



An updated checklist of Thrips (Insecta: Thysanoptera) of Sikkim

Th D Songomsing Chiru^{1,*}, Thang Johnson¹, R R Rachana² and R Varatharajan¹

¹Department of Zoology, Manipur University, Imphal 795003

²ICAR-National Bureau of Agricultural Insect Resources, Bengaluru 560024, India

Abstract

Systematic surveys of thrips were undertaken during 2019-2022 with specific reference to Khangchendzonga National Park in order to understand the species richness of this World heritage habitat. The study revealed presence of 56 species in Sikkim. The suborder Tubulifera is represented by 24 species which can be grouped into 14 genera under two subfamilies such as Phlaeothripinae and Idolothripinae in Phlaeothripidae. Similarly, the collection records have indicated as many as 32 species of terebrantians under Thripidae. All the above said 32 thripids belong to 20 genera which are grouped within four subfamilies, with the lion's share of 25 species in Thripinae, followed by 5 Panchaethripinae, and one each of Dendrothripinae and Sericothripinae. Analysis of the species composition in terms of their feeding habit and habitat reflected that 83% of the thrips are phytophagous, 13% mycophagous and 4% obligate predators. From amongst the phytophagous forms, 27 are phyllophilous, 17 flower dwelling anthophilous species, and 4 poeophilous. A close scrutiny also revealed the presence of pests, of which *Sciothrips cardamomi* Ramakrishna, *Thrips palmi* Karny, and *Ceratohripoides claratris* Shumsher are notable pests with appreciable economic importance.

Keywords: Thrips, checklist, Sikkim, survey, pest.

Introduction

Thrips (Order Thysanoptera) play a pivotal role as pollinators (Terry & Mound, 2001; Varatharajan *et al.*, 2016), predators (Ananthakrishnan, 1993), gall inducers (Raman & Ananthakrishnan, 1984), and most significantly, as pests and vectors of tospoviruses (Mound, 1996, 2005). Their importance as serious pests of crops can be attributed to their polyphagous nature, high reproductive capacity, short generation time, high survival of cryptic instars (this is not clear what the authors want to say), and reproduction both by sexual and parthenogenesis, besides acquiring the tendency to develop resistance to insecticides (Amutha & Rachana, 2022).

Over 6000 species, with 329 genera under the suborder Terebrantia and 458 genera under the suborder Tubulifera are known globally (Thripswiki, 2023). For the Indian fauna, a total of 763 species have been reported (Tyagi & Kumar, 2016; Rachana & Varatharajan, 2017), including nearly 200 species recorded from the north-eastern region

(Varatharajan, 2005). Compared to other parts of the country, the fauna of Sikkim has been poorly studied. Sen *et al.* (1988) were the first to document thrips in this region with a report of 17 species. A recent study (Chiru *et al.*, 2023) highlighted the occurrence of 44 species. The present paper aims at providing an updated checklist of the thysanopteran fauna of Sikkim, with specific focus on the Khangchendzonga National Park.

Materials and Methods

Study area

The Khangchendzonga National Park (KNP) covers an area of 1784 km², constituting 25.14% of the total geographical area of Sikkim. 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 m asl (Mt. Khangchendzonga peak) (Tambe, 2007; Chhetri, 2005). Nearly 90% of the park lies at an elevation above 3,000 m, and about 70% of the park is located above 4,000 m; thereby displaying varying elevations

*Author for correspondence : songomsing@manipuruniv.ac.in, Orcid id: <https://orcid.org/0000-0001-5061-5634>

Article Received on: 10.04.2023

Accepted on: 17.06.2023

with just 42 km aerial distance (Sathyakumar *et al.*, 2011; 2014). The KNP presides strategically at the convergence of three biogeographic realms, viz., Palaearctic, Africotropical, and Indo Malayan (Mani 1974) and is also one of the important Global 200 Ecoregions (Olson & Dinerstein, 1998). The park is also endowed with three extreme climatic conditions such as high rainfall (380 –550 cm) in the lower and middle zones; high snowfalls at the upper region and relatively high humidity in the whole sector making a unique ecological site (Lavkumar, 1980). The annual rainfall in the region ranges from 750-2750 mm with three main types of vegetations: such as moist temperate forest (1829 –2730 m), sub-alpine forest (2730 –3650m) and alpine forest (>3650m) (Anon., 2000; Champion & Seth, 1968).

