



## THRIPS FAUNA OF KHANGCHENDZONGA NATIONAL PARK, SIKKIM WITH FIRST DESCRIPTION OF HITHERTO UNKNOWN MALE *SMILOTHRIPS PRODUCTUS* BHATTI

TH D SONGOMSING CHIRU<sup>1</sup>, TH JOHNSON<sup>1</sup>, R VARATHARAJAN<sup>1</sup> AND R R RACHANA<sup>2\*</sup>

<sup>1</sup>Department of Zoology, School of Life Sciences, Manipur University, Imphal 795003, Manipur, India

<sup>2</sup>ICAR-National Bureau of Agricultural Insect Resources, Bengaluru 560024, Karnataka, India

\*Email: vavarachana@gmail.com (corresponding author): ORCID ID 0000-0001-5061-5634

### ABSTRACT

Survey was conducted to assess thrips fauna of Khangchendzonga National Park (KNP), Sikkim Himalaya during 2020 and 2021 and it resulted in the collection of 44 species of thrips at the altitude ranging from 899-2035 m asl. In terms of feeding diversity, 18 phyllophilous, 15 anthophilous, 2 gall inducers, 4 mycophagous and 5 grass inhabiting thrips were recorded. The previously unknown male of *Smilothrips productus* Bhatti is also described for the first time. The individuals of *S. productus* collected from India were found to be only macropterous, while that of Chinese forms include both micropterous and brachypterous.

**Key words:** Survey, thrips, Sikkim, Terebrantia, Tubulifera Himalaya, Khangchendzonga National Park, host plant, phyllophilous, anthophilous, mycophagous, *Smilothrips*.

Thrips belong to the insect order Thysanoptera whose current strength is about 6,377 extant species in 785 genera (ThripsWiki, 2022). The name ‘thrips’ is taken from the ancient Greek word θρίψ, *thrips* meaning “woodworm” and can denote both singular and plural forms. Other common names are thunderflies, thunderbugs, storm flies, thunderblights, storm bugs, corn fleas, corn flies, corn lice, freckle bugs, harvest bugs and physopods (Kirk, 1996; Marren and Mabey, 2010; Kobro, 2011). Some of the thrips species play a pivotal role as pollinators (Mound and Terry, 2001; Nyree et al., 2004; Varatharajan et al., 2016) and predators (Lewis, 1973; Ananthakrishnan, 1993). A few of them are pests (Ananthakrishnan, 1993; Mound, 2005), vectors of tospoviruses (Mound, 1996) and gall inducers (Ananthakrishnan, 1978, 1979; Raman and Ananthakrishnan, 1984). A total of 763 species are known from India (Tyagi and Kumar, 2016; Rachana and Varatharajan, 2017), of which, nearly 200 species have been recorded from the northeastern region (Varatharajan, 2005). Thrips fauna of northeastern India has been extensively surveyed by the researchers of Manipur University and ZSI. However, the Sikkim Himalayan region has been unexplored with a stray report of a few species (Sen et al., 1988). Owing to lack of information pertaining to thrips of the Sikkim Himalaya which lies in a strategic position besides, sharing international boundary with Nepal, China and Bhutan; it becomes imperative to know about thrips fauna. The present study focuses on thrips fauna of this organic state in general including that of

Khangchendzonga National Park, Sikkim, which is a part of the biodiversity hotspot region of the eastern Himalaya.

### MATERIALS AND METHODS

Khangchendzonga National Park (KNP) is recently inscribed to the UNESCO’s mixed natural and cultural ‘World Heritage Site’ which covers an area of 1784 km<sup>2</sup> constituting 25.14% of the total geographical area of Sikkim (<http://whc.unesco.org/en/newproperties>; Tambe, 2007). It spreads along 27°30’ - 27°55’ N latitude and 88°02’ - 88°37’ E longitude with an altitude ranging from 1829 m (foothill) to 8585 masl (Mt. Khangchendzonga peak) (Tambe, 2007; Chhetri, 2005). Survey was undertaken during the relaxation periods of Covid-19 pandemic in 2020 and 2021. Extraction of the specimens from their micro-habitats such as leaf, flower, grass was mostly carried out by gentle tapping of twigs in addition to direct counting, sweeping, modified Tullgren and other trapping methods (Ananthakrishnan, 1984). For further processing, the extracted specimens were preserved in a standard collection fluid comprising 10% Ethanol and Glacial Acetic acid in the ratio 9:1 with a few drops of Triton-X (Bhatti, 1997), and permanent slides were prepared following the standard protocol given by Bhatti (1999). Identification of thrips was done using standard keys from the monographs and publications of Ananthakrishnan and Sen, 1980; Bhatti, 1980; Dang et al., 2014; Mound and Minaei, 2007; Mound and Ng, 2009; Sen et al., 1988; Palmer et al.,

1989; Varatharajan, 2005. The specimens were also compared with reference slides available at the Insect Museum of Manipur University (IMMU). Some of the specimens were identified with the help of Dr L A Mound, CSIRO, Australia, and final validation was done using Thrips Wiki. Such identified voucher specimens were deposited in the National Insect Museum of ICAR-NBAIR, Bangalore and also at IMMU.

