CRISTIANO LOPES ANDRADE

ANÁLISE FILOGENÉTICA DE CIIDAE (COLEOPTERA: TENEBRIONOIDEA)

Tese apresentada à Universidade Federal de Viçosa, como parte das exigências do Programa de Pós-Graduação em Entomologia, para obtenção do título de *Magister Scientiae*.

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APROVADA: Viçosa, 20 de Fevereiro de 2004.

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(Conselheiro)

Prof. José Henrique Schoereder

Prof. Flávia Maria da Silva Carmo

Prof. Doralice Maria Cella

Prof. Carlos Frankl Sperber
(Orientador)

“Tudo é igual; nada merece a pena; o mundo não tem sentido; o saber asfixia”.

O Adivinho, em
Assim Falava Zaratustra, de Friedrich Nietzsche

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RESUMO

LOPES-ANDRADE, Cristiano, M.S., Universidade Federal de Viçosa, fevereiro de 2004. **Análise filogenética de Ciidae (Coleoptera: Tenebrionoidea).** Orientador: Carlos Frankl Sperber. Conselheiros: Adilson Ariza Zacaro e Jorge Abdala Dergam dos Santos.

Ciidae é uma família de pequenos besouros micetobiontes, que vivem principalmente em corpos-de-frutificação de macrofungos conhecidos vulgarmente como orelhas-de-pau. Esta família tem distribuição mundial, e conta atualmente com 40 gêneros e cerca de 600 espécies descritas. Esta dissertação trata da análise filogenética dos principais gêneros (21) da família Ciidae, incluindo representantes de todos os *taxa* supragenérico e, quando possível, a espécie-tipo de cada gênero. Para tornar possível a análise filogenética desses *taxa*, houve a necessidade da organização de uma coleção de referência para Ciidae. Posteriormente, foram feitos estudos da morfologia externa e da morfologia de genitália de machos e fêmeas, e os resultados desses estudos são apresentados na forma de seis artigos, uma nota científica, dois resumos expandidos e dois manuscritos. Com base nesses estudos, foi construída uma matriz com 59 espécies como grupos terminais (54 como grupo interno e cinco como grupo externo) e 96 caracteres. Essa matriz foi analisada utilizando um algorítmo heurístico (TBR), com 4000 replicações, utilizando caracteres com pesos iguais e pesagem sucessiva de caracteres, sendo os caracteres otimizados posteriormente nos dois cladogramas finais de consenso estrito. A análise filogenética, com a matriz final e a lista de caracteres analisados, é apresentada por completo no segundo manuscrito. A análise demonstrou que a família Ciidae e suas duas subfamílias (Sphindociinae e Ciinae) são grupos monofiléticos. Contudo, as tribos de Ciinae (Ciini, Orophiini e Xylographellini) não foram sustentadas pela análise.

ABSTRACT

LOPES-ANDRADE, Cristiano, M.S., Universidade Federal de Viçosa, February 2004. **Phylogenetic analysis of Ciidae (Coleoptera: Tenebrionoidea).** Advisor: Carlos Frankl Sperber. Committee members: Adilson Ariza Zacaro and Jorge Abdala Dergam dos Santos.

Ciidae is a family of minute mycetobiont beetles, which lives mainly in fruiting bodies of macrofungi, commonly known as bracket fungi. This family is distributed worldwide, and has currently 40 genera and around 600 species described. This dissertation is on a phylogenetic analysis of the main Ciidae genera (21), including species of all the suprageneric *taxa* and, as far as possible, the type species of each genus. The organization of a reference collection of Ciidae was necessary to make possible the conduction of a phylogenetic analysis. Moreover, studies on the external morphology of male and female genitalia were conducted, and the results of these studies are presented as six articles, one scientific note, two abstracts and two manuscripts. Based on these studies, a matrix was constructed with 59 species as terminal groups (54 as ingroup and five as outgroup) and 96 characters. This matrix was analyzed with an heuristic algorithm (TBR), with 4000 replications, using unweighted characters, and successive weighting of characters; afterwards, the characters were optimized in both final and strict consensus cladograms. The phylogenetic analysis, with the final matrix and the list of analyzed characters, is thoroughly presented in the second manuscript. The analysis has shown that the family Ciidae and its subfamilies (Sphindociinae and Ciinae) are monophyletic groups. However, the tribes of Ciinae (Ciini, Orophiini and Xylographellini) were not supported by the analysis.

INTRODUÇÃO GERAL

Nos últimos anos, cresceu muito o interesse pelos insetos micetócolos, que são aqueles que possuem algum grau de associação com fungos. Esses insetos são divididos em (*sensu* Scheerpeltz & Höfler 1948): (i) micetoxenos, que visitam ocasionalmente o fungo; (ii) micetófilos, que são polífagos que se alimentam de diversos recursos em decomposição ou predadores de outros insetos que habitam os fungos; (iii) micetobiontes, insetos cuja associação com o fungo é obrigatória, já que tanto as larvas como os adultos dependem exclusivamente do fungo como hospedeiro e alimento. Poucos grupos de insetos são caracteristicamente micetobiontes, valendo citar Cecidomyiidae (Diptera), Dorcatominae (Coleoptera: Anobiidae) e Ciidae (Coleoptera). A família Ciidae é reconhecidamente o grupo de micetobiontes mais diverso e abundante, representando grande parte da biomassa de insetos presentes em macrofungos.

Biologia

Os ciídeos (Coleoptera: Tenebrinoidea: Ciidae) são pequeninos besouros que vivem em corpos de frutificação de macrofungos, principalmente em orelhas-de-pau. Esses insetos são considerados micetobiontes (*sensu* Scheerpeltz & Höfler 1948), já que tanto as larvas como os adultos dependem exclusivamente de macrofungos para se desenvolverem. Há poucos registros sobre adultos de ciídeos fora desses *habitats*, valendo citar alguns coletados em luz (Lawrence 1971; Lopes-Andrade obs. pes.) ou em armadilhas de interceptação de vôo (Andreas Herrmann com. pes.). Há, também, registros de coleta de *Atlantocis lauri* (Wollaston, 1854), uma espécie áptera, em serapilheira e embaixo de troncos de árvores na ilha Madeira (Israelson 1985).

A maior parte dos dados sobre a especificidade de espécies de ciídeos a determinados macrofungos são para a Região Neárctica (Lawrence 1973), Europa (Reibnitz 1999) e Japão (Kawanabe 1995, 1996, 1998, 1999). A grande maioria dos ciídeos vivem em fungos Aphyllophorales (Basidiomycetes: Schizophyllaceae, Stereaceae, Polyporaceae, Ganodermataceae, Hymenochaetaceae), e alguns poucos em Agaricales (Basidiomycetes: Pleurotaceae, Tricholomataceae, Bolbitiaceae). O gênero *Orthocis* Casey, 1898 vive principalmente em fungos da família Auriculariaceae (Basidiomycetes: Auriculariales). Alguns autores propõem que os fungos utilizados por espécies de ciídeos atuais podem ser filogeneticamente próximos dos fungos explorados por suas espécies ancestrais (*e.g.*, Gumier-Costa *et al.* 2003).

Como conseqüência de sua dependência por fungos, os ciídeos são afetados por modificações ambientais que interferem na disponibilidade de macrofungos

(Thunes *et al.* 1999). Isto ocorre quando há alterações nas condições necessárias para o desenvolvimento desses fungos, ou quando diminui a qualidade ou quantidade de substrato onde esses fungos poderiam se desenvolver (Jonsell & Nordlander 1995; Fossli & Andersen 1998; Rukke 2000).

Os dados sobre a dispersão de ciídeos são esparsos e inconclusivos. Diversos autores (Jonsell & Nordlander 1995; Fäldt *et al.* 1999; Guevara et al. 2000a,b) demonstraram que os ciídeos são atraídos por substâncias voláteis (mencionadas também como odores) exalados pelos corpos-de-frutificação, e que as espécies de Ciidae apresentariam diferentes graus de especificidade a esses voláteis. Jonsson *et al.* (1997) discutem que indivíduos colonizadores poderiam liberar feromônio(s) de agregação, atraindo conspecíficos.

Importância econômica

Há poucos registros de Ciidae como espécie-praga ou de importância econômica. Madenjian *et al.* (1993) mencionaram três espécies como pragas de cogumelos secos comestíveis: *Cis asiaticus* Lawrence, 1991; *Cis chinensis* Lawrence, 1991; *Orthocis auriculariae* Lawrence, 1991. Todas foram encontradas em embalagens de fungos provenientes da Tailândia e China, mas adquiridas em lojas de alimentos importados nos EUA (Lawrence 1991). Estes insetos também podem causar prejuízos a coleções científicas de fungos; este é o caso, por exemplo, de *Hadraule blaisdelli* (Casey, 1900), que pode ter dezenas de gerações em um mesmo fungo, sem adição de água ou de nenhum nutriente (Klopfestein & Graves 1992).

Sistemática

A primeira espécie de Ciidae foi descrita como *Dermestes boleti* Scopoli, 1763, com base em exemplares coletados em Carniola (província de Kranjska, Eslovênia). Hoje, sabe-se que essa espécie também ocorre no Cáucaso e no Japão. Posteriormente, *Derm. boleti* foi transferido para um gênero novo, *Cis* Latreille, 1796. O vocábulo *Cis* vem do grego “κισ” (“Kis”), substantivo masculino que designa “verme que escava madeira”, possível alusão aos imaturos que pareceriam vermes; por causa deste nome, acreditou-se durante muito tempo que esses besouros se alimentavam diretamente de madeira. A descrição de outras espécies com características similares e incluídas em *Cis* levou Leach (*in* Samouelle 1819) a delimitar uma família à parte para este gênero, chamada “Cisidae”. Porém, a derivação do nome da família não está correta, já que o “s” de *Cis* deveria ser suprimido para se adicionar o sufixo “-idae”. Uma variação do grego “κισ” (“Kis”) é “κιοσ” (“Kios”), o que poderia levar à derivação

“Cioidae”, que também foi utilizada por alguns autores a partir da segunda metade do século XIX até o início do século XX (Gistel 1856; Gemminger & Harold 1869; Fåhraeus 1871; Kiesenwetter 1877; Reitter 1878, 1902; Gorham 1883; Casey 1898; Perkins 1900; Kraus 1908; Dalla Torre 1911; Dury 1917; Bréthes 1924; Lesne 1924). Contudo, o gênero nominotípico não foi descrito com base nesta variante. Outro nome que aparece na literatura é “Cissidae” (Wollaston 1854; Waterhouse 1860), que pode ter sido simplesmente um erro de grafia.

Ciidae é o nome correto (Grensted 1940) e todos os taxônomos em atividade concordam com isso (*e.g.* Lawrence 1965; Kawanabe 1994a). Portanto, Ciidae é o nome que deve ser usado para se referir a esta família de besouros. Em muitos livros didáticos (*e.g.* Borror *et al.* 1997), na última listagem das espécies da família (Abdullah 1973), e em trabalhos faunísticos na Europa (*e.g.* Reibnitz 1999) imperou o uso do nome Cisidae. Trabalhos faunísticos ou didáticos não devem ter influência forte na nomenclatura zoológica. Por exemplo, em Borror *et al.* (1997) a classificação de Coleoptera se baseou indiretamente no *Coleopterorum Catalogus* (*e.g.*, Dalla Torre 1911) que, por sua vez, utilizou uma nomenclatura tradicional sustentada em trabalhos do século XIX. Há, contudo, outros trabalhos mais recentes sobre a taxonomia deste grupo (*e.g.*, Miyatake 1954; Lawrence 1971; Lawrence & Newton 1995), que poderiam ter servido como referência no livro supracitado.

A primeira revisão mundial da família foi feita por Mellié (1848) e incluía 106 espécies distribuídas em 7 gêneros (*Endecatomus* Mellié, 1848; *Xylographus* Mellié, 1847; *Ropalodontus* Mellié, 1847; *Cis* Latreille, 1796; *Ennearthron* Mellié, 1847; *Orophius* Redtenbacher, 1847; *Octotemnus* Mellié, 1847) e 1 subgênero (*Ceracis* Mellié, 1848), e não 8 gêneros como citado por Lawrence (1971). Alguns desses gêneros já tinham sido descritos por Mellié (1847) em um pequeno trabalho, com base em espécies descritas originalmente no gênero *Cis*. Várias modificações importantes se sucederam depois deste trabalho: (i) o nome do gênero *Ropalodontus* foi corrigido para *Rhopalodontus* por Dohrn in Strübling, 1851 (*acc.* Pope 1977); (ii) *Endecatomus* foi retirado da família e transferido para Bostrichidae por LeConte (1861); (iii) *Orophius* foi rebaixado à subgênero de *Octotemnus* (Reitter 1878); (iv) *Ceracis* ganhou *status* de gênero (Lacordaire 1857). O restante dos gêneros citados por Mellié (1848) são válidos até hoje. A única mudança drástica na caracterização dos gêneros deste trabalho (*op. cit.*) foi a transferência de diversas espécies de *Ennearthron* para *Ceracis* Mellié, 1848, na revisão dos *Ceracis* da América do Norte (Lawrence 1967b).

Os trabalhos subseqüentes à Mellié (1848) foram, em sua maioria, descrições de espécies nos gêneros já existentes. Alguns gêneros de Ciidae foram transferidos para outras famílias, e outros foram sinonimizados: (i) o gênero *Rhipidandrus* LeConte, 1862, foi transferido para Ciidae (LeConte & Horn 1883), mas retornou para

Tenebrionidae; (ii) *Pterogenius* Candèze, 1861, por sua vez, foi para uma nova família (Pterogeniidae), juntamente com *Histanocerus* Motschulsky, 1858 (*in* Crowson 1955); (iii) *Sphindocis* Fall, 1917 foi retirado de Ciidae (Lawrence 1971); (iv) diversos gêneros foram sinonimizados principalmente com *Cis* (*e.g.*, *Eridaulus* Thomson, 1863, *Macrocis* Reitter, 1878, *Cisdygma* Reitter, 1885, *Xestocis* Casey, 1898).

Posteriormente, estudos de espécimes coletados em expedições científicas às ilhas do Pacífico (Perkins 1900; Scott 1926; Blair 1928; Zimmerman 1938) levaram à descoberta de diversos ciídeos, que foram descritos em gêneros novos, a saber: *Apterocis* Perkins, 1900; *Dimerapterocis* Scott, 1926; *Paratrichapus* Scott, 1926; *Polynesicis* Zimmerman, 1938; *Scolytocis* Blair, 1928; e *Tropicis* Scott, 1926. Estudos da fauna japonesa levaram à descrição de gêneros restritos a esse país: *Acanthocis* Miyatake, 1954; *Anoplocis* Kawanabe, 1996; *Dichodontocis* Kawanabe, 1994; *Hyalocis* Kawanabe, 1993; *Lipopterocis* Miyatake, 1954; *Neoennearthron* Miyatake, 1954; *Nipponapterocis* Miyatake, 1954; *Nipponocis* Nobuchi & Wada, 1955; *Odontocis* Nakane & Nobuchi, 1955; *Paraxestocis* Miyatake, 1954; *Syncosmetus* Sharp, 1891; e *Xylographella* Miyatake, 1985. Atualmente, um dos focos de interesse da taxonomia supra-específica de Ciidae é justamente comparar estes gêneros considerados endêmicos e questionar a validade dos mesmos. Algumas sinonímias, inclusive, serão propostas em breve (*e.g.*, *Nipponocis* como sinônimo de *Cis*; Lawrence com. pes.).

Grande parte dos gêneros de Ciidae têm ampla distribuição geográfica, sendo alguns holárcticos (*Dolichocis* Dury, 1919; *Ennearthron*; *Hadraule* Thomson, 1863; *Octotemnus*; *Rhopalodontus*; *Strigocis* Dury, 1917; *Sulcacis* Dury, 1917), paleárcticos (*Cisarthron* Reitter, 1885), pantropicais (*Xylographus*), neotropicais (*Falsocis* Pic, 1916; *Malacocis* Gorham, 1886; *Porculus* Lawrence, 1987) ou mundiais (*Cis*; *Orthocis*). Poucos gêneros são endêmicos dos EUA (*Plesiocis* Casey, 1898; *Sphindocis* Fall, 1917), da Europa Oriental (*Diphyllocis* Reitter, 1885; *Wagaicis* Lohse, 1964) e de ilhas do Atlântico (*Atlantocis* Israelson, 1985).

Ciidae conta atualmente com 40 gêneros (Anexo 1) e cerca de 600 espécies descritas (Adbullah 1973; Lawrence com. pes.). Contudo, sabe-se que a diversidade dessa família é muito maior, principalmente nos trópicos. Até o momento, as faunas mais bem estudadas foram a Neárctica (Casey 1884, 1898; Lawrence 1967b, 1971, 1974a,b, 1982), Japonesa (Miyatake 1954, 1955, 1959, 1982, 1985; Nakane & Nobuchi 1955, 1956; Nobuchi 1955, 1959, 1960a,b; Nobuchi & Wada 1956; Chujô 1939, 1940a,b, 1941, 1966; Kawanabe 1993, 1994a,b, 1995a,b, 1996a,b, 1997a,b, 2002; Kawanabe & Miyatake 1996), Paleárctica (Reitter 1885, 1886, 1887, 1902, 1911, 1913a,b, 1915; Thomson 1863; Abeille de Perrin 1874a,b, 1876; Królik 2002; Ruta 2003), e as das ilhas do Pacífico Sul (Blackburn & Sharp 1885; Blair 1927, 1928, 1932, 1935, 1940, 1941, 1944; Zimmerman 1938, 1939, 1941, 1942).

Até 2001, os estudos taxonômicos sobre a fauna Neotropical se restringiram à descrições esparsas. Com exceção do trabalho de Mellié (1848), a quase totalidade das espécies neotropicais foi descrita por Bréthes (1922, 1923, 1924), Friedenreich (1881), Gorham (1883, 1886, 1898), Lawrence (1987) e Pic (1916a,b, 1922, 1923, 1930, 1940).

Muitos autores tentaram estabelecer uma classificação supragenérica para Ciidae. A grande maioria das divisões adotadas, porém, eram artificiais (*e.g.*, Cisinae e Octotemninae, *in* Winkler 1927). Lawrence (1971), em sua revisão dos Ciidae da América do Norte, adotou uma divisão simples de Ciidae em duas subfamílias: Orophiinae e Ciinae. A primeira incluía os gêneros *Octotemnus* Mellié, 1847, *Paratrichapus* Scott, 1926, *Rhopalodontus* Dohrn in Strübling, 1851 (mencionado erroneamente como *Rhopalodontus* Mellié, 1847), *Scolytocis* Blair, 1928, e *Xylographus* Mellié, 1847. Todos os outros gêneros conhecidos até então foram incluídos em Ciinae. Posteriormente, o próprio autor desse trabalho (*op. cit.*) alterou essa classificação, mudando o *status* dessas subfamílias para tribos (Orophiini e Ciini), que foram incluídas em uma única subfamília, Ciinae (Lawrence 1974a). Contudo, em um *addendum* do mesmo trabalho, Lawrence propôs o retorno de *Sphindocis denticollis* Fall, 1917 para Ciidae, em uma subfamília própria (Sphindociinae). Lawrence (1974b) estudou em detalhes os imaturos de *Sphindocis* Fall, 1917 e delimitou finalmente a subfamília Sphindociinae com mais precisão. Posteriormente, Lawrence (1982, 1987) utilizou esta última classificação, que também foi adotada por autores japoneses (*e.g.*, Kawanabe 1993). Entretanto, um estudo mais detalhado do gênero japonês *Xylographella* levou à descrição de uma nova tribo de Ciinae, chamada Xylographellini (Kawanabe & Miyatake 1996); segundo estes últimos autores, o gênero *Scolytocis* seria incluído dubitavelmente nesta nova tribo.

Entretanto, em seu trabalho sobre os Coleoptera do mundo, Lawrence *et al.* (1999) abandonaram a divisão de Ciinae em tribos, dada a falta de autapomorfias conhecidas para cada um desses *taxa*. Assim, não há um consenso sobre a classificação de Ciidae, e é necessário que se encontrem autapomorfias consistentes, que possam justificar uma classificação supragenérica da família.

Relações filogenéticas

A família Ciidae pertence à superfamília Tenebrionoidea (antiga divisão Heteromera, in pars), da série Cucujiformia da subordem Polyphaga. Esta subordem é a mais diversificada dentro dos Coleoptera. Cucujiformia (Tenebrionoidea + Cucujoidea) é considerado um ramo monofilético (Lawrence 1995). Grande parte das espécies deste grupo possuem algum grau de associação ou dependência por fungos

(Lawrence et al. 1999). Dentro de Tenebrionoidea, Ciidae é um ramo basal, estando extremamente próximo a Pterogeniidae (considerado como grupo irmão), Archaeocrypticidae, Prostomidae, Mycetophagidae e Melandryidae (Lawrence 1982).

Não há nenhuma filogenia de Ciidae publicada, nem mesmo para grupos de espécies ou gêneros dentro desta família. Todas as propostas de relações filogenéticas feitas até o momento são completamente empíricas, e se restringiram à indicação de proximidade entre alguns gêneros.

Breve diagnose da família Ciidae

A seguir é apresentada uma breve diagnose dos adultos de Ciidae (*sensu* Lawrence 2002), citando os caracteres básicos que os separam de adultos de outras famílias da ordem Coleoptera. Salienta-se que esta diagnose não inclui resultados obtidos nesta dissertação.

> "Cabeça globular, parcialmente escondida pelo pronoto. Olhos protuberantes, ovais e inteiros, grossamente facetados. Área frontoclipeal com sutura distinta. Antenas com 8 a 10 antenômeros (Ciinae) ou 11 (Sphindociinae), sendo que os últimos três formam uma clava (com exceção de Sphindociinae) em que cada antenômero têm 4 tufos de sensilas (Ciini e Orophiini) ou mais de quatro tufos (Xylographellini). Clípeo dos machos, algumas vezes, com cornos, dentes, ou tubérculos. Labro esclerotizado; mandíbulas pequenas, largas, com ápices bidentados e mola basal desenvolvida; maxila com gálea e lacínia desenvolvidas (Sphindociinae) ou reduzidas (Ciinae); palpos maxilares com quatro palpômeros. Lábio com lígula reduzida; palpo labial com três palpômeros.
> Pronoto transverso a quadrangular, com largura basal similar à largura do élitro; algumas vezes alargado no meio ou na base; laterais retas ou curvas, lisas ou ligeiramente crenuladas (Ciinae) ou dentadas (Sphindociinae); processo prosternal estreito no ápice ou com lados paralelos, raramente ausente; processo posterocoxal desenvolvido; cavidades procoxais abertas internamente, externamente ou fechadas; trocantins expostos parcialmente ou escondidos; procoxas externamente transversas (Ciini) ou cônicas (Orophiini e Xylographellini), contíguas ou separadas. Mesosterno transverso, podendo ser muito pequeno; mesocoxas globosas, cavidades coxais circulares ou transversas, contíguas ou ligeiramente separadas, mas não são fechadas lateralmente pelos esternos; mesotrocantins escondidos ou expostos, junção entre mesotrocanter e fêmur oblíqüa, separando a base do fêmur da coxa; escutelo desenvolvido ou reduzido; metasterno subquadrangular, sem linhas coxais, com ou sem sutura metasternal; metacoxas transversas, contíguas ou ligeiramente separadas; tíbias finas a fortemente dilatadas no ápice ou no meio, com ou sem espinhos externos, esporões apicais presentes ou ausentes; fórmula tarsal 4–4–4 (raramente 3–3–3), tarsômeros finos, os primeiros juntos e sempre menores que o último. Élitro inteiro, sem pontos nas estrias, mas com pontos entre elas; epipleura estreita, se extendendo até a proximidade do ápice do élitro. Asas membranosas presentes (às vezes ausentes, principalmente em espécies de ilhas oceânicas), mas com venação reduzida; célula radial ausente, célula oblonga presente, lóbulo anal ausente, área mediana com uma veia (Ciinae) ou três (Sphindociinae).
> Adbômen com cinco esternos visíveis, todos livres (Ciinae) ou os dois primeiro conados (Sphindociinae); primeiro esternito visível (ventrito) sem linhas coxais; machos geralmente com uma fóvea ou conjunto de pêlos na área mediana do primeiro ventrito. Sexos similares ou machos com cornos, tubérculos, ou outras estruturas na cabeça e/ou pronoto. Nono esternito nos

machos com ou sem coluna mediana, tergitos IX e X extremamente reduzidos ou membranosos; *aedeagus* similar ao de outros Tenebrionoidea, simétrico, com lobo mediano membranoso (Sphindociinae) ou escletotizado (Ciinae), tégmen ventral sem colunas ou lóbulos acessórios, parâmeros fundidos mas articulados com falobase (designado como *basal piece* em trabalhos escritos em inglês). Genitália de fêmea pouco conhecida, geralmente bem desenvolvida: base com um par de valvíferos elongados, cada um sustentado por um báculo longitudinal, cóxitos tão longos quanto os valvíferos, cada um dividido transversalmente em quatro partes e com um báculo transversal sustentando a base, estiletes bem desenvolvidos, inseridos nos ápices dos cóxitos; genitália da fêmea ocasionalmente reduzida, com cóxitos de somente duas partes. Espículo ventral das fêmeas geralmente longo."

Citogenética e morfologia interna

Grande parte das espécies de Polyphaga (Coleoptera) descritas citogeneticamente apresenta o número diplóide 2n = 20 cromossomos, e a meiofórmula 9 + Xy_p (Smith & Virkki 1978). Segundo estes autores (*op. cit.*), o cariótipo ancestral de Polyphaga teria este mesmo número diplóide; o sistema de determinação de sexo Xy_p não seria um caráter ancestral, mas sim uma característica comum em Coleoptera. Desvios do número diplóide 2n=20 cromossomos, como aumento ou decréscimo do número de cromossomos autossomais e/ou do número de cromossomos sexuais, estão relacionados com eventos de poliploidia ou rearranjos cromossômicos (Smith & Virkki 1978).

Há poucos dados sobre citogenética de Ciidae na literatura. O primeiro trabalho sobre citogenética dessa família foi feito por Lawrence (1967a), que estudou duas espécies de Ciidae: *Cis fuscipes* Mellié, 1848; e *Cis impressus* Casey, 1898. Esta última espécie foi sinonimizada com a primeira no mesmo trabalho (*op. cit.*), com base nos argumentos de que não haveria diferenças morfológicas entre elas, e de que possuíam o mesmo número diplóide (2n = 14). Este autor (*op. cit.*) verificou também que todos os indivíduos identificados anteriormente como *C. fuscipes* eram fêmeas, e experimentos em laboratório sugeriram finalmente que essa espécie seria partenogenética. Smith & Virkki (1978) citam dados não publicados sobre a meiofórmula de outras duas espécies: (i) *Sulcacis lengi* Dury, 1917, com 9 + Xy_p; e (ii) *Octotemnus laevis* Casey, 1898, com 10 + Xy_p. Estes mesmos autores (*op. cit.*) argumentam que preferem manter *C. fuscipes* e *C. impressus* como espécies separadas.

Há pouca informação presente na literatura sobre a morfologia interna de Ciidae. Descrições histológicas da anatomia dos sistemas digestivo e reprodutivo de adultos de *Had. blaisdelli* foram feitas por Klopfestein & Graves (1992). Segundo estes autores (*op. cit.*), as gônadas de *Had. blaisdelli* têm basicamente o mesmo padrão descrito para outras espécies de Polyphaga: cada ovário é formado por três ovaríolos telotróficos; e cada testículo por três testíolos.

Objetivo

O objetivo geral desta dissertação é propor uma filogenia para a família Ciidae.

MATERIAL

Foram analisados cerca de 1700 espécimes pertencentes a 113 espécies: 48 não descritas; 64 já descritas, incluindo quatro apresentadas nesta dissertação; e uma descrição apresentada nesta dissertação ainda como manuscrito. Essas espécies pertencem a 21 gêneros, sendo que um deles é novo para a ciência.

Para desenvolver este trabalho, foi necessária a organização de uma coleção de referência para a família que incluísse gêneros de grande distribuição, representantes de todos os *taxa* supragenéricos e, quando possível, espécies-tipo de cada gênero. A lista de espécies analisadas é apresentada na Tabela 1, indicando o número de exemplares de cada espécie (contando somente os exemplares montados), dados resumidos de coleta e coleção de origem. Parte do material analisado foi obtido por empréstimo, doação e troca com colecionadores particulares ou museus, nacionais e internacionais.

A negociação com museus e colecionadores particulares foi demorada e cuidadosa, e a translocação do material para o Brasil chegou algumas vezes a demorar meses. Assim, foram determinados prazos para a análise do material: (i) inclusão de gêneros na análise filogenética com exemplares disponíveis até 30.ix.2003; (ii) análise de espécies com espécimes machos e fêmeas disponíveis até 31.x.2003. Espécies disponíveis depois dessas datas foram, em alguns casos, comparadas com espécies do mesmo gênero sob microscópio estereoscópico, somente para a confirmação de algumas sinapomorfias.

Coletas esparsas foram feitas para incrementar a coleção, principalmente nas Regiões Sudeste e Norte do Brasil. Grande parte das espécies não identificadas, também expostas na Tabela 1, são novas para a ciência e oriundas dessas coletas. A análise desse material seguiu os mesmo prazos estipulados para espécimes obtidos de museus.

Tabela 1. Apresentação geral das 113 espécies de Ciidae analisadas (1700 espécimes). As espécies sublinhadas são as espécies tipo do gênero. O símbolo * depois do nome da espécie indica que holótipo, alótipo e parátipos foram analisados; ** indica que somente parátipos foram analisados. Na coluna "Localidades", as siglas iniciais de três letras se referem aos países, seguindo a convenção de abreviação de nomes de países da ONU. Na coluna "n" são indicados os números de espécimes analisados. Na coluna "CO" (Coleção de Origem) os números em algarismo romano se referem à coleção onde originalmente estavam depositados os espécimes, a saber: (i) C. Lopes-Andrade, Viçosa, MG, Brasil; (ii) Albert Allen, EUA; (iii) John F. Lawrence, Austrália; (iv) Rafal Ruta, Polônia; (v) Roman Królik, Polônia; (vi) Glenda Orledge, Inglaterra; (vii) Essig Museum of Entomology, EUA; (viii) Museum of Comparative Zoology, Harvard University, EUA.

