# FRUIT FLY FAUNA (INSECTA: DIPTERA) OF JAMMU & KASHMIR HIMALAYA, INDIA: CHECK LIST AND BIODIVERSITY

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#### ABSTRACT

The present paper deals with 48 species of fruit flies, belonging to 21 genera under families Drosophilidae (Sub-family Drosophilinae), Tephritidae (Sub-family Dacinae, Tephritinae and Trypetinae), occurring in diverse areas and localities of Jammu and Kashmir Himalayan region. The fruit fly species are responsible for causing great damage to valuable tropical and temperate fruit and vegetable crops of these regions. The crops attacked in Jammu region include ber, citrus, guava, mango and phalsa. The crops affected in Kashmir region include apple, cherry, pomegranate, walnut and members of cucurbitaceae family. The database pertaining to fruit fly fauna has been updated in the light of recent systematic and nomenclatural changes. An up-to-date systematic annotated checklist of species has been provided. Besides, local distribution, diversity and invasive drosophilid and tephritids pest species, have briefly been discussed.

Keywords: Fruit Flies, Check List, Biodiversity, Jammu & Kashmir

#### INTRODUCTION

The fruit flies belong to Sub-order Brachycera of Order Diptera, Infra-order Muscomorpha, Section Schizophora, Sub-section Acalyptratae, Superfamily Tephritidea (Family Tephritidae) and Superfamily Ephydroidea (family Drosophilidae). The Tephritid fruit flies are known as true fruit flies, varying in size from small to moderately large (2.5 to 10mm), with wings more or less distinctly patterned and are often colourful, sometimes referred to as peacock flies. The Drosophilids are often known as common fruit flies. The other names of Drosophilids are vinegar/pomace or wine flies. These fruit flies are small to moderately large (1.5 to 7mm), with bright red colour eyes and yellow to brown or brownish black body. The larvae of Tephritids are maggot like, damaging a variety of fruits, vegetable, flower buds and other parts of the plant. The genus Bactrocera, is the most serious pest of agricultural importance in different parts of the world including Jammu and Kashmir. Some species are beneficial as biological control agent of weed. Drosophilid fruit flies breed in decaying fruits and fungi, also fresh sap and nectar from flower. Drosophila has a great significance as a biological model organism. D. suzukii (Spotted- wing Drosophila) is an invasive pest species, reported to be as a serious pest of agricultural crops, especially thin skinned fruits (EPPO Alert List 2014). Some Drosophilids are ectoparasitic or predaceous on mealy bugs and small homopterans. Larvae of some species of Scaptomyza utilized a variety of substrate, including as animal predators, not found in other Drosophila clan (Lapoint et al., 2013). In Kashmir, Bhagat & Lone (1984) reared the larvae of Scaptomyza pallida from aphid colonies (Aphis fabaesolanella) on host plant, Rumex nepalensis.

#### MATERIALS AND METHODS

The database incorporated in this communication pertains to 48 species of fruit flies, occurring in diverse habitats, in vast localities of Jammu and Kashmir State. This State is located in the northern part of the Indian Sub-continent in the vicinity of the Karakorum and the western Himalayan mountain ranges. This State is divided into three geographically and climatically different regions, *viz*. Ladakh (cold desert), Kashmir (temperate) and Jammu (sub-tropical). The database of fruit-fly- fauna of Jammu and Kashmir region of paramount zoo-geographical significance has been updated in the light of latest taxonomical changes after consulting relevant published works and the world online data on the surveys, diversity, fruit fly pest status and invasive species.

### **Research Article**

The synonymies of taxa, are listed under valid species, given in parentheses in the systematic inventory. The references pertaining to authors reporting and describing taxa, are in the form of code numbers, given in parentheses in front of listed fruit fly species. In addition to these, abbreviations in connection with local distribution of fruit fly fauna are given in square brackets in front of listed valid fruit fly species have been used. The keys to the code numbers as well as abbreviations are cited at the end of annotated systematic check list. For the purpose of updation of taxonomical / nomenclatural changes of fruit fly taxa, the monumental work and the world online data given by Norrbom *et al.*, (1998, 1999), and Wiegmann and Yeats (2007), have been followed.

