



## Research Article

# Thrips and their natural enemies in different ornamental plants of Himachal Pradesh

SUMAN SANJTA<sup>1\*</sup>, USHA CHAUHAN<sup>1</sup> and PAWAN KUMAR MEHTA<sup>2</sup>

<sup>1</sup>Department of Entomology, Dr. Y S Parmar University of Horticulture and Forestry, Nauni, Solan – 173230, Himachal Pradesh, India

<sup>2</sup>Department of Entomology, CSKHPKV Palampur, Kangra – 176062, Himachal Pradesh, India

\*Corresponding author E-mail: sumansanjta@gmail.com

**ABSTRACT:** During a survey conducted in different ornamentals under mid-hill conditions of Himachal Pradesh, twenty six species of thrips viz. *Thrips* spp. (two different species), *T. tabaci* Lindeman, *T. flavus* Schrank, *T. flavidulus* Bagnall, *T. carthami* Shumsher Singh, *T. palmi* Karny, *T. kodaikanalensis* Ananthakrishnan and Jagadish, *T. simplex* Morison, *T. hawaiiensis* Morgan, *T. setosus* Moulton, *T. andrewsi* Bagnall, *T. florum* Schmutz, *T. himalyanus* Pelikan, *Taeniothrips* sp., *Microcephalothrips abdominalis* Crawford DL, *Frankliniella sulphurea* Trybom, *Neohydatothrips samayankur* Kudo, *Megalurothrips* sp., *Scirtothrips dorsalis* Hood, *Scolothrips sexmaculatus* Pergande, *Aeolothrips* spp. and *A. indicus* Bhatti, *Haplothrips?* *tenuipennis*, *Haplothrips tenuipennis* Bagnall and *H. clarisetis* Priesner were reported. Out of these, *Thrips tabaci* and *Thrips flavus* dominated all species by contributing 10 and 18.33 per cent, respectively. Among natural enemies *Orius* sp., *Coccinella septempunctata*, *Hipodamia variegata*, *Oenopia* Kirby, *Amblyseius* sp, *Euseius* sp and spiders (unidentified) were found. The results of this study update the list of thrips and their associated natural enemies in the state. It paves new ways for the researchers for future studies on the thrips and their impact as the vectors of diseases and assessment of predatory potential of different predatory species of thrips and natural enemies can be exploited for the management of pest species.

**KEY WORDS:** Himachal Pradesh, natural enemies, ornamental, thrips

(Article chronicle: Received: 09-08-2017; Revised: 08-02-2018; Accepted: 12-03-2018)

## INTRODUCTION

Mid hills of Himachal Pradesh are located between 30° 85' N–32° 29' N latitude and 75° 10' E–77° 16' E longitude at an altitude of 935-1525 meters above mean sea level. Due to its unique geographical position and edapho-climatic conditions, it is suitable for growing different kinds of ornamental plants (Thakur *et al.*, 2009). Ornamental plants are grown for their aesthetic value and for commercial purpose as cut flower, loose flowers and seed purpose. Many different kinds of insects and mites i.e., tetranychid mites, aphids, thrips etc. feed on ornamental plants which hamper their aesthetic and economic value (Mirab-balou *et al.*, 2009), out of which thrips are reported to be one of the important pest. Because of the small size of thrips, life stages and rapid movement make it difficult to detect these insects in fresh vegetation, and they also can transmit viruses on different plants

(Silagyi and Dixon, 2006; Parrella *et al.*, 2003). During the past decades, the losses of agricultural and horticultural produce caused by thrips increased considerably, resulting in losses of millions of dollars (ThripsWiki, 2015). Despite postharvest and quarantine procedures, thrips species are spreading worldwide very quickly. Insecticide resistance has continued to be a widespread problem with the thrips, as populations have continued to evolve resistance to all manner of new insecticides (Gao *et al.*, 2012). Therefore, to combat insecticide resistance in the thrips non-insecticidal tactics, such as biological control is required. Various species have been reported to feed on thrips. The most abundant group of natural enemies of thrips are eulophids, anthocorid bugs, predatory mites, coccinellids, neuropterans, cecidomyiid and spiders (Yee *et al.*, 2000). But from Himachal Pradesh, no earlier reports are present on this aspect. In view of this, the present investigation was carried out to study the diversity of the thrips fauna and its

associated natural enemies in different vegetable crops in the mid hill conditions of Himachal Pradesh.

