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# Seasonal incidence of grape vine thrips and their correlation with weather parameters

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**Abstract**
The studies on seasonal incidence of grape thrips, *Rhipiphorothrips cruentatus* Hood (Thripidae: Thysanoptera) were carried out at All India Co-ordinated Research Project (AICRP) on Fruits, Department of Horticulture, MPKV., Rahuri, during 2017-18. The studies on seasonal incidence revealed that the incidence of active stages both nymphs and adults started appearing from November 1st week (7.88/shoot) when new flush started after fruit or forward pruning in October, 2017. The population gradually increased and peak incidence was observed from second week of December (50thstandard meteorological week) *i.e.*, (8.28/shoot) to second week of January (2ndstandard meteorological week) *i.e.*, (8.53/shoot). The higher incidence of thrips was coincided with the flowering stage of grape vine. The linear correlation studies revealed that the weather parameters *viz.*, maximum (r = -0.558) and minimum temperatures (r = -0.419) are significantly negative correlated with thrips incidence. Whereas, it had significant positive correlation with both morning (r = 0.474) and evening relative humidity (r = 0.233).While all other weather parameters such as rainfall (r = $0.092^{NS}$), sunshine (r = $-0.094^{NS}$) and wind velocity (r = $-0.130^{NS}$) have not shown any significant relationship with population of thrips.

**Keywords:** Seasonal incidence, correlation, Thrips

## Introduction
Grapes (*Vitis vinifera* L.) is one of the important and widely grown fruit crops in the world. It is temperate by origin however, it has been successfully cultivated in tropical and subtropical climatic condition of India by modifying the required horticultural practices. Grapes are said to have originated from Asia Minor and then spread to Greece, Germany, the United States of America and the Philippines. Grapes seems to have been introduced to India from Iran and Afghanistan in 1300 AD as reported by Bose *et al*., 1999 [2].

In recent years considerable interest has been aroused in India about grape cultivation due to prolific yield, export potential and good returns. Therefore, the area under grape is constantly increasing. In India, grapes are grown over an area of 1,38,000 ha with the production of 30 lakh MT. Maharashtra is the leading grape growing state covering an area of about 78000 ha with the production of 1.80 lakh MT reported in Annual Report NRCG, 2017-2018 [1].

Commercial viticulture has made a considerable progress in Maharashtra during past decade. The per hectare yield obtained in the well maintained vineyards of Thompson seedless in Maharashtra is about 40 tonnes and is reported to be perhaps the highest in the world. Its cultivation was initially confined mainly to Pune, Nasik, Sangli, Solapur and Ahmednagar districts. Now, it has been extended to Aurangabad, Satara, Beed, Osmanabad, Lathur and Nanded districts of the state.

Thrips, once considered to be the insect pests of minor importance in horticultural crops, but have gained the paramount importance due to their ability to cause economic losses, to subsist on new hosts and by being polyphagous in nature reported by Dahiya *et al*., 1995 [4]. *Ripiphorothrips cruentatus* (H.) and *Scirtothrips dorsalis* (H.) are the species recorded infesting the leaves and berries reported by Butani. 1979 [3].

Thrips ***(****Rhipiphorothrips cruentatus* H.) both nymphs and adults cause damage by rasping the lower surface of the leaf with their stylets and sucking the oozing cell sap. The injured surface is marked by the number of minute spots thereby producing a speckled silvery effect, which can be detected from a distance. They feed in groups, generally on the undersurface of the leaves. Curling of the leaves is observed in case of severe incidence reported in Kulakarni *et al*., 2007 [8].

Females lay eggs in rachis, pedicels and on newly developed berries. Nymphs feed on pollen and internal tissues of calyptra. Thrips also attack blossoms and developing berries. Fruit setting is poor and yield is considerably reduced. Some feeding also occurs on the surface of berries causing scarring and hallow spots at the feeding site. Thrips are also responsible for the scab formation on the berries. The affected berries develop a corky layer and become brown. Fruits obtained from seriously attacked plants are of poor quality and fetch low price in the market. Therefore, considering the importance of the grape and the problems posed by insect pests, an in depth study on the nature of damage, seasonal incidence in correlation with weather parameters, of thrips on grapes was initiated

**Materials and methods**

Occurrence and seasonal incidence studies of thrips, *Rhipiphorothrips cruentatus* Hood (Thripidae: Thysonoptera) were carried out at AICRP on Fruits, commencing after October, 2017 pruning to November, 2018. The thrips population was correlated with weather parameters *viz*., maximum temperature, minimum temperature, relative humidity and rainfall to quantify the impact of abiotic factors on the incidence levels of thrips.

