relative humidity found to be the most favorable for the leaf webber and positively correlated with larval population. Remaining other weather variables had negatively correlated with larval population.

In the present study mango shoot webber activity observed in the month of August to April. Less and similar finding Srivastava and Verghese (1983) reported that the webber infestation began from June and continued upto December and also Tandon and Srivastava (1982) [16] reported the increasing of webber the month of October to November in Utter Pradesh. Soumya *et al.*, (2017) [11] investigated that the months between October and December had high population. After January till about April there was no population that occurred on the leaves. Vijaya *et al.*, (2011) studied on seasonal incidence of mango leaf webber, *Orthaga euadrusalis* in seven varieties of mango during 2009 revealed low intensity during 30th standard week, gradual

improvement up to 42nd standard week, sudden increase at 44th standard week and peak activity were recorded in 50th standard week.

Kasar *et al.* (2017) [7] to study the incidence and distribution pattern of mango leaf webber, *Orthaga exvinacea* Hampson during 2012-13 and 2013-14 at mango orchard of Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal. The results indicated that the most active period of mango leaf webber in both years was found from August to December. Correlation results indicated that all weather parameters had negative relationship only relationship of morning relative humidity was positively significant effect on the leaf webber population.

References

1. Anonymous. Screening of mango varieties and evaluation of various insecticides against mango leaf webber, *Orthaga euadrusalis* Walker. Annual Report, 38th PPSC meeting of Agril. Research Council, Gujarat Agricultural University, Anand 2003, 50-51.
2. Anonymous. All India Coordinated Research Project on Sub-tropical Fruits, Annual Report, CSIR, Lucknow 2004, 107-108.
3. Anonymous. Horticulture at a Glance, Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of

- India 2009.
4. Anonymous. Deputy Director Horticulture, Distt. Bilaspur. Chhattisgarh 2012-13, 3.
 5. Anonymous. Pests of fruits (banana, citrus, sapota, mango and pomegranate) 'e' pest surveillance and pest management advisory. National centre for integrated pest management, New Delhi 2013, 5.
 6. Anonymous 2014c. <http://www.cishlko.org> (5th April 2016).
 7. Kasar N, Marack JC, DAS UK, Jha S. Incidence and distribution pattern of leaf webber (*Orthaga exvinacea* Hampson) on mango. Journal of Applied Entomology 2017;5(2):1196-1199.
 8. Maldonado-Celis ME, Yahia EM, Bedoya R, Landázuri P, Loango N, Aguillón J *et al.* Chemical Composition of Mango (*Mangifera indica* L.) Fruit: Nutritional and Phytochemical Compounds. Front. Plant Sci 2019;10:1073.
 9. Mari AK, Khan M, Aziz E, Khoso AG, Eisaw AEK. Insect Pests and Predators Associated with Mango Varieties. Entomol Ornithol Herpetol 2020;9(2):1000225.
 10. Pena JE, Mohyuddin AI, Wysoki M. A Review of the Pest Management Situation in Mango Agro-ecosystems. Phytoparasitica 1998;26(2):129-148.
 11. Soumya BR, Verghese A, Jayanthi PDK. Diversity and economic status of lepidopteran insect-pest on two major varieties of mango. Journal of Entomology and Zoology Studies 2017;5:838-843.
 12. Srivastava BK. Growth potential of *Laphygma exigua* in relation to cotton winter food plants. Madras Agric. J 1959;46(6):225-259.
 13. Srivastava RP, Tandon PL, Lal B. Natural control of important insect pests of mango. Research Report on Mango Workers Meeting held at Panaji, Goa 1979, 275-277.
 14. Srivastava RP, Tandon PL. Studies of insect pathogens in mango leaf webber *Orthaga euadrusalis* Walker Entomon 1980;5:219-221.
 15. Tandon PL, Srivastava RP. New records of parasites and predators. Entomon 1980;5:243-244.
 16. Tandon PL, Srivastava RP. Notes on new pests of mango in India; Science and Culture 1982;48:78-80.
 17. Tandon PL, Verghese A. World list of insects, mites and other pests of mango, Tech. DOC No. 5, IIHR, Bangalore 1985, 22.
 18. Tandon PL. Problem and prospects of IPM in fruit trees, In: Trends in Agricultural IPM (Eds. Dhaliwal, G. S. and Arora, R.). Commonwealth Publishers, New Delhi 1994, 395.
 19. Tandon PL, Srivastava RP. New records of parasites and predators. Entomon 1980;5:243-244.