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# Seasonal incidence and effect of abiotic factors on population dynamics of thrips on groundnut (*Arachis hypogaea* L.) during *rabi* season

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**Abstract**
Seasonal incidence of thrips in groundnut was studied during *rabi*, 2015-16 at dry land farm, S.V. Agricultural College, Tirupati in two groundnut varieties *i.e.,* Dharani and Kadiri-6 (K6). The results indicated that, the incidence of thrips on groundnut was observed from 52nd standard week of 2015 to 17th standard week of 2016. Foliar damage was high in November second fortnight ($D_1$) sown crop compared to December first ($D_2$), December second ($D_3$) and January first fortnight ($D_4$) sown crops. In $D_1$, $D_2$, $D_3$, $D_4$ sown groundnut crops, foliar damage due to thrips was high during 4th standard week to 15th standard week of 2016. Weather parameters like maximum temperature, minimum temperature showed positive association with thrips incidence in terms of foliar damage. On the contrary, morning relative humidity, evening relative humidity showed negative association with thrips damage in groundnut. Among the six weather parameters, Max temperature and evening relative humidity showed significant influence on thrips incidence in two cultivars of groundnut (Dharani and K-6) in $D_1$ $D_2$ $D_3$ and $D_4$ sown crops. Six weather parameters *viz.,* maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, sunshine hours and wind speed combinedly influenced *S. litura* damage to the extent of 94 per cent ($R^2$= 0.94), 95 per cent ($R^2$= 0.95) in $D_1$, 76 per cent ($R^2$=0.76), 75 per cent ($R^2$=0.75) in $D_2$, 73 per cent ($R^2$=0.73), 75 per cent ($R^2$=0.75) in $D_3$ and 76 and 79 per cent ($R^2$= 0.76 and 0.79) in Dharani and K-6 cultivars respectively.

**Keywords:** Abiotic factors, *Arachis hypogaea*, thrips

## Introduction
Groundnut (*Arachis hypogaea* L.) is an important oil seed crop of tropical and sub-tropical regions of the world. India ranks first in groundnut cultivation with an area of 5.53 m ha and occupies second place in production (9.67 million tonnes) with productivity of 1750 kg $ha^{-1}$. In India, groundnut is mostly grown in five states *viz.,* Gujarat, Andhra Pradesh, Tamil Nadu, Karnataka and Maharashtra which accounts for 80 per cent of total area and 84 per cent of total production of groundnut. In Andhra Pradesh, groundnut is grown in an area of 13.86 ***lakh hectares*** with a total production of 7.48 lakh tonnes and productivity of 644 kg $ha^{-1}$ (www. Indiastat.com, 2013-2014).

Studies revealed that 15 - 20 per cent of the total oilseed produced is lost directly or indirectly by the attack of insect and mite pests every year. In groundnut crop, some of the insect pests cause considerable yield losses. Among these insect pests, white grub cause yield losses up to 20-100 per cent, tobacco caterpillar causes up to 15-30 per cent, red hairy caterpillar causes up to 75 per cent, leaf miner causes up to 49 per cent, jassids causes yield losses up to 17 per cent, thrips causes up to 17 per cent yield losses (Ghewande and Nandagopal, 1997) [1].

Thrips mainly feed by lacerating and sucking the sap from leaves (Khan and Hussain, 1965) [4]. Four genera commonly infest groundnut namely *Scirtothrips dorsalis* Distant, *Frankliniella schultzei* Trybom, *Thrips palmi* Karny and *Caliothrips indicus* Bagnall. Thrips live in young foliage especially between the folded groundnut leaflets and flowers that inhibit terminal buds and flowers. Both nymphs and adults feed by rasping the surface of rapidly growing leaf tissues and suck the released plant fluid. They cause tiny scars on leaves leading to stunted plant growth. Damaged leaves may become papery and distorted, infested terminal leaves lose color, rolled up and drop before maturity (Chisholm and Lewis, 1984) [2]. weather parameters play an important role on the population dynamics and distribution of groundnut thrips and also yield loss in groundnut crop due to thrips incidence. Hence the present studies were conducted at S.V. Agricultural College Farm, Tirupati during *rabi*, 2015-16.

