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# Population Dynamics of Thrips *Scirtothrips dorsalis* Hood as Influenced by Staggered Planting of Chilli under Bengaluru Conditions

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Abstract

Population dynamics of thrips, *Scirtothrips dorsalis* Hood as influenced by staggered planting of chilli crop under Bengaluru conditions (IIHR, Hessaraghatta) was studied during kharif and rabi seasons of 2015-16 and 2016-17. During kharif season of 2015-16, peak population of thrips over different plantings was 11.93-28.87 thrips / plant when the crop age was between 74 and 103 days, coincided with II$^{nd}$ FN of October. Also a second peak (6.6 - 12 thrips / plant) on kharif crop was during mid - December, when the crop age was 132-160 days. During 2016-17 thrips incidence was relatively low (1.4 - 4.33) during mid-October and modest (3.93-8.33) during early December (crop aged 168 - 200 days). On rabi crop of 2015-16, a more evident peak (26.33-76.20 thrips) was during I$^{st}$ FN of March when the crop age was 104-136 days, but the peak activity of thrips was observed from entire February to beginning of March during 2016-17 rabi season (36-46.13 thrips / plant, the crop aged 85-108 days). Multiple linear regression analysis indicated positive impact of maximum temperature, bright sunshine hours and evaporation, negative effect of rainfall and wind speed on the abundance of thrips, which accounted for 50-79 per cent variation in the activity of thrips attributed to weather factors. With reference to age of the crop / crop phenology, thrips activity started at the early stage, reached peak by middle age with one to two distinct peaks and declined further as the crop attained maturity. This crop age-related population buildup pattern of *S. dorsalis* was more or less similar irrespective of the planting time and the cropping season.

Keywords : Chilli, population dynamics, thrips and staggered planting

Chilli (*Capsicum annuum* L.) is one of the important spice cum vegetable crops grown for domestic market as well as export purpose. In India, Karnataka occupies a prime place in chilli cultivation and enjoys (I and II) position in crop area coverage (25.75%) and production (29%), respectively (Anon, 2014-15). About 25 insects have been recorded infesting chilli leaves and fruits, of which, thrips, *S. dorsalis* is considered as the most serious and important pest (Butani, 1976). Amin (1979) described the symptoms of chilli leaf curl malady caused by feeding injury of thrips, while, Dadasaheb (2013) estimated loss in the yield of green chilli due to thrips to range from 74 to 75 per cent. The variability in thrips populations on crops is determined by the natural growth of the population and the influence of weather on thrips activity and their multiplication rate (Kirk, 1997). An understanding of the factors that influences such population changes is essential in predicting the population of thrips. Weather variables including rainfall, temperature, relative humidity and wind speed have been reported as important factors that significantly affect thrips numbers (Ananthakrishnan, 1993: Kirk, 1997). A basic understanding of the relationship of weather factors with thrips population is important in developing an integrated management strategy for thrips on chilli crop and in planning suitable control measures under a given set of climatic conditions. The prime objective of the present study was to determine the population fluctuation pattern of thrips on staggered planted chilli crop and to investigate on the association of population density of thrips with weather parameters, natural enemies abundance and phenology of the crop. The data generated as well would be useful for predicting chilli thrips outbreaks under varied climatic conditions and to evolve suitable control / management strategies.

## Material and Methods

To study the population dynamics of the thrips, *S. dorsalis* under field conditions, the chilli cultivar, Arka Meghana was grown in 0.2 ha area with a spacing of 60×30cm with staggered planting at fortnightly interval during May-June months in kharif and during October-November months in rabi season. The study was carried out in the Vegetable block of Indian Institute of Horticultural Research, Hessaraghatta, Bengaluru during kharif and rabi seasons of 2015-16 and 2016-17. Recommended agronomic practices except plant protection measures were followed for raising the crop. The whole experimental plot was divided into 3 equal quadrats considering them as replications. Population of thrips was recorded at weekly interval from five randomly selected plants in each quadrate by tapping the growing tip of the plant on a white acrylic sheet. Observations were recorded as soon as the thrips appeared / noticed to be fairly active and continued up to final picking / harvest of chilli fruits. The data recorded were expressed as average number of thrips / 3 tappings / plant. To determine the effect of various weather parameters on fluctuation of *S.dorsalis* on chilli crop, weather data of meteorological laboratory in the IIHR farm were made used. Weather data including natural enemies abundance and crop age (as independent variables) and thrips population data (dependent variable) were subjected to Correlation and Multiple Regression Analysis to determine the influence of these factors on the activity of thrips during the cropping period in different seasons.

## Results and Discussion

*Scirtothrips dorsalis* population data as influenced by planting date (&crop age) during rainy season/ kharif of 2015-16 and 2016-17 are presented in Table 1-4.