Gêneros	Espécies	Grupo	Localidades	n	CO
Atlantocis Israelson, 1985	*Atl. lauri* (Wollaston, 1854)	-	PRT: Madeira (Ribeiro Frio)	1	ii
Ceracis Mellié, 1848	*Cer. cornifer (Mellié, 1848)*	*furcifer*	BRA: MG (Viçosa, Ubá); SP (Piracicaba); RJ (Gruçaí); ES (Santa Teresa)	46	i
	Cer. limai L.-A., Madureira & Zacaro, 2002 *	*singularis*	BRA: MG (Viçosa, Lavras); ES (Venda Nova do Imigrante)	22	i
	Cer. variabilis (Mellié, 1848)	*furcatus*	BRA: MG (Viçosa); SP (Piracicaba)	62	i
	Cer. sp. 1	*furcatus*	BRA: PA (Parauapebas)	21	i
	Cer. sp. 2	*furcifer*	BRA: ES (Venda Nova do Imigrante)	1	i
	Cer. sp. 3	*furcifer*	USA: St. Thomas	1	ii
Cis Latreille, 1796	*C. bidentatus (Olivier, 1790)*	-	ROU: Munji Fagarasului	9	iv
	C. bilamellatus Wood, 1884	*bilamellatus*	GBR: Ashurstwood	6	vi
	C. boleti (Scopoli, 1763)	*boleti*	POL: Pila vic.; GBR: Reading University Campus	9	iv, vi
	C. castaneus Mellié, 1848	*fagi*	POL: Kuznik Nat. Reserve	2	iv
	C. comptus Gyllenhal, 1827	*comptus*	TUR: prov. Kirklareli; POL: Nadlesnictwo Kluczbork, Wielkopolska-Kujawy	10	v
	C. dentatus Mellié, 1848	-	POL: Swietorrzyskie	5	iv
	C. fagi Waltl, 1839	*fagi*	POL: Swietorrzyskie	5	iv
	C. festivus (Panzer, 1793)	*festivus*	POL: Puszcza Bialowieska	2	v
	C. fissicornis Mellié, 1848	-	POL: Puszcza Bialowieska	2	iv
	C. fuscipes Mellié, 1848	*fuscipes*	USA: Morehead City	4	viii
	C. glabratus Mellié, 1848	-	POL: Bielowieza Nat. Park	6	iv
	C. hispidus (Paykull, 1798)	-	POL: Pila - Kalina vic.	4	iv, v
	C. jacquemarti Mellié, 1848	*nitidus*	GBR: Tullochroisk	2	vi
	C. leoi L.-A., Gumier-Costa & Zacaro, 2003 *	*comptus*	BRA: MG (Viçosa, Ubá)	196	i
	C. lineatocribratus Mellié, 1848	*nitidus*	GBR: Rannoch	2	vi
	C. micans (Fabricius, 1792)	*boleti*	POL: Bialowiesza Primeval Forest & Puszcza Bialowieska; GBR: Rogate	5	iv, v
	C. nitidus (Fabricius, 1792)	*nitidus*	POL: Pila vic.; GBR: Reading University Campus & Neston	10	iv, vi
	C. punctulatus Gyllenhal, 1827	*punctulatus*	POL: Plocicznc	9	iv
	C. pygmaeus Marsham, 1802	*festivus*	GBR: Rogate	2	vi
	C. quadridens Mellié, 1848	-	POL: Puszcza Bialowieska & Swietokrzyski	2	iv, v
	C. striolatus Casey, 1898	*comptus*	USA: Michigan (Saugatuk)	4	viii
	C. tauriensis Królik, 2002 **	*comptus*	TUR: prov. Içel	24	v
	C. tomentosus Mellié, 1848	*punctulatus*	TUR: prov. Kirklareli	2	v
	C. versicolor Casey, 1898	*comptus*	USA: California (Mendo, Nacimiento & Monterey)	12	vii, viii
	C. sp. 1	*taurus*	BRA: PA (Parauapebas)	19	i
	C. sp. 2	*bilamellatus*	BRA: SP (Rio Claro)	29	i
	C. sp. 3	*comptus*	BRA: MG (Pico do Boné)	34	i
	C. sp. 4	*comptus*	BRA: MG (Serra do Cipó)	39	i
	C. sp. 5	*bilamellatus*	BRA: MG (Lima Duarte - "Ibitipoca")	11	i
	C. sp. 6	*taurus*	BRA: RJ (Rio de Janeiro)	12	i, ii
	C. sp. 7	*taurus*	ARG: Cordillera	1	ii
	C. sp. 8	*taurus*	GTM: Las Escobas	1	ii

Gêneros	Espécies	Grupo	Localidades	n	CO
	C. sp. 9	*taurus*	PRY: Guaiara	1	ii
	C. sp. 10	*taurus*	PER: Madre de Dios	1	ii
	C. sp. 11	*comptus*	BRA: MG (Patrocínio)	4	i
	C. sp. 12	*taurus*	BRA: MG (Ubá, Viçosa)	48	i
	C. sp. 13	*taurus*	BRA: MG (Lavras)	4	i
	C. sp. 14	*taurus*	BRA: ES (Domingos Martins, Venda Nova do Imigrante)	12	i
	C. sp. 15	*taurus*	BRA: MG (Ingaí)	3	i
	C. sp. 16	*taurus*	BRA: SP (Piracicaba)	27	i
Dolichocis Dury, 1919	*D. laricinus (Mellié, 1848)*	-	POL: Puszcza Bialowieska	3	v
	D. manitoba (Dury, 1919)	-	USA: California (Canyon Dan - Plumas & Huntington Lake) POL: Kuznik Nat. Reserve	6	iii, viii
Ennearthron Mellié, 1847	*E. cornutum (Gyllenhal, 1827)*	-	TUR: prov. Kirklareli	8	iv, v
	E. victori L.-A. & Zacaro, 2003 *	-	BRA: MG (Viçosa, Ubá); SP (Piracicaba)	360	i
Falsocis Pic, 1916	*F. alaydeae* i.l. *	-	BRA: MG (Viçosa); ES (Venda Nova do Imigrante)	15	i
Hadraule Thomson, 1863	*H. blaisdelli* (Casey, 1900)	-	USA: California	11	iii, vii
	H. elongatula (Gyllenhal, 1827)	-	POL: Puszcza Bialowieska	1	v
	H. sp. 1 *	-	BRA: MG (Ubá)	15	i
	H. sp. 2	-	DOM; exemplar fóssil preservado em âmbar	1	ii
Malacocis Gorham, 1886	*M. brevicollis* (Casey, 1898)	-	USA: Monroe	5	iii, viii
Octotemnus Mellié, 1847	*O. glabriculus (Gyllenhal, 1827)*	-	POL: Pila; GBR: Bath	11	iv, vi
	O. laevis Casey, 1898	-	USA: California (Sta. Cruz, Berkeley); Bloomingdale; Transylvania	14	vii, viii
	O. laminifrons (Motschulsky, 1860)	-	JPN: Nara	4	iv
	O. opacus Mellié, 1848	-	ESP: Ilhas Canárias (Tenerifa)	1	iv
	O. sp. 1	-	JPN: Nara	4	iv
	O. sp. 2	-	PHL: Ilhas Negros, Mt. Caula	2	ii
Orthocis Casey, 1898	*Ort. pseudolinearis (Lohse, 1965)*	-	POL: Puszcza Bialowieska	4	v
	Ort. punctatus (Mellié, 1848)	-	Espécimes da coleção Blanchard, sem dados de coleta (provavelmente USA)	3	iii
	Ort. reflexicollis (Abeille de Perrin, 1874)	-	AUT: Graz-Keiserwald; POL: Bieszczady	2	v
	Ort. sp. 1	-	BRA: MG (Viçosa)	16	i
	Ort. sp. 2	-	BRA: MG ("Pico do Boné")	13	i
	Ort. sp. 3	-	MYS: Tioman	1	ii
	Ort. sp. 4	-	MEX: Chiapas	1	ii
Plesiocis Casey, 1898	*P. cribum* Casey, 1898	-	USA: California (Cambria)	6	iii
Porculus Lawrence, 1987	*Por. grossus* Lawrence, 1987	-	BRA: SP (Parelheiros)	1	ii
	Por. piceus (Mellié, 1848)	-	PER: Huanuco (Tingo Maria)	1	ii
Rhopalodontus Dohrn in Strübling, 1851	*Rh. americanus* Lawrence, 1971 **	-	USA: Wisconsin (Woodruff)	2	viii
	Rh. lawrencei Ruta, 2003 **	-	THA: Chiang (Mai)	2	iv
	Rh. novorossicus Reitter, 1902	-	UKR: Olivia (Sul da Criméia)	2	iv
	Rh. perforatus (Gyllenhal, 1813)	-	POL: Kuznik Nat. Res.; GBR: Rannoch	11	iv, vi
	Rh. strandi Lohse, 1969	-	POL: Bialowieski	4	iv, v
Scolytocis Blair, 1928	*Scolytocis* sp. 1	-	BRA: RJ (Nova Friburgo)	49	i
	Scolytocis sp. 2	-	FJI: Wainiloka Ovalau	3	iii
	Scolytocis sp. 3	-	CRI: Heredia	4	iii
	Scolytocis sp. 4	-	BRA: RS (Boqueirão)	4	iii
	Scolytocis sp. 5	-	BRA: SC (Nova Teutônia, Serra do Mar)	18	iii

Gêneros	**Espécies**	**Grupo**	**Localidades**	**n**	**CO**
Sphindocis Fall, 1917	*Sph. denticollis* Fall, 1917	-	USA: Calif. (Trinity)	2	iii
Strigocis Dury, 1917	*Str. bilimeki* (Reitter, 1878)	-	MEX: Hidalgo	2	viii
	Str. opacicollis Dury, 1917	-	USA: Michigan (Saugatuk); New Jersey (Oakland); Massachusetts (Concord)	7	iii, viii
	Str. opalescens (Casey, 1898)	-	MEX: Veracruz	2	viii
Sulcacis Dury, 1917	*Sul. affinis* (Gyllenhal, 1827)	-	POL: Pila vic.	3	iv
	Sul. bidentulus (Rosenhauer, 1847)	-	POL:Wielkopolska-Kujawy	12	iv
	Sul. curtulus (Casey, 1898)	-	USA: Calif. (Mendo, Tulare & Oakland)	12	vii
	Sul. fronticornis (Panzer, 1809)	-	POL: Bialowiesza Primeval Forest; CHE: Genebra	10	iii, iv
	Sul. lengi Dury, 1917	-	USA: Manchester (Bennington)		viii
Wagaicis Lohse, 1964	*Wag. wagae* (Wankowicz, 1869)	-	POL: Puszcza Bialowieska	1	v
Xylographella Miyatake, 1985	*Xylographella punctata* Miyatake, 1985	-	JPN: Chu-Zenji	3	iii
Xylographus Mellié, 1847	*X. bostrichoides* (Dufour, 1843)	-	TUR: prov. Kirklareli & Igneada	6	v
	X. contractus Mellié, 1848	-	BRA: MG (Viçosa)	9	i
	X. lucasi L.-A. & Zacaro, 2003	-	BRA: ES (Venda Nova do Imigrante)	82	i
	X. madagascariensis Mellié, 1848	-	MDG: Analamazaotra	1	ii
	X. sp. 1	-	UGA: Kikaya	2	ii
	X. sp. 2	-	BRA: PA (Parauapebas)	33	i
	X. sp. 3	-	BRA: SP (Piracicaba)	39	i
	X. sp. 4	-	BRA: MG (Viçosa)	6	i
	X. sp. 5	-	BRA: MG (Ubá)	14	i
	X. sp. 6	-	BRA: MG (Guaraciaba)	4	i
	X. sp. 7	-	BRA: MG (Lavras)	16	i
	X. sp. 8	-	BRA: MG (Ingaí)	2	i
	X. sp. 9	-	BRA: RJ (Rio de Janeiro)	4	i
	X. sp. 10	-	BRA: ES (Santa Teresa)	2	i
	X. sp. 11	-	BRA: ES (Sooretama)	6	i
	X. sp. 12	-	BRA: ES (Venda Nova do Imigrante)	4	i
	X. sp. 13	-	BRA: ES (Domingos Martins)	11	i
Gen. nov.	Gen. nov. sp. 1	-	BRA: ES; (Domingos Martins, Santa Teresa); MG (Viçosa & Lavras)	33	i
	Gen. nov. sp. 2	-	PAN: Barro Colorado	15	iii
	Gen. nov. sp. 3	-	PAN: Barro Colorado	15	iii

Tabela 2. Apresentação das cinco espécies utilizadas como grupo externo na análise filogenética. Na coluna "Localidades", as siglas iniciais de três dígitos se referem aos países, seguindo a convenção de abreviação de nomes de países da ONU. Na coluna "n" são indicados os números de espécimes analisados de cada espécie. Todos os exemplares são oriundos da coleção do Museum of Comparative Zoology, Harvard University, EUA.

Famílias	**Gêneros**	**Espécies**	**Localidades**	**n**
Archeocrypticidae	*Enneboeus* Waterhouse, 1878	*Enneboeus caseyi* Kaszab, 1964	PAN: Chiriqui	4
Mycetophagidae	*Mycetophagus* Hellwig, 1792	*Mycetophagus flexuosus* Say, 1826	USA: Massachusetts (Belmont, Tyringham) ; New York (Rensselaerville)	7
Prostomidae	*Prostomis* Latreille, 1819	*Prostomis mandibularis* (Fabricius, 1801)	USA: espécimes das coleções de F. Allen Eddy e de Liebeck	5
Pterogeniidae	*Histanocerus* Motschulsky, 1858	*Histanocerus puberans* Burckhardt & Löbl, 1992	MYS: Pahang Temerloh District	4
Tetratomidae	*Penthe* Newman, 1838	*Penthe obliquata* (Fabricius, 1801)	USA: espécimes da coleção de C. A. Frost	5

MÉTODOS

Coleta

O modo mais fácil de encontrar ciídeos é coletando fungos orelhas-de-pau que apresentam pequenos orifícios na sua camada externa. Esses fungos crescem em troncos de árvores em decomposição e, em alguns casos, em árvores ainda vivas de ambientes alterados ou áreas urbanas. Estes insetos habitam, até onde se sabe, somente os corpos-de-frutificação dos fungos; portanto, só estas estruturas eram retiradas e levadas para o laboratório.

Criação de ciídeos em laboratório

Algumas espécies de Ciidae foram criadas em laboratório, no mesmo fungo onde foram coletadas. Cada espécie foi mantida isolada em pote plástico com tampa perfurada. Um recipiente de vidro com algodão e água foi colocado em cada pote para manter a umidade do(s) fungo(s). Parte dos adultos, mortos ou vivos, foram recolhidos e guardados em álcool absoluto.

Estes ciídeos foram criados pelos seguintes motivos: (i) necessidade de obter grande número de indivíduos para facilitar a descrição das espécies novas; (ii) obter indivíduos vivos para análise citogenética; (iii) obter genitálias mais bem preservadas.

Estudo da morfologia externa

A morfologia externa dos espécimes analisados foi estudada tanto por observação direta em microscópio estereoscópico como pela análise de fotografias em Microscópio Eletrônico de Varredura convencional (MEV) ou de pressão variável (MEV–PV).

Observações em lupa

Os exemplares de museus e de coleções particulares foram diretamente observados sob microscópio estereoscópico. Exemplares vivos ou fixados em álcool foram secos e montados posteriormente em triângulo de papel afixado em alfinete entomológico (nº 1 ou nº 2), utilizando cola hidrossolúvel.

Análise em MEV e MEV–PV

Para a análise em MEV ou MEV–PV, foi utilizado o protocolo descrito abaixo:

a. desidratar em série alcoólica (70, 80 e 100%; somente para **MEV**);
b. passar no ponto crítico (somente para **MEV**);
c. montar em suporte de alumínio (**MEV** e **MEV–PV**);
d. cobrir com ouro (somente para **MEV**);
e. analisar o material.

Os registros fotográficos no MEV e MEV-PV foram feitos utilizando filmes 120mm e meio digital, respectivamente.

Análise da genitália

Para estudar a morfologia da genitália de machos e fêmeas, foram dissecados espécimes (**i**) vivos, (**ii**) fixados em álcool absoluto ou (**iii**) montados em alfinetes entomológicos. Os números em algarismos romanos indicam variações no protocolo de dissecção, quando pertinente. A metodologia utilizada é descrita a seguir:

a. hidratar em água quente (somente para **ii** e **iii**) por 15 minutos;
b. remover o abdômen em solução fisiológica (**i**) ou água (**ii** e **iii**);
c. amolecer e clarear com solução saturada de KOH por 30 minutos;
d. remover a genitália do abdômen;
e. montar a genitália entre lâmina e lamínula utilizando como meio de inclusão gel de álcool polivinílico saturado em solução de lacto-fenólica*;
f. secar a lâmina em estufa a 60º C por uma hora;
g. etiquetar a lâmina indicando: número; espécie; e localidade.

*Fazer uma solução A saturada de álcool polivinílico em água a 60º C; fazer uma solução B de ácido fênico e ácido lático na proporção de 1:1; misturar essas duas soluções na proporção 14 A : 11 B.

As lâminas contendo os escleritos genitais foram observadas e fotografadas em microscópio binocular. Todas as fotografias foram feitas com uma câmera digital Nikon Coolpix 995.

Descrição de espécies

Não seria possível descrever todas as espécies novas disponíveis na coleção de referência em uma única dissertação. A comprovação de que uma espécie é realmente nova depende do estudo aprofundado da literatura, e da comparação com tipos primários, parátipos ou paralectótipos, topótipos e metátipos. Há vários outros problemas que devem ser considerados: (i) alguns tipos estão perdidos, como no caso das duas espécies do gênero *Trichapus* Friedenreich, 1881; (ii) muitas espécies são conhecidas somente pelos tipos e estes, em grande parte, estão em museus europeus. Esses exemplares têm que ser estudados *in loco*, já que a remessa de tipos primários pelo correio é arriscada; (iii) as descrições são, muitas vezes, insatisfatórias e em alguns casos se pode dizer que são excessivamente simples (e.*g*., os trabalhos de Maurice Pic, autor que descreveu 1/6 das espécies de Ciidae); (iv) para uma descrição satisfatória é necessário que se tenha uma boa série típica (mais de 50 espécimes); (v) a literatura disponível está em diversas línguas, grande parte em latim, francês, alemão, inglês, polonês, romeno, russo e japonês. Assim, foram descritas para esta dissertação somente espécies comprovadamente novas, e que eram importantes para a apresentação de novos caracteres estudados.

Outras espécies importantes, mas não descritas nesta dissertação, pertencem ao gênero *Scolytocis* Blair, 1928 – gênero incluído, com ressalvas, na tribo Xylographellini. Este gênero possui somente uma espécie descrita (*Scolytocis samoensis* Blair, 1928), com poucos exemplares conhecidos e coletados nas ilhas Samoa. Um exemplar fêmea de uma espécie nova foi encontrada em Venda Nova do Imigrante (ES) em 1999 mas a falta de exemplares machos impediu que ela fosse incluída nesta dissertação. Em 21.xi.2003, depois do prazo estabelecido para inclusão neste trabalho, foram recebidos como empréstimo exemplares de outras quatro espécies: (i) de Fiji, coletadas por E.C. Zimmerman em 1938; (ii) da Costa Rica, coletadas por Terry Erwin e J. F. Lawrence; (iii) duas espécies do Brasil coletadas por Fritz Plaumann em Santa Catarina; (iv) uma espécie coletada por Paschoal Grossi em Nova Friburgo, RJ. A espécie coletada por Zimmerman é a mais próxima de *Scol. samoensis*.

O gênero mencionado como novo na Tabela 1, que também teve espécies incluídas na análise filogenética, será descrito juntamente com J. F. Lawrence com o nome "*Phellinocis*" , em referência aos fungos do gênero *Phellinus* (Hymenochaetaceae), utilizados como *habitat* por esses insetos. Há três espécies desse gênero conhecidas até o momento, distribuídas: (i) no Panamá e Costa Rica; (ii) somente no Panamá; (iii) na Região Sudeste do Brasil.

Cinco espécies são descritas neste trabalho: (i) *Ceracis limai* Lopes-Andrade, Madureira & Zacaro, 2003; (ii) *Cis leoi* Lopes-Andrade, Gumier-Costa & Zacaro; (iii) *Xylographus lucasi* Lopes-Andrade & Zacaro, 2003; (iv) *Ennearthron victori* Lopes-Andrade & Zacaro, 2003; e (v) *Falsocis alaydeae* i.l. Vale enfatizar que, de acordo com o Código Internacional de Nomenclatura Zoológica, **a última espécie não é**

considerada válida, já que a descrição ainda não foi publicada em periódico científico.

A descrição de cada espécie seguiu o seguinte protocolo:

a. comprovar que a espécie é nova;
b. separar todos os indivíduos presentes na coleção pertencentes à espécie;
c. dissecar alguns indivíduos para extração da genitália;
d. determinar e etiquetar o espécime que será o holótipo (macho), e os que serão parátipos (machos e fêmeas) – incluindo o alótipo (fêmea);
e. analisar em MEV ou MEV–PV;
f. analisar a genitália em microscópio;
g. medir 10 representantes de cada localidade, quando houver espécimes disponíveis, além do holótipo e do alótipo, seguindo os parâmetros morfométricos determinados por Lawrence (1987);
h. encontrar características diagnósticas para a espécie;
i. descrever a morfologia externa e a morfologia da genitália de machos.

Citogenética

Para complementar os dados de citogenética disponíveis na literatura, e na tentativa de incluí--los na matriz de caracteres, algumas espécies foram analisadas citogeneticamente. Foram analisados machos e/ou fêmeas de seis espécies de quatro gêneros, a saber: *Ceracis variabilis* (Mellié, 1848); *Cis leoi*; *Cis* sp.12 (grupo *taurus*); *Cis* sp.16 (grupo *taurus*); *Xylogralhus contractus* Mellié, 1848 (*sensu lato*); e *Xylographus* sp.3.

Só foram dissecados indivíduos adultos, e foram feitas preparações (semipermanentes ou permanentes) somente com as gônadas. Quando possível, foi contado o número de folículos de cada gônada. Os protocolos utilizados são apresentados abaixo.

Preparações semipermanentes

Estas preparações foram feitas para uma avaliação preliminar do cariótipo de algumas espécies, utilizando o protocolo abaixo. Em algumas preparações, os passos "**b**", "**c**" e/ou "**e**" não foram seguidos.

a. dissecar os indivíduos em solução fisiológica para insetos;
b. hipotonizar com água de torneira durante aproximadamente um minuto;

c. fixar em Carnoy I (metanol : ácido acétido glacial, 3:1) por uma hora;

d. colocar a gônada em uma lâmina limpa;

e. amolecer a gônada com ácido acético a 45%;

f. adicionar duas gotas de orceína lacto-acética (25ml de ácido lático a 70% em água destilada, 25ml de ácido acético glacial puro, 1g de orceína), e deixar corar por 10 minutos;

g. cobrir com lamínula;

h. esmagar levemente a preparação entre folhas de papel filtro;

i. lutar com esmalte o material, entre lâmina e lamínula.

Preparações permanentes

Para confirmação do número diplóide de cromossomos e montagem de cariótipos, algumas preparações permanentes de células gonadais foram obtidas segundo a técnica de Imai *et al.* (1988), com algumas modificações na solução corante utilizada: 3% de Giemsa e 3% de tampão fosfato 0,1M, pH 6.8, em água destilada.

Análise cladística

Os dados de morfologia externa e interna, e de citogenética, foram compilados em uma matriz de caracteres utilizando o programa NEXUS 0.5.0. Nessa matriz, os grupos terminais eram espécies, dando preferência a: (i) *status* taxonômico, *i.e.*, espécies-tipo de gêneros válidos ou sinonimizados; (ii) espécies pertencentes a grupos de espécies distintos; (iii) espécies com exemplares disponíveis para extração da genitália. Foram incluídas espécies de 21 gêneros, que representam todos os gêneros disponíveis na coleção de referência.

A matriz possuía inicialmente 60 grupos terminais e 106 caracteres. Posteriormente, foram excluídos um grupo terminal do gênero *Cis* e 12 caracteres constantes. A matriz foi analisada no programa PAUP 4.0 utilizando algorítmos heurísticos, já que uma análise parcimoniosa não seria possível devido ao tamanho da matriz. Foi escolhida a árvore com menor número de passos. Posteriormente, a evolução dos caracteres na árvore obtida foi analisada no programa MESQUITE 1.0 (Maddison & Maddison 2003); isso permitiu que alguns caracteres fossem reavaliados, levando à partição de um caráter em dois e a inclusão de outro novo. A matriz final ficou com 96 caracteres e 59 grupos terminais, e foi convertida para o formato do programa WINCLADA, sendo posteriormente analisada no prograna NONA. A evolução dos caracteres foi analisada novamente no programa WINCLADA, utilizando a árvore mais parcimoniosa obtida no NONA.

RESULTADOS

Os resultados desta dissertação são apresentados em forma de artigos (4.1. a 4.6.), notas científicas (4.7.), resumos (4.8 e 4.9.), e manuscritos completos (4.10. e 4.11.). Os nove primeiros trabalhos já foram publicados, e são apresentados aqui na íntegra. Os dois últimos artigos ainda não foram submetidos e estão, portanto, na forma de manuscritos. Estes trabalhos são listados a seguir:

Artigos publicados

- Recent advances in the study of the Brazilian Ciidae (Coleoptera: Tenebrionoidea).
- Delimitation of the *Ceracis singularis* group (Coleoptera: Tenebrionoidea: Ciidae), with the description of a new Neotropical species.
- *Cis leoi*, a new Brazilian species of Ciidae (Coleoptera: Tenebrionoidea).
- Why do male *Xylographus contractus* Mellié (Coleoptera: Ciidae) present abdominal fovea? Evidence of Sexual Pheromone Secretion.
- *Xylographus lucasi*, a new Brazilian species of Ciidae (Coleoptera: Tenebrionoidea).
- The first record of *Ennearthron* Mellié, 1847 (Coleoptera: Tenebrionoidea: Ciidae) in the Southern Hemisphere, with the description of a distinctive new species.

Nota científica publicada

- Two cases of Homonymy in the genus *Cis* Latreille (Coleoptera: Tenebrionoidea: Ciidae).

Resumos publicados

- Comparative morphology of the abdominal fovea in Neotropical Ciidae (Coleoptera: Tenebrionoidea).
- Considerations on the ultramorphology of the antennal sensillifers of Neotropical Ciidae (Coleoptera: Tenebrionoidea).

Manuscritos completos

- Falsocis alaydeae sp. nov. (Coleoptera: Tenebrionoidea: Ciidae) from Brazil.
- Phylogeny of Ciidae (Coleoptera: Tenebrionoidea).

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Recent advances in the study of the Brazilian Ciidae (Coleoptera: Tenebrionoidea)

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ABSTRACT
Ciidae is a widespread family of minute mycetobiont beetles which live in association with some macrofungi. Studies on this family may help to elucidate the phylogenetic relationship of the basal groups of Tenebrionoidea, as Pterogeniidae, Prostomidae, Archeocrypticidae and Mycetophagidae. There is no revisionary work giving emphasis to the Brazilian ciids, and that makes difficult the continuity of some researches. Here, a list of described genera and species already recorded from Brazil is presented, including two genera not cited before, and together with notes on some recent advances on the taxonomy and systematics of Brazilian ciids.

RESUMO
Ciidae é uma família de pequenos besouros cosmopolitas que vivem em associação obrigatória com alguns macrofungos, sendo portanto considerados micetobiontes. O estudo dessa família pode ajudar a elucidar as relações filogenéticas de alguns grupos basais de Tenebrionoidea, como Pterogeniidae, Prostomidae, Archeocrypticidae e Mycetophagidae. Não há nenhum estudo amplo sobre os ciídeos brasileiros, o que dificulta a continuidade de algumas pesquisas sobre estes insetos. Neste trabalho são apresentadas uma lista de gêneros e espécies descritas, incluindo dois gêneros não reportados anteriormente para o Brasil, e notas sobre alguns avanços recentes na taxonomia e sistemática dos ciídeos brasileiros.

The ciids are minute fungus-feeders beetles which live in obligatory association with the mycelia and fruiting bodies of some wood-rotting macrofungi (Basidiomycotina). They are considered to be mycetobionts beetles (Scheerpeltz and Höfler 1948, Klimaszewski and Peck 1987), as all their life cicle take place in the fungus, which is used as food and habitat (Navarrete-Heredia 1991). The majority of the species lives in Polyporaceae *sensu lato* (Holobasidiomycetes: Aphyllophorales), but the genus *Orthocis* Casey shows a greater preference to some Auriculareaceae (Phragmobasiodiomycetes: Auriculariales).

Due to their food dependence, ciids are important in the degradation of wood-rotten macrofungi. Therefore, they are in the basis of the trophic web, together with other scavengers such as necrophagous and saprophagous organisms. However, as a consequence of their habits, ciids are vulnarable to habitat fragmentation (Rukke 2000). In intensively managed forests, ciid populations are affected by the decrease of their resource, which is directly related to the availability of dead wood (Thunes *et al.* 2000).

This work aims to present an updated list of genera and species of Brazilian ciids, including two genera not cited before, with notes on some recent advances on their taxonomy, and systematics.

RESULTS AND DISCUSSION

Taxonomy and systematics panorama

The family Ciidae is a basal group of Tenebrionoidea (old Heteromera section), and is phylogenetically related to the families Mycetophagidae, Archaeocrypticidae, Tetratomidae, Prostomidae, and Pterogeniidae (Lawrence 1982). The latter family is probably its sister group.

The first and unique whole taxonomic treatment of the worldwide Ciidae was made by Mellié (1848). Since that work, only one revision of the group was made (Lawrence 1971), however it included only the Nearctic ciids and comments on some Neotropical species. Recently, there was an agreement about the taxonomic limits of the family (Lawrence 1974b), which nowadays comprises two subfamilies: (i) Ciinae, with over 40 genera and more than 500 described species; and (ii) Sphindociinae, which is restricted to the Nearctic Region (California, USA), and includes only *Sphindocis denticollis* Fall.

Ciinae species can be easily separated from the other tenebrionoid beetles by the presence of an abdominal fovea (Fig.1A) and four sensillifers in each of the last three articles of the antenna (antennal club; Fig.1B). *Sphindocis denticollis* do not have these sensillifers and the first two urosternites are connated, but it can be distinguished from Pterogeniidae by the presence of an antennal club and the tarsal formula 4-4-4. A whole characterization of Ciidae (Ciinae and Sphindociinae) is provided by Lawrence (1974b). The division of Ciinae into Orophiini and Ciini is being avoided (see Lawrence *et al.* 1999), but previous works of the same author considered these tribes as valid taxa (Lawrence 1982 and 1987). Further works are necessary to evaluate whether or not these tribes are phylogenetically plausible.

There is no revisionary work exclusively on the Brazilian ciids, and the last list of species was provided by Blackwelder (1945). In this list, seven genera were recorded from Brazil: *Cis* Latreille, *Ceracis* Mellié, *Ennearthron* Mellié, *Macrocis* Reitter, *Malacocis* Gorham, *Trichapus* Fried., and *Xylographus* Mellié. However, the species mentioned as *Ennearthron* were transferred to the genus *Ceracis* by Lawrence (1967b), *Macrocis* Reitter was synonymized with *Cis*, and *Malacocis bahiensis* Pic was excluded from this genus as it probably belongs to the *Cis taurus* group (Lawrence 1971). Afterwards, the genus *Porculus* was described based on five species, two distributed in Brazil (Lawrence 1987). Therefore, five genera were officially recognized from Brazil until this work.

Two collections of Brazilian ciids were analyzed: one pertaining to Museu de Zoologia da USP (MZ/USP, SP, Brazil) and the other to C. Lopes-Andrade (UFV, MG, Brazil). The former have specimens from Mellié and Friedenreich personal collections (probably type specimens), many recently collected specimens, and the holotype and paratypes of *Porculus grossus* Lawrence. The latter collection also have many recently collected specimens and some species belonging to genera not recorded from Brazil before.

A list of species and genera of Brazilian ciids, is presented in Table 1. A brief discussion of each genera is provided below.