**RESULTS AND DISCUSSION** 

Systematic Check list / Inventory

### Family 1.Drosophilidae

## Sub- family: Drosophilinae

### Tribe 1.: Colocasiomyini

1. Scaptodrosophila ebonata (Parshad & Duggal) (15) [Pa]

- (= Drosophila (Pholadoris) ebonata Prashad & Duggal (23)
- 2. Drosophila (Dorsilopha) buskii Coquillett (23) [ Pa ]
- 3. Drosophila (Drosophila) brachynephros Okada (23) [Pa]
- 4. Drosophila (Drosophila) curviceps Okada & Kurokawa (23) [Sr.]
- 5. Drosophila (Drosophila) immigrans Sturtevant (23) [ Pa, Sr ]
- 6. Drosophila (Drosophila) kashmirensis Kumar & Gupta (17) [ Sr ]
- 7. Drosophila (Drosophila) pentasoma Parshad 7 Duggal (23) [Gu, Pa, Sr]
- 8. Drosophila (Drosophila) testacea van-Roser (23) [Gu, Pa, Sr]
- 9. Drosophila (Spophophora) ananassae Doleschall (23, 25)[Sr]
- 10. Drosophila (Sophophora) bifasciata Pomini (23) [Gu, Pa]
- 11. Drosophila (Sophophora) epiobscura Parshad & Duggal (23) [ Pa ]
- 12. Drosophila (Sophophoira) Helvetica Burla (23) [Gu, Pa]
- 13.\*Drosophila (Sophophora) suzukii indicus Parsahad & Paika (23) [Gu, Pa, Sr]
- 14. Drosophila (Sophophora) jambulina Prashad & Paika (23) [Sr]
- 15. Drosophila (Sophophora) kikkawai Burla (23) [Sr]
- 16. Drosophila (Sophophora) melanogaster Meigen (8, 23) [Gu, Pa, Sr]
- 17. Drosophila (Sophophora) nepalensis Okada (23) [Pa, Sr]
- 18. Drosophila (Sophophora) pulchrella Tan, Hsu & Sheng (23) [ Pa ]
- 19. Drosophila (Sophophora) rufa Kikkawa & Peng (23) [ Gu, Pa ]
- 20. Scaptomyza graminum Fallen (15) [Gu]
- (= Scaptomyza (Scaptomyza) graminum (Fallen) (23)
- 21. Scaptomyzahimalayana Takada (15) [Gu, Sr]
- (= Scaptomyza (Parascaptomyza) himalayana Takada (17)
- 22. Scaptomyza pallida (Zetterstedt) (15) [Gu, Pa]
- (=Scaptomyza (Parascaptomyza) pallida (Zetterstedt) (6,23)

## Family 2: Tephritidae

## Sub family 1: Dacinae

## Tribe: Dacini

23.\*Bactrocera (Bactrocera) dorsalis Hendel (4, 11, 12, 21) [Bu, Ja, Sr]

(=Dacusdorsalis Hendel) (26)

- 24.\*Bactrocera (Bactrocera) zonata (Saunders) (21) [ Ja ]
- 25. Bactrocera (Zeugodacus) scutellaris (Bezzi) (11, 12) [Bu, Sr]
- 26.\*Bactrocera (Zeugodacus) cucurbitae (Coquillett) (4,7, 11, 12) [ Bu, Sr ]
- 27. Bactrocera (Zeugodacus) tau (Walker) (4, 11, 12) [ Bu, Sr ]
- 28. Dacus sp. (22) [JK]

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# Sub-family 2: Tephritinae

# Tribe 1: Noeetini

29. Ensina sonchi (Linnaeus) (3, 4) [ Sr ]

## Tribe2:Tephrellin

- 30. Pliomelaena udhampurensis Agarwal & Kapoor (3, 4) [ Ja ]
- 31. Sphaeniscusatilius (Walker) (4) [ JK ]
- 32. Oxyaciura monochaeta (Bezzi) (19,20) [ JK ]
- (=Aciura monochaeta Bezzi) (5)
- 33. Oxyaciura xanthotricha Bezzi (19, 20) [ JK ]
- (=Aciura kashmirica Zaka-ur-Rab) (27)