### Kharif season 2015-16 (planting July-August 2015)

Occurrence of *S.dorsalis* on chilli crop was observed from 3rd week of September (*i.e.,* 38th std. week) and continued for the entire crop period. Thrips population was low (1.07, 0.33 and 0.13 thrips/plant) on I, II and III plantings, which corresponded to 75, 65 and 55 days age of the crop, respectively. Thrips number gradually increased and reached peak 21.53, 23.27, 28.87 and 11.93 thrips/plant) corresponding with planting and crop age (I,II, III and IV plantings, 103, 93, 83 and 74 days old crop) by 3rd week of October (42ndstd.week). Further, the population showed a declining trend till 1st week of November. Subsequent peak of 17.6 thrips /plant was evident on 131 days old crop of the I planting by second week of November, but on other plantings, thrips population was found till 1st week of December. Another simultaneous population peak was observed on all plantings (11.47, 12.00, 11.53 and 6.6 thrips / plant corresponding with 159, 149, 139 and 133 days age of chilli crop) during second week of December (50th std. week). As the crop matured with final harvest of chilli fruits, thrips population recorded a declining trend (Table I).

With respect to the age of the crop the thrips population was initially low (1.07, 0.33, 0.13 and 0.13 thrips / plant) on I, II, III and IV plantings (55 to 75 days old early stage crop,) and showed peak21.53, 23.27, 28.87 and 11.93 thrips / plant, on 103 to 74 days old mid stage crop,and decreased to (4.53, 6.80, 4.53 and 2.93 thrips / plant on 187 to 161 days late stage crop nearing maturity stage (Fig.1). The occurrence of thrips on first planting is late (75 days after planting) compared to other plantings (60 to 65 days after planting)and the lowest incidence (0.13-11.93 thrips/ plant) was observed on the fourth crop planted during first week of August (31th std. week) compared to other plantings (up to 29 thrips/plant).

### Kharif season 2016-17 (planting May-June)

During kharif 2016-17 (May-June planting) the population of thrips on first planting showed build-up from early stage and reached peak (5.73 thrips / plant) during 4th week of July, the population decreased by the 3rd week of October, then observed increasing by 4th week of October. The population increased to (6 thrips / plant) during last week of November and recorded modest population till the maturity of the crop with I, II, III, IV and V plantings, the incidence remained low till the late stage of the crop, that reached peak inch before the crop maturity (8.33, 3.93, 8.47 and 12.73 thrips / plant) by 48, 47, 50 and 50 standard weeks, which corresponds to 189, 168 days crop age, during second and first fortnights of November and December. The population was usually low during early

TABLE I

*Population of thrips,* S. dorsalis *on staggered planting of chilli during kharif season 2015-16*

| Recording of observation (std. week) | Number of thrips* | | | |
|---|---|---|---|---|
| | Planting-1 (crop age) | Planting-2 (crop age) | Planting-3 (crop age | Planting-4 (crop age) |
| 23/09/15 (38) | 1.07 (75) | 0.33(65) | 0.13 (55) | - |
| 1/10/15 (39) | 5.00(82) | 1.27(72) | 0.20(62) | - |
| 9/10/15 (40) | 4.33(89) | 2.67(79) | 0.53(69) | 0.13(60) |
| 14/10/15 (41) | 11.47(96) | 12.33(86) | 10.60(76) | 4.20(67) |
| 20/10/15 (42) | 21.53(103) | 23.27(93) | 28.87(83) | 11.93(74) |
| 27/10/15 (43) | 18.13(110) | 18.07(100) | 17.27(90) | 9.27(81) |
| 04/11/15 (44) | 12.93(117) | 15.33(107) | 10.27(97) | 7.20(88) |
| 14/11/15 (46) | 17.60(131) | 14.00(121) | 12.27(111) | 5.93(95) |
| 21/11/15 (47) | 2.93(138) | 2.73(128) | 3.33(118) | 1.73(102) |
| 26/11/15 (48) | 3.27(145) | 3.53(135) | 3.80(125) | 1.93(119) |
| 06/12/15 (49) | 6.73(152) | 6.87(142) | 5.20(132) | 3.00(126) |
| 15/12/15 (50) | 11.47(159) | 12.00(149) | 11.53(139) | 6.60(133) |
| 21/12/15 (51) | 4.33(166) | 5.87(156) | 7.20(146) | 3.20(140) |
| 29/12/15 (52) | 8.33(173) | 7.73(163) | 7.87(153) | 3.87(147) |
| 08/01/16 (2) | 7.13(180) | 6.27(170) | 5.67(1160) | 4.60(154) |
| 21/01/16 (3) | 4.53(187) | 6.80(177) | 4.53(167) | 2.93(161) |

** mean of 3 tappings of young shoots/plant*

and mid-stage of the crop, increased as the crop advanced and remained active till the crop end. The occurrence of the thrips across different plantings also followed the same pattern. The activity observed early on first planting compared to subsequent plantings (Table II and Fig.1).