Collection and Identification

The insects were collected from their microhabitats such as leaf, flower, twigs, leaf litter, and plan galls by gently tapping on the white board coupled with other trapping methods such as delayed counting, sweeping, and modified Tullgren (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 the collected specimens was carried out using standard keys provided by Ananthakrishnan & Sen, 1980; Bhatti, 1980; Dang *et al.*, 2014; Mound & Minaei, 2007; Mound & 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 ThripsWiki. Voucher specimens were deposited in the National Insect Museum of ICAR-NBAIR, Bangalore, and IMMU.

Systematic accounts

I. Sub-order: Terebrantia

Family: Thripidae

Sub-family: Thripinae Stephens, 1829

Genus: *Anaphothrips* Uzel, 1895

1. *Anaphothrips latis* Bhatti, 1967

Specimen studied: 3 , KNP, Sikkim; Poepphilous; ex.

Allium odorum (Liliaceae).

Distribution: India– Maharashtra, Sikkim; **World** – Ethiopia, Netherlands, Zimbabwe.

2. *Anaphothrips sudanensis* Trybom, 1911

Specimen studied: 4 , KNP, Sikkim; Poepphilous; ex. Grass (Poaceae).

Distribution: Cosmopolitan

Genus: *Ayyaria* Karny, 1927

3. *Ayyaria chaetophora* Karny, 1926

Specimen studied: 2 , 1 KNP, Sikkim; Phyllophilous; ex. *Phaseolus vulgaris* (Fabaceae).

Distribution: India – Andhra Pradesh, Arunachal Pradesh, Assam, Delhi, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Nagaland, Odisha, Tamil Nadu, Uttar Pradesh, West Bengal, Sikkim; **World** – Australia, China, Christmas Island (Indian Ocean), Japan, Philippines, Tahiti, Taiwan.

Genus: *Ceratothripoides* Bagnall, 1918

4. *Ceratothripoides claratris* Shumsher, 1946

Specimen studied: 3 , KNP, Sikkim; Pest; ex. Tomato (Solanaceae).

Distribution: India– Delhi, Maharashtra, Odisha, Sikkim, Manipur, Tamil Nadu; **World**– East Africa, Philippines.

Genus: *Ctenothrips* Franklin, 1907

5. *Ctenothrips transeolineae* Chen, 1979

Specimen studied: 2 , 1 KNP, Sikkim; Phyllophilous; ex. *Pilea pumila* (Urticaceae).

Distribution: India– Himachal Pradesh, Sikkim; **World**– Taiwan.

Genus: *Dichromothrips* Priesner, 1932

6. *Dichromothrips nakahari* Mound 1976

Specimen studied: 3 , 1 KNP, Sikkim; Anthophilous; ex. *Streptosolen jamesonii* (Solanaceae); *Dendrobium* sp. (Orchidaceae).

Distribution: India – Assam, Arunachal Pradesh, Meghalaya, Nagaland, West Bengal.

Remark: This species is recorded so far only from India.

Genus: *Lefroyothrips* Priesner, 1938

7. *Lefroyothrips lefroyi* Bagnall 1913

Specimen studied: 2 , 1 KNP, Sikkim; Anthophilous; ex.

Bergenia ciliate (Saxifragaceae).

Distribution: **India**– Assam, Himachal Pradesh, Uttar Pradesh, West Bengal, Nagaland, Sikkim; **World**– Malaysia, Philippines, Indonesia, China, Taiwan.

Genus: *Megalurothrips* Bagnall, 1915

8. *Megalurothrips distalis* Karny, 1913

Specimen studied: 3 , KNP, Sikkim; Anthophilous; ex. *Phaseolus* sp. (Fabaceae).

Distribution: **India**– Andaman Island, Arunachal Pradesh, Assam, Meghalaya, Nagaland, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal, Sikkim; **World**– China, Fiji, Indonesia, Japan, Korea, Philippines, Sri Lanka, Taiwan.

Genus: *Mycterothrips* Trybom, 1910

9. *Mycterothrips nilgiriensis* Ananthkrishnan, 1960

Specimen studied: 2 , KNP, Sikkim; Anthophilous; ex. *Solanum incanum* (Solanaceae).

