RECORDS OF DACINE FRUIT FLIES AND NEW SPECIES OF DACUS (DIPTERA: TEPHRITIDAE) IN BHUTAN

R. A. I. Drew and M.C. Romig

International Centre for the Management of Pest Fruit Flies, Australian School of Environmental Studies, Faculty of Environmental Sciences, Griffith University, QLD 4111, Australia
Email: D.Drew@griffith.edu.au (Corresponding author)

C. Dorji
National Plant Protection Centre, Department of Agriculture, Ministry of Agriculture, Thimphu, Bhutan

ABSTRACT.– Twenty-nine species of Bactrocera Macquart and Dacus Fabricius are recorded from Bhutan, including two new species, Dacus (Mellesis) dorjii Drew & Romig and Dacus (Mellesis) fletcheri Drew. Information is given on location of type specimens, host plants, attractant records and geographic distributions for all species. For revised species, synonymies, diagnoses and remarks are also included.

KEY WORDS.– Tephritidae, Dacinae, Bactrocera, Dacus, Bhutan.

INTRODUCTION

The subfamily Dacinae, consisting primarily of two major genera, Bactrocera Macquart and Dacus Fabricius, is distributed from the southern and eastern African continent, across southern Asia and the Indian subcontinent, through southeast Asia and across the southern Pacific zone (Tsuruta & White, 2001; Drew, 2004). The fauna in the southern Asian and Indian subcontinental areas has been described primarily by Bezzi (1913, 1915, 1916), Kapoor (1971, 1993), Munro (1935, 1939), Perkins (1938), Hering (1956), Hardy (1971), Drew & Hancock (1994), Drew et al. (1998), White & Evenhuis (1999), Tsuruta & White (2001) and Drew & Raghu (2002). However, the fauna of Bhutan has not previously been extensively surveyed and researched. This fauna is distributed in a unique region for the Dacinae which is widely regarded as a tropical/subtropical subfamily of Tephritidae. The species in Bhutan are the most northern of all Dacinae in the general area of distribution of the subfamily and the fact that they occur in higher altitudes in the southern and eastern escarpment of the Himalayas, makes them particularly interesting. This paper presents records and new species collected during a survey in Bhutan from 2000 to 2005.

MATERIALS AND METHODS

Morphological terminology follows Drew & Hancock (1994). Specimens have been received on loan for study from or are located in the Australian National Insect Collection, CSIRO, Canberra (ANIC); The Natural History Museum, London, UK (BMNH); Bernice P. Bishop Museum, Honolulu, Hawaii, USA (BPBM); Deutsches Entomologisches Institut, Eberswalde, Germany (DEI); Institute of Zoology, Academia Sinica, Beijing, China (IZAS); Hungarian Natural History Museum, Budapest, Hungary (MNM); Museo Civico di Storia Naturale, Milano, Italy (MSNM); Museum Zoologicum Bogoriense, Bogor, Java (MZB); National Plant Protection Centre, Thimphu, Bhutan (NPPC); Queensland Department of Primary Industries, Brisbane, Australia (QDPI); Queensland Museum, Brisbane, Australia (QM); University of Queensland Insect Collection, Brisbane, Australia (UQIC); National Museum of Natural History, Smithsonian Institution, Washington D.C., USA (USNM); Zoologisches Museum, Berlin, Germany (ZMB); Zoological Museum, University of Copenhagen, Denmark (ZMUC); Zoological Reference Collection of the Raffles Museum of Biodiversity Research, National University of Singapore (ZRC); Zoological Survey of India, Kolkata (ZSI).

SPECIES LIST OF BACTROCERA AND DACUS FOUND IN BHUTAN

Bactrocera Macquart

Bactrocera (Bactrocera) aethriobasis (Hardy)
Bactrocera (Bactrocera) correcta (Bezzi)
Bactrocera (Bactrocera) dorsalis (Hendel)
Bactrocera (Bactrocera) gombokensis Drew & Hancock
Bactrocera (Bactrocera) invadens Drew, Tsuruta & White
Bactrocera (Bactrocera) nigrofemoralis White & Tsuruta
Bactrocera (Bactrocera) rubiginosa Wang & Zhao
Bactrocera (Bactrocera) tuberculata (Bezzi)
Bactrocera (Bactrocera) verbascifoliae Drew & Hancock
Bactrocera (Bactrocera) vishnu Drew & Hancock
Bactrocera (Bactrocera) zonata (Saunders)
Bactrocera (Hemigynmodacus) diversa (Coquillett)
Bactrocera (Tetracoccus) minax (Enderlein)
Bactrocera (Zeugodacus) assamensis White
Bactrocera (Zeugodacus) atrifacies (Perkins)
Bactrocera (Zeugodacus) biguttata (Bezzi)
Bactrocera (Zeugodacus) cucurbitae (Coquillett)
Bactrocera (Zeugodacus) diaphora (Hendel)
Bactrocera (Zeugodacus) scutellaris (Bezzi)
Bactrocera (Zeugodacus) scutellata (Hendel)
Bactrocera (Zeugodacus) signata (Hering)
Bactrocera (Zeugodacus) tui (Walker)
Bactrocera (Zeugodacus) yoshinotoi (Hardy)
Bactrocera (Zeugodacus) zahadi Mahmood

Dacus Fabricius

Dacus (Callistra) longicornis (Wiedemann)
Dacus (Melissia) dorji, new species
Dacus (Melissia) jeffeni White
Dacus (Melissia) fletcheri, new species
Dacus (Melissia) siamensis Drew & Hancock

TAXONOMY

Bactrocera Macquart

Bactrocera (Bactrocera) aethriobasis (Hardy)

Dacus aethriobasis Hardy, 1973: 30. Holotype male in KUB.
Bactrocera (Bactrocera) aethriobasis – Norrbom et al., 1998: 87.


Diagnosis. – A large species; face fulvous with a pair of medium sized oval black spots; scutum entirely red-brown, postpronotal lobes and notopleura yellow, mesopleural stripe reaching anterior npl. seta dorsally, broad parallel sided lateral postsutural vittae ending behind ia. seta, medial postsutural vitta absent; setae: sc. 2; prsc. 2; ia. 1; p.sa. 1; a.sa. 1; mpl. 1; npl. 2; scp. 4; scutellum yellow with narrow red-brown basal band; legs with all segments entirely fulvous; wings with cells bc and c colourless and entirely devoid of microtrichria, narrow pale fuscous costal band confluent with R3+4, and extremely narrow and very pale fuscous beyond apex of R3+4, around costal margin of wing to end just beyond extremity of R3+4, cubital streak reduced to pale fuscous within cell cup, supernumerary lobe weak; abdominal terga III-V either entirely dark fuscous to black or dark fuscous to black with dark red-brown either side of a medial longitudinal black band from centre of tergum IV to cover anterior 3/4 of tergum V, a pair of oval black shining spots on tergum V.

Attractant. – Methyl eugenol.


Hosts. – Wide host range in wild and commercial fruits (see Allwood et al., 1999).

Remarks. – A non pest species previously recorded only from Widespread (Pakistan, India, Nepal, Sri Lanka, Thailand, Southern China). New record for Bhutan. It is readily distinguished by the following characters – scutum red-brown, broad parallel sided lateral postsutural vittae, wings with a very narrow costal band and cubital streak absent, abdominal terga III-V black.

Bactrocera (Bactrocera) correcta (Bezzi)

Bactrocera (Bactrocera) correcta – Liang et al., 1993: 137; Norrbom et al., 1998: 89.

Material examined. – BHUTAN: 1 male, Thimphu, Lumitshawa, 18 Oct. 2000, coll. C. Dorji, attracted to methyl eugenol. Specimen in NPPC.

Diagnosis. – Face fulvous with a pair of small transverse oval black spots; scutum with base colour mostly black, postpronotal lobes and notopleura yellow, mesopleural stripe reaching to anterior npl. seta dorsally, moderately broad parallel sided lateral postsutural vittae reaching to ia. seta, medial postsutural vitta absent; setae: sc. 2; prsc. 2; ia. 1; p.sa. 1; a.sa. 1; mpl. 1; npl. 2; scp. 2; scutellum yellow except for narrow black basal band; legs with all segments entirely fulvous except tending fuscous apically on hind tibiae; wings with cells bc and c colourless and entirely devoid of microtrichria, narrow costal band confluent with R3+4 and ending at apex of this vein, a small fuscous spot around apex of R3+4, cubital streak absent, supernumerary lobe weak; abdominal terga III-V red-brown with a black ‘T’ pattern consisting of a narrow transverse black band across anterior margin of tergum III and a narrow medial longitudinal black band over all three terga and very narrow dark fuscous lateral margins on terga IV and V, a pair of oval red-brown shining spots on tergum V.

