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Source: Florida Entomologist, 94(3) : 379-388

Published By: Florida Entomological Society

URL: https://doi.org/10.1653/024.094.0301

MORPHOLOGICAL CHARACTERIZATION AND DISTRIBUTION OF SENSILLA ON MAXILLARY PALPI OF SIX *BACTROCERA* FRUIT FLIES (DIPTERA: TEPHRITIDAE)

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Abstract

Several members of the Tephritidae (Diptera) are destructive pests of fruits and vegetables. This study used scanning electron microscopy to analyze the external morphology, typology, size, and distribution of maxillary palpus sensilla of both female and male adults of 6 fruit fly species, *Bactrocera cucurbitae* (Coquillett), *B. diaphora* (Hendel), *B. dorsalis* (Hendel), *B. minax* (Enderlein), *B. scutellata* (Hendel), and *B. tau* (Walker). The palpus is equipped with *sensilla chaetica*, *sensilla basiconica*, and microtrichia. In addition, the possible functions of the sensillum types are discussed. Probable functions include the mechanoreception of *sensilla chaetica* and microtrichia, and olfaction of *sensilla basiconica*. Future functional morphology and electrophysiological studies are needed to confirm these proposed functions.

Key Words: *Bactrocera*, mouthparts, ultrastructure, scanning electron microscopy, sensilla

Resumen

Varios miembros de la familia Tephritidae (Diptera) son plagas destructivas de las frutas y hortalizas. Este estudio utilizó microscopía electrónica de escano para analizar la morfología externa, tipología, tamaño y distribución de las sensilas del palpo maxilar de los adultos machos y hembras de seis especies de la mosca de la fruta, *Bactrocera cucurbitae* (Coquillett), *B. diaphora* (Hendel), *B. dorsalis* (Hendel), *B. minax* (Enderlein), *B. scutellata* (Hendel) y *B. tau* (Walker). Los palpos están equipados con sensilas queticas, sensilas basicónicas y microtriquia. Además, se discuten las posibles funciones de las clases de sensilas. Las funciones probables incluyen la mecanorrecepción de sensilas queticas y de microtrichia, y la olfación de las sensilas basicónicas. Estudios futuros de la morfología funcional y electrofisiológicas son necesarios para confirmar las funciones propuestas.

Fruit flies (Diptera: Tephritidae) are among the most important insect pests worldwide with the larval stages attacking a wide variety of fruits and vegetables (Clarke et al. 2005). *Bactrocera* is one of the largest genera in the Tephritidae with over 500 described species belonging in 28 subgenera (Smith et al. 2003). These species are widely distributed in the Asia-Pacific region. In China, *Bactrocera cucurbitae* (Coquillett), *Bactrocera diaphora* (Hendel), *Bactrocera dorsalis* (Hendel), *Bactrocera minax* (Enderlein), *Bactrocera scutellata* (Hendel), and *Bactrocera tau* (Walker) are commonly found in the field (Hu et al. 2010). Among these 6 species, the oriental fruit fly, *B. dorsalis*, can be the most economically serious insect pest in tropical and subtropical regions (Li et al. 2007). The oriental fruit fly is highly polyphagous and is able to infest the fruits of more than 250 species of host plants, including commercial crops such as mango, citrus, coffee, and chili pepper, as well as non-cultivated wild hosts (Clarke et al. 2005).

Fruit flies, like other insects, acquire information about their environment through sensory systems. Furthermore, many monitoring and control techniques for tephritid flies use olfactory-based behavioral manipulation (Hull & Cribb 1997). In insects, olfactory receptor neurons are located in cuticular sensilla which exist on the antennae and other head-associated body parts (Anton et al. 2003). Maxillary palpi, which are in direct contact with a feeding substrate, perceive odors more directly than antennae, which often perceive diffused odors rather than concentrated ones through direct contact (Wasserman & Itagaki 2003). As part of our ongoing research on olfactory mechanisms used for mate and host location by tephritid species, the characterization and determination of the abundance and distribution of sensilla of different fruit flies using scanning electron microscopy (SEM) techniques became imperative. Recently, the antennal sensilla of 6 *Bactrocera* species have been described (Hu et al. 2010). Yet little work has been published describing the abundance and distribution of sensilla on the maxillary palpi. Thus, the aim of our study was to examine, describe, quantify and compare the sensilla present on the maxillary palpi of both females and males of 6 fruit fly species, i.e., *B. cucurbitae*, *B. diaphora*, *B. dorsalis*, *B. minax*, *B. scutellata*, and *B. tau,* as a prerequisite for future electrophysiological studies of the antennal sensory system involved in chemical communication.

Materials and Methods

Adult *B. cucurbitae, B. diaphora, B. dorsalis, B. minax, B. scutellata,* and *B. tau* were collected using glass McPhail traps with proteinaceous baits placed in navel orange (*Citrus reticulata* L.) orchards in Yunnan Province and Chongqing Municipality, China, in 2009. After identification, specimens were kept in 70% alcohol before being prepared for Scanning Electron Microscopy (SEM). Voucher specimens were deposited in the insect collection of Southwest University, Chongqing, People's Republic of China.