## RESULTS AND DISCUSSION

### A. Checklist

Survey of Thysanoptera fauna with respect to KNP revealed the occurrence of 44 species of thrips in 25 genera under Thripidae and Phlaeothripidae of the two respective suborders namely Terebrantia and Tubulifera with the representation of 14 Phlaeothripids in 8 genera. This includes 4 fungal spores feeding Idolothripinae of the genus *Elaphrothrips*. On the other hand, among the 27 species of terebrantians, 22 were represented by members of Thripinae in 12 genera, and 4 species under 4 genera by panchaethripines, besides a species under Dendrothripinae. Systematic inventory of 44 species of thrips collected from KNP during the survey period is represented in Table 1. While analysing the collection record in terms of thrips feeding habit and habitat, it revealed the occurrence of 18 species of phyllophilous, 15 anthophilous, 2 cecidogenous, 4 mycophagous and 5 poeophilous thrips. The male of *Smilothrips productus* Bhatti was also collected for the first time and described below. Further, the data related to plant host association indicated that thrips were collected from nearly 46 plant species belonging to 32 families, in which members of the families viz., Poaceae, Solanaceae, Moraceae, Fabaceae, Asteraceae and Zingiberaceae were primary source for thrips.

### B. *Smilothrips productus* Bhatti (Figs. 1-10)- first description of male

*Smilothrips* Bhatti 1976: 323. Type species: *Smilothrips productus* Bhatti 1976: 323.

The generic name *Smilothrips* was erected for the type species *productus* based on macropterous female (Bhatti 1976). Subsequently, two different wing morphs of *S. productus* viz.,- micropterous and brachypterous females were described from south China (Mirab-balou et al., 2013). The insect specimens were collected from *Stipa* sp. (Poaceae) and *Carex* sp. (Cyperaceae) respectively. The present study provides the first description of male of this species, hitherto unknown to science.

Male macropterous. Body uniformly light yellow except for abdominal segments IX and X and apical 2/3 of antennal segment III, IV-VII, which are dark brown (Figs. 1 and 2). Head strongly produced in front of eyes; sculptured in posterior third; interocellar setae placed within ocellar triangle; anteocellar setae situated on base of anterior production of head, much shorter than interocellar setae; postocular setae well-developed, not uniserial-arranged in apparently two rows, setae pair II placed back of I, and IV back of III (Figs. 4 and 5). Ocelli present. Mouth cone rounded. Maxillary palps 3-segmented.

Antennae 7-segmented, segments III with forked and IV with simple sense cone each (Fig. 3); segment III distinctly pedicellate and comparatively longer (Fig. 2). Pronotum with 2 pairs of marginal setae inner to angular setae median area smooth with no setae (Fig. 6). Mesonotum with transverse anastomosing striae; median pair of setae placed at about middle of sclerite. Metascutum sculptured with broad reticulations; median pair of setae far behind anterior margin; metanotal campaniform sensilla absent (Fig. 7). Mesothoracic sternopleural sutures present. Spinula absent on both meso- and metasternum. Fore wing well developed with prominent setae on veins (Fig. 10). Abdominal tergite I completely sculptured with transverse anastomosing striae; II-IX unsculptured in posterior half, in anterior half with widely spaced transverse anastomosing lines on II-VIII (Fig. 9). Tergites with only 2 pair of median setae; S1 reduced on tergite I, better developed on II-VII, longer and stouter on VIII, on each of these segments subequal to S2. Pleurotergites with 5-6 elongate blunt teeth posteriorly; seta S6 placed on laterotergite area. Sides of tergites II-VII and their posterior margin without teeth or microtrichia; VIII with a complete comb of long microtrichia on posterior margin (Fig. 8). Sternite II with 2 pairs of posteromarginal setae; III-VII each with 3 pairs. Presence of rod-like glandular areas on sternites III-VII. Abdominal segment X with 2 pairs of stout setae (Source: Diagrammatic representation of tergal setae S1-S6 or B1-B6 from Masumoto and Okajima, 2006. Fig. 28: 28 pp.)

Measurements (in microns): Length (width). Body length 1738; head 290 (148), head projection in front of eyes 55 (80); interocellar setae 53, anteocellar setae 29, postocular setae 28-37; distance between interocellar setae 17; distance between hind ocelli 34. Pronotum 174(190); posteroangular setae: inner 47, outer 36; posteromarginal setae 23; anteromarginal setae 20. Distance of median metanotal setae from anterior

