

Redescription of *Armigeres (Leicesteria) longipalpis* (Leicester) (Diptera: Culicidae) from Sarawak, Malaysia

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Abstract Redescription of *Armigeres (Leicesteria) longipalpis* (Leicester) was presented based on the specimens collected in Sarawak, Malaysia. Illustrations of abdominal ornamentations of adult male and female, pupa and larva were given for the first time. The larvae of the species were collected in water accumulation of green bamboo stumps and splits, and tree holes in mountain forest.

Keywords *Armigeres longipalpis* – redescription – immature stages – Sarawak – Malaysia

INTRODUCTION

During a recent mosquito survey in Sarawak, a fairly large series of adult and larval specimens and associated larval and pupal exuviae of the species belonging to the subgenus *Leicesteria* of genus *Armigeres* were collected and available for description [1, 2]. Some of them are identified as *Armigeres (Leicesteria) longipalpis* (Leicester), 1904 based on the male genitalia [3]. This species was originally described from Kuala Lumpur, Malaysia and then confused with *Armigeres (Leicesteria) cingulatus* (Leicester), 1908 from the same type locality, due to the resemblance and variability of the pale bands on the abdomen. The taxonomic confusion between the species was clarified by Barraud [4], Macdonald [3] and Thurman [5]. The structures of the male genitalia are useful in distinguishing these species. With existing descriptions of adult male and female of *Ar. longipalpis* [3 – 5], the important adult characters and male genitalia are given briefly by current standards. Illustrations of pupa, larva and abdominal

ornamentations of male and female of this species are also given for the first time in this paper.

MATERIALS AND METHODS

Specimens of *Armigeres longipalpis* were collected as larva from green bamboo stumps by I. Miyagi, T. Okazawa and T. Toma: 5 ♂♂ on pin with pupal (P) and/or larval (L) exuviae mounted on slide (274, 275, 296, 446, 409) and genitalia (G) on slide (143, 154, 135, 126, 142), 3 ♂♂ with P, L (227, 285, 297), 5 ♀♀ with P, L (155, 167, 201, 202, 428), 3 ♀♀, 6 whole larvae on slides collected at Ba'Kelalan and Bario (3° 59' 0" N, 115° 37' 0" E) Kelabit highland (ca 1,000 m elevation), on 21 – 30 August 2008. 1 ♂ with P, L (478) and G (161), 2 ♂♂ with P, L (423, 472); 1 ♀ with P, L (495) at Matang National Park, Kuching on 5 September 2008.

The illustrations of the abdominal ornamentation in the species were based mainly on fresh specimens, as deformity in the colorations of the sterna occurs in dry specimens [6]. The terminology used for the adults and immature stages mainly follows Harbach and Knight [7, 8]. The siphon and trumpet indices of larva and pupa used here follow Belkin's [9] "Ratio of dorsal length to median width". The specimens examined are deposited in the Sarawak Museum, Kuching, Malaysia.

DESCRIPTIONS AND DISCUSSION

Armigeres (Leicesteria) longipalpis (Leicester)

(Figs 1, 2, 3 and Tables 1, 2)

Leicesteria longipalpis Leicester in Theobald, 1904, *Entomologist*, 37: 211.

Armigeres (Leicesteria) longipalpis. Macdonald, 1960, *Stud. Inst. Med. Res. Malaya*, 29: 126 (♀, ♂, L).

Description

Female (Fig. 1A, C, D, H) – *Head*: Vertex covered with flat, broad, dark scales and with a central patch of pale broad scales; occiput with a posterior patch of several pale and brown upright forked scales; inter-ocular with one dull yellow seta and white scales; ocular line with 6 well developed reclinate dark setae and with white scale line; postgena (in lateral view) dark, divided by pale horizontal scale patch. Proboscis, ca 2.3 mm, uniformly dark dorsally without ventral pale scale line. Maxillary palpus ca 1.0 mm, dark without pale scales. Clypeus with several pale scales on outer surface. Pedicel yellowish, inner surface with a patch of white scales mingled with dark scales. Antenna ca 2.0 mm long, first segment of flagellomere with pale scales. *Thorax*: Integument dark brown with narrow, curved, light brown and golden scales; antear area, from lateral scutal fossal to

