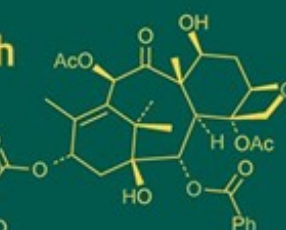


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Goldie Malsawmkimi

College of Agriculture, IGKV,
Raipur, Chhattisgarh, India

Dhanendra Kumar Rana

College of Agriculture, IGKV,
Raipur, Chhattisgarh, India

Akanand Dhimar

College of Agriculture, IGKV,
Raipur, Chhattisgarh, India

Seasonal population dynamics of major thrips species associated with soybean and groundnut in the Chhattisgarh Plain Zone

Goldie Malsawmkimi¹, Dhanendra Kumar Rana², Akanand Dhimar³

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ABSTRACT

Thrips are important insect pests of soybean and groundnut, and their abundance can vary with crop growth stage, plant part and prevailing weather conditions. The present study investigated the seasonal population dynamics of major thrips species associated with soybean and groundnut and their relationship with crop phenology and weather parameters in the Chhattisgarh Plain Zone. The study was conducted at the Instructional-cum-Research Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, during the rainy season of 2025–2026. *Thrips* populations were monitored weekly from 20 days after sowing until harvest, with observations recorded separately on leaves and flowers. Three predominant species, *Megalurothrips usitatus*, *Haplothrips ceylonicus* and *Thrips parvispinus*, exhibited distinct seasonal fluctuations, with population increases generally coinciding with the flowering and reproductive stages of the crops. *Megalurothrips usitatus* was the most abundant species, reaching maximum populations of 7.52 thrips per leaf and 9.52 thrips per flower on soybean during the 33rd standard meteorological week. On groundnut, its maximum population reached 5.70 thrips per leaf during the 32nd standard meteorological week and 7.95 thrips per flower during the 33rd standard meteorological week. *Haplothrips ceylonicus* and *Thrips parvispinus* attained their highest populations during the flowering to early reproductive stages. Across both crops, thrips populations were consistently higher on flowers than on leaves. Significant associations with weather parameters varied among species and crops, with temperature and relative humidity showing notable relationships. The findings demonstrate that thrips abundance is influenced by both crop phenology and prevailing weather conditions and highlight flowering as an important period for intensified monitoring of thrips populations in soybean and groundnut.

Keywords: *Megalurothrips usitatus*, *Haplothrips ceylonicus*, *Thrips parvispinus*, Population dynamics, Soybean, Groundnut

Introduction

Thrips (Thysanoptera: Thripidae) comprise an important group of minute insects associated with a wide range of agricultural crops. Several phytophagous species cause direct feeding injury to leaves, flowers and developing fruits, while some species also act as vectors of economically important plant viruses (Tyagi *et al.*, 2017) [1].

Their widespread distribution and ability to damage crops and transmit plant viruses make them an important group of pests in agricultural production, particularly in tropical and subtropical regions.

Soybean and groundnut are important oilseed crops that are affected by several economically important insect pests, including thrips. In groundnut, thrips feeding can cause silencing, necrosis and distortion of young leaflets. Some species like *Thrips palmi* is also a vector of Groundnut bud necrosis virus (GBNV; *Orthotospovirus arachinecrosis*) (Lakshmi *et al.*, 1995; Ghosh *et al.*, 2019) [2, 3]. In soybean, thrips feeding can cause silencing, bronzing and distortion of young foliage, while *Neohydatothrips variabilis* is recognized as the primary vector of Soybean vein necrosis virus (SVNV), with *Frankliniella fusca* and *F. tritici* also capable of transmitting the virus (Han *et al.*, 2019) [4]. Seasonal studies on groundnut have reported distinct periods of thrips occurrence and peak abundance, with substantial variation among seasons and locations (Wankhede *et al.*, 2020) [5]. Such seasonal variation highlights the importance of understanding the timing and magnitude of thrips populations for effective monitoring and timely management.