Distribution: **India**– Himachal Pradesh, Jammu and Kashmir, Madhya Pradesh, Maharashtra, Punjab, Tamil Nadu, Uttar Pradesh, Rajasthan, Nagaland, Sikkim; **World**– China, Nepal, Australia.

Genus: *Sciothrips* Bhatti, 1970

10. *Sciothrips cardamomi* Ramakrishna 1935

Specimen studied: 2 , KNP, Sikkim; Pest; ex. *Elettaria cardamom* (Zingiberaceae); *Hedygium coronarium* (Zingiberaceae).

Distribution: **India** – Arunachal Pradesh, Manipur, Tamil Nadu, Sikkim; **World** – China, Costa Rica, Taiwan.

Genus: *Scirtothrips* Shull, 1909

11. *Scirtothrips dorsalis* Hood, 1919

Specimen studied: 3 , KNP, Sikkim; Phyllophilous; ex. *Maesa chisia* (Primulaceae); *Capsicum* sp. (Solanaceae).

Distribution: Cosmopolitan

Genus: *Smilothrips* Bhatti, 1976

12. *Smilothrips productus* Bhatti, 1976

Specimen studied: 1 , KNP, Sikkim; Poepphilous; ex. *Carex* sp. (Poaceae).

Distribution: **India**– Himachal Pradesh, Jammu & Kashmir, Sikkim; **World**– China.

Genus: *Stenchaetothrips* Bagnall, 1926

13. *Stenchaetothrips biformis* Bagnall, 1913

Specimen studied: 3 , 1 KNP, Sikkim; Poepphilous; ex. *Bambusa* sp. (Poaceae); *Oryza sativa* (Poaceae).

Distribution: **India** – Arunachal Pradesh, Delhi, Himachal Pradesh, Karnataka, Madhya Pradesh, Manipur, Meghalaya, Odisha, Punjab, Sikkim, Tamil Nadu, Uttar Pradesh, West Bengal; **World** – Brazil, Indonesia, Japan, Malaysia, Pakistan, Philippines, Romania, Taiwan, Thailand, UK, Vietnam.

Genus: *Taeniothrips* Amyot & Serville, 1843

14. *Taeniothrips orchidi* Ananthkrishnan, 1968

Specimen studied: 4 , 1 KNP, Sikkim; Anthophilous; ex. *Rhododendron* sp. (Ericaceae).

Distribution: **India**– Uttar Pradesh, Sikkim.

Remark: This species is recorded so far only from India.

15. *Taeniothrips major* Bagnall, 1916

Specimen studied: 2 , KNP, Sikkim; Anthophilous; ex. *Hydrangea macrophylla* (Hydrangeaceae).

Distribution: **India**– Uttar Pradesh, Himachal Pradesh, Manipur, Nagaland, Sikkim; **World**– Nepal

Genus: *Thrips* Linnaeus, 1758

16. *Thrips atactus* Bhatti, 1967

Specimen studied: 2 , KNP, Sikkim; Phyllophilous; ex. *Phaseolus* sp. (Fabaceae).

Distribution: **India**– West Bengal, Sikkim; **World**– Nepal, Laos, Thailand, Japan.

17. *Thrips beharensis* Ramakrishna & Margabandhu, 1939

Specimen studied: 3 , KNP, Sikkim; Anthophilous; ex. *Magnolia* sp. (Magnoliaceae); *Solanum indicum* (Solanaceae).

Distribution: **India** – Bihar, Manipur, Sikkim, West Bengal.

Remark: This species is recorded so far only from India.

18. *Thrips carthami* Shumsher, 1946

Specimen studied: 4 , KNP, Sikkim; Phyllophilous; ex. *Zanthoxylum acanthopodium* (Rutaceae).

Distribution: **India**– Jammu and Kashmir, Himachal Pradesh, Delhi, Nagaland, Sikkim; **World**– Pakistan, Bhutan, Iran.

19. *Thrips cedri* Bhatti, 1980

Specimen studied: 4 , KNP, Sikkim; Phyllophilous; ex. *Ficus* sp. (Moraceae); *Cedrus deodara* (Pinaceae).

Distribution: India– Himachal Pradesh, Sikkim.

Remark: This species is recorded so far only from India.

20. *Thrips flavus* Schrank, 1776

Specimen studied: 3 , KNP, Sikkim; Anthophilous; ex. *Kalanchoe blossfeldiana* (Crassulaceae); *Solanum indicum* (Solanaceae).

