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Incidence of various insect pests and their seasonal history on chilli crop in Malwa region

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Abstract
The experiment entitled Incidence of various insect pests and their seasonal History on chilli crop in Malva region of Madhya Pradesh conducted during Rabi 2018-2019 and 2019 -2020 in the department of Entomology of School of agriculture at Dr. B.R. Ambedkar University of social science Mhow Indore (M.P.). during the year of 2018 - 2019 & 2019 - 2020, the data on thrips and mites population and per cent white fly, jassids and aphids infestation under field condition along with weather parameters viz., temperature (Maximum and minimum), relative humidity and rainfall are given in Observations recorded on thrips population revealed that activity of thrips started from second week of July (21SW) and continued up to the crop termination i.e. last second week of December. The maximum thrips population (6.77) was recorded. The observation recorded on mites population revealed that activity of mites started from second week of July (21 SW) and continued up to the crop termination i.e. last second week of December. The maximum mites population (5.45) was recorded. The maximum whitefly population (5.22) was recorded in 3rd week of August (25 SW) when maximum and minimum temperature and humidity respectively. The maximum aphid population (4.53) was recorded in 3rd week of August (26 SW) when maximum and minimum temperature and humidity respectively. The maximum jassid population (3.87) was recorded in 3rd week of August (38 SW) when maximum and minimum temperature and humidity respectively. The leaf curl infestation of 9.2 per cent was first observed in third week of July (21 SW), which increased gradually and reached a maximum of 23.00 per cent in the 8th week after transplanting during 28th SW, when the maximum and minimum temperature and relative humidity were recorded respectively.

Keywords: various insect pests, seasonal history, chilli crop

Introduction
Chilli (*Capsicum annuum* L.) is one of the important spice cum vegetable crops of India and is being widely cultivated throughout warm temperate, tropical and subtropical countries. Capsicum annum L. (2n=24) is one of the important cash crops grown in almost all parts of the country and is widely grown in the tropics and subtropics as well as under glass houses in temperate regions. It is commonly used as condiments; the pungency in chili is due to a substance "capsaicin" (Kumar *et al*., 2006) [9]. India is a major producer, exporter and consumer of chili.

Chilly occupied an area of 843 thousand hectares in India with annual production of 3678 thousand million tonnes in 2017-18 (Anonymous, 2018) [2]. Its productivity was reported to be 1.95 tonnes / hectare (Anonymous, 2015) [1]. In India, chilli is grown in an area of 7.43 L ha, with a production of 14.53 L tons. The important chilli growing states in India are MP, Orissa, Maharashtra, Karnataka and also in a number of other states as a round the year crop. In Madhya Pradesh, chilli is cultivated in an area of 1.89 L hectares with a production of 2.08 L tons. Guntur district in Andhra Pradesh alone contributes to over 35% in the area under chilli crop in India.

Among these, thrip; *Scirtothrips dorsalis* Hood; whitefly; *Bemisia tabaci* Gennadius, aphid, *Aphis gossypii* Glover; jassid, *Amrasca biguttula biguttula* and mite, *Polyphagotarsonemus latus* Banks are major sucking pests causing 60 to 75 per cent yield loss in green chilli (Patel and Gupta, 1998). Nearly 35 species of insect pests were reported on chilli which include thrips, aphid, whitefly, fruit borer, cutworm, plant bug, mite and other minor pests (Sorensen, 2005) [18]. Among all the sucking pests thrips, *Scirtothrips dorsalis* Hood and whitefly, *Bemisia tabaci* Gennadius were reported as dominant pests (Berke and Sheih, 2000) [3].

The estimated losses due to sucking pests were up to 30 to 90 per cent (Varadharajan, 1994. Nelson and Natrajan, 1994 and Kumar, 1995) [19, 13, 7]. Mites have become a major problem in chilli cultivation. It appears in the nursery itself and spreads to the main field during November. Leaves damaged by *Polyphagotarsonemus latus* (Banks) curl downward and the flowers become distorted and fail to open normally. In most attacked hosts the internodes are greatly shortened and fruit drop may occur under severe infestations (Pena and Bullock, 1994) [14].

In addition, crop also suffers from diseases like Leaf curl which is one of the important diseases caused by Gemini virus transmitted by whitefly, *Bemisia tabaci* and also by thrips, *Scirtothrips dorsalis* and *Polyphagotarsonemus latus* (Venkatesh *et al.*, 1998) [20].

Looking to the importance of insect pests in chili, it is necessary to develop an updated database of activity of insect pests and natural enemies in chilli in the zone besides working out the role of sowing dates & weather parameters for modifying the insect pests dynamics. Simultaneously, the evaluation of safer means of insect pests management needs attention.