Table 1. Checklist of the thrips fauna- Khangchendzonga National Park, Sikkim

| S. No. | Species   | Host plant   | Micro-habitats | Place of collection               | Altitude (in m) asl | Date of collection | Coordinate                 | No. of ♀/♂ Collected | Feeding habit |
|--------|---|--|----------------|-----------------------------------|---------------------|--------------------|----------------------------|----------------------|---------------|
|        |   | Suborder: Tubulifera   |                | Family: Phlaeothripidae           |                     |                    | Subfamily: Idolothripinae  |                      |               |
| 1.     | <i>Elaphrothrips curvipes</i> Priesner 1929         | <i>Mangifera indica</i> (Anacardiaceae);<br><i>Bambusa</i> sp. (Poaceae)       | Leaf-litter    | KNP, West Sikkim                  | 1802                | 18.iii.2021        | 272349N<br>881312E         | 4♀                   | Mycophagous   |
|        |   |  |                | Tadong, East Sikkim               | 1199                | 11.iii.2021        | 271853N<br>883549E         |                      |               |
| 2.     | <i>Elaphrothrips denticollis</i> Bagnall, 1909      | <i>Mangifera indica</i> (Anacardiaceae);<br><i>Bambusa</i> sp. (Poaceae)       | Leaf-litter    | KNP, West Sikkim                  | 1802                | 18.iii.2021        | 272349N<br>881312E         | 3♀                   | Mycophagous   |
|        |   |  |                | Tadong, East Sikkim               | 1199                | 11.iii.2021        | 271853N<br>883549E         |                      |               |
| 3.     | <i>Elaphrothrips procer</i> Schmutz, 1913           | <i>Bambusa</i> sp. (Poaceae);<br><i>Carica papaya</i> (Caricaceae)             | Leaf-litter    | KNP, West Sikkim                  | 1803                | 18.iii.2021        | 272350N<br>881312E         | 2♀                   | Mycophagous   |
|        |   |  |                | Robong, South Sikkim              | 1006                | 12.iii.2021        | 271303N<br>882012E         |                      |               |
| 4.     | <i>Elaphrothrips spiniceps</i> Bagnall, 1932        | <i>Bambusa</i> sp. (Poaceae);<br><i>Carica papaya</i> (Caricaceae)             | Leaf-litter    | KNP, West Sikkim                  | 1803                | 18.iii.2021        | 272350N<br>881312E         | 2♀                   | Mycophagous   |
|        |   |  |                | Tadong, East Sikkim               | 1199                | 11.iii.2021        | 271853N<br>883549E         |                      |               |
|        |   | Suborder: Tubulifera   |                | Family: Phlaeothripidae           |                     |                    | Subfamily: Phlaeothripinae |                      |               |
| 5.     | <i>Dolichothrips indicus</i> Hood, 1919             | <i>Thysanolaena maxima</i> (Poaceae);<br><i>Albizia myriophylla</i> (Fabaceae) | Phyllode       | KNP, West Sikkim                  | 1825                | 18.iii.2021        | 272256N<br>881310E         | 4♀                   | Poephilous    |
|        |   |  |                | Robong, South Sikkim              | 1016                | 12.iii.2021        | 271302N<br>882011E         |                      |               |
| 6.     | <i>Dolichothrips montanus</i> Ananthakrishnan, 1964 | <i>Ficus</i> sp. (Moraceae);<br><i>Lantana camara</i> (Verbenaceae)            | Leaf           | KNP, West Sikkim                  | 1730                | 18.iii.2021        | 272220N<br>881317E         | 4♀                   | Phyllophilous |
|        |   |  |                | Robong, South Sikkim              | 1017                | 12.iii.2021        | 271302N<br>882014E         |                      |               |
| 7.     | <i>Gigantothrips elegans</i> Zimmermann, 1900       | <i>Ficus</i> sp. (Moraceae)  | Leaf           | KNP, West Sikkim                  | 1730                | 18.iii.2021        | 272220N<br>881317E         | 4♀                   | Phyllophilous |
|        |   |  |                | 2 <sup>nd</sup> Mile, East Sikkim | 1931                | 10.iii.2021        | 272027N<br>883725E         |                      |               |
| 8.     | <i>Haplothrips bagrolis</i> Bhatti, 1973            | <i>Artemisia nilagirica</i> (Asteraceae)                                       | Leaf           | KNP, West Sikkim                  | 1827                | 19.iii.2021        | 272256N<br>881309E         | 2♀                   | Phyllophilous |

(contd.)

|     |   |   |               |   |      |             |                    |       |               |
|-----|---|---|---------------|---|------|-------------|--------------------|-------|---------------|
| 9.  | <i>Haplothrips ganglbaueri</i><br>Schmutz, 1913                     | <i>Tridax procumbens</i><br>(Asteraceae);<br><i>Bougainvillea bonsai</i><br>(Nyctaginaceae) | Flower        | KNP,<br>West<br>Sikkim                  | 1826 | 18.iii.2021 | 272256N<br>881309E | 5♀    | Anthophilous  |
|     |   |   |               | Tadong,<br>East<br>Sikkim               | 1183 | 11.iii.2021 | 271853N<br>883548E |       |               |
| 10. | <i>Haplothrips gowdeyi</i><br>Franklin, 1908                        | <i>Millettia pinnata</i><br>(Fabaceae);<br><i>Tagetes</i> sp.<br>(Asteraceae)               | Flower        | KNP,<br>West<br>Sikkim                  | 1977 | 18.iii.2021 | 272350N<br>881255E | 6♀    | Anthophilous  |
|     |   |   |               | Tadong,<br>East<br>Sikkim               | 1217 | 11.iii.2021 | 271853N<br>883549E |       |               |
| 11. | <i>Haplothrips longisetosus</i><br>Ananthakrishnan,<br>1955         | <i>Ficus</i> sp.<br>(Moraceae)  | Leaf          | KNP,<br>West<br>Sikkim                  | 1759 | 18.iii.2021 | 272242N<br>881311E | 3♀    | Phyllophilous |
|     |   |   |               | Robong,<br>South<br>Sikkim              | 1017 | 12.iii.2021 | 271302N<br>882011E |       |               |
| 12. | <i>Haplothrips tenuipennis</i><br>Bagnall, 1918                     | <i>Ipomea</i> sp.<br>(Convolvulaceae)   | Flower        | KNP,<br>West<br>Sikkim                  | 1718 | 18.iii.2021 | 272209N<br>881320E | 3♀    | Anthophilous  |
|     |   |   |               | Pabong,<br>South<br>Sikkim              | 940  | 13.iii.2021 | 271227N<br>882220E |       |               |
| 13. | <i>Liothrips aberrans</i><br>Muraleedharan<br>& Sen, 1978           | <i>Strobilanthes capitatus</i><br>(Acanthaceae)   | Leaf-<br>gall | KNP,<br>West<br>Sikkim                  | 2000 | 19.iii.2021 | 272409N<br>881239E | 4♀ 4♂ | Cecidogenous  |
| 14. | <i>Liothrips himalayanus</i><br>Ananthakrishnan<br>& Jagadish, 1970 | <i>Quercus serrata</i><br>(Fagaceae);<br><i>Aconogum mole</i><br>(Polygonaceae)             | Leaf          | KNP,<br>West<br>Sikkim                  | 1956 | 19.iii.2021 | 272343N<br>881301E | 4♀ 2♂ | Phyllophilous |
|     |   |   |               | 2 <sup>nd</sup> Mile,<br>East<br>Sikkim | 2012 | 10.iii.2021 | 272029N<br>883720E |       |               |
| 15. | <i>Mesothrips perlucidus</i><br>Muraleedharan<br>& Sen, 1981        | <i>Urtica dioica</i><br>(Urticaceae)  | Leaf          | KNP,<br>West<br>Sikkim                  | 1841 | 19.iii.2021 | 272455N<br>881211E | 4♂    | Phyllophilous |
|     |   |   |               | Upper<br>Wok,<br>South<br>Sikkim        | 1279 | 3.x.2020    | 271305N<br>882110E |       |               |
| 16. | <i>Podothrips odonaspicola</i><br>Kurosawa, 1937                    | <i>Carex paniculata</i><br>(Cyperaceae)   | Phyllode      | KNP,<br>West<br>Sikkim                  | 2002 | 19.iii.2021 | 272409N<br>881239E | 1♀    | Poephilous    |
|     |   |   |               | Pabong,<br>South<br>Sikkim              | 970  | 12.iii.2021 | 271215N<br>882153E |       |               |
| 17. | <i>Thlibothrips manipurensis</i><br>Muraleedharan,<br>1982          | <i>Muanthemum bifolium</i><br>(Asparagaceae)  | Leaf-gall     | KNP,<br>West<br>Sikkim                  | 1937 | 19.iii.2021 | 272355N<br>881255E | 4♀ 3♂ | Cecidogenous  |

