Research Article

New Record of Fruit Flies (Diptera: Tephritidae) from Poonch Division of Azad Jammu and Kashmir

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Abstract | Within the tropical Asian countries, the family Tephritidae is well represented and includes some of the most serious economic pests of fruits and vegetables around the world. The objective of this paper is to present taxonomy and new records of fruit flies. This manuscript deals with distribution records presented for species of fruit flies from Poonch Division of Azad Jammu and Kashmir. Taxonomic issues with specimen are discussed. The specimens were collected from seven localities including Rawalakot, Banbake, Jandali, Pakhar, Kakuta, Mandhol and Bagh (Harighel) using McPhail traps during the years 2016-2017. Specimens were identified up-to species level using taxonomic key by Mahmood and Hassan (2005) and pictorial key by Prabarker (2012). A total of 09 species of fruit fly of family Tephritidae from study sites were identified. Among these nine species, *Bactrocera scutellaris, B. tau, B. nigrofemoralis, B. correcta, Dacus sphaerodalis* are reported first time from Azad Jammu and Kashmir while *D. longicornis* is a new record from Pakistan and Azad Jammu and Kashmir.

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Introduction

Fruit flies belong to family Tephritidae: the largest family of order Diptera (Drew, 1989), with more than five thousand described species worldwide. Approximately 1400 species of fruit fly develop in fleshy fruits (Norrbomet et al., 1997). These are found in almost all habitats with appropriate plant life all over the world ranging from rainforest to open savannah (Drew, 1989; De Meyer et al., 2010). These medium sized flies with coloured wings cause damage to wide variety of fruits, vegetables and other plant parts (White and Elson-Harris, 1992; Agarwal and Sueyoshi, 2005; Prabhakar et al., 2012). About 250 of these species are causing severe damage and achieved pest status by feeding on plants of economic importance, however, about seventy species of fruit flies are considered major agricultural pests and others are minor pests (White and Elson-Harris, 1992). In Pakistan fruit flies are also serious pests causing losses at the farm level and with added losses to traders, exporters and retailers. Without control losses caused by fruit flies have been estimated to be 21% for fruits and 24 % for cucurbits (Stonehouse et al., 1998). *Bactrocer zonata* (Saunders) has been recognized as a serious pest of fruits like citrus, mango and guava in Pakistan with an estimated 50 to 55 % infestation in guava only (Syed, 1970). *B. zonata* has been observed

as serious pest of guava, musk melon and cucumber in different areas of Baluchistan, Pakistan (Anonymous, 2002). Two fruit fly species *B. cucurbitae* (Coquillett) and *B. zonata* are most notorious and widespread pest all over the country. In Pakistan *B. zonata* is abundant in most areas of Baluchistan, Sindh, and Punjab, also recorded from Islamabad and Peshawar hill (Sarwar, 2006).

The genus *Dacus* Fabricius (Diptera: Tephritidae: Dacini) is also one of the most economically important fruit flies (White and Elson-Harris, 1992). There are about two hundred and forty eight *Dacus*s species most of which show a strong preference for attacking the pods of Asclepiadaceae and Apocynaceae, or the fruits and flowers of Cucurbitaceae (Drew and Romig, 2013). Majority of *Dacus* species are distributed in the African continent nevertheless several species are also found in the Indian Subcontinent, Southeast Asia, Australia and the Pacific (Drew and Romig, 2013). *Dacus* (*Callantra*) *longicornis* Wiedemann has a widespread distribution across Southern Asia and Southeast Asia and attacks Cucurbitaceae species (Prabhakar et al., 2012). Despite widespread distribution of *D. longicornis* in Southern and Southeast Asia very limited studies focused on *D. longicornis* are available except for taxonomy and first record in some countries and areas (Prabhakar et al., 2012; Khan, 2009).

The knowledge of the diversity, as well as the time of population outbreaks of a particular species of Tephritoidea with economic importance, is a prerequisite for the establishment of integrated pest management strategies of fruit fly populations (Ronchi-Teles and Silva, 2005). It appears that as a result an accurate knowledge of the fly pest species in this region would play a significant role to the current understanding of Dacinae biogeography. Though Pakistan is an important strategic power located in South-east Asia, but its fruit fly fauna has been poorly studied in comparison to other neighbouring countries of the region. (Norrbom et al., 1999; Wang xj et al., 2002; Drew, 2004).

