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REVISÃO TAXONÔMICA E ANÁLISE FILOGENÉTICA DE *ALVARINUS* BLANCHARD, 1850 (COLEOPTERA, MELOLONTHIDAE: MACRODACTYLINI)

RECIFE

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Tese apresentada ao Programa de Pós-graduação em Biologia Animal da Universidade Federal de Pernambuco, como requisito para obtenção do título de Doutora em Biologia Animal.

Orientadora: Profª Drª Luciana Iannuzzi

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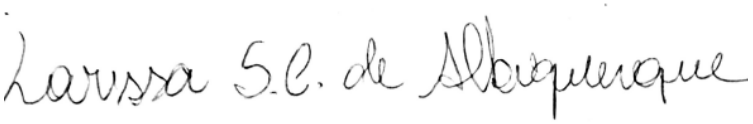

Larissa Simões Corrêa de Albuquerque

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ADVERTÊNCIA

Esta tese não constitui publicação de acordo com o Artigo 9, presente no Código Internacional de Nomenclatura Zoológica da “International Comission on Zoological Nomenclature”, por isso não deve ser considerada para quaisquer atos nomenclaturais relacionados.

Os nomes propostos são um exercício que objetiva correções e sugestões aos possíveis nomes científicos que virão a ser publicados.

RESUMO

Alvarinus Blanchard, 1850 (Melolonthidae, Melolonthinae, Macrodactylini) é um dos 47 gêneros de Macrodactilyni, e está distribuído na região Neotropical. Com o objetivo de avaliar a monofilia de *Alvarinus*, foi conduzida uma análise filogenética, inicialmente com 16 espécies incluídas no gênero. Para isso, foram construídos 53 caracteres morfológicos, com 32 táxons terminais (14 do grupo externo e 18 do grupo interno). De acordo com os resultados obtidos pela análise filogenética, o grupo foi recuperado como polifilético. Para estabelecer sua monofilia, o táxon foi redefinido a partir da seguinte transformação: presença de aba nos parâmeros. *Corminus* Burmeister foi considerado um sinônimo válido de *Alvarinus* Blanchard. *Alvarinus guayaquilanus* (Moser), *A. oblongus* (Moser) e *A. parvulus* (Moser) foram posicionadas em *incertae sedis* de Melolonthinae. *Alvarinus subsericeus* Blanchard e *A. submetallicus* Blanchard foram transferidos para *Plectris* LePeletier & Audinet-Seville, provisoriamente, até que uma revisão mais detalhada deste gênero seja realizada. *Plectris aeneicollis* (Moser) foi transferida para *Alvarinus*. A nova proposta de classificação para *Alvarinus* Blanchard inclui 11 espécies, duas delas novas e descritas neste trabalho. São designados oito lectótipos e propostas quatro novas sinonímias: *Alvarinus maniculatus* (Burmeister, 1855) **syn. nov.** e *Plectris rectangula* Frey, 1967 **syn. nov.** (anteriormente sinonimizado com *Alvarinus pallidipenis* Blanchard, 1850) com *A. hilarii* Blanchard, 1850; *A. luridipennis* (Burmeister, 1855) **syn. nov.** com *A. pallidipennis* Blanchard, 1850; e *A. setulosus* (Moser, 1919) **syn. nov.** com *A. brasiliensis* (Moser, 1919).

Palavras-chave: Cladística; corós do Novo Mundo; nova combinação.

ABSTRACT

Alvarinus Blanchard, 1850 (Melolonthidae, Melolonthinae, Macrodactylini) is one of the 47 genera included in Macrodactilyni, and is distributed on Neotropical region. Aiming to evaluate *Alvarinus* monophyly, a phylogenetic analysis was conducted with all species previously included in this taxon, using 53 morphological characteres, and 32 terminal taxa (14 outgroups and 18 ingroups). The results showed that *Alvarinus* is poliphyletic. To recover its monophyly, this genus was redefined with the following transformation: paramera with flap. *Corminus* Burmeister, 1855 was considered a valid synonym of *Alvarinus*. *Alvarinus guayaquilanus* (Moser), *A. oblongus* (Moser) and *A. parvulus* (Moser) were placed as *incertae sedis* of Melolonthinae. *Alvarinus subsericeus* Blanchard and *A. submetallicus* Blanchard were provisionally transferred to *Plectris* LePeletier & Audinet-Seville, until a detailed review of this genus is performed. *Plectris aeneicollis* (Moser) was transferred to *Alvarinus*. A new classification is proposed for *Alvarinus* which now includes 11 species, with two new species described in the present work. Eight lectotypes are designated, and four synonyms are proposed: *Alvarinus maniculatus* (Burmeister, 1855) **syn. nov.** and *Plectris rectangula* Frey, 1967 **syn. nov.** (previously synonymyzed with *Alvarinus pallidipenis* Blanchard, 1850) for *A. hilarii* Blanchard, 1850; *A. luridipennis* (Burmeister, 1855) **syn. nov.** para *A. pallidipennis* Blanchard, 1850; e *A. setulosus* (Moser, 1919) **syn. nov.** for *A. brasiliensis* (Moser, 1919).