Scanning Electron Microscopy (SEM)

Approximately 20 adults of each species were decapitated under a stereomicroscope (SZX12; Olympus, Tokyo, Japan) using a sharp blade. The maxillary palpi of females and males were removed separately and fixed in 2.5% glutaraldehyde mixed with phosphate buffer solution, pH 7.4, at 4°C for 24h. Maxillary palpi were subjected to postfixation in 1% osmium tetroxide for 2h. After having been washed 3 times for 15 min each time in double-distilled H_2O, the specimens were dehydrated in a graded alcohol series of 30, 50, 70, 80, and 90% and absolute ethanol for 15 min at each concentration. This dehydration process was followed by critical-point drying. Subsequently, either the ventral or dorsal sides of maxillary palpi were mounted on sticky tape. Immediately before observation, the maxillary palpi were sputter coated with gold in an E-1010 high-resolution sputter coater (Hitachi, Tokyo, Japan). The specimens were examined in an S-3000N SEM scanning electron microscope (Hitachi) operated at 15kV.

Statistical Analysis

The morphological terminology used here followed that of Schneider (1964), Zacharuk (1985), and Dickens et al. (1988). Three to 5 maxillary palpi were observed for each fruit fly species and sex. Sensilla on the dorsal and ventral surfaces of the maxillary palpi were identified, counted, and measured. Measurements (micrometers) obtained from photomicrographs of 3 to 5 samples for each sex and species were used to calculate means. The number of various types of sensillum per unit area was used to estimate the number of sensilla on the whole maxillary palpus. A sampling quadrant on the surface of maxillary palpus was randomly chosen and the number of each type of sensillum within that quadrant was counted. The area of each sampling photograph quadrant was 2,958 μm^2 with magnification at 1800×. The values were converted to density, i.e., number per one unit area of 10,000 μm^2. Two-way analysis of variance (ANOVA) with interaction was used to examine the effects of species and sex on the abundance, length, and diameter of each sensillum type, and the length and diam of the maxillary palpus structure. Data were analyzed using JMP 8.0.2 software (SAS Institute 2009).

Results

General Maxillary Palpus Morphology

The maxillary palpi were attached to the proximal part of the proboscis (Fig. 1A). The proboscis covered the palpi except for their tips, and they were extended during probing and feeding. The complete surface of the maxillary palpus was exposed to the environment. There was a significant species × sex interaction for palpus length. This interaction was driven by *B. minax* females, which had the longest maxillary palpi (1266.3 ± 117.7 μm) of the 6 species ($F_{5,36}$ = 3.94, P = 0.006) (Table 1). There were no significant differences in the diam of palpi among the 6 species or the sexual genders ($F_{5,36}$ = 0.54, P = 0.74).

