

Delimitation of the *Ceracis singularis* group (Coleoptera: Tenebrionoidea: Ciidae), with the description of a new Neotropical species

Cristiano Lopes-Andrade, Marcelo Silva Madureira

Departamento de Biologia Animal, Setor de Entomologia, Universidade Federal de Viçosa, 36571-000, Viçosa, MG, Brasil

Adilson Ariza Zacaro¹

Departamento de Biologia Geral, Universidade Federal de Viçosa, 36571-000, Viçosa, MG, Brasil

ABSTRACT

Ceracis is a genus of minute fungus beetles distributed throughout the New World, with some species occurring in Indo-Pacific Islands. Even though the Nearctic species had been revised, there are still many undescribed species from the Neotropical Region. The delimitation of species-groups is useful for the study of biogeography and phylogeny of taxa with a considerable number of undescribed species. In this work, we delimit the *Ceracis singularis* group on the basis of peculiar morphological characters and describe a new species belonging to this group. We also discuss the implications of this group's distribution, suggesting some hypotheses regarding the expansion and radiation of *Ceracis*.

RESUMO

Ceracis é um gênero de pequeninos besouros que vivem em fungos, distribuídos pelo Novo Mundo e com algumas espécies ocorrendo em Ilhas Indo-Pacíficas. Embora este gênero tenha sido revisado, recentemente, ainda há muitas espécies que não foram descritas, principalmente da Região Neotropical. A delimitação de grupos de espécies tem sido necessária para o estudo da biogeografia e filogenia de taxa com um número considerável de espécies não descritas. Neste trabalho, nós delimitamos o grupo *Ceracis singularis* com base em caracteres morfológicos peculiares e descrevemos uma nova espécie deste grupo. Nós também discutimos as implicações da distribuição desse grupo, sugerindo algumas hipóteses sobre a expansão e irradiação de *Ceracis*.

Ceracis Mellié is one of the most diversified genus of Ciidae, having 43 described species: 36 species occurring on the New World and seven species being spread over Indo-Pacific Islands, three on Japan, and the others on Fiji, Marquesas, New Caledonia and Guam (Abdullah 1973, Kawanabe 1994b, Lawrence 1967, 1971). Five species occur in Brazil: *Cer. bicornis* (Mellié), *Cer. cornifer* (Mellié), *Cer. cucullatus* (Mellié), *Cer. variabilis* Mellié, and *Cer. ruficornis* Pic (Lopes-Andrade 2002).

The biology of ciid beetles is very interesting, and many studies on these mycetobiont beetles are being conducted by us. However, these works are being limited by the poor knowledge of the taxonomy of Neotropical ciids (Lopes-Andrade 2002). Aiming to propose new characters to be used in Ciidae classification, and to understand some aspects of its systematics, our team is working on a cladistic analysis of some species belonging to the known New World genera of

¹Corresponding author: Adilson Ariza Zacaro. E-mail: aazacaro@ufv.br

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Ciidae (unpublished data). Some characters which will be discussed here, and in a certain extent the biogeographic scenario proposed below, are based on unpublished results.

Ceracis is part of a group of Ciidae genera, such as *Odontocis* Nakane and Nobuchi, *Waigacis* Lohse, *Paraxestocis* Miyatake, *Porculus* Lawrence, and *Dichodontocis* Kawanabe, easily recognized by the laminate prosternal process (Lawrence 1987, Kawanabe 1994a). In the past, most Ciidae genera were defined in the basis of inadequate characters, such as antennal segmentation, which now is known to be variable even within a genus. A 10-segmented antenna is a plesiomorphy of this group (even of Ciinae), and there is a tendency toward reduction of the antennal segmentation in many independent lineages, showing that it is an homoplastic character. The antennae of all known species of *Porculus* and *Dichodontocis* are 10-segmented, however those of *Odontocis* and *Waigacis* are 9-segmented, and those of most *Ceracis* are 8 or 9-segmented. Within *Ceracis*, however, there are two species with 10-segmented antennae: *Cer. furcicollis* (Blair), from Marquesas Islands, and *Cer. singularis* (Dury), which occurs in Canada and USA, with one single record from Costa Rica (Lawrence 1967, 1971).

As the number of described and, even more, undescribed forms of Ciidae is high in the New World, some species-groups are being delimited to facilitate their study, mainly in the genera *Cis* and *Ceracis*. Lawrence (1967) proposed two groups of *Ceracis* (*Cer. furcifer* gp. and *Cer. cucullatus* gp.), to deal with some of the non-North American species. Afterwards, Lopes-Andrade (2002) delimited the *Cer. furcatus* gp., to deal with a group of species which are taxonomically problematic. It is necessary to emphasize that these species-groups are taxonomic tools, and they cannot be considered *a priori* to be monophyletic taxa.

In this work we describe a new species of *Ceracis*, delimit the *Ceracis singularis* group and discuss its geographic distribution and phylogenetic relationships, shedding some light on the biogeography of *Ceracis*.