(contd.)

| Suborder: Terebrantia |   |   | Family: Thripidae |   |      | Subfamily: Thripinae |                    |       |               |
|-----------------------|---|---|-------------------|---|------|----------------------|--------------------|-------|---------------|
| 18.                   | <i>Anaphothrips sudanensis</i><br>Trybom, 1911                | Grass (Poaceae)   | Phyllode          | KNP,<br>West<br>Sikkim                  | 1753 | 18.iii.2021          | 272342N<br>881309E | 6♀    | Poepphilous   |
| 19.                   | <i>Ctenothrips transeolineae</i><br>Chen, 1979                | <i>Pilea pumila</i><br>( <i>Urticaceae</i> )  | Leaf              | KNP,<br>West<br>Sikkim                  | 1754 | 19.iii.2021          | 272442N<br>881209E | 2♀ 1♂ | Phyllophilous |
| 20.                   | <i>Ctenothrips niger</i> Kudo,<br>1977                        | <i>Artemisia nilagirica</i><br>( <i>Asteraceae</i> )  | Leaf              | KNP,<br>West<br>Sikkim                  | 1826 | 19.iii.2021          | 272256N<br>881309E | 1♀    | Phyllophilous |
| 21.                   | <i>Dichromothrips nakahari</i> Mound<br>1976                  | <i>Streptosolen jamesonii</i><br>( <i>Solanaceae</i> );<br><i>Dendrobium</i> sp.<br>( <i>Orchidaceae</i> )        | Flower            | Yuksom,<br>KNP,<br>West<br>Sikkim       | 1800 | 18.iii.2021          | 272309N<br>881308E | 3♀ 4♂ | Anthophilous  |
| 22.                   | <i>Lefroyothrips lefroyi</i> Bagnall<br>1913                  | <i>Bergenia ciliata</i><br>( <i>Saxifragaceae</i> )   | Flower            | KNP,<br>West<br>Sikkim                  | 1718 | 19.iii.2021          | 272209N<br>881320E | 2♀ 1♂ | Anthophilous  |
| 23.                   | <i>Megalurothrips distalis</i> Karny,<br>1913                 | <i>Phaseolus</i> sp.<br>( <i>Fabaceae</i> )   | Flower            | Yuksom,<br>KNP, West<br>Sikkim          | 1730 | 18.iii.2021          | 272227N<br>881323E | 5♀    | Anthophilous  |
| 24.                   | <i>Mycterothrips nilgiriensis</i><br>Ananthakrishnan,<br>1960 | <i>Solanum incanum</i><br>( <i>Solanaceae</i> )   | Flower            | Upper<br>Wok,<br>South<br>Sikkim        | 1591 | 3.x.2020             | 271309N<br>882124E | 4♀    | Anthophilous  |
| 25.                   | <i>Sciothrips cardamomi</i><br>Ramakrishna<br>1935            | <i>Elettaria cardamom</i><br>( <i>Zingiberaceae</i> );<br><i>Hedychium coronarium</i><br>( <i>Zingiberaceae</i> ) | Leaf              | KNP,<br>West<br>Sikkim                  | 1820 | 18.iii.2021          | 272255N<br>881308E | 3♀    | Phyllophilous |
| 26.                   | <i>Scirtothrips dorsalis</i> Hood,<br>1919                    | <i>Maesa chisia</i><br>( <i>Primulaceae</i> );<br><i>Capsicum</i> sp.<br>( <i>Solanaceae</i> )                    | Leaf              | KNP, West<br>Sikkim                     | 1825 | 18.iii.2021          | 272256N<br>881309E | 5♀    | Phyllophilous |
|                       |   |   |                   | 2 <sup>nd</sup> Mile,<br>East<br>Sikkim | 1972 | 10.iii.2021          | 272028N<br>883721E |       |               |

(contd.)

