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43/2 Varadarajulu Nagar, 5<sup>th</sup> Street West, Ganapathy, Coimbatore, Tamil Nadu 641006, India  
Registered Office: 3A2 Varadarajulu Nagar, FCI Road, Ganapathy, Coimbatore, Tamil Nadu 641006, India  
Ph: +91 9385339863 | [www.threatenedtaxa.org](http://www.threatenedtaxa.org)  
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Cover: Marine invertebrates - made with acrylic paint. © P. Kritika.



## Rayed Thistle Fly *Tephritis cometa* Loew (Diptera: Tephritidae) a new record to India

Rayees Ahmad<sup>1</sup> , Tariq Ahmad<sup>2</sup> & Barkat Hussain<sup>3</sup>

<sup>1,2</sup> Entomology Research Laboratory, Department of Zoology, University of Kashmir, Srinagar, Jammu & Kashmir 190006, India.

<sup>3</sup> Division of Entomology, Faculty of Horticulture, Sher-e-Kashmir University of Agriculture Science & Technology- Kashmir, Jammu & Kashmir 190025, India.

<sup>1</sup> bhatrayees10@gmail.com, <sup>2</sup> drtariqento@kashmiruniversity.ac.in, <sup>3</sup> bhatbari@rediffmail.com (corresponding author)

**Abstract:** *Tephritis cometa* Loew, 1840, known to infest field thistle or Canada thistle or creeping thistle *Cirsium arvense*, a medicinal plant used as a tonic and to treat disease such as diarrhea and tuberculosis; it is diuretic. *Cirsium arvense* is a perennial flowering plant belonging to the family Asteraceae and is native to Europe, northern Africa, and western Asia. We report the first record of *Tephritis cometa* Loew, 1840 in southern Asia from Kashmir, India. The identified specimen of *Tephritis cometa*, commonly known as Rayed Thistle Fly was found on *Cirsium arvense*, a grass (Asteraceae) at the site, SKU2 in district Kulgam. However, the actual host plant is unknown. This paper includes morphological studies, key identification, diagnosis, and its distribution.

**Keywords:** Kulgam, methyl eugenol, yellow simple bottle trap, southern Asia.

### Urdu:

تفریٹس کومٹا لوی 1890، ایک ایسا کیڑا ہے جو کہ کئیڑا تھسل یا کریٹنگ تھسل، سرسیم اروینس پودے کے بیٹھ کر اس پہ انڑے دیتا ہے۔ پھر یہ انڑے لاروے میں تبدیل ہوتے ہیں اور اس پودے کو کھاتے ہیں۔ سرسیم اروینس بہت ہی مفید پودا ہے جو انسان کی سحت کیلئے بہت کارگر ثابت ہے۔ یہ ایک ایسا پودا ہے جو کہ بہت ساری بیماریوں جیسے دست، تپ دق اور پیشاب کی بیماری کیلئے علاج ہوتا ہے۔ یہ پودا ایسٹیریسی فیملی سے وابستہ ہے جس میں پھول کھلتے رہتے ہیں اور یہ یورپ، شمالی افریقہ اور مغربی ایشیا میں بنیادی طور پر پایا جاتا ہے۔ تفریٹس کومٹا لوی 1890، کو ہم نے پہلی بار جنوبی ایشیا کے کشمیر انڑیا کے ایک ظلع کلگام کے سائٹ ایس۔ کے۔ یو 2 میں دریافت کیا ہے۔ دراصل کشمیر میں یہ کس پودے پہ اپنا گزر بسر کرتی ہے یہ ابھی ہم نہیں جان پائے۔ اس پیر میں اس کیڑے کی بنیادی پھجان، بیرونی جسم کے بارے میں اطلاعات اور کہاں کہاں پایا جاتا ہے سب شامل ہے۔ اشارتی الفاظ: کلگام، میتھاعیل اوچینال، زرد رنگ کے بوتل والے ٹراپ، جنوبی ایشیا

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**Author details:** RAYEES AHMAD is a research scholar at Department of Zoology, University of Kashmir, working on fruit flies and their sustainable management with Pheromone Application Technology (PAT) and Sterile Insect Technique (SIT). TARIQ AHMAD is a professor at Department of Zoology, University of Kashmir, working on the alien flora of Kashmir and their management using native insect herbivores. BARKAT HUSSAIN is a professor cum chief scientist at Division of Entomology, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, working on Pheromone Application Technology.