Ceracis limai sp. nov.

Holotype, Male. Body length (excluding head): 1.4 mm; greatest elytral width: 0.55 mm; greatest pronotal width: 0.5 mm; greatest depth (taken through the elytra and metasternum): 0.5 mm. Body 2.55 times as long as elytral width, convex, glabrous. Dorsal and ventral surfaces dark reddish brown; labial palpi, maxillary palpi and antenna yellowish brown; legs reddish brown. Frontoclypeal ridge produced, forming a short, broad, slightly concave lamina, which is shallowly emarginate at apex; Antenna 10-segmented; segment III 1.4 times as long as IV. Pronotum 1.1 times as long as broad, widest behind middle; sides rounded; anterior edge produced, forming a flat, slightly elevated lamina, which is deeply emarginate apically and bears a short, longitudinal elevation on each side, giving the appearance of two rounded, slightly divergent horns, each bearing a dorsal knob; disc strongly impressed anteriorly between the two knobs; surface distinctly granulate; punctures about 0.07 times as large as scutellar base and separated by 1.0 to 2.0 diameter; interstices of punctures with microreticulation. Elytra 1.55 times as long as broad, and 1.55 times as long as pronotum; sides subparallel for half of their lengths and gradually converging apically; punctuation single and sparse. Metasternum 0.46 as long as wide; suture very short. First urosternite with a circular and margined pubescent fovea at middle. **Male genitalia.** As illustrated in Figure 2.

Allotype, Female. Body length (excluding head): 1.43 mm; elytral length: 0.85 mm; greatest elytral width: 0.65 mm; greatest pronotal width: 0.55 mm; greatest depth: 0.55 mm. First urosternite lacking a pubescent fovea, and pronotum without secondary sexual characteristics.

Variation in a series of paratypes. Male (n = 4): Body length (excluding head) 1.25 - 1.85 (X = 1.55, SD = 0.26); greatest elytra width 0.65 - 0.68 (X = 0.66, SD = 0.01). Body length 1.85 - 2.85 (X = 2.35, SD = 0.44) times as long as elytral width. Pronotum 0.82 - 1.11 (X = 1.00, SD = 0.13) as long as broad. Elytra 1.11 - 1.69 times (X = 1.46, SD = 0.25) as long as broad, and 1.47 - 2.22 times (X = 1.68, SD = 0.36) as long as pronotal length. Female (n = 4): Body length (excluding

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head) 1.3 - 1.6 ($X = 1.48$, $SD = 0.14$); greatest elytra width 0.45 - 0.65 ($X = 0.55$, $SD = 0.09$). Body length 2.23 - 3.50 ($X = 2.75$, $SD = 0.54$) times as long as elytral width. Pronotum 1.04 - 1.22 ($X = 1.14$, $SD = 0.09$) as long as broad. Elytra 1.31 - 2.11 times ($X = 1.63$, $SD = 0.34$) as long as broad, and 1.36 - 1.52 times ($X = 1.44$, $SD = 0.07$) as long as pronotal length.

Type series. Holotype: BRASIL, MG, Viçosa, "Mata da Biologia", 20. I. 2002, C. Lopes-Andrade *leg.* Allotype: same data as holotype. Paratypes: 4 males, 4 females, same data as holotype; 2 males, same locality, 11. XI. 1999, F. Gumier-Costa & C. Lopes-Andrade *leg.*; 6 males, BRASIL, ES, Venda Nova do Imigrante, 31. V. 2002, R. Falqueto *leg.*

Etymology. This species is named in honor of José Lopes de Lima, grandfather of Cristiano Lopes-Andrade.

Distribution. Viçosa, Minas Gerais State, and Venda Nova do Imigrante, Espírito Santo State. Known to occur only on Southeast Brazil.

Host fungi. *Phellinus* sp. and *Ganoderma* sp.

DELIMITATION OF THE GROUP

Ceracis limai is most similar to *Ceracis furcicollis* (Blair) from Polynesia (Marquesas Islands), due to the sparse punctuation of the elytra. It is also allied to *Cer. singularis* (Dury), but this North American species has seriate elytral punctuation. All these species share some peculiarities not present in other species of *Ceracis*: i) a 10-segmented antenna; ii) a produced frontoclypeal ridge with a short and slightly concave lamina (Fig. 3A); iii) pronotum with the anterior edge produced, forming a lamina that is deeply emarginate apically, bearing a short and longitudinal elevation on each side, giving the appearance of two rounded and slightly divergent horns, each one with a dorsal knob (Fig. 3B), and pronotal disc impressed anteriorly between the two knobs. Lawrence (1967) have already linked *Cer. singularis* and *Cer. furcicollis* on the basis of pronotal horn shape, although he did not use a species-group name. On the basis of the characters discussed above, this species-group is now named *Ceracis singularis* group, and it should also include *Ceracis limai*.