Method and Material

Incidence of insect pest and mites was recorded at an interval of 7 days. Minute to small pest counted made on 3 top leaves of 5 randomly selected plants from five locations of the trial.

Thrips, whitefly and mites population was recorded on 2 top, 2 middle and two lower leaves of a plant population of aphid on 6 cm length of a top branch of chilli plants while of Jassid on five randomly selected plants. Larval populations of lepidopteron insects recorded on 10 randomly selected plants / locations. The activity of the insects on the crop had been noted down from germination to transparent to harvesting of the crop.

The data obtained was statistically analysed and presented in tabular form.

Table 1: Details of Incidence of various insect pests and their seasonal History on chilli crop

Design	RBD
Treatment	07
Replication	04
Sowing Time	September - October
Date of sowing	1st Nov, 10th Nov, 20th Nov, 30th Nov, 10th Dec, 20th Dec and 30th Dec
Plot size	20 m × 20 m
Crop	Chilli
Variety	Pride 151
Insecticide	--

Result and Discussion

(A) Seasonal incidence of insect pest of chili

During the year of 2018-19, the data on thrips and mites population and per cent white fly, jassids and aphids infestation under field condition along with weather parameters viz., temperature (Maximum and minimum), relative humidity and rainfall are given in Table 4.1.

Observations recorded on thrips population revealed that activity of thrips started from second week of July (21 SW) and continued up to the crop termination i.e. last second week of December. The maximum thrips population (6.77) was recorded in 3rd week of August (26 SW) when maximum and minimum temperature and humidity respectively.

Observation recorded on mites population revealed that activity of mites started from second week of July (21 SW) and continued up to the crop termination i.e. last second week of December. The maximum mites population (5.45) was recorded in 1st week of Dec (39 SW) when maximum and minimum temperature and humidity respectively.

Observation recorded on whitefly population revealed that activity of thrips started from second week of July (21 SW) and continued up to the crop termination i.e. last second week of December. The maximum whitefly population (5.22) was recorded in 3rd week of August (25 SW) when maximum and minimum temperature and humidity respectively.

Observation recorded on aphid population revealed that activity of thrips started from second week of July (21 SW) and continued up to the crop termination i.e. last second week of December. The maximum aphid population (4.53) was recorded in 3rd week of August (26 SW) when maximum and minimum temperature and humidity respectively.

Observation recorded on jassid population revealed that activity of jassids started from second week of July (21 SW) and continued up to the crop termination i.e. last second week of December. The maximum jassid population (3.87) was recorded in 3rd week of August (38 SW) when maximum and minimum temperature and humidity respectively.

The leaf curl infestation of 9.2 per cent was first observed in third week of July (21 SW), which increased gradually and reached a maximum of 23.00 per cent in the 8th week after transplanting during 28th SW, when the maximum and minimum temperature and relative humidity were recorded.

Table 1: Seasonal incidence of sucking pests of chili during the 2018-19

Standard Week	Date and Month	Thrips/ leaf	Mites/leaf	White fly/ leaf	Aphids/ leaf	Jassids/ leaf
21	15 - 22 Jul	0.00	0.00	0.00	0.00	0.00
22	23 -29 Jul	4.40	4.47	4.64	0.60	2.13
23	30 Jul -7 Aug	4.47	4.60	4.60	0.40	2.93
24	8 -15 Aug	5.13	3.73	3.75	4.27	3.40
25	16- 23 Aug	4.60	**5.27**	5.22	4.20	2.93
26	24 - 30 Aug	4.07	4.97	4.67	4.53	2.40
27	31 Aug- 7 Sep	4.11	1.80	1.83	3.20	1.60
28	8 -15 Sep	4.55	1.45	1.47	3.27	1.53
29	16-23 Sep	5.69	1.66	1.69	3.69	1.78
30	24 -30 Sep	5.78	2.35	2.48	2.71	1.66

31	1 - 7 Oct	6.16	3.22	1.88	1.90	1.49
32	8 - 15 Oct	6.77	2.46	1.80	1.88	1.87
33	16-23 Oct	5.98	2.89	1.93	1.95	1.91
34	24 -30 Oct	5.41	3.44	1.97	1.92	1.95
35	31 Oct - 7 Nov	5.39	3.78	2.33	2.24	2.87
36	8 – 15 Nov	4.87	4.31	2.84	2.60	2.71
37	16 – 23 Nov	4.16	4.89	3.74	3.01	3.22
38	24- 30 Nov	5.48	5.37	3.36	3.25	3.87
39	1 Dec- 7 Dec	5.67	5.45	4.12	4.29	3.66
40	8-15 Dec	5.23	5.31	4.66	4.73	3.22

During the year of 2019-20, the data on thrips and mites population and per cent white fly, jassids and aphids infestation under field condition along with weather parameters viz., temperature (Maximum and minimum), relative humidity and rainfall are given in Table 4.1.

