

THE FRUIT FLY FAUNA (DIPTERA: TEPHRITIDAE: DACINAE) OF THE RAINFOREST HABITAT OF THE WESTERN GHATS, INDIA

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ABSTRACT. – Twenty-one species are recorded from the New Amarambalam Forest in the Western Ghats of India, eight of which are new species. Two new species based on earlier surveys in southern India are also included. The new species are: *Bactrocera* (*Bactrocera*) *apiconigroscutella*, *B. (B.) amarambalensis*, *B. (B.) neoarecae*, *B. (B.) neonigrotibialis*, *B. (B.) paraosbeckiae*, *B. (B.) paraverbascifoliae*, *B. (B.) penecorrecta*, *B. (B.) pseudoversicolor*, *B. (Daculus)* *yercaudiae*, *B. (Sinodacus)* *binoyi*. Information is given on location of type specimens, host plants, attractant records and geographic distributions for the species that are described in detail. A full list and key to the species of the genus *Bactrocera* Macquart recorded from the Indian subcontinent are presented.

KEY WORDS. – Tephritidae, Dacinae, *Bactrocera*, Western Ghats, Oriental, rainforest.

INTRODUCTION

The dacine fruit flies of the Indian subcontinent have received considerable attention in studies by Bezzi (1913, 1915, 1916), Hardy (1971), Hering (1938, 1941, 1956), Kapoor (1971, 1993), Kapoor et al. (1980), Munro (1935, 1938, 1939), Perkins (1938) and Senior-White (1921, 1922, 1924). More recently Drew & Hancock (1994a) revised the *Bactrocera dorsalis* complex, including several Indian species, while Ranganath & Veenakumari (1995) recorded 11 species of *Bactrocera* Macquart in the Andaman Islands, some of which have Indian origins while others occur in South East Asia. Tsuruta et al. (1997) published a list of host plants of Dacinae in Sri Lanka while Tsuruta et al. (1998) provided a pictorial key to Sri Lankan pest species. In Cabikay, White & Hancock (1997) listed 43 species of Dacinae, including species of the genus *Dacus* Fabricius and a single species of *Ichneumonopsis* Hardy, from the Indian subcontinent. White & Evenhuis (1999) added two more *Bactrocera* species of the subgenus *Zeugodacus* while a recent study by Tsuruta & White (2001) on the Sri Lankan dacine fauna records 28 species, some of which also occur in India.

This paper is based on a survey carried out in the New Amarambalam Reserve Forest, a part of the Nilgiri Biosphere Reserve (Western Ghats, India) for three months in early 1999. The New Amarambalam Forest is an area of undisturbed lowland rainforest and forms a part of the core areas of the Nilgiri Biosphere Reserve. It covers approximately 265 square kilometres and is situated 11° 14' to 11° 24'N latitude and 76° 19' to 76° 33'E longitude and

is north-west of Silent Valley National Park. Approximately 250 square kilometres are unexploited evergreen and semi-evergreen forests (Ramachandran et al., 1998). This region represents the major endemic rainforest habitat of Dacinae in India (Drew & Hancock, 1999). Consequently, an accurate knowledge of the species in this zone will be significant to our current understanding of regional dacine biogeography.

Species of the genera *Ichneumonopsis* and *Dacus* from Asia have already been reviewed in detail by Drew & Hancock (1994b) and Drew et al. (1998), respectively. We therefore focus on the remaining Dacinae of India, all of which belong to the genus *Bactrocera* Macquart. Only species of this genus were trapped in our survey of the rainforest. In addition we also describe a few species collected from earlier surveys in southern India, given their biogeographical affinities to the region surveyed recently. The new species were described and named by R.A.I. Drew. We provide a comprehensive list of, and key to all known species in the genus *Bactrocera* from the Indian subcontinent (comprising India, Pakistan, Bangladesh, Bhutan and Sri Lanka). We have not included *Bactrocera* (*Zeugodacus*) *yoshimotoi* (Hardy), which was suggested as possibly present in Bhutan by White & Evenhuis (1999), because of the uncertainty of the identity of the specimens which they studied.

We revise some known species, where descriptions were incomplete and not accompanied by helpful illustrations. While photographs and computer generated descriptions, illustrations and keys may be useful tools in taxonomic research, we urge taxonomists to provide comprehensive

descriptions accompanied by clear scientific illustrations to enable accurate definitions of species and their placement within the Dacinae.

TERMINOLOGY AND ABBREVIATIONS

Morphological terminology follows McAlpine (1981) and as explained in Drew & Hancock (1994a). Setae are abbreviated as follows: *a. sa.*, anterior supra-alar; *ia.*, intra-alar; *mpl.*, mesopleural; *npl.*, notopleural; *prsc.*, prescutellar; *p.sa.*, posterior supra-alar; *sc.*, scutellar; *scp.*, scapular. The following abbreviations have been used for specimen depositories:

ANIC	Australian National Insect Collection, CSIRO, Canberra
BMNH	The Natural History Museum, London
BPBM	Bernice P. Bishop Museum, Honolulu, Hawaii, USA
HORDI	Horticulture Research and Development Institute, Gannoruwa, Sri Lanka
KFRI	Kerala Forest Research Institute, Peechi, Kerala
MHNG	Muséum d'Histoire naturelle, Genève
NMNH	National Museum of Natural History, Smithsonian Institution, Washington D.C., USA
NPC	National Pusa Collection, Indian Agricultural Research Institute, New Delhi
QDPI	Queensland Department of Primary Industries, Brisbane
ZRC	Zoological Reference Collection of the Raffles Museum of Biodiversity Research, National University of Singapore
ZSI	Zoological Survey of India, Kolkata

SYSTEMATICS

TAXONOMIC ARRANGEMENT

GENUS *BACTROCERA*

(* indicates presence in southern India)

Bactrocera (*Afrodacus*) *fastigata* Tsuruta & White *
Bactrocera (*Asiadacus*) *brachycera* (Bezzi)
Bactrocera (*Bactrocera*) *affinis* (Hardy) *
Bactrocera (*Bactrocera*) *amarambalensis*, new species *
Bactrocera (*Bactrocera*) *apicofuscans* White & Tsuruta *
Bactrocera (*Bactrocera*) *apiconigroscutella*, new species *
Bactrocera (*Bactrocera*) *brunneola* White & Tsuruta
Bactrocera (*Bactrocera*) *caryeae* (Kapoor) *
Bactrocera (*Bactrocera*) *ceylanica* Tsuruta & White
Bactrocera (*Bactrocera*) *correcta* (Bezzi) *
Bactrocera (*Bactrocera*) *dorsalis* (Hendel) *
Bactrocera (*Bactrocera*) *fernandoi* Tsuruta & White
Bactrocera (*Bactrocera*) *hantanae* Tsuruta & White
Bactrocera (*Bactrocera*) *kandiensis* Drew & Hancock
Bactrocera (*Bactrocera*) *latifrons* (Hendel) *
Bactrocera (*Bactrocera*) *merapiensis* Drew & Hancock *
Bactrocera (*Bactrocera*) *neoarecae*, new species *
Bactrocera (*Bactrocera*) *neonigrotibialis*, new species *

Bactrocera (*Bactrocera*) *nigrofemoralis* White & Tsuruta *
Bactrocera (*Bactrocera*) *paraosbeckiae*, new species *
Bactrocera (*Bactrocera*) *paraverbascifoliae*, new species *
Bactrocera (*Bactrocera*) *penecorrecta*, new species *
Bactrocera (*Bactrocera*) *perigrapha* White & Tsuruta
Bactrocera (*Bactrocera*) *profunda* Tsuruta & White
Bactrocera (*Bactrocera*) *pseudoversicolor*, new species *
Bactrocera (*Bactrocera*) *selenophora* Tsuruta & White
Bactrocera (*Bactrocera*) *syzygii* White & Tsuruta
Bactrocera (*Bactrocera*) *verbascifoliae* Drew & Hancock *
Bactrocera (*Bactrocera*) *versicolor* (Bezzi) *
Bactrocera (*Bactrocera*) *vishnu* Drew & Hancock *
Bactrocera (*Bactrocera*) *zonata* (Saunders) *
Bactrocera (*Daculus*) *oleae* (Gmelin)
Bactrocera (*Daculus*) *yercaudiae*, new species *
Bactrocera (*Hemigymnodacus*) *diversa* (Coquillett) *
Bactrocera (*Javadacus*) *pallescentis* (Hardy)
Bactrocera (*Javadacus*) *scutellaria* (Bezzi) *
Bactrocera (*Javadacus*) *trilineata* (Hardy) *
Bactrocera (*Paratridacus*) *garciniae* (Bezzi) *
Bactrocera (*Parazeugodacus*) *bipustulata* (Bezzi) *
Bactrocera (*Sinodacus*) *binoyi*, new species *
Bactrocera (*Sinodacus*) *watersi* (Hardy) *
Bactrocera (*Tetradacus*) *minax* (Enderlein)
Bactrocera (*Zeugodacus*) *assamensis* White
Bactrocera (*Zeugodacus*) *biguttata* (Bezzi)
Bactrocera (*Zeugodacus*) *caudata* (Fabricius) *
Bactrocera (*Zeugodacus*) *cucurbitae* (Coquillett) *
Bactrocera (*Zeugodacus*) *duplicata* (Bezzi) *
Bactrocera (*Zeugodacus*) *freidbergi* White
Bactrocera (*Zeugodacus*) *gavisa* (Munro) *
Bactrocera (*Zeugodacus*) *scutellaris* (Bezzi) *
Bactrocera (*Zeugodacus*) *sicieni* (Chao & Lin)
Bactrocera (*Zeugodacus*) *signata* (Hering)
Bactrocera (*Zeugodacus*) *tau* (Walker) *
Bactrocera (*Zeugodacus*) *zahadi* Mahmood *

Key to known species of *Bactrocera* of the Indian subcontinent

1. Wings with infuscation on crossveins in addition to costal band and cubital streak.....*B. (Zeugodacus) cucurbitae* (Coquillett)
- Wings colourless, at most with costal band and cubital streak.....2
- 2(1). Costal band either absent or discontinuous with a break distal to apex of R_{2+3} or with an extremely narrow section distal to apex of R_{2+3} before expanding into a spot in wing apex.....3
- Costal band complete and distinct for entire length.....12
- 3(2). Costal band entirely absent, at most, wing with a small fuscous spot around apex of R_{4+5}4
- Costal band present but either discontinuous or with an extremely narrow section distal to apex of R_{2+3} before expanding into a spot in wing apex5
- 4(3). Costal band entirely absent; short, narrow lateral postsutural vittae present; fore and mid femora entirely black; 4 scutellar setae present.....*B. (Parazeugodacus) bipustulata* (Bezzi)

- Costal band absent but with a small fuscous spot around apex of R_{4+5} ; lateral and medial postsutural vittae absent; all femora fulvous; 2 scutellar setae present.....*B. (Daculus) oleae* (Gmelin)
- 5(3). Scutum red-brown.....6
- Scutum black.....7
- 6(5). Prescutellar setae absent; mesopleural stripe equal in width to notopleuron.....*B. (Bactrocera) affinis* (Hardy)
- Prescutellar setae present; mesopleural stripe extending to anterior notopleural seta dorsally.....*B. (Bactrocera) zonata* (Saunders)
- 7(5). Medial postsutural vitta present; lateral postsutural vittae narrow and ending before *ia*. setae; femora with dark fuscous to black markings apically.....8
- Medial postsutural vitta absent; lateral postsutural vittae broad and ending at *ia*. setae; femora entirely fulvous.....11
- 8(7). Scutellum yellow with or without an apical black spot; a small yellow spot anterior to mesonotal suture as an extension of each lateral postsutural vitta9
- Scutellum black with yellow around each basal seta; lateral postsutural vittae not extended into a spot anterior to the mesonotal suture10
- 9(8). A broad cubital streak present.....*B. (Zeugodacus) scutellaris* (Bezzi)
- A narrow cubital streak present.....*B. (Zeugodacus) freidbergi* White
- 10(8). Cubital streak present....*B. (Zeugodacus) assamensis* White
- Cubital streak absent.....*B. (Zeugodacus) biguttata* (Bezzi)
- 11(7). Abdominal terga III-V orange-brown with a black "T" pattern and narrow dark lateral margins on terga IV and V; scutellum with a narrow black basal band*B. (Bactrocera) correcta* (Bezzi)
- Abdominal terga III-V mostly black with small dark red-brown spots posterocentrally each side of a medial longitudinal black band; scutellum with a broad black basal band.....*B. (Bactrocera) penecorrecta*, new species
- 12(2). Costal band of uniform width and overlapping R_{4+5} for entire length; abdomen elongate and petiolate*B. (Tetradacus) minax* (Enderlein)
- Costal band not overlapping R_{4+5} or, if so, then possessing a large fuscous spot in wing apex13
- 13(12). Costal band with a distinct large spot in wing apex14
- Costal band of a uniform width throughout or with only a slight expansion in wing apex19
- 14(13). Costal band overlapping R_{4+5} ; medial postsutural vitta absent *B. (Paratridacus) garciniae* (Bezzi)
- Costal band not overlapping R_{4+5} ; medial postsutural vitta present.....15
- 15(14). Two scutellar setae present; *a.sa.* setae absent*B. (Asiadacus) brachycera* (Bezzi)
- Four scutellar setae present; *a.sa.* setae present.....16
- 16(15). Prescutellar setae absent; scutum entirely red-brown; costal band confluent with R_{4+5}*B. (Sinodacus) watersi* (Hardy)
- Prescutellar setae present; scutum either red-brown with distinct black markings or black with some red-brown patterns; costal band confluent with or just overlapping R_{2+3}17
- 17(16). Scutellum yellow with a dark fuscous to black spot on apex*B. (Zeugodacus) signata* (Hering)
- Scutellum entirely yellow.....18
- 18(17). Scutum red-brown with distinct black markings lateral to medial postsutural vitta; costal band just overlapping R_{2+3}*B. (Zeugodacus) tau* (Walker)
- Scutum black with red-brown anterocentrally; costal band confluent with R_{2+3}*B. (Zeugodacus) zahadi* Mahmood
- 19(13). Lateral and medial postsutural vittae absent*B. (Sinodacus) binoyi*, new species
- Lateral postsutural vittae present; medial postsutural vittae present or absent.....20
- 20(19). Anterior supra-alar setae absent.....21
- Anterior supra-alar setae present.....25
- 21(20). Scutum red-brown.....22
- Scutum black.....23
- 22(21). Prescutellar setae absent*B. (Daculus) yercaudiae*, new species
- Prescutellar setae present.....*B. (Javadacus) pallescentis* (Hardy)
- 23(21). Medial postsutural vitta absent.....*B. (Afrodacus) fastigata* Tsuruta & White
- Medial postsutural vitta present.....24
- 24(23). Notopleura yellow; face entirely fulvous; scutellum entirely yellow.....*B. (Javadacus) trilineata* (Hardy)
- Notopleura black; face fulvous with distinct black spots; scutellum yellow with black spots on apex*B. (Javadacus) scutellaria* (Bezzi)
- 25(20). Medial postsutural vitta absent26
- Medial postsutural vitta present.....27
- 26(25). Four *sc.* setae present.....*B. (Zeugodacus) duplicata* (Bezzi)
- Two *sc.* setae present.....31
- 27(25). Four *sc.* setae present.....28
- Two *sc.* setae present.....30
- 28(27). Mesopleural stripe ending midway between anterior margin of notopleuron and anterior notopleuron and anterior *npl.* seta dorsally.....*B. (Hemigymnodacus) diversa* (Coquillett)
- Mesopleural stripe reaching to anterior *npl.* seta or to postpronotal lobe dorsally.....29
- 29(28). Face fulvous with a pair of large oval black spots; mesopleural stripe an inverted "L" shape and extending to postpronotal lobe; lateral postsutural vittae widening posterior to *ia.* setae to almost contact the scutellum; frons entirely fulvous.....*B. (Zeugodacus) gavisia* (Munro)
- Face fulvous with a black transverse line across oral margin; mesopleural stripe reaching to anterior *npl.* seta dorsally; lateral postsutural vittae parallel sided ending at *ia.* setae; femora fulvous with apical fuscous patterns*B. (Zeugodacus) caudata* (Fabricius)
- 30(27). Lateral postsutural vittae parallel sided and reaching *ia.* setae; all femora fulvous with preapical dark markings*B. (Hemigymnodacus) diversa* (Coquillett) (some specimens)
- Lateral postsutural vittae tapering posteriorly to end before *ia.* setae; femora mostly black.....*B. (Zeugodacus) sicieni* (Chao & Lin)
- 31(26). Scutum base colour red-brown.....32
- Scutum base colour black.....36
- 32(31). Prescutellar setae absent*B. (Bactrocera) apicofuscans* White & Tsuruta
- Prescutellar setae present.....33
- 33(32). Scutellum yellow with a dark fuscous apical spot*B. (Bactrocera) versicolor* (Bezzi)
- Scutellum entirely yellow.....34