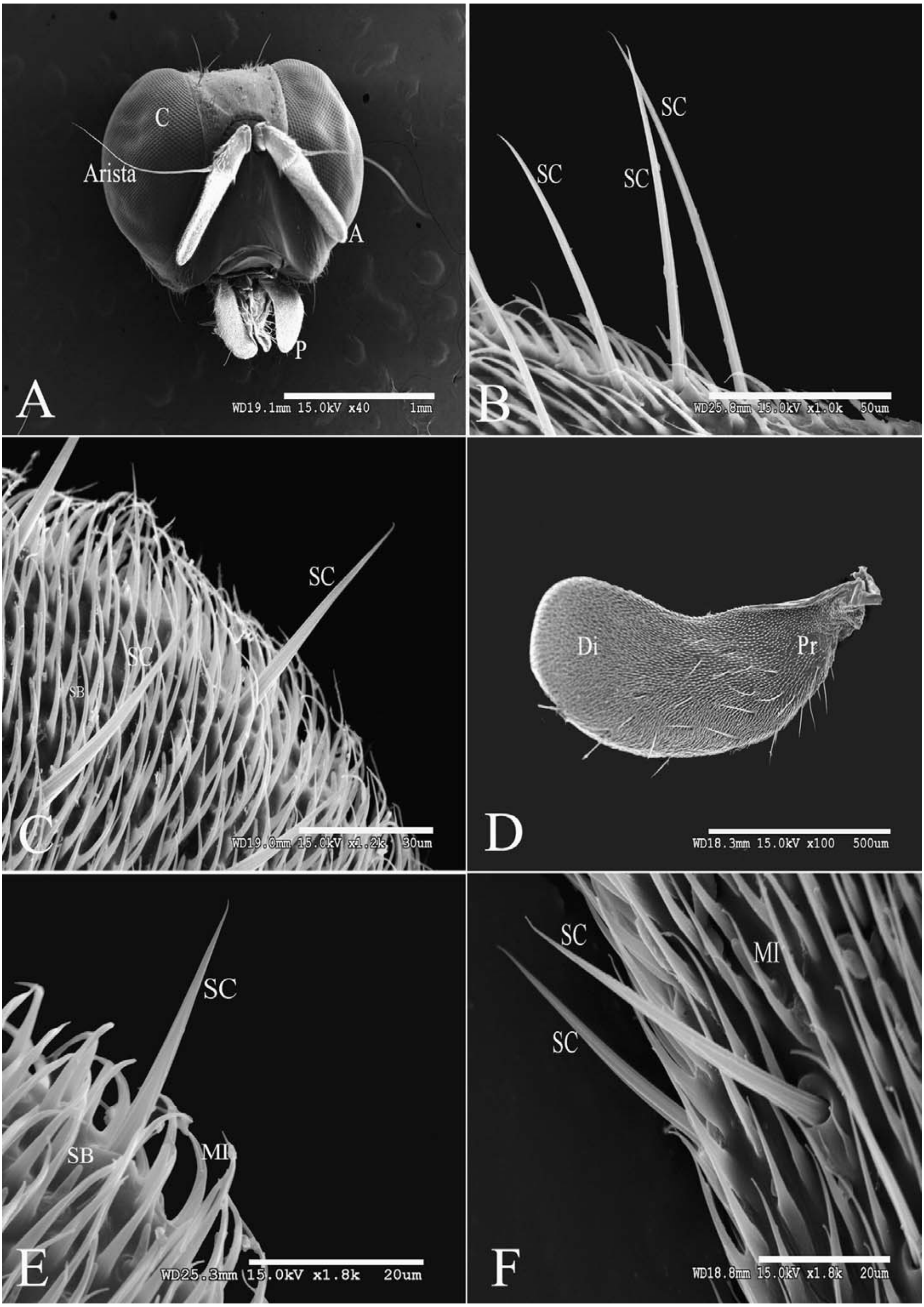

Fig. 1. Scanning electron micrographs of head and sensilla of *B. cucurbitae, B. diaphora,* and *B. tau*. A. Head of *B. cucurbitae* ♀ bearing large compound eyes (C), antennae (A) and maxillary palpi (P). Heads of the other 5 species are similar. B. *B. cucurbitae* ♀: *sensilla chaetica* (SC) on middle of palpus. C. *B. cucurbitae* ♂: *sensilla chaetica* (SC) on distal part of palpus. D. *B. diaphora* ♀: *sensilla chaetica* on maxillary palpus. E. *B. diaphora* ♂: *sensilla chaetica* (SC) and microtrichia (MI) on promixal part of palpus. F. *B. tau* ♀: *sensilla chaetica* (SC) on distal part of palpus. Pr: promixal part; Di: distal part. A. 1mm; B. 50 µm; C. 30 µm. D. 500 µm; E. 20 µm; F. 20 µm.

TABLE 1. MEAN LENGTH AND DIAMETER (±SE) (μM) OF MAXILLARY PALPI OF THE SIX *BACTROCERA* SPECIES (N = 4).

Species	Sex	Length	Diameter
B. cucurbitae	♀	525.0 ± 51.9 c	202.5 ± 14.3
	♂	703.5 ± 50.6 bc	227.5 ± 12.9
B. diaphora	♀	659.8 ± 56.8 bc	190.0 ± 20.8
	♂	600.0 ± 57.1 bc	235.0 ± 13.2
B. dorsalis	♀	642.5 ± 46.6 bc	215.0 ± 8.7
	♂	639.0 ± 31.8 bc	210.8 ± 27.6
B. minax	♀	1266.3 ± 117.7 a	352.5 ± 54.6
	♂	898.8 ± 110.3 b	321.8 ± 31.9
B. scutellata	♀	702.5 ± 68.0 bc	238.8 ± 32.3
	♂	816.3 ± 76.7 bc	252.5 ± 21.4
B. tau	♀	651.5 ± 50.7 bc	222.0 ± 10.5
	♂	671.3 ± 34.5 bc	225.0 ± 9.6

Means followed by the same letter within a column are not significantly different (Tukey HSD $P < 0.05$).

Types of Maxillary Palpus Sensilla

Sensilla chaetica (SC), microtrichia (MI) and *sensilla basiconica* (SB) were observed on the maxillary palpi of females and males of all 6 species. There were significant species × sexual gender interactions for length and diam, but only significant differences between the sexes for microtrichia length, microtrichia diam and *sensilla basiconica* length (Table 2). The *sensilla chaetica* (SC) occurred on the maxillary palpi of both sexes of the 6 fruit fly species, but were distributed sparsely at the distal ends of the palpi (Fig. 1-D). The SC were characterized by a grooved surface and straight hairs with sharp tips, each of which was located in a wide socket (Fig. 1-B, C, E and F). The SC were longest (>103 μm) for *B. minax* males and females, and *B. scutellata* males (Table 3). The *B. minax* male SC had the widest diam (7.8 ± 1.3 μm) followed by *B. tau* females (6.3 ± 0.9 μm) (Table 3)