Brazilian Ciidae genera

Ceracis Mellié

This genus was recently revised by Lawrence (1967b), who determined its taxonomic limits. Although the emphasis was on the Nearctic *Ceracis*, some Neotropical species was synonymized, included or excluded from the genus and put in a species group. However, some doubts concerning *Cer. furcatus* (Bosc), *Cer. militaris* Mellié, *Cer. furcifer* Mellié and *Cer. variabilis* Mellié (Fig. 2A) still exists, and synonyms may arose in a near future. To facilitate further works, all these species are here put together in the *Ceracis furcatus* group. For the same reason, *Cer. cornifer* (Mellié) is included here in the *Cer. furcifer* group (*sensu* Lawrence 1967b).

Table 1: List of genera and species of Ciidae (Coleoptera: Tenebrionoidea) cited for Brazil. The symbol * indicates that the genera are cited for the first time to Brazil in this work, and ** indicates doubtful information (see text for a better explanation). MZ/USP stands for "Museu de Zoologia da Universidade de São Paulo", and LAC indicates the specimens deposited in C. Lopes-Andrade personal collection. The column "Group" indicates the name of the species complex where each species is included.

Genera	Species	Group	Distribution	Collection
Ceracis Mellié, 1848				
	Ceracis bicornis (Mellié, 1848)	*Ceracis cucullatus*	Peru, Brazil, Mexico	MZ/USP
	Ceracis cornifer (Mellié, 1848)	*Ceracis furcifer*	Brazil	MZ/USP, LAC
	Ceracis cucullatus (Mellié, 1848)	*Ceracis cucullatus*	Latin America	
	Ceracis cf. *variabilis* Mellié, 1848	*Ceracis furcatus*	Brazil	LAC
	Ceracis ruficornis Pic, 1916	*Ceracis furcifer*	Brazil	MZ/USP
Cis Latreille, 1796				
	Cis apicipennis Pic, 1916		Brazil	
	Cis diadematus Mellié, 1848		Brazil	MZ/USP
	Cis fulvipes Mellié, 1848		Brazil	
	Cis gounellei Pic, 1916		Brazil	
	Cis grossus Mellié, 1848		Brazil	
	Cis pallidus Mellié, 1848	*Cis pallidus*	Brazil	MZ/USP
	Cis robustus Pic, 1916		Brazil	
	Cis testaceimembrius (Pic, 1916)	*Cis taurus*	Brazil	
	Cis testaceus (Pic, 1916)	*Cis taurus*	Brazil	
	Cis tricornis (Gorham, 1883)	*Cis tricornis*	Brazil, Mexico	MZ/USP
	Cis validithorax Pic, 1916		Brazil	
	Cis sp. nov.		Brazil	LAC
Ennearthron Mellié, 1847*				
	Ennearthron sp., undescribed species		USA, Brazil	LAC
Falsocis Pic, 1916*				
	Falsocis sp., undescribed species		Brazil	LAC
Porculus Lawrence, 1987				
	Porculus grossus Lawrence, 1987		Latin America	MZ/USP
	Porculus vianai (Pic, 1940)		South America	MZ/USP
Trichapus Friedenreich, 1881				
	Trichapus glaber Fried., 1881		Brazil	
	Trichapus pubescens Fried., 1881**		Brazil	MZ/USP
Xylographus Mellié, 1847				
	Xylographus brasiliensis Pic, 1940		Brazil	MZ/USP
	Xylographus contractus Mellié, 1848		Brazil	MZ/USP, LAC
	Xylographus rufipes Pic, 1930		Argentina, Brazil	MZ/USP

Cis Latreille

This genus has many described Brazilian species, but an undescribed species is being found (Fig. 2B). This group includes several species which are problematic in the taxonomical level, as far as the type series are small, many types are lost, some species were characterized based on females specimens or small-horned males, and the identification is sometimes almost impossible with the characteristics provided in the descriptions. This genus urges a revision, but due to the number of included species (more than 300) and its worldwide geographical distribution, it is surely a hard work.

Ennearthron Mellié

There are only two American species of this genus, *Enn. spenceri* (Hatch) (Canada) and *Enn. aurisquamosum* Lawrence (United States), both known by few specimens. It was believed that the New World representants of this genus were exclusively Nearctic, but recently a new species of *Ennearthron* (Fig. 3A) was collected in two Brazilian localities (Piracicaba, São Paulo State; and Viçosa, Minas Gerais State). This species is probably well distributed in Southeast Brazil, as these localities are very far from each other.

Falsocis Pic

This genus comprises just the nomynotypic species *Falsocis opacus* Pic (Guyane), and the subspecies *Falc. opaca flava* Pic (Guyana). Recently, a new species of *Falsocis* (Fig. 3B) was found in Viçosa, Minas Gerais State.

Porculus Lawrence

This genus seems to be well-defined. It resembles some *Ceracis*, but lacks the spines at the apex of protibia, which bears a conspicuous external stout tooth. Although it is distributed throughout the Neotropical Region represented by five species (Lawrence, 1987), it was not found in recent collections on Brazil.

Trichapus Friedenreich

This is a problematic genus: the types are lost, there are no specimens identified by comparison and the characters provided in the description resemble that of some *Porculus* and *Ceracis*. *Trichapus pubescens* Friedenreich was designated as the type species of the genus by Lawrence (1987). There is one ciid in MZ/USP labelled "*Solenopus pubescens* i.l., Brasilien" from Friedenreich collection. It may be the holotype, but unfortunately it is not in good condition and there is no available information on this specimen.

Xylographus Mellié

This is a widespread genus easily found in any field collection on Brazil. Three species were already reported, but there are some doubtful identified specimens that may belong to new species. The New World *Xylographus* are restricted to the neotropics, and is phylogenetically related to *Octotemnus* Mellié and *Rhopalodontus* Mellié. One species, *Xyl. porcus* Gorham, was already recorded from Mexico (Navarrete-Heredia and Burgos-Solorio 2000), showing that species of this genus are well-distributed in the neotropics.

New perspectives in the study of Ciidae

Ciidae is a poorly studied group, and there are no data on many aspects of its biology. The greater part of the data concern the host preference, but there are available information mainly for the Nearctic species. Some species seems to be monophagous (Lawrence 1973 and 1974a), but more researches are need to evaluate whether or not it is an artifact of low collection efforts.

Sometimes ciids present a gregarious behavior (Lawrence 1974a), and it may be related to secretion of aggregation pheromone. Field studies made by Jonsson *et al.* (1997) pointed out that the beetle *Dorcatoma robusta* Strand (Anobiidae), which is also a polypore feeder, uses long-range sex pheromone during the host colonization.

Internal morphology information was already provided for *Hadraule blaisdelli* (Casey). This species shows a meroistic telotrophic ovariole, which is a pattern for polyphagan beetles, and each ovariole presented three follicles (Klopfestein and Graves 1992). Karyotype information was provided by Lawrence (1967a), who mentioned the diploid number (2n=14 chromosomes) for the parthenogenetic species *Cis fuscipes* Mellié, however no details on the sex determination system and chromosome morphology of *C. fuscipes* were provided. Smith and Virkki (1978) also mentioned *Sulcacis lengi* Dury, with 2n = 20 (18 + Xyp), and *Octotemnus laevis* Casey, with 2n = 22 (20 + Xyp).

Studies on many biological aspects of the Brazilian Ciidae are being conducted, mainly concerning their etology and morphology. New species belonging to the genera *Cis*, *Ennearthron*, *Falsocis* and *Xylographus* are underdescription. However, a taxonomic revision of some groups and an approach to the phylogeny of the family are necessary for the continuity of these studies.

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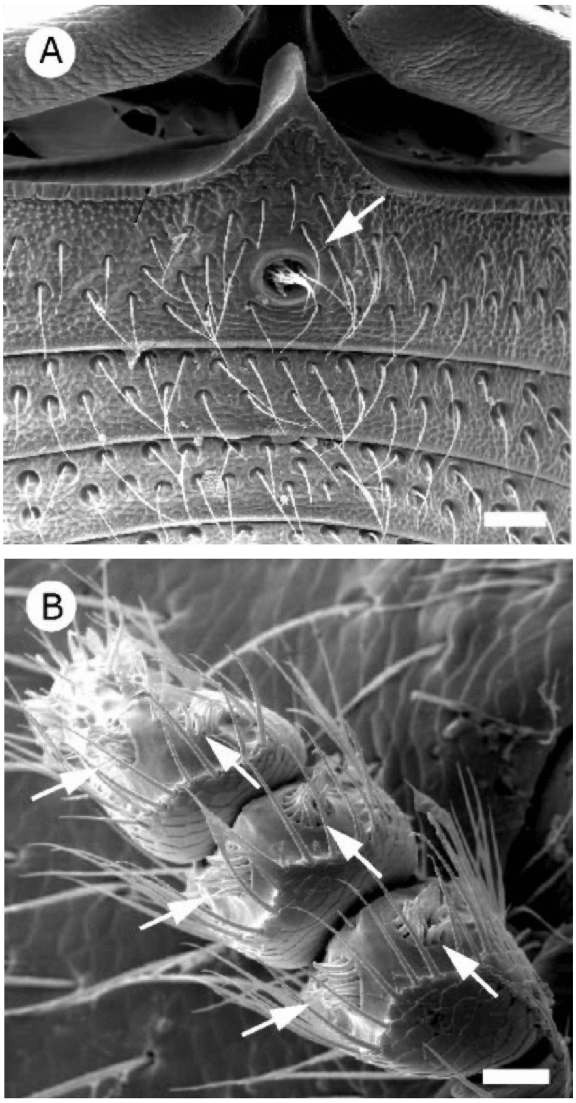

Figure 1. **A.** Urosternites of a male *Cis taurus* (Reitter), showing the abdominal fovea (arrow) of the first urosternite. **B.** Antenna of *Xylographus contractus* Mellié, showing the sensillifers (arrows) of the antennal club. Scale bars: 100m (A), 20m (B).

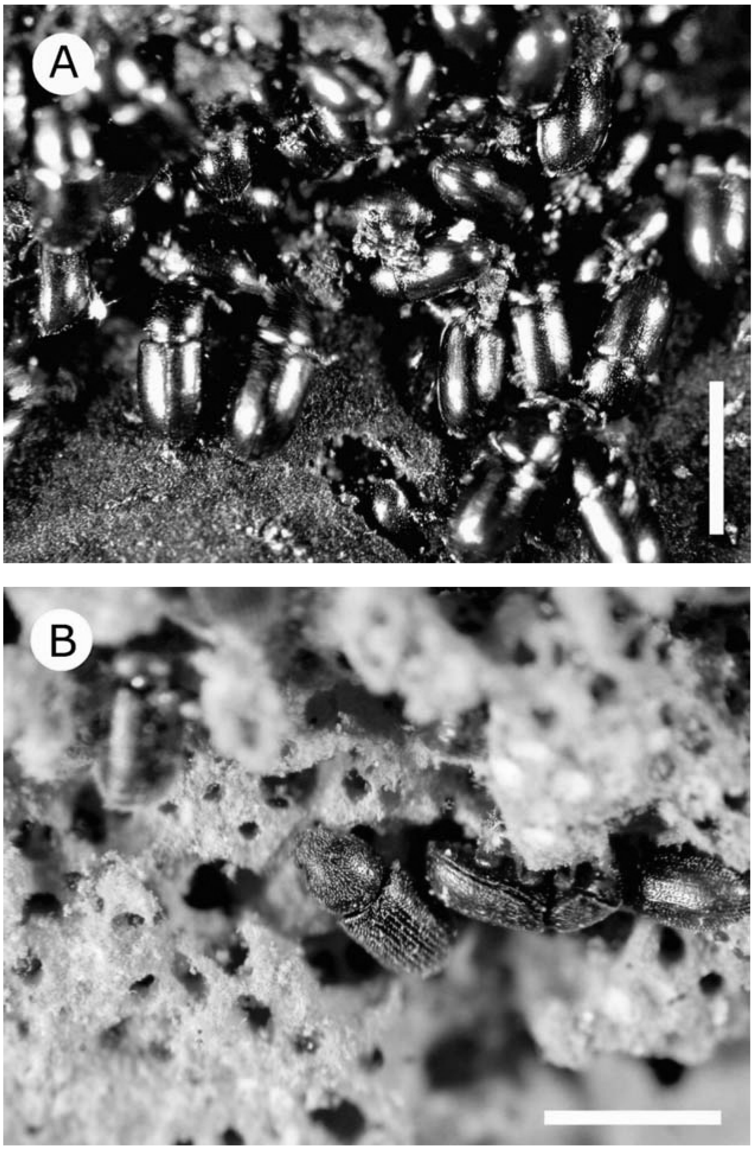

Figura2. Two ciids populations from Southeast Brazil. **A.** *Ceracis* cf. *variabilis* Mellié. **B.** *Cis* sp., an undescribed species from Minas Gerais State. Scale bars: approximately 1.5mm.

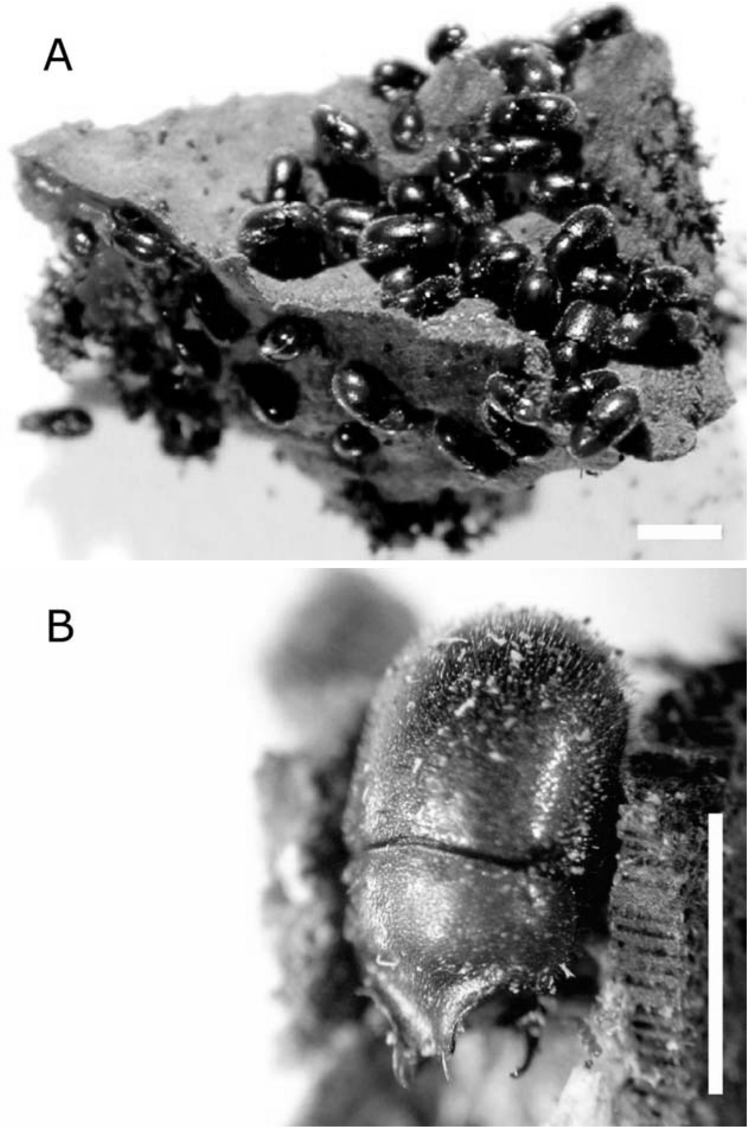

Figure 3. Two undescribed species of ciids from Southeastern Brazil, belonging to genera not previously recorded from Brazil. **A.** *Ennearthon* sp. **B.** male *Falsocis* sp. Scale bars: approximately 1.5mm.

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

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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 Ciidae (unpublished

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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, *Wagaicis* 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 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 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) is 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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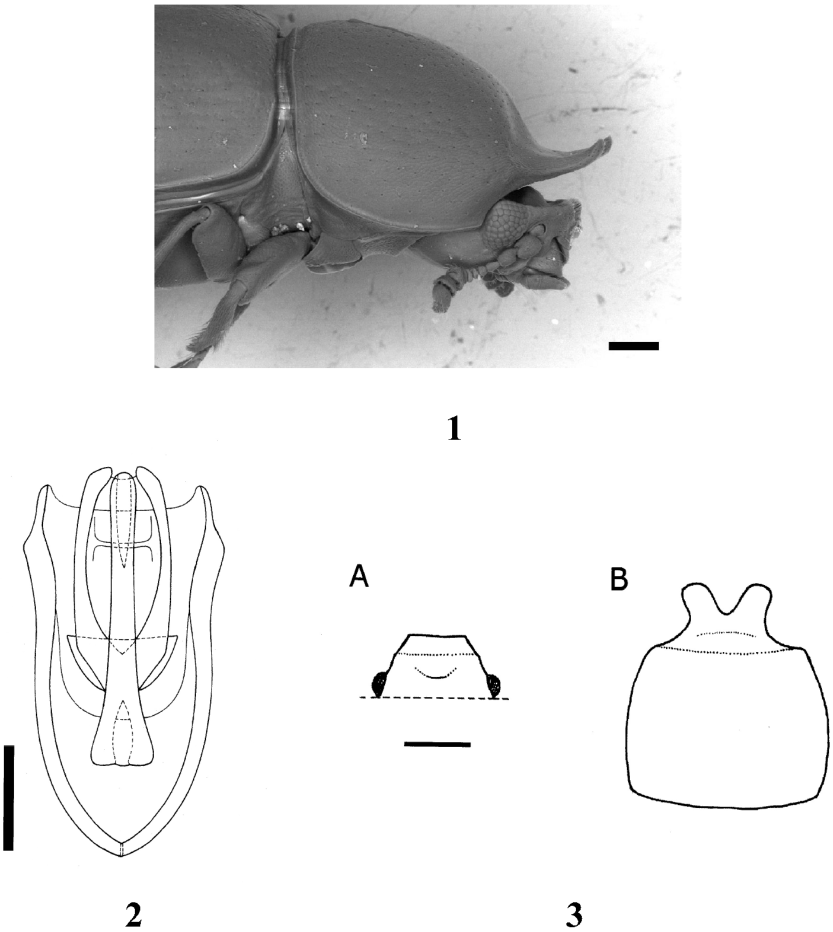

Figures1-3. *Ceracis limai* sp. nov., male. 1. SEM photograph of the lateral view of pronotum and head. Bar: 100µm. 2. Genitalia. Bar: 0.07mm. 3. A. Dorsal view of the head. B. Dorsal view of pronotum. Both drawed to the same scale. Bar: 0.25mm.

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Cis leoi, a new species of Ciidae (Coleoptera: Tenebrionoidea) from the Neotropical Region

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Abstract

Cis leoi, a new species of ciid beetle from the state of Minas Gerais, Brazil, is described based on external morphology and cytogenetics. Its placement in the *Cis* species group is discussed.

Key words: Mycetobiont, minute fungus-beetle, Ciidae, Ciinae, *comptus* group, chromosome, meiosis

Resumo

Cis leoi, uma nova espécie de ciídeo do estado de Minas Gerais, Brasil, é descrita com base na morfologia externa e citogenética. Seu posicionamento no grupo *Cis* é discutido.

Palavras-chave: Micetobionte, pequeninos besouros de fungo, Ciidae, Ciinae, grupo *comptus*, cromossomos, meiose

Introduction

Cis Latreille, 1796, is the nominotypic genus of the family Ciidae, including around 370 described species from all the biogeographic regions (Abdullah 1973). According to the Lopes-Andrade's checklist (2002a), there are only 11 described species of *Cis* known to occur in Brazil: *Cis apicipennis* Pic, 1916; *Cis diadematus* Mellié, 1848; *Cis fulvipes* Mellié, 1848; *Cis gounellei* Pic, 1916; *Cis grossus* Mellié, 1848; *Cis pallidus* Mellié, 1848; *Cis*

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robustus Pic, 1916; *Cis testaceimembris* (Pic, 1916); *Cis kawanabei* Lopes-Andrade, 2002 (see Lopes-Andrade 2002b); *Cis tricornis* (Gorham, 1883); and *Cis validithorax* Pic, 1916. The new species described below was cited by Lopes-Andrade (2002a) as *Cis* sp. (*op. cit.*, Fig. 2b).

Methods

Specimens of *Cis leoi* sp. nov. were found in bracket mushroom from two localities of Minas Gerais State, Brazil (Ubá, in an atlantic forest remnant; and Viçosa, in an urban area). Part of the specimens was killed in 70% alcohol and some were reared in the laboratory and used for cytogenetics and genitalia examination.

To avoid gold covering, a paratype was photographed in a Variable Pressure SEM (LEO 435). Other specimens were left in a solution of 4% KOH to allow genitalia extraction. The genitalia were mounted in a glass slide using a water-soluble mounting media (56% saturated aqueous solution of polyvinil alcohol, 22% phenol acid and 22% lactic acid) and then they were photographed in a Nikon Coolpix 995 digital camera adapted in a microscope (Olympus BX 41). The holotype and allotype, plus 10 specimens of each locality, were measured in a Leica stereomicroscope. We followed the measurements used by Lawrence (1987).

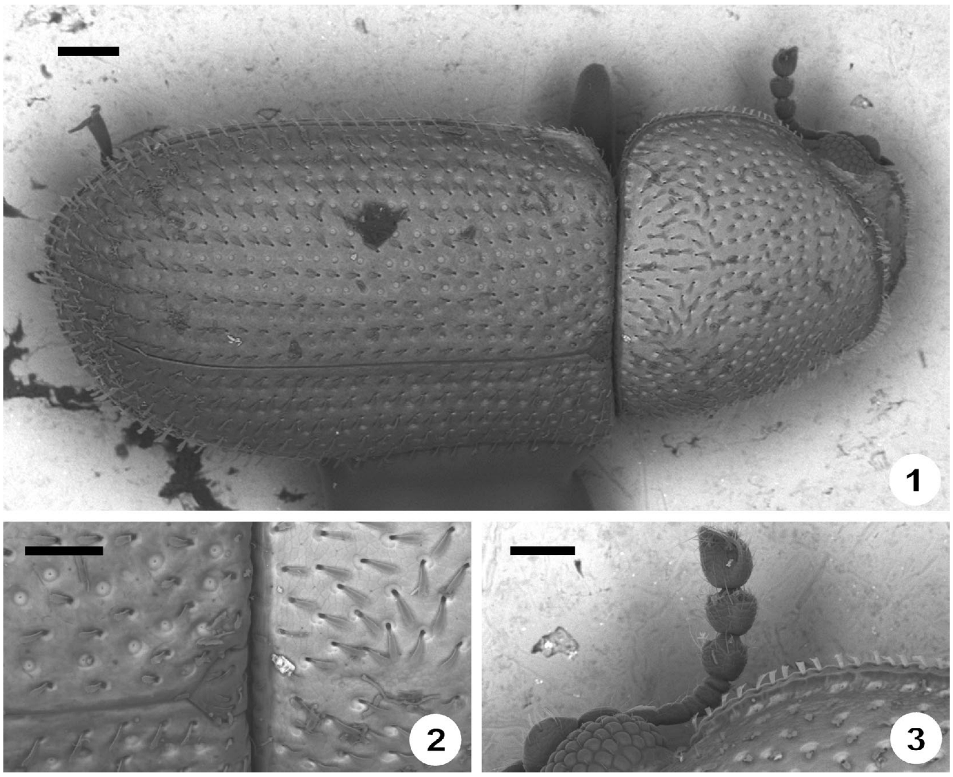
The meioformulae were evaluated using lactic-acetic-orcein chromosome preparations. Male gonads of specimens from both localities were isolated in insect saline solution. The gonads were briefly hypotonized with tap water and then fixed with Carnoy I (methanol-glacial acetic acid, 3:1). After one hour of fixation, each gonad were placed on a clean slide and softened with one drop of acetic-acid (45%). The staining of the nuclear material was carried out adding two drops of 2% lactic-acetic-orcein (25ml of lactic acid 70% in distilled water, 25 ml of pure glacial acetic acid, 1g orcein). After 10 minutes of staining, the material was covered with a cover slip and then it was smoothly squashed between a folded filter paper. The preparation was sealed with polish nail to prevent drying.

Cis leoi **Lopes-Andrade, Gumier-Costa & Zacaro, sp. nov. (Figs 1-6)**

Holotype. Male, BRASIL: MG: Ubá, Fazenda Córrego do Pari, [S 21°08', W 42°52'], 311m, 02-05.xi.2000 (F. Gumier-Costa). **Allotype.** Female, same data as holotype. Besides a locality label, both holotype and allotype have a red label with their identifications.

Diagnosis. This species is easily separated from the other described Brazilian species by the distinct seriate and dual elytral punctation, combined with the lack of conspicuous frontoclypeal tubercles in both sexes.

Description of holotype. *Male.* Body length (excluding head): 1.75 mm; greatest elytral width: 0.7 mm; greatest pronotal width: 0.65 mm; greatest depth (taken through the elytra and metasternum): 0.45 mm.



FIGURES 1-3. *Cis leoi* **sp. nov.**, male paratype (SEM); **Fig. 1.** Body, dorsal view; **Fig. 2.** Scutellum surrounded by part of the elytra and pronotum; **Fig. 3.** Part of the head, dorsal view. Scale bars, respectively: 100µm, 50µm, and 50µm.

Body 2.5 times as long as elytral width, convex, opaque on dorsum, dark reddish brown; antenna and palpi yellowish brown; legs reddish brown.

Head convex, deeply and ovally concave in the middle of vertex, conspicuously punctate; punctures uniform in size, bearing short and robust yellowish bristles; interstices between punctures finely reticulate; clypeus with one small, inconspicuous tubercle on each side; antenna with 3rd segment as long as 4th; 5th to 7th subequal; 8th to 10th forming a loose club, each club segment bearing four "sensillifers" formed by a group of short, sparse and not well-organized sensilla.

Pronotum 0.92 times as long as broad, strongly convex; anterior angles slightly produced; lateral margins narrow, finely crenulate (Fig. 3), barely visible for their entire lengths from above; dorsum irregularly and distinctly punctate; punctures uniform and similar in size to those on head, each bearing a short, robust, yellowish bristle; intervals between punctures finely reticulate. Scutellum pentagonal (Fig. 2). Elytra 1.64 times as long as broad, and 1.9 times as long as pronotum; sides subparallel in basal two-thirds, then gradually converging to apex; lateral margins not visible from above, except for basal corners; disc with dual and seriate punctation (Figs 1, 2), the larger punctures being two to three times the size of the smaller ones; the smaller punctures inconspicuous, bearing bristles similar to those of pronotum; suture not margined.

Prosternal disc weakly tumid medio-longitudinally; prosternal process parallel-sided, almost the same length as prosternum, and slightly curved. Outer angle of protibial apex produced forming a tooth. Metasternum with a median suture, extending from the posterior portion of the metasternum to the beginning of its disc. First urosternite (ventrite I) with a circular, margined pubescent fovea at middle, with a diameter of one-third the distance between the intercoxal process apex and the base of the urosternite I.

Male genitalia. (Fig. 4) Eighth abdominal sternite subtrapezoidal, with a truncate apical margin armed with relatively short hairs at the middle and long hairs at the lateral corners. Tegmen rather stout, nearly parallel-sided and with a deep emargination at its middle. Aedeagus almost twice as long as tegmen, larger at middle.

Description of allotype. *Female.* Body length (excluding head): 1.65 mm; elytral length: 1.05 mm; greatest elytral width: 0.7 mm; greatest pronotal width: 0.65 mm; greatest depth: 0.4 mm. Outer angle of protibial apex angulate, sometimes barely pronounced. First urosternite lacking a pubescent fovea.

Other specimens examined. Paratypes: 19 males, 39 females, 17 with undetermined sex, same data as holotype; 27 males, 37 females, 53 with undetermined sex, BRASIL: MG: Viçosa, Vila Gianetti, iv.2001 (A.A. Zacaro & C. Lopes-Andrade). Besides a locality label, all paratypes have a yellow label with their identifications.

Variation in a series of paratypes. Male paratypes (n = 10; 5 from each locality): body length (excluding head): 1.2 - 1.95 mm (mean = 1.48; S.D. = 0.29); elytral length: 0.75 - 1.2 mm (mean = 0.95; S.D. = 0.17); greatest elytral width: 0.6 - 0.8 mm (mean = 0.67; S.D. = 0.10); greatest pronotal width: 0.5 - 0.8mm (mean = 0.6; S.D. = 0.12); greatest depth: 0.45 - 0.6 mm (mean = 0.48; S.D. = 0.07).

Female paratypes (n = 10; 5 from each locality): body length (excluding head): 1.0 - 1.7 mm (mean = 1.48; S.D. = 0.2); elytral length: 0.65 - 1.15 mm (mean = 0.97; S.D. = 0.14); greatest elytral width: 0.5 - 0.75 mm (mean = 0.68; S.D. = 0.08); greatest pronotal width: 0.45 - 0.65 mm (mean = 0.58; S.D. = 0.06); greatest depth: 0.4 - 0.55 mm (mean = 0.48; S.D. = 0.05).

In some males and females, the clypeus lacks the lateral small tubercles. In some males, these tubercles are somewhat conspicuous, being easily seen in ventral or dorsal view; however, it is not a reliable characteristic to differentiate them from females. In this species, there are two accurate ways to confirm the sex: the presence of the fovea in males; and the morphology of the genitalia.

FIGURES 4-6. *Cis leoi* **sp. nov.**; **Fig. 4.** Male genitalia. The arrow indicates the VIII sternite; **Fig. 5.** Male metaphase I (population from Viçosa, MG, Brazil) showing nine autosomal bivalents and the sex bivalent Xy_P (arrow); **Fig. 6.** First meiotic bivalents of a male (population from Ubá, MG, Brazil), showing the sex bivalent Xy_P (arrow). Scale bars: 100μm (Fig. 4); 5μm (Figs. 5 and 6).

Karyology. Metaphase I plates of spermatocytes of *Cis leoi* from Viçosa (MG) showed nine autosomal bivalents and a sexual bivalent which was morphologically identified as belonging to the Xy_p sex determination system (Fig. 4). The meioformula of this population is 9II + Xy_p. Although many specimens of *Cis leoi* from the population of Ubá (MG) were analysed, only suitable information about the sex determination system (Xy_p) could be obtained (Fig. 5).

Host fungus. Bracket mushroom (Polyporaceae *s. lat.*), undetermined species.

Etymology. This species is named in honor of Léo Falqueto Vaz-de-Mello, born in april 16th, 2002, son of the coleopterologist Mr. Fernando Zagury Vaz-de-Mello and the microbiologist Ms. Silvia Altoé Falqueto.

Distribution. Minas Gerais State, Southeast Brazil. Known to occur in two cities, Ubá and Viçosa.

Depositories. Holotype (male), allotype (female), 4 males and 4 females paratypes at Museu de Zoologia da Universidade de São Paulo, São Paulo, SP, BRAZIL. Eight specimens will be deposited in the following personal or institutional collections: Dr. Paulo Sérgio Fiuza Ferreira, Museu de Entomologia da Universidade Federal de Viçosa, Viçosa, MG, BRAZIL; Mr. Rafal Ruta (personal collection), POLAND; Mr. Roman Królik (personal collection), POLAND; M.C. José Luís Navarrete-Heredia, Colección Entomológica del Centro de Estudios en Zoología, Universidad de Guadalajara, MEXICO; Dr. Makoto Kawanabe, collection of the Entomological Laboratory, College of Agriculture, Ehime University, Matsuyama, Ehime Pref., JAPAN; Dr. John F. Lawrence, Australian National Insect Collection, CSIRO Entomology, Canberra, AUSTRALIA. Two males and 2 females in the personal collection of Mr. Ayr de Moura Bello (Rio de Janeiro, RJ, BRAZIL). Remaining paratypes (132) are in the personal collection of the senior author.