However, information on the species-specific seasonal dynamics of thrips associated with soybean and groundnut remains limited in the Chhattisgarh Plain Zone, particularly in relation to crop phenology and weather conditions. Temperature, relative humidity and rainfall may influence thrips development, activity and population growth, although the nature and magnitude of these relationships can vary among species, seasons and locations (Priyanka *et al.*, 2023) [6]. Species-specific studies have also demonstrated differences

Corresponding Author:**Goldie Malsawmkimi**

College of Agriculture,
IGKV, Raipur,
Chhattisgarh, India

in the timing and magnitude of seasonal activity in soybean, emphasizing the importance of region-specific information on population peaks and crop-stage associations (Keough *et al.*, 2018) [7]. Such information is essential for improving pest monitoring and developing timely management strategies. Therefore, the present study was undertaken to investigate the seasonal population dynamics of major thrips species associated with soybean and groundnut and to determine their relationship with crop growth stages and prevailing weather parameters in the Chhattisgarh Plain Zone.

Materials and methods

The field experiment was conducted at the Instructional-cum-Research Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, during *kharif* 2025–2026. Soybean (GC Soybean-11-15) and groundnut (CG Mungfali) were grown in plots of 5 × 4 m following recommended agronomic practices, except for insecticide application. *Thrips* populations were monitored at weekly intervals from 20 days after sowing until harvest. Five plants were randomly selected per plot, and observations were recorded from the upper, middle and lower portions of the plants. *Thrips* were counted by gently jerking leaves and flowers over a white paper sheet, and populations were expressed as mean number of thrips per leaf and per flower.

Observations were recorded in terms of standard meteorological weeks (SMW) and days after sowing (DAS). Leaf populations were monitored from 20 DAS, while flower observations were recorded from the onset of flowering. Weather data, including maximum and minimum temperature, rainfall, morning and evening relative humidity, wind velocity and bright sunshine hours, were obtained from the Agricultural Meteorological Observatory, IGKV, Raipur. Microclimatic observations were also recorded near the crop canopy using a temperature–humidity meter (FD-HYGRO, Forensics Detectors). The association between thrips population and weather parameters was determined using correlation analysis (Steel *et al.*, 1980) [8]. Population abundance on leaves and flowers was compared statistically, with significance assessed at the 5% level.

Results and discussions

Seasonal population dynamics of thrips

The population dynamics of *Megalurothrips usitatus*, *Haplothrips ceylonicus* and *Thrips parvispinus* are presented in Table 1 and table 2. All three species exhibited a gradual increase in population from the vegetative stage, followed by a decline towards crop maturity, although the timing and magnitude of peak abundance varied among species and crops.

Megalurothrips usitatus

Among the thrips species monitored, *M. usitatus* exhibited the highest population levels on both soybean and groundnut. It was first recorded during the 27th standard meteorological week (SMW) with 1.10 thrips/leaf on both soybean and groundnut. Its population on soybean increased progressively and reached a maximum of 7.52 thrips/leaf during the 33rd SMW (61 DAS), after which it declined and became absent after the 39th SMW. On groundnut, the population reached a maximum of 5.70 thrips/leaf during the 32nd SMW (55 DAS) and subsequently declined towards crop maturity. The seasonal mean population was 3.26 thrips/leaf on soybean and 2.27 thrips/leaf on groundnut. Thus, the maximum population of *M. usitatus* occurred during 32nd–33rd SMW, corresponding to the flowering to early pod-development period. This seasonal pattern agrees with previous observations of *M. usitatus* on soybean (Chang, 1987) [9] where its populations on soybean increased during vegetative growth, reached maximum abundance during flowering and declined as the crop matured. The higher seasonal mean on soybean further suggests that crop characteristics and the availability of suitable feeding sites may influence host preference. The concentration of the population during flowering indicates that this stage represents an important window for surveillance and management of *M. usitatus*.

The population on flowers showed a similar increasing trend but reached considerably higher levels than on leaves. On soybean, *M. usitatus* was first observed during the 29th SMW (34 DAS) with 2.40 thrips/flower and increased to a maximum of 9.52 thrips/flower during the 33rd SMW (61 DAS). On groundnut, it appeared during the 31st SMW (48 DAS), increased to 5.70 thrips/flower during the 32nd SMW and attained a maximum of 7.95 thrips/flower during the 33rd SMW (61 DAS). The seasonal mean populations were 5.48 and 5.12 thrips/flower on soybean and groundnut, respectively. *M. usitatus* has been reported to show a clear preference for reproductive plant parts (Chang, 1988) [10], while flowering legumes provide suitable conditions for feeding, oviposition and population growth (Tang *et al.*, 2023) [11].

