

## FURTHER NOTES ON *MACROMIA* RAMBUR FROM HONG KONG, WITH DESCRIPTIONS OF THE LARVAE (ANISOPTERA: CORDULIIDAE)

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*Received December 20, 1995 / Reviewed and Accepted February 13, 1996*

The larvae of *M. urania* Ris, *M. berlandi* Lieft. and *M. katae* Wilson are described and illustrated; those of the latter 2 spp. for the first time. Details of habitat preferences and biological notes are provided.

### INTRODUCTION

The adults of the 3 *Macromia* species known from Hong Kong were treated in detail by WILSON (1993). They are *M. berlandi* Lieftinck, 1941, *M. katae* Wilson, 1993, and *M. urania* Ris, 1916. Descriptions of their last instar larvae are given in this paper. They were bred out for confirmation of identity. The larvae of *M. berlandi* and *M. katae* have not previously been described. All three *Macromia* species can be found in the streams which drain Hong Kong's Sha Lo Tung basin where each species occupies a distinct habitat type. Details of habitat preferences and biological notes are provided.

### *MACROMIA BERLANDI* LIEFTINCK

Figures 1-7

*Macromia borneensis* Martin, 1906: 69, fig. A: 1 ♂, Tonkin.

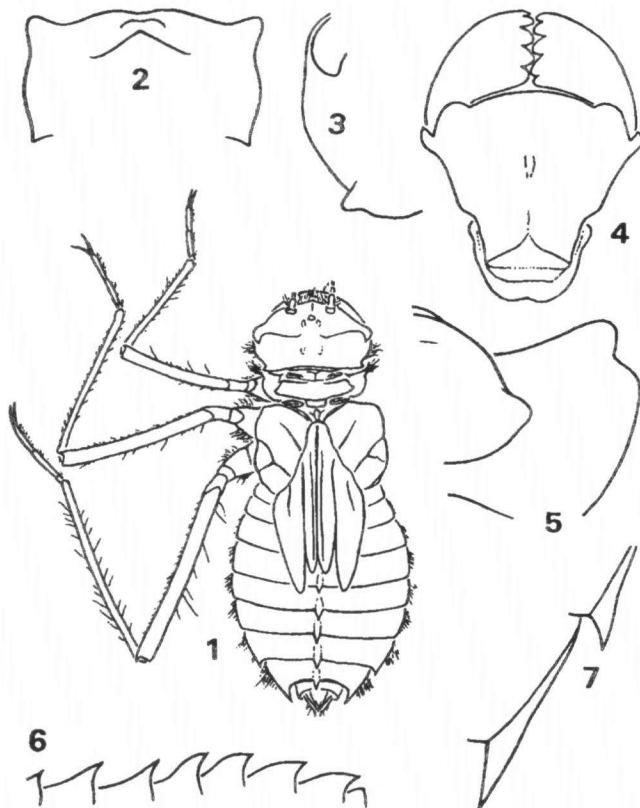
*Macromia berlandi* Lieftinck, 1941: 94-98, figs 1(a, c): 1 ♂, type-loc. Tonkin;  
Wilson, 1993: 235-237, figs 1-5: 1 ♂, Sha Lo Tung, 20-VI-1992; – Do., 26-VI-1992;  
Wilson, 1995: 31 (key), 134-135 (photo's; ♂, ♀, larva), 139, 141, 143: Hong Kong.

**Material.** – 2 larvae, Sha Lo Tung, Hong Kong, 8-V-1993 (1 ♀, 1 ♂, emerged 11-V-1993 and 18-V-1993), 4 larvae, s. l., 27-II-1995 (1 ♂, emerged 26-IV-1995, 2 ♂, emerged May 1995); 1 ♂, s. l.,

24-VI-1995, 2 ♂, s. l., 25-VI-1995, 1 ♀, s. l., 2-VII-1995; 1 ♀ (teneral), Sham Tseng Settlement Basin, Hong Kong. 2-VII-1994.

**DESCRIPTION OF LARVA.** – **D i m e n s i o n s** (in mm): Total length 26.0-29.0, greatest width of head 7.0-7.3, length of metafemur 11.7-12.1, length of abdomen 17.0-18.5, greatest width 10.4-11.0.

