

New distributional records of fungus feeder Thrips (Thysanoptera) from Odisha, India

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Abstract

Thrips belong to the order Thysanoptera and are known for their diverse feeding habitats from leaf feeders to fungal spore feeders. Till now, Odisha state was poorly surveyed and known by 35 species of order Thysanoptera including two species of subfamily Idolothripinae. Further, to explore the thrips diversity especially the members of the Idolothripinae, multiple field surveys were conducted from 2019 to 2022 in Odisha state of India, and collected 7 species of the subfamily Idolothripinae for the first time. These 7 species of thrips are *Dinothrips spinosus* (Schmutz), *Gastrothrips acuticornis* (Hood), *Gastrothrips falcatus* (Ananthakrishnan), *Loyolaia indica* Ananthakrishnan, *Nesothrips brevicollis* (Bagnall), *Nesothrips lativentris* (Karny) and *Nesothrips minor* (Bagnall). Species diagnosis, material studied, distribution, and illustrations of these new taxa are also provided.

Keywords: Fungus feeders, Idolothripinae, India

Introduction

Globally, 6,415 species are reported within two suborders Terebrantia and Tubulifera with nine families and six subfamilies (ThripsWiki, 2023). The suborder Tubulifera comprises a single family Phlaeothripidae with two subfamilies (Phlaeothripinae and Idolothripinae). The subfamily Idolothripinae with 744 extant species covers almost 12% of the global thrips diversity (ThripsWiki, 2023). Members of this subfamily are usually fungus feeders and can be distinguished from their sister group Phlaeothripinae by broad or sub-parallel maxillary stylets, absence of maxillary guides, and long S2 setae on tergite IX (Mound & Palmer, 1983).

The Indian Thysanopteran fauna is known by 739 species including 53 Idolothripinae (Tyagi & Kumar, 2016). Members of the subfamily Idolothripinae usually occur on dead leaves and dead branches and are considered fungus-feeding thrips (Tree *et al.*, 2010). Idolothripinae species exhibit a wide range of body sizes ranging from 1mm to 15 mm. Due to sexual dimorphism,

and polymorphism in thrips, conspecific males and females have sometimes been identified mistakenly as different species, or even different genera.

Several Indian geographic regions are still unexplored resulting in the gap of information regarding Idolothripinae species diversity. Odisha an eastern coastal peninsular state of India is well-known for its rich biodiversity and diverse agroclimatic zones. So far only 35 species of thrips have been reported from this region (Tyagi & Kumar, 2016; Singha *et al.*, 2016; Rachana *et al.*, 2017; Singha *et al.*, 2022). Out of 35 species, only two species of the subfamily Idolothripinae were reported. To mitigate the information gap, several field surveys were undertaken from 2019-2022 and seven species of subfamily Idolothripinae were identified as new to this region. The species are *Dinothrips spinosus* (Schmutz), *Gastrothrips acuticornis* (Hood), *Gastrothrips falcatus* (Ananthakrishnan), *Loyolaia indica* Ananthakrishnan, *Nesothrips brevicollis* (Bagnall), *Nesothrips lativentris* (Karny) and *Nesothrips minor* (Bagnall).

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Materials and Methods

Specimens were collected by beating method from different host plants and were preserved in 70% high-grade alcohol. The genomic DNA of these specimens was extracted by non-destructive method and stored at -30°C for future studies. The voucher specimens were retrieved after lysis and mounted onto the glass slides following the published literature (Bhatti, 1999; Tyagi *et al.*, 2015). Photographs were taken using a Leica stereo microscope (Leica DM-1000) through the Leica software application suite (LAS EZ). Specimens were identified using the available morphological keys (Ananthkrishnan, 1961, 1967; Mound, 1974; Eow *et al.*, 2014). The identified slides were labelled with unique registration numbers and deposited in the National Zoological Collection of Zoological Survey of India, Kolkata.

Results and Discussion

Systematic account

Order THYSANOPTERA Haliday, 1836

Suborder TUBULIFERA Haliday, 1836

Family PHLAEOTHIRIPIDAE Uzel, 1895

Subfamily IDOLOTHRIPINAE Bagnall, 1908

1. Genus *Dinothrips* Bagnall, 1908

The genus *Dinothrips* includes six distinct species, primarily inhabiting dead branches. These species can be readily distinguished from other genera by the presence of a pelta that is separated into three distinct sections, as well as an expanded mesothoracic spiracular process in males. According to Palmer and Mound (1978), there is evidence of sexual dimorphism in certain species of *Dinothrips*, wherein males possess an expanded mesothoracic spiracular process, while females do not exhibit such development.

Dinothrips spinosus (Schmutz, 1913)

1913. *Ischyrothrips spinosus* Schmutz: 1078.

