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SEXUAL DIMORPHISM IN *PSEUDONEMORPHUS VERSTEEGI* (RITSEMA) (COLEOPTERA: CERAMBYCIDAE), CITRUS TRUNK BORER[ω]

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ABSTRACT

The citrus trunk borer, *Pseudonemorphus versteegi* (Ritsema) (Coleoptera: Cerambycidae), is the most destructive pest of citrus in the entire northeastern Himalayan region of India. Adult beetles are stout, large in size, measuring 18.0 to 33.3 mm in length with bluish white elytra and 11-segmented filiform antennae. The antennae are 2.71 and 1.61 times longer than the lengths of the bodies of male and female beetles, respectively. These studies reveal and detail sexual dimorphism characters in adult of *Pseudonemorphus versteegi.*

Key Words: Citrus trunk borer, antennae, funicular segments, morphological traits

RESUMEN

El barrenador del tronco de los cítricos, *Pseudonemorphus versteegi* (Ritsema) (Coleoptera: Cerambycidae), es la plaga más destructiva de los cítricos en toda la región noreste del Himalaya de la India. Los escarabajos adultos son robustos, de gran tamaño, de 18.00 a 33.32 mm de longitud, con élitros de color azul blanco y con antenas filiformes de once segmentos. Las antenas fueron 2.71 y 1.61 veces más largas que la longitud de los cuerpos de los escarabajos machos y hembras, respectivamente. Estos estudios revelaron aspectos del dimorfismo sexual en los adultos de *Pseudonemorphus versteegi*.

Palabras Clave: Barrenador del tronco de los Cítricos, antena, segmento funicular, rasgos morfológicos

Citrus trunk borer, *Pseudonemorphus versteegi* (Ritsema) (Coleoptera: Cerambycidae), is the most destructive pest of citrus in the entire northeastern Himalayan region of India (Hayes 1945; Sachan & Gangwar 1982). Thakur & Shylesha (1996) found 60-80 per cent damage to Khasi mandarin (*Citrus reticulata* Blanco; Sapindales: Rutaceae) plants due to the citrus trunk borer in Meghalaya. Adults appear in citrus orchards in late Mar to mid Apr in the state of Meghalaya (Shukla & Gangwar 1989). Male beetles of this species was originally described by Ritsema (1881) as *Monohammus versteegi* and he named this species after Mr. W. F. Versteeg, one of the Members of the Committee for the Scientific Sumatra-Expedition. Although the external differences between male and female beetles are slight, the sexes can be easily distinguished without magnification by viewing the length of funicular antennal segments compared to the length of the beetles body. Studies were undertaken to elucidate sexual dimorphism in morphological characters in adults of *Pseudonemorphus versteegi*.

MATERIALS AND METHODS

Adult beetles used in this study were collected from the citrus orchard of the Division of Entomology, ICAR Research Complex for NEH Region, Umiam, Meghalaya in mid-Apr, 2009. Lengths and breadths of adult beetles were measured with the help of a vernier scale. Adult beetle length was measured from the center of the ecdysial line on the head to the tip of the abdomen. Likewise the breadth of the beetle was measured at the widest region of the elytra near the thorax. Beetle weight was taken by an electronic balance. The lengths of different antennal segments of both male and female adult beetles were measured. The relative length of each antennal segment in comparison to the scape was calculated for both the sexes. The funicular index and cephalic index were calculated as follows;

$$\text{Funicular Index} = \frac{\text{Length of first funicular segment}}{\text{Length of second funicular segment}} \times 100$$

$$\text{Cephalic Index} = \frac{\text{Head length}}{\text{Head width}} \times 100$$

$$\text{Scape Index} = \frac{\text{Scape length}}{\text{Head width}} \times 100$$

Student's *t*-distribution was used in testing the significance of the differences in treatment means of morphological parameters between male and female beetles following the procedure described by Rangaswamy (2010).