**Author contributions:** Conceptualization, RA, BH, & TA; methodology, BH, RA, & TA; formal analysis, RA; field survey, RA; data curation, RA; writing-original draft preparation, RA; All authors have visualized and reviewed the manuscript.

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## INTRODUCTION

There are roughly 4,500 species of true fruit flies (Diptera: Tephritidae), and about 100 of them are pests of commercially farmed fruits (Norrbom et al. 1999; Korneyev & Dilberk 2000). Tephritids are known to traverse enormous distances and are invasive in all continents (Duyck et al. 2004). These notorious insects are phytophagous, and some of them can be harmful pests or employed as weed-controlling bioagents (White & Elson-Harris 1992). The majority of them are members of a few sizable genera, such as *Bactrocera* and *Dacus*, which are widespread throughout zoogeographic regions.

*Tephritis* Latreille is the third largest genus in the Tephritinae and the sixth largest genus in the Tephritidae with roughly 170 species (Norrbom et al. 1999; Korneyev & Diribek 2000). The majority of *Tephritis* species consume various species of the same genus and are commonly referred to as stenophagous or monophagous (Korneyev 2016). Some characteristic features such as two dark frontal setae; dorso-central setae located on or just posterior to transverse suture; two orbital setae, anterior setae acuminate and dark (brown or blackish), posterior setae typically lanceolate and pale (whitish or yellowish; in 2 species brown or black); flat scutellum with two sets of setae, with apical setae that are 0.5–0.6 times longer than basal setae; wing pattern varies greatly between species, typically reticulate with a well-developed apical fork, but can also be stellate or even banded (Freidberg & Kugler 1989; Merz 1994) set *Tephritis* apart from the other genera in the subfamily Tephritinae.

Korneyev (2013), described eleven species of the genus *Tephritis*, mostly from the Palaearctic Middle East, with an unusual banded wing pattern with four new records: *Tephritis afrostriata*, *T. cameo*, *T. gladius*, and *T. ochroptera*. Korneyev & Evstigneev (2019), redescribed six species from western Palaearctic region in which *T. conura* (Loew, 1844), *T. hendeliana* Hering, 1944, and *T. hyoscyami* (Linnaeus, 1758) are from Europe, *T. anthrax* Korneyev & Evstigneev, 2019 from Caucasian and Transcaucasia mountains, while other two, *T. cardualis* Hardy, 1974 and *T. atokoptera* Agarwal & Kapoor, 1988, from Pakistan and India, respectively. Among the nine species of Tephritidae that are recorded for the first time from Transcaucasia are two new species, *T. oedipus* Hendel, 1927 and *T. hendeliana* Hering, 1944 (Evstigneev & Glukhova 2022).

*T. cometa* Loew, (1840), belongs to the tribe Tephritini, family Tephritidae and has been identified

