

Taxonomical notes on some fossil soldier beetles (Cantharidae)

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In this document I describe the oldest fossil taxon of soldier beetles: †*Chauliognathus koonwarra* sp. nov. known so far, from the Lower Cretaceous of Australia. I also set up the new fossil tribe †Nothotythonychini tr. nov. for to accomodate the genus †*Nothotythonyx*. Furthermore, the fossil taxa †*Lithocanthis lunglokshuiensis* Lin in Lin & Lee, 1997 and †*Wongyekokia angustis* Lin in Lin & Lee, 1997 are transferred from the family Cantharidae to the family Carabidae new placements, and †*Podabrus santaritensis* Cockerell, 1936 is still considered an available name and a representative of the family Cantharidae. †*Electronycha prussica* Kazantsev, 2013 and †*Michalskanthis bursztynica* Fanti, 2017 are considered as part of the tribe Cacomorphocerini new placements.

Key words: systematics, soldier beetles, fossils, compression, amber.

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INTRODUCTION

The study of the fossil soldier beetles (Fanti 2017) has increased dramatically in recent years and is very important because improve knowledge on evolution, taxonomy and biogeography. This article describes the oldest currently known Cantharidae, belonging to the living genus *Chauliognathus* Hentz, 1830 from the Cretaceous deposits (Aptian) of Koonwarra in Australia. The genus currently lives in North and South America and in Australia-New Guinea (Delkeskamp 1977; Ramsdale 2002). The adults are frequently found on flowers, where they mate and feed on pollen and nectar. The larvae are more common in soil or debris, where they are predators. The adults are most frequently found in summer and early fall (Ramsdale 2002). In the paper, I also establish a new fossil Cretaceous tribe from Kachin amber in Myanmar, that has intermediate features between the subfamilies

Malthiniinae Kiesenwetter, 1852 and Cantharinae Imhoff, 1856, and take stock of some taxonomic problems.

MATERIALS AND METHODS

I have studied all the literature concerning the taxa in object. The handmade drawing was made based on the original drawing and picture. Then, it was reprocessed using a Ulead PhotoImpact Viewer SE program.

RESULTS

†*Chauliognathus koonwarra* sp. nov.
(Fig. 1)

Cantharid indet: Jell & Duncan 1986: 114 (Table 1), 156–157, Fig. 39.A (drawing, p. 158), Fig. 40.A (photograph, p. 159); Jell 2004: 72 (redescription, photograph and drawing); Fanti

2017: 30; Poropat et al. 2018: pag. 178 and Table 10.

purported cantharid: Ramsdale 2010: 158.

some other citations: Nicholson 2012; The Paleobiology Database.



Fig. 1. *Chauliognathus koonwarra* sp. nov. Reconstruction of the *habitus* (based on: Jell & Duncan 1986; Jell 2004).

Holotype. National Museum of Victoria (now Museums Victoria) Palaeontological Collection (NMVP), Melbourne (Australia), with the code NMVP103331.

Type locality. Australia, Victoria, South Gippsland Highway, road south of Leongatha, 3 km east of Koonwarra, Koonwarra Fossil Bed – Site NMVPL425.

Type horizon. Lower Cretaceous, Middle-Late Aptian with an age of 122.5–112.0 mya, and in particular 115+/-6 mya or 118+/-5 mya (Bean 2017; Poropat et al. 2018). Koonwarra Fossil Bed (upper Strzelecki Group).

Systematic placement. General habitus, tarsal formula (5-segmented hind tarsus), narrow pronotum, clypeus region produced forward, elytra abbreviated and soft, are perfectly compatible in the panorama of Cantharidae which living in Australia only with the genus *Chauliognathus* Hentz, 1830 (Cantharidae, Chauliognathinae).

Differential diagnosis. No species of the genus *Chauliognathus* is known from the Cretaceous period, currently. The fossil *Chauliognathus pristinus* Scudder, 1876 of the Eocene of Florissant (USA), differs from the new species here described, for the pronotum scarcely wider than head with a rounded anterior margin (Scudder 1876). *Ch. koonwarra* sp. nov. differs from the living species in Australia for the elytra strongly abbreviated, the pronotal shape, and for the small size.

Redescription. Based on Jell & Duncan (1986) and Jell (2004): Body length: 7 mm.