Keywords: Cladistics; New World chafers; new combination.

SUMÁRIO

1 INTRODUÇÃO

A história da classificação de Scarabaeoidea pode ser distinguida em três fases: a primeira compreende o período iniciado pelos estudos de Linnaeus em 1735 até a publicação de Lacordaire no ano de 1856. Este período é caracterizado por publicações que antecederam "A Origem das Espécies", portanto não são influenciadas pelas ideias evolutivas de Charles Darwin (KOHLMANN; MORÓN, 2003). A segunda fase ocorreu entre os anos de 1869 e 1955, e representa uma comparação entre propostas de Coleoptera, a partir de publicações relacionadas a levantamentos regionais e mundiais (KOHLMANN; MORÓN, 2003); A última fase engloba trabalhos publicados após 1957, em que é possível observar influência de teorias evolutivas, utilizando mecanismos fenéticos e filogenéticos (cladística e molecular) (KOHLMANN; MORÓN, 2003; KJER et al. 2016).

Dentro das famílias existentes em Scarabaeoidea, há uma discussão acerca de Scarabaeidae Latreille, 1802 *sensu* LAWRENCE & NEWTON (1995), classificação amplamente aceita, e que engloba tanto besouros coprofagos e copronecrófagos (Scarabaeinae e Aphodiinae), bem como de fitófagos e fitosaprófagos (Cetoniinae, Dynastinae, Melolonthinae e Rutelinae) anteriormente agrupados em Laparosticti e Pleurosticti (ERICHSON, 1847). Esta classificação foi proposta seguindo a localização dos espiráculos abdominais, onde Pleurosticti possuem essas estruturas na região dorsal dos ventritos, enquanto nos Laparosticti os mesmos estão presentes nas membranas intersegmentares que conectam os tergitos aos ventritos (ERICHSON, 1847; KOHLMANN, 2006). Estudos filogenéticos recentes indicam que Scarabaeidae não é um grupo natural (GREBENNIKOV & SCHOLTZ, 2004; AHRENS, SCOTT; VOGLER, 2011), e recentemente foi proposta a revalidação da família Melolonthidae Leach, 1819, a partir de uma compilação destes trabalhos, que passa a incluir apenas as subfamílias com hábito fitófago e fitosaprófago, e propõem que a classificação de Laparosticti e Pleurosticti não seja mais utilizada (CHERMAN & MORÓN, 2014).

Dentre as mais de 170 famílias da ordem Coleoptera, Melolonthidae Leach, 1819 (ENDRÖDI, 1966; CHERMAN; MORÓN, 2014) é uma das mais diversas, com 17.000

espécies. Recentemente, a família foi revalidada e reune suas espécies em seis subfamílias: Dynastinae, Euchirinae, Hopliinae, Melolonthinae, Sericinae e Rutelinae (CHERMAN; MORÓN, 2014).

Melolonthinae Samouelle, 1819 uma das maiores subfamílias de Scarabaeoidea, possui aproximadamente 750 gêneros e 11.000 espécies e com ampla distribuição geográfica (NEL; SCHOLTZ, 1990; EVANS, 2005). No Novo Mundo está representada por 122 gêneros e 2.705 espécies (EVANS, 2003; NEITA-MORENO ET AL., 2012). Na fase adulta, representantes dos grupos podem não se alimentar, ou serem estritamente fitófagos, consumindo folhas, flores ou pequenas sementes (RITCHER, 1958). A subfamília é representada por besouros entre 3-60 mm de comprimento (SCHOLTZ; GREBENNIKOV, 2005), que possuem coloração amarronzada, em alguns casos são metálicos, e frequentemente com alta densidade de pelos recobrindo o corpo. A maior parte das espécies deste táxon não apresenta ornamentações em forma de chifres ou cornos, embora *Ceratolontha venezuelae* Arrow, 1948 (Macrodactylini) tenha duas projeções em forma de chifres no clípeo (KATOVICH, 2008) e *Rhinaspis ohausi* Moser, 1921 um tubérculo no pronoto (FUHMANN; VAZ-DE-MELLO, 2017).