## Material and Methods

A field trial was conducted with two groundnut varieties Kadiri-6 (K-6) and Dharani to study the seasonal incidence and influence of various weather parameters on incidence of *S. litura* during *rabi* 2015-16. The trial was laid out in observational trial of 5x5m$^2$ area under four dates of sowing *i.e.*, second fortnight of November ($D_1$), first fortnight of December ($D_2$), second fortnight of December ($D_3$) and first fortnight of January ($D_4$) by following normal agronomic practices except for plant protection developed by ANGRAU.

The incidence of thrips was initiated from 28 days after sowing (DAS). Data on incidence of thrips in terms of damaged plants was recorded from total number of plants/m$^2$ and number of leaves damaged by thrips. Similarly, weather parameters were recorded on daily basis from meteorological station and compiled to standard week wise for analyzing the data.

For thrips per cent damage was calculated by using the following formula

$$\text{Per cent damage} = \frac{\text{Number of leavess damaged}}{\text{Total number of leaves per plant}} \text{ X } 100$$

## Results and Discussions

During *rabi* 2015-16 field incidence of thrips in terms of foliar damage was recorded from 52$^{nd}$ standard week of 2015 to 17$^{th}$ standard week of 2016 in all the four dates of sowings (November II fortnight, December I fortnight, December II fortnight and January I fortnight) of two groundnut cultivars *i.e.*, Dharani and Kadiri-6 (K-6).

The data indicated that the thrips damage was first noticed in 52$^{nd}$ standard weeks of 2015 and 1$^{st}$, 2$^{nd}$ and 4$^{th}$ standard weeks of 2016 in $D_1$, $D_2$, $D_3$ and $D_4$ sown crops, respectively. Foliar damage was high in November second fortnight ($D_1$) sown crop compared to December first ($D_2$), December second ($D_3$) and January first fortnight ($D_4$) sown crops. In $D_1$ damage was ranged from 13.59 to 29.47 and 14.41 to 28.45 per cent in Dharani and K-6 varieties. In case of $D_2$ sown crop, the incidence was ranged from 8.46 to 24.56 per cent in Dharani and 7.89 to 25.68 per cent in K-6 variety in $D_3$ sown crop, the incidence was 11.95 to 25.62 per cent in Dharani and 12.60 to 26.34 per cent in K-6. Similarly, in $D_4$ sown crop, the incidence was 0.34 to 25.62 per cent in Dharani and 0.63 to 27.89 per cent in K-6.

In $D_1$, $D_2$, $D_3$, $D_4$ sown groundnut crops, foliar damage due to thrips was high during 4$^{th}$ standard week to 15$^{th}$ standard week of 2016 which were coinciding with 22$^{nd}$ January to 15$^{th}$ April and incidence was ranged from 18.94 to 29.47 per cent in Dharani and 19.54 to 28.45 per cent in K-6 in $D_1$, in $D_2$ 14.87 to 24.80 and 15.23 to 25.64, in $D_3$ 15.63 to25.62 and 15.89 to 26.34 and in $D_4$ 7.33 to 25.62 and 8.39 to 27.89 in Dharani and K-6 varieties, respectively. (Table.1, Fig.1). The results of the present investigations are in accordance with the results of earlier workers also reported that the population of thrips (22.5 adults/5 sweeps) were recorded at the end of 4$^{th}$ standard weeks, respectively. Both the maximum temperature ($^0$C) and sunshine (h) were found to show direct relationship with the population thrips during *kharif* season.

Multiple regressions analysis indicated that the population of *S. litura* and leafhopper with different weather parameters had a significant interaction during *Kharif.* Whereas population of leaf hopper and thrips had a significant interaction with different weather parameters during summer, Harish *et al.* (2014) [3].

Correlation studies on influence of weather parameters like, maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, sunshine hours and wind speed on foliar damage due to thrips were carried during *rabi*, 2015-2016. Weather parameters like maximum temperature, minimum temperature showed positive association with thrips incidence in terms of foliar damage. On the contrary, morning relative humidity, evening relative humidity showed negative association with thrips damage in groundnut. Sunshine hours showed positive associate with thrips damage in $D_1$ and $D_4$ sown crop and negatively associated with $D_2$ and $D_3$ sown crop. Wind speed showed positive association with thrips damage in $D_1$, $D_3$ and $D_4$ sown crop and negatively associated with $D_2$ sown crop.

