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NOTES ON CHLOROGOMPHIDAE FROM SOUTHERN CHINA, WITH DESCRIPTIONS OF TWO NEW SPECIES (ANISOPTERA)

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Chlorogomphus shanicus sp. n. and *Chloropetalia soarer* sp. n. are described and illustrated from north Guangdong, China. *Chlorogomphus icarus* Wilson & Reels is synonymised with *C. usudai* Ishida and *C. papilio* Ris is illustrated.

INTRODUCTION

Considerable information regarding chlorogomphid dragonflies has been gathered in recent years from Chinese territory and neighbouring Vietnam. After a long gap, following CHEN's (1950) descriptions of two new species from Taiwan, several new Chinese species descriptions have been provided by KARUBE (1995a; 2001), ISHIDA (1996), CHAO (1999) and WILSON & REELS (2001). KARUBE (1995b) also described six new species from Thailand and Indo-China including four from north Vietnam, one from Thailand and one from Laos. Later, in the same year, ASAHINA (1995) described two new species from northern Vietnam. Two further species descriptions are provided here from material gathered from the mountainous areas of northern Guangdong. The opportunity is also taken to synonymise the recently described *Chlorogomphus icarus* Wilson & Reels with *C. usudai* Ishida and illustrate the little known *C. papilio*. CARLE (1995) has also spurred an interest in the Chlorogomphidae following his establishment of the Chloropetalinae and new combination of Chlorogomphinae, and creation of three chlorogomphine tribes, containing seven genera of which five were newly established.

CHLOROGOMPHUS (AURORACHLORUS) PAPILIO RIS, 1927

Figures 1-10

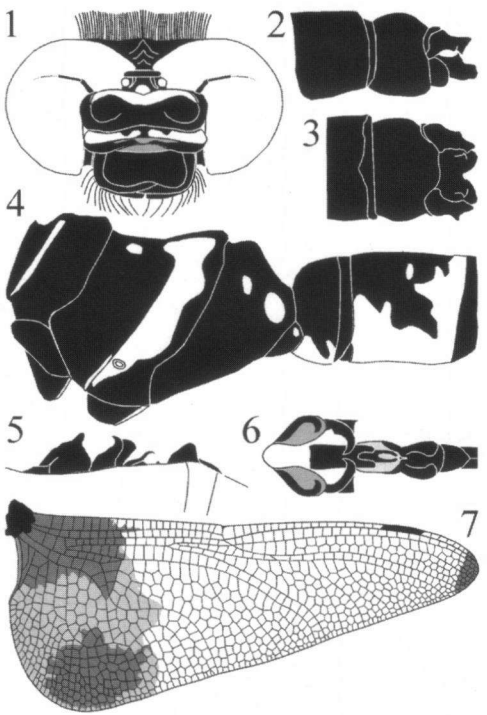
Chlorogomphus papilio: RIS, 1927: 103-105, fig. 1, (♀, Lien-Ping, Guangdong); NEEDHAM, 1930: 95-96, pl.10, fig. 4a, 4b (Sichuan and Guangxi); CHEN, 1950: 138, 146-147, figs 1, 13, (Fujian).

Aurorachlorus papilio: CARLE, 1995: 391; CHAO, 1999: 4.

Material. – 3 ♂, Mulun, Guangxi, 21-VII-1998, leg. G.T. Reels; 1 ♀, Dadingshan, Guangdong, 30-VI-2000, coll. B. Hau; 1 ♂, do, 1-VII-2000, G.T. Reels leg.; 1 ♀, Longtanjiao, Guangdong, 2-VII-2000, coll. K.D.P. Wilson; 2 ♂, Dadongshan, Guangdong, 6-VII-2000, coll. K.D.P. Wilson.

DISTRIBUTION. – China (Fujian, Guangdong, Guangxi, and Sichuan).

Measurements (mm). – ♂ abd. + app. 67.0-68.0, hw. 60.0-64.0; ♀ abd. + app. 59.0-61.0, hw. 67.0-72.0.



Figs 1-7. *Chlorogomphus papilio*, ♂, Guangdong: (1) head, frontal; – (2) caudal genitalia, lateral; – (3) caudal genitalia, dorsal; – (4) synthorax, lateral; – (5) secondary genitalia, lateral; – (6) secondary genitalia, ventral, – (7) hind wing.

REMARKS. – Surprisingly, for such a large and colourful dragonfly, few illustrations are available for this charismatic insect. Drawings of the head, synthorax, secondary and caudal genitalia for both male and females are provided in Figures 1-7 & 8-9. The female possesses extremely broad hind wings (31-33 mm). Both males and females possess partly coloured wings, heavily pigmented with blackish brown basally and at the extreme tips. There are also additional areas of creamish white basally, as shown for hind wings in Figures 7 and 10.