Ainda existem problemas em relação ao real número de tribos e gêneros de Melolonthinae, e isso se deve principalmente à escassez de estudos taxonômicos e filogenéticos (SMITH, 2006). Pelo fato das espécies desta subfamília apresentarem grande importância econômica, por abrigar grupos conhecidamente pragas agroecológicas, especialmente em sua fase larval (LAWRENCE; NEWTON, 1995), é fundamental o reconhecimento das espécies deste grupo, a fim de que o controle de pragas seja mais efetivo (CHERMAN ET. AL, 2013).

Dentre as tribos mais diversas da subfamília, Macrodactylini se destaca com 47 gêneros e 1025 espécies (SMITH; MONDACA, 2015). Recentemente, Macrodactylini foi alvo de revisão filogenética para o reestabelecimento dos limites genéricos (KATOVICH, 2008). Entretanto, nesta última filogenia, não foram incluídos todos os gêneros preexistentes da tribo (80 táxons), sendo isso justificado pela falta de acesso e consequente análise dos exemplares-tipo (KATOVICH, 2008).

Dos 47 gêneros atuais de Macrodactylini, encontra-se *Alvarinus* Blanchard, 1850 que possui 16 espécies (EVANS; SMITH, 2009; SMITH; MONDACA, 2015). Este gênero apresenta ampla distribuição na América do Sul, registrafo para os seguintes países: Argentina, Bolívia, Brasil e Equador, sendo o Brasil o país que abriga a maior parte da sua diversidade, com registros para 14 das 16 espécies (EVANS & SMITH, 2009). De acordo com informações contidas nas descrições originais, o gênero está distribuído nos seguintes estados brasileiros: Bahia, Goiás, Rio de Janeiro, Espírito Santo e Minas Gerais, porém estes dados demonstram que existem grandes lacunas relativas à sua ocorrência, que podem ser explicadas pela escassez de coletas ou ausência de identificação do material depositado em coleções científicas (BLANCHARD, 1850; BURMEISTER, 1855; MOSER, 1919, 1921, 1924).

Alvarinus foi descrito a partir das espécies: *A. hilarii* Blanchard, 1850, *A. pallidipenis* Blanchard, 1850, *A. submetallicus* Blanchard, 1850 e *A. subsericeus* Blanchard, 1850. Levando em consideração o mais recente trabalho taxonômico realizado com Macrodacylini, *Corminus* Burmeister, 1855, que apresentava 12 espécies, tornou-se sinônimo júnior de *Alvarinus*, que reunia quatro (EVANS & SMITH, 2007; KATOVICH, 2008), totalizando em 16 espécies atualmente. Apesar disso, até o momento não foi realizada uma revisão taxonômica do gênero, portanto, a partir desta problemática, o objetivo deste trabalho é avaliar a monofilia de *Alvarinus* Blanchard, 1850, bem como verificar o relacionamento entre as espécies do gênero e revisar a taxonomia do mesmo.

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2 ANÁLISE FILOGENÉTICA DE *ALVARINUS* BLANCHARD, 1850 (MELOLONTHIDAE, MELOLONTHINAE, MACRODACTYLINI)

INTRODUÇÃO

Macrodactylini Kirby, 1837 é uma das tribos mais representativas de Melolonthinae Samouelle, 1819 (Coleoptera, Melolonthidae) com 47 gêneros e aproximadamente 1025 espécies (SMITH; MONDACA, 2015). Com base na necessidade do reestabelecimento dos limites genéricos, a tribo foi alvo de revisão taxonômica e análise filogenética (KATOVICH, 2008). Esse autor, em sua análise, não utilizou todas as espécies tipo dos gêneros da tribo, propondo sinonímias, sem testá-las, bem como sem a devida análise dos exemplares-tipo. Foram desconsiderados 12 dos 80 gêneros preexistentes no grupo, sendo isso justificado pela falta de acesso e consequente análise dos mesmos (KATOVICH, 2008).