The microtrichia were densely distributed on the maxillary palpi (Fig. 2-A-D). The microtrichia have longitudinal grooves along the shaft of the sensillum and crests with slightly sharp tips. Microtrichia on palpi of females tended to be longer than those on the palpi of males with the notable exception of *B. scutellata* in which they were 18.6 ± 0.8 μm and 20.5 ± 2.0 μm long in females and males, respectively. In *B. minax* the lengths of palpus microtrichia were as follows: females -24.3 ± 0.2 μm; the longest of all 6 species, and males -22.8 ± 1.0 μm; and the corresponding widths were 4.5 ± 0.3 μm and 6.2 ± 0.9 μm, i.e., the widest of all 6 species (Table 3). *B. dorsalis* males had the shortest maxillary palpus microtrichia (12.6 ± 0.7 μm) and the narrowest diam (1.5 ± 0.0 μm).

The *sensilla basiconica* were numerous toward the tip of the maxillary palpus and had slightly pointed tips (Fig. 2-A, B and D). They were each set into a tight socket (Fig. 3 -A and F). The lengths of *sensilla basiconica* differed significantly between some species, and sexes, and there was a significant species × sex interaction; however the diam of *sensilla basiconica* differed significantly between species but not between sexes and there was a significant species × sex interaction (Table 2). The *sensilla basiconica* length was longest for *B. minax* females and shortest for *B. dorsalis* and *B. scutellata* females (Table 3). *Sensilla basiconica* diam were greater for *B. minax* females and narrower for both *B. diaphora* and *B. dorsalis* males (Table 3).

Abundance and Distribution of Maxillary Palpus Sensilla

The distribution patterns of sensilla on the maxillary palpi of females and males of 6 fruit fly species were very similar (Figs. 1, 2, 3). The abundance of sensilla differed significantly between species, and there were significant species × sex interactions; however only the distally distributed SC had significant differences between sexes (Table 4).

Overall, *B. cucurbitae* and *B. diaphora* form a homogenous subset (Table 5) with a significantly greater abundance of total sensilla than the other 4 fruit fly species. *B. cucurbitae* males have more MI than the other species (Table 5). SC occur both distally and proximally on the maxillary palpus. *B. cucurbitae* and *B. diaphora* females had significantly more SC than the other species.

Microtrichia (MI) were the most abundant of all sensilla on the maxillary palpus. The mean MI abundance for *B. cucurbitae* males was 56% greater than for *B. dorsalis* females, which had the lowest mean MI abundance (Table 5). *Sensilla basiconica* (SB) were found distally on the palpus also. SB abundance was greater in males than females for 3 of the 6 species, i.e., *B. cucurbitae*, *B. dorsalis*, and *B. tau*. Mean SB abundance was 31% greater in *B. cucurbitae* males than in *B. minax* males (Table 5).

TABLE 2. ANOVA TABLE FOR SENSILLA LENGTH AND DIAMETER OF SIX *BACTROCERA* SPECIES ($N = 4$).

Trait	Source of variation	*df*	*SS*	*F*	*P*
Length of SC	Species	5	29889.21	30.54	<0.001
	Sex	1	580.32	2.96	0.094
	Species × Sex	5	8072.16	8.25	<0.001
	Error	36	7047.48		
Diameter of SC	Species	5	74.05	15.45	<0.001
	Sex	1	0.69	0.72	0.402
	Species × Sex	5	32.75	6.84	<0.001
	Error	36	34.5		
Length of MI	Species	5	442.2	27.11	<0.001
	Sex	1	75.75	23.21	<0.001
	Species × Sex	5	97.64	5.99	<0.001
	Error	36	117.46		
Diameter of MI	Species	5	57.36	19.03	<0.001
	Sex	1	7.71	12.79	0.001
	Species × Sex	5	17.28	5.73	0.001
	Error	36	21.7		
Length of SB	Species	5	208.66	17.60	<0.001
	Sex	1	11.41	4.81	0.035
	Species × Sex	5	51.47	4.34	0.003
	Error	36	85.37		
Diameter of SB	Species	5	3.85	3.60	0.01
	Sex	1	0.5	2.33	0.135
	Species × Sex	5	4.02	3.76	0.008
	Error	36	7.71		

SC, *sensilla chaetica*; MI, microtrichia; SB, *sensilla basiconica*.

TABLE 3. MEAN (±SE) LENGTH AND DIAMETER (MM) OF THE SENSILLA PRESENT ON THE MAXILLARY PALP OF SIX *BACTROCERA* SPECIES ($N = 4$).