Materials and Methods

Study site

The state of Azad Jammu and Kashmir lies between longitude 73^0 to 75^0 and latitude 33^0 to 36^0 with total area of 5134 square miles (13,297 square kilometres). The altitude varies from 2500ft to 9000ft above sea level and crops are cultivated up to 8000ft. The climate of Poonch division is subtropical to temperate. The temperature ranges between 3.3 to 46.6℃ and average rain fall is 507.7 mm per year. The present study was conducted in eight different localities (Rawalakot, Kharick, Ban bake, Jandali, Pakhar, Hajera (Kakuta, Mandhol), Bagh (Harighel) of Poonch division of Azad Jammu and Kashmir.

Collection

Adult fruit flies were collected by using McPhail traps containing cotton pieces treated with 10-12 drops of attractant (Methyl Eugenol and Cue lure) mix with chemical insecticides (Malathion). Also, fruit flies' specimen was collected from infected plant hosts like Peach, Figg, pear, Persimmon, Apple and Guava in vegetable cucumber, Bitter gourds and Bottle gourds. 6-8 traps were placed in one hectare. These traps were hanged at the height of 2-3 meter with the branches of fruit trees in the experimental area under observation. The trapped specimen's data like number of species in each trap was recorded on fortnightly bases throughout the year.

Preservation

Collected specimens were brought to laboratory of department of Entomology in glass vials and pinned. After pinning specimens were oven dried 45-50°C and preserved in wooden boxes with necessary information i.e. host, locality, date of collection and collector name on tag.

Identification

The collected specimens were identified under microscope (Leica MZ6) up to species level with the help of available literature (Mahmood and Hassan, 2005) and pictorial keys (Prabhakar, 2012). The specimens were identified on the basis of morphological characters like antenna, wings pattern, strips pattern on thorax, legs types, tergites present on abdomen.

Results and Discussion

Taxonomy

A total 09 species belonging to 02 genera of family Tephritidae (Diptera) were identified from different host plant, vegetable and fruit trees from the study site. Key to collected species of Genus *Bactrocera* is provided.

Key to collected species of genus Bactrocera

1. Scutum with a pair of lateral vitae and medial vitae…..2
- Scutum with lateral vitae but without medial vitae…..4
2. Femora yellow brown except ¼ part black; Scutellum yellow with black spot....*B. scutellaris*.
- Femora entirely yellow brown; Scutellum yellow without an apical black spot ….3
3. Forewing with cubital streak and costal band with a large spot at wing apex; Wing without vein dm-cu and usually r-m vein not covered with infuscate mark…*B. tau.*
- Forewing with cubital streak and costal band without large spot at wing apex; Wing with vein dm-cu and usually r-m vein covered with infuscate mark.... *B. cucurbitae.*
4. Anepisternal strip extended forward to join anterior notopleural seta; thorax shorter to pre-abdomen….5
- Anepisternal strip not extended forward to join anterior notopleural seta; Thorax equal to pre-abdomen..... *B. dorsalis.*
5. Costal band wide between vein sc and R_{4+5} at wing apex; cell c with microtrichae; Femora with dark black marking… *B. nigrofemoralis.*
- Costal band narrow between vein sc and R_{4+5} at wing apex; cell c without microtrichae; Femora without dark black marking …..6
6. Face with black spot in each antennal furrow; Scutumcolor brown …. *B. zonata.*
- Face either with a pair of transverse black spot adjacent to the antennal furrow or with these spot joint to form a transverse black line above the mouth; scutumcolour black, ….. *B. correcta.*

