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Notes on the Lure Responsiveness of Fruit Flies of the Tribe Dacini (Diptera: Tephritidae) in Sri Lanka

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Abstract. Twenty-four dacine fruit fly species were recorded in a lure trapping survey in Sri Lanka. The number of species attracted by a cue lure (CL) or methyl eugenol (ME), and those that didn't respond to either but were recorded in a fruit collection survey, were 17, 7, and 6, respectively. These records and the distribution of responsiveness among dacine fruit flies of Sri Lanka according to the existing classification were investigated. The results showed that those that responded to ME were distributed in only one genus, *Bactrocera* (*Bactrocera*), while those that responded to CL were distributed widely across different genera and subgenera: *Bactrocera* (subgenera *Afrodacus*, *Bactrocera*, *Zeugodacus*, *Javadacus*, and *Parazeugodacus*), and *Dacus* (*Callantra*). The results were consistent with the general tendency of responsiveness among Dacini. The ratio of species that responded to CL and those that responded to ME was about 2.4: 1.

Key words: Fruit fly, Dacini, *Bactrocera*, *Dacus*, lure response, Sri Lanka

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Introduction

Fruit flies of the tribe Dacini Bezzi are characterized not only by morphological characters, but also behavioral (physiological) characters such as their responsiveness to male lures. By using these characters, many faunal as well as population surveys have recently been conducted in various countries in Asia and Australasia (Drew, 1989; Drew & Hancock, 1994; Allwood *et al.*, 1997; Tsuruta & White, 2001; Drew & Raghu, 2002). Responses to male lures are also useful for identification, because of the consistency in responsiveness among species to a single fixed lure in principle.

The present authors conducted fruit fly faunal surveys in Sri Lanka using lure-baited traps during the period of 1993-1996. Before this survey, comprehensive lure response data had not been reported for Sri Lanka; the results include many new taxon-specific lure records. In this paper, all lure response data recorded and the distribution of lure responsiveness among all known members of Dacini fruit flies in Sri Lanka are given.

Materials and Methods

Fruit flies of the tribe Dacini were collected in Steiner-type traps baited with cue lure (4-[4-(acetyloxy)phenyl]-2-butanone; CL) or methyl eugenol (1,2-dimethoxy-4-(2-propenyl) benzene; ME). About 40 permanent as well as numerous temporary trapping sites covering almost all agro-ecological regions were selected. In addition to the lure trapping surveys, collection of infested fruits and vegetables were also made to obtain records of those species that did not respond to the lures. The tribal, generic, and subgeneric classifications, including subgeneric groups, followed that of Drew (1989).

Results

A total of 24 species were recorded in the lure trapping survey, and of these, 17 responded to CL and 7 to ME. In addition, 6 species were recorded in the fruit collection survey, but not the trapping survey. All are listed in Table 1. The distribution of lure responsiveness among all known fruit flies in Sri Lanka was arranged in accordance with an existing classification as listed in table 2.

Discussion

Lure responsiveness is a relatively stable taxonomic character. Furthermore, it is interesting to examine how responsiveness to a single kind of lure in principle or non-responsiveness is determined through phylogenetic diversification.

Table 1. Fruit flies recorded by trapping or during fruit collection surveys in Sri Lanka

Lure		
Methyl eugenol		
<i>Bactrocera</i>	(<i>B.</i>)	) <i>apicofuscans</i> White et Tsuruta
<i>B.</i>	(<i>B.</i>)	) <i>correcta</i> (Bezzi)
<i>B.</i>	(<i>B.</i>)	) <i>dorsalis</i> (Hendel)
<i>B.</i>	(<i>B.</i>)	) <i>kandiensis</i> Drew et Hancock
<i>B.</i>	(<i>B.</i>)	) <i>paraverbascifoliae</i> Drew
<i>B.</i>	(<i>B.</i>)	) <i>versicolor</i> (Bezzi)
<i>B.</i>	(<i>B.</i>)	) <i>zonata</i> (Saunders)