wing root, with a line of white broad and narrow scale patch; median prescutellar area with several white scales (sometimes replaced with light brown scales) and two strong prescutellar setae. All lobes of scutellum with a patch of dull yellow broad scales and with 3 or 4 well developed marginal setae. Anteprenotal lobe covered closely with white broad scales and with 8 well developed dark setae; postpronotal lobe with grayish broad scales and 7 or 8 dark setae above and with white broad scales below. Paratergite with several pale setae. Pleuron of upper proepisternal, subspiracular and postspiracular areas, mesokatepisternum and mesanepimeron with patch of white scales; approximately 10 long dull yellow setae on mesokatepisternum and 15 dark setae on upper mesepimeral area. *Legs*: All coxae with patches of white and dark scales and with yellowish setae on anterior side; all legs dark dorsally with white scale line from base to apex ventrally, and with a row of several conspicuous spine-like setae, without pale rings. Forefemur,

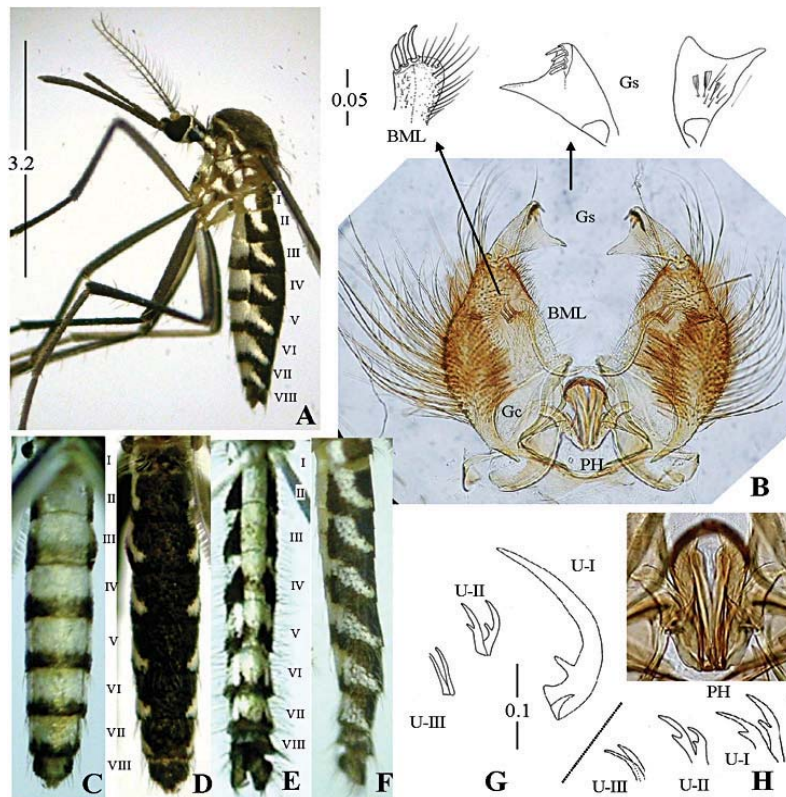


Figure 1. Adult female (A, C, D, H) and male (B, E, F, G) of *Armigeres (Leicesteria) longipalpis*. A, whole body (lateral aspect); B, genitalia (ventral aspect); C, E, abdominal sterna I – VIII (ventral aspect); D, abdominal terga I – VIII (dorsal aspect); F, abdominal terga I – VIII (lateral aspect); G, H, unguis I – III. BML, basal mesal lobe; Gc, gonocoxite; Gs gonostylus (both aspects); PH, phallosome; U-I, U-II and U-III, fore-, mid- and hindungues. Scales: mm.