**Rabi 2015-16 (planting October-November 2015)**

The thrips population data as influenced by planting date (&crop age) during rabi season of 2015-16 are presented in Table III. Thrips incidence was relatively late compared to kharif crop, but modest, 5.73, 4.67 and 4.47 thrips/plant on I, II and III plantings corresponding with 108, 98 and 92 days old crop. The population gradually increased and reached peak (39.27 76.20, 51.87 and 26.33 in I, II, III and IV

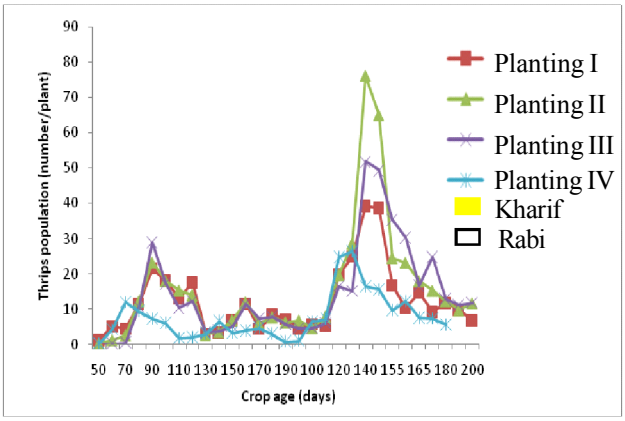


Fig. 1: Influence of crop age on chilli thrips population during 2015-16

plantings when the crop age was 136, 126, 120 and 104 days, respectively by second week of March (10th std. week). The thrips activity gradually decreased towards maturity. The thrips population observed more

TABLE II

*Population of thrips,* S. dorsalis *on staggered planting of chilli during kharif season 2016-17*

| Recording of observation (std. week) | Number of thrips* | | | | |
|---|---|---|---|---|---|
| | Planting-I (crop age) | Planting-II (crop age) | Planting-III (crop age | Planting-IV (crop age) | Planting-V (crop age) |
| 13/07/16 (28) | 0.47(61) | 0.80(49) | 0.60(35) | - | - |
| 20/07/16 (29) | 3.47(68) | 1.73(56) | 0.47(42) | - | - |
| 27/07/16 (30) | 5.73(75) | 3.00(63) | 0.47(49) | - | - |
| 03/08/16 (31) | 0.73(82) | 0.27(70) | 0.07(56) | - | - |
| 10/08/16 (32) | 3.60(89) | 1.60(77) | 0.87(63) | 0.07(54) | - |
| 17/08/16 (33) | 1.53(96) | 2.20(84) | 0.73(70) | 0.53(61) | 0.20(52) |
| 23/08/16 (34) | 1.20(103) | 0.93(91) | 0.73(77) | 0.87(68) | 0.13(59) |
| 31/08/16 (35) | 1.60(110) | 1.27(98) | 0.33(84) | 1.60(75) | 1.73(66) |
| 06/09/16 (36) | 0.33(117) | 0.33(105) | 1.33(91) | 1.07(82) | 0.13(73) |
| 14/09/16 (37) | 0.93(124) | 0.67(112) | 0.47(98) | 1.53(89) | 1.07(80) |
| 21/09/16 (38) | 0.33(131) | 0.47(119) | 0.40(105) | 0.40(96) | 0.53(87) |
| 28/09/16 (39) | 0.67(138) | 0.27(126) | 0.27(112) | 2.07(103) | 1.47(94) |
| 05/10/16 (40) | 0.53(145) | 0.60(133) | 0.73(119) | 0.67(110) | 1.13(101) |
| 13/10/16 (41) | 0.27(152) | 0.33(140) | 0.67(126) | 1.73(117) | 0.60(108) |
| 19/10/16 (42) | 2.13(159) | 2.07(147) | 2.27(133) | 0.87(124) | 2.13(115) |
| 26/10/16 (43) | 4.33(166) | 3.20(154) | 3.07(140) | 4.27(131) | 1.40(122) |
| 02/11/16 (44) | 2.80(173) | 1.40(161) | 0.93(147) | 0.60(138) | 0.47(129) |
| 09/11/16 (45) | 2.67(180) | 2.60(168) | 2.47(154) | 1.93(145) | 2.13(136) |
| 19/11/16 (46) | 2.27(187) | 6.33(175) | 2.00(161) | 5.53(152) | 2.60(143) |
| 24/11/16 (47) | 2.53(194) | 7.27(182) | 3.93(168) | 3.87(160) | 2.60(150) |
| 30/11/16 (48) | 6.00(201) | 8.33(189) | 3.40(175) | 2.07(167) | 4.13(157) |
| 06/12/16 (49) | 5.73(208) | 2.40(196) | - | 5.60(174) | 6.00(164) |
| 14/12/16 (50) | 3.87(215) | 3.60(203) | - | 8.47(181) | 12.73(171) |
| 21/12/16 (51) | - | - | - | 7.87(188) | 8.73(178) |