Discussion. *Cis leoi* may be included in the *Cis comptus* group (*sensu* Lawrence 1971), due to the following characteristics: (i) distinct seriate and dual elytral punctation; (ii) lack of conspicuous frontoclypeal tubercles in male; and (iii) the morphology of the male genitalia, since the tegmen and aedeagus resemble that of *Cis orius* Kompantsev. The group *comptus* was originally proposed by Lawrence (1971) and comprised four species: the holarctic species *Cis comptus* Gyllenhal and *Cis striatulus* Mellié; and the nearctic species *Cis striolatus* Casey and *Cis versicolor* Casey. Kompantsev (1996) included other three palearctic species in this group: *Cis seriatocribatus* Reitter, *Cis clavicornis* Baudi and *Cis orius* Kompantsev. In addition, *Cis tauriensis* Królik, a Turkish new species of the *comptus* group, was described recently (Królik 2002). Kawanabe (2001) pointed out that *Cis sasajii* Kawanabe is closely allied to *Cis comptus* in general features, but did not effectively include this species in the group *comptus*. Therefore, the group *comptus* have nine described species until now. It should be emphasized that these groups of species are just taxonomic tools, and they cannot be considered *a priori* to be monophyletic taxa. Little information on Ciidae cytogenetics is found in the literature (Smith & Virkki 1978). Data on *Cis fuscipes* Mellié (and its synonym *Cis impressa* Casey, Lawrence 1965), with 2n =

14, shows a deviation from the basic meioformula (9II + Xy_P) described for polyphagan species (Smith & Virkki 1978).

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ECOLOGY, BEHAVIOR AND BIONOMICS

Why do Male *Xylographus contractus* Mellié (Coleoptera: Ciidae) Present Abdominal Fovea? Evidence of Sexual Pheromone Secretion

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Por que Machos de *Xylographus contractus* Mellié (Coleoptera: Ciidae) Apresentam Fóvea Abdominal? Evidências de Secreção de Feromônio Sexual

RESUMO - A maioria dos machos de cifdeos possuem uma fóvea no primeiro urosternito. Foram testadas duas hipóteses alternativas para explicar a função da fóvea abdominal em machos de *Xylographus contractus* Mellié: (i) a fóvea secreta feromônio sexual, e (ii) a fóvea secreta feromônio de agregação. Para isso, avaliou-se a resposta de 59 indivíduos, separadamente, a dois estímulos olfativos (extrato da fóvea e controle) em olfatômetro tipo Y. Nas análises, consideraram-se as respostas dos 47 indivíduos que se dirigiram a um dos braços do olfatômetro. A probabilidade de se deslocar em direção ao extrato de fóvea foi maior para fêmeas do que para machos (χ^2 = 3,94, P = 0,047). A proporção de machos que se dirigiram para cada um dos braços do olfatômetro foi a mesma (χ^2 = 0,29, P = 0,59). A fóvea abdominal dos machos secreta feromônio sexual, não sendo secretado nenhum feromônio de agregação por essa mesma estrutura. Sugere-se que o feromônio sexual seja usado em comunicação a curta distância, mediando mecanismos pré-copulatórios.

PALAVRAS-CHAVE: Besouro micetobionte, corte copulatória, tangorreceptor

ABSTRACT - Most male ciids present a fovea in the first urosternite. We tested two alternative hypotheses for the function of male abdominal fovea in *Xylographus contractus* Mellié: (i) the fovea secretes sexual pheromone, and (ii) the fovea secretes aggregation pheromone. For this, 59 specimens were submitted, separately, to two stimuli (fovea extracts and control) in an y-shaped glass olfactometer. For the analyses, we considered the 47 individuals that moved toward one of the longer olfactometer branches. The probability of moving toward the fovea extract was greater for females than for males (χ^2 = 3.94, P = 0.047). The proportion of males that moved toward any of the olfactometer branches was the same (χ^2 = 0.29, P = 0.59). We concluded that the male's abdominal fovea secretes a sexual pheromone and that there is no aggregation pheromone being secreted by this structure. We suggested that this sexual pheromone is used for short-range communication, acting in pre-copulatory courtship.

KEY WORDS: Mycetobiont beetle, copulatory courtship, tangoreceptor

Ciids are cosmopolitan minute fungus beetles (Lawrence 1965, Lawrence 1987) that live in association with the mycelia and fruiting bodies of wood-rotting fungi, especially bracket fungi (Basidiomycetes, Polyporaceae *s. lat.*). They are considered mycetobionts, because both larvae and adults are entirely dependent on a fungus for food and shelter (Scheerpeltz & Höfler 1948, Lawrence 1973, Navarrete-Heredia 1991, Navarrete-Heredia & Burgos-Solorio 2000). Despite their small body size, their populations represent a considerable biomass and actually contribute to the degradation of Polyporaceae (Lawrence 1973). Their population density may be very high, reaching 10,000 individuals per fungus (Navarrete-Heredia & Burgos-Solorio 2000). Ciids have already been recognized as dried fungi pests, both in commercial products and in herbarium collections (Lawrence 1971, Lawrence 1991, Madenjian *et al.* 1993).

In most Ciidae species, the males have a pubescent fovea in the first urosternite (Lawrence 1971), whose function is not clear. As this character is exclusive to males, it could be suggested that the abdominal fovea secretes sexual pheromone. An alternative hypothesis to explain the function of this fovea is that it could secret an aggregation pheromone. Similar abdominal structures are found in males of many different beetles (Lawrence 1971), such as in *Aegithus melaspis* (Coleoptera: Erotylidae), which have gregarious behavior (Navarrete-Heredia & Novelo-Gutiérrez 2000). Aggregation pheromone attracts both sexes, maximizing resource exploitation, overcoming host resistance, enhancing the probability of sexual meetings and may include security from predation (Gullan & Cranston 2000). This kind of pheromone has already been found in several insect orders, such as Coleoptera (*e.g.*, bark beetles), Blattodea and social Hymenoptera (Vilela & Della Lucia 1987). A third hypothesis would be that the male abdominal fovea secretes alarm pheromones. Such pheromones are characteristic of most social and several subsocial insects (Gullan & Cranston 2000). As far as Ciidae do agregate inside their resource (Navarrete-Heredia & Burgos-Solorio 2000), alarm pheromones could have high adaptive value. To our knowledge, since *X. contractus* was described (Mellié 1848), there has been no other study on its biology nor pheromone production.

In the present study, we tested three hypotheses: (i) the abdominal fovea of *Xylograpus contractus* Mellié (Ciidae) secretes sexual pheromone; (ii) this fovea secretes aggregation pheromone; (iii) the fovea secretes alarm pheromone.

Material and Methods

Ciid Collection and Maintenance. *X. contractus* was collected in bracket fungus at Viçosa (Mata do Paraíso), Minas Gerais State, Brazil (20º45'S, 42º50'W). The colonies were bred under controlled conditions (26 ± 1ºC, without light) from October 1999 to January 2001. This species develops quickly under laboratory conditions. A great number of adults (>500) were obtained each time, due to generation overlapping. This ciid species does not have any conspicuous sexual dimorphism, which allowed us to carry out a blind experiment, *i.e.*, we only knew an individual's sex after its use in the experiment.

Scanning Electron Microscopy. The ultrastructure of the urosternite was analyzed to (i) confirm fovea presence in *X. contractus*, because it is absent in some *Xylographus* species (Lawrence 1971), and (ii) evaluate the presence of pores in other parts of the urosternite, which could be related to pheromone secretion.

Some specimens were covered with gold in a sputtering (Balzers MED 010) and photographed in a Scanning Electron Microscopy (Zeiss DSM 940 A).

Extract Preparation. Dissections were made in physiological solution (NaCl 0.09%) at low temperatures (*circa* 0ºC), to avoid loss of volatile substances. The first urosternite of thirty males was cut and put in separate tubes with 200 µl of bi-distilled hexan to obtain the extracts. Samples were stored in 2 ml tubes with teflon-lined lids until use, and kept at -30ºC until their use in the experiments.

Olfactometer Experiments. We exposed 59 specimens to two stimuli in an olfactometer: (i) extract of the first male urosternite, without visceral contents; (ii) pure bi-distilled hexan. The apparatus used consisted of a Y-shaped glass tube with one shorter and two longer branches (Eiras & Mafra Neto 2001). In each of the longer branches we put an air pump (to produce airflow), a filter with activated coal (to avoid contaminants), a fluxometer (SHO -RATE; I_n/h AIR @ t 20ºC and p_a 1.013 bar) to control airflow, a container with water and another with a stimulus, directly connected to the branch. Filter papers with 40 µl of a stimulus (extract or pure hexan) were placed in each of the latter containers. The airflow was calibrated in 0.1 $m.s^{-1}$. A track of filter paper, Y-shaped, was placed through the short branch, reaching 15cm of each of the longer branches to provide a substrate for walking. This procedure also was adopted to make the replacement of the insects easier. The track was changed for each tested specimen to prevent contaminants or interference of any substance. Each specimen was used only once.

The experiment was conducted with one specimen each time. Each specimen was placed 5cm in front of the olfactometer bifurcation. Specimens that did not present any response within 10 min. were discarded. Specimens that presented a response, *i.e.*, moved to one of the longer olfactometer branches, were sacrificed in carbon dioxide gas and dissected to allow sex determination.

Predictions. If the first hypothesis (the abdominal fovea secretes sexual pheromone) were correct, females would be more attracted to fovea extracts than to the control. If the second hypothesis (the fovea secretes aggregation pheromone) were correct, then not only females, but also males would be attracted to fovea extracts. In this case one could not discard simultaneous secretion of sexual pheromone. If the third hypothesis (the fovea secretes alarm pheromone) were correct, both male and female would avoid fovea extracts.

Statistical Analyses. All statistical analyses were done with the GLIM 4 statistical package (Francis *et al.* 1994). Generalized linear models were used in place of the usual nonparametric statistical tests to ensure greater statistical power (Siegel 1975). To test the hypothesis that the fovea secretes sexual pheromone, a generalized linear model was used, analogous to logistic regression, with binomial errors and logit link function (Crawley 1993). The prediction of this hypothesis was that sex would affect the probability choosing one olfactometer branch, and that there should be a greater number of females that moved to the branch with the fovea extract.

To test the hypothesis that the fovea secretes aggregation pheromone, we analyzed a contingency table with the Chi-squared test. Even if there were a sexual pheromone, an aggregation pheromone could also be secreted, leading to a greater number of males moving towards the branch with the fovea extract. If there were only secretion of aggregation pheromone, there should be a greater number of specimens, irrespective of sex, moving towards the branch with the fovea extract.

Results

Pores were not found around the male's abdominal fovea or in any of the urosternites (Fig. 1). Several bristles surround the fovea, forming a setose patch, and make the discrimination of the fovea itself difficult (Fig. 2). Fovea or pores were not found in the female's urosternites (Fig. 3).

In the experiment, 47 individuals (31 males and 16 females) moved toward one of the longer olfactometer branches. The other 12 specimens, that moved to the minor

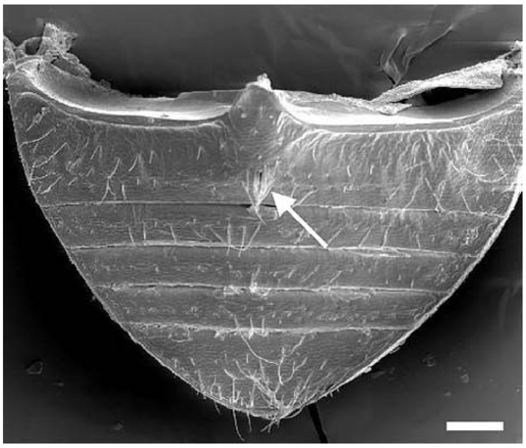

Figure 1. Urosternites of a male *Xylographus contractus*. Arrow indicates a setose patch in the middle of the first urosternite. Note that there are not any other setose patches on the abdomen, but only some sparsed bristles. Scale bar: 100 µ.

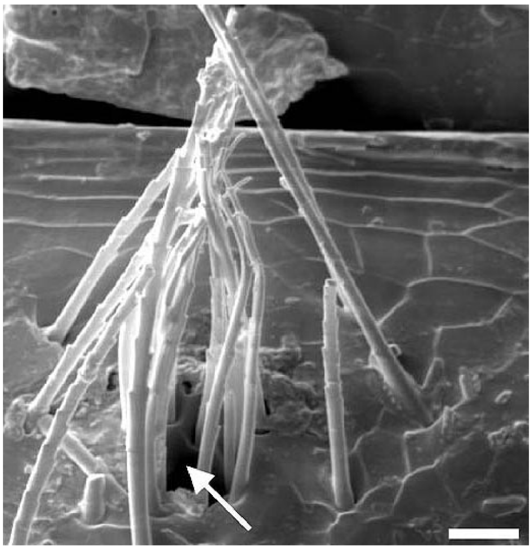

Figure 2. First urosternite (third sternite) of a male *Xylographus contractus*. Arrow indicates the fovea, which is surrounded by bristles, forming a setose patch. Scale bar: 10 µ.

branch or did not move, were not considered in the analyses. The probability of moving to the branch with extract was higher for females (12 in 16) than males (14 in 31; $\chi^2 = 3.94$, P = 0.047). Thus the hypothesis that the fovea secretes sexual pheromone was accepted. The number of males that moved toward the branch with extract did not differ from the number of males that moved toward the other branch ($\chi^2 = 0.29$, P = 0.59). Thus the hypothesis that the fovea secretes aggregation pheromone was rejected.

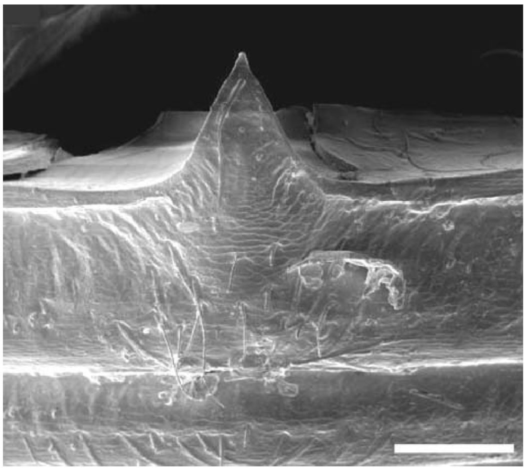

Figure 3. First urosternites of a female *Xylographus contractus*. Note that there is no fovea or pore in the middle of the first urosternite (third sternite). Scale bar: 100 µ.

Discussion

Our results revealed that (i) the male's fovea is the only structure that could secrete pheromones in the abdominal sternites of *X. contractus*, (ii) the male abdominal fovea secretes sexual pheromone and (iii) that it does not secrete aggregation or alarm pheromones. Why are bristles arranged around the fovea? Males are generally found outside the fungus, while females stay inside it for longer, laying their eggs in chambers of the galleries' walls (Lawrence 1974). To copulate, either the males should produce some pre-copulatory stimulus to attract the females to the surface, or the females should leave the fungus and find their mates by chance. Males outside the fungus scratch their abdomen in the surface before copulation (Lopes-Andrade pers. obs.). Therefore, the foveal bristles may be some kind of tangoreceptor sensilla (Snodgrass 1935), which stimulates pheromone secretion. Thus, the sexual pheromone of males may be important in pre-copulatory courtship, attracting females to the fungus surface, where copulation takes place. Therefore, the pheromone produced by males may be courtship, and not a long-range attraction pheromone. Additionally, the fovea bristles may serve to increase pheromone spreading, facilitating the dispersion of the odor plume. This mechanism may enhance the area covered by the odor plume in a short distance. Jonsson *et al.* (1997) suggested that long-range pheromones are absent in Ciidae. For long-range attraction, fungus volatiles play the most important role (Jonsell & Nordlander 1995, Fossli & Andersen 1998, Fäldt *et al.* 1999).

As ciids present gregarious behavior (Lawrence 1974), there could be an aggregation pheromone being secreted. Lawrence (1973) suggested that such a pheromone would be secreted together with the feces. An abdominal fovea is found in almost all ciids, but this does not mean that in all these species the fovea has the same function, *i.e.*, secreting a sexual pheromone. For instance, in some species of *Xylographus* Mellié and *Cis* Latreille, it was suggested that the fovea is vestigial or completely absent (Lawrence 1971). Experiments to evaluate the presence of other pheromones, in addition to the sexual, are still necessary.

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Xylographus lucasi, a new Brazilian species of Ciidae (Coleoptera: Tenebrionoidea)

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ABSTRACT
In this work, a new Brazilian species of *Xylographus* Mellié is described based on external features and morphology of the internal male genitalia. Some diagnostic characters are presented to distinguish *Xylographus lucasi* sp. nov. from the described Brazilian species of the genus.
KEY WORDS
Minute fungus-beetles, Ciinae, Orophiini, Neotropical Region.

RESUMO
Neste trabalho, uma nova espécie brasileira de *Xylographus* Mellié é descrita utilizando-se de características externas e morfologia da genitália interna de machos. Algumas características diagnósticas são apresentadas para distinguir *Xylographus lucasi* sp. nov. de outras espécies Brasileiras já descritas do gênero.
PALAVRAS-CHAVE
Pequeninos besouros de fungo, Ciinae, Orophiini, Região Neotropical.

The genus *Xylographus* Mellié, 1847, belongs to the tribe Orophiini (*sensu* Lawrence 1982), and it is mainly characterized by the combination of the following features: (i) body extremely convex; (ii) head not visible from above; (iii) antenna 10-segmented; (iv) prosternal process tapering; (v) tibiae gradually extending toward their apices, bearing a row of teeth in their outer margins.

Xylographus is the largest genus of Orophiini and it comprises 34 species (Adbullah 1973, but see Kawanabe 1995). Nine species occur in the neotropics (Blackwelder 1945, Lawrence 1967, Lopes-Andrade 2002), and two of these species, *X. contractus* Mellié, 1848 and *X. brasiliensis* Pic, 1916, have their type locality in Brazil (the latter from Rio Verde, probably Goiás State). Abdullah (1973) wrongly assigned *X. brasiliensis* to Africa. One other species, *X. rufipes* Pic, 1930, were cited for Brazil by Lopes-Andrade (*op. cit*), based in an identified specimen from Museu de Zoologia (MZ / USP, BRAZIL), but this should be confirmed.

The new species described below was first cited by Lopes-Andrade and Zacaro (2002; Fig. 2) as *Xylographus* sp.

MATERIAL AND METHODS

Specimens of *X. lucasi* sp. nov. were found in a single bracket mushroom, probably *Ganoderma* sp. (Ganodermataceae), from Venda Nova do Imigrante, Espírito Santo State, Brazil (20°20'23''S, 41°08'05''W). The specimens were killed in 70% alcohol, and then stored in 95% alcohol until they were mounted. Some specimens were air dryed, coated with gold, and then photographed in a Zeiss 940-A scanning electron microscope (SEM). Anatomical preparations of genitalia, tibiae and antenna were made according to Lopes-Andrade *et al.* (2003). Both holotype and allotype were chosen because they had their genitalia extroverted, and also because the former had a distinct pubescence in the first ventrite. To avoid damage to the holotype, we preferred to dissect a male paratype to show the genitalia in detail. The holotype and allotype, plus 10 specimens, were measured in a stereomicroscope (Leica MZ 12), following the parameters cited by Lawrence (1987).

Xylographus lucasi **Lopes-Andrade & Zacaro, sp. nov. (Figs. 1-10)**

Diagnosis. This species is recognizable by the combination of the following characters: (i) elytra as long as broad (Fig. 1), which clearly distinguishes it from *X. contractus*; (ii) disc of elytra and pronotum glabrous (Fig. 1), which easily differentiate it from the species related to *X. rufipes*; (iii) left mandibula without a "horn" (Fig. 3), which is present in *X. corpulentus* Mellié; (iv) distribution of the teeth in the outer margin of the tibiae (Fig. 7); (v) morphology of the male genitalia (Figs. 8-10).

Description of holotype. *Male.* Body length (excluding head): 2.65 mm; greatest elytral width: 1.40 mm; greatest pronotal width: 1.35 mm; greatest depth (taken through the elytra and metasternum): 1.25 mm. Body 1.89 times as long as elytral width, extremely convex (Figs. 1-2), shiny on dorsum, black; antenna (excluding the club), buccal apparatus and tarsi dark yellowish brown; antennal club, legs and abdomen dark brown.

Head convex, slightly concave in the middle of the vertex, sparsely punctate; punctures uniform in size, bearing long and slim yellowish bristles; intervals among punctures finely reticulate; clypeus without tubercles; antenna with 3rd segment 1.75 times as long as 4th; 5th to 7th subequal; 8th to 10th forming a loose club (Fig. 6), each club segment bearing four "sensillifers" formed by a group of short and apically rounded sensilla, which are tight and well-organized in at least two concentric layers (Figs. 4-6).

Pronotum 0.89 times as long as broad, strongly convex; anterior margin curved inward, continuous to the bowed lateral margins (Fig. 2); margins smooth, lateral margin barely visible for their entire lengths from above (Fig. 1); dorsum irregularly and distinctly punctate; punctures uniform in size, just slightly larger than those on head; intervals among punctures finely reticulate; puncture near the pronotum margin bearing long and slim, yellowish bristles. Scutellum triangular. Elytra 1.04 times as long as broad, and 1.21 times as long as pronotum; sides parallel in basal two thirds, then gradually converging to apex; lateral margins not visible from above, except for basal corners (Fig. 1); disc with irregular and dual punctation, the big punctures being slightly larger than those of pronotum, and the small punctures four times smaller than the bigger ones; punctures near the outer margins bearing bristles similar to those of pronotum; suture margined (Fig. 1).

Prosternal disc concave; prosternal process tapering, being smaller than the prosternal length. Outer margins of tibiae with a row of teeth as shown in Fig. 7. Metasternum without a median suture, disc slightly convex and without punctures; lateral sides of metasternum punctate, each puncture bearing a long and slim, yellowish bristle. Disc of first ventrite with a very small, circular and pubescent fovea, near the posterior margin of the sclerite, which is seen as a setose patch in low magnifications.

Male genitalia of a paratype. Anterior edge of the eighth sternite with median strut (Fig. 8, arrow); presence of one bristle in the apex of each branch of the ninth tergite (Fig. 9, arrows); basal piece, tegmen and median lobe as shown in Fig. 10.

Description of allotype. *Female.* Body length (excluding head): 2.75 mm; elytral length: 1.45 mm; greatest elytral width: 1.50 mm; greatest pronotal width: 1.40 mm; greatest depth: 1.30 mm. First ventrite lacking a pubescent fovea.

Variation in a series of paratypes. In the majority of the type series, the pubescence in the first ventrite were not visible, making difficult to determine the sex of the specimens for sure without dissecting them. Thus, we just measure 12 sorted individuals, as follows: body length (excluding head): 2.45 - 2.95 mm (mean = 2.68; S.D. = 0.13); elytral length: 1.35 - 1.60 mm (mean = 1.44; S.D. = 0.08); greatest elytral width: 1.30 - 1.60 mm (mean = 1.44; S.D. = 0.07); greatest pronotal width: 1.25 - 1.50 mm (mean = 1.36; S.D. = 0.08); greatest depth: 1.15 - 1.50 mm (mean = 1.33; S.D. = 0.10).

Etymology. This species is named in honor of Lucas Caiafa Cardoso Reis, son of my friends Ronaldo Reis Júnior and Amanda Fialho, who was born in August 14th 1995.

Distribution. Known from a single field collection in Venda Nova do Imigrante, Espírito Santo State, Southeastern Brazil.

Specimens examined and depositories. Holotype, male, BRASIL: ES: Venda Nova do Imigrante, 13-16.xi.1999 (F. Z.Vaz-de-Mello); allotype, female, same data as holotype. Besides a locality label, both holotype and allotype have a red label with their identifications; paratypes (120 specimens): same data as holotype. Besides a locality label, all paratypes have a yellow label with their identifications. Holotype (male), allotype (female), 4 males and 4 females paratypes at Museu de Zoologia da Universidade de São Paulo, São Paulo, SP, BRAZIL. Four specimens will be deposited in the following institutional and Personal Collections (PC): Dr. Paulo Sérgio Fiuza Ferreira, Museu de Entomologia da Universidade Federal de Viçosa, Viçosa, MG, BRAZIL; M.C. José Luís Navarrete-Heredia, Colección Entomológica del Centro de Estudios en Zoología, Universidad de Guadalajara, MEXICO; Dr. Makoto Kawanabe, collection of the Entomological Laboratory, College of Agriculture, Ehime University, Matsuyama, Ehime Pref., JAPAN; Dr. John F. Lawrence, Australian National Insect Collection, CSIRO Entomology, Canberra, AUSTRALIA; Col. Ayr de Moura Bello, BRAZIL (PC); Mr. Rafal Ruta (PC), POLAND; Mr. Roman Królik (PC), POLAND; Dr. Glenda M. Orledge (PC), UK; Mr. Leonardo Delgado (PC), MEXICO. Remaining paratypes (72) are in the personal collection of the senior author.

Discussion. The genus *Xylographus* seems to be consistent, however it is difficult to recognize new species due to the lack of details in early works made by authors as Maurice Pic. For instance, his description of *X. brasiliensis* is vague and do not allow much interpretation (see Pic 1916), making difficult the identification of specimens without comparison with the primary type. This situation will only be circumvented by a revision of the genus.

The organization and external morphology of the sensillifers' sensilla of the antennal club are usually not mentioned in descriptions of ciids, but this character deserves more attention. In this genus, these sensilla are very close to each other and generally organized in at least two concentric rows (Lopes-Andrade and Zacaro 2002). In *Octotemnus glabriculus* (Gyllenhal) and *O. laminifrons* Motschulsky these sensilla are also organized in concentric rows, but they are somewhat sparser (Lopes-Andrade, pers. obs.).

The eighth sternite of *X. lucasi* with a sclerotized anterior edge bearing a median strut is similar to that found on other Brazilian *Xylographus* species (Lopes-Andrade, pers. obs.) and to the ones observed in five japanese species of *Octotemnus* Mellié (see Kawanabe 2002): *O. glabriculus*, *O. omogensis* Miyatake, *O. parvulus* Miyatake, *O. pilosoceps* Kawanabe, *O. punctidorsum* Miyatake. Future works should evaluate whether or not this character is a synapomorphy of *Octotemnus* and *Xylographus*, and also if it is shared with other genera of Orophiini. The bristle in the apex of each branch of the ninth tergite has also been found in other Brazilian *Xylographus*, therefore future studies may determine whether or not it is an autapomorphy of this genus.

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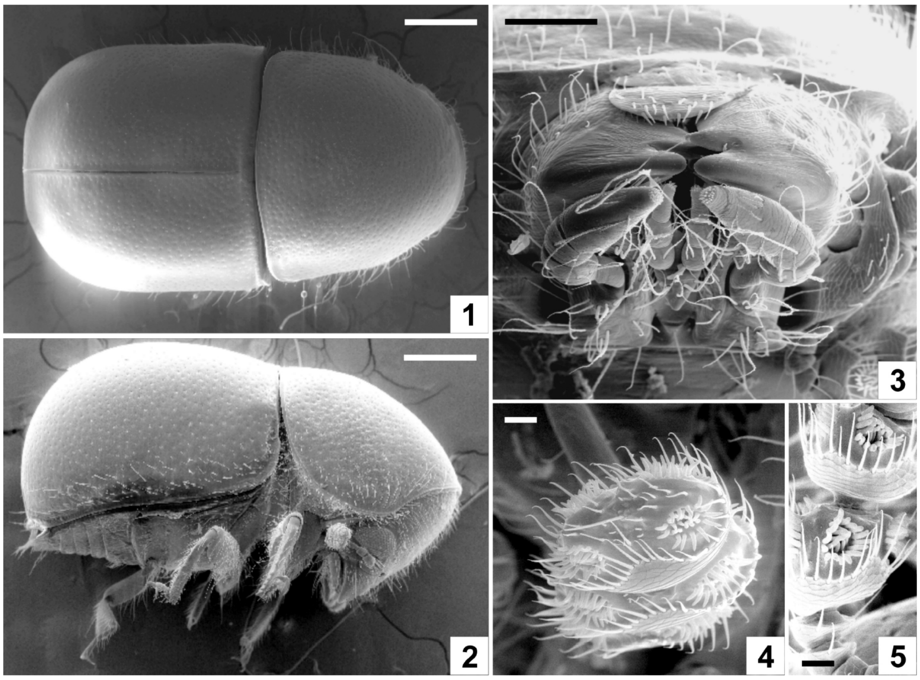

Figures 1-5. SEM of *Xylographus lucasi* sp. nov. **Fig. 1.** Dorsal view. **Fig. 2.** Lateral view. **Fig. 3.** Buccal apparatus; note the absence of a "horn" in the left mandibula. **Fig. 4.** Antennal club viewed from above; note that all the four sensillifers are easily seen in the last antennal club. **Fig. 5.** Detail of an antennal club, showing the sensillifers. Scale bars represent: 175µm (Fig. 1), 165µm (Fig. 2), 100µm (Figs. 3 and 4), and 20µm (Fig. 5).

Figure 6-7. *Xylographus lucasi* sp. nov., digital photography. **Fig. 6.** Antenna. **Fig. 7.** From left to right: pro, meso and meta tibiae, showing the teeth of their outer margins (arrows). Scale bars: 100µm.

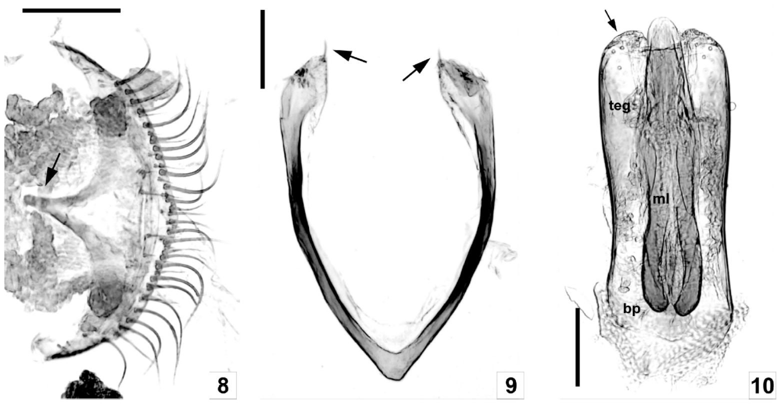

Figure 8-10. *Xylographus lucasi* sp. nov., digital photography. **Fig. 8.** Eighth sternite, showing the sclerotized anterior edge bearing a median strut (arrow). **Fig. 9.** Ninth tergite, showing the bristle in the apex of each branch (arrows). **Fig. 10.** Basal piece (bp), tegmen (teg) and median lobe (ml); note the presence of papilae (arrow) in the tegmen apex. Scale bars: 100µm.

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The first record of *Ennearthron* Mellié, 1847 (Coleoptera: Tenebrionoidea: Ciidae) in the Southern Hemisphere, with the description of a distinctive new species

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Abstract

This paper presents the description of *Ennearthron victori* sp. nov. In contrast to all known species of this genus, *E. victori* is the first one occurring in the Southern Hemisphere (Neotropical Region, Brazil, Minas Gerais and São Paulo States) and, the only one in which males lack a fovea on the first ventrite.