Among the six weather parameters, maximum temperature (r = 0.61, 0.55), evening relative humidity (r= -0.78, -0.78) and wind speed (r = 0.68, r = 0.67) showed significant influence on thrips incidence in two cultivars of groundnut (Dharani and K-6) in $D_1$ sown crop. In case of $D_2$ maximum temperature (r=0.55, 0.53) and evening relative humidity (r=-0.64, -0.63) showed significant influence on thrips incidence in two cultivars of groundnut (Dharani and K-6). In $D_3$ maximum temperature (r= 0.61, 0.60), minimum temperature (r= 0.58,0.58) and evening relative humidity (r=-0.65, -0.64) showed significant influence on thrips damage, $D_4$ sown crop sunshine hours (r=-0.50) showed significant influence on thrips damage in K-6 and in Dharani weather parameters not showed significant influence on thrips incidence in two cultivars of groundnut (Dharani and K-6) (Table. 2, Fig. 2).

The results are comparable with Subhash *et al.*, (2012) [5] revealed that thrips showed negative correlation with rainfall (r= -0.106, -0.056 and -0.134, respectively). Thrips showed positive correlation to both maximum (r=0.277) and minimum temperature (r=0.087).

Regression analysis on influence of weather parameters *viz.*, Maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, sunshine hours and wind speed on foliar damage caused by the thrips indicated that all the weather parameters together resulted in 94 per cent ($R^2$= 0.94) and 95 per cent ($R^2$= 0.95) in groundnut cultivars Dharani and K-6 sown during November second fortnight. Among the all the weather parameters three parameters influenced on the damage caused by the leaf miner in Dharani up to the extent of 75 per cent ($R^2$=0.75) and K-6 up to the extent of 73 per cent ($R^2$=0.73).

Regression equation developed by the forward selection were Y = 13.899 +(0.261 Max temp. + (-0.574) RH eve.+ (0.000) WS +5.138 and Y = 16.872 +(0.191) Max temp. + (-0.590) RH eve. + (0.000) WS + 5.183. In case of $D_2$ sown crop, all the weather parameters influenced to the extent of 76 per cent ($R^2$=0.76), 75 per cent ($R^2$=0.75) among the six weather parameters maximum temperature, evening relative humidity and wind speed influenced on the damage caused by the thrips in Dharani up to the extent of 53 per cent ($R^2$=0.53) and in K-6 up to 51 per cent ($R^2$=0.51). The regression equations developed by the forward selection were Y = 32.271 + (-0.299) Max temp. + (-0.437) RH eve.+ (3.333) WS +6.387 and Y = 37.309 + (-0.406) Max temp. + (-0.465) RH eve. + (3.390) WS + 6.766.

In case of $D_3$ sown crop, all the weather parameters influenced to the extent of 73 per cent ($R^2$=0.73), 75 per cent ($R^2$=0.75) in Dharani and K-6. Among the all the weather parameters three weather parameters influenced on the damage caused by the leaf miner in Dharani up to the extent of 56per cent ($R^2$ =56) and in K-6 up to 55 per cent ($R^2$

=0.55). Regression equations were developed by using the forward selection were Y = 151.715 + (-4.476) Max temp. + (2.815) Min temp.+ (-0.983) RH eve. +5.404 and Y = 150.697 + (-4.444) Max temp. + (2.830) Min temp. + (-0.979) RH eve +5.663.

In $D_4$ sown crop all the weather parameters were influenced the damage up to extent of 76 and 79 per cent ($R^2$= 0.76 and 0.79) in Dharani and K-6. Among the all-weather parameters three parameters influenced on the damage caused by the thrips in Dharani up to extent of 52 per cent ($R^2$= 0.51) and in K-6 up to 51per cent ($R^2$= 0.51). Regression equations developed by using the forward selection were Y = 63.578 + (-0.746) RH eve. + (-4.016) SSH + (3.114) WS +6.861 and Y = 66.948 + (-0.771) RH eve +(-4.300) SSH +(3.242) WS +7.297 in Dharani and K-6, respectively (Table. 3).

Present investigations are supported by Harish *et al*. (2014) [3] who reported that coefficient of multiple regression ($R^2$) for thrips population on groundnut was 36, 54 and 80per cent during *kharif*, *rabi* and summer seasons, respectively.

