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New Distribution Records of Fruit Fly *Dacus sphaeroidalis* (Bezzi) (Diptera:Tephritidae) From Pakistan and Improved Description of this Pest Species.

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Research Article

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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 based on the latest scientific consensus available to help the researchers for their accurate and easy identification. This manuscript deals with new distribution records presented for species of fruit fly *Dacus sphaeroidalis* (Bezzi) (Diptera: Tephritidae: Dacinae), resulting from local fruit flies monitoring program. Speiemens of fruit fly were collected from rearing of their maggots feeding on the fruits of Chinese violet (*Telosma cordata*) host and then adults captured for identification and description. Now new distribution records of the species *D. sphaeroidalis* are presented, and described and illustrated for the first time for fauna of Pakistan. Taxonomic issues with specimen are discussed, described and illustrated from this region of which further host range has yet to be investigated. Although the newly recorded species closely resembles with other species of the genus *Dacus*, yet, the differences between these species are given.

INTRODUCTION

Tephritidae fruit flies are important and widespread insect pests of fruit and vegetable crops, which infest a great variety of native and exotic hosts [1]. This family consists of small to medium size flies about 2-12 mm long; fronto-orbital plate usually bears one or more frontal bristles, antennae with bare or plumose arista, wings usually with a pattern consisting of brown strips and spots, costal vein with two interruptions [2]. A number of flies pest inflict attack on fruits and vegetables, but Tephritid fruit flies are recognized to generate a huge notoriety to the horticultural industry than any pest worldwide. During the past, a steady but slow awareness on the importance of fruit flies has been created in the region due to their direct and indirect injury and damage to exportable fruits and vegetables. But, now fruit flies have gained a considerable attention due to the recent invasions into areas where they were not present earlier. This global region represents the most important threatening habitat of fruit flies belonging to family Tephritidae [3].

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 [4]. 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 neighboring countries of the region. Some recently

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published information on the subfamily Dacinae, especially new records of *D. sphaeroidalis* species found in global fauna are well established. In addition to description and illustrations of species, new records, their identification and bionomics, and checklist to the species are provided [5, 6, 7]. Our efforts of collection of Tephritids from Pakistan examined a small but interesting locality, mainly collected by gathering their hosts and also examined a few additional specimens. Of the species examined, one is described as new record known from this country. An important and future step of our research is to investigate the host of each captured species of fruit fly, in order to better understand the relationships among them and the diversity of their host plants. Therefore, this paper deals with material from the collections of fruit flies (Subfamily Dacinae) held with other specimens collected by the authors in the Department of Entomology, University of Agriculture, Faisalabad. The specimens of genus *Dacus* Fabricius were collected from an orchard in the municipality of Rawalpindi. This species up to now had been reported from foreign localities only, but now it is a finding of new record for this species. Undoubtedly, an additional collection focused on fruit flies sampling will further increase their number into global fauna.

MATERIALS AND METHODS

Study Site

Samplings of fruit flies were done during mission organized under the framework of the integrated pest control program. Geographically, the study site Rawalpindi city of country Pakistan lies on the geographical coordinates of 24° 57' 0" North latitude and 67° 13' 0" East longitude. The average elevation of city is about 488 meters above the sea level located in the province of Punjab. The climatic conditions of the study site are semi-arid with warm summer and harsh winter seasons and a little arid condition in early summer. The mean daily summer temperatures is about 38 oC and in sever winter, the average temperature falls to 6 ^{o}C. The rainfall is approximately 36-50 mm in winter (December-February) and 200 mm per month during summer.

Study Techniques

The specimen materials of fruit flies were collected either by rearing from their infected plant hosts or by means of standard net sweeping. The collected fruit flies were stored in vials with 75% alcohol for transportation purpose. Then specimens collected were shipped to laboratory for technical identification. Species of collected specimens were identified according to morphological observations and identity of species was confirmed. Collected specimens were identified by using taxonomic keys and species descriptions. For identification, illustrations of used diagnostic characters had been consulted and included. In addition to the information of this recently material collected, other information included in this paper had been supplemented with older records of deposited collections and records of published literature. The data on the fruit flies included the observations on males and females on the basis of keys available for the identification of both sexes. Taxonomy used in this paper had been followed from published literature of subfamily Dacinae. All the materials are deposited in the Entomological collections at the University of Agriculture, Faisalabad.

RESULTS AND DISCUSSION

Genus *Dacus* Fabricius

1805 *Dacus* Fabricius, Syst. Antl, p. 272.Type: *Dacus armatus* Fabricius
The collected specimens of this species exactly tally with the published descriptions (Drew, 1989; White and Elson -Harris, 1992; Kapoor, 1993) [8, 2, 9] of this genus.

Dacus sphaeroidalis (Bezzi) (Figs. 1- 3)

1916 *Mellesis sphaeroidalis* Bezzi, Bull. Ent. Res., 7: 115.
1937 *Callantra sphaeroidalis* Perkins, Proc. Roy. Soc. Qd., 48: 55.
1987 *Callantra discophora* Agarwal, Biol. Bull. India, 9 (2): 35.
1992 *Dacus* (*Callantra*) *sphaeroidalis* White and Elson-Harris, Wallingford, CAB Inter., 601 pp.