**H e a d** (Figs 1-4). – Wide, with eyes slightly protruding laterally and dorsally. Postocular lobes widely rounded and with small posterolateral tooth. Frontal shelf low, obtusely angulated as seen in frontal aspect. Prementum markedly wider than long, with margin of ligula widely rounded, smooth, and set with short thin setae more laterally, and short spinoid setae more medially; labial palps with 7 teeth bearing large spinoid setae; 4 palpal setae, 1 seta of moderate size at base of palp; 3-4 pairs of large (primary) premental setae, 2 pairs of small (secondary) premental



Figs 1-7. *Macromia berlandi* Lieftinck, last instar larva: (1) dorsal aspect; – (2) head, frontal aspect; – (3) postocular lobe; – (4) labium, ventral aspect; – (5) prothoracic processes and notal lobe; – (6) middorsal abdominal spines, lateral aspect; – (7) lateral spines of abdominal segments 8 and 9, ventral aspect.

setae, the two groups widely separated; numerous minute spinoid setae.

**T h o r a x** (Figs 1, 5). – Prothorax slightly narrower than head; lateral prothoracic processes poorly differentiated, anterior process a narrow lobe, posterior process widely rounded; notal lobe widely rounded anterolaterally, narrowly rounded to obtusely pointed posterolaterally. Synthorax wider than head. Legs with hairs and small spines; profemur slightly shorter than width of head, markedly shorter than width of synthorax. Wing sheaths reaching to or slightly beyond end of abdominal segment 5.

**A b d o m e n** (Figs 1, 6, 7). – About 1.5 times as wide as head; middorsal spines on segments 3-9, those on segments 3-5 rather slim and straight, those on segments 6-9 rather stout and more or less hooked; lateral spines on segments 8 and 9, those on 9 rather straight and about twice as long as those on 8.

### MACROMIA KATAE WILSON

Figures 8-14

*Macromia katae* Wilson, 1993: 237-240, figs 11-17: Holotype ♂, Sha Lo Tung, Hong Kong, 3-VII-1992; Wilson, 1995: 31 (key), 130-131 (photo's; ♂, ♀, larva), 139, 143, 145: Hong Kong.

**M a t e r i a l.** – 1 exuviae, Sha Lo Tung, Hong Kong, 16-V-1992, 1 exuviae, s. l., 5-VI-1992, 1 larva, s. l., 8-V-1993 (emerged VI-1993), 1 larva, s. l., 27-II-1995, 4 larvae, s. l., 1-XI-1995; 3 ♀, Wu Kau Tang, Hong Kong, 31-V-1993.

**DESCRIPTION OF LARVA.** – **D i m e n s i o n s** (in mm): Total length 21.0-23.5, greatest width of head 6.2-6.8, length of metafemur 10.2-10.9, length of abdomen 13.0-14.0, greatest width 8.2-8.7.

