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NOTES ON THE *RHINOCYPHA CUCULLATA* SELYS GROUP FROM BORNEO, WITH A DESCRIPTION OF *R. VIOLA* SPEC. NOV. (ZYGOPTERA: CHLOROCYPHIDAE)

A.G. ORR

CRC-TREM, Griffith University, Nathan, Qld-4111, Australia

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The new sp. from the central Kalimantan province of Borneo is described and figured. The original type series of *R. cucullata* Selys was examined and a ♂ specimen is designated as lectotype. The single ♀ syntype is shown to in fact be *R. humeralis* Selys. The true ♀ *R. cucullata* is described and figured for the first time. Significant characters of *R. aurofulgens* Laidl. are figured for comparative purposes. Keys are provided to both sexes of the three species, comprising the extended *cucullata* group of F.F. Laidlaw (1950, *Trans. R. ent. Soc. Lond.* 101: 233-269).

INTRODUCTION

In his revision of the Chlorocyphidae, LAIDLAW (1950) defined the *cucullata* group, including *Rhinochypha cucullata* Selys, 1873 and *R. aurofulgens* Laidlaw, 1931, species both endemic to Borneo. Recently I examined material from central Kalimantan in the collection of Dr Allen Davies, representing a very distinct new species of *Rhinocypha*, clearly belonging to this group. The material was part of a small series collected by Chris Jiggins, then an undergraduate at Cambridge University, and was the subject of a small ecological and behavioural study. A description is provided below.

In the course of studying comparative material I also became aware that the original description of *R. cucullata* (SELYS, 1873) comprises a composite species, male and female syntypes being distinct species. To stabilize the present nomenclatural usage, a male syntype is designated as lectotype of *R. cucullata* here. The single female syntype is reidentified as *R. humeralis* Selys, 1873, a species which was described in the same paper. Material of both species labelled "Labuan" (but in fact possibly originating somewhere on mainland Borneo) was available to Selys and it appears he made the wrong association, no recognized female of *R. humeralis* being recorded. As new

material has come to my notice from among M.A. Lieftinck's collections, housed in the National Museum of Natural History, Leiden, I am able to provide a description of what is almost certainly the true female of *R. cucullata*.

The following abbreviations are used to indicate deposition of type material: CUM, Cambridge University Zoology Museum, England; – IRSN, Institut royal des Sciences naturelles de Belgique, Brussels, Belgium; – RMNH, National Museum of Natural History, Leiden, the Netherlands.

RHINOCYPHA VIOLA SP. NOV.

Figures 1a, b, c, 2e, f, 3a, 4a

M a t e r i a l. – **Holotype** ♂: central Kalimantan, Sg Marung. (0°6'S, 114°19'E), 7-VIII-1992, C. Jiggins leg. (deposited in CUM). – **Paratypes**: 3 ♂, 1 ♀, same data as holotype; 1 ♂ coll. A.G. Orr; remainder in CUM.

E t y m o l o g y – *viola*, strictly a feminine noun in apposition, suggesting the violet colour of the hindmost segments of the abdomen.

MALE **holotype**. – H e a d: dorsally mostly black with bases of mandibles and genae light blue, and five small, yellowish marks on occiput as follows: a pair of spots immediately behind posterior ocelli, a pair of small postocular spots and a short transverse median bar on the hind margin of the occiput. Antennae black. Ventrally black except for base of labium which is well-defined creamy white.

T h o r a x. – Prothorax black marked with pale greenish-yellow; anterior lobe entirely pale above; median lobe with incomplete slightly rounded dorsolateral bands; posterior lobe with lateral angles pale. Synthorax dark above with very fine pale green antehumeral bands broken anteriorly to form a small spot, continuing as a fine line for about two thirds of the length of the humeral suture, then reappearing as a distinct dorsal spot immediately in front of the antealar triangle; antealar triangle traversed lengthwise by two very fine parallel yellow lines; sides with very short, fine, dorsal, greenish posthumeral stripe, a small greenish dorsal streak immediately posterior to mesometapleural suture and a relatively narrow irregular pale blue transverse band extending from the mesinfraepisternum to the base of the abdomen. Venter pale with extensive black marking. Legs mostly black; coxae and trochanters yellowish behind; inner surface of mid and hind tibiae with bright white pruinescence; tibiae not expanded. Wings (Fig. 1a) long and narrow, rounded apically; inner part hyaline with heavy brownish-yellow suffusion; apex with very broad opaque patches, only slightly iridescent on both surfaces; inner margin of apical patch fairly well defined; in forewing meeting costa around Px 7 and strongly slanted outward; in hindwing meeting costa around Px 5 and only slightly slanted outwards. Forewing opaque patch with small, central, non-iridescent window consisting of two rows of five cells level with the basal end of the pterostigma (in the holotype both forewings are set on the left side of the body); pterostigma black, long, covering about 8 cells, acute basally and apically and expanded apically.