**Table 1:** Population dynamics of *thrips* on groundnut during *rabi*, 2015-16

| Standard week | Weather parameters | | | | | | % of foliage damage by thrips | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Max. temp (°C) | Min. temp (°C) | RH mor. (%) | RH eve. (%) | SSH (hours) | WS (kmph) | $D_1$ (Nov II FN) | | $D_2$ (Dec I FN) | | $D_3$ (Dec II FN) | | $D_4$ (Jan I FN) | |
| | | | | | | | Dharani | K6 | Dharani | K6 | Dharani | K6 | Dharani | K6 |
| 50 (10-16,Dec) | 30.4 | 20.6 | 91.9 | 63.9 | 6.6 | 2.2 | 0 | 0 | 0 | 0 | -- | -- | -- | -- |
| 51 ( 17-23, Dec | 31.0 | 19.7 | 91.0 | 63.6 | 8.2 | 2.0 | 0 | 0 | 0 | 0 | -- | -- | -- | -- |
| 52 (24-31 Dec) | 29.7 | 18.1 | 88.0 | 60.6 | 7.7 | 4.7 | 13.59 | 14.41 | 0 | 0 | 0 | 0 | -- | -- |
| 1(1-7, Jan), 2016 | 30.0 | 16.5 | 90.1 | 58.0 | 8.5 | 3.8 | 14.57 | 15.23 | 11.86 | 12.48 | 0 | 0 | -- | -- |
| 2(8-14, Jan) | 29.6 | 14.8 | 89.1 | 54.7 | 8.0 | 3.4 | 15.67 | 16.32 | 12.48 | 13.12 | 11.95 | 12.6 | 0 | 0 |
| 3 ( 15-21, Jan) | 30.0 | 17.9 | 91.9 | 60.7 | 5.6 | 3.0 | 16.87 | 16.98 | 13.53 | 14.12 | 14.32 | 15.43 | 0 | 0 |
| 4(22-28, Jan) | 30.7 | 20.4 | 91.7 | 58.7 | 6.2 | 5.1 | 18.94 | 19.54 | 14.87 | 15.23 | 15.63 | 15.89 | 7.33 | 8.34 |
| 5( 29-Jan- 4 Feb) | 33.1 | 16.9 | 84.7 | 33.7 | 9.0 | 2.9 | 20.36 | 21.03 | 15.26 | 16.23 | 16.94 | 17.34 | 9.02 | 9.34 |
| 6(05-11, Feb) | 32.4 | 18.6 | 89.6 | 41.7 | 7.8 | 3.5 | 23.47 | 24.58 | 16.89 | 17.21 | 17.35 | 17.58 | 9.34 | 10.23 |
| 7(12-18, Feb) | 32.5 | 19.1 | 88.9 | 48.0 | 8.8 | 4.3 | 25.63 | 21.95 | 18.97 | 19.23 | 18.26 | 19.21 | 15.35 | 16.48 |
| 8(19- 25, Feb) | 34.6 | 21.1 | 87.0 | 39.1 | 9.6 | 4.2 | 29.47 | 23.56 | 24.56 | 25.68 | 19.46 | 19.57 | 16.34 | 17.34 |
| 9(26-Feb-04-Mar) | 33.15 | 21.29 | 87.13 | 43.00 | 7.26 | 4.39 | 28.96 | 28.45 | 22.45 | 23.45 | 20.42 | 22.34 | 18.64 | 18.49 |
| 10(5-11, Mar) | 34.54 | 22.11 | 86.00 | 38.14 | 7.80 | 3.93 | 25.3 | 26.34 | 21.58 | 22.12 | 22.34 | 23.5 | 20.94 | 21.54 |
| 11(12-18, Mar) | 36.60 | 25.53 | 79.71 | 41.43 | 6.24 | 4.51 | 22.43 | 21.45 | 24.86 | 25.64 | 25.62 | 26.34 | 23.45 | 25.34 |
| 12(19-25, Mar) | 39.19 | 24.90 | 72.14 | 27.00 | 7.61 | 3.96 | -- | -- | 18.97 | 19.24 | 20.23 | 21.54 | 25.62 | 27.89 |
| 13(26, Mar -01, April) | 36.27 | 23.43 | 77.67 | 33.33 | 8.35 | 4.07 | -- | -- | 8.46 | 7.89 | 22.89 | 23.43 | 24.62 | 24.59 |
| 14(2-8, April) | 36.4 | 23.7 | 77.0 | 34.0 | 8.3 | 4.0 | -- | -- | -- | -- | 20.98 | 19.94 | 20.63 | 21.59 |
| 15(9-15, April) | 38.3 | 25.7 | 76.7 | 33.7 | 8.3 | 4.2 | -- | -- | -- | -- | 11.96 | 12.99 | 19.64 | 20.34 |
| 16(16-22, April) | 39.4 | 26.0 | 75.9 | 30.6 | 8.9 | 4.6 | -- | -- | -- | -- | -- | -- | 8.94 | 7.63 |
| 17(23-29, April) | 39.9 | 27.0 | 74.4 | 33.0 | 9.9 | 4.5 | -- | -- | -- | -- | -- | -- | 0.34 | 0.63 |

