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Detection of Tephritid Fruit Flies using Food Attractants Baited Trap in Bangladesh

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Abstract: A preliminary survey of dacine fruit flies (Diptera: Tephritidae) of Atomic Energy Research Establishment campus, Ganakbari, Savar, Dhaka, Bangladesh was conducted during September, 2023 to January, 2024 using new traps baited with food attractants contain mainly hydrolyzed protein from China. The use of food attractants revealed capture of both males and females of fruit fly species and other non-target insects those are usually not attracted to synthetic lures. In the present study the presence of the fruit fly species *Bactrocera* (*Zeugodacus*) *diversa* (Coquillett) (15), *Bactrocera* (*Javadacus*) *zahadi* (Mahmood) (3), *Bactrocera* (*Parasinodacus*) *momordicae* (David & Ajaykumara) (5), and *Bactrocera* (*Bactrocera*) *dorsalis* complex (=*invadens* Drew, Tsuruta & White) (16) (all Dacinae: Dacini), *Dimeringophrys pallidipennis* Hardy (2) and *Euphranta crux* (Fabricius) (1) (Trypetinae: Adramini) was detected. Apart from these fly species, females of other available *Bactrocera* species and non-target insect species were collected during the survey. The experimental results indicated the potential of food attractants to detect unknown fruit flies of the tribes Dacini and Adramini in Bangladesh.

Key words: Dacini · Tephritid fruit flies · survey · food attractants · trap ·, non-target insect

INTRODUCTION

The fruit fly tribe Dacini is a species-rich taxon within the family Tephritidae and comprised around a fifth of all known species [1-2]. The tribe has received considerable taxonomic attention and new species are continuously being identified [3-4]. In the Asia-Pacific region, there are 730 species of Dacini reported, but only 72 of these species are important pests [5].

In Bangladesh, an annotated checklist of 34 Dacini fruit flies was published by Leblanc *et al.* [3]. Synthetic male pheromone lures are commonly used to monitor and mass trap pestiferous tephritid fruit flies. But, not all fruit fly species are attracted to synthetic lures.

The aim of the present work was to detect the presence of new Dacini fruit flies in the Atomic Energy Research Establishment (AERE) (N 23.954°E 90.280°), Ganakbari, Savar, Dhaka, Bangladesh using food attractants baited trap. The abundance of non-target insect species was also recorded.

MATERIALS AND METHODS

Traps baited with food attractants dissolved into water were set at five different locations of AERE office campus during September, 2023 - January, 2024. The AERE office campus contains different varieties of local and exotic crop plantations (medicinal, ornamental, fruits), besides bushes and herbs. Trap locations were: i. Field behind Institute of Energy Science, ii. Field near Institute of Food and Radiation Biology (IFRB), iii. Field near Secondary Standard Dosimetry Laboratory (SSDL), Institute of Nuclear Science and Technology (INST), iv. Field behind Tandem Accelerator Building, INST, and v. Field near AERE canteen. Traps baited with food attractants (the main component is one kind of

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Fig. 1: Trap and sachet of food attractants.

hydrolyzed protein) (Fig. 1) were hung on tree branches with shaded areas approximately 1.5 meters above the ground. The flies were collected at weekly interval over 17 weeks.

Identification of Fruit Fly and Non-Target Insect Species: Tephritid fruit flies and non-target insects collected in the traps were counted and recorded in the laboratory of Insect Biotechnology Division, IFRB, AERE. Each fly species was separated and then selected species were photographed with a Leica Microscope (Leica DMC 2900, Germany). High resolution images were sent to David Hancock (Carlisle, United Kingdom) for identification. *Bactrocera* Macquart is a diversified genus of tribe Dacini with several cryptic species which are pests. Virgilo *et al.* [6] raised the *Zeugodacus* group to genus level based on their molecular phylogenetic studies but here we followed Hancock and Drew [7] and consider the *Zeugodacus* group to all be subgenera of *Bactrocera*. The fly species were preserved in 100% ethanol in an Eppendorf tube and kept in freezer (-20°C).