Key words: Neotropical, Brazil, Ciidae, Ciinae, Ciini, beetle, mycetobiont

Resumo

Este trabalho apresenta a descrição de *Ennearthron victori* sp.nov. Em contraste com todas as outras espécies descritas deste gênero, *E. victori* é a primeira que ocorre no Hemisfério Sul (Região Neotropical, Brasil, Estados de Minas Gerais e São Paulo) e é a única em que os machos não apresentam fóvea no primeiro ventrito.

Palavras-chave: Neotropical, Brasil, Ciidae, Ciinae, Ciini, besouro, micetobionte

Introduction

Ennearthron Mellié, 1847, is a genus close to *Cis* Latreille, 1796, and, is characterized by the nine antennomeres and the presence of a notch in the middle of the male clypeus (Kawanabe 1996; Lawrence 1971).

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There are eight described species in *Ennearthron*: *E. amamense* Miyatake, 1959; *E. chujoi* Nakano & Nobuchi, 1955; *E. ishiharai* Miyatake, 1954; *E. mohrii* Miyatake, 1954; *E. robusticorne* Kawanabe, 1996; *E. cornutum* (Gyllenhal, 1827); *E. aurisquamosum* Lawrence, 1971 and *E. spenceri* (Hatch, 1961). The first five species occur in Japan, the last two in North America, and *E. cornutum* is Palaearctic (Abdullah 1973; Kawanabe 1996; Lawrence 1971). Lawrence (1971) cited the existence of three or four new species from India and China. The new species described below was previously cited by Lopes-Andrade (2002, Fig. 3a) as *Ennearthron* sp.

Methods

Specimens of *Ennearthron victori* sp. nov. were collected in bracket mushrooms from three Brazilian localities: Viçosa and Ubá, Minas Gerais State (in an urban area and Atlantic forest remnant, respectively); and, in Piracicaba, São Paulo State.

For external morphology, some specimens were analyzed using scanning electron microscopy (SEM; JEOL-JSM T200). The specimens were dehydrated in a series of alcohol solutions, critical point dried (Balzers CPD 020), mounted on stubs and sputter-coated with gold.

Genitalia extraction and examination followed Lopes-Andrade *et al.* (2003) for specimens belonging to these three localities. The holotype and allotype, plus 10 specimens from each locality (5 males and 5 females), were measured under a stereomicroscope (Leica MZ 12), following the measurements used by Lawrence (1987).

Ennearthron victori Lopes-Andrade & Zacaro, sp. nov. (Figs. 1–7)

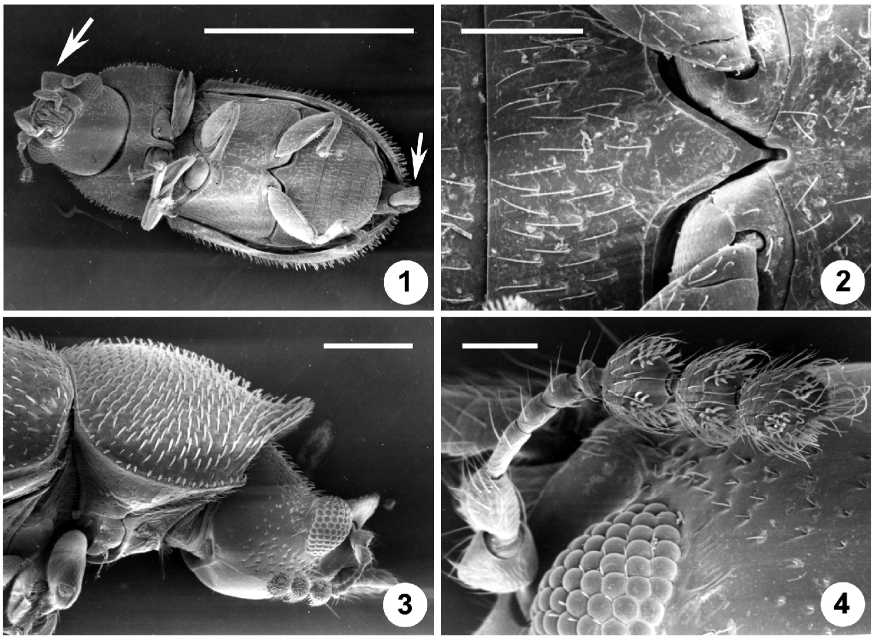
Holotype. Male, BRASIL: MG: Viçosa, Vila Gianetti, xi.2001 (A. A. Zacaro & C. Lopes-Andrade). Allotype. Female, same data as holotype. In addition to the locality label, both the holotype and allotype have a red label with their identifications.

Diagnosis. This species can be easily distinguished from the other *Ennearthron* species by the following combination of characteristics: (i) absence of a fovea in the first ventrite of males (Figs. 1–2); (ii) morphology of the male genitalia.

Description of holotype. *Male.* Body length (excluding head): 1.45 mm; greatest elytral width: 0.65 mm; greatest pronotal width: 0.65 mm; greatest depth (taken through the elytra and metasternum): 0.55 mm.

Body 2.23X as long as elytral width, convex, shiny on dorsum, dark reddish brown; antenna, bucal apparatus and legs yellowish brown; antennal clubs and mandibles darker. Vestiture of short, stout and shiny yellowish bristles.

Head convex, vertex shallowly concave in the anterior-lateral portions and weakly convex at middle, sparsely and inconspicuously punctate. Punctures small, shallow, uniform in size, each bearing one shiny, short, stout yellowish bristle. Intervals among punctures smooth; frontoclypeal ridge produced forward, emarginate in middle, forming two subtriangular plates which reflex above, with conspicuous median notch between them; antenna with 3rd antennomere 1.5X as long as 4th. The 5th and 6th antennomeres almost with the same length, 7th to 9th forming a loose club, each club antennomere bearing four "sensillifers" formed by a group of short and slender sensilla (Figs. 3–4).



FIGURES 1–4. Scanning electron microscopy of *Ennearthron victori* sp. nov. (male, topotypes) evidencing some features of the external morphology. **1.** Whole ventral view; large and small arrows indicate, respectively, the produced frontoclypeal ridge and the protruded genitalia. **2.** Detail of the first ventrite, which lacks any structure resembling a fovea or setose patch. **3.** Lateral view of pronotum and head. **4.** Antenna. Scale bars: 1mm (Fig. 1); 100µm (Fig. 2); 200µm (Fig. 3); 50µm (Fig. 4).

Pronotum (including apical projections) 0.92X as long as broad, anterior corners obtusely angulate, strongly produced forward into two subtriangular projections which protrude beyond head (Fig. 3). These projections are rounded at apex and separated by a distance of twice the length of scutellum; lateral margins narrowly ridge, finely crenulate and setose, first two-thirds invisible from above, posterior portion barely visible; disc strongly convex; sides in lateral view nearly arcuate, widest at middle, slightly convergent apically; basal margin very narrowly ridged, slightly sinuate, lateroposterior angles broadly rounded; dorsum irregularly, closely and distinctly punctate; punctures uniform in size, larger than in head, each puncture bearing one shiny, short and robust yellowish bristle; punctures remote at middle, forming a distinct line; intervals among punctures smooth. Scutellum subpentagonal, with some punctures and bristles. Elytra 1.31X as long as broad, 1.42X as long as pronotum; sides subparallel in anterior two thirds, then gradually converging to apex, with margins not visible from above; punctation single; punctures tight, rough, uniform in size, with obscure outline, rather deeper and slightly larger than those on pronotum, partially seriate; intervals among punctures smooth; each puncture bearing one short, stout, shiny bristle. Suture not margined.

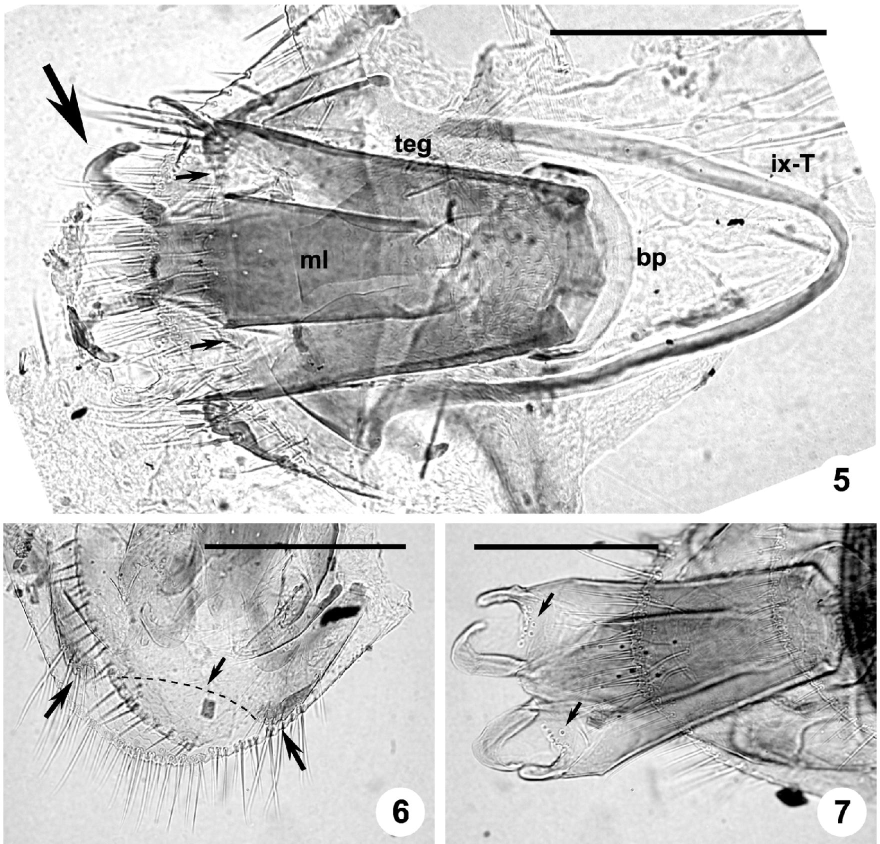
Prosternal disc biconcave; prosternal process broad, slightly enlarged at apex. Protibia with outer apical angle produced and dentate. Metasternum with longitudinal suture in its middle, extending from base to disc. First ventrite without pubescent fovea or setose patch. *Male genitalia in topotypes.* Tegmen with two small lateral projections. Median lobe slightly enlarged near middle, with tapering apical portion armed with two long and slender hooked projections; basal margin rounded. Eighth sternite with emarginate apical margin, bearing both long and short setae on lateral corners, which are somewhat angulate. Basal piece and ninth sternite as shown in Figs. 5–7.

Description of allotype. *Female*. Body length (excluding head): 1.5 mm; elytral length: 0.90 mm; greatest elytral width: 0.60 mm; greatest pronotal width: 0.65 mm; greatest depth: 0.55 mm. Head without protruded plates, and pronotum without projections.

Other specimens examined. Paratypes (360): 11 males, 7 females, same data as holotype; 6 males, 12 females, BRASIL: MG: Viçosa, Vila Gianetti, 29.xi.2001 (A. A. Zacaro & C. Lopes-Andrade); 145 males, 156 females, BRASIL: MG: Ubá, Fazenda Córrego do Pari, [S 21°08', W 42°52'], 311m, x.2001 (F. Gumier-Costa); 12 males, 11 females, BRASIL: SP: Piracicaba, viii.2000 (P. Milano). Besides a locality label, all paratypes have a yellow label with their identifications.

Variation in a series of paratypes. Male paratypes (n = 15; 5 from each locality): body length (excluding head): 1.15–1.75 mm (mean = 1.5; S.D. = 0.18); elytral length: 0.7–1.1 mm (mean = 0.91; S.D. = 0.12); greatest elytral width: 0.55–0.95 mm (mean = 0.68; S.D. = 0.1); greatest pronotal width: 0.5–0.75 mm (mean = 0.65; S.D. = 0.07); greatest depth: 0.4–0.7 mm (mean = 0.57; S.D. = 0.08).
Female paratypes (n = 15; 5 from each locality): body length (excluding head): 1.15–1.6 mm (mean = 1.44; S.D. = 0.13); elytral length: 0.75–1.05 mm (mean = 0.92; S.D. = 0.08); greatest elytral width: 0.5–0.75 mm (mean = 0.66; S.D. = 0.07); greatest pronotal width: 0.5–0.65 mm (mean = 0.59; S.D. = 0.04); greatest depth: 0.4–0.65 mm (mean = 0.56; S.D. = 0.07).

Host fungus. Bracket mushroom (Polyporaceae *sensu lato*), unidentified species.



FIGURES 5–7. Genitalia of *Ennearthron victori* sp. nov. (male, topotypes). **5.** Whole view evidencing the ninth sternite (ix-T), basal piece (bp), tegmen (teg) and median lobe (ml); the large and small arrows indicate, respectively, the hooked apical projection and the apical margin of the eighth sternite. **6.** Detail of the eighth sternite; the large arrows indicate the lateral corners bearing setae; the dashed line (small arrow) reinforces the emarginate apical margin. **7.** Detail of tegmen and median lobe; note the presence of papillae (arrows) near the small lateral projections of tegmen; some sparse papillae can also be observed in the middle of the median lobe. Scale bars 100µm.

Etymology. This species is named in honor of Victor Vassoler Zacaro (*in memoriam)*, nephew of Adilson A. Zacaro.

Distribution. Known to occur in the Southeast Region of Brazil, in Ubá and Viçosa (Minas Gerais State) and Piracicaba (São Paulo State).

Depositories. Holotype (male), allotype (female), 12 males and 12 females paratypes at Museu de Zoologia da Universidade de São Paulo, São Paulo, SP, BRAZIL. Eight specimens will be deposited in the following personal or institutional collections: Dr. Paulo Sérgio Fiuza Ferreira, Museu de Entomologia da Universidade Federal de Viçosa, Viçosa, MG, BRAZIL; Dr. Juan Grados Arauco, Departamento de Entomología, Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, PERU; M.C. José Luís Navarrete-Heredia, Colección Entomológica del Centro de Estudios en Zoología, Universidad de Guadalajara, MEXICO; Mr. Rafal Ruta (personal collection), POLAND; Mr. Roman Królik (personal collection), POLAND; Dr. Glenda M. Orledge (personal collection), UK; Dr. Makoto Kawanabe, collection of the Entomological Laboratory, College of Agriculture, Ehime University, Matsuyama, Ehime Pref., JAPAN; Dr. John F. Lawrence, Australian National Insect Collection, CSIRO Entomology, Canberra, AUSTRALIA; Mr. Cheryl B. Barr, Essig Museum of Entomology, University of California, USA; Dr. Philip D. Perkins, Museum of Comparative Zoology, Harvard University, USA; Mr. Albert Allen (personal collection), USA; California State Collection of Arthropods, Sacramento, USA. Two males and 2 females in the personal collection of Mr. Ayr de Moura Bello (Rio de Janeiro, RJ, BRAZIL). Remaining paratypes (236) are in the personal collection of the senior author.

Discussion. Considering the general external features, *Ennearthron victori* is closest to *E. aurisquamosum* Lawrence, 1971. Information about the morphology of the male genitalia of *E. amamense* and *E. chujoi* is provided by Miyatake (1959). Kawanabe (1996) only showed the tegmen and the eighth sternite in schematic representations. The eighth sternite of *E. victori* is most similar to that of *E. chujoi*, both of which also have a rounded basal margin of the median lobe. The tegmen and median lobe of *E. amamense* and *E. chujoi* share the following features with the ones observed in *E. victori*: (i) presence of papillae in the apical margin of the tegmen and in the apical portion of median lobe; (ii) tapering apical portion of median lobe (not considering the hooked projections of *E. victori*); (iii) tegmen and median lobe almost with the same length.

However, the male genitalia of the other *Ennearthron* species should be described to confirm whether or not these are generic autapomorphies. Besides being the ninth member of this genus, *E. victori* is also the first species known from the Southern Hemisphere, and also the first one in which males do not have a fovea in the first ventrite.

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Nota Científica

Dugesiana 9(2): 54, 2002.

Two cases of homonymy in the genus *Cis* Latreille (Coleoptera: Tenebrionoidea: Ciidae)

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Lawrence (1971), in his revision of the North American Ciidae, synonymized the genus *Macrocis* Reitter with *Cis* Latreille. Adbullah (1973), in his catalogue of the worldwide Ciidae, considered *Macrocis* as a valid genus, but other authors (Kawanabe 1997, Navarrete-Heredia and Burgos-Solorio 2000, Lopes-Andrade 2002) followed the classification of Lawrence (1971). However, the acceptance of this classification led to two cases of homonymy: *Cis setifer* Reitter, 1884 with *Cis setifer* (Gorham, 1883); and *Cis testaceus* (Pic, 1916) with *Cis testaceus* Fåhraeus, 1871. In this work, I propose the name *Cis reitteri* to replace the name of the junior secondary homonym *Cis setifer* Reitter, 1884, which was originally described from Lenkoran in Azerbaijan, Caspian Sea (Reitter 1884). This replacement name is in honor of E. Reitter.

In the second case, I propose the name *Cis kawanabei* to replace the name of the junior homonym *Cis testaceus* (Pic, 1916), which was described from Brazil (Pic 1916). This replacement name is in honor of John F. Lawrence. *Cis setifer* (Gorham, 1883) and *Cis testaceus* Fåhraeus, 1871, respectively, are being here considered the senior homonyms. Therefore, they should be maintained.

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COMPARATIVE MORPHOLOGY OF THE ABDOMINAL FOVEA IN NEOTROPICAL CIIDAE (COLEOPTERA: TENEBRINOIDEA)

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Almost all ciids have a specialized structure in the middle of the first urosternite (III sternite). This structure is known as fovea[1], but here it will be called "fovea region". The fovea region basycally comprises a depression or hole (the fovea itself), pores and bristles. In some species this region is extremely reduced or even absent. The scope of this work is to describe the morphology of the abdominal fovea region of four Brazilian species (*Xylographus contractus* Mellié, *Ceracis corniferum* Mellié, an undescribed species from Southeast Brazil, and *Cis taurus* (Reitter)).

The specimens were collected in Southeast Region of Brazil from populations established in various bracket fungi (Basidiomycetes: Polyporaceae *sensu lato*) and were submitted for Scanning Electron Microscopy (SEM) analyses. For SEM, the specimens were fixed in alcohol 80%, dried in silica gel for four hours, sputter-coated with gold (Balzers MED 010) and photographed in a SEM (Zeiss DSM 940 A). Some specimens were just air-dried and photographed in a Variable Pressure SEM-VP (Phillips LEO 435VP). All SEM procedures and analyses took place at the laboratories of NAP/MEPA (ESALQ/USP).

In *Xyl. contractus*, the fovea region comprises a narrow hole, surrounded by many bristles, forming a dense setose patch (Fig.1). In *Cer. corniferum* (Figs2,3) and in the undescribed genus (Fig.4), the fovea region is generally an elevation of the urosternite cuticle, with many pores, sparse bristles and no visible hole . In *C. taurus* (Fig.5), the fovea region is a depression, sometimes with a distinct margin, and with many pores and sparse bristles.

It was supposed that the fovea region of some *Xylographus* were naked or even absent[1], but here is shown that at least in *Xyl. contractus* the fovea region has many setae and a distinct hole. Even using SEM, the fovea itself is difficult to see due to it small diameter, and it should be evaluated if this structure is actually absent in other *Xylographus*. Based on the morphological information found in literature[1,2,3] the fovea region of *Cis* seems to be similar to that of *Sphindocis* Fall. Therefore, this character is common within Ciinae, and the reduction or modification of this structure is here being considered a further modification. Due to the difficulty in observing details of this structure, there are no available information data for other related genera, such as *Odontocis* Nakane and Nobuchi, *Paraxestocis* Miyatake, *Waigacis* Lohse[4].

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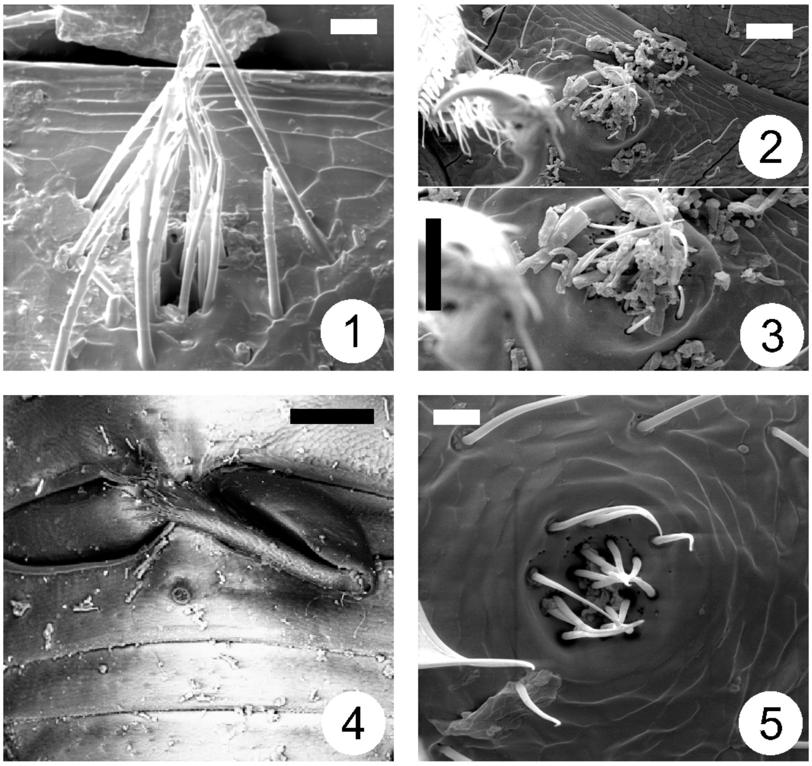

Legends
Figure 1. Setose patch in the first urosternite of a male *Xylographus contractus* Mellié. SEM; scale bar: 20μm.
Figures 2 and 3. Whole view and detail, respectively, of the fovea region of *Ceracis corniferum* Mellié. SEM; scale bars: 20μm.
Figure 4. Part of the urosternite of a male specimen from an undescribed genus occurring in the Neotropical region. SEM-VP; scale bar: 100μm.
Figure 5. Detail of the abdominal fovea of *Cis taurus* (Reitter). SEM; scale bar: 10μm.

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CONSIDERATIONS ON THE ULTRAMORPHOLOGY OF THE ANTENNAL SENSILLIFERS OF NEOTROPICAL CIIDAE (COLEOPTERA: TENEBRINOIDEA)

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Ciids are widespread minute fungus beetles mostly diversified in the tropical regions. This family is divided in two subfamilies, Ciinae and Sphindociinae. The antenna of Ciinae is 8, 9 or 10-segmented, with the distal three segments forming a conspicuous club, hence the club is 2-segmented in *Hadraule blaisdelli* (Casey). In *Sphindocis denticollis* Fall (Sphindociinae), the antenna is 11-segmented, also with a 3-segmented club, as in the family Pterogeniidae. In Ciinae species, each antennal club bears four groups of sensilla, forming a structure known as sensillifer[1], which function is unknown. These sensillifers are absent in Sphindociinae. The purpose of this work is to describe by Scanning Electron Microscopy (SEM) the morphology of the antennal sensillifers of four Brazilian Ciidae genera.

Specimens belonging to four genera (*Cis* Latreille, *Xylographus* Mellié, *Ceracis* Mellié and an undescribed genus from Southeast Brazil) were analysed by SEM. The specimens were fixed in alcohol 80%, dried in silica gel for four hours, sputter-coated with gold (Balzers MED 010) and photographed in a SEM (Zeiss DSM 940 A). Some specimens were just air-dried and photographed in a Variable Pressure SEM-VP (Phillips LEO 435VP). All SEM work took place at the laboratories of NAP/MEPA (ESALQ/USP).

In the analysed populations of *Cis* (Fig.1), the region just arround each sesillifer is smooth, followed by scale-sculptured areas with sparse bristles. Each sensilllum is short and apically rounded. The sensillifer itself is composed by sparse sensilla, restricted to a somewhat circle area. In *Xylographus* (Fig.2), each antennal club is divided into two distinct regions: an apical one, defined as a smooth region where the sensillifers are placed; and a basal region, which has a scale-like sculpture. These regions are limited by a row of bristles. The sensilla of each sensillifer are arranged at least in two concentric, well-organized, rows; they are placed in a depression forming a brush-like structure in which the sensilla are very close to each other. In this genus, each sensillum is short, and apically rounded. The antennal clubs of *Ceracis* (Figs 3,4) and the new genus (Fig.5) are very similar to each other. In both genera, the sensilla of each sensilifer are conspicuously elongated and fusiform. These sensilla are placed in a circle area, surrounded by a somewhat elevated margin. Each sensillum is very close to each other, but without a concentric organization.

The function of these sensillifers are not well known, but they may be higroreceptors[1] or specific chemoreceptors. Ciids are attracted by polypores volatiles[2,3] and most of the species have a specialized host preference[4], therefore the antennal sensilla may be specific chemoreceptors for fungi volatiles. The study of the antennal sensillifers provide discriminative characters, such as the degree of organization, shape, and number of sensilla. The brush-like morphology of the antennal sensillifer in *Xylographus* is strongly modified, but it should be evaluated whether or not the related genera *Octotemnus* Mellié and *Rhopalodontus* Mellié present such a configuration of the sensillifer. The structure of the sensillifer and the sensilla morphology of *Cis* seems to be common in this group. The fusiform shape, and agglomerated organization of the sensilla in *Ceracis* and the new genus are very different, and these genera may probably form a separate group. Thus, the study of the antennal morphology could be used to solve the relationship among genera within Ciinae.

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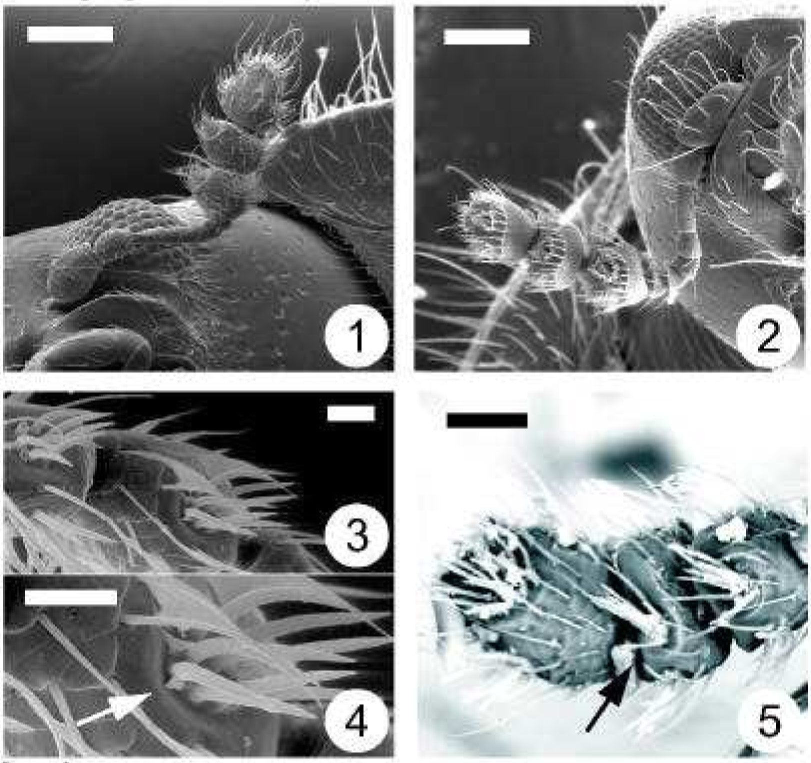

Legends
Figure 1. Whole view of the antenna of *Cis taurus*. (Reitter). SEM; scale bar: 100μm.
Figure 2. Whole view of the antenna of *Xylographus* sp. evidencing a distinct club. SEM; scale bar: 100μm.
Figures 3 and 4. Whole view and detail of sensillifers of *Ceracis corniferum* Mellié evidencing an elevated margin (arrow) surrounding the fusiform sensilla. SEM; scale bars: 10μm.
Figure 5. Whole view of the antennal club of an undescribed genus from Southeast Brazil, showing extremely long sensilla (arrow) of the sensillifers. SEM-VP; scale bar: 25μm.

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***Falsocis alaydeae* sp. nov. (Coleoptera: Tenebrionoidea: Ciidae) from Southeastern Brazil.**

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Abstract

This paper presents the description of *Falsocis alaydeae* sp. nov. This is the second species of the genus, which was believed to be restricted to French Guiana. This new species was collected in two localities, both in Southeastern Brazil: Viçosa (Minas Gerais State); and Venda Nova do Imigrante (Espírito Santo State).

Key Words: Neotropical, Ciinae, Ciini, beetle

Resumo

Este trabalho apresenta a descrição de *Falsocis alaydeae* sp. nov. Esta é a segunda espécie do gênero, que acreditava-se ser restrito à Guiana Francesa. Esta nova espécie foi coletada em duas localidades, ambas no Sudeste do Brasil: Viçosa (Estado de Minas Gerais); e Venda Nova do Imigrante (Estado do Espírito Santo).

Palavras-chave: Neotropical, Ciinae, Ciini, besouro

Introduction

The genus *Falsocis* Pic, 1916 belong to the tribe Ciini (*sensu* Lawrence 1982) and has just one described species: *Falsocis opacus* Pic, 1916 (from French Guiana). Pic (1922) also described what he called a “variety” of this species, named *Falsocis opacus* var. *flavus* Pic, 1922 (also from French Guiana). This new species is included in the genus *Falsocis* based on the following characteristics (Lawrence 1971; Pic 1916): (i) body extremely convex; (ii) each antenna with ten antennomeres; (iii) presence of horns in the head and pronotum of males; (iv) tapering intercoxal process of prosternum.

Anatomical preparations of genitalia were made according to Lopes-Andrade *et al.* (2003). The holotype was photographed in a variable pressure SEM (LEO 435) and measured in a stereomicroscope (Leica MZ 12) following the parameters cited by Lawrence (1987). The new species described below was first cited by Lopes-Andrade (2002; Fig. 3B) as *Falsocis* sp.

Falsocis alaydeae Lopes-Andrade & Zacaro, sp. nov. (Figs. 1–4)

Holotype. Male, BRASIL: MG: Viçosa, x.2000 (C. Lopes-Andrade). Allotype. Female, BRASIL: MG: Viçosa, Mata da Biologia, 20.i.2002 (C. Lopes-Andrade). Besides a locality label, both holotype and allotype have a red label with their identifications.

Diagnosis. This species can be easily distinghished from *Fals. opacus* by the following combination of characteristics: (i) clypeus pubescent; (ii) pubescence of the lateral margins and disc of pronotum consisting of long and slender bristles.

Description of holotype. *Male.* Body length (excluding head): 2.25 mm; greatest elytral width: 1.35 mm; greatest pronotal width: 1.25 mm; greatest depth (taken through the elytra and metasternum): 1.15 mm.

Body 1.65X as long as elytral width, strongly convex, slightly shiny on dorsum, light yellowish brown. Head convex, finely reticulate on dorsum, with some broad and sparse punctures; clypeus with one long and conspicuous tubercle on each side, and two small tubercles between them; 3rd antennomere as as long as 4th; 5th to 7th subequal; eighth to ninth forming a loose club, each club bearing four “sensillifers” formed by a group of long, not well-organized sensilla.