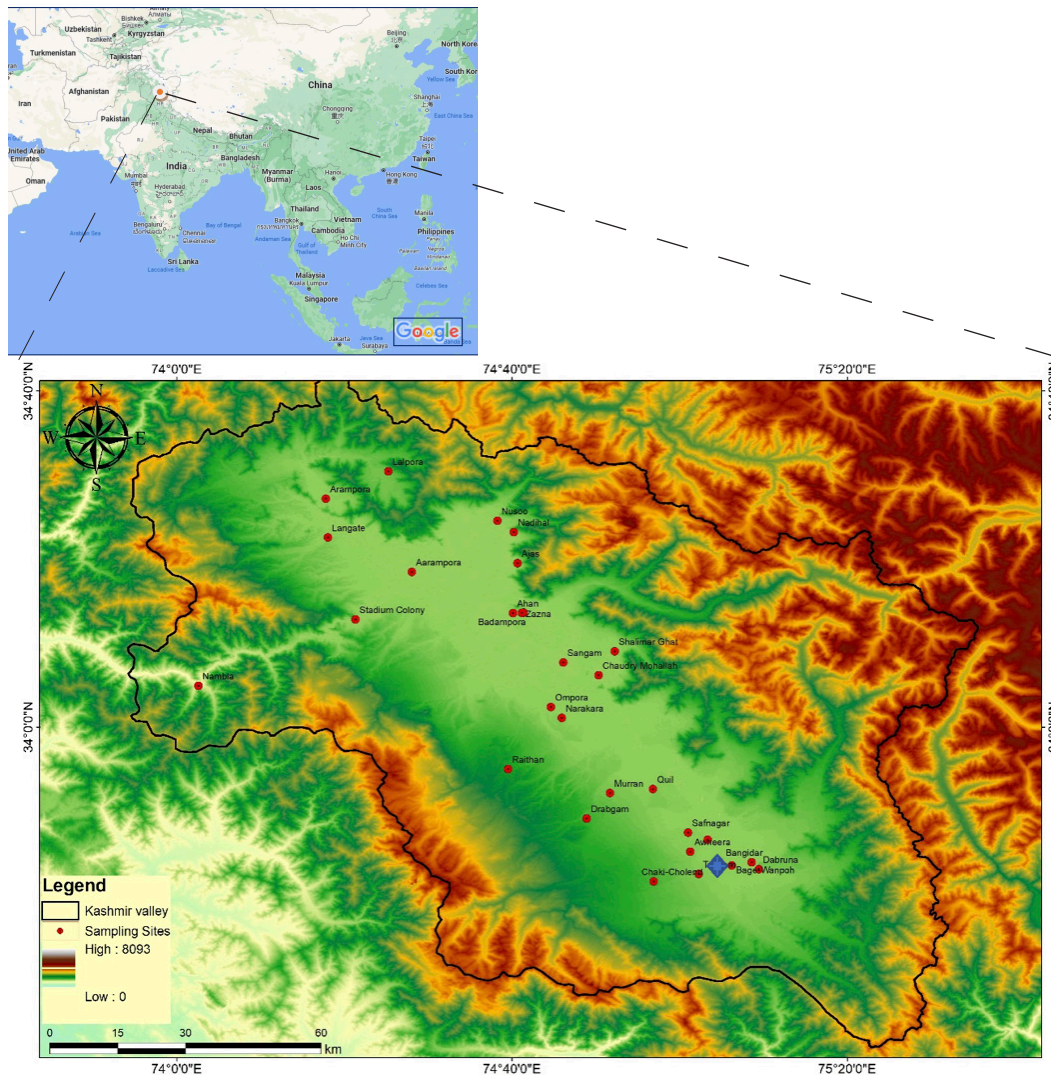
as a frequent pest of *Cirsium arvense*, *C. vulgare*, and *C. lappaceum*. Typically, the larvae of *T. cometa* eat the flowers of *Cirsium* species, while some species induce the formation of galls in roots or stems of Asteraceae (Freidberg 1984; Merz 1994). The records of *T. cometa* for the first time were reported from Flanders and Belgium (Nobby 2001), Fom El Gherza Dam, a wet land habitat in Biskar region (Deghivhe-Diab et al. 2021), Iran (Namin et al. 2010), Turkey (Kutuk 2006; Kutuk & Katranci 2021), and Europe, Israel, Afghanistan, Kazakhstan, Mangolia, & China (Norrbom et al. 1999).