Results

Adults of citrus trunk borer used in our analysis were 18.0 to 33.3 mm in length with bluish white elytra marked with black spots. Males (0.998 g) weighed less than females (1.162 g), but not significantly less (t_{29} = 1.53, NS). Females were 18.0 to 31.8 mm long and 6.6 to 10.9 mm wide, and males 21.9 to 33.3 mm long and 7.7 to 11.9 mm wide (Table 1 and Fig. 1). Male and female beetles were not found significantly different in length (t_{29} = 0.11, NS) and breadth (t_{29} = -0.62, NS). The cephalic index of the male (155.4) was significantly different from the female (143.3) (t_{29} = 4.61, $P < 0.001$). Adults of *Pseudonemorphus versteegi* have hornlike filliform antennae. The antennae of the males were 2.71 × longer than their body length, while those of the female were somewhat shorter (1.61 ×). Sexual size dimorphism in the length of antenna was statistically highly significant (t_{29} = 12.68, $P < 0.0001$). On each of the 11 antennal segments, the basal portion is bluish-white, while the remainder is black resulting in a striking black and bluish-white pattern. The anterior end of

Table 1. Morphological parameters of adult citrus trunk borer (*Pseudonemorphus versteegi*).

	Male		Female	
Parameters	Mean ± SD	Range	Mean ± SD	Range
Length (mm)	27.79 ± 3.12	21.85-33.32	27.70 ± 3.82	18.00-31.75
Breadth (mm)	9.20 ± 1.09	7.65-11.85	9.38 ± 1.23	6.56-10.94
Weight (g)	0.998 ± 0.343	0.285-1.682	1.16 ± 0.44	0.33-1.83
Antenna (mm)	76.63 ± 12.86	53.51-97.68	44.62 ± 5.36	32.97-52.39
Antenna/Body length	2.71 ± 0.22	2.11-3.09	1.61 ± 0.13	1.43-1.93
Funicular Index	117.55 ± 7.31	100-132.77	121.49 ± 5.65	112.63-139.02
Cephalic Index	155.36 ± 13.32	129.76-175	143.28 ± 8.57	121.19-162.57
Scape Index	149.09 ± 14.46	115.38-175.95	66.88 ± 6.03	58.53-88.34

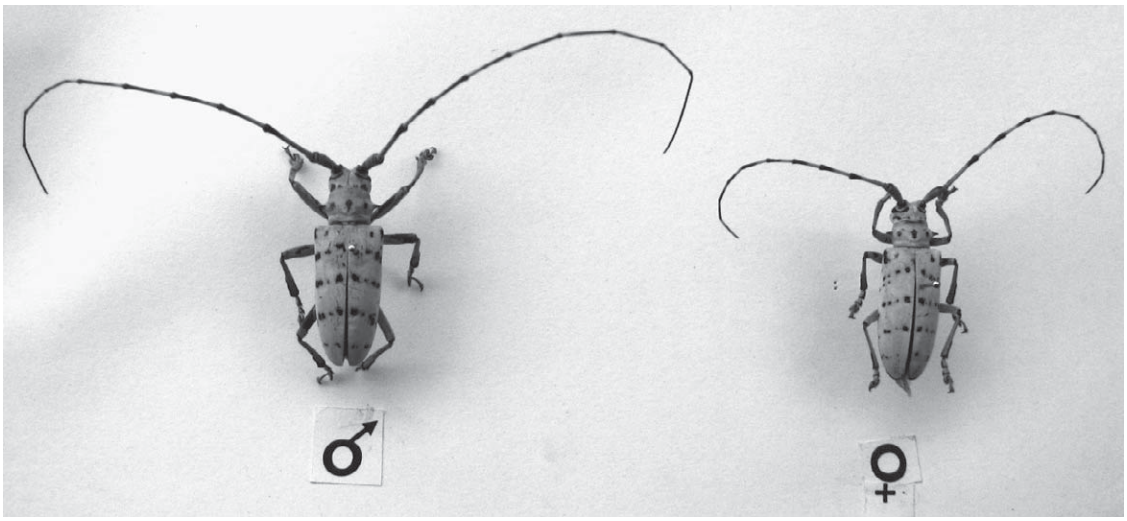

Fig.1. Adults of citrus trunk borer, *Pseudonemorphus versteegi.* The sex of most adults can be distinguished without magnification by viewing the lengths of funicular segments compared to overall body length.