Attractant. – Methyl eugenol.

Distribution. – Thailand. New record for lower altitudes of Bhutan.

Hosts. – No known record.

Remarks. – A non pest species previously recorded only from Thailand. It is readily distinguished by the following characters – scutum red-brown, broad parallel sided lateral postsutural vittae, wings with a very narrow costal band and cubital streak absent, abdominal terga III-V black.
**Bactrocera (Bactrocera) dorsalis** (Hendel)


*Dacus ferrugineus* – Fabricius, 1805: 274.

*Dacus dorsalis* Hendel, 1912: 18. Lectotype female, Taiwan: Koshun, Formosa, ix.08 (Sauter) (BMNH).

*Bactrocera ferruginea* – Bezzì, 1913: 95.

*Chaetodacus ferrugineus var. dorsalis* (Hendel), Hendel, 1915: 426.

*Chaetodacus ferrugineus* – Bezzì, 1916: 104.

*Chaetodacus ferrugineus dorsalis* – Bezzì, 1916: 104.

*Chaetodacus ferrugineus var. okinawanus* Shiraki, 1933: 62; Hardy & Adachi, 1956: 8; Hardy, 1969: 402 (syn.).


*Strumeta dorsalis* – Hering, 1956: 63.

*Strumeta ferruginea* – Hering, 1956: 63.


*Bactrocera (Bactrocera) dorsalis* – Drew & Hancock, 1994: 24; Norrbom et al., 1998: 91. Holotype male in BMNH.

**Material examined.** – BHUTAN: a large number of specimens collected in areas of Bhutan below 1500 m altitude in both cultivated and subtropical habitats. All specimens attracted to methyl eugenol. Specimens in NPPC and QDPI.

**Diagnosis.** – Face fulvous with a pair of medium sized circular black spots; scutum with base colour black, postpronotal lobes and notopleura yellow, mesopleure stripe reaching midway between anterior margin of notopleuron and anterior npl. seta dorsally, a pair of broad parallel sided lateral postsutural vittae ending just behind ia. seta, medial postsutural vitta absent; setae: sc. 2; prsc. 2; ia. 1; p.sa. 1; a.sa. 1; mpl. 1; npl. 2; scp. 4; scutellum yellow with a narrow black basal band; legs with segments mostly fulvous except fore tibiae pale fuscous and hind tibiae fuscous; wings with cells bc and c colourless, microtrichia in outer corner of cell c only, narrow fuscous costal band confluent with R\(_{3+4}\) and remaining narrow around costal margin to end just beyond apex of R\(_{4+5}\), a narrow pale fuscous cubital streak, supernumerary lobe weak; abdominal terga III-V fulvous with a black ‘T’ pattern consisting of a narrow transverse black band across anterior margin of tergum III and a narrow mediolongitudinal black band over all three terga, narrow dark fuscous to black anterolateral corners on terga IV and V (in some specimens the lateral margins of tergum III tend to have medium width lateral dark fuscous to black bands, a pair of oval fulvous shining spots on tergum V (see Drew & Hancock, 1994 for a complete description).

**Attractant.** – Methyl eugenol.

**Distribution.** – Widespread from the Indian subcontinent, across southeast Asia and the northern Pacific (see Drew & Hancock, 1994).

**Hosts.** – A very wide range of wild and commercial fruits (see Allwood et al., 1999).

**Remarks.** – This species has been adequately described and illustrated by Drew & Hancock (1994). It is recognized as a species of major economic significance within the *dorsalis* complex. The *dorsalis* complex comprises species with a black scutum, lateral postsutural vittae present, medial postsutural vitta absent, wings colourless except for narrow costal band, abdominal terga III-V pale with a black ‘T’ pattern.

---

**Bactrocera (Bactrocera) gombokensis** Drew & Hancock

*Bactrocera (Bactrocera) gombokensis* Drew & Hancock, 1994: 24; Norrbom et al., 1998: 91. Holotype male in BMNH.


**Diagnosis.** – A medium sized species; face fulvous with a pair of large circular black spots; scutum base colour black, postpronotal lobes and notopleura yellow, mesopleure stripe reaching midway between anterior margin of notopleuron and anterior npl. seta dorsally, a pair of medium width parallel sided lateral postsutural vittae ending at ia. seta, medial postsutural vitta absent; setae: sc. 2; prsc. 2; ia. 1; p.sa. 1; a.sa. 1; mpl. 1; npl. 2; scp. 4; scutellum yellow with a narrow black basal band; legs with femora fulvous with large black subapical spots on outer surfaces; wings with cells bc and c colourless, microtrichia in outer corners of cell c only, a narrow fuscous costal band confluent with R\(_{3+4}\), and remaining narrow around costal margin to end just beyond apex of R\(_{4+5}\), a narrow pale fuscous cubital streak, supernumerary lobe weak; abdominal terga III-V orange-brown with a ‘T’ pattern consisting of a narrow transverse black band across anterior margin of tergum III and widening to cover outer 1/3 of the lateral margins, a narrow mediolongitudinal black band over all three terga, anterolateral corners of terga IV and V dark fuscous to black.

**Attractant.** – Cue lure.

**Distribution.** – Peninsular Malaysia. New record for Bhutan.

**Hosts.** – No known record.

**Remarks.** – *Bactrocera gombokensis* Drew & Hancock is a non-pest member of the *dorsalis* complex. It is readily distinguished by the following characters – large black spots on outer apical surfaces of all femora, costal band narrow without apical expansion and cubital streak absent.
**Diagnosis.** – A medium sized species; face fulvous with a pair of medium to large oval black spots; scutum with base colour red-brown with variable dark fuscous to black patterns (in occasional specimens the scutum base colour is black), postpronotal lobes and notopleura yellow, mesopleural stripe reaching midway between anterior margin of notopleuron and anterior npl. seta dorsally, a pair of broad parallel sided lateral postsutural vittae reaching at or just behind ia, seta, medial postsutural vitta absent; setae: sc. 2; prsc. 2; ia. 1; p.sa. 1; a.sa. 1; mpl. 1; npl. 2; scp. 4; scutellum yellow except for narrow dark basal band; legs with femora entirely fulvous; wings with cells bc and c colourless, microtrichia in outer corner of cell c only, narrow fuscous costal band confluent with R3-4, and remaining narrow around costal margin to end just beyond extremity of R4-5, a narrow pale fuscous cubital streak, supernumerary lobe weak; abdominal terga III-V orange-brown with a ‘T’ pattern consisting of a narrow transverse black band across anterior margin of tegum III which expands to cover lateral margins, a narrow medial longitudinal black band over all three tegra, narrow dark fuscous to black lateral margins on terga IV and V, dark orange-brown shining spots on tegum V.

**Attractant.** – Methyl eugenol.

**Distribution.** – Sri Lanka, Central Africa. New record for Bhutan.

**Hosts.** – Recorded from guava, mango, citrus, papaya, and some wild hosts in Africa (see Drew et al., 2005).

**Remarks.** – This species was recently described (Drew et al., 2005) after it invaded central Africa from Kenya through to Ghana. It is proving to be a major pest in the countries it has invaded and has probably originated in Sri Lanka. It is similar to Bactrocera dorsalis (Hendel), Bactrocera kandiensis Drew & Hancock and Bactrocera rubigina Wang & Zhao. It differs from *B. dorsalis* in having a red-brown scutum occasionally with dark patterns, narrow lateral postsutural vittae and a longer male aedeagus. It differs from *B. kandiensis* in having a smaller bare colourless area adjacent to cell bm in the wing and from *B. rubigina* in having a narrower costal band not overlapping R2-3, a more distinct dark ‘T’ pattern on abdominal terga III-V, shining spots on tegum V pale coloured and males attracted to methyl eugenol.