# Tribe3: Tephritini

- 34. Campiglossa producta (Loew) (4) [ JK ]
- 35. Dioxyna sororcula (Wiedmann) (4) [ JK ]
- 36. Acanthiophilus helianthi (Rossi) (3,4) [ Ja ]
- 37. Tephritis atocoptera Agarwal & Kapoor (3,4) [ Sr ]
- 38. Tephritis conura (Loew) (4) [ JK ]
- 39. Tephritis maccus Hering (4) [ JK ]

# Tribe 4: Terelliini

- 40. Chaetostomella completa Kapoor, Malla & Ghosh (4, 10) [ Ka ]
- (= Chaetostoma completa Kapoor, Malla & Ghosh (16)
- 41. Orellia sp. (8)[ Sr ]
- 42. Terellia sarolensis (Agarwal & Kapoor) (4) [ JK ]
- (=Chaetostoma sarolensis Agarwal & Kapoor (2, 4)

## Tribe 5: Xyphosiini

- 43. Ictericodes cashmerensis (Hendel) (13)[Ka]
- (=Icterica cashmerensis Hendel) (14)

## Sub-family 3: Trypetinae

## Tribe 1: Carpomyini

- 44. Carpomya vesuviana Cost (4)[ JK ]
- 45.\*Rhagoletis cingulata (Loew) (24)[ Ka ]
- 46. Rhagoletis completa Cresson (18)[ Ka ]

## Tribe 2: Trypetini

- 47. Acidiella angustifrons (Hendel) (4) [Ka]
- (=Myiolia (Acidella) angustifrons (Hendel) (14)
- 48. Cornutrypeta melanonotum (Brunetti) (4) [ JK ]
- (=*Vidalia melanonotum* (Brunetti) (9)

## \*Indicates as Invasive Species

Key to code numbers given above, in parentheses: 1 = Agarwal & Kapoor (1982); 2 = Agarwal & Kapoor (1985); 3 = Agarwal & Kapoor (1988); 4 = Agarwal & Sueyoshi- (2005); 5 =Bezzi (1913); 6 = Bhagat & Lone (1984); 7 = Bhat*et al.*, (2011); 8 = Bhat 1991);9 = Brunetti (1917); 10 = Foote (1984); 11 = Ganie*et al.*, (2013 a); 12 = Ganie*et al.*, (2013 b); 13 = Hardy (1977); 14 = Hendel (1927)15 = Kandpal& Singh (2010); 16 = Kapoor*et al.*, (1979); 17 = Kumar & Gupta (1985); 18 = Mir & Wani (2005); 19 = Norrbom*et al.*, (1998); 20 =Norrbom*et al.*, (1999); 21 = Rai*et al.*, (2008); 22 = Parry & Pawar (1988); 23 = Parshad & Duggal (1966); 24 = Rishi (1968); 25 = Singh (1989); 26 = Tara*et al.*, (2006); 27 = Zaka-ur-Rab (1977).

**Key to abbreviations, given above in square brackets**: Bu = Budgam; Gu = Gulmarg; Ja= Jammu; JK=Jammu & Kashmir; Ka = Kashmir; Pa= Pahalgam; Sr =Srinagar.

## **Research Article**

## Fruit Fly Diversity

In the light of above given systematic inventory, a total of 48 species of fruit fly, belonging to 21 genera are known to occur in localities of Jammu and Kashmir. These species are belonging to two separate families, viz. Drosophilidae (Sub -family Drosophilinae), Tephritidae (Sub-family Dacinae, Tephritinae and Trypetinae). However, from the Ladakh region, so far only two species of Tephritid are known (Chandra and Sidhu, 2009). The Drosophilids of Jammu and Kashmir include a total of 22 species under 3 genera, whereas the Tephritids as many as 26 species belonging to 18 genera. This accounts for 45.83 % and 54.14% of Drosophilids and Tephritids respectively, of the total fruit flyfauna of these regions.