CHLOROGOMPHUS (SINOROGOMPHUS) SHANICUS SP. NOV.

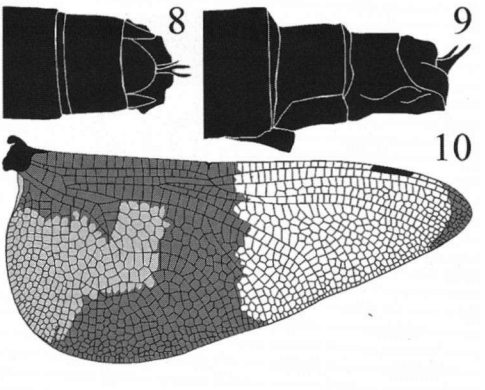
Figures 11-25

Material. – **Holotype**: ♂, Henglongbei (Ba Bao Shan), N Guangdong, 28-VI-2000, coll. K.D.P. Wilson. – **Paratype**: 1 ♀, Henglongbei (Ba Bao Shan), N Guangdong, 28-VI-2000, coll.

K.D.P. Wilson. – Additional material: 1 ♀, NW Guangdong, 30-IV-1998, G.T. Reels leg.; 1 ♀, Dadingshan, N Guangdong, 30--VI-2000, B. Hau leg. – Holotype will be deposited at Tai Lung Experimental Station, Agriculture, Fisheries and Conservation Department, Lin Tong Mei, Sheung Shui, Hong Kong SAR, China.

Etymology. – Named from the Cantonese 'shan', meaning mountain.

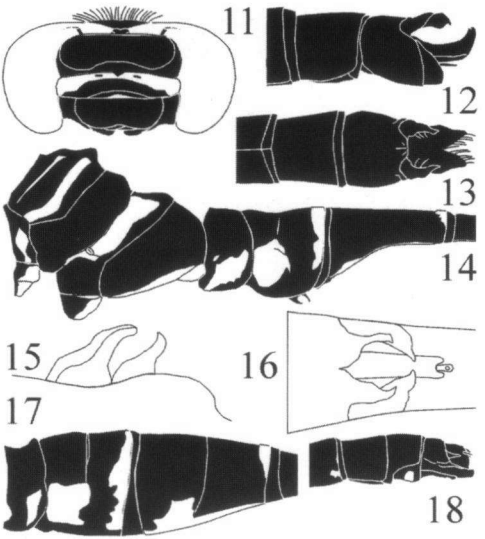
A clear winged species with broadly protruding frons and broad, dog-legged antehumeral stripe.



Figs 8-10. *Chlorogomphus papilio*, ♀, Guangdong: – (8) caudal genitalia, dorsal; – (9) caudal genitalia, lateral; – (10) hind wing.

MALE. – Labium pale, brownish yellow. Labrum shiny black. Anteclypeus black. Postclypeus bright lemon yellow, finely bordered black, with central triangular-shaped black spot at upper border and a pair of small centralized dark brown, rectangular, indented spots (Fig. 11). Face of frons black with central 3/5ths forming a broad, shallow protrusion. Upper frons black with narrow, lower lip-shaped, yellow, frontal crest occupying about central three-quarters width of frons. Vertex black and raised to form a pyramidal protuberance which has two tiny narrowly and shallowly divided peaks. Occiput raised with thick fringe of long hairs. Prothorax black. Coxae black with posterior, outer face yellow. Synthorax black with narrow dorsal stripe, narrowly pointed towards head and expanded to form oval, truncate edged tip below wings. Broad, yellow antehumeral stripe, which does not extend to the black alar sinus and follows humeral suture, to form a dog-legged kink before ending at the mesokatepisternum (Fig. 14). Metepisternum with yellow stripe covering the spiracle and abruptly narrowing to follow line of suture with metakatepisternum, which is predominantly black. Metepimeron bordered yellow below and metaposternum yellow. Base of abdomen is illustrated in Figure 14. Abdominal segments 3-5 with narrow, yellow dorsal ring at posterior border invaded at dorsal carina. Segment 6 entirely black. Segment 7 with broad, yellow, distal ring, which extends to ventrum and occupies approximately 1/8 of segment length. Segments 8-10 black. Superior appendages with no extero-lateral spines. Inferior appendages extend well beyond superior appendages and are deeply indented, centrally to from a double pointed, m-shaped tip (Figs 12-13). Wings hyaline. Costa of wing with golden yellow line along upper leading edge. Anal field 7-8 cells.