---

**Diagnosis.** – Face entirely black except narrow fulvous lateral margins and dorsally below antennal sockets; scutum entirely black, postpronotal lobes and notopleura yellow, mesopleural stripe reaching anterior npl. seta dorsally, narrow parallel sided lateral postsutural vittae reaching to ia. seta, medial postsutural vitta absent; setae: sc. 2; prsc. 2; ia. 1; p.sa. 1; a.sa. 1; mpl. 1; npl. 2; scp. 4; scutellum yellow except for narrow to medium black basal band; legs with fore femora shining black on entire outer surfaces, fulvous on inner surfaces and on basal and apical extremities, mid femora entirely shining black except dark fulvous on basal and apical extremities, hind femora fulvous except shining black on apical 1/3, fore tibiae fuscous, mid tibiae dark fuscous to black sides, hind tibiae dark fuscous, tarsal segments entirely dark fuscous with fore femora shining black on apical 3/4, a very narrow fuscous cubital streak, supernumerary lobe weak; abdominal tegum III dark fuscous to black except red-brown posteroventrally either side of a narrow medial longitudinal black band, tegum IV fuscous to dark fuscous except red-brown posteroventrally either side of a narrow medial longitudinal black band (the posteroventral red-brown markings extend towards the lateral margins), tegum V red-brown with dark fuscous anterolateral corners and a narrow medial longitudinal fuscous to black band, a pair of oval dark fuscous to black shining spots on tegum V.

**Attractant.** – Cue lure.

**Distribution.** – Southern India, Sri Lanka. New record for Bhutan.

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

**Remarks.** – This species belongs to a group similar to *Bactrocera nigrotibialis* (Perkins), having a black scutum, wings with a narrow fuscous costal band and cubital streak, femora and tibiae with extensive areas of black and abdominal tegra mostly black. It is distinct in possessing a broader mesopleural stripe reaching dorsally to the anterior npl. seta, and the lateral postsutural vittae narrow, parallel sided and reaching to the ia. seta. It is not known to be a pest species.
**Bactrocera (Bactrocera) rubigina** Wang & Zhao

*Dacus rubiginus* Wang & Zhao, 1989: 211. Holotype male in IZAS.  
*Bactrocera (Bactrocera) rubigina* – Liang et al., 1993: 138; Norrbom et al., 1998: 95.


**Diagnosis.** – Face fulvous with a pair of medium sized oval black spots; scutum with base colour red-brown and dark red-brown to fuscous shining spots on tergum V, anterolateral corners of terga IV and V dark fuscous, a narrow medial longitudinal black band over abdominal terga III–V entirely black. Wing with costal band overlapping R2+3 where it is very pale and widening slightly beyond apex of R2+3, to end beyond extremity of R4+5, a narrow fuscous cubital streak, supernumerary lobe weak; abdominal terga III–V red-brown with a ‘T’ pattern consisting of a narrow transverse black band across anterior margin of tergum III and widening to cover lateral margins where it tends to be dark fuscous, a narrow medial longitudinal black band over all three terga but ending before posterior margin of tergum V, anterolateral corners of terga IV and V dark fuscous, a pair of dark red-brown to fuscous shining spots on tergum V.

**Attractant.** – Cue lure.

**Distribution.** – China (Hainan). New record for Bhutan.

**Hosts.** – *Litsea verticillata* (Family Lauraceae) (see Liang et al., 1993).

**Remarks.** – This species is similar to *Bactrocera invadens* Drew, Tsuruta & White in general body colours. See remarks on *B. invadens* for similarities and differences. It is important to note that males of *B. rubigina* Wang & Zhao respond to cue lure while males of *B. invadens* respond to methyl eugenol. *Bactrocera rubigina* is not a pest species.

**Bactrocera (Bactrocera) tuberculata** (Bezzi)

*Chaetodacus tuberculatus* Bezzi, 1916: 106. Holotype male in BMNH.  
*Bactrocera (Bactrocera) tuberculata* – Liang et al., 1993: 138; Norrbom et al., 1998: 96.


**Diagnosis.** – Face fulvous with a pair of medium sized circular black spots; scutum entirely black, postpronotal lobes and notopleura yellow, mesopleural stripe reaching almost to anterior npl. seta dorsally, a pair of broad parallel sided lateral postspiracular vittae ending behind ia. seta, medial postspiracular vitta absent; setae: sc. 2; prsc. 2; ia. 1; p.sa. 1; a.sa. 1; mpl. 1; npl. 2; scp. 4; scutellum yellow except for a narrow black basal band; legs with all segments entirely fulvous; wings with cells bc and c colourless and entirely devoid of microtrichria, a narrow pale fuscous costal band confluent with R3+4 and ending at extremity of this vein, a small fuscous spot around apex of R4+5, a very narrow pale fuscous cubital streak, supernumerary lobe weak; abdominal terga III–V entirely black.

**Attractant.** – Methyl eugenol.

**Distribution.** – Myanmar, Southwest China. New record for Bhutan.

**Hosts.** – A range of commercial and wild hosts (see Allwood et al., 1999).

**Remarks.** – This species is unique in having a black scutum, abdominal terga III–V entirely black, wing with costal band terminating at apex of R3+4 and a small fuscous spot around apex of R4+5. It is not known to be a pest species.

**Bactrocera (Bactrocera) verbascifoliae**  
Drew & Hancock

*Bactrocera (Bactrocera) verbascifoliae* Drew & Hancock, 1994: 64; Norrbom et al., 1998: 96. Holotype female in BMNH.
Drew & Romig: Dacine fruit flies in Bhutan


Diagnosis. – Face fulvous with a pair of medium size circular black spots; scutum with base colour black, postpronotal lobes and notopleura yellow, mesopleural stripe reaching midway between anterior margin of notopleuron and anterior npl. seta dorsally, a pair of narrow parallel sided lateral postspiracular vittae ending at ia. seta, medial postspiracular vitta absent; setae: sc. 2; prsc. 2; ia. 1; p.sa. 1; a.sa. 1; mpl. 1; npl. 2; scp. 4; scutellum yellow except for narrow black basal band; legs with femora entirely fulvous except for a large oval black spot on outer apical surfaces of fore femora, fore and mid tibiae fulvous tending dark fuscous basally, hind tibiae dark fuscous, tarsi with all segments entirely fulvous; wings with cells bc and c colourless, microtrichia in outer corner of cell c only, narrow fuscous costal band just overlapping R4+5 and remaining narrow to end just beyond extremity of R4+5, a narrow fuscous cubital streak confined to cell cup, supernumerary lobe weak; abdominal terga III-V dark orange-brown except for dull black across anterior 1/2 of tergum III and expanding to cover lateral margins and anterolateral corners of terga IV and V dark fuscous to black.

Attractant. – Methyl eugenol.

Distribution. – Southern India. New record for Bhutan.

Hosts. – No known record.

Remarks. – This species is a non pest member of the dorsalis complex and is distinct in having a large oval preapical black spot on the fore femora, a narrow medial longitudinal dark band on abdominal terga III-V and fuscous shining spots on tergum V (see Drew & Hancock, 1994).

Bactrocera (Bactrocera) zonata (Saunders)

Dasyneura zonata Saunders, 1842: 61.
Bactrocera maculigera Doleschall, 1858: 122.
Rivellia persicata Bigot, 1890: 192.
Dacus ferrugineus var. mangiferae Cotes, 1893: 17.
Bactrocera (Bactrocera) zonata – Norrbom et al., 1998: 96.

Material examined. – BHUTAN: a large number of specimens collected across Bhutan from the following locations below approx. 1600 m – Sarpang District, Purana Bastey, Gelephu; Mongar District, Namling; Chukha District, Phuentsholing; Punakha District, Rimchu. All specimens attracted to methyl eugenol. Specimens in NPPC and QDPI.

Diagnosis. – Face fulvous with small circular black spots; scutum entirely red-brown, postpronotal lobes and notopleura yellow, mesopleural stripe reaching to anterior npl. seta dorsally, medium width parallel sided lateral postspiracular vittae reaching just behind ia. seta, medial postspiracular vitta absent; setae: sc. 2; prsc. 2; ia. 1; p.sa. 1; a.sa. 1; mpl. 1; npl. 2; scp. 2; scutellum yellow except for a narrow red-brown basal band; legs with all segments fulvous except hind tibiae pale fuscous; wings with cells bc and c colourless and devoid of microtrichia, pale fuscous costal band confluent with R4+5, and ending at apex of this vein, small fuscous spot around apex of R4+5 cubital streak absent but with a very pale fuscous tint in cell cup, supernumerary lobe weak; abdominal terga III-V red-brown with a narrow transverse black band across anterior margin of tergum III and expanding to dark fuscous
across lateral margins and a narrow medial longitudinal black band over all three terga (these dark patterns can be reduced to a narrow transverse band across anterior margin of tergum III sometimes broken in the midline and the medial longitudinal band reduced to a narrow dark fuscous line on tergum V), a pair of oval red-brown shining spots on tergum V.