|     |  |   |             |   |              |                            |   |       |               |
|-----|--|---|-------------|---|--------------|----------------------------|---|-------|---------------|
| 27. | <i>Smilothrips productus</i> Bhatti, 1976                | <i>Carex</i> sp. (Poaceae)  | Phyllode    | KNP, West Sikkim                                    | 2030         | 19.iii.2021                | 272336N<br>881319E                        | 1♂    | Poepphilous   |
| 28. | <i>Stenchaetothrips bififormis</i> Bagnall, 1913         | <i>Bambusa</i> sp. (Poaceae);<br><i>Oryza sativa</i> (Poaceae)                        | Phyllode    | KNP, West Sikkim                                    | 2019         | 19.iii.2021                | 272411N<br>881243E                        | 3♀ 1♂ | Poepphilous   |
| 29. | <i>Taeniothrips orchidi</i> Ananthakrishnan, 1968        | <i>Rhododendron</i> sp. (Ericaceae)   | Flower      | Tadong, East Sikkim<br>KNP, West Sikkim             | 1198<br>1796 | 11.iii.2021<br>18.iii.2021 | 271853N<br>883549E<br>2722310N<br>881307E | 6♀ 2♂ | Anthophilous  |
| 30. | <i>Taeniothrips major</i> Bagnall, 1916                  | <i>Hydrangea macrophylla</i> (Hydrangeaceae)  | Flower      | Upper Wok, South Sikkim<br>Yuksom, KNP, West Sikkim | 1792<br>1750 | 14.xi.2020<br>19.iii.2021  | 271303N<br>882138E<br>272242N<br>881208E  | 3♀    | Anthophilous  |
| 31. | <i>Thrips atactus</i> Bhatti, 1967                       | <i>Phaseolus</i> sp. (Fabaceae)   | Leaf        | Yuksom, KNP, West Sikkim                            | 1730         | 18.iii.2021                | 272227N<br>881323E                        | 2♀    | Phyllophilous |
| 32. | <i>Thrips beharensis</i> Ramakrishna & Margabandhu, 1939 | <i>Magnolia</i> sp. (Magnoliaceae);<br><i>Solanum indicum</i> (Solanaceae)            | Flower      | Upper Wok, South Sikkim<br>KNP, West Sikkim         | 1591<br>1955 | 3.x.2020<br>19.iii.2021    | 271309N<br>882124E<br>272343N<br>881301E  | 4♀    | Anthophilous  |
| 33. | <i>Thrips carthami</i> Shumsher, 1946                    | <i>Zanthoxylum acanthopodium</i> (Rutaceae)   | Leaf        | KNP, West Sikkim                                    | 2000         | 19.iii.2021                | 272409N<br>881239E                        | 2♀    | Phyllophilous |
| 34. | <i>Thrips cedri</i> Bhatti, 1980                         | <i>Ficus</i> sp. (Moraceae);<br><i>Cedrus deodara</i> (Pinaceae)                      | Leaf & Cone | Kholaghari, South Sikkim<br>KNP, West Sikkim        | 934<br>1816  | 13.iii.2021<br>18.iii.2021 | 271215N<br>882153E<br>272258N<br>881309E  | 3♀    | Phyllophilous |
| 35. | <i>Thrips flavus</i> Schrank, 1776                       | <i>Kalanchoe blossfeldiana</i> (Crassulaceae);<br><i>Solanum indicum</i> (Solanaceae) | Flower      | Robong, South Sikkim<br>KNP, West Sikkim            | 1000<br>1804 | 12.iii.2021<br>18.iii.2021 | 271300N<br>882011E<br>272315N<br>881306E  | 3♀    | Anthophilous  |
| 36. | <i>Thrips florum</i> Schmutz 1913                        | <i>Amaranthus spinosus</i> (Amaranthaceae);<br><i>Citrus maxima</i> (Rutaceae)        | Flower      | Chemchey, South Sikkim<br>KNP, West Sikkim          | 1989<br>1726 | 14.iii.2021<br>18.iii.2021 | 271324N<br>882206E<br>272221N<br>881317E  | 4♀    | Anthophilous  |
|     |  |   |             | Robong, South Sikkim                                | 965          | 12.iii.2021                | 271305N<br>882041E                        |       |               |

(contd.)

(contd. Table 1)

|     |  |  |                     |                                     |      |             |                    |                             |               |
|-----|--|--|---------------------|-------------------------------------|------|-------------|--------------------|-----------------------------|---------------|
| 37. | <i>Thrips formosanus</i><br>Priesner, 1934             | <i>Piper betle</i><br>(Piperaceae)   | Leaf                | KNP, West<br>Sikkim                 | 1965 | 19.iii.2021 | 272346N<br>881257E | 9♀                          | Phyllophilous |
| 38. | <i>Thrips hawaiiensis</i><br>Morgan, 1913              | <i>Lantana camara</i><br>(Verbenaceae);<br><i>Ricinus communis</i><br>(Euphorbiaceae)            | Flower              | KNP, West<br>Sikkim                 | 1792 | 19.iii.2021 | 272314N<br>881306E | 5♀                          | Anthophilous  |
| 39. | <i>Thrips palmi</i><br>Karny, 1925                     | <i>Coelogyne cristata</i><br>(Orchidaceae);<br><i>Urena lobata</i><br>(Malvaceae)                | Flower<br>(Orchids) | KNP, West<br>Sikkim                 | 1800 | 19.iii.2021 | 272314N<br>881306E | 19♀1♂                       | Anthophilous  |
|     |  |  |                     | Suborder: Terebrantia               |      |             | Family: Thripidae  | Subfamily: Panchaethripinae |               |
| 40. | <i>Astrothrips tumiceps</i> Karny, 1923                | <i>Hedychium gardenium</i><br>(Zingiberaceae)  | Leaf                | KNP, West<br>Sikkim                 | 1804 | 19.iii.2021 | 272249N<br>881312E | 2♀                          | Phyllophilous |
| 41. | <i>Heliothrips haemorrhoidalis</i><br>Bouche, 1833     | <i>Capsicum annum</i><br>(Solanaceae);<br><i>Ficus</i> sp.<br>(Moraceae)                         | Leaf                | KNP, West<br>Sikkim                 | 1806 | 18.iii.2021 | 272235N<br>881332E | 3♀                          | Phyllophilous |
|     |  |  |                     | Upper<br>Wok,<br>South<br>Sikkim    | 1719 | 4.x.2020    | 271304N<br>882131E |                             |               |
| 42. | <i>Heliothrips aino</i> Kudo, 1992                     | <i>Strobilanthes capitatus</i><br>(Acanthaceae);<br><i>Cyrtococcum</i> sp.<br>(Poaceae)          | Flower              | KNP, West<br>Sikkim                 | 1950 | 19.iii.2021 | 272409N<br>881239E | 2♀                          | Anthophilous  |
|     |  |  |                     | Rangu-<br>thang,<br>South<br>Sikkim | 900  | 13.iii.2021 | 271200N<br>882156E |                             |               |
| 43. | <i>Monilothrips kemp</i> Moulton, 1929                 | <i>Matteuccia struthiopteris</i><br>(Onocleaceae);<br><i>Dryopteris</i> sp.<br>(Dryopteridaceae) | Leaf<br>(Fern)      | KNP, West<br>Sikkim                 | 1825 | 18.iii.2021 | 272255N<br>881310E | 2♀                          | Phyllophilous |
|     |  |  |                     | Upper<br>Wok,<br>South<br>Sikkim    | 1750 | 15.iii.2021 | 271304N<br>882135E |                             |               |
|     |  |  |                     | Sub-order: Terebrantia              |      |             | Family: Thripidae  | Sub-family: Dendrothripinae |               |
| 44. | <i>Dendrothrips stannardi</i><br>Ananthakrishnan, 1958 | <i>Maesa indica</i><br>(Primulaceae);<br><i>Schima wallichii</i><br>(Theaceae)                   | Leaf                | KNP, West<br>Sikkim                 | 1777 | 19.iii.2021 | 272316N<br>881305E | 2♀1♂                        | Phyllophilous |
|     |  |  |                     | Upper<br>Wok,<br>South<br>Sikkim    | 1636 | 14.iii.2021 | 271308N<br>882127E |                             |               |

