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Investigations on population dynamics of sucking pests infesting chilli (*Capsicum annum* L.)

AT Chaudhary and HV Pandya

Abstract
Investigations were carried out on "Population dynamics of sucking pests infesting chilli [*Capsicum annum* L.]" at Instructional Farm, ASPEE College of Horticulture and Forestry, Regional Horticultural Research Station, Navsari Agricultural University, Navsari during 2017-18 and 2018-19.
Based on average data of two years, the results revealed that thrips population was from initiated 38th SMW and its appearance continued till crop maturity *i.e.* 3rd SMW indicating its peak level (5.85/3 leaves) during 49th SMW. Similarly, population of whitefly started appearing from 38th SMW (0.70/3 leaves) which reached to its peak level (7.30/3 leaves) during 47th SMW. The population of aphid started from 41st SMW (1.36/3 leaves) which increased gradually and reached its peak level (10.05/3 leaves) during 45th SMW. Lastly, mite population started appearing from 36th SMW (3.43/3 leaves) which reached to the peak level (18.93/3 leaves) during 43rd SMW.

Keywords: Chilli, *Capsicum annum* L., thrips, whitefly, aphid, mite

Introduction
In India, chilli is cultivated in 7.94 lakh hectares, while its production is 12.76 lakh MT and productivity 1.64 t/ha [2]. Andhra Pradesh, Karnataka and Maharashtra accounts for 75 per cent of total area and production in the country. In Gujarat, it is cultivated in area of 0.43 lakh hectares, with 0.68 lakh MT production and 1.58 t/ha productivity [2].
In India and Sri Lanka, chilli suffers from a malady called "murda" with characteristic leaf curl symptoms. This "murda" syndrome has been attributed to the attack of a tiny tarsonemid mite (*Polyphagotarsonemus latus* Banks) and thrips (*Scirtothrips dorsalis* Hood). Overall, yield loss due to thrips and mites is estimated to the tune of 50 per cent [1]. Apart from the sucking pests, the crop is also vulnerable to fruit borer *viz., (Helicoverpa armigera* Hubner) [19], with 20-30 per cent damage to chilli fruits by the pest.
The basic information on relative occurrence and population dynamics is necessary before deciding the strategy for management of any insect pest [12] and [13] studied the population dynamics of thrips, whitefly, mite and aphid in relation to weather parameters on chilli in north Karnataka and Rajasthan, respectively. Abundant literature is available on life history, feeding habit and control measures of thrips however, work on population dynamics of sucking pests infesting chilli is not much available hence, attempts were made to have comprehensive information on population dynamics of thrips, whitefly, mite and aphid infesting chilli in relation to weather parameters.

Materials and Methods
Present investigation on population dynamics of sucking pests infesting chilli [*Capsicum annum* L.] was carried out at Instructional Farm, Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari during late *kharif* 2017-18 and 2018-19. To study the effect of weather parameters on population fluctuation of chilli thrips, whitefly, aphids and mites chilli variety GVC-111 was raised. The experimental plot was laid out in 408 m^2 (20.40 m X 20 m) plot. The plot was kept without insecticidal spray to allow thrips, whitefly, mite and aphid to multiply throughout the season.
For recording the observations, 20 plants were randomly selected from net plot area. The observations on number of nymphs as well as adults were counted on three leaves at top, middle and bottom of each tagged plant. The observations were taken regularly at weekly interval from first week after transplanting to till harvest. The data on weather parameters were obtained from meteorological observatory college farm Navsari Agricultural University,

Navsari for the investigation. Regression equation was worked out for those weather parameters having significant correlation with population of chilli pest. The regression and correlation coefficient were worked out using standard statistical procedure.

Results and Discussion

Population of thrips was initiated from the third week after transplanting (WAT) *i.e.* 38th standard meteorological week (SMW) and continued till crop maturity *i.e*. 3rd SMW and reached to a peak level (5.80/3 leaves) during 14th WAT *i.e.* 49th SMW during 2017-18 (Table 1). During 2018-19, population of thrips was initiated from the third week after transplanting (WAT) *i.e.* 38th SMW and continued till crop maturity *i.e*. 3rd SMW and reached to the peak level (5.90/3 leaves) during 14th WAT *i.e.* 49th SMW. On the basis of average of two years, population of thrips was initiated from the third week after transplanting (WAT) *i.e.* 38th SMW and continued till to crop maturity *i.e*. 3rd SMW and reached the peak level (5.85 thrips/3 leaves) during 14th WAT *i.e.* 49th SMW.