Abdomen. – Dorso-ventrally flattened with strong median carina; subapical encircling dorsolateral flange on segment 2 very slightly expanded (Fig. 3a); ground colour matt black, dorsum of segments 1-9 marked with blue and lilac as shown in Figure 1b and as follows: segments 1-4 light cobalt blue; segments 5-7 purplish blue; segments 8-9 deep lilac; laterally with blue marking on segments 1-5 only; segment 1 a distinct lateral spot just reaching dorsum; segment 2, a broad apically expanded patch continuous with blue visible on dorsum (Fig. 1b) and forming nearly a mirror image of it; segment 3 a small isolated streak basally and a spot apically; segments 4-5 each with a tiny, obscure, isolated, basal spot. Remainder of abdomen black. Anal appendages black, superiors strongly forcipate apically, inferiors about half length of superiors.

Measurements (mm): Abdomen + appendages 18; hindwing 22.5.

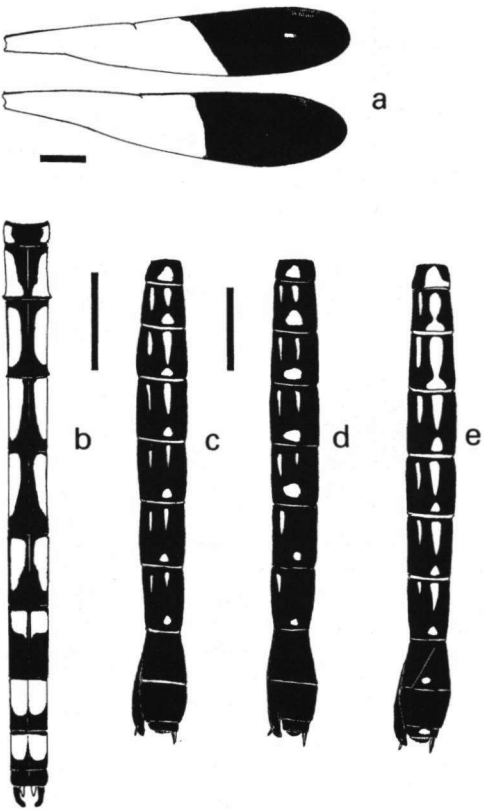

Fig. 1. Structural features: (a) *Rhinocypha viola* sp. n. holotype ♂ fore- and hindwing; – (b) *R. viola* sp. n. holotype ♂ abdomen, dorsal aspect; – (c) *R. viola* sp. n. ♀ abdomen, lateral aspect; – (d) *R. cucullata* Selys ♀ abdomen, lateral aspect (same scale as last); – (e) *R. aurofulgens* Laidlaw (Kuala Belalong, Brunei) ♀ abdomen, lateral aspect (same scale as last). – [Scale bars = 3 mm]

FEMALE **paratype** – Head (Fig. 2e): dorsally mostly black marked as follows: bases of mandibles and genae pale yellow but labrum black except for small lateral yellow spots (Fig. 2f); tiny well separated paired orange spots mid-dorsally on postclypeus and frons; sides of frons and vertex with fine pale line bordering compound eye; a pair of tiny orange spots immediately behind posterior ocelli; occiput with tiny orange postocular spots connected by a short indistinct transverse median bar on the hind margin of the occiput. Antennae with external surface of segment 1 pale yellow, remainder black. Ventrally head black except for base of labium which is extensively creamy white.