RESULTS AND DISCUSSION

The presence of *Bactrocera* (*Javadacus*) *zahadi* (Mahmood), *Bactrocera* (*Parasinodacus*) *momordicae* (David & Ajaykumara), *Dimeringophrys pallidipennis* Hardy (Figs. 2B, C, E) and *Euphranta crux* (Fabricius) (Fig. 2F) are new records for Bangladesh. Apart from above mentioned fruit fly species we also recorded the presence of other Dacini: *Bactrocera* (*Javadacus*) *cucurbitae* (Coquillett), *Bactrocera* (*Javadacus*) *tau* (Walker), *Bactrocera* (*Zeugodacus*) *diversa* (Coquillett) (Fig. 2A) and *Bactrocera* (*Bactrocera*) *invadens* Drew, Tsuruta & White (Fig.2D). Two *Bactrocera* (*Bactrocera*) *rubigina* (Wang & Zhao) were also detected in the trap. The captured flies mostly comprised *B. cucurbitae* and *B. tau*. The identification and number of other species in the families Apidae (bees), Arachnidae (spiders), Formicidae (weaver ants, small and medium size black ants), Calliphoridae (*Lucilia cuprina* L.), Drosophilidae, Lonchaeidae, Milichidae, Muscidae, Platystomatidae (*Agadasys hexablepharis, Plagiostenopterina* sp.) were also counted and recorded.

Identification of Specific Fruit Fly Species:

***Bactrocera* (*Zeugodacus*) *diversa* (Coquillett, 1904):** *Bactrocera diversa* lacks the pecten on abdominal tergite 3 in males and has an elongate oviscape that darkens posteriorly [3]. Four females and eight males *B. diversa* (Fig. 2A) were collected from the field of IFRB, AERE on 28 November, 2023 in the food attractant baited trap. The species occurs in Pakistan, India, Nepal, Bangladesh, Sri Lanka, China, Thailand and Vietnam [3,8]. Feeding of *B. diversa* is recorded inside flower buds of numerous species of Cucurbitaceae [8].

***Bactrocera (Javadacus) zahadi* Mahmood, 1999:** *Bactrocera zahadi* Mahmood is a member of the *B. tau* complex (Fig. 2B). It is a medium-sized (6.1± 0.062 mm) reddish brown species with irregular to round facial black spots. Scutum is reddish brown, with dark patches at

