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WEATHER RELATED INTRA-PLANT DISTRIBUTION OF INVASIVE CHILLI THRIPS (*THRIPS PARVISPINUS* KARNY)

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ABSTRACT

A field experiment was conducted during *kharif* season in the year 2022-23 at post graduate research block, Raichur to study the population dynamics of invasive thrips *Thrips parvispinus* karny in chilli crop in relation to weather parameters. The first incidence of thrips on leaves, flowers and fruits appeared from 40th, 42nd and 45th standard meteorological week (SMW) respectively, and attained a peak during 50th (7.60/leaf), 47th (21.54/flower), 49th (3.89/fruit) SMW. The nymph primarily chooses to inhabit leaves, whereas adults tend to favour residing in flowers. Thrips on leaves, flowers were positively correlated with maximum temperature (r = 0.109, r = 0.006) and negatively correlated with rainfall (r = -0.325, r = -0.116). Thrips on fruits negatively correlated with temperature and rainfall (r = -0.438*, r = -0.325). Maximum temperature (r= -0.414*, r= -.430*, r= -0.454* and r= -0.378*) had highly significant and negative influence on coccinellids, spiders, chrysopids and predatory thrips, population respectively.

***Keywords*:** Distribution, Invasive, Leaves, flowers, fruits Thrips, Weather.

Introduction

Chilli, (*Capsicum annuum*), a member of the Solanaceae family, is one of India's most important vegetable and spice crops, it is widely grown in warm temperate, tropical, and subtropical regions. It is also called as sweet pepper, bell pepper and green pepper. It is an excellent source of vitamins A, B and C (Gill, 1989). India is the largest producer, consumer and exporter of dry chilli in the world. Chilli was cultivated on an area of 852,000 hectares with 1578000 MT of production and 1.90 MT productivity per ha during 2021-22 (Anon., 2023). A number of factors are responsible for lower yield includes adverse climatic conditions, poor quality seeds, diseases, insects and mites which significantly affects both the quality and production of chilli. The yield losses have been estimated range from 50- 90 per cent due to insect pests of chilli (Nelson and Natrajan, 1994; Kumar, 1995). Chilli is infested by thrips, *Scirtothrips dorsalis* Hood, whitefly, *Bemisia tabaci* Genn, aphid, *Aphis gossypii* Glover, tobacco caterpillar, *Spodoptera litura* (F.), fruit borer, *Helicoverpa armigera* (Hubner) and mites, *Polyphagotarsonemus latus* Banks, right from germination to harvest of the crop.

Thrips parvispinus (Karny 1922) is an invasive thrips and a member of the "*Thrips Orientalis* group" (Mound 2005) (Thysanoptera: Thripidae). It is also known as tobacco thrips, western thrips, and Taiwanese thrips. *T. parvispinus*, an invasive thrips, was recently found in India where it caused a severe, widespread infestation in more than 0.4 million ha of chilli (*C. annuum* L.) growing areas. This species is indigenous to Thailand and is most common there and in other South East Asian nations.

T. parvispinus causes direct damage by feeding and breeding on the young leaves and flowers. Adults

mostly colonize flowers and the underside of leaves, whilst larvae deeply puncture and scrape the chlorophyll off the underside of the leaf and suck the cell sap, resulting in a yellowish to reddish brown section on the top side of the leaf. (Sridhar *et al*. 2021). This invasive thrips is primarily found in white and aromatic flowers (Mound and Collins 2000). Brownish streaks are produced when petals are scraped. It consumes pollen, which causes the blossom to dry out and wither (Maharijaya *et al*. 2011). This study provides basic information on relative occurrence and distribution of thrips on plant parts over period of time which is necessary before deciding the strategy for management of any insect pest and also the relationship between weather parameters and pest population succession as there is more scope for weather-based prediction and management strategies.

Materials and Methods

A field experiment was conducted to study population dynamics on chilli crop during 2022-2023 at Post Graduate research Block, Main Agricultural Research Station, College of Agriculture, Raichur, Karnataka during *Kharif* 2022-2023. A popular hybrid chilli, HPH 5531 were raised in a plot size of 20 x 10 m^2 with spacing of 90 x 45 cm, was completely kept free from any insecticide application. Population of thrips were observed at weekly intervals starting from transplanting to harvest according to the Standard Meteorological Week during morning hours between 7.00 am to 9.00 am. Ten plants were randomly selected in the plot and the observations were taken from top three leaves in vegetative stage, top ten flowers and fruits in flowering and fruiting stage respectively in each plant. The natural enemies recorded also recorded from ten randomly selected plants and expressed number of predators per plant.