		Sensilla chaetica		Microtrichia		Sensilla basiconica	
Species	Sex	Length	Diameter	Length	Diameter	Length	Diameter
B. cucurbitae	♀	40.5 ± 1.5 c	3.0 ± 0.0 c	22.5 ± 0.5 ab	4.4 ± 0.2 abc	9.6 ± 0.8 bcd	2.1 ± 0.3 ab
	♂	44.9 ± 1.1 c	3.0 ± 0.0 c	21.5 ± 1.0 ab	2.8 ± 1.1 bcd	11.7 ± 0.2 ab	2.0 ± 0.0 ab
B. diaphora	♀	33.4 ± 2.1 c	2.9 ± 0.1 c	24.0 ± 0.0 a	4.6 ± 0.2 ab	11.4 ± 0.6 ab	1.9 ± 0.1 ab
	♂	58.7 ± 4.8 bc	2.6 ± 0.1 c	16.9 ±0.7 cde	2.9 ± 0.1 bcd	11.7 ± 0.3 ab	1.5 ± 0 b
B. dorsalis	♀	42.4 ± 3.9 c	3.0 ± 0.2 c	15.2 ± 0.7 de	3.2 ± 0.5 bcd	6.7 ± 0.4 d	1.7 ± 0.1 b
	♂	36.0 ± 2.1 c	3.5 ± 0.4 c	12.6 ±0.7 e	1.5 ± 0.0 d	7.5 ± 0.2 cd	1.5 ± 0.0 b
B. minax	♀	103.3 ± 11.3 a	4.5 ± 0.3 bc	24.3 ± 0.2 a	4.5 ± 0.3 abc	14.1 ± 1.8 a	2.5 ± 0.3 ab
	♂	110.8 ± 13.7 a	7.8 ± 1.3 a	22.8 ± 1.0 a	6.2 ± 0.9 a	13.2 ± 0.5a b	2.2 ± 0.2 ab
B. scutellata	♀	62.5 ± 3.3 bc	3.6 ± 0.5 c	18.6 ± 0.8 bcd	2.6 ± 0.1 cd	6.1 ± 0.1 d	1.6 ± 0.0 b
	♂	109.8 ± 13.7 a	3.8 ± 0.2 c	20.5 ± 2.0 abc	2.0 ± 0.0 d	11.0 ± 0.9 abc	2.5 ± 0.5 ab
B. tau	♀	84.0 ± 6.3 ab	6.3 ± 0.9 ab	23.8 ± 0.3 a	2.9 ± 0.4 bcd	11.1 ± 0.9 abc	2.8 ± 0.3 a
	♂	47.5 ± 2.6 c	4.0 ± 0.0 bc	19.0 ± 1.0 bcd	1.9 ± 0.1 d	9.7 ± 0.4 bcd	1.7 ± 0.1 ab

Means followed by the same letter within a column are not significantly different (Tukey HSD $P < 0.05$).