Dentro desta tribo, incluído *Alvarinus* Blanchard, 1850. Este grupo está amplamente distribuiído na América do Sul, e registrado para os seguintes países: Argentina, Bolívia, Brasil e Equador, em que o Brasil é país que abarca a maior parte da sua diversidade, com registros de 14 espécies (EVANS & SMITH, 2009). De acordo com a hipótese proposta por KATOVICH (2008), *Corminus* Burmeister, 1855, que apresentava 12 espécies, tornou-se sinônimo júnior de *Alvarinus*, que reunia quatro (EVANS & SMITH, 2007), totalizando, atualmente, 16 espécies. A hipótese proposta por KATOVICH (2008) indica que: as peças bucais, especialmente de mandíbula e mento, de *Alvarinus* Blanchard, 1850 representam uma forma transicional entre as duas grandes linhagens, indicadas como “Clado 1” e “Clado 2”.

Além disso, na matriz de dados desse trabalho, não foi discriminada uma linha para indicar os caracteres de *Corminus canescens* Burmeister, 1855, levantando-se questionamentos em relação a sinonímia de *Corminus* com *Alvarinus* estabelecida por ele. O autor apontou apenas *A. hilarii*, espécie tipo do gênero, sem incluir uma linha para *C. canescens*, espécie-tipo de *Corminus* codificando estados distintos para o mesmo caráter. Não fica claro, nessa análise, se as variações são intraespecíficas, ou se são estados presentes em *A. hilarii* e *C. canescens*. A partir desta problemática, o objetivo

deste trabalho é avaliar a monofilia de *Alvarinus* Blanchard, 1850 e propor hipóteses de o relacionamento entre as espécies do gênero.

MÉTODOS

Levantamento dos caracteres

Foram estudados cerca de 200 exemplares adultos das espécies de *Alvarinus* e dos grupos externos foram analisados a partir de visitas e empréstimos de coleções entomológicas nacionais e internacionais (Tab. 1), e o levantamento dos caracteres foi realizado por meio de observações no estereomicroscópio Zeiss Stemi DV4, bem como a partir das descrições originais dos táxons. Os caracteres utilizados foram de morfologia externa. As medições foram efetuadas a partir da utilização de uma régua graduada e também de ocular micrométrica acoplada ao estereomicroscópio Leica MZ6. As medições foram transformadas em caracteres descritivos. As fotografias foram realizadas com câmera digital acoplada à lupa de automontagem Leica M205C e processadas a partir do software Leica Application Suit (LAS, version 6.0), utilizadas também para a análise dos caracteres.

Grupo interno (Tab. 1 e 2)

O grupo interno inclui as 18 espécies, das quais 16 são *Alvarinus* Blanchard *sensu* Katovich (2008) e duas espécies novas a serem descritas no Capítulo II (Tab. 2).

Grupos externos (Tab. 1 e 3)

Neste capítulo, *Plectris rectangula* Frey, 1967, foi considerada uma espécie válida, assim utilizado como grupo externo, pois ao avaliar-se o espécime tipo, concluiu-se que a sinonímia proposta por FREY (1969) não era válida, não sendo este sinônimo júnior de *Alvarinus pallidipennis* Blanchard. No capítulo dois, a sinonímia será reavaliada.

Parte dos terminais foi escolhida para verificar se todas as espécies de *Alvarinus* realmente faziam parte do grupo. Por isso, a partir da observação de espécimes em museus internacionais, e considerando a semelhança entre espécimes de *Plectris* e de *Alvarinus*, foram estudados *Plectris castaneipennis* (Moser, 1921), *Plectris fuscoviridis* (Moser, 1918), *P. paranensis* (Moser, 1921), *P. viridifusca* (Moser, 1918), para investigar o que foi proposto por LACORDAIRE (1856), e *P. tomentosa* LePeletier & Audinet-Serville, 1828, por ser a espécie tipo do gênero. LACORDAIRE (1856) revisou o gênero *Alvarinus*, e observou que *A. submetallicus* e *A. subsericeus* provavelmente não faziam parte do mesmo grupo de *A. hilarii* e *A. pallidipenis*, no entanto, não propõe nenhuma mudança taxonômica. Nesse trabalho, o autor apenas discute que *A. subsericeus* apresentava caracteres semelhantes a *Clavipalpus* Laporte, 1832. Além disso, táxons dos gêneros utilizados por KATOVICH (2008) também foram selecionados, como *Clavipalpus dejeani* Laporte, 1829, *Isonychus sulphureus* Mannerheim, 1829, para testar os caracteres transicionais de mandíbula e mento observados pelo autor. De *Philochloenia* Dejean, 1833 foi estudada *Philochloenia sulcatum* Blanchard, 1850, que apesar de não ser a espécie-tipo, foi confirmada que está inclusa no gênero (Fuhmann, comunicação pessoal). Este táxon foi utilizado porque *Plectris aeneicollis* (Moser), táxon do grupo externo deste trabalho, foi originalmente descrita no gênero. Também foram utilizadas duas espécies de *Macrodactylus* Dejean, 1821: *Macrodactylus suturalis* Mannerheim, 1829 e *M. subspinosus* (Fabricius, 1775), este último com enraizador, por se tratar da espécie tipo de Macrodactylini.