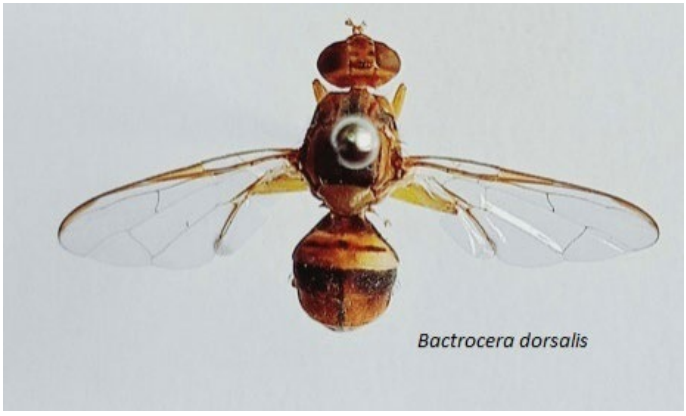
Bactrocera dorsalis (Hendel, 1912)

Morphological description: Body length: 6.50-7.00 mm. Body colour: yellowish-brown. Face having black spot beneath antennal furrow. Frontal strips brownish-gray, with small pale-yellow hair. Anepisternal stripe not extended forward to join anterior not opleural seta, anterior supra-alar seta present. Abdominal tergites except I and II not fused, all tergites red brown colour, yellow brown transverse band, apical I tergite black. Tibiae brown except fore and mid tibiae.

Distribution: Taiwan, Singapore, Indian subcontinent and in South East Asia, Bangladesh, Bhutan, Cambodia, China, Jammu and Kashmir, Japan, Nepal, Pakistan, Sri Lanka, Taiwan, Thailand, United Arab Emirates America, Angola, Botswana, Congo, Ethiopia, South Africa, Sudan, Australia, Guam and New Zealand.

Material examined: Hajira (Mandol: 5109♂, Kakuta: 9019♂), 15-V- 2016–30-V-2017; Harighel: 309♂ 15-V- 2016–30-V-2017; Rawalakot: 4313♂,15-V-2016–30-V-2017; Jandali: 2864♂ 15-V- 2016–30-V-2017; Banbhake: 1507♂ 15-V- 2016–30-V-2017.

Remarks/ new record: This species has been reported from Pakistan and in Azad Jammu and Kashmir region by Mahmood and Hassan (2005) and Drew and Hancock (1994). During present study this species is record from Rawalakot and Hajira.



Bactrocera zonata (Saunders, 1841)

Morphological description: Body length: 5.25-6.10 and colour: mainly orange to brown. Dark spot present in each antennal groove. Post-pronotal lobes lacking setae scutum with anterior supra-alar and pre-scutellar acrostichal setae present. I tergite red brown with black lateral margins apical yellow brown transverse band. Costal band with cell sc spot vein r_{4+5} wing apex, microtrichae not present in cell bc. Hind tibiae yellow brown with outer side black.

Distribution: Pakistan, Bangladesh, Bhutan, India, Jammu and Kashmir, Iran, Israel, Laos, Myanmar, Nepal, Saudi Arabia, Sri Lanka, Thailand, United Arab Emirates, Vietnam, Yemen, Egypt, Libya, Sudan, USA and New Zealand.

Material examined: Hajira (Mandol: 1409♂, Kakuta: 1869♂) 15-V- 2016–30-V-2017; Harighel 31♂5-V- 2016–30-V-2017; Rawalakot 173♂ 15-V- 2016–30-V-2017; Jandali 26♂ 15-V- 2016–30-V-2017; Banbhake 152♂15-V- 2016–30-V-2017.

Remarks/new record: This species has already been reported from Pakistan and in Azad Jammu and Kashmir region by Mahmood and Hassan (2005) and Qureshi et al. (1991). During present study this species is record from Rawalakot and Hajira

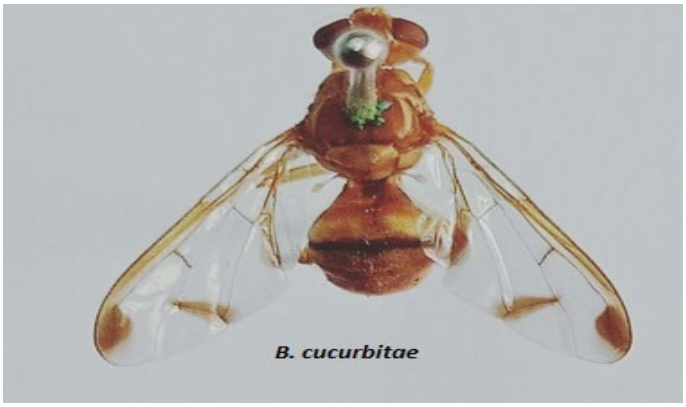
Bactrocera (Zeugodacus) cucurbitae (Coquillett, 1899)