margin 37. Fore wing 1063. Antennal segments I-VII: I 46(38), II 43(27), III 100(24), IV 80(22), V 70(20), VI 74(21), and VII 28(9).

**Specimen studied:** 1♂, India, Sikkim, KNP from leaves of *Carex* sp. (Cyperaceae), 19.iii.2021 (Th.D. Songomsing Chiru); deposited in National Bureau of Agricultural Insect Resources, Bengaluru, India (accession number: ICAR/NBAIR/THYS/19032021).

**Comments:** Although the individuals of *Smilothrips* resemble that of *Taeniothrips* in general body outlook,

but separable from the latter by the presence of distinct anterior head projection, postocular chaetotaxy, slender body, head longer than wide, absence of spinula on both meso- and metasternum. However, the male of this species differs from female by having light yellow body colour except for IX and X abdominal segments and apical 2/3 of antennal segment III-VII which are dark brown, antennal segment III with forked sense cone and IV with simple sense cone, presence of glandular areas on abdominal segments III-VII, a pair of claspers and 2 pairs of stout setae on IX and X abdominal segments (Table 2).

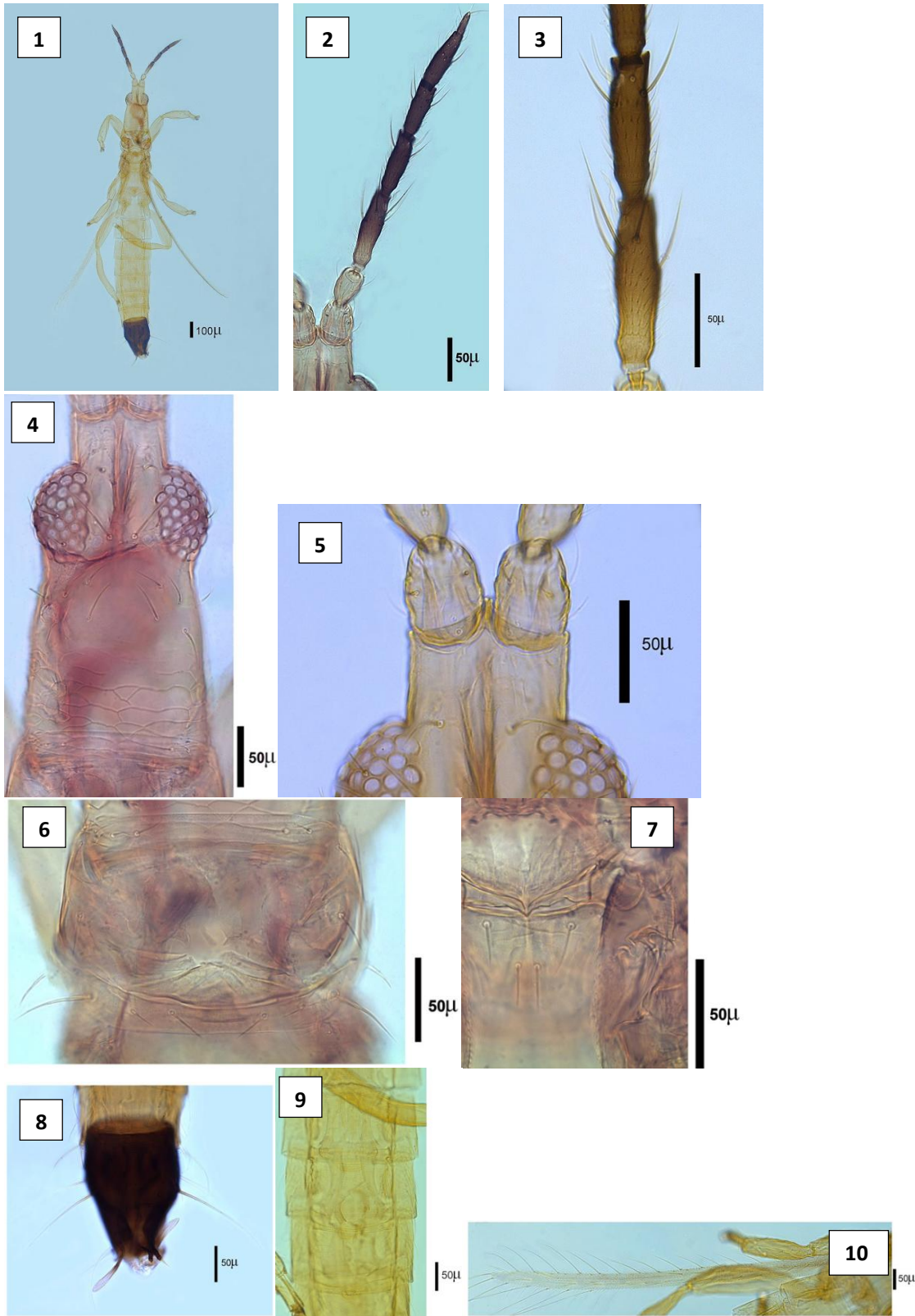


Fig. 1-10. *Smilothrips productus* Bhatti-male

1. Whole body; 2. Antenna; 3. Antennal segments III & IV; 4. Head; 5. Head anterior projection; 6. Pronotum; 7. Metanotal median setae; 8. Abdominal segments VIII-X; 9. Male glandular areas on sclerites IV-VII; 10. Forewing



Table 2. Comparison- male and female of *Smilothrips productus*

| Parameters                                | Female<br>(Collected from J&K)  | Female<br>(Collected from China)   | Male<br>(Collected from Sikkim)  |
|---|---|--|--|
| Host foliage:                             | <i>Stipa sibirica</i> (Poaceae)   | <i>Carex</i> sp. (Cyperaceae)  | <i>Carex</i> sp.   |
| Place of collection:                      | Jammu & Kashmir   | Sichuan, Pingwu County, Laohegou   | Khangchendzonga National Park, Sikkim  |
| Body colour                               | Blackish brown, including antennae (except the lighter pedicel of III and the clear sub-basal area just next to pedicel). Tibiae much lighter, fore tibiae pale in about distal third, mid tibiae pale at apex. | Dark brown, including antennae (except antennal segment III with pale area at pedicel and 1/3 of segment). All tibiae and tarsi yellowish brown to pale yellow, sometimes hind tibiae apical 1/4 pale. | Body uniformly light yellow except for abdominal segments IX and X and apical 2/3 of III antennal segment & IV-VII completely dark. All tibiae uniformly pale yellow with brownish tarsal tips; hind tibiae longer than fore & mid-tibiae. |