Material examined: 1♀: India, Odisha, Koraput, Odisha Central University, Sunabeda, 900m, 24.x.2022, grass, (Reg. No. 12339/H17), coll. by Abhishek Patidar.

Diagnosis: Female (Macropterous); Body dark brown; antennal segments brown except III yellow with apical dark band. Head longer than wide; maxillary stylets

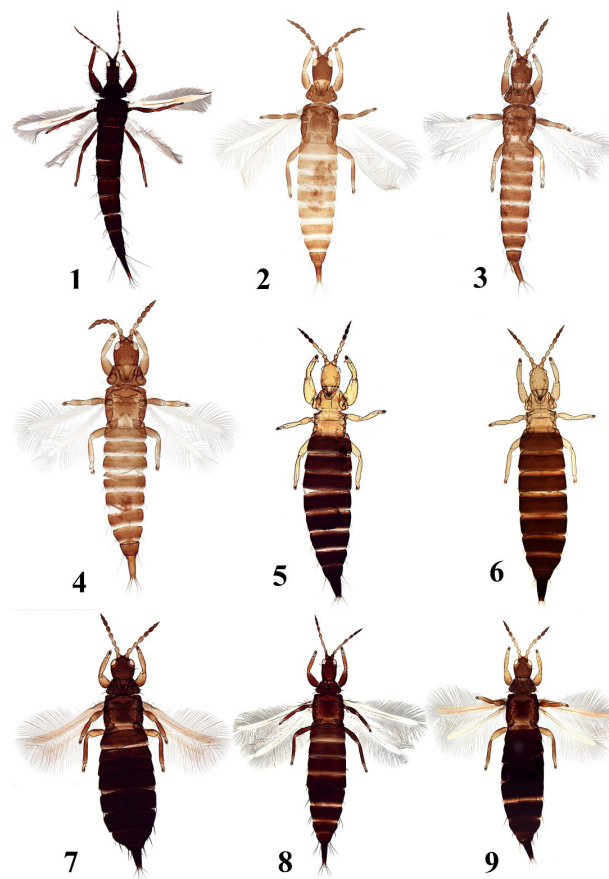


Figure 1. (1) *Dinothrips spinosus*, female (2) *Gastrothrips acuticornis*, male (3) *Gastrothrips falcatus*, male (4) *Gastrothrips falcatus*, male (5) *Loyolaia indica*, male (6) *Loyolaia indica*, female (7) *Nesothrips brevicollis*, female (8) *Nesothrips lativentris*, female (9) *Nesothrips minor*, female.

broad, V-shaped; ocellar and postocular setae well-developed. Antennae 8-segmented; III more than 3.5 times as long as its apical dark band; III with two and IV with four sense cones. Pronotum broader than longer with one pair of well-developed posteroangular setae; the mesothoracic spiracular process of male bifurcated; metathoracic sternopleural suture absent. Metanotum with median pair of setae acute and placed far away from the anterior margin. Forewing with 60-61 duplicated cilia. Fore tarsus with a prominent tooth. Pelta is divided into three separate parts. Tergite III-VI each with two pairs of wing-retaining setae; tergite IX with S1, S2, and S3 setae longer than the tube; tube as long as head, anal setae shorter than the tube. Antecostal ridge on sternite II in female not interrupted medially.

Distribution: India: Karnataka, Kerala, Odisha (New Record) Uttarakhand. *Elsewhere:* New Guinea, Philippines, Sri Lanka.

2. Genus *Gastrothrips* Hood, 1912

The genus *Gastrothrips* is known by 38 species and predominantly inhabits dead twigs and branches (ThripsWiki, 2023). Most of the species within the genus *Gastrothrips* exhibit considerable allometric variations. Members of this genus can be recognized by the shape of the tube which is constricted apically to straight with tapering sides, antennal segment IV with four sense cones, and abdominal tergites III-V each with one pair of wing-retaining setae.

(i) *Gastrothrips acuticornis* (Hood 1925).

1925. *Cryptothrips acuticornis* Hood: 65.

Material examined: 1♂: India, Odisha, Cuttack, Baranga Village, 26m, 14. iii.2018, General vegetation, (Reg. No. 11822/H17), coll. by Vikas and Kaomud.

Diagnosis: Male (Macropterous). Body brown except yellow fore tibiae and; antennal segment III basally. Head 1.1 times longer than wide; cheeks narrow at base; maxillary stylets broad and V-shaped; post ocellar setae small; postocular setae well developed, weakly blunt apically. Antennae 8-segmented; III with two sense cones, IV with three sense cones; VIII slender as long as VII. Pronotum with well-developed mid-lateral, epimeral setae and posteroangular setae. Praepectus present. Metanotum with median setae far away from anterior margin. Forewing with 7-8 duplicated cilia. Fore femora with small tooth. The pelta is triangular without lateral wings. Tergite III-VI each with one pair of wing-retaining setae; IX with S3 seta as long as the tube; tube straight, shorter than the head, anal setae slightly longer than the tube.

