Redescription of adults of *Kribiodorum belalong* Cranston (Diptera, Chironomidae, Chironomini) from Gunung Mulu National Park, Sarawak, Malaysia

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Abstract

The adult male of *Kribiodorum belalong* Cranston (Diptera: Chironomidae) was described only from a teneral adult specimen along with pupae. Certain key characters are unavailable or unmeasurable in the teneral form, e.g., wing dimensions, abdominal coloration pattern, and fine details of the hypopygium including the dorsal shape of the anal point. Here we redescribe and figure the adult male, and describe and illustrate the adult female of *Kribiodorum belalong* for the first time, both based on specimens recently collected in Gunung Mulu National Park, Sarawak, Malaysia. We provide some comments on the putative phylogenetic position of *Kribiodorum* Kieffer.

Introduction

Kribiodorum belalong Cranston was described based on a pharate male from Brunei (Borneo). However, the colours of teneral specimens such as this are imprecise, especially in the wing, legs and abdomen, which prevents comparison with congeners in these details. Furthermore, the anal point, which is important for species delimitation in this genus, was unavailable in dorsal view due to the mounting process. Therefore, *Kribiodorum belalong* is redescribed and figured from an adult male based on specimens collected recently in Sarawak, Malaysia. In addition, the adult female is described for the first time. The phylogenetic position of *Kribiodorum* Kieffer can now be discussed in more detail than previously.

Material and methods

Adults were collected by the UV-light traps at Lupar stream bank along the 'Botany loop' trail in Gunung Mulu National Park, Sarawak. Specimens were preserved in ethanol and dissected and slide-mounted in Euparal under an Olympus SZ61 stereomicroscope. Photographs were taken for each specimen under an Olympus BX53 compound microscope through a mounted camera-ToupView™. Digital photos of different focal planes were stacked using Helicon Focus version 7. Morphological terminology and abbreviations follow Sæther (1980). The colour is described based now on fresh specimens preserved in alcohol. The examined specimens are deposited in the following institutions: Department of Ecology, Jinan University, Guangzhou (EJNU), Australian National Insect Collection CSIRO, Canberra, Australia (ANIC) and Sarawak Forestry Corporation (SFC).

Taxonomy

Kribiodorum belalong Cranston, 2018

Kribiodorum belalong Cranston, 2018: 538 (pharate male and pupa).

Material examined. 2 females, slide mounted in Euparal, MALAYSIA: Sarawak, Gunung Mulu National Park, Lupar stream of Melinau River, 82 m.a.s.l., 04°2'15.7''N, 114°48'47.9''E, 12.vi.2023, light trap, H.Q. Tang (EJNU and SFC). 2 males as previous except 10.vii.2024 (EJNU and SFC). Holotype, 1 mature male pupa. BRUNEI: Temburong District, Kuala Belalong Field Study Centre, Sungai Belalong, 04°33'N 115°09'E, -.viii.1995 (Cranston) (ANIC).

Colour (Fig. 1A). Golden-yellow in general, with banded wing and dark ringed legs. Thorax shining yellow, slightly deeper in scutal vittae, sometimes close to background colour. Wing with two cross bands along the transect section, with a slender connection through the m cell, pale in the basal, middle and apical section. Leg darker subapically on femur and tibia of p_1 and p_3, of p_2 paler with dense grey setae on distal half femur and total length of Ti. Tarsus on p_1 brown, slight lighter in basal section of ta_1. In mid and hind legs, apical portion of ta_1 and ta_2, nearly whole length of ta_3, and full length of ta_4 and ta_5 dark brown. Abdomen light brown except brown AI and dark brown AVII–VIII, sometimes, a faint posterior brown band present in AII–VI. Hypopygium pale.