## MATERIALS AND METHODS

The study was carried out at Nauni, (1275 meters above mean sea level) and surrounding areas (near University campus of UHF, Nauni) in Solan district of Himachal Pradesh. Thrips and their natural enemies were collected from different ornamentals (Table 1) in both seasons (summer and winter) of the year during 2013 and 2014. At each collection site, five plants were randomly selected for sampling. From each plant five leaves or flowers were selected randomly for collection and were beaten on white tray with a stick. The fallen thrips were collected in the collecting fluid containing 60% alcohol and glacial acetic acid (9:1) with Triton-X (1 mL/1000mL) and were mounted as prescribed by Bhatti (1999). The natural enemies were collected and preserved by carding or pinning. The slides with mounted specimens were observed under phase contrast microscope. Thrips were identified using taxonomic keys, digital images and descriptions of Palmer (1992), Bhatti (1980), Ananthkrishnan and Sen (1980), and Masumoto (2010). Some of the specimens were sent to Dr J S Bhatti (Retired Prof, Hans Raj college, Delhi), Dr. Vikas Kumar (Scientist C, CDT, ZSI, Kolkata) and Dr. Koumud Tyagi (PDF, CDT, ZSI, Kolkata) for identification or confirmation of identity. Natural enemies were identified with the identified reference specimens present in the laboratory. For estimating the diversity of thrips and their associated natural enemies the data of individual plants/trees of fruits, vegetables, ornamentals and medicinal plants was pooled together. The species which were present in negligible numbers were not considered for diversity calculations. The following formulae were used:

Relative proportion of *i*th species =

$$\frac{\text{Total number of individuals of } i\text{th species}}{\text{Total number of individuals of all the species}}$$

**Diversity indices:** Diversity indices like Shannon diversity index, maximum diversity, species evenness and species dominance was calculated as per procedure given by Shannon (1948) which is described as under:

Shannon diversity index (H) =  $-\sum p_i \log_e p_i$  ;

where  $p_i$  = fraction of *i*th species

Maximum diversity index ( $H_{\max}$ ) =  $\log_e k$  ;

$k$  = total number of species

Species evenness (J) =  $H$

Species dominance (D) =  $\frac{H}{H_{\max} - 1 - J}$

## RESULTS AND DISCUSSION

During the investigation, twenty six species of thrips were

recorded in different ornamentals like rose, chrysanthemum, calendula, helichrysum, hydrangea, bouganvillea, marigold, geranium, acania, pansy, nasturtium, lupin, sweet allysum, sweet william, gladiolus, dahlia, daisy, carnation, wall flower and weeping willow. Among the identified thrips, twenty two species were phytophagous and four were predatory. The phytophagous species were Thrips spp. (two different species), *T. tabaci*, *T. simplex*, *T. carthami*, *T. palmi*, *T. andrewsi*, *T. himalyanus*, *T. setosus*, *T. hawaiiensis*, *T. kodaikanalensis*, *T. florum*, *T. flavus*, *T. flavidulus*, *Scirtothrips dorsalis*, *Megalurothrips peculiaris*, *Neohydathrips samayankur*, *Frankliniella sulphurea*, *Taeniothrips* sp. *Microcephalothrips abdominalis*, *Haplothrips clarisetis*, *Haplothrips tenuipennis* and *Haplothrips ?tenuipennis*. Predatory species were *Scolothrips sexmaculatus*, *Aeolothrips* sp. and *A. indicus*. Sood and Kakkar (1990) conducted a survey on ornamentals in different areas of Himachal Pradesh. The ornamentals surveyed were iris, rose, dahlia, sweet pea, chrysanthemum, marigold, zinnia, calendula, carnation, nasturtium, oriental poppy, phlox, hibiscus, sweet william, celosia and gladiolus. They reported eleven species of thrips which were *Frankliniella schultzei*, *Microcephalothrips abdominalis*, *Lefroythrips lefroyi*, *Megalurothrips distalis*, *Thrips flavus*, *T. hawaiiensis*, *Taeniothrips flavus*, *Haplothrips ganglbaueri*, *Haplothrips coloratus* and *Liothrips* sp. However, they didn't record any predatory thrips species whereas in the present study three predatory species were recorded. *Lefroythrips lefroyi*, *Megalurothrips distalis*, *Haplothrips ganglbaueri*, *Haplothrips coloratus* and *Liothrips* sp., which were reported by Sood and Kakkar (1990), couldn't be collected in the present study. The difference could be due to different crops and locality surveyed. Sood and Kakkar (1990) conducted survey in different areas of Himachal Pradesh whereas present survey was confined to Nauni and surrounding areas. Among natural enemies *Orius* sp., *Coccinella septempunctata*, *Hippodamia variegata*, *Oenopia* Kirby, *Amblysius* sp. *Euseius* sp. and spiders (unidentified) were found.