Distribution: India – Arunachal Pradesh, Delhi, Goa, Haryana, Himachal Pradesh, Jammu & Kashmir, Manipur, Meghalaya, Punjab, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal; **World** – Austria, China, Croatia, England, Germany, Iran, Japan, Korea, North America, Pakistan, Taiwan, Slovakia.

21. *Thrips florum* Schmutz 1913

Specimen studied: 3 , KNP, Sikkim; Anthophilous; ex. *Amaranthus spinosus* (Amaranthaceae); *Citrus maxima* (Rutaceae).

Distribution: Cosmopolitan

22. *Thrips formosanus* Priesner, 1934

Specimen studied: 4 , KNP, Sikkim; Phyllophilous; ex. *Piper betle* (Piperaceae).

Distribution: India– Kerala, Manipur, Nagaland, Tamil Nadu; **World**– China, Nepal, Taiwan.

23. *Thrips hawaiiensis* Morgan, 1913

Specimen studied: 3 , KNP, Sikkim; Anthophilous; ex. *Lantana camara* (Verbenaceae); *Ricinus communis* (Euphorbiaceae).

Distribution: India – Andaman Island, Assam, Arunachal Pradesh, Delhi, Karnataka, Manipur, Meghalaya, Sikkim, West Bengal; **World** – Australia, China, Fiji, Hawaii, Indonesia, Iran, Jamaica, Japan, Mexico, Sri Lanka, Tahiti, Taiwan, USA.

24. *Thrips palmi* Karny, 1925

Specimen studied: 6 , 1 KNP, Sikkim; Pest; ex. *Coelogyne cristata* (Orchidaceae); *Urena lobata* (Malvaceae).

Distribution: India – Arunachal Pradesh, Delhi, Karnataka, Manipur, Odisha, Punjab, Sikkim; **World** – Australia, Brazil, China, Guam, Hong Kong, Indonesia, Japan, Malaysia, Mauritius, Nigeria, Pakistan, Philippines, Singapore, Sri Lanka, Sudan, Taiwan, Thailand, USA.

Genus: *Vulgatothrips* Han, 1997

25. *Vulgatothrips smilax* Bhatti, 1976

Specimen studied: 1 , KNP, Sikkim; Phyllophilous; ex. *Artemisia nilagirica* (Asteraceae).

Distribution: India– Himachal Pradesh, Sikkim; **World**– Nepal.

Sub-family: Panchaetothripinae

Genus: *Astrothrips* Karny, 1921

26. *Astrothrips tumiceps* Karny, 1923

Specimen studied: 2 , KNP, Sikkim; Phyllophilous; ex. *Hedygium gardenium* (Zingiberaceae).

Distribution: India- Assam, Arunachal Pradesh, Delhi, Karnataka, Madhya Pradesh, Manipur, Punjab, Tamil Nadu, Uttar Pradesh, West Bengal, Sikkim; **World**- Australia, Indonesia, Java, Pakistan, Philippines, Thailand.

Genus: *Heliothrips* Haliday, 1836

27. *Heliothrips haemorrhoidalis* Bouche, 1833

Specimen studied: 3 , KNP, Sikkim; Phyllophilous; ex. *Capsicum annum* (Solanaceae); *Ficus* sp. (Moraceae).

Distribution: India- Andamans, Arunachal Pradesh, Karnataka, Kerala, Maharashtra, Manipur, Meghalaya, Nagaland, Tamil Nadu, Sikkim; **World**- Australia, China, Germany, England, Finland, Sri Lanka, Suriname, Taiwan.

Genus: *Helionothrips* Bagnall, 1932

28. *Helionothrips aino* Ishida, 1931

Specimen studied: 2 , KNP, Sikkim; Anthophilous; ex. *Strobilanthes capitatus* (Acanthaceae); *Cyrtococcum* sp. (Poaceae).

Distribution: India- Himachal Pradesh, Sikkim. **World**- China, Japan, Taiwan.

Genus: *Monilothrips* Moulton, 1929

29. *Monilothrips kempfi* Moulton, 1929

Specimen studied: 2 , KNP, Sikkim; Phyllophilous; ex. *Matteuccia struthiopteris* (Onocleaceae); *Dryopteris* sp. (Dryopteridaceae).