| Body length*                              | 1830  | 1500-1700  | 1738   |
| Sense cones on III & IV antennal segments | Forked sense cones on both segments   | Forked sense cones on both segments  | Forked sense cone on III and simple sense cone on IV segment   |
| Tergal setae                              | S1-S6 present   | S1-S6 present  | S1, S2 and S6 present; S3, S4 and S5 absent  |
| Setae on terminal abdominal segments      | Absent  | Absent   | 2 pairs of stout terminal setae present  |
| Forewing*                                 | 1196-1216 (macropterous)  | 173 (micropterous); 445 (brachypterous)  | 1063 (macropterous)  |

\*All measurements in microns

#### ACKNOWLEDGEMENTS

The authors acknowledge Sikkim Forest Department, Government of Sikkim, Deorali for granting permission to undertake this survey in the KNP. Thanks are due to Dr. Laurence Mound, CSIRO, Australia, for determining the identity of some of the thrips species and also for his valuable suggestions and comments, and Head, Department of Zoology, Manipur University, Canchipur for providing necessary facilities. Dr. K. Tilotama Devi, Scientist (Plant Taxonomy), ORDC, Hengbung, Manipur and Dr. Sanatombi, Department of Botany, Manipur University are also acknowledged for identifying the host plants. The support of Mr. Chungboi Chiru and Ms. Arati Manger during the survey are also duly acknowledged.

#### FINANCIAL SUPPORT

Authors thank the Ministry of Tribal Affairs, Government of India, New Delhi for financial support under the scheme of National Fellowship for ST students (NFST-2020).

#### AUTHOR CONTRIBUTION STATEMENT

Th D Songomsing Chiru carried out the survey, collected the specimens and processed them for the taxonomic research studies. The specimens were identified by all the authors based on the available keys and reference slides. All authors contributed equally in the preparation of this manuscript and read and approved this manuscript for submission.

#### CONFLICT OF INTEREST

No conflict of interest.

#### REFERENCES

- Ananthakrishnan T N. 1973. Mycophagous Tubulifera of India. Occasional Publications of the Entomology Research Institute, No. 2. 144 pp.
- Ananthakrishnan T N. 1978. Thrips galls and gall thrips. Zoological Survey of India, Technical monograph no.1. 69 pp.
- Ananthakrishnan T N. 1979. Biosystematics of Thysanoptera. Annual Review of Entomology 24: 159-183.
- Ananthakrishnan T N, Sen S. 1980. Taxonomy of Indian Thysanoptera. Handbook series No.1, Zoological Survey of India. pp. 234.