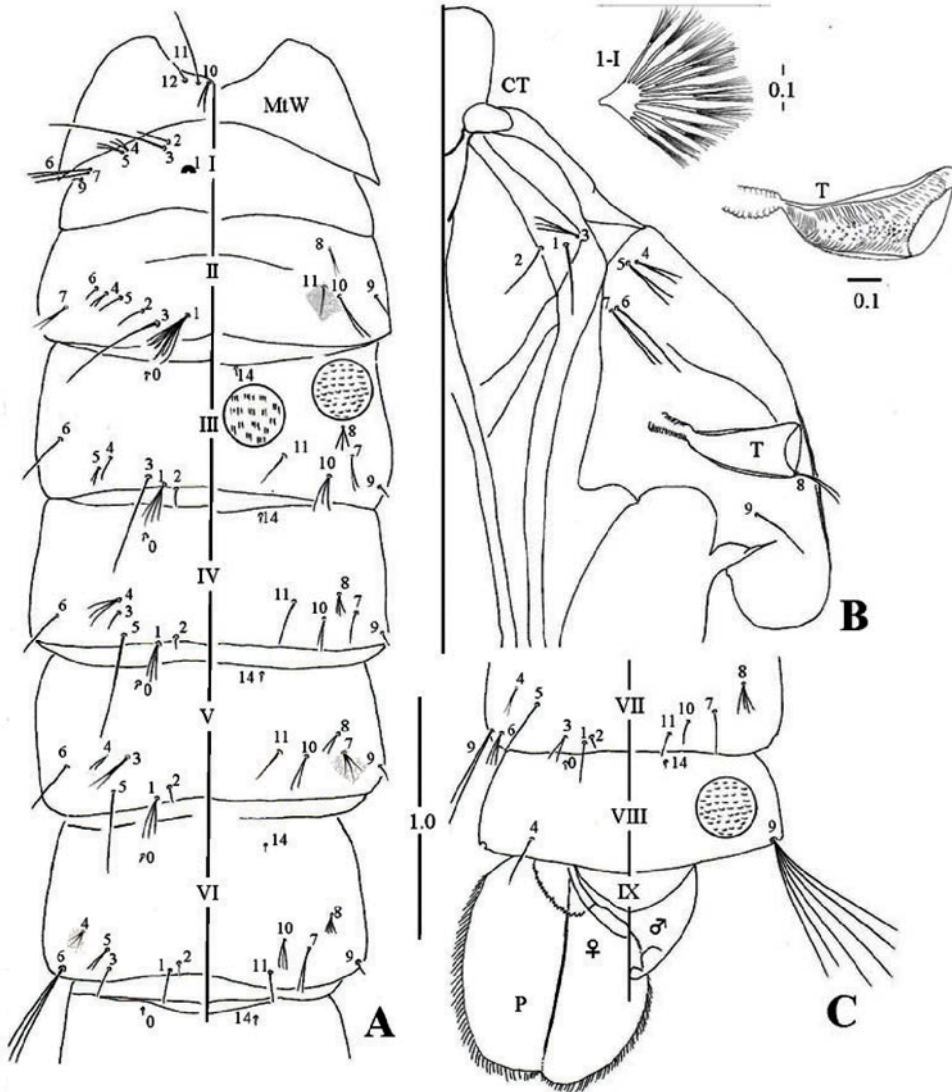


Figure 2. Pupa (exuvia) of *Armigeres (Leicestertia) longipalpis*. A, metathoracic wing (MtW) and abdominal segments I – VI (both aspects); B, part of cephalothorax (CT); C, abdominal segments VII – IX and paddle (P) (lateral aspect). 1-I, seta 1 on abdominal segment I; T, trumpet. Scales: mm.

