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On the identity of the type species of the planthopper genus *Oliarus* Stål, 1862, *Oliarus walkeri* (Stål, 1859) (Hemiptera: Cixiidae)

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Abstract

Type-material of *Oliarus walkeri* (Stål, 1859) was re-examined. A supplementary description is given. For the first time, the only male specimen contained in the type series is figured. Published information on the geographic distribution of *O. walkeri* based on misidentification is corrected: *O. walkeri* is confirmed to occur on the west coast of the Malay Peninsula (Melaka) and on Borneo (Sarawak). The morphology of the male copulatory organ, the aedeagus, is interpreted, and characters hypothesized here as apomorphic are pointed out.

Key words: Taxonomy, lectotype, morphology, Oriental Region

Introduction

Oliarus Stål, 1862 has long been a notorious catch-all genus for Pentastirine Cixiidae from nearly all parts of the world (e.g., Metcalf 1936; Mead and Kramer 1982; Van Stalle 1991). Several authors recognized the morphological diversity of species groups contained in *Oliarus* and subsequently erected numerous genera to accommodate several such groups (e.g., Van Stalle 1985, 1986a–d; Emeljanov 1992, 2001a, b) from the Palearctic, the Nearctic, Afrotropical and Oriental regions, leaving only 46 species from the Oriental and Australian Region (including the Pacific) in *Oliarus* s.str. (Emeljanov 2001 b). None of these groupings, however, have been explicitly founded on commonly derived characters (synapomorphies) and may or may not be monophyla. To understand the evolutionary history and biogeography of the Pentastirini, and even the Cixiidae, a phylogenetic analysis is mandatory. As a first step, it is attempted here to define the scope of the genus *Oliarus* sensu stricto more exactly (as postulated by Emeljanov 2001b) by making available more information on the morphology of its type species, *Oliarus walkeri* (Stål, 1859).

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Historic background

Stål (1859) described *Cixius walkeri* based on specimens from "Malacca" (today Melaka: Malaysia) and "Manilla" (today Manila: Philippines), collected during the expedition of the royal Swedish vessel "Eugenie" to Southeast Asia, Australia and the Americas during 1851–1853. In the original description (in Latin) he neither indicated the number of specimens nor designated a type. He gave measurements of body length and width of a male. Three years later, in 1862, he erected the genus *Oliarus* to accommodate the following species: "*Cixius pallidus H.-Sch.*, *santae helenae* Stål, *franciscanus* Stål, *walkeri* Stål, *bohemanni* Stål, *hottentottus* Stål, *moestus* Stål et aliae species indeterminatae" (Stål 1862: 306) on the basis of characters of the external morphology of the head and thorax. Distant (1906) subsequently designated *Cixius walkeri* Stål, 1859 as the *typus generis* for *Oliarus*. In the same publication, Distant gave the same information on body proportions for *walkeri* as Stål in his original description, and provided figures of the habitus and head in frontal aspect (Distant 1906: 256). It is unclear whether the specimen figured is from the type series and whether it is a male or female. [1]

Muir (1924) published the male genitalia of a cixiid specimen from Basilan (Philippines) which he conceived to be conspecific with *O. walkeri*, and gave further information on the type-material deposited in the Swedish Museum of Natural History, Stockholm ("two specimens from Manila, a female, the type, and a specimen without an abdomen, and one male from Malacca"). According to Muir (1924: 518), he was not able to examine the genitalia of the male from Malacca. Muir (l.c.) gave no indication as to why he assumed that the female from Manila was the type.

Van Stalle (1991) re-examined the type-material (the same 3 specimens mentioned by Muir) which he considered as syntypes and designated the male specimen from Malacca as lectotype and the female specimen from Manila as paralectotype. The figures he provided, however, of the head, tegmina, wings, hindleg, and male genitalia are from a specimen from Sarawak (Borneo) which he interpreted as conspecific with O. *walkeri*. He did not dissect and examine the only male from the type series in order to keep this specimen intact (Van Stalle, personal communication). Consequently, the identity of *Oliarus walkeri* (Stål) and thus of the genus *Oliarus* itself remained unclear.

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1. Although Distant makes no mention of any details on the material he examined, he thanks "Dr Aurivillius for an opportunity of figuring it" [the species, i.e. *Oliarus walkeri*]. Aurivillius was the head of the Entomology Department of the Swedish Natural History Museum (1879–1901). He then worked at the Swedish Academy of Science which administrated the Swedish Natural History Museum until the 1950's (B. Gustaffson, personal communication). This acknowledgement apparently implies that Distant did examine the type series; however, there is no specimen with spread wings in it as is figured in Distant (1906: 256).