Haplothrips ceylonicus

H. ceylonicus was first observed during the 27th SMW at 1.10 thrips/leaf on both crops. On soybean, the population increased gradually and attained a maximum of 4.95 thrips/leaf during the 34th SMW (68 DAS). On groundnut, the maximum population of 4.50 thrips/leaf was recorded during the 36th SMW (81 DAS). The seasonal mean populations were 2.67 thrips/leaf on soybean and 2.33 thrips/leaf on groundnut. The species persisted for a longer period on groundnut than on soybean. The gradual increase in population from the vegetative stage to flowering is consistent with the general ecology of *Haplothrips* species, which are commonly associated with flowers and pollen (Lewis, 1997) [12].

H. ceylonicus appeared on soybean flowers during the 29th SMW and attained a maximum of 5.95 thrips/flower during the 34th SMW (68 DAS). On groundnut, it was first recorded during the 31st SMW and reached a maximum of 5.85 thrips/flower during the 35th SMW (74 DAS). The seasonal mean population was 3.50 thrips/flower on soybean and 3.92 thrips/flower on groundnut. Similar observations have also been reported, with pollen availability identified as an important factor regulating the abundance of flower-inhabiting thrips (Kirk, 1997) [13]. The persistence of *H. ceylonicus* during the later reproductive stage therefore appears to be closely associated with the continued availability of suitable floral resources.

Thrips parvispinus

Thrips parvispinus was recorded from the 27th SMW on both crops. On soybean, the population increased from 0.45 thrips/leaf and reached a maximum of 3.30 thrips/leaf during the 35th SMW (74 DAS), whereas on groundnut it attained a maximum of 2.80 thrips/leaf during the 32nd SMW (55 DAS). The population subsequently declined towards crop maturity. The seasonal mean populations were 1.85 thrips/leaf on soybean and 1.40 thrips/leaf on groundnut. A comparable seasonal pattern was also documented in chilli, where *T. parvispinus* populations appeared shortly after the vegetative stage, increased progressively with crop development, reached their maximum during peak flowering, and subsequently declined towards harvest (Srinivasnaik *et al.*, 2025) [14]. Although the crop differs from the present study, both investigations indicate that flowering is an important period for population build-up of *T. parvispinus*.

On flowers, *T. parvispinus* reached 4.10 thrips/flower on soybean at 34th SMW (68 DAS), whereas the maximum population on groundnut was 3.80 thrips/flower during the 34th SMW (68 DAS). The seasonal mean population was 2.32 thrips/flower on soybean and 2.50 thrips/flower on groundnut. The occurrence of peak populations during the reproductive phase suggests that *T. parvispinus*, like the other predominant species, benefited from the availability of flowers and young reproductive tissues. Its stronger association with flowers is also consistent with its ecology as a flower-associated thrips (Reitz, 2009) [15].

Leaf versus flower population

The interaction between crop and plant part (leaf and flower) on the population of the three predominant thrips species, *Megalurothrips usitatus*, *Haplothrips ceylonicus* and *Thrips parvispinus* are presented in Table 3.

Thrips abundance differed between plant parts, with flowers supporting higher populations than leaves across both crops. The mean popu-

lation of all the three species occurred at higher densities on flowers than leaves in both crops.

Table 1. Population dynamics of thrips species on major oilseed crops during *Kharif* season (2025-26) on a per leaf basis

Date of observation	SMW	DAS	Mean population of thrips/leaf					
			Soybean			Groundnut		
			<i>M. usitatus</i>	<i>H. ceylonicus</i>	<i>T. parvispinus</i>	<i>M. usitatus</i>	<i>H. ceylonicus</i>	<i>T. parvispinus</i>
5-07-2025	27	20	1.10	1.10	0	1.10	1.10	1.00
12-07-2025	28	27	1.55	1.75	0.45	1.75	1.58	1.30
19-07-2025	29	34	2.40	2.00	1.10	2.20	1.70	1.45
26-07-2025	30	41	3.20	2.89	1.55	3.55	1.75	2.00
02-08-2025	31	48	3.55	2.80	2.20	3.60	2.20	2.10
09-08-2025	32	55	4.25	3.20	2.40	5.70	2.40	2.80
16-08-2025	33	61	7.52	3.35	2.80	4.95	2.80	2.20
23-08-2025	34	68	6.46	4.95	3.10	4.50	3.20	2.10
30-08-2025	35	74	5.70	4.50	3.30	3.60	3.85	2.00
6-09-2025	36	81	4.50	3.20	2.00	2.20	4.50	1.80
13-09-2025	37	88	3.20	2.95	2.40	2.00	4.35	1.75
20-09-2025	38	95	2.20	2.55	2.00	1.75	3.89	1.50
27-09-2025	39	102	0	1.20	1.55	1.60	3.40	1.20
4-10-2025	40	108	0	1.00	1.10	1.55	2.55	1.00
11-10-2025	41	115	-	-	-	1.30	2.45	0.80
18-10-2025	42	122	-	-	-	0.85	1.30	0.75
25-10-2025	43	129	-	-	-	0.70	0.80	0.50
01-11-2025	44	166	-	-	-	0.30	0.50	0.30
07-11-2025	45	142	-	-	-	0	0	0
Seasonal mean			3.26	2.67	1.85	2.27	2.33	1.40