India is located at the intersection of the Afro-tropical, Indo-Malayan, and Paleo-Arctic realms and, therefore, possesses characteristic elements from all three. The combination of these three diverse realms gives the nation a rich and distinctive biological variety, due to which, India is one among world's 12 mega-diverse nations (Sinha et al. 2010). The Kashmir Himalaya is a part of the Himalayan biodiversity hotspot that has a serious threat of invasion by foreign insect species. Despite harmful impacts of these insect species on native biodiversity and economic and ecological systems of the region, a field-based intensive sampling study for management of fruit fly with pheromone application technology (PAT) is lacking, which merits urgent research attention. Therefore, it is necessary to recognise the fruit flies that can severely harm a variety of horticultural, agricultural and other plant species. Furthermore, the majority of *Tephritis* species infest the flowerheads and, in certain cases, the stems of Asteraceae hosts, which may lead to the development of galls (Freidberg 1984). As a result, our objective is to investigate pheromone application technology for the management of all known and undiscovered fruit flies that have travelled thousands of miles to establish in the Kashmir Himalaya.

## MATERIALS AND METHODS

### Survey and trap installation

Kashmir, the northernmost geographical region of the Indian subcontinent where apricots are grown on 2,880 ha, cherry on 2,713 ha, plum on 1,427 ha and peach on 714 ha of land (Daily Hindustan Times 5 August 2022). In Kashmir Valley's fruit and vegetable production zones, a total of 30 sites, three from each district, were chosen for survey through 2019–2021 (Image 1). A total of 94 para-pheromone-filled traps were placed over all the selected areas to catch fruit flies. All the implanted traps were constructed using simple cold drink bottles, which contained methyl eugenol inside hanging rubber



**Image 1.** Sampling sites selected for the management of tephritid fruit flies in Kashmir, India.

septa and SPLAT at the bottom. Three equally spaced holes, each measuring 1.5 cm<sup>2</sup>, were drilled into the basic bottle trap using a hot T-type handle spanner and a glue gun for the entry of fruit flies.

**Collection and identification**

All the installed traps were checked and refreshed fortnightly. The voucher specimens were deposited at the Zoology Museum, University of Kashmir. For identification, Hering (1944), Freidberg & Kugler (1989), and Merz (1994) were consulted and further confirmation by Prof. Drew, director, ICMF, Griffith University, Queensland, Australia.

**Morphological studies**

The present work is totally based on morphological studies following Kutuk (2006), Mohamadzade et

al. (2015), and Gharajedaghi et al. (2011a). Studied morphological characters show differences in wing patterns among different species and are presented in the plate (Image 2). Photographs of wing and habitus were taken using a Leica S9D Stereo zoom microscope at the Entomology Research Laboratory, Department of Zoology, University of Kashmir.

**RESULTS**

According to the results of our morphological study, *Tephritis cometa* has now crossed into India’s territory and may be a severe threat to several grass plants, particularly the country’s *Cirsium* spp.