**Table 1. Different ornamental crops surveyed**

Ornamental plants	Rose ( <i>Rosa</i> sp.), gladiolus ( <i>Gladiolus</i> hybrid), marigold ( <i>Tagetes</i> spp.), carnation ( <i>Dianthus caryophyllus</i> ), chrysanthemum ( <i>Dendranthema grandiflorum</i> ), jasmine ( <i>Jasminum</i> sp.), hydrangea ( <i>Hydrangea macrophylla</i> ), annuals (winter and summer), weeping willow, bottle brush, bouganvillea

Among natural enemies *Orius* sp. occurred in rose, chrysanthemum and dahlia and spiders were present on bouganvillea, helichrysum and rose. *Coccinella septempunctata* was found on rose, helichrysum and nasturtium, whereas, *Oenopia kirbyi* was collected from helichrysum and calendula. *Hippodamia variegata*, *Amblysius* sp. and *Euseius*

**Table 2. Distribution of Thrips and their natural enemies in different ornamental plants**

Order	Family	Species	Crop	Location
Thysanoptera	Thripidae	<i>Thrips tabaci</i>	Chrysanthemum, calendula, helichrysum, hydrangea, bouganvillea	Nauni, Gaura
		<i>Thrips</i> sp.	Sweet william, candy tuft	Nauni
		<i>Thrips</i> sp.	Bells of Ireland	Nauni
		<i>Thrips flavus</i>	Marigold, calendula, geranium	Nauni, Gaura
		<i>Thrips palmi</i>	Marigold, nasturtium, calendula, pansy, lupin, sweet allysum	
		<i>Thrips flavidulus</i>	Marigold, acania, pansy,	Nauni
		<i>Thrips carthami</i>	Marigold, nasturtium, calendula, pansy	Nauni
		<i>Thrips setosus</i>	Lupin, calendula, sweet William	Nauni
		<i>Thrips kodaikanalensis</i>	Helichrysum	Nauni
		<i>Thrips simplex</i>	Gladiolus	Nauni
		<i>Thrips hawaiiensis</i>	Rose, acania, marigold, dahlia	Nauni, Gaura
		<i>Thrips andrewsi</i>	Rose, lupin	Nauni
		<i>Thrips florum</i>	Rose, dahlia	Nauni, Gaura
		<i>Thrips himalyanus</i>	African daisy, marigold, sweet allysum	Nauni
		<i>Taeniothrips</i> sp.	Lupin, bouganvillea	Nauni
		<i>Retithrips syriacus</i>	Acania	Nauni
		<i>Microcephalothrips abdominalis</i>	Marigold, lupin, rose	Nauni
		<i>Frankliniella sulphurea</i>	Carnation	Nauni
		<i>Neohydatothrips samayankur</i>	Marigold	Nauni, Rajgarh, Gaura
		<i>Megalurothrips peculiaris</i>	Calendula	Nauni
	<i>Scirtothrips dorsalis</i>	Weeping willow	Nauni	
	<i>Scolothrips sexmaculatus</i>	Rose	Nauni	
	Aeolothripidae	<i>Aeolothrips</i> sp.	Wall flower	Nauni
		<i>Aeolothrips indicus</i>	Calendula, lupin	Nauni
	Phlaeothripidae	<i>Haplothrips tenuipennis</i>	Helichrysum, chrysanthemum, dahlia, pansy, rose, sweet william	Nauni, Gaura
		<i>Haplothrips ?tenuipennis</i>	Candy tuft	Nauni
<i>Haplothrips clarisetis</i>		Chrysanthemum, helichrysum	Nauni	
Hemiptera	Anthocoridae	<i>Orius</i> sp.	Rose, Chrysanthemum, dahlia	Nauni
Coleoptera	Coccinellidae	<i>Coccinella septempunctata</i>	Rose, Helichrysum, Nasturtium	Nauni, Gaura
		<i>Hippodamia variegata</i>	Rose	Nauni
		<i>Oenopia kirbyi</i>	Rose	Nauni
Mesostigmata	Phytoseiidae	<i>Amblyseius</i> sp.	Rose	Nauni
		<i>Euseius</i> sp.	Rose	Nauni