Distribution: India – Madhya Pradesh, Manipur, Nagaland, Tamil Nadu, Uttar Pradesh, West Bengal, Sikkim; **World** – Africa, China, Taiwan, U.S.A.

Genus: *Selenothrips* Karny, 1911

30. *Selenothrips rubrocinctus* Giard, 1901

Specimen studied: 3 , KNP, Sikkim; Pest; ex. Guava (Myrtaceae).

Distribution: India– Andaman Island, Assam, Arunachal Pradesh, Karnataka, Kerala, Manipur, Meghalaya, Nagaland, West Bengal, Sikkim; **World**–

Bangladesh, China, Honduras, Mexico, Myanmar, Philippines, Sri Lanka, Taiwan, Thailand.

Sub-family: Dendrothripinae Priesner, 1925

Genus: *Dendrothrips* Uzel, 1895

31. *Dendrothrips stannardi* Ananthakrishnan, 1958

Specimen studied: 2, 1 KNP, Sikkim; Phyllophilous; ex. *Maesa indica* (Primulaceae); *Schima wallichii* (Theaceae).

Distribution: **India** – Arunachal Pradesh, Manipur, Nagaland, Tamil Nadu, Sikkim; **World** – China.

Sub-family: Sericothripinae Karny, 1921

Genus: *Neohydatothrips* John, 1929

32. *Neohydatothrips samayunkur* Kudo, 1995

Specimen studied: 5, KNP, Sikkim; Phyllophilous; ex. *Magnolia champaca* (Magnoliaceae).

Distribution: **India** – Andaman Island, Arunachal Pradesh, Delhi, Himachal Pradesh, Karnataka, Maharashtra, Manipur, Uttarakhand, Sikkim; **World** – Australia, China, Costa Rica, El Salvador, Japan, Kenya, Mexico, Sri Lanka, Taiwan, U.S.A.

II. Sub-order: Tubulifera

Family: Phlaeothripidae Uzel, 1895

Sub-family: Phlaeothripinae Uzel, 1895

Genus: *Adraneothrips* Hood, 1925

33. *Adraneothrips disjunctus* Ananthakrishnan, 1972

Specimen studied: 2, KNP, Sikkim; Phyllophilous; ex. *Urtica dioica* (Urticaceae).

Distribution: **India** – Arunachal Pradesh, Andhra Pradesh, Manipur, Sikkim.

Remark: This species is recorded so far only from India.

Genus: *Dolichothrips* Karny, 1912

34. *Dolichothrips indicus* Hood, 1919

Specimen studied: 3, KNP, Sikkim; Poepphilous; ex. *Thysanolaena maxima* (Poaceae); *Albizia myriophylla* (Fabaceae).

Distribution: **India** – Delhi, Karnataka, Kerala, Manipur, Meghalaya, Tamil Nadu, West Bengal, Sikkim; **World** – Guam, Sri Lanka, Taiwan.

35. *Dolichothrips montanus* Ananthakrishnan, 1964

Specimen studied: 2, KNP, Sikkim; Phyllophilous; ex. *Ficus sp.* (Moraceae); *Lantana camara* (Verbenaceae).

Distribution: **India** – Arunachal Pradesh, Assam, Manipur, Nagaland, Tamil Nadu, Sikkim.

Remark: This species is recorded so far only from India.

Genus: *Gigantothrips* Zimmermann, 1900

36. *Gigantothrips elegans* Zimmermann, 1900

Specimen studied: 2, KNP, Sikkim; Phyllophilous; ex. *Ficus sp.* (Moraceae).

Distribution: **India** – Arunachal Pradesh, Bihar, Delhi, Karnataka, Manipur, Odisha, Punjab, Tamil Nadu, Sikkim; **World** – Australia, China, Indonesia, Philippines, Taiwan, Thailand.

Genus: *Haplothrips* Amyot & Serville, 1843

37. *Haplothrips bagrolis* Bhatti, 1973

Specimen studied: 2, KNP, Sikkim; Phyllophilous; ex. *Artemisia nilagirica* (Asteraceae).

Distribution: **India** – Himachal Pradesh, Manipur, Sikkim.

Remark: This species is recorded so far only from India.

38. *Haplothrips ganglbaueri* Schmutz, 1913

Specimen studied: 3, KNP, Sikkim; Anthophilous; ex. *Tridax procumbens* (Asteraceae); *Boungainvillea bonsai* (Nyctaginaceae).