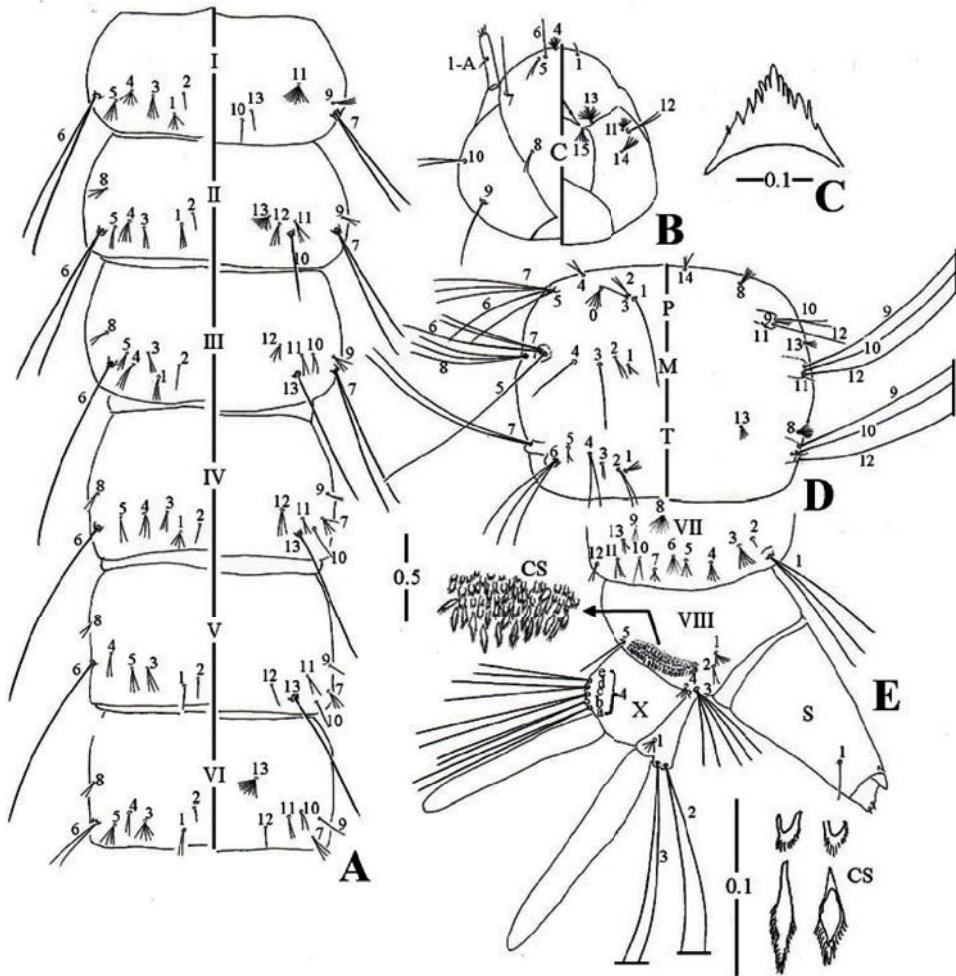


Figure 3. Fourth-instar larva of *Armigeres (Leicestertia) longipalpis*. A, abdominal segments I – VI (both aspects); B, head (both aspects); C, dorsoscutum (ventral aspect); D, thorax (both aspects); E, abdominal segments VII, VIII, X and siphon (S) (lateral aspect). CS, comb scales. Scales: mm.

ca 2.50 mm, foretibia 2.25 mm, foretarsus I 1.35 mm, II 0.75 mm, III 0.5 mm, IV 0.32 mm, V 0.27 mm. All ungues as in Fig. 1H; foreungues (U-I) and midungues (U-II) with submedian teeth; hindungues (U-III) small, simple. *Wing*: Length ca 3.50 mm. Cell R_2 ca 1.5 times the length of its stem; alula with a row of small scales; upper calypter with a row of hair-like scales; halter, capitellum dark, scabellum light in colour. *Abdomen*: Length ca 3.50 mm; sterna (Fig. 1C), I, II white to light yellow; III – VII white basally with black apical band, VIII mostly white scaled; terga (Fig. 1D), I blackish with many yellowish setae dorsolaterally; lateral white markings on terga II – VII curved obliquely to the dorsum, forming dorsal subapical pale band on each segment, the pale band usually interrupted dorsally without lateral yellow brown scales (Fig. 1A, D).

Male (Fig. 1B, E, F, G) – Resembles the female except in the following characters. *Head*: Proboscis, ca 2.50 mm with a line of dull pale scale on underside reaching from base to near tip. Palpus dark, ca 2.1 mm, little longer than proboscis, 1st segment as long as 2nd segment, junction of the segments white faintly; 2nd and 3rd with 2 or 3 well developed setae. Antenna little shorter than proboscis and maxillary palpus. *Thorax*: Pleural patches more conspicuous than those of female. *Abdomen*: Ornamentation as in female but with many pale and dark setae on lateral and dorsal parts of all segments (Fig. 1E, F). *Legs*: Foretarsus IV apparently shorter than V. Foreungues (U-I) large, unequal in size, the larger one with submedian small tooth, the other very small, obsolete; midungues small (U-II), equal, both with small submedian tooth; hindungues (U-III) smallest, equal in size, without submedian tooth (Fig. 1G). *Wing*: Length ca 3.6 mm. *Genitalia* (Fig. 1B): Tergum IX with apical area partly sclerotized and divided into two lobes by a shallow U shaped depression with 7 – 10 fine setae on each lobe. Sternum IX broad with many scales entirely and with 20 – 25 fine setae on apical margin. Gonocoxite (Gc): broad, tapering at base, 1.57 as long as its breadth at center, with dense longitudinal patch of scales ventrally and with many long setae laterally. Basal mesal lobe (BML): finger-like with a row of 3 graded blunt spines on outer apical margin and with many fine setae on inner lateral margin. Gonostylus (Gs): triangular in shape with 3 or 4 spines on dorsal corner and with few small scales and setae on central surface. Phallosome (PH) oval in shape, with crenulated apical margin.