Five vines were selected for this study. From each vine five shoots are randomly selected. The counts were made by tapping shoots gently on a black paper sheet, for counting population of both nymphs and adults a magnifying lens of 10X was used and their numbers are noted in data sheet by Duraimurugan and Jagadish, 2004 [5]. Occurrence, seasonal incidence and peak periods of infestation were documented by collecting the absolute counts of the thrips at weekly intervals round the year.

**Meteorological data**

The data on weather parameters *viz*., maximum temperature, minimum temperature, relative humidity and rainfall was obtained from AICRP on Water Management, MPKV, Rahuri. Geographically, the central campus of Mahatma Phule Krishi Vidyapeeth, Rahuri is situated between 19.3491°N, 74.6461°E varied from 495 to 569 meters above the sea level. Climatically, this area falls in semi arid tropics with annual rainfall varying from 307 to 619 mm. The average rainfall being 520 mm, distributed over 15 to 45 days in different months. Nearly 80 per cent of the rainfall is received from South-West monsoon from June to September. The annual average maximum temperature is 30 $^0$C with a range of 33 to 41 $^0$C and mean minimum temperature 17.2 $^0$C with the range between 9.5 to 17 $^0$C and average maximum and minimum humidity ranged from 59 to 35 per cent, respectively.

**Results and Discussion**

The population counts of thrips were recorded at weekly intervals commencing from October pruning 2017 to November, 2018. The results revealed that the incidence of active stages both nymphs and adults started appearing from November 1$^{st}$ week (7.88/shoot) when new flush started after fruit or forward pruning in October, 2017 (Fig.1). The population gradually increased and peak incidence was observed from second week of December, (50$^{th}$ standard meteorological week) *i.e.*, (8.28/shoot) to second week of January, (2$^{nd}$ standard meteorological week) *i.e.*, (8.53/shoot). The higher incidence of thrips was coincided with the flowering stage of grape vine. Thus there was increase in the population when new flush started and highest population was observed at the flowering stage while there was decrease in the population level when leaves get older and after fruit setting. Thrips and its damage symptoms were observed which were presented in plate 1.

The incidence of thrips started when maximum and minimum temperature was 31.3 ºC and 13.7 ºC where morning and evening humidity was 58.4 per cent and 29.6 per cent, respectively. The thrips population increased gradually and reached to its peak (8.53/shoot) at 28.1 ºC maximum and 12.2 ºC minimum temperature. The present results are in agreement with Kulkarni *et al.* 2008 [9] who reported that the thrips population was observed throughout the year with an average peak of 8-10 thrips/shoot of vine in November and December months, which coincide the flowering period.