Thorax. – Prothorax black, dorsally marked on the median and posterior lobes with pale yellow lateral streaks forming a discontinuous band on either side viewed from above; anterior lobe almost entirely pale above; sides dark. Synthorax dark above

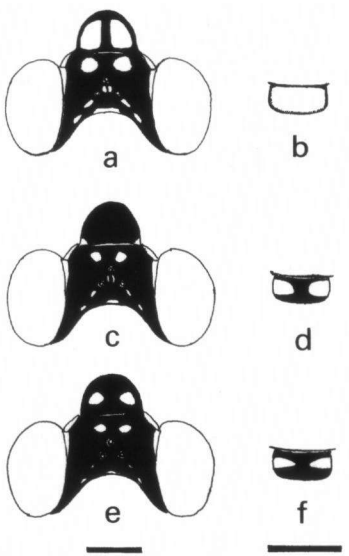

Fig. 2. Dorsal view of head and anterior view of labrum in females: (a-b) *R. aurofulgens*; – (c-d) *R. cucullata*; – (e--f) *R. viola* sp. n. (paratype). – [Scale bars = 1mm]

with very fine pale yellow antehumeral bands broken anteriorly to form a small spot, continuing as a fine line for about three quarters of the length of the humeral suture, then recurring as a tiny dorsal spot immediately in front of the antealar triangle; antealar triangle traversed lengthwise by two very fine parallel yellow lines; faint yellowish dusting on median carina; sides with fine, dorsal, yellowish posthumeral stripe, about half length of humeral suture, a small yellowish dorsal streak immediately posterior to mesometapleural suture, a small dorsal spot on the metepisternum and a relatively narrow irregular creamy transverse band extending from the mesinfraepisternum to the base of the abdomen, including almost all the metepimeron. Venter (poststernum) ground colour black with four pale marks as shown in Figure 4a. Legs mostly black; posterior half of coxae, all of the trochanters and bases of femora yellowish behind. Wings long and narrow, hyaline with heavy brownish-yellow suffusion. Pterostigma black, long, covering 5-5.5 cells, acute basally and apically.

Abdomen (Fig. 1c). – Black with creamy to orange markings; segment 1 with lateral spot; segments 2-7 with dorsal streak and spot like a backward directed exclamation mark and ventral streak; dorsal and ventral streak on posterior segments much reduced; median carina on dorsum of segments 2-7 marked with yellowish orange. Remainder of abdomen black. Anal appendages and valves black.

Measurements (mm). – Abdomen + appendages 17; hindwing 23.5.

REMARKS. – This striking species appears to be closest to *R. aurofulgens* Laidlaw, known from northern Borneo, and also shows strong affinities with *R. cucullata* Selys, widely distributed throughout lowland Borneo. The male differs from *R. aurofulgens* in the details of colour on the head, in the reduced colour on the thorax, in the presence of tibial pruinescence, in the shape and coloration of the wings and in the abdominal coloration which is less extensive and of very different hues. The conspicuous subapical flange on segment 2 of male *R. cucullata* (Fig. 3b) and *R. aurofulgens* (Fig. 3c) is only very slightly developed in *R. viola* (Fig. 3a). There is little variation in the type series; in two of the paratypes the small window in the forewing is entirely lacking. The female is similar to that of *R. aurofulgens* (Figs 1e, 2a,b, 4c), saving that the pale coloration is considerably reduced, the labrum is extensively black in *R. viola*, creamy in *R. aurofulgens*, and all other markings are considerably narrower. On the venter of the synthorax (Figs 4a, c) the third marking from the front in *R. viola* is distinctly

smaller and emarginate on its posterior border, whereas that of *R. aurofulgens* is mostly broader and crown- shaped. On the abdomen, besides an overall reduction in extent of markings, pale lateral markings present on segment 8 and segment 10 of *R. aurofulgens* are entirely lacking in *R. viola*. The female of *R. cucullata* (Figs 1d, 2d,e, 4b) is very similar to that of *R. viola*. Apparent differences are discussed below.