The consistently greater abundance on flowers indicates that reproductive structures provided more favourable feeding and breeding conditions than foliage. The greater abundance of *H. ceylonicus* and *T. parvispinus* on groundnut flowers may be associated with the availability of fresh flowers over a relatively extended reproductive period. Floral resources, particularly pollen, can provide important nutritional resources for flower-associated thrips and contribute to population de-

velopment and reproductive success (Kirk, 1997; Reitz *et al.*, 2020) [13, 16]. Therefore, the present results indicate that flowering is a critical phenological stage for the build-up of the thrips complex on soybean and groundnut. Consequently, monitoring programs based exclusively on leaf sampling may underestimate thrips abundance during the flowering period.

Table 2. Population dynamics of thrips species on major oilseed crops during *Kharif* season (2025-26) on a per flower basis

Date of observation	SMW	DAS	Mean population of thrips/flower					
			Soybean			Groundnut		
			<i>M. usitatus</i>	<i>H. ceylonicus</i>	<i>T. parvispinus</i>	<i>M. usitatus</i>	<i>H. ceylonicus</i>	<i>T. parvispinus</i>
19-07-2025	29	34	2.40	2.00	1.10	-	-	-
26-07-2025	30	41	3.20	2.09	1.55	-	-	-
02-08-2025	31	48	4.55	2.80	2.20	4.60	2.20	1.80
09-08-2025	32	55	6.25	3.20	2.40	5.70	3.40	2.00
16-08-2025	33	61	9.52	3.35	2.80	7.95	3.80	3.20
23-08-2025	34	68	7.46	5.95	4.10	5.50	4.20	3.80
30-08-2025	35	74	5.00	4.30	2.10	4.50	5.85	3.00
06-09-2025	36	81	-	-	-	4.00	4.20	2.50
13-09-2025	37	88	-	-	-	3.50	3.60	1.20
Seasonal mean			5.48	3.50	2.32	5.12	3.92	2.50

Relationship with weather parameters

The correlation coefficients between major microclimatic factors and the population of the predominant thrips species on soybean and groundnut during the *Kharif* season of 2025–2026 are presented in Table 4. Under microclimatic conditions, *M. usitatus* on groundnut showed a significant positive association with morning relative humidity ($r = 0.470^*$), this suggests that relatively humid morning con-

ditions may favour its activity and survival. Similar observations were reported where the development and abundance of *M. usitatus* were influenced by environmental factors, particularly temperature, humidity and host phenology (Tang *et al.*, 2023) [11], whereas *T. parvispinus* on soybean exhibited significant negative associations with maximum temperature ($r = -0.589^*$) and minimum temperature ($r = -0.575^*$), but a positive association with morning relative humidity ($r = 0.619^*$). Associations between *T. parvispinus* population dynam

ics, weather conditions and crop phenology were also previously reported (Srinivasnaik *et al.*, 2025) [14].

Table 3. Interaction between thrips population of leaf and flower on major oilseed crops during *Kharif* season (2025-26)

Crops	Mean population of thrips species (per leaf and flower)					
	<i>M. usitatus</i>		<i>H. ceylonicus</i>		<i>T. parvispinus</i>	
	leaf	flower	leaf	flower	leaf	flower
Soybean	3.26	5.48	2.67	3.50	1.85	2.32
Groundnut	2.27	5.12	2.33	3.92	1.40	2.50
C.D.	0.831	0.416	0.514	0.257	0.508	0.254
<i>SE_d</i>	0.405	0.203	0.251	0.125	0.247	0.124
<i>SE_m</i>	0.286	0.143	0.177	0.089	0.175	0.087
Interaction						
C.D.	1.176		0.727		0.718	
<i>SE_d</i>	0.573		0.354		0.350	
<i>SE_m</i>	0.405		0.251		0.247	