a. Berry scars b. Thrips Nymph

**Plate 1:** Thrips and damage symptoms in grapes

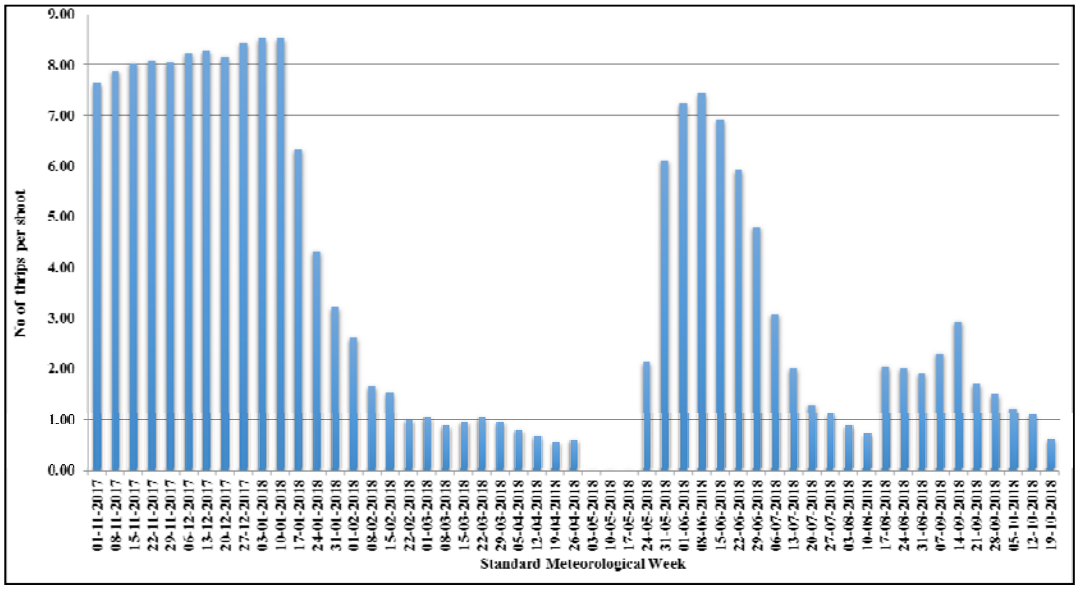


**Fig 1:** Incidence of thrips on grapes (November 2017 to October 2018)

**Correlation studies**

The effect of different weather factors like rainfall, sunshine, wind velocity, relative humidity, maximum temperature and minimum temperature, on the incidence of thrips on grape vine were correlated and presented below (Table 1 and Fig 2). Multiple linear regression models were also carried out for thrips population and weather parameters which were presented in (Table 2).

The linear correlation studies revealed that the weather factors maximum (r = -0.558) and minimum temperatures (r = -0.419) are significantly negatively correlated with thrips incidence. Whereas, it had significant positive correlation with both morning (r = 0.474) and evening relative humidity (r = 0.233). The present correlation studies of weather parameters influence on the incidence of grape vine thrips are in accordance with the Gowtham *et al*. 2009 [6] who reported a significant negative correlation between population of thrips and maximum and minimum temperature and remaining other weather factors does not have much influence on thrips population. While all other factors such as rainfall (r = $0.092^{NS}$), sunshine (r = $-0.094^{NS}$) and wind velocity (r = $-0.130^{NS}$) have not shown any significant relationship with the population of thrips. Even though rainfall was positively correlated with the population of thrips but it was not found to be statistically significant.

Over all, the occurrence and seasonal incidence of thrips was influenced negatively by maximum and minimum temperature while positively correlated with morning and evening relative humidity other weather parameters such as sunshine, wind velocity and rainfall have not shown any significant impact on the incidence levels of thrips population.

**Table 1:** Correlation studies between incidence of grapethrips and weather parameters during 2017-2018.

| Sr. No. | Weather parameters | Correlation coefficient (r) |
|---|---|---|
| 1. | Rainfall (mm) | $0.092^{NS}$ |
| 2. | Sunshine (Hr) | $-0.094^{NS}$ |
| 3. | Wind velocity (Kmph) | $-0.130^{NS}$ |
| 4. | Evening relative humidity | 0.233* |
| 5. | Morning relative humidity | 0.474** |
| 6. | Minimum Temperature | -0.419** |
| 7. | Maximum Temperature | -0.558** |

**Correlation is significant at the 0.01 level.
*Correlation is significant at the 0.05 level
NS - Non Significant.

**Multiple linear regression analysis**

Multiple linear regression models were also carried out for thrips population and weather parameters which were presented in (Table 2).

$$Y = a + bx$$

Y= Incidence of thrips
a= intercept
x= weather factor
b = Slope

Results indicated that rainfall ($X_1$) was contributed 0.6 per cent ($R^2$ = 0.006) towards the thrips incidence only. With addition of sunshine ($X_2$), wind velocity ($X_3$), morning relative humidity ($X_4$), evening relative humidity ($X_5$), minimum temperature($X_6$) and maximum temperature ($X_7$) values of $R^2$ increased up to 0.90, 6.90, 20.00, 46.40, 52.10 and 53.10 per cent, respectively. Thus, it was clearly evident that morning relative humidity, minimum and maximum temperature was the major contributing weather parameters with 46.40, 52.10 and 53.10 per cent respectively for incidence of thrips. The total weather parameters influence on the incidence of thrips to the extent of 53.10 percent ($R^2$ =

0.531). The present regression results are in agreement with Nagaraj *et al*. 2017 [11]., who reported that total influence of weather parameters on the thrips incidence during October pruning in grape vine is 65.80 per cent with $R^2 = 0.658$.