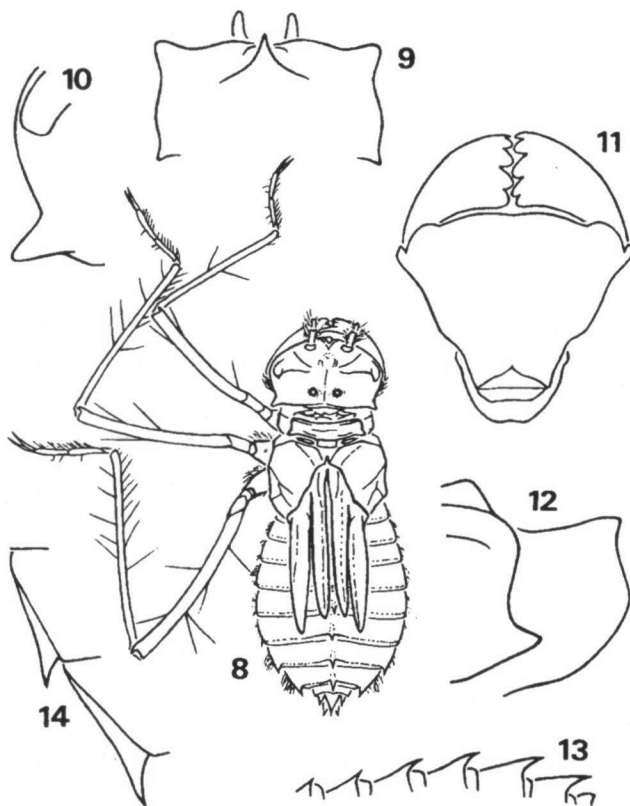
**H e a d** (Figs 8-11). – Wide, with eyes slightly protruding laterally and dorsally. Postocular lobes widely rounded, with narrow upright cone near midline and with large posterolateral tooth. Frontal shelf high, acutely conical as seen in frontal aspect. Prementum markedly wider than long, with margin of ligula very widely rounded to almost slightly bilobed, smooth, and set with short thin setae more laterally, and short spinoid setae more medially; labial palps with 6-7 teeth bearing large spinoid setae; 5 palpal setae, 1 very small seta at base of palp; 5 pairs of large (primary) premental setae, 2-3 pairs of small (secondary) premental setae, the two groups not more widely separated than the individual secondary setae from each other; numerous minute spinoid setae.

**T h o r a x** (Figs 8, 12). – Prothorax slightly narrower than head; lateral prothoracic processes hardly differentiated, anterior process a small angular lobe, posterior process widely rounded; notal lobe slightly rounded anterolaterally, distinctly pointed to horn-like posterolaterally. Synthorax as wide as head. Legs long and spiny; profemur longer than width of head or thorax. Wing sheaths reaching close to end of abdominal segment 7.

**A b d o m e n** (Figs 8, 13, 14). – About 1.3 times as wide as head; middorsal

spines on segment 4-9, all rather straight and slim, those on segments 4 and 5 short, those on segments 6-9 rather long; lateral spines on segments 8 and 9, those on 9 less than twice as long as those on 8.

DISCUSSION. – The closest congener of *Macromia katae* is *M. arachnomima* Lief-tinck. Both the larva and adult of *M. arachnomima* were described and illustrated by LIEFTINCK (1953) who remarked that, this new species [...] “is not closely allied to any of its congeners”. He further remarked that [...] he [...] “was at first quite unable to recognize as belonging to any known genus. The excessively long wings and enormous legs of this strange form were reminiscent of some large spider or opilionid and did not seem to foreshadow the proportions these parts have in any of the known species of *Macromia*; the curious tubercles on the head and the stiff spiny bristles on the femora being additional ornamentations found in places where



Figs 8-14. *Macromia katae* Wilson, last instar larva: (8) dorsal aspect; – (9) head, frontal aspect; – (10) postocular lobe; – (11) labium, ventral aspect; – (12) prothoracic processes and notal lobe; – (13) middorsal abdominal spines, lateral aspect; – (14) lateral spines of abdominal segments 8 and 9, ventral aspect.

no such outgrowths would normally be expected". Although appreciably larger, *M. katae* is clearly very closely related to *arachnomima*, with the same stream habitat preference and similar larval and adult forms. The larvae of both species possess a pair of cones or tubercles on the vertex near the midline and a frontal horn. The frontal horn of *M. arachnomima* apparently projects from between the antennae in a forward direction whereas the frontal projection of *M. katae* is sharply angled upward (see Fig. 9) (cf. LIEFTINCK, 1953: 404, figs 7a, 7b). Adults of the two species have been compared at the Leiden Museum where Dr van Tol has confirmed their distinctness at species level. Of the world's 117 species of *Macromia* listed by BRIDGES (1994), apparently only *M. arachnomima* and *M. katae* belong to the highly specialized *M. arachnomima* group.