This contribution attempts to answer the following questions:

- Are the specimens in the type-series of *Oliarus walkeri* (Stål) from the Philippines and Malacca conspecific?
- Are the species figured by Muir 1924 from Basilan (Philippines) and Van Stalle 1991 from Sarawak (Borneo) conspecific with each other and/or with (any of) the species in the type series?
- If there is more than one species involved, which one can be regarded as *Oliarus walkeri*?
- What are its morphological characteristics?
- What is the geographical distribution of *Oliarus walkeri*?

Material and methods

The following material was examined.
Type material of *Oliarus walkeri* (Stal, 1859), deposited in the Swedish Museum of Natural History, Stockholm), consisting of 3 specimens labelled as follows:

- 1 female: “Manilla” (printed black on white paper), “*Oliarus walkeri*” (handwritten), “Typus” (printed on red cardbord). [Paralectotype, designated (but not labelled) by Van Stalle 1991: 42]
- 1 specimen without abdomen: “Manilla” (printed, black on white paper), “Kinb.”(printed black on white paper), „Paratypus“ (printed on red cardbord)
- 1 male: “Malacca” (printed black on white paper), “Kinb.” (printed black on white paper), “Paratypus” (printed on red cardbord). [Lectotype, designated (but not labelled) by Van Stalle 1991: 42]
- 1 male specimen on which Muir´s (1924: plate 1, figs 8a, b) figures of “O. *walkeri* “ were based (Bishop Museum, Honolulu, Hawai´í).

The only male specimen from the type-series of O. *walkeri* was removed from its pin and briefly softened in a moist chamber until the genital capsule could be removed easily. The genital capsule was then transferred to 10% KOH and macerated at room temperature for 24 hours while the specimen was card-mounted to prevent further damage to the brittle exoskeleton. Apparently, this specimen had been mechanically manipulated previously: the tegmina and wings are partly damaged dorsally of the genital capsule, the anal tube is missing entirely, and the aedeagus which was protruding between the parameres had been broken off near its base and was barely hanging on to the specimen. Also, the right lateral spine of the aedeagus (see below) is broken off near its base. The remaining fragments were then stored in glycerine in a plastic vial pinned underneath the specimen.

Examination of the male genitalia of Muir´s O. *walkeri*-specimen was done directly on Muir´s original (permanent) caedax genital mount, without any further preparation.

Taxonomy

According to information given by Bert Gustafsson, curator at the Swedish Museum of Natural History, Stockholm, the labelling of the types was not done by Stål, but "have probably been put on in the nineteenhundredfifties" (B. Gustafsson, personal communication) and must be regarded as unauthorized.

Muir´s (1924: 518) statement "a female, the type" may be based on the fact that the female of the type-series is the only specimen bearing a hand-written label "*Oliarus walkeri* Stål". As it is uncertain, however, whether the handwriting is indeed Stål´s – a comparison with labels written by Muir revealed a high similarity – there is no reason to assume that the female is indeed the type. These findings corroborate Van Stalle´s (implicit) conclusion that the three specimens have to be regarded a syntype-series and his consequent designation of the male from Malacca as lectotype.[1] The specific identity of the two other specimens cannot be stated with certainty: while being clearly members of the Pentastirini, there are no clear morphological indicators of conspecifity of the intact female from Manila with the male from Malacca; due to the missing abdomen in the other specimen, morphological information is too sparse to even determine its sex.