Pupa (Fig. 2, Table 1) – *Cephalothorax* (Fig. 2B): Yellow to light brown pigmentation. Trumpet (T), 0.45 mm, index ca 2.5. Setae 1-CT single longer than others. *Abdomen*: Length ca 5.0 mm; very fine imbricative spicules laterally on segments II – VIII and very fine needle-like spicules on segments II – IV ventrocentrally (Fig. 2A, C); seta 1-I long, fanlike with 8 – 13 main branches; 1-II conspicuous with 7 – 30 branches; 3-II, III and 5-IV, V long, single; seta 6-VI long

Table 1. Numbers of branches for pupae of *Ar. longipalpis* (Leicester).

Seta No	Cephalo-thorax	Abdominal segments							
		I	II	III	IV	V	VI	VII	VIII
0	-	-	-	1	1	1	1	1	1
1	1	M+	7-30	4-8	3-8	3-5	1-5	1, 2	-
2	1, 2	1	1	1	1	1	1	1	-
3	3-5	1	1*	1*	1-3	2-7	1, 2	1-3	-
4	2-4	2-5	1-6	1-3	3-7	2-5	2, 3	1, 2	1, 2
5	1-4	1, 2	1-6	1-3	1*	1*	1-4*	1, 2	-
6	1	1-3	1-6	1-4	1-4	1-3	1-3	2-4	-
7	1-3	1-5	2-5	1-7	1-5	3-5	1-5	1-3	-
8	2-4	-	2	2-4	2-5	2-4	2-4	2-6	-
9	1	1, 2	1	1	1	1	1	2-6*	6-9*
10	2-4	-	1-4	1-3	1, 2	1, 2	1-3	1, 2	-
11	1	-	1	1	1	1	1	1-5	-
12	1, 2	-	-	-	-	-	-	-	-
14	-	-	-	1	1	1	1	1	1

+ dendritic with many branches. *long, weakly aciculated
 Obsolete and missing setae are shown with a hyphen (-).
 Specimens examined: 4 pupal exuviae from Bario and Bakelalan, Sarawak.

Table 2. Numbers of branches for fourth-instar larvae of *Ar. longipalpis* (Leicester).

Seta No	Head	Thorax			Abdominal segments								
		P	M	T	I	II	III	IV	V	VI	VII	VIII	
0	-	5-7	-	-	-	-	-	-	-	-	-	-	-
1	1	1	3-5	2-6	2-6	2-5	4-6	3-6	2	2	2, 3*	5-20	-
2	-	2, 3	1-3	2, 3	1, 2	1	1, 2	1, 2	1	1	1	1-4	-
3	-	1-3	1, 2	2-4	3-7	2-4	2-4	2-4	3-9	2	4-6	3-8*	-
4	8-16	2-4	1, 2	2, 3	4-13	4-12	2-4	2-4	2	3	2-5	2-4	-
5	2	1*	1*	1-3	3-5	1-4	2-4	2, 3	3-5	2-6	3-6	1*	-
6	1	1*	1, 2*	2-5*	2-5*	2*	1*	1, 2*	1, 2*	2, 2*	5-10	-	-
7	1, 2	3-8	2-4*	2-5*	2-4*	1, 2*	1, 2*	4-7	3-7	3-7	3-9	1-X=4-8	-
8	1-3	3-8*	2, 3	10-20	-	3-6	2, 3	2, 3	2-4	2-5	11-15	-	-
9	1	1-3	1, 2*	1*	3, 4	2-4	1-5	2-4	1-4	1-5	4-12	2-X=2*	-
10	1-3	1, 2	1, 2*	1*	1, 2	1, 2	2-4	1-4	2, 3	2-4	2, 3	-	-
11	7, 8	1	1, 2	1	10-14	3-6	2-4	2-4	2-4	2-5	6-13	3-X=1, 2*	-
12	2-5	1	1, 2*	1, 2*	-	2-6	2-4	2-4	1-3	1, 2	2-4	-	-
13	10-18	-	11-21	6-10	1, 2	10-14	1	1*	1*	9-16	10-18	4-X=10, 11*	-
14	5-7	2-4	-	-	-	-	-	-	-	-	-	-	-
15	5-9	-	-	-	-	-	-	-	-	-	-	-	-