- 34(33). Lateral postsutural vittae narrow to medium width and ending just behind *ia*. setae.....
*B. (Bactrocera) pseudoversicolor*, new species
- Lateral postsutural vittae narrowing posteriorly to end before *ia*. setae.....35
- 35(34). Scutum red-brown without dark markings; abdominal terga III-V with narrow lateral dark markings.....
*B. (Bactrocera) brunneola* White & Tsuruta
- Scutum dark red-brown with extensive fuscous patterns; abdominal terga III-V with broad lateral longitudinal dark bands.....*B. (Bactrocera) paraosbeckiae*, new species
- 36(31). Costal band overlapping R_{2+3} (sometimes pale over R_{2+3}).....37
- Costal band confluent with R_{2+3}40
- 37(36). All femora entirely fulvous.....
*B. (Bactrocera) verbascifoliae* Drew & Hancock
- Fore femora with a preapical black spot.....38
- 38(37). Postpronotal lobes with anteromedial corners dark red-brown.....*B. (Bactrocera) amarambalensis*, new species
- Postpronotal lobes entirely yellow.....39
- 39(38). Abdominal tergum IV with dark lateral markings.....
*B. (Bactrocera) vishnu* Drew & Hancock
- Abdominal tergum IV without dark lateral markings.....
*B. (Bactrocera) profunda* Tsuruta & White
- 40(36). All femora entirely fulvous.....41
- Dark fuscous to black markings on, at least, fore and hind femora.....46
- 41(40). Lateral postsutural vittae broad, parallel sided and extending to *ia*. setae.....42
- Lateral postsutural vittae of medium width and ending before *ia*. setae.....43
- 42(41). Cubital streak present and distinct.....
*B. (Bactrocera) dorsalis* (Hendel)
- Cubital streak very weak or absent.....
*B. (Bactrocera) hantanae* Tsuruta & White
- 43(41). Mesopleural stripe broad, extending almost to postpronotal lobe dorsally.....*B. (Bactrocera) latifrons* (Hendel) (some specimens)
- Mesopleural stripe narrower, not extending anterior of anterior *npl.* seta.....44
- 44(43). Stout ventral spines on fore femora.....
*B. (Bactrocera) syzygii* White & Tsuruta
- No ventral spines on fore femora.....45
- 45(44). Lateral postsutural vittae tapering posteriorly; mesopleural stripe just wider than notopleuron dorsally; abdominal tergum III entirely dark fuscous to black.....
*B. (Bactrocera) merapiensis* Drew & Hancock
- Lateral postsutural vittae parallel sided; mesopleural stripe extending midway between anterior margin of notopleuron and anterior *npl.* seta dorsally; abdominal tergum III with posterocentral orange-brown areas either side of medial longitudinal black band.....
*B. (Bactrocera) paraverbascifoliae*, new species
- 46(40). Dark fuscous to black preapical spots on outer surfaces of fore and hind femora.....
*B. (Bactrocera) neoarecae*, new species
- Dark fuscous to black markings on all femora.....47
- 47(46). Mesopleural stripe broad, extending almost to postpronotal lobe dorsally.....*B. (Bactrocera) latifrons* (Hendel) (some specimens)
- Mesopleural stripe narrower, not extending to, or nearly to postpronotal lobe.....48
- 48(47). Lateral postsutural vittae narrow to medium width, parallel sided and ending posteriorly at *ia*. setae.....49
- Lateral postsutural vittae narrow to medium width, tapering posteriorly to end before *ia*. setae.....51
- 49(48). Postpronotal lobes with anteromedial corners red-brown.....
*B. (Bactrocera) kandiensis* Drew & Hancock
- Postpronotal lobes entirely yellow.....50
- 50(49). Scutum entirely black.....
*B. (Bactrocera) fernandoi* Tsuruta & White
- Scutum black with two red-brown stripes anteromedially.....
*B. (Bactrocera) ceylanica* Tsuruta & White
- 51(48). Face entirely black.....
*B. (Bactrocera) nigrofemoralis* White & Tsuruta
- Face fulvous or fuscous with black spots.....52
- 52(51). Scutellum with a black basal triangle.....
*B. (Bactrocera) perigrapha* White & Tsuruta
- Scutellum with a black basal band, narrow to broad in width.....53
- 53(52). Lateral postsutural vittae elongate, tapering posteriorly to end before *ia*. setae; fore and mid femora with preapical dark spots; hind femora with either preapical dark spots or black around apex.....54
- Lateral postsutural vittae narrow and short, ending posteriorly at level of *a.sa.* setae; all femora with extensive black markings.....55
- 54(53). Hind femora each with a preapical dark spot; abdominal terga III-V with broad lateral longitudinal dark bands.....
*B. (Bactrocera) caryae* (Kapoor)
- Hind femora with black around apices; abdominal terga III-V orange-brown with a black “T” pattern and without broad lateral dark margins.....
*B. (Bactrocera) selenophora* Tsuruta & White
- 55(53). Scutellum entirely yellow with a narrow black basal band; mid femora with approximately basal $1/2$ fulvous.....
*B. (Bactrocera) neonigrotibialis*, new species
- Scutellum yellow with a black spot on apex and a broad black basal band; mid femora almost entirely black.....
*B. (Bactrocera) apiconigroscutella*, new species

***Bactrocera (Afrodacus) fastigata* Tsuruta & White**
 (Fig. 1)

Bactrocera (Afrodacus) fastigata Tsuruta & White, 2001: 72-73.
 Holotype male in HORDI.

Material examined. – 1 male, INDIA: New Amarambalam Forest, Kerala, coll. S. Raghu, 15 Feb.1999 – 25 Feb.1999, attracted to cue lure, deposited in QDPI.

Description. – male.

Head – Vertical length 1.54mm. Frons, length 1.25 times breadth; orange-brown with dark fuscous around orbital setae and on anteromedial hump; latter covered by a small number of short dark hairs; orbital setae black: 1 *s.or.*, 2 *i.or.*; lunule dark fuscous. Ocellar triangle black. Vertex dark fuscous. Face fulvous with large subquadrate black spots; length 0.45mm. Genae fulvous, large dark fuscous subocular spot present; dark fuscous seta present. Occiput fuscous, yellow along eye margins; occipital row with 4 strong black setae. Antennae with segments 1 and 2 red-brown, segment 3 fuscous; a weak red-brown dorsal seta on segment 2; arista black (red-brown basally); length of segments: 0.19mm; 0.34mm; 0.65mm.

Thorax – Scutum black with brown margins lateral to postsutural vittae. Pleural areas black except red-brown below postpronotal lobes and posterior to katapisternum.

Yellow markings as follows: postpronotal lobes; notopleura; medium sized mesopleural stripe, reaching midway between anterior margin of notopleuron and anterior *npl.* seta dorsally, continuing to katepisternum below as a large transverse spot, anterior margin straight; anatergite (posterior apex black); anterior $\frac{1}{2}$ katatergite (remainder black); two very narrow, short, lateral postsutural vittae ending before level of *p.sa.* setae. Postnotum black laterally, dark brown medially. Scutellum yellow except for a narrow black basal band. Setae: *sc.* 2; *prsc.* 2; *ia.* 1; *p.sa.* 1; *a.sa.* absent; *mpl.* 1; *npl.* 2; *scp.* 4.

Legs – All segments fulvous except for elongate-oval dark fuscous to black preapical spots on each femur, fore and hind tibiae fuscous and base of mid tibiae fuscous; mid tibiae each with an apical black spur.

Wings – Length 5.62mm; cells bc and c with a pale fuscous tint; microtrichia in outer corner of cell c only; remainder of wings colourless except fuscous cell sc, narrow fuscous costal band confluent with R_{2+3} and remaining narrow as it ends between extremities of R_{4+5} and M, narrow fuscous cubital streak; dense aggregation of microtrichia around A_1+CuA_2 ; supernumerary lobe of medium development.

Abdomen – Oval; terga free; pecten present on tergum III. Tergum I and sterna I and II wider than long. Tergum I red-brown; tergum II red-brown with black anterolateral corners, narrow transverse black spots subanteriorly and posterolateral fulvous areas; terga III-V red-brown with a 'T' pattern consisting of a broad transverse dark fuscous band across anterior margin of tergum III and which widens laterally to include entire lateral margins, and a narrow medial longitudinal dull black band over all three terga. A

pair of oval red-brown shining spots on tergum V. Posterior lobe of surstylus short, sternum V with a deep concavity on posterior margin.

Attractant – Cue lure.

Female – Not known.

Distribution – Southern India, Sri Lanka.

Hosts – No known record.

Remarks. – *Bactrocera* (*Afrodacus*) *fastigata* is similar to species in the *dorsalis* – complex but fits imperfectly into the subgenus *Bactrocera* because the *a.sa.* setae are absent. It is distinguished by having a black scutum, very narrow and short lateral postsutural vittae, an elongate oval dark preapical spot on each femur, wing with a narrow costal band and abdominal terga III-V red-brown with a dark "T" shaped pattern. It is similar to *B. (Javadacus) scutellaria* (Bezzi) and *B. (Javadacus) trilineata* (Hardy) in having the *a.sa.* setae absent and scutum black, but differs from these species in having the medial postsutural vitta absent and a short surstylus lobe.

***Bactrocera* (*Bactrocera*) *amarambalensis* Drew,
new species
(Fig. 2)**

Material examined. – Holotype – male, INDIA: New Amarambalam Forest, Kerala, coll. S. Raghu, 15 Feb.1999-25 Feb.1999, attracted to methyl eugenol, deposited in BMNH.

Paratype – 1 male, same data as holotype, deposited in QDPI.

Description. – male

Head – Vertical length 1.62mm. Frons length 1.31 times breadth; red-brown with fuscous around orbital setae and on anteromedial hump; latter covered with short pale hairs; orbital setae black: 1 *s.or.*, 2 *i.or.*; lunule fuscous. Ocellar triangle black. Vertex pale fuscous. Face fulvous with moderately large oval black spots; length 0.55mm. Genae fulvous, dark fuscous subocular spot present; dark seta present. Occiput red-brown, fulvous along eye margins; occipital row with 3-6 large black setae. Antennae with segments 1 and 2 red-brown, segment 3 red-brown with pale fuscous on apex and outer surface; a red-brown dorsal seta on segment 2; arista black (red-brown basally); length of segments: 0.22mm; 0.36mm; 0.82mm.

Thorax – Scutum black with dark red-brown lateral to lateral postsutural vittae, anterior to mesonotal suture and inside postpronotal lobes. Pleural areas black except red-brown below postpronotal lobes. Yellow markings as follows: postpronotal lobes (except dark red-brown anteromedial corners); notopleura; medium sized mesopleural stripe, reaching midway between anterior margin of notopleuron and anterior *npl.* seta dorsally, continuing to katepisternum as a small transverse spot, anterior margin weakly convex;

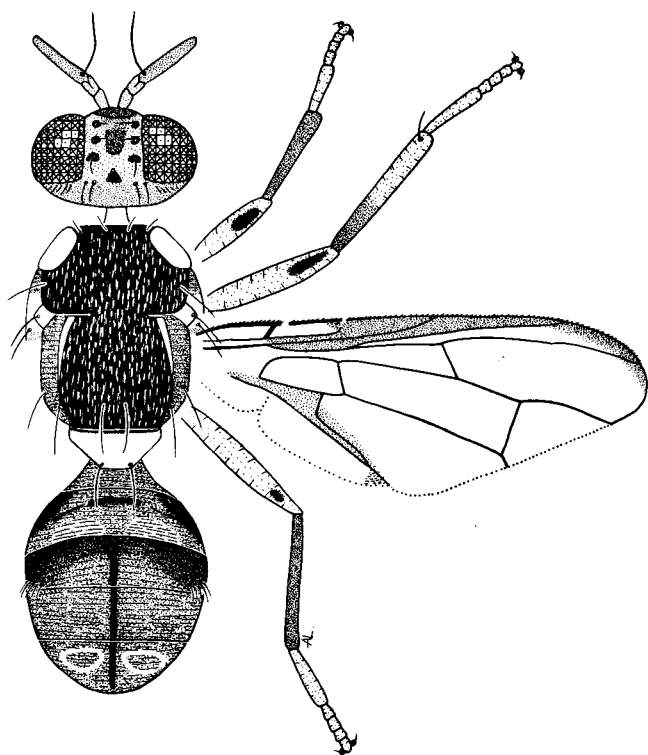


Fig. 1. *Bactrocera* (*Afrodacus*) *fastigata* Tsuruta & White, male.

anatergite (posterior apex black); anterior 5/8 katatergite (remainder black); two narrow parallel sided lateral postsutural vittae ending at *ia*. setae. Postnotum black. Scutellum yellow except for a narrow black basal band. Setae: *sc.* 2; *prsc.* 2; *ia.* 1; *p.sa.* 1; *a.sa.* 1; *mpl.* 1; *npl.* 2; *scp.* 4.

Legs – Femora fulvous except for a black subapical elongate oval spot on outer surfaces of fore femora, fore tibiae fuscous basally to pale fuscous apically, mid tibiae fulvous with pale fuscous on outer surface of basal area, hind tibiae fuscous, all tarsal segments fulvous; mid tibiae each with an apical black spur.

Wings – Length 6.31mm; cells *bc* and *c* colourless; microtrichia in outer corner of cell *c* only; remainder of wings colourless except fuscous cell *sc*, narrow fuscous costal band slightly overlapping R_{2+3} as a pale tint and with a slightly swelling around apex of R_{4+5} , a narrow pale fuscous cubital streak; a dense aggregation of microtrichia around A_1+CuA_2 ; supernumerary lobe of medium development.

Abdomen – Oval; terga free; pecten present on tergum III. Tergum I and sterna I and II wider than long. Tergum I dark fuscous to black except for a narrow red-brown transverse band posterocentrally; tergum III red-brown except for small transverse black bands anteriorly and narrow black lateral margins; terga III-V red-brown except for a 'T' pattern made up of a transverse band across anterior margin of tergum III which is dark fuscous across lateral margins and fuscous and narrower centrally and a narrow dull black medial

longitudinal band over all three terga, narrow lateral fuscous to dark fuscous margins on terga IV and V. A pair of oval fuscous shining spots on tergum V. Posterior lobe of surstylus short, sternum V with a deep concavity on posterior margin.

Attractant – Methyl eugenol.

Female – Not known.

Distribution – Southern India.

Hosts – No known record.

Remarks. – *Bactrocera* (*Bactrocera*) *amarambalensis* is similar to *B. verbascifoliae* Drew & Hancock, *B. arecae* (Hardy and Adachi) and *B. kandiensis* Drew & Hancock in the *dorsalis* – complex in possessing narrow parallel sided lateral postsutural vittae, a narrow fuscous costal band and a 'T' shaped black pattern on abdominal terga III-V. It differs from *B. verbascifoliae* and *B. kandiensis* in having a dark preapical spot on the fore femora only and from *B. arecae* in having dark red-brown anteromedial corners on the postpronotal lobes, a uniformly black scutum and narrow black lateral margins on abdominal terga III-V. It is also similar to *B. (Bactrocera) vishnu* Drew & Hancock and *B. (Bactrocera) profunda* Tsuruta & White in the costal band just overlapping R_{2+3} and possessing a preapical black spot on the fore femora, but differs from these species in having dark red-brown anteromedial corners on the postpronotal lobes. This species has not been found outside of the rainforest areas of the Western Ghats.

***Bactrocera* (*Bactrocera*) *apicofuscans* White & Tsuruta (Fig. 3)**

Bactrocera (*Bactrocera*) *apicofuscans* White & Tsuruta, 2001: 73-75. Holotype male in HORDI.

Material examined. – 1 male, INDIA: New Amarambalam Forest, Kerala, coll. S. Raghu, 15 Feb.1999-25 Feb.1999, attracted to methyl eugenol, deposited in QDPI.

Description. – male

Head – Vertical length 1.80mm. Frons length 1.17 times breadth; red-brown with fuscous around orbital setae and on anteromedial hump and fulvous along lateral margins; latter covered with a few short pale hairs; orbital setae dark fuscous: 1 *s.or.*, 2 *i.or.*; lunule red-brown. Ocellar triangle black. Vertex red-brown. Face fulvous with large elongate-oval black spots; length 0.60mm. Genae fulvous, fuscous subocular spot present; red-brown seta present. Occiput red-brown, fulvous along eye margins; occipital row with 4 strong red-brown setae. Antennae with segments 1 and 2 red-brown, segment 3 missing; length of segments: 0.29mm; 0.41mm.

Thorax – Scutum red-brown without dark markings. Pleural areas red-brown without dark markings. Yellow markings as follows: postpronotal lobes (except anteromedial corners

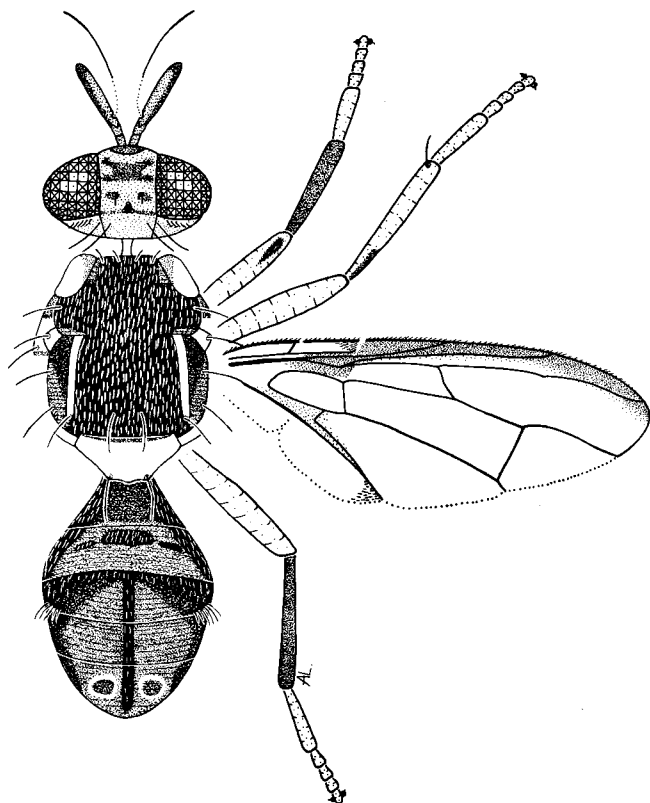


Fig. 2. *Bactrocera* (*Bactrocera*) *amarambalensis*, new species, male.

red-brown); notopleura; mesopleural stripe slightly wider than notopleuron dorsally, continuing to katapisternum below as a transverse spot, anterior margin straight; anatergite (posterior apex red-brown); anterior $1/2$ katatergite (remainder red-brown); two very narrow lateral postsutural vittae, tapering posteriorly to end well before *ia*. setae. Postnotum red-brown. Scutellum yellow except for a narrow red-brown basal band. Setae red-brown: *sc*. 2; *prsc*. absent; *ia*. 1; *p.sa*. 1; *a.sa*. 1; *mpl*. 1; *npl*. 2; *scp*. 4.