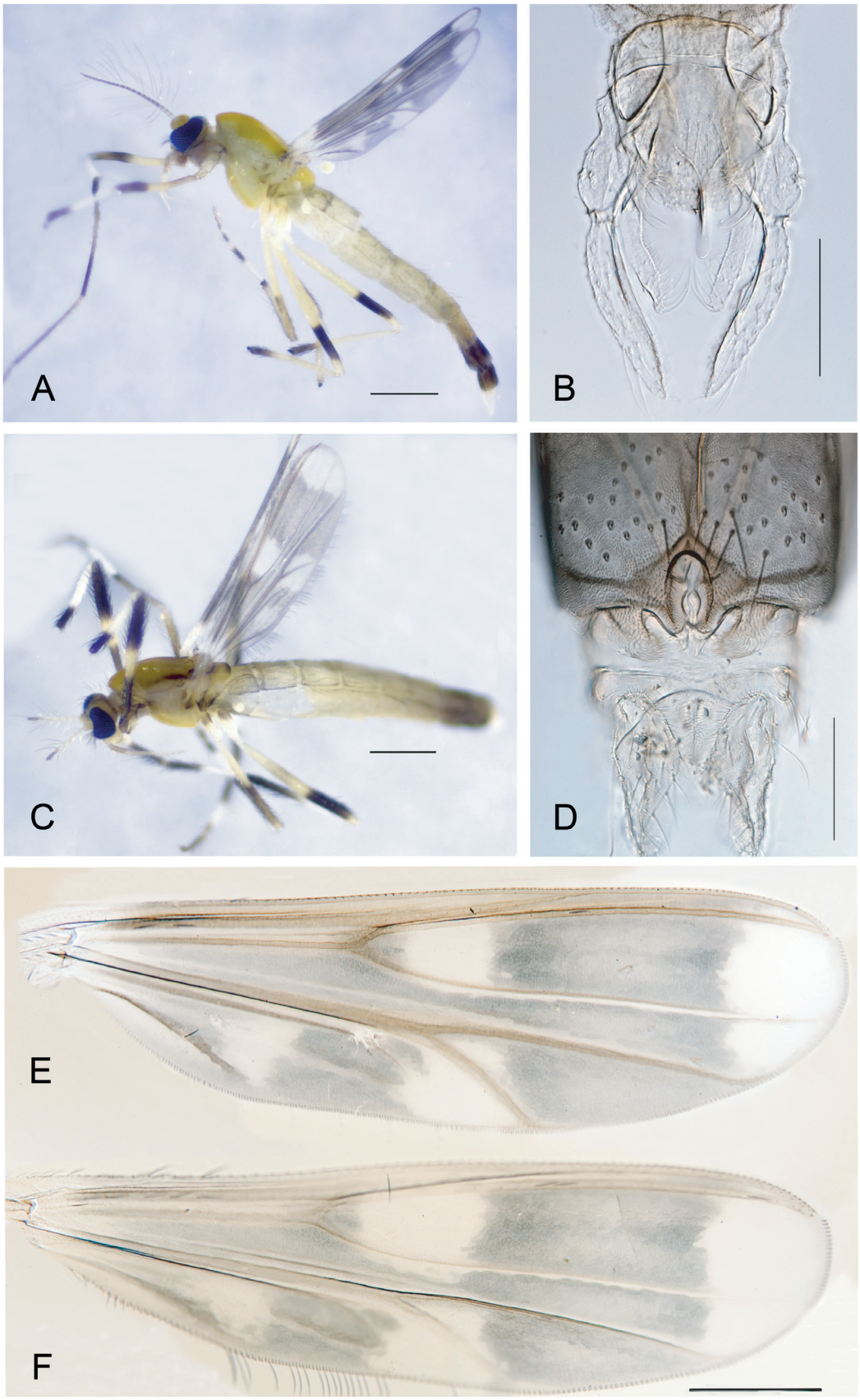

Figure 1. *Kribiodorum belalong*, adult. A. male habitus; B. male genitalia; C. female habitus; D. female genitalia; E. male wing; F. female wing (Scales: A, C, 500 µm; B, D, 100 µm; E–F, 250 µm).