The results of present investigation are in close confirmation with the past reports wherein, Lingeri (1998) [10] found that incidence of *S. dorsalis* was more pronounced during December to January month. The pest population tended to increase during dry period with lower minimum temperature and lower intensity of rainfall. Barot *et al*. (2012) [3] observed infestation of thrips from 1st week after transplanting *i.e.* last week of August and remained in field till the crop maturity *i.e.* 3rd week of February. Pathipati *et al*. (2014) [15] noticed peak thrips population in the 52nd Standard Meteorological Week. In all the earlier reports, active period and peak level of chilli thrips was noticed during December-January months when temperature remained low and relative humidity being lower, which is also mentioned in the reports of the current investigation hence current results are said to be in accordance with earlier reports.

Population of whitefly was started from 3rd WAT *i.e.* 38th SMW (0.80/3 leaves) and reached to the peak level (7.20/3 leaves) during 12th WAT *i.e.* 47th SMW during 2017-18 (Table 2). During 2018-19, population of whitefly was started from 3rd WAT *i.e.* 38th SMW (0.60/3 leaves) and reached to the peak level (7.40/3 leaves) during 12th WAT *i.e.* 47th SMW. Average of two years revealed that population of whitefly was started from 3rd WAT *i.e.* 38th SMW (0.70/3 leaves) and reached to the peak level (7.30/3 leaves) during 12th WAT *i.e.* 47th SMW. Earlier, Bhardiya and Patel (2005) [4] reported maximum population of whitefly on brinjal in the fourth week of October. Dhaka and Pareek (2008) [8] observed that the incidence of whitefly started in the second and third weeks of June and remained throughout the growth period of the crop. Meena *et al.* (2013) [13] observed that whitefly appeared on chilli crop soon after transplanting *i.e.* third week of July and continued up to harvest of the crop *i.e.* fourth week of November. These reports indicate almost the same trend of whitefly appearance as observed in the current investigation thus, the current results are said to be in confirmation.

Population of aphid was started from the (1.32/3 leaves) 6th WAT *i.e.* the 41st SMW. The population got increased gradually and reached the peak level (9.56/3 leaves) at 10th WAT coinciding with 45th SMW during 2017-18 (Table 3). During 2018-19, population of aphid was started from the (1.4/3 leaves) 6th WAT *i.e.* 41st SMW The population was increased gradually and reached the peak level (10.54/3 leaves) at 10th WAT coinciding with 45th SMW. Average of two years revealed that population of aphid was started from the (1.36/3 leaves) 6th WAT *i.e.* 41st SMW. The population was increased gradually and reached the peak level (10.05/3 leaves) at 10th WAT coinciding with 45th SMW. The results of present investigation are in close confirmation with past reports wherein Bhardiya and Patel (2005) [4] reported peak activity of aphid, *Aphis gossypii* on brinjal during third week of November. Meena *et al.* (2013) [13] observed that the aphid appeared little late during both the years in chilli crop. Roopa and Kumar (2014) [17] reported incidence of chilli aphid throughout the cropping season.

Population of mite was started from 1st WAT *i.e.* 36th SMW (4.23/3 leaves) and reached to the peak level (18.21/3 leaves) during 8th WAT *i.e.* 43rd SMW during 2017-18 (Table 4). During 2018-19, population of mite was started from 1st WAT *i.e*. 36th SMW (2.63/3 leaves) and reached to the peak level (19.64/3 leaves) during 8th WAT *i.e.* 43rd SMW. On the basis of average of two years, population of mite was started from 1st WAT *i.e.* 36th SMW (3.43/3 leaves) and reached to the peak level (18.93/3 leaves) during 8th WAT *i.e.* 43rd SMW. Lingeri *et al.* (1998) [10] reported mite population throughout the cropping period on all dates of transplanting wherein peak activity of chilli mite was noticed in the month of November. Patil and Nandihalli (2009) [16] reported maximum mite population during 42nd standard week and then decreased gradually till the termination of crop. There was gradual increase in yellow mite population from 2nd week of October and attaining peak (14.13 mite/3 leaves) during 2nd week of November (46th standard week). Meena *et al.* (2013) [13] revealed appearance of mite population from fourth week of July and continued up to fourth week of September indicating peak population in the second week of September. Active period of chilli mite was last week of October and November mentioned by the earlier workers which are also noticed in the current reports (4th week of October). Thus, results of the current investigation said to be confirmed.

