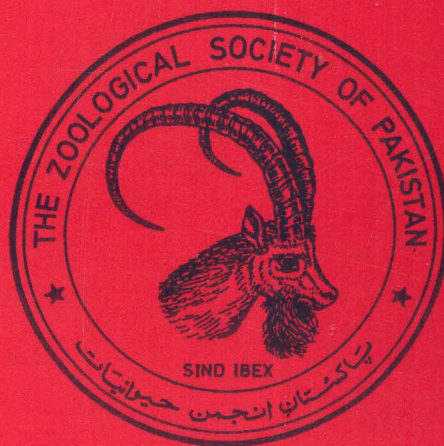


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REVISION OF SUBFAMILY DACINAE (FRUIT FLIES) (TEPHRITIDAE: DIPTERA) OF  
SOUTH-EAST ASIA

KHALID MAHMOOD AND SYED AZHAR HASAN



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**KHALID MAHMOOD AND SYED AZHAR HASAN**

*Zoological Sciences Division, Pakistan Museum of Natural History, Garden Avenue,  
Islamabad, Pakistan*

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# Revision of Subfamily Dacinae (Fruit Flies) (Tephritidae: Diptera) of South-East Asia

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**Abstract:** Identification of fruit flies has an important role in formulating integrated pest management tools, making intelligent plant quarantine decisions, biocontrol of weed, protecting environment and conservation of biodiversity. The subfamily Dacinae (Tephritidae: Diptera) in South-East-Asia is revised. Key to species, synonymy, description, material examined, photographs of the tomentum pattern on prescutum, wing, scales on the distal end of eversible membrane of ovipositor and aculeus tip are given.

**Key Words:** Taxonomy, Fruit flies, Dacines, Tephritidae, Diptera, South-East Asia

## INTRODUCTION

**F**ruit flies (Diptera, Tephritidae) cause most of the damage to fruits and vegetables in the Indian sub-continent. The members of the subfamily Dacinae infest almost all kinds of fleshy fruits, including solanaceous and cucurbitaceous plants. Many species are specialised and host specific in their feeding habits, while others are generalists and attack a wide range of fruits and vegetables. The two most notorious and destructive species of fruit flies in the old world tropics are *Bactrocera dorsalis* Hendel (The Oriental fruit fly) and *Bactrocera cucurbitae* Coquillett (The melon fly). These two species are native to India and are widespread in the Oriental region (Kapoor *et al.*, 1980).

Reports from Pakistan reveal that *Bactrocera* (*Zeugodacus*) *cucurbitae* normally causes 20 - 75% damage to melon production, while about 80% of guava fruits in markets were found infested by *Bactrocera dorsalis*. High infestation of guava has resulted in abandoning the production of this popular fruit in Southern Pakistan, thus declining export of this fruit by about 50% (Kafi, 1986). In India fruit fly infestation ranged from 2 - 80%, depending upon fruit fly species and host plant. The peach fruit fly *Bactrocera zonata* (Saunders) causes up to 50%

damage to peach and apricot in Himachal Pradesh state (Rajak, 1986).

Beside direct loss, fruit fly infestation is a major trade barrier, resulting in the indirect economic loss to the growers. The quarantines regulations imposed by importing countries, especially developed countries, either ban a producing country from a potential export market, or insist on effective dis-infestation of fruit grown in areas with fruit fly, ultimately increasing the cost of production (Singh, 1991) and reducing shelf-life. Therefore, fruit flies are major obstacles in development of fruit industry in developing countries.

With the increase in international air travel and transport, there has been a considerable risk in the introduction of exotic fruit fly species. Nine species of fruit flies have been introduced in California (USA) in the last ten years (Liquido and Cunningham, 1991) and four in Hawaii (USA) (Vargas and Nishida, 1991).

Despite important role of fruit fly taxonomy in; i) formulating the IPM and saving the damage caused by these pests, ii) making realistic quarantine decisions to save the horticulture industry from foreign pests and avoiding the introduction of these pests in new areas, only a little taxonomic work has been done in South-East Asian region. A brief review of taxonomic work in this region is given below.

Bezzi (1913, 1914, 1916) did the first

comprehensive taxonomic work on the Indian fruit flies present in the Indian Museum (now the National Collection of Zoological Survey of India), Calcutta. Munro (1935) described nine new species from the National Collection of Zoological Survey of India, Calcutta. Hardy (1964, 1971) did a monographic work on fruit flies from Nepal based on expedition collection and on Sri Lanka, respectively. Syed *et al.* (1970a, 1970b) and Syed (1970a, 1970b) studied the distribution, biology, seasonal occurrence, natural enemies, hosts range and life histories of different species in different climatic regions of Pakistan. White and Elson-Harris (1992) dealt with adults and third instar larvae of economically important (pest) species of the world, largely to help the quarantine staff and other worker to identify the pest species. Kapoor (1993) did work on taxonomy, zoogeography, pest status and control of Indian fruit flies. He did not mention characters of taxonomic importance of the species.

In the present study, the subfamily Dacinae (Tephritidae: Diptera) in South-East Asia is revised. Key to forty species, synonymy, description, material examined, photographs of the tomentum pattern on prescutum, wing, aculeus tip and scales on the distal end of eversible membrane of ovipositor are given. Already described species are redescribed here as most of the descriptions were made in early previous century and are inadequate.

## MATERIALS AND METHODS

Specimens belonging to the subfamily Dacinae, present in the collections of the Department of Entomology, The Natural History Museum, London from South-East Asian countries (Bhutan, India, Nepal, Pakistan and Sri Lanka), were used for this study. Specimens examined from the National Museum of Natural History, Smithsonian Institute, Washington DC are indicated by NMNH. Additional specimens were also collected from Pakistan and deposited in the Natural History Museum, London. Specimens were examined using 'Wild Herrbrugg' microscope. The following taxonomically important characters were studied.

### Head

Length of 1st flagellomere, facial marks.

### Thorax

Tomentum pattern on prescutum, scutum colour (other than vittae), postpronotal lobe colour (if other than yellow), notopleuron colour (if other than yellow), notopleural vitta (if present), lateral vitta of scutum, medial vitta of scutum, katatergite and anatergite colour (if other than yellow), scutellum mark, anterior supra-alar (*a.sa.*) seta, prescutellar acrostichal (*prsc.*) seta, scutellar (*sc.*) setae, form and forward expansion of anepisternal stripe, tibiae colour, femora colour, wing pattern (except costal band), costal band width, costal band apical expansion, costal band depth, costal band apical darkness, cell bc microtrichiae, cell c microtrichiae, cell br basal microtrichiae, wing length.

### Abdomen

Tergites fused, tergite markings, tergite I wasp-waisted, tergite III (males) with pecten, shape of sternite V (males), length of surstylus lobe, aculeus length and shape of aculeus apex, scales on the distal end of eversible membrane of ovipositor and males lure response.

The tomentum pattern on prescutum, shape of aculeus apex and scales on the distal end of eversible membrane of ovipositor were examined using a Scanning Electron Microscope (SEM) [Hitachi S 2500 (specimens examined after coating) or ISI ABT-55 (specimens examined without coating)]. The photographs of the wings were taken with Olympus BH-2 microscope and camera.

For studying the tomentum pattern on prescutum in the SEM (Hitachi S 2500), the head, wings, legs and abdomen were removed from the thorax and were preserved in gelatine capsule, pinned with label in the collection. The females specimens were dissected for measurement of aculeus length, studying the shape of aculeus apex and scales on the distal end of eversible membrane of ovipositor in SEM. The dissections were carried out by the procedure described by White and Elson-Harris (1992). The standard procedure of critical point drying (where necessary), mounting and coating were followed. Measurements were made using video camera and video plan software. The classifications of Drew (1989), White and Wang (1992) and terminology of McAlpine (1981), White and Elson-Harris (1992) were followed.

*Collection of fruit flies*

Fruit flies were collected from different regions of Pakistan, including Azad Kashmir, during July/August 1993, using "Dri - fly traps" and wax blocks impregnated with methyl eugenol, cue lure and dichlorvos. The traps were set in the evening and flies were collected the next morning. Methyl eugenol and cue lure were also used in liquid form. A small amount of methyl eugenol or cue lure was applied on the surface of leaf and observed for about two hours. In some cases the methyl eugenol and cue lure were applied on the surface of the leaf in the evening and specimens were collected next morning. The males that were attracted, were collected by a weep net and prepared/labelled, as described by White and Elson-Harris (1992). The collection was deposited in the Department of Entomology, the Natural History Museum, London. Some holotype and paratypes were given to the Pakistan Museum of Natural History, Islamabad.

## KEY TO THE SPECIES

- 1 Scutum with a pair of lateral vittae .....2
- Scutum without lateral vittae.....34
- 2 Scutum with medial vitta .....3
- Scutum without medial vitta .....19
- 3 Wing with veins dm-cu and usually also r-m covered by isolated infusate marks.....*Bactrocera (Zeugodacus) cucurbitae* (Coquillett)
- Wing pattern without infusate marks covering veins dm-cu and r-m.....4
- 4 Scutellum with one pair of setae (apical pair).....5
- Scutellum with two pairs of setae (basal and apical) .....12
- 5 Scutum with anterior supra-alar seta.....6
- Scutum without anterior supra-alar seta.....8
- 6 Scutum without prescutellar acrostichal seta. 1st flagellomere longer than ptilinal fissure along one side of face.....*Dacus (Callantra) icariiformis* (Enderlein)
- Scutum with prescutellar acrostichal seta. 1st flagellomere shorter than ptilinal fissure along one side of face.....7
- 7 Face entirely black, males with pecten .....*Bactrocera (Zeugodacus) sicieni* (Chao and Lin)
- Face not entirely black, females with a black transverse line above mouth opening. Males without facial mark: lacking a pecten.....*Bactrocera (Paratridacus) diversa* (Coquillett)
- 8 Abdominal tergites fused to a single sclerotized plate.....*Dacus (Leptoxyda) persicus* (Hendel)
- Abdominal tergites not fused except tergites 1+2, which are always fused. (When viewed from underside the segments seems to be overlapping).....9
- 9 Abdominal segment I+II wasp-waisted (longer than broad). Wing longer than 8mm .....10
- Abdominal segment I+II not wasp-waisted (broader than long). Wing shorter than 6mm.....11
- 10 Anepisternal stripe extended forward to the postpronotal lobe. Costal band width from wing base to below vein  $R_{4+5}$ . Costal band overlapping vein  $R_{2+3}$  in depth .....*Bactrocera (Tetradacus) minax* (Enderlein)
- Anepisternal stripe not extended forward. Costal band width from vein Sc to below vein M. Costal band not overlapping vein  $R_{2+3}$  in depth.....*Bactrocera (Tetradacus) brachycera* (Bezzi)
- 11 Face with a black spot in each antennal furrow.....*Bactrocera (Zeugodacus) scutellarius* (Bezzi)
- Face entirely yellow without any mark .....*Bactrocera (Javadacus) trilineata* (Hardy)
- 12 Scutum without prescutellar acrostichal seta.....*Bactrocera (Paradacus) watersi* (Hardy)
- Scutum with prescutellar acrostichal seta.....13
- 13 A black spot in each antennal furrow .....14
- Face with a transverse line or without any markings .....18
- 14 Anepisternal stripe shaped like inverted "L" and joined to the postpronotal lobe .....15
- Anepisternal stripe triangular or parallel-sided and not joined to the postpronotal lobe .....16
- 15 Scutellum yellow. All femora yellow brown .....*Bactrocera (Zeugodacus) gavisia* (Munro)
- Scutellum yellow with black apex. Femora yellow brown with apical one third black.....*Bactrocera (Zeugodacus) kaghanae* Mahmood
- 16 Postpronotal lobe yellow with anterodorsal black mark. Costal band not overlapping vein  $R_{2+3}$  in depth. Aculeus apex trilobed .....*Bactrocera (Zeugodacus) scutellaris* Bezzi
- Postpronotal lobe yellow. Costal band overlapping vein  $R_{2+3}$  in depth. Aculeus apex needle shaped .....17
- 17 Scutellum yellow with black apex.....*Bactrocera (Zeugodacus) signata* (Hering)
- Scutellum yellow .....*Bactrocera (Zeugodacus) zahadi* Mahmood
- 18 A complete black transverse line on face. Males with pecten .....*Bactrocera (Zeugodacus) caudata* (Fabricius)
- Females with a black transverse line on face, males without any facial markings. Males without pecten .....*Bactrocera (Hemigymnodacus) diversa* (Coquillett)
- 19 Scutellum with two pairs of setae (basal and apical).....20
- Scutellum with one pair of setae (apical).....22
- 20 Cell br narrow part with microtrichae. Costal band starts from wing base and overlapping vein  $R_{2+3}$  in depth. Males without pecten .....*Bactrocera (Paratridacus) garciniae* Bezzi
- Cell br narrow part without microtrichae. Costal band starts from vein Sc and not overlapping vein  $R_{2+3}$  in depth. Males with pecten.....21
- 21 Face entirely black.....*Bactrocera (Parazeugodacus) bipustulata* (Bezzi)
- Face with a transverse black line above mouth opening and black spots under antennae base which may joined to form an other transverse line .....*Bactrocera (Zeugodacus) duplicata* (Bezzi)
- 22 Scutum with anterior supra-alar seta .....23

- . Scutum without anterior supra-alar seta ..... *Bactrocera (Javadacus) pallescentis* (Hardy)
- 23 Cell br narrow part with microtrichae ..... 24
- . Cell br narrow part without microtrichae ..... 30
- 24 Face entirely black ..... *Bactrocera (Bactrocera) nigrofrimoralis* White and Tsuruta
- . Face not entirely black ..... 25
- 25 Anepisternal stripe extended forward to join postpronotal lob. .... *Bactrocera (Bactrocera) latifrons* (Hendel)
- . Anepisternal stripe not extended to join postpronotal lob. .... 26
- 26 All femora with apical black spot, at least at extreme apex .... 27
- . Femora without apical black spot (sometimes fore femur may have a black spot) ..... 28
- 27 Tergites III-V with lateral broad black marking ..... *Bactrocera (Bactrocera) caryae* (Kapoor)
- . Tergites III-V with narrow or without lateral broad black marking ..... *Bactrocera (Bactrocera) kandiensis* Drew and Hancock
- 28 Tomentum pattern on prescutum with a wide longitudinal gap ..... *Bactrocera (Bactrocera) verbascifoliae* Drew and Hancock
- . Tomentum pattern on prescutum without longitudinal gap ..... 29
- 29 Abdominal tergite III with a basal narrow black transverse band. Males attracted to methyl eugenol ..... *Bactrocera (Bactrocera) dorsalis* (Hendel)
- . Abdominal tergite III almost covered with a basal broad black transverse band. Males attracted to cue lure ..... *Bactrocera (Bactrocera) vishnu* Drew and Hancock
- 30 Scutellum black with a yellow spot on each side ..... *Bactrocera (Zeugodacus) biguttata* (Bezzi)
- . Scutellum yellow ..... 31
- 31 Scutum without prescutellar acrostichal seta ..... *Bactrocera (Bactrocera) affinis* (Hardy)
- . Scutum with prescutellar acrostichal seta ..... 32
- 32 Scutellum yellow sometimes with black apex. Wing costal band continuous from vein Sc to below vein  $R_{4+5}$  at the apex; without black spot at the apex of  $R_{4+5}$ . Aculeus 2.7mm long ..... *Bactrocera (Bactrocera) versicolor* (Bezzi)
- . Scutellum entirely yellow. Wing costal band within cell sc only; a black spot at the apex of  $R_{4+5}$ . Aculeus 1.1mm ..... 33
- 33 Face either with a pair of transverse black spots adjacent to the antennal furrow or with these spots joined to form a transverse black line above the mouth. Scutum colour black .. *Bactrocera (Bactrocera) correcta* (Bezzi)
- . Face with a black spot in each antennal furrow. Scutum colour brown ..... *Bactrocera (Bactrocera) zonata* (Saunders)
- 34 Abdominal segment I+II not wasp-waisted ..... 35
- . Abdominal segment I+II wasp-waisted ..... 37
- 35 Abdominal tergites III-V not fused ..... *Bactrocera (Daculus) oleae* (Gmelin)
- . All abdominal tergites fused to form a single sclerotized plate ..... 36
- 36 Anepisternal stripe extended to join postpronotal lob. Abdomen black brown. Costal band extending from vein Sc to vein  $R_{2+3}$  and isolated from a spot at the apex of vein  $R_{4+5}$ . .... *Dacus (Dacus) keiseri* (Hering)
- . Anepisternal stripe not joined with postpronotal lobe. Abdomen brown. Costal band extending from vein Sc to wing apex, without isolated spot ..... *Dacus (Didacus) ciliatus* (Loew)
- 37 Scutum with anterior supra-alar seta ..... 38
- . Scutum without anterior supra-alar seta ..... 40
- 38 Face entirely black ..... *Dacus (Callantra) crabroniformis* (Bezzi)
- . Face with a black spot in each antennal furrow ..... 39
- 39 Costal band light coloured, and expanded into a spot at apex; depth of costal band (at the end of  $R_1$ ) to  $R_{4+5}$ . Cell bc without microtrichae. Abdomen light brown, with apex of tergite I + II pale yellow, with a longitudinal black line ..... *Dacus (Callantra) discophora* Hering
- . Costal band dark coloured, without a spot at apex; depth of costal band (at the end of  $R_1$ ) to between  $R_{4+5}$  and M. Cell bc with a complete covering of microtrichae. Abdomen dark brown ..... *Dacus (Callantra) longicornis* Weidmann
- 40 Face with a transverse line above mouth ..... *Dacus (Callantra) polistiformis* (Senior-White)
- . Face with a black spot in each antennal furrow ..... *Dacus (Callantra) sphaeroidalis* (Bezzi)

### Genus *BACTROCERA* Macquart

*Bactrocera* Macquart, 1835: 452. [Type-species *Bactrocera longicornis* Macquart, 1835, by monotypy].

*Dacus* Fabricius: auctt. partim, pre 1989.

*Bactrocera* Macquart: Drew, 1989: 12; Hardy and Foote 1989: 503; White and Elson-Harris, 1992:165; Kapoor 1993: 72.

#### 1 - *Bactrocera (Bactrocera) affinis* (Hardy) (Figs. 1-4)

*Dacus (Neodacus) affinis* Hardy 1954:7. [Type loc. India (Tamil Nadu)].

*Dacus (Bactrocera) affinis* Hardy; Hardy 1977:48.

*Bactrocera (Bactrocera)* sp near *B. (B.) zonata* (Saunders); White and Elson-Harris, 1992:277.

*Dacus zonatus* (Saunders): auctt. partim, S. India (misidentification).

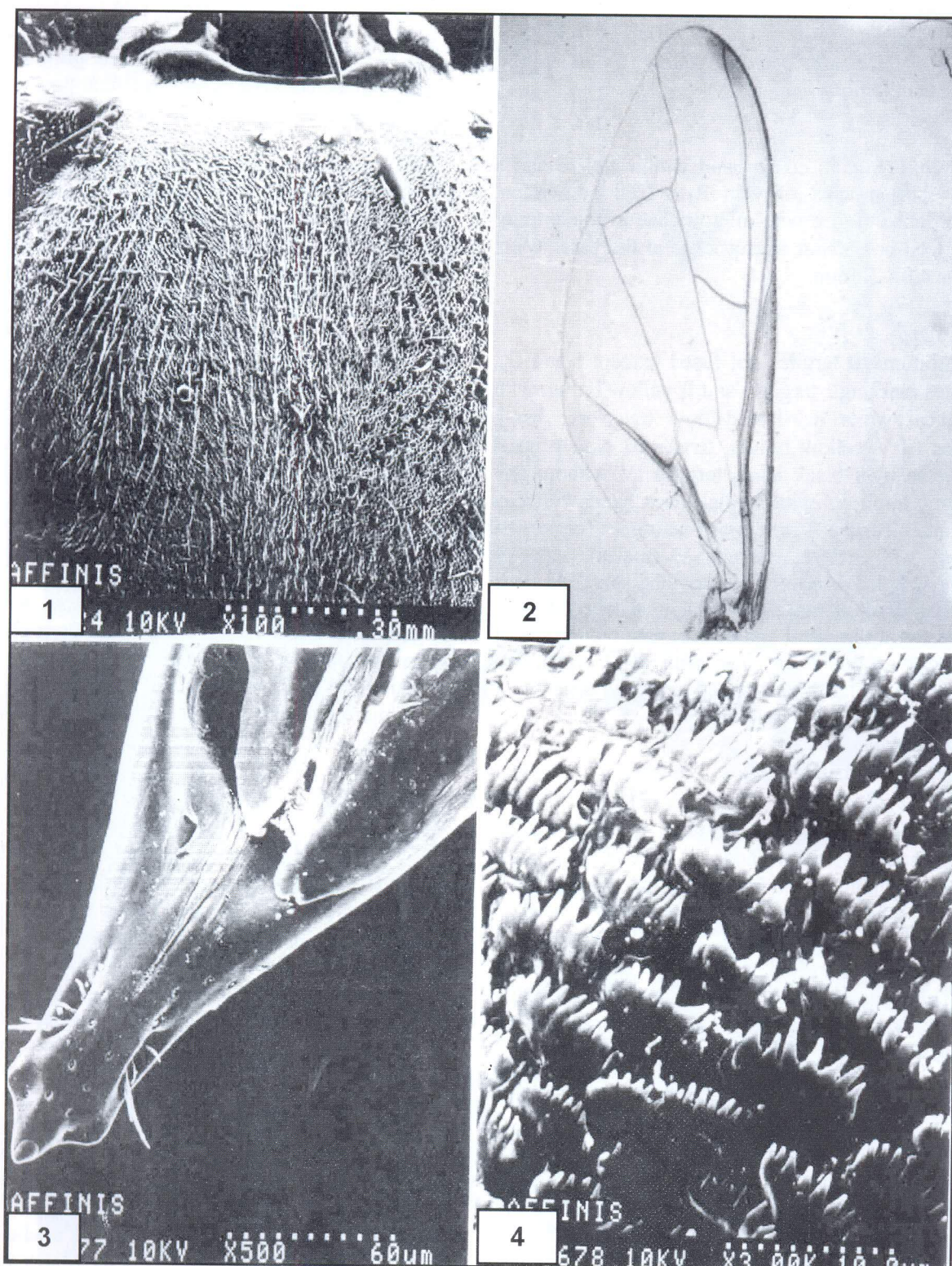
*Bactrocera (Bactrocera) affinis* (Hardy): Kapoor 1993:73.

#### Head

First flagellomere shorter than ptilinal fissure. Face with a black spot in each antennal furrow.

#### Thorax

Tomentum pattern without longitudinal gap in the middle of prescutum (Fig.1). Scutum colour (other than vittae) red brown. Lateral vitta of scutum present, yellow, ending well before intra-alar seta. Medial vitta of scutum absent. Scutellum yellow. Setae; *a.sa.* present, *pr.sc.* absent, *sc.* one pair. Anepisternal stripe extended forward to anterior notopleural seta.



Figs. 1-4. *B. affinis*. 1, tomentum pattern on prescutum. 2, wing. 3, aculeus apex. 4, scales on the distal end of eversible membrane of ovipositor.

*Legs*

All tibiae and femora yellow brown; tibiae darker than femora.

*Wing*

Wing (Fig. 2) costal band within cell *sc* and a black spot at apex of vein  $R_{4+5}$ . Cell *bc* without microtrichiae. Cell *c* with microtrichiae in the anterior apex. Cell *br* without microtrichiae at the base. Wing length: 4.8 – 5.4mm.

*Abdomen*

Abdominal tergites not fused (except I and II). Tergites markings: tergite I and II yellow brown with an apical white or light yellow transverse band, tergites III-V yellow brown, tergite III with a basal transverse light black band, tergites IV without any marking, tergite V with medial black bands between ceromata. Tergite I not wasp-waisted. Tergite III (males) with pecten. Sternite V (males) with V-shaped notch. Posterior surstylus lobe short. Aculeus length: 0.70 – 0.80mm. Aculeus apex trilobed (Fig.3). The scales at the distal end of eversible membrane of ovipositor of medium size with 8-11 tooth-like structure (Fig.4). Males attracted to methyl eugenol.

*Material examined*

**India:** Yercaud, 6 males (paratype), vi.1950, 1 female, 12-20.v.1914, 1 male, 1.viii.1917, 2 males, 3.vi.1992, Coonor, 2 males, 28-30.v.1992, Madakasira, 3 males and 1 female, 7.v.1914, Kemmannugundi, 1 male, 21.v.1992, Chethalli, 2 males, 22-24.v.1992, 1 male, 1.iv.1986.

*Comments*

This species differ from *B. zonata* in lacking prescutellar acrotichal seta and having trilobed aculeus.

2 - *Bactrocera (Bactrocera) caryae* Kapoor  
(Figs. 5-8)

*Chaetodacus ferrugineus incisus* Bezzi, 1916:105, not Walker, 1860, (misidentification)

*Dacus (Bactrocera) caryae* Kapoor, 1971:479. [Type loc., India (Karnataka as Mysore)].

*Bactrocera (Bactrocera) caryae* Kapoor, White and Elson-Harris, 1992:186.

*Head*

First flagellomere shorter than ptilinal fissure. Face with a black spot in each antennal furrow.

*Thorax*

Tomentum pattern without longitudinal gap in the middle of prescutum (Fig.5). Scutum colour (other than vittae) black. Postpronotal lobe yellow with dorso-anterior part black or dark brown. Lateral vitta of scutum present, yellow, ending before intra alar seta. Medial vitta of scutum absent. Scutellum yellow. Setae; *a.sa.* present, *prsc.* present, *sc.* one pair. Anepisternal stripe not extended forward.

*Legs*

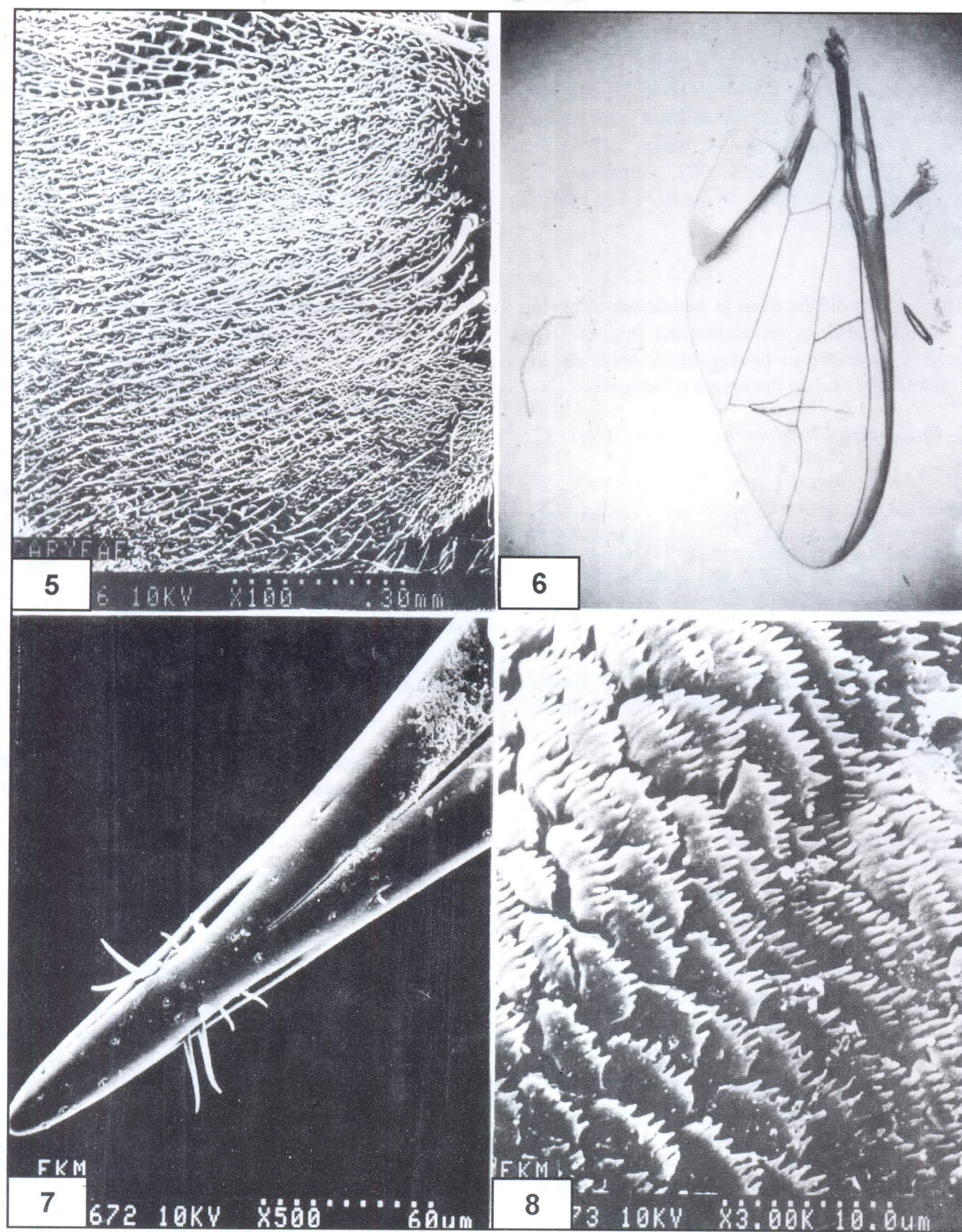
Fore tibia light red brown with dark outer portion. Mid tibia light red brown with black base. Hind tibia black. All femora yellow brown with a large black spot on the apices.

*Wing*

Wing (Fig.6) costal band width from vein *Sc* to slightly below vein  $R_{4+5}$  at wing apex. Costal band not expanded apically. Costal band not overlapping vein  $R_{2+3}$  in depth. Cell *bc* without microtrichiae. Cell *c* with microtrichiae only in anterior apex. Cell *br* with microtrichiae at the base in anterior part. Wing length: 4.5 – 6.5mm.

*Abdomen*

Abdominal tergites not fused (except I and II). Tergites markings: tergite I black with a apical transverse light yellow brown band, tergite II yellow brown with black lateral margins and a basal transverse black band, tergites III – V yellow brown with a medial longitudinal black band, tergite III with a basal transverse black band and expanded on lateral margins, tergite IV with broad lateral margins that almost cover the entire lateral margins, tergite V also with broad lateral black markings. Tergite I not wasp-waisted. Tergite III (males) with pecten. Sternite V (males) with V- shaped notch. Posterior surstylus lobe short. Aculeus length: 1.56 – 1.78 mm. Aculeus apex needle shaped (Fig.7). The scales at the distal end of eversible membrane of ovipositor of medium size with 8-11 tooth-like structure (Fig.8). Males attracted to methyl eugenol.



Figs. 5-8. *B. caryeae*. 5, tomentum pattern on prescutum. 6, wing. 7, aculeus apex. 8, scales on the distal end of eversible membrane of ovipositor.

*Material examined*

**India:** Vattalkundu, 110 males, 2.vi.1992, Thadiyankudisai, 38 males, 1.vi.1992, ICAR Res.Stn., 29 males, 22-24.v.1992, Pannaikadu, 14 males, 1.v.1992, Kemmannugundi, 31 males, 21.v.1992, Mudigere, 10 males, 20-22.v.1992, Appangala, 23 males, 23.v.1992, Chethalli, 4 males, 14.iv.1986, 2 females, 31.iii.1986.

*Comments*

This species differs from *B. kandiensis* in having broad lateral markings on abdominal tergites III-V and from *B. dorsalis* in having black spots on the postpronotal lobe and on the apices of femora.

**3 - *Bactrocera (Bactrocera) correcta* (Bezzi)**  
(Figs. 9-12)

*Chaetodacus correctus* Bezzi 1916:107. [Type loc., India(Bihar)].  
*Bactrocera zonata* (Saunders) Bezzi 1913:94. (misidentification)  
*Dacus (Bactrocera) correctus* (Bezzi), Hardy, 1977:49.  
*Bactrocera (Bactrocera) correcta* (Bezzi), White and Elson-Harris, 1992:180; Kapoor, 1993:73

*Head*

First flagellomere shorter than ptilinal fissure. Face with a black transverse line in each antennal furrow below antennae base, sometimes not joined in the middle.

*Thorax*

Tomentum pattern without longitudinal gap in the middle of prescutum (Fig. 9). Scutum colour (other than vittae) black. Lateral vitta of scutum present, yellow, ending beyond intra alar seta. Medial vitta of scutum absent. Scutellum yellow. Setae; *a.sa.* present, *prsc.* present, *sc.* one pair. Anepisternal stripe extended forward to anterior notopleural setae.

*Legs*

All tibiae and femora yellow brown except hind tibia, which is with black apex or dark.

*Wing*

Wing (Fig.10) costal band within cell *sc* only (light brown in colour) and a black spot at the apex of vein  $R_{4+5}$ . Cell *bc* without microtrichae. Cell *c* with microtrichae in anterior apex. Cell *br* without microtrichae at the base. Wing length: 4.6 – 5.3mm.

*Abdomen*

Abdominal tergites not fused (except I and II). Tergites markings: tergite I black with a apical yellow brown transverse band, tergite II yellow with a basal transverse black band, tergites III – V red brown with a medial longitudinal black band, tergite III with a basal narrow transverse black band, tergites IV and V with black triangular lateral markings. Tergite I not wasp-waisted. Tergite III (males) with pecten. Sternite V (males) with V- shaped notch. Posterior surstylus lobe short. Aculeus length: 1.05 – 1.07mm. Aculeus apex needle shaped (Fig.11). The scales at the distal end of eversible membrane of ovipositor of medium size with 8 to 11 tooth-like structure (Fig.12). Males attracted to methyl eugenol.

*Material examined*

**India:** Pannaikadu, 3 males, 1.vi.1992, near Yercaud, 29 males, 3.vi.1992, near Kodaikanal, 3 males, 1.vi.1992, Burlair, 16 males, 29-30.vi.1992, Vattalkundu, 3 males, 2.vi.1992, TNAU Res.Stn., 12 males 1.vi.1992, Tenmalai, 22 males, 12-15.v.1937. **Sri Lanka:** Kanthalla, 4 males and 3 females, 31.vii.1990, Peradeniya, 4 males, 24.vii.1913, 3 males, 24.viii.1913, 3 males, viii-ix.1992.