Análise filogenética

A lista de caracteres abaixo segue com os valores de índice de consistência (IC) e retenção (IR) ao lado de cada caráter. Os caracteres e os estados foram levantados a partir da observação do material disponível, além de caracteres já descritos nos trabalhos de AHRENS (2006), CHERMAN ET AL. (2016), FUHRMANN (2015) e KATOVICH (2008).

A matriz de caracteres foi editada a partir do programa Mesquite v. 3.10 (MADDISON; MADDISON, 2015). A polarização dos caracteres foi realizada através

de comparação com o grupo externo, a priori (NIXON; CARPENTER, 1993). Os caracteres foram tratados de forma não ordenada e sem pesagens. Os dados não aplicáveis foram tratados com o símbolo "-", e indisponíveis como "?". Os caracteres foram tratados como binários, e descritos seguindo a proposta de SERENO (2007). As autapomorfias foram descritas na lista de caracteres, no entanto, não foram utilizadas na análise.

A análise de Parcimônia foi conduzida através do programa TNT v. 1.5 (GOLOBOFF; FARRIS; NIXON, 2008), utilizando-se a estratégia de busca "Traditional Search". As configurações utilizadas foram: "hold "10000", "Random seed" (1, 10, 100) para verificar se alterava o número de árvores mais parcimoniosas, "Repls. 6500", "tree bissection reconnection (TBS)", "trees to save per replication 10", "colapse trees after search".

As árvores obtidas foram resumidas à topologia do Consenso Estrito. O tamanho da árvore, índice de consistência (IC) e de retenção (IR), tanto para as árvores, quanto para os caracteres, foram calculados pelo TNT v. 1.5 (GOLOBOFF; FARRIS; NIXON, 2008). Para analisar o suporte dos ramos, foi calculado o Bremer (BREMER, 1994).

Os cladogramas recuperados foram observados a partir do programa WINCLADA v. 1.00.08 (NIXON, 2008), e editados com o auxílio do Adobe Illustrator CS6 (ADOBE SYSTEMS INC.).

RESULTADOS E DISCUSSÃO

Foram levantados 53 caracteres para 32 táxons (Tabs. 2-3), sendo um relacionado à pilosidade do corpo; 22 relacionados à cabeça, 23 ao tórax e 10 ao abdome, descritos abaixo e plotados na matriz de dados (Tab. 3).

Descrição dos caracteres para a análise filogenética

Corpo

1- Cerdas, superfície dorsal do corpo, tipo: (0) piliforme (Fig. 3); (1) escamiforme (Fig. 4) (IC = 1.0; IR = 1.0).

Cerdas piliformes são projeções cuticulares em forma de pelo, tendo a sua largura diminuída em direção ao ápice. Cerdas escamiformes apresentam morfologia semelhante a uma escama, apresentando maior diâmetro na região média e ápice afilado

Cabeça

2- Parietal, área pós-ocular: (0) escondida (Fig. 3); (1) visível (Fig. 4). (IC = 1.0; IR = 1.0). Na condição escondida, o pronoto recobre a região parietal.

3- Sutura fronto-clipeal: (0) distinta (Fig. 1); (1) indistinta. (IC = 1.0; IR = 1.0). Neste caso, a sutura fronto-clipeal indistinta é quando a pontuação da fronte e do clípeo não permite a visualização da mesma.

4- Clípeo, margem anterior, conformação: (0) voltada para cima (Fig. 5); (1) não voltada para cima (Fig. 1) (IC = 1.0; IR = 1.0). Margem, quando voltada para cima, o clípeo apresenta concavidade.

5- Clípeo, margem anterior, forma: (0) sinuosa (Fig. 6); (1) truncada (Fig. 7) (IC: 0.25; IR: 0.40).

6- Clípeo, margens laterais: (0) convergentes (Fig. 6); (1) paralelas (Fig. 3) (IC = 1.0; IR = 1.0). Na"convergentes", o clípeo tem o formato trapezoidal, enquanto na "paralelas", sua forma é quadrangular.