Distribution: India: Andhra Pradesh, Kerala, Odisha (New Record), Tamil Nadu. *Elsewhere:* Australia, Hawaii, New Caledonia, Queensland, United States of America, West Indies.

(ii) *Gastrothrips falcatus* (Ananthakrishnan 1968)

1967. *Nesothrips falcatus* Ananthakrishnan: 610.

Material examined: 2♂: India, Odisha, Bhubai, Dhauli, 53m, 18. iii.2018, General vegetation, (Reg. No. 10135/H17, 10136/H17), coll. by Vikas and Kaomud.

Diagnosis: Male (Macropterous), Body brown including femora; antennal segments II and III pale at apex; forewings pale. Head as wide as long; maxillary stylets V-shaped; postocular setae long. Antennae 8-segmented, segment III with 2 sense cones and IV with 3 sense cones; VIII broad at the proximal end. Pronotum with well-developed mid-lateral, epimeral and posteroangular setae. Metanotum with median setae far away from anterior margin; median progression present. Fore coxae and fore femora each with a stout spur-like setae on the posterior margin; fore tarsus tooth occasionally present. Fore wings without duplicated cilia. The pelta is hat-shaped with a well-developed median lobe and slender lateral wings. Tergite III-VI each with one pair of wings-retaining setae; IX with S3 setae longer than the tube; tube straight, anal setae shorter than the tube. Major males of this species with very stout recurved setae of the posterior margin of fore femora and fore coxae, the median process of metanotum projecting backwards over the pelta.

Distribution: India: Andhra Pradesh, Goa, Karnataka, Kerala, Odisha (New Record), Tamil Nadu.

3. Genus *Loyolaia* Ananthakrishnan, 1964

The genus *Loyolaia* is known by three species and is usually inhabiting on fungus (ThripsWiki 2023). They can be differentiated from other genera by the size of the body, the presence of the one sense cone on segments III and 3 on IV, and the pelta with lateral lobes.

(i) *Loyolaia indica* Ananthakrishnan 1964

1965. *Loyolaia indica* Ananthakrishnan: 107.

Material examined: 1♂, 1♀: India, Odisha, Ganjam, 33m, 24. iii.2016, Grass, (Reg. No. 8048/H17, 8049/H17) coll. by Devkant Singha; 1♂, 1♀: Sambalpur, 144m, 24.iii.2016, General vegetation, (Reg. No. 12181/H17, 12182/H17) coll. by A. Ramesh Kumar.

Diagnosis: Both sexes (Apterous). Body distinctly bicoloured. Head, thorax yellow, abdomen brown. All tarsi dark brown. Antennal segments I-IV yellow. Head slightly longer than wide, widest across cheeks; maxillary stylets V-shaped; postocular setae long and pointed. Antennae 8-segmented, segment III with one and IV with 4 sense cones. Pronotum trapezoidal, with pointed mid-lateral, epimeral and posteroangular setae; basantra present. Metanotum broad; median setae away from the

anterior margin. The pelta is reticulated, hat-shaped with well-developed lateral wings. Fore tarsus with small teeth in females and well-developed teeth in males. Abdomen broad; tergite II distinctly reticulated; tergite IX with S1 and S3 setae longer than the tube; tube as long as head; anal setae shorter than the tube.

Distribution: India: Odisha (New Record), Tamil Nadu, West Bengal.

4. Genus *Nesothrips* Kirkaldy, 1907

The genus *Nesothrips* is known by 30 species and usually inhabits dead branches, with a few in leaf litter and some at the base of grasses. Most of the species of this genus have V-shaped maxillary stylets. Members of this genus exhibit intra-specific structural variation about wing morphs and sexual dimorphism. Males vary in size and body form, from major to minor males, particularly in the size and shape of the prothorax and fore femora, and the presence of a fore tarsal tooth.

(i) *Nesothrips brevicollis* (Bagnall, 1914)

1914. *Oedemothrips brevicollis* Bagnall: 29.

Material examined: 1♀: India, Odisha, Ganjam, 35m, 20. iii.2016, General vegetation, (Reg. No. 8052/H17) coll. by Devkant Singha; 4♀, Gopalpur, 29m, 15. iii.2013, General vegetation, (Reg. No. 6258/H17, 6259/H17, 6260/H17, 6261/H17) coll. by Biswatosh Ghosh.