MALE DESCRIPTION

Body length 6.35- 9.76 mm. Body coloration reddish-orange.

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Head

Length 0.76- 1.65 mm. Width 1.42- 2.41 times greater than length; frons 1-1.19 times wider than eye, with its upper part orange yellow; frontal stripe reddish, with pale yellow hair on lower side; 1 pair of superior and 2 pairs of inferior frontal orbital bristles, acuminate, black; ocellar triangle black; vertex orange yellow; inner and outer vertical bristle pairs long, acuminate, strongly developed, black; postorbital setae very small, acuminate, black; lunule orange yellow; face 0.48- 0.60 times shorter than antenna, orange yellow, with long black longitudinal line in each antennal furrow; epistome slightly projecting forward; gena 1.71- 1.94 times wider than 3rd antennal segment, orange yellow, with 1 pair of black bristles; subocular spot brown; mouthparts capitate; antenna very long (mean 1.57 mm), fulvous except 2nd and 3rd segments, which have outer surface fuscous, latter 3.67-4.88 times longer than wide; arista bare, black, with fulvous base; occiput orange yellow, with its middle part palish-red.

Thorax

Length 2.06-2.65 mm. Shorter than preabdomen (3.53-4.88 mm), 1.17-1.57 times longer than wide; scutum reddish-brown, without any medial or lateral vittae; notopleuron, large mesopleural stripe, anatergite and katatergite yellow; scutellum triangular, convex, yellow; subscutellum orange; postnotum fulvous; mediotergite dark brown; haltere yellow; anterior supra-alar and prescutellar acrostichal setae absent.

Setae

Sep. 4, *a.npl.* 2, *p.npl.* 2, *mpl.* 2, *p.sa.* 2, */a.* 2, *sc.* 2 (apical), all black and acuminate.

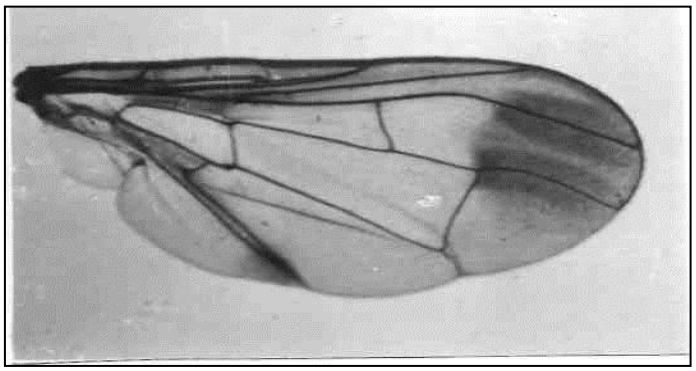
Legs

Coxae, trochanters, tibiae, fore and mid femora and one-third of hind femur reddish-brown, the remaining parts fulvous; mid tibia with 1 black apical spur.

Wings

(Fig. 1). Length 5.88 -7.24 mm. Shorter than body (6.35-9.76 mm), costal band extending from wing base to below vein M at apex, darkened apically to form gemminate large brown spot, extending up to cell m; basal radial cell with its narrow part above basal medial cell, brownish-yellow; anal stripe in posterior cubital cell extension ending at wing margin; vein R 4+5 with many ventral setulae and also at its node; basal costal, costal and basal radial cells with microtrichia basally; supernumerary lobe moderately developed.

Figure 1: *Dacus sphaeroidalis* Wing (male)



Abdomen

(Fig. 2). Length 3.53-4. 88 mm. Terga fused, I+II wasp-waisted (longer than broad), former reddish-brown, latter yellowish-brown, with apical yellow transverse band, III reddish-brown having pecten and with black transverse band basally, IV yellowish-red, last one yellowish-brown, with T-shaped dark reddish-brown mark.

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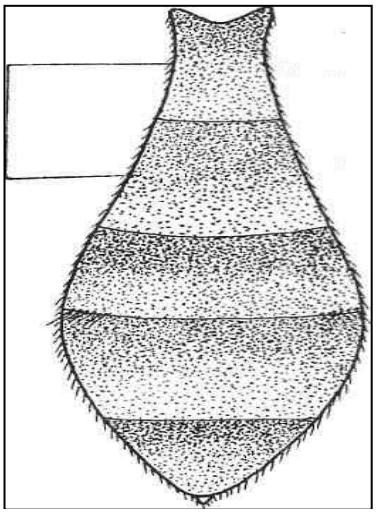

Figure 2: Abdomen of *Dacus sphaeroidalis* (dorsal aspect of male)

FEMALE DESCRIPTION

Body length 9.88- 11.47 mm. Similar to male except the following:- Second and 3rd antennal segments with outer surface orange, the latter with inner side of apex dark brown; occiput orange yellow, with its upper middle yellow, lower middle red; tergum III without pecten, IV with dorso-lateral black small patches; ovipositor (Fig. 3) (mean 1.47 mm) shorter than preabdomen (mean 4.8 mm); oviscape (mean 0.37 mm) yellow, with red longitudinal line; eversible membrane fulvous; aculeus reddish-yellow, needle-like.