TABLE 2. MORPHOLOGY OF ANTENNAL SEGMENTS OF ADULT CITRUS TRUNK BORER.

	Length of antennal segments (mm)					
	Male			Female		
Segment	Mean	SD (±)	Range	Mean	SD (±)	Range
Scape	4.19 d	0.54	3.00-5.05	3.76 ef	0.55	2.30-4.60
Pedicel	0.76 e	0.12	0.50-1.01	0.64 h	0.08	0.50-0.80
F1	8.46 b	1.08	6.45-10.57	6.73 a	0.73	5.02-7.95
F2	7.22 c	0.97	5.50-9.00	5.56 b	0.68	4.10-6.50
F3	6.97 c	0.96	5.15-8.37	4.77 c	0.56	3.83-5.63
F4	6.93 c	1.02	5.00-8.40	4.27 de	0.54	3.10-5.02
F5	7.13 c	1.10	5.01-8.80	4.02 e	0.50	3.00-4.81
F6	7.16 c	1.13	5.10-8.54	3.71 f	0.44	2.80-4.56
F7	7.34 c	1.37	4.85-9.40	3.49 f	0.44	2.50-4.20
F8	7.21 c	1.37	4.55-9.60	3.20 g	0.44	2.10-3.87
F9	13.27 a	3.79	6.70-19.95	4.47 d	0.72	3.00-5.56
SEd (±)	0.39	—	—	0.14	—	—
CD at 0.05	0.76**			0.27**		

** Significant at p = 0.01.
Figures followed by the different letter are significantly different.

the first segment is enlarged with the second segment smallest in both the sexes.

In the male the last antennal segment is the longest (13.3 mm) followed by third segment (F_1) (8.5 mm). The length of each funicular segment decreased from F_1 (8.5 mm) to F_4 (6.9 mm), slightly increased from F_5 (7.1 mm) to F_7 (7.3 mm) and decreased to 7.2 mm for the F_8 segment in case of male antennae. However, the lengths from F_2 to F_8 were not significantly different from each other in the male, and to the naked eye they appeared to have the same length (Table 2 and Fig. 2). Antennal segments of the female beetle also differed significantly from each other (Table 2) with the third segment (F_1) being the longest (6.7 mm). The lengths of the funicular segments decreased continuously from F_1 to F_8 before increasing to 4.5 mm at the F_9 (Fig. 2). The length of each segment relative to the first segment for the male antenna was recorded as 1:0.19:2.03:1.73:1.66:1.65:1.70:1.71:1.74:1.71:3.12, and for the female as 1:0.17:1.80:1.49:1.28:1.14:1.08:1.00:0.94:0.86:1.19. The scape index of the male (149.1) is higher than the female (66.9) and significantly different (t_{29} = 30.44, $P < 0.001$). However, the funicular indices of males and females are not significantly different (t_{29} = -2.01, NS). In males body length is surpassed within the first six antennal segments (Fig. 3), whereby it takes almost seven segments in females. Scanning electron microscopy (SEM) of beetle antennae illustrate that the male scape possesses more hairs than the female (Fig. 4).