** mean of 3 tappings of young shoots/plant*

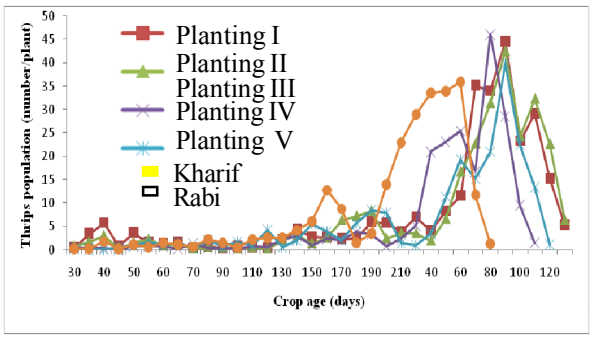


Fig. 2: Influence of crop age on chilli thrips population during 2016-17

on I, II and III plantings (5.73-39.27, 4.67-76.20 and 4.47 to 51.87 thrips / plant, respectively) compared to IV planting planted during last week of November (0.80-26.33 thrips / plant).

**Rabi 2016-17(planting October –November 2016)**

Thrips population during rabi 2016-17 increased gradually from the early stage of the crop and the peak population of 44.53, 42.53, 46.13, 39.80 and 36 thrips / plant was observed from 6-9 standard weeks (February 2017) on 85-108 days crop, was gradually

TABLE III

*Population of thrips,* S. dorsalis *on staggered planting of chilli during rabi season 2015-16*

| Recording of observation (std. week) | Number of thrips* | | | |
|---|---|---|---|---|
| | Planting-I (crop age) | Planting-II (crop age) | Planting-III (crop age | Planting-IV (crop age) |
| 10/02/16 (6) | 5.73 (108) | 4.67 (98) | 4.47 (92) | 0.80 (76) |
| 17/02/16 (7) | 5.27 (115) | 7.87 (105) | 5.93 (99) | 1.07 (83) |
| 23/02/16 (8) | 19.87 (122) | 19.73 (112) | 16.53 (106) | 6.40 (90) |
| 03/03/16 (9) | 24.87 (129) | 28.60 (119) | 15.13 (113) | 7.13 (97) |
| 11/03/16 (10) | 39.27 (136) | 76.20 (126) | 51.87 (120) | 24.67 (104) |
| 18/03/16 (11) | 38.73 (143) | 65.07 (133) | 49.27 (127) | 26.33 (111) |
| 25/03/16 (12) | 16.73 (150) | 24.53 (140) | 35.40 (134) | 16.33 (118) |
| 30/03/16 (13) | 10.27 (157) | 23.20 (147) | 30.27 (141) | 15.47 (125) |
| 05/04/16 (14) | 14.73 (164) | 18.00 (154) | 16.73 ( 148) | 9.60 (132) |
| 15/04/16 (15) | 9.20 (171) | 15.27 (161) | 24.73 (155) | 12.13 (139) |
| 23/04/16 (16) | 11.73 (178) | 12.20 (168) | 12.80 (162) | 7.47 (146) |
| 28/04/16 (17) | 9.80 (185) | 9.73 (175) | 11.13 (169) | 7.27 (153) |
| 06/05/16 (8) | 6.60 (192) | 11.73 (182) | 11.73 (176) | 5.53 (160) |