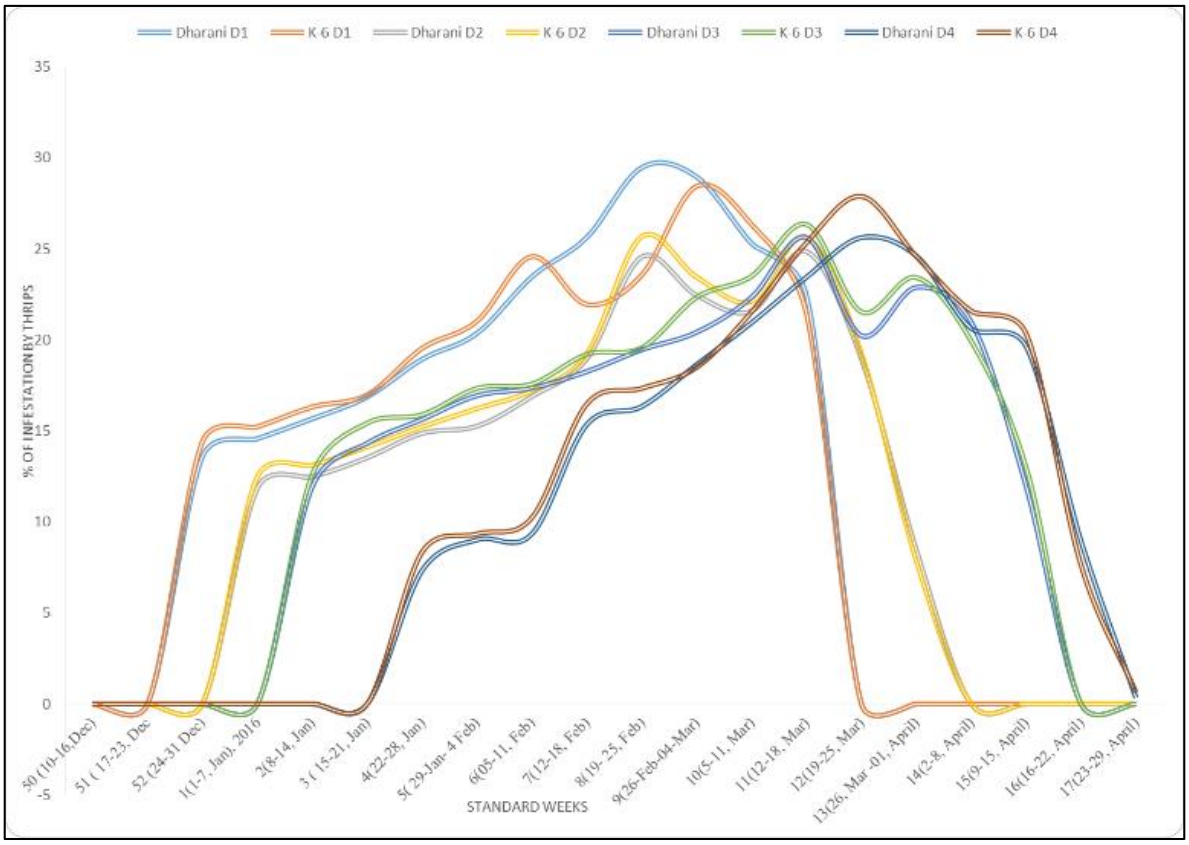


**Fig 1:** Incidence of thrips on groundnut during *rabi*, 2015-16

**Table 2:** Correlation studies of groundnut thrips in relation to weather parameters during *rabi* 2015-16.

| Weather parameter | $D_1$ | | $D_2$ | | $D_3$ | | $D_4$ | |
|---|---|---|---|---|---|---|---|---|
| | Dharani | K-6 | Dharani | K-6 | Dharani | K-6 | Dharani | K-6 |
| Maximum temperature (X1) | 0.61* | 0.55* | 0.55* | 0.53* | 0.61* | 0.60* | 0.24 | 0.24 |
| Minimum temperature (X2) | 0.23 | 0.18 | 0.34 | 0.32 | 0.58* | 0.58* | 0.004 | 0.030 |
| Morning RH (X3) | -0.50 | -0.49 | -0.34 | -0.32 | -0.41 | -0.40 | -0.23 | -0.26 |
| Evening RH (X4) | -0.78* | -0.78* | -0.64* | -0.63* | -0.65* | -0.64* | -0.40 | -0.41 |
| Sunshine hours (X5) | 0.22 | 0.14 | -0.41 | -0.40 | -0.08 | -0.11 | 0.48 | 0.50* |
| Wind speed (X6) | 0.68* | 0.67* | -0.43 | -0.43 | 0.01 | 0.01 | 0.35 | 0.38 |

r value at 0.05 is 0.53

* Significant at 5%.