*Comments*

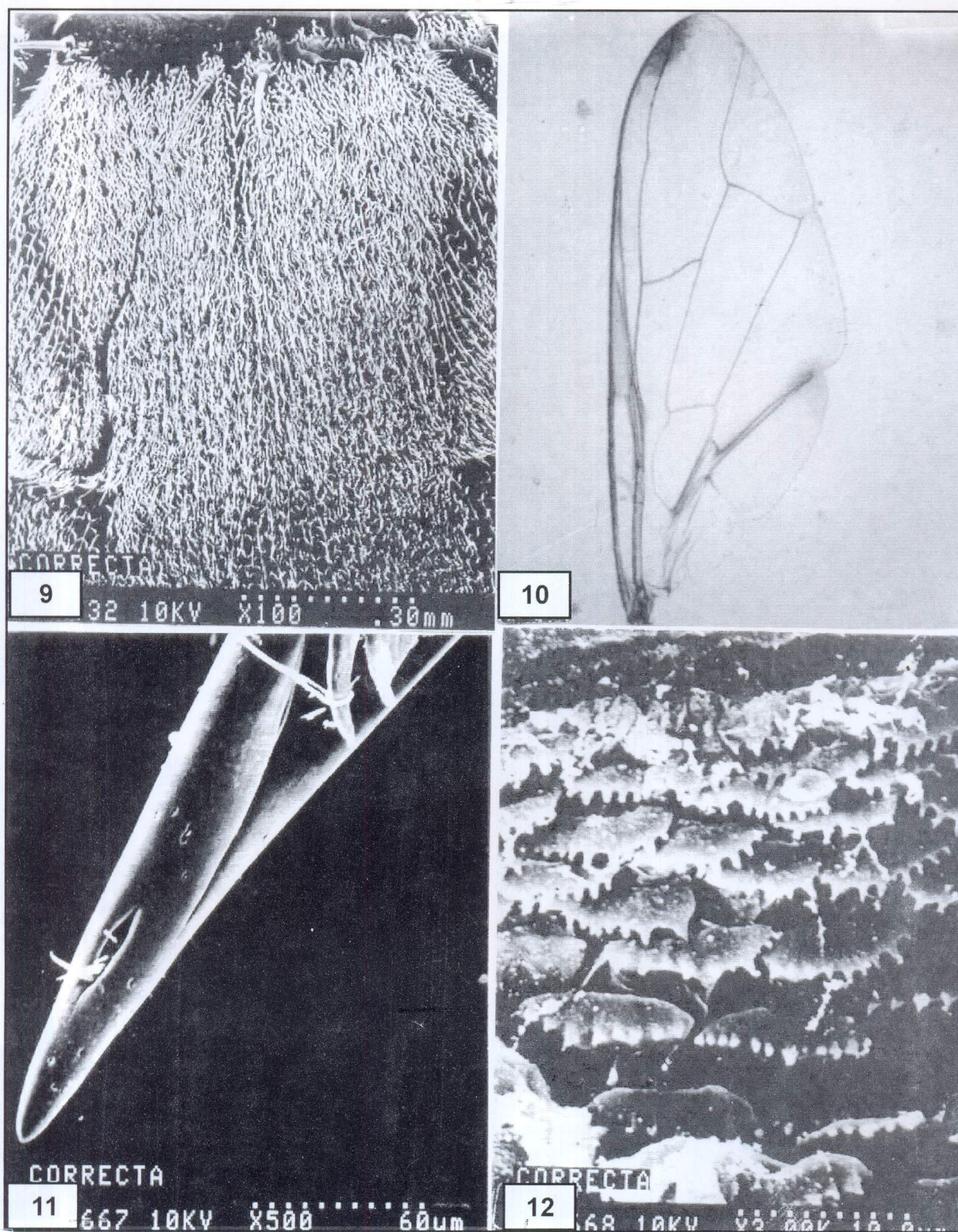
This species differs from *B. zonata* in having black scutum and black transverse black line above mouth opening.

**4 - *Bactrocera (Bactrocera) dorsalis* (Hendel)**  
(Figs. 13-16)

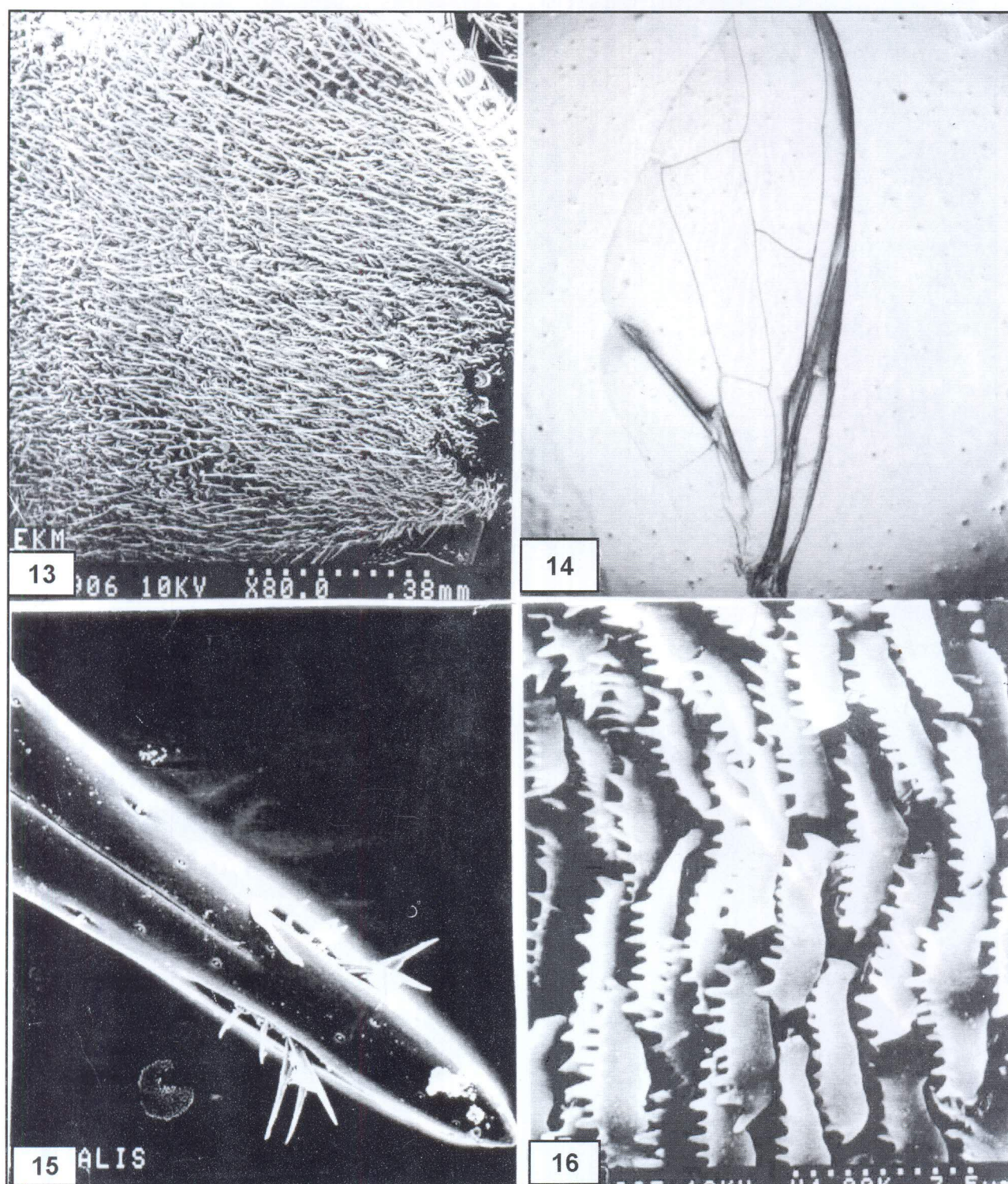
*Dacus dorsalis* Hendel, 1912:18. [Type loc. Taiwan as Formosa (Koshun)].  
*Musca ferruginea* Fabricius, 1794:342. [Type loc. East India].  
*Bactrocera conformis* Doleschall, 1858:122. [Type loc. Indonesia (Maluku)].  
*Chaetodacus ferrugineus* var. *okinawanus* Shiraki, 1933:62. [Type loc. Japan (Nago)].  
*Dacus (Bactrocera) dorsalis* Hendel: Hardy, 1977:49.  
*Bactrocera (Bactrocera) dorsalis* (Hendel): Drew, 1989:63; White and Elson-Harris, 1992: 187; Kapoor, 1993: 74; Drew and Hancock, 1994:17.

*Head*

First flagellomere shorter than ptilinal fissure. Face with a black spot in each antennal furrow.



Figs. 9-12. *B. correcta*. 9, tomentum pattern on prescutum. 10, wing. 11, aculeus apex. 12, scales on the distal end of eversible membrane of ovipositor.



Figs. 13-16. *B. dorsalis*. 13, tomentum pattern on prescutum. 14, wing. 15, aculeus apex. 16, scales on the distal end of eversible membrane of ovipositor.

*Thorax*

Tomentum pattern without longitudinal gap in the middle of prescutum (Fig.13). Scutum colour (other than vittae) red brown to black. Lateral vitta of scutum present, yellow, ending in front of intra alar seta. Medial vitta of scutum absent. Scutellum yellow. Setae; *a.sa.* present, *prsc.* present, *sc.* one pair. Anepisternal stripe not extended forward.

*Legs*

Fore tibia red brown with outer part black brown. Mid tibia red brown with slightly black base. Hind tibia black. All femora red brown.

*Wing*

Wing (Fig.14) costal band width from vein Sc to slightly below vein  $R_{4+5}$  at wing apex. Costal band not overlapping vein  $R_{2+3}$  in depth. Cell bc without microtrichae. Cell c with microtrichae in the anterior apex only. Cell br with microtrichae at the base. Wing length: 4.0 – 7.0mm.

*Abdomen*

Abdominal tergites not fused (except I and II). Tergites markings: tergite I black with apical transverse yellow brown band, tergite II yellow brown with basal transverse black band, tergites III – V with medial longitudinal black band, tergite III with a basal narrow transverse black band, tergite IV and V with black triangular lateral markings, sometimes longitudinal black bands on lateral margins and sometimes without any mark. Tergite I not wasp-waisted. Tergite III (males) with pecten. Sternite V (males) with V-shaped notch. Posterior surstylus lobe short. Aculeus length: 1.28 – 1.5 mm. Aculeus apex needle shaped (Fig.15). The scales at the distal end of eversible membrane of ovipositor large, with 8 to 11 tooth-like structure (Fig.16). Males attracted to methyl eugenol.

*Material examined*

**Taiwan (Formosa):** Koshun, 1 male (lectotype), 9.v.08, 2 females (paralectotype), 9.v.08, 10 males (paralectotype), 9.v.08, Tainan, 1 male (paralectotype), v.1912. (designated by Drew and Hancock, 1994). **India:** Burlair, 8 males, 29.v.1992, Chethalli, 8 males, 22-24.v.1992, Nandi, 18 males,

26.v.1992, Kushalnagar, 8 males, 24.v.1992, Vattalkunda, 5 males, 2.vi.1992. **Pakistan:** Chakwal, 12 males, 25.vii.1993, Haripur, 30 males, 9.viii.1993, Muzaffarabad, 10 males, 4.viii.1993, Rawalpindi, 30 males, 26.x.1992, 30 males, 3.viii.1993, 3 males and 3 females, 27.vii.1961. **Sri Lanka:** Colombo, 29 males, 7-20.ix.1992, Peradeniya, 27 males, vii-xi.1992.

*Comments*

The variability in this species in Taiwan (Type locality), Hawaii, India and Thailand has been discussed by Mahmood (1999a). Munro (1939) discussed colour variations in this species in India and Pakistan. Pakistani form of *B. dorsalis* is paler in colour and has a longer aculeus than of the type specimens.

**5 - *Bactrocera (Bactrocera) kandiensis***

Drew and Hancock

(Figs. 17-20)

*B. (B.)* sp. near *dorsalis* (D), White and Elson-Harris, 1992:198.

*Bactrocera (Bactrocera) kandiensis* Drew and Hancock, 1994: 31. [Type loc., Peradeniya (Sri Lanka)].

*Head*

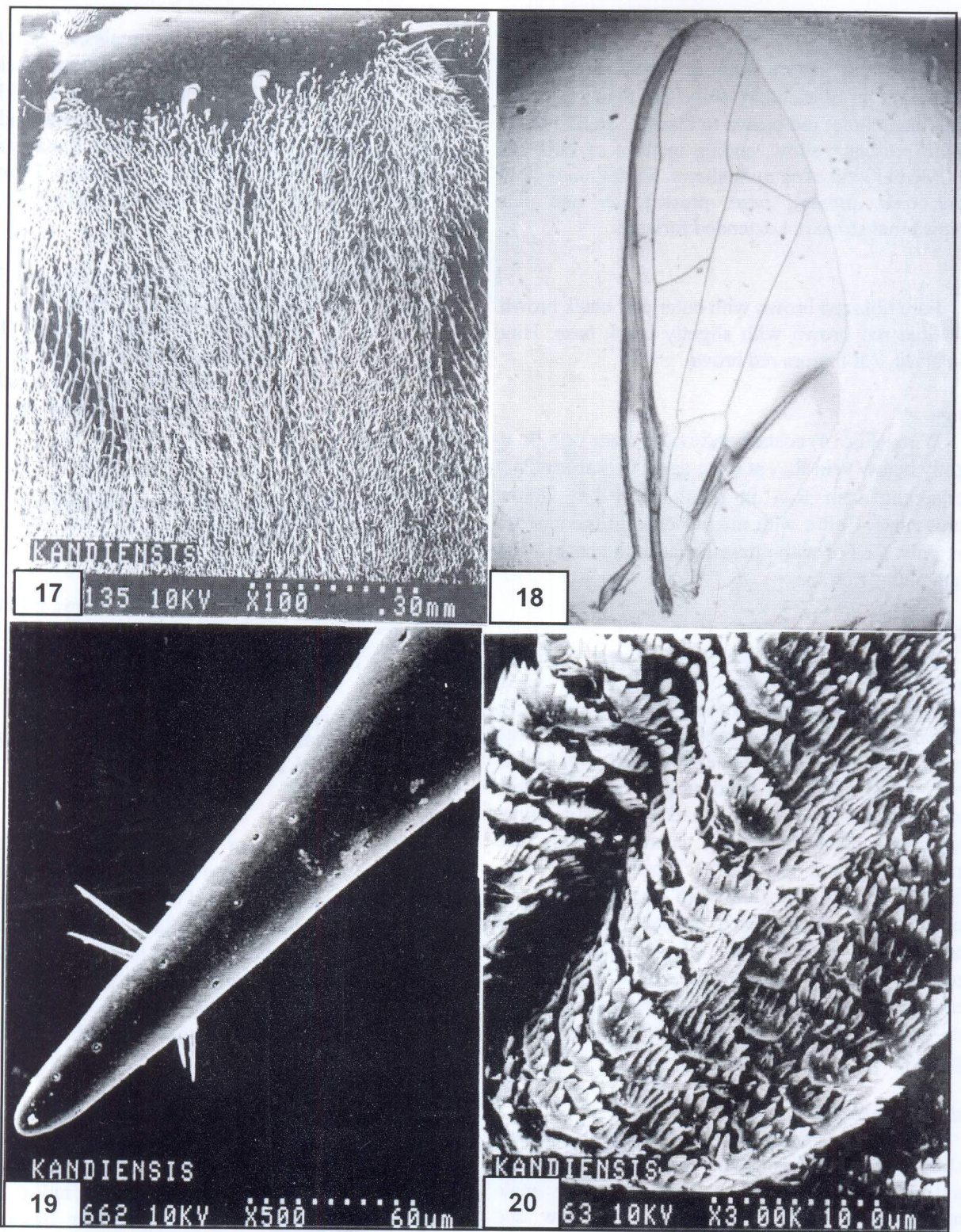
First flagellomere shorter than ptilinal fissure. Face with a black spot in each antennal furrow.

*Thorax*

Tomentum pattern without longitudinal gap in the middle of prescutum (Fig.17). Scutum colour (other than vittae) black. Postpronotal lobe yellow with anteromedial corner black. Lateral vitta of scutum present, yellow, ending in front of intra alar seta. Medial vitta of scutum absent. Scutellum yellow. Setae; *a.sa.* present, *prsc.* present, *sc.* one pair. Anepisternal stripe not extended forward.

*Legs*

Fore tibia yellow brown with darker outer portion. Mid tibia yellow brown with darker base. Hind tibia black. All femora yellow brown. Fore femur with an outer black spot covering apical 2/3 of the femur. Mid femur with an outer black spot covering apical half of the femur. Hind femur with an outer black spot covering apical 1/3 of the femur.



Figs. 17-20. *B. kandiensis*. 17, tomentum pattern on prescutum. 18, wing. 19, aculeus apex. 20, scales on the distal end of eversible membrane of ovipositor.

*Wing*

Wing (Fig.18) costal band width from vein Sc to slightly below vein  $R_{4+5}$  at wing apex. Costal band not overlapping vein  $R_{2+3}$  in depth. Cell bc without microtrichae. Cell c with microtrichae in the anterior apex only. Cell br with microtrichae at the base. Wing length: 5.0 – 6.5mm.

*Abdomen*

Abdominal tergites not fused (except I and II). Tergites markings: tergite I black or dark red brown with light brown apical transverse band, lateral margins shiny black which extend on tergite II, tergite II yellow brown with basal transverse black band, tergites III – V red brown with a medial longitudinal narrow black band, tergite III with a narrow to moderate broad basal transverse black band, tergite IV and V with anterolateral triangular or longitudinal narrow line shaped black markings. Tergite I not wasp-waisted. Tergite III (males) with pecten. Sternite V (males) with V- shaped notch. Posterior surstylus lobe short. Aculeus length: 1.6 – 1.82mm. Aculeus apex needle shaped (Fig.19). The scales at the distal end of eversible membrane of ovipositor of medium size, with 8 to 11 tooth-like structure (Fig.20). Males attracted to methyl eugenol.

*Material examined*

**Sri Lanka:** Peradeniya, 1 female (Holotype), vi.1901, 1 male (Paratype), vi. 1901, 2 males (Paratype), 10.vii.1914, 13 males, 12-14.x.1992, 26 males, viii-xi.1992, Kandy, 1 male (Paratype), 29.vi.1953, 1 male, 18.vi.1953, 1 male, 20.v.1991, Colombo, 5 males, 7-20.x.1992, Battaramulla, 23 males, 16-18.x.1992.

*Comments*

This species differs from *B. dorsalis* in having black spots on the apex of all the femora and the postpronotal lobe with anterodorsal portion black. This species also differs from *B. caryae* in having narrow anterolateral markings on abdominal tergites III-V.

6 - *Bactrocera (Bactrocera) latifrons* (Hendel)  
(Figs. 21-24)

*Chaetodacus latifrons* Hendel, 1915:425. [Type loc., Tainan,

Takao and Suisharyo Taiwan (as Formosa)].

*Dacus (Bactrocera) latifrons* (Hendel): Hardy, 1977:50.

*Bactrocera (Bactrocera) latifrons* (Hendel): White and Elson-Harris, 1992:208; Kapoor, 1993:75.

*Head*

First flagellomere shorter than ptilinal fissure. Face with a black spot in each antennal furrow.

*Thorax*

Tomentum pattern without longitudinal gap in the middle of prescutum (Fig.21). Scutum colour (other than vittae) black. Lateral vitta of scutum present, yellow, ending in front of intra alar seta. Medial vitta of scutum absent. Scutellum yellow. Setae; *a.sa.* present, *prsc.* present, *sc.* one pair. Anepisternal stripe extended forward beyond anterior notopleural seta.

*Legs*

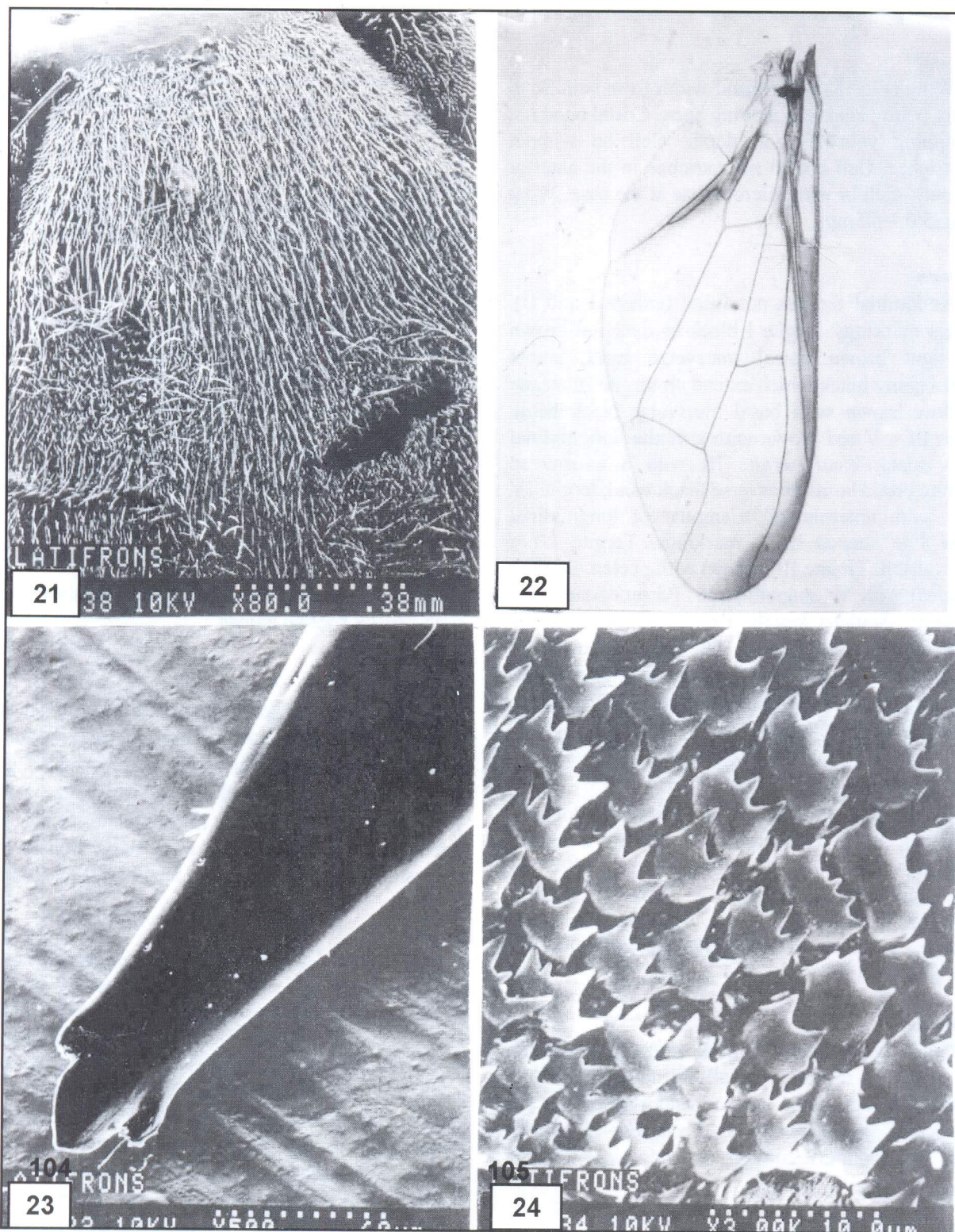
All tibiae black brown. All femora yellow brown with a black spot on apices.

*Wing*

Wing (Fig.22) costal band width from vein Sc to below vein  $R_{4+5}$  at wing apex. Costal band not overlapping vein  $R_{2+3}$  in depth. Costal band slightly expanded to form a small spot at wing apex around vein  $R_{4+5}$ . Cell bc without microtrichae. Cell c with microtrichae in the anterior apex only. Cell br with microtrichae at the base. Wing length: 5.0 – 5.9mm.

*Abdomen*

Abdominal tergites not fused (except I and II). Tergites markings: all tergites red brown, tergite I black or black brown with light brown apical transverse band, tergite II light brown with a basal transverse black band, tergites III – V red brown with a narrow medial longitudinal black band, tergite III with a narrow to moderately broad basal transverse black band. Tergite I not wasp-waisted. Tergite III (males) with pecten. Sternite V (males) with V-shaped notch. Posterior surstylus lobe short. Aculeus length: 1.52 – 1.75 mm. Aculeus apex trilobed shaped (Fig.23). The scales at the distal end of eversible membrane of ovipositor small, with 3 to 5 tooth-like structure (Fig.24). Males lure response unknown.



Figs. 21-24. *B. latifrons*. 21, tomentum pattern on prescutum. 22, wing. 23, aculeus apex. 24, scales on the distal end of eversible membrane of ovipositor.

*Material examined*

**Taiwan (Formosa):** Tainan, 1 male (Type), 1912. **India:** Yercaud, 1 female, 16.v.1946, Mudigere, 2 males and 1 female, 20-22.v.1992, Coimbatore, 2 males, 22.vii.1936. **Sri Lanka:** Tudaganga, 1 female, 9.xi.1918, 1 female, 10.xii.1918, 1 female, 22.ix.1918, 1 female, 19.vii.1918, 1 female, 27.viii.1919, Hingurakgoda, 1 male, 20.xii.195, Kandy, 1 male, 9.viii.1892.

*Comments*

This species is different from *B. affinis* in having microtrichia at the base of cell br and from *B. dorsalis*, in having trilobed aculeus and anepisternal stripe extended beyond anterior notopleural seta.

**7 - *Bactrocera (Bactrocera) nigrofemoralis***

White and Tsuruta  
(Figs. 25-28)

*Bactrocera (Bactrocera) nigrofemoralis* Tsuruta and White, 2001: 79.

*Head*

First flagellomere shorter than ptilinal fissure. Face entirely black.

*Thorax*

The anterior part of the prescutum without tomentum and posterior part without any pattern (Fig.25). Scutum colour (other than vittae) black. Postpronotal lobe yellow with anterodorsal corner black. Notopleuron yellow with anterolateral part black. Lateral vitta of scutum present, yellow, narrow, short, ending half way on post scutum. Medial vitta of scutum absent. Scutellum yellow. Setae; *a.sa.* present, *pr.sc.* present, *sc.* one pair. Anepisternal stripe extended forward to anterior notopleural seta.

*Legs*

Fore tibiae brown black. Mid tibia yellow brown with basal 1/3 slightly dark coloured. Hind tibia dark black. Fore and mid femora dark black. Hind femur basal half yellow brown, apical half dark black.

*Wing*

Wing (Fig.26) costal band width from vein Sc to slightly below vein R<sub>4+5</sub> at wing apex. Costal band not

expanded apically. Costal band not overlapping vein R<sub>2+3</sub> in depth. Cell bc without microtrichae. Cell c with microtrichae in the anterior apex only. Cell br with microtrichae at the base. Wing length: 3.8 – 5.1 mm.

*Abdomen*

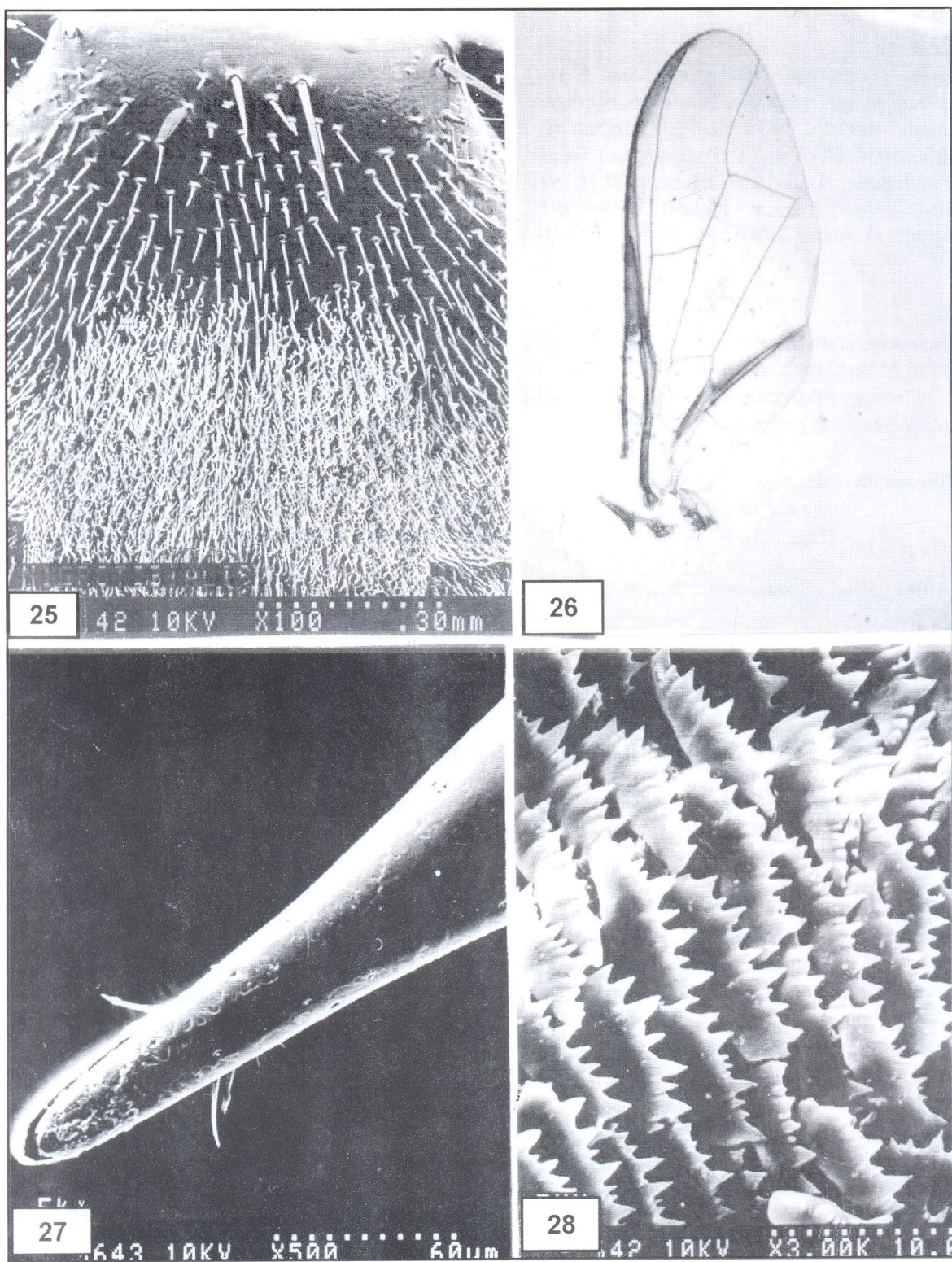
Abdominal tergites not fused (except I and II). Tergites markings: tergite I dark black with a apical, narrow, incomplete transverse brown black band, tergite II basal half dark black, apical half yellow brown, tergite III entirely dark black, tergites IV and V dark black with two longitudinal yellow brown bands on both sides of medial longitudinal black band. Tergite I not wasp-waisted. Tergite III (males) with pecten. Sternite V (males) with V- shaped notch. Posterior surstylus lobe short. Aculeus length: 1.2mm. Aculeus apex needle shaped (Fig.27). The scales at distal end of eversible membrane of ovipositor long with 6-11 tooth-like structure (Fig.28). Males attracted to cue lure.

*Material examined*

**Bhutan:** Tatapani, 1 male, 9-13.ix.1990, Thandiyankudisai, 1 male, 1.vi.1992, India, Near Yercaud, 4 males, 3.vi.1992, Coonoor, 3 males, 29-30.vi.1992, Talakaveri. 5 males, 23.v.1992, Vattalkundu, 7 males, 2.vi.1992, Chethalli, 1 female, 14.vi.1986, Burlair, 3 males, 29.v.1992. **Pakistan:** Rawalpindi, 15 males, 15.viii.1993. **Sri Lanka:** Trincomali, 2 females, 3.viii.1890, Peradeniya, 3 males, viii-xi.1992, 1 female, vi.1901, Gannoruwa, 4 males, 20.v.1991.

*Comments*

This species is similar to *Bactrocera (Bactrocera) nigrotibialis* (Perkins) in South-East Asia. The lateral vittae are parallel sided in this species but tapering posteriorly in *B. nigrotibialis*. Anepisternal stripe is not or slightly expanded forward in *B. nigrotibialis* while in this species it is extended to anterior notopleural setae. Tibiae and femora are black except basal 2/3 of hind femur which is yellow brown in *B. nigrotibialis* while in this species fore tibia brown black, mid tibia yellow brown with basal 1/3 slightly dark coloured, hind tibia dark black, fore and mid femora dark black, hind femur basal half yellow brown, apical half dark



Figs. 25-28. *B. nigrofemoralis*. 25, tomentum pattern on prescutum. 26, wing. 27, aculeus apex. 28, scales on the distal end of eversible membrane of ovipositor.

black. Most records of *B. nigrotibialis* by White and Elson-Harris (1992) and Kapoor (1993) in the Indian Sub-continent were based on this species.

### 8 - *Bactrocera (Bactrocera) verbascifoliae*

Drew and Hancock  
(Figs. 29-32)

*Bactrocera (Bactrocera) verbascifoliae* Drew and Hancock:  
Drew and Hancock, 1994:64. [Type loc., Thailand (Doi pui  
and Chiang Mai.)].

#### Head

First flagellomere shorter than ptilinal fissure. Face with a black spot in each antennal furrow.

#### Thorax

Tomentum pattern with longitudinal gap in the middle of prescutum (Fig.29). Scutum colour (other than vittae) black. Lateral vitta of scutum present, yellow, ending at intra alar seta. Medial vitta of scutum absent. Scutellum yellow. Setae; *a.sa.* present, *prsc.* present, *sc.* one pair. Anepisternal stripe not extended forward.

#### Legs

Fore tibia yellow brown with outer part slightly black. Mid tibia yellow brown with dark base. Hind tibia black. All femora yellow brown.