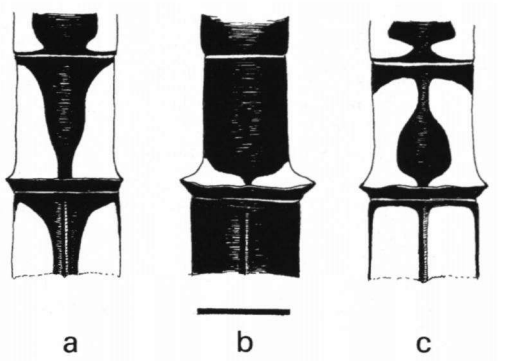

Fig. 3. Dorsal view of base of male abdomen: (a) *R. viola* sp. n. (holotype); – (b) *R. cucullata* (lectotype); – (c) *R. aurofulgens* (Kuala Belalong, Brunei). Note expanded flange near apex of segment 2, especially prominent in *R. cucullata*. – [Scale bar = 1mm]

HABITAT AND BEHAVIOUR. – *R. viola* was the subject of an ecological and behavioral study (JIGGINS, 1993) in which it is erroneously referred to as *R. cucullata* Selys. The locality is almost at the geographical centre of Borneo, near the junction of the Marung and Barito Rivers at an altitude of 150-200m. The vegetation included disturbed and primary lowland dipterocarp forest. It was found on small, clear, rocky forest streams branching off the main river in both disturbed and primary forest but especially in the latter. It was by far the most frequently recorded of 22 odonate species which included *Rhinocypha spinifer* Laidlaw, *Heliocypha biseriata* (Selys), *Dysphaea dimidiata* Selys, *Euphaea impar* Selys, *E. subcostalis* (?) Selys, *Neurobasis longipes* Hagen, *Vestalis amoena* Selys, *Rhinagrion borneense* (Selys), undetermined *Coeliccia* and *Prodasineura* spp., *Orthetrum chrysis* (Selys), *O. pruinosum schneideri* (Förster) and *Zygonyx iris errans* (?) Lieftinck (JIGGINS, 1993). During territorial disputes males of *R. viola* faced each other hovering with their abdomens cocked upwards. This is the exact posture adopted by *R. aurofulgens* and *R. cucullata*, as described and figured by ORR (1996), but not other *Rhinocypha*. Courtship behaviour involved the display of the pruinosed tibiae as is usual in the family (but not *R. aurofulgens*). Females laid their eggs in the rotting wood of fallen logs in the stream. The species was evidently very common where it occurred, but the extent of its distribution is uncertain. Central Kalimantan is very poorly collected but it is surely an obvious insect and would be expected to occur even in student collections, which are appearing sporadically.

RHINOCYPHA CUCULLATA SELYS, 1873

Figures 1d, 2c,d, 3b, 4b

Rhinochypha cucullata, Selys 1873: 492-493 [pp. 28-29 in reprint edn]

Type material. – **Lectotype** (here designated) ♂ [abdomen detached], "Labuan Borneo" (yellow

label in Selys' hand), "Rhino. humeralis S." (white label in Selys' hand), "Collection Selys/ cucullata/ Révision Martin 190" (grey label), "Coll R.I.Sc.N.B./ Borneo/ ex collection Selys" (yellow label). – **Paralectotypes** 3 ♂ all with "Coll R.I.Sc.N.B./ Borneo/ ex collection Selys" (yellow label): 1 [abdomen missing], "Labuan, Borneo" (yellow label in Selys' hand), "Rhi cucullata Selys ♂ Labuan" (white label in Selys' hand); 1 [head and abdominal segments 3-10 broken and in separate capsules], "Labuan" (white label not in Selys' hand), "Labuan Borneo" (yellow label in Selys' hand), "114" (two rough grey labels bearing this number); 1[abdominal segments 4-10 missing], "Labuan Borneo" (yellow label in Selys' hand), "Rh. Cucullata Selys ♂ Labuan" (white label in Selys' hand). All above specimens are held in the IRSN, Brussels.

Other material. – 1 ♂, Sarawak (in Selys' hand), (coll. Selys, IRSN); – 1 ♂, 1 ♀, SE Borneo, S. Mentawir leg., 20-10-1950 (RMNH); – 3 ♂, Kuala Belalong, Brunei, IX-1992, A.G. Orr leg.; 1 ♂, Sg. Benutan, Brunei, V-1995, A.G.Orr leg. (coll. A.G. Orr).