$D_1$: Date of sowing: 27-11-2015 $D_2$: Date of sowing: 12-12-2015

$D_3$: Date of sowing: 27-12-2015 $D_4$: Date of sowing: 11-01-2016

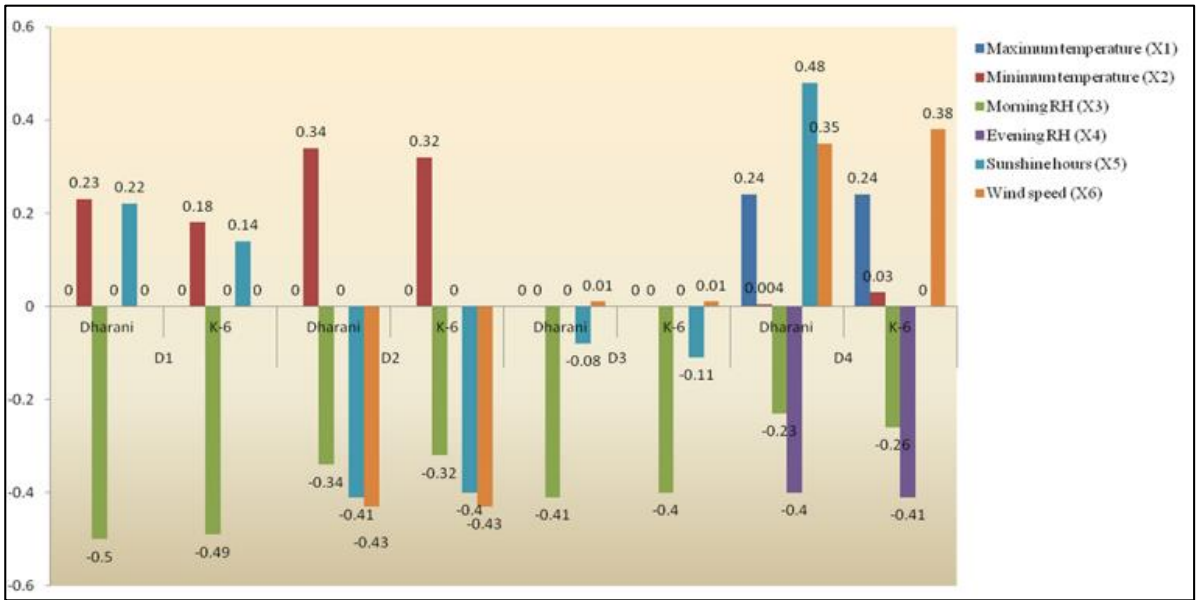


**Fig 2:** Correlation studies of groundnut thrips in relation to weather parameters during *rabi* 2015-16

**Table 3:** Regression analysis of groundnut thrips in relation to weather parameters during *rabi*, 2015-16.

| Regression model | Regression equation thrips | R2 |
|---|---|---|
| **Dharani** | | |
| $D_1$ (Full model) | Y = -227.233 +(5.356) Max temp.+(-2.752) Min temp.+(1.498) RH mor.+(-0.271) RH eve.+(-1.941) SSH+(6.390) WS+2.916 | 0.94 |
| $D_1$ (Forward selection) | Y = 13.899 + (0.261 Max temp. + (-0.574) RH eve.+(0.000) WS +5.138 | 0.751 |
| $D_2$ (Full model) | Y = -312.623 + (5.394) Max temp +(-0.597) Min temp. + (2.015) RH mor. +(-0.064) RH eve.+(-0.053)SSH +(-2.099)WS+5.221 | 0.76 |
| $D_2$ (Forward selection) | Y = 32.271 + (-0.299) Max temp. + (-0.437) RH eve.+(3.333) WS +6.387 | 0.531 |
| $D_3$ (Full model) | Y= -5.650 +(-0.041) Max temp. + (0.394) Min temp. + (0.921) RH mor. + (-0.918) RH eve. +(-3.467) SSH +(1.126) WS +4.898 | 0.733 |
| $D_3$ (Forward selection) | Y = 151.715 + (-4.476) Max temp. + (2.815) Min temp.+(-0.983) RH eve. +5.404 | 0.56 |
| $D_4$(Full model) | Y = 31.241 + (-0.258) Max temp. + (0.165) Min temp. + (0.884) RH mor. + (-2.947) RH eve. +(5.125) SSH +(-4.738) WS +5.549 | 0.766 |
| $D_4$(Forward selection) | Y = 63.578 + (-0.746) RH eve. +(-4.016) SSH +(3.114) WS +6.861 | 0.52 |
| **K-6** | | |
| $D_1$ (Full model) | Y = -90.923 + (2.633) Max temp.+(-1.965) Min temp.+(1.022) RH mor.+(-0.557) RH eve.+(-2.617) SSH+(5.536) WS+2.471 | 0.95 |