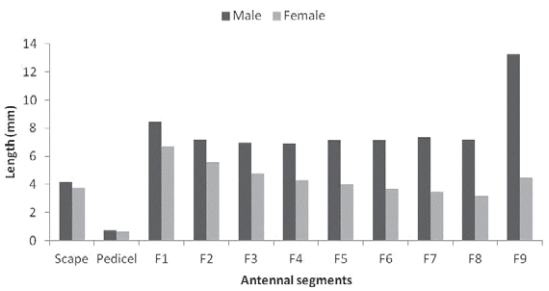

Fig.2. Lengths of antennal segments of males and females of *Pseudonemorphus versteegi.*

DISCUSSION

This investigation revealed that there are slight external morphological differences between male and female citrus trunk borers. The cephalic index for males is higher than in females resulting in a different frontal face view of the sexes (= sexual dimorphism). Adult males weigh less than females. However, the lengths, breadths and weights of male and female beetles are not significantly different. Antennal length is a sexually dimorphic character with the antennae of the male being significantly longer than that of the female. To the naked eye, the F_2 to F_8 funicular segments of male beetles appear to be of equal length. On the other hand, the lengths of the funicular segments of the female decrease progressively from F_1 to F_8. The sex of most adults can be distinguished without magnification by viewing the lengths of funicular segments compared to overall body length. The