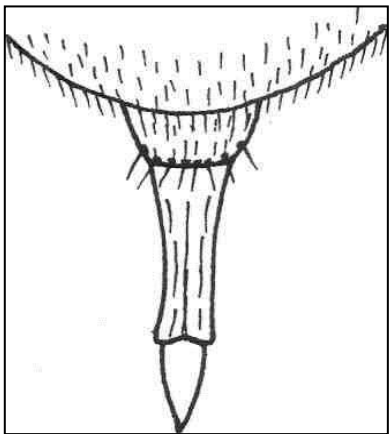

Figure 3: *Dacus sphaeroidalis* Ovipositor (female)

Material examined

From Rawalpindi collected 2 males, 1 female, 25- 3- 1996; 3 males, 2 females, 13- 4- 1996.

Habitat

Adults of this species were reared from the maggots feeding on the fruit of Chinese violet (*Telosma cordata*).

Distinguishing characters

It can be easily differentiated from all other species of the genus *Dacus* by the presence of a large brown gemminate wing spot, extending up to cell m, and anterior supra-alar and prescutellar acrostichal setae, which are absent.

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Measurements (mm): 5 males, 3 females

Body parts	Male			Female		
	Range	Mean	S. D.	Range	Mean	S. D.
B.L.	6.35-9.76	7.87	1.19	9.88-11.47	10.60	0.66
H.L.	0.76-1.65	1.13	0.28	0.94-01.29	01.09	0.15
H.H.	1.18-1.76	1.41	0.11	1.76-01.77	01.77	0.01
H.W.	1.76-2.35	2.00	0.23	2.47-02.77	02.65	0.13
FR.W.	0.59-0.88	0.70	0.11	0.94-01.00	00.96	0.03
E.W.	0.59-0.74	0.67	0.07	0.76-00.88	00.84	0.06
A.L.	1.41-1.82	1.57	0.18	1.88-02.06	01.96	0.08
A.S3.L	0.71-0.88	0.83	0.08	0.94-01.00	00.98	0.03
A.S3.W.	0.18-0.24	0.20	0.03	0.12-00.18	00.16	0.03
F.L.	0.76-0.94	0.84	0.07	1.06-01.18	01.14	0.06
G.W.	0.24-0.41	0.32	0.06	0.35-00.47	00.39	0.06
T.L.	2.06-2.65	2.53	0.41	3.06-03.35	03.21	0.12
T.W.	1.65-2.06	1.81	0.14	2.06-02.35	02.19	0.12
W.L.	5.88-7.24	6.61	0.53	7.94-08.35	08.17	0.18
PA.L.	3.53-4.88	4.21	0.58	4.70-05.00	04.80	0.14
O.L.	-	-	-	1.06-01.88	01.47	0.34
OS.L.	-	-	-	0.35-00.41	00.37	0.03
H.W./H.H.	1.34-1.57	1.42	0.09	1.40-01.56	01.49	0.07
H.W./H.L.	1.42-2.41	1.87	0.42	2.15-02.87	02.45	0.31
H.H./H.L.	1.07-1.55	1.30	0.21	1.37-01.87	01.63	0.21
FR.W./E.W.	1.00-1.19	1.04	0.08	1.10-01.24	01.16	0.06
F.L./A.L	0.48-0.60	0.54	0.05	0.55-00.63	00.58	0.04
A.S3.L/A.S3.W.	3.67-4.88	4.16	0.52	5.22-05.55	05.39	0.17
G.W./A.S3.W.	1.71-1.94	1.79	0.11	1.94-03.91	02.59	0.93
T.L./T.W.	1.17-1.57	1.39	0.14	1.30-01.57	01.47	0.12

Pakistan is among the major fruits and vegetables producer 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. The present authors for this rationale examined fruit samples from orchards in some localities and found that *D. sphaeroidalis* was one of the most abundant species of fruit flies attacking Chinese violet (*T. cordata*). It is known that in primary tree-plants the stability and heterogeneity of the vegetation are higher than in secondary afforest and this favors species richness in groups of phytophagous insects such as fruit fly pests [10]. In this genus, species richness tends to agree with the diversity of plant species. The diversity of fruit trees in a natural afforest increases the likelihood of occurrence of monophagous species of fruit flies [11], and therefore, increases the probability of a greater

diversity of Tephritoidea in the ecosystem. This pattern is also common in other groups of arthropods [12, 13]. The level of our data presentation and the obvious dispersion of the fruit fly fauna to other parts of the country can make more accurate association of the fly fauna. Hopefully, phylogenetic research is undertaking and molecular techniques for large numbers of Dacinae species are advancing, these dissertations might provide some further useful baseline information on *D. sphaeroidalis*.

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