Distribution: **India** – Arunachal Pradesh, Andaman Island, Andhra Pradesh, Delhi, Haryana, Karnataka, Madhya Pradesh, Manipur, Meghalaya, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal, Sikkim; **World** – Australia, China, Egypt, Indonesia, Iran, New South Wales, Pakistan, Sri Lanka, Sudan, Sumatra, Japan.

39. *Haplothrips gowdeyi* Franklin, 1908

Specimen studied: 5, KNP, Sikkim; Anthophilous; ex. *Millettia pinnata* (Fabaceae); *Tagetes sp.* (Asteraceae).

Distribution: Cosmopolitan

40. *Haplothrips longisetosus* Ananthakrishnan, 1955

Specimen studied: 3, KNP, Sikkim; Phyllophilous; ex. *Ficus sp.* (Moraceae).

Distribution: **India** – Assam, Kerala, Manipur, Sikkim, Tamil Nadu, Uttar Pradesh.

Remark: This species is recorded so far only from India.

41. *Haplothrips tenuipennis* Bagnall, 1918

Specimen studied: 2, KNP, Sikkim; Anthophilous; ex. *Ipomea sp.* (Convolvulaceae).

Distribution: **India** – Andaman Island, Arunachal Pradesh, Assam, Madhya Pradesh, Maharashtra, Manipur, Rajasthan, Tamil Nadu, West Bengal, Sikkim;

World – China, Indonesia.

Genus: *Liothrips* Uzel, 1895

42. *Liothrips aberrans* Muraleedharan & Sen, 1978

Specimen studied: 2 , 2 KNP, Sikkim; Cecidogenous; ex. *Strobilanthes capitatus* (Acanthaceae).

Distribution: **India** – Assam, Arunachal Pradesh, Nagaland, Sikkim, West Bengal.

Remark: This species is recorded so far only from India.

43. *Liothrips himalayanus* Ananthakrishnan & Jagadish, 1970

Specimen studied: 2 , 1 KNP, Sikkim; Phyllophilous; ex. *Quercus serrata* (Fagaceae); *Aconogum mole* (Polygonaceae).

Distribution: **India** – Arunachal Pradesh, Assam, Manipur, Meghalaya, Nagaland, West Bengal, Sikkim.

Remark: This species is recorded so far only from India.

Genus: *Mesothrips* Zimmermann, 1900

44. *Mesothrips perlucidus* Muraleedharan & Sen, 1981

Specimen studied: 2 , KNP, Sikkim; Phyllophilous; ex. *Urtica dioica* (Urticaceae).

Distribution: **India**– Manipur, Nagaland, Tripura.

Remark: This species is recorded so far only from India.

Genus: *Podothrips* Hood, 1913

45. *Podothrips odonaspicola* Kurosawa, 1937

Specimen studied: 1 , KNP, Sikkim; Poepphilous; ex. *Carex paniculate* (Cyperaceae).

Distribution: **India**– Andaman, Sikkim, West Bengal; **World**– Japan.

Genus: *Praepodothrips* Priesner & Seshadri, 1953

46. *Praepodothrips priesneri* Ananthakrishnan, 1955

Specimen studied: 2 , KNP, Sikkim; Phyllophilous; ex. *Lawsonia* sp. (Lythraceae). **Distribution:** **India** – Andaman Island, Arunachal Pradesh, Manipur, Nagaland, Tamil Nadu, Sikkim.

Remark: This species is recorded so far only from India.

Genus: *Stephanothrips* Trybom, 1913

47. *Stephanothrips occidentalis* Hood & Williams, 1925

Specimen studied: 2 , KNP, Sikkim; Mycophagous; ex. Mixed leaf litter.

Distribution: **India** – Arunachal Pradesh, Andhra Pradesh, Kerala, Manipur, Tamil Nadu, Tripura, West Bengal, Sikkim; **World** – Angola, Australia, Jamaica,

Japan, Malaysia, Mexico, Philippines, South Africa, Taiwan, Thailand, Trinidad, USA.

Genus: *Thlibothrips* Priesner, 1952

48. *Thlibothrips manipurensis* Muraleedharan, 1982

Specimen studied: 2 , 1 KNP, Sikkim; Cecidogenous; ex. *Muanthemum bifolium* (Asparagaceae).

Distribution: **India** – Manipur, Nagaland, Sikkim.