Pronotum (including apical projections) 0.76X as long as broad, strongly convex; anterior angles conspicuously produced and angulate; pronotum in lateral view with anterior margin deeply curved inward and elevated forming a plate, and lateral margin extremely curved outward; lateral margins narrow, barely visible for their entire lengths from above; dorsum with irregular, disctinct and single punctation; punctures broad, uniform in size, coalescent in the disc but somewhat sparse at the anterior portion; each puncture bearing a shiny, robust and long yellowish bristle; intervals among punctures finely reticulate. Scutellum subpentagonal, with some punctures and bristles. Elytra strongly convex, 0.96X as long as broad and, 1.37X as long as pronotum; sides slightly divergent in basal three-fourths, then converging to apex; disc with distinct, irregular and single punctation; punctures similar to those on pronotum; intervals among punctures smooth, each puncture bearing a long, robust and shiny yellowish bristle. Suture margined.

Prosternal disc concave (Fig. 1); prosternal process tapering. Protibia with one proeminent outer apical tooth. Metasternum with longitudinal suture extending from the posterior margin toward its disc. First ventrive with a margined and pubescent fovea (Fig. 3).

Male genitalia in a paratype. Tegmen as long as median lobe, slightly emarginate at the apical margin (Fig. 4); basal margin acute. Ninth tergite “U” shaped, without bristles in the branch’s apices.

Description of allotype. *Female.* Body length (excluding head): 2.25 mm; greatest elytral width: 1.4 mm; greatest pronotal width: 1.2 mm; greatest depth (taken through the elytra and metasternum): 1.1 mm. Pronotum and clypeus without apical projections (Fig. 2).

Other specimens examined. Paratypes (11): 2 males, 2 females, same data as holotype; 3 males, same data as allotype; 3 males, 1 female, BRASIL: ES: Venda Nova do Imigrante, 31.v.2002 (R. Falqueto).

Variation in a series of paratypes. Male paratypes (n = 4): body length (excluding head): 2.25–2.90 mm (mean = 2.51; S.D. = 0.28); elytral length: 1.40–1.70 mm (mean = 1.50; S.D. = 0.14); greatest elytral width: 1.45–1.60 mm (mean = 1.51; S.D. = 0.06); greatest pronotal width: 1.15–1.50 mm (mean = 1.33; S.D. = 0.14); greatest depth: 1.10–1.30 mm (mean = 1.21; S.D. = 0.09).

Female paratype (n = 1): body length (excluding head): 2.25 mm; elytral length: 1.35 mm; greatest elytral width: 1.4 mm; greatest pronotal width: 1.2 mm; greatest depth: 1.1 mm.

Host fungus. *Phellinus* sp. (Hymenochaetaceae). Specimens are seen feeding on the basidiocarp’s dorsum, making convex excavations on the fungus surface.

Etymology. This species is named in honor of Alayde Lopes Reis, mother of the senior author.

Distribution. Southeastern Brazil: Viçosa (Minas Gerais State) and Venda Nova do Imigrante (Espírito Santo State).

Depositories. Holotype (male), and allotype (female) at Museu de Zoologia da Universidade de São Paulo, São Paulo, SP, BRAZIL. Paratypes (11) are in the personal collection of the senior author.

Discussion. *Falsocis* is low diversified and restricted to the Neotropical Region. It seems to be closely related to *Sulcacis* Dury, 1917 due to its tapering prosternum process. It also resembles *Malacocis* Gorham, 1886 in the oblong body form. It is extremely necessary to compare specimens of *Fals. alaydeae* with the type species of the genus to evaluate other characters which would better define this genus.

Acknowledgements

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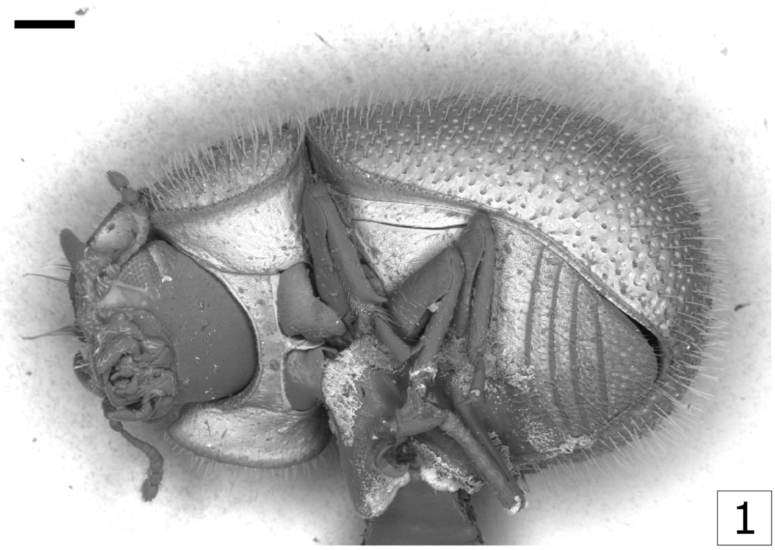
Figure legends

Figures 1–2. Scanning electron microscopy of *Falsocis alaydeae* sp. nov. **1.** Whole lateral-ventral view of a male paratype. **2.** Whole lateral-dorsal view of a female paratype. Scale bars: 200ìm.

Figures 3–4. *Falsocis alaydeae* sp. nov. **3.** Scanning electron microscopy of the abdomen of a male paratype, evidencing the presence of a fovea in the middle of the first ventrite (arrow). **4.** Tegmen (teg) and median lobe (ml) of a male genitalia. Scale bars: 100ìm (Fig. 3); 50ìm (Fig. 4).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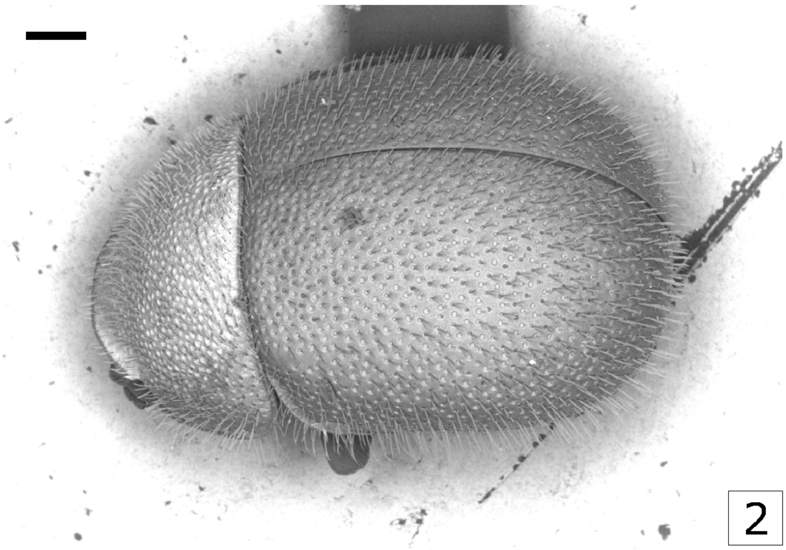
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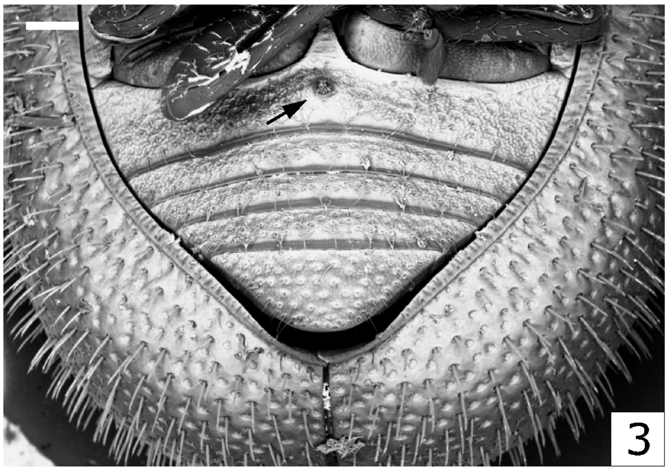
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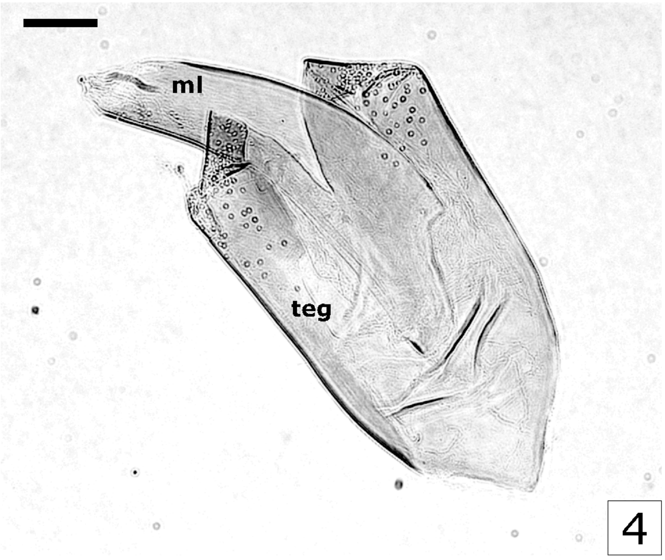
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Phylogenetic analysis of Ciidae (Coleoptera: Tenebrionoidea).

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Abstract

The phylogenetic relationship among the main Ciidae genera were analyzed on the basis of a total of fifty-nine selected species. These included fifty-four species of ciid belonging to twenty-one genera (one undescribed), and five species belonging to five basal families of Tenebrionoidea (Archeocrypticidae, Mycetophagidae, Prostomidae, Pterogeniidae and Tetratomidae) as outgroups. Ninety-six adult characters were subjected to cladistic analysis, which led to two strict consensus cladograms: (i) one based on unweighted characters (length = 410, CI = 0.31, RI = 0.70); and (ii) another based on successive weighting of characters (length = 411, CI = 0.31, RI = 0.70). From the result, it is concluded that Ciidae and its two subfamilies (Sphindociinae and Ciinae) are monophyletic. However, none of the tribes of Ciinae were supported in the analysis: Ciini was polyphyletic; Orophiini was paraphyletic; and Xylographellini appeared as a subgroup of Orophiini. The monophyletism of seventeen genera of Ciidae (*Sphindocis* Fall plus sixteen genera of Ciinae) were comproved, eight of them being strongly supported by autapomorphies. The current classification of Ciidae is discussed based on the results of this study.

Key words: minute fungus-feeders beetles, Ciinae, Sphindociinae.

Resumo

As relações filogenéticas entre os principais gêneros de Ciidae foram estudadas com base em cinqüenta e nove espécies. Destas, cinqüenta e quatro são espécies de Ciidae de vinte e um gêneros (um não descrito), e cinco são espécies pertencentes a cinco famílias basais de Tenebrionoidea (Archeocrypticidae, Mycetophagidae, Prostomidae, Pterogeniidae e Tetratomidae). Noventa e seis caracteres de adultos foram utilizados na análise cladística, que resultou em dois cladogramas de consenso estrito: (i) um com base em caracteres sem peso (passos = 410, IC = 0,31, IR = 0,70); e (ii) outro com base em pesagem sucessiva de caracteres (passos = 411, IC = 0,31, IR = 0,70). Pelos resultados, pode-se concluir que Ciidae é monofilético, assim como suas duas subfamílias (Sphindociinae e Ciinae). Porém, nenhuma das tribos de Ciinae foi sustentada pela análise: Ciini é polifilético; Orophiini, parafilético; e Xylographellini apareceu como um subgrupo de Orophiini. O monofiletismo de dezessete gêneros de Ciidae foi comprovado (*Sphindocis* Fall mais dezesseis gêneros de Ciinae), oito deles sustentados por autapomorfias. A classificação atual de Ciidae é discutida com base nos resultados deste estudo.

Palavras-chave: pequeninos besouros de fungo, Ciinae, Sphindociinae.

Introduction

The family Ciidae, commonly known as minute fungus-feeders beetles, comprises more than 600 described species in appoximately 40 genera. The group is of great interest because of its positioning among the basal Tenebrionoidea, as it is closely related to families such as Melandryidae, Tetratomidae, Prostomidae, Archeocrypticidae and Pterogeniidae. Despite occurring worldwide, the first and unique monograph of the family was that of Mellié (1848), and no other world study has been made since (Lawrence 1971). Contributions made within the following 120 years consisted mainly of works concerning the European (*e.g.*, Abeille de Perrin 1874), Japanese (*e.g.*, Miyatake 1954, 1955a, b; Chûjô 1939) and Pacific fauna (Blair 1928, 1941, 1944; Zimmerman 1938, 1939, 1941, 1942). In the last 35 years, however, some authors attempted to compare the worldwide fauna, which led to many synonymizations of species and even genera (*e.g.*, Lawrence 1965, 1967, 1971; Kawanabe 1995). The knowledge on the distribution of ciid taxa is being improved, and some genera and species groups thought to be endemic are being reported to other biogeographic regions (Lawrence 1965, 1971; Lopes-Andrade *et al.* 2002; Lopes-Andrade *et al.* 2003; Lopes-Andrade & Zacaro 2003a, b).

Many authors attempted to establish a suprageneric classification of Ciidae. However, most classifications proposed were artificial and unjustifiable. Lawrence (1971), in his revision of the North American Ciidae, adopted a division in two subfamilies: Orophiinae and Ciinae. The former comprised *Octotemnus* Mellié, 1847, *Paratrichapus* Scott, 1926 and, *Rhopalodontus* Dohrn in Strübling, 1851 (erroneously cited as *Rhopalodontus* Mellié, 1847), *Scolytocis* Blair, 1928 and, *Xylographus* Mellié, 1847. All the other known genera were included in Ciinae. Afterwards, Lawrence (1974a) modified this classification, changing the *status* of these subfamiles to tribes (Orophiini and Ciini) included in the single subfamily Ciinae. However, in an *addendum* of the same work, Lawrence (*op. cit.*) proposed the return of *Sphindocis denticollis* Fall, 1917 to Ciidae in its own subfamily (Sphindociinae). Moreover, Lawrence (1974b) studied in details the imatures of *Sphindocis* Fall, 1917 and delimited with more accuracy the subfamily Sphindociinae. Lawrence (1982, 1987) used this classification, which was also adopted by Japanese authors (*e.g.,* Kawanabe 1993). Afterwards, an accurate study of the Japanese genus *Xylographella* Miyatake, 1986 led to the description of a new tribe of Ciinae, called Xylographellini (Kawanabe & Miyatake 1996). The latter authors doubtfully included *Scolytocis* in this new tribe, due to characters cited in the original description of the genus (Blair 1928).

However, Lawrence *et al.* (1999) did not adopt the division of Ciinae in tribes, probably due to the lack of autapomorphies to each of these tribes. Therefore, nowadays there is no consensus on the classification of Ciidae.

The aim of this work is to perform a phylogenetic analysis of the family Ciidae, to evaluate the consistence of its current classification and to test the monophyly of its main genera.

Material and Methods

Taxa

This study analyzed 54 taxa of Ciidae. Character coding was based on 113 ingroup species belonging to twenty described and one undescribed genera and, five outgroup species (Appendix 1). We attempted to include the type species of all the ingroup genera, but this was not possible for the following ones: *Atlantocis* Israelson, 1985; *Ceracis* Mellié, 1848; *Falsocis* Pic, 1916; *Malacocis* Gorham, 1886; *Porculus* Lawrence, 1987; and, *Scolytocis* Blair, 1928.

We used a multiple outgroup to perform the analysis, with five species belonging to five basal families of Tenebrionoidea: Archeocrypticidae, Mycetophagidae, Prostomidae, Tetratomidae and Pterogeniidae (Appendix 1). Pterogeniidae is generally considered to be closely related to Ciidae (Lawrence 1971) and a sister group relationship has already been suggested (Lawrence 1982). Rooting through unconstrained simultaneous analysis of several outgroups is a favoured option because it serves as a test of the monophyletism of the ingroup (Barriel & Tassy 1988).

Characters

Initially, 106 adult characters were coded. Afterwards, twelve constant characters were excluded, a character was divided in two and a new one was added to the final matrix (Appendix 2). The 96 remaining characters were partitioned as follows (Appendix 3): external morphology (74); female genitalia (2); male genitalia (16); internal morphology (2); cytogenetics (2). Most of the definitions and limits of characters and character states used here are described in the works of Lawrence (1971, 1987), Lawrence *et al.* (1999), Lopes-Andrade *et al.* (2002), Lopes-Andrade *et al.* (2003) and, Lopes-Andrade & Zacaro (2003a, b). Information in the matrix were based on direct observations made by the authors, with the exception of some cytogenetic data taken from Smith & Virkki (1978) and Lawrence (1965) and, the number of testioles of *Hadraule blaisdelli* (Casey, 1900) mentioned by Klopfestein and Graves (1992).

Phylogenetic analysis

Data analysis was performed using NONA 2.0 (Goloboff 1999), and all characters were treated as unordered. The analyses comprised four main steps: (i) maximum parsimony cladograms were generated by heuristic search, in which Tree-Bisection-Reconnection (TBR) branch swapping was perfomed with 4000 replications; (ii) same analysis, but with successive weighting of characters; (iii) Jackknife based on the strict consensus tree of the first analysis. In this step, more frequent clades of the strict consensus tree were evaluated based on the whole matrix. It gave an idea on the stability of the analysis; (iv) Bootstrap based on the strict consensus tree of the first analysis. In this step, random subsets of characters were analysed with random weighting, showing in which frequency the clades of the strict consensus tree appear. It gave an idea of the strongness of the analysis. Character optimization was done on the strict consensus cladogram of the first step, to show apomorphies of each clade.

Results

The heuristic search for a maximum parsimony solution resulted in 108 cladograms (length = 410, CI = 0.31, IR = 0.70) in the first step of the analysis (unweighted characters) and, two cladograms (length = 411, CI = 0.31, RI = 0.70) in the second step (successive weighting of characters). Strict consensus trees for both steps are presented respectively in Figures 1 and 2. Apomorphies are indicated in each branch of these cladograms, based on the results of character optimization. Figure 3 and 4 show, respectively, the Jackknife and Bootstrap values, in percent, at each node of the cladograms. The high values of Jackknife and Bootstrap (≥ 50%) show that the clades are stable and strongly supported

The monophyletism of Ciidae was strongly supported by five autapomorphies: (i) labial palpi inserted in the apex of prementum (ch. 20-0); (ii) preapical mesotarsomeres together shorter than apical one (ch. 66-1); (iii) epipleuron absent or incomplete (ch. 68-0); (iv) first two ventrites not connate (ch. 69-0); (v) presence of fovea or setose patch in the first ventrite of males (ch. 70-1). However, nothing can be said about its sister group, as the multiple outgroup just intend to better root the trees. Moreover, evaluation of the relationships of the outgroup families is beyond the aim of this paper.

Ciidae is clearly divided in two monophyletic groups: Sphindociinae and Ciinae. Sphindociinae is supported by one autapomorphy: the denticulate lateral carinae (ch. 27-2). Ciinae is supported by five autapomorphies, as follows: (i) antenna with ten antennomeres (ch. 3-1); (ii) presence of sensillifers in the antennal club (ch.7-1); (iii) intercoxal process of prosternum parallel-sided (ch. 45-1); (iv) absence of apical spurs in meso and metatibiae (ch. 62-0); (v) absence of a median strut in the anterior edge of the ninth sternite of males (ch. 79-0). However, the tribal divisions adopted until now have shown to be inconsistent. The tribe Ciini have shown to be polyphyletic. It included Orophiini, which is paraphyletic and delimited by six autapomorphies: (i) sensilla of the antennal sensillifers well organized (ch. 11-1); (ii) procoxae conical externally (ch. 53-1); (iii) meso and metatibiae strongly dilated at middle or apically (ch. 63-1); (iv) outer margin of meso and metatibiae spinose (ch. 64-1); (v) female genitalia with two transversal divisions of coxites (ch. 74-0); (vi) reduced spiculum ventrale of females (ch. 75-0). Xylographellini appeared as a subgroup of Orophiini with three autapomorphies: (i) presence of more than four sensillifers per antennomere (ch. 10-1); (ii) prementum emarginate longitudinally (ch. 18-1); (iii) apical palpomere of labial palpi securiform to cultriform (ch. 22-2).

The genera *Ceracis* Mellié, 1848, *Cis* Latreille, 1796, *Orthocis* Casey, 1898, and *Sulcacis* Dury, 1917 are polyphyletic. *Ceracis* is part of a group which included the monophyletic genera *Porculus* Lawrence, 1987, *Wagaicis* Lohse, 1964, and the new genus. *Orthocis* and the greater part of *Cis* stayed at the base of Ciinae. Four species of *Sulcacis* do form a monophyletic group, but *Sulcacis bidentulus* (Rosenhauer, 1847) appeared in a separate clade.

Sixteen genera of Ciinae have shown to be monophyletic taxa, but the following nine genera did not present any autapomorphy: *Falsocis* Pic, 1916; *Octotemnus* Mellié, 1847; *Plesiocis* Casey, 1898; *Porculus*; *Rhopalodontus* Dohrn in Strübling, 1851; *Strigocis* Dury, 1917; *Xylographella* Miyatake, 1985; *Xylographus* Mellié, 1847. The other seven monophyletic genera were supported by at least one autapomorphy, as follows: (i) *Ennearthron* Mellié, 1847, presence of a notch in the middle of male clypeus (ch. 14-1) and, male genitalia with paired struts in the anterior edge of median lobe (ch. 90-1); (ii) *Hadraule* Thomson, 1863, pronotum widest anteriorly (ch. 30-0) and, anterior portion of prosternum at midline twice as long as prosternal process (ch. 49-3); (iii) new genus, outer apical angle of protibiae with two proeminent teeth (ch. 56-2); (iv) *Malacocis* Gorham, 1886, male genitalia with long opposing paired struts in the anterior edge of tegmen (ch. 82-2); (v) *Dolichocis* Dury, 1919, male genitalia with large and deep subapical excavation on each side of median lobe (ch. 89-1); (vi) *Atlantocis* Israelson, 1985, posterior wings absent (ch. 44-0); (vii) *Scolytocis* Blair, 1928, presence of extremelly small globular tubercles mainly in clypeus, pronotum and elytra (ch. 1-1).

Discussion

The current classification of Ciidae into two subfamilies (Sphindociinae and Ciinae) is acceptable in a phylogenetic scenario, and it should be maintained. However, there is no reason to maintain the tribal division of Ciinae, as they are clearly paraphyletic and polyphyletic clades. According to the results of this work, the tribe Ciini is collapsed in many clades. For example, in the case of giving a tribal *status* to Orophiini, the tribe Xylographellini would have to be aborted, and Ciini would have to be divided into at least ten tribes. However, much of these clades did not present any autapomorphy, and such a classification cannot be proposed in this work. Moreover, the positioning of *Cis* Latreille and *Orthocis* Casey have not been clarified yet.

Cis Latreille is the most diversified genus of Ciidae, with at least 300 described species. It occurs worldwide (Lawrence 1971, Abdullah 1973), and even its subgroups have a large geographic distribution. For example, the *comptus* group (*sensu* Kompantsev 1996), basically Holarctic, was recently reported to the Neotropical Region (Lopes-Andrade *et al.* 2003). The limits of *Cis* are not well defined, as species are described in this genus based in an antenna with ten antennomeres (ch. 3-1) and, a parallel-sided intercoxal process of prosternum (ch. 45-1). These states of characters are plesiomorphic for the clades of *Cis*, as shown by the character optimization: these character states (ch. 3-1; ch. 45-1) are autapomorphies of Ciinae. If the monophyletism of *Cis* is comproved in future works, with sufficient synapomorphies, a possible solution for these clades would be the division in subgenera. These subgenera may be partially based in the species groups already proposed (*e.g.*, *comptus*, *taurus*, *nitidus*), which are being extensively used in recent taxonomic works to better position any new species in *Cis* (*e.g.*, Kawanabe 1997b, 2001; Królik 2002), and not in the current subgeneric concepts used by some authors, such as Abdullah (1973).

The genus *Orthocis* Casey is also distributed worldwide, with more than 40 described species. There were already many discussions about the validity of this genus: some authors considered it as valid (*e.g.*, Lawrence 1965), while others prefer to take it as a synonym of *Cis* (*e.g.*, Abdullah 1973). Although the *Orthocis* species presented in this analysis did not appear in a monophyletic clade, all the species were together in the base of Ciinae, below all the species of *Cis* and the other clades of this subfamily. It suggests that there are few synapomorphies, even homoplasious ones, defining these clades. However, recent and unplublished studies (Lopes-Andrade pers. obs.) of the morphology of male genitalia are showing that some characters may arise as autapomorphies, supporting the monophyletism of *Cis* and its validity as a genus.

The case of the genus *Ceracis* Mellié is much more delicate. This genus is most diversified in the Nearctic and Neotropical Regions, with some species occurring in

Japan and South Pacific Islands (Lawrence 1967; Lopes-Andrade *et al.* 2002). The limits of *Ceracis* were settled in a revision of North American species (Lawrence 1967) and they were not questioned since then. Some characters mentioned in this revision (*op. cit.*) are plesiomorphic, according to the results of our analyses, and others are not presented in some species. For instance, *Ceracis cornifer* (Mellié) has clearly a parallel-sided intercoxal process of prosternum, and a male genitalia which is clearly different from the basic morphological plan of *Ceracis* (Lopes-Andrade pers. obs.). Another revision of the genus is necessary, including all the worldwide genera and species groups related to *Ceracis* (*e.g.*, *Porculus* Lawrence, *Odontocis* Nakane & Nobuchi, *Wagaicis* Lohse).

Sulcacis Dury is a Holarctic genus with seven described species, and it is considered to be well defined (see Lawrence 1965). In our analysis, five of these species were included. The monophyletism of part of the genus was comproved ((*Sulc. affinis* + *Sulc. curtulus*) + (*Sulc. fronticornis* + *Sulc. lengi*)), based in one homoplasious synapomorphy: presence of pubescence in clypeus (ch. 15-1); only *Sulc. bidentulus* (Rosenhauer) stayed apart from this clade. However, it could have been an artifact of the analysis, as this species has many unknown states of characters; moreover, Lawrence (1965) pointed out that *Sulc. lengi* Dury was the most atypical member of the genus, a position which I am inclined to agree (Lopes-Andrade pers. obs.). The division of *Sulc.* in subgenera (*Entypus* and *Entypocis*) is unsustainable. These subgenera are defined basically on the number of antennomeres, a character which is vague in the taxonomy of Ciidae when considered alone. Lawrence (1965) had already pointed out that these subgenera were unnecessary, and that the division of the species to subgenera on the basis of number of antennomeres might not always be reflected on the phylogeny; Kawanabe (1997a) referred to the relationships of the *Sulc.* species just in the basis of species groups, not subgenera. Therefore, the abortion of a subgeneric division of *Sulc.* is thoroughly acceptable.

Among the monophyletic genera shown in this work, a problematic case is the genus *Atlantocis* Israelson. It was defined here in the basis of one autapomorphy, the absence of posterior wings (ch. 44-0). However, this state of character also occurs in other three genera not present in this analysis: *Apterocis* Perkins, *Dimerapterocis* Scott and, *Nippoapterocis* Miyatake. *Atlantocis* occurs only in the islands of Canary, Madeira and Azores (Atlantic Ocean); the other genera occur in the Pacific Ocean. It might be concluded that this state of character is convergent and, in this case, it would not be taken as an autapomorphy.

Xylographellini (*Xylographella* Miyatake + *Scolytocis* Blair) *sensu* Kawanabe & Miyatake (1996) is clearly monophyletic, but do not deserve a tribal *status*. In our analysis, it appeared as a clade among the Orophiini genera and, this position was strongly supported. The clade (*Rhopalodontus* + (*Octotemnus* + (*Xylographus* + (*Xylographella* + *Scolytocis*)))) is the most stable and well defined in the whole analysis, with six autapomorphies and high Jackknife and Bootstrap values (see Figs. 3 and 4). However, its positioning among the other Ciinae is still uncertain.

Conclusions

Ciidae (Sphindociinae + Ciinae) is a monophyletic clade. The tribes of Ciinae (Ciini, Orophiini and Xylographellini), however, are unsustainable and are here aborted. The study of the ultramorphology of the antenna and fovea, together with the morphology of female genitalia, are of great interest for the suprageneric classification. Studies on the morphology of the male genitalia are most important for the generic and infrageneric classification.

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Figure legends

Figure 1. Strict consensus of 108 maximum parsimony cladograms (Length = 410, CI = 0.31, RI = 0.70) resulting from heuristic search (TBR) based on unweighted and unordered characters, with indication of apomorphies. Number above hatchmarks refer to characters. Numbers below hatchmarks indicate character state transformations (to the state indicated). Homoplasious character state transformations indicated by open hatchmarks.

Figure 2. Strict consensus of two maximum parsimony cladograms (Length = 411, CI = 0.31, RI = 0.70) resulting from heuristic search (TBR) based on unordered, but successive weighted, characteres. Numbers above hatchmarks refer to characters. Numbers below hatchmarks indicate character state transformations (to the state indicated). Homoplasious character state transformations indicated by open hatchmarks.

Figure 3. Jackknife values for the strict consensus cladogram of the first step of the phylogenetic analysis.

Figure 4. Bootstrap values for the strict consensus cladogram of the first step of the phylogenetic analysis.