** mean of 3 tappings of young shoots / plant*

TABLE IV

*Population of thrips,* S. dorsalis *on staggered planting of chilli during rabi season 2016-17*

| Recording of observation (std. week) | Number of thrips* | | | | |
|---|---|---|---|---|---|
| | Planting-I (crop age) | Planting-II (crop age) | Planting-III (crop age | Planting-IV (crop age) | Planting-V (crop age) |
| 28/12/16 (52) | 7.00(66) | 3.53(55) | - | - | - |
| 06/01/17 (1) | 4.07(73) | 2.00(62) | 0.80(54) | 1.40(40) | - |
| 11/01/17 (2) | 8.27(80) | 6.60(69) | 2.40(61) | 1.00(47) | 1.47(36) |
| 19/01/17 (3) | 11.60(87) | 16.73(76) | 5.20(68) | 3.40(54) | 3.47(43) |
| 25/01/17 (4) | 35.13(94) | 22.80(83) | 21.00(75) | 11.27(61) | 13.93(50) |
| 01/02/17 (5) | 33.93(101) | 31.40(90) | 23.13(82) | 19.20(68) | 22.93(57) |
| 08/02/17 (6) | 44.53(108) | 42.53(97) | 25.47(89) | 15.20(75) | 29.00(64) |
| 15/02/17 (7) | 23.33(115) | 24.33(104) | 16.80(96) | 21.00(82) | 33.60(71) |
| 22/02/17 (8) | 29.13(122) | 32.33(111) | 46.13(103) | 39.80(89) | 33.93(78) |
| 01/03/17 (9) | 15.20(129) | 22.67(118) | 28.60(110) | 22.60(96) | 36.00(85) |
| 08/03/17 (10) | 5.20(136) | 6.33(125) | 9.60(117) | 13.40(103) | 11.73(92) |
| 15/03/17 (11) | 0.53(143) | 0.87(132) | 1.53(124) | 1.07(110) | 1.27(99) |

* mean of 3 tappings of young shoots / plant

decreased. Thrips incidence ranged from 0.53-44.53, 0.87-42.53, 0.80-46.13, 1.07-39.80 and 1.27-36 thrips / plant on I, II, III, IV and V plantings, respectively. As observed and recorded in other seasons, the thrips population build up from early stage of the crop, reached peak on middle aged crop and declined at crop maturity. This population buildup trend was more or less similar or uniform with all the plantings (Table IV and Fig. 2).

**Influence of abiotic and biotic factors on the abundance of chilli thrips**

Incidence of *S. dorsalis versus* abiotic (weather parameters) and biotic (natural enemies and crop age) over different plantings during 2015-16 revealed significant positive association of minimum temperature (0.19**), afternoon relative humidity (0.11**), evaporation (0.33**), wind speed (0.14*), sunshine hours (0.24**) and natural enemies (coccinellids, spiders *etc.)* (0.10**), while rainfall (-0.21**) exhibited negative significant association with thrips population with I planting. In the II planting, the thrips population was positively correlated with maximum temperature (0.41*), evaporation (0.41*) and natural enemies (0.70**). Significant positive correlation for thrips population in III and IV plantings were, maximum temperature (0.53*; 0.57*), minimum temperature (0.38**; 0.47*), evaporation (0.50**; 0.50*) and natural enemies (0.7**; 0.76*).

Multiple linear regression analysis indicated that thrips population increased by 5.21 units, 4.81units and decreased by 0.18 units with maximum temperature, minimum temperature and crop age, respectively with I planting. With II planting, the population decreased by 7.04 and 29.03 units with wind speed and crop age, respectively. The population decreased by 7.34 and 3.88 units with wind speed with III and IV plantings, respectively (Table V).

TABLE V

*Correlation and regression analysis of thrips population with abiotic (weather factors) and biotic factors (natural enemies and age of the crop - phenology) during 2015-16*

| Variables | Correlation (Linear) | | | | Multiple Linear Regression | | | |
|---|---|---|---|---|---|---|---|---|
| | P I | P II | P III | P IV | P I | P II | P III | P IV |
| $X_1$ | 0.34 | 0.41* | 0.53* | 0.57** | 5.21* | 4.44 | 5.47 | 0.93 |
| $X_2$ | 0.19** | 0.22 | 0.38** | 0.47* | 4.81** | -3.15 | -2.86 | 0.54 |
| $X_3$ | 0.02 | -0.11 | -0.15 | -0.09 | 0.61 | 1.22 | 0.71 | 0.41 |
| $X_4$ | 0.11** | -0.02 | 0.04 | 0.04 | 0.39 | 0.35 | 0.05 | -0.17 |
| $X_5$ | 0.33** | 0.41* | 0.50** | 0.50** | -0.80 | 1.14 | -1.60 | -0.51 |
| $X_6$ | 0.14** | 0.08 | 0.05 | 0.22 | -2.90 | -7.04* | -7.34* | -3.88* |
| $X_7$ | -0.21** | -0.22 | -0.27 | 0.33 | -0.14 | -0.13 | -0.12 | -0.04 |
| $X_8$ | 0.24** | 0.22 | 0.23 | 0.09 | 1.57 | 0.50 | 0.10 | 0.10 |
| $X_9$ | 0.10** | 0.70** | 0.70** | 0.76** | 7.38 | 29.03** | 20.81 | 13.09** |
| $X_{10}$ | -0.04 | 0.05 | 0.16 | 0.04 | -0.18* | -0.12 | -0.12 | 0.01 |

**Significant at 1 per cent; *Significant at 5 per cent; P-Planting

$X_1$- Max. Temp.; $X_2$-Min. Temp.;$X_3$- RH (Morning); $X_4$- RH (Afternoon); $X_5$- Evaporation; $X_6$- Wind speed; $X_7$-Rainfall; $X_8$- Sunshine hours; $X_9$- Natural enemies; $X_{10}$- Crop age.