Observations recorded on thrips population revealed that activity of thrips started from third week of October (33 SW) and continued up to the crop termination i.e. last second week of December. The maximum thrips population (7.47 thrips/leaf) was recorded in 3rd week of August (33 SW) when maximum and minimum temperature and humidity respectively.

Observation recorded on mites population revealed that activity of mites started from second week of July (21 SW) and continued up to the crop termination i.e. last second week of December. The maximum thrips population (7.78) was recorded in 3rd week of September (30 SW) when maximum and minimum temperature and humidity respectively.

Observation recorded on whitefly population revealed that activity of thrips started from second week of July (21 SW) and continued up to the crop termination i.e. last second week of December. The maximum whitefly population (6.87) was recorded in 3rd week of November (37 SW) when maximum and minimum temperature and humidity respectively.

Observation recorded on aphid population revealed that activity of thrips started from second week of July (21 SW) and continued up to the crop termination i.e. last second week of December. The maximum aphid population (6.52) was recorded in 3rd week of December (40 SW) when maximum and minimum temperature and humidity respectively.

Observation recorded on jassid population revealed that activity of thrips started from second week of July (21 SW) and continued up to the crop termination i.e. last second week of December. The maximum jassid population (3.87 jassid / plant) was recorded in 4th week of November (38 SW) when maximum and minimum temperature and humidity respectively.

The leaf curl infestation of 9.1 per cent was first observed in third week of July (21 SW), which increased gradually and reached a maximum of 21.00 per cent in the 8th week after transplanting during 28th SW, when the maximum and minimum temperature and relative humidity were recorded.

Table 2: Seasonal incidence of sucking pests of chili during the 2019-20

Standard Week	Date and Month	Thrips/ leaf	Mites/leaf	White fly/ leaf	Aphids/ leaf	Jassids/ leaf
21	15 - 22 Jul	0.00	0.00	0.00	0.00	0.00
22	23 -29 Jul	4.33	4.41	4.38	0.59	3.11
23	30 Jul – 7 Aug	4.72	4.77	4.73	0.55	3.03
24	8 -15 Aug	4.23	5.73	5.71	4.77	4.52
25	16- 23 Aug	4.18	5.16	5.42	4.60	3.43
26	24 - 30 Aug	4.75	4.62	4.81	5.13	5.77
27	31 Aug- 7 Sep	4.41	4.78	4.53	5.01	3.74
28	8 -15 Sep	3.98	3.77	3.61	4.99	5.16
29	16-23 Sep	5.87	4.74	3.89	3.77	5.23
30	24 -30 Sep	5.15	7.78	4.55	4.42	4.55
31	1 - 7 Oct	6.78	6.45	5.12	5.18	5.13
32	8 - 15 Oct	6.23	4.73	5.17	5.27	5.45
33	16-23 Oct	7.47	4.17	6.11	6.14	5.64
34	24 -30 Oct	4.85	5.54	4.78	4.67	5.62
35	31 Oct - 7 Nov	7.24	6.21	4.85	4.81	6.32
36	8 – 15 Nov	5.73	6.78	5.51	5.64	6.27
37	16 – 23 Nov	6.13	5.41	6.87	6.13	6.42
38	24- 30 Nov	6.74	5.87	5.78	6.21	6.53
39	1 Dec- 7 Dec	7.41	6.23	5.61	5.83	5.75
40	8-15 Dec	6.25	6.69	6.21	6.52	6.31

Discussion

Seasonal incidence of thrips (*Scirtothrips dorsalis* Hood)

Observations recorded from thrips /three leaf states that first incidence of population was recorded from 1st week of January and it was nearly constant upto 4th standard week and then the population declined gradually upto 8th standard week. Peak population was recorded to be in 18th standard week i.e.,12.58/three leaves when the average temperature, relative humidity and weekly total rainfall were 31.2 0c, 66.79% and 17.8 mm respectively. The lowest population recorded was found in 5th standard meteorological week i.e., 0.11/ 3 leaf when the average temperature, relative humidity and weekly total rain fall were 21.52 0 C, 70.50 % and 0.0 mm respectively.