Morphological description: Body length: 5.50-7.00 mm and colour: Radish-brown. Dark brown frontal strip, several black small hairs. Intra-alar seta present, notopleura vitta not present, lateral vitta present scutum tergite I dark red brown with apical yellow brown transverse band. R_{4+5} dark apically dark spot wing apex overlapping vein R_{2+3} in depth. Fore tibia yellow brown to red brown.

Distribution: Pakistan, Afghanistan, Bangladesh, Bhutan, Cambodia, China, Hong Kong, Japan, Nepal, Oman, India, Jammu and Kashmir, Iran, Taiwan, Israel, Laos, Myanmar, Nepal, Saudi Arabia, Sri Lanka, Thailand, United Arab Emirates, Vietnam, Yemen, Egypt, Kenya, Libya, Sudan, USA, Australia and New Zealand.

Material examined: Hajira (Mandol: 259♂, Kakuta: 168♂) 15-V- 2016–30-V-2017; Harighel 672♂, 15-V- 2016–30-V-2017; Rawalakot 2♂, 15-V- 2016–30-V-2017.

Remarks / New record: This species has been reported from Pakistan in Azad Jammu and Kashmir, Muzafarabad by Mahmood and Hassan (2005). During study this species is recorded from Rawalakot, Bagh and Hajira.



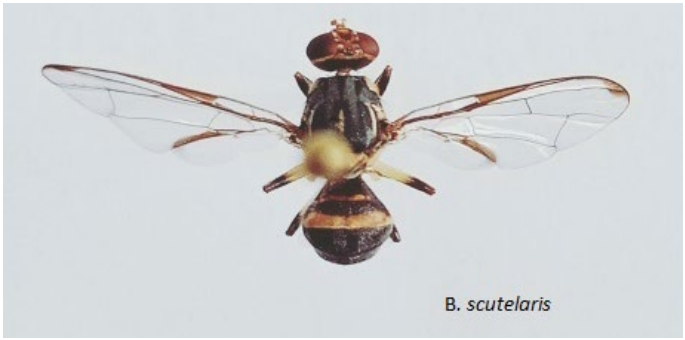
Bactrocera (Zeugodacus) scutellaris (Bezzi, 1913)

Morphological description: Body length: 6.55-6.70 mm and colour: black. Face black spot antennal furrow, black frontal strip small pale-yellow hair. Black scutum except vittae, yellow medial and lateral vittae. Tergite colour brown to black. Costal band expanded apically to form a spot at wing apex.

Distribution: Pakistan, China, Sri Lanka, India, Vietnam, Malaysia, Thailand, Myanmar, Bhutan and Nepal.

Material examined: Hajira (Mandol: 172♂, Kakuta: 24♂) 15-V- 2016–30-V-2017; Harighel 146♂, 15-V-2016–30-V-2017; Rawalakot 4♂, 15-V- 2016–30-V-2017; and Banbhake 198♂, 15-V- 2016–30-V-2017.

Remarks / new record: This species has been reported from Pakistan by Mahmood and Hassan (2005). New record for Azad Jammu and Kashmir.



Bactrocera tau (Walker, 1849)

Morphological description: Body colour: Brownish yellow with black patches and length: 6.50-7.50 mm. Dark brown frontal strip, with several small black hairs basely as well as apically. Black scutum except vittae, black area behind post pronotal lobe. Targa largely yellow, narrowly black laterally. Costal band extending to wing apex, large spot expanded distally

covering apical part cell r_{4+5}. Femora tip dark brown.

Distribution: Bangladesh, Bhutan, Cambodia, Fujian, Hong Kong, Indonesia, Malaysia, Taiwan Singapore, Pakistan, China, Sri Lanka, India, Vietnam, Malaysia, Thailand, and Nepal.