7- Clípeo, borda látero-posterior: (0) não cobrindo o *canthus* ocular (Fig. 15); (1) cobrindo parcialmente o *canthus* ocular (Fig. 1) (IC =0.25; IR = 0.66). Na condição 1, a borda posterior do clípeo é projetada, cobrindo o *canthus* ocular.

8- Clípeo, borda lateral, região média: (0) reta ou fracamente constrita (Fig.7); (1) fortemente constrita (Fig. 9) (IC =0.16; IR = 0.37). Quando a borda lateral apresenta uma constrição pronunciada na região média, ocorre a formação de um lobo na região lateral do clípeo.

9- Clípeo, vista ventral, área entre a margem e o labro: (0) reduzida (Fig. 10); (1) ampla (Fig. 11) (IC = 0.50; IR = 0.66). Área reduzida apresenta largura da margem anterior do clípeo mais seis vezes maior em relação comprimento até a inserção do labro. Área ampla, o comprimento da margem anterior do clípeo é duas vezes maior em relação ao comprimento da região ventral, até a inserção do labro.

10- Clípeo, vista ventral, disco, pilosidade: (0) ausente; (1) presente. (IC: 0.25; IR: 50). O disco do clípeo, vista ventral ventral, é a região central do mesmo, que pode apresentar cerdas, ou não.

11- Labro, vista frontal, visibilidade: (0) totalmente visível (Fig.12); (1) parcialmente visível (IC = 0.33; IR = 0.77). As espécies que apresentam labro parcialmente visível, em vista frontal. A estrutura não é visível em vista dorsal, e reduzida, caráter presente em

diversos grupos de Scarabaeoidea e se comportou de forma homoplástica (NEL & DE VILLIERS, 1988; AHRENS, 2006).

12- Labro, face frontal: (0) sinuosa (Fig. 12); (1) reta ou fracamente sinuosa (Fig. 11) (IC = 0.25; IR = 0.66). Esse caráter foi definido, por Katovich (2008) como "fortemente ovado" e "estreitamente ovado. Considerando a morfologia da estrutura, identificou-se que seria mais aquedado o tratamento aqui utilizado.

13- Mandíbula, concavidade ventral: (0) ausente ou rasa (Fig. 13); (1) profunda (Fig. 14). (IC: 0.50; IR: 0.66).

14- Mandíbula, área molar: (0) ausente; (1) presente (Fig. 14). A mola é uma área rugosa, ou carenada, da mandíbula, localizada na região posterior da mesma, que apresenta função de triturar o alimento (COSTA; IDE; SIMONKA, 2006). Autapomorfia de *Philochloenia sulcatum*.

15- Mandíbula, área molar, ranhuras: (0) desenvolvidas (Fig. 15); (0) reduzidas (Fig. 16). (IC: 1.0; IR: 1.0)

16- Mandíbula, área molar membranosa: (0) ausente; (1) presente (Fig. 15). Autapomorfia *Philochloenia sulcatum*.

17- Mandíbula, dente incisor: (0) ausente (Fig. 13); (1) presente (Fig. 14). (IC: 1.0; IR: 1.0)

18- Maxila, gálea, dentes: (0) ausentes (Fig. 17); (1) presentes (Fig. 18). (IC: 0.20; IR: 0.50)

19- Maxila, gálea, dentes, tamanho: (0) desenvolvidos (Fig. 19); (1) reduzidos (Fig. 18). (IC: 1.0; IR: 1.0). (Contingente ao estado 1 do caráter 18).

20- Maxila, palpo, palpômero IV concavidade dorsal: (0) ausente (Fig. 20); (1) presente (Fig. 7). (IC: 0.33; IR: 0.71)

21- Mento, superfície: (0) plana (Fig. 21); (1) convexa (Fig. 12) (IC = 0.33; IR = 0.66).

22- Mento, concavidade longitudinal: (0) ausente (Fig. 21); (1) presente (Fig. 22). (IC = 0.33; IR = 0.71).

23- Lábio, premento, margem anterior: (0) truncada (Fig. 23); (1) sinuosa (Fig. 24). (IC = 1.0; IR = 1.0).

Tórax

Protórax

24- Pronoto: (0) curto (Fig. 25); (1) longo (Fig. 26) (IC = 1.0; IR = 1.0). Pronoto curto: largura mais de uma vez maior em relação ao comprimento. Pronoto longo: comprimento mais que uma vez maior em relação à largura.