**Attractant.** – Methyl eugenol.

**Distribution.** – Sri Lanka, India, Nepal, China, Thailand. New record for Bhutan.

**Hosts.** – Flowers of a range of wild and commercial species of the Family Cucurbitaceae.

**Remarks.** – Bactrocera diversa (Coquillett) is a biologically unusual species of Dacinae in that it oviposits into flowers of its host, not fruit. It is readily distinguished by the following characters – face entirely fulvous (no dark patterns), scutum black with lateral and medial postsutural vittae, yellow spot anterior to mesonotal suture, wing with cells bc and c colourless, narrow costal band confluent with R4+5, strong supernumerary lobe in males, legs with subapical dark spots on all femora, abdominal terga III-V with black ‘T’ patterns on all terga. It is a pest species in that it causes loss of flowers in commercial crops but does not have quarantine significance for export trade.

Bactrocera (Hemigymnodacus) diversa (Coquillett)

*Dacus diversus* Coquillett, 1904: 139. Syntypes in USNM.

*Dacus quadrifidus* Hendel, 1928: 343.

*Dacus citronellae* Kapoor & Katryar, 1969: 123.

*Dacus (Hemigymnodacus) diversus* – Hardy, 1973: 19.

*Bactrocera (Hemigymnodacus) diversa* – Liang et al., 1993: 138.

*Bactrocera (Paratridacus) diversa* – Norrbom et al., 1998: 99.

**Material examined.** – BHUTAN: 1 male, Purana Bastey, 30 Nov.2004, coll. Karma Namgyel, attracted to methyl eugenol. Specimen in NPPC.

**Diagnosis.** – Face entirely fulvous without dark markings; scutum entirely black, postpronotal lobes and notopleura yellow, mesopleural stripe almost reaching anterior npl. seta dorsally, broad parallel sided lateral postsutural vittae beginning with a small spot anterior to mesonotal suture and ending just behind ia. seta, a narrow medial longitudinal postsutural vitta present; setae: sc. 2; prsc. 2; ia. 1; p.sa. 1; a.sa. 1; mpl. 1; npl. 2; scp. 2; scutellum yellow except for narrow black basal band; legs with femora fulvous with dark fuscous to black subapical spots on outer surfaces of all femora (on the mid femora they cover approximately 1/2 the outer apical surface), fore and mid tibiae fulvous tending dark fuscous basally, hind tibiae dark fuscous, tarsal segments entirely fulvous; wings with cells bc and c colourless, microtrichia in outer corner of cell c only, narrow dark fuscous costal band confluent with R4+5, and widening across apex of wing, medium width dark fuscous cubital streak present, supernumerary lobe strong and rounded; abdominal terga III-V red-brown with distinct ‘T’ patterns on terga III and IV consisting of a transverse black band across anterior margin of each tergum and a medium width medial longitudinal black band running to hind margin of each tergum, tergum V red-brown with large anterolateral dark fuscous to black corners and a narrow medial longitudinal dark fuscous to black band on anterior 1/2, a pair of red-brown oval shining spots on tergum V.

**Attractant.** – Methyl eugenol.

**Distribution.** – From Sri Lanka, India and Pakistan through to Vietnam. New Record for Bhutan.

**Remarks.** – A wide range of wild and commercial host plants (see Allwood et al., 1999).

**Diagnosis.** – Face entirely fulvous without dark markings; scutum entirely black, postpronotal lobes and notopleura yellow, a broad lateral yellow band connecting postpronotal lobe and notopleuron, mesopleural stripe extending anterior to npl. seta dorsally, two broad parallel sided lateral postsutural vittae ending at ia. seta, a short narrow medial longitudinal postsutural vitta; setae: sc. 2; prsc. absent; ia. 1; p.sa. 1; a.sa. absent; mpl. 1; npl. 2; scp. 2; scutellum yellow with a narrow red-brown basal band; legs with all segments mostly fulvous; wings with cells bc and c fuscous, microtrichia in outer corner of cell bc and outer 1/2 of cell c, a broad fuscous costal band overlapping R4+5 and becoming darker towards the apex but not expanding into a spot, a narrow fuscous cubital streak but not reaching margin of wing, supernumerary lobe weak; abdomen elongate oval and petiolate (similar to many Dacus species), terga III-V orange-brown with a moderately broad transverse fuscous band across anterior
margin of tergum III and a medium width medial longitudinal pale fuscous band over all three terga, anterolateral corners of tergum IV fuscous, anterolateral corners of tergum V pale fuscous.

**Attractant.** – Weak attraction to methyl eugenol during 2000 field work in Bhutan.

**Distribution.** – Sikkim, India, Bhutan, China.

**Hosts.** – A wide range of wild and edible citrus (Family Rutaceae).

**Remarks.** – Bactrocera minax (Enderlein) is an extremely large species, probably the largest known Bactrocera. It is readily distinguished by its Dacus (Callantra) like petiolate abdomen shape, general red-brown colour patterns on the thorax and abdomen, broad costal band overlapping R₄₊₅ and with a dark fuscous spot in apex which is not an expansion of the band. It is a significant pest species.

**Bactrocera (Zeugodacus) assamensis White**

Bactrocera (Zeugodacus) assamensis White, in White & Evenhuis, 1999: 522. Holotype female in BMNH.


**Diagnosis.** – A large species; face fulvous with a pair of medium sized elongate oval black spots; postpronotal lobes yellow with inner margins narrowly black; notopleura either entirely dark fuscous to black or dark fuscous to black with small apical yellow spots; scutum shining black; narrow lateral postspiracular vitellae present; very short and narrow medial postspiracular vitellae present; mesopleural stripe reaching midway between anterior margin of notopleuron and anterior npl seta dorsally; scutellum yellow with a broad medial longitudinal dark fuscous to black band or in some specimens a broad apical dark fuscous to black spot; wing with a narrow dark fuscous costal band extremely narrow or absent beyond apex of R₄₊₅ and widening into a distinct spot across apex of R₅₋₆ and a narrow fuscous cubital streak; a small diffuse fuscous spot around Cu₄ in hind margin of wing; cells bc and c colourless; microtrichia in outer corner of cell c only; abdominal terga III-V mostly dark fuscous to black with small red-brown spots postero-centrally on terga III and IV either side of a narrow medial longitudinal black band and red-brown across posterior margin of tergum V.

**Attractant.** – Cue lure.

**Distribution.** – Assam. New record for Bhutan.

**Hosts.** – No known record.

**Remarks.** – Bactrocera (Zeugodacus) assamensis White is similar to Bactrocera (Zeugodacus) biguttata (Bezzi), Bactrocera (Zeugodacus) freidbergi White and Bactrocera (Zeugodacus) tappanus (Shiraki) in having two sc. setae and dark coloured notopleura. It differs from B. freidbergi in having dark patterns on the scutellum, from B. tappanus in having abdominal terga III-V mostly dark fuscous to black and femora uniformly black around apices, and from B. biguttata in having a medial longitudinal dark band on the scutellum, microtrichia on cell br of wing and cubital streak present. It is not a pest species.

**Bactrocera (Zeugodacus) atrifacies (Perkins)**

Zeugodacus atrifacies Perkins, 1938: 140. Type probably lost, not in UQIC or QM.


**Diagnosis.** – A medium sized species; face entirely shining black; postpronotal lobes and notopleura yellow; scutum shining black; medium width lateral and narrow medial postspiracular vitellae present; a yellow spot anterior to mesonotal suture; mesopleural stripe reaching midway between anterior margin of notopleuron and anterior npl seta dorsally; scutellum yellow with a broad medial longitudinal dark fuscous to black band or in some specimens a broad apical dark fuscous to black spot; wing with a narrow dark fuscous costal band extremely narrow or absent beyond apex of R₄₊₅ and widening into a distinct spot across apex of R₅₋₆ and a narrow fuscous cubital streak; a small diffuse fuscous spot around Cu₄ in hind margin of wing; cells bc and c colourless; microtrichia in outer corner of cell c only; abdominal terga III-V mostly dark fuscous to black with small red-brown spots postero-centrally on terga III and IV either side of a narrow medial longitudinal black band and red-brown across posterior margin of tergum V.