Remark: This species is recorded so far only from the north-east India.

Genus: *Urothrips* Bagnall, 1909

49. *Urothrips tarai* Stannard, 1970

Specimen studied: 1 , KNP, Sikkim; Mycophagous; ex. Leaf litter of *Quercus*.

Distribution: **India** – Arunachal Pradesh, Manipur, Nagaland, Uttar Pradesh, Sikkim.

Remark: This species is recorded so far only from India.

Genus: *Xylaplothrips* Priesner, 1928

50. *Xylaplothrips ligs* Ananthakrishnan & Jagadish, 1971

Specimen studied: 1 , KNP, Sikkim; Mycophagous; ex. *Hydrangea macrophylla* (Hydrangeaceae).

Distribution: **India** – Andhra Pradesh, Delhi, Manipur, Karnataka, Sikkim.

Remark: This species is recorded so far only from India.

51. *Xylaplothrips debilis* Ananthakrishnan & Jagadish, 1971

Specimen studied: 2 , KNP, Sikkim; Mycophagous; ex. Herbs.

Distribution: **India**– Andhra Pradesh, Arunachal Pradesh, Delhi, Karnataka, Kerala, Manipur, Sikkim, West Bengal; **World**– Indonesia.

Sub-family: *Idolothripinae* Bagnall, 1908

Genus: *Elaphrothrips* Buffa, 1909

52. *Elaphrothrips curvipes* Priesner 1929

Specimen studied: 3 , KNP, Sikkim; Mycophagous; ex. *Mangifera indica* (Anacardiaceae); *Bambusa* sp. (Poaceae).

Distribution: **India** – Karnataka, Kerala, Maharashtra, Manipur, Meghalaya, Sikkim, Tamil Nadu, West Bengal; **World** – Bhutan, Germany, Indonesia, Laos, Malaysia, Thailand.

53. *Elaphrothrips denticollis* Bagnall, 1909

Specimen studied: 3 , KNP, Sikkim; Mycophagous;

ex. *Mangifera indica* (Anacardiaceae); *Bambusa* sp. (Poaceae).

Distribution: **India** – Arunachal Pradesh, Assam, Karnataka, Kerala, Manipur, Meghalaya, Sikkim, Tamil Nadu, Tripura, West Bengal; **World** – Indonesia, Malaysia, Myanmar, Sri Lanka.

54. *Elaphrothrips procer* Schmutz, 1913

Specimen studied: 2, KNP, Sikkim; Mycophagous; ex. *Bambusa* sp. (Poaceae); *Carica papaya* (Caricaceae).

Distribution: **India**– Kerala, Manipur, Nagaland, Tamil Nadu, Sikkim; **World**– China.

55. *Elaphrothrips spiniceps* Bagnall, 1932

Specimen studied: 2, KNP, Sikkim; Mycophagous; ex. *Bambusa* sp. (Poaceae); *Carica papaya* (Caricaceae).

Distribution: **India**– Kerala, Manipur, Nagaland, Tamil Nadu, Sikkim; **World**– China.

Genus: *Nesothrips* Kirkaldy, 1907

56. *Nesothrips brevicollis* Bagnall, 1914

Specimen studied: 2, KNP, Sikkim; Mycophagous; ex. Mixed leaf litter **Distribution:** **India**– Kerala, Manipur, Nagaland, Tamil Nadu, Sikkim; **World**– China.

Results and Discussion

The present study has resulted in bringing the total number of thrips collected from Sikkim to 56 species. The suborder Terebrantia is represented by a single family Thripidae, with 32 species in 22 genera, while the family Phlaeothripidae of the suborder Tubulifera is represented by 24 species in 14 genera. The four subfamilies of Thripidae, namely, Thripinae, Panchaethripinae, dendrothripinae, and Sericothripinae

are represented by 25, 5, 1, and 1 species respectively. Phlaeothripinae forms a major subfamily in the suborder Tubulifera with 19 species in 12 genera, while the subfamily Idolothripinae is represented by 5 species in 2 genera.

The plant dependent phytophagous thrips constitute the major share of 45 species, followed by 9 species of mycophagous forms feeding on fungal spores & mycelia, while the predatory thrips were comprise two species. It is also noteworthy to mention that some pest species, viz., *S. dorsalis*, *S. cardamomi* and *T.palmi* were collected. Considering the strategic location of the study area with a wide range of ecosystems and elevations the current figure of 56 species can be considered an understatement. There should be many more species that are yet to be recorded, and further surveys are needed.