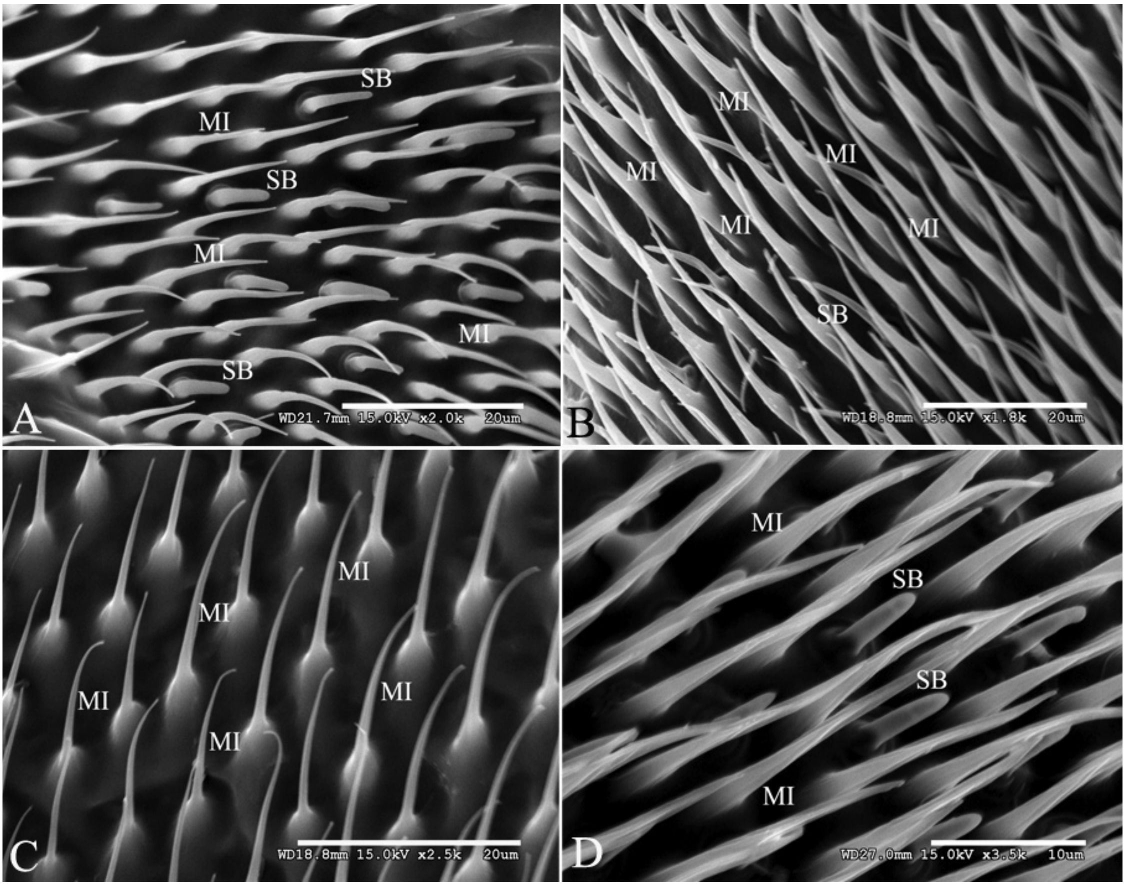

Fig. 2. Microtrichia and *sensilla basiconica* on maxillary palpi of *B. dorsalis, B. minax,* and *B. scutellata*. A. *B. dorsalis* ♀: microtrichia (MI) and *sensilla basiconica* (SB) on middle of palpus. B. *B. minax* ♂: microtrichia (MI) interspersed with *sensilla basiconica* (SB) covering the palpus surface. C. *B. minax* ♂: microtrichia (MI) on proximal part palpus. D. *B. scutellata* ♀: microtrichia (MI) extending beyond and interspersed with *sensilla basiconica* (SB) on palpus surface. A. 20 µm; B. 20 µm; C. 20 µm; D. 10 µm.

Discussion

This study describes the morphology and abundance of various sensilla located on the maxillary palpi of adult females and males of 6 fruit fly species, i.e., *B. cucurbitae*, *B. diaphora*, *B. dorsalis*, *B. minax*, *B. scutellata*, and *B. tau*. The results in this study generally conform to those previously reported for other dipteran species (Sukontason et al. 2003; Wasserman & Itagaki 2003; Spiegel et al. 2005; Ngern-Klun et al. 2007; Sukontason et al. 2007; Chen & Fadamiro 2008; Smallegange et al. 2008).

Microtrichia described in this study are similar to those on the maxillary palpi of several Diptera families such as *Chrysomya nigripes* [Calliphoridae] (Ngern-Klun et al. 2007), *Neobelliera bullata* (Wasserman & Itagaki 2003), *Hydrotaea chalcogaster* [Muscidae] (Sukontason et al. 2007), *Lutzomyia longipalpis* [Psychodidae] (Spiegel et al. 2005), *Musca domestica* [Muscidae] (Smallegange et al. 2008). The MI are the most abundant on the maxillary palpi of both sexes of the 6 species. They were classified as non-innervated structures in some insect species (Fernandes et al. 2002, 2004; Sukontason et al. 2007; Smallegange et al. 2008). The microtrichia are most often described as mechanoreceptors associated with antennal structures (Hull & Cribb 1997; Siddiqui et al. 2010), and specifically associated with dipteran antennae (Castrejon-Gomez & Rojas 2009; Arzuffi et al. 2008; Chen & Fadamiro 2008; Fernandes et al. 2002; Sukontason et al. 2004, 2007). Recently, Hu et al. (2010) described MI on the antennae of *Bac-*