Legs – Fore femora fulvous basally and red-brown apically with a large elongate-oval dark fuscous spot on outer surfaces, mid femora with basal $1/3$ fulvous and remainder dark red-brown to fuscous, hind femora fulvous except apical $1/3$ dark red-brown to fuscous, fore and mid tibiae red-brown and hind tibiae dark red-brown, tarsi with basal segments fulvous and apical four segments red-brown; mid tibiae each with an apical red-brown spur.

Wings – Length 7.08mm; cell bc fuscous, cell c pale fuscous, microtrichia in outer corner of cell c only; remainder of wings colourless except for a dark fuscous cell sc, broad dark fuscous costal band almost confluent with R_{4+5} and slightly wider and darker at apex, a narrow dark fuscous cubital streak; a dense aggregation of microtrichia around A_1+CuA_2 ; supernumerary lobe of medium development.

Abdomen – Oval; terga free; pecten present on tergum III. Tergum I and sterna I and II wider than long. Terga I and II red-brown with a narrow medial longitudinal dark fuscous band over tergum I and anterior part of tergum II and large posterolateral very pale fulvous to white areas on tergum II; terga III-V red-brown with a narrow black 'T' pattern. A pair of oval red-brown shining spots on tergum V. Posterior

lobe of surstylus short, sternum V with a deep concavity on posterior margin.

Attractant – Methyl eugenol.

Female – Not known.

Distribution – Southern India, Sri Lanka.

Hosts – No known record.

Remarks. – *Bactrocera* (*Bactrocera*) *apicofuscans* White & Tsuruta is similar to *B. pseudoversicolor*, new species, and *B. versicolor* (Bezzi) in possessing a red-brown scutum, abdominal terga III-V red-brown with a black "T" shaped pattern and wings with a narrow fuscous costal band. It differs from these two species in having the *prsc*. setae absent, cell bc fuscous, cell c pale fuscous, postpronotal lobes with anteromedial corners red-brown, lateral postsutural vittae narrow and short and ending well before *ia*. setae. Also, the costal band is not expanded into a spot into the apex as described by Tsuruta & White (2001) but is widening slightly at the apex and slightly darker in colour at this point.

***Bactrocera* (*Bactrocera*) *apiconigroscutella* Drew,
new species
(Fig. 4)**

Material examined. – Holotype – male, INDIA: Bababudangiri, near Kemmannugundi, 1600m, coll. D. L. Hancock, 21 May. 1992, attracted to cue lure, deposited in BMNH.

Description. – male

Head – Vertical length 1.44mm. Frons length 1.35 times breadth; fulvous with dark fuscous around orbital setae and on anteromedial hump; latter with a small number of short pale hairs; orbital setae black: 1 *s.or.*; 2 *i.or.*; lunule dark fuscous. Ocellar triangle black. Vertex dark fuscous. Face fulvous with a pair of very large oval black spots; length 0.43mm. Genae fulvous, large dark fuscous to black subocular spot; red-brown seta present. Occiput black, fulvous along eye margins; occipital row with 6 black setae. Antennae with segments 1 and 2 fulvous, segment 3 fulvous with fuscous on apex and outer surface; a weak pale dorsal seta on segment 2; length of segments: 0.17mm; 0.26mm; 0.79mm.

Thorax – Scutum black without pale markings. Pleural areas black except dark fuscous below postpronotal lobes. Yellow markings as follows: postpronotal lobes (anteromedial corners black and extending into centre of lobe); notopleura (black encroaching onto anterior and posterior margins); mesopleural stripe reaching almost midway between anterior margin of notopleuron and anterior *npl*. seta dorsally, continuing to katapisternum as a transverse spot, anterior margin straight; anatergite (posterior apex black); anterior $2/3$ katatergite (remainder black); two narrow, short lateral postsutural vittae, narrowing posteriorly to end just behind

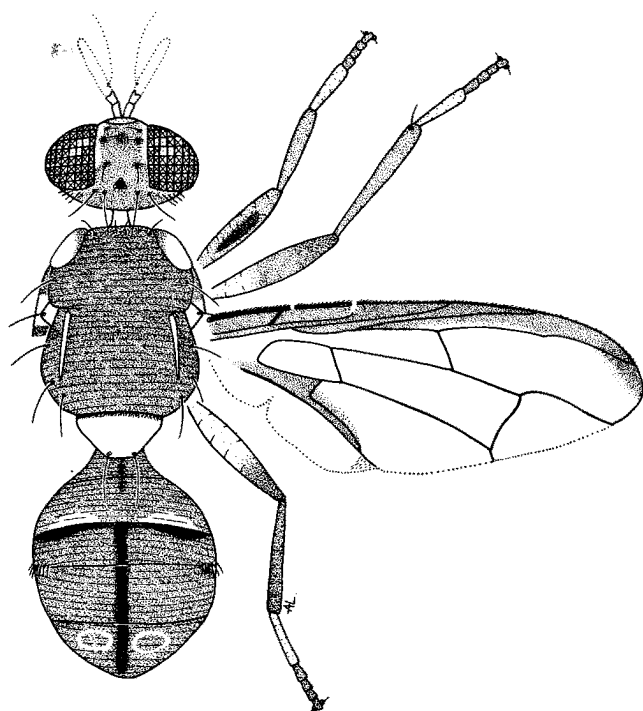


Fig. 3. *Bactrocera* (*Bactrocera*) *apicofuscans* White & Tsuruta, male.

level of *a.sa.* setae. Postnotum black. Scutellum yellow except for a broad black basal band and a black spot on apex that encloses both apical setae. Setae: *sc.* 2; *prsc.* 2; *ia.* 1; *p.sa.* 1; *a.sa.* 1; *mpl.* 1; *npl.* 2; *scp.* 4.

Legs – Fore femora black except narrow fulvous bands around base and apex and fulvous on the entire inner surface, mid femora entirely black except for narrow fulvous bands around base and apex, hind femora fulvous with black on apical $\frac{1}{2}$; fore tibiae dark fuscous, mid tibiae dark fuscous basally and fuscous apically, hind tibiae dark fuscous to black; all tarsi with basal segment fulvous and apical four segments fuscous; mid tibiae each with an apical black spur.

Wings – Length 5.14mm; cells *bc* and *c* colourless; microtrichia in outer corner of cell *c* only; remainder of wings colourless except fuscous cell *sc*, narrow fuscous costal band confluent with R_{2+3} and remaining narrow before ending just beyond apex of R_{4+5} , narrow fuscous cubital streak; dense aggregation of microtrichia around A_1+CuA_2 ; supernumerary lobe of medium development.

Abdomen – Oval; terga free; pecten present on tergum III. Tergum I and sterna I and II wider than long. Terga I and

II black except for a narrow dark red-brown transverse band along intersegmental line between the terga and a broad transverse orange-brown band across posterior margin of tergum II; terga III-V dark fuscous to black except for small areas of dark red-brown posterocentrally on terga IV and V either side of a medium width medial longitudinal, dark fuscous to black band. A pair of oval black shining spots on tergum V. Posterior lobe of surstylus short, sternum V with a deep concavity on posterior margin.

Attractant – Cue lure.

Female – Not known.

Distribution – Southern India.

Hosts – No known record.

Remarks. – *Bactrocera* (*Bactrocera*) *apiconigroscutella*, new species, belongs to the *nigrotibialis* – complex with the entire thorax mostly black, wings colourless except for a narrow costal band and cubital streak and legs with extensive areas of black. *B. apiconigroscutella* is similar to the other known species in the complex i.e. *B. lata* (Perkins), *B. neonigrotibialis*, new species, *B. nigrofemoralis* White & Tsuruta and *B. nigrotibialis* (Perkins) in the general characters of the complex. It differs from *B. nigrotibialis* and *B. nigrofemoralis* in possessing a pair of facial spots rather than the face being entirely black and from all four species in having a black spot on the apex of the scutellum. It also differs from *B. nigrofemoralis* in having a narrower mesopleural stripe that does not extend to the anterior *npl.* seta and from *B. neonigrotibialis* in having the mid femora almost entirely black, not with the basal $\frac{1}{2}$ fulvous, and in possessing a broader black basal band on the scutellum.

Bactrocera (*Bactrocera*) *caryeae* (Kapoor)

Chaetodacus ferrugineus incisus – Bezzi, 1916:105 (partim), not Walker, 1861. [Misidentification].

Dacus (*Strumeta*) *caryeae* Kapoor, 1971: 479-480. Holotype male, INDIA: Mysore, Coorg, 2 Jun. 1914 (B.F.), on *Caryea arborea* (NPC) [not available for study].

Dacus (*Bactrocera*) *caryeae* – Hardy, 1977: 49.

Bactrocera (*Bactrocera*) *caryeae* – White & Elson-Harris, 1992: 186; Drew & Hancock, 1994a:13-15.

Material examined. – 208 males, New Amarambalam Forest, Kerala, coll. S. Raghu, 15 Feb.1999 – 25 Feb.1999, attracted to methyl eugenol; 147 males, same locality, coll. C. F. Binoy, 5 Apr.1999-22 Apr.1999, attracted to methyl eugenol. Specimens deposited in KFRI, NPC, QDPI, ZRC and ZSI.

Diagnosis. – A medium sized species (wing length 6.00mm); a pair of large elongate-oval black facial spots present; postpronotal lobes yellow with fuscous anterodorsal corners; notopleura yellow; scutum dull black; mesopleural stripe of medium width; two narrow lateral postsutural vittae ending at or just before *ia.* setae; medial postsutural vitta absent; scutellum yellow with black basal band that can be narrow

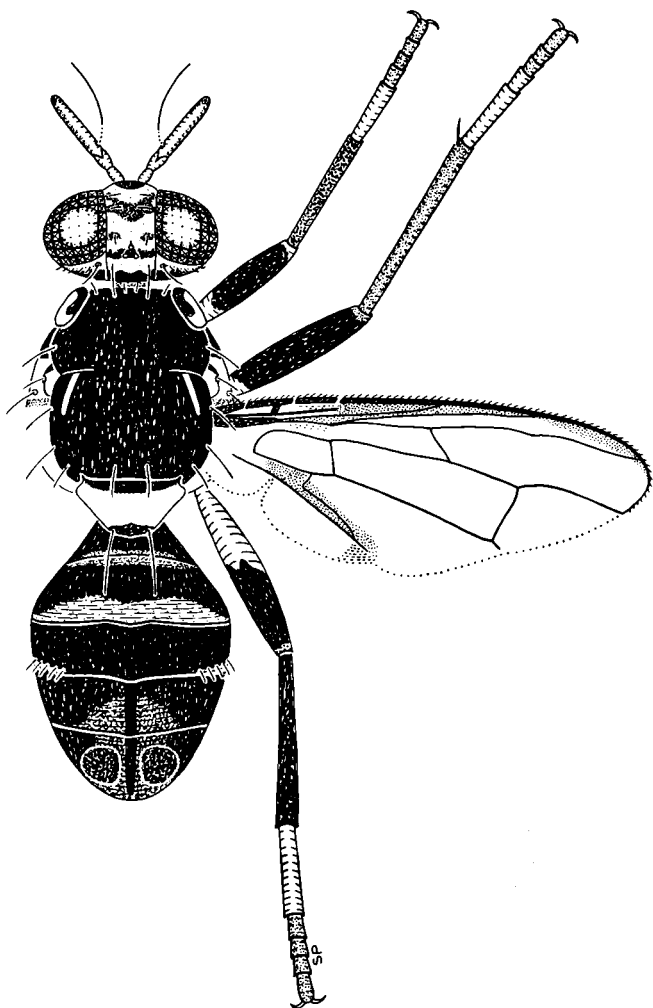


Fig. 4. *Bactrocera* (*Bactrocera*) *apiconigroscutella*, new species, male.

or broad; all femora with large elongate-oval subapical dark fuscous to black spots; wing with a narrow fuscous costal band confluent with R_{2+3} and very narrow cubital streak confined within lobe of cell cup; cells bc and c colourless; microtrichia in outer corner of cell c only; abdominal terga III-V with dark fuscous to black markings as follows – across anterior margin of tergum III, broad lateral longitudinal bands and a narrow medial longitudinal band over all three terga.

Attractant – Methyl eugenol.

Distribution – Southern India and Sri Lanka.

Hosts – A range of edible fruits including citrus, mango, guava and *Artocarpus*.

Remarks. – *Bactrocera (Bactrocera) caryeae* is a member of the *dorsalis* – complex of species, best distinguished by the elongate-oval facial spots, narrow lateral postsutural vittae, large dark fuscous to black subapical spots on all femora and broad lateral longitudinal dark fuscous to black bands on abdominal terga III-V. It has been described and illustrated in detail by Drew & Hancock (1994a). In general, it is distributed in the tropical climatic zone of southern India, in contrast to *B. dorsalis* which predominates in the northern subtropical areas.

***Bactrocera (Bactrocera) correcta* (Bezzi)**
(Fig. 5)

Chaetodacus correctus Bezzi, 1916: 107. Syntypes in ZSI.

Bactrocera (Bactrocera) correcta – Norrbom et al., 1998: 89.

See Norrbom et al., 1998: 89 for complete list of synonyms.

Material examined. – 24 males, New Amarambalam Forest, Kerala, coll. S. Raghu, 15 Feb.1999-25 Feb.1999, attracted to methyl eugenol; 35 males, same locality, coll. C. F. Binoy, 5 Mar.1999-22 Mar.1999, attracted to methyl eugenol; 55 males, same locality, coll. C. F. Binoy, 5 Apr.1999-22 Apr.1999, attracted to methyl eugenol. Specimens deposited in KFRI, NPC, QDPI, ZRC and ZSI.

Description. – male

Head – Vertical length 1.27mm. Frons, length 1.24 times breadth; fulvous with dark fuscous around orbital setae and on anteromedial hump; latter covered by a small number of short pale hairs; orbital setae black: 1 *s.or.*, 2 *i.or.*; lunule dark fuscous. Ocellar triangle black. Vertex dark fuscous. Face fulvous with transverse, elongate black spots almost meeting in centre; length 0.38mm. Genae fulvous, pale fuscous subocular spot present; fuscous seta present. Occiput dark red-brown with large dark fuscous to black areas, fulvous along eye margins; occipital row with 4-6 weak dark setae. Antennae with segments 1 and 2 red-brown, segment 3 red-brown with pale fuscous on outer surface; a weak dorsal seta on segment 2; arista black (red-brown basally); length of segments: 0.12mm; 0.24mm; 0.60mm.

Thorax – Scutum black with small areas of dark red-brown below and behind lateral postsutural vittae, around mesonotal suture and inside postpronotal lobes. Pleural areas black except red-brown below postpronotal lobes. Yellow markings as follows: Postpronotal lobes; notopleura; mesopleural stripe reaching almost to anterior *npl.* seta dorsally, continuing to katapisternum as a transverse spot, anterior margin straight; anatergite (posterior apex black); anterior $\frac{1}{2}$ katatergite (remainder black); two broad parallel sided lateral postsutural vittae ending behind *ia.* setae. Postnotum black. Scutellum yellow except for a narrow black basal band. Setae: *sc.* 2; *prsc.* 2; *ia.* 1; *p.sa.* 1; *a.sa.* 1; *mpl.* 1; *npl.* 2; *scp.* 4.

Legs – All segments fulvous except hind tibiae pale fuscous; mid tibiae each with an apical black spur.

Wings – Length 4.95mm; cells bc and c colourless; both cells entirely devoid of microtrichia; remainder of wings colourless except for a pale fuscous cell *sc*, a short narrow pale fuscous costal band confluent with R_{2+3} and ending at apex of this vein, a small oval fuscous spot around apex of R_{4+5} , cubital streak as a pale fuscous tint mostly confined within cell cup; a dense aggregation of microtrichia around A_1+CuA_2 ; supernumerary lobe of medium development.

Abdomen – Oval; terga free; pecten present on tergum III. Tergum I and sterna I and II wider than long. Tergum I black; tergum II red-brown with a narrow transverse black band that does not reach lateral margins and black anterolateral

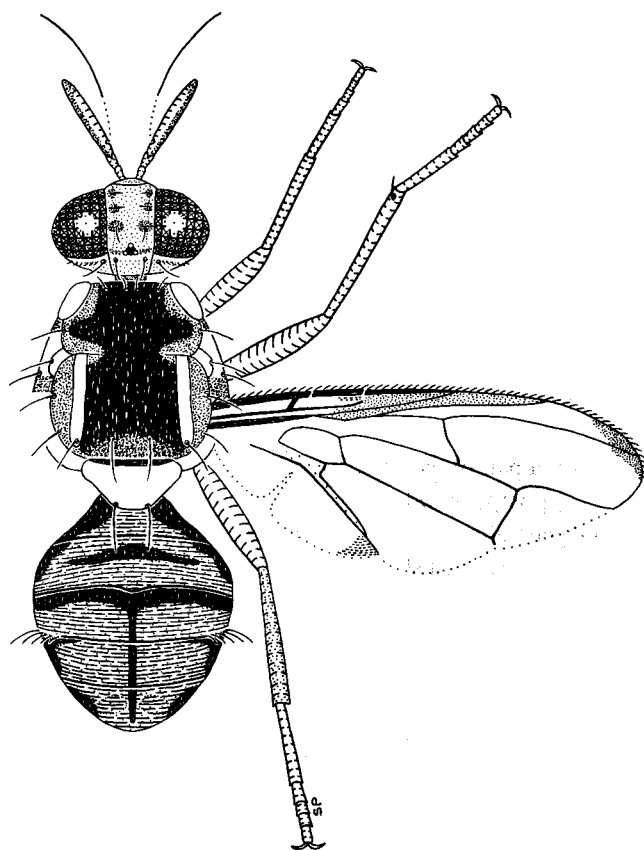


Fig. 5. *Bactrocera (Bactrocera) correcta* (Bezzi), male.

corners; terga III-V red-brown with a black 'T' pattern and black anterolateral corners on terga IV and V. A pair of oval red-brown shining spots on tergum V. Posterior lobe of surstylus short, sternum V with a deep concavity on posterior margin.