#### Wing

Wing (Fig.30) costal band width from vein Sc to slightly below vein  $R_{4+5}$  at wing apex. Costal band not overlapping vein  $R_{2+3}$  in depth. Cell bc without microtrichae. Cell c with microtrichae in the anterior apex only. Cell br with microtrichae at the base. Wing length: 4.0 – 5.5mm.

#### Abdomen

Abdominal tergites not fused (except I and II). Tergites markings: tergite I yellow brown with basal 2/3 black, extending on lateral margins of tergite II, tergite II yellow brown with basal transverse black band, tergites III – V with a moderately broad medial longitudinal black band, tergite III with a basal broad transverse black band, which extend on lateral margins to cover the entire tergite, tergites IV and V with broad black lateral markings. Tergite I not wasp-

waisted. Tergite III (males) with pecten. Sternite V (males) with V- shaped notch. Posterior surstylus lobe short. Aculeus length: 1.4 mm. Aculeus apex needle shaped (Fig.31). The scales at the distal end of eversible membrane of ovipositor of medium size, with 10 to 14 tooth-like structure (Fig.32). Males attracted to methyl eugenol.

#### Material examined

**Bhutan:** Tashi, 10 males, 4.x.1991, Lingmethay, 10 males, 3.x.1991. **India:** Nilgiris hills, 3 males (Paratype), 27.v.1992, Coonoor, 35 males, 19-30.v.1992, 10 males, 29.v.1992, Naduvittum, 21 males, 27.v.1992, Wellington, 17 males, 29.v.1992, Coimbatore, 1 male, 29.viii.1925, 1 male and 1 female, 15.viii.1927, Nilgris, 2 males, 22.viii.1935. **Sri Lanka:** Hakgala, 4 males, 1.xii.1994, Rendapola, 2 males, 14.x.1994.

#### Comments

Differs from *B. dorsalis* in having broad basal transverse band on tergite III and broad lateral markings on tergites IV and V. Differs from *B. vishnu* in lacking black spots on outer apex of fore femur. The males this species were attracted to methyl eugenol, while the males of *B. vishnu* were attracted to cue lure.

### 9 - *Bactrocera (Bactrocera) versicolor* (Bezzi)

(Figs. 33-36)

*Chaetodacus ferrugineus* var. *versicolor* Bezzi, 1916:105. [Type loc., Sri Lanka (Peradeniya)]

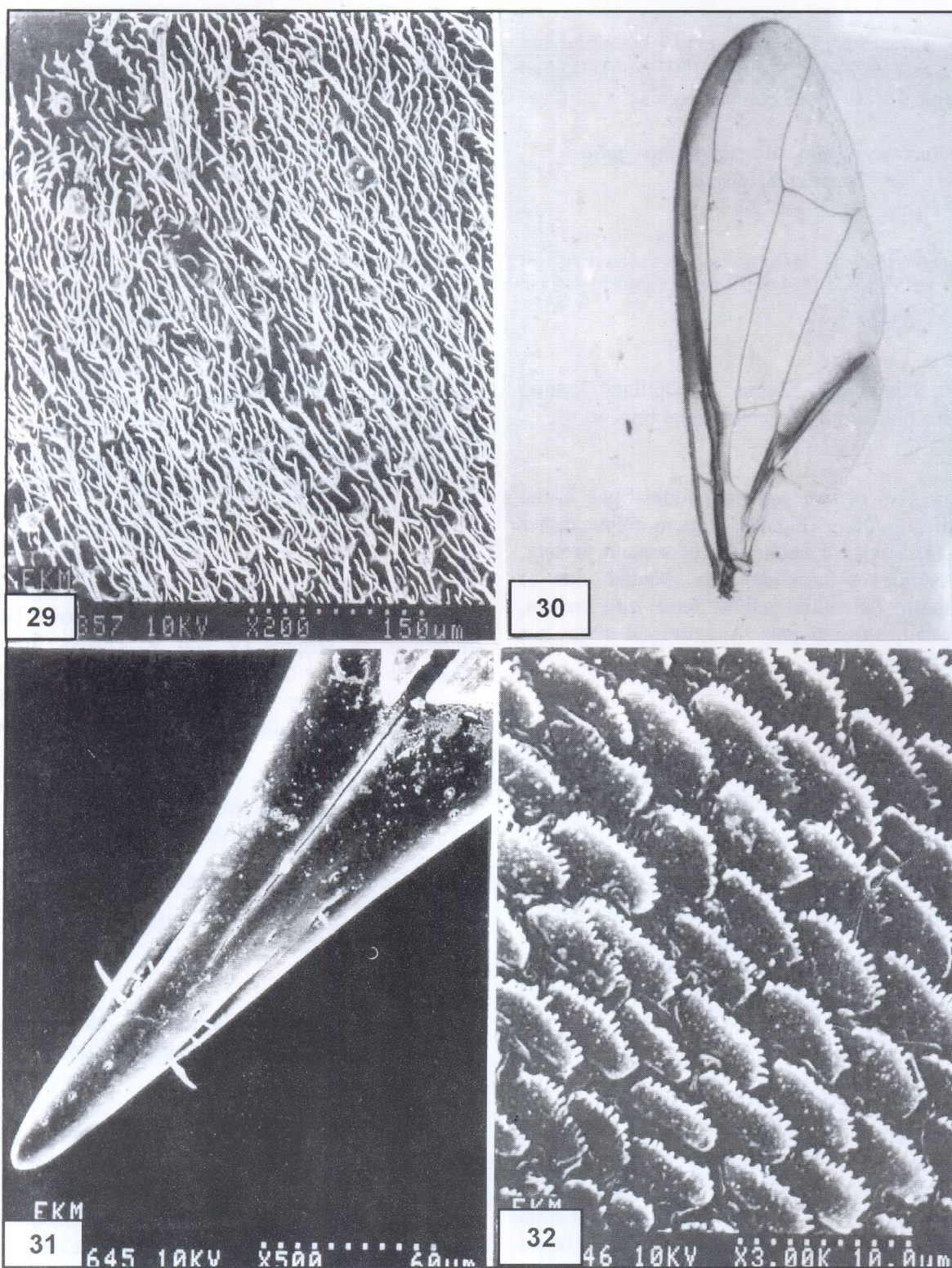
*Bactrocera (Bactrocera) versicolor* (Bezzi) White and Elson-Harris, 1992: 277.

#### Head

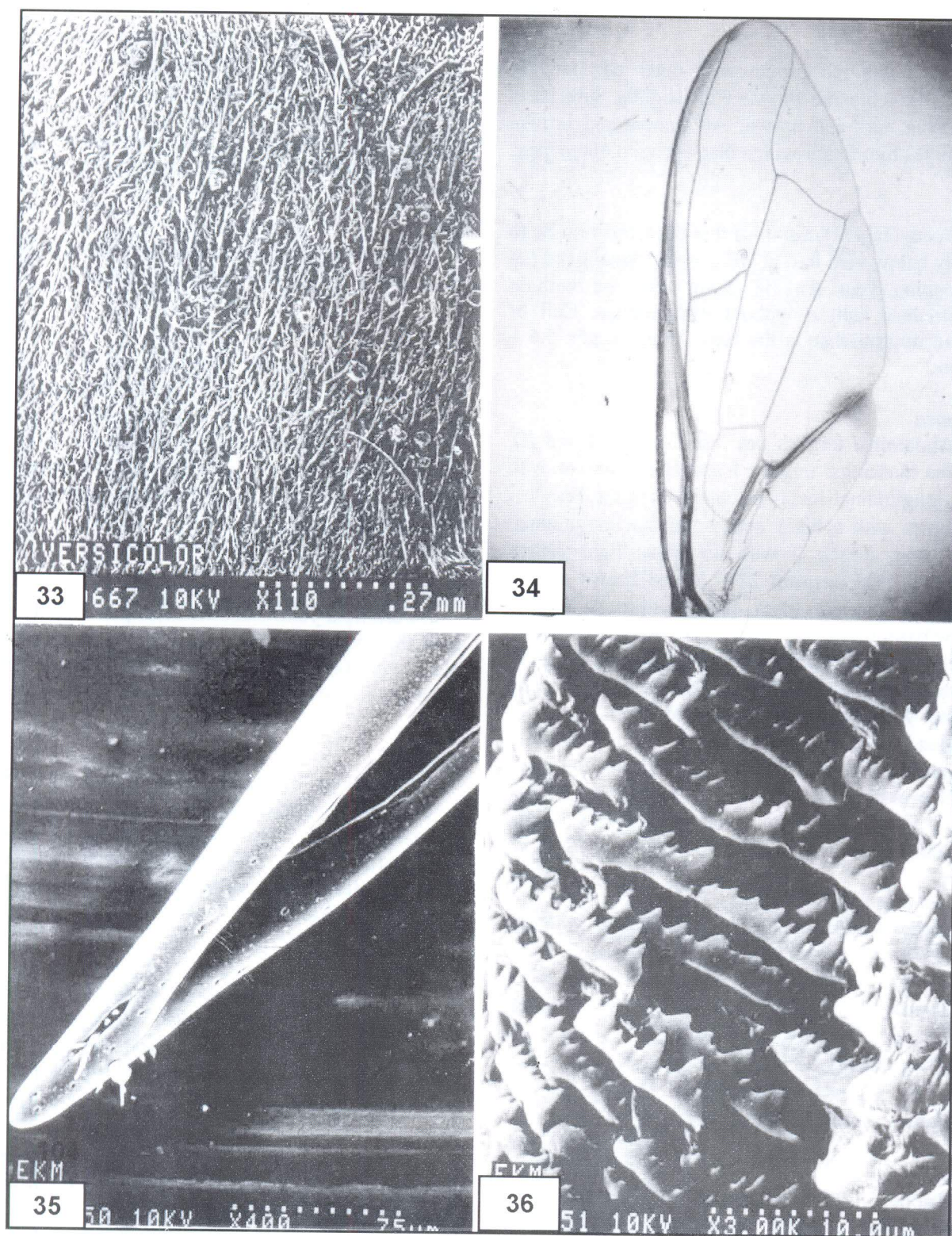
First flagellomere shorter than ptilinal fissure. Face with a black spot in each antennal furrow.

#### Thorax

Tomentum pattern without longitudinal gap in the middle of prescutum (Fig.33). Scutum colour (other than vittae) red brown. Lateral vitta of scutum present, yellow, crossing intra alar seta. Medial vitta of scutum absent. Scutellum yellow with black apex (sometimes not visible). Setae; *a.sa.* present, *prsc.* present, *sc.* one pair. Anepisternal stripe extended forward to anterior notopleural seta.



Figs. 29-32. *B. verbascifoliae*. 29, tomentum pattern on prescutum. 30, wing. 31, aculeus apex. 32, scales on the distal end of eversible membrane of ovipositor.



Figs. 33-36. *B. versicolor*. 33, tomentum pattern on prescutum. 34, wing. 35, aculeus apex. 36, scales on the distal end of eversible membrane of ovipositor.

*Legs*

Fore tibia red brown with outer part slightly black. Mid tibia red brown with slightly dark base. Hind tibia dark red brown. All femora red brown, sometimes fore femur with a black spot on outer apex.

*Wing*

Wing (Fig.34) costal band width from vein Sc to slightly below vein  $R_{4+5}$  at wing apex. Costal band not overlapping vein  $R_{2+3}$  in depth. Cell bc without microtrichae. Cell c without microtrichae. Cell br without microtrichae at the base. Wing length: 5.6 – 7.1mm.

*Abdomen*

Abdominal tergites not fused (except I and II). Tergites markings: tergites I and II red brown with black longitudinal bands on lateral margins, tergite I sometimes with a black spot or medial longitudinal black band, tergite II with an apical light yellow transverse band, tergites III – V red brown medial longitudinal narrow black band, tergite III with a narrow basal transverse black band, tergites IV and V with anterolateral black triangular markings. Tergite I not wasp-waisted. Tergite III (males) with pecten. Sternite V (males) with V- shaped notch. Posterior surstylus lobe short. Aculeus length: 2.7 mm. Aculeus apex needle shaped (Fig.35). The scales at the distal end of eversible membrane of ovipositor were long, with 7 to 10 tooth-like structure (Fig.36). Males attracted to methyl eugenol.

*Material examined*

**India:** Chethalli, 2 males, 20.iii.1986, 1 male, 22.iii.1986, 3 females, 20-22.v.1992, Pusa, 1 male, 14.vi.1914, Coimbatore, 1 male, 4.vii.1913, Kodaikanal, 1 male, 1.vi.1992. **Sri Lanka:** Peradeniya, 21 males, vii-xi.1992, 5 males, 12-14.x.1992, Kandy, 1 male, 12-14.x.1992, 1 male, 20.x.1993, 1 male, 18.x.1993, 1 male, 6.x.1993, Monaragala, 2 males, 30.xii.1994.

*Comments*

Kapoor (1993) mentioned this species as a synonym of *B. dorsalis*, however this species differ *B. dorsalis* in lacking microtrichia at the base of cell br, having a long aculeus and anepisternal stripe extended forward to anterior notopleural seta.

10 - *Bactrocera (Bactrocera) vishnu*

Drew and Hancock

(Figs. 37-38)

*Bactrocera (Bactrocera) vishnu* Drew and Hancock: Drew and Hancock, 1994: 65 [Type loc., India (E. of Kodaikanal)].

*Head*

First flagellomere shorter than ptilinal fissure. Face with a black spot in each antennal furrow.

*Thorax*

Tomentum pattern without longitudinal gap in the middle of prescutum (Fig.37). Scutum colour (other than vittae) black. Lateral vitta of scutum present, yellow, ending before intra alar seta. Medial vitta of scutum absent. Scutellum yellow. Setae; *a.sa.* present, *pr.sc.* present, *sc.* one pair. Anepisternal stripe not extended forward.

*Legs*

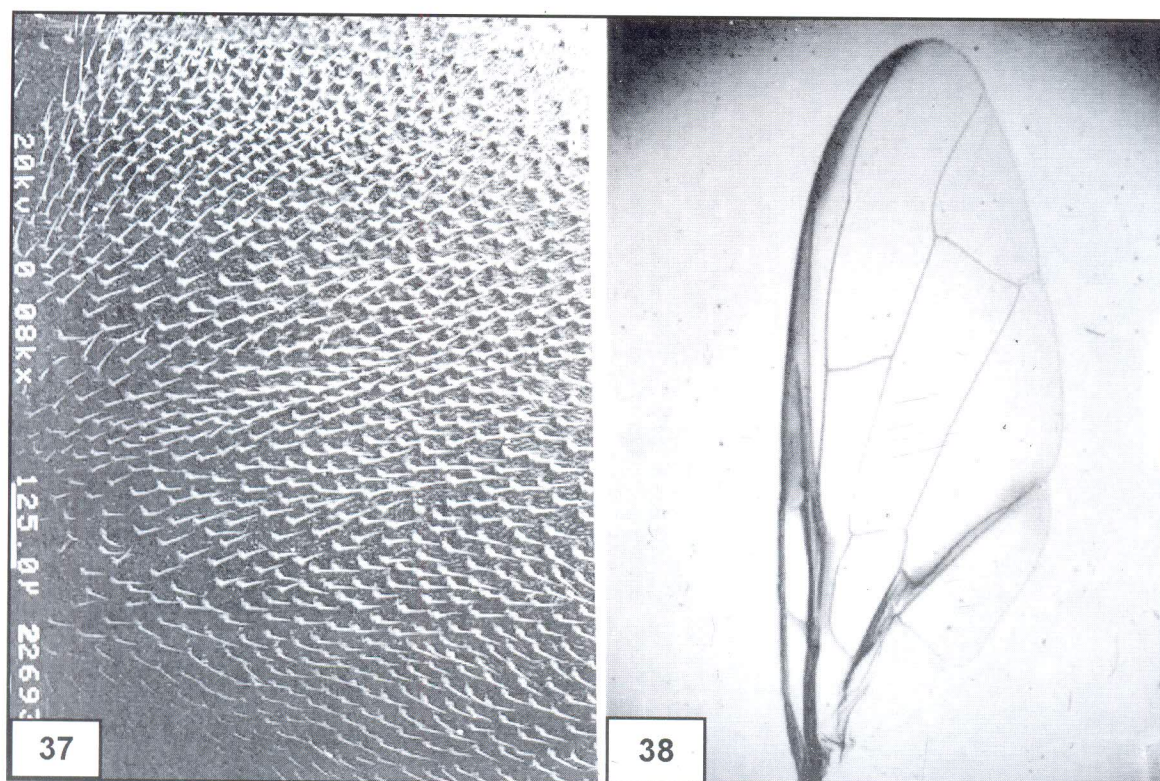
Fore tibia yellow brown outer part slightly dark. Mid tibia yellow brown with dark base. Hind tibia black. Fore femur yellow brown with a black spot on outer apex. Mid and hind femora yellow brown.

*Wing*

Wing (Fig.38) costal band width from vein Sc to slightly below vein  $R_{4+5}$  at wing apex. Costal band not overlapping vein  $R_{2+3}$  in depth. Cell bc without microtrichae. Cell c with microtrichae in the anterior apex only. Cell br with microtrichae at the base. Wing length: 5.5 – 7.0mm.

*Abdomen*

Abdominal tergites not fused (except I and II). Tergites markings: tergite I black with a yellow apical transverse band and black lateral margins which extend to the end of tergite II, tergite II yellow brown with basal transverse black band, tergites III – V yellow brown with a medial longitudinal black band, tergite III almost covered with broad transverse black band, tergites IV and V with black lateral markings. Tergite I not wasp-waisted. Tergite III (males) with pecten. Sternite V (males) with V- shaped notch. Posterior surstylus lobe short. Males attracted to cue lure.



Figs. 37-38. *B. vishnu*. 37, tomentum pattern on prescutum. 38, wing.

#### Material examined

**India:** Near Kodaikanal, 1 male (Holotype), 1.vi.1992, 1 male (Paratype), 2.vi.1992, Vattalkundu, 6 males, 2.vi.1992.

#### Comments

This species differs from *B. dorsalis* in having broad basal transverse band on tergite III and being attracted to cue lure.

#### 11 - *Bactrocera (Bactrocera) zonata* (Saunders) (Figs. 39-42)

*Dasyneura zonatus* Saunders, 1841:61. [Type loc., India (Bengal)].

*Rivellia persicae* Bigot, 1891:92. [Type loc., India (Assam)].

*Dacus ferrugineus* var. *nmangiferae* Cotes, 1893:17. [Type loc., India (Bihar)].

*Dacus (Bactrocera) zonatus* (Saunders): Hardy, 1977:52.

*Bactrocera (Bactrocera) zonata* (Saunders): White and Elson-Harris, 1992:239; Kapoor, 1993:76.

#### Head

First flagellomere shorter than ptilinal fissure.

Face with a black spot in each antennal furrow.

#### Thorax

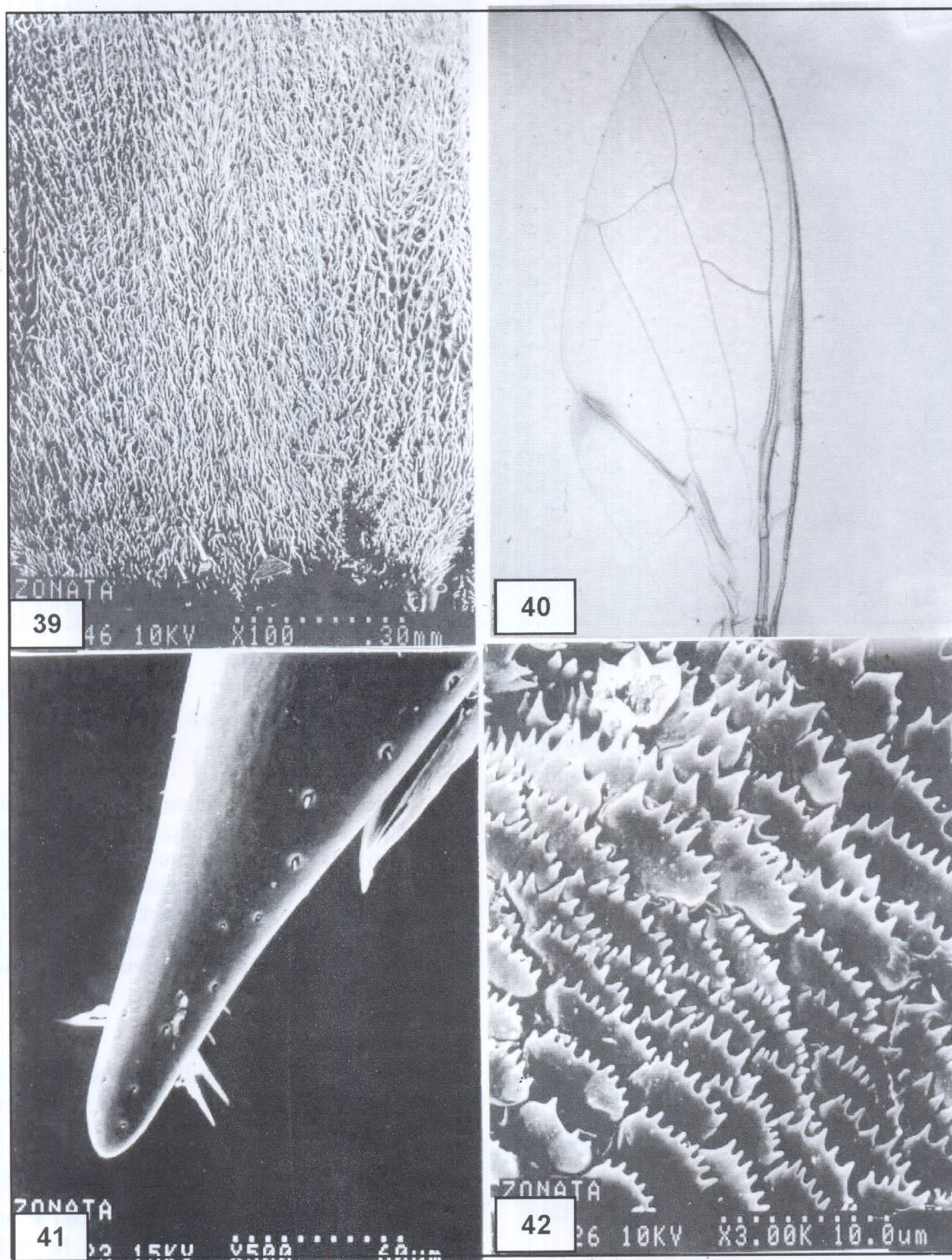
Tomentum pattern without longitudinal gap in the middle of prescutum (Fig.39). Scutum colour (other than vittae) red brown rarely black. Lateral vitta of scutum present, yellow, ending beyond intra alar seta. Medial vitta of scutum absent. Scutellum yellow. Setae; *a.sa.* present, *prsc.* present, *sc.* one pair. Anepisternal stripe extended forward to anterior notopleural setae.

#### Legs

Fore and mid tibiae yellow brown. Hind tibia yellow brown with outer side black. All femora yellow brown.

#### Wing

Wing (Fig.40) costal band within cell *sc* and a spot on vein  $R_{4+5}$  at wing apex. Cell *bc* without microtrichae. Cell *c* without microtrichae. Cell *br* without microtrichae at the base. Wing length: 4.6 – 5.5mm.



Figs. 39-42. *B. zonata*. 39, tomentum pattern on prescutum. 40, wing. 41, aculeus apex. 42, scales on the distal end of eversible membrane of ovipositor.

*Abdomen*

Abdominal tergites not fused (except I and II). Tergites markings: tergite I red brown with black lateral margins and a apical yellow brown transverse band, sometimes black tergite with a apical red brown transverse band, tergite II yellow white or yellow with a basal black and sometimes red brown transverse band, the lateral margins black, tergites III – V red brown with a medial longitudinal black band, sometimes lacking on tergite III and IV, tergite III with a basal transverse black band, mostly lacking in the middle, tergites IV and V with lateral longitudinal markings. Tergite I not wasp-waisted. Tergite III (males) with pecten. Sternite V (males) with V-shaped notch. Posterior surstylus lobe short. Aculeus length: 1.05 – 1.25 mm. Aculeus thick apex needle shaped (Fig.41). The scales at the distal end of eversible membrane of ovipositor of medium size, with 7 to 10 tooth-like structure (Fig.42). Males attracted to methyl eugenol.

*Material examined*

**India:** Bareilly, 3 males and 3 females, 29-31.viii.1949, Chethalli, 2 males and 1 female, 23-27.vi.1986, Muzafferpur, 35 males, 27.iv.1913, Calcuta, 4 males, 10.iv.1908, Pusa, 9 males, 14.v.1913, Mudigere, 3 males, 20-22.v.1992, Vattalkundu, 4 males, 2.vi.1992, Yercaud, 4 males, 3.vi.1992. **Pakistan:** Karachi, 30 males, 18-20.vii.1993, Hyderabad, 30 males, 19.vii.1993, Sailkot, 13 males, 26.vii.1993, Sheikhpura, 14 males, 26.vii.1993, Lahore, 17 males, 27.vii.1993, Multan, 17 males, 30.vii.1993, Bahawalpur, 18 males, 30.vii.1993, Murree, 1 male, 3.viii.1993, Muzaffarabad, 2 males, 4.viii.1993, Rawalpindi, 3 males and 3 females, 16.viii.1961, Kaghan, 1 male, 5.viii.1993, Mansehra, 8 males, 8.viii.1993.

*Comments*

This species is different from *B. dorsalis* in having costal band within cell sc, spot on apex of vein  $R_{4+5}$  and lacking microtrichia at the base of cell br.

12 - *Bactrocera (Daculus) oleae* (Gmelin)  
(Figs. 43-46)

*Musca oleae* Gmelin 1790:2844. [Type loc., S.Europe].  
*Oleae asitica* Silvestri, 1916:242. [Type loc., S.Europe].

*Dacus (Polistomimetes) oleae* (Gmelin), Hardy, 1977:56.

*Daculus oleae* (Gmelin), Cogan and Munro 1980:519.

*Bactrocera (Daculus) oleae* (Gmelin): White and Wang, 1992:278; White and Elson-Harris, 1992:241.

*Bactrocera (Polistomimetes) oleae* (Gmelin): Kapoor, 1993:77.

*Head*

First flagellomere shorter than ptilinal fissure. Face with a black spot in each antennal furrow.

*Thorax*

Tomentum pattern with wide longitudinal gap in the middle of prescutum (Fig.43). Scutum colour (other than vittae) black. Lateral vitta of scutum absent. Medial vitta of scutum absent. Katatergite black. Scutellum yellow. Setae; *a.sa.* absent, *pr.sc.* absent, *sc.* one pair. Anepisternal stripe extended forward to anterior notopleural setae.

*Legs*

All tibiae and femora yellow brown.

*Wing*

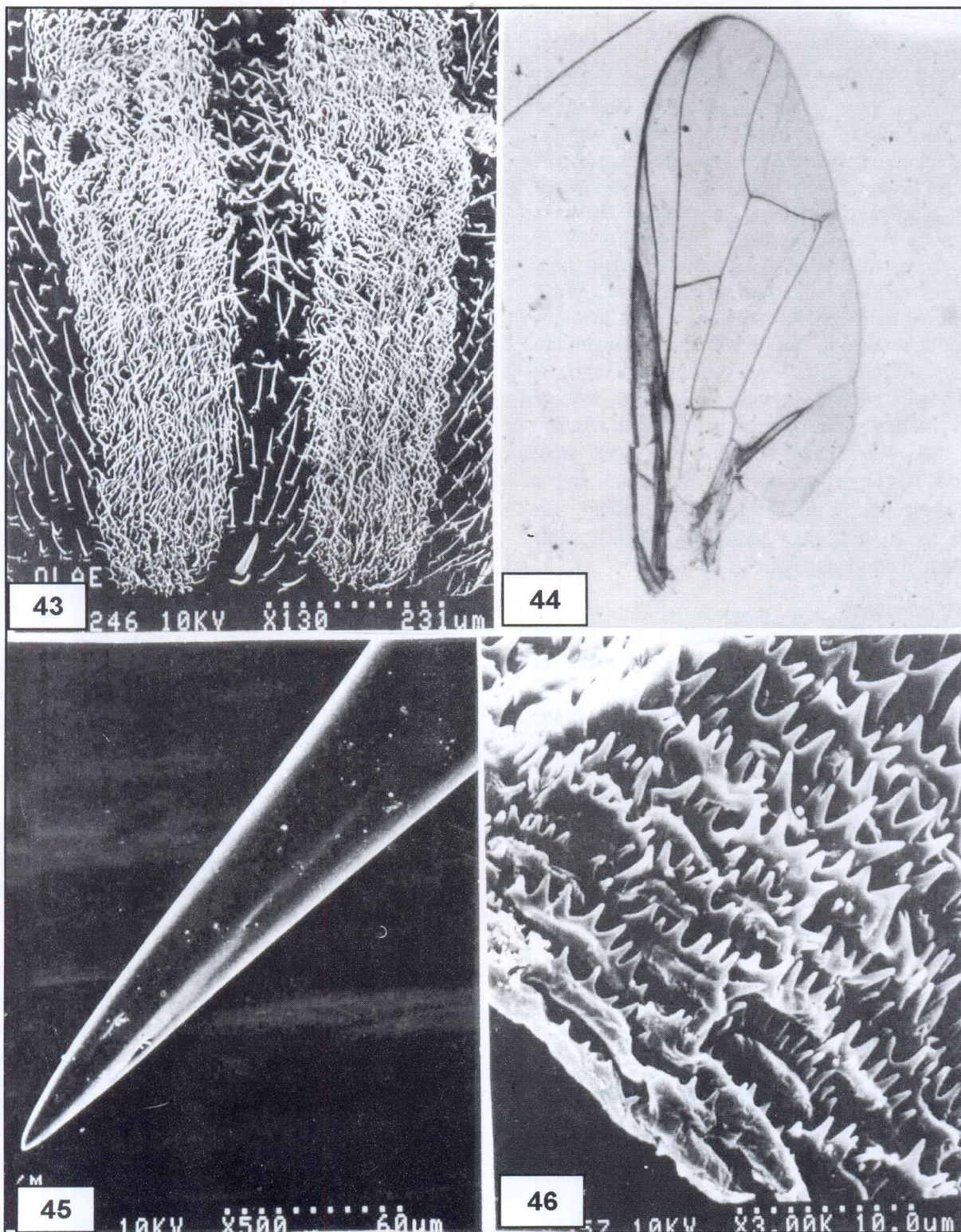
Wing (Fig.44) costal band light brown within cell sc and a spot on vein  $R_{4+5}$  at wing apex. Cell bc without microtrichae. Cell c without microtrichae. Cell br without microtrichae at the base. Wing length: 4.2 – 5.1 mm.

*Abdomen*

Abdominal tergites not fused (except I and II). Tergites markings: all tergites yellow brown, tergite I with lateral black markings, tergite II with a basal broad transverse black band, (sometimes lateral marking only), tergites III and IV with black lateral markings. Tergite I not wasp-waisted. Tergite III (males) without pecten. Sternite V (males) without V-shaped notch. Posterior surstylus lobe short. Aculeus length: 0.90 – 1.05 mm. Aculeus apex needle shaped (Fig.45). The scales at the distal end of eversible membrane of ovipositor long, with 6 to 10 tooth-like structures (Fig.46). Males lure response unknown.

*Material examined*

Specimens of this species from Indian Subcontinent were not available. Specimens from Cyprus, Greece and Spain were studied for above description.



Figs. 43-46. *B. olae*. 43, tomentum pattern on prescutum. 44, wing. 45, aculeus apex. 46, scales on the distal end of eversible membrane of ovipositor.

*Comments*

This species was unique in lacking thoracic vittae, anterior supra-alar seta absent and prescutellar acrostichal seta.

13 - *Bactrocera (Hemigymnodacus) diversa*  
(Coquillett)  
(Figs. 47-50)

*Dacus diversus* Coquillett, 1904:139. [Type Loc., Sri Lanka (Colombo)]

*Bactrocera diversa* (Coquillett): Bezzi, 1913:94

*Chaetodacus diversus* (Coquillett): Bezzi, 1916:108.

*Dacus (Chaetodacus) diversus* (Coquillett): Munro, 1935:16.

*Asiadacus diversus* (Coquillett): Perkins, 1937:57.

*Dacus (Gymnodacus) diversus* Coquillett: Hardy 1954: 5-23.

*Dacus (Hemigymnodacus) diversus* Coquillett: Hardy 1973:19-21.

*Bactrocera (Hemigymnodacus) diversa* (Coquillett): White and Elson-Harris, 1992:244; Kapoor, 1993:78.

*Head*

First flagellomere shorter than ptilinal fissure. In females specimens face with a transverse black band above mouth opening, males specimens without any mark.

*Thorax*

Tomentum pattern with narrow longitudinal gap in the middle of prescutum (Fig.47). Scutum colour (other than vittae) black. Lateral vitta of scutum present, yellow, ending in front of intra alar seta. Medial vitta of scutum present. Scutellum yellow. Setae; *a.sa.* present, *prsc.* present, *sc.* one pair. Anepisternal stripe extended forward anterior notopleural seta.

*Legs*

In females specimens all tibiae black, in males specimens all tibiae yellow brown with slightly dark bases. All femora yellow brown with black spots on outer apices.

*Wing*

Wing (Fig.48) costal band width from vein Sc to below vein R<sub>4+5</sub> at wing apex. Costal band slightly expanded apically. Costal band not overlapping vein R<sub>2+3</sub> in depth. Cell bc without microtrichae. Cell c with microtrichae at anterior apex. Cell br with microtrichae at the base. Wing length: 4.5 - 5.8mm.

*Abdomen*

Abdominal tergites not fused (except I and II). Tergites markings: tergite I black or sometimes with apical transverse yellow brown band, tergite II light yellow with basal 1/3 black, tergites III - V black, with apical full red brown. In some specimens tergites III - V with a medial longitudinal black band, tergite III with a basal transverse black band, tergites IV and V with anterolateral dark. Tergite I not wasp-waisted. Tergite III (males) without pecten. Sternite V (males) without V- shaped notch. Posterior surstylus lobe long. Aculeus length: 1.25mm. Aculeus apex needle shaped (Fig.49). The scales at the distal end of eversible membrane of ovipositor long, with 12 to 16 tooth-like structures (Fig.50). Males attracted to methyl eugenol.