MALE. – The lectotype is designated on the basis of being the most intact and recognizable specimen of the putative type series available. The determination label "R. humeralis" (in Selys's handwriting) attached to the pin of the lectotype is confusing. It may have become placed there due to an error by Selys himself (or by some later worker), since Selys in the same paper in which he described *R. cucullata*, accurately described also *R. humeralis*. It would scarcely be possible for an experienced worker making a direct comparison to confuse the two species and indeed the specimen matches extremely well with Selys' description of *cucullata*, that of *humeralis* being very different. Evidence that the label has been repeatedly removed is provided by the presence of three separate pin holes which lends credence to the suggestion that the label was erroneously placed on the specimen well after the determination was made. Other determination labels have only one hole.

Since in his description, Selys gives only "Labuan" as the locality of the type material, the specimen labelled "Sarawak" in Coll. Selys is not considered to represent a syntype. In his original description SELYS (1873) indicates that he examined an unspecified number of males and females from his own collection and from that of R. McLachlan (now held in the BMNH). It is probable that only one female was available, since he provides a single set of measurements, whereas for the males he provides a range. The series examined is thought to include all syntype males since according to Mr David Goodger there are no males from Labuan in the McLachlan collection. Selys' description of the male of *R. cucullata* remains adequate except for the colour of the dorsal abdominal markings on segments 8-9 which are pale lilac rather than blue, at least in the living specimen. Other salient features are listed in the key below and the modified second abdominal segment of the lectotype is figured (Fig. 3b).

FEMALE. – The female syntype of *cucullata* from "Labuan", held in the Natural History Museum, London, ex McLachlan collection, and accurately described by Selys, is clearly the female of *R. humeralis* which is well known from collections of mating pairs. It bears conspicuous broad terminal markings on all wings. I have closely observed (but not collected) *R. cucullata* mating in Brunei and although I am unable to provide a description of the female on this basis I am certain the wings of the female were without terminal markings. Recently I was able to examine, preserved in the same

envelope, a pair of *R. cucullata* from S.E. Borneo. These were evidently collected by A.M.R. Wegner, whose material from the same site and date is listed in LIEFTINCK (1953). On the envelope in Lieftinck's hand is written "♀ Rhinocypha cucullata (?)". It seems reasonable to suppose that this is a genuine pair, especially as it is in agreement with my own field observations. It is also reasonable to suppose that any doubt in Lieftinck's mind might have arisen from the clear difference between this specimen and Selys' description with which he was almost certainly familiar. A description of the female *cucullata* follows.

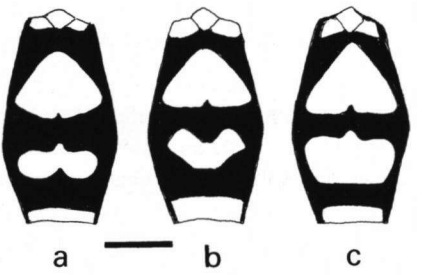

Fig. 4. Venter of female synthorax (poststernum): (a) *R. viola* sp. n. (paratype); – (b) *R. cucullata*; – (c) *R. aurofulgens*. – [Scale bar = 1mm]

H e a d (Fig. 2c). – Dorsally mostly black marked as follows: bases of mandibles and genae pale yellow but labrum black except for moderate sized lateral yellow spots (Fig. 2d); frons with small paired spots. In all other respects similar to *R. viola* female (above) except for the markings on the postclypeus which is almost entirely black with tiny pale spots confined to its posterior corners and the presence of tiny paired elongate spots in the intra-ocellar triangle, lacking in *R. viola*.

T h o r a x. – Pale markings similar in form to those described above for *R. viola* but a little reduced. Legs and wings as in *R. viola*. Venter of synthorax (poststernum) ground colour black with four pale marks as shown in Figure 4b; differs from *R. viola* especially in the form of the third marking from the front, which is roughly 'V' shaped and the posterior band which is considerably broader than in *R. viola*.