**Material examined:** 2 male, ZoKU-Art/06209, 14.VIII.2021, Tarigam, Kulgam, Jammu & Kashmir, India,

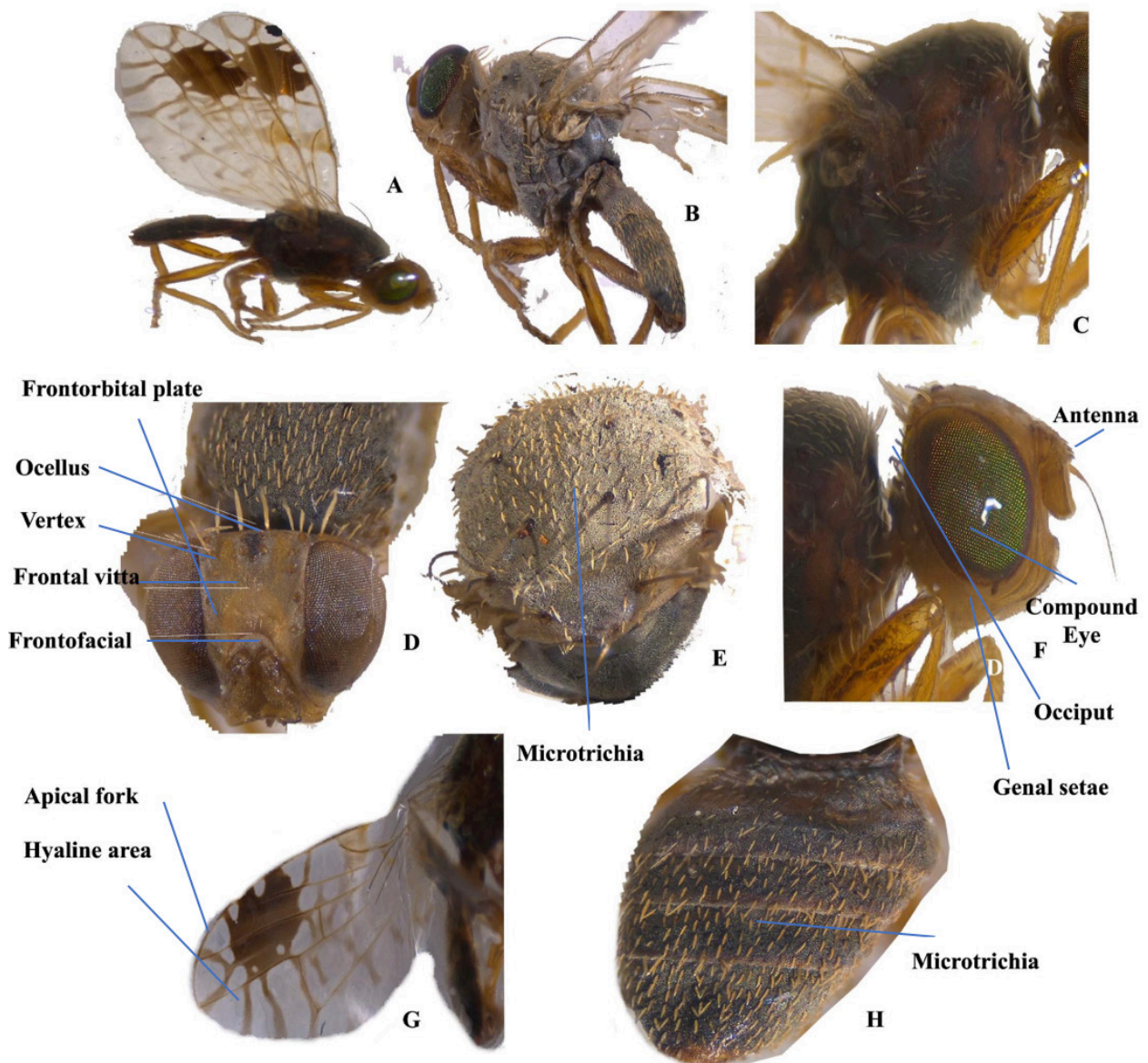


Image 2. *Tephritis cometa*: A—Habitus | B—Lateral habitus | C—Lateral thorax | D—Frontal habitus Ommatidia | E—Dorsal thorax | F—Ommatidia | G—Wing | H—Abdomen. © Rayees Ahmad.

33.7081°N & 75.0380°E, 1,569.14 m, McPhail trap 2, A. Rayees.

**Diagnosis:** A small fly of about 5–6 mm with distinctively patterned wings. Ocellus with star shaped mark and five ocellar and frontal setae. Frons about 1.8 times as long as eye width, third segment of antenna about 1.7 times as long as wide: apical fork of wing present; branches of apical fork widen distinctly towards wing margin; two or more hyaline areas present in cell m; basal half of wing mainly hyaline; cell r1 with small subapical hyaline spot; branches of apical fork uniformly narrow along their entire length; hyaline spot of cell  $r_{2+3}$  continuous with basal indentation of cell r1 (usually 3

hyaline spots), (Image 2). The species is collected along with *Bactrocera* spp. in the MacPhail pheromone trap containing methyl eugenol and SPLAT gel.