FEMALE. – Much larger and bulkier than male with similar colour pattern. Vertex raised into prominent conical protuberance, narrowly divided as in male. Tiny additional yellow spot at upper margin of mesepimeron below wings. Similarly a larger yellow spot on the central upper margin of metepimeron below wings. Base of segment 2



Figs 11-18. *Chlorogomphus shanicus* sp. n., Henglongbei (Ba Bao Shan), north Guangdong: (11) ♂, head, frontal; – (12) ♂, caudal genitalia, lateral; – (13) ♂, caudal genitalia, dorsal; – (14) ♂, synthorax, lateral; – (15) ♂, secondary genitalia, lateral; – (16) ♂, secondary genitalia, ventral; – (17) ♀, basal abdomen, lateral; – (18) ♀, caudal abdomen, lateral.

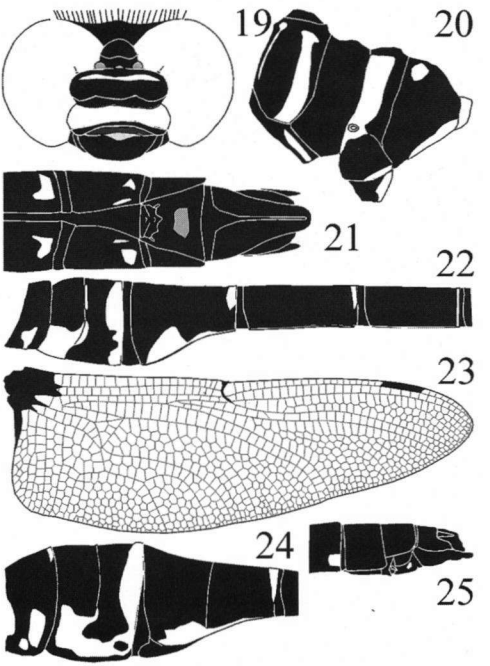
beset with thick tuft of long black hairs. Segment 6 with large posterior ring, occupying 1/4 length of segment and triangular-shaped at sides. Segment 7 with yellow spot at lower, lateral, posterior border and fine, yellow, vertical line above at lateral border. Pale orange yellow quadrate spot at centre of ventrum of ninth abdominal segment (Fig. 21). Wings hyaline with the exception of extreme bases which are enfumed dark brown not extending to arculus (Fig. 23).

Two of the three females were each obtained from different locations to the type male and paratype female from Henglongbei, although all material was obtained from northern Guangdong. The female from northwest Guangdong appears more or less identical (Figs 19-23) to the paratype female but there are slight differences in the basal abdominal colour pattern of the female obtained from Dadingshan, north Guangdong, which are illustrated in Figures 24-25. Notably the yellow colour pattern of the second abdominal segment is more extensive at the lower ventrum and an isolated round black spot is located at the distal ventral corner.

Measurements (mm). – ♂ abd. + app. 62.5, hw. 48.5; ♀ abd. + app. 71.0-73.0, hw. 59.0-60.0.

REMARKS. – Eight species belonging to CARLE's (1995) *Sinorogomphus* grouping are currently known from China. *Chlorogomphus shanicus* also belongs to this group. The other members include *kitawakii* KARUBE (1995a), *infuscatus* NEEDHAM (1930), *gracilis* WILSON & REELS (2001), *montanus* CHAO (1999), *suzukii* (Oguma) (see also CHEN, 1950), *nasutus* NEEDHAM (1930) (see also KARUBE, 1995b and ASAHINA, 1995), *tunti* NEEDHAM (1930) (see also KLOTS, 1947) and *urolobatus* CHEN (1950) (see also CHAO, 1999). *C. kitawakii* and *gracilis* are extremely fine, long bodied species with relatively small wings. *C. nasutus, suzukii, tunti* and *urolobatus* all possess superior appendages with prominent, stout, extero-lateral spines. These spines are absent in *shanicus*. Both *infuscatus* and *montanus* are known only from the females. According to NEEDHAM's (1930) description *C. infuscatus* has a wide and conspicuous bright yellow ring, trilobed at each side, covering the apical quarter of abdominal segment 7. The apical quarter of this segment in the female and male of *C.*

shanicus is predominantly black. Also Needham makes no mention of a vertex forming a large pyramidal process, which is conspicuously present in *shanicus*. NAVAS (1936) described a variety of *C. infuscatus* var. *holophea* from Zhejiang, with forewing tinted dark brown to beyond the nodus. The female *C. shanicus* is clear winged apart from slight invasion of dark brown at extreme base, which does not extend to arculus. *C. montanus* is probably the closest congener. It is separated by the colouration of its second abdominal segment, which is entirely yellow, latero-ventrally and the metepimeron and metaposternum, which are uniformly black. In *shanicus* the yellow area at the ventral half of the second abdominal segment is deeply invaded, centrally with black and the ventral margin of the metepimeron and metaposternum are yellow.