Correlation studies

Highly significant negative correlation was found between thrips population on chilli and minimum temperature (r=-0.613) and average temperature (r=-0.563) during 2017-18 (Table 5). During 2018-19, highly significant negative correlation was found between thrips population on chilli and minimum temperature (r=-0.612). Average of two years revealed that highly significant negative correlation was found between thrips population on chilli and minimum temperature (r=-0.620) as well as average relative humidity (r=-0.572). Earlier, Lingeri *et al.* (1998) [10] reported increase in thrips population during dry period with lower minimum temperature. Kumar *et al.* (2006) [9] reported that thrips had negative correlation with relative humidity. Meena *et al*. (2013) [13] revealed that the population of thrips was negatively correlated with minimum and average temperature, maximum, minimum and average relative humidity. In the current investigation temperature and relative humidity exhibited negative correlation with thrips population which is also indicated by the earlier workers, thus present results are said to be in accordance with earlier reports.

Highly significant negative correlation was found between whitefly population on chilli and minimum temperature (r=-0.670), evening relative humidity (r=-0.629) and average relative humidity (r=-0.600) during 2017-18 (Table 6). During

2018-19, significant negative correlation was found between whitefly population on chilli and minimum temperature (r=-0.528), wind speed (r=-0.490) and rainfall (r=-0.477). Average of two years revealed that highly significant negative correlation was found between whitefly population on chilli and minimum temperature (r=-0.601), evening relative humidity (r=-0.612) and average relative humidity (r=-0.613). In past, Mane and Kulkarni (2011) [11] observed that when temperature and humidity increased, there was increase in the whitefly population and vice-versa. Bhute *et al*. (2012) [6] reported that morning RH and evening RH had significant and negative correlation with whitefly population. In the current investigation, positive relationship of temperature and negative relationship of relative humidity with whitefly population confirm with earlier reports and thus confirms the current investigation.

Highly significant positive correlation was found between aphid population on chilli and sunshine hours (r=0.571) during 2017-18 (Table 7). During 2018-19, highly significant negative correlation was found between aphid population on chilli and wind speed (r=-0.600). Average of two years revealed that population of aphids was highly significant negative correlation between aphid population on chilli and wind speed (r=-0.589) and highly significant positive correlation between aphid population and sunshine hours (r=0.620). Debaraj and Singh (2004) [7] reported negative correlation between temperature and aphid. Roopa and Kumar (2014) [17] revealed that the aphid population exhibited a negative correlation with maximum temperature, minimum temperature and sunshine. In the current investigation, correlation of minimum temperature and relative humidity found negative but non-significant correlation which is also indicated by Debaraj and Singh (2004) [7] which implies that with decrease in minimum temperature and relative humidity, there was corresponding increase in aphid population which is also indicated in the above reports thus, confirms the current results.

Highly significant positive correlation was found between mite population on chilli and maximum temperature (r=0.819), average temperature (r=0.711) and evaporation (r=0.876) during 2017-18 (Table 8). During 2018-19, highly significant positive correlation was found between mite population on chilli and maximum temperature (r=0.854), average temperature (r=0.750), wind speed (r=0.699), sunshine hours (r=0.574) and evaporation (r=0.596). Average of two years revealed that population of mite was highly significant positive correlation between mite population on chilli and maximum temperature (r=0.894), average temperature (r=0.738) and evaporation (r=0.832). Lingeri *et al.* (1998) [10] revealed highly significant positive correlation of temperature with mite population. Montasser *et al.* (2011) [14] reported significant positive relationship between temperature and mite population. In the current investigation, significant correlation of temperature was evident which in also reported by Lingeri *et al.* (1998) [10] and Montasser *et al.* (2011) [14] thus current results are in conformity with earlier reports.