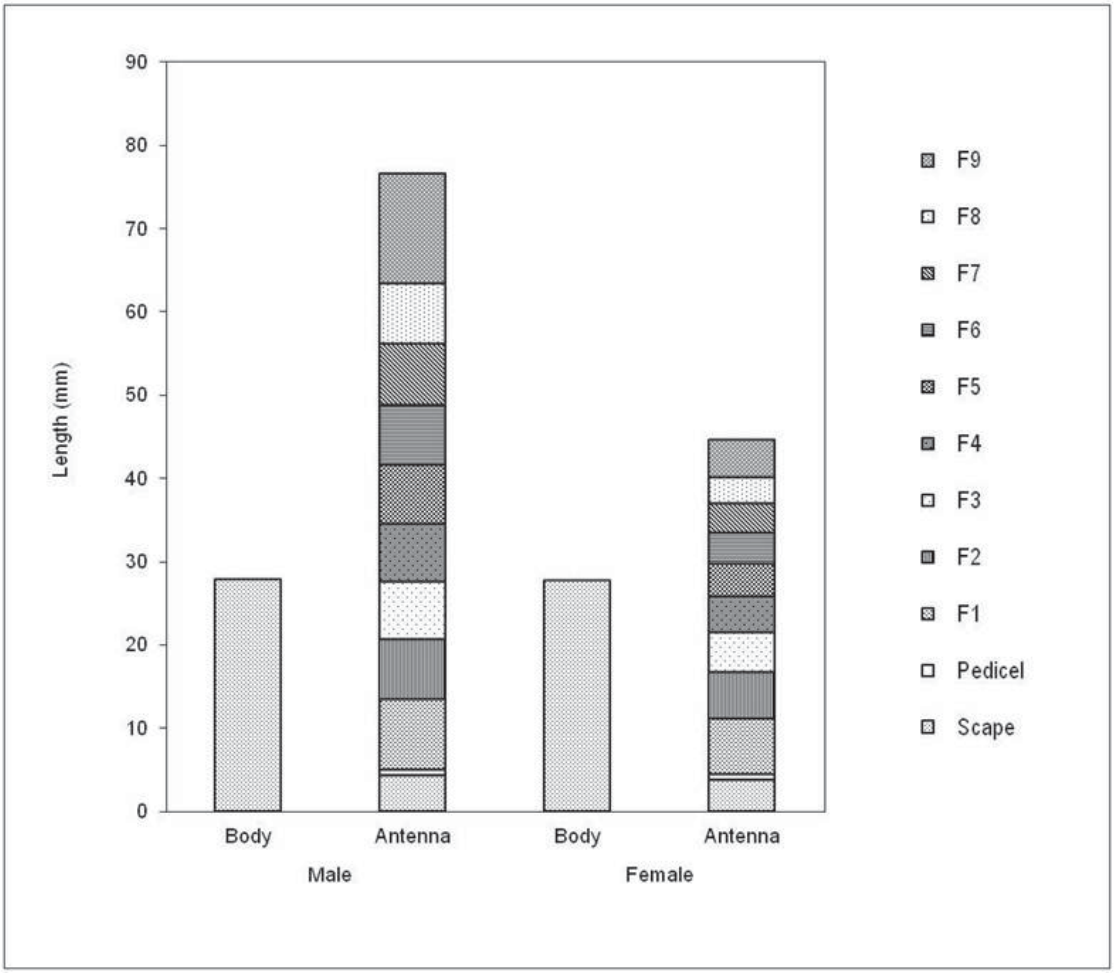

Fig. 3. Lengths of the various antennal segments vs body lengths of adult males and adult females of *Pseudonemorphus versteegi.*

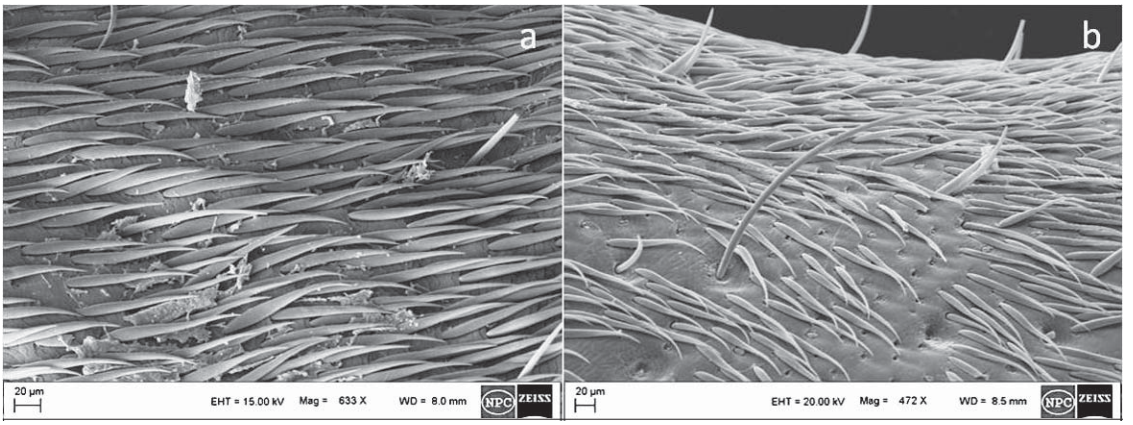

Fig. 4. Hairs on the scape of *Pseudonemorphus versteegi* (a) adult male and (b) adult female.

male scape possesses more hairs than females. The scape index for the male was also higher than for the female. Moller et al. (1997) also observed sexual gender size dimorphism in antennae of many cerambycid species with males typically having the longer antennae.

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References Cited

Hayes, W. B. 1945. The citrus industry in Sikkim. Indian J. Hort. 3: 49-55.

Moller, A. P., and Zamora-Munoz, C. 1997. Antennal asymmetry and sexual selection in a cerambycid beetle. Animal behaviour 54(6): 1509-1515.

Rangaswamy, R. 2010. A Text Book of Agricultural Statistics. New Age International (P) Ltd., New Delhi. pp. 69-70.

Sachan, J. N., and Gangwar, S. K. 1982. Insect pests of citrus *In* Tech. Bull. No. 16 On mandarin orange decline in North Eastern Hill Region and its control. ICAR Research Complex, Shillong. 33 pp.

Shukla, R. P., and Gangwar, S. K. 1989. Management of citrus trunk borer, *Anoplophora (Monohammus) versteegi* Rits. (Coleoptera: Cerambycidae) in Meghalaya. Indian J. Hill Farming 2(1): 95-96.

Thakur, N. S. A., and Shylesha, A. N. 1996. Management of citrus trunk borer - major pest of khasi mandarin in Meghalaya, pp. 206-208 *In* Proc. Natl. Symp. on IPM and Sustainable Agriculture: An Entomological Approach, 22-24 Sep 1995, Sanatan Dharm College, Muzaffarnagar, India. .