DISCUSSION

Besides one record of *Cer. singularis* from Costa Rica, no other specimen of *Ceracis* with 10-segmented antenna have previously been collected in the Neotropical Region. Lawrence (1967) argued that the lack of *Cer. singularis* on Mexico could be an artifact of collection. However, further work in this country did not encounter this species, although some collecting efforts have been made in the central states (Navarrete-Heredia and Burgos-Solorio 2000). Lawrence (1967) divided the North American *Ceracis* in four geographic groups (Northern, Western Mexican, Eastern Mexican, and West Indian), and pointed out that the species belonging to the Northern group include most of the "older elements" of the North American Ciidae fauna. This leads to the idea that *Ceracis* could have been originated in the northern North America, although Lawrence (1967) did not undertake this discussion.

Among the Neotropical Ciidae genera, *Ceracis* is closely allied to *Porculus*, which is distributed from Mexico to Argentina (Lawrence 1987), and to an undescribed genus occurring in Panama, Costa Rica and Brazil. This might suggest that these three phyletic lines have at least diverged in the Neotropical Region. Among these three genera, *Ceracis* would be the first which had expanded through the continent, reaching the Oceania, suggesting a hypothesis to explain the presence of *Ceracis* in some Pacific Islands. Alternatively, they could have come from the Pacific. These hypotheses can be evaluated with further studies of the ciid fauna of Oceania. The expansion of *Cer.* to North America probably occurred in the Cenozoic, after the approach of that continent to the South America. Subsequent radiation of the genus probably occurred in the latter continent, where such groups as the *Cer. furcifer* and *Cer. cucullatus* groups have emerged. Then, some species of these groups could have reached North America, being

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represented nowadays by *Cer. monocerus* and *Cer. thoracicornis*, for instance. Therefore, the gradient pattern – more “conservative” species in the northern North America and recent groups near Mexico, *sensu* Lawrence (1967) – could have resulted from a radiation center of the genus outside the North America.

SYSTEMATICS OF BRAZILIAN CIIDAE

This report increases the number of described Brazilian species to 24. However, Lopes-Andrade (2002) did not consider an informal report of *Cis pusillus* Gorham (Lawrence 1971), and did not include *Cis bahiensis* (Pic) in his list as a mistake. *Cis bahiensis* was originally described in the genus *Malacocis* Gorham, but Lawrence (1971) proposed that this species could belong to the *Cis taurus* group. Therefore, 26 ciid species occur in Brazil, which is much more than the 16 mentioned by Navarrete-Heredia and Fierros-López (2001).

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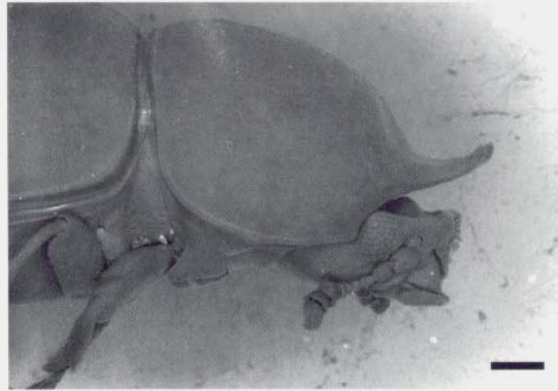
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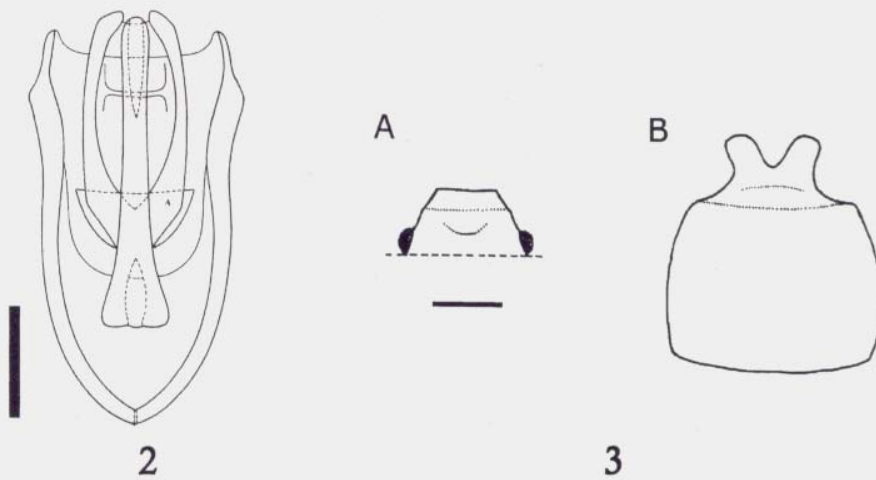
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Figures 1-3. *Ceracis limai* sp. nov., male. 1. SEM photograph of the lateral view of pronotum and head. Bar: 100 μ m. 2. Genitalia. Bar: 0.07mm. 3. A. Dorsal view of the head. B. Dorsal view of pronotum. Both drawn to the same scale. Bar: 0.25mm.