Table 1: Population of thrips infesting chilli

Month	SMW	Week after transplanting	Mean number of thrips per three leaves		
			2017-18	2018-19	Average
4-10 Sept	36	1	0	0	0.00
11-17 Sept	37	2	0	0	0.00
18-24 Sept	38	3	0.50	0.60	0.55
25 Sept-1 Oct	39	4	0.80	1.20	1.00
2-8 Oct	40	5	1.40	1.60	1.50
9-15 Oct	41	6	2.00	2.30	2.15
16-22 Oct	42	7	2.30	2.50	2.40
23-29 Oct	43	8	2.80	2.80	2.80
30 Oct-5 Nov	44	9	3.50	3.40	3.45
6-12 Nov	45	10	4.20	4.30	4.25
13-19 Nov	46	11	4.60	4.80	4.70
20-26 Nov	47	12	4.80	5.12	4.96
27 Nov- 3 Dec	48	13	5.40	5.60	5.50
4-10 Dec	49	14	5.80	5.90	5.85
11-17 Dec	50	15	5.10	5.70	5.40
18-24 Dec	51	16	4.60	4.85	4.73
25-31 Dec	52	17	3.52	3.86	3.69
1-7 Jan	1	18	2.20	3.10	2.65
8-14 Jan	2	19	1.80	2.80	2.30
15-21 Jan	3	20	1.10	1.20	1.15

SMW- Standard Meteorological Week

Table 2: Population of whitefly infesting chilli

Month	SMW	Week after transplanting	Mean number of whitefly per three leaves		
			2017-18	2018-19	Average
4-10 Sept	36	1	0	0	0.00
11-17 Sept	37	2	0	0	0.00
18-24 Sept	38	3	0.80	0.60	0.70
25 Sept-1 Oct	39	4	1.20	1.10	1.15
2-8 Oct	40	5	1.80	1.50	1.65
9-15 Oct	41	6	2.60	2.30	2.45
16-22 Oct	42	7	3.25	3.56	3.41

23-29 Oct	43	8	4.12	4.85	4.49
30 Oct-5 Nov	44	9	5.13	5.61	5.37
6-12 Nov	45	10	5.60	5.90	5.75
13-19 Nov	46	11	6.80	6.80	6.80
20-26 Nov	47	12	7.20	7.40	7.30
27 Nov- 3 Dec	48	13	6.10	7.10	6.60
4-10 Dec	49	14	5.42	6.52	5.97
11-17 Dec	50	15	5.10	5.89	5.50
18-24 Dec	51	16	4.23	4.62	4.43
25-31 Dec	52	17	4.80	4.21	4.51
1-7 Jan	1	18	3.58	3.52	3.55
8-14 Jan	2	19	2.58	3.10	2.84
15-21 Jan	3	20	1.23	1.50	1.37

SMW- Standard Meteorological Week

Table 3: Population of aphid infesting chilli

Month	SMW	Week after transplanting	Mean number of aphid per three leaves		
			2017-18	2018-19	Average
4-10 Sept	36	1	0	0	0
11-17 Sept	37	2	0	0	0
18-24 Sept	38	3	0	0	0
25 Sept-1 Oct	39	4	0	0	0
2-8 Oct	40	5	0	0	0
9-15 Oct	41	6	1.32	1.40	1.36
16-22 Oct	42	7	4.21	2.50	3.36
23-29 Oct	43	8	5.42	4.98	5.20
30 Oct-5 Nov	44	9	8.52	8.63	8.58
6-12 Nov	45	10	9.56	10.54	10.05
13-19 Nov	46	11	6.21	7.25	6.73
20-26 Nov	47	12	4.21	5.21	4.71
27 Nov- 3 Dec	48	13	2.10	3.41	2.76
4-10 Dec	49	14	1.20	1.00	1.10
11-17 Dec	50	15	0.89	0.62	0.76
18-24 Dec	51	16	0.60	0.42	0.51
25-31 Dec	52	17	0.40	0.23	0.32
1-7 Jan	1	18	0	0	0
8-14 Jan	2	19	0	0	0
15-21 Jan	3	20	0	0	0