Material Examined: Hajira (Mandol: 634♂, Kakuta: 288♂) 15-V- 2016–30-V-2017; Harighel 870♂, 15-V- 2016–30-V-2017; Rawalakot 7♂, 15-V- 2016–30-V-2017 and Banbhake 23♂, 15-V- 2016–30-V-2017.

Remarks/ New record: This species has been reported from Pakistan by Syed (1970). New record for Azad Jammu and Kashmir.

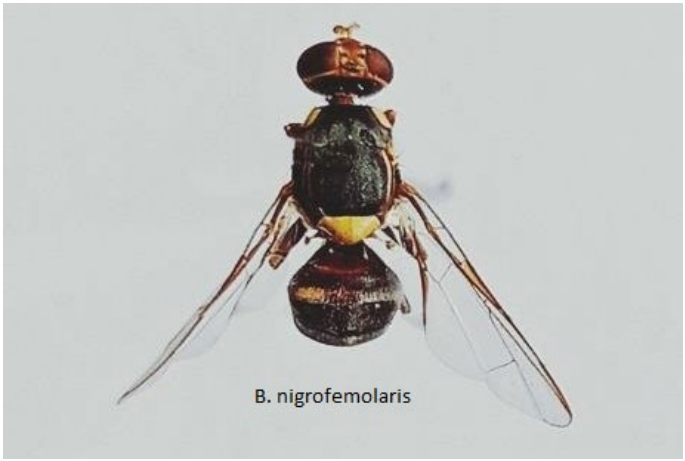
Bactrocera nigrofemoralis Tsuruta and white 2001

Morphological description: Body Colour black, face entirely black. Lateral vitta of scutum present, medial vitta of scutum absent. Tergite I dark black with apical narrow incomplete transverse brown black band. Cell bc without microtrichae, cell c with microtrichae in anterior apex only. Fore tibiae brown black, mid tibiae yellow brown with basal 1/3 slightly dark coloured.

Distribution: Pakistan, China, Sri Lanka, India, Thailand, Nepal and Bhutan.

Material Examined: Hajira (Mandol 47♂), 15-V- 2016–30-V-2017; Harighel 31♂, 15-V- 2016–30-V-2017; Rawalakot 6♂, 15-V- 2016–30-V-2017.

Remarks/ New record: This species has been reported from Pakistan by Mahmood and Hassan (2005). In the present study this species is record from Azad Jammu and Kashmir.



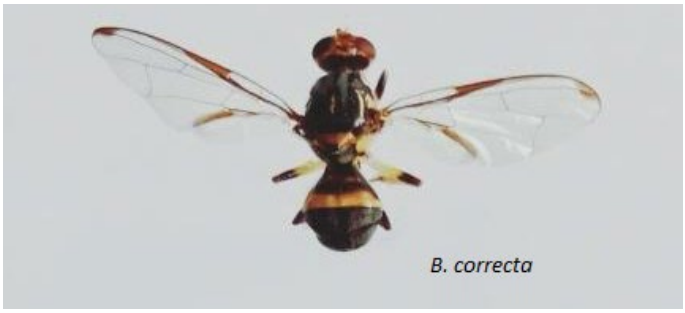
Bactrocera (Bactrocera) correcta (Bezzi, 1916)

Morphological description: Face yellowish to brown with a pair of small transverse oval black spots. Scutum colour black, dorsally meso-pleural strip reaching anterior notopleural seta. Abdominal tergites III-V red brown; black T pattern transverse band across anterior margin of III tergum. Wing cell bc and c colourless and microtrichae absent. Legs all segment entirely yellowish-brown except hind tibiae brownish-gray apically.

Distribution: This specie was recorded from India, Sri Lanka, Nepal, Thailand, Southern china, Pakistan Bhutan, Japan, Myanmar, Taiwan and USA.

Material Examined: Mandol: 15-IX- 2016, 1♂.

Remarks/ New record: This species has already been reported from Pakistan by Mahmood and Hassan (2005). This is recorded from Rawalakot and Hajira, Azad Jammu and Kashmir during this study.



Genus dacus fabricius

Key to the species of genus Dacus Fabricius:

- Costal band broad overlapping vein R_{4+5} expanding into a large spot in wing apex.... *Dacus (Callantra) sphaerodalis* (Bezzi).