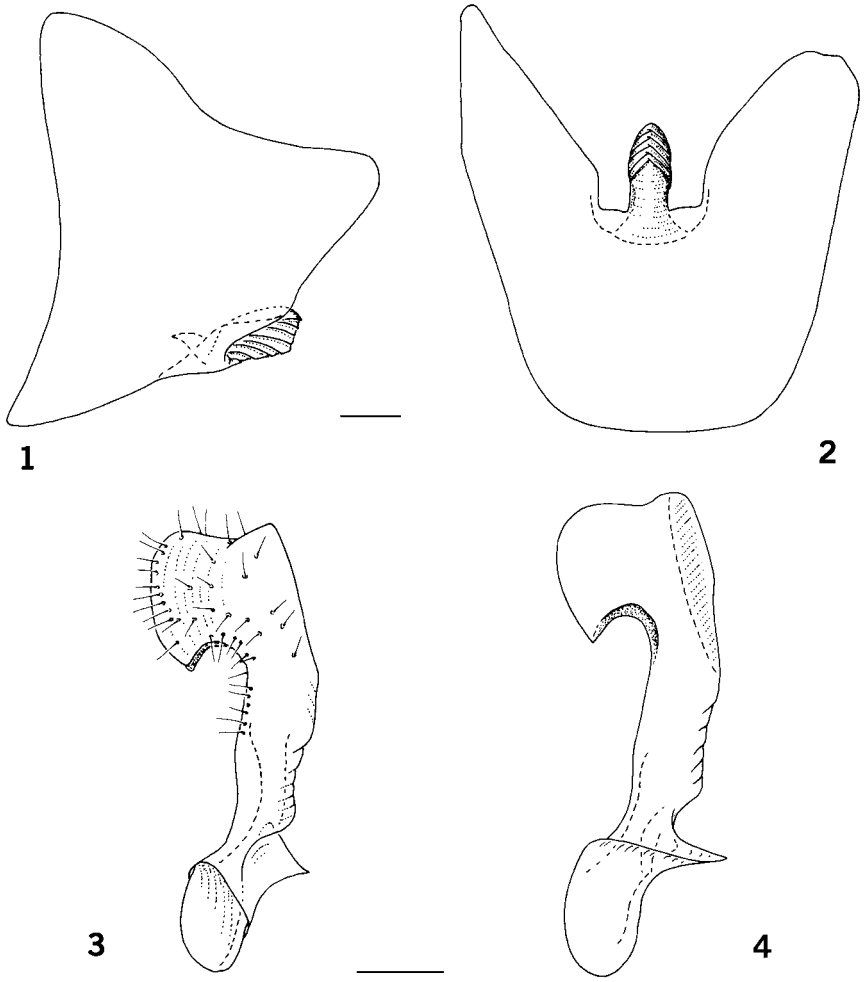
Consequently, the lectotype male from Malacca defines the morphological concept of *Oliarus walkeri* (Stål). According to the high similarity in male genital structure, especially of the aedeagus, between the specimen from Malacca and the male from Sarawak (figured by Van Stalle, 1991: 41) it appears safe to assume that these two specimen are conspecific.

Re-examination of the male specimen from Basilan Island (Philippines), presumably first considered by Muir as a new species from Basilan (handwritten on mount "*O. basilensis* Muir" but then crossed out and identified as „*Oliarus walkeri* D."[2] and figured in Muir 1924 (plate 1, figs 8a, b), revealed that this male is not conspecific with *O. walkeri.* It pertains very likely to *Oliarus reductus* (Walker, 1868) as figured and described by Van Stalle (1989: 179, 1991: 37). *Oliarus reductus* was described from Mysol (today: Misoöl) (Indonesia) and has been reported to occur also in Malaysia, Borneo (Sarawak), the Philippine Islands, Papua New Guinea, "and is probably a widespread species" (Van Stalle 1989: 173).

1. Lectotype designated (but not labelled) by Van Stalle, 1991: 42. Subsequently labelled as Lectotype by H. Hoch, 2005
2. "D." most likely stands for „Distant", mislabelled by Muir.

Supplementary description and male genital morphology

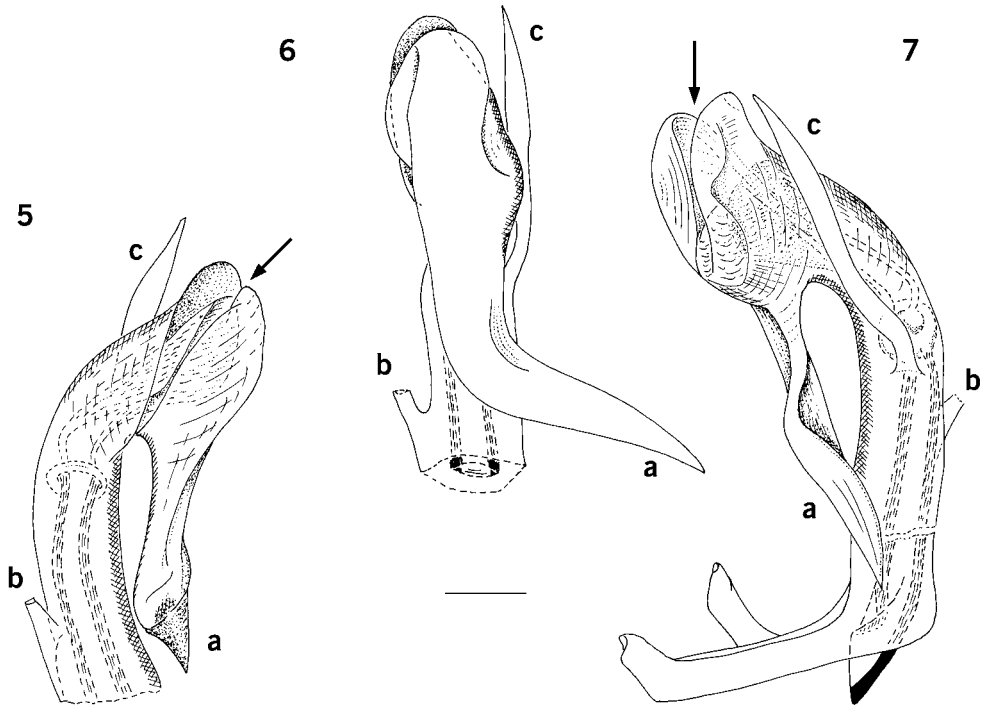
Head and thorax as described by Van Stalle (1991: 41). Hind tibiae with 2 lateral and 6 apical spines; 1st metatarsus with 7, 2nd metatarsus with 5 apical teeth; metatarsi without macrochaetae (platellae).