Figs 19-25. [19-23] ♀, *Chlorogomphus shanicus* sp. n., northwest Guangdong: (19) head, frontal; – (20) synthorax, lateral; – (21) caudal abdomen, ventral; – (22) basal abdomen, lateral; – (23) hind wing; – [24-25] ♀, Dadingshan, north Guangdong: (24) basal abdomen, lateral; – (25) caudal abdomen, lateral.

CHLOROGOMPHUS (OROGOMPHUS) USUDAI ISHIDA, 1996

Chlorogomphus usudai: ISHIDA, 1996: 51-54, figs 1-8, (♀, Hainan).
Chlorogomphus icarus: WILSON & REELS, 2001: 172-174, figs 69-75, (♂, ♀, Hainan), **syn. nov.**
Aurorachlorus usudai: CHAO, 1999: 4-5, (Hainan).

Unfortunately the authors, who recently described the male and female of this species from Hainan (WILSON & REELS, 2001), overlooked the original description, based on female material only, from Hainan Island. Although this oversight was discovered before the publication of *C. icarus*, it was nevertheless too late to amend the proofs. Accordingly, *C. icarus* is synonymised here with *C. usudai*.

ISHIDA (1996) considered *usudai* to be closely related to *C. brunneus* Oguma from Japan. Some features of the males are similar, such as tips of superior appendages, which possess a small apical notch in both species. However, *usudai* may not be closely related to *brunneus*. CARLE (1995) classified members of the Chlorogomphidae into

eight genera, contained in two subfamilies; the Chloropetaliinae Carle and Chlorogomphinae Selys. Carle considered *brunneus* to belong to *Orogomphus* Selys, whereas, according to CHAO (1999), *usudai* belongs to *Aurorachlorus* Carle. The genus *Aurorachlorus* is characterized, inter alia, by the presence of an anal loop with 28-35 cells (CARLE, 1995). If this classification were to be adopted then *usudai* belongs to *Aurorachlorus*, but according to the key provided by Carle, it belongs to *Orogomphus*. Although females of *usudai* have 28-35 cells it should be noted *usudai* males and *papilio* males, the type species of *Aurorachlorus*, have a lot fewer cells than 28-35 (Fig. 7).

There are many features of *usudai*, which are quite different from *A. papilio* Ris, notably the lack of an antehumeral stripe. The caudal appendages are much closer in form to *C. brevistigma* Oguma from Taiwan, which belongs to the *Orogomphus* grouping. Carle suggested that *Aurorachlorus* may be derived from *Orogomphus*. Indeed *usudai* appears to be intermediate between these two groupings, but closest to *Orogomphus*.

CHLOROPETALIA SOARER SP. NOV.

Figures 26-34

Material. – **Holotype** ♂, Dadingshan N Guangdong, 30-VI-2000, B. Hau leg. – **Paratypes**: 3 ♂, Dadingshan, N Guangdong, 30-VI-2000, B. Hau leg.; 1 ♂, 1 ♀, Xiaohuangshan (Ba Bao Shan), N Guangdong, 27-VI-2000, coll. K.D.P. Wilson; 1 ♂, do, 27-VI-2000, G.T. Reels, leg. – Holotype will be deposited at Tai Lung Experimental Station, Agriculture, Fisheries and Conservation Department, Lin Tong Mei, Sheung Shui, Hong Kong SAR, China.

Etymology. – Named from the English 'soar' meaning to rise, fly, or glide high and with little apparent effort.

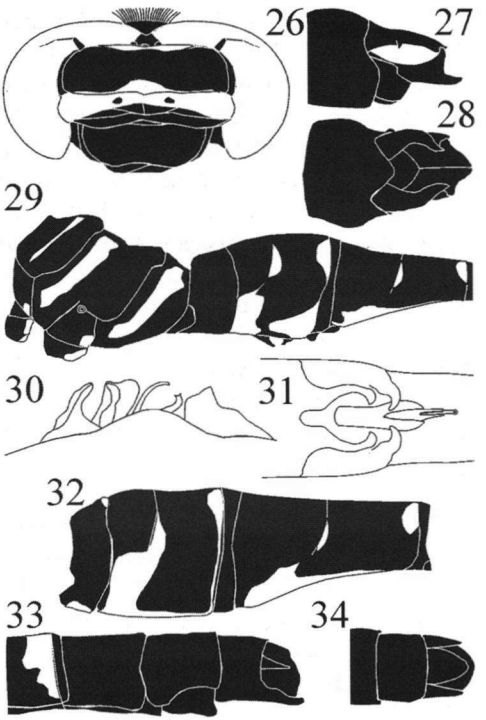
A clear winged species with single wedge-shaped dorsal stripe and protruding frons.