**Attractant.** – Cue lure.
**Distribution.** – China, Malaysia. New record for Bhutan.

**Hosts.** – No known record.

**Remarks.** – *Bactrocera (Zeugodacus) atrifacies* (Perkins) belongs to the *scutellaris* complex and particularly the group with 4 sc. setae. It differs from other species in this group in possessing an entirely black face. In facial colour, general leg colour patterns and terga III-V mostly dark fuscous to black, it is similar to *Bactrocera (Zeugodacus) diaphora* (Hendel) but the latter possesses two sc. setae.

One specimen in UQIC with the following labels is not the type of *B. atrifacies* – “Pahang FMS, Kuala Teku 500’, Dec 6th 1921, H.M. Pendlebury”, “TYPE”, “*Zeugodacus maculipennis* Dol. det. F.A. Perkins”, “*Dacus (Zeugodacus) atrifacies* (Perkins), poss. as *limbipennis* Macq. From Bukit Kuta, Selangor”. This is a specimen of *Bactrocera (Zeugodacus) caudata* (Fabricius) and the label data are not in agreement with those recorded by Perkins (1938) for *B. atrifacies*. It is not a pest species.

**Bactrocera (Zeugodacus) biguttata** (Bezzi)

*Chaetodacus biguttatus* Bezzi, 1916: 111, holotype in ZSI.

*Bactrocera (Bactrocera) biguttatus* – Hardy, 1977: 49.

*Bactrocera (Zeugodacus) biguttata* – Norrbom et al., 1998: 102.


**Diagnosis.** – A unique medium to large sized species; face fulvous with a pair of medium sized oval black spots; postpronotal lobes yellow with crescent shaped black markings on inner surfaces; notopleura shining black; scutum entirely shining black; very narrow lateral and medial postsutural vittae present; mesopleural stripe reaching midway between anterior margin of notopleuron and anterior npl. seta dorsally; scutellum shining black with small anterolateral yellow corners; wing with a narrow fuscous costal band paler between R2+3 and R4+5 and expanding into a large spot in apex of wing, pale infuscation along r-m crossvein and dark fuscous along dm-cu crossvein, a broad fuscous cubital streak; cells bc and c colourless; microtrichia in outer corner of cell c only; abdominal terga III-V red-brown with a ‘T’ pattern consisting of a narrow black transverse band across anterior margin of tergum III and a medium to broad medial longitudinal band over all three terga, anterolateral corners of terga IV and V fuscous to dark fuscous.

**Attractant.** – Cue lure.

**Distribution.** – Endemic to the region from Pakistan and India across southeast Asia. Now widespread across tropical and subtropical countries, including Papua New Guinea, Solomon Islands, northern Pacific islands, northern Africa and Egypt.

**Hosts.** – A wide range of wild and edible host fruits from many plant families and specialising in the Family Cucurbitaceae (see Allwood et al., 1999).

**Remarks.** – *Bactrocera (Zeugodacus) cucurbitae* (Coquillett) is one species of Dacinae that has been extensively studied,
both ecologically and taxonomically. It is regarded as one of the major pest species within the Dacinae and has a worldwide distribution in the tropical and subtropical zones. See Drew (1989) for details. During the late 1990s, it spread across the Solomon Islands. It is readily distinguished in having basic red-brown on the scutum and abdomen with variable dark patterns, wing with the costal band expanded into a large spot at apex and r-m and dm-cu crossveins infuscated, abdominal terga III-V with a black ‘T’ pattern.

**Bactrocera (Zeugodacus) diaphora** (Hendel)


*Dacus (Strumeta) diaphorus* – Hardy, 1973: 40.


*Dacus (Zeugodacus) siceni* Chao & Lin, 1993: 77. New name for *Dacus ater* Chan, 1940.


**Diagnosis.** – A medium sized species; face shining black; postpronotal lobes and notopleura yellow; scutum shining black; narrow lateral and medial postspiracular vittae; a yellow spot anterior to mesonotal suture; mesopleural stripe reaching almost to anterior *npl* seta dorsally; scutellum yellow with a dark fuscous to black, abdominal terga III-V mostly dark fuscous to black. It possesses two *sc* setae and yellow notopleura. It differs from this species in having the face entirely black and all femora with large areas of dark fuscous to black. It is not a pest species.

**Remarks.** – *Bactrocera (Zeugodacus) diaphora* (Hendel) is similar to *Bactrocera (Zeugodacus) yoshimotoi* (Hardy) in possessing two *sc* setae and yellow notopleura. It differs from this species in having the face entirely black and all femora with large areas of dark fuscous to black. It is not a pest species.

**Bactrocera (Zeugodacus) scutellaris** (Bezzi)


*Dacus pusaensis* Kapoor & Katiyar, 1970: 252; Norrbom et al., 1998: 103 (syn.).


**Diagnosis.** – A small to medium sized species; face fulvous with a pair of transverse oval black spots pointed towards centre; postpronotal lobes and notopleura yellow; scutum shining black; narrow lateral and medial postspiracular vittae present; a very small yellow spot anterior to mesonotal suture; mesopleural stripe equal in width to notopleuron dorsally; scutellum yellow with a distinct black apical spot; wing with a narrow dark fuscous costal band widening slightly across apex of R₄₋₅, a narrow fuscous cubital streak; cells bc and c colourless; microtrichia in outer corner of cell c only; abdominal terga III-V entirely dark fuscous to black, terga IV and V dark fuscous except red-brown on posterior apex of tergum V.

**Attractant.** – Cue lure.

**Distribution.** – From India and Sri Lanka to China and across southeast Asia. New record for Bhutan.

**Hosts.** – No known record.
Material examined – Cue lure.

Distribution. – Widespread across south Asia to southeast Asia. New record for Bhutan.

Hosts. – Flowers of species in the Family Cucurbitaceae (see Allwood et al., 1999).

Remarks. – Bactrocera (Zeugodacus) scutellaris Bezzi appears to be the most widespread of all scutellaris complex species. It is readily distinguished by the shining black scutum, very narrow lateral and medial poststural vittae, scutellum yellow with a dark spot at apex, costal band extremely narrow beyond apex of R2+3 and with a small spot around apex of R4+5, abdominal terga III-V mostly dark fuscous to black. As for B. diversa (Coquillett), B. scutellaris attacks flowers of Cucurbitaceae species so may have pest status but no quarantine significance for export trade.

Bactrocera (Zeugodacus) scutellata (Hendel)

Dacus scutellatus Hendel, 1912: 20, holotype male in DEI.
Dacus (Chaetodacus) bezzii Miyake, 1919: 146.
Zeugodacus scutellatus – Shiraki, 1933: 82.


Diagnosis. – A large species; face fuscous to black. As for B. diversa (Coquillett) and B. scutellaris (Bezzi), face with circular black spots, scutellum yellow with a black apical spot, femora entirely fuscous, 4 sc. setae, wing with a strong supernumerary lobe and broad cubital streak, costal band confluent with R2+3 and remaining narrow beyond apex of R2+3 before widening gradually across apex of R4+5, abdominal terga III-V each with a separate general ‘T’ pattern. As for B. diversa (Coquillett) and B. scutellaris, B. scutellata attacks flowers of some Cucurbitaceae species so may have pest status but no quarantine significance for export trade.

Bactrocera (Zeugodacus) signata (Hering)

Zeugodacus bezziatus f. signata Hering, 1941: 10, male and female syntypes in BMNH. New record for Bhutan.


Diagnosis. – A large species; face fuscous with a pair of medium sized oval black spots; postpronotal lobes and notopleura yellow; scutum orange-brown with extensive areas of black; lateral and medial poststural vittae present; a yellow spot anterior to mesonotal suture; mesopleural stripe reaching midway between anterior margin of notopleuron and anterior npl. seta dorsally; scutellum yellow with a dark fuscous apical spot; wing with a narrow fuscous costal band overlapping R2+3 and ending in a tau like spot in apex of wing, a moderately broad fuscous cubital streak; cells bc and c colourless; microtrichia in outer corner of cell c only; abdominal terga III-V each with a dark fuscous to black ‘T’ pattern.

Attractant. – Cue lure.

Distribution. – Sikkim. New record for Bhutan.

Hosts. – No known record.