*long, weakly aciculated.
 Obsolete and missing setae are shown with a hyphen (-).
 Specimens examined: 5 fourth-stage larvae from Bario and Bakelalan, Sarawak.

with 1 – 3 branches; 9-VII long with 2 – 6 aciculate branches, 9-VIII long with 6 – 9 aciculate branches. *Paddle* (P): Length ca 0.95 mm, lightly pigmented except at base, with midrib from base to apex and with marginal filamentous spicules; seta 1-P usually obsolete, if present single, very fine. *Genital lobe*: Extending to ca 0.47 of paddle in male, to ca 0.29 of paddle in female.

Fourth-instar larva (Fig. 3, Table 2) – *Head* (Fig. 3B): Ca 1.13 mm, slightly shorter than the width; light yellow-brown in colour; dorsomentum (Fig. 3C) with a strong median tooth and with 6 or 7 teeth on each side. Seta 1-C small, single, tapering; 9-C long, single, stronger than the others. *Antenna*: Integument smooth, yellow in colour, length ca 0.27 of head; shaft about the same breadth from base to apex, seta 1-A single at 0.5 from base. *Thorax* (Fig. 3D): Seta 1-P long, single; 3-M single or double, shorter than 1-P; 5-M long, single; 8-M long, 2, 3 branched; 9, 10, 12-M long, single or double; 7-T long, 2 – 5 branched; 9, 10-T long, single. All these setae more or less aciculated. *Abdomen* (Fig. 3 A, E): All segments without ventral patch of fine spicules. Setae 1-I weak with 2 – 6 branches; 6-I, II large, usually double; 6-III large, single; 6-IV large, single or double; 7-I long, 2 – 4 branched; 7-II large, single or double; 13-III – V large, single; 1-VII large, 2 or 3 branched; 3-VIII well developed with 3 – 8 branches. All these large setae more or less aciculated and arising from small lightly sclerotized plates or tubercles. Comb (CS) of 70 – 80 fringed scales including 2 types, the distal scales larger with central sharp-pointed spine and the basal scales smaller rounded with uniform fringes. Saddle incomplete, pigmented brown; anal papilla long-oval with rounded apices. Siphon: Length variable, 0.89 – 0.97 mm, index 1.4 – 1.5; seta 1-S usually single or double, arising about 0.20 from apical end.

TAXONOMIC DISCUSSION

Although the subgenera *Armigeres* and *Leicesteria* of the genus *Armigeres* are easily distinguished in the adult stages, reliable separations of the pupal and larval stages are not known [3, 10].

Armigeres longipalpis is characterized as follows: In adult, thorax is not strongly produced over head in lateral view; clypeus has several pale scales; lateral white markings on terga II – VII curved to the dorsum but do not join to form complete bands without additional distinct lateral yellow brown scales; all legs are dark without pale rings; foretarsus IV is apparently shorter than V in male. Male genitalia is unique in conical gonocoxite with dense patch of scales and setae; in triangular gonostylus with 3 or 4 dorsoapical spines and with few fine scales and setae on central part; basal mesal lobe has a row of 3 graded spines and many marginal setae on apical margin. In general appearance, the female of *Ar. longipalpis* somewhat resembles *Armigeres (Leicesteria) digitatus* (Edwards), but

its clypeus is bare and palpus is 2/3 length of proboscis [3, 5]. The larva and pupa of this species are very similar to those of *Armigeres (Leicesteria) annulipalpis* (Theobald) [2]. The larva differs in the shapes of comb scales and number of branches in setae 6, 7-II, III and abdominal seta 5-VIII. There are no reliable distinguishing characters for the pupal stage.

Biological notes

The larvae of *Ar. longipalpis* were found in green living bamboo stumps and splits in bamboo forest in Bario, Ba'Kelalan, Matang National Park, Sarawak. Nothing is known of the biting habits.

Distribution

Malaysia (Selangor and Sarawak), Indonesia, Thailand, Cambodia, Laos, Vietnam, India.

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