Cue lure		
<i>B.</i>	(<i>Afrodacus</i>)	) <i>fastigata</i> Tsuruta et White
<i>B.</i>	(<i>B.</i>)	) <i>brunneola</i> White et Tsuruta
<i>B.</i>	(<i>B.</i>)	) <i>ceylanica</i> Tsuruta et White
<i>B.</i>	(<i>B.</i>)	) <i>fernandoi</i> Tsuruta et White
<i>B.</i>	(<i>B.</i>)	) <i>hantanae</i> Tsuruta et White
<i>B.</i>	(<i>B.</i>)	) <i>nigrofemorialis</i> White et Tsuruta
<i>B.</i>	(<i>B.</i>)	) <i>perigrapha</i> White et Tsuruta
<i>B.</i>	(<i>B.</i>)	) <i>profunda</i> Tsuruta et White
<i>B.</i>	(<i>B.</i>)	) <i>selenophora</i> Tsuruta et White
<i>B.</i>	(<i>Javadacus</i>)	) <i>trilineata</i> (Hardy)
<i>B.</i>	(<i>Zeugodacus</i>)	) <i>caudata</i> (Fabricius)
<i>B.</i>	(<i>Z.</i>)	) <i>cucurbitae</i> (Coquillett)
<i>B.</i>	(<i>Z.</i>)	) <i>duplicata</i> (Bezzi)
<i>B.</i>	(<i>Z.</i>)	) <i>gavisia</i> (Munro)
<i>B.</i>	(<i>Z.</i>)	) <i>zahadi</i> Mahmood
<i>Dacus</i>	(<i>Callantra</i>)	) <i>discophorus</i> (Hering)
<i>D.</i>	(<i>C.</i>)	) <i>ramanii</i> Drew et Hancock

Non-responding or no known lure		
<i>B.</i>	(<i>B.</i>)	) <i>latifrons</i> (Hendel)*
<i>B.</i>	(<i>B.</i>)	) <i>syzygii</i> White et Tsuruta
<i>B.</i>	(<i>Hemigymnodacus</i>)	) <i>diversa</i> (Coquillett)
<i>B.</i>	(<i>Paratridacus</i>)	) <i>garciniae</i> (Bezzi)
<i>D.</i>	(<i>Didacus</i>)	) <i>ciliatus</i> (Hering)
<i>D.</i>	(<i>Di.</i>)	) <i>keiseri</i> (Hering)

* : A synthetic lure is known for this species, but was not used in our survey.

Some taxonomic groups, defined by morphological characters, have positive associations with specific kinds of lures; for example, species of the subgeneric group *Zeugodacus* generally respond to CL, except for the non-responding species, *B. (Hemigymnodacus) diversa* and *B. (Paratridacus) garciniae*. Among species of *Dacus*, responsiveness differs in each species of the same subgenus; in the subgenus *Callantra*, for example, *D. (C.) ramanii* positively responds to CL, while *D. (C.) discophorus* rarely does so. Among members of *Bactrocera* subgeneric groups, there are species that respond to CL and ME, and those that don't respond to either. The responsiveness of each species is clearly different even among morphologically very similar species such as members of the *B. dorsalis* species complex; for example, *B. dorsalis*, *B. kandiensis* and *B. paraverbascifoliae* respond to ME, while *B. fernandoi*, *B. profunda*, *B. hantanae*, and *B. fastigata* respond to CL. In addition, in the *B.*

zonata species group, which represents three species, all members respond to ME. These results are completely consistent with the summary of general tendency of responsiveness among Dacini given by Drew & Hancock (2000).

In addition to these lure responding species there are several species that were recorded only in the fruit collection survey. *Bactrocera*. (*B.*) *latifrons*, *B.* (*B.*) *syzygii*, *B.* (*Paratridacus*) *garcinia*, *B.* (*Hemigymnodacus*) *diversa*, *D.* (*Didacus*) *ciliatus* and *D.* (*Di.*) *keiseri* were recorded in the fruit collection survey, but not the trapping survey (Tsuruta *et al.*, 1997; Tsuruta & White, 2001), and *D.* (*Leptoxyda*) *persicus*, which occurs in Sri Lanka was recorded neither in the lure tapping nor the fruit collection surveys. Most individuals of *D.* (*C.*) *discophorus* were obtained in the fruit collection survey, but only a single individual was captured in the trap baited with CL, thus the responsiveness of this species seems to be very weak at best.

Distribution of lure responsiveness

Of the Sri Lankan dacine fruit flies, those that responded to ME were found only in the subgenus *Bactrocera*, while those that responded to CL were recorded across many different taxonomic groups, such as the *Bactrocera* subgeneric groups including subgenera, *Afrodacus* and *Bactrocera*, and the *Zeugodacus* subgeneric groups including subgenera, *Zeugodacus*, *Javadacus*, and *Parazeugodacus*, and the species of different genus and subgenus such as *Dacus* (*Callantra*). These facts generally support the view that "Cuelure may represent the 'primitive' lure for both *Dacus* and *Bactrocera*" (Drew & Hancock, 2000).