Remarks. – Bactrocera (Zeugodacus) signata (Hering) in many characters resembles tau complex species. It is similar to Bactrocera (Zeugodacus) rubella (Hardy) in possessing extensive areas of red-brown on the scutum, 4 sc. setae, medial and lateral poststural vittae, basic red-brown scutum, wings colourless except for costal band and cubital streak, costal band expanded into a spot at apex and lateral poststural vittae reaching to or behind ia. setae. It differs from B. rubella in having a well developed supernumerary lobe in the male wing, costal band just overlapping R2+3 (not almost to R4+5) and apical spot in costal band around apex of R4+5 (not

Attributant. – Cue lure.

Distribution. – Distributed across subtropical southeast Asia. New record for Bhutan.

Hosts. – Flowers of species in the Family Cucurbitaceae (see Allwood et al., 1999).

Remarks. – Bactrocera (Zeugodacus) scutellata (Hendel) is a large species readily distinguished by the shining black scutum, lateral and medial poststural vittae broader than in
reaching M). Within the tau complex, it is similar to *Bactrocera (Zeugodacus) pubescens* (Bezzi) in having a dark fuscous spot on the apex of the scutellum but differs in possessing dark fuscous spots on the apices of all femora and the apex of the aculeus needle shaped. In *B. pubescens* the femora are entirely fulvous and the apex of the aculeus trilobed. In studying large numbers of *B. tau* (Walker) specimens from across southeast Asia, none has been observed with a dark spot on the apex of the scutellum. This is not a pest species.

**Bactrocera (Zeugodacus) tau** (Walker)

*Dasyneura tau* Walker, 1849: 1074.

*Dacus haenary* de Meijere, 1911: 375, type locality, Sumatra.

*Dacus caudatus* var. *rubilus* Hendel, 1912: 16, type locality Taiwan.


*Dacus (Zeugodacus) tau* – Hardy, 1977: 60.


**Diagnosis.** – A medium sized species; face fulvous with a pair of medium sized circular to oval black spots; postpronotal lobes and notopleura yellow; scutum black with large areas of red-brown centrally and anterocentrally; mesopleural stripe slightly wider than notopleuron dorsally; a moderately broad medial postsutural vitta; two narrow lateral postsutural vittae; mesopleural stripe reaching midway between anterior margin of notopleuron and suture in front of lateral postsutural vittae; mesopleural stripe slightly wider than notopleuron dorsally; scutellum yellow; wing with a narrow fuscous costal band confluent with R$_{2+3}$ and remaining narrow beyond apex of this vein before widening across apex of R$_4+5$, a broad fuscous cubital streak; cells bc and c colourless; microtrichia in outer corner of cell c only; abdominal terga III-V fulvous with a black ‘T’ pattern and anterolateral corners of terga IV and V with broad black markings.

**Attractant.** – Cue lure.

**Distribution** – Widespread across south and southeast Asia. New record for Bhutan.

**Hosts** – Recorded from nine plant families and specialising in species of the Family Cucurbitaceae.

**Remarks.** – *Bactrocera (Zeugodacus) tau* (Walker) is a very common species throughout southeast Asia. It is an economic pest species, mainly in cucurbit crops, but can be misidentified as it belongs to a complex of closely related species. It is best distinguished by the following characters – scutum black with large areas of red-brown, costal band expanded into a distinct spot at apex, supernumerary lobe in male wing large and keel shaped, abdominal terga III-V fulvous with a black ‘T’ pattern and lateral margins of terga IV and V with either anterolateral corners dark or with lateral longitudinal dark bands over both terga.

**Bactrocera (Zeugodacus) yoshimotoi** (Hardy)

*Dacus (Strumeta) yoshimotoi* Hardy, 1973: 53. Holotype male in BPBM.

**Bactrocera (Bactrocera) yoshimotoi** – Hardy, 1977: 52; Norrbom et al., 1998: 96.

**Bactrocera (Zeugodacus) yoshimotoi** – White & Evenhuis, 1999: 534.


**Diagnosis.** – A small to medium sized species; face fulvous with a pair of small to large transverse oval black spots; postpronotal lobes and notopleura yellow; two narrow lateral postsutural vittae; a moderately broad medial postsutural vitta; mesopleural stripe confluent with R$_{2+3}$ and remaining narrow beyond apex of this vein before widening across apex of R$_4+5$, a broad fuscous cubital streak; cells bc and c colourless; microtrichia in outer corner of cell c only; abdominal terga III-V fulvous with a black ‘T’ pattern on each tergum, tergum V red-brown with a broad medial longitudinal black band and moderately broad black lateral margins.

**Attractant.** – Cue lure.

Hosts. – No known record.

Remarks. – *Bactrocera (Zeugodacus) yoshimotoi* (Hardy) is readily distinguished by the face with transverse oval black spots, postpronotal lobes and notopleura yellow; two *sc* setae, femora entirely fulvous, a strong supernumerary lobe in the male wing, abdominal terga III and IV with separate black ‘T’ patterns and tegrum V with a medial longitudinal black band and lateral margins black. It is not a pest species.

*Bactrocera (Zeugodacus) zahadi* Mahmood


Diagnosis. – A medium sized species; face fulvous with a pair of large irregularly oval black spots; postpronotal lobes and notopleura yellow; scutum black with areas of red-brown; lateral and medial post sutural vittae present; small yellow spot anterior to mesonotal suture; mesopleure stripe just slightly wider than notopleuron dorsally; scutellum entirely yellow; wing with a narrow fuscous costal band expanding into a tau-like spot in apex of wing, a broad fuscous cubital streak; cells bc and c colourless; microtrichia in outer corner of cell c only; legs with femora fulvous except for subapical dark fuscous spots on fore and mid femora and dark fuscous around apical 1/4 of hind femora; abdominal terga III-V fulvous with a ‘T’ pattern consisting of a narrow transverse black band across anterior margin of tegrum III and a moderately broad medial longitudinal black band over all three terga, large anterolateral black corners on terga IV and V.

Attractant. – Cue lure.

Distribution. – Southern Sri Lanka, India, Myanmar, Pakistan and Bhutan.

Hosts. – No known record.

Remarks. – *Bactrocera (Zeugodacus) zahadi* Mahmood is extremely close to *Bactrocera (Zeugodacus) tau* (Walker) and may be a synonym of the latter. After studying large numbers of *B. tau* from across southeast Asia, it is clear that the lateral dark colour patterns on abdominal terga IV and V vary from small dark anterolateral corners to broad lateral longitudinal dark bands over both terga. Also, the femora colour varies from entirely fulvous to fulvous with preapical dark spots on some or all femora. One sound characteristic of *B. tau* is that it possesses a large keel shaped supernumerary lobe in the male wing which also is present in the holotype of *B. zahadi*. No good characters can be found to separate *B. tau* and *B. zahadi*. It is not a pest species.

Dacus Fabricius

Under genus *Dacus*, the species are placed within the subgenera *Callantra* Walker and *Mellesis* Bezzi in accordance with the subgeneric classification of Hancock & Drew (2006).

*Dacus (Callantra) longicornis* Wiedemann

*Dacus longicornis* Wiedemann, 1830: 524; de Meijere, 1911: 380; Bezzi, 1909: 292. Type locality: Java. Holotype female in ZMB.

*Dacus vespoides* Doleschall, 1859: 123. Type locality: Ambon, Indonesia. Holotype male in ZMB.


*Dacus vespoides* – Bezzi 1909: 262 (syn.).

*Mellesis destillatoria* Bezzi, 1916: 118; Drew et al., 1998: 604 (as syn.). Type locality: Bhamo, Burma. Holotype female in MSNM.

*Mellesis eumenoides* Bezzi, 1916: 119; Drew et al., 1998: 604 (as syn.). Type locality: Tatkon, Burma. Lectotype male in BMNH.

*Mellesis bioculata* Bezzi, 1919: 437; Drew et al., 1998: 604 (as syn.). Type locality: Mt Makiling, Luzon, Philippines. Lectotype male in MSNM.


*Callantra destillatoria* – Hardy, 1973: 9; Hardy, 1977: 45.

*Callantra eumenoides* – Hardy, 1973: 11; Hardy, 1977: 45.

*Callantra bioculata* – Hardy, 1974: 6–7; Hardy, 1977: 45.

*Callantra longicornis* – Hardy, 1977: 45–46.

*Callantra unifasciatus* Hardy, 1982: 184–186; Drew et al., 1998: 604 (as syn.). Type locality: Wotu, Sulawesi. Holotype male in MBB.