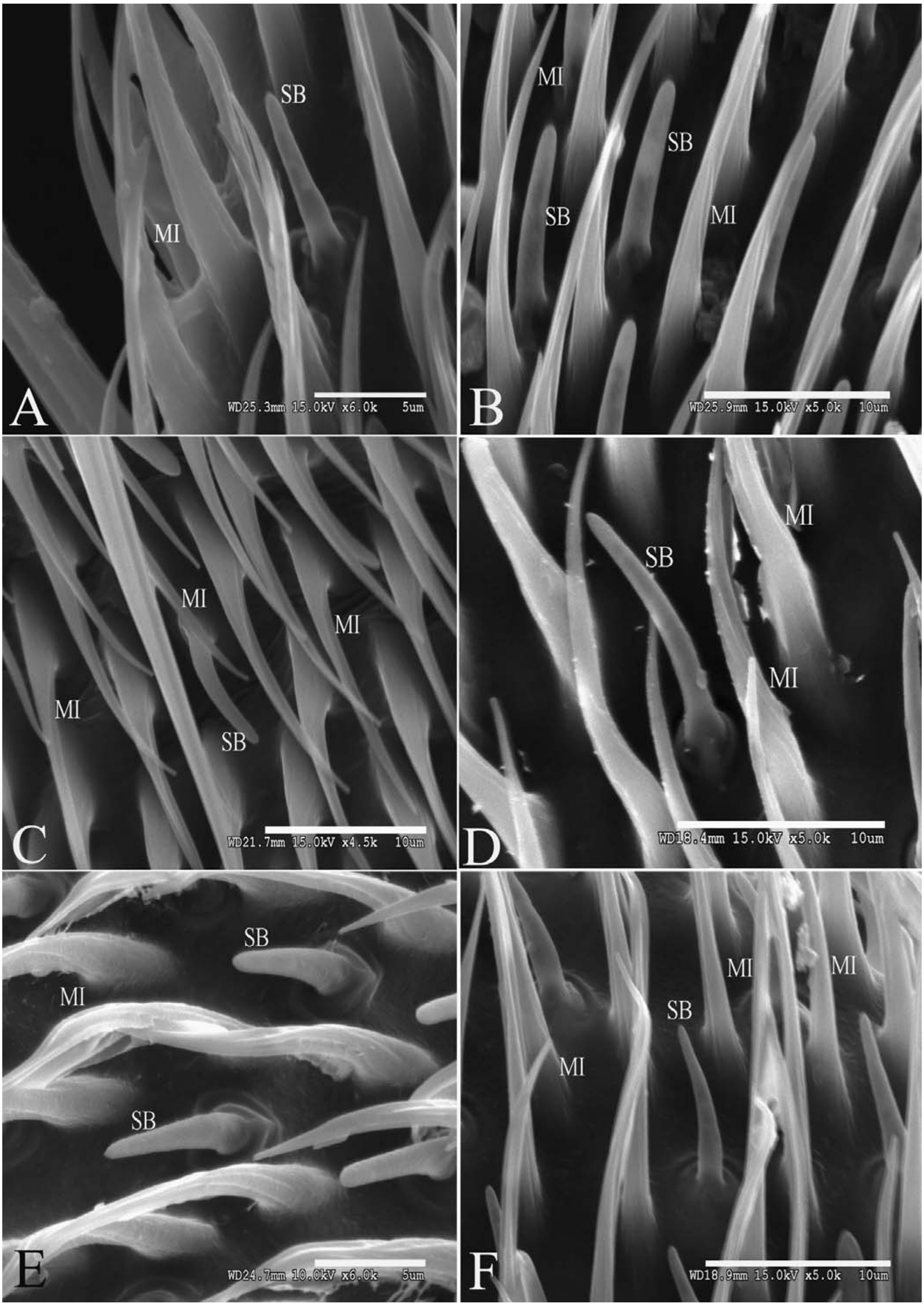

Fig. 3. Detailed views of *sensilla basiconica* and microtrichia on the ventral sides of the maxillary palpi of the 6 *Bactrocera* species. A. *B. cucurbitae* ♂: ventral view details of *sensilla basiconica* (SB) and microtrichia (MI). B. *B. diaphore* ♂: microtrichia (MI) interspersed with *sensilla basiconica* (SB) covering the palpus surface. C. *B. dorsalis* ♂: ventral view detail of *sensilla basiconica* (SB) and microtrichia (MI). D. *B. minax* ♀: distal end of palpus of showing *sensilla basiconica* (SB). E. B. scutellata ♂: *sensilla basiconica* (SB) covering the palpus surface. F. *B. tau* ♀: *sensilla basiconica* (SB) and microtrichia (MI) on distal end of palpus. A. 5 µm; B. 10 µm; C. 10 µm; D. 10 µm; E. 5 µm; F. 10 µm.

TABLE 4. ANOVA TABLE FOR NUMBER OF SENSILLA (MICROTRICHIA [MI], *SENSILLA BASICONICA* [SB] AND *SENSILLA CHAETICA* [SC]) PER UNIT AREA (10,000 µM²) ON MAXILLARY PALPI OF *BACTROCERA* FEMALES AND MALES (*N* = 4).

Trait	Source of variation	*df*	*SS*	*F*	*P*
MI	Species	5	156871.74	21.72	<0.001
	Sex	1	51.22	0.035	0.852
	Species × Sex	5	4216.72	5.84	<0.001
	Error	36	52007.11		
SB	Species	5	7320.96	5.51	0.001
	Sex	1	518.70	1.95	0.171
	Species × Sex	5	4430.55	3.34	0.014
	Error	36	9557.99		
SC	Species	5	6454.10	95.40	<0.001
	Sex	1	135.88	10.04	0.003
	Species × Sex	5	420.45	6.22	<0.001
	Error	36	487.08		
Total Abundance	Species	5	286912.50	36.17	<0.001
	Sex	1	206.46	0.13	0.72
	Species × Sex	5	64900.74	8.18	<0.001
	Error	36	57113.81		

SC, *sensilla chaetica*; MI, microtrichia; SB, *sensilla basiconica*.

TABLE 5. MEAN (±SE) NUMBER OF SENSILLA (MICROTRICHIA [MI], *SENSILLA BASICONICA* [SB] AND *SENSILLA CHAETICA* [SC]) PER UNIT AREA (10,000 µM²) ON MAXILLARY PALPI OF *BACTROCERA* FEMALES AND MALES (*N* = 4).