*Material examined*

**India:** Bombay, 3 males and 3 females, 1888, 3 males, 15.viii.1917, Pusa, 3 males and 1 female, 14.vi.1908, Karikal, 2 males and 3 females, 21.i.1947, Mudigere, 3 males and 3 females, 20-22.v.1992, Chandigrah, 2 males, 15.iii.1994, 1 male, 21.i.1994. **Pakistan:** Rawalpindi, 2 males and 1 female, 30.ix.1961. **Sri Lanka:** Tuduganga, 3 males and 2 females, 1.xii.1918, Uggalkaltota, 4 males, 32.i.-8.ii.1970 (NMNH).

*Comments*

In this distinctive species males lack facial spots and pecten, females with a black transverse facial line above mouth.

14 - *Bactrocera (Javadacus) pallescentis* (Hardy)  
(Figs. 51-54)

*Dacus (Afrodacus) aberrans pallescentis* Hardy 1955: 5. [Type Loc., India (Uttar Pradesh)]

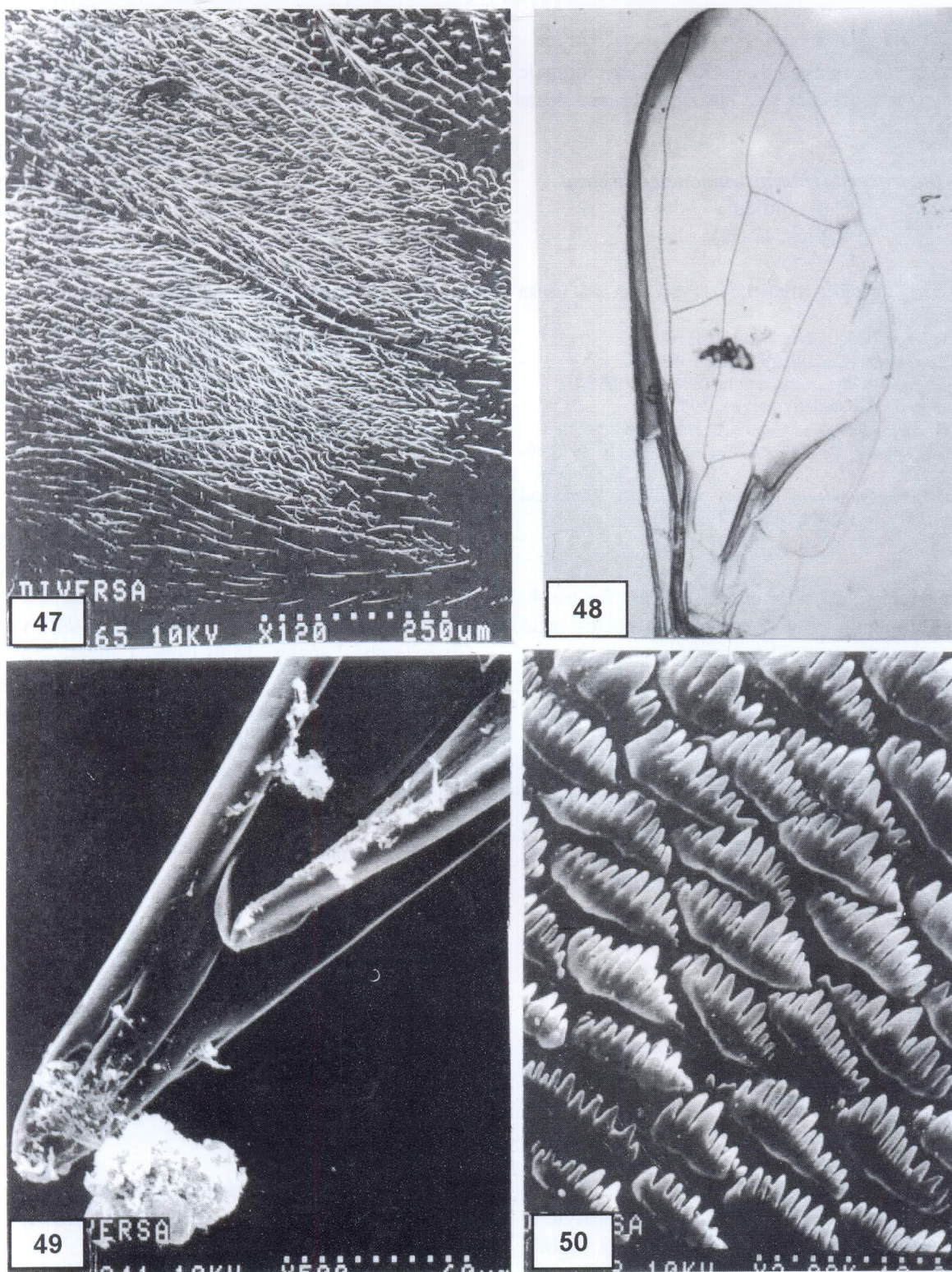
*Bactrocera (Afrodacus) aberrans pallescentis* (Hardy); Kapoor, 1993:79.

*Head*

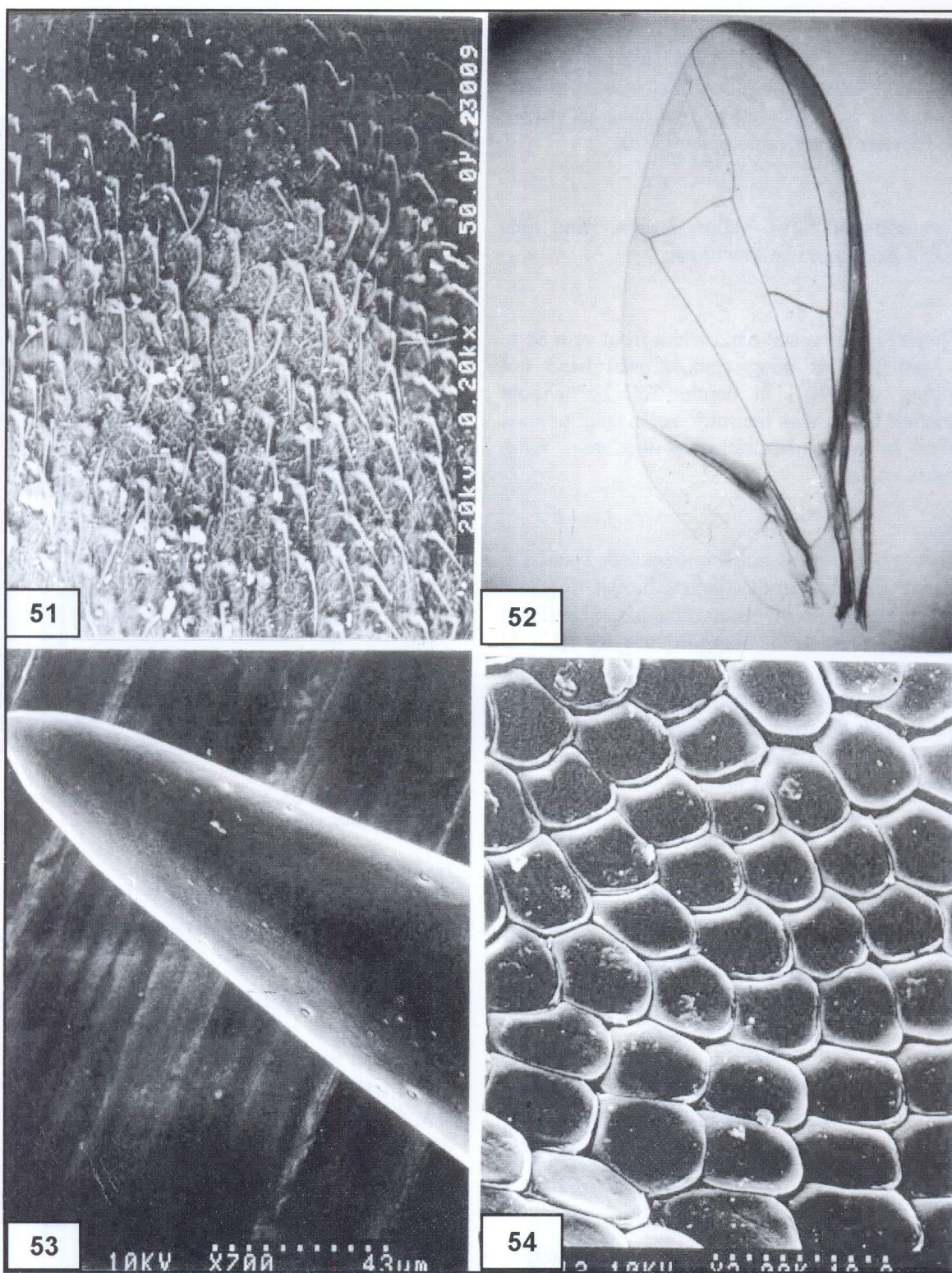
First flagellomere shorter than ptilinal fissure. Face with a black spot in each antennal furrow.

*Thorax*

Tomentum pattern without longitudinal gap on prescutum (Fig.51). Scutum colour (other than vittae) red brown. Lateral vitta of scutum present, yellow,



Figs. 47-50. *B. diversa*. 47, tomentum pattern on prescutum. 48, wing. 49, aculeus apex. 50, scales on the distal end of eversible membrane of ovipositor.



Figs. 51-54. *B. pallescentis*. 51, tomentum pattern on prescutum. 52, wing. 53, aculeus apex. 54, scales on the distal end of eversible membrane of ovipositor.

ending in front of intra alar seta. Medial vitta of scutum absent. Scutellum yellow. Setae; *a.sa.* absent, *pr.sc.* present, *sc.* one pair. Anepisternal stripe extended forward anterior notopleural seta.

#### Legs

Fore and mid tibiae yellow brown. Hind tibia light black. All femora yellow brown.

#### Wing

Wing (Fig.52) costal band width from vein Sc to below vein  $R_{4+5}$  at wing apex. Costal band not overlapping vein  $R_{2+3}$  in depth. Cell bc without microtrichae. Cell c with microtrichae in anterior apex only. Cell br with microtrichae at the base. Wing length: 4.0 – 6.7mm.

#### Abdomen

Abdominal tergites not fused (except I and II). Tergites markings: all tergites yellow brown, tergites I and II with a basal narrow transverse black band and black markings on lateral margins, tergites III – V with a medial longitudinal black band, tergite III with a basal transverse black band, tergites IV and V with anterolateral black markings. Tergite I not wasp-waisted. Tergite III (males) with pecten. Sternite V (males) without V- shaped notch. Posterior surstylus lobe long. Aculeus length: 2.1mm. Aculeus apex tubular shaped (Fig.53). The scales at the distal end of eversible membrane of ovipositor small oval shaped (Fig.54). Males lure response unknown.

#### Material examined

**India:** Nilgris, 1 female, 22.vi.1888, Ranikhet, 5 males (Paratypes), vi.1949.

#### Comments

This species is different from *B. aberrans* (from Australia) in having red brown scutum colour rather than black. Both of these species have different shape of scales at the distal end of eversible membrane of ovipositor.

#### 15 - *Bactrocera (Javadacus) scutellaria* (Bezzi) (Figs. 55)

*Chaetidacus scutellarius* Bezzi, 1916:110. [Type Loc., India (Karnataka as Mysore)]

*Dacus (Bactrocera) scutellarius* (Bezzi); Hardy, 1977:52.

*Bactrocera (Bactrocera) scutellarius* (Bezzi); Kapoor, 1993:76.

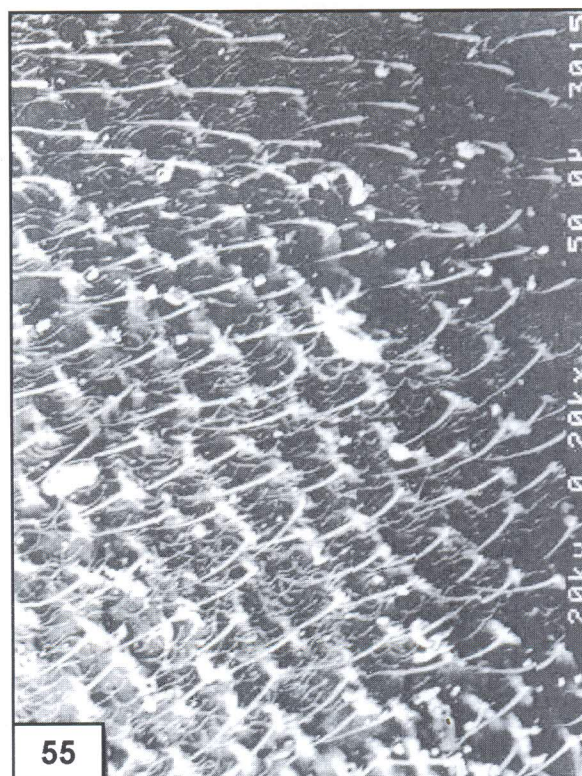


Fig. 55. *B. scutellaria*. Tomentum pattern on prescutum.

#### Head

First flagellomere shorter than ptilinal fissure. Face with a black spot in each antennal furrow.

#### Thorax

Tomentum pattern without longitudinal gap in the middle of prescutum (Fig.55). Scutum colour (other than vittae) black. Notopleuron black. Lateral vitta of scutum present, yellow, ending before intra alar seta. Medial vitta of scutum present, yellow. Scutellum yellow with black mark on apex. Setae; *a.sa.* absent, *pr.sc.* present, *sc.* one pair. Anepisternal stripe extended forward to join postpronotal lobe.

#### Legs

Fore tibia dark red brown. Mid tibia red brown. Hind tibia dark red brown. Fore and mid femora black with yellow brown base. Hind femur yellow brown with apical 1/3 black.

*Wing*

Wing costal band width from vein Sc to below vein  $R_{4+5}$  at wing apex. Costal band slightly expanded at the wing apex. Costal band not overlapping vein  $R_{2+3}$  in depth. Cell bc without microtrichae. Cell c with microtrichae in the anterior apex only. Cell br with microtrichae at the base. Wing length: 5.5mm.

*Abdomen*

Abdominal tergites not fused (except I and II). Tergites markings: all tergites mostly black, tergite I and II each with apical transverse yellow brown band. Tergite I not wasp-waisted

*Material examined*

**India:** Goorghalli, 1 female (Type), 14-24.iii.1918.

*Comments*

This species is different from *Bactrocera scutellaris* in having black notopleuron, anepisternal stripe extended forward and lacking medial longitudinal gap in tomentum pattern on prescutum and anterior supra-alar setae.

16 - *Bactrocera (Javadacus) trilineata* (Hardy)  
(Figs. 56-57)

*Dacus (Afrodacus) trilineatus* Hardy 1955:12. [Type Loc., India (Bangalore)]

*Bactrocera (Javadacus) trilineata* (Hardy); White and Elson-Harris, 1992:277; Kapoor, 1993:73.

*Head*

First flagellomere shorter than ptilinal fissure. Facial mark absent.

*Thorax*

Tomentum pattern with narrow longitudinal gap in the middle of prescutum (Fig.56). Scutum colour (other than vittae) black. Notopleuron yellow with black anterior portion. Lateral vitta of scutum present, yellow, crossing intra alar seta. Medial vitta of scutum present, yellow. Scutellum yellow. Setae; *a.sa.* absent, *prsc.* present, *sc.* one pair. Anepisternal stripe extended forward to join postpronotal lob.

*Legs*

All tibiae femora yellow brown.

*Wing*

Wing (Fig.57) costal band width from vein Sc to below vein  $R_{4+5}$  at wing apex. Costal band expanded at apex of vein  $R_{4+5}$  to form a spot. Costal band not overlapping vein  $R_{2+3}$  in depth. Cell bc without microtrichae. Cell c with microtrichae in anterior apex only. Cell br with microtrichae at the base. Wing length: 4.3 – 4.7mm.

*Abdomen*

Abdominal tergites not fused (except I and II). Tergites markings: tergites I and II black each with a yellow brown apical transverse band, tergites III – V yellow brown with a medial longitudinal black band, tergite III with a basal transverse black band, expanded on lateral margins, tergites IV and V with broad lateral markings. Tergite I not wasp-waisted. Tergite III (males) with pecten. Sternite V (males) without V- shaped notch. Posterior surstylus lobe long. Males attracted to cue lure.

*Material examined*

**Sri Lanka:** Peradeniya, 3 males, 8.xi.1992, Tabbora, 3 males, 22.x.1994, 1 male, 1.xi.1994, 1 male, 7.x.1994, Rendapola, 1 male, 14.x.1994, 1 male, 18.xi.1994.

*Comments*

This is distinct species in lacking facial markings, anterior supra-alar seta and having medial vitta.

17 - *Bactrocera (Paradacus) watersi* (Hardy)  
(Figs. 58-61)

*Dacus (Paradacus) watersi* Hardy 1954:12. [Type Loc., India (Madras)]

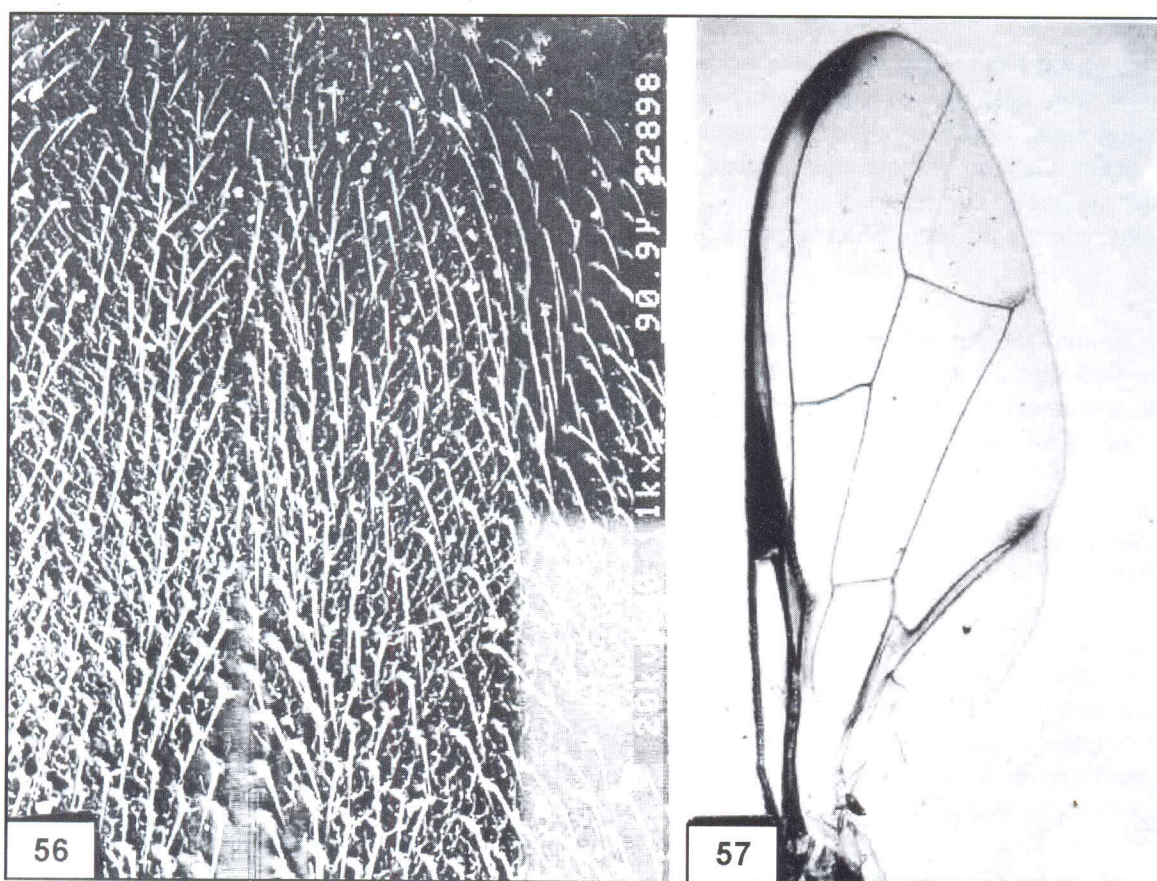
*Bactrocera (Paradacus) watersi* (Hardy); Kapoor, 1993:79.

*Head*

First flagellomere shorter than ptilinal fissure. Face with a longitudinal black spot in each antennal furrow.

*Thorax*

Tomentum pattern with narrow longitudinal gap in the middle of prescutum (Fig.58). Scutum colour (other than vittae) red brown. Postpronotal lobe light yellow. Notopleuron light yellow. Lateral vitta of



Figs. 56-57. *B. trilineata*. 56, tomentum pattern on prescutum. 57, wing.

scutum present, yellow, crossing intra alar seta. Medial vitta of scutum present, yellow. Katatergite light yellow. Anatergite light yellow. Scutellum yellow with apical 1/3 black. Setae; *a.sa.* present, *prsc.* absent, *sc.* two pairs. Anepisternal stripe not extended forward.

#### Legs

All tibiae yellow brown or red brown. All femora yellow brown with red brown apical spots.

#### Wing

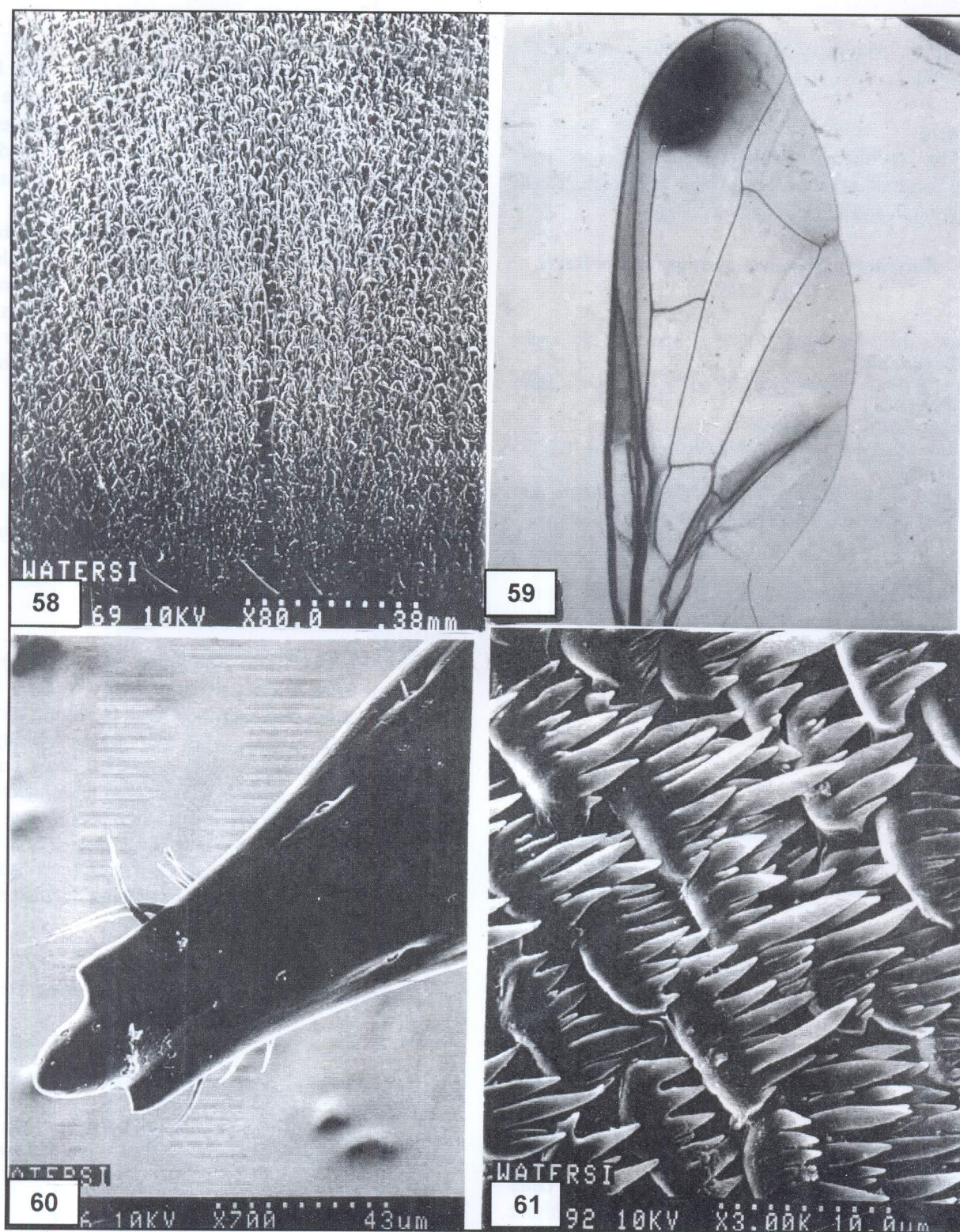
Wing (Fig.59) costal band width from vein Sc to below vein  $R_{4+5}$  at wing apex. Costal band expanded at apex of vein  $R_{4+5}$  to form a spot. Costal band overlapping vein  $R_{2+3}$  in depth. Cell bc without microtrichae. Cell c with microtrichae in anterior apex only. Cell br with microtrichae at the base. Wing length: 9.1 – 9.7mm.

#### Abdomen

Abdominal tergites not fused (except I and II). Tergites markings: all tergites red brown, tergite I with a very narrow apical yellow transverse band, tergite II with a apical yellow transverse band, tergites III – V with a medial longitudinal black band, tergite III with a basal transverse black band, tergites IV and V with anterolateral markings (sometimes without any mark). Tergite I not wasp-waisted. Tergite III (males) with pecten. Sternite V (males) without V-shaped notch. Aculeus length: 3.7mm. Aculeus apex trilobed (Fig. 60). The scales at the distal end of eversible membrane of ovipositor of medium size, with 7 to 11 long tooth – like structure (Fig.61). Males lure response unknown.

#### Material examined

**India:** Kodaikanal, 4 females and 3 males, 13 males and 3 females, 28.x.1970 (NMNH). 1951



Figs. 58-61. *B. watersi*. 58, tomentum pattern on prescutum. 59, wing. 60, aculeus apex. 61, scales on the distal end of eversible membrane of ovipositor.

(Paratypes), Mudigere, 7 females and 5 males, 20-22.v.1992.

#### Comments

This is distinct relatively large species with lateral and medial vittae, costal band overlapping vein  $R_{2+3}$  in depth and aculeus apex trilobed.

#### 18 - *Bactrocera (Paratridacus) garciniae* Bezzi (Figs. 62-65)

*Bactrocera garciniae* Bezzi 1913:97. [Type Loc., Sri Lanka (Peradeniya)]

*Dacus yayeyamanus* Matsumura, 1916:412. [Type Loc., Japan (Yayeyama)]

*yayeyamanus*, error of *yayeyamanus*

*Bactrocera (Paratridacus) expandens* (Walker); Hardy, 1977:55 (in part)

*Bactrocera (Paratridacus) expandens* (Walker); White and Elson-Harris, 1992:257 (in part); Kapoor, 1993:79.

#### Head

First flagellomere shorter than ptilinal fissure. Face with a black spot in each antennal furrow.

#### Thorax

Tomentum pattern without longitudinal gap in the middle of prescutum (Fig.62). Scutum colour (other than vittae) black or red brown. Lateral vitta of scutum present, yellow, ending in front of intra alar seta. Medial vitta of scutum absent. Katatergite half yellow, half red brown. Scutellum yellow. Setae; *a.sa.* present, *prsc.* present, *sc.* two pairs. Anepisternal stripe extended forward to anterior notopleural seta.

#### Legs

Fore tibia red brown. Mid tibia yellow brown. Hind tibia dark red brown. Fore and mid femora yellow brown with outer large black spots. Hind femur yellow brown with apical 1/3 black.

#### Wing

Wing (Fig.63) costal band width from base of wing to below vein  $R_{4+5}$  at wing apex. Costal band expanded at apex to form a spot. Costal band overlapping vein  $R_{2+3}$  in depth. Cell bc without microtrichiae. Cell c with microtrichiae in anterior half only. Cell br with microtrichiae at the base. Wing length 7.8mm.

#### Abdomen

Abdominal tergites not fused (except I and II). Tergites markings: all tergites red brown, tergite II with a apical transverse yellow white band and lateral margins black, tergites III – V with a medial longitudinal black band, tergite III with a basal transverse black band, expanded laterally, tergites IV and V without marking. Tergite I not wasp-waisted. Tergite III (males) without pecten. Sternite V (males) without V- shaped notch. Aculeus length: 1.47mm. Aculeus apex trilobed shaped (Fig.64). The scales at the distal end of eversible membrane of ovipositor of medium size, with 3 to 5 long tooth – like structure (Fig.65). Males lure response unknown.

#### Material examined

**Sri Lanka:** Peradeniya, 1 male and 2 females, 1.iii.1996 (ex *Garcinia* sp.), Kandy, 1 female, 8-10.ix.1977 (NMNH), Peradeniya, 2 males, 5.vii.1936 (ex *Garcinia* sp.) (NMNH).

#### Comments

This species was placed in synonymy with *Bactrocera (Paratridacus) expandens* (Walker) (in South-East Asia), however it differed in having broad spot in antennal furrow, wing with large black spot on apex, cells bc and c pale coloured, large outer black spot on fore and mid femora and anepisternal stripe expanded forward rather than small spot in antennal furrow, wing without large black spot on apex, cells bc and c coloured as costal band, small outer apical black spot on all femora and anepisternal stripe not expanded.

#### 19 - *Bactrocera (Parazeugodacus) bipustulata* Bezzi (Figs. 66-69)

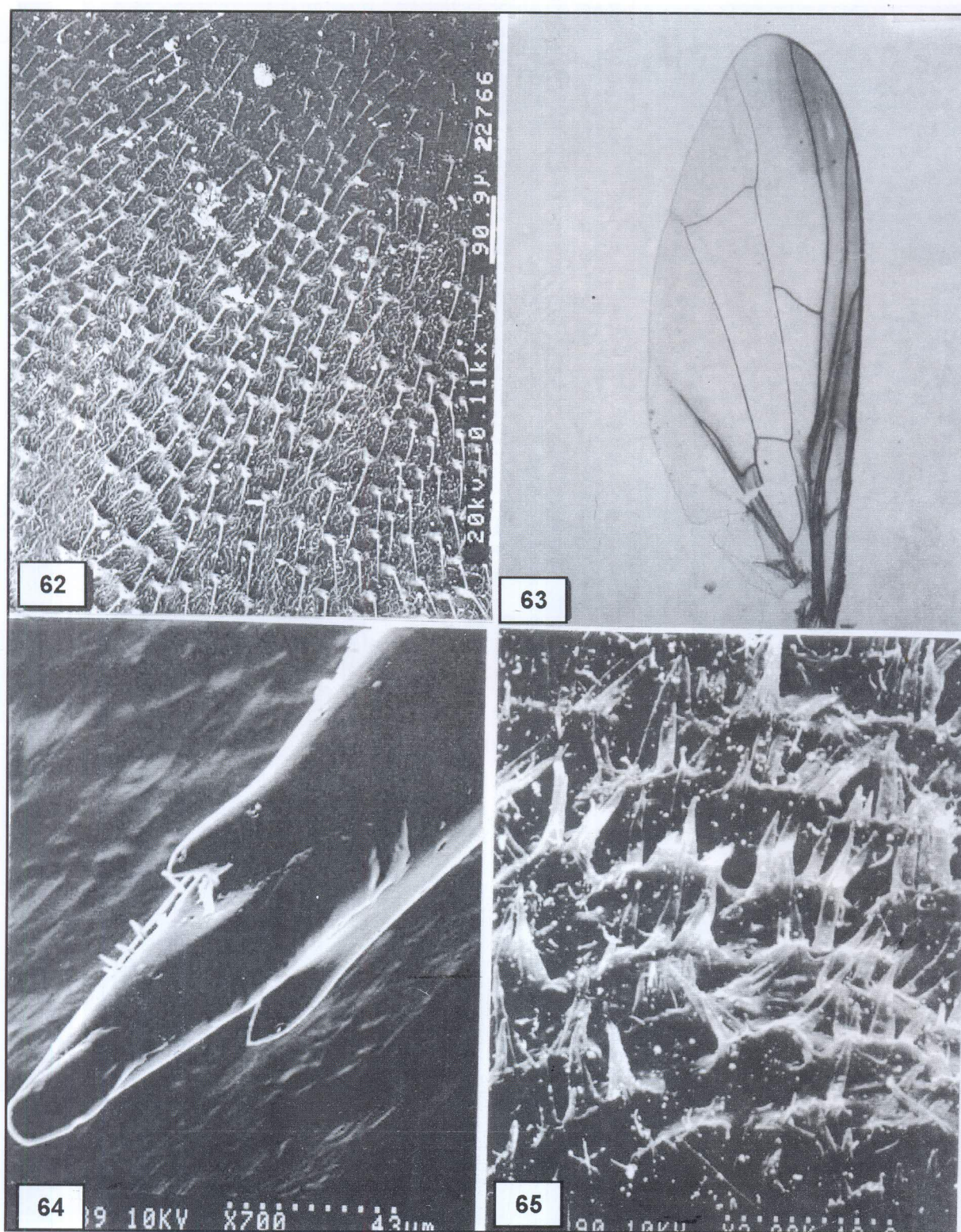
*Bactrocera (Chaetodacus) bipustulata* Bezzi 1914:153. [Type Loc., India (Karnataka as Mysore)]

*Dacus (Parazeugodacus) bipustulata* Bezzi; Hardy, 1977:56.