*Callantra variegata* Wang, 1990: 73, 76; Drew et al., 1998: 604 (as syn.). Type locality: Daimonglong, Yunnan, China. Holotype male in IZAS.

*Dacus (Callantra) variegata* – Liang et al., 1993: 139.


*Dacus (Callantra) longicornis* – Drew et al., 1998: 604.


Diagnosis. – Face fulvous with a pair of small irregularly oval black spots; scutum dark red-brown without distinct dark patterns, postpronotal lobes yellow except posterodorsal corners fuscous, notopleura yellow, mesopleural stripe narrow equal in width to notopleuron dorsally, lateral and medial post sutural vittae absent, a narrow yellow triangle running along anterior margin of mesonotal suture with base on notopleuron; setae: *sc* 2; *prsc* absent; *ia* 1; *p.sa* 1; *a.sa* 1; *mpl* 1; *mpl* 2; *scp* 4; scutellum yellow except for broad red-brown basal band; legs with fore femora dark red-brown to fuscous, mid femora dark red-brown to fulvous except fulvous
on basal 1/4, hind femora dark fuscous, fore and mid tibiae dark red-brown to fuscous, hind tibiae dark fuscous, fore tarsi with all segments dark red-brown, mid and hind tarsi with basal segment fuscous and apical four segments red-brown; wings with cells bc and c fuscous, dense microtrichia over all of cell c and most of cell bc, a broad dark fuscous costal band overlapping R4+5 for its entire length and sometimes becoming darker at apex, cubital streak indistinct but a broad pale fuscous area generally over cell cup and across wing margin towards cell dm, supernumerary lobe weak; abdominal terga III-V generally dark fuscous to black with a paler band often across posterior margin of tergum III, large orange-brown spots posterocentrally on terga IV and V with the spot on tergum V often expanded anteriorly into a medial longitudinal orange-brown band, oval shining spots on tergum V red-brown to dark fuscous.

**Attractant.** – Cue lure.

**Distribution.** – Widespread across the region from southern Asia to southeast Asia (see Drew et al., 1998).

**Hosts.** – Wild species in the Family Cucurbitaceae (see Drew et al., 1998).

**Remarks.** – This species has a widespread distribution across southern Asia and southeast Asia and has been regularly misidentified with numerous synonyms being described (see notes above). It has been adequately described and illustrated by Drew et al. (1998) and is best distinguished by the combination of the following characters – red-brown scutum, cells bc and c fuscous, costal band overlapping R4+5, face fuscous with a pair of black spots, anatergite fuscous, katatergite yellow, postpronotal lobes mostly yellow, mesopleural stripe narrow (slightly wider than notopleuron dorsally). It has minor pest status.

**Dacus (Mellesis) dorjii** Drew & Romig, new species

**(Fig. 1)**

**Material examined.** – Holotype: male, BHUTAN: Lumitshawa, 17 May.2000, attracted to cue lure, coll. C. Dorji, deposited in BMNH.


**Diagnosis.** – A medium sized species; face mostly black with oral and lateral margins fulvous; postpronotal lobes black; notopleura yellow; scutum black; lateral and medial poststatural vittae absent; a yellow triangle along anterior margin of mesonotal suture; mesopleural stripe equal in width to notopleuron dorsally; scutellum yellow; wing with a broad dark fuscous costal band overlapping R4+5 throughout, cubital streak absent; cells bc and c fuscous; microtrichia covering all of cell c and outer 1/2 of cell bc; abdominal terga mostly black except for a narrow red-brown transverse band across intersegmental line between terga I and II and orange-brown spots posterocentrally on terga IV and V.

**Description.** – **Male.** Head. Height 1.26mm. Frons: length 1.33 times breadth; fuscous with fulvous along anterior margin and dark fuscous around bases of orbital setae; orbital setae black: 1 s.or., 2 i.or.; lunule fuscous. Ocellar triangle black. Vertex black. Face black consisting of a central triangular black patch connecting two medium sized oval black spots, oral and lateral margins fulvous to red-brown; length 0.36mm. Genae fulvous, large dark fuscous subocular spot present. Occiput black, fulvous along eye margins; occipital row with a small number of weak setae. Antennae with segment 1 dark fuscous, segment 2 black, segment 3 dark fuscous; arista black (red-brown basally); length of segments: 0.42mm; 0.45mm; 0.75mm.

Thorax. Scutum black with red-brown behind ia. setae. Pleurral areas entirely black. Yellow markings as follows: notopleura; narrow mesopleural stripe equal in width to notopleuron dorsally, anterior margin straight; a distinct triangle along anterior margin of mesonotal suture with base on notopleuron. Postpronotal lobes black. Anatergite and katatergite entirely black. Lateral and medial poststatural vittae absent. Postnotum entirely black. Scutellum yellow except for narrow dark basal band. Setae: sc. 2; prsc. absent; ia. 1; p.sa. 1; a.sa. absent (occasionally one weak seta present); mpl. 1; npl. 2; scp. 2.

Legs. All femora entirely black except small areas of dark red-brown on apices of mid and hind femora; all tibiae dark fuscous to black; fore tarsi with basal segment fuscous and apical four segments slightly darker fuscous, mid and hind tarsi with basal segment fuscous and apical four segments red-brown; mid tibiae each with an apical black spur.

Wings. Length 5.9mm; cells bc and c fuscous; dense microtrichia covering all of cell c and outer 1/2 of cell bc; remainder of wings colourless except dark fuscous cell sc, broad dark fuscous costal band overlapping R4+5 throughout; cubital streak absent; dense aggregation of microtrichia around A1+CuA2; supernumerary lobe weak.

Abdomen. Elongate oval and petiolate; terga fused; pecten present on tergum III. Tergum I and sterna I and II longer than wide. All terga entirely black except dark red-brown across intersegmental line between terga I and II and orange-brown posteroventral markings on terga IV and V. Posterior lobe of surstylus long, sternum V with a slight concavity on posterior margin.
Attractant. – Cue lure.

Distribution. – Known mostly from the higher altitudes of Bhutan (over 2,000 m).

Hosts. – No known record.

Remarks. – Dacus (Mellesis) dorjii new species, is similar to Dacus (Mellesis) siamensis Drew & Hancock, Dacus (Mellesis) tenebrosus Drew & Hancock and Dacus (Mellesis) vijaysegarani Drew & Hancock in the general colour patterns of the body, legs and wings. It differs from these species in possessing a black face, entirely yellow notopleura and the anatergite and katatergite entirely black and in lacking a.sa. setae.  D. dorjii also differs from D. tenebrosus in having a narrow mesopleural stripe equal in width to the notopleuron and from D. siamensis in having distinct orange-brown spots posterocentrally on terga IV and V. It is not a pest species.

Etymology. – This species is named after Mr. Chencho Dorji, National Plant Protection Centre, Ministry of Agriculture, Thimphu, Bhutan in recognition of his contributions to Entomology, especially fruit fly research, in that country.

Dacus (Mellesis) feijeni White

Dacus (Callantra) feijeni White, in Drew et al., 1998: 590.  Holotype male in BMNH.

Fig. 1. Dacus (Mellesis) dorjii, new species, holotype male: dorsal view.
Material examined. – BHUTAN: 1 male, Rimchu trap No. 1, 17 May.2000, coll. C. Dorji; 1 male, 16 km from Namling, 1600 m, 9 Jun.2001, coll. Brian Fletcher. Both specimens attracted to cue lure. Specimens in NPPC and QDPI.

Diagnosis. – Face fulvous with a pair of large circular to oval black spots; scutum dark red-brown, postpronotal lobes and notopleura yellow, narrow mesopleural stripe equal in width to notopleuron dorsally, a yellow triangle along anterior margin of mesonotal suture with base at notopleuron, lateral and medial postsutural vittae absent; setae: ia: sc: 2; prsc: absent; ia: 1; p.sa: 1; a.sa: 1; mpl: 1; npl: 2; scp: 4; scutellum yellow except for narrow red-brown basal band; legs with fore and mid femora entirely red-brown, hind femora fulvous tending fuscous to dark fuscous on apical 1/3, fore tibiae fuscous, mid tibiae red-brown tending fuscous apically, hind tibiae dark red-brown to fuscous, tarsi with basal segment fulvous and apical four segments fulvous to red-brown; wings with cells bc and c pale fuscous, dense microtrichia covering all of cell c and outer corner of cell bc, a broad dark fuscous costal band confluent with R_{4+5} basally then distinctly overlapping this vein around the region of r-m crossvein to the apex of the wing, cubital streak absent, supernumerary lobe weak; abdomen elongate oval and petiolate, terga III-V red-brown with a ‘T’ pattern consisting of a broad fuscous to dark fuscous band across anterior margin of tergum III expanding to cover lateral margins and a narrow medial longitudinal dark fuscous band over all three terga, broad fuscous to dark fuscous anterolateral corners on terga IV and V.