In Kashmir region, Drosophilids show distribution in areas like Gulmarg, Pahalgam and Srinagar, with total of species prevalence as 10 spp.,15 spp. and 12 spp. respectively. *Drosophila* (*D.*) *pentasoma*, *D.* (*D.*) *suzukiiindicus* and *D.* (*S.*) *melanogaster*, showed their occurrence in all the three areas (see Inventory). In Kashmir region, *D.* (*S.*) *melanogaster* is reported to cause damage to fruits, *viz.* apple, cherry and pear (Bhat, 1991). In addition to this, drosophilid, *D.* (*D.*) *suzukiiindicus*, recorded by Duggal and Prashad (1966) from Kashmir can cause great damage to number of fruits, especially soft skinned as an invasive pest. The various Tephritid genera, with total number of species, which pose threat to valuable temperate and tropical fruits and vegetables pertaining to Jammu and Kashmir region include Dacus (1 sp.), *Bactrocera* (5 spp.), *Orellia* (1 sp.) and *Rhagoletis* (2 spp).

The tropical fruits such as ber, citrus, guava, mango and phalsa are observed to be severely affected by *Bactroceros (B.) dorsalis* and *B. (B.) zonata* in Jammu region (Rai, 2008; Tara *et al.*, 2006). In Kashmir region, the fruits like apple, cherry, pomegranate and walnut are found to be damaged by *Dacussp., Orellia* sp., *Rhagoletis cingulata* and *R. completa* (Bhat,1991; Parry and Pawar, 1989; Mir and Wani, 2005 and Rishi, 1968) (see Table 1).In addition this, in Kashmir region, the vegetables (bottle gourd, cucumber and other members of family cucubitaceae, have been found to be affected by *B. (B.) dorsalis*, *B. (Z.) scutellaris, B. (Z.) ciucurbitae* and *B. (Z.) tau* (Bhat *et al.*, 2011; Ganie *et al.*, 2013) (see table, 1).

# Table 1: Host crop / plant- complex of Tephritids of Jammu and Kashmir Himalaya

# Scientific/common name of tephritid Crop (vegetable& fruit) and plant

Acanthiophilus helianthi\*Centaureacynas (Safflower bud fly / capsule fly)

Bactrocera (B.) dorsalis\*\*\*Ber, citrus, fruits of family (Oriental fruit fly) cucurbitaceae, mango and phalsa

Bactrocera (B.) zonata\*Ber, citrus, guava, mango and phalso (Peach fruit fly, guava fruit fly)

Bactrocera (Z.) cucurbitae\*\* Bottle gourd, cucumis and other vegatables of the (Melon fly) family cucubitaceae

Bactrocera (Z.) scutellaris\*\*Fruits of the family cucurbitaceae

Bactrocera (Z.) tau\*\*\*Fruits of the family cucurbitaceae

*Dacus*sp\*\*.Wild variety of pomegranate

Orellia sp.\*\*Apple fruit and medicinal plant (Artemisia)

*Rhagoletis cingulata*\*\* Cherry fruit (Cherry fruit fly)

Rhagoletis completa\*\* Walnut (Juglansregia) (Walnut husk fly)

\* indicates distribution in Jammu region; \*\* indicate distribution in Kashmir region and \*\*\* indicate distribution in Jammu and Kashmir region.

## Invasive Fruit Fly Pest Species in Jammu & Kashmir

Fruit flies, viz. Drosophila (S.) suzukii, Bactroceros (B.) dorsalis, B. (B.) zonata, B. (Zeugodacus) cucurbitae and Rhagoletis cingulate, are important invasive species, showed wide distribution in Jammu and Kashmir. D. (S.) suzukii has been reported from India and this region as sub species indicus (Parshad and Paika, 1964; Duggal and Parshad, 1966). These species have high potential for spread and also can cause great economic damage to many fruit and vegetable crops, particularly cucurbits as important pests.

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In view of invasive nature and high risk of attack, these species have been put on Alert Lists (A1, A2) of EPPO (European and Mediterranean Plant Protection Organization, Paris, France and also included in Invasive Species Compendium of CABI- International (U.K). The listing of the Invasive species by EPPO and CABI is as: *B. cucurbitae*, *R. cingulata* (OEPP/ EPPO, 2013); *B. dorsalis*, *B. zonata* (CABI,2014 a, 2014b; OEPP/ EPPO,2013) and *D. suzukii* (Anon., 2012; EPPO,2014).

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