**Multiple regression analysis of thrips population during 2015-16 as follows:**

1. Y (Thrips I planting) =-96.32+5.21*$X_1$-4.81**$X_2$+0.61$X_3$+0.39$X_4$-0.80$X_5$-2.90$X_6$-0.14$X_7$+1.57$X_8$ +7.38$X_9$-0.18*$X_{10}$; $R^2$=0.63
2. Y (Thrips II planting) =-153+4.44$X_1$-3.15$X_2$+1.22$X_3$+0.35$X_4$+1.14$X_5$-7.04*$X_6$-.13$X_7$0.50$X_8$ +29.03X**$_9$-0.12$X_{10}$; R2=0.77
3. Y (Thrips III planting) =-121+5.47$X_1$-2.86$X_2$+0.71$X_3$+0.05$X_4$-1.60$X_5$-7.34*$X_6$-0.12$X_7$+0.10$X_8$ -20.81$X_9$-0.12$X_{10}$; R2=0.71
4. Y (Thrips IV planting)=-48.49+0.93$X_1$+0.54$X_2$+0.41$X_3$-0.17$X_4$-0.51$X_5$-3.88*$X_6$-0.04$X_7$+0.10$X_8$+13.09**$X_9$-0.10$X_{10}$; R2=0.79

During 2016-17, the correlation between thrips population and biotic and abiotic factors revealed that morning RH (-0.48** and -0.52**), afternoon RH (-0.43* each), wind speed (-0.41* each) and natural enemies (-0.45** and -0.36*) showed significant negative correlation, whereas, evaporation (0.42* and 0.47**) and sunshine hours (0.42* and 0.44**) had significant positive influence on thrips activity in I and II plantings, respectively. In III and IV plantings, the minimum temperature (-0.42** and -0.41*) was negatively correlated, while evaporation (0.46** and 0.46**) and sunshine hours (0.42* and 0.38*) were significantly positively correlated, respectively. The minimum temperature (-0.54**) and morning RH (-0.38*) showed significant negative correlation, whereas evaporation (0.47**) showed significant positive correlation in V planting. With regression analysis it was evident that afternoon RH helped the buildup of thrips population, while minimum temperature adversely affected build-up of thrips at all plantings (Table VI).

The overall influence of different weather factors as well as natural enemies abundance and crop age on the population of thrips is indicated by multiple linear regression equations (Table V and VI). The factors studied accounted for higher impact of 63 -79 per cent on the activity of thrips over different plantings during 2015-16, but the effect of these factors was although statistically significant, the extent of variation explained by these factors on the activity of thrips during 2016-17 was relatively low, 50-64 per cent. This evidently showed the greater influence of weather factors on thrips abundance being more apparent in 2015-16 and the plantings during the year were spread over July- August period compared to May- June period in 2016-17.

TABLE VI

*Correlation and Regression analysis of thrips population with abiotic (weather factors) and biotic factors (natural enemies and age of the crop / phenology) during 2016-17*

| Variables | Correlation (Linear) | | | | | Multiple Linear Regression | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | P I | P II | P III | P IV | P V | PI | P II | P III | P IV | P V |
| $X_1$ | 0.06 | 0.13 | 0.33 | 0.37* | 0.35 | -0.66 | 0.93 | 1.42 | 1.03 | 1.83 |
| X2 | 0.68** | 0.63** | -0.45** | -0.41* | -0.54** | -4.06 | -3.91* | -5.16** | -2.49* | -4.30** |
| $X_3$ | -0.48** | -0.52** | -0.30 | -0.30 | -0.38* | -0.21 | -0.77 | -0.23 | -0.27 | -0.81 |
| $X_4$ | -0.43* | -0.43* | -0.22 | -0.22 | -0.30 | 0.76* | 0.84* | 0.95* | 0.59* | 0.89* |
| $X_5$ | 0.42* | 0.47** | 0.46** | 0.46** | 0.47** | 4.66 | 0.88 | 2.20 | 2.10 | 1.32 |
| $X_6$ | -0.41* | -0.41* | -0.27 | -0.25 | -0.29 | -0.84 | -0.34 | 0.91 | -0.20 | 1.06 |
| $X_7$ | -0.19 | -0.21 | -0.19 | -0.18 | -0.18 | -0.01 | -0.02 | 0.00 | -0.02 | -0.09 |
| $X_8$ | 0.42* | 0.44** | 0.42* | 0.38* | 0.31 | 0.28 | 0.45 | 0.56 | 0.44 | -0.68 |
| $X_9$ | -0.45** | -0.36* | -0.21 | -0.18 | -0.12 | -2.91 | 1.82 | 2.53 | -2.46 | 2.43 |
| $X_{10}$ | -0.20 | -0.11 | 0.07 | -0.01 | -0.20 | -0.04 | -0.03 | 0.09 | 0.04 | 0.00 |