Attractant. – Cue lure.

Distribution. – Bhutan.

Hosts. – No known record.

Remarks. – This species was adequately described and illustrated in Drew et al. (1998). It is best distinguished by possessing the combination of dark red-brown scutum, yellow postpronotal lobes, red-brown femora and tibiae and abdominal terga III-V red-brown to fuscous. It is not a pest species.

Dacus (Mellessis) fletcheri Drew, new species

(Fig. 2 a, b)

Material examined. – Holotype: male, BHUTAN: 19 km from Sengor, altitude 2600 m, 6 Jun.2001, coll. Brian Fletcher, attracted to cue lure, deposited in BMNH.


Diagnosis. – A large species; face with a pair of medium sized oval black spots and a distinct black spot medially below bases of antennae; postpronotal lobes dark fuscous to black; notopleura yellow; scutum black; lateral and medial postsutural vittae absent; a distinct yellow triangle along anterior margin of mesonotal suture; narrow mesopleural stripe equal in width to notopleuron dorsally; scutellum yellow; wing with a broad dark fuscous costal band overlapping R_{4+5}; cubital streak absent; cells bc and c dark fuscous; microtrichia covering all of both cells bc and c; abdominal terga II-V black with distinct orange-brown spots posteromedially and increasing in size from terga II-IV and a medial longitudinal orange-brown area on tergum V which expands across posterior margin of tergum; terga II-IV with large protuberances posterocentrally along the midline best viewed in lateral view of the abdomen.

Description. – Male. Head. Height 1.76mm. Frons: length 1.26 times breadth; fuscous with fulvous along lateral and anterior margins and darker fuscous around bases of orbital setae; orbital setae black: 1 s.or, 2 i.or.; lunule fuscous. Ocellar triangle black. Vertex dark fuscous. Face generally fuscous with a pair of medium sized oval black spots and a black spot medially below bases of antennae; length 0.48 mm. Genae fuscous, small dark fuscous subocular spot present; black seta present. Occiput black, fulvous along eye margins; occipital row with 2–4 small black setae. Antennae with segments 1 and 2 dark fuscous to black; segment 3 dark fuscous; length of segments: 0.66mm; 0.72mm; 1.14mm.

Thorax. Scutum black with red-brown behind ia. setae and around margins of mesonotal suture and yellow triangle anterior to mesonotal suture. Pleural areas entirely dark fuscous to black. Yellow markings as follows: notopleura; narrow mesopleural stripe equal in width to notopleuron dorsally, anterior margin straight; a distinct triangle along anterior margin of mesonotal suture with base at notopleuron. Postnotum dark fuscous to black. Anatergite fuscous to black; katatergite entirely black. Lateral and medial postsutural vittae absent. Postnotum black. Scutellum yellow except for narrow black basal band. Setae: ia: sc: 2; prsc: absent; ia: 1; p.sa: 1; a.sa: 1; mpl: 1; npl: 2; scp: 2.

Legs. Femora entirely black except for small apical red-brown areas; fore tibiae dark fuscous to fuscous, mid and hind tibiae red-brown to fuscous; fore tarsi with all segments fuscous to dark fuscous, mid and hind tarsi with basal segment fulvous and apical four segments pale fuscous; mid tibiae each with an apical black spur.

Wings. Length 8.25mm; cells bc and c dark fuscous; dense microtrichia covering all of both cells; remainder of wings colourless except for a broad dark fuscous costal band confluent with vein M at basal area of cell dm and distinctly overlapping R_{4+5} to apex of wing; cubital streak absent; dense aggregation of microtrichia around A_{1}+Cu_{A_{2}}; supernumerary lobe weak.
Fig. 2. *Dacus (Mellesis) fletcheri*, new species, holotype male: a, dorsal view; b, abdomen lateral view.
Abdomen. Elongate oval and petiolate; terga fused; pecten present on tergum III. Tergum I and sternae I and II longer than wide. Tergum I dark fuscous to black with narrow red-brown band along intersegmental line between tergum I and II; tergum II black with a large orange-brown spot posterocentrally; terga III and IV black with orange-brown posterocentral areas increasing in size from tergum II to tergum IV; tergum V black with a medial longitudinal orange-brown area that expands across posterior margin. A pair of oval shining spots which vary from entirely orange-brown to dark fuscous to black on the anterior half and orange-brown on posterior half. Posterior lobe of surstylus long, sternum V with a slight concavity on posterior margin. Terga II, III and IV with distinct large protuberances posterocentrally on the mid-line (these are best observed from the lateral view of the abdomen).

Attractant. – Cue lure.

Distribution. – Known only from the higher altitudes of Bhutan, generally above 2000 m.

Hosts. – No known record.

Remarks. – *Dacus (Mellessis) fletcheri* new species, is similar to *Dacus (Callantra) siamensis* Drew & Hancock, *Dacus (Mellessis) tenebrosus* Drew & Hancock and *Dacus (Mellessis) vijaysegarani* Drew & Hancock in the general colour patterns of the body, wings and legs. It is distinct from this species in possessing large posterocentral orange-brown markings on abdominal terga II, III and IV and orange-brown medially on tergum V, large protuberances posteromedially on the midline of terga II, III and IV and the abdominal shape elongate-oval, not distinctly club shaped. It is not a pest species.

Etyymology. – This species is named after Dr. Brian Fletcher, Sydney, Australia, in recognition of his outstanding contributions to fruit fly ecology, especially in the subfamily Dacinae, worldwide. He also collected the holotype and some paratypes of this species.

*Dacus (Mellessis) siamensis* Drew & Hancock

*Dacus (Callantra) siamensis* Drew & Hancock, in Drew et al., 1998: 626. Holotype male in BMNH.


Diagnosis. – Face fulvous with a ‘U’ shaped black pattern consisting of medium sized oval black spots connected with a narrow black band across the dorsal margin of face; scutum primarily dull black, postpronotal lobes dark fuscous to black, notopleura yellow, mesopleural stripe slightly wider than notopleuron dorsally, lateral and medial postsutural vittae absent; a yellow triangle along anterior margin of mesonotal suture with base at notopleuron; setae: sc. 2; prsc. absent; ia. 1; p.sa. 1; a.sa. 1; mpl. 1; npl. 2; scp. 4; scutellum yellow except for a narrow black basal band; legs with all femora entirely black (tending paler on apices of mid femora), all tibiae entirely dark fuscous, fore tarsi with all segments fuscous, mid and hind tarsi with basal segments fulvous and apical four segments fuscous; wings with cells bc and c dark fuscous, dense microtrichia covering all of cell c and most of cell bc, a broad dark fuscous costal band overlapping R_{4+5}, cubital streak absent, in some specimens there is a very pale fuscous tint throughout most of wing membrane, supernumerary lobe weak; abdomen elongate, club shaped and petiolate, all terga generally dark fuscous to black except fulvous along intersegmental line between terga I and II and, in some specimens, dark orange-brown posterocentrally on terga IV and V.

Attractant. – Cue lure.

Distribution. – Central and northern Thailand. New record for Bhutan.

Hosts. – No known record.

Remarks. – This species has been adequately described and illustrated in Drew et al. (1998). It is readily distinguished by the following characters: scutum black, postpronotal lobes black, notopleura yellow, anatergite black, katatergite mostly yellow, face fulvous with an inverted U-shaped black pattern, costal band overlapping R_{4+5}, cells bc and c dark fuscous, femora and tibiae mostly black, abdominal terga mostly black. It is not a pest species.

ACKNOWLEDGEMENTS

Information and specimens for this study were obtained from a project in Bhutan funded by the Australian Centre for International Agricultural Research (ACIAR). Logistical support within Bhutan was provided by the Program Director of the National Plant Protection Centre, Ministry of Agriculture, Mr N.K. Pradhan. Dr Bert Orr prepared the illustrations. All this assistance is gratefully acknowledged.

LITERATURE CITED