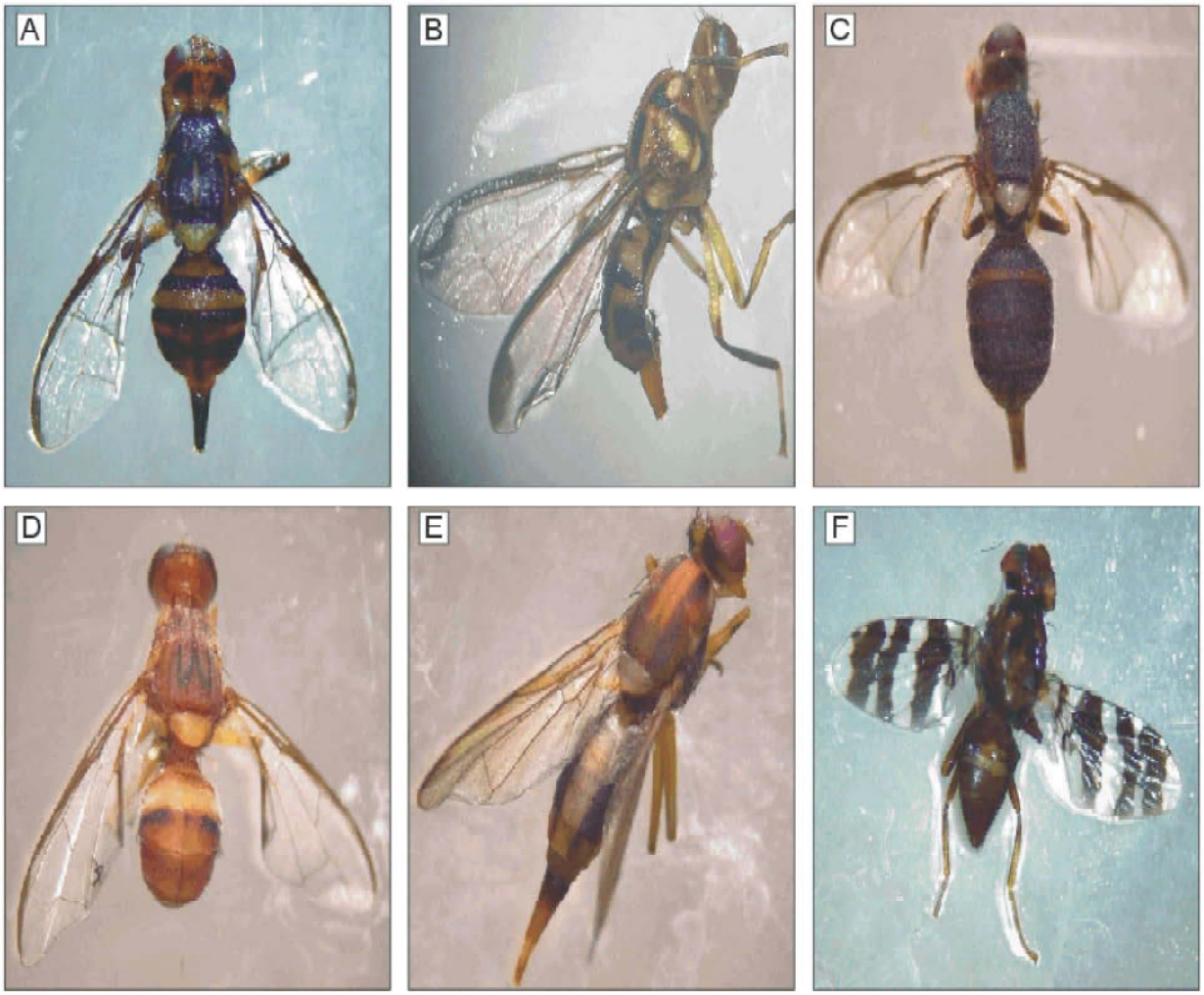

Fig. 2(A-F): Images of fruit flies. A**.** Female *Bactrocera diversa* (Coquillett), B. Female *Bactrocera zahadi* (Mahmood), C. Female *Bactrocera* (*Parasinodacus*) *momordicae* (David & Ajaykumara), D. Male *Bactrocera dorsalis* complex (=*invadens*), E. Female *Dimeringophrys pallidipennis* Hardy and F. Male *Euphranta crux* (Fabricius).

laterally in some specimens. Both lateral and median postsutural vittae present. Supernumerary lobe is strong, depressed and keel shaped. *B. zahadi* has prominent black markings on apices of all femora and wing with a distinct apical spot [9]. One female and two males of *B. zahadi* were collected in food attractant baited traps on 13 December, 2023 from AERE campus, Bangladesh.

B. zahadi, like other *B. tau* complex species is a serious pest in the mid and low hills of Himachal Pradesh, India [9]. *B. tau* and *B. zahadi* are similar in morphological features, host range (mostly Cucurbits) and distribution, hence often there is confusion between *B. tau* and *B. zahadi,* but can be differentiated with the help of characters such as wing and genitalia morphology [10]. It is known to occur in Sri Lanka, India, Myanmar, Pakistan and Bhutan [8]. Newly recorded in Bangladesh.

***Bactrocera* (*Parasinodacus*) *momordicae* (David & Ajaykumara, 2024):** The fore femur is black and mid and hind femora of *B.* (*Parasinodacus*) *momordicae* is basally fulvous and apically black, face fulvous with two parallel transverse black bands, across oral margin and below antennal sockets. Five adult males and females of *B. momordicae* (Fig. 2C) were detected in food attractant baited trap from the field of IFRB, AERE on 28 November, 2023. Records of *Bactrocera cilifer* (Hendel) from the Indian Subcontinent (including Bangladesh [3]) were referred to *B. momordicae* by David *et al.* [11].

Table 1: Summary of Tephritid fruit fly species collected in traps baited with food attractants placed at five locations of AERE campus during September, 2023 - January, 2024.

Fruit fly species	Attraction to male lures	Number of species captured by food attractants	Pest Status
Bactrocera (*Parasinodacus) momordicae* (David & Ajaykumara)	CL	(3 females, 2 males)	Infests flowers of Spiny Gourd
Bactrocera (Bactrocera) dorsalis complex (=*invadens*)	Methyl eugenol (ME)	(6 females, 10 males)	Major Polyphagous fruit pest
Bactrocera (*Zeugodacus*) *diversa* (Coquillett)	Eugenol, ME, Zingerone (Zn)	(10 females, 5 males)	Pest of Cucurbitaceae (flowering stage)
Bactrocera (*Javadacus*) *cucurbitae* (Coquillett)	CL, Zn, Raspberry Ketone	(14 females, 59 males)	Major pest of Cucurbitaceae and Solanaceae
Bactrocera (*Javadacus*) *tau* (Walker)	CL	(21 females, 42 males)	Pest of Cucurbitaceae and Solanaceae
Bactrocera (*Javadacus) zahadi,* Mahmood	CL	(1 female, 2 males)	Pest of Cucurbitaceae
Bactrocera (*Bactrocera*) *rubigina* (Wang & Zhao)	CL, Zn	(2 males)	Non-pest
Dimeringophrys pallidipennis Hardy	--	(2 females)	breed in Moraceae (Jackfruit)
Euphranta crux (Fabricius)	--	(1 male)	--

Table 2: The capture of non-target insects in traps baited with food attractants placed at five locations of AERE campus during September, 2023-January, 2024.