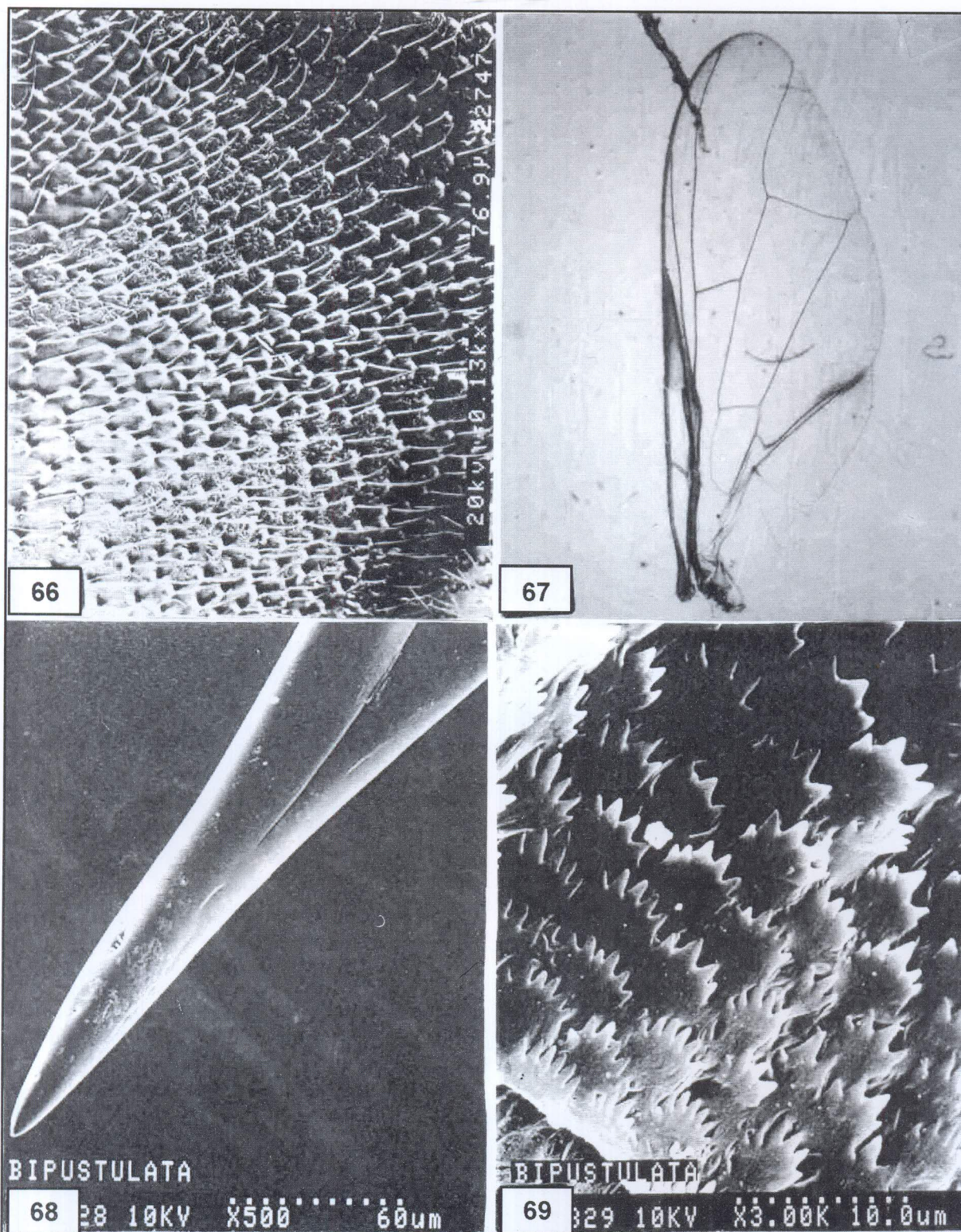
*Bactrocera (Parazeugodacus) bipustulata* Bezzi; Kapoor, 1993:80.

#### Head

First flagellomere shorter than ptilinal fissure. Face entirely black.



Figs. 62-65. *B. garciniae*. 62, tomentum pattern on prescutum. 63, wing. 64, aculeus apex. 65, scales on the distal end of eversible membrane of ovipositor.



Figs. 66-69. *B. bipustulata*. 66, tomentum pattern on prescutum. 67, wing. 68, aculeus apex. 69, scales on the distal end of eversible membrane of ovipositor.

*Thorax*

Tomentum pattern with wide longitudinal gap in the middle of prescutum (Fig.66). Scutum colour (other than vittae) black. Postpronotal lobe light yellow with anterodorsal portion black. Notopleuron light yellow. Lateral vitta of scutum yellow, short, ending before anterior supra-alar seta. Medial vitta of scutum absent. Katatergite light yellow. Anatergite light yellow. Scutellum black with yellow lateral margins. Setae; *a.sa.* present, *prsc.* present, *sc.* two pairs. Anepisternal stripe not extended forward.

*Legs*

Fore and hind tibiae black. Mid tibia yellow brown with slightly dark base. Fore and mid femora black with yellow brown base. Hind femur yellow brown with apical 1/3 black.

*Wing*

Wing (Fig.67) costal band width within cell *sc* only. Cell *bc* without microtrichae. Cell *c* with microtrichae in anterior apex only. Cell *br* without microtrichae at the base. Wing length 4.2 – 5.1mm.

*Abdomen*

Abdominal tergites not fused (except I and II). Tergites markings: tergite I black with an apical transverse yellow black narrow band, tergite II yellow brown with a basal transverse black band which slightly expand posteriorly in centre and on lateral margins, tergites III – V with a medial longitudinal black band, tergite III almost covered with transverse black band, tergites IV and V yellow brown with lateral markings covering lateral margins. Tergite I not wasp-waisted. Tergite III (males) with pecten. Sternite V (males) without V- shaped notch. Aculeus length: 1.17mm. Aculeus apex needle shaped (Fig.68). The scales at the distal end of eversible membrane of ovipositor broad, with 5 to 7 long tooth-like structure (Fig.69). Males attracted to cue lure.

*Material examined*

**India:** Arabidcool, 1 male (Type), 29.iv.1918, 1 male, 29.iv.1918, Santavexi, 1 male, 14.x.1915, 2 males, 17.x.1918, Appangala, 6 males, 23.v.92, Nilgiris, 1 female, 22.vi.1888.

*Comments*

This species is unique in having short lateral vittae, black scutellum with yellow spots on sides, costal band within cell *sc* only and base of cell *br* without microtrichia.

20 - *Bactrocera (Tetradacus) brachycera*  
(Bezzi) new combination  
(Figs. 70-71)

*Mellessis brachycera* Bezzi 1916:116. [Type Loc., India (Utter Pradesh)]

*Callantra brachycera* Bezzi; Hardy, 1977:45.

*Dacus (Callantra) brachycera* Bezzi; Kapoor, 1993:83.

*Head*

First flagellomere shorter than ptilinal fissure. Face with a long black spot in each antennal furrow.

*Thorax*

Tomentum pattern with wide longitudinal gap in the middle of prescutum (Fig.70). Scutum colour (other than vittae) prescutum red brown, postscutum dark red brown. Postpronotal lobe yellow brown. Notopleuron light yellow. Lateral vitta of scutum light yellow, ending in front of intra-alar seta. Medial vitta of scutum present, light yellow. Katatergite light yellow. Anatergite light yellow. Scutellum yellow. Setae; *a.sa.* absent, *prsc.* absent, *sc.* one pair. Anepisternal stripe not extended forward.

*Legs*

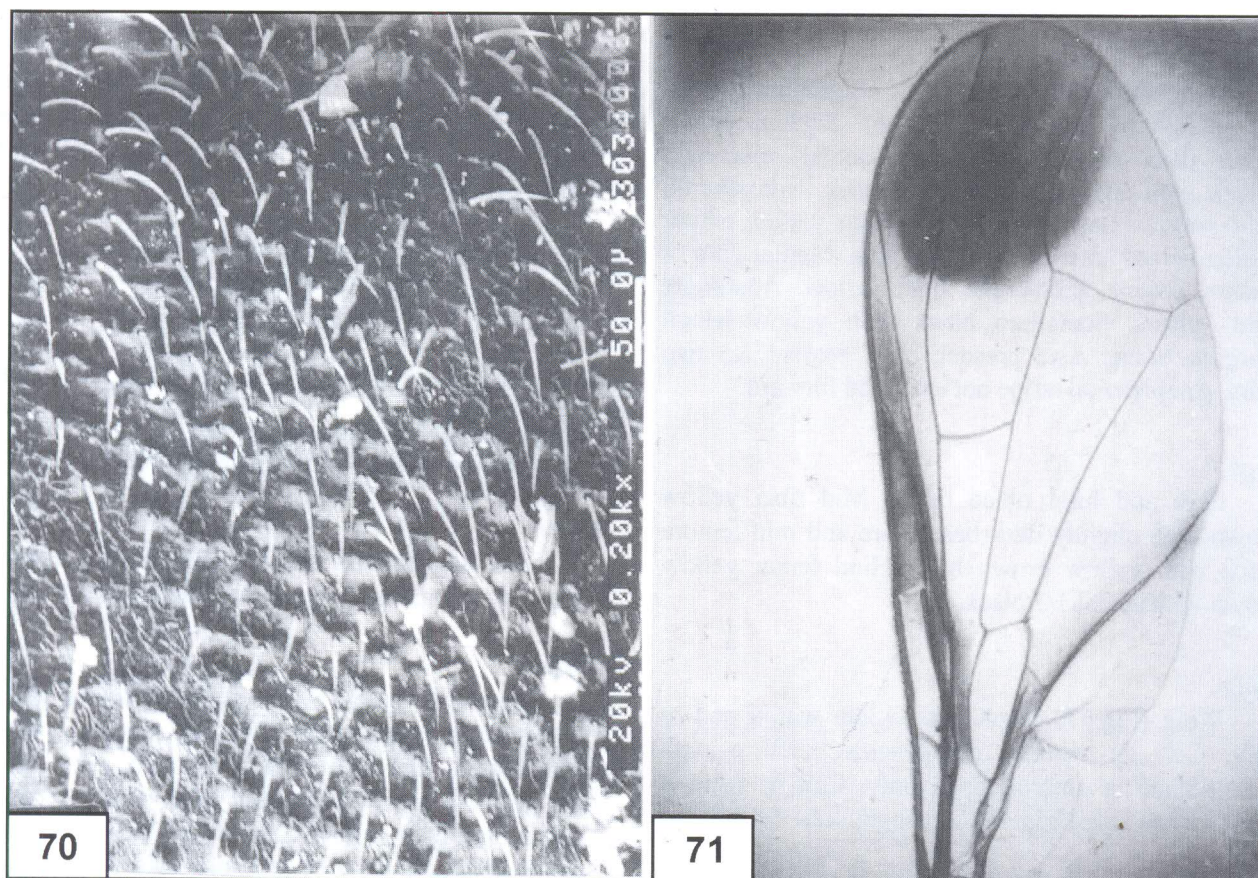
All tibiae red brown. All femora brown with apical half red brown.

*Wing*

Wing (Fig.71) costal band width from vein *Sc* to below vein *M* at wing apex. Costal band expanded and darkened apically to form a spot at wing apex. Costal band not overlapping vein *R*<sub>2+3</sub> in depth. Cell *bc* without microtrichae. Cell *c* with microtrichae in anterior apex only. Cell *br* with microtrichae at the base. Wing length 8.4mm.

*Abdomen*

Abdominal tergites not fused (except I and II). Tergites markings: tergite I light red brown with lateral margin brown black, tergite II yellow brown



Figs. 70-71. *B. brachycera*. 70, tomentum pattern on prescutum. 71, wing.

with a brown black spot in the anteroventral part, lateral margins brown black, tergites III – V red brown, with a moderately broad medial longitudinal black band, tergite III with a broad basal transverse brown black band, tergites IV and V with anterolateral black brown markings. Tergite I wasp-waisted. Tergite III (males) with pecten. Sternite V (males) without V- shaped notch. Posterior surstylus lobe short. Males lure response unknown.

#### Material examined

**Bhutan:** Tashi, 1 male, 26.x.1991, Jolikit, 1 male, 18.v.1915. **India:** Bhimtal, 1 female (Type), 20.vi.1912, Ranikhet, 1 female, 29.vi.1949.

#### Comments

Kapoor (1993) placed this species under the genus *Dacus*. However, in the present article this species is placed in the genus *Bactrocera* as abdominal tergites are free.

#### 21 - *Bactrocera (Tetradacus) minax* (Enderlein) (Figs. 72-75)

*Polistomimetes minax* Enderlein, 1920:358. [Type Loc., India (Sikkim)].

*Mellesis citri* Chen, 1940:133. [Type Loc., China (Sichuan)].

*Dacus (Polistomimetes) minax* (Enderlein), Hardy, 1977:56.

*Bactrocera (Tetradacus) minax* (Enderlein), White and Wang, 1992:276, White and Elson-Harris, 1992:256.

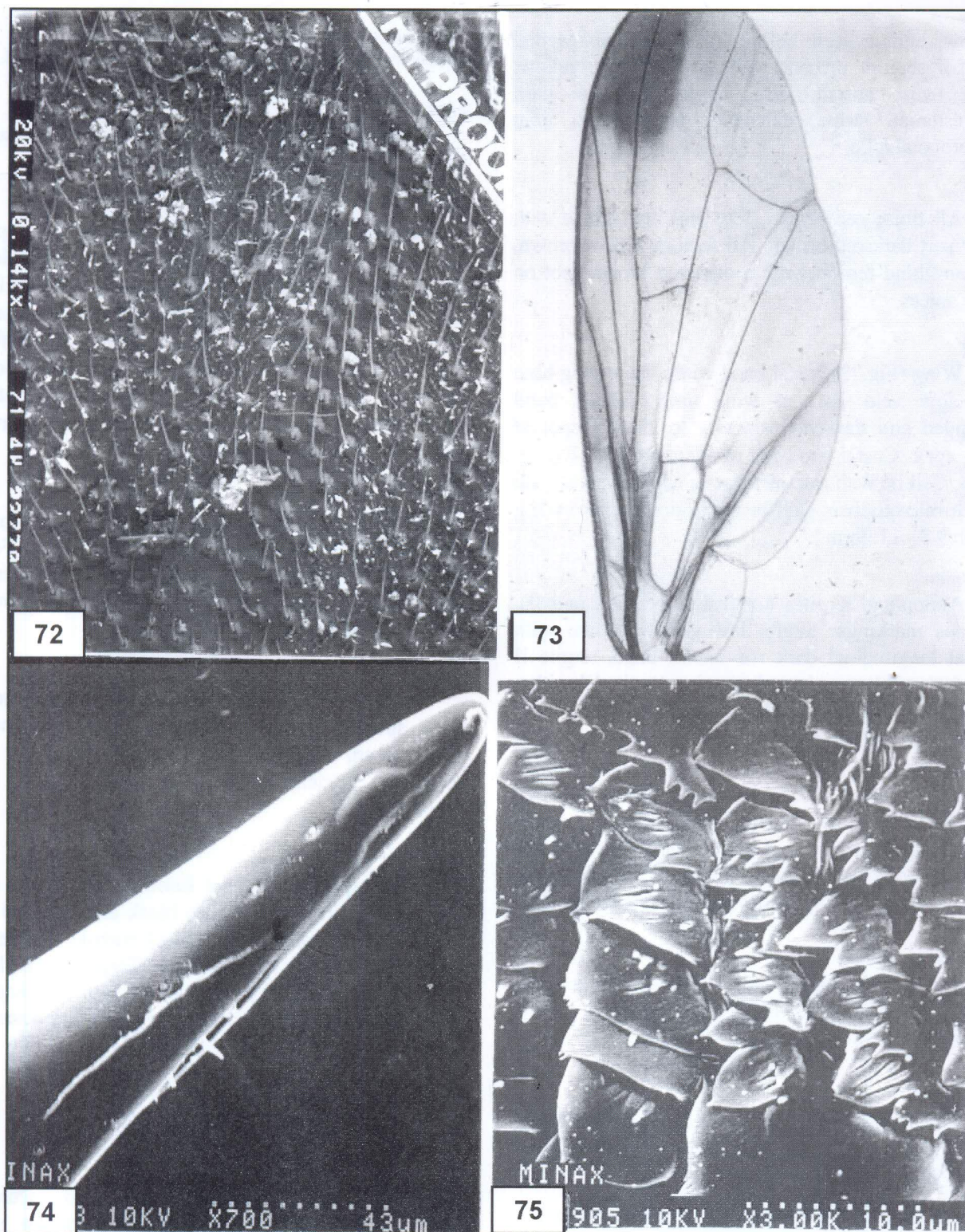
*Bactrocera (Polistomimetes) minax* (Enderlein), Kapoor, 1993:77.

#### Head

First flagellomere shorter than ptilinal fissure. Face with a long black spot in each antennal furrow.

#### Thorax

Tomentum pattern with wide longitudinal gap in the middle of prescutum (Fig.72). Scutum colour (other than vittae) red brown. Notopleural vitta present, yellow. Lateral vitta of scutum light yellow,



Figs. 72-75. *B. minax*. 72, tomentum pattern on prescutum. 73, wing. 74, aculeus apex. 75, scales on the distal end of eversible membrane of ovipositor.

narrow, ending well before intra-alar seta. Medial vitta of scutum present, yellow. Scutellum yellow. Setae; *a.sa.* absent, *prsc.* absent, *sc.* one pair. Anepisternal stripe extended forward to join postpronotal lobe.

#### Legs

All tibiae red brown, fore and hind tibiae with outer part dark red brown. All femora yellow brown, mid and hind femora with a dark red brown spot on outer apices.

#### Wing

Wing (Fig.73) costal band width from wing base to below vein  $R_{4+5}$  at wing apex. Costal band expanded and darkened apically to form a spot at wing apex. Costal band not overlapping vein  $R_{4+5}$  in depth. Cell bc with microtrichae in anterior apex. Cell c with microtrichae. Cell br with microtrichae. Wing length 9.5 - 11.0mm.

#### Abdomen

Abdominal tergites not fused (except I and II). Tergites markings: tergite I-V yellow brown with medial longitudinal dark red brown band, tergite II with dark red brown lateral margins, tergite III with a apical transverse dark red brown band, tergites IV and V with anterolateral dark red brown markings. Tergite I wasp-waisted. Tergite III (males) with pecten. Sternite V (males) without V- shaped notch. Posterior surstylus lobe short. Aculeus length: 3.7 - 4.4mm. Aculeus apex needle shaped (Fig.74). The scales at the distal end of eversible membrane of ovipositor of various shape (Fig.75). Males lure response unknown.

#### Material examined

**Bhutan:** 2 males and 1 female, 24.xi.1986.  
**India:** Sikkim, 1 male, 1903, 2 males and 1 female (Type), 1920.

#### Comments

This species is distinct notopleural, lateral and medial vittae, anepisternal stripe extended forward and broad costal band.

#### 22 - *Bactrocera (Zeugodacus) biguttata* (Bezzi) (Figs. 76-77)

*Chaetodacu biguttatus* Bezzi, 1916:111. [Type loc., India (West Bengal)].

*Dacus (Bactrocera) biguttatus* (Bezzi) Hardy, 1977: 49.

*Bactrocera (Bactrocera) biguttata* (Bezzi), Kapoor, 1993: 73.

#### Head

First flagellomere shorter than ptilinal fissure. Face with a black spot in each antennal furrow.

#### Thorax

Tomentum pattern with wide longitudinal gap in the middle of prescutum (Fig.76). Scutum colour (other than vittae) black. Postpronotal lobe yellow with dorsal part black. Notopleuron black. Lateral vitta of scutum present, yellow, ending well before intra alar seta. Medial vitta of scutum present, yellow. Scutellum black with yellow lateral margins. Setae; *a.sa.* present, *prsc.* present, *sc.* one pair. Anepisternal stripe not extended forward.

#### Legs

Fore tibia brown black. Mid tibia red brown (sometimes brown black). Hind tibia black. Fore femur black with basal 1/4 yellow brown. Mid femur yellow brown with apical 1/3 to 1/2 black. Hind femur yellow brown with apical 1/3 black.

#### Wing

Wing (Fig.77) costal band within cell sc and a black spot at apex of vein  $R_{4+5}$ . Cell bc without microtrichae. Cell c without microtrichae. Cell br without microtrichae at the base. Wing length: 7.1 - 8.2mm.

#### Abdomen

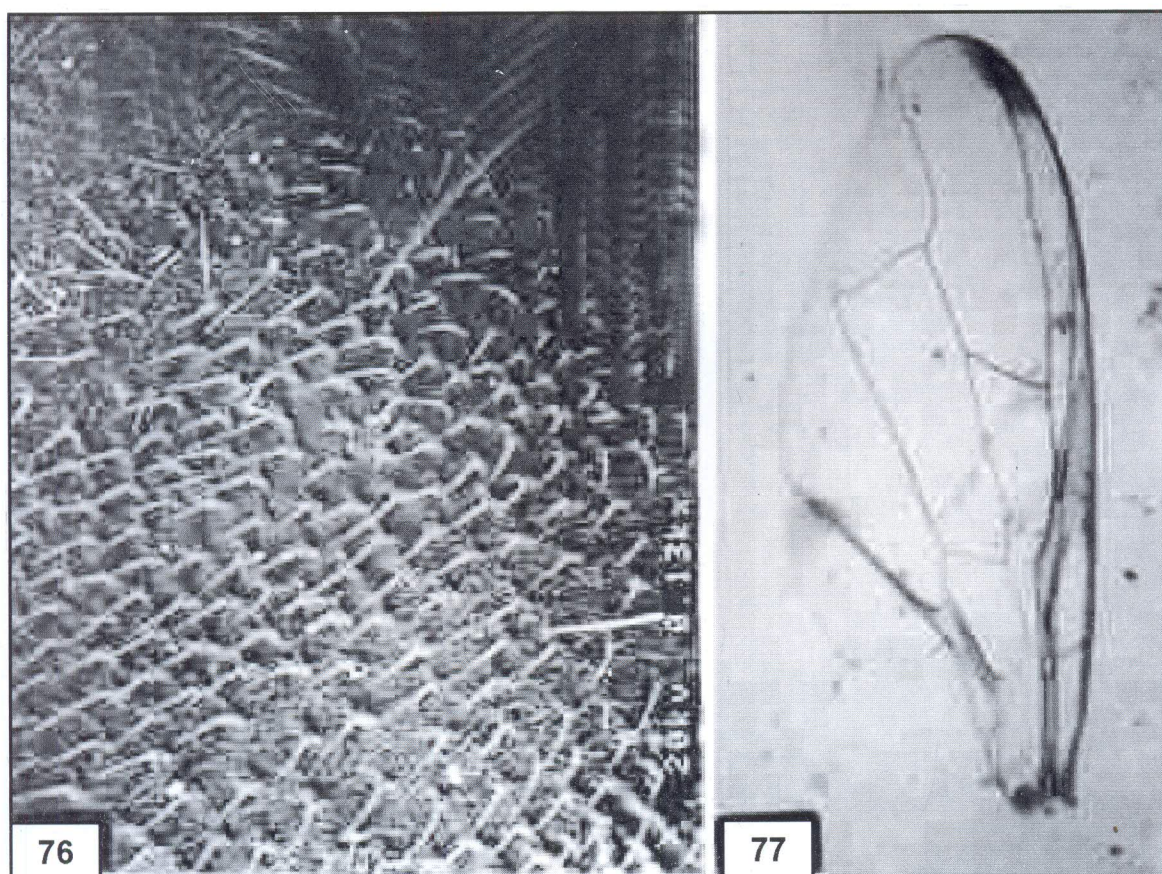
Abdominal tergites not fused (except I and II). Tergites markings: all tergites black except I and II, which are with apical yellow black narrow transverse bands. Tergite I not wasp-waisted. Tergite III (males) with pecten. Sternite V (males) without V- shaped notch. Posterior surstylus lobe long. Males attracted to cue lure.

#### Material examined

**India:** Darjeeling, 4 males, 13-18.ix.1917.

#### Comments

This distinct species has a black notopleuron, lateral and medial vittae, anterior supra-alar and prescutellar acrostichal setae, cell br without microtrichae at the base. Costal band within cell sc and a black spot at apex of vein  $R_{4+5}$ .



Figs. 76-77. *B. biguttata*. 76, tomentum pattern on prescutum. 77, wing.

23 - *Bactrocera (Zeugodacus) caudata* (Fabricius)  
(Figs. 78-81)

*Dacus caudatus* Fabricius, 1805:276. [Type Loc., Java]  
*Bactrocera maculipennis* Doleschall, 1856. [Type Loc., Java]  
*Dasyneura caudatus* (Fabricius), Walker, 1849:1073.  
*Dacus (Zeugodacus) caudatus* Fabricius, Hardy, 1977:57.  
*Bactrocera (Zeugodacus) caudata* (Fabricius), White and Elson-Harris, 1992:262; Kapoor, 1993:80.

*Head*

First flagellomere shorter than ptilinal fissure. Face with a black transverse line in antennal furrow.

*Thorax*

Tomentum pattern with a narrow longitudinal gap in the middle of prescutum (Fig.78). Scutum colour (other than vittae) black. Lateral vitta of scutum present, yellow, crossing intra alar seta. Medial vitta of scutum present, yellow. Scutellum yellow. Setae; *a.sa.* present, *prsc.* present, *sc.* two

pairs. Anepisternal stripe extended forward to anterior notopleural seta.

*Legs*

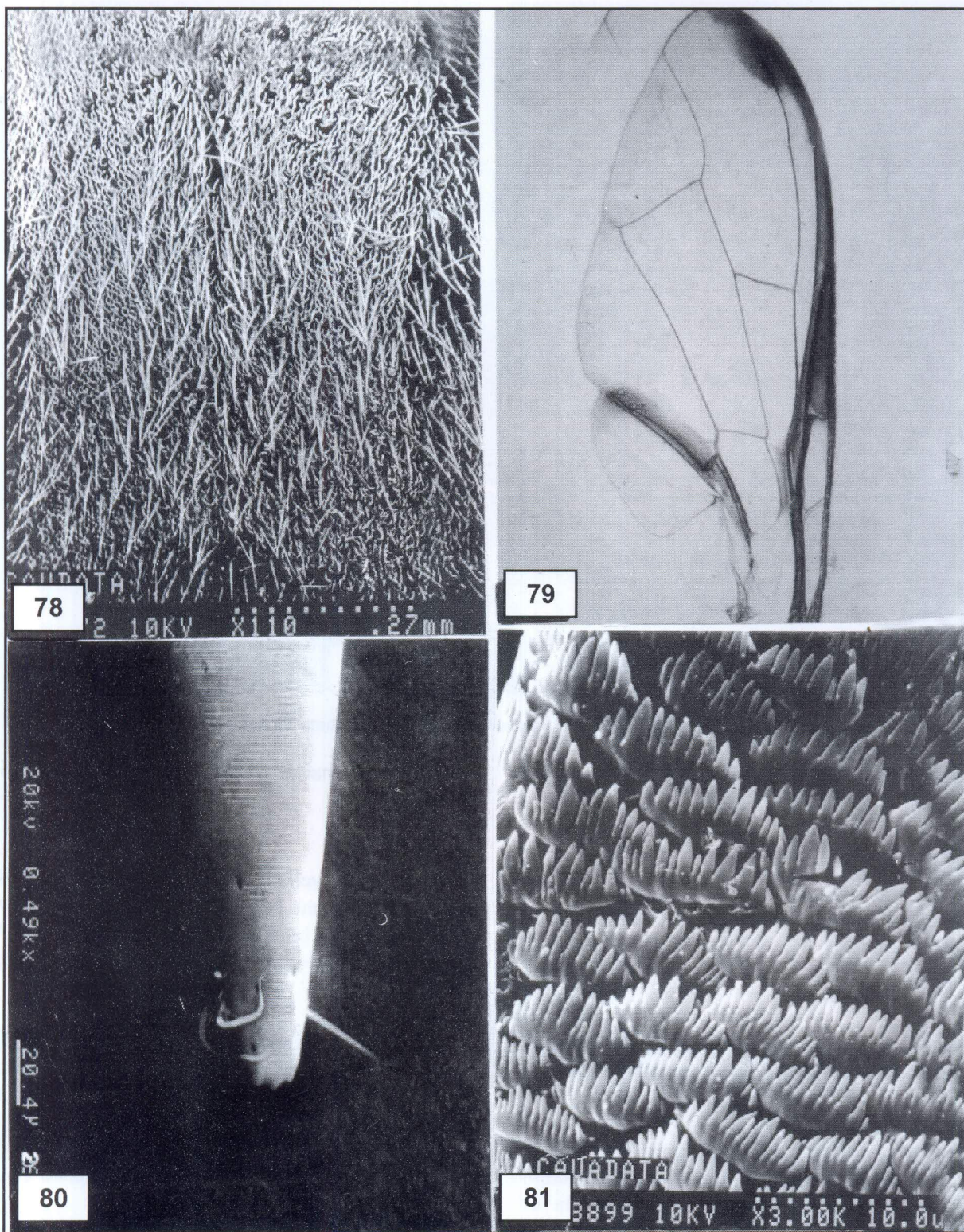
Fore tibia yellow brown with outer dark red brown longitudinal band. Mid tibia yellow brown with slightly dark base. Hind tibia dark red brown. All femora yellow brown with a black spot on outer apex.

*Wing*

Wing (Fig.79) costal band width from vein Sc to below vein  $R_{4+5}$  at wing apex. Costal band expanded apically to form a black spot at wing apex. Costal band not overlapping vein  $R_{2+3}$  in depth. Cell bc without microtrichiae. Cell c with microtrichiae in the anterior apex only. Cell br with microtrichiae at the base. Wing length: 5.0 – 6.9mm.

*Abdomen*

Abdominal tergites not fused (except I and II).



Figs. 78-81. *B. caudata*. 78, tomentum pattern on prescutum. 79, wing. 80, aculeus apex. 81, scales on the distal end of eversible membrane of ovipositor.

Tergites markings: tergite I red brown with narrow black lateral margins, tergite II yellow brown with a basal transverse black band and with narrow black lateral margins, tergites III – V medial longitudinal black band, tergite III with a basal transverse black band, tergites IV and V with anterolateral black markings. Tergite I not wasp-waisted. Tergite III (males) with pecten. Sternite V (males) without V-shaped notch. Posterior surstylus lobe long. Aculeus length: 1.06 – 1.2mm. Aculeus apex trilobed shaped (Fig.80). The scales at the distal end of eversible membrane of ovipositor long, with 8 to 10 small tooth-like structure (Fig.81). Males attracted to cue lure.

#### Material examined

**India:** Dessa, 1 male, x.1898, Bihar (Pusa), 1 male, 3.i.1915, Coimbatore, 1 male, 23.ii.1912. **Sri Lanka:** Hingurakgoda, 1 male, 21.ix.1994, Weerawilla, 2 males, 20.x.1994, 1 male, 22.ix.1994, Illuppallma, 1 male, 26.x.1993.

#### Comments

This species differ from *B. tau* in having a transverse black line above mouth opening, tomentum pattern on prescutum with a narrow longitudinal gap, extended anepisternal stripe and shape of aculeus apex being trilobed.

### 24 - *Bactrocera (Zeugodacus) cucurbitae* (Coquillett) (Figs. 82-85)

*Dacus cucurbitae* Coquillett, 1899:129. [Type Loc., Hawaii (Honolulu)]

*Dasyneura caudatus* of Walker, 1849:1073. (Misidentification, not Fabricius 1805).

*Bactrocera cucurbitae* (Coquillett): Bezzi, 1913:96.

*Chaetodacus cucurbitae* (Coquillett): Bezzi, 1916:109, Hendel, 1915:426, Shiraki, 1933:73.

*Strumeta cucurbitae* (Coquillett): Perkins, 1938:127.

*Dacus (Strumeta) cucurbitae* (Coquillett): Hardy and Adachi, 1954:165, Hardy, 1973:38.

*Dacus (Zeugodacus) cucurbitae* Coquillett: Hardy, 1977:57.

*Bactrocera (Zeugodacus) cucurbitae* Coquillett: Drew, 1989:212; White and Elson-Harris, 1992:508; Kapoor, 1993:81.

#### Head

First flagellomere shorter than ptilinal fissure. Face with a black spot in each antennal furrow.

#### Thorax

Tomentum pattern with wide longitudinal gap in the middle of prescutum (Fig.82). Scutum colour (other than vittae) red brown. Lateral vitta of scutum present, yellow, ending in front of (sometimes crossing) intra alar seta. Medial vitta of scutum present, yellow. Scutellum yellow. Setae; *asa*. present, *prsc*. present, *sc*. two pairs (sometimes one). Anepisternal stripe not extended forward.

#### Legs

Fore tibia yellow brown to red brown. Mid tibia yellow brown with slightly dark base. Hind tibia red brown. All femora yellow brown with apical ¼ red brown.