Attractant – Methyl eugenol.

Distribution – Widely distributed in South East Asia.

Hosts – Recorded from a wide range of commercial/edible host fruits (see Allwood et al., 1999 for detailed listing and Tsuruta et al., 1997 for host records in Sri Lanka).

Remarks. – *Bactrocera correcta* is a serious pest species with a broad host range. It has been recorded causing major infestations in commercial fruit crops in southern Vietnam and central to northern Thailand. It is similar to *B. dorsalis* in colour patterns of the thorax, abdomen and legs, but differs in possessing transverse facial spots and an incomplete costal band. *Bactrocera correcta* is similar to *B. (Bactrocera) penecorrecta*, new species, in possessing a black scutum, lateral postsutural vittae broad and ending at *ia*. setae and femora entirely fulvous. It differs from *B. penecorrecta* in having abdominal terga III-V mostly orange-brown with black markings (not mostly black) and the scutellum with a narrow black basal band.

Bactrocera (Bactrocera) dorsalis (Hendel)

Dacus dorsalis Hendel, 1912: 18. Lectotype female in BMNH.

Bactrocera (Bactrocera) dorsalis – Drew & Hancock, 1994a: 17-20.

See Drew & Hancock, 1994a: 17-18 for complete list of synonyms.

Material examined. – 14 males, New Amarambalam Forest, Kerala, coll. S. Raghu, 15 Feb.1999-25 Feb.1999, attracted to methyl eugenol; 9 males, 5 Mar.1999-22 Mar.1999; 8 males, New Amarambalam Forest, Kerala, coll. C. F. Binoy, 5 Apr.1999-22 Apr.1999, attracted to methyl eugenol. Specimens deposited in KFRI, NPC, QDPI, ZRC and ZSI.

Diagnosis. – A medium sized species (wing length 6.40mm average); a pair of medium sized circular black facial spots present; postpronotal lobes yellow; notopleura yellow; scutum generally dull black but may have areas of red-brown of varying sizes and shapes; mesopleural stripe of medium width; two broad lateral postsutural vittae, parallel sided and ending behind *ia*. setae; medial postsutural vittae absent; scutellum yellow with a narrow black basal band; legs mostly fulvous with fore tibiae pale fuscous and hind tibiae fuscous; wing with a narrow fuscous costal band confluent with R and a narrow pale fuscous cubital streak; cells bc and c^{2+3} colourless; microtrichia in outer corner of cell c only; abdominal terga III-V red-brown with a distinct black 'T' and anterolateral corners of terga IV and V dark fuscous to black.

Attractant – Methyl eugenol.

Distribution – Endemic to a wide area of South East Asia. Introduced to Hawaii and Mariana Islands. More recently introduced into Tahiti. Within India, *B. dorsalis* is widespread but appears more common in the subtropical zones.

Hosts – A wide range of commercial and wild host fruits. See Allwood et al (1999) for the most recent comprehensive listings and Tsuruta et al. (1997) for hosts recorded in Sri Lanka.

Remarks. – *Bactrocera (Bactrocera) dorsalis* is one of the major pest species of *Bactrocera*, worldwide. Only *Bactrocera papayae* Drew & Hancock would be a more damaging pest species. *Bactrocera dorsalis* is similar to *B. carambolae* Drew & Hancock, *B. papayae*, *B. occipitalis* (Bezzi) and *B. philippinensis* Drew & Hancock in possessing the general colour patterns of *dorsalis* – complex species. *Bactrocera dorsalis* is distinct in possessing a short ovipositor, a narrow costal band (confluent with R_{2+3}), a narrow medial dark band on terga III-V forming the stem of the 'T' and narrow lateral dark markings on the same terga.

Bactrocera (Bactrocera) merapiensis Drew & Hancock

Bactrocera (Bactrocera) merapiensis Drew & Hancock, 1994a: 40-41. Holotype male in BPBM.

Material examined. – 28 males, New Amarambalam Forest, Kerala, coll. S. Raghu, 15 Feb.1999-25 Feb.1999, attracted to cue lure; 5 males, same locality, coll. C. F. Binoy, 5 Mar.1999-22 Mar.1999, attracted to cue lure. Specimens deposited in KFRI, NPC, QDPI, ZRC and ZSI.

Diagnosis. – A medium sized species (wing length 5.80mm); a pair of medium sized oval black facial spots present; postpronotal lobes yellow; notopleura yellow; scutum black without pale markings; mesopleural stripe slightly wider than notopleuron dorsally; two lateral postsutural vittae of medium width, narrowing posteriorly to end before *ia*. setae; medial postsutural vittae absent; scutellum yellow with a narrow black basal band; legs with all segments fulvous except fore tibiae fuscous, mid tibiae pale fuscous basally and hind tibiae dark fuscous; wing with a narrow fuscous costal band confluent with R_{2+3} (narrowing to a point a apex of R_{2+3} before expanding slightly to apex of wing) and narrow fuscous cubital streak; cells bc and c colourless; microtrichia in outer corner of cell c only; abdominal terga III-V with a medial two broad lateral longitudinal dark fuscous to black bands joined along anterior margin of tergum III; a pair of dark fuscous shining spots on tergum V.

Attractant – Cue lure.

Distribution – Known from Indonesia (Java and Sumatra) and Kerala (Southern India).

Hosts – No known records.

Remarks. – This species has been adequately described and illustrated by Drew & Hancock (1994a). It is a member of the *B. dorsalis* complex of species and best distinguished by the narrowing lateral postsutural vittae, narrow costal band confluent with R_{2+3} , femora entirely fulvous, abdominal terga with broad lateral longitudinal dark fuscous to black bands and dark fuscous shining spots and its attraction to cue lure. *Bactrocera merapiensis* is also similar to *B. (Bactrocera) paraverbascifoliae*, new species, and *B. (Bactrocera) syzygii* White & Tsuruta in having femora entirely fulvous, lateral postsutural vittae ending before *ia*. setae and mesopleural stripe narrow to medium width. *Bactrocera syzygii* differs from the other two species in having stout ventral spines on the fore femora and *B. merapiensis* differs from *B. paraverbascifoliae* in having the lateral postsutural vittae tapering posteriorly, a narrower mesopleural stripe just wider than the notopleuron and abdominal tergum III entirely dark fuscous to black.

***Bactrocera (Bactrocera) neoarecae* Drew, new species**
(Fig. 6)

Material examined. – Holotype – male, INDIA: New Amarambalam Forest, Kerala, coll. C. F. Binoy, 5 Apr.1999-22 Apr.1999, attracted to methyl eugenol, deposited in BMNH.

Description. – male

Head – Vertical length 1.03mm. Frons length 1.13 times breadth; fulvous with pale fuscous around orbital bristles and on anteromedial hump; latter with a small number of short pale hairs; orbital seta black: 1 *s.or.*, 2 *i.or.*; lunule pale fuscous. Ocellar triangle black. Vertex fuscous. Face fulvous with a pair of small oval transverse black spots not meeting in midline; length 0.38mm. Genae fulvous, no subocular spot; red-brown seta present. Occiput black, fulvous along eye margins; occipital row with a small number of pale setae. Antennae with segments 1 and 2 red-brown, segment 3 red-brown with fuscous on apex and outer surface; a weak red-brown dorsal seta on segment 2; arista black (red-brown basally); length of segments: 0.12mm; 0.19mm; 0.29mm.

Thorax – Scutum black without pale markings except for red-brown anterior to mesonotal suture. Pleural areas black except red-brown below postpronotal lobes. Yellow markings as follows: postpronotal lobes; notopleura; medium sized mesopleural stripe, reaching midway between anterior margin of notopleuron and anterior *npl.* seta dorsally, continuing to katapisternum as a transverse spot, anterior margin slightly convex; anatergite (posterior apex black); anterior $1/2$ katatergite (remainder black); two parallel sided lateral postsutural vittae of medium width ending behind *ia*. setae. Postnotum black. Scutellum yellow except for a broad black basal band. Setae: *sc.* 2; *prsc.* 2; *ia.* 1; *p.sa.* 1; *a.sa.* 1; *mpl.* 1; *npl.* 2; *scp.* 4.

Legs – All segments fulvous except for dark fuscous to black preapical oval spots on outer surfaces of fore and hind femora

and hind tibiae dark fuscous; fore and mid tibiae each with an apical black spur.

Wings – Length 4.92mm; cells *bc* and *c* colourless; microtrichia in outer corner of cell *c* only; remainder of wings colourless except fuscous cell *sc*, narrow fuscous costal band confluent with R_{2+3} and gradually widening to end between extremities of R_{4+5} and *M*, a narrow very pale fuscous cubital streak; a dense aggregation of microtrichia around A_1+CuA_2 ; supernumerary lobe of medium development.

Abdomen – Oval; terga free; pecten present on tergum III. Tergum I and sterna I and II wider than long. Tergum I dark fuscous except for a narrow posteroventral transverse red-brown band; tergum II dark fuscous to black except for a narrow anteroventral transverse red-brown band and a broad transverse fulvous band across posterior margin; terga III-V each with a broad dark fuscous to black ‘T’ pattern with paler areas lateral to midline fuscous on tergum III and red-brown on terga IV and V. A pair of red-brown oval shining spots on tergum V. Posterior lobe of surstylus short, sternum V with a deep concavity on posterior margin.

Attractant – Methyl eugenol.

Female – Not known.

Distribution – Southern India.

Hosts – No known record.

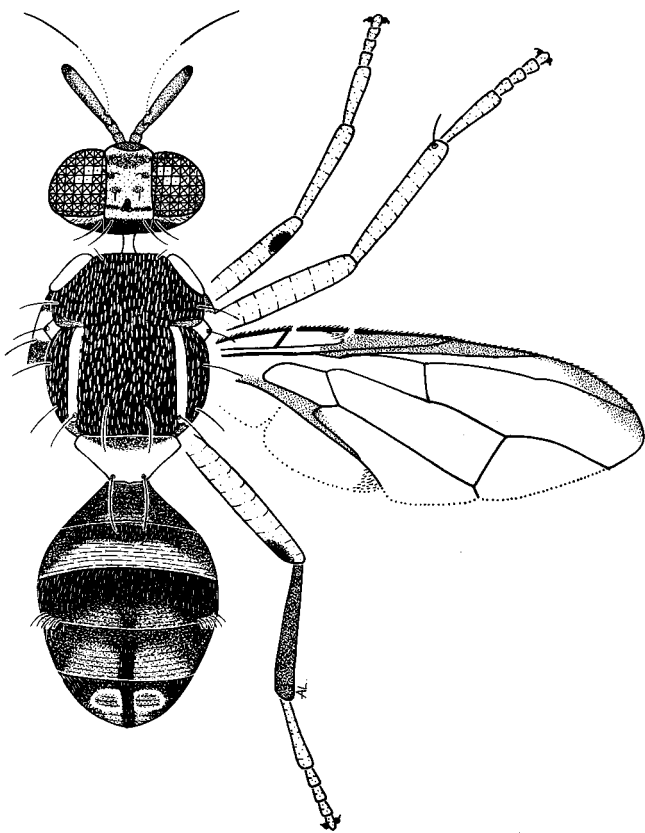


Fig. 6. *Bactrocera (Bactrocera) neoarecae*, new species, male.

Remarks. – *Bactrocera* (*Bactrocera*) *neoarecae* is similar to *B. arecae* in possessing narrow to medium width, parallel sided lateral postsutural vittae, a narrow costal band and cubital streak and cells bc and c colourless. It differs from *B. arecae* in having a uniformly black scutum, preapical dark spots on hind femora in addition to that on the fore femora, costal band very narrow beyond apex of R_{2+3} and then gradually widening across apex of R_{4+5} , abdominal terga III, IV and V each with a dark “T” pattern and with a broad black basal band on the scutellum. *Bactrocera arecae* has not been recorded from the Indian subcontinent.

***Bactrocera* (*Bactrocera*) *neonigrotibialis* Drew,
new species
(Fig. 7)**

Material examined. – Holotype – male, INDIA: New Amarambalam Forest, Kerala, coll. S. Raghu, 15 Feb.1999-25 Feb.1999, attracted to cue lure, deposited in BMNH.

Paratype – 1 male, New Amarambalam Forest, Kerala, coll. C. F. Binoy, 5 Mar.1999-22 Mar.1999, attracted to cue lure, deposited in QDPI.

Description. – male

Head – Vertical length 1.42mm. Frons length 1.22 times breadth; red-brown with fulvous along lateral and anterior margins and fuscous to dark fuscous around orbital setae and on anteromedial hump; latter covered with a large number of short pale hairs; orbital setae black: 1 *s.or.*, 2 *i.or.*; lunule dark fuscous. Ocellar triangle black. Vertex black. Face fulvous with large elongate oval black spots almost filling entire antennal furrow; length 0.53mm. Genae fulvous, dark fuscous to black subocular spot present; black seta present. Occiput black, fulvous along eye margins; occipital row with 2-6 black setae. Antennae with segments 1 and 2 red-brown, segment 3 missing; a strong pale dorsal seta on segment 2; length of segments: 0.22mm; 0.31mm.

Thorax – Scutum black without pale markings. Pleural areas black except dark fuscous below postpronotal lobes and above mid coxae. Yellow markings as follows: postpronotal lobes (anteromedial corners black); notopleura; narrow mesopleural stripe, equal in width to notopleuron dorsally, continuing to katapisternum as a small transverse spot, anterior margin straight; anatergite (posterior apex black); anterior $1/2$ katatergite (remainder black); two narrow, short lateral postsutural vittae, narrowing sharply posteriorly to end at or just behind level of *a.sa.* setae. Postnotum black. Scutellum yellow except for a narrow to medium width black basal band. Setae: *sc.* 2; *prsc.* 2; *ia.* 1; *p.sa.* 1; *a.sa.* 1; *mpl.* 1; *npl.* 2; *scp.* 4.

Legs – Fore femora fulvous except for apical $2/3$ of outer surfaces shining black, mid femora fulvous except apical $1/2$ dark fuscous to black, hind femora fulvous except $1/3$ dark fuscous to black; fore tibiae fuscous to dark fuscous, mid tibiae fuscous, hind tibiae dark fuscous; all tarsal segments fulvous; mid tibiae each with an apical black spur.

Wings – Length 5.76mm; cells bc and c colourless; microtrichia in outer corner of cell c only; remainder of wings colourless except fuscous cell sc, narrow fuscous costal band confluent with R_{2+3} and widening slightly before ending just before extremity of R_{4+5} , narrow fuscous cubital streak; dense aggregation of microtrichia around A_1+CuA_2 ; supernumerary lobe of medium development.

Abdomen – Oval; terga free; pecten present on tergum III. Tergum I and sterna I and II wider than long. Tergum I black except for a narrow transverse band across posterior margin which does not reach lateral margins; tergum II black except for a broad transverse fulvous band across posterior margin which narrows to posterolateral corners; terga III dark fuscous to black with a medium width medial longitudinal black band; terga IV-V dark red-brown centrally with a medium width medial longitudinal black band and broad lateral longitudinal dark fuscous bands over both terga (in the paratype, the colour patterns on terga III-V are slightly paler). A pair of oval dark fuscous shining spots on tergum V. Posterior lobe of surstylus short, sternum V with a deep concavity on posterior margin.

Attractant – Cue lure.

Female – Not known.

Distribution – Southern India.

Hosts – No known record.

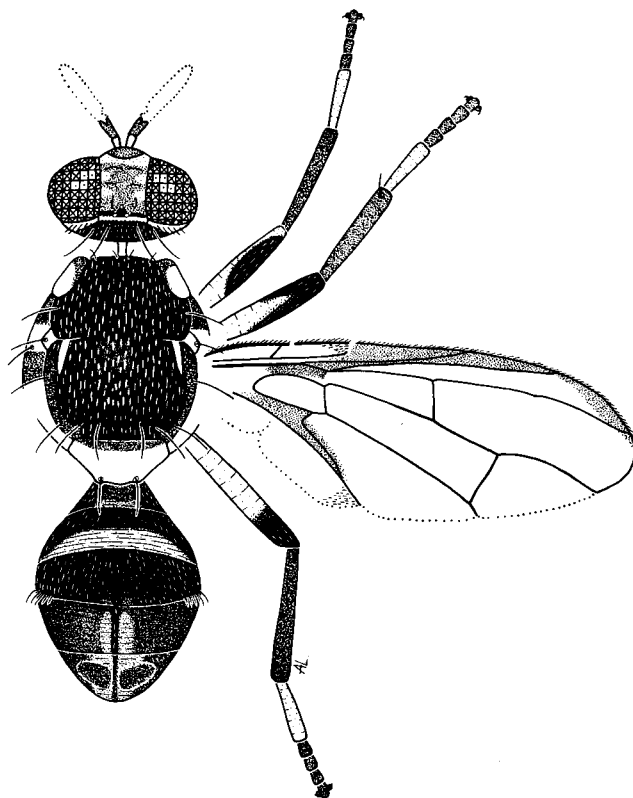


Fig. 7. *Bactrocera* (*Bactrocera*) *neonigrotibialis*, new species, male.