**Significant at 1 per cent, *Significant at 5 per cent, P-Planting

$X_1$- Max. Temp.; $X_2$-Min. Temp.; $X_3$- RH (Morning); $X_4$- RH (Afternoon); $X_5$- Evaporation;
$X_6$- Wind speed; $X_7$- Rainfall; $X_8$- Sunshine hours; $X_9$- Natural enemies; $X_{10}$- Crop age.

**Multiple regression analysis of thrips population during 2016-17 as follows:**

1. Y (Thrips I planting)=74.24-0.66$X_1$-4.06**$X_2$ 0.21$X_3$+0.76*$X_4$+4.66$X_5$-0.84$X_6$-0.01$X_7$+0.28$X_8$ -2.91$X_9$-0.04$X_{10}$; $R^2$=0.64
2. Y (Thrips II planting)=71.59+0.93$X_1$-3.91**$X_2$0.77$X_3$+0.84X*$_4$+0.88$X_5$-0.34$X_6$-0.02$X_{7+}$0.45$X_8$ +1.82$X_9$-0.03$X_{10}$; $R^2$=0.60
3. Y (Thrips III planting)=-14.43+1.42$X_1$5.16**$X_2$+0.23$X_3$+0.95*$X_4$+2.20$X_5$+0.91$X_6$-0.00$X_7$+0.56$X_8$ +2.53$X_9$+0.09$X_{10}$; $R^2$=0.56
4. Y (Thrips IV planting)= +4.57+1.03$X_1$-2.49*$X_2$-0.27$X_3$+0.59*$X_4$+2.10$X_5$-0.20$X_6$-0.02$X_7$+0.44$X_8$ -2.46$X_{9+}$0.04$X_{10}$; $R^2$=0.50
5. Y (Thrips V planting)=+53.42+1.83$X_1$-4.30**$X_2$-0.81$X_3$+0.89*$X_4$+1.32$X_5$+1.06$X_6$-0.09$X_7$-0.68$X_8$+2.43$X_{9+}$0.00$X_{10}$; $R^2$=0.60)

Seasonal activity of chilli thrips under Bengaluru conditions as studied over staggered planting during July- August (kharif season of 2015-16) indicated the gradual buildup of the pest from 60 days age of the crop registering a peak by II FN of October (11.93-28.87 thrips / plant), when the crop was between 74 and 103 days age. A second peak (6.6-12 thrips) across different plantings was during mid-December. In 2016-17, plantings in May-June period also recorded an early distinct peak by last week of July (3-5.73 thrips), when the crop was 60-75 days old. However, further buildup could record a more distinct peak between last week of November and first week of December (3.93-8.33 thrips). Similar peak incidence of chilli thrips on kharif / rainy season crops were observed during October in Parbhani area of Maharashtra (Bhede *et al.,* 2008), during November-December period in Anand region of Gujarat (Barot *et al.,* 2012) and in Guntur of Andhra Pradesh (Pathipati *et al.,* 2014). The peak incidence of thrips during September on kharif crop has been reported by Meena *et al.* (2013) from Udaipur of Rajastan and this variation in the present Bengaluru study is attributed to locational difference.

Rabi crops planted during October-November under Bengaluru conditions in the present study experienced peak population of thrips from the beginning of February to middle of March and this was the only distinct peak observed on rabi season crops. The peak thrips incidences have been reported by Patel *et al.* (2009) and Barot *et al.* (2012) in Anand of Gujarat during February-March period, which corresponds to the present report of distinct peak during February- March in the rabi season.

The overall influence of different weather parameters on the activity of thrips in the present study during 2015-17 period indicated positive influence of maximum temperature, bright sunshine hours and evaporation and negative influence of RH, rainfall and wind speed being more evident (Table V and VI). Reports of maximum atmospheric temperature favoring the buildup of thrips on chilli crops in Anand region of Gujarat (Patel *et al.,* 2009; Barot *et al.,* 2012), Pune area of Maharashtra (Misal *et al.,* 2016), Udaipur region of Rajastan (Meena *et al.,* 2013) and Guntur of Andhra Pradesh (Pathipati *et al.,*2014) supported the finding of the present study. So also the negative influence of total rainfall as well as morning and afternoon relative humidities.