**Table 3. Diversity of thrips and natural enemies on ornamental plants**

Species	Relative proportion (%)
A. Phytophagous species	
<i>Thrips tabaci</i>	10
<i>Thrips flavus</i>	18.33
<i>Thrips flavidulus</i>	3.33
<i>Thrips carthami</i>	3.33
<i>Thrips setosus</i>	1.67
<i>Thrips palmi</i>	3.33
<i>Thrips kodaikanalensis</i>	1.67
<i>Thrips simplex</i>	1.67
<i>Thrips hawaiiensis</i>	3.33
<i>Thrips andrewsi</i>	1.67
<i>Thrips florum</i>	5
<i>Thrips himalyanus</i>	3.33
<i>Frankliniella sulphurea</i>	1.67
<i>Taeniothrips</i> sp.	1.67

<i>Microcephalothrips abdominalis</i>	6.67
<i>Neohydatothrips samayankur</i>	3.33
<i>Megalurothrips peculiaris</i>	1.67
<i>Scirtothrips dorsalis</i>	1.67
<i>Haplothrips clarisetis</i>	1.67
<i>Haplothrips tenuipennis</i>	3.33
<i>Haplothrips ?tenuipennis</i>	1.67
B. Predatory species	1.67
<i>Scolothrips sexmaculatus</i>	
<i>Aeolothrips</i> sp.	1.67
<i>Aeolothrips indicus</i>	1.67
<i>Amblyseius</i> sp.	1.67
<i>Euseius</i> sp.	1.67
<i>Orius</i> sp.	5
<i>Hippodamia variegata</i>	1.67
<i>Coccinella septempunctata</i>	3.33
<i>Oenopia kirbyi</i>	1.67
Spiders (unidentified)	1.67
Total	100
Shanon index (H)	3.27
H <sub>max</sub>	3.4
Evenness (J)	0.96
Dominance (D)	0.04

sp. were collected from only rose. Nisha Devi and Gupta (2010) recorded two species of predacious anthocorid bugs, namely *Orius niger* Wolff and *O. bifilarus* Ghauri feeding on thrips collected from jasmine from Solan. Sanjta and Chauhan (2015) also recorded *Orius* sp., *Oenopia kirbyi* and *Coccinella septempunctata* feeding on thrips from Nauni, Soaln on different fruit trees. Greenberg *et al.*, (2009) also recorded *Orius* spp., *Hippodamia* spp. (Coccinellid beetles) and spiders associated with thrips on cotton in Texas. *Amblyseius* sp. and *Euseius* sp. were also recorded by Chandel and Chauhan (2014) from Solan on rose.