**Table 2:** Multiple linear regression analysis between incidence of grape thrips and weather parameters during 2017-2018

| Sr. No | Variable | Regression model | $R^2$ |
|---|---|---|---|
| 1. | Rainfall ($X_1$) | $Y = 3.546 + 0.016X_1$ | 0.006 |
| 2. | Sun shine ($X_2$) | $Y = 4.005 + 0.010\ X_1 - 0.067X_2$ | 0.009 |
| 3. | Wind velocity ($X_3$) | $Y = 6.054 + 0.023X_1 - 0.221X_2 - 0.343X_3$ | 0.069 |
| 4. | Relative Humidity (M) ($X_4$) | $Y = -3.564 + 0.007X_1 + 0.443X_2 - 0.368X_3 + 0.136X_4$ | 0.200 |
| 5. | Relative Humidity (E) ($X_5$) | $Y = -10.701 + 0.004X_1 + 0.262X_2 + 0.022X_3 - 0.152X_4 + 0.300X_5$ | 0.464 |
| 6. | Minimum temperature ($X_6$) | $Y = -3.780 + 0.013X_1 + 0.209X_2 + 0.242X_3 - 0.102X_4 + 0.230X_5 - 0.259X_6$ | 0.521 |
| 7. | Maximum temperature ($X_7$) | $Y = 3.151 + 0.021X_1 + 0.356X_2 + 0.254X_3 - 0.123X_4 + 0.208X_5 - 0.105X_6 - 0.270X_7$ | 0.531 |

*M = Morning,
*E = Evening

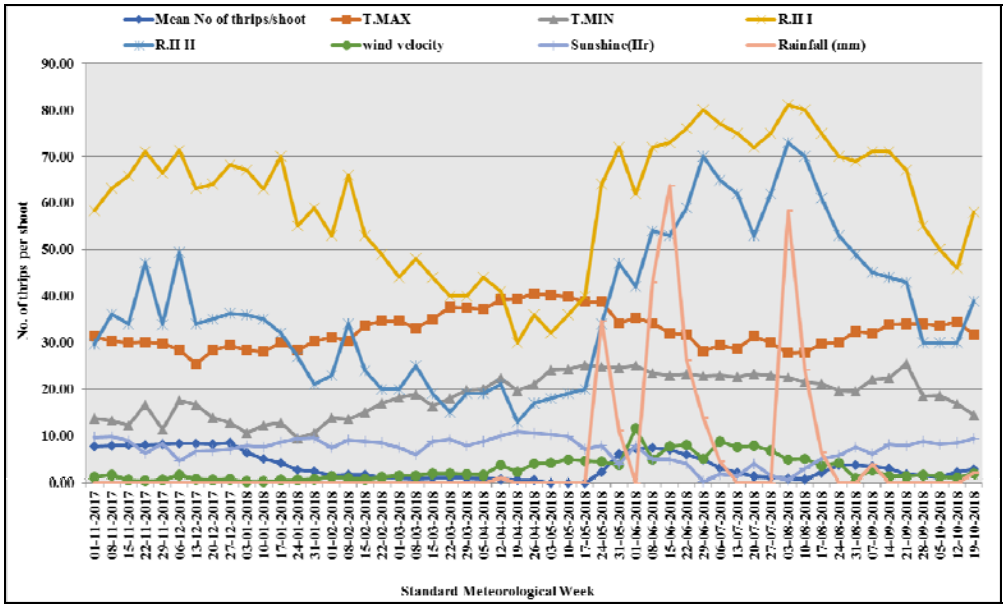


**Fig 2:** Impact of weather parameters on population of grape thrips

## Conclusion

The infestation of thrips [*Rhipiphorothrips cruentatus* H.] was found maximum in first week of January, 2018 (1st SMW), higher incidence of thrips coincided with the flowering stage of grape vine and revealed negatively correlation with maximum and minimum temperatures. Whereas, it had significant positive correlation with both morning and evening relative humidity. While all other factors such as rainfall, sunshine and wind velocity have not shown any significant influence on the population of thrips.

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