FIGURES 1–4. *Oliarus walkeri* (Stål, 1852). Male genitalia (Lectoype, specimen from Malacca). Fig. 1, genital segment, left lateral aspect; fig. 2, same, ventral aspect; fig.3, left paramere, ventrolateral aspect; fig. 4, same, maximal aspect. Scale lines: 0.1 mm.

Male genitalia of lectotype (figs 1–7). Pygofer (genital segment) in caudal aspect slightly wider than its maximum height, slightly asymmetrical: caudal margin in lateral aspect produced into a dorsolateral lobe extending caudally on the left side, rounded on the right side; medioventral process with fine lateral grooves converging ventrocaudally, dorsally rounded, smooth. Parameres elongate, medially with a longitudinal ledge, apical dilation with a distinct lateroventral angle pointing basad. Anal segment missing.

Aedeagus. Periandrium rigid, without articulation between shaft and flagellum, proximally tubular, distally bent dorsad, apically produced into two more or less ear-shaped lobes, these connected ventrally by a strongly sclerotized bridge from which a strong and solid spinose process (a) arises and is curved at a nearly right angle basolaterad to the left side. Apically, the periandrium lobes sheathe a membraneous spout which is probably homologous to the flagellum. Phallotreme located apically, in the cavity enclosed by the the ear-shaped lobes of the periandrium (figs 5, 7, arrow). Periandrium with two additional lateral spinose processes: one (b) arising on the right side near the aedeagal base (broken off in the lectotype) and one (c) arising on the left side, slender, terete, slightly curved at near its base, pointing dorsocaudad.



FIGURES 5–7. *Oliarus walkeri* (Stål, 1852). Male genitalia (Lectoype, specimen from Malacca). Fig. 5, aedeagus, right lateral aspect; fig. 6, dorsal aspect; fig. 7, same, left lateral aspect (basal part reconstructed from fragments). Figs 5–7: dash lines indicate where periandrium is broken in the lectotype specimen. Scale lines: 0.1 mm.

Distribution

There are now only two confirmed records of *Oliarus walkeri* (Stål): Malacca (today: Melaka), west coast of Malay Peninsula), and Borneo (Sarawak). The species may have a wider distribution in South-East Asia; however, published records from the Philippines,

Singapore, Penang (today: Pinang), and Java (Metcalf 1936) require confirmation on the basis of the examination of male specimens.

Ecology: There is no information available from the collection labels pertaining to biology or ecology of this species.

Phylogenetic implication

While Van Stalle (1991) provided a comprehensive taxonomic treatment of the *Oliarus* s.l. species of the Oriental region but did not further subdivide the taxon, Emeljanov (2001 b) recognized the high morphological diversity among species from the Oriental region placed in *Oliarus* and erected several additional genera to better reflect its heterogeneity. Accordingly, the genus *Oliarus* s.str. now contains 46 species (Emeljanov 2001 b: 71) from the Oriental region, which share several characters of the head carination and the parameres. Whether or not any of these characters are indeed synapomorphies shared by the species contained in *Oliarus* s.str. can only be decided on the basis of a comprehensive phylogenetic analysis. The special configuration of the aedeagus (without articulation between shaft and flagellum; flagellum sheathed by process of periandrium, not movable against shaft) of *O. walkeri* is not only highly apomorphic within the Pentastirini, but also within the Cixiidae. As far as can be assessed from published descriptions and figures, the species accommodated in *Oliarus* s.str. sensu Emeljanov (2001 b) do not appear to share this apomorphy. Whether this particular configuration of the aedeagus constitutes an autapomorphie of *O. walkeri* or is a synapomorphy for several taxa, cannot be assessed here, and deserves a more comprehensive study.

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