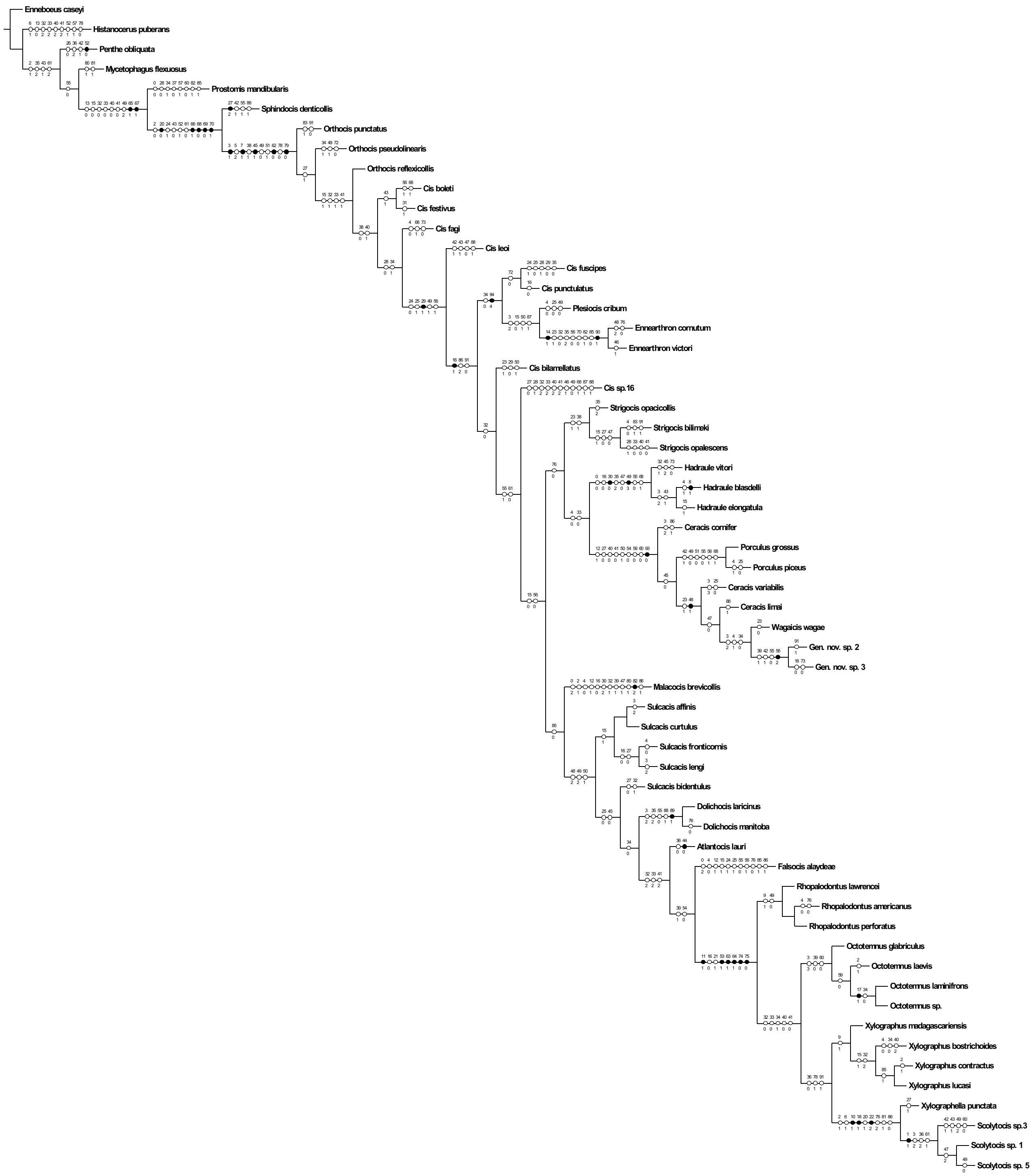
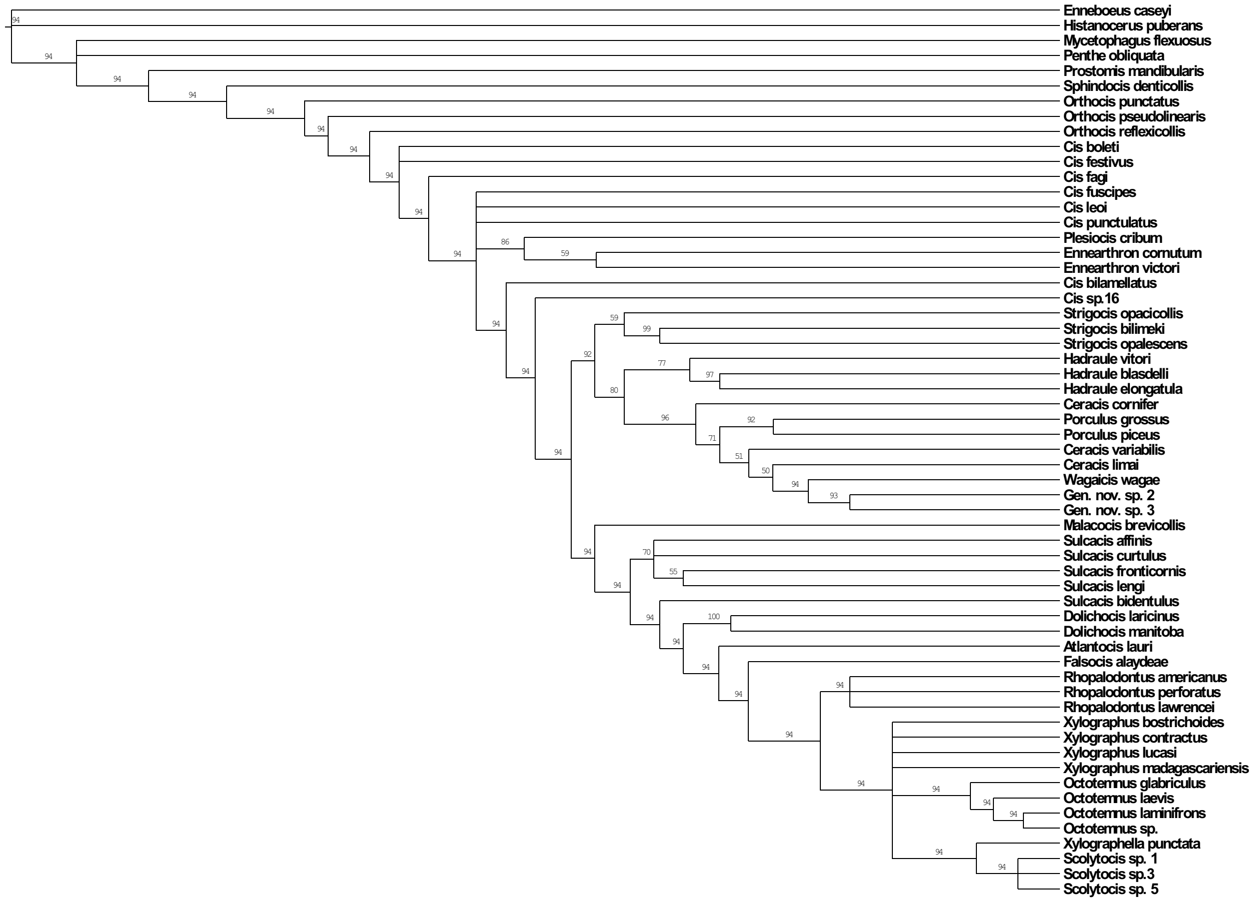

Enneboeus caseyi
Histanocerus puberans
Penthe obliquata
Mycetophagus flexuosus
Prostomis mandibularis
Sphindocis denticollis
Orthocis punctatus
Orthocis pseudolinearis
Orthocis reflexicollis
Cis boleti
Cis festivus
Cis fagi
Cis leoi
Cis fuscipes
Cis punctulatus
Plesiocis cribum
Ennearthron cornutum
Ennearthron victori
Cis bilamellatus
Cis sp.16
Strigocis opacicollis
Strigocis bilimeki
Strigocis opalescens
Hadraule vitori
Hadraule blaisdelli
Hadraule elongatula
Ceracis cornifer
Porculus grossus
Porculus piceus
Ceracis variabilis
Ceracis limai
Wagaicis wagae
Gen. nov. sp. 2
Gen. nov. sp. 3
Malacocis brevicollis
Sulcacis affinis
Sulcacis curtulus
Sulcacis fronticornis
Sulcacis lengi
Sulcacis bidentulus
Dolichocis laricinus
Dolichocis manitoba
Atlantocis lauri
Falsocis alaydeae
Rhopalodontus lawrencei
Rhopalodontus americanus
Rhopalodontus perforatus
Octotemnus glabriculus
Octotemnus laevis
Octotemnus laminifrons
Octotemnus sp.
Xylographus madagascariensis
Xylographus bostrichoides
Xylographus contractus
Xylographus lucasi
Xylographella punctata
Scolytocis sp.3
Scolytocis sp. 1
Scolytocis sp. 5

Figura 1


Enneboeus caseyi
Histanocerus puberans
Mycetophagus flexuosus
Penthe obliquata
Prostomis mandibularis
Sphindocis denticollis
Orthocis punctatus
Orthocis pseudolinearis
Orthocis reflexicollis
Cis boleti
Cis festivus
Cis fagi
Cis leoi
Cis fuscipes
Cis punctulatus
Plesiocis cribum
Ennearthron cornutum
Ennearthron victori
Cis bilamellatus
Cis sp.16
Strigocis opacicollis
Strigocis bilimeki
Strigocis opalescens
Hadraule vitori
Hadraule blasdelli
Hadraule elongatula
Malacocis brevicollis
Ceracis cornifer
Porculus grossus
Porculus piceus
Ceracis variabilis
Ceracis limai
Wagaicis wagae
Gen. nov. sp. 2
Gen. nov. sp. 3
Sulcacis affinis
Sulcacis curtulus
Sulcacis fronticornis
Sulcacis lengi
Sulcacis bidentulus
Dolichocis laricinus
Dolichocis manitoba
Atlantocis lauri
Falsocis alaydeae
Rhopalodontus lawrencei
Rhopalodontus americanus
Rhopalodontus perforatus
Octotemnus glabriculus
Octotemnus laevis
Octotemnus laminifrons
Octotemnus sp.
Xylographus bostrichoides
Xylographus lucasi
Xylographus contractus
Xylographus madagascariensis
Xylographella punctata
Scolytocis sp.3
Scolytocis sp. 1
Scolytocis sp. 5

Figura 2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Histanocerus puberans
Mycetophagus flexuosus
Penthe obliquata
Prostomis mandibularis
Sphindocis denticollis
Orthocis punctatus
Orthocis pseudolinearis
Orthocis reflexicollis
Cis boleti
Cis festivus
Cis fagi
Cis fuscipes
Cis leoi
Cis punctulatus
Plesiocis cribum
Ennearthron cornutum
Ennearthron victori
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Strigocis opacicollis
Strigocis bilimeki
Strigocis opalescens
Hadraule vitori
Hadraule blasdelli
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Ceracis cornifer
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Gen. nov. sp. 2
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Dolichocis manitoba
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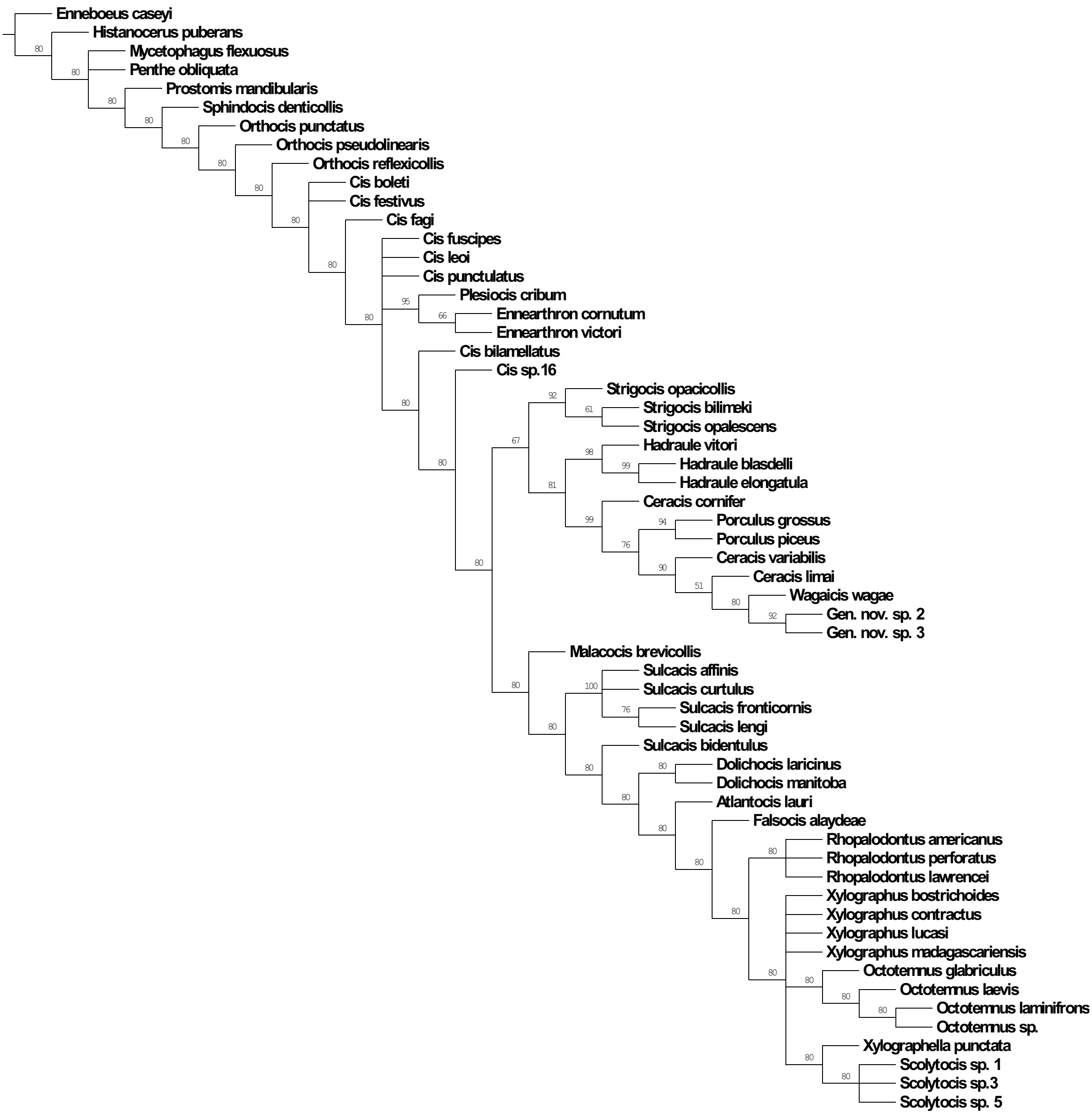
Rhopalodontus perforatus
Rhopalodontus lawrencei
Xylographus bostrichoides
Xylographus contractus
Xylographus lucasi
Xylographus madagascariensis
Octotemnus glabriculus
Octotemnus laevis
Octotemnus laminifrons
Octotemnus sp.
Xylographella punctata
Scolytocis sp. 1
Scolytocis sp.3
Scolytocis sp. 5

Figura 3


Enneboeus caseyi
Histanocerus puberans
Mycetophagus flexuosus
Penthe obliquata
Prostomis mandibularis
Sphindocis denticollis
Orthocis punctatus
Orthocis pseudolinearis
Orthocis reflexicollis
Cis boleti
Cis festivus
Cis fagi
Cis fuscipes
Cis leoi
Cis punctulatus
Plesiocis cribum
Ennearthron cornutum
Ennearthron victori
Cis bilamellatus
Cis sp.16
Strigocis opacicollis
Strigocis bilimeki
Strigocis opalescens
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Gen. nov. sp. 2
Gen. nov. sp. 3
Malacocis brevicollis
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Sulcacis lengi
Sulcacis bidentulus
Dolichocis laricinus
Dolichocis manitoba
Atlantocis lauri
Falsocis alaydeae
Rhopalodontus americanus
Rhopalodontus perforatus
Rhopalodontus lawrencei
Xylographus bostrichoides
Xylographus contractus
Xylographus lucasi
Xylographus madagascariensis
Octotemnus glabriculus
Octotemnus laevis
Octotemnus laminifrons
Octotemnus sp.
Xylographella punctata
Scolytocis sp. 1
Scolytocis sp.3
Scolytocis sp. 5

Figura 4

Appendix 1 (Part 1). The 118 species analyzed in+A55 this work. Type species are in bold. The symbol * indicates the species used as terminal groups in the phylogenetic analysis.

Status	Genus	Species	Group
Outgroup			
Archeocrypticidae	*Enneboeus* Waterhouse, 1878	*Enneboeus caseyi* Kaszab, 1964 *	-
Mycetophagidae	*Mycetophagus* Hellwig, 1792	*Mycetophagus flexuosus* Say, 1826 *	-
Prostomidae	*Prostomis* Latreille, 1819	*Prostomis mandibularis* (Fabricius, 1801) *	-
Pterogeniidae	*Histanocerus* Motschulsky, 1858	*Histanocerus puberans* Burckhardt & Löbl, 1992 *	-
Tetratomidae	*Penthe* Newman, 1838	*Penthe obliquata* (Fabricius, 1801) *	-
Ingroup			
Ciidae	*Atlantocis* Israelson, 1985	*Atl. lauri* (Wollaston, 1854) *	-
	Ceracis Mellié, 1848	*Cer. cornifer* (Mellié, 1848) *	*furcifer*
		Cer. limai L.-A., Madureira & Zacaro, 2002 *	*singularis*
		Cer. variabilis (Mellié, 1848) *	*furcatus*
		Cer. sp. 1	*furcatus*
		Cer. sp. 2	*furcifer*
		Cer. sp. 3	*furcifer*
	Cis Latreille, 1796	*C. bidentatus* (Olivier, 1790)	-
		C. bilamellatus Wood, 1884 *	*bilamellatus*
		***C. boleti* (Scopoli, 1763) ***	*boleti*
		C. castaneus Mellié, 1848	*fagi*
		C. comptus Gyllenhal, 1827	*comptus*
		C. dentatus Mellié, 1848	-
		C. fagi Waltl, 1839 *	*fagi*
		C. festivus (Panzer, 1793) *	*festivus*
		C. fissicornis Mellié, 1848	-
		C. fuscipes Mellié, 1848 *	*fuscipes*
		C. glabratus Mellié, 1848	-
		C. hispidus (Paykull, 1798)	-
		C. jacquemarti Mellié, 1848	*nitidus*
		C. leoi L.-A., Gumier-Costa & Zacaro, 2003 *	*comptus*
		C. lineatocribratus Mellié, 1848	*nitidus*
		C. micans (Fabricius, 1792)	*boleti*
		C. nitidus (Fabricius, 1792)	*nitidus*
		C. punctulatus Gyllenhal, 1827 *	*punctulatus*
		C. pygmaeus Marsham, 1802	*festivus*
		C. quadridens Mellié, 1848	-
		C. striolatus Casey, 1898	*comptus*
		C. tauriensis Królik, 2002 *	*comptus*
		C. tomentosus Mellié, 1848	*punctulatus*
		C. versicolor Casey, 1898	*comptus*
		C. sp. 1	*taurus*
		C. sp. 2	*bilamellatus*
		C. sp. 3	*comptus*
		C. sp. 4	*comptus*
		C. sp. 5	*bilamellatus*
		C. sp. 6	*taurus*
		C. sp. 7	*taurus*
		C. sp. 8	*taurus*
		C. sp. 9	*taurus*
		C. sp. 10	*taurus*
		C. sp. 11	*comptus*
		C. sp. 12	*taurus*
		C. sp. 13	*taurus*
		C. sp. 14	*taurus*
		C. sp. 15	*taurus*
		C. sp. 16 *	*taurus*
	Dolichocis Dury, 1919	*D. laricinus* (Mellié, 1848) *	-
		***D. manitoba* (Dury, 1919) ***	-
	Ennearthron Mellié, 1847	***E. cornutum* (Gyllenhal, 1827) ***	-
		E. victori L.-A. & Zacaro, 2003 *	-
	Falsocis Pic, 1916	*F. alaydeae* i.l. *	-
	Hadraule Thomson, 1863	*H. blaisdelli* (Casey, 1900) *	-
		***H. elongatula* (Gyllenhal, 1827) ***	-
		H. sp. 1 *	-
		H. sp. 2	-
	Malacocis Gorham, 1886	*M. brevicollis* (Casey, 1898) *	-
	Octotemnus Mellié, 1847	***O. glabriculus* (Gyllenhal, 1827) ***	-
		O. laevis Casey, 1898 *	-
		O. laminifrons (Motschulsky, 1860) *	-
		O. opacus Mellié, 1848	-
		O. sp. 1 *	-
		O. sp. 2	-

Appendix 1 (Part 2). The 118 species analyzed in this work. Type species are in bold. The symbol * indicates the species used as terminal groups in the phylogenetic analysis.

Status	Genus	Species	Group
Ingroup	*Orthocis* Casey, 1898	*Ort. pseudolinearis* (Lohse, 1965) *	-
		***Ort. punctatus* (Mellié, 1848) ***	-
		Ort. reflexicollis (Abeille de Perrin, 1874) *	-
		Ort. sp. 1	-
		Ort. sp. 2	-
		Ort. sp. 3	-
		Ort. sp. 4	-
	Plesiocis Casey, 1898	***P. cribum* Casey, 1898 ***	-
	Porculus Lawrence, 1987	*Por. grossus* Lawrence, 1987 *	-
		Por. piceus (Mellié, 1848) *	-
	Rhopalodontus Dohrn in Strübling, 1851	*Rh. americanus* Lawrence, 1971 *	-
		Rh. lawrencei Ruta, 2003 *	-
		Rh. novorossicus Reitter, 1902	-
		***Rh. perforatus* (Gyllenhal, 1813) ***	-
		Rh. strandi Lohse, 1969	-
	Scolytocis Blair, 1928	*Scolytocis* sp. 1 *	-
		Scolytocis sp. 2	-
		Scolytocis sp. 3 *	-
		Scolytocis sp. 4	-
		Scolytocis sp. 5 *	-
	Sphindocis Fall, 1917	***Sph. denticollis* Fall, 1917 ***	-
	Strigocis Dury, 1917	*Str. bilimeki* (Reitter, 1878) *	-
		***Str. opacicollis* Dury, 1917 ***	-
		Str. opalescens (Casey, 1898) *	-
	Sulcacis Dury, 1917	*Sul. affinis* (Gyllenhal, 1827) *	-
		Sul. bidentulus (Rosenhauer, 1847) *	-
		Sul. curtulus (Casey, 1898) *	-
		Sul. fronticornis (Panzer, 1809) *	-
		***Sul. lengi* Dury, 1917 ***	-
	Wagaicis Lohse, 1964	***Wag. wagae* (Wankowicz, 1869) ***	-
	Xylographella Miyatake, 1985	***Xylographella punctata* Miyatake, 1985 ***	-
	Xylographus Mellié, 1847	***X. bostrichoides* (Dufour, 1843) ***	-
		X. contractus Mellié, 1848 *	-
		X. lucasi L.-A. & Zacaro, 2003 *	-
		X. madagascariensis Mellié, 1848 *	-
		X. sp. 1	-
		X. sp. 2	-
		X. sp. 3	-
		X. sp. 4	-
		X. sp. 5	-
		X. sp. 6	-
		X. sp. 7	-
		X. sp. 8	-
		X. sp. 9	-
		X. sp. 10	-
		X. sp. 11	-
		X. sp. 12	-
		X. sp. 13	-
	Gen. nov.	Gen. nov. sp. 1	-
		Gen. nov. sp. 2 *	-
		Gen. nov. sp. 3 *	-

Appendix 2 (Part 1): Final matrix with 59 terminal groups and 96 characters. The state of each character has been coded numerically, starting from "0". Unknown and inapplicable character states were coded respectively as "?" and "-".

Taxon \ Character											1										2										3										4									
	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
Enneboeus caseyi	1	0	0	0	0	2	0	0	0	0	-	-	-	1	0	1	0	0	0	1	1	0	0	0	1	0	1	0	0	0	2	1	1	1	0	0	1	0	?	0	1	1	0	0	1	2	0	2	0	0
Histanocerus puberans	1	0	0	0	0	2	1	0	2	0	-	-	-	0	0	1	0	0	0	1	1	0	0	0	0	0	1	0	0	0	1	0	2	2	0	0	1	1	0	0	2	2	0	0	1	2	0	1	0	1
Mycetophagus flexuosus	1	0	1	0	0	1	0	0	2	0	-	-	-	1	0	1	0	0	0	1	?	0	1	0	0	0	1	0	0	0	1	0	1	1	0	2	1	1	0	0	1	1	0	1	1	2	0	0	0	1
Penthe obliquata	1	0	1	0	1	0	-	0	-	0	-	-	-	1	0	1	0	0	0	1	1	0	1	0	0	0	0	-	-	-	1	1	1	1	0	2	2	1	0	0	1	1	1	1	1	2	0	0	0	1
Prostomis mandibularis	0	0	1	0	1	1	0	0	0	0	-	-	-	0	0	0	0	0	0	0	1	1	0	0	0	0	0	-	-	-	1	1	0	0	1	2	1	0	0	0	0	0	0	1	1	2	0	0	0	2
Atlantocis lauri	1	0	0	1	1	2	0	1	0	0	0	0	0	0	0	0	1	0	?	0	0	?	?	1	0	0	1	1	0	1	1	0	2	2	0	1	0	1	0	0	2	2	0	0	0	?	?	?	?	?
Ceracis cornifer	1	0	0	2	0	2	0	1	0	0	0	0	1	0	-	0	1	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0	0	1	1	1	1	0	0	0	0	0	0	1	1	0	2	0	1
Ceracis limai	1	0	0	1	0	2	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	1	1	0	0	1	1	0	0	0	1	1	1	1	0	0	0	0	0	0	1	0	0	0	1	1
Ceracis variabilis	1	0	0	3	0	2	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	1	1	0	0	0	1	1	1	1	0	0	0	0	0	0	1	0	0	2	1	1
Cis bilamellatus	1	0	0	1	1	2	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	1	1	1	0	0	1	0	0	1	1	1	1	1	0	0	1	1	0	0	1	1	0	2	0	1
Cis boleti	1	0	0	1	1	2	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	1	0	1	0	1	1	0	2	1	1	0	0	1	1	0	1	1	1	0	2	0	0
Cis fagi	1	0	0	1	0	2	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	0	0	1	0	1	1	1	1	1	1	0	0	1	1	0	0	1	1	0	2	0	0
Cis festivus	1	0	0	1	1	2	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	1	0	1	1	1	1	0	1	1	1	0	0	1	1	0	1	1	1	0	2	0	0
Cis fuscipes	1	0	0	1	1	2	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	1	1	1	0	1	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	2	0	1
Cis leoi	1	0	0	1	1	2	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	0	1	1	0	1	1	1	1	1	1	0	0	1	1	1	1	1	1	0	0	0	1
Cis punctulatus	1	0	0	1	1	2	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	0	1	1	0	1	1	0	1	1	1	0	0	1	1	0	0	1	1	0	2	0	1
Cis sp.16	1	0	0	1	1	2	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	0	1	1	1	0	2	2	1	1	1	1	0	0	2	2	0	0	1	1	1	2	0	0
Dolichocis laricinus	1	0	0	2	1	2	0	1	0	0	0	0	0	0	0	0	1	0	?	0	0	?	?	0	0	0	1	1	0	1	1	0	0	1	0	2	1	1	0	0	0	1	0	0	1	?	?	?	?	?
Dolichocis manitoba	1	0	0	2	1	2	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	1	0	2	1	1	0	0	0	1	0	0	1	0	0	2	2	2
Ennearthron cornutum	1	0	0	2	1	2	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	1	1	1	0	1	1	0	0	1	0	2	1	1	0	0	1	1	0	0	1	1	0	2	2	1
Ennearthron victori	1	0	0	2	1	2	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	1	1	1	0	1	1	0	0	1	0	2	1	1	0	0	1	1	0	0	1	1	1	2	0	1
Falsocis alaydeae	2	0	0	1	0	2	0	1	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	1	1	1	1	0	1	1	0	2	2	0	1	1	1	0	1	2	2	0	0	1	0	0	1	2	1
Gen. nov. sp. 2	1	0	0	2	1	2	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	1	1	0	0	1	1	0	0	0	0	1	1	1	0	1	0	0	1	0	1	0	0	0	1	1
Gen. nov. sp. 3	1	0	0	2	1	2	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	1	1	0	0	0	0	1	1	1	0	1	0	0	1	0	1	0	0	0	1	1
Hadraule blasdelli	0	0	0	2	1	2	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	1	2	1	1	0	0	1	1	0	1	1	1	0	0	0	3
Hadraule elongatula	0	0	0	2	0	2	0	1	0	0	0	0	0	0	0	1	0	0	?	0	0	?	?	0	0	1	1	1	0	0	0	0	0	0	1	2	1	1	0	0	1	1	0	1	1	?	?	?	?	?
***Hadraule* sp.**	0	0	0	1	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	1	0	1	2	1	1	0	0	1	1	0	0	1	2	0	0	0	3
Malacocis brevicollis	2	0	1	1	0	2	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	2	0	1	1	1	1	1	1	0	1	1	1	0	0	1	1	0	1	0	1
Octotemnus glabriculus	1	0	0	3	1	2	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	1	0	0	0	1	1	1	1	0	0	0	0	0	0	1	0	0	1	2	2
Octotemnus laevis	1	0	1	3	1	2	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	1	0	0	0	1	1	1	1	0	0	0	0	0	0	1	0	0	1	2	2
Octotemnus laminifrons	1	0	0	3	1	2	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	1	1	0	0	0	0	1	1	1	0	0	0	0	0	0	1	0	0	1	2	2
***Octotemnus* sp.**	1	0	0	3	1	2	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	1	1	0	0	0	0	1	1	1	0	0	0	0	0	0	1	0	0	1	2	2
Orthocis pseudolinearis	1	0	0	1	1	2	0	1	0	0	0	0	0	0	0	0	0	0	?	0	0	?	?	0	1	0	1	1	1	0	1	0	0	0	1	2	1	1	1	0	0	0	0	0	1	1	0	0	0	1
Orthocis punctatus	1	0	0	1	1	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	1	0	0	0	0	2	1	1	1	0	0	0	0	0	1	1	0	0	0	0
Orthocis reflexicollis	1	0	0	1	1	2	0	1	0	0	0	0	0	0	0	1	0	0	?	?	0	?	?	0	1	0	1	1	1	0	1	0	1	1	0	2	1	1	1	0	0	1	0	0	1	?	?	?	?	?
Plesiocis cribum	1	0	0	2	0	2	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	1	1	0	1	1	0	1	1	1	?	0	1	1	0	0	1	1	0	2	0	0
Porculus grossus	1	0	0	1	0	2	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0	0	1	1	1	1	0	0	0	0	1	0	1	0	0	2	0	0
Porculus piceus	1	0	0	1	1	2	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	1	1	1	1	0	0	0	0	1	0	1	0	0	2	0	0
Rhopalodontus americanus	1	0	0	1	0	2	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	1	1	0	2	2	0	1	1	1	0	1	2	2	0	0	1	0	0	1	2	0
Rhopalodontus perforatus	1	0	0	1	1	2	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	1	1	0	2	2	0	1	1	1	0	1	2	2	0	0	1	0	0	1	2	0
Rhopalodontus lawrencei	1	0	0	1	1	2	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	1	0	2	2	0	1	1	1	0	1	2	2	0	0	1	0	0	1	2	0
Scolytocis sp. 1	1	1	1	2	1	2	1	1	0	0	1	1	0	0	0	0	0	0	1	0	1	1	2	0	0	0	1	0	0	1	1	0	0	0	1	1	2	1	0	1	0	0	0	0	1	0	0	2	2	1
Scolytocis sp.3	1	1	1	2	1	2	1	1	0	0	1	1	0	0	0	0	0	0	1	0	1	1	2	0	0	0	1	0	0	1	1	0	0	0	1	1	2	1	0	1	0	0	1	1	1	0	0	1	2	2
Scolytocis sp. 5	1	1	1	2	1	2	1	1	0	0	1	1	0	0	0	0	0	0	1	0	1	1	2	0	0	0	1	0	0	1	1	0	0	0	1	1	2	1	0	1	0	0	0	0	1	0	0	2	2	0
Sphindocis denticollis	1	0	0	0	0	1	0	0	0	0	-	-	-	0	0	0	0	0	0	1	0	1	0	0	1	0	1	2	1	0	1	0	0	0	0	2	1	1	0	0	0	0	1	0	1	2	0	0	0	2
Strigocis bilimeki	1	0	0	1	0	2	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	1	1	0	0	0	1	0	0	1	1	1	1	1	1	0	1	1	0	0	1	1	0	0	0	1
Strigocis opacicollis	1	0	0	1	1	2	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	1	1	0	0	1	0	0	1	?	2	1	1	1	0	1	1	0	0	1	1	0	2	0	1
Strigocis opalescens	1	0	0	1	1	2	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	1	1	0	1	0	1	0	0	0	1	1	1	1	1	0	0	0	0	0	1	1	0	0	0	1
Sulcacis affinis	1	0	0	2	1	2	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	1	0	1	1	0	0	1	?	1	1	1	0	0	1	1	0	0	1	1	0	2	2	2
Sulcacis curtulus	1	0	0	1	1	2	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	1	0	1	1	0	0	1	?	1	1	1	0	0	1	1	0	0	1	1	0	2	2	2
Sulcacis bidentulus	1	0	0	1	1	2	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	1	1	1	1	1	1	0	0	1	1	0	0	1	0	0	2	2	2
Sulcacis fronticornis	1	0	0	1	0	2	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0	1	?	1	1	1	0	0	1	1	0	0	1	1	0	2	2	2
Sulcacis lengi	1	0	0	2	1	2	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0	1	?	1	1	1	0	0	1	1	0	0	1	1	0	2	2	2
Wagaicis wagae	1	0	0	2	1	2	0	1	0	0	0	0	?	0	0	0	1	0	?	?	0	?	?	0	0	1	1	0	0	1	1	0	0	0	0	1	1	1	0	0	0	0	0	0	1	0	?	?	1	?
Xylographella punctata	1	0	1	1	1	2	1	1	0	0	1	1	0	0	0	0	0	0	1	0	1	1	2	0	0	0	1	1	0	1	1	0	0	0	1	1	0	1	0	1	0	0	0	0	1	0	0	1	2	1
Xylographus bostrichoides	1	0	0	1	0	2	0	1	0	1	0	1	0	0	0	1	0	0	0	?	0	1	?	0	0	0	1	0	0	1	1	0	2	0	0	1	0	1	0	1	2	0	0	0	1	0	0	1	2	1
Xylographus contractus	2	0	1	1	1	2	0	1	0	1	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0	1	1	0	2	0	1	1	0	1	0	1	0	0	1	0	1	0	0	1	2	1
Xylographus lucasi	2	0	0	1	1	2	0	1	0	1	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0	1	1	0	2	0	1	1	0	1	0	1	0	0	1	0	1	0	0	1	2	1
Xylographus madagascariensis	2	?	0	1	1	2	0	1	0	1	0	1	0	0	0	0	0	0	0	?	0	1	?	0	0	0	1	0	0	1	1	0	0	0	1	1	0	1	0	1	0	0	1	0	1	0	0	1	2	1

Appendix 2 (Part 2): Final matrix with 59 terminal groups and 96 characters. The state of each character has been coded numerically, starting from "0". Unknown and inapplicable character states were coded respectively as "?" and "-".