- Costal band broad overlapping vein R_{4+5} not expanding into a large spot in wing apex ..... *Dacus longicornis Weidman.*

Dacus (Callantra) sphaerodalis (Bezzi, 1916)

Morphological description: Body length: 7.00-9.70 mm and colour: radish brown. Reddish frontal strip; pale yellow hair on side, one pair anterior and two pair posterior frontal orbital bristles. Scutum colour reddish brown without any medial or lateral vitae. Abdominal tergites fused. Costal and basal radial cells with microtrichae basally, wing length 5.80-7.20.

Distribution: This specie was recorded from Pakistan, China, Sri Lanka, India, Thailand, Nepal and Bhutan.

Material Examined: Hajira (Mandol 34♂, Kakuta 6♂), 15-V- 2016–30-V-2017and Harighel 23♂, 15-V- 2016–30-V-2017.

Remarks/ New record: This species has been reported from Pakistan by Sarwar and Riaz (2013). In the present study this is a new record from Azad Jammu and Kashmir.

Dacus (Callantra) longicornis (Wiedemann, 1830)

Morphological description: Vertex black, face black triangular pattern connecting two intermediate sized oval black spot, head length 1.00- 1.30. Narrow mesopleuron strip equal width notopleuron dorsally, black postpronotal lobes, black anatergite, black katatergite. Petiolate elongate and oval, all tergites are combined. Cell bc and c brownish-grey, cell c and cell bc microtrichae present. Femora entirely black with dark red-brown on apex, mid and hind.

Distribution: It was reported from China, Sri Lanka, India, Thailand, Nepal and Bhutan.

Material Examined: Mandol: 15-X-2016, 1♂.

Remarks / New record: In the present study the species is found from Hajira. This is new record for Azad Jammu and Kashmir and Pakistan.

Discussion

Fruit fly is a serious pest causing severe damage to several fruits and vegetables and effect economy and trade of many countries. In Pakistan fruit fly causes losses in vegetables and fruits that range from 20-90% in different part of country. Pakistan is among the major fruits and vegetables producing countries, which are providing important source of nutrition for its local population, but also to other countries of world. Today, with increasing globalization, it has become necessary for the nation not only to feed its own population, but also have to export these produces to other countries of world. There are many challenges for an exporting country to send its perishable items to other populations of the humankind. The main challenge faced by this country is the strict requirement of quality control and restrictive quarantine measures imposed by importing countries. Thus, to export fruits and vegetables produces in abroad, it is imperative to minimize the concerns owing to fruit fly pests. In present study total 09 species of fruit flies (Diptera: Tephritidae) were reported from Poonch division of Azad Jammu and Kashmir. The captured flies mostly contained four species *Bactrocera zonata, Bactrocera cucurbitae*, *Bactrocera dorsalis* and *Bactrocera tau (Walker). Bactrocera (Bactrocera) nigrofemoralis*, *Bactrocera correcta, Bactrocera scutellaris, Dacus sphaerodalis and Dacus longicornis* were recorded occasionally. The population trend of all these species was changed throughout the year, it could not be compared with the level of infestation by these species during the

years. Minimum population of fruit flies was recorded in May and maximum in August. These results are similar with findings of Mahmood and Mishkatullah (2007) which shows maximum population in August from district Chakwal. Hui and Jinghong (2007) also reported the same population trend of fruit flies in Xishuangbanna, Yunnan Province, China. Out of these 09 species 06 were reported as a new record for Azad Jammu and Kashmir and 01 Specie is a new record for Pakistan. Three species *Bactrocera dorsalis* (Hendel), *Bactrocera zonata* (Saunders) and *Bactrocera (Zeugodacus) cucurbitae* (Coquillett) are already reported from Azad Jammu and Kashmir by Mahmood and Hassan (2005).

Author's Contribution

Usman Zubair: Data collection , identification of the specimens and preparation of manuscript.
Anjum Shehzad: Technical Input at every step.
Muhammad Ishaque Mastoi: Conception of the idea.
Khalid Mahmood: Overall Management of the article.

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