SMW- Standard Meteorological Week

Table 4: Population of mites infesting chilli

Month	SMW	Week after transplanting	Mean number of mite per three leaves		
			2017-18	2018-19	Average
4-10 Sept	36	1	4.23	2.63	3.43
11-17 Sept	37	2	6.96	4.52	5.74
18-24 Sept	38	3	8.00	7.89	7.95
25 Sept-1 Oct	39	4	9.62	10.23	9.93
2-8 Oct	40	5	11.42	12.52	11.97
9-15 Oct	41	6	15.23	16.34	15.79
16-22 Oct	42	7	16.82	18.23	17.53
23-29 Oct	43	8	18.21	19.64	18.93
30 Oct-5 Nov	44	9	17.52	18.23	17.88
6-12 Nov	45	10	12.52	16.20	14.36
13-19 Nov	46	11	10.23	14.30	12.27
20-26 Nov	47	12	5.31	8.20	6.76
27 Nov- 3 Dec	48	13	3.15	6.40	4.78
4-10 Dec	49	14	1.23	2.10	1.67
11-17 Dec	50	15	0	0	0
18-24 Dec	51	16	0	0	0
25-31 Dec	52	17	0	0	0
1-7 Jan	1	18	0	0	0
8-14 Jan	2	19	0	0	0
15-21 Jan	3	20	0	0	0

SMW- Standard Meteorological Week

Table 5: Correlation between weather parameters and thrips population infesting chilli

S. No.	Year	Temperature (˚C)			Relative Humidity (%)			Wind Speed (km/hr)	Sunshine (hours)	Evaporation (mm/day)	Rainfall (mm)
		Maximum	Minimum	Average	Morning	Evening	Average				
1	2017-18	-0.257	-0.613**	-0.563**	-0.462*	-0.513*	-0.537*	-0.005	0.147	-0.465*	-0.138
2	2018-19	-0.030	-0.612**	-0.443	-0.283	-0.427	-0.422	-0.328	0.166	0.030	-0.490*
3	Average	-0.144	-0.620**	-0.508*	-0.505*	-0.544*	-0.572**	-0.248	0.165	-0.279	-0.308

* Significant at 5 per cent level (r = ± 0.444); ** Significant at 1 per cent level (r = ± 0.561)

Table 6: Correlation between weather parameters and whitefly population infesting chilli

S. No.	Year	Temperature (˚C)			Relative Humidity (%)			Wind Speed (km/hr)	Sunshine (hours)	Evaporation (mm/day)	Rainfall (mm)
		Maximum	Minimum	Average	Morning	Evening	Average				
1	2017-18	-0.068	-0.670**	-0.527*	-0.420	-0.629**	-0.600**	-0.207	0.350	-0.290	-0.225
2	2018-19	0.153	-0.528*	-0.303	-0.314	-0.385	-0.413	-0.490*	0.302	0.117	-0.477*
3	Average	0.047	-0.601**	-0.419	-0.490*	-0.612**	-0.613**	-0.449*	0.357	-0.121	-0.369

* Significant at 5 per cent level (r = ± 0.444); ** Significant at 1 per cent level (r = ± 0.561)

Table 7: Correlation between weather parameters and aphid population infesting chilli

S. No.	Year	Temperature (˚C)			Relative Humidity (%)			Wind Speed (km/hr)	Sunshine (hours)	Evaporation (mm/day)	Rainfall (mm)
		Maximum	Minimum	Average	Morning	Evening	Average				
1	2017-18	0.458*	-0.190	0.050	-0.287	-0.434	-0.413	-0.337	0.571**	0.421	-0.223
2	2018-19	0.526*	-0.039	0.204	-0.171	-0.032	-0.113	-0.600**	0.533*	0.418	-0.226
3	Average	0.536*	-0.119	0.131	-0.331	-0.385	-0.394	-0.589**	0.620**	0.460*	-0.273

* Significant at 5 per cent level (r = ± 0.444); ** Significant at 1 per cent level (r = ± 0.561)

Table 8: Correlation between weather parameters and mite population infesting chilli

S. No.	Year	Temperature (˚C)			Relative Humidity (%)			Wind Speed (km/hr)	Sunshine (hours)	Evaporation (mm/day)	Rainfall (mm)
		Maximum	Minimum	Average	Morning	Evening	Average				
1	2017-18	0.819**	0.497*	0.711**	0.279	0.170	0.228	-0.350	0.353	0.876**	0.034
2	2018-19	0.854**	0.530*	0.750**	-0.189	-0.044	-0.130	-0.699**	0.574**	0.596**	-0.162
3	Average	0.894**	0.517*	0.738**	0.106	0.083	0.099	-0.640**	0.491*	0.832**	-0.034

* Significant at 5 per cent level (r = ± 0.444); ** Significant at 1 per cent level (r = ± 0.561)

Conclusion
From the present investigation, it is concluded that population of thrips, whitefly, aphid and mite was higher during November and December. Maximum temperature, average relative humidity, wind speed, sunshine hours and evaporation influenced the infestation of thrips, whitefly, aphid and mite.