#### Wing

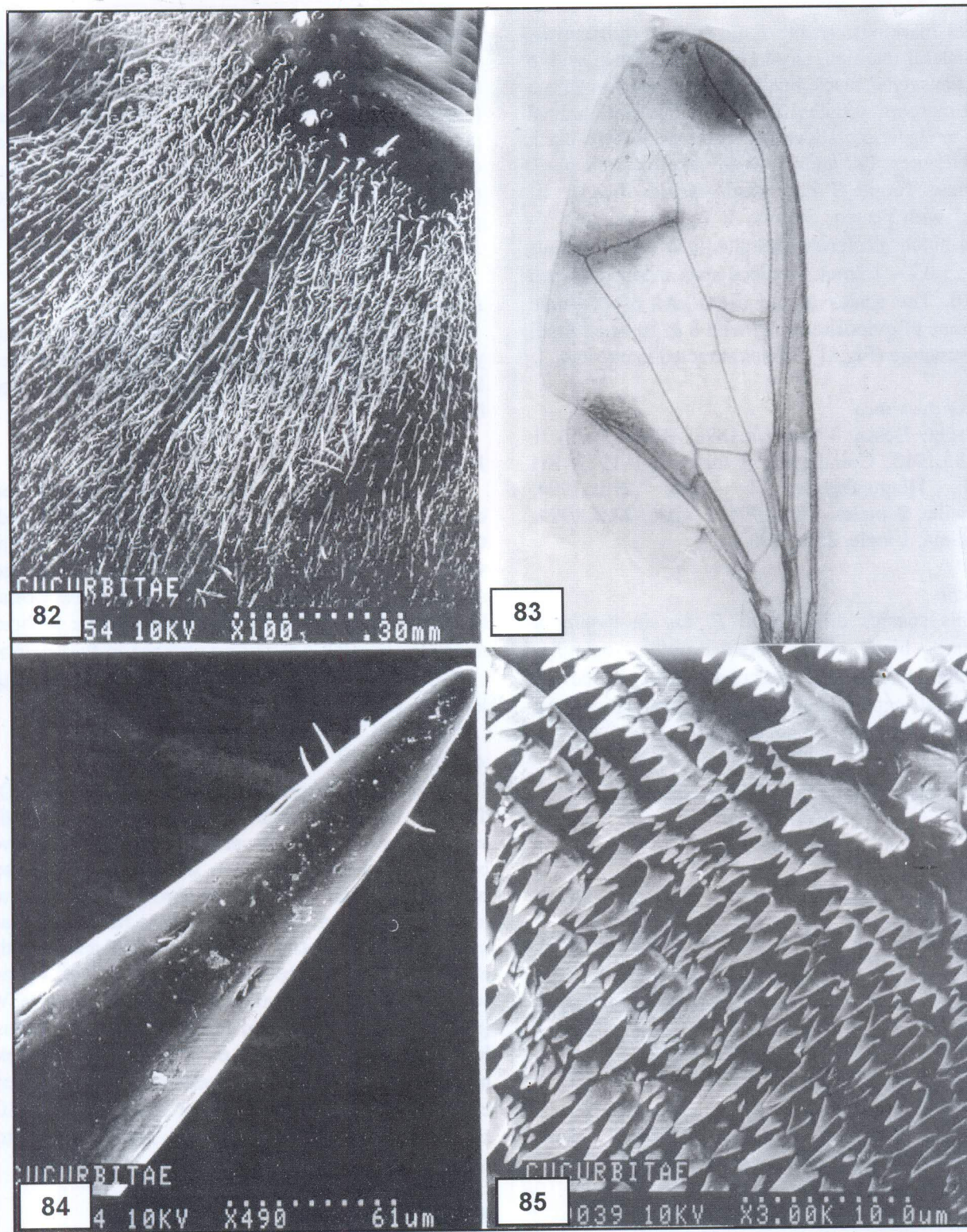
Wing (Fig.83) with infusate marks on crossveins r-m and dm-cu in addition to costal band. Costal band width from vein Sc to below vein R<sub>4+5</sub> at wing apex. Costal band darkened and expanded apically to form a black spot at wing apex. Costal band overlapping vein R<sub>2+3</sub> in depth. Cell bc without microtrichiae. Cell c with microtrichiae in the anterior apex only. Cell br with microtrichiae at the base. Wing length: 5.0 – 6.5mm.

#### Abdomen

Abdominal tergites not fused (except I and II). Tergites markings: tergite I dark red brown with apical yellow brown transverse band, tergite II yellow brown with basal red brown incomplete transverse band, tergites III – V yellow brown with narrow medial longitudinal black band, tergite III with a basal narrow transverse black band, tergites IV and V with anterolateral black markings. Tergite I not wasp-waisted. Tergite III (males) with pecten. Sternite V (males) without V-shaped notch. Posterior surstylus lobe long. Aculeus length: 1.6 – 1.7mm. Aculeus apex needle shaped (Fig.84). The scales at the distal end of eversible membrane of ovipositor long, with 8 to 10 small tooth-like structure (Fig.85). Males attracted to cue lure.

#### Material examined

**India:** Dessa, 5 males and 3 females, vi.1898, **Pakistan:** Peshawar, 4 males and 1 female, 21.viii.1961, Haripur, 8 males, 9.viii.1993,



Figs. 82-85. *B. cucurbitae*. 82, tomentum pattern on prescutum. 83, wing. 84, aculeus apex. 85, scales on the distal end of eversible membrane of ovipositor.

Muzaffarabad, 3 males, 4.viii.1993, Rawalpindi, 30 males, 3.viii.1993, Multan, 30 males and 3 females, 29.vii.1993, Hyderabad, 10 males, 19.vii.1993. Thousands of specimens from different localities were collected during July/August 1993. **Sri Lanka:** Pundaluoya, 4 males and 9 females, vi.1897, Kundasale, 1 male and 5 females, vi.1897, Kandy, 5 males and 10 females, viii.1957, 1 male, 12-14.x.1992, Battaramulla, 6 males, 16-18.viii.1992, Peradeniya, 14 males, 12-14.viii.1992.

#### Comments

This species differs from *B. tau* in having characteristic infusate marks on crossveins r-m and dm-cu.

#### 25 - *Bactrocera (Zeugodacus) duplicata* (Bezzi) (Figs. 86-87)

*Chaetodacus duplicatus* Bezzi, 1916:107. [Type Loc., India (Madhya Pradesh)]

*Dacus (Zeugodacus) duplicatus* (Bezzi), Hardy, 1977:57.

*Bactrocera (Zeugodacus) duplicata* (Bezzi), White and Elson-Harris, 1992:278; Kapoor, 1993:82.

#### Head

First flagellomere shorter than pitilinal fissure. Face with a black transverse line above mouth opening and two black spots below antennae base, which may be sometimes joined to form another black band.

#### Thorax

Tomentum pattern without longitudinal gap in the middle of prescutum (Fig.86). Scutum colour (other than vittae) black. Lateral vitta of scutum present, yellow, crossing intra alar seta. Medial vitta of scutum absent. Scutellum yellow. Setae; *a.sa.* present, *pr.sc.* present, *sc.* two pairs. Anepisternal stripe extended forward to anterior postpronotal lobe.

#### Legs

Fore tibia yellow brown to red brown. Mid tibia yellow brown with basal part slightly darker than the rest. Hind tibia black. Fore femur yellow brown with a black spot on outer apex. Mid and hind femora yellow brown with apical 1/3 black.

#### Wing

Wing (Fig.87) costal band width from vein Sc to

below vein  $R_{4+5}$  at wing apex. Costal band expanded apically to form a black spot at wing apex. Costal band not overlapping vein  $R_{2+3}$  in depth. Cell bc without microtrichae. Cell c with microtrichae in the anterior apex only. Cell br without microtrichae at the base. Wing length: 5.2 – 5.8mm.

#### Abdomen

Abdominal tergites not fused (except I and II). Tergites markings: tergite I black with apical transverse narrow yellow brown band, tergite II yellow basal half black and apical half yellow white, tergites III – V entirely black band. Tergite I not wasp-waisted. Tergite III (males) with pecten. Sternite V (males) without V- shaped notch. Posterior surstylus lobe long. Males attracted to cue lure.

#### Material examined

**India:** Packmari, 1 male and 1 female (types), 30.v.1905, Mudigere, 1 male, 20-22.v.1921. **Sri Lanka:** Monaragala, 1 male, 13.x.1994, 1 male, 30.xii.1994, Nalanda, 1 male, 10.x.1994, Pelwehara, 1 male, 25.x.1994.

#### Comments

This is a distinct species, usually with a black transverse band above mouth opening and a black spot below each antennal base, which may sometimes join to form another transverse black band, extended anepisternal stripe, cell br without microtrichae at the base.

#### 26 - *Bactrocera (Zeugodacus) gavis* (Munro) (Figs. 88-89)

*Dacus (Zeugodacus) gavis* Munro, 1935:15. [Type loc., India (Barkuda Island)].

*Dacus (Zeugodacus) gavis* Munro; Hardy, 1977:82.

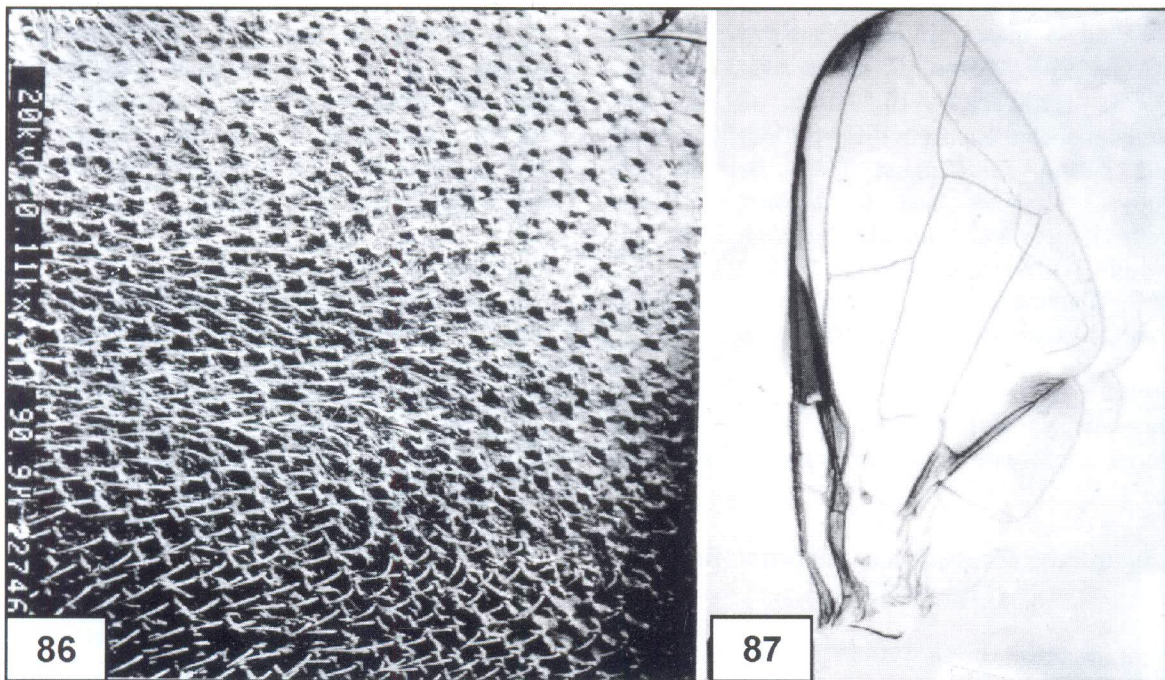
*Bactrocera (Zeugodacus) gavis* (Munro), Kapoor, 1993:82.

#### Head

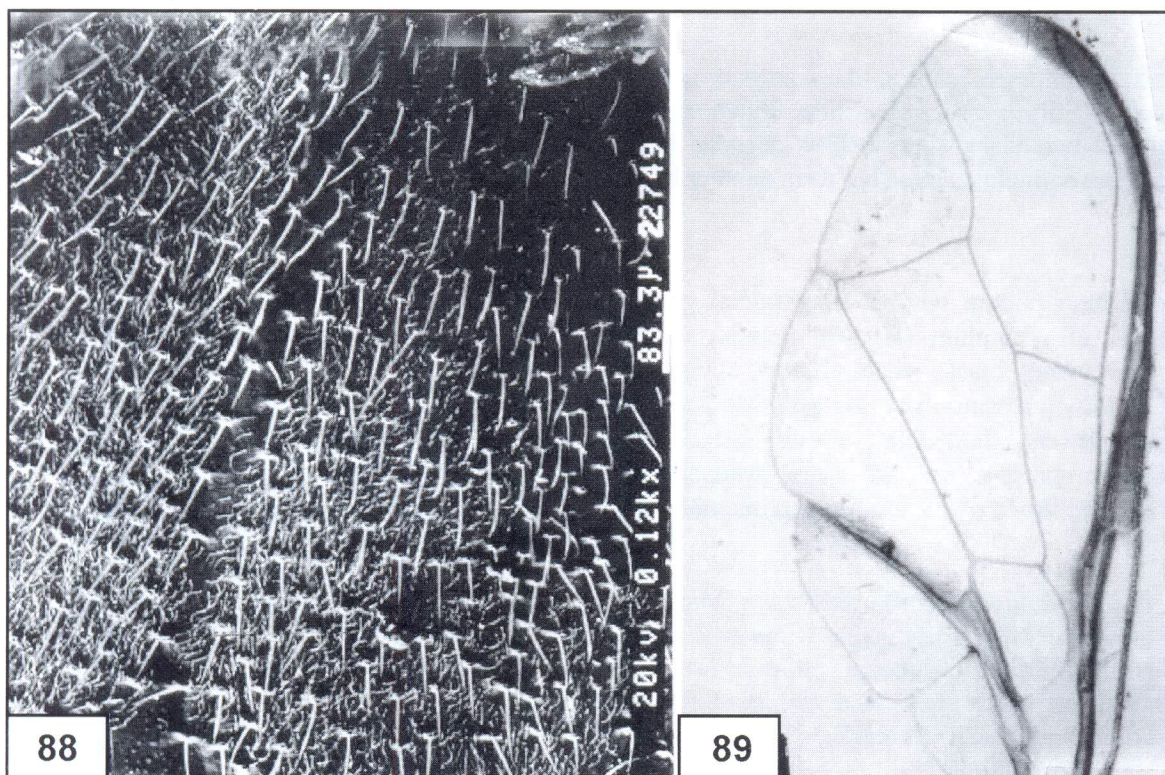
First flagellomere shorter than pitilinal fissure. Face with a large black spot in each antennal furrow.

#### Thorax

Tomentum pattern with a wide longitudinal gap in the middle of prescutum (Fig.88). Scutum colour (other than vittae) black, with two longitudinal red



Figs. 86-87. *B. duplicata*. 86, tomentum pattern on prescutum. 87, wing.



Figs. 88-89. *B. gavis*. 88, tomentum pattern on prescutum. 89, wing.

brown bands on prescutum. Postpronotal lobe light yellow brown. Notopleuron light yellow brown. Lateral vitta of scutum present, yellow, crossing intra alar seta. Medial vitta of scutum present, light yellow brown. Katatergite yellow brown. Anatergite yellow brown. Scutellum yellow. Setae; *a.sa.* present, *prsc.* present, *sc.* two pairs. Anepisternal stripe extended forward to join postpronotal lobe.

#### Legs

Fore and mid tibiae yellow brown. Hind tibia red brown. All femora yellow brown.

#### Wing

Wing (Fig.89) costal band width from vein Sc to below vein  $R_{4+5}$  at wing apex. Costal band not overlapping vein  $R_{2+3}$  in depth. Cell bc without microtrichiae. Cell c with microtrichiae in the anterior apex only. Cell br with microtrichiae at the base. Wing length: 4.7 – 5.0mm.

#### Abdomen

Abdominal tergites not fused (except I and II). Tergites markings: tergite I black with a transverse apical red brown band, tergite II red brown with a basal transverse black band expanded on lateral margins, tergites III – V red brown with a medial longitudinal black band, tergite III with a basal narrow transverse black band, tergites IV and V with broad lateral black markings. Tergite I not wasp-waisted. Tergite III (males) with pecten. Sternite V (males) without V- shaped notch. Posterior surstylus lobe long. Males attracted to cue lure.

#### Material examined

**Sri Lanka:** Peradeniya, 2 males, 8.xi.1992, Inginimitiya, 1 male, 27.i.1995, Kataragama, 1 male, 20.x.1994, Pallegama, 1 male, 27.xii.1994, Bindunuwewa, 1 male, 23.iii.1995, Weerawilla, 1 male, 20.x.1994, Illuppallma, 1 male, 10.ix.1993.

#### Comments

This is a distinct species with black facial spots, two longitudinal red brown bands on prescutum, extended anepisternal stripe and shaped like inverted "L".

### 27 - *Bactrocera* (*Zeugodacus*) *kaghanae* Mahmood (Figs. 90-91)

*Bactrocera* (*Zeugodacus*) *kaghanae* Mahmood (In press)

#### Head

First flagellomere shorter than ptilinal fissure. Face with a black spot in each antennal furrow.

#### Thorax

Tomentum pattern with wide longitudinal gap in the middle of prescutum (Fig.90). Scutum colour (other than vittae) black. Lateral vitta of scutum present, yellow, ending in front of intra alar seta. Medial vitta of scutum present, yellow. Scutellum yellow with black mark on apex. Setae; *a.sa.* present, *prsc.* present, *sc.* two pairs. Anepisternal stripe extended forward to anterior notopleural seta.

#### Legs

All tibiae brown black. All femora yellow brown with apical black spot sometimes faded.

#### Wing

Wing (Fig.91) costal band width from vein Sc to vein  $R_{2+3}$  (cell sc and  $r_1$  light brown) and a spot at apex of vein  $R_{4+5}$ . Cell bc without microtrichiae. Cell c with microtrichiae in the anterior apex only. Cell br with microtrichiae at the base. Wing length: 6.2 – 7.0mm.

#### Abdomen

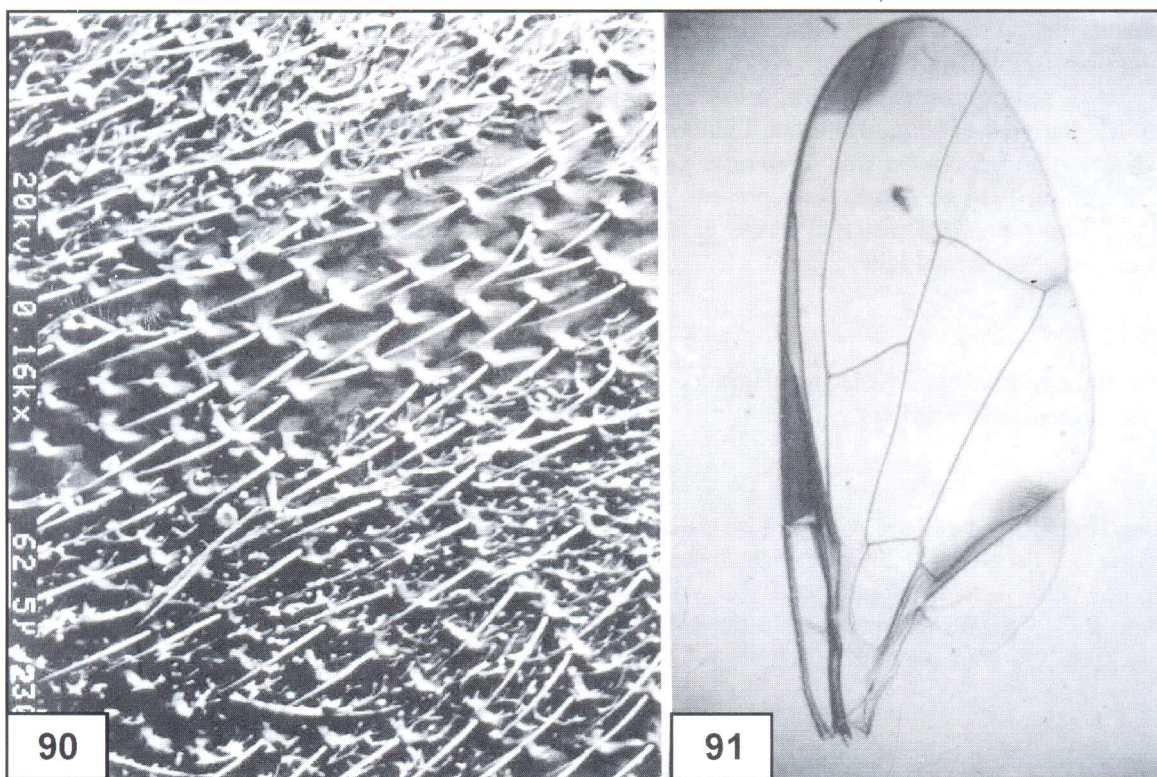
Abdominal tergites not fused (except I and II). Tergites markings: all tergites brown black, tergite I and II each apical transverse yellow brown band. Tergite I not wasp-waisted. Tergite III (males) with pecten. Sternite V (males) without V- shaped notch. Posterior surstylus lobe long. Males attracted to cue lure.

#### Material examined

Holotype **Pakistan**, Kaghan, 1 male 5.viii.1993. Paratypes 8 males, same data as holotype.

#### Comments

This species is different from *Bactrocera* (*Zeugodacus*) *scutellaris* Bezzi in having extended anepisternal lobe.



Figs. 90-91. *B. kaghanae*. 90, tomentum pattern on prescutum. 91, wing.

**28 - *Bactrocera (Zeugodacus) scutellaris* Bezzi**  
(Figs. 92-95)

*Bactrocera scutellaris* Bezzi, 1913:98. [Type loc. India (Assam, Uttar Pradesh).

*Chaetodacus scutellaris* (Bezzi): Bezzi, 1916:113.

*Dacus (Zeugodacus) scutellaris* (Bezzi): Hardy, 1977:59.

*Bactrocera (Zeugodacus) scutellaris* (Bezzi): White and Elson-Harris, 1992:278; Kapoor, 1993:82.

**Head**

First flagellomere shorter than ptilinal fissure. Face with a black spot in each antennal furrow.

**Thorax**

Tomentum pattern with wide longitudinal gap in the middle of prescutum (Fig.92). Scutum colour (other than vittae) black. Postpronotal lobe yellow with anterodorsal black marking. Lateral vitta of scutum present, yellow, ending in front of intra alar seta. Medial vitta of scutum present, yellow. Scutellum yellow with black mark on apex. Setae;

*a.sa.* present, *prsc.* present, *sc.* two pairs. Anepisternal stripe not extended forward.

**Legs**

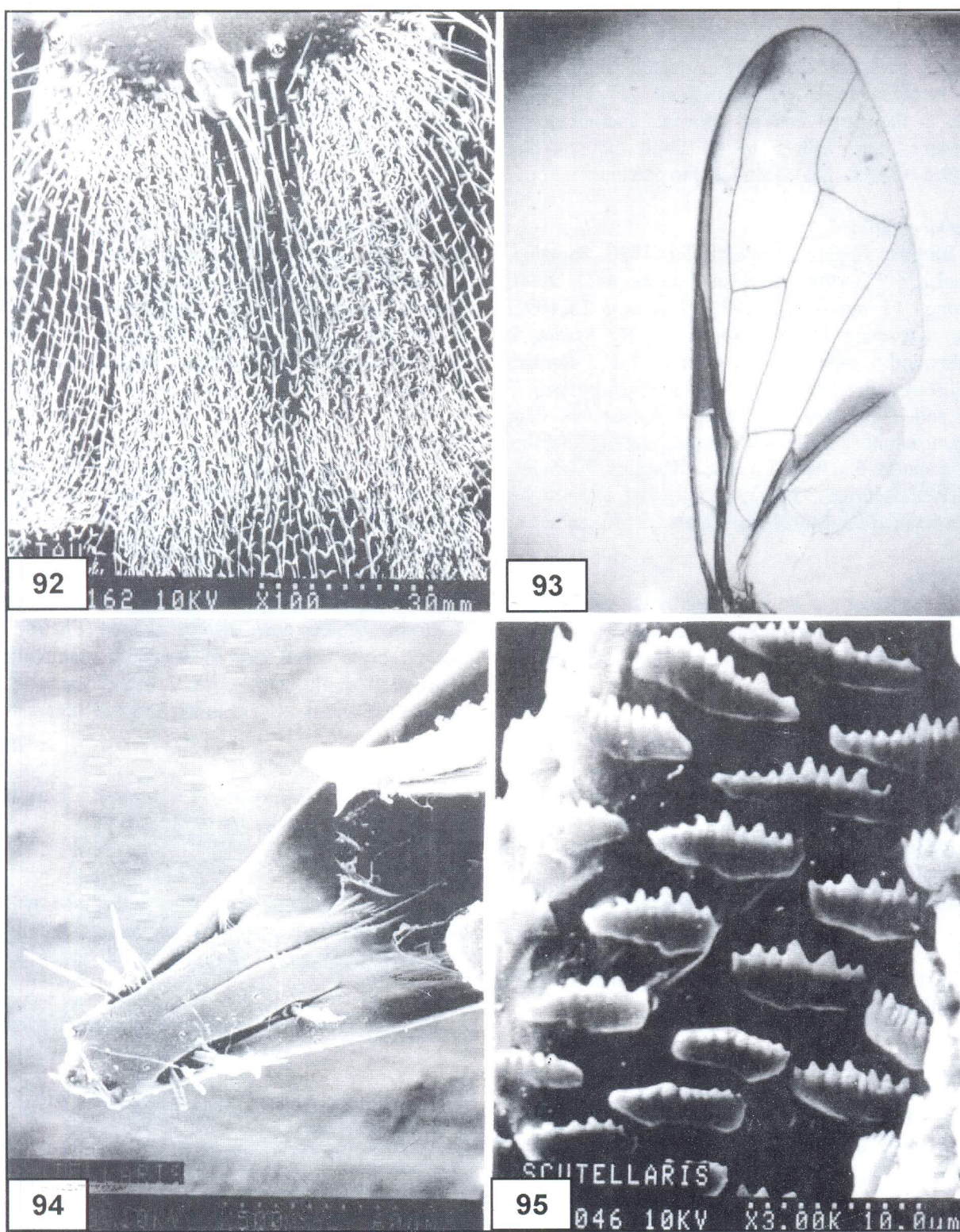
All tibiae brown black. All femora yellow brown with apical 1/3 brown black.

**Wing**

Wing (Fig.93) costal band width from vein Sc to vein  $R_{4+5}$  at wing apex. Costal band expanded apically to from a spot at apex. Costal band not overlapping vein  $R_{2+3}$  in depth. Cell bc without microtrichae. Cell c with microtrichae in the anterior apex only. Cell br with microtrichae at the base. Wing length: 6.2 – 7.0mm.

**Abdomen**

Abdominal tergites not fused (except I and II). Tergites markings: all tergites brown black, tergite I and II each apical transverse yellow brown band. Tergite I not wasp-waisted. Tergite III (males) with



Figs. 92-95. *B. scutellaris*. 92, tomentum pattern on prescutum. 93, wing. 94, aculeus apex. 95, scales on the distal end of eversible membrane of ovipositor.

pecten. Sternite V (males) without V- shaped notch. Posterior surstylus lobe long. Aculeus length: 1.05 mm. Aculeus apex trilobed shaped. (Fig.94). The scales at the distal end of eversible membrane of ovipositor long, with 5 to 10 small tooth – like structure (Fig.95). Males attracted to cue lure.

#### Material examined

**Bhutan:** Diaphu, 6 males, 5.ix.1990, Santalay, 14 males, 4-7.ix.1990, Limidar, 7 males, 4-7.ix.1990, Rontong, 13 males, 0.ix.1991, 2 males, 2.x.1991. **India:** Kurseong 1 male, 10-26.ix.1909, Assam, 2 females and 1 male, 7.x.1920, Naini Tal, 1 female, 16.ix.1934, Uttar Pradesh, 1 female, 15-18.ix.1945, 1 male and 2 females, 6.ix.1949, 1 female, vi.1950, Splan, 1 female, 10.viii.1988. Nepal, Watling, 2 males and 2 females, 6.x.1965. **Pakistan:** Kaghan, 70 males, 5.viii.1993, Murree, 15 males, 3.viii.1993, Haripur, 22 males, 9.viii.1993, Mansehra, 8 males, 8.viii.1993.

#### Comments

This species can be identified by the presence of black facial spots, anterior supra-alar seta, prescutellar acrostichal seta, black apex of scutellum and trilobed aculeus.

#### 29 - *Bactrocera (Zeugodacus) sicienti* (Chao and Lin) new combination (Figs. 96-99)

*Chaetodacus ater* Chen, 1940:131. [Type loc., China (Sichuan)].

*Dacus (Zeugodacus) sicienti* Chao and Lin, 1993:142.

#### Head

First flagellomere shorter than ptilinal fissure. Face entirely black.

#### Thorax

Tomentum pattern with a narrow longitudinal gap in the middle of prescutum (Fig.96). Scutum colour (other than vittae) black. Lateral vitta of scutum present, yellow, ending in front of intra alar seta. Medial vitta of scutum present, yellow. Scutellum yellow with black mark at apex. Setae; *a.sa.* present, *prsc.* present, *sc.* two pairs. Anepisternal stripe extended forward to anterior notopleural seta.

#### Legs

Fore tibia yellow brown slightly black at base. Mid tibia yellow brown. Hind tibia red brown. Fore femur dark black. Mid and hind femora black with basal ¼ yellow brown.

#### Wing

Wing (Fig.97) costal band width from vein Sc to below vein  $R_{4+5}$  at wing apex. Costal band slightly expanded at wing apex. Costal band not overlapping vein  $R_{2+3}$  in depth. Cell bc without microtrichae. Cell c with microtrichae in the anterior apex only. Cell br with microtrichae at the base. Wing length: 5.5 – 5.7mm.

#### Abdomen

Abdominal tergites not fused (except I and II). Tergites markings: tergites I and II yellow brown with basal transverse black bands, tergites III – V almost black. Tergite I not wasp-waisted. Tergite III (males) with pecten. Sternite V (males) without V- shaped notch. Posterior surstylus lobe long. Aculeus length: 1.17mm. Aculeus apex trilobed shaped (Fig.98). The scales at the distal end of eversible membrane of ovipositor small, with 6 to 7 broad tooth – like structure (Fig.99). Males attracted to cue lure.

#### Material examined

**Bhutan:** Rontong, 2 males, 30.ix.1991, Manchungang, 1 male, 4.x.1991.

#### Comments

This is a distinct species with face entirely black, lateral and medial vittae, anterior supra-alar and prescutellar acrostichal seta and trilobed aculeus.

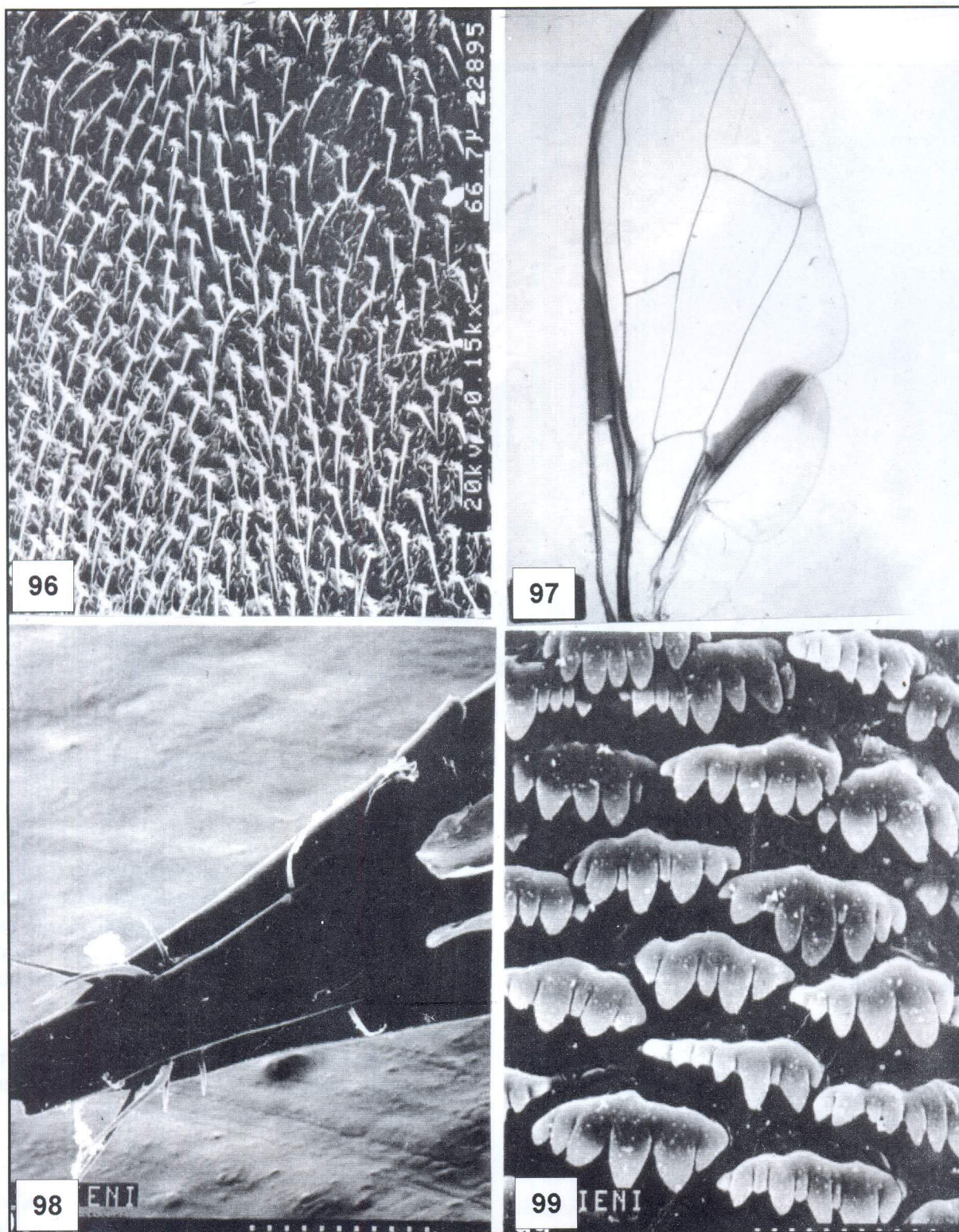
#### 30 - *Bactrocera (Zeugodacus) signata* (Hering) (Figs. 100-101)

*Zeugodacus bezzianus* form *signata* Hering, 1941:10. [Type Loc. India (Sikkim)].