Remarks. – *Bactrocera* (*Bactrocera*) *neonigrotibialis* belongs to the *neigrotibialis* – complex with mostly black on the thorax (except for yellow markings), wings with a narrow costal band and cubital streak and no additional fuscous markings, legs with extensive black markings. The other species in the complex are *B. apinigroscutella*, new species, *B. lata* (Perkins), *Bactrocera nigrofemoralis* White & Tsuruta and *B. nigrotibialis* (Perkins). *B. neonigrotibialis* differs from the other species in having a combination of a fulvous face with large elongate oval black spots, the lateral postsutural vittae shorter and ending at level of *a.sa.* setae, femora fulvous except fore femora with apical 2/3 of outer surfaces black, apical 1/2 of mid femora and apical 1/3 of hind femora dark fuscous to black.

***Bactrocera* (*Bactrocera*) *nigrofemoralis*
White & Tsuruta
(Fig. 8)**

Bactrocera (*Bactrocera*) *nigrofemoralis* White & Tsuruta, 2001: 79-82. Holotype male in BMNH.

Material examined. – 4 males, INDIA: New Amarambalam Forest, Kerala, coll. S. Raghu, 15 Feb.1999-25 Feb.1999, attracted to cue lure; 5 males, New Amarambalam Forest, Kerala, coll. C. F. Binoy, 5 Mar.1999-22 Mar.1999, attracted to cue lure; 26 males, New Amarambalam Forest, Kerala, coll. C. F. Binoy, 5 Apr.1999-22 Apr.1999, attracted to cue lure. Specimens deposited in KFRI, NPC, QDPI, ZRC and ZSI.

Description. – male

Head – Vertical length 1.37mm. Frons length 1.23 times breadth; dark red-brown to fuscous; fulvous laterally and with dark fuscous around orbital setae and on anteromedial hump; latter with a few short pale hairs; orbital setae black: 1 *s.or.*, 2 *i.or.*; lunule fuscous. Ocellar triangle black. Vertex dark fuscous. Face shining black; length 0.46mm. Genae fulvous, dark fuscous to dull black subocular spot present; black seta present. Occiput black, fulvous along eye margins; occipital row with 3-6 small black setae. Antennae with segments 1 and 2 dark red-brown to fuscous, segment 3 red-brown with dark fuscous on apex and outer surface; a weak dorsal seta on segment 2; arista black (red-brown basally); length of segments: 0.19mm; 0.26mm; 0.67mm.

Thorax – Scutum shining black without pale markings. Pleural areas entirely black. Yellow markings as follows: postpronotal lobes (anteromedial corners dark fuscous to black); notopleura (except black around base making yellow a smaller area); mesopleural stripe reaching to anterior *npl.* seta dorsally, continuing to katapisternum as a small transverse spot, anterior margin straight; anatergite (posterior apex black); anterior 5/8 katatergite (remainder black); two narrow lateral postsutural vittae, narrowing posteriorly to end well before *ia.* setae. Scutellum yellow except for a moderately broad black basal band. Setae black: *sc.* 2; *prsc.* 2; *ia.* 1; *p.sa.* 1; *a.sa.* 1; *mpl.* 1; *npl.* 2; *scp.* 4.

Legs – Fore femora mostly shining black but may be dark fulvous on some or all of inner surfaces, mid femora entirely shining black, hind femora with basal 2/3 fulvous and apical 1/3 shining black; fore tibiae fuscous (tending darker basally), mid tibiae fulvous (tending fuscous basally), hind tibiae dark fuscous; all tarsal segments fulvous; mid tibiae each with an apical black spur.

Wings – Length 5.01mm; cells *bc* and *c* colourless; microtrichia in outer corner of cell *c* only; remainder of wings colourless except fuscous cell *sc*, narrow fuscous costal band confluent with R_{2+3} and remaining narrow to end just beyond extremity of R_{4+5} , a narrow fuscous cubital streak; dense aggregation of microtrichia around A_1+CuA_2 ; supernumerary lobe of medium development.

Abdomen – Oval; terga free; pecten present on tergum III. Tergum I and sterna I and II wider than long. Terga I and II black except for a narrow red-brown band along intersegmental line and a broad transverse fulvous to red-brown band across posterior 1/2 of tergum II and narrowing to lateral margins; terga III-V red-brown except for a broad black band across anterior margin of tergum III, broad black lateral longitudinal bands over all three terga and a narrow medial longitudinal black band from black base of tergum III to apex of tergum V (in some specimens, the central red-brown area is reduced through tergum III being entirely black and/or black across anterior margin of tergum IV). A pair of

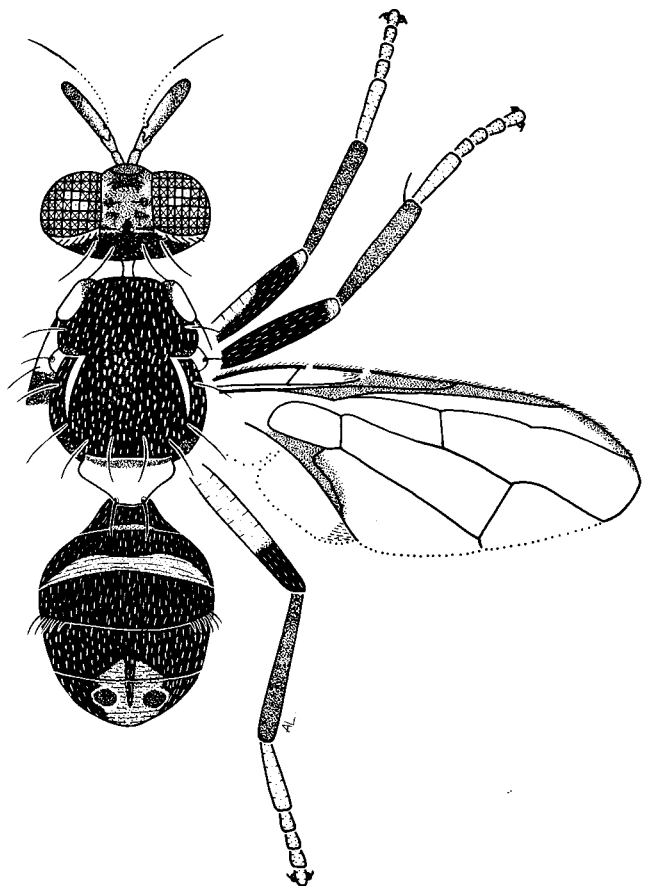


Fig. 8. *Bactrocera* (*Bactrocera*) *nigrofemoralis* White & Tsuruta, male.

oval black shining spots on tergum V. Posterior lobe of surstylus short, sternum V with a deep concavity on posterior margin.

Attractant – Cue lure.

Female – Not known.

Distribution – Southern India.

Hosts – *Terminalia catappa* (Combretaceae) (Tsuruta et al., 1997)

Remarks. – *Bactrocera* (*Bactrocera*) *nigrofemoralis* belongs to the *nigrotibialis* – complex discussed under *B. neonigrotibialis*. It is distinct in possessing a black face, the mesopleural stripe reaching to the anterior *npl.* seta and a broad basal black band on the scutellum.

***Bactrocera* (*Bactrocera*) *paraosbeckiae* Drew,
new species
(Fig. 9)**

Material examined. – Holotype - male, INDIA: New Amarambalam Forest, Kerala, coll. S. Raghu, 15 Feb.1999-25 Feb.1999, attracted to cue lure, deposited in BMNH.

Paratypes – 6 males, same data as holotype; 20 males, New Amarambalam Forest, Kerala, 5 Mar.1999-22 Mar.1999, C. F. Binoy, attracted to cue lure. 8 paratypes in QDPI, 4 in ANIC, 4 in BMNH, 3 in NPC, 4 in ZRC and 3 in ZSI.

Description. – male

Head – Vertical length 1.42mm. Frons length 1.35 times breadth; fulvous with dark fuscous around orbital setae and on anteromedial hump; latter covered by short pale hairs; orbital setae black: 1 *s.or.*, 2 *i.or.*; lunule dark fuscous. Ocellar triangle black. Vertex dark fuscous. Face fulvous with large oval black spots; length 0.46mm. Genae fulvous, dark fuscous subocular spot present; black seta present. Occiput red-brown with large dark fuscous to black areas, fulvous along eye margins; occipital row with 4-6 large dark setae. Antennae with segments 1 and 2 red-brown, segment 3 red-brown with fuscous on apex and outer surface; a weak pale dorsal seta on segment 2; arista black (red-brown basally); length of segments: 0.24mm; 0.34mm; 0.72mm.

Thorax – Scutum dark red-brown with fuscous patterns which vary in size; the most common is a broad fuscous area across posterior margin with narrow longitudinal broken lines running anteriorly from this zone, fuscous between postpronotal lobes and notopleura and across anterior margin. Pleural areas dark fuscous to black with red-brown to fuscous below postpronotal lobes. Yellow markings as follows: postpronotal lobes; notopleura; medium sized mesopleural stripe, reaching midway between anterior margin of notopleuron and anterior *npl.* seta dorsally, continuing to katapisternum below as a small transverse spot, anterior margin straight to slightly convex; anatergite (posterior apex

black); anterior 5/8 katatergite (remainder black); two narrow lateral postsutural vittae, narrowing posteriorly to end before *ia.* setae. Postnotum black. Scutellum yellow except for a narrow black basal band. Setae: *sc.* 2; *prsc.* 2; *ia.* 1; *p.sa.* 1; *a.sa.* 1; *mpl.* 1; *npl.* 2; *scp.* 4.

Legs – Femora entirely fulvous except for a diffuse small dark subapical spot on the fore femora of some specimens, fore and hind tibiae dark fuscous, mid tibiae dark fuscous basally to fuscous apically, all tarsal segments fulvous; mid tibiae each with an apical black spur.

Wings – Length 5.28mm; cells *bc* and *c* colourless; microtrichia in outer corner of cell *c* only; remainder of wings colourless except fuscous cell *sc*, narrow fuscous costal band slightly overlapping R_{2+3} where it is extremely pale and not widening apically, narrow pale fuscous to fuscous cubital streak; dense aggregation of microtrichia around A_1+CuA_2 ; supernumerary lobe of medium development.

Abdomen – Oval; terga free; pecten present on tergum III. Tergum I and sterna I and II wider than long. Tergum I black except for a narrow posterocentral transverse red-brown band; tergum II black except for a narrow anterocentral transverse red-brown line and a broad transverse fulvous band across posterior margin; terga III-V red-brown except for a black 'T' pattern and broad fuscous to dark fuscous lateral longitudinal bands over all three terga. A pair of oval fuscous shining spots on tergum V. Posterior lobe of surstylus short, sternum V with a deep concavity on posterior margin.

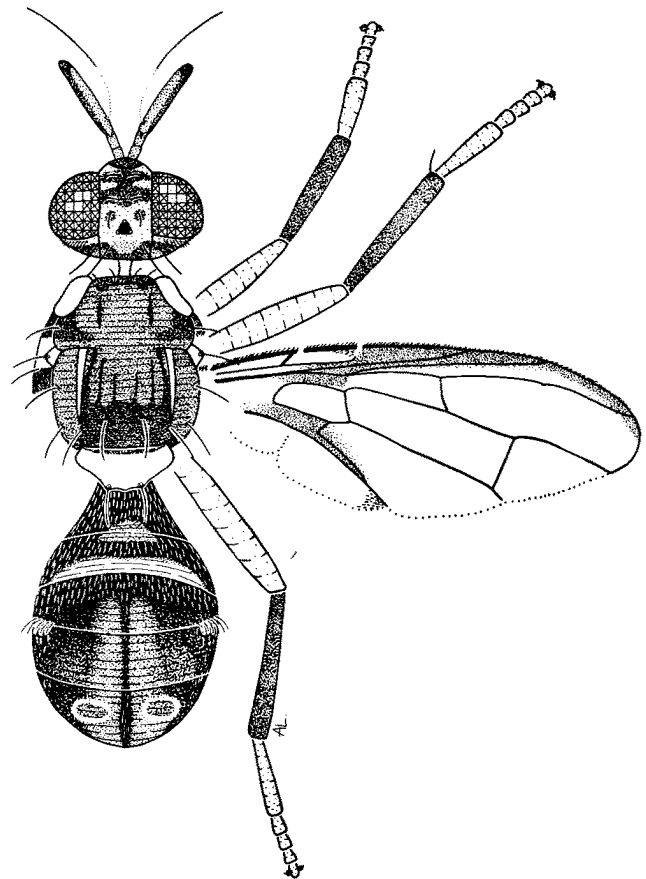


Fig. 9. *Bactrocera* (*Bactrocera*) *paraosbeckiae*, new species, male.

Attractant – Cue lure.

Female – Not known.

Distribution – Southern India.

Hosts – No known record.

Remarks. – *Bactrocera* (*Bactrocera*) *paraosbeckiae* is similar to *B. osbeckiae* Drew & Hancock in the general colour patterns of the legs, wings and abdomen. It differs in having a dark red-brown scutum with fuscous patterns which vary in shape and size, in contrast to *B. osbeckiae* which has a mostly black scutum. It is also similar to *B. brunneola*, *B. pseudoversicolor*, new species, and *B. versicolor* in having a red-brown scutum and *a.sa.* and *pr.sc.* setae present. *Bactrocera versicolor* is distinct in having a dark apical spot on the scutellum and *B. pseudoversicolor* is separate in having the lateral postsutural vittae ending posterior to the *ia.* setae. *Bactrocera paraosbeckiae* differs from *B. brunneola* in having extensive fuscous markings on the dark red-brown scutum and abdominal terga III-V with broad, lateral longitudinal dark bands.

***Bactrocera* (*Bactrocera*) *paraverbascifoliae* Drew,
new species
(Fig. 10)**

Material examined. – Holotype - male, INDIA: New Amarambalam Forest, Kerala, coll. C. F. Binoy, 5 Apr.1999-22 Apr.1999, attracted to methyl eugenol, deposited in BMNH.

Paratype – 1 male, same data as holotype, deposited in QDPI.

Description. – male

Head – Vertical length 1.32mm. Frons length 1.36 times breadth; red-brown with pale fuscous around orbital bristles and on anteromedial hump; latter covered with short pale hairs; orbital setae black: 1 *s.or.*, 2 *i.or.*, lunule pale fuscous. Ocellar triangle black. Vertex pale fuscous. Face fulvous with medium sized circular to oval black spots; length 0.55mm. Genae fulvous, fuscous subocular spot present; red-brown seta present. Occiput red-brown with black spots laterally and fulvous along eye margins; occipital row with 1-3 small dark setae. Antennae with segments 1 and 2 red-brown, segment 3 red-brown with fuscous on apex and outer surface; a strong red-brown seta on segment 2; arista black (red-brown basally); length of segments: 0.22mm; 0.31mm; 0.67mm.

Thorax – Scutum black with red-brown to dark red-brown below and behind lateral postsutural vittae, around mesonotal suture and inside postpronotal lobes. Pleural areas black except red-brown below postpronotal lobes. Yellow markings as follows: postpronotal lobes; notopleura; medium sized mesopleural stripe, reaching midway between anterior margin of notopleuron and anterior *npl.* seta dorsally, continuing to katapisternum below as a transverse spot, anterior margin slightly convex; anatergite (posterior apex

black); anterior 5/8 katatergite (remainder black); two parallel sided lateral postsutural vittae of medium width ending just before *ia.* setae. Postnotum black except dark red-brown on lower central margin. Scutellum yellow except for a narrow black basal band. Setae: *sc.* 2; *pr.sc.* 2; *ia.* 1; *p.sa.* 1; *a.sa.* 1; *mpl.* 1; *npl.* 2; *scp.* 2.

Legs – All segments fulvous except a small area of dark fuscous on base of fore tibiae and fuscous on base of mid tibiae and hind tibiae dark fuscous basally to fuscous apically; mid tibiae each with an apical black spur.

Wings – Length 5.70mm; cells *bc* and *c* colourless; microtrichia in outer corner of cell *c* only; remainder of wings colourless except for dark fuscous cell *sc*, a narrow fuscous to dark fuscous costal band confluent with R_{2+3} and gradually widening to end between extremities of R_{4+5} and *M*, a narrow fuscous cubital streak; a dense aggregation of microtrichia around A_1+CuA_2 ; supernumerary lobe of medium development.

Abdomen – Oval; terga free; pecten present on tergum III. Tergum I and sterna I and II wider than long. Tergum I fuscous anterocentrally, dark fuscous laterally and with a broad transverse red-brown band across posterior margin; tergum II red-brown except for a narrow transverse black band anteriorly which ends laterally just before the dark fuscous lateral margins; terga III-V orange-brown except for a distinct black 'T' pattern and broad lateral longitudinal dark fuscous bands which are interrupted by orange-brown on the posterolateral areas of tergum IV. A pair of oval red-brown shining spots on tergum V. Posterior lobe of surstylus short, sternum V with a deep concavity on posterior margin.

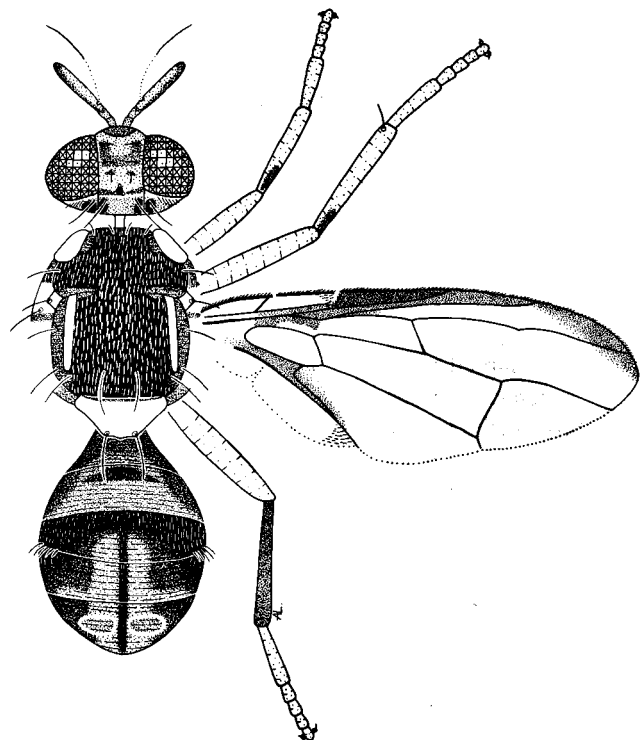


Fig. 10. *Bactrocera* (*Bactrocera*) *paraverbascifoliae*, new species, male.