| $D_1$ (Forward selection) | Y = 16.872 +(0.191) Max temp. + (-0.590) RH eve. +(0.000) WS +5.183 | 0.731 |
| $D_2$ (Full model) | Y = -329.497 +(5.718) Max temp +(-0.714) Min temp +(2.119)RH mor. +(-0.056) RH eve.+(-0.047)SSH +(-2.202)WS +5.547 | 0.75 |
| $D_2$ (Forward selection) | Y = 37.309 +(-0.406) Max temp. + (-0.465) RH eve. +(3.390) WS +6.766 | 0.511 |
| $D_3$ (Full model) | Y = -28.606 +(0.665) Max temp. +(-0.018) Min temp. +(1.042) RH mor. +(-0.908) RH eve.+(-3.989)SSH +(1.561) WS + 4.874 | 0.75 |
| $D_3$ (Forward selection) | Y = 150.697 +(-4.444) Max temp. +(2.830) Min temp. +(-0.979) RH eve +5.663 | 0.55 |
| $D_4$(Full model) | Y = 50.761 +(-0.385) Max temp. +(0.202) Min temp. +(0.694) RH mor.+(-3.317) RH eve +(5.404) SSH +(-4.982) WS +5.405 | 0.79 |
| $D_4$(Forward selection) | Y = 66.948 +(-0.771) RH eve. +(-4.300) SSH +(3.242) WS +7.297 | 0.51 |

**References**


1. Ghewande MP, Nandagopal V. Integrated pest management in groundnut (*Arachis hypogaea* L.) in India. Integrated Pest Management Reviews. 1997; 2:1-15.
2. Chisholm IF, Lewis T. A new look at thrips (Thysanoptera) mouthparts, their action and effects of feeding on plant tissue. Bulletin of Entomological Research. 1984; 74:663-675
3. Harish G, Nataraja MV, Jasrotia P, Holajjer P, Savaliya SD, Gajera M. Impact of weather on the occurrence pattern of insect pests on groundnut. Legume Research. 2014; 38(4):524-535.
4. Khan MK, Hussain M. Role of coccinellid and syrphid predators in biological control of aphid. Indian Oilseed Journal. 1965; 9:67-70.
5. Subhash B, Kandakoor, Khader Khan H, Chakravarthy AK, Ashok kumar CT, Venkataravana P. The incidence and abundance of sucking insect pests on groundnut. Current Biotica. 2012; 6(3):342-348.
6. www. Indiastat.com, 2013-2014.