Species	Sex	MI	SB	SC	Total
B. cucurbitae	♀	574 ± 11.0 ab	73 ± 6.4 b	42 ± 1.9 a	689 ± 17.2 ab
	♂	628 ± 29.2 a	117 ± 13.0 a	32 ± 0.9 ab	777 ± 26.6 a
B. diaphora	♀	605 ± 20.8 a	80 ± 8.2 ab	39 ± 2.1 a	725 ± 20.5 a
	♂	572 ± 8.7 bcd	67 ± 4.1 b	27 ± 2.8 b	678 ± 10.0 abc
B. dorsalis	♀	403 ± 33.6 f	68 ± 10.9 b	11 ± 1.9 c	482 ± 39.3 f
	♂	489 ± 27.0 cdef	69 ± 8.7 b	12 ± 1.5 c	570 ± 29.5 def
B. minax	♀	549 ± 8.5 bcd	56 ± 7.9 b	10 ± 2.1 c	616 ± 3.1 bcde
	♂	479 ± 18.9 def	52 ± 6.8 b	8 ± 1.6 c	540 ± 39.0 def
B. scutellata	♀	496 ± 8.8 def	84 ± 7.9 ab	8 ± 0.8 c	588 ± 11.0 cde
	♂	436 ± 17.6 ef	77 ± 8.7 ab	10 ± 0.9 c	522 ± 14.0 ef
B. tau	♀	508 ± 12.8 def	62 ± 4.0 b	13 ± 2.4 c	583 ± 11.3 cde
	♂	543 ± 3.0 bcd	80 ± 6.7 ab	15 ± 1.8 c	637 ± 7.0 bcd

Means followed by the same letter within a column are not significantly different (Tukey HSD *P* = 0.05).

trocera species, which they considered to have a mechanosensory function. MI on the surface of the maxillary palpi of the 6 fruit flies may also be mechanoreceptors.

The mechanosensory function of bristles of the *sensilla chaetica* have previously been described on the palpi of various species as follows: de Bruyne et al. (1999) (*Drosophila*), Wasserman & Itagaki (2003) (*Neobellieria bullata*), and Sukontason (2007) (*Hydrotaea chalcogaster*). The morphological structure of *sensilla chaetica* observed in this study is in concordance with those characterized on the palpi of the Dipteran, *Neobellieria bul-*

lata (Wasserman & Itagaki 2003); therefore, it is likely that this type of sensilla is also involved with mechanosensory function.

The *sensilla basiconica* seen in this study are similar to SB on the palpi of other Diptera (de Bruyne et al. 1999; Ngern-Klun et al. 2007; Wasserman & Itagaki 2003). SB have also been reported in the antennae of other non-Dipteran insects such as the eucalyptus woodborer, *Phoracantha semipunctata* [Coleoptera: Cerambycidae] (Lopes et al. 2002); although the exact number of SB on the palpi was undetermined. Kelling et al. (2002) found 75-90 SB on the palpi of the housefly, *Musca domestica,* and ~60 SB have been recorded from *Drosophila* (de Bruyne et al. 1999), similar to the range (55-117) found in the 6 species of *Bactrocera*. The presence of wall pores suggest that SB have an olfactory role (Zacharuk 1985; Lopes et al. 2002). The presence of SB with dendritic branches also suggests an olfactory function, which has been verified by the use of electrophysiological recordings in *Phoracantha semipunctata* (F.) [Coleoptera: Cerambycidae] (Lopes et al. 2002). However, this type of sensilla is similar to the sensilla in the palpi of other Diptera (de Bruyne et al. 1999; Ngern-Klun et al. 2007; Wasserman & Itagaki 2003). With the exception of *B. cucurbitae*, the sensilla occurred in nearly equal numbers on both sexes, which suggests that SB may have host discrimination olfactory functions.

In conclusion, the maxillary palpi of *B. cucurbitae*, *B. diaphora*, *B. dorsalis*, *B. minax*, *B. scutellata*, and *B. tau* are equipped with morphologically similar sensilla. *Sensilla chaetica* and microtrichia on the palpi of females and males suggest the importance of mechanoreception. The distally distributed *sensilla basiconica* are not as numerous as the microtrichia, but the presence of cuticular pores suggests an olfactory function. Those results will provide information needed for ongoing studies of behavioral responses of fruit flies to environmental stimuli.

Acknowledgments

This study was funded in part by the National Basic Research Program of China (2009CB125903, 2009CB119200), Natural Science Foundation of Chongqing (CSTC, 2009BA1042), the Program for Changjiang Scholars and Innovative Research Team in University (IRT0976), and the earmarked fund for Modern Agro-Industry (Citrus) Technology Research System of China to Jin-Jun Wang. We thank Mr. Stephen Sanders for his time to critically read the revised manuscript.

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