MALE. – Labium, a golden creamy yellow. Front of head is illustrated in Figure 26. Labrum black. Anteclypeus black. Postclypeus yellow, finely bordered black distally. Face of frons black, with central quarter, distinctly protruding and base finely bordered yellow, expanded centrally. Top of frons predominantly black with central, yellow, lower lip-shaped crest occupying about half width of frons. Vertex black raised into small rounded protuberance. Occiput raised with thick fringe of long hairs. Prothorax black with fine, pale, creamy orange border at margin of anterior dorsal lobe. Synthorax black with yellow, wedge-shaped dorsal stripe, broadest at posterior end. Coxae black, with yellow spots at posterior face. Mesepimeron black with broad yellow stripe as illustrated in Figure 29. Metepimeron also black with central, broad yellow stripe. Metaposternum black. Metakatepisternum black with yellow spot posteriorly. Legs black, short without prominent spines. Wings hyaline with black veins and pterostigma. Fine golden yellow edge to upper costa. Anal field 8-13 cells. Base of abdomen as illustrated in Figure 29. Segments 4-6 with small dorsal ring at distal border. Ring

on segment 7 much broader, occupying 1/8 of length of segment, and extending to ventrum.

FEMALE. – Larger and stouter than male with much broader head. Head and body colour patter similar to male. Vertex with larger protuberance than male which is shallowly divided. Frons not as protruding as male with flatter, broader protrusion. Postclypeus yellow with thicker black basal border than male. Prothorax as male with additional small yellow spot at lateral margin of posterior lobe. Synthorax with small additional yellow spot on metepisternum at posterior corner below wings. Wings broader than male, hyaline and enfumed with dark brown at extreme base, not extending to arculus. Base of abdomen as shown in Figure 32. Caudal abdomen as illustrated in Figures 33-34.

Measurements (mm). – ♂ abd. + app. 54.0-60.5; hw. 46.0-49.0; ♀ abd. + app. 65.5-66.0, hw 52.5-54.0.



Figs 26-34. *Chloropetalia soarer* sp. n., north Guangdong: (26) ♂, head, frontal; – (27) ♂, caudal genitalia, lateral; – (28) ♂, caudal genitalia, dorsal; – (29) ♂, synthorax, lateral; – (30) ♂, secondary genitalia, lateral; – (31) ♂, secondary genitalia, ventral; – (32) ♀, basal abdomen, lateral; – (33) ♀, caudal abdomen, lateral; – (34) caudal abdomen, dorsal.

REMARKS. – Only one other chlorogomphid, belonging to the genus *Chloropetalia* (CARLE, 1995), is known from China, which is *C. usignata* CHAO (1999). It is easily distinguished from *soarer* by the structure of the inferior appendages. The inferior appendages of *soarer* are uniquely protruded to form a central projection, which extends well beyond the superior appendages. The inferior appendages of *usignata* are narrowly invaginated centrally, without protrusion and are only slightly longer than the superior appendages (cf. CHAO, 1999: 9, figs 11-18). Other members of this genus include *selysi* Fraser, *atkinsoni* Selys and *olympicus* Fraser from India and Nepal and *dyak* Laidlaw ranging from Peninsular Malaysia, Sumatra and Borneo to the Philippines.

DISCUSSION

CARLE's (1995) phylogenetic systematic analysis has greatly helped our understanding of the Chlorogomphidae groupings. Carle's definitions of newly described genera are contained within a key, but there are one or two conflicting elements within the key. For example the subfamily Chlorogomphinae is defined as possessing well developed lateral mesanepisternal stripes but these stripes are absent in *Aurorachlorus*, which is a genus contained within Carle's Chlorogomphinae. See also remarks for *C. usudai* above, concerning anal loop characterisation of *Aurorachlorus*. The establishment of the Chloropetaliinae and *Chloropetalia* genus are generally accepted, but perhaps consideration of the wealth of new material, collected in recent years from China and Indo-China, should be completed, leading to comprehensive and improved characterisation at generic level, before Carle's *Aurorachlorus* and his remaining, 'chlorogomphine', genera are finalised and accepted.

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