Diagnosis: Female (Macropterous). Body brown with dark brown abdomen; antennal segment I-IV and extreme base of V yellow. All femora yellow with shaded base; fore tibiae brownish yellow; mid- and hind tibiae brown. Head wider than long; cheeks weakly rounded; postocellar setae well developed situated on the posterior margin of hind ocelli, postocular setae as long as eyes and pointed at apex. Antennae 8-segmented; segment III with 2 and IV with 4 sense cones. Pronotum with weak transverse striations near posterior margin; major pronotal setae pointed apically, anteromarginal setae short. Metanotum with weak polygonal reticulation; median setae far away from the posterior margin. Fore wing broad with 2 sub-basal setae and 3-5 duplicated cilia. The pelta is hat-shaped with a median lobe relatively wide; a campaniform sensilla is present. Abdominal tergite II-VII each with one pair of wing-retaining setae; S1 and S2 setae of tergite IX shorter than the tube; tube shorter than head with sides weakly convex, anal setae shorter than the tube.

Distribution: India: Kerala, Madhya Pradesh, Odisha (New Record). *Elsewhere:* Hookotoo, Japan, Luchu Island, Makoo, Okinawa, Taiwan.

(ii) *Nesothrips lativentris* (Karny, 1913)

1913. *Rhaebothrips lativentris* Karny: 129.

Material examined: 3♀: India, Odisha, Jagatsinghpur, 10m, 20. iii.2018, Grass clumps, (Reg. No. 9503/H17, 9504/H17, 11839/H17) coll. by Vikas & Kaomud.

Diagnosis: Female (Macropterous); Body dark brown; tarsi paler; tube blackish brown. Antennal segments I-II and VI-VIII are brown, the apical part of II, III, and the basal part of IV-V yellow. Forewings weakly shaded. Head longer than wide; postocellar setae placed between the posterior margin of hind ocelli and longer than the distance between their bases; post ocular setae as long as eyes and pointed. Antennae 8-segmented; segment III with 2 and IV with 4 sense cones. Forewings with 13-21 duplicated cilia. Pronotum with 5 pairs of major setae, antero-marginal and antero-angular setae small; metathoracic sternopleural suture complete and long. Pelta with lateral wings. Tergites II-VII each with one pair of wing-retaining setae; IX with S1 and S2 setae shorter than the tube; tube 0.9 times as long as head with sides straight, anal setae shorter than the tube.

Distribution: India: Andaman Island, Arunachal Pradesh, Meghalaya, Odisha (New Record), Tripura, West Bengal. *Elsewhere:* Widespread around the tropics.

(iii) *Nesothrips minor* (Bagnall 1921)

1921 *Coenurothrips minor* Bagnall: 287.

Material examined: 1♀: India, Odisha, Semiliguada, Koraput, 909m, 23.x.2022, Carrot, (Reg. No. 12438/H17) coll. by Abhishek Patidar.

Diagnosis: Macropterous. Body brown; tube pale distally. Antennal segment I-III yellow; IV brown with base yellow; V-VIII dark brown. Legs yellow with brown shading. Fore wings shaded with pale brown. Head slightly broader than long, widest across eyes; maxillary style broad and V-shaped; postocellar setae acute and placed on the posterior margin of hind ocelli; postocular setae as long as eyes. Antennae 8-segmented; segment III with 2 sense cones and IV with 4 sense cones. Forewings with 5-6 duplicated cilia. Pronotum weakly sculptured in posterior 3/4th; major setae 5 pairs; notopleural suture complete.

Metathoracic sternopleural suture complete and curved. Metanotum with weak polygonal reticulation; median setae far away from the anterior margin. The pelta is hat-shaped; the median lobe is rounded and the lateral wings are flat; a campaniform sensilla is present. Tergite III-VII each with pair of wing-retaining setae, IX with S1 and S2 setae shorter than the tube; tube shorter than head; anal setae shorter than the tube.

Distribution: India: Odisha (New Record), Tamil Nadu.

Elsewhere: Australia, Fiji, Hawaii, Indonesia, Peninsular Malaysia, Mauritius, France, Rodrigues, Thailand.

Conclusion

Members of the subfamily Idolothripinae usually occur on dead leaves, and dead branches, and are considered as fungus feeding thrips (Tree *et al.*, 2010). Idolothripinae

species exhibit a wide range of body sizes ranging from 1mm to 15 mm. Due to sexual dimorphism, and polymorphism in thrips, conspecific males and females have sometimes been identified mistakenly as different species, or even different genera. The present study was made a preliminary approach towards unveiling the thrips diversity from the study area. A total of seven species were added as new distributional records to the fauna of Odisha state of India. However, multiple surveys need to be conducted shortly to canvas their actual diversity.

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