Table 1. Lengths (μm) and proportions of legs of *Kribiodorum belalong* Cranston, male (n = 2–3). Data from holotype teneral (ten.) male (Cranston, 2018).

	fe	ti	ta_1	ta_2	ta_3	ta_4	ta_5	LR	BV	SV
P_1	740-850, 790	450-480, 460	1100	650	420	370	190	2.29	1.49	1.21
P_2	650-720, 680	400-430, 417	340	120	60	50	40	0.79	5.52	3.38
P_3	830-900, 867	660-700, 680	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
P_1 (ten.)	550	400	630	400	250	280	100	2.00	1.50	1.50
P_2 (ten.)	570	440	320	110	70	45	50	0.76	4.75	3.16
P_3 (ten)	600	610	320	240	110	190	110	0.53	2.00	3.78

Table 2. Lengths (μm) and proportions of legs of *Kribiodorum belalong* Cranston, female (n = 3).

	fe	ti	ta_1	ta_2	ta_3	ta_4	ta_5	LR	BV	SV
P_1	750-940, 837	420-520, 473	1020-1280, 1110	600-770, 660	380-500, 440	340-420, 381	160-210, 188	2.45-2.47, 2.46	1.44-1.47, 1.46	1.13-1.15, 1.14
P_2	600-750, 663	370-500, 427	310-400	85-120	50	35	40	0.80-0.84, 0.82	5.69-6.78, 6.31	3.09-3.13, 3.11
P_3	780-1000, 880	620-800, 693	460-500	260-270	240-245	170-180	80-90	0.75	2.53	3.04

Male (n = 2). Total length 3.03–3.25 mm. Wing length 1.35–1.40 mm.

Head. Flagellomere 1–12, 450–480 μm; flagellomere 13, 340–400 μm, apical seta 40–50 μm; AR 0.76–0.83. Lengths (μm) of Pm 1–5: 30–35; 20–30; 120–140; 120–145; 150–165, respectively. Temporals 5–6. Clypeus with 12–16 setae.

Thorax (Fig. 2A). Ac 2, restricted to the anterior of antepronotum lobe; Dc 5, including 1 humeral; Pa 3. Sct with 4–6 setae.

Wing (Figs 1A, C). Anal lobe reduced, VR 1.34–1.36. R with 12–15 setae; R_1 with 10–13 setae; R_{4+5} with 13–18 setae, other veins and cells bare.

Legs. Fore tibia with curved spur, 50–65 μm long. Most tarsi of legs broken, with only femur and tibia remaining. Lengths and proportions of legs as in Table 1.

Hypopygium (Figs 1B, 2B). Anal tergite bands weak, separate, medially with 10–16 anal setae, distally with 5–7 marginal setae each side. Anal point 40–50 μm long, spatulate distally, SVo 55–60 μm long, comprising setose pad-like base, bearing 4–5 long surface setae and digitus slightly curved inwardly, bare (Fig. 2B). MVo connected with SVo base, with 5–7 strong setae arising from distinct tubercles. Inferior volsella slender, distally bearing 4–6 long and strong setae. Gonocoxite 100–110 μm long. Gonostylus 110–125 μm long, may be with slightly swollen subapex. Hypopygium ratio 0.88–0.92.

Female (n = 2). Total length 2.95–3.50 mm, wing length 1.28–1.45 mm.

Colour (Fig. 1C). As male except lateral vittae are slightly brown in posterior section and last flagellomere is darker brown.

Head. Antenna with 6 flagellomeres, Fl 1-5 250–290, Fl 6 70–90 μm long, AR 0.28–0.31. Lengths (μm) of Pm 1–5: 30–35; 20–25; 120–150; 145–150; 170–175, respectively. Temporals 5–7. Clypeus with 18–26 setae.

Thorax. As male, Ac 2, Dc 5 with 1 in humeral position; Pa 3. Sct with 4 setae.