The data collected was averaged per plant basis and was correlated with weather parameters viz., maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, rainfall and sunshine hours by using SPSS software version 16.0.

Results and Discussion

Distribution of *T. parvispinus* on leaves

Activity of thrips population on chilli leaves was found throughout the crop growth period which ranged from 0.00 to 7.60 per leaf with a mean population of 3.04 per leaf (Table 1). The incidence commenced from first week of October *i.e.,* 40th SMW (1.2 per leaf) and gradual increase was observed from second week of October. Population of thrips reached maximum during the 50th SMW *i.e.,* second week of December (7.60 per leaf) followed by 48th SMW *i.e.,* last week of November (7.30 per leaf). There was increased incidence of thrips from last week of November to second week of December ranged from 7.30 per leaf to 7.60 per leaf. However, the infestation of thrips was maximum during 47th SMW to 2nd SMW, the population decreased from second week of January (2nd SMW) to second week of February (6th SMW). There was slight increase in the incidence of thrips from third week of February (7th SMW) to last week of March (13th SMW) due to fluctuation in the environment.

The present findings are in conformity with earlier workers, Reddy *et al.* (2017) who reported that the thrips activity initiated in first week of October (40th SMW) and reached peak towards the end of December (52nd SMW). Furthermore, the study revealed that thrips remained prevalent throughout the entire duration of the crop growth period. Similarly, Pathipati *et al*. (2014) revealed that the infestation and severity of insect pests were highly influenced by weather parameters. Thrips population reached its peak (1.80 per leaf) in the 52nd SMW. Similar results were noticed by Chintkuntlawar *et al*. (2021) reported that in the thrips reached its peak during 51st SMW and prevalent throughout crop growth.

The correlation between thrips population in chilli on leaves and weather parameter. Maximum temperature (r= 0.109) positively non-significant, minimum temperature (r= -0.158) was found negatively non-significant whereas, morning relative humidity (r= 0.279) positively non-significant and evening relative humidity (r= -0.289) were showed negatively non-significant correlation. Rainfall (r= -0.325) exhibited negatively non- significant correlation (Table 2).

The observations are in confirmation with the results obtained by Patel (1992) who reported negative correlation between thrips population and rainfall. Similarly, findings are in accordance with Ankush (2022) who reported a non-significant positive correlation with maximum temperature and non-significant negative correlation with minimum temperature, rainfall, minimum relative humidity. Similar results were obtained by Nautiyal *et al*. (2022) reported a non-significant positive correlation with maximum temperature and non-significant negative correlation with, rainfall, minimum relative humidity, evening relative humidity. Kotresh *et al*. (2020) reported that thrips exhibited non-significant negative correlation with rainfall and minimum relative humidity. Samanta *et al*. (2017) revealed that population fluctuation of thrips was found positively

correlated with mean temperature and negatively correlated with rainfall and other abiotic factors (mean relative humidity, wind speed and bright sunshine).

Distribution of *T. parvispinus* on flowers

The thrips population exhibited variability throughout the study period which are depicted in the table. 1, with the lowest count at 0.80 per flower and the highest at 21.54 per flower. On average, there were approximately 6.80 thrips per flower. The infestation began in early October (44th SMW) with an initial count of 0.8 per flower, and it steadily increased from late October. The most significant surge occurred during the 47th SMW in the third week of November, with a peak of 21.54 thrips per flower, closely followed by the second week of November (46th SMW) with 20.24 thrips per flower. This escalation continued from early to late November, ranging from 17.56 to 21.54 thrips per flower. However, the population gradually declined from the second week of January (2nd SMW) to the second week of February (6th SMW). There was a slight increase in thrips population from the third week of February (7th SMW) to the end of March (13th SMW), likely influenced by environmental factors.