Bright sunshine period during chilli cropping period significantly influenced the build-up of thrips in the entire period of present study, as observed by Barot *et al*. (2012) and Patel *et al*. (2009) in Gujarat and by Bhede *et al*. (2008) and Misal *et al*. (2016) in Maharashtra. Positive influence of minimum temperature in the present study did not agree with the adverse effect on thrips buildup in Guntur area of Andhra Pradesh (Pathipati *et al.,* 2014) and Anand region of Gujarat (Barot *et al.,* 2012).

A critical analysis of data relevant to dynamics of thrips buildup and associated infestation level over two years period (2015-17) revealed the severity of thrips damage on chilli crop during the rabi season, particularly during Feb.-March period under Bengaluru conditions. This is so as the number of thrips exceeded the apparent economic threshold level of 1 thrips / leaf reported by Patel *et al*. (2009) under Gujarat conditions. The corresponding rabi peaks (Feb.-March) in the present study were reasonably high (more than the ETL, *i.e.,* 24.67 to 76.20 thrips / tapping of young shoots with at least 12 to 18 leaves - Std. week 10 in 2016; 15.20 to 44.53 thrips - Std. week 6 in 2017). This also necessitated our intervention for immediate control of thrips during this period of Feb.-March.

The present study generated data on the population fluctuation of thrips, *S. dorsalis* on staggered planting of chilli crop and the influence of ambient weather conditions on their build-up and activity. The chilli crop is being grown almost throughout the year but with varied planting time, the probable incidence of this major pest need to be addressed with appropriate management strategies, particularly on the middle aged crop more severely damaged coinciding with Nov.-Dec. (during kharif / rainy season) and Feb.-Mar. (during rabi).

## References


Amin, P. W., 1979, Leaf curl disease of chilli peppers in Maharashtra, India. *PANS*, **25** : 131-134.

Ananthakrishnan, T. N., 1993, Bionomics of thrips. *Ann. Rev. Entomol.*, **38** : 71-92.

Anonymous, 2014-15, Revealing Agriculture in India, statistically an associate website of *indiastat.com.*

Barot, B. V., Patel, J. J. and Shaikh, A. A., 2012, Population dynamics of chilli thrips, *Scirtothrips dorsalis* Hood in relation to weather parameters. *AGRES – An International e-Journal,* **4**:480-485.

Bhede, B. V., Suryawanshi, D. S. and More, D. G., 2008, Population dynamics and bio efficacy of newer insecticide against chilli thrips, *Scirtothrips dorsalis* (Hood). *Ind. J. Ent.,* **70**(3) : 223-226.

Butani, D. K., 1976, Pests and diseases of chillies and their control. *Pesticides*, **10**:38-41.

Dadasaheb, S. T., 2013, Population dynamics, yield losses and management of thrips, *Scirtothrips dorsalis* Hood infesting chilli. *M. Sc. (Agri.) Thesis,* Department of Entomology, College of Agriculture, Junagadh Agricultural University.

Kirk, W. D., 1997, Distribution, abundance and population dynamics. *Thrips as Crop Pests*. *CABI,* UK., p. 217-258.

Misal, S. S., Shaikh, A. A. and Kharbadec, S. B., 2016, Correlations betweenWeather Parameters and Pests in Organic Green Chilli (*Capsicum annuum* L.). *Adv. Life Sci.,* **5**(1) 164-166.

Meena, R. S., Ameta, O. P. and Meena B. L., 2013, Population dynamics of sucking pests and their correlation with weather parameters in chilli, *Capsicum annuum*. *The Bioscan,* **8**(1): 177-180.

Patel, B. H., Koshiy, D. J. and Korat, D. M., 2009, Population dynamics of chilli thrips, *Scirtothrips dorsalis* Hood in relation to weather parameters. *Karnataka J. Agric. Sci.,* **22**(1): 108-110.

Patel, B. H., Koshiya, D. J., Korat, D. M. and Vaishnav, P. R., 2009, Evaluation of some insecticides against chilli thrips *Scirtothrips dorsalis* Hood. *Karnataka J. Agric. Sci*., **22**(2): 327-330.

Pathipati, V. L., Vijayalakshmi, T. and Naidu, L. N., 2014, Seasonal incidence of major insect pests of chilli in relation to weather parameters in Andhra Pradesh. *Pest Management in Horticultural Ecosystems*, **20**(1) : 36-40.


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