A b d o m e n (Fig. 1d). – Black with creamy markings, very like *R. viola* and differing as follows: segments 2-5 with dorsal streak and spot like a backward directed exclamation mark and ventral streak; dorsal streak absent on segments 6-7; posterior spots on segments 2-5 larger than in *R. viola*.

M e a s u r e m e n t s (mm). – Abdomen + appendages 16.3; hindwing 22.8.

REMARKS. – The female of *R. cucullata* is very similar to that of *R. viola* described above and differs from *R. aurofulgens* in being considerably darker. Differences from *R. viola* tend to involve a slight loss of pale coloration but on the labrum pale spots are well developed as opposed to small and obscure in *R. viola*. The posterior markings on the venter of the synthorax are quite different and may prove diagnostic. Differences indicated, if consistent, would be sufficient to separate the two but as both descriptions are each based on a single specimen, there must remain some uncertainty regarding the possibility of separating females of the two species. The female of *R. aurofulgens*, of which five females were examined (all from Kuala Belalong, Brunei), shows some variation, including a considerable reduction in the pale coloration in one specimen, although in this individual the marking on the labrum and basal segments of the abdomen are still definitive.

DISCUSSION

There seems little doubt that *R. aurofulgens*, *R. cucullata* and *R. viola* form a natural grouping with *R. viola* perhaps being the most primitive. In the male of *R. viola* the general form of the abdomen is like that of the other two species but in the posterior flange on segment 2, a probable synapomorphy, is poorly developed (Fig. 3a). Using *R. humeralis* for outgroup comparisons, the legs are unmodified (expanded in *cucullata*, colour reduced in *aurofulgens*) and the wing shape and wing marking is the least modified of the three species.

A key to the males and females of the three species follows:

MALES

1 Inner border of terminal patches on all wings meeting costa nearer pterostigma than nodus; upper and undersides of patches entirely with light metallic copper iridescence. Dorsum of abdomen extensively brilliant light blue on segments 1-9 with thin median black line on dorsal carina; segment 2 somewhat expanded into flange at posterior margin. Legs entirely black, lacking pruinescence (Fig. 3c) ..... ***aurofulgens***

– Inner border of terminal patches on all wings meeting costa nearer nodus than pterostigma; upperside of patches dark and only slightly reflective. Abdominal marking different from above; segment 2 with or without flange. Legs with white or blue pruinescence on mid and hind tibiae 2

2 Wings broad; underside of apical patch with brilliant coppery-green iridescence on basal two thirds. Dorsum of abdomen black except for segments 8-9 which are pale lilac; segment 2 with a very well developed flange at the posterior margin, blue on its anterior face. Mid and hind tibiae expanded and pruinescent light blue on the flexor surface (Fig. 3b) ..... ***cucullata***

– Wings of normal width; underside lacking strong iridescence. Abdomen dorsum extensively dark blue grading to violet posteriorly on segments 1-9; median carina with broad black line; segment 2 scarcely expanded at posterior margin. Mid and hind tibiae with bright white pruinescence; little expanded (Figs 1a, b, 3a) ..... ***viola***

FEMALES

1 Labrum entirely pale; spots on postclypeus and frons conspicuous. Abdomen with broad lateral bands confluent with posterior spots at least in segments 2-3; small lateral spots present on segments 8 and 10 (Figs 1e, 2a, b, 4c) ..... ***aurofulgens***

– Labrum at least partially black; spots on postclypeus and frons very small and inconspicuous. Abdomen darker with lateral bands on anterior segments not meeting posterior spot and no lateral spots posterior to segment 7 2

2 Labrum with lateral spots almost round and well developed; spots absent from centre of postclypeus. Third pale mark from front on poststernum roughly 'V' shaped, posterior mark relatively broad. Dorso-lateral bands lacking on abdominal segments 6-7 (Figs 1d, 2c, d, 4b) ..... ***cucullata***

– Labrum with smaller narrower lateral spots; small but distinct pale spots on centre of postclypeus. Third pale mark from front on poststernum 'beret'- shaped with a small anterior median projection, posterior mark relatively narrw. Very weak dorso-lateral bands present on abdominal segments 6-7 (Figs 1c, 2e, f, 4a) ..... ***viola***

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