Correlation studies (Table 1) between thrips population and weather parameters revealed that population of thrips showed significant positive correlation with average temperature, maximum and minimum temperature and a Int. J. Curr. Microbiol. App. Sci (2018) 7(10): 2936-2948 2939 significant negative correlation with maximum relative humidity while

non-significant positive correlation with temperature difference and non-significant negative correlation with relative humidity (minimum and average) and weekly rainfall. This can be inferred as activity of thrips population increases with high temperature, high relative humidity and decreases with rainfall but population increases with the rise of temperature difference. The results were confirmed by Bhede *et al*., (2008) [4, 5] and Patel *et al*., (2009) [15].

Seasonal incidence of Mite (Polyphagotarsonemus latus Banks)

Population studies on mites observed as mite/three leaves stated that the mite infestation started from 1st SMW (1.00 mites/ three leaves) and the population tends to remain at a range of 1-6 mites/three leaves upto 7th SMW. A drastic increase in population was noticed in 8th SMW (12.22 mites/ three leaves) and then gradually declined upto 10thSMW. Then mite population suddenly increased from 13th SMW upto 19th SMW, where peak population was recorded to be 28.55/three leaves, when the average temperature, relative humidity and weekly total rainfall were recorded to be 31.040C, 74.29% and 71.1mm respectively. It was followed by gradually decline in population upto 25th SMW, leading to lowest recorded population i.e. 0.11/three leaves.

Correlation studies (Table 2) between mites population and weather parameters revealed that mites population showed a significant positive correlation with temperature difference, maximum temperature and average temperature while it showed significant negative correlation with relative humidity (maximum, minimum, average). A nonsignificant negative correlation was found between mite population and weekly total rainfall. The population of mites showed a non-significant positive correlation with minimum temperature. This inference drawn from correlation studies gives a account of mite population to increase with high temperature and temperature difference, while decreases with high relative humidity and heavy weekly total rainfall. The result was confirmed by Lingeri *et al*., (1998) [11], Bhede and Bhosle (2008) [4, 5], Patil *et al*., (2009) [15] and Chaven *et al*., (2003) [7].

Seasonal incidence of Aphid (Aphis gossypii Glov.)

The incidence of aphid started from 1st standard week i.e. 1.22 per three leaves; with peak population attained by 17th standard week i.e. 30.45 per three leaves when average temperature, relative humidity and weekly total rainfall were 33.760C, 67.29% and 0.0 mm respectively. Again population gradually declined from 18th to 26th standard week attaining lowest population in 33rd standard week. It is notably observed there was no incidence of aphids during 38th and 39th standard week.

Correlation studies revealed that the aphid population had a non-significant positive correlation with temperature difference while non-significant negative correlation with rainfall (weekly total) and relative humidity (minimum, average). On the contrary it showed significant positive correlation with temperature (maximum, minimum, average) while showed significant negative correlation with maximum relative humidity (Table 3). This indicates that activity of aphid population increases with increase in maximum, minimum and average temperature and decreases with rainfall. The pest population decreases under warm humid conditions. This result is also similar with the findings of Meena *et al*., (2013) [12] and Butani (1970) [6].

Seasonal incidence of Whitefly (*Bemesia tabaci* Genn.)

Observation taken showed that whitefly incidence started from 1st standard week (0.44/three leaves) reaching a peak population in 44th standard week i.e. 6.22 per three leaves when the average temperature, relative humidity and weekly total rainfall were 27.720 C, 84.00% and 7.4mm respectively.. Lowest Population was attained during 21st, 26th and 27th standard week i.e. 0.11 whitefly per three leaves. Correlation studies (Table 4) between whitefly population and weather parameters revealed that whitefly population showed significant positive correlation with temperature difference while significant negative correlation with minimum temperature and weekly total rainfall. On the contrary non-significant negative correlation was found between whitefly populations and temperature (maximum, average) and relative humidity (maximum, minimum, average). This indicates that activity of whitefly decrease with relative humidity, decrease in temperature and rainfall. This result is also similar with the findings of Khalid *et al*., (2009) [10].

Seasonal incidence of jassid (*Amrsca bigutula bigutula*)

Observations taken as jassid/three leaves revealed that infestation was started from 1st standard week (0.22/three leaves) with the peak population reaching in 20th standard week i.e. 1.45 per three leaves when the average temperature, relative humidity and weekly total rainfall were 29.050 C, 79.86% and 67.5 mm respectively. It also states that the jassid population was found to be less or negligible in the whole year. Correlation studies (Table 5) between jassid population and weather parameter revealed that the population of jassids showed a significant positive correlation with maximum temperature while non-significant negative relation correlation with relative humidity (maximum, minimum, average) and weekly total rainfall. On the contrary there was a non-significant positive correlation found between jassid population with temperature difference, minimum temperature and average temperature. This can be inferred that activity of jassids increases with temperature and decreases with heavy rains. The result is similar with the findings of Saini *et al*., (2017) [16].

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