The population of thrips on flowers were maximum on 8th week after transplanting *i.e.* 21.54 thrips per flower after that population of thrips decreases, this findings are supported by Johari (2016) where they have found highest population after 8th week after transplanting and quoted that the thrips population in chilli plantation is affected by several factors such as the age of the plant, number of flowers, temperature and humidity, and predators. Eight weeks after planting chilli plants flowering phenology full or nearly all of chilli plants were in bloom.

The population of *T. parvispinus* nymph was more than adult in the leaf. While the population of *T. parvispinus* adult was more on flower than nymph population. There were strong indications that the nymph stadium prefers live on the part of the leaf than the flower, while the adult prefers the flower rather than the leaf (Fig. 1). These results shows that maximum infestation occurs during the flowering period of chilli crop. It clearly shows that, thrips majorly attack flowers which affect the development of fruits by reducing the pollination due to feeding on anthers or by reducing the vigour or it may be due to embryo abortion.

Visschers *et al.* (2023) reported that the preference of adult thrips for flowers was positively correlated with the concentration of trehalose and fructose in anthers, as well as the quantity of pollen present. Additionally, they found that pollen serves as a crucial supplementary source of nutrients for the thrips. The correlation analysis between the presence of thrips on flowers and various environmental factors, including temperature, rainfall, relative humidity, and sunshine hours presented in table 2., reveals that there is non-significant positive correlation with maximum temperature(r=0.006) and minimum Relative humidity(r=0.053) and non-significant negative correlation with minimum temperature(r=-0.209), maximum relative humidity (r= -0.005), sunshine hours(r=-0.246), rainfall (r= -0.116)**.** While there are some subtle trends, such as a slight tendency for thrips presence to decrease with higher minimum temperatures and increased relative humidity, these correlations do not reach statistical significance.

Distribution of *T. parvispinus* on fruits

The thrips found on fruit was very less when compared to leaves and flowers, and the thrips population fluctuated between 0.57 and 3.89, with an average of 2.19. The highest number of thrips per flower was observed in week 49, while the lowest number was observed in week 14 (Table 1).

The correlation analysis between the presence of thrips on fruits and various environmental factors, including temperature, rainfall, relative humidity, and sunshine hours presented in table 2., reveals that significant correlation is between the thrips population and the maximum temperature, with a coefficient of -0.438, non-significant negative with minimum temperature, rainfall, sunshine hours and positive with relative humidity. The present findings were in accordance with Gopal *et al*. (2018) who observed that there is negative correlation of *S. dorsalis* on chilli fruits with maximum and minimum temperature, rainfall, sunshine hours.

Conclusion

The population of thrips found throughout the crop growth period, active and peak level of chilli thrips was noticed during November - January months. The thrips population tended to increase during dry period with lower minimum temperature and lower intensity of rainfall. The correlation analysis between thrips on leaves and flowers in relation to weather parameters indicates that none of the parameters influenced significantly on thrips population.