Attractant – Methyl eugenol.

Female – Not known.

Distribution – Southern India.

Hosts – No known record.

Remarks. – *Bactrocera* (*Bactrocera*) *paraverbascifoliae* belongs to the *dorsalis* – complex. It is similar to *B. verbascifoliae* in possessing narrow to medium width, parallel sided lateral postsutural vittae and entirely fulvous femora. It differs from *B. verbascifoliae* in having the lateral postsutural vittae ending before the *ia.* setae and the costal band widening gradually from the apex of R_{2+3} to extremity of wing. The wing pattern is similar to that of *B. latilineola* Drew & Hancock but *B. paraverbascifoliae* differs from this species in having a broader mesopleural stripe, narrower lateral postsutural vittae and in lacking a preapical dark spot on the fore femora. The similarities to and differences from *B. merapiensis* and *B. syzygii* have been discussed under the **Remarks** on *B. merapiensis*.

***Bactrocera* (*Bactrocera*) *penecorrecta* Drew,
new species
(Fig. 11)**

Material examined. – Holotype – male, INDIA: New Amarambalam Forest, Kerala, coll. C. F. Binoy, 5 Apr.1999-22 Apr.1999, attracted to methyl eugenol, deposited in BMNH.

Paratype – 1 male paratype, same data as holotype, deposited in QDPI.

Description. – male

Head – Vertical length 0.98mm. Frons length 1.47 times breadth; fulvous with pale fuscous to fuscous around orbital setae and on anteromedial hump; latter without short hairs; orbital setae black: 1 *s.or.*, 2 *i.or.*; lunule fulvous. Ocellar triangle black. Vertex fuscous. Face fulvous with transverse oval black spots, almost meeting in midline; length 0.36mm. Genae fulvous, pale fuscous subocular spot present; red-brown seta present. Occiput black, fulvous along eye margins; occipital row with a small number of short pale setae. Antennae with segments 1 and 2 red-brown, segment 3 red-brown with fuscous on apex and outer surface; a weak pale dorsal seta on segment 2; arista black (red-brown basally); length of segments: 0.12mm; 0.19mm; 0.43mm.

Thorax – Scutum black with red-brown posterolateral to lateral postsutural vittae and anterior to mesonotal suture. Pleural areas black except red-brown to dark fuscous below postpronotal lobes. Yellow markings as follows: postpronotal lobes; notopleura; mesopleural stripe, reaching almost to anterior *npl.* seta dorsally, continuing to katapisternum below as a transverse spot, anterior margin straight; anatergite (posterior apex black); anterior 5/8 katatergite (remainder black); two moderately broad parallel sided lateral postsutural vittae ending behind *ia.* setae. Postnotum black.

Scutellum yellow except for a moderately broad black basal band. Setae: *sc.* 2; *prsc.* 2; *ia.* 1; *p.sa.* 1; *a.sa.* 1; *mpl.* 1; *npl.* 2; *scp.* 2.

Legs – All segments fulvous except fore tibiae and tarsi pale fuscous, hind tibiae dark fuscous and hind tarsi pale fuscous; mid tibiae each with an apical black spur.

Wings – Length 3.92mm; cells *bc* and *c* colourless; microtrichia in outer corner of cell *c* only; remainder of wings colourless except fuscous cell *sc*, narrow fuscous costal band confluent with R_{2+3} and ending at apex of this vein before continuing as a large oval fuscous spot across apex of R_{4+5} , a narrow pale fuscous cubital streak confined within cell cup; a dense aggregation of microtrichia around A_1+CuA_2 ; supernumerary lobe of medium development.

Abdomen – Oval; terga free; pecten present on tergum III. Tergum I and sterna I and II wider than long. Tergum I black except for a narrow transverse red-brown band across posterior margin but not reaching lateral margins; tergum II black with a broad red-brown transverse band across posterior margin and which narrows towards posterolateral corners; terga III-V black except dark fuscous spots posterocentrally on tergum III and dark red-brown spots posterocentrally on terga IV and V either side of a medial longitudinal black band. A pair of oval dark red-brown shining spots on tergum V. Posterior lobe of surstylus short, sternum V with a deep concavity on posterior margin.

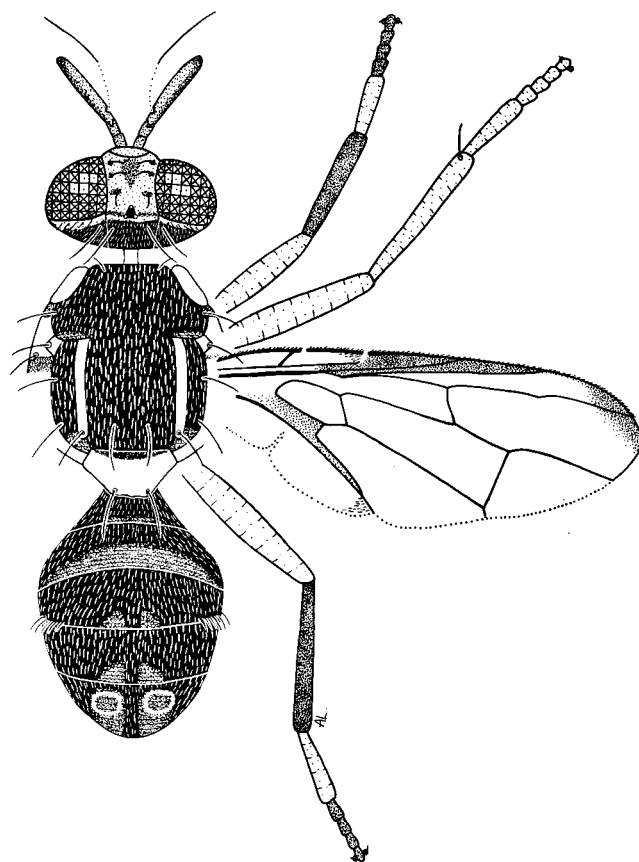


Fig. 11. *Bactrocera* (*Bactrocera*) *penecorrecta*, new species, male.

Attractant – Methyl eugenol.

Female – Not known.

Distribution – Southern India.

Hosts – No known record.

Remarks. – *Bactrocera* (*Bactrocera*) *penecorrecta* is similar to *B. correcta* in possessing a fulvous face with transverse oval black spots, a black scutum with parallel sided lateral postsutural vittae, femora entirely fulvous and costal band interrupted beyond apex of R_{2+3} to form a separate oval spot across apex of R_{4+5} . It differs from *B. correcta* in having a moderately broad black band on the scutellum, abdominal terga III-V mostly black with small dark red-brown spots posterocentrally either side of the medial longitudinal black band.

Bactrocera (*Bactrocera*) *pseudoversicolor* Drew,
new species
(Fig. 12)

Material examined. – Holotype – male, INDIA: New Amarambalam Forest, Kerala, coll. C. F. Binoy, 5 Apr.1999-22 Apr.1999, attracted to methyl eugenol, deposited in BMNH.

Paratype – 1 male, same data as holotype, deposited in QDPI.

Description. – male

Head – Vertical length 1.52mm. Frons length 1.33 times breadth; red-brown with pale fuscous to fuscous around orbital setae and fulvous along lateral margins; orbital setae dark fuscous: 1 *s.or.*, 2 *i.or.*; lunule red-brown. Ocellar triangle black. Vertex pale fuscous. Face fulvous with medium sized oval black spots; length 0.528mm. Genae fulvous, dark fuscous subocular spot present; dark fuscous seta present. Occiput red-brown with large lateral black markings and fulvous along eye margins; occipital row with 3-6 strong dark setae. Antennae with segments 1 and 2 red-brown, segment 3 red-brown with fuscous on apex and outer surface; a weak pale dorsal seta on segment 2; arista black (red-brown basally); length of segments: 0.14mm; 0.36mm; 0.70mm.

Thorax – Scutum red-brown without dark markings. Pleural areas black except red-brown below postpronotal lobes and above mid and hind coxae. Yellow markings as follows: postpronotal lobes; notopleura; medium sized mesopleural stripe, reaching almost midway between anterior margin of notopleuron and anterior *npl.* seta dorsally, continuing to katapisternum as a transverse spot, anterior margin slightly convex; anatergite (posterior apex); anterior 5/8 katatergite (remainder black); two narrow to medium width, parallel sided lateral postsutural vittae ending just behind *ia.* setae. Postnotum broadly red-brown centrally and black laterally. Scutellum yellow except for narrow dark red-brown basal band. Setae red-brown: *sc.* 2; *prsc.* 2; *ia.* 1; *p.sa.* 1; *a.sa.* 1; *mpl.* 1; *npl.* 2; *scp.* 4.

Legs – All femora fulvous except for an oval fuscous subapical spot on outer surfaces of mid femora, fore tibiae pale fuscous, mid tibiae fulvous except for a small fuscous area basally, hind tibiae fuscous, tarsi fulvous except for apical four segments of fore tarsi pale fuscous and all hind tarsal segments fuscous; mid tibiae each with an apical black spur.

Wings – Length 6.10mm; cells *bc* and *c* colourless; microtrichia in outer corner of cell *c* only; remainder of wings colourless except dark fuscous cell *sc*, narrow fuscous costal band confluent with R_{2+3} and remaining narrow as it ends between extremities of R_{4+5} and *M*, a narrow fuscous cubital streak; a dense aggregation of microtrichia around A_1+CuA_2 ; supernumerary lobe of medium development.

Abdomen – Oval; terga free; pecten present on tergum III. Tergum I and sterna I and II wider than long. Tergum I fulvous with broad black lateral margins; tergum II fulvous with a narrow transverse black band anteriorly and narrow black lateral margins; terga III-V red-brown with a dark 'T' pattern, the stem of which is a narrow medial longitudinal fuscous band over all three terga and with fuscous to dark fuscous margins on terga IV and V. A pair of oval fuscous to dark fuscous shining spots on tergum V. Posterior lobe of surstylus short, sternum V with a deep concavity on posterior margin.

Attractant – Methyl eugenol.

Female – Not known.

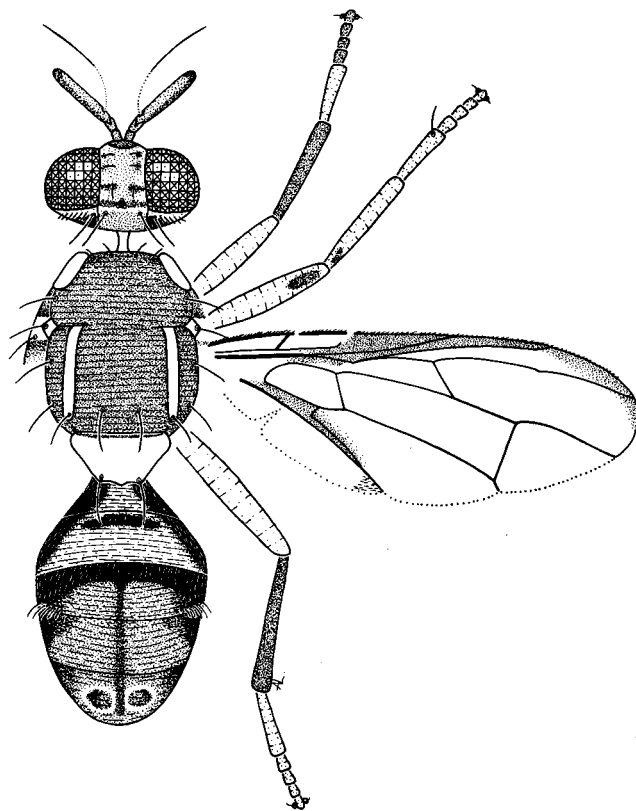


Fig. 12. *Bactrocera* (*Bactrocera*) *pseudoversicolor*, new species, male.

Distribution – Southern India.

Hosts – No known record.

Remarks. – *Bactrocera* (*Bactrocera*) *pseudoversicolor* is a general red-brown species similar to *B. versicolor* and *B. apicofuscans*. It differs from *B. apicofuscans* in having a narrower costal band (confluent with R_{2+3}), colourless cells bc and c, *prsc.* setae present and dark lateral margins on terga III-V. It differs from *B. versicolor* in possessing a narrow mesopleural stripe (equal in width to the notopleuron), and lacking a dark apical spot on the scutellum and dark preapical spots on the fore and hind femora. Its similarities to and differences from *B. brunneola* and *B. paraosbeckiae* are discussed under the **Remarks** on *B. paraosbeckiae*.

***Bactrocera* (*Bactrocera*) *versicolor* (Bezzi)**

(Fig. 13)

Chaetodacus ferrugineus var. *versicolor* Bezzi, 1916: 105.
Syntypes in BMNH.

Bactrocera (*Bactrocera*) *versicolor* – White & Hancock, 1997.

Material examined. – 5 males, New Amarambalam Forest, Kerala, coll. S. Raghu, 15 Feb.1999-25 Feb.1999, attracted to methyl eugenol; 1 male, same locality, coll. C. F. Binoy, 5 Mar.1999-22 Mar.1999, attracted to methyl eugenol; 8 males same locality, coll. C. F. Binoy, 5 Apr.1999-22 Apr.1999, attracted to methyl eugenol; 1 female, Poonmudi Range, Trivandrum Dt, Kerala State, South India; 1 female, Poonmudi Range, 3000ft, Trivandrum Dist., Kerala State, South India, coll. T.R.S. Nathan, May.1971; 2 females, Poonmudi Range, 3000ft, Trivandrum Dt, Kerala State, South India, May.1972. Specimens deposited in KFRI, MHNG, NPC, QDPI, ZRC and ZSI.

Description. – male

Head – Vertical length 1.76mm. Frons, length 1.29 times breadth; red-brown centrally, fulvous laterally, with dark fuscous around orbital setae and on anteromedial hump; latter covered with a small number of short pale hairs; orbital setae dark red-brown: 1 *s.or.*, 2 *i.or.*; lunule dark fuscous. Ocellar triangle black. Vertex fuscous. Face fulvous with medium sized oval black spots; length 0.50mm. Genae fulvous, dark fuscous subocular spot present; red-brown seta present. Occiput red-brown, fulvous along eye margins; occipital row with 4-8 dark setae. Antennae with segments 1 and 2 red-brown, segment 3 red-brown with fuscous on apex and outer surface; a weak pale dorsal seta on segment 2; arista black (red-brown basally); length of segments: 0.22mm; 0.36mm; 0.89mm.

Thorax – Scutum red-brown with a narrow medial longitudinal fuscous line and narrow fuscous margins around lateral postsutural vittae. Pleural areas red-brown with fuscous immediately before and behind mesopleural stripes. Yellow markings as follows: Postpronotal lobes; notopleura; mesopleural stripe of medium width, reaching midway between anterior margin of notopleuron and anterior *npl.* seta dorsally, continuing to katapisternum as a transverse spot,

anterior margin straight; anatergite (posterior apex fuscous); anterior $1/2$ katatergite (remainder fuscous); two parallel sided lateral postsutural vittae of medium width, ending behind *ia.* setae. Postnotum red-brown, tending fuscous laterally. Scutellum yellow except for a narrow red-brown basal band and a dark fuscous apical spot. Setae: *sc.* 2; *prsc.* 2 (occasionally absent); *ia.* 1; *p.sa.* 1; *a.sa.* 1; *mpl.* 1; *npl.* 2; *scp.* 2.

Legs – All segments fulvous except for a subapical pale fuscous spot on outer surfaces of fore and mid femora and pale fuscous on apices of hind femora, pale fuscous on outer surfaces of fore tibiae, on outer basal surfaces of mid tibiae, hind tibiae entirely fuscous; mid tibiae each with an apical red-brown spur.

Wings – Length 6.98mm; cells bc and c colourless; extremely small area of microtrichia in outer corner of cell c only; remainder of wings colourless except for fuscous cell sc, a very narrow fuscous costal band confluent with R_{2+3} and ending just beyond extremity of R_{4+5} , a very narrow pale fuscous cubital streak confined within cell cup; a dense aggregation of microtrichia around A_1+CuA_2 ; supernumerary lobe of medium development.

Abdomen – Oval; terga free; pecten present on tergum III. Tergum I and sterna I and II wider than long. Tergum I pale fuscous, tending red-brown posterocentrally; tergum II red-brown with posterolateral fulvous areas, a medial longitudinal dark fuscous spot and dark fuscous anterolateral corners; terga III-V red-brown with a black 'T' pattern (the

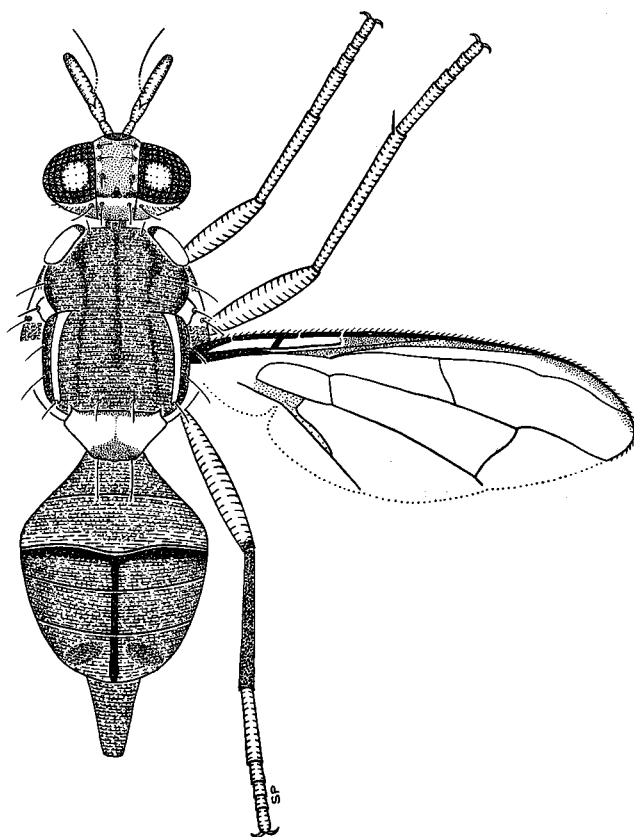


Fig. 13. *Bactrocera* (*Bactrocera*) *versicolor* (Bezzi), female.

stem of the 'T' is a narrow medial longitudinal band), dark fuscous anterolateral corners on terga IV and V and dark red-brown to fuscous oval shining spots on tergum V. Posterior lobe of surstylus short, sternum V with a deep concavity on posterior margin.