Taxon \ Character	5										6										7										8										9					
	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5
Enneboeus caseyi	0	0	2	0	1	1	0	0	1	1	1	1	1	0	0	0	0	0	1	1	0	0	-	-	?	?	2	0	2	1	0	0	0	0	1	0	2	0	0	0	0	1	?	?	?	?
Histanocerus puberans	0	1	1	0	1	1	0	1	0	1	1	1	1	0	0	0	0	0	1	1	0	0	-	-	1	1	1	0	0	?	?	0	0	0	1	0	2	0	0	0	0	-	?	?	?	?
Mycetophagus flexuosus	0	0	2	0	1	0	0	0	0	1	1	2	1	0	0	0	0	0	1	1	0	0	-	-	1	1	2	0	2	1	1	1	0	0	0	0	2	0	0	0	0	1	?	?	?	?
Penthe obliquata	0	1	0	0	1	1	0	0	1	1	1	2	1	0	0	0	0	0	1	1	0	0	-	-	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	3	2
Prostomis mandibularis	0	0	2	0	1	0	0	1	1	1	0	2	1	0	0	1	0	1	1	1	0	0	-	-	?	?	0	0	2	?	?	0	1	0	1	1	?	?	?	0	0	?	?	?	?	?
Atlantocis lauri	?	?	?	0	1	1	0	?	?	?	?	?	0	0	0	1	1	1	0	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Ceracis cornifer	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	?	0
Ceracis limai	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	1	2	0	1	0	0	0	?	?	?	?
Ceracis variabilis	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	0	1	1	1	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	1	0	2	0
Cis bilamellatus	1	1	1	0	1	0	1	0	0	0	1	1	0	0	0	1	1	1	0	0	1	0	1	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Cis boleti	0	1	1	0	1	0	1	0	0	1	1	1	0	0	0	1	1	1	1	0	1	0	1	1	?	?	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	?	?	?	?
Cis fagi	0	1	1	0	1	0	0	0	0	0	1	1	0	0	0	1	1	1	1	0	1	0	1	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Cis festivus	0	1	1	0	1	0	0	0	0	1	1	1	0	0	0	1	1	1	0	0	?	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Cis fuscipes	0	1	1	0	1	0	1	0	0	0	1	1	0	0	0	1	1	1	0	0	1	0	0	1	?	?	1	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	?	?	4	0
Cis leoi	0	1	1	0	1	0	1	0	0	1	1	1	0	0	0	1	1	1	0	0	1	0	1	1	1	1	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	2	2	1	0
Cis punctulatus	0	1	1	0	1	0	1	0	0	0	1	1	0	0	0	1	1	1	0	0	1	0	0	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Cis sp.16	0	1	1	0	1	1	1	0	0	0	1	0	0	0	0	1	1	1	1	0	1	0	1	1	1	1	1	0	0	0	0	0	0	0	0	1	2	1	1	0	0	0	2	2	1	0
Dolichocis laricinus	?	1	1	0	1	0	0	?	?	?	?	?	0	0	0	1	1	1	0	0	1	0	1	1	?	?	1	0	0	0	0	0	0	0	0	0	2	0	1	1	0	0	?	?	?	?
Dolichocis manitoba	1	1	1	0	1	0	0	0	0	1	1	2	0	0	0	1	1	1	0	0	1	0	1	1	?	?	0	0	0	0	0	0	0	0	0	0	2	0	1	1	0	0	?	?	?	?
Ennearthron cornutum	1	1	1	0	1	0	0	0	0	1	1	1	0	0	0	1	1	1	0	0	0	0	-	-	1	1	0	0	0	0	0	0	1	0	0	0	2	1	0	0	1	-	?	?	?	?
Ennearthron victori	1	1	1	0	1	0	0	0	0	1	1	1	0	0	0	1	1	1	0	0	0	0	-	-	1	1	1	0	0	0	0	0	1	0	0	0	2	1	0	0	1	-	2	1	4	0
Falsocis alaydeae	1	1	1	0	0	0	1	0	0	1	1	2	0	0	0	1	1	1	0	0	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	2	2	?	?
Gen. nov. sp. 2	1	1	1	0	0	0	2	0	0	0	0	0	0	0	0	1	1	1	0	0	1	0	1	1	1	1	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	1	?	?	?	?
Gen. nov. sp. 3	1	1	1	0	0	0	2	0	0	0	0	0	0	0	0	1	1	1	0	0	1	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	?	?	?	?
Hadraule blasdelli	0	1	1	0	1	0	0	0	0	1	1	0	0	0	0	1	1	1	1	0	1	0	1	1	?	?	0	0	0	0	0	0	0	1	0	1	2	?	?	0	0	?	2	2	?	?
Hadraule elongatula	?	?	?	0	1	0	0	?	?	?	?	?	0	0	0	1	1	1	1	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
***Hadraule* sp.**	0	1	1	0	1	0	0	0	0	1	1	0	0	0	0	1	1	1	1	0	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	1	2	1	1	0	0	2	2	2	?	?
Malacocis brevicollis	0	1	1	0	1	1	0	0	0	1	1	0	0	0	0	1	1	1	0	0	1	0	1	1	?	?	1	0	1	0	1	0	2	0	0	0	1	0	0	0	0	0	?	?	?	?
Octotemnus glabriculus	1	1	1	1	0	1	0	0	0	1	0	0	0	1	1	1	1	1	0	0	-	1	-	-	0	0	1	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	?	?	?	?
Octotemnus laevis	1	1	1	1	0	1	0	0	0	0	0	0	0	1	1	1	1	1	0	0	-	1	-	-	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	?	?	0	0
Octotemnus laminifrons	1	1	1	1	0	1	0	0	0	0	0	0	0	1	1	1	1	1	0	0	-	1	-	-	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
***Octotemnus* sp.**	1	1	1	1	0	1	0	0	0	0	0	0	0	1	1	1	1	1	0	0	-	1	-	-	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Orthocis pseudolinearis	0	1	1	0	1	0	0	?	0	1	1	0	0	0	0	1	1	1	0	0	1	0	0	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Orthocis punctatus	0	1	1	0	1	0	0	0	0	1	1	0	0	0	0	1	1	1	0	0	1	0	1	1	?	?	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	?	?	?	?
Orthocis reflexicollis	?	1	1	0	1	0	0	?	?	?	?	?	0	0	0	1	1	1	0	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Plesiocis cribum	1	1	1	0	1	0	1	0	0	1	1	1	0	0	0	1	1	1	0	0	1	0	1	0	1	1	1	0	0	0	0	0	0	0	0	1	2	1	0	0	0	0	?	?	?	?
Porculus grossus	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1	1	0	?	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Porculus piceus	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1	1	0	1	0	1	1	1	1	0	0	1	0	0	0	0	0	0	1	2	0	0	0	0	1	?	?	?	?
Rhopalodontus americanus	1	1	1	1	0	1	0	0	0	1	1	0	0	1	1	1	1	1	0	0	-	1	-	-	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	?	?	?	?
Rhopalodontus perforatus	1	1	1	1	0	1	0	0	0	1	1	0	0	1	1	1	1	1	0	0	-	1	-	-	0	0	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	?	?	?	?
Rhopalodontus lawrencei	1	1	1	1	0	1	0	?	0	?	1	0	0	1	1	1	1	1	0	0	-	1	-	-	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Scolytocis sp. 1	1	1	1	1	0	1	0	0	0	0	1	1	0	1	1	1	1	1	0	0	-	0	-	-	0	0	2	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	?	?	?	?
Scolytocis sp.3	1	1	1	1	0	1	0	0	0	0	0	1	0	1	1	1	1	1	0	0	-	0	-	-	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Scolytocis sp. 5	1	1	1	1	0	1	0	0	0	1	1	1	0	1	1	1	1	1	0	0	-	0	-	-	0	0	2	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	?	?	?	?
Sphindocis denticollis	0	0	1	0	1	1	0	0	0	1	1	0	1	0	0	1	1	1	0	0	1	0	1	1	?	?	1	0	2	1	0	0	0	0	0	0	0	0	1	0	0	1	?	?	?	?
Strigocis bilimeki	0	1	1	0	1	1	0	0	0	?	?	0	0	0	0	1	1	1	0	0	1	0	1	1	1	1	0	0	0	0	0	0	0	1	0	1	2	0	0	0	0	1	?	?	?	?
Strigocis opacicollis	0	1	1	0	1	1	0	?	0	1	1	0	0	0	0	1	1	1	0	0	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	?	?	?	?	?
Strigocis opalescens	0	1	1	0	1	1	0	0	0	1	1	0	0	0	0	1	1	1	0	0	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	?	?	?	?
Sulcacis affinis	1	1	1	0	1	1	0	0	0	1	1	0	0	0	0	1	1	1	0	0	1	0	1	1	1	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Sulcacis curtulus	1	1	1	0	1	1	0	0	0	1	1	0	0	0	0	1	1	1	0	0	1	0	1	1	1	1	1	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	?	?	?	?
Sulcacis bidentulus	1	1	1	0	1	1	0	0	0	1	1	1	0	0	0	1	1	1	0	0	1	0	1	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Sulcacis fronticornis	1	1	1	0	1	1	0	0	0	1	1	0	0	0	0	1	1	1	0	0	1	0	1	1	1	1	1	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	?	?	?	?
Sulcacis lengi	1	1	1	0	1	1	0	0	0	1	1	0	0	0	0	1	1	1	0	0	1	0	1	1	1	1	1	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	?	?	1	0
Wagaicis wagae	1	?	?	?	?	1	0	?	?	?	?	?	0	0	0	1	1	1	?	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Xylographella punctata	1	1	1	1	0	1	0	0	0	1	1	0	0	1	1	1	1	1	0	0	0	0	-	-	?	?	2	?	?	?	?	1	?	?	0	0	0	0	0	?	?	1	?	?	?	?
Xylographus bostrichoides	1	1	1	1	0	1	0	?	?	?	?	?	0	1	1	1	1	1	?	0	?	?	?	?	0	0	1	0	1	0	1	0	0	0	0	0	2	0	0	0	0	1	?	?	?	?
Xylographus contractus	1	1	1	1	0	1	0	0	0	1	1	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	1	0	1	0	1	0	0	0	0	1	2	0	0	0	0	1	2	2	1	1
Xylographus lucasi	1	1	1	1	0	1	0	0	0	1	1	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	1	0	1	0	1	0	0	0	0	1	2	0	0	0	0	1	?	?	?	?
Xylographus madagascariensis	1	1	1	1	0	1	0	?	?	?	?	?	0	1	1	1	1	1	?	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

Appendix 3 (Part 1): List of characters and states of character used in the phylogenetic analysis.

0. Body shape:
   - 0. strongly flattened
   - 1. slightly flattened to moderately convex
   - 2. strongly convex
1. Extremely small and somewhat globular tubercles, mainly in clypeus, pronotum and elytra:
   - 0. absent
   - 1. present
2. Antenna insertions in dorsal view:
   - 0. concealed
   - 1. visible
3. Number of antennomeres:
   - 0. eleven
   - 1. ten
   - 2. nine
   - 3. eight
4. Third antennomere in relation to fourth:
   - 0. III as long as IV
   - 1. III at least 1.5X longer than IV
5. Antenna:
   - 0. without club
   - 1. with weak club
   - 2. with strong club
6. Antennomeres of antennal club:
   - 0. loose
   - 1. compact
7. Sensillifers of the antennal club:
   - 0. absent
   - 1. present
8. Number of antennomeres of the antennal club:
   - 0. three
   - 1. two
   - 2. more than three
9. Setae of antennal club:
   - 0. not forming a distinct row
   - 1. forming a distinct row
10. Number of sensillifers of the antennal club:
    - 0. four sensillifers per antennomere
    - 1. more than four sensillifers per antennomere
11. Organization of the sensilla of the antennal sensillifers:
    - 0. not well organized
    - 1. well organized
12. Sensilla of the antennal sensillifers:
    - 0. short
    - 1. long
13. Anterior or mesal edge of the eyes:
    - 0. not or only barely emarginate
    - 1. shallowly emarginate or slightly divided by canthus
14. Notch in the middle of male clypeus:
    - 0. absent
    - 1. present
15. Pubescense of clypeus:
    - 0. absent or indistinct
    - 1. present
16. Horns and/or tubercles in males clypeus:
    - 0. absent
    - 1. present
17. Mandibula in males:
    - 0. as long as in females
    - 1. longer than in females
18. Prementum:
    - 0. not emarginate
    - 1. longitudinally emarginate
19. Apical palpomere of maxillary palpi :
    - 0. cylindrical to fusiform
    - 1. slightly expanded and truncate to subtriangular
    - 2. securiform to cultriform
20. Labial palpi:
    - 0. inserted in the apex of prementum
    - 1. inserted in the middle of prementum
21. First palpomere of labial palpi:
    - 0. reduced
    - 1. elongate, equal or subequal to second palpomere
22. Apical palpomere of labial palpi:
    - 0. cylindrical to fusiform
    - 1. slightly expanded and truncate to subtriangular
    - 2. securiform to cultriform
23. Horns and/or tubercles in the anterior edge of pronotum in males:
    - 0. absent
    - 1. present
24. Anterior corners of pronotum:
    - 0. not produced
    - 1. produced
25. Anterior angles of pronotum:
    - 0. absent or broadly rounded
    - 1. present
26. Lateral carinae:
    - 0. absent or incomplete
    - 1. present
27. Lateral carinae, whether smooth, crenulate or denticulate:
    - 0. smooth
    - 1. crenulate
    - 2. denticulate
28. Lateral carinae, whether with raised margin:
    - 0. without raised margin
    - 1. with raised margin or narrow bead
29. Lateral carinae from dorsal view:
    - 0. entirely visible
    - 1. partially or completely concealed
30. Pronotum widest:
    - 0. anteriorly
    - 1. at middle
    - 2. posteriorly
31. Posterior angles of pronotum:
    - 0. absent or broadly rounded
    - 1. obtuse, right or moderately to strongly acute
32. Pubescense of the lateral margins of pronotum:
    - 0. absent or indistinct
    - 1. consisting of short bristles
    - 2. consisting of long and slender bristles
33. Pubescense of the disc of pronotum:
    - 0. absent or indistinct
    - 1. consisting of short bristles
    - 2. consisting of long and slender bristles
34. Intervals among punctures of pronotum:
    - 0. not microreticulate
    - 1. with microreticulation

Appendix 3 (Part 2): List of characters and states of character used in the phylogenetic analysis.

35. Shape of scutellum:
    0. rounded to subquadrate
    1. subtriangular or triangular
    2. subpentagonal or pentagonal
36. Scutellum, whether reduced or developed:
    0. reduced
    1. developed
    2. strongly developed
37. Scutellum, whether abruptly elevated or not:
    0. not abruptly elevated
    1. abruptly elevated
38. Elytra, margin at apex:
    0. not inflexed
    1. inflexed
39. Elytra, lateral margins near apices:
    0. not bending dorsally, or bending just a little
    1. bending dorsally
40. Elytra, pubescence in the lateral margins:
    0. absent or indistinct
    1. consisting of short bristles
    2. consisting of long and slender bristles
41. Elytra, pubescence of disc:
    0. absent or indistinct
    1. consisting of short bristles
    2. consisting of long and slender bristles
42. Punctation of the elytral disc, whether single or dual:
    0. single or indistinct
    1. dual
43. Elytral punctation, whether irregular or seriate:
    0. irregularly punctate
    1. subseriate or seriate
44. Posterior wings:
    0. absent
    1. present
45. Intercoxal process of prosternum:
    0. narrowed apically
    1. parallel sided
    2. expanded at apex apically
46. Median logitudinal carina of prosternum:
    0. absent or very weak
    1. present and well distinct
47. Prosternum shape:
    0. flat to tumid
    1. concave
    2. biconcave
48. Shape of the intercoxal process of prosternum:
    0. not laminate
    1. laminate
49. Prosternum, anterior portion at midline:
    0. shorter than prosternal process
    1. as long as prosternal process
    2. longer than prosternal process
    3. twice as long as prosternal process
50. Intercoxal process of prosternum at apex:
    0. broadly rounded, angulate or truncate
    1. acute or narrowly rounded, or apex not visible
51. Procoxal cavities, shape externally:
    0. closed
    1. openned
52. Postcoxal projections:
    0. absent or very short
    1. moderately long but not meeting intercoxal process of prosternum
    2. meeting intercoxal process of prosternum
53. Procoxae, shape externally:
    0. slightly transverse
    1. conical
54. Procoxae, whether contiguous or separated:
    0. contiguous
    1. separated
55. Spines in the apices of protibiae:
    0. absent
    1. present
56. Protibiae, whether with outer apical tooth:
    0. without tooth
    1. with one proeminent tooth
    2. with two proeminent teeth
57. Mesosternum, whether separated from mesepisterna:
    0. separated by complete sutures from mesepisterna
    1. partly or complete fused to mesepisterna
58. Shape of mesocoxal cavities:
    0. slightly transverse
    1. circular
59. Mesocoxae, whether contiguous or separated:
    0. contiguous or narrowly separated
    1. separated
60. Metacoxae, whether contiguous or separated:
    0. contiguous
    1. narrowly separated
61. Median suture of metasternum:
    0. absent or extremely reduced
    1. reaching the middle of its disc
    2. extending from the posterior margin toward its disc
62. Apical spurs of meso and metatibiae:
    0. absent
    1. present
63. Shape of meso and metatibiae:
    0. slender
    1. strongly dilated at middle or apically
64. Outer margin of meso and metatibiae:
    0. not spinose
    1. spinose
65. Number of mesotarsomeres:
    0. five distinct tarsomeres
    1. four distinct tarsomeres
66. Preapical mesotarsomeres together:
    0. longer than apical one
    1. shorter than apical one
67. Number of metatarsomeres:
    0. one fewer than on mesotarsi
    1. as many as on mesotarsi
68. Epipleuron, whether absent, incomplete or complete:
    0. absent or incomplete
    1. complete
69. First two ventrites:
    0. not connate
    1. connate

Appendix 3 (Part 3): List of characters and states of character used in the phylogenetic analysis.

70. Fovea or setose patch in the first ventrite of males:
    0. absent or indistinct
    1. present
71. Flap cover of fovea or setose patch in the first ventrite of males:
    0. absent
    1. present
72. Fovea or setose patch in the first ventrite of males; whether margined:
    0. not margined
    1. margined
73. Shape of fovea or setose patch in the first ventrite of males:
    0. restricted to a small area
    1. large and well visible
74. Female genitalia, number of tranversal divisions of coxites:
    0. two
    1. four
75. Spiculum ventrale of females:
    0. reduced
    1. long
76. Male genitalia; shape of the ninth tergite:
    0. "U"
    1. "V"
    2. "Y"
77. Ninth tergite of male genitalia, whether hooked outwardly:
    0. not outwardly hooked
    1. outwardly hooked
78. Ninth tergite of male genitalia, one bristle in the apices of each branch:
    0. absent
    1. present
    2. present, but more than 1 bristle
79. Male genitalia, median strut of the anterior edge of ninth sternite:
    0. absent
    1. present
80. Male genitalia, median strut of the anterior edge of eighth sternite:
    0. absent
    1. present
81. Male genitalia, shape of tegmen:
    0. subtriangular to subtrapezoidal
    1. extremely elongated
82. Male genitalia, opposing paired struts in the anterior edge of tegmen:
    0. absent
    1. present, but short
    2. present, but long
83. Male genitalia, small and deep subapical excavation on each side of tegmen:
    0. absent
    1. present
84. Male genitalia, bristles at the apex of tegmen:
    0. absent
    1. present
85. Tegmen of male genitalia, whether emarginate or not:
    0. entire
    1. emarginated, forming two or more lobes
86. Male genitalia, shape of the median lobe:
    0. filiform
    1. tubular
    2. enlarged or modified
87. Male genitalia, median lobe widest:
    0. width iqual of subiqual throught its entire length
    1. at middle
88. Male genitalia; median lobe length in relation to tegmen:
    0. as long as tegmen or slightly shorter
    1. longer
89. Male genitalia, large and deep subapical excavation on each side of median lobe:
    0. absent
    1. present
90. Male genitalia, paired struts in the anterior edge of median lobe:
    0. absent
    1. present
91. Male genitalia, apex of median lobe:
    0. truncate, rounded or expanded
    1. acute
    2. emarginate at middle
92. Gonads, number of ovarioles per ovary:
    0. 1
    1. 2
    2. 3
93. Gonads, number of testioles per testis:
    0. 1
    1. 2
    2. 3
94. Cytogenetics, diploid number of chromossomes:
    0. 22
    1. 20
    2. 18
    3. 16
    4. 14
95. Cytogenetics, sex determination system:
    0. Xyp
    1. XY
    2. neoXY

CONCLUSÕES GERAIS

A análise filogenética apresentada nesta dissertação representa somente parte de todo um trabalho de padronização e incrementação do conhecimento sistemático sobre a família Ciidae (Coleoptera: Tenebrionoidea). Este trabalho não pretendeu ser exaustivo, mas sim explorar possibilidades que propociassem avanços no conhecimento taxonômico do grupo.

O primeiro avanço concreto foi a organização de uma coleção de referência para Ciidae. Grande parte das coleções de Ciidae existentes no mundo são coletâneas de espécimes oriundos de coletas esparsas, geralmente de uma única região biogeográfica ou mesmo de uma pequena área ou floresta. A maior coleção de Ciidae existente no Brasil até 1999 (MZ/USP) contava com 113 espécimes, grande parte somente de espécies brasileiras. O restante das coleções juntas não chegava a este montante. Isto limitava qualquer estudo mais abrangente sobre o grupo como, por exemplo, trabalhos de filogenia e biogeografia. Agora, a coleção de referência conta não somente com os 1.700 espécimes analisados nesta dissertação; há cerca de 2.500 espécimes montados em alfinetes entomológicos e mais de 30.000 acondicionados em álcool etílico. Com as novas aquisições, o número de espécies chega a quase 200, com representantes de mais da metade dos gêneros existentes no mundo. Com isso, estudos nas áreas de ecologia e etologia se tornam possíveis, já que o trabalho de identificação de ciídeos se tornou viável; estudos comparativos de morfologia externa, de genitália de machos e fêmeas, e mesmo de biologia molecular, poderão ser feitos com maior rapidez.

Cinco espécies neotropicais foram descritas nesta dissertação, valendo lembrar que uma delas (*Falsocis alaydeae*) ainda não foi publicada. A descrição dessas espécies aumentou em muito o conhecimento tanto da distribuição de alguns grupos de ciídeos como dos limites taxonômicos dos mesmos. Nestas descrições, a nomenclatura utilizada para a morfologia interna e externa, e os protocolos de preparação de genitálias, foram padronizados, o que irá facilitar muito os futuros trabalhos de taxonomia de Ciidae.

A análise filogenética apontou quais estudos sobre Ciidae são mais emergenciais: (i) a revisão dos gêneros *Ceracis* Mellié, *Cis* Latreille e *Orthocis* Casey, procurando principalmente características consistentes que definam melhor esses grupos; (ii) estudos exaustivos sobre a morfologia de genitália de machos e fêmeas. A genitália de machos mostrou ser mais eficaz para a classificação genérica ou infragenérica, enquanto a de fêmea é mais útil para se entender eventos de cladogênese mais antigos (classificação supragenérica); (iii) a ultra-estrutura de antena e fóvea abdominal também mostrou ser de extrema importância para se entender melhor as relações supragenéricas de Ciidae; (iv) a morfologia interna (como número de testíolos ou ovaríolos) tem importância na classificação de alguns gêneros estritamente relacionados, como *Ceracis*, *Porculus* Lawrence, e *Wagaicis* Lohse; (v) dados citogenéticos ainda são inconclusivos, mas algumas espécies apresentam número diplóide diferente do padrão de Polyphaga (Coleoptera). Portanto, é importante que se continue a reunir dados sobre a cariologia do grupo.

Os resultados da análise filogenética atestaram o monofiletismo da família Ciidae, assim como de suas duas subfamílias: Sphindociinae e Ciinae. A divisão de Ciinae em tribos existente até então deverá ser definitivamente abolida. Dentre os gêneros analisados, 17 são monofiléticos: o gênero mono-específico e nominotípico de Sphindociinae; e dezesseis gêneros de Ciinae. Somente quatro gêneros mostraram ser parafiléticos ou polifiléticos: *Ceracis*; *Cis*; *Orthocis*; e *Sulcacis* Dury. Contudo, esses quatro gêneros juntos contém cerca de 400 espécies, o que representa mais de 65% das espécies descritas de Ciidae.

ANEXO 1

Neste anexo é apresentada a lista de gêneros de Ciidae do mundo. Esta lista, originalmente, é parte integrante do projeto de listagem dos gêneros de organismos vivos (UBio Project: index of genera of all living organisms). Uma versão preliminar desta já pode ser vista na seguinte *homepage*: http://www.coleoptera.org/p1621.htm

A seguir, é apresentada uma versão editada desta lista.

Family: Ciidae Leach *in* Samouelle, 1819
Contributors: Rafal Ruta & Cristiano Lopes-Andrade
Date: 04.11.2003
Source: Abdullah M., 1972. The systematic position of the Cisidae (Heteromera) including a catalogue of the world and comments on central European families of Cucujoidea (Coleoptera). Zool. Beitr. (N.F.), 19: 189-246. **[revised und updated]**
Lawrence J. F., 1971. Revision of the North American Ciidae (Coleoptera). Bull. Mus. Comp. Zool. 142, 5: 419-522.

Subfamily: Sphindociinae Lawrence, 1974
- **Genus:** *Sphindocis* Fall, 1917

Subfamily: Ciinae Leach in Samouelle, 1819
- **Tribe:** Ciini
  - **Genus:** *Acanthocis* Miyatake, 1954
  - **Genus:** *Anoplocis* Kawanabe, 1996
  - **Genus:** *Apterocis* Perkins, 1900
  - **Genus:** *Atlantocis* Israelson, 1985
  - **Genus:** *Ceracis* Mellié, 1848
  - **Genus:** *Cis* Latreille, 1796
    - **Synonyms:** *Cisdygma* Reitter, 1885; *Eridaulus* Thomson, 1863; *Macrocis* Reitter, 1878; *Xestocis* Casey, 1898; *Dimerocis* Peyerimhoff, 1918
  - **Genus:** *Cisarthron* Reitter, 1885
  - **Genus:** *Dichodontocis* Kawanabe, 1994
  - **Genus:** *Dimerapterocis* Scott, 1926
  - **Genus:** *Diphyllocis* Reitter, 1885
  - **Genus:** *Dolichocis* Dury, 1919
  - **Genus:** *Ennearthron* Mellié, 1847
  - **Genus:** *Euxestocis* Miyatake, 1954
  - **Genus:** *Falsocis* Pic, 1916
  - **Genus:** *Hadraule* Thomson, 1863
    - **Synonyms:** *Maphoca* Casey, 1900; *Mapheae* Dalla Torre, 1911; *Pityocis* Peyerimhoff, 1918; *Ennearthon* (*Knablia*) Roubal, 1936
  - **Genus:** *Lipopterocis* Miyatake, 1954
  - **Genus:** *Malacocis* Gorham, 1886
    - **Synonym:** *Brachycis* Casey, 1898
  - **Genus:** *Neoennearthron* Miyatake, 1954
  - **Genus:** *Nipponapterocis* Miyatake, 1954
  - **Genus:** *Nipponocis* Nobuchi et Wada, 1955
  - **Genus:** *Odontocis* Nakane et Nobuchi, 1955
  - **Genus:** *Orthocis* Casey, 1898
    - **Synonym:** *Cis (Mellieicis)* Lohse, 1964
  - **Genus:** *Paraxestocis* Miyatake, 1954
  - **Genus:** *Plesiocis* Casey, 1898
  - **Genus:** *Polynesicis* Zimmerman, 1938
  - **Genus:** *Porculus* Lawrence, 1987
  - **Genus:** *Strigocis* Dury, 1917
  - **Genus:** *Sulcacis* Dury, 1917
    - **Synonym:** *Entypus* Redtenbacher, 1847; *Entypocis* Lohse, 1964
  - **Genus:** *Syncosmetus* Sharp, 1891
    - **Synonym:** *Omogocis* Miyatake, 1954
  - **Genus:** *Trichapus* Friedenreich, 1881
  - **Genus:** *Tropicis* Scott, 1926
  - **Genus:** *Wagaicis* Lohse, 1964
- **Tribe:** Orophiini
  - **Genus:** *Hyalocis* Kawanabe, 1993
  - **Genus:** *Octotemnus* Mellié, 1847
    - Synonyms: *Orophius* Redtenbacher, 1847; *Orophyus* Kiesenwetter, 1877; *Orophinus* Marschall, 1873
  - **Genus:** *Paratrichapus* Scott, 1926
  - **Genus:** *Rhopalodontus* Mellié, 1847
  - **Genus:** *Xylographus* Mellié, 1847
- **Tribe:** Xylographellini Kawanabe et Miyatake, 1996
  - **Genus:** *Scolytocis* Blair, 1928
  - **Genus:** *Xylographella* Miyatake, 1985

ANEXO 2

Dugesiana 10(1): 39, 3 de octubre 2003.

COMENTARIOS AL NÚMERO ANTERIOR

Por un error involuntario, el trabajo de Cristiano Lopes-Andrade: "Two cases of homonymy in the genus *Cis* Latreille (Coleoptera: Tenebrionoidea: Ciidae)" contiene un error. En el segundo párrafo, segunda línea (p. 54) dice: This replacement name is in honor of John F. Lawrence. Debe decir: *This replacement name is in honor of M. Kawanabe*. El editor.