- Ananthkrishnan T N. 1984. Bioecology of thrips. Indira Publishing House, USA. pp. 205.
- Bhagat R C. 2011. Species richness and host-plant diversity of thrips (Thripidae: Thysanoptera) in Jammu and Kashmir. Indian Journal of Applied and Pure Biology 26(1): 85-89.
- Bhatti J S. 1976. Some new Indian Thripidae (Thysanoptera). Oriental Insects 10: 317-326.
- Bhatti J S. 1980. Species of the genus thrips from India (Thysanoptera). Systematic Entomology 5: 109-166.
- Bhatti J S. 1997. Fauna of Delhi, State fauna series - Thysanoptera. Zoological Survey of India 6: 291-324.
- Bhatti J S. 1999. New characters for identification of pest species *Thrips florum* and *Thrips hawaiiensis*. Thrips (1): 259-266.
- Chhetri D R. 2005. Ethnomedicinal plants of the Khangchendzonga National Park, Sikkim, India. Ethnobotany 17: 96-103.
- Dang L H, Mound L A and Qiao G X. 2014. Conspectus of the Phlaeothripinae genera from China and Southeast Asia (Thysanoptera, Phlaeothripidae). Zootaxa 3807(1): 001-082.
- Dang L H, Zhao L, Wang X and Qiao G X. 2019. Review of Podothrips from China (Thysanoptera, Phlaeothripidae), with one new species and three new records. Zookeys 882: 41-49.
- Jeremy M R. 1974. A revision of the grass-living genus Podothrips (Thysanoptera: Phlaeothripidae). Journal of Entomology (B) 43(2): 261-282.
- Kirk W D J. (1996) Thrips. Naturalists' handbooks 25. Richmond Publishing Co. Ltd., Slough. 70 pp.
- Kobro S. 2010. Checklist of Nordic Thysanoptera. Norwegian Journal of Entomology 58: 21-26.
- Lewis T. 1973. Thrips, their biology, ecology and economic importance. Academic Press, London and New York. 349 pp.
- Marren P, Mabey R. 2010. Bugs Britannica. Catalogue No. 17419, Random House, London. 500 pp.
- Masumoto M and Okajima S. 2006. A revision of and key to the world species of Mycterothrips Trybom (Thysanoptera, Thripidae). Figure-28. pp. 28.
- Mirab-Balou M, Yang S L, Tong X L. 2013. A newly recorded genus *Smilothrips* Bhatti (Thysanoptera: Thripidae) in China. Entomotaxonomia (2013) 35(3): 179-184.
- Mound L A. 1996. The Thysanoptera vector species of tospoviruses. Acta Horticulturae 431: 298-309.
- Mound L A and Terry. 2001. Pollination of the central Australian cycad, *Macrozamia macdonnellii* by a new species of basal clade thrips (Thysanoptera). International Journal of Plant Sciences 162: 147-154.
- Mound L A. 2005. Thysanoptera - diversity and interactions. Annual Review of Entomology 50: 247-269.
- Mound L A and Minaei K. 2007. Australian thrips of the *Haplothrips* lineage (Insecta: Thysanoptera). Journal of Natural History 41(45-48): 2919-2978.
- Mound L A, Ng Y F. 2009. An illustrated key to the genera of Thripinae (Thysanoptera) from South East Asia. Zootaxa 2265: 27-47.
- Nyree J, Zerega C, Mound L A and Weiblen G D. 2004. Pollination in the New Guinea endemic *Antiaropsis decipiens* (Moraceae) is mediated by a new species of thrips, *Thrips antiaropsidis* sp. nov. (Thysanoptera: Thripidae). International Journal of Plant Sciences 165(6): 1017-1026.
- Palmer J M, Mound L A, du Heaume G J. 1989. CIE guides to insects of importance to man. 2. Thysanoptera. Wallingford: CAB Int. 73 pp.
- Raman A, Ananthkrishnan T N. 1984. Biology of gall thrips (Thysanoptera: Insecta), pp. 107-127. Ananthkrishnan T N. (ed.). Biology of gall insects. Oxford and IBH Publishing Co, New Delhi.
- Rachana R R, Varatharajan R. 2017. A new species of the genus *Thrips* (Thysanoptera: Thripidae) from the Western Ghats of India. Zootaxa 4221(4): 491-493.
- Sen S, Pramanik N K, Sengupta C K. 1988. Thysanoptera fauna of north eastern India. Records of Zoological Survey of India, Occasional Paper 100: 1-123.
- Sathyakumar S, Bashir T, Bhattacharya T, Poudyal K. 2011. Assessing mammal distribution and abundance in intricate eastern Himalayan habitats of Khangchendzonga, Sikkim, India. Mammalia 75(3): 257-268.
- Sen S, Pramanik N K, Sengupta C K. 1988. Thysanoptera fauna of North Eastern India. Records of Zoological Survey of India, Occasional paper, No. 100: 1-123.
- Tambe S. 2007. Ecology and management of the alpine landscape in the Khangchendzonga National Park, Sikkim Himalaya. PhD thesis. FRI University, Dehradun, India.
- Tyagi K, Kumar V. 2016. Thrips (Insecta: Thysanoptera) of India: An Updated Checklist. Halteres 7: 64-98.
- ThripsWiki. 2022. Thrips Wiki- providing information on the world thrips. [http://thrips.info/wiki/Main\\_Page](http://thrips.info/wiki/Main_Page) (accessed on 20 July, 2022).
- UNESCO World Heritage Centre. 2022. <http://whc.unesco.org/en/newproperties/> accessed on 3 August, 2022.
- Varatharajan R, Maisnam S, Shimray C V, Rachana R R. 2016. Pollination potential of thrips (Insecta: Thysanoptera) - an overview. Zoo's Print XXXI (4): 6-12.
- Varatharajan R. 2005. Faunistic diversity of thrips (Thysanoptera) of North Eastern India. Silver Jubilee Publication of Manipur University. 73 pp.

(Manuscript Received: September, 2022; Revised: May, 2023;

Accepted: May, 2023; Online Published: June, 2023)

Online First in [www.entosocindia.org](http://www.entosocindia.org) and [indianentomology.org](http://indianentomology.org) Ref. No. e23777