Head rounded, with clypeal region somewhat produced forward, convex anteriorly. Eyes rounded-subelliptic, inserted laterally to the head and about half to the posterior margin. Mandibles elongated, falciform, with apices crossing. Maxillary palps with last palpomere elongated. Antennae not preserved. Pronotum wider than head, almost as long as wide, anterior margin straight, posterior margin convex, sides slightly concave anteriorly, posterior corners strongly rounded, anterior corners acute and slightly protruding. Scutellum wide, truncate at apex or slightly rounded. Elytra soft, short and not covering some abdominal segments, wider than pronotum,

parallel-sided, apexes rounded. Abdomen elongated with eight visible tergites which are transverse and subequal in length except for the longer two last segments. Legs robust and short; coxae robust with insertion slightly separated; trochanters elongated, robust, rounded at apex; femora enlarged, slightly curved, sturdier than tibiae; metatibia distinctly longer than metafemur, cylindrical, thin, slightly enlarged at apex. Tarsal formula 5-5-5, tarsus shorter than tibia; first tarsomere elongated, the longest; second and third tarsomere short, sub-equal and together as long as first tarsomere; fourth tarsomere short and bilobed; fifth tarsomere thinner than fourth, robust, very slightly elongated; claws apparently simple.

Etymology. From the type locality Koonwarra Fossil Bed and the rural village Koonwarra. In the Aboriginal word “Koonwarra” = swan. Specific epithet is to be treated as noun in apposition.

Remarks. Specimen described, photographed and drawn, but never named by Jell & Duncan (1986) and Jell (2004). The specimen is very well preserved, even if the antennae and part of the legs are missing (Jell & Duncan 1986). It is an adpression/compression fossil. In the original description (Jell & Duncan 1986) it was compared with the living *Telephorus* = *Cantharis* and *Heteromastix* (Jell & Duncan 1986).

†**Nothotythtonychini tr. nov.**

Type genus. †*Nothotythtonyx* Y.-D. Li, Biffi, Kundrata & Cai, 2022. Tribe monotypic. Extinct tribe.

Etymology. From the name of the type genus [stem: *Tythtonych-*] (Bouchard et al. 2011).

Distribution. Known only from Burmese (Kachin) amber of Myanmar.

Diagnosis. New tribe based on the combination of these characters: Last maxillary palpomere elongate and fusiform with apex acute, pronotum with well-defined borders, antennae strongly serrate, short elytra not covering some abdominal segments, tibiae with apical spurs, tarsal

claws simple and ovopositor with long gonostyli (Li et al. 2022).

Discussion. Based on the above characters, Li et al. (2022) insert the genus *Nothotythtonyx* in the subfamily Malthininae, although the ovopositor with long gonostyli, therefore the well-defined coxites and styli are the “primitive form” and typical of the subfamily Cantharinae (Brancucci 1980; Li et al. 2022). Also, the last maxillary palpomere is not particularly globular but elongated. Clearly indicating the peculiarity of the taxon. I consider the character of the styles to be very important and they could make the tribe †*Nothotythtonychini* tr. nov. belong to the subfamily Cantharinae, but only further discoveries and new studies could shed light on the current systematic position. Therefore, here I continue, like the authors of the genus *Nothotythtonyx*, to consider it provisionally belonging to the subfamily Malthininae, but the new tribe could also be elevated to a subfamily with an intermediate evolutionary position between Cantharinae Imhoff, 1856 and Malthininae Kiesenwetter, 1852.

Li et al. (2022) do not include *Nothotythtonyx* in any of the four known tribes of the subfamily Malthininae. The presence of gular sutures confluent and mandibles strongly toothed of *Nothotythtonyx*, are not typical characters of the tribes Malthinini Brancucci, 1980 and Malthodini Böving & Craighead, 1931 (Li et al. 2022). *Nothotythtonyx* differs from the tribe Malthinini Kiesenwetter, 1852 for the shorter elytra with surface somewhat punctate, presence of tibial spurs, antennae strongly serrate, unelongated metacoxae and well developed styli (Li et al. 2022). These authors do not take into consideration the fossil tribe †*Mimoplatycini* Kazantsev, 2013 which however has a conspicuously carinated pronotum and males’ abdomen with six segments (Kazantsev 2013).

Furthermore, *Nothotythtonyx* doesn’t have much in common with *Tythtonyx* LeConte, 1851 since the latter genus has gular sutures separated and the gonostyli absent (Brancucci 1980; Li et al. 2022).

The Cretaceous species *Archaeomalthodes rosetta* Hsiao, Ślipiński & Pang, 2016 has recently been reinserted to the original position of the subfamily Malthinae and its tribe Malthodini (Fanti 2021). It has no visible gular sutures (Hsiao et al. 2016) and the resemblance with the tribe Nothotythonychini tr. nov. cannot be well ascertained (but it is possible) at the moment. Although, Fanti (2021) had already guessed that it was more closely related to other known Cretaceous species and, therefore, belongs to Cantharinae or a new subfamily or tribe.