25- Pronoto, disco, pontuação: (0) densa (Fig. 26); (1) esparsa (Fig. 27). (IC = 1.0; IR = 1.0).

26- Pronoto, disco, cerdas: (0) ausente (Fig. 28); (1) presente (Fig. 27). (IC= 0.25; IR=0)

27- Pronoto, disco, cerdas, tamanho: (0) longas (Fig. 5); (1) curtas (Fig. 7). (IC= 1.0; IR=1.0)

28- Pronoto, margem posterior, lobo médio: (0) ausente (Fig. 26); (1) presente (Fig. 28) (IC = 0.25; IR = 0.66).

29- Tíbias, esporão tibial: (0) presente; (1) ausente (Fig. (IC = 0.20; IR = 0.60).

30- Esporão tibial, tamanho: (0) longo; (1) curto (IC = 50; IR = 83) (Contingente ao estado 0 do caráter 30). Esporão tibial longo apresenta comprimento mais que quatro vezes a sua largura. Esporão tibial curto equivale à comprimento ser duas vezes a largura do mesmo.

31- Tíbias, dentes tibiais, dente I: (0) presente; (1) ausente (IC = 25; IR = 78).

32- Tíbia, região proximal, margem externa: (0) projetada; (0) não projetada. (IC = 1.0; IR = 1.0). No gênero *Macrodacylus*, a protíbia apresenta uma forte dilatação, formada pela projeção da margem externa proximal.

33- Pré-tarso, empódio, superfície dorsal, carena longitudinal: (0) ausente; (1) presente (Fig. 31) (IC = 0.50; IR = 0.80). Na condição presente, o empódio apresenta uma elevação longitudinal, em forma de carena. Este caráter está presente no empódio de todas as penas.

Mesotórax

34- Escutelo, divisão escuto/escutelo: (0) ausente (Fig. 26): (1) presente (Fig. 27). (IC = 1.0; IR = 1.0). *Macrodactylus* e *Isonychus* não apresentam divisão, entre escutelo e escuto. Quando presente, é indicada por uma carena.

35- Escutelo, margem anterior, projeção mediana: (0) ausente; (1) presente (IC = 33; IR = 66) (Fig. 31). Quando presente, a projeção mediana se dá em forma de dente, de ápice agudo.

36- Escutelo, região posterior, forma: (0) arredondado (Fig. 31); (1) subtriangular (Fig. 28) (IC = 33; IR = 77).

37- Élitro, epipleura, dobra: (0) conspícua (Fig. 32); (1) inconspícua (Fig. 33) (IC = 1.0; IR = 1.0). A epipleura, em Scarabaeoidea, é considerada a dobra das margens laterais dos élitros (LAWRENCE et al., 2010).

38- Tíbia, superfície externa, ornamentação: (0) ausente; (1) presente (Fig. 34) (IC = 1.0; IR = 1.0). A condição presente se refere a dentes na superfície externa da tíbia, o número varia entre as espécies.

39- Tíbia, superfície externa, carenas transversas: (0) ausente; (1) presente. (IC = 0.50; IR= 0.75). Estas carenas são projeções do tegumento, onde estão inseridas, em forma de fileira, cerdas espiniformes.

40- Tíbia, margem distal: (0) truncada; (1) sinuosa (Fig. 34) (IC = 1.0; IR = 1.0).

Metatórax

41- Fêmur, formato: (0) estreito (Fig. 35); (1) largo (Fig. 36). (IC = 0.50; IR = 0.66). Fêmur estreito: comprimento três ou mais vezes maior em relação à largura. Fêmur largo: Comprimento menos de três vezes maior em relação à largura.

42- Fêmur, dilatação apical: (0) gradual (Fig. 37); (1) abrupta (Fig. 38). (IC = 0.33; IR = 0.66).

43- Tíbia, carenas transversas: (0) ausente; (1) presente (Fig. 38). (IC = 0.16; IR = 0.37). A mesma explicação do caráter 39.

Abdome

44- Pigídio, formato: (0) longo; (1) curto (Fig. 38) (IC = 1.0; IR = 1.0). Pigídio longo: comprimento mais de uma vez maior em relação à largura. Pigídio curto: largura mais de uma vez maior em relação ao comprimento.

Edeago

Neste estudo, foi adotada a terminologia utilizada por Ahrens (2006), para as regiões da falobase sensu lato, que são apódema da falobase, localizada na porção distal, e falobase sensu stricto, na porção proximal (Figs. 40-41).