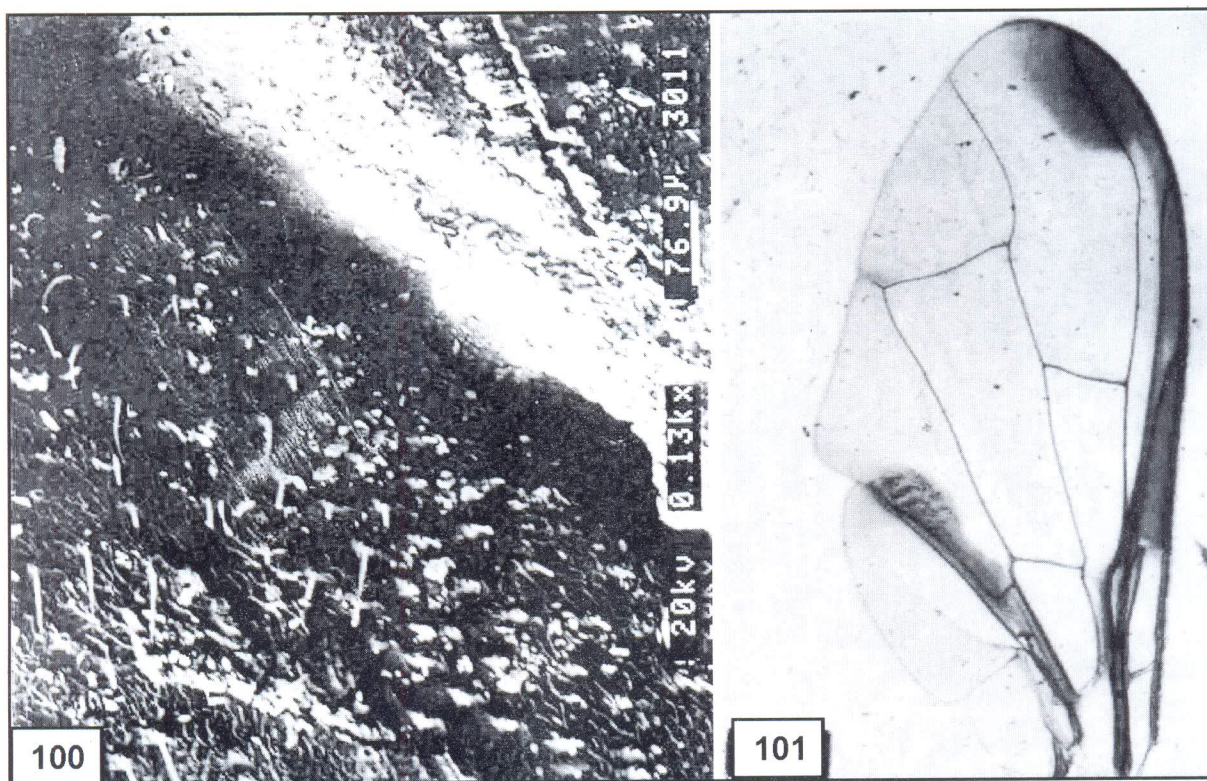
*Bactrocera (Zeugodacus) signata* (Hering), Mahmood, 1999b: 225.

#### Head

First flagellomere shorter than ptilinal fissure. Face with a black spot in each antennal furrow.



Figs. 96-99. *B. sicieni*. 96, tomentum pattern on prescutum. 97, wing. 98, aculeus apex. 99, scales on the distal end of eversible membrane of ovipositor.



Figs. 100-101. *B. signata*. 100, tomentum pattern on prescutum. 101, wing.

#### Thorax

Tomentum pattern with wide longitudinal gap in the middle of prescutum (Fig.100). Scutum colour (other than vittae) black. Lateral vitta of scutum present, yellow, ending in front of intra alar seta. Medial vitta of scutum present, yellow. Scutellum yellow with black apex. Setae; *a.sa.* present, *prsc.* present, *sc.* two pairs. Anepisternal stripe not extended forward.

#### Legs

Fore tibia black. Mid tibia yellow brown with base slightly darker than the rest. Hind tibia dark black. All femora yellow brown with black apices.

#### Wing

Wing (Fig.101) costal band width from vein Sc to beyond vein  $R_{4+5}$  at wing apex. Costal band expanded apically to form a spot. Costal band overlapping vein  $R_{2+3}$  in depth. Cell bc without microtrichae. Cell c with microtrichae in the anterior

apex only. Cell br with microtrichae at the base. Wing length: 7.0 – 7.6mm.

#### Abdomen

Abdominal tergites not fused (except I and II). Tergites markings: all tergites yellow brown, tergites I and II with lateral black margins, tergite II with basal transverse black band. Tergites III–V medial longitudinal black band, tergite III with a basal black transverse band, tergites IV and V with broad rectangular anterolateral black markings. Tergite I not wasp-waisted. Tergite III (males) with pecten. Sternite V (males) without V- shaped notch. Posterior surstylus lobe long. Males attracted to cue lure.

#### Material examined

**India:** Sikkim, 1 male and 1 female (Types) date unknown, **Bhutan:** Tashi, 3 males, 4.x.1991, Manchungang, 2 males, 4.x.1991, Rongtong, 3 males, 30.ix.1991, Songasa, 2 males, 13.ix.1991, Aunangyan, 1 male, 3.x. 1991.

*Comments*

This is different species from *B. tau* in having black mark on scutellum apex.

31 - *Bactrocera (Zeugodacus) zahadi* Mahmood  
(Figs. 102-105)

*Bactrocera (Zeugodacus) Zahadi* Mahmood,  
1999b:232. [Type Loc. India (Mudigere)].

*Head*

First flagellomere shorter than ptilinal fissure. Face with a black spot in each antennal furrow.

*Thorax*

Tomentum pattern with wide longitudinal gap in the middle of prescutum (Fig.102). Scutum colour (other than vittae) black generally with two medial longitudinal red brown bands on prescutum. Lateral vitta of scutum present, yellow, ending at intra alar seta. Medial vitta of scutum present, yellow. Scutellum yellow. Setae; *a.sa.* present, *pr.sc.* present, *sc.* two pairs. Anepisternal stripe not extended forward.

*Legs*

Fore tibia yellow brown with a longitudinal black band on outer surface. Mid tibia yellow brown with base slightly darker than the rest. Hind tibia dark black. All femora yellow brown with black spot on outer apices.

*Wing*

Wing (Fig.103) costal band width from vein Sc to below vein  $R_{4+5}$  at wing apex. Costal band expanded apically to form a spot at apex. Costal band overlapping vein  $R_{2+3}$  in depth. Cell bc without microtrichiae. Cell c with microtrichiae in the anterior apex only. Cell br with microtrichiae at the base. Wing length: 6.2 – 8.4mm.

*Abdomen*

Abdominal tergites not fused (except I and II). Tergites markings: all tergites yellow brown, tergite I and II each apical transverse yellow brown band lateral margins black. Tergites III – V medial longitudinal black band, tergite III with a basal black transverse band, tergites IV with broad rectangular

lateral black markings covering the entire lateral tergite, tergite V with broad lateral marking. Tergite I not wasp-waisted. Tergite III (males) with pecten. Sternite V (males) without V-shaped notch. Posterior surstylus lobe long. Aculeus length: 1.9 – 2.4mm. Aculeus apex needle shaped (Fig.104). The scales at the distal end of eversible membrane of ovipositor long, with 9 to 12 small and long tooth-like structure (Fig.105). Males attracted to cue lure.

*Material examined*

**Bhutan:** Aunangyan, 1 male, 3.x.1991, Tatapani, 5 males, 9-13.ix.1991, Santalay, 7 males, 4-7.ix.1991, Lamidara, 6 males, 4-7.ix.1991, 3 males, 4.xi.1990, Rongtong, 8 males, 30.ix.1991, Tashi, 3 males, 4.x.1991, 1 male and 1 female, 26.x.1991, Manchungang, 9 males, 4.x.1991, 1 male, 28.x.1991, Songasa, 5 males, 13.ix.1991, Buthoha, 1 male, 11.x.1991. **India:** Coimbatore, 1 female, 27.iii.1933, Karnataka, 1 female, 2-12.ix.1912, 1 female, 24.x-16.xi.1915, 1 male, 14.xi.1915, Mudigere, 51 males and 21 females, 22-22.v.1992, 1 female, 4.vii.1949, 1 male, vi. 1940. **Pakistan:** Rawalpindi, 30 males, 3.viii.1993, Murree, 4 males, 3.viii.1993, Haripur, 30 males, 9.viii.1993, Mansehra, 3 males, 8.viii.1993, Muzaffarabad, 19 males, 4.viii.1993. **Sri Lanka:** Peradeniya, 5 males and 4 females, i.1910, 6 males, 12-14.x.1992, 1 male, viii-xi.1921, Badullah, 2 females, 9.viii.1930, Kandy, 1 male, 24-28.x.1992.

*Comments*

Most records of *Bactrocera (Zeugodacus) tau* by White and Elson-Harris (1992) and Kapoor (1993) in the Indian Sub-continent were based on this species. The differences between this species and *B. tau* were discussed by Mahmood (1999b).

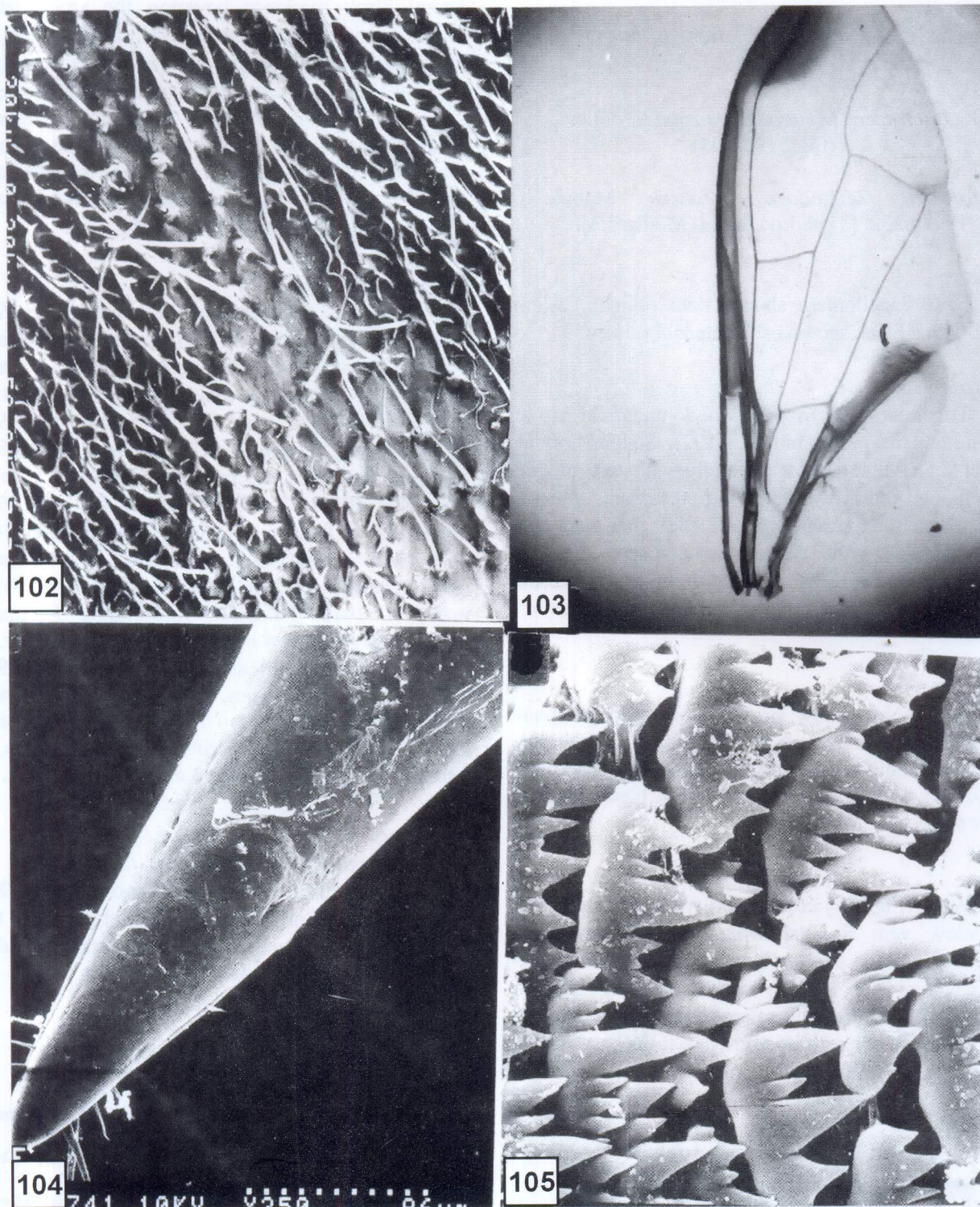
Genus *DACUS* Fabricius

*Dacus* Fabricius, 1805:272. [Type species *Dacus armatus* Fabricius, 1805, des. of Hendel, 1927:24].

*Tridacus* Bezzi, 1915:86 (as subgenus). [Type species *Dacus armatus* Fabricius, 1805, des. of Collart, 1935:9].

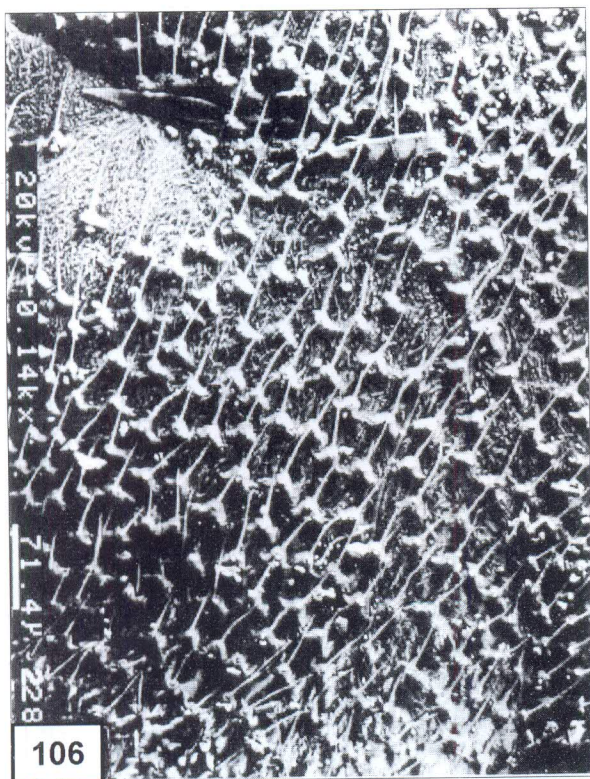
*Neodacus* Perkins 1937:58 [Type species *Neodacus newmani* Perkins, by orig. des.]

*Dacus* Fabricius: Hardy, 1977:47; Cogan and Munro, 1980:519; Drew, 1989:16; Hardy and Foote 1989:509; White and Elson-Harris, 1992:313; Kapoor 1993:82.



Figs. 102-105. *B. zahadi*. 102, tomentum pattern on prescutum. 103, wing. 104, aculeus apex. 105, scales on the distal end of eversible membrane of ovipositor.

32 - *Dacus (Callantra) crabroniformis* (Bezzi)  
(Figs. 106)



Figs. 106. *D. crabroniformis*, tomentum pattern on prescutum

*Monacrostichus crabroniformis* Bezzi, 1914:153. [Type loc., India (Yercaud)]

*Mellesis crabroniformis* (Bezzi), Bezzi, 1916:117.

*Callantra crabroniformis* (Bezzi), Perkins, 1937:58, Hardy, 1977:45.

*Dacus (Callantra) crabroniformis* (Bezzi), Kapoor, 1993:83.

**Head**

First flagellomere longer than ptilinal fissure. Face entirely black.

**Thorax**

Tomentum pattern without longitudinal gap in the middle of prescutum (Fig.106). Scutum colour (other than vittae) black. Postpronotal lobe yellow with dorsal portion black. Lateral vitta of scutum absent. Medial vitta of scutum absent. Katatergite black. Scutellum yellow. Setae; *a.sa.* absent, *prsc.* absent, *sc.* one pair. Anepisternal stripe not extended forward.

**Legs**

Fore and mid tibiae yellow brown. Hind tibia yellow brown with red brown mark on apex. Fore and mid femora red brown. Hind femur yellow brown with apical 1/3 red brown.

**Wing**

Wing costal band width from vein Sc to below vein  $R_{4+5}$  at wing apex. Costal band expanded apically. Costal band overlapping vein  $R_{2+3}$  in depth. Cell bc without microtrichae. Cell c with microtrichae. Cell br with microtrichae at the base. Wing length: 4.6mm.

**Abdomen**

Abdominal tergites fused. Tergites markings: all tergites black, tergite IV with two light brown spots. Tergite I wasp-waisted. Tergite III (males) with pecten. Sternite V (males) without V-shaped notch. Posterior surstylus lobe long. Males lure response unknown.

**Material examined**

**India:** Yercaud, 1 male, 21.iv-4.v.1913 (Holotype).

**Comments**

A distinct species with black face, costal band overlapping vein  $R_{2+3}$ , lacking, anterior supra alar seta and microtrichia in cell bc.

33 - *Dacus (Callantra) discophorus* (Hering)  
(Figs. 107-110)

*Callantra discophora* Hering, 1956:64. [Type loc., Sri Lanka (Teldeniya)].

*Callantra discophora* Hering, Hardy, 1977:45.

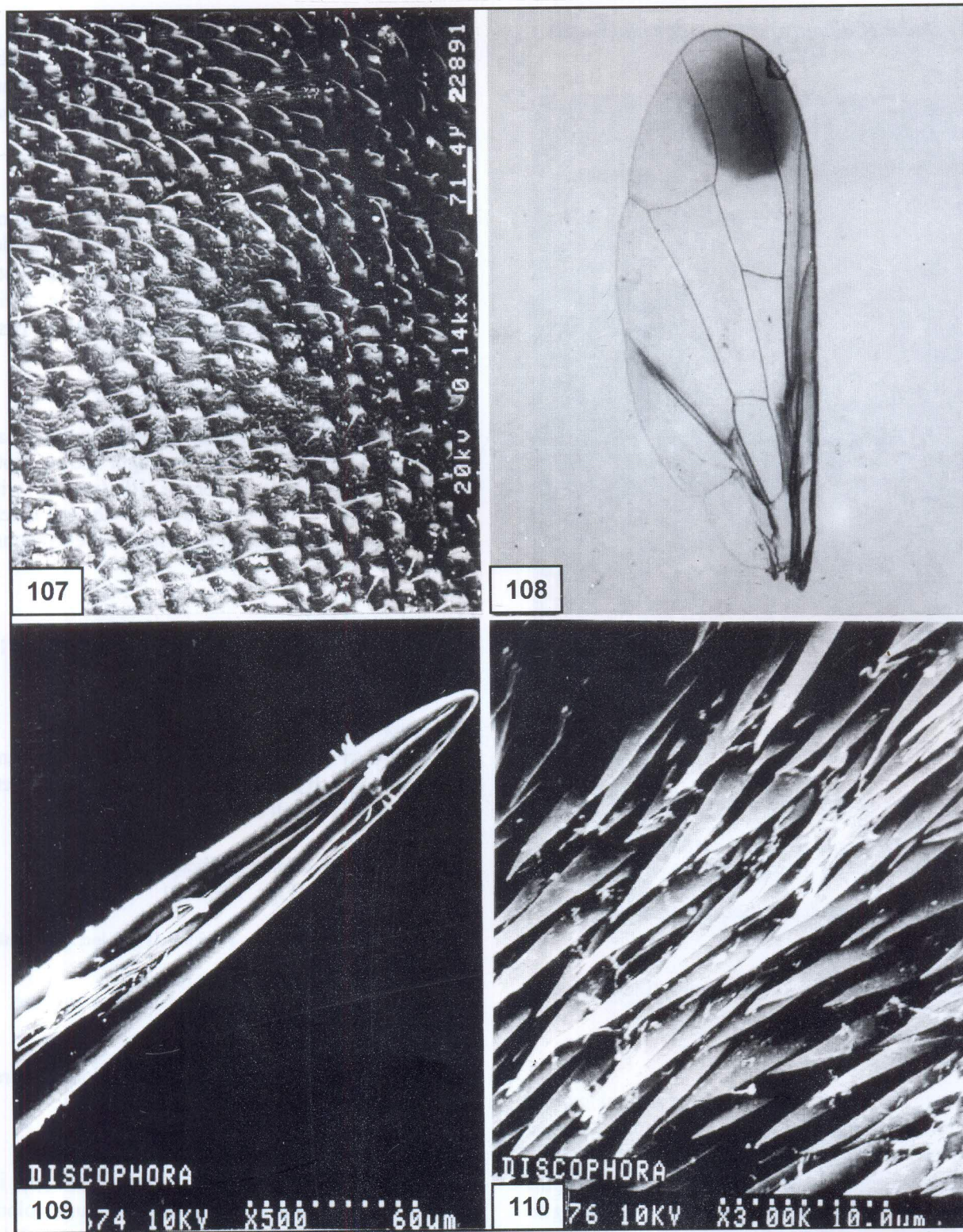
*Dacus (Callantra) discophora* (Hering) Drew et al, 1998:586.

**Head**

First flagellomere longer than ptilinal fissure. Face with a black spot in each antennal furrow.

**Thorax**

Tomentum pattern without longitudinal gap in the middle of prescutum (Fig.107). Scutum colour (other than vittae) red brown. Postpronotal lobe yellow brown. Lateral vitta of scutum absent. Medial vitta of scutum absent. Scutellum yellow. Setae; *a.sa.*



Figs. 107-110. *D. discophorus*. 107, tomentum pattern on prescutum. 108, wing. 109, aculeus apex. 110, scales on the distal end of eversible membrane of ovipositor.

present, *prsc.* absent, *sc.* one pair. Anepisternal stripe not extended forward.

#### Legs

All tibiae red brown. All femora red brown with yellow brown bases.

#### Wing

Wing (Fig.108) costal band width from wing base to below vein M at wing apex. Costal band expanded apically to form a spot at wing apex. Costal band overlapping vein  $R_{2+3}$  in depth. Cell bc without microtrichiae. Cell c with microtrichiae. Cell br with microtrichiae at the base. Wing length: 6.1 – 6.9mm.

#### Abdomen

Abdominal tergites fused. Tergites markings: all tergites red brown, with a medial longitudinal dark red brown narrow band, tergites I and II with yellow brown apical transverse bands. Tergite I wasp-waisted. Tergite III (males) with pecten. Sternite V (males) without V-shaped notch. Aculeus length: 2.55mm. Aculeus apex needle shaped (Fig.109). The scales at the distal end of eversible membrane of ovipositor long, needle – like structure (Fig.110). Posterior surstylus lobe long. Males lure response unknown.

#### Material examined

**India:** Bombay, 1 female, 1888, Kallar, 3 males, 6.v.1925.

#### Comments

Kapoor (1993) mentioned this species as a synonym of *D. sphaeroidalis*. However, this species differ from *D. sphaeroidalis* in having anterior supra alar seta and lacking microtrichia in the cell bc.

#### 34 - *Dacus (Callantra) icariiformis* (Enderlein)

*Callantra icariiformis* Enderlein, 1920:358, Hardy, 1977:45. [Type loc., India (Sikkim)]

*Dacus (Callantra) icariiformis* Enderlein, Kapoor, 1993:83.

#### Head

First flagellomere longer than ptilinal fissure. Face with a black spot in each antennal furrow.

#### Thorax

Tomentum pattern not clear. Scutum colour (other than vittae) dark brown. Postpronotal lobe yellow brown. Lateral vitta of scutum present yellow, ending in front of intra-alar seta. Medial vitta of scutum present, yellow. Anatergite brown. Scutellum yellow. Setae; *a.sa.* present, *prsc.* absent, *sc.* one pair. Anepisternal stripe not extended forward.

#### Legs

All tibiae and femora dark red brown, mid and hind femora with yellow brown bases.

#### Wing

Wing costal band width from wing base to below vein  $R_{4+5}$  at wing apex. Costal band overlapping vein  $R_{2+3}$  in depth. Cell bc with microtrichiae. Cell c with microtrichiae. Cell br with microtrichiae at the base. Wing length: 7.7mm.

#### Abdomen

Abdominal tergites fused. Tergites markings: all tergites red brown, tergite II with basal and apical yellow brown transverse bands, tergites III-V with a black brown medial longitudinal band, tergites IV and V with apical yellow brown spots around the medial band. Tergite I wasp-waisted. Tergite III (males) with pecten. Sternite V (males) without V-shaped notch. Posterior surstylus lobe long. Males lure response unknown.

#### Material examined

**India:** Sikkim, 1 female, date unknown.

#### Comments

A distinctive species with lateral and medial vittae and microtrichia in cell bc.

#### 35 - *Dacus (Callantra) longicornis* Wiedemann (Figs. 111-114)

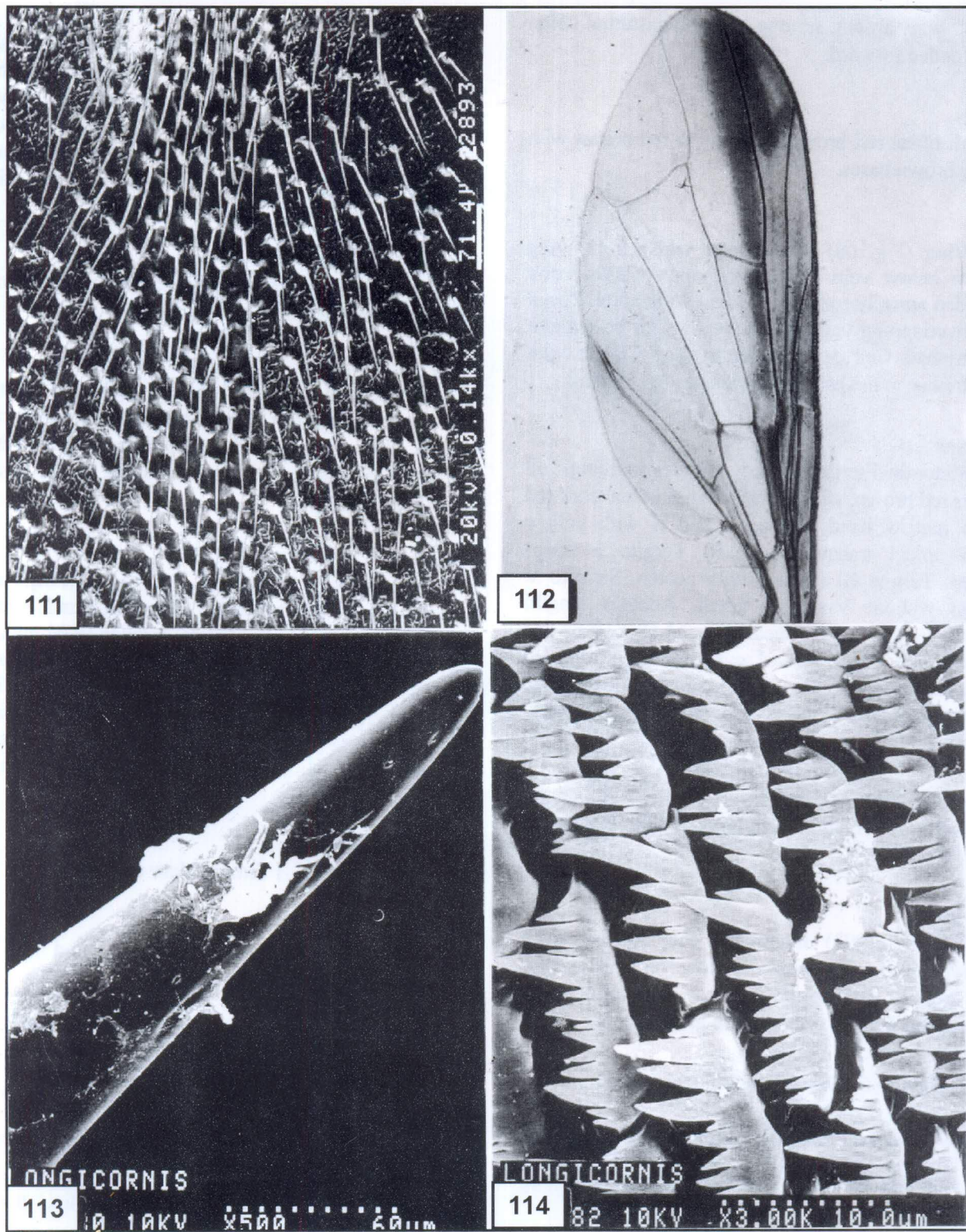
*Dacus longicornis* Wiedemann, 1830:524. [Type loc., Java (Moluccas)].

*Bactrocera vespoides* Doleschall, 1858:123. [Type loc., Java (Moluccas)].

*Callantra smieroides* Walker, 1860:154. [Type loc., Sulawesi].

*Mellessis destillatoria* Bezzi, 1916:118. [Type loc., Burma (Bhamo)].

*Mellessis eumenoides* Bezzi, 1916:119. [Type loc., Upper Burma (Takton)].



Figs. 111-114. *D. longicornis*. 111, tomentum pattern on prescutum. 112, wing. 113, aculeus apex. 114, scales on the distal end of eversible membrane of ovipositor.

*Mellessis bioculata* Bezzi, 1919:437. [Type loc., Philippines (Mount Makiling)].

*Callantra unifasciatus* Hardy, 1982:184. [Type loc., Sulawesi].

*Callantra variegata* Wang, 1990:73. [Type loc., China (Yunnan)].

*Dacus (Callantra) eumenoides* (Bezzi), Kapoor, 1993:83.

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

### Head

First flagellomere longer than ptilinal fissure. Face with a black spot in each antennal furrow.

### Thorax

Tomentum pattern with wide longitudinal gap in the middle of prescutum (Fig.111). Scutum colour (other than vittae) red brown. Postpronotal lobe yellow brown. Notopleuron yellow brown. Lateral vitta of scutum absent. Medial vitta of scutum absent. Anatergite red brown. Scutellum yellow brown. Setae; *a.sa.* present, *prsc.* absent, *sc.* one pair. Anepisternal stripe not extended forward.

### Legs

All tibiae red brown. All femora red brown with yellow brown bases.

### Wing

Wing (Fig.112) costal band width from wing base to below vein  $R_{4+5}$  at wing apex. Costal band overlapping vein  $R_{2+3}$  in depth. Cell bc with microtrichae. Cell c with microtrichae. Cell br with microtrichae at the base. Wing length: 8.4 – 9.2mm.

### Abdomen

Abdominal tergites fused. Tergites markings: all tergites red brown, with light brown apical transverse bands on each tergite. Tergite I wasp-waisted. Tergite III (males) with pecten. Sternite V (males) without V-shaped notch. Aculeus length: 3.47mm. Aculeus apex needle shaped (Fig.113). The scales at the distal end of eversible membrane of ovipositor long, with 7 to 13 long and small tooth – like structure (Fig.114). Males attracted to cue lure.

### Material examined

**Bhutan:** Tatapani, 1 male, 9-13.ix.1990, 1 male, 14.ix.1990. **Sri Lanka:** Kandaf, 1 male, 30.vi.1992.

### Comments

This species can be identified by the presence of black facial spots, anterior supra alar seta and microtrichia in the cell bc.

### 36 - *Dacus (Callantra) polistiformis* (Senior-White) (Figs. 115)

*Mellessis polistiformis* Senior-white, 1922:156. [Type loc., India (Sukna E.Himalaya)]

*Callantra munroi* Zaka-ur-Rab, 1961:358. [Type loc., India (Aligarh)]

*Callantra nepalensis* Hardy, 1964:149. [Type loc., Nepal (River Arun)]

*Callantra quadristriata* Munro, 1984: 155. [Type loc., India (Bihar)]

*Dacus (Callantra) polistiformis* (Senior-White), White *et al.*, 1998: 620.

### Head

First flagellomere longer than ptilinal fissure. Face with a light black transverse line.

### Thorax

Tomentum pattern without longitudinal gap in the middle of prescutum (Fig.115). Scutum colour (other than vittae) red brown. Postpronotal lobe yellow with dorsal portion black. Lateral vitta of scutum absent. Medial vitta of scutum absent. Katatergite yellow. Anatergite dark brown. Scutellum yellow. Setae; *a.sa.* absent, *prsc.* absent, *sc.* one pair. Anepisternal stripe not extended forward.

### Legs

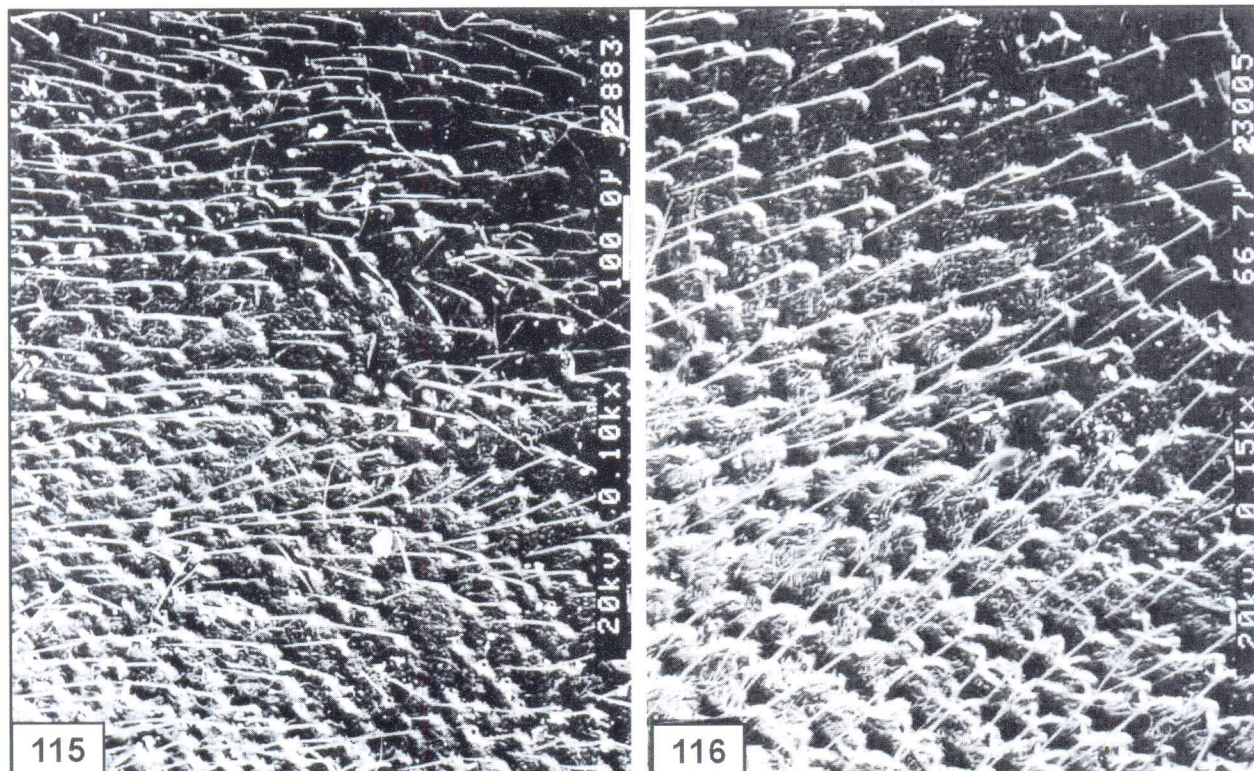
All tibiae and femora red brown, mid and hind femora with basal  $\frac{1}{4}$  yellow brown.