Acknowledgements

We expressed our sincere gratitude to the Ministry of Tribal Affairs, Government of India for the NFST Fellowship grant to carry out this work. The authors acknowledge the 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 species and to the Head, Department of Zoology, Manipur University, Canchipur, for providing the 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.

References

- Amutha M, Rachana R R. 2022. Species diversity of thrips on cotton. Indian Journal of Entomology Online published Ref. No. e21262.
- Ananthakrishnan T N. 1984. Bioecology of Thrips. Indira Publishing House, USA. pp.205.
- Ananthakrishnan T N, Sen S. 1980. Taxonomy of Indian Thysanoptera. Handbook series No.1, Zoological survey of India. pp.234.
- Ananthakrishnan T N. 1993. Bionomics of Thrips. Annual Review of Entomology. 38: 71-92.
- Anonymous 2000. Sikkim soils prepared and published by National Bureau of Soil Survey and Land Use Planning (ICAR), Nagpur, Regional Centre, Calcutta, in cooperation with Department of Agriculture, Department of Forest, Government of Sikkim.
- 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.
- Champion H G and Seth S K. 1968. A Revised Survey of the Forest Types of India. Manager of Publication, Government of India, Delhi.
- Chiru Songomsing Th D, Thang Johnson, Rachana R R and Varatharajan R. 2023. Thrips fauna of Khangchendzonga National Park, Sikkim with first description of hitherto unknown male *Smilothrips productus* Bhatti. *Indian Journal of Entomology*.
- Chhetri D R. 2005. Ethnomedicinal plants of the Khangchendzonga National Park, Sikkim, India. *Ethnobotany*. Vol (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.
- Lavkumar K. 1980. Khangchendjunga, WWF-India newsletter; 33: 8-10.
- Mound L A. (1996). The Thysanoptera vector species of tospoviruses. *Acta Horticulturae* 431: 298-309.
- 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 and Ng Y F. 2009. An illustrated key to the genera of Thripinae (Thysanoptera) from South East Asia. *Zootaxa* 2265: 27-47.
- 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.
- Mani M S. 1974. Biogeographical evolution in India. *Monographiae Biologicae* book series. Volume (23): 698-724.
- Olson & Dinerstein. 1998. The Global 200: A Representation Approach to Conserving the Earth's Most Biologically Valuable Ecoregions. *Conservation Biology*. Vol. 12, No. 3: 502-515.
- Palmer J M, Mound L A and du Heaume G J. 1989. CIE guides to insects of importance to man. 2. Thysanoptera. Wallingford: CAB Int. 73 pp.
- Raman A & Ananthakrishnan T N. 1984. Biology of gall thrips (Thysanoptera: Insecta), pp. 107-127. In: Ananthakrishnan T N. (ed.). *Biology of Gall Insects*. Oxford & IBH Publishing Co, New Delhi.
- Rachana R R and 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 and 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.
- Sathyakumar S, Bashir T, Bhattacharya T, Poudyal K & Manjari Roy. 2014. Precarious status of the Endangered dhole *Cuon alpinus* in the high elevation Eastern Himalayan habitats of Khangchendzonga Biosphere Reserve, Sikkim, India. *Oryx*, Volume 48, Issue 1, January 2014: 125-132.
- Tambe S. 2007. Ecology and management of the alpine landscape in the Khangchendzonga National Park, Sikkim Himalaya. PhD thesis. FRI University, Dehradun, India.
- ThripsWiki. 2023. Thrips Wiki— providing information on the World thrips. Accessed online at http://thrips.info/wiki/Main_Page [accessed on 7 February, 2023].
- Tyagi K and Kumar V. 2016. Thrips (Insecta: Thysanoptera) of India: An Updated Checklist. *Halteres* 7: 64-98.
- Varatharajan R. 2005. Faunistic Diversity of Thrips (Thysanoptera) of North Eastern India. Silver Jubilee Publication of Manipur University. 73 pp.
- Varatharajan R, Maisnam S, Shimray C V and Rachana R R. 2016. Pollination potential of Thrips (Insecta: Thysanoptera) - an overview. *Zoo's Print XXXI* (4): 6-12.