Wing. Pattern as in Fig. 1F. VR 1.30–1.34. Vein setation: R with 13–15, R_1 with 12–16 and R_{4+5} with 20–28.

Legs. Patterned as in male. Lengths and proportions of legs as in Table 2.

Genitalia (Figs 1D, 2C–D). Notum long, thin, 135–160 μm long, rami short, 30–35 μm long. Gonocoxapodemes gently curved, slightly fused medially, each enclosing setal patch, bearing 18–25 setae. Coxosternapodeme strongly sclerotized, weakly curved. Gonapophysis VIII (Figs 1D, 2C) comprising elongate dorsomesal lobe, microtrichiose, hyaline apico-medially, and distinct ventrolateral lobe, broad, microtrichiose with many simple medio-apically directed setae. Apodeme lobe small and lobe-like. Labia well developed, triangular apex, hyaline, without microtrichia. Gonocoxite IX small, with 3–4 setae. Tergite IX an undivided single plate, bearing 35–40 setae. Postgenital plate

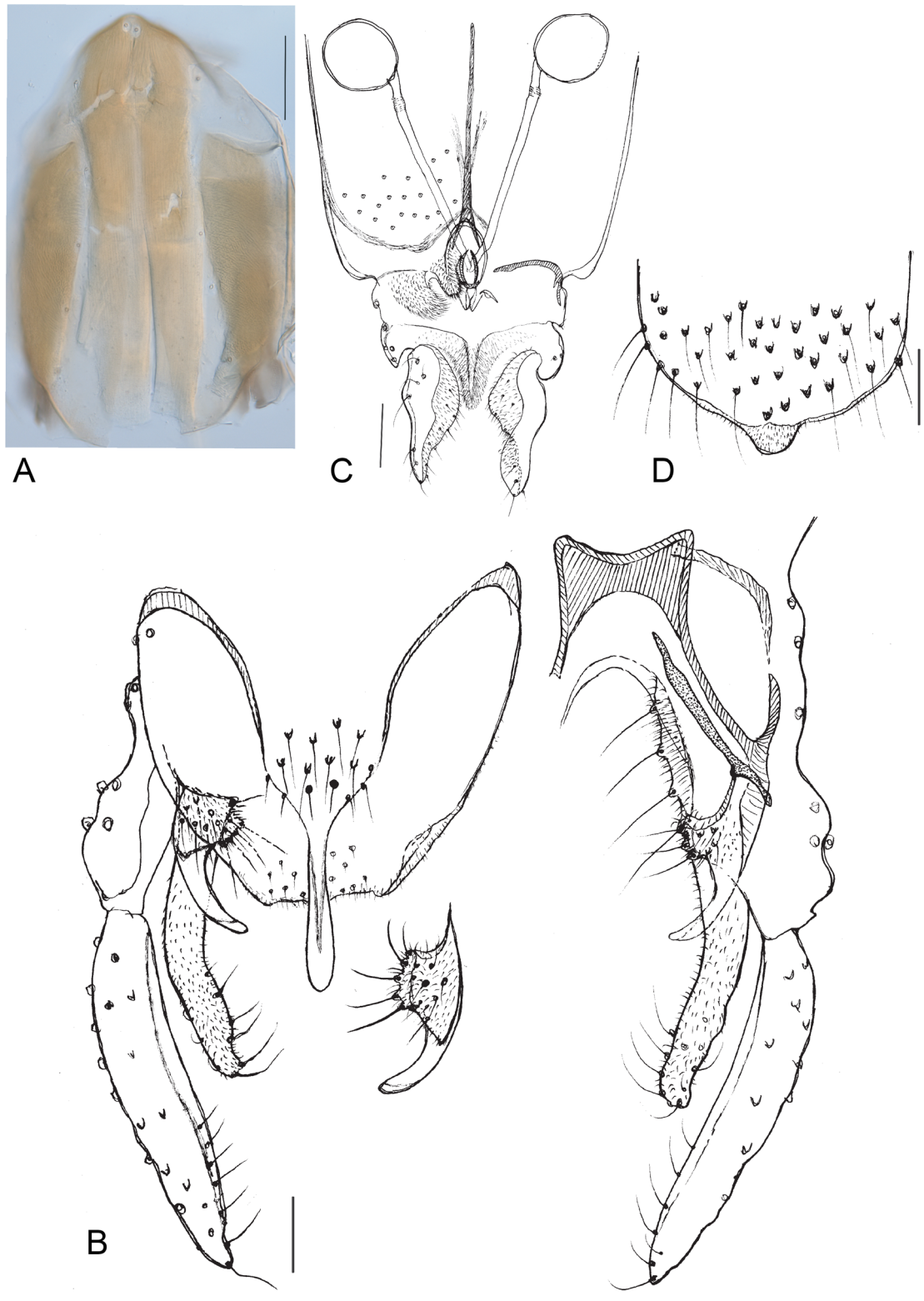

Figure 2. *Kribiodorum belalong*, adult. A. dorsal thorax; B. male hypopygium, left side dorsal, inset superior volsella, right side, semi-stylized ventral; C. female genitalia, ventral; D. female genitalia, tergite IX (Scales: A, 100 µm; B, 25 µm; C–D, 50 µm).

triangular, no clear boundary. Seminal capsule oval, 50–60 µm in diameter, with a wrinkled section near the neck. Cerci large, quadrate, 100–125 µm long by 45–50 µm wide in dorsal view.

Remarks. The combination of the wing pigment pattern and the form of the hypopygial gonocoxite lobes matches the teneral male holotype of *K. belalong* Cranston. There are no other candidate species in the region and the conspecificity of our material can be confirmed. Comparison of the described species of *Kribiodorum* shows that *K. belalong* resembles the Neotropical *Kribiodorum amazonicum* Dantas & Hamada in a similar (but not identical) hypopygium, and further, to the Nearctic species *Kribiodorum perpulchrum* (Mitchell). These species can be separated easily by wing and leg pigment patterns, and also by differing contours of the digitus of the superior volsella.