†*Lithocantharis lunglokshuiensis* Lin in Lin & Lee, 1997

Note. Species of the Paleocene of Hong Kong (Lin 1997), preserved only on the elytra that are equipped with numerous and fine striae (Fanti 2017). Character not present in the family Cantharidae, therefore *Lithocantharis lunglokshuiensis* Lin in Lin & Lee, 1997 is here tentatively transferred to the family Carabidae new placement, which often have this type of features.

This species is also erroneously considered to be from Cretaceous (Zhao et al. 2022).

†*Wongyekokia angustris* Lin in Lin & Lee, 1997

Note. Species of the Paleocene of Hong Kong (Lin 1997), preserved only on an elytron and a large part of the pronotum. The elytra also in this species are endowed with numerous and sometimes interrupted striae (Fanti 2017). Character practically not present in the family Cantharidae, therefore *Wongyekokia angustris* Lin in Lin & Lee, 1997 is here tentatively transferred to the family Carabidae new placement, which often have this type of features.

This species is also erroneously considered to be from Cretaceous (Zhao et al. 2022).

†*Podabrus santaritensis* Cockerell, 1936

Note. Fanti (2017) in his catalog of the soldier beetles of the world, also lists the species *Podab-*

rus santaritensis, being correctly described for the rules of the Code (ICZN 1999). The original description is based on an elytron only. Today, agree to Hsiao & Ho (2018) a description with these diagnostic characters is to be discouraged. However, Cockerell had a perfect knowledge of the fossil-bearing locality (Sunchal, Quebrada “El Griton”, Argentina) and its faunas and especially in some (few) species of Cantharidae and therefore also *Podabrus*, there is the presence of these three elytral costae and two very small striae. This character makes also the species within the period and the place unique and therefore its displacement in a kind of *incertae sedis* made by Hsiao & Ho (2018), only produces a more uncertain and confusing taxonomy.

The species is correctly described and therefore the name is to be considered perfectly available and thus it is a representative of the family Cantharidae (Fanti 2017).

†*Electronycha prussica* Kazantsev, 2013

†*Michalskantharis burszynica* Fanti, 2017

Note. Due to the supernumerary antennomeres, these genera are tentatively considered here as part of the tribe Cacomorphocerini Fanti & Kupryjanowicz, 2018 new placements.

DISCUSSION

The Koonwarra Fossil Bed contains the best record and arguably the best-preserved fossil insects within the Victorian Cretaceous, and of any age from Australia (Jell & Duncan 1986), and *Chauliognathus koonwarra* sp. nov. is the oldest species of soldier beetles currently described. It is almost comparable in age only to *Molliberus albae* Peris & Fanti, 2018 from Spanish amber: 110 million years ago (Peris & Fanti 2018). Only a few remains of soldier beetles of the Lebanese amber: about 135–125 million years ago (Kirejtshuk & Azar 2013a, 2013b) are older than the new species described here, however they are too fragmented or referred to a larva (Fanti 2017). *Ch. koonwarra* was formed, as adpression fossil, in lithified clay-

stone and fine-grained sandstone and siltstone in a pond, lake. The assemblage faunal composition of the Koonwarra Fossil Bed is relatively modern at family level, with around three-quarters of the recorded species assigned to extant clades (Poropat et al. 2018). Koonwarra site is unusual in the quantite of immature aquatic insect (Poropat et al. 2018) and the low number of specimens suggests to consider the terrestrial coleopterans as allochthonous taxa, arrived and preserved into the ancient lake during or after death (Jell & Duncan 1986). It is particularly noteworthy that all previously known Cretaceous remains of the family Cantharidae coming from Spanish amber, Burmese amber and Agdzhakend amber (Fanti et al. 2018; Peris & Fanti 2018; Fanti & Damgaard 2019, 2020; Kazantsev & Perkovsky 2019; Zhao et al. 2022) are referable to currently extinct genera and therefore they are not survived the great mass extinction of the Cretaceous: 66 million years ago. Thus, *Chauliognathus koonwarra* is the first species that demonstrates that at least one genus (*Chauliognathus*) has crossed the K-T boundary unscathed and confirms that the Koonwarra site faunas has very similar to the current ones and also that the Chauliognathinae are a very ancient subfamily in the panorama of soldier beetles.

The new tribe Nothotythtonychini tr. nov. points out that in the Burmese Cretaceous we have a series of taxa quite different from the present ones, whose phylogenetic relationships remain unclear and undefined.

As the fragmented remains of *Lithocantharis lunglokshuiensis*, *Wongyekokia angustis* and *Podabrus santaritensis* demonstrate, the descriptions without the presence and the possibility of seeing many useful diagnostic characters should be currently avoided.

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