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References
1. Ahmed K, Mehmood MG, Murthy NSR. Losses due to various pests in pepper. *Capsicum* Newsletter. 1987; 6:83-84.
2. Anonymous. Spices Board, Ministry of commerce and Industry, Ministry of Agriculture, Govt of India, 2013-14. (13153 and 14268).
3. Barot BV. Patel JJ, Shaikh AA. Population dynamics of chilli thrips, *Scirtothrips dorsalis* Hood in relation to weather parameters. AGRES – Int. e-J. 2012; 1(4):480-485.
4. Bharadia AM, Patel BR. Succession of insect pests of brinjal in north Gujarat. Pest Manag. Econ. Zool. 2005; 13(1):159-161.
5. Bhede BV, Suryawanshi DS, More DG. Population dynamics and bio-efficacy of newer insecticide against chilli thrips, *Scirtothrips dorsalis* (Hood). Indian J Ent. 2008; 70(3):223-226.
6. Bhute NK, Bhosle BB, Bhede BV, More DG. Population dynamics of major sucking pests of Bt. cotton. Indian J Ent. 2012; 74(3):246-252.
7. Debaraj Y, Singh TK. Population dynamics of cabbage aphid *Brevicoryne brassicae* (Linn.) in relation to abiotic and biotic factors at different altitudes of Manipur. Indian J Ent. 2004; 66(2):172-175.
8. Dhaka SR, Pareek BL. Weather factors influencing population dynamics of major insect pests of cotton under semi-arid agro-ecosystem. Indian J Ent. 2008; 70(2):157-163.
9. Kumar MR, Reddy KL, Lakshmi V, Reddy DR, Gour TB. Survey of thrips infesting roses and its relation with weather parameters. Indian J Ent. 2006; 68(2):197-202.
10. Lingeri MS, Awaknavar JS, Lingappa S, Kulkarni KA. Seasonal occurrence of chilli mites (*Polyphagotarsonemus latus* Banks) and thrips (*Scirtothrips dorsalis* Hood). Karnataka J Agri. Sci. 1998; 11(2):380-385.
11. Mane PD, Kulkarni SN. Population dynamics of whitefly, *Bemisia tabaci* on brinjal. Int. J Plant Prot. 2011; 4(1):140-142.
12. Manjunatha M, Hanchinal SG, Reddy GVP. Survey of yellow mite and thrips on chilli in North Karnataka. Insect Envirn. 2001; 6(4):178.
13. Meena RS, Ameta OP, Meena BL. Population dynamics of sucking pests and their correlation with weather parameters in chilli, *Capsicum annum* L. crop. The Bioscan. 2013; 8(1):177-180.

14. Montasser AA, Marzouk AS, Hanafy ARI, Hassan GM. Seasonal fluctuation of the broad mite *Polyphagotarsonemus latus* (Acari: Tarsonemidae) and its predatory mites on some pepper cultivars in Egypt. Int. J Envirn. Sci. Engineering. 2011; 2:9-20.
15. Pathipati VL, Vijayalakshmi T, Naidu LN. Seasonal incidence of major insect pests of chilli in relation to weather parameters in Andhra Pradesh. Pest Management Hortil. Ecosystems. 2014; 20(1):36-40.
16. Patil RS, Nandihalli, BS. Seasonal incidence of mite pests on brinjal and chilli. Karnataka J Agri. Sci. 2009; 22(3):729-731.
17. Roopa M, Kumar CTA. Seasonal incidence of pests of capsicum in Bangalore conditions of Karnataka, India. Global J Biol. Agri. Health Sci. 2014; 3(3):203-207.
18. Saha SR, Rashid MH, Yasmin L, Alam MM, Hossain MA. Disease insect reactions of sweet pepper under the field conditions of Bangladesh. Int. J Sustainable Crop Prod. 2007; 2(6):6-9.
19. Shivaramu K, Kulkarni KA. Integrated management of chilli fruit borer, *H. armigera* Hub. Proc. II Nation. Symp. on Integrated Pest Management in Horticulture Crops: New Molecules, Bio pesticides and Environment, held at Bangalore 17-19th, 2001, 59-60.