### MACROMIA URANIA RIS

Figures 15-21

*Macromia urania* Ris, 1916: 66, 68-70, figs 42-43 & pl. 3, fig. 2-3: 2 ♂, 1 ♀, type-loc. Tonkin; Wilson, 1993: 236-237, figs 6-10: 3 teneral ♀, Tai Tong (emerged VI-1992 from final instar larvae collected 24-VI-1992); 1 ♂, Ping Yeung, 30-V-1992; 1 ♀, Sha Lo Tung, 14-VI-1992; Wilson, 1995: 31 (key), 132-133 (photo's; ♂, ♀, larva), 139, 141: Hong Kong.

**Material.** – 1 ♂, Sha Lo Tung, Hong Kong, 24-VI-1995, 3 ♂, s. l., 2-VII-1995, 4 larvae, s. l., 1-XI-1995; 1 ♀, She Shan, Hong Kong, 15-V-1993; 3 larvae, Tai Tong, Hong Kong, 24-V-1992, 4 exuviae s. l., 24-IV-1992, 3 larvae, s. l., 13-V-1995.

The larva of *Macromia urania* has previously been described by ISHIDA (1969) and is illustrated in KAWAI (1985: 91, key 92, figs 1a-e). MATSUKI & LIEN (1982: 19) have provided a larval key for the three Taiwanese *Macromia* species which include *M. chui* Asahina, *M. clio* Ris and *M. urania*. The larva of *M. urania* from Hong Kong does not differ significantly from larvae of *M. urania* from Japan. It is described here for comparison with the other two species of *Macromia* from Hong Kong.

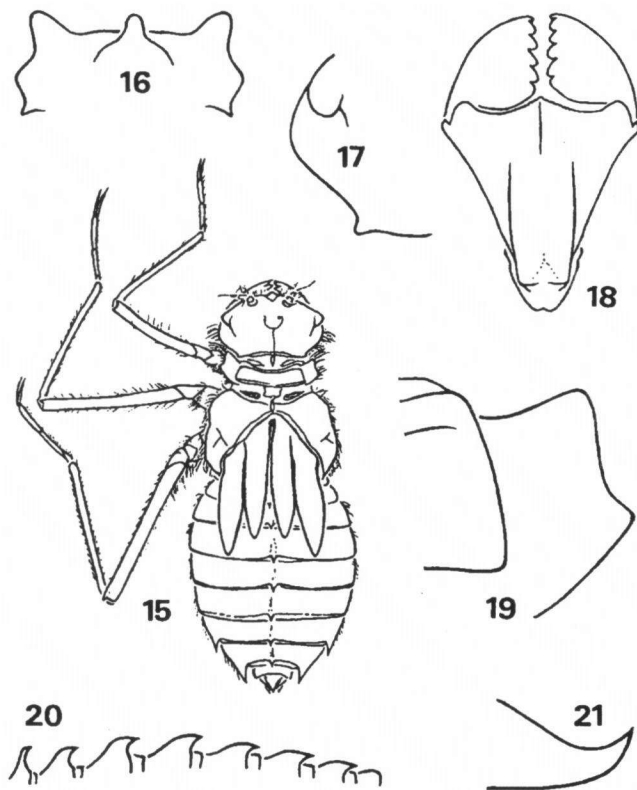
**DESCRIPTION OF LARVA.** – **D i m e n s i o n s** (in mm): Total length 21.5-23.5, greatest width of head 5.8-6.1, length of metafemur 8.7-9.3, length of abdomen 13.5-14.5, greatest width 8.0-8.8.

**H e a d** (Figs 15-18). – Moderately wide, with eyes strongly protruding dorsally. Postocular lobes narrowly rounded and with very small posterolateral tooth. Frontal shelf high, rather narrow and apically rounded as seen in frontal aspect. Prementum hardly wider than long; three well developed ventral longitudinal keels, one anteromedial and two posterolateral; margin of ligula angulated, crenulate, and set with short thin setae more laterally, and short spinoid setae more medially; labial palps with 7 teeth bearing large spinoid setae; 5 palpal setae, 1 seta of moderate size at base of palp; 6 pairs of large (primary) premental setae, 2 pairs of small (secondary) premental setae, the two groups not more widely separated than

the individual secondary setae from each other; numerous minute spinoid setae.