The ratio of species that respond to ME and those that respond to CL among all known species of Dacini worldwide is about 3: 1 (White, 2000), while the ratio obtained in Sri Lanka (2.4: 1) is a little smaller. However, this ratio is regarded as reasonable because the trapping surveys did not adequately cover natural vegetation areas where species that respond to CL are generally abundant.

Taxonomic notes

Although the subgenus *Hemigymnodacus* was considered a synonym of *Paratridacus* in a recent catalogue (Norrbon, A.L. *et al.*, 1998), it has been used to classify *B. diversa* following Delfinado & Hardy (1977). According to White (2000), this species responds to ME, but it has yet to be recorded in our lure trapping surveys, although it has been collected from flowers of cultivated cucurbits. Furthermore, *B. bipustulata* is placed in the subgenus *Zeugodacus* according to the recent catalogue (Norrbon *et al.*, 1998), but we placed this species in the subgenus *Parazeugodacus* following Delfinado & Hardy (1977).

It is hoped that more surveys in various other geographical regions will be conducted using male lures, thus adding to the taxon-specific lure records and enabling further analysis of the phylogenetic relationships of lure responsiveness among species of Dacini. This will also be

Table 2. Distribution of lure responsiveness in dacine fruit flies of Sri Lanka

Species	Lure
Genus <i>Bactrocera</i> Macquart	
<i>Bactrocera</i> group of subgenera	
Subgenus <i>Afrodacus</i> Bezzi	
<i>Bactrocera (Afrodacus) fastigata</i> Tsuruta et White	CL
Subgenus <i>Bactrocera</i> Macquart	
Species placed in complex	
<i>B. dorsalis</i> species complex	
<i>B. caryeae</i> (Kapoor)	ME*
<i>B. ceylanica</i> Tsuruta et White	CL
<i>B. dorsalis</i> (Hendel)	ME
<i>B. fernandoi</i> Tsuruta et White	CL
<i>B. hantanae</i> Tsuruta et White	CL
<i>B. kandiensis</i> Drew et Hancock	M
<i>B. paraverbascifoliae</i> Drew	M
<i>B. profunda</i> Tsuruta et White	CL
<i>B. syzygii</i> White et Tsuruta	N
<i>B. zonata</i> species group	
<i>B. correta</i> (Bezzi)	ME
<i>B. versicolor</i> (Bezzi)	ME
<i>B. zonata</i> (Saunders)	ME
Species not placed in complex	
<i>B. apicofuscans</i> White et Tsuruta	ME
<i>B. latifrons</i> (Hendel)	N
<i>B. nigrofemorialis</i> White et Tsuruta	CL
<i>B. perigrapha</i> White et Tsuruta	CL
<i>Zeugodacus</i> group of subgenera	
Subgenus <i>Hemigymnodacus</i> Hardy	
<i>B. diversa</i> (Coquillett)	N
Subgenus <i>Javadacus</i> Hardy	
<i>B. trilineata</i> (Hardy)	CL
Subgenus <i>Paratridacus</i> Shiraki	
<i>B. garciniae</i> (Bezzi)	N
Subgenus <i>Parazeugodacus</i> Shiraki	
<i>B. bipustulata</i> (Bezzi)	CL*
Subgenus <i>Zeugodacus</i> Hendel	
<i>B. caudata</i> (Fabricius)	CL
<i>B. cucurbitae</i> (Coquillett)	CL
<i>B. duplicata</i> (Bezzi)	CL
<i>B. gavis</i> (Munro)	CL
<i>B. zahadi</i> Mahmood	CL
Genus <i>Dacus</i> Fabricius	
Subgenus <i>Callantra</i> Walker	
<i>D. discophorus</i> (Hering)	CL
<i>D. ramanii</i> (Drew et Hancock)	CL
Subgenus <i>Didacus</i> Collart	
<i>D. ciliatus</i> (Hering)	N
<i>D. keiseri</i> (Hering)	N
Subgenus <i>Leptoxyda</i> Hendel	
<i>D. persicus</i> (Hendel)	N*

* : Entry of these species on this list and their lure data are based on specimens preserved in NHM, London.

CL: Cue lure ME: Methyl eugenol N: Non-responding or No known lure

helpful for more practical purposes such as identification of fruit flies associated with plant quarantine fields.

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