**Remarks:** The genus *Tephritis* has general characteristics making it easily identifiable from other Tephritid fruit flies due to the presence of long and thick inner vertical setae.

**Head:** The head is predominantly yellow to brown; yellowish on the occiput and ocellar tubercle; brown anterior orbital setae; white postorbital setae; first flagellomere yellow; basal half on arista yellow; palpus mostly yellow, brownish at apex; wide fronto-facial angle.

**Table 1. Occurrence of *Tephritis cometa* at SKU site in Kulgam District of southern Kashmir Zone, India.**

Zones	Southern Kashmir				Central Kashmir			Northern Kashmir		
Sites Year	Site SAN	Site SKU	Site SPU	Site SSP	Site CBD	Site CGA	Site CSR	Site NBN	Site NBR	Site NKU
2019	-	-	-	-	-	-	-	-	-	-
2020	-	-	-	-	-	-	-	-	-	-
2021	-	+	-	-	-	-	-	-	-	-
Total Specimens	0	2 males	0	0	0	0	0	0	0	0

+—present | —absent | 2—number of specimens trapped.

**Thorax:** The majority of the setae are brown and acuminate; setulae are numerous usually in pairs on the margin of the scutellum; the basal scutellar seta are longer than the apical scutellar seta; yellow halter; the ground colour is often black; the microtrichia are grey; the scutellum is shiny and silvery.

**Legs:** Numerous yellow setulae; tarsi usually brown.

**Wing:** Branches of apical fork widen distinctly towards wing margin; two or more hyaline areas present in cell m; basal half of wing mainly hyaline; cell r<sub>1</sub> with small subapical hyaline spot; branches of apical fork uniformly narrow along their entire length; hyaline spot of cell r<sub>2+3</sub> continuous with basal indentation of cell r<sub>1</sub>.

**Abdomen:** Ground colour usually black; microtrichia numerous and shiny.

**Measurements:** Body: 5–6 mm; male wing: 4–5 mm.

**Habitat:** Various habitats such as horticulture and agriculture crop including grassland and areas where Californian Thistle occur (Freidberg 1984; Merz 1994; Deghivhe-Diab et al. 2021).

**Distribution:** West and Middle Asia, Europe, Israel, Afghanistan, Russia, Kazakhstan, Mangolia, & China (Norbom et al. 1999), Estonia, Latvia, Lithuania, Ukraine, Moldova, Azerbaijan, Georgia, Armenia, Kazakhstan, Uzbek, Tajikistan, Kirghis, Turkomanas, Switzerland, England, Anglia, Germany, & Turkey (Foote 1984; White 1988; Freidberg & Kugler 1989; Merz 1994; Kutuk & Ozgur 2003; Kutuk 2006), Netherland, France, & Iran (Namin et al. 2010; Gharajedaghi et al. 2011b), Flanders & Belgium (Nobby 2001), and Fom El Gherza Dam, a wet land habitat in Biskar region (Deghivhe-Diab et al. 2021).

**Host plants:** Numerous authors have described a variety of hosts, including *Cirsium gaillardotii*, *C. vulgare*, *C. arvense*, and *C. palustre* (White 1988; Freidberg & Kugler 1989; Merz 1994). We caught it at the SKU2 site in the Kulgam district where there were fruits including *Malus domestica* Borkh., *Pyrus* spp. L. and *Prunus persica* L., vegetables- *Cucurbita pepo* L., *Capsicum* sp. L.,

*Solanum lucoopersicum* L., *S. melongena* L., and grasses- *Cirsium arvense* Scop., *Bromus inermis* Leyss., *Cynodon dactylon* L., *Impatiens* sp. L., *Mentha longifolia* L., and *Plantago major* L. were present. However, the actual host is not known here in Kashmir Himalaya.

**India status:** Reported for the first time in India.

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