The correlation coefficients between major macroclimatic parameters and the population of the predominant thrips species on soybean and groundnut during the *Kharif* season of 2025–2026 are presented in Table 5. Under macroclimatic conditions, *M. usitatus* on soybean showed significant negative associations with minimum temperature ($r = -0.596^*$) and sunshine hours ($r = -0.543^*$) and positive associations with morning ($r = 0.446^*$) and evening relative humidity ($r = 0.540^*$). None of the macroclimatic variables showed a significant association with *M. usitatus* on groundnut. *H. ceylonicus* showed sig-

nificant negative associations with maximum temperature ($r = -0.473^*$) and rainfall ($r = -0.445^*$) on soybean, while *T. parvispinus* showed a significant negative association with minimum temperature ($r = -0.529^*$) and significant positive association with evening relative humidity ($r = 0.528^*$). On groundnut, significant associations were observed mainly for *T. parvispinus* with morning relative humidity ($r = -0.538^*$), wind velocity ($r = 0.546^*$) and sunshine hours ($r = 0.534^*$).

Table 4. Correlation coefficient (r) between microclimate and thrips species on major oilseed crops during *Kharif* season (2025-26)

Thrips species	Crops	Max. Temp.(°C)	Min. Temp. (°C)	Relative Humidity (%)	
				I	II
<i>M. usitatus</i>	Soybean	-0.017	-0.080	0.092	-0.252
	Groundnut	-0.434	-0.392	0.470*	0.123
<i>H. ceylonicus</i>	Soybean	0.134	0.052	-0.027	-0.220
	Groundnut	-0.186	-0.273	0.213	-0.149
<i>T. parvispinus</i>	Soybean	-0.589*	-0.575*	0.619*	0.157
	Groundnut	0.090	-0.014	-0.026	-0.288

*Significant at $P = 0.05$ ($r = \pm 0.443$)

The significant correlations indicate that weather conditions were associated with thrips population fluctuations. However, the direction and magnitude of the relationships varied among species and crops. The positive association of morning relative humidity with *T. parvispinus* and *M. usitatus* suggests that relatively humid conditions may favour their activity or persistence, whereas the negative associa-

tion with temperature observed for *T. parvispinus* suggests reduced abundance under relatively warmer conditions during the study period. These relationships should be interpreted as associations rather than direct causal effects because thrips abundance is also influenced by crop phenology, plant condition and other biotic factors.

Table 5. Correlation coefficient (r) between macroclimate and thrips species on major oilseed crops during *Kharif* season (2025-26).

Thrips species	Treatment	Max. Temp .(°C)	Min. Temp. (°C)	Rainfall (mm)	Relative Humidity (%)		Wind velocity (Kmph)	Sun Shine (hours)
					I	II		
<i>M. usitatus</i>	Soybean	-0.397	-0.596*	-0.596*	0.446*	0.540*	-0.397	-0.543*
	Groundnut	-0.095	-0.291	-0.291	0.181	0.329	-0.023	-0.126
<i>H. ceylonicus</i>	Soybean	-0.473*	-0.401	-0.401	0.235	0.370	-0.169	-0.265
	Groundnut	-0.126	-0.398	-0.287	0.337	0.427	-0.175	-0.307
<i>T. parvispinus</i>	Soybean	-0.304	-0.529*	-0.334	-0.409	0.528*	-0.304	-0.475
	Groundnut	-0.277	0.393	-0.233	-0.538*	-0.277	0.546*	0.534*

*Significant at $P = 0.05$ ($r = \pm 0.443$)

Conclusion

The population dynamics study revealed distinct seasonal fluctuations in the major thrips species associated with soybean and groundnut during kharif 2025–2026, with population buildup coinciding broadly with the flowering and early reproductive stages. *Megalurothrips usitatus* was the predominant species and attained its maximum population during the 33rd SMW, reaching 7.52 thrips/leaf and 9.52 thrips/flower on soybean. *Haplothrips ceylonicus* reached maximum abundance during late flowering to early pod development, whereas *T. parvispinus* attained its highest population around 68 DAS. Populations were consistently higher on flowers than leaves, highlighting the importance of reproductive plant parts for monitoring. Weather variables influenced thrips abundance differently among species and host crops, with temperature and relative humidity showing the most notable associations. These findings indicate that crop phenology, together with prevailing weather conditions, should be considered when developing monitoring and forecasting strategies for thrips in soybean and groundnut.

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