**T h o r a x** (Figs 15, 19). – Prothorax about as wide as head; lateral prothoracic processes poorly differentiated, anterior process a larger angular lobe, posterior process a smaller angular lobe; notal lobe not differentiated, almost rectangular. Synthorax wider than head. Legs hairy; profemur shorter than width of head, markedly shorter than width of synthorax. Wing sheaths reaching approximately to end of abdominal segment 5. From an early instar until final instar distinctive diamond-shaped eye spots are located at the base of the wing sheaths. The eye spots are predominantly black with a smaller black bordered ferruginous orange spot occupying the inner half of the diamond. This feature is not easily discernible in specimens preserved in alcohol.

**A b d o m e n** (Figs 15, 20, 21). – Almost 1.5 times as wide as head; middorsal spines on segments 3-9, all rather hooked, spine on segment 3 high and slim, re-



Figs 15-21. *Macromia urania* Ris, last instar larva: (15) dorsal aspect; – (16) head, frontal aspect; – (17) postocular lobe; – (18) labium, ventral aspect; – (19) prothoracic processes and notal lobe; – (20) middorsal abdominal spines, lateral aspect; – (21) lateral spine of abdominal segment 9, lateral aspect.

maining spines rather low and stout; lateral spines on segments 8 and 9, spine on 9 with tip strongly upcurved.

**HABITAT PREFERENCES.** – None of Hong Kong's three *Macromia* species have been found in boulder streams with high torrential flows, which is the dominant habitat in Hong Kong's mountainous terrain. Larvae were collected only from small wooded, or partially wooded streams, 3-6 m wide, with shallow gradients and substrates dominated by coarse sand. Although subjected to torrential flows during heavy rain fall periods in Hong Kong's May to October wet season, the mean current speeds of these streams are low.

Larvae of *Macromia berlandi* are restricted to slow flowing stream sections in pools and slacks and are found on substrates comprised of muddy sand.

Larvae of *Macromia katae* are not found in or on bottom substrates of any kind but are exclusively associated with submerged roots in water with moderate or fast flow. The majority of larvae were taken from tree roots but one specimen was taken from the roots of ginger lily, *Hedychium coronarium* Koen. Larvae transferred to tanks for observation and breeding out adopt a vertical position clinging to plant stems, sticks and matting. The long spines on the legs of *M. katae* are no doubt of assistance to the larva in maintaining its position attached to tree roots in fast currents.

Larvae of *Macromia urania* prefer relatively fast flowing water and are found on the substrate surface of sandy reaches in moderately fast runs, in sandy gravel, and at stream margins with sand, gravel, leaves and root material.

**BIOLOGICAL NOTES.** – In Hong Kong the adults of all three *Macromia* species emerge from late May to July, with peak activity occurring in June and early July. The beginning of the emergence period coincides with the commencement of the wet season and the marked increase in mean temperatures.

The habitat preference of the larvae is a reflection of the males' choice of territories and the oviposition sites used by the females.

Mature *Macromia urania* males are the first of the three *Macromia* species to arrive at the stream at approximately 07:30 h in the morning. Their patrols are 5-15 m long and centered over gravel riffles sections. The first author has observed *M. urania* ovipositing at three sites in Hong Kong (Tai Tong, She Shan and Sha Lo Tung) and one in Guangdong (Dinghu Shan), all during the morning. The sites adopted for oviposition were gravel riffles. The eggs are dislodged by making brief contact with the water surface. Male territorial activity is much reduced after 10:00 h.

Mature *Macromia berlandi* males arrive at the stream from approximately 09:00 h, and territorial activity is reduced after 10:00 h. The patrols of the males are longer than *M. urania* beats and include entire slow flowing stream sections, which occur between riffles, above weirs and natural stream impoundments such as fallen trees. The lengths of patrols and slow flowing sections measure up to 20 m at Sha Lo Tung where observations of *M. berlandi* were made. Oviposition occurs, immediately after pairing, in the slow flowing sections.

The males of *Macromia katae* are last to arrive at the stream, with highest activity observed from 09:30 to 11:00 h. Oviposition occurs at the stream margin with eggs dropped over thick mats of submerged tree roots.

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