Table 1 : Intra plant distribution of *T. parvispinus* on chilli

SMW	*T. parvispinus*/ leaf	*T. parvispinus*/ flower	*T. parvispinus*/ fruit	Temperature (°C)		Rainfall (mm)	Relative Humidity (%)		Sunshine hours
				Max.	Min.		I	II	
38	0.00	-	-	29.70	20.00	8.20	89.00	69.00	2.60
39	0.00	-	-	30.40	19.40	0.60	84.00	56.00	5.40
40	1.21	-	-	30.80	19.60	50.00	91.00	64.00	4.10
41	1.00	-	-	29.40	16.90	106.20	91.00	66.00	2.50
42	1.43	-	-	30.10	20.00	23.60	91.00	68.00	3.70
43	3.01	-	-	31.70	20.40	43.60	89.00	65.00	5.30
44	3.12	0.80	-	30.40	17.30	0.00	86.00	45.00	8.40
45	3.65	1.50	1.21	30.20	19.20	0.00	80.00	44.00	6.00
46	2.33	20.24	3.02	31.00	19.90	0.00	84.00	38.00	7.10
47	4.08	21.54	3.34	30.60	17.40	0.00	78.00	40.00	5.10
48	7.34	17.56	3.60	29.20	17.60	0.40	78.00	47.00	3.90
49	7.21	6.54	3.89	31.00	17.80	0.00	73.00	47.00	5.20
50	7.60	8.92	3.12	30.70	17.10	0.00	71.00	38.00	4.20
51	1.11	1.02	1.04	28.70	18.90	13.40	85.00	59.00	2.30
52	4.34	5.04	3.66	31.00	15.20	0.00	85.00	36.00	6.10
1	3.31	6.07	2.08	31.60	18.20	0.00	84.00	42.00	6.30
2	4.00	4.10	1.86	30.70	18.90	0.00	82.00	41.00	4.90
3	2.41	3.56	1.02	30.30	13.20	0.00	74.00	25.00	8.40
4	2.62	4.50	2.76	31.10	16.00	0.00	76.00	29.00	9.20
5	1.21	1.28	1.12	30.40	17.50	0.00	78.00	31.00	7.90
6	2.23	2.87	1.50	31.30	17.20	0.00	76.00	35.00	6.80
7	2.82	3.21	2.03	33.50	18.30	0.00	68.00	29.00	8.30
8	2.92	4.56	2.25	34.10	15.40	0.00	54.00	16.00	9.70
9	2.26	5.87	1.24	34.60	18.40	0.00	58.00	23.00	9.60
10	2.81	6.54	1.12	34.60	18.10	0.00	53.00	22.00	8.00
11	3.00	7.40	1.54	34.70	18.50	0.00	51.00	23.00	7.40
12	3.43	8.50	1.67	34.90	20.40	3.00	66.00	31.00	5.50
13	3.81	9.12	0.93	34.40	19.60	9.40	65.00	24.00	7.80
14	4.03	7.90	0.57	37.90	22.00	0.00	47.00	21.00	7.90

SMW: Standard Meteorological Week

Table 2 : Influence of weather parameters on *T. parvispinus* population

Part of plant	Correlation Coefficient (r)					
	Temperature		Rainfall	Relative humidity		Sunshine hours
	Maximum	Minimum		RH I	RH II	
Leaf	0.109	-0.158	-0.325	-0.279	-0.289	0.023
Flower	0.006	-0.209	-0.116	-0.005	0.053	-0.246
Fruit	-0.438*	-0.316	-0.325	0.410	0.394	-0.337

Note: *. Correlation is significant at the 5% level

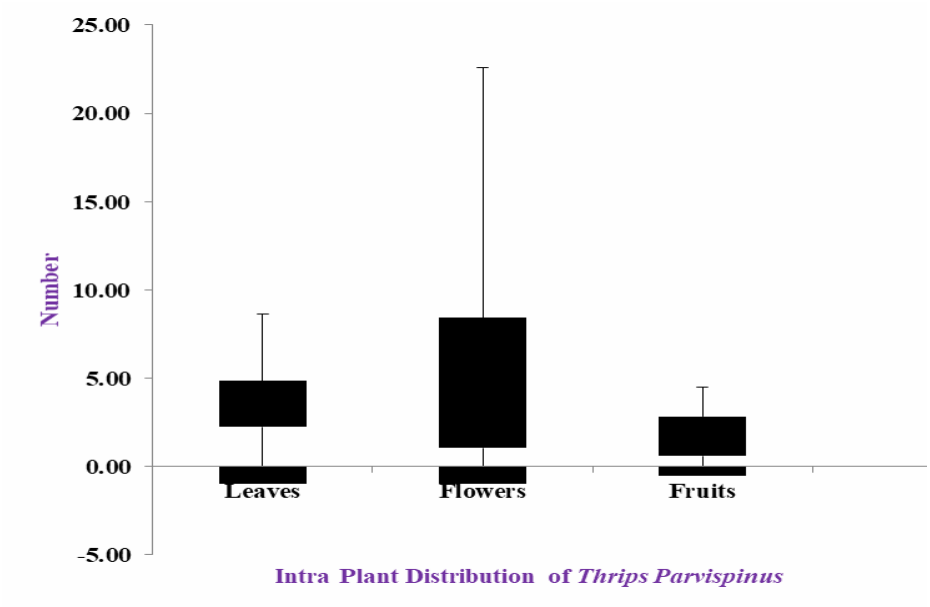

Fig. 1: Distribution of *T. parvispinus* on different plant parts of chilli

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