Attractant – Methyl eugenol.

Distribution – Known from India, Bhutan and Sri Lanka.

Hosts – Recorded from only one host, *Manilkara zapota* (Family: Sapotaceae) (White & Elson-Harris, 1992).

Remarks. – *Bactrocera versicolor* is a species confined to the Indian subcontinent. It is distinct in being a general red-brown species with a large dark fuscous apical spot on the scutellum and black 'T' shaped pattern over abdominal terga III-V. Its similarities to and differences from the other red-brown species recorded from India are noted under the **Remarks** on *B. paraosbeckiae* and *B. pseudoversicolor*. Figure 13 is based on a female. Since there is no sexual dimorphism in this species, it is still an accurate representation of the species' characters.

Bactrocera (Bactrocera) vishnu Drew & Hancock

Bactrocera (Bactrocera) vishnu Drew & Hancock, 1994a: 65-66.
Holotype male in BMNH.

Material examined. – 147 males, New Amarambalam Forest, Kerala, coll. S. Raghu, 15 Feb.1999-25 Feb.1999, attracted to cue lure; 55 males, same locality, coll. C. F. Binoy, 5 Mar.1999-22 Mar.1999, attracted to cue lure; 15 males, same locality, coll. C. F. Binoy, 5 Apr.1999-22 Apr.1999, attracted to cue lure. Specimens deposited in KFRI, NPC, QDPI, ZRC and ZSI.

Diagnosis. – A medium sized species (wing length 6.20mm); a pair of large oval black facial spots present; postpronotal lobes yellow, notopleura yellow; scutum black except for dark red-brown posterolateral to lateral postsutural vittae, around mesonotal suture and inside postpronotal lobes; more narrow posteriorly; two lateral postsutural vittae of medium width, mesopleural stripe ending midway between anterior margin of notopleuron and anterior *npl* seta dorsally; medial postsutural vitta absent; parallel sided and ending at or just behind *ia* setae; scutellum yellow with a narrow black basal band; legs with femora fulvous except for an oval black subapical spot on outer surfaces of fore femora, fore and mid tibiae fuscous (dark basally), hind tibiae dark fuscous; wing with a narrow fuscous costal band slightly overlapping R_{2+3} where it is pale, a narrow fuscous cubital streak mostly confined within cell cup, cells bc and c colourless, microtrichia in outer corner of cell c only; abdominal terga III-V red-brown with a dark 'T' pattern as follows – a medium width medial longitudinal dull black band over all three terga, a transverse band across tergum III which is dark fuscous to dull black and broader laterally, very narrow fuscous to dark fuscous margins on terga IV and V; a pair of oval fuscous shining spots on tergum V.

Attractant – Cue lure.

Distribution – Southern India.

Hosts – No known record.

Remarks. – This species was adequately described and figured by Drew & Hancock (1994a). It is distinguished by the general *dorsalis* – complex characters, parallel sided (or sub-parallel) lateral postsutural vittae, narrow fuscous costal band just overlapping R_{2+3} , black subapical spot on outer surfaces of fore femora and attraction to cue lure. *Bactrocera (Bactrocera) profunda* Tsuruta & White is very similar to *B. vishnu* and appears to differ only on the absence of lateral dark markings on abdominal tergum IV. It is not a pest species and has only been collected in native forest areas of South India.

Bactrocera (Bactrocera) zonata (Saunders) (Fig. 14)

Dasyneura zonatus Saunders, 1842: 61. Location of types unknown.

Bactrocera (Bactrocera) zonata – Norrbom et al., 1998: 96.
See Norrbom et al., 1998: 96 for complete list of synonyms.

Material examined. – 3 males, New Amarambalam Forest, Kerala, coll. C. F. Binoy, 5 Mar.1999-22 Mar.1999, attracted to methyl eugenol; 5 males, same locality, coll. C. F. Binoy, 5 Apr.1999-22 Apr.1999, attracted to methyl eugenol. Specimens deposited in NPC, DPI and ZSI.

Description. – male.

Head – Vertical length 1.37mm. Frons, length 1.47 times breadth; pale fuscous with red-brown laterally and fuscous to dark fuscous around orbital bristles and on anteromedial hump; orbital bristles dark fuscous: 1 *s.or.*, 2 *i.or.*; lunule red-brown. Ocellar triangle black. Vertex red-brown. Face fulvous with medium sized oval black spots; length 0.41mm. Genae red-brown; pale seta present. Occiput red-brown with large lateral black areas and fulvous along eye margins; occipital row consisting of indistinct small pale hairs. Antennae with segments 1 and 2 red-brown, segment 3 red-brown with fuscous on apex and outer surface; arista black (red-brown basally); length of segments: 0.18mm; 0.26mm; 0.64mm.

Thorax – Scutum red-brown with a pale fuscous pattern posteriorly. Pleural areas red-brown with fuscous anterior and posterior to mesopleural stripe. Yellow markings as follows: Postpronotal lobes; notopleura; mesopleural stripe reaching to or almost to anterior *npl* seta, continuing to katapisternum as a transverse spot, anterior margin slightly concave; anatergite (posterior apex dark fuscous); anterior 5/8 katatergite (remainder dark fuscous); two parallel sided lateral postsutural vittae of medium width and ending at or just behind *ia* setae. Postnotum red-brown with dark fuscous to black lateral margins. Scutellum yellow with a narrow dark red-brown basal band. Setae: *sc.* 2; *prsc.* 2; *ia.* 1; *p.sa.* 1; *a.sa.* 1; *mpl.* 1; *npl.* 2; *scp.* 2.

Legs – Fulvous with apices of femora red-brown and hind tibiae pale fuscous to fuscous; mid tibiae each with an apical black spur.

Wings – Length 5.04mm; cells bc and c colourless and devoid of microtrichia; remainder of wings colourless except for fuscous cell sc, a short narrow fuscous costal band confluent with R_{2+3} and ending at apex of this vein, a small oval fuscous spot around apex of R_{4+5} ; cubital streak reduced to a pale tint within cell cup; a dense aggregation of microtrichia around A_1+CuA_2 ; supernumerary lobe of medium development.

Abdomen – Oval; terga free; pecten present on tergum III. Tergum I and sterna I and II wider than long. Tergum I red-brown with fuscous lateral margins; tergum II red-brown with a broad fulvous posterior margin; terga III-V red-brown with a black 'T' pattern (this is sometimes broken in centre of tergum III where the stem meets the transverse band); in some specimens there are narrow anterolateral fuscous corners on terga IV and V. A pair of oval red-brown shining spots on tergum V. Posterior lobe of surstylus short, sternum V with a deep concavity on posterior margin.

Attractant – Methyl eugenol.

Distribution – Endemic to India, Sri Lanka, Thailand and northern Vietnam and introduced into Mauritius and Egypt.

Hosts – A wide range of commercial/edible host fruits (see Allwood et al., 1999 for detailed listing and Tsuruta et al., 1997 for hosts recorded in Sri Lanka).

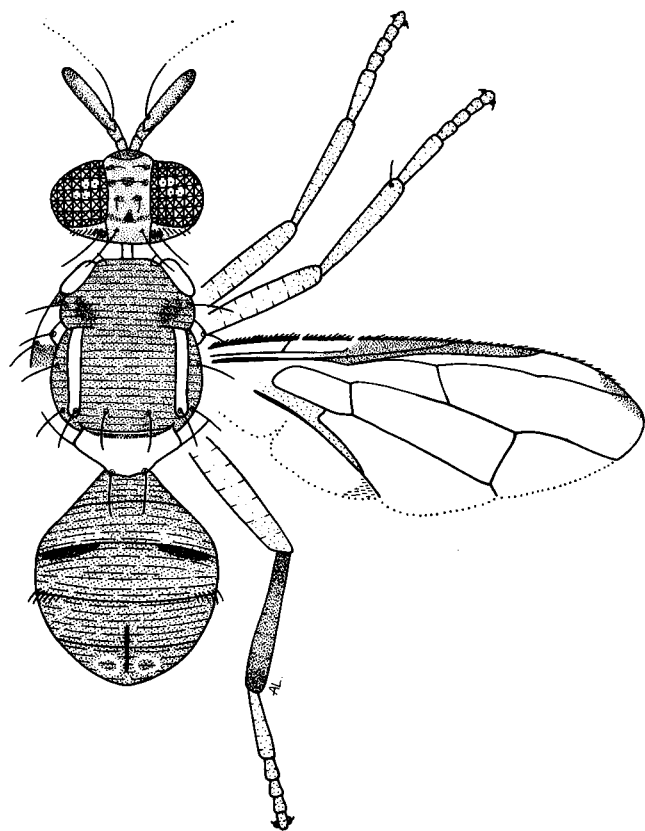


Fig. 14. *Bactrocera (Bactrocera) zonata* (Saunders), male.

Remarks. – *Bactrocera zonata* is a serious pest species in India but causes less damage in other parts of its distribution. It is a general red-brown species similar to *B. (Bactrocera) affinis* (Hardy) in having a wing pattern which is similar to that of *B. correcta* i.e. an incomplete costal band with a fuscous spot around apex of R_{4+5} . *Bactrocera correcta* is different in having a black scutum and black 'T' pattern on abdominal terga III-V. *Bactrocera zonata* differs from *B. affinis* in possessing *prsc.* setae and a wider mesopleural stripe which extends to the anterior *npl.* seta dorsally. *Bactrocera zonata* has recently been introduced into Egypt.

Bactrocera (Daculus) yercaudiae Drew, new species
(Fig. 15)

Material examined. – Holotype - male, INDIA: 15 km from Yercaud, 750m, coll. D. L. Hancock, 3 Jun.1992, attracted to cue lure, deposited in BMNH.

Paratypes – 1 male, same data as holotype; 1 male, Bangalore, coll. D. L. Hancock, 29 May.1992, attracted to cue lure; 1 male, Bangalore, Karnataka, 916m, coll. G. Bhat, 9 Feb.1988, attracted to cue lure; 1 male, Bangalore, Karnataka, 916m, coll. G. Bhat, 30 Feb.1988, attracted to cue lure, one paratype in ANIC, 1 in NPC, 2 in QDPI.

Description. – male

Head – Vertical length 1.79mm. Frons length 1.35 times breadth; red-brown with narrow fulvous lateral margins and pale fuscous around orbital setae and on anteromedial hump; latter covered with small pale hairs; orbital setae black: 1 *s.or.*, 2 *i.or.*; lunule red-brown. Ocellar triangle black. Vertex red-brown. Face fulvous with medium sized elongate-oval black spots; length mm. Genae fulvous, red-brown subocular spot present; red-brown seta present. Occiput red-brown, fulvous along eye margins; occipital row with 5-7 dark red-brown setae. Antennae with segments 1 and 2 red-brown, segment 3 red-brown with pale fuscous on apex and outer surface; a weak pale dorsal seta on segment 2; arista black (red-brown basally); length of segments: 0.22mm; 0.36mm; 0.89mm.

Thorax – Scutum orange-brown with red-brown markings as follows: narrow margins along inner sides of lateral postsutural vittae, below these vittae and occasional irregular shaped areas anterolaterally. Pleural areas orange-brown with, at most, narrow red-brown to fuscous along anterior margin of mesopleural stripe. Yellow markings as follows: postpronotal lobes (except anteromedial corners orange-brown); notopleura (except with orange-brown encroaching on anterior and posterior margins); narrow mesopleural stripe, equal in width to notopleuron dorsally, continuing to katepisternum below as a small transverse spot, anterior margin either straight or slightly concave; anatergite (posterior apex orange-brown); anterior $1/2$ katatergite (remainder orange-brown with narrow fuscous line along margin with yellow area); two narrow, parallel sided, lateral postsutural vittae beginning as a small spot anterior to mesonotal suture and ending at *ia.* setae. Postnotum orange-

brown with, at most, a narrow vertical fuscous line. Scutellum yellow with a broad red-brown basal band. Setae: *sc.* 2; *prsc.* absent; *ia.* 1; *p.sa.* 1; *a.sa.* absent; *mpl.* 1; *npl.* 2; *scp.* 2.

Legs – Fore femora red-brown with irregular shaped fuscous to dark fuscous patterns on outer surfaces, mid femora red-brown except pale fulvous on basal $\frac{1}{4}$ and with similar dark markings to fore femora, hind femora with basal $\frac{1}{2}$ pale fulvous and apical $\frac{1}{2}$ red-brown; fore tibiae pale fuscous, mid tibiae fulvous except pale fuscous basally, hind tibiae fuscous; all tarsi with basal segment pale fulvous and apical four segments fulvous; mid tibiae each with an apical red-brown spur.

Wings – Length 6.31mm; cells *bc* and *c* colourless; microtrichia in outer corner of cell *c* only; remainder of wings colourless except fuscous cell *sc*, narrow fuscous costal band just overlapping R_{2+3} as a pale tint and remaining narrow before ending just beyond extremity of R_{4+5} , a narrow fuscous cubital streak; dense aggregation of microtrichia around A_1+CuA_2 ; supernumerary lobe of medium development.

Abdomen – Oval; terga free; pecten present on tergum III. Tergum I and sterna I and II wider than long. Terga I and II red-brown except for a broad transverse fulvous band across posterior margin of tergum II; terga III-V red-brown with a “T” pattern made up of very narrow black bands. A

pair of oval fuscous to dark fuscous shining spots on tergum V. Posterior lobe of surstylus short, sternum V with a deep concavity on posterior margin.

Attractant – Cue lure.

Female – Not known.

Distribution – Southern India.

Hosts – No known record.

Remarks. – *Bactrocera yercaudiae*, new species, is here placed in the subgenus *Daculus* subject to a full revision of the supraspecific classification of the genus *Bactrocera*. It is similar to *B. (Javadacus) pallascentis* (Hardy) in having a red-brown scutum and anterior supra-alar setae absent. It differs from *B. pallascentis* in having the prescutellar setae absent and shorter posterior surstylus lobes. *Bactrocera yercaudiae* is similar to *B. (Bactrocera) affinis* (Hardy) in possessing a red-brown scutum, a narrow mesopleural stripe and prescutellar setae absent but differs from this species in having the anterior supra-alar setae absent and a complete costal band.

***Bactrocera (Sinodacus) binoyi* Drew, new species**
(Fig. 16)

Material examined. – Holotype – male, INDIA: New Amarambalam Forest, Kerala, coll. C. F. Binoy, 5 Mar.1999-22 Mar.1999, attracted to cue lure, deposited in BMNH.

Paratypes – 4 males, same data as holotype; 5 males, New Amarambalam Forest, Kerala, coll. C. F. Binoy, 5 Apr.1999-22 Apr.1999, attracted to cue lure; 2 males, S. India, Hort. Farm, Coonoor, 1450m, coll. D. L. Hancock, 29 May.1992, attracted to cue lure; 6 paratypes in QDPI, 2 in ANIC, 2 NPC, 1 in ZRC.

Description. – male.

Head – Vertical length 1.21mm. Frons length 1.25 times breadth; fulvous with dark fuscous around orbital setae and pale fuscous on anteromedial hump; latter covered with a large number of short pale hairs; orbital setae black: 1 *s.or.*, 3 *i.or.*; lunule fuscous. Ocellar triangle black. Vertex black. Face fulvous with medium sized circular black spots; length 0.48mm. Genae fulvous, dark fuscous subocular spot present; black seta present. Occiput broadly black with red-brown centrally, fulvous along eye margins; occipital row with 4-6 slender dark setae. Antennae with segments 1 and 2 red-brown, segment 3 dark fuscous; a weak dorsal seta on segment 2; arista black (red-brown basally); length of segments: 0.14mm; 0.22mm; 0.53mm.