#### ACKNOWLEDGEMENT

Authors are grateful to Dr J S Bhatti (Retd. Prof. Hans raj College), Dr Laurence Mound (CAB International Institute of Entomology), Dr. Vikas Kumar (Scientist C, CDT, ZSI, Kolkata) and Dr Kaumud Tyagi (PDF, CDT, ZSI, Kolkata) for identification of certain specimens, for providing literature and valuable suggestions.

#### REFERENCES

- Ananthakrishnan TN, Sen S. 1980. Taxonomy of Indian Thysanoptera. *ZSI Handbook Series* **1**: 1–234.
- Bhatti JS. 1980. Species of the genus Thrips from India (Thysanoptera). *Syst Entomol.* **5**: 109–166. <https://doi.org/10.1111/j.1365-3113.1980.tb00404.x>
- Bhatti JS. 1999. Enigmatic tentorium in adults of the Onion thrips, *Thrips tabaci*. *Thrips* **1**: 15–30.
- Chandel V, Chauhan U. 2014. Diversity of mite (Acari) fauna associated with vegetables and ornamental plants in midhill conditions of Himachal Pradesh. *J Biol Control.* **28**(2): 18–2
- Gao, Y, Lei, Z, Reitz, SR. 2012. Western flower thrips resistance to insecticides: detection, mechanisms and management strategies. *Pest Manag Sci.* **68**: 1111–1121. <https://doi.org/10.1002/ps.3305> PMID:22566175
- Masumoto M. 2010. Key to genera of the subfamily Thripinae (Thysanoptera: Thripidae) associated with Japanese plant quarantine. *Res Bull Pl Prot Station Japan* **46**: 25–59.
- Majid M. 2014. Newly recorded species of the genus *Haplothrips* (Insecta: Thysanoptera) from Iran. *J Crop Prot.* **3**(4): 557–561.
- Devi N, Gupta PR. 2010. Anthocorid bugs encountered on cultivated crops and ornamentals, and an attempt to rear *Orius niger* Wolff under laboratory conditions. *Pest Manag Econ Zool.* **18**(1): 313–320.
- Palmer JM. 1992. Thrips from Pakistan to the Pacific: a review. *Bull Br Mus Nat Hist Entomol.* **61**: 1–76.

- Parrella G, Gognalons P, Gebreselassie K, Vovlas C, Marchoux G. 2003. Update of the host range of tomato spotted wilt virus. *J Plant Pathol.* **85**: 227–264.
- Sanjta S, Chauhan U. 2015. Survey of thrips fauna and their natural enemies in different fruit crops under mid hills of Himachal Pradesh. *J Insect Sci.* **28**(2):202-207.
- Shannon CE. 1948. A mathematical theory of communication. *Bell System Tech J.* **27**: 379–423. <https://doi.org/10.1002/j.1538-7305.1948.tb00917.x>
- Silagyi AJ, Dixon WN. 2006. Assessment of chilli thrips, *Scirtothrips dorsalis*, in Florida. Florida Cooperative Agricultural Pest Survey, Division of Plant Industry, Florida Department of Agriculture and Consumer Services, Gainesville.
- Sood AK, Kakar KL. 1990. Record of insect and non-insect pests on ornamental plants from Himachal Pradesh. *J Insect Sci.* **3**(2): 141–145.
- Thakur P, Kashyap B, Gupta YC. 2009. Wild ornamental bulbous plants of Himachal Pradesh for landscaping. *Int J Forest Usufructs Mgmt.* **10**(1): 67–74.
- Thrips wiki. 2015 Available from: [http://thrips.info/w/index.php?title=Main\\_Page&oldid=49404](http://thrips.info/w/index.php?title=Main_Page&oldid=49404)
- Yee WL, Phillips PA, Rodgers J, Faber BA. 2000. Abundance and population trends of predators of *Scirtothrips perseae* and *Oligonychus perseae* on avocado in Ventura County, California. California conference on biological control II, The Historic Mission Inn Riverside, California USA. pp. 195–200.