Systematics

When Reiss (1982) evaluated the systematic position of *Kribiodorum* (as *Stelechomyia*), he found no close Holarctic Chironomini genus that matched the character state combinations observed in *Kribiodorum*. However, Reiss (loc. cit.) noted that the characteristic wing and leg colour patterning, the long, curved fore tibial spur and a dilate subapex of the fore femora are shared with *Lauterborniella* Thienemann & Bause and *Zavreliella* Kieffer. However, the dramatically different immature stages induced Reiss to switch some undescribed Neotropical genera. If omitting the wing pattern and placing more weight on the male hypopygial morphology, especially of the superior volsella, *Kribiodorum* also resembles *Imparipecten* Freeman and *Nilodosis* Kieffer (Tang & Cranston, 2017; Fusari et al., 2018).

To date, six *Kribiodorum* species have been described (Cranston, 2018; Dantas & Hamada, 2021) but with no further discussion on systematic relationships. Ongoing phylogenetic studies of the tribe Chironomini, based on concatenated markers of five genes (Tang & Cranston, submitted), provides unequivocal support for *Kribiodorum* as sister to *Nilothauma* Kieffer (Bayesian posterior probability = 1). This surprising pairing is sister with highest support to a speciose cluster comprising *Imparipecten*, *Yaeprimus* + core *Chironomus* and relatives. *Zavreliella* and *Lauterborniella* are distant, refuting Reiss's (1982) suggestion of a close relationship.

The unexpected, yet maximally supported, sister relationship to *Nilothauma*, is warranted on morphology only in the pupal stage in which the thoracic horn, tergite spinulation and pattern of taeniae (LS – setae) are similar in both, but dramatic differences are evident in the morphology of males and larva. Perhaps a xylophagous and psammorheophilic life-style are distinct evolutionary pathways that shaped disparate morphologies in adult and larva stages.

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