### Wing

Wing costal band width from wing base to below vein  $R_{4+5}$  at wing apex. Costal band darkened apically. Costal band overlapping vein  $R_{4+5}$  in depth. Cell bc with microtrichae. Cell c with microtrichae. Cell br with microtrichae at the base. Wing length: 8.3 – 8.5mm.

### Abdomen

Abdominal tergites fused. Tergites markings: tergites I, II and III red brown with apical part of tergite I and II yellow brown, tergites IV and V



Figs. 115-116. *D. polistiformis*., tomentum pattern on prescutum. 116, *D. sphaeroidalis*, Tomentum pattern on prescutum.

yellow brown with red brown lateral margins. Tergite I wasp-waisted. Tergite III (males) with pecten. Sternite V (males) without V-shaped notch. Posterior surstylus lobe long. Males lure response unknown.

#### Material examined

**India:** Jermyn, 1 male, date Unknown. **Sri Lanka:** Sukna, 1 male, 14.xii.1919.

#### Comments

This species can be identified by the presence of black transverse line above mouth opening, microtrichia in cell bc and absence anterior supra alar seta.

#### 37 - *Dacus (Callantra) sphaeroidalis* (Bezzi) (Figs. 116)

*Mellessis sphaeroidalis* Bezzi. 1916:115. [Type loc., India (Uttar Pradesh)]

*Callantra sphaeroidalis* (Bezzi), Hardy, 1977:46.

*Dacus (Callantra) sphaeroidalis* (Bezzi), White and Elson-Harris, 1992:338; Kapoor, 1993:83.

#### Head

First flagellomere longer than ptilinal fissure. Face with a long black longitudinal line in each antennal furrow.

#### Thorax

Tomentum pattern without longitudinal gap in the middle of prescutum (Fig.118). Scutum colour (other than vittae) red brown. Lateral vitta of scutum absent. Medial vitta of scutum absent. Scutellum yellow. Setae; *a.sa.* absent, *prsc.* absent, *sc.* one pair. Anepisternal stripe not extended forward.

#### Legs

All tibiae, fore and mid femora red brown. Hind femur light brown with apical 1/3 red brown.

*Wing*

Wing costal band width from wing base to below vein M at wing apex. Costal band expanded apically to form a large spot. Costal band not overlapping vein  $R_{2+3}$  in depth. Cell bc with microtrichae. Cell c with microtrichae. Cell br with microtrichae at the base. Wing length: 8.4mm.

*Abdomen*

Abdominal tergites fused. Tergites markings: tergites I and II red brown with yellow brown apical transverse bands, tergite III red brown with a basal transverse black band, tergite IV light red brown, tergite V yellow brown, with a dark red brown "T" shaped mark. Tergite I wasp-waisted. Tergite III (males) with pecten. Sternite V (males) without V-shaped notch. Posterior surstylus lobe long. Males attracted to cue lure.

*Material examined*

**India:** Dehra Dun, 1 male, 16.vii.1912.

*Comments*

This species can be identified by the face with black spot, scutum without anterior supra alar seta, wing costal band not overlapping vein  $R_{2+3}$ , costal band expanded apically to form a big spot on wing apex.

**38 - *Dacus (Dacus) keiseri***  
(Hering) new combination.

*Daculus keiseri* Hering, 1956:66. [Type Loc., Sri Lanka (Hingurahgoda)]

*Dacus (Polistomimetes) keiseri* (Hering), Hardy, 1977:56.  
*Bactrocera keiseri* (Hering), White and Wang, 1992:278.

*Head*

First flagellomere shorter than ptilinal fissure. Face with a black spot in each antennal furrow.

*Thorax*

Tomentum pattern not clear. Scutum colour (other than vittae) brown black. Lateral vitta of scutum absent. Medial vitta of scutum absent. Scutellum yellow. Setae; *a.sa.* present, *pr.sc.* absent, *sc.* one pair. Anepisternal stripe extended forward to join postpronotal lob.

*Legs*

All tibiae and femora yellow brown.

*Wing*

Wing costal band within cell sc and a black spot at the apex of vein  $R_{4+5}$ . Costal band not overlapping vein  $R_{2+3}$  in depth. Cell bc without microtrichae. Cell c with microtrichae in the anterior apex only. Cell br with microtrichae at the base. Wing length: 3.5 – 3.8mm.

*Abdomen*

Abdominal tergites fused. Tergites markings: tergites I and II black brown with apical transverse red brown band, tergite III-V with a medial longitudinal black band, tergite III entirely black brown, tergites IV and V red brown with broad black lateral, covering the entire lateral tergites. Tergite I not wasp-waisted. Tergite III (males) with pecten. Sternite V (males) without V-shaped notch. Males lure response unknown.

*Material examined*

**Sri Lanka:** Put. Kala Oya, 1 male, 1.viii.1975 (NMNH), Ham. Palatupana, 1 male, 3-6.ii.1975 (NMNH).

*Comments*

This species can be identified by its scutum with anepisternal stripe extended forward to join postpronotal lob, wing with costal band within cell sc only and a spot on wing apex.

**39 - *Dacus (Didacus) ciliatus* Loew**  
(Figs. 117-120)

*Dacus ciliatus* Loew, 1862:13 [Type Loc., South Africa (Guinea and Cape)]

*Dacus sigmoides* Coquillett, 1902:29 [Type Loc., Mauritius]

*Dacus brevistylus* Bezzi, 1908:149 [Type Loc., Ethiopia (Eritrea)]

*Dacus appoxanthus* var. *decolor* Bezzi, 1924:467. [Type Loc., South Africa]

*Dacus insistens* Curran, 1927:85 [Type Loc., Angola (Zaire)]

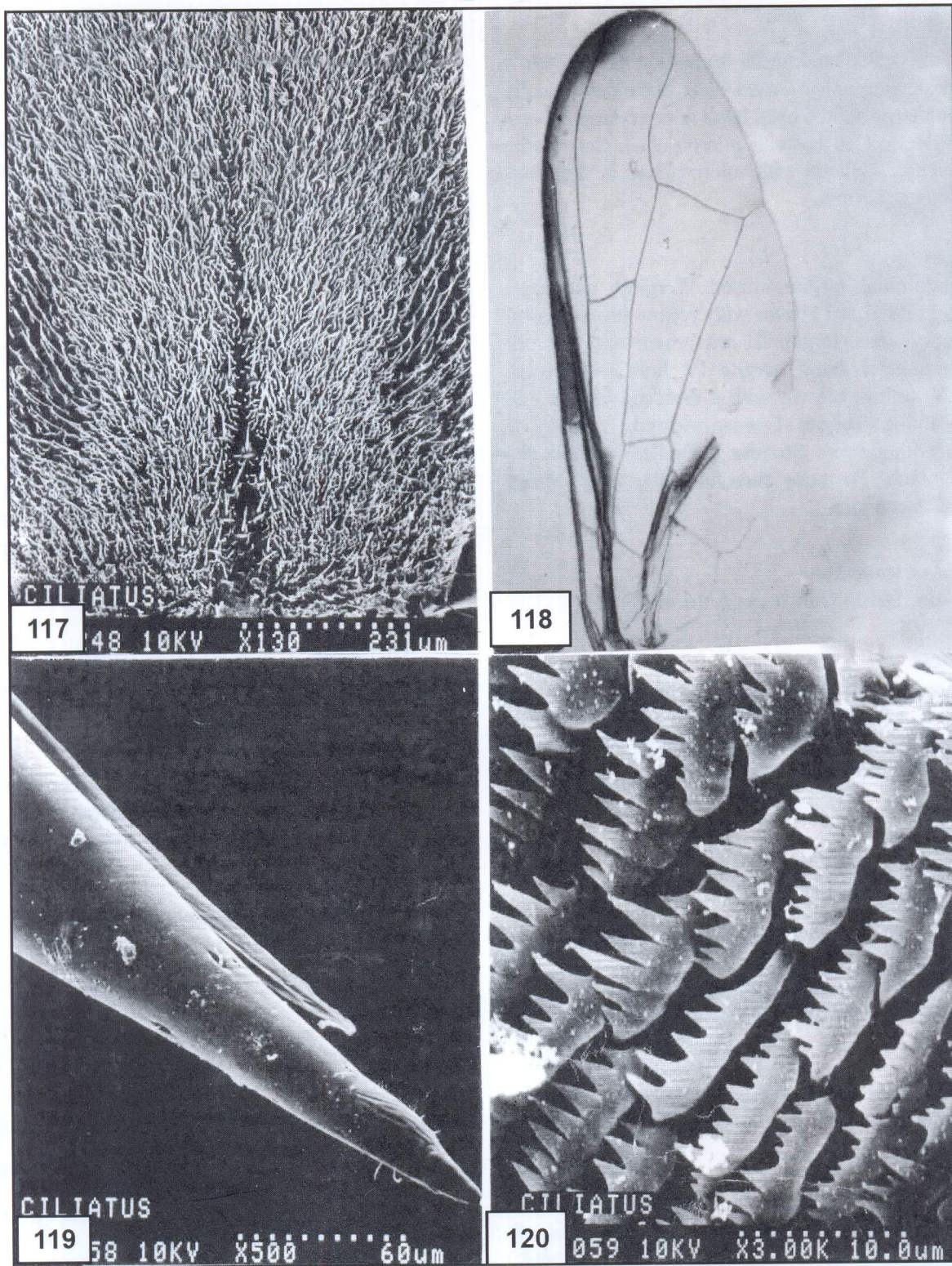
*Didacus ciliatus* Loew: Cogan and Munro, 1980:521.

*Dacus (Bactrocera) coccinae* Premalata and Atwar Singh, 1988:401. [Type Loc., India (Chandigarh)]

*Dacus (Didacus) ciliatus* Loew, Hardy, 1977:53, White and Elson-Harris, 1992:329; Kapoor, 1993:83.

*Head*

First flagellomere shorter than ptilinal fissure. Face with a black spot in each antennal furrow.



Figs. 117-120. *D. ciliatus*. 117, tomentum pattern on prescutum. 118, wing. 119, aculeus apex. 120, scales on the distal end of eversible membrane of ovipositor.

*Thorax*

Tomentum pattern with narrow longitudinal gap in the middle of prescutum (Fig.117). Scutum colour (other than vittae) red brown. Lateral vitta of scutum absent. Medial vitta of scutum absent. Anatergite red brown. Scutellum yellow. Setae; *a.sa.* absent, *prsc.* absent, *sc.* one pair. Anepisternal stripe not extended forward.

*Legs*

All tibiae and femora yellow brown.

*Wing*

Wing (Fig.118) costal band width from vein Sc to below vein  $R_{4+5}$  at wing apex. Costal band expanded apically. Costal band not overlapping vein  $R_{2+3}$  in depth. Cell bc without microtrichae. Cell c with microtrichae in the anterior apex only. Cell br with microtrichae at the base. Wing length: 4.5 – 6.0mm.

*Abdomen*

Abdominal tergites fused. Tergites markings: all tergites red brown, tergite II with apical transverse white band. Tergite III, sometimes with dorsolateral black spots on each side. Tergite I not wasp-waisted. Tergite III (males) with pecten. Sternite V (males) without V-shaped notch. Posterior surstylus lobe long. Aculeus length: 1.4mm. Aculeus apex needle shaped (Fig.119). The scales at the distal end of eversible membrane of ovipositor long, with 5 to 7 tooth – like structure (Fig.120). Males lure response unknown.

*Material examined*

**India:** Coimbatore, 1 female, 1.vi.1931, 1 female, 31.x.1935, 2 females, 27.viii.1935, 1 male, 25.v.1931, Bareilly, 3 males, v.1950, **Pakistan:** Rawalpindi, 3 males and 1 female, 27.ix.1961, Quetta, 1 male and 1 female, 2.viii.1931.

*Comments*

A distinctive species without lateral and medial vittae on scutum and anterior supra alar and prescutellar acrostichal setae absent; anepisternal stripe not extended forward.

40 - *Dacus (Leptoxyda) persicus* (Hendel)  
(Figs. 121-124)

*Leptoxyda* sp. Near *Longistyla*, Bezzi, 1913: 92 (Pakistan, Karachi)

*Dacus Longistylus*, authors, not Wiedemann, 1930, (Asian records misidentifications).

*Leptoxyda persicus* Hendel, 1927: 29. [Type Loc. Iran (Baluchistan)]

*Dacus (Leptoxyda) persicus* (Hendel): Hardy, 1977:29; White and Elson-Harris, 1992:313.

*Head*

First flagellomere shorter than ptilinal fissure. Face with a black spot in each antennal furrow.

*Thorax*

Tomentum pattern without longitudinal gap in the middle of prescutum (Fig.121). Scutum colour (other than vittae) black brown. Lateral vitta of scutum present, yellow, ending in front of intra alar seta. Medial vitta of scutum present (at least traces), yellow. Scutellum yellow. Setae; *a.sa.* absent, *prsc.* absent, *sc.* one pair. Anepisternal stripe slightly extended forward, ending before anterior notopleural seta.

*Legs*

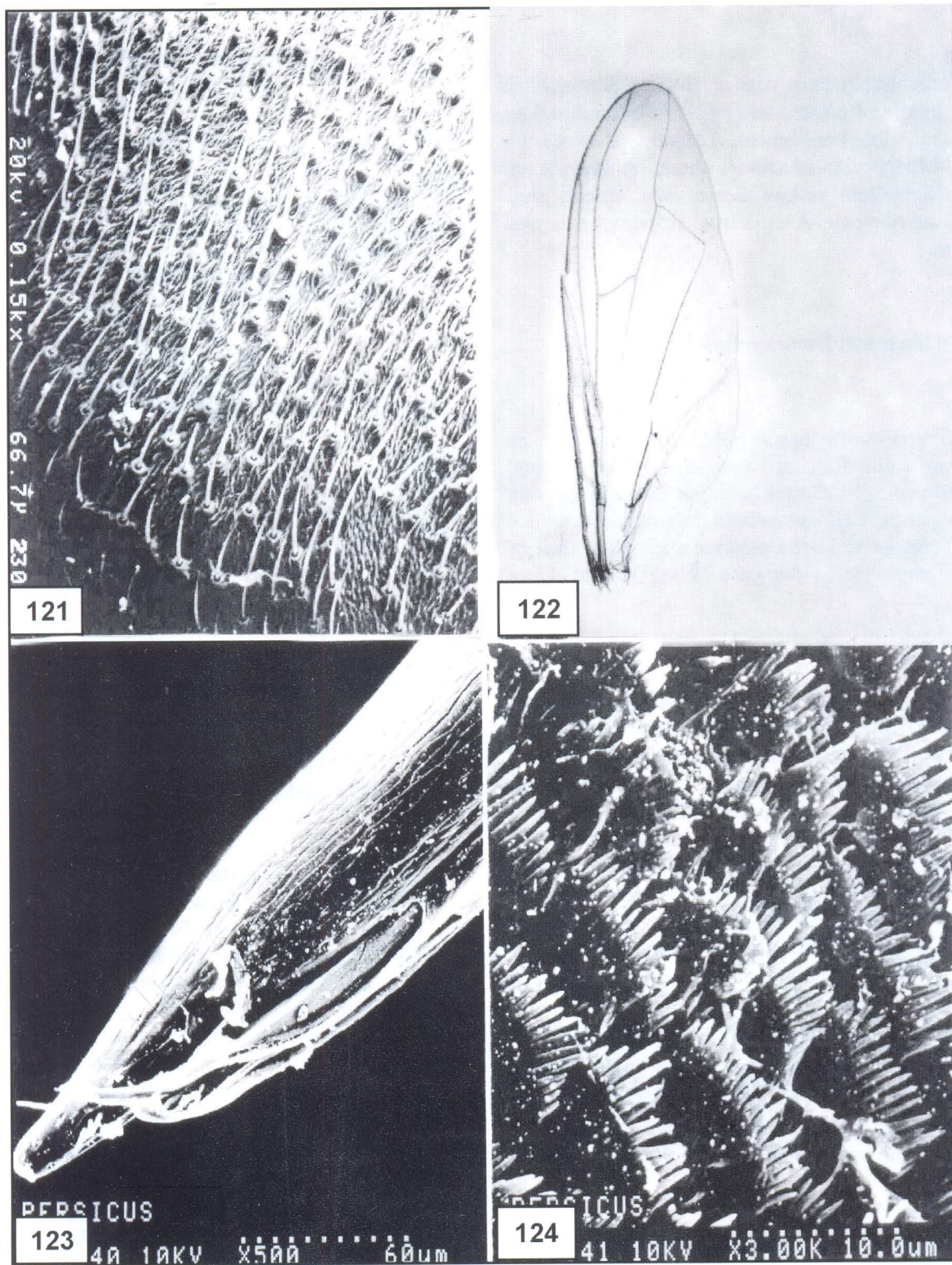
All tibiae and femora yellow brown.

*Wing*

Wing (Fig.122) costal band width from vein Sc to below vein  $R_{4+5}$  at wing apex. Costal band overlapping vein  $R_{2+3}$  in depth. Cell bc without microtrichae. Cell c with microtrichae in the anterior apex only. Cell br with microtrichae at the base. Wing length: 6.1mm.

*Abdomen*

Abdominal tergites fused. Tergites markings: all tergites red brown to dark red brown, sometimes with a medial longitudinal black band (often on tergite V). Tergite I not wasp-waisted. Tergite III (males) without pecten. Sternite V (males) without V- shaped notch. Posterior surstylus lobe short. Aculeus length: 3.75mm. Aculeus apex tubular shaped (Fig.123). The scales at the distal end of eversible membrane of ovipositor broad, with 9 to 12 long narrow tooth – like structure (Fig.124). Males lure response unknown.



Figs. 121-124. *D. persicus*. 121, tomentum pattern on prescutum. 122, wing. 123, aculeus apex. 124,, scales on the distal end of eversible membrane of ovipositor.

*Material examined*

**Iran:** Baluchistan, 1 male and 1 female (Type), 25.ii.1901. **India:** Deesa, 3 males and 6 females, iii-vii.1901, Hyderabad, 1 male, 5.vi.1971, Bombay, 2 males, 1888. **Pakistan:** Faisalabad, 1 female, 4.vii.1934. **Sri Lanka:** Trincomali, 4 males, 8.vii.1890, 1 male and 1 female, 1.x.1890, 1 male, 11.xi.1891, 1 male and 1 female, 14.vii.1907, Uggalkaltota, 1 male, 31.i.-8.ii.1970 (NMNH), Ambalantota, 3 males and 3 females, 28.x.1970 (NMNH), Mayiyangan, 1 male and 1 female, 23.xi.1972 (NMNH), Palatupana, 1 male and 1 female, 8-10.iii.1972 (NMNH), Mannar, 5 males and 1 female, 4-5.ix.1976 (NMNH).

*Comments*

This species can be identified by the scutum with lateral and medial vittae, wing with costal band overlapping vein  $R_{2+3}$ .

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## REFERENCES

- BEZZI, M., 1908. Dittere eritrei raccolti dal Dott. Andreini e dal Prof. Tellini. Parte seconda. Diptera cyclorrhapha. *Boll. Soc. ital. Ent.*, **39**(1907): 3-199.
- BEZZI, M., 1913. Indian Trypanoids (fruit flies) in the collection of the Indian Museum, Calcutta. *Mem. Indian Mus.*, **3**: 53-175.
- BEZZI, M., 1914. Two new species of fruit flies from Southern India. *Bull. ent. Res.*, **5**: 153-154.
- BEZZI, M., 1915. On the Ethiopian fruit flies of the genus *Dacus*. *Bull. ent. Res.*, **6**: 85-101.
- BEZZI, M., 1916. On the fruit flies of the genus *Dacus* (s.l.) occurring in India, Burma and Ceylon. *Bull. ent. Res.*, **7**: 99-121.
- BEZZI, M., 1919. Fruit flies of the genus *Dacus sensu-latiore* (Diptera) from the Philippine Islands. *Philip. J. Sci.*, **15**: 411-443.
- BEZZI, M., 1924. South African trypanoid Diptera in the collection of the South Africa Museum. *Ann. S. Afr. Mus.*, **19**: 449-577.
- BIGOT, J. M. F., 1891. New species of Indian Diptera. *Indian Mus. Notes*, **1**: 191-192.
- CHAO, Y. S. AND LIN, X., 1993. Three new species of *Dacus* (Diptera: Tephritidae) from China. *Entomotaxonomia*, **15**: 137-143.
- CHEN, H. S., 1940. Two new Dacinae from Szechwan. *Sinensia*, **11**: 131-135.
- COGAN, B. H. AND MUNRO, H. K., 1980. 40-Family Tephritidae, In: *Catalogue of the Diptera of the Afrotropical Region* (ed. R.W. Crosskey), pp.518-554. British Museum Natural History. London.
- COQUILLET, D. W., 1899. A new trypetid from Hawaii. *Ent. News*, **10**: 129-130.
- COQUILLET, D. W., 1902. New Diptera from southern Africa. *Proc. U.S. natn. Mus.*, **24**: 27-32.
- COQUILLET, D. W., 1904. New Diptera from India and Australia. *Proc. ent. Soc. Wash.*, **3**: 137-140.
- COTES, E. C., 1893. Miscellaneous notes. *Indian Mus. Notes*, **3**: 1-62.
- CURRAN, C. H., 1927. Diptera of the American Museum Congo Expedition. Part I. Bibionidae, Bombyliidae, Dolichopodidae, Syrphidae, Trypanidae. *Bull. Am. Mus. nat. Hist.*, **57**: 33-89.
- DOLESCHALL, C. L., 1856. Erste bijdrag tot de kennis der dipterologische fauna van Nederlandsch Indie. *Natuurk. Tijdschr. Ned.-Indie*, **10** (Ser. 7): 403-414.
- DOLESCHALL, C. L., 1858. Derde bijdrage tot de kennis der dipteren fauna van Nederlandsch Indie. *Natuurk. Tijdschr. Ned. Indie*, **17** (Ser. 3e,4): 73-128.
- DREW, R.A.I., 1989. The tropical fruit flies (Diptera: Tephritidae: Dacinae) of the Australasian and Oceanian regions. *Mem. Qd. Mus.*, **26**: 1-521.
- DREW, R. A. I. AND HANCOCK, D., 1994. The *Bactrocera dorsalis* complex of fruit flies (Diptera: Tephritidae: Dacinae) in Asia. *Bull. ent. Res. Suppl.*, **1** no.2.
- DREW, R. A. I., HANCOCK, D.L. AND WHITE, I.M., 1998. Revision of the tropical fruit flies (Diptera: Tephritidae: Dacinae) of South-east Asia. II. *Dacus* Fabricius. *Inverteb. Tax.*, **12**: 567-654.
- ENDERLEIN, G., 1920. Zur Kenntnis tropischer Frucht-Bohrfliegen. *Zool. Jb.*, **43**: 336-360.
- FABRICIUS, J. C., 1794. Entomologia Systematica emendata et aucta. *Hafniae*, **4**: 472.
- FABRICIUS, J.C., 1805. *Systema antiatorum secundum ordines, genera, species adiectis synonymis, locis observationibus descriptionibus*. Brunsvigae, Brunswick, 373pp.
- GMELIN, J. F., 1790. Caroli a Linne, systema naturae secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis. *Editio decima tertia, aucta, reformata*, **I**: 2225-3020.
- HARDY, D. E., 1954. The *Dacus* subgenera *Neodacus* and *Gymnodacus* of the world. *Proc. ent. Soc. Wash.*, **56**: 5-23.
- HARDY, D. E., 1955. The *Dacus* (*Afrodacus*) Bezzi of the world (Tephritidae, Diptera). *J. Kans. ent. Soc.*, **28**: 3-15.
- HARDY, D. E., 1964. Diptera from Nepal, the fruit flies

- (Tephritidae). *Bull. Br. Mus. nat. Hist. (Ent.)*, **15**: 147-169.
- HARDY, D.E., 1971. Diptera: Tephritidae from Ceylon. *Ent. Scand. Suppl.*, pp.1-6.
- HARDY, D. E., 1973. The fruit flies (Tephritidae- Diptera) of Thailand and bordering countries. *Pacif. Insects Monogr.*, **31**: 1-353, 8pls.
- HARDY, D. E., 1977. Family Tephritidae. In: *A catalog of the Diptera of the Oriental Region* (eds. M.D. Hardy and D.E. Hardy), vol. 3, pp. 44-134. University press of Hawaii, Honolulu.
- HARDY, D.E., 1982. The Dacini of Sulawesi (Diptera:Tephritidae). *Treubia*, **28**:173-241.
- HARDY, D. E. AND ADACHI, M. S., 1954. Studies in the fruit flies of the Philippine Island, Indonesia and Malaya. Part I. Dacini (Tephritidae-Diptera). *Pacif. Sci.*, **8**: 147-204.
- HARDY, D. E. AND FOOTE, R. H., 1989. Family Tephritidae, In: *Catalog of the Diptera of the Australasian and Oceanian Regions* (ed. N.L. Evenhuis), pp. 502-531. Bishop Mus. Press and E.J. Brill.
- HENDEL, F., 1912. H. Sauter's Formosa-Ausbeute. Trypetidae. *Suppl. Ent.*, **1**: 13-24.
- HENDEL, F., 1915. H. Sauter's Formosa-Ausbeute. Tephritinae. *Anns. Mus. natl. Hungar.*, **13**:424-467.
- HENDEL, F., 1927. Trypetidae. [Fam.] 49. In: *Die Fliegen der palaearktischen Region* (ed. E. Lindner), vol. 5, pp. 1-221. Stuttgart.
- HERING, E. M., 1941. Dipteren von den Kleinen Sunda-Inseln. *Arb. Morph. Taxon. Ent. Berlin*, **8**: 24-45.
- HERING, E. M., 1956. Trypetide (Dipt.) von Ceylon. *Verh. naturf. Ges. Basel*, **67**: 62-74.
- KAFI, A., 1986. *Progress and problems in controlling fruit flies infestation*. Paper presented at FAO expert consultation on progress and problems in controlling fruit fly infestation, RAPA, Bangkok, 16-19 December 1986.
- KAPOOR, V. C., 1971. Four new species of fruit flies (Tephritidae) from India. *Orient. Insects*, **5**:477-482.
- KAPOOR, V. C., 1993. *Indian fruit flies (Insecta: Diptera: Tephritidae)*. International science Publisher, New York. pp.1-228.
- KAPOOR, V. C., HARDY, D. E., AGARWAL, M. L. AND GREWAL, J. S., 1980. *Fruit fly (Diptera:Tephritidae) systematics of the Indian subcontinent*. Export Publisher Jullundur, India.
- LIQUIDO, N. J. AND CUNNINGHAM, R. T., 1991. Ecological consideration in eradicating exotic fruit fly introductions. In: *Proceedings First International Symposium on Fruit flies in the Tropics* (eds. S. Vijaysegaran and A.G. Ibrahim), pp. 235-241. Kuala Lumpur, 1988. Malaysian Agricultural Research and Development Institute, Kuala Lumpur.
- LOEW, H., 1862. Bidrag till kannedomen om Afrikas Diptera. *Ofvers. K. Vetensk. Akad. Forh. Stochk.*, **19**: 3-14.
- MACQUART, J., 1835. Histoire Naturelle des Insects. Dipteres. Tome Deuxieme. In: *Novvelles suites a Buffon, formant avec les oeuvres de cet auteur, un cours complet d'histoire naturelle*. 703pp.
- MAHMOOD, K., 1999a. Intraspecific variation in two pest species of the Oriental fruit fly *Bactrocera dorsalis* (Hendel) (Tephritidae:Diptera) complex. *Pakistan J. Zool.*, **31**: 315-321.
- MAHMOOD, K., 1999b. Taxonomy of *Bactrocera* (*Zeugodacus*) *tau* (Tephritidae: Diptera) complex in Asia. *Pakistan J. Zool.*, **31**: 219-235.
- MAHMOOD, K. A new species of fruit fly of genus *Bactrocera* (Dacinae: Tephritidae: Diptera) from Pakistan. *Pakistan J. Zool.* (submitted).
- McALPINE, J. F., 1981. Morphology and terminology – adults. In: *Manual of Nearctic Diptera –I* (eds. J.F. Mc Alpine, B.V. Peterson, G.E. Shewell, H.J. Teskey, J.R. Vockeroth, and D.M. Wood), vol. 27, pp. 9-63. Monograph of the biosystematics Research Institute, Ottawa.
- MATSUMURA, S., 1916. *Thousand insects of Japan*. Additamenta II. Keisei-sha, Tokyo. pp.185-474.
- MUNRO, H. K., 1935. Records of Indian Trypetidae with the description of some apparently new species. *Rec. Indian Mus.*, **37**: 15-27.
- MUNRO, H. K., 1939. The fruit fly, *Dacus ferrugineus* Fabr., and its variety *dorsalis* Hendel in North West India. *Indian J. Ent.*, **1**: 101-105.
- MUNRO, H. K., 1984. A taxonomic treatise on the Dacidae (Tephritidae, Diptera) of Africa. *Ent. Mem. Dept. Agric. Tech. Serv. Repub. S. Afr.*, **61**:1-313.
- PERKINS, F. A., 1937. Studies in Australian and Oriental Trypanidae. Part 1. New genera of Dacinae. *Proc. R. Soc. Qd.*, **48**:51-60.
- PERKINS, F. A., 1938. Studies in Oriental and Australian Trypanidae. Part 2. Adraminae and Dacinae from India, Ceylon, Malaya, Eumatra, Java, Borneo, Philippine Island and Formosa. *Proc. R. Soc. Qd.*, **49**:120-144.
- PREMLATA AND SINGH, A., 1988. A new species of genus *Dacus* Fabricius (Tephritidae: Diptera) from India. *J. Bombay nat. Hist. Soc.*, **84**:401-404.
- RAJAK, R. L., 1986. *Fruit fly situation in India*. Paper presented at FAO expert consultation on progress and problems in controlling fruit fly infestation, RAPA, Bangkok, 16-19 December 1986.
- SAUNDERS, W. W., 1842. Descriptions of the four new dipterous insects from central and northern India. *Trans. ent. Soc. Lond.*, **3**: 59-61.
- SENIOR-WHITE, R. A., 1922. New species of Diptera from Indian region. *Mem. Dept. agric. India. (Ent. Ser.)*, **7**: 107-169.
- SHIRAKI, T., 1933. A systematic study of Trypetidae in the Japanese Empire. *Mem. Fac. Sci. Agric. Taihoku imp. Univ.*, **8**, Ent. **2**: 1-509.
- SINGH, R. B., 1991. Significance of fruit flies in fruit and vegetable production in the Asia-Pacific region. In: *Proceedings, First International Symposium on Fruit flies in the Tropics, Kuala Lumpur, 1988*. (eds. S. Vijaysegaran and A.G. Ibrahim), pp. 11-29. Malaysian Agricultural Research and Development Institute, Kuala Lumpur.
- SILVESTRI, F., 1916. Prima notizia sulla presenza della *Musca delle olive* e di un parassita di essa in India. *Atti Accad. naz. Dei Lincei*, **25**: 424-427.
- SYED, R.A., 1970a. Studies on Trypetids and their natural enemies in West Pakistan. V. *Dacus* (*Strumeta*) *cucurbitae* Coquillett. *C.I.B.C. Tech. Bull.*, **13**: 63-75.

- SYED, R.A., 1970b. Studies on Trypetids and their natural enemies in West Pakistan *Dacus* species of lesser importance. *Pakistan J. Zool.*, **2**: 17-24.
- SYED, R. A., GHANI, M. A. AND MURTAZA, M., 1970a. Studies on trypetids and their natural enemies in West Pakistan. III. *Dacus (Strumeta) zonatus* (Saunders). *C.I.B.C. Tech. Bull.*, **13**: 1-16.
- SYED, R. A., GHANI, M. A. AND MURTAZA, M., 1970b. Studies on Trypetids and their natural enemies in West Pakistan. IV. Further observation on *Dacus (Strumeta) dorsalis* Hendel. *C.I.B.C. Tech. Bull.*, **13**: 17-30.
- TSURUTA, K. AND WHITE, I.M. 2001. Eleven new species of the genus *Bactrocera* Macquart (Diptera: Tephritidae) from Sri Lanka. *Ent. Sci.*, **4**: 69-87.
- VARGAS, R. I. AND NISHIDA, T., 1991. Spatial distribution of fruit flies in Hawaii: development of eradication strategies. In: *Proceedings First International Symposium on Fruit flies in the Tropics, Kuala Lumpur, 1988* (eds. S. Vijaysegaran, and A.G. Ibrahim), pp.242-250. Malaysian Agricultural Research and Development Institute, Kuala Lumpur.
- WALKER, F., 1849. *List of specimens of dipterous insects in the collection of the British Museum*, Part 4, pp.689-1172.
- WALKER, F., 1859-1860. Catalogue of dipterous insects collected at Makassar in Celebes, by Mr. A.R.Wallace, with descriptions of new species [continued]. *J. Proc. Linnean Soc., Lond. Zool. Issue*, **4**: 90-96, 97-144 (1859), 145-172 (1860).
- WANG, X. -J., 1990. Notes on six new species of the genus *Callantra* from China (Diptera: Tephritidae). *Acta Zootax. Sinica*, **15**: 67-76.
- WIEDEMANN, C. R. W. 1830. *Aussereuropaische zweifflugelige Insekten*. **2**: 684
- WHITE, I. M. AND ELSON-HARRIS, M. M., 1992. *Fruit flies of economic significance: their identification and bionomics*. C.A.B. international, U.K. pp. 1-601.
- WHITE, I. M. AND WANG, X. -J., 1992. Taxonomic notes on some dacinæ (Diptera: Tephritidae) fruit flies associated with citrus, olives and cucurbits. *Bull. ent. Res.*, **82**: 275-279.
- ZAKA-UR-RAB., 1961. Miscellaneous notes 20. A new species of the genus *Callantra* Walker from India (Diptera: Trypetidae). *J. Bombay nat. Hist. Soc.*, **58**: 538-541.