Thorax – Scutum dull black with a large area of dark fuscous posteriorly and dark red-brown as a spot anterocentrally and inside postpronotal lobes. Pleural areas dark fuscous to black, slightly paler above mid coxae and below postpronotal lobes. Yellow markings as follows: postpronotal lobes; notopleura; a triangle along anterior margin of mesonotal suture;

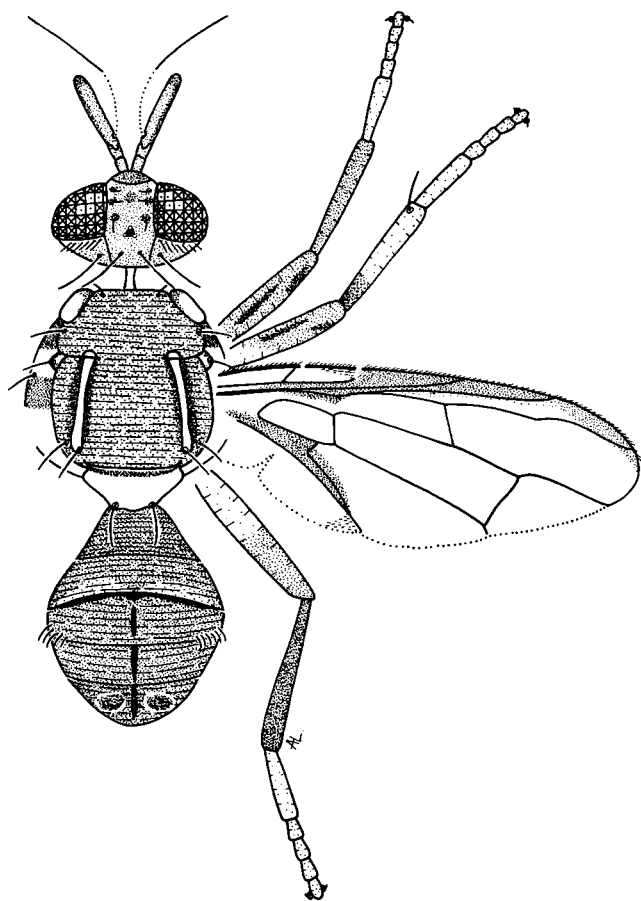


Fig. 15. *Bactrocera (Daculus) yercaudiae*, new species, male.

mesopleural stripe of medium width, reaching midway between anterior margin of notopleuron and anterior *npl.* seta dorsally, continuing to katapisternum as a large transverse spot, anterior margin straight; anatergite (posterior apex black); anterior 2/3 katatergite (remainder black). Lateral and medial postsutural vittae absent. Postnotum black with a narrow red-brown vertical band centrally. Scutellum yellow with a narrow black basal band. Setae black: *sc.* 2; *prsc.* absent; *ia.* 1; *p.sa.* 1; *a.sa.* 1; *mpl.* 1; *npl.* 2; *scp.* 4.

Legs – Fore femora fulvous basally with apical 2/3 dark fuscous to black, mid femora fulvous with apical 1/3 dark fuscous to black and hind femora fulvous basally with apical 1/4 dark fuscous to black; tibiae fulvous except with fuscous to dark fuscous on apical and basal margins of hind tibiae; all tarsi fulvous except pale fuscous on apical three segments; mid tibiae with a weak apical black spur.

Wings – Length 5.28mm; cells *bc* and *c* colourless; microtrichia in outer corner of cell *c* only; remainder of wings colourless except fuscous cell *sc*, narrow fuscous costal band just overlapping R_{2+3} as a pale tint and expanding around apex of R_{4+5} , a broad fuscous cubital streak; a dense aggregation of microtrichia around A_1+CuA_2 ; supernumerary lobe strong.

Abdomen – Elongate oval; terga free; pecten present on tergum III. Tergum I and sterna I and II as long as wide. Tergum I dark fuscous centrally, black laterally and with a narrow orange-brown posterior margin; tergum II black with posterior 1/2 fulvous and which becomes narrow laterally;

terga III-V orange-brown with a broad black 'T' pattern and broad lateral longitudinal dark fuscous bands over all three terga. A pair of oval orange-brown shining spots on tergum V. Posterior lobe of surstylus long, sternum V with a shallow concavity on posterior margin.

Attractant – Cue lure.

Female – Not known.

Distribution – Southern India.

Hosts – No known record.

Remarks. – *Bactrocera* (*Sinodacus*) *binoyi* and *B. watersi* (Hardy) are the only two species of the subgenus *Sinodacus* recorded from the Indian subcontinent. *B. binoyi* is easily separated from *B. watersi* in possessing a black scutum without medial and lateral postsutural vittae, a wider mesopleural stripe, an entirely yellow scutellum, costal band without a large apical spot, cells *bc* and *c* colourless and broad lateral longitudinal dark bands on abdominal terga III-V.

Bactrocera (*Zeugodacus*) *cucurbitae* (Coquillett)

Dacus cucurbitae Coquillett, 1899: 129. Lectotype female in NMNH.

See Drew, 1989: 212-213 for full list of synonyms.

Material examined. – 1 male, New Amarambalam Forest, Kerala, coll. S. Raghu, 15 Feb.1999-25 Feb.1999, attracted to cue lure. Specimen deposited in QDPI.

Diagnosis. – A medium sized species (wing length 6.20mm); a pair of medium sized elongate oval black facial spots present; postpronotal lobes yellow; notopleura yellow; scutum entirely red-brown or with fuscous to dark fuscous markings; mesopleural stripe slightly wider than notopleuron dorsally; two narrow lateral postsutural vittae of uniform width, beginning anterior to mesonotal suture and ending before *ia.* setae; a narrow, short medial postsutural vitta present; scutellum yellow with a narrow dark fuscous basal band; legs with femora fulvous except for apical dark patterns which are red-brown on fore femora and fuscous to dark fuscous on mid and hind femora, fore tibiae fuscous, mid tibiae fulvous with fuscous basally, hind tibiae dark fuscous, all tarsi fulvous; wing with narrow fuscous costal band overlapping R_{2+3} and expanding into a spot in wing apex, a broad fuscous cubital streak, a distinct fuscous pattern around *dm-cu* crossvein, a weak pale fuscous pattern around *r-m* crossvein; cells *bc* and *c* colourless, microtrichia in outer corner of cell *c* only; abdominal terga III-V orange-brown with a distinct black 'T' pattern and with anterolateral corners of terga IV and V fuscous to dark fuscous.

Attractant – Cue lure.

Distribution – Widespread in South East Asia and spread to many parts of the world (see Drew, 1989).

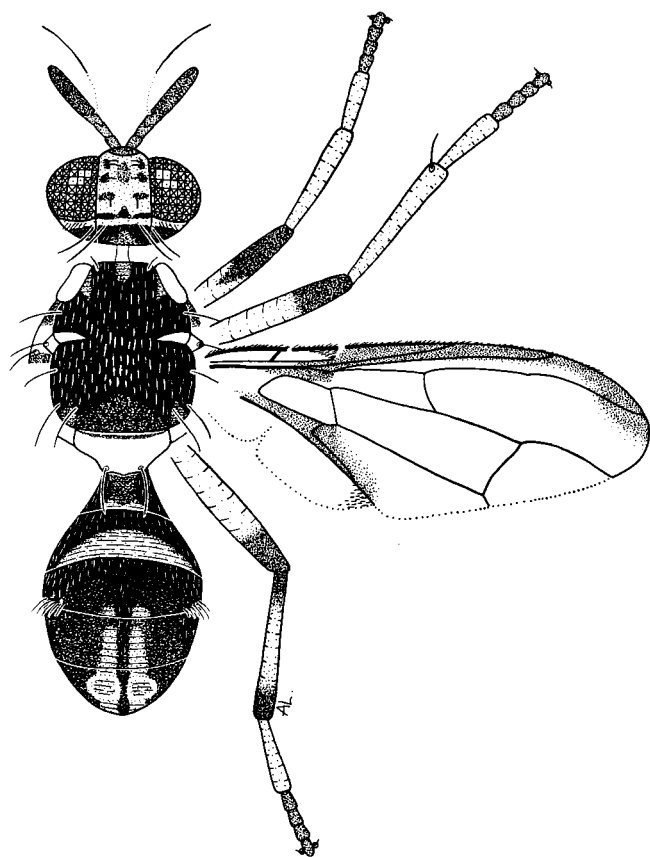


Fig. 16. *Bactrocera* (*Sinodacus*) *binoyi*, new species, male.

Hosts – A wide range of wild and commercial/edible fruits (see Allwood et al, 1999 for most recent detailed listing and Tsuruta et al., 1997 for hosts recorded in Sri Lanka).

Remarks. – *Bactrocera (Zeugodacus) cucurbitae* is recognised as one of the major worldwide tephritid pests. It has been spread to many countries from its area of endemism and is generally more common in disturbed or cultivated habitats. Only one specimen was collected in this survey which indicates that it is not common in the genuine rainforest areas. *Bactrocera cucurbitae* is best distinguished by the red-brown scutum with dark markings, lateral and medial postsutural vittae present, wing with a distinct spot in apex of costal band and infuscation around the r-m and dm-cu crossveins.

***Bactrocera (Zeugodacus) gavis* (Munro)**
(Fig. 17)

Dacus gavis Munro, 1935: 15. Holotype in ZSI.

Bactrocera (Zeugodacus) gavis – Tsuruta & White, 2001: 70.

Material examined. – Holotype - male, INDIA: Barkuda Id., Chilka Lake, Genjam dist., Madras Pres., coll. F. H. Gravely, 15-22 Jul.1916, deposited in ZSI

Others – 1 male, Marudamalai Hills, 1800 feet, coll. T.R.S.N., Coimbatore District, South India, Oct.1972, deposited in MHNG; 1 male, Vaikom, Ernakulum, Kerala, coll. S. Vijaysegaran, 11 Aug.1988, attracted to cue lure, deposited in QDPI.

Description. – male.

Head – Vertical length 1.30mm. Frons length 1.24 times breadth; red-brown with dark fuscous on anteromedial hump; latter covered with a large number of short pale hairs; orbital setae black: 1 *s.or.*, 2 *i.or.*; lunule pale fuscous. Ocellar triangle black. Vertex red-brown. Face fulvous with large oval black spots; length 0.54mm. Genae fulvous, dark fuscous subocular spot present; black seta present. Occiput dark fuscous, fulvous along eye margins; occipital row with a large number of weak pale setae. Antennae with segments 1 and 2 red-brown, segment 3 red-brown with dark fuscous on apex and outer surface; a weak dorsal seta on segment 2; arista black (red-brown basally); length of segments: 0.14mm; 0.24mm; 0.63mm.

Thorax – Scutum shining black except for a broad area of red-brown anteromedially. Pleural areas black without pale markings. Yellow markings as follows: postpronotal lobes; notopleura; a broad triangle along anterior margin of mesonotal suture; a broad mesopleural stripe reaching to postpronotal lobes dorsally, continuing to katapisternum as a very long transverse spot, anterior margin strongly concave; anatergite (posterior apex black); anterior 2/3 katatergite (remainder black); two broad parallel sided lateral postsutural vittae expanding behind *ia*. setae and joining to scutellum; a moderately long and broad medial postsutural vitta tapering to a point anteriorly and posteriorly. Postnotum black. Scutellum yellow except for narrow black basal band. Setae

black: *sc.* 4; *prsc.* 2; *ia.* 1; *p.sa.* 1; *a.sa.* 1; *mpl.* 1; *npl.* 2; *scp.* 2.

Legs – All segments fulvous except hind tibiae fuscous and apical four segments of hind tarsi fuscous; mid tibiae each with an apical black spur.

Wings – Length 4.86mm; cells bc and c colourless; microtrichia in outer corner of cell c only; remainder of wings colourless except fuscous cell sc, narrow fuscous costal band confluent with R_{2+3} and widening slightly across apex of R_{4+5} , a narrow pale fuscous cubital streak; a dense aggregation of microtrichia around A_1+CuA_2 ; supernumerary lobe of medium development.

Abdomen – Oval; terga free; pecten present on tergum III. Tergum I and sterna I and II wider than long. Tergum I orange-brown with broad lateral black margins; tergum II fulvous with a narrow transverse black band across anterior margin and widening laterally; terga III-V fulvous with a black 'T' pattern and broad anterolateral black markings on terga IV and V. A pair of oval fulvous shining spots on tergum V. Posterior lobe of surstylus long, sternum V with a slight concavity on posterior margin.

Attractant – Cue lure.

Female – Not known.

Distribution – Southern India, Sri Lanka.

Hosts – No known record.

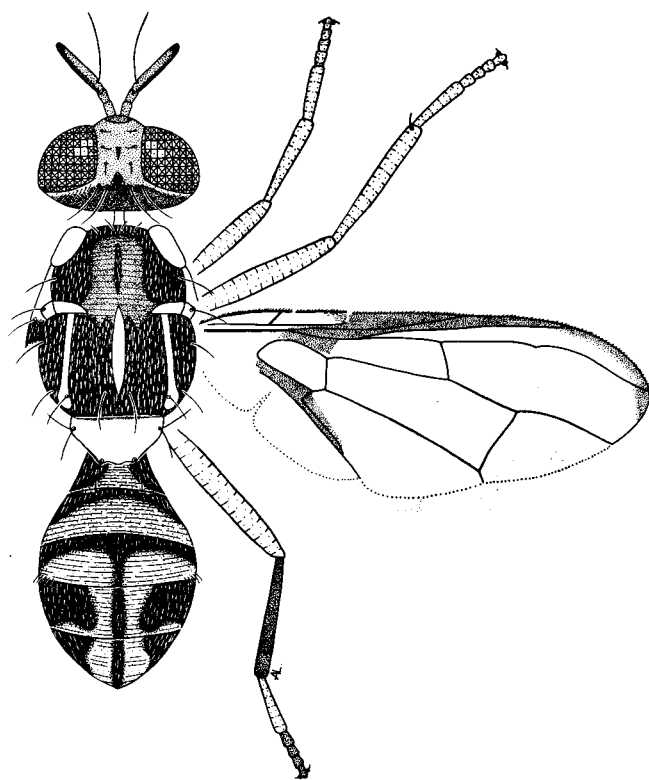


Fig. 17. *Bactrocera (Zeugodacus) gavis* (Munro), male.

Remarks. – *Bactrocera* (*Zeugodacus*) *gavisa* is similar to *B. (Zeugodacus) connexa* (Hardy) in possessing a predominantly black scutum, a broad mesopleural stripe reaching to the postpronotal lobe dorsally, and a narrow costal band confluent with R_{2+3} . *Bactrocera gavisa* differs from *B. connexa* in having a yellow triangular marking along anterior margin of mesonotal suture, a broad red-brown marking anteromedially on scutum, unique lateral postsutural vittae that widen posterior to *ia*. setae and almost reach the scutellum and broad lateral black markings on terga IV and V. The broad, inverted “L” shaped mesopleural stripe is a unique character that can be used to separate *B. gavisa* from other species of the subgenus *Zeugodacus* in India.

***Bactrocera (Zeugodacus) zahadi* Mahmood**
(Fig. 18)

Bactrocera (Zeugodacus) zahadi Mahmood, 1999: 232-234.
Holotype in BMNH.

Material examined. – INDIA: 1 male, New Amarambalam Forest, Kerala, coll. C. F. Binoy, 5 Mar.1999-22 Mar.1999, attracted to cue lure, deposited in QDPI.

Diagnosis. – A medium sized species (wing length 4.92mm); face fulvous with large circular/ angulate black spots; postpronotal lobes and notopleura yellow; scutum black except dark fuscous across posterior margin and red-brown anterocentrally from level of mesonotal suture to anterior margin (there is a black medial longitudinal black band within this area); lateral and medial postsutural vittae present; a yellow spot anterior to mesonotal suture in line with each

lateral postsutural vitta; mesopleural stripe slightly wider than notopleuron dorsally, continuing on to katepisternum as a large transverse band, anterior margin straight; scutellum yellow except for a narrow black basal band; wing with a narrow fuscous costal band confluent with R_{2+3} and expanding into a distinct spot around apex of R_{4+5} and a broad fuscous cubital streak; costal cells colourless with microtrichia in outer corner of cell c only; legs with femora fulvous except for dark fuscous subapical spots on outer surfaces of all femora and fuscous around remainder of apices of mid and hind femora, fore tibiae fuscous, mid tibiae fulvous except for fuscous basally, hind tibiae dark fuscous, tarsal segments fulvous except apical four segments tending fuscous; abdominal terga III-V fulvous except for a distinct black ‘T’ pattern and broad dark fuscous lateral margins on terga IV and V; a pecten on tergum III and a pair of oval fulvous shining spots on tergum V; posterior lobe of surstylus long and posterior margin of sternum V almost straight (very slightly concave; abdominal sterna I, III, IV and V dark fuscous to black.

Attractant – Cue lure.

Female – Not studied but recorded by Mahmood (1999).

Distribution – Southern India, Sri Lanka.

Hosts – No known record.

Remarks. – This species is a member of the *tau* – complex that we are presently studying as part of a large study of the *Bactrocera (Zeugodacus)* of South East Asia. Consequently, a detailed description will be included in this major study and published at a later date. *Bactrocera zahadi* differs from *B. (Zeugodacus) tau* (Walker) in having the costal band confluent with R_{2+3} (not just overlapping this vein) and the scutum black with red-brown anterocentrally.

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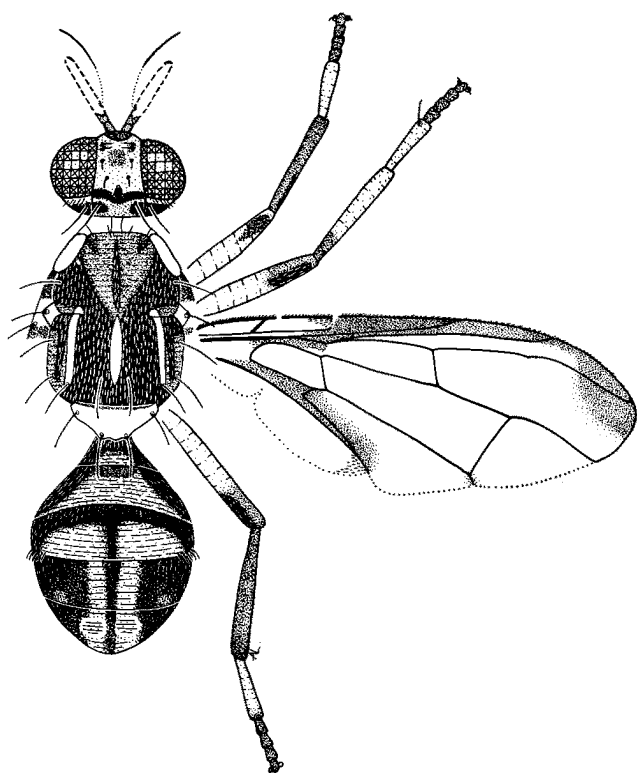


Fig. 18. *Bactrocera (Zeugodacus) zahadi* Mahmood, male.

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