Order/Family/Genus/Species	Total number of non-target insects
Arachnids (Jumping spiders - Salticidae)	3
Calliphoridae (Blow fly, *Lucilia cuprina* L.)	1
Drosophilidae	21
Hymenoptera	
Weaver ants- *Oecophylla*	18
Small black ants	30
Big black ants	17
Bees (Apidae)	2
Lonchaeidae	17
Milichiidae	50
Muscidae (*Atherigona*)	60
Large black Muscidae	52
Neriidae (stilt-legged flies)	14
Platystomatidae (*Agadasys hexablepharis, Plagiostenopterina* sp.)	151
Unknown small flies	712

***Bactrocera dorsalis* complex (=*B. invadens* Drew, Tsuruta & White, 2005):** *Bactrocera* (*Bactrocera*) *invadens* (Fig. 2D) belongs to the *Bactrocera dorsalis* complex. It is often confused with *Bactrocera dorsalis* (Hendel) but differs in the narrower lateral postsutural yellow vittae and usually a mostly red-brown scutum with variable black markings. In this study, one male was first collected from the field of IFRB, AERE on 17th September, 2023 in a food attractant baited trap. The main host plant for this insect pest is mango, but it also invades loquat, guava, shaddock, orange, cucurbit, papaya, avocado, and many other fruits [12]. It occurs in India, Bhutan, Nepal, Sri Lanka, Pakistan, Bangladesh and many countries in the Afrotropical region [13].

***Dimeringophrys pallidipennis* Hardy, 1973:** Fruit flies of the Tribe Adramini are characterized by the presence of long, fine, erect hair-like setulae on the anatergite [14]. About 181 species in 26 genera are reported from the world, of which 16 genera are known to occur in the Oriental region. *Dimeringophrys* Enderlein is a genus in the subfamily Trypetinae. In Bangladesh, two adult females *Dimeringophrys pallidipennis* Hardy (Fig. 2E) were captured in traps near AERE canteen and Tandem Accelerator Building on 17 September, 2023. The species was described from Thailand [15] and recorded for the first time from India by David *et al*. [16] and is also found in southern China [17]. The presence of a narrow costal band and lack of infuscation along crossvein DM-Cu differentiate it from the related *D. parilis* (Hardy) and *D. bilineata* Enderlein, with the former also known from India [8]. It has been bred from *Artocarpus heterophyllus* (Moraceae) [17].

***Euphranta crux* (Fabricius, 1794):** *Euphranta crux* (Fabricius, 1794) (Trypetinae: Adramini) (Fig. 2F), originally described from India, was redescribed and illustrated Bezzi (1913) [18] based on specimens collected from Calcutta except for postabdominal structures, which were described by David *et al.* [19]. One male *E. crux* was captured in a food attractant baited trap on 24 December, 2023 from field near canteen, AERE campus.

In the present study, a total 180 fruit fly specimens and 1148 non-target insect and arachnid specimens were captured (Tables 1 and 2) during 17 weeks trapping with food attractants from September, 2023 to January, 2024. Under non-target insects one female *Plagiostenopterina* Hendel (Platystomatidae) (Fig. 3) was captured on 2nd January, 2024 in food attractant baited trap in field near IFRB, AERE. Several tephritid fruit flies and other insect species were reported to capture by hand picking, handheld net or sweeping net [20, 21, 22, 23, 24]. The food attractants and trap used in

Fig. 3: Dorsal view of *Plagiostenopterina* Hendel.

the present study found effective in capturing diverse insect species including Dacini fruit flies. The food attractants were able to captured both male and female flies which may have significant impact on the management of pestiferous fruit species in Bangladesh.

The present study revealed the fact that the use of traps baited with food attractants has significant effect on the capture on the unknown (both male and female) fruit fly species including those are not responsive to synthetic pheromones lures. The presence of *Bactrocera zahadi* Mahmood, *Bactrocera* (*Parasinodacus*) *momordicae* (David & Ajaykumara), *Dimeringophrys pallidipennis* Hardy and *Euphranta crux* (Fabricius) are new records in Bangladesh.

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