45- Falobase, apódema basal, comprimento: (0) curto; (1) longo (IC =0.50; IR = 0.91). Apódema basal curto: comprimento é menos que uma vez a sua largura. Na condição "longo", o comprimento é mais que duas vezes a largura. No estado "curto", a falobase o comprimento é menos que uma vez a sua largura.

46- Falobase, porção distal, comprimento: (0) longo (Fig. 40); (1) curto (Fig. 41) (IC =0.33; IR = 0.84). Na condição “longo”, o comprimento é mais que duas vezes a largura. No estado “curto”, a falobase o comprimento é menos que uma vez a sua largura.

47- Falobase, face dorsal, depressão mediana: (0) ausente (Fig. 40); (1) presente (fig. 41) (IC = 0.50; IR = 0.92). A depressão, quando presente, está localizada entre os parâmeros e o apódema da falobase, formando dois lobos laterais, na face dorsal.

48- Parâmeros, aba: (0) ausente (Fig. 42); (1) presente (Fig. 43) (IC = 0.50; IR = 0.92). Aba, quando presente, é uma projeção da margem interna do parâmero, com tegumento fino.

49- Parâmeros, aba, comprimento: (0) longa (Fig. 43); (1) curta (Fig. 44) (IC = 0.50; IR = 0.75). (Contingente ao estado 1 do caráter 34). Na condição “longa”, a aba atinge ou ultrapassa a região da porção distal do comprimento do parâmero.

50- Parâmeros, dente látero-apical: (0) ausente (Fig. 45); (1) presente (Fig. 46) (IC = 50; IR = 90).

51- Parâmeros, dente latero-apical, tamanho: (0) desenvolvido (Fig. 46); (1) reduzido (Fig. 47) (IC = 1.0; IR = 1.0) (Contingente ao estado 1 do caráter 50).

52- Parâmeros, região dorsal, porção distal, torção: (0) ausente (Fig. 43); (1) presente (Fig. 48). (IC = 1.0; IR = 1.0) A torção da porção apical se refere a um dobramento da margem interna do parâmero, no sentido externo.

53- Parâmeros, vista frontal, ápice, deflexão convergente (IC = 0.50; IR = 0.50): (0) ausente (Fig. 45); (1) presente (Fig. 49).

A análise filogenética resultuou em 12 árvores mais parcimoniosas, gerando um consenso estrito com um total de 118 passos (IC=0.43; IR=0.76). O consenso estrito (Fig. 1) não recuperou o gênero *Alvarinus* Blanchard como monofilético, na forma como se encontra, como observado no clado A (Fig. 2).

Alvarinus submetallicus Blanchard, junto com *Plectris viridifusca* (Moser) e *P. fuscoviridis* (Moser), integraram um grupo monofilético (Clado A), fora de *Alvarinus*, reunidos por duas transformações: presença de aba nos parâmeros (49:1) e presença de torção apical dos parâmeros (53:1) (Fig. 2), sustentado por um suporte de de Bremer igual à 2. Entretanto, no entanto, este clado não formou um agrupamento monofilético com *Plectris tomentosa* LePeletier & Audinet-Serville, 1828, espécie-tipo do gênero. Estes resultados mostram que, possivelmente, *Plectris* não é um grupo natural, no entanto, *A. submetallicus* faz parte de uma linhagem que está alocada neste táxon, atualmente. Por isso, esta espécie será transferida para *Plectris* até que uma revisão do gênero seja realizada.

O clado C (Fig. 1), formado por *Alvarinus subsericeus* Blanchard, *Plectris castaneipennis* (Moser) e *P. paranensis* (Moser), foi suportado por sete transformações: concavidade presente no palpômero IV maxilar (21:1); esporão protibial longo (31:0); superfície dorsal do empódio com carena longitudinal (34:1); margem anterior do escutelo com projeção mediana (36:1); superfície externa da mesotíbia ornamentada com dentes (39:1); margem distal da tíbia sinuosa (41:1); pigídio curto (45:1).

De acordo com o posicionamento filogenético de *Alvarinus subsericeus* (clado C), foi possível observar que esta espécie foi recuperada em um clado monofilético que reúne *Plectris tomentosa*, *P. castaneipennis* (Moser) e *P. paranensis* (Moser) e duas espécies indeterminadas de *Paulosawaya* Martínez & d'Andretta, 1956 (Fig. 2) (Fuhrmann, comunicação pessoal), gênero revalidado por Fuhmann & Vaz-de-Mello (2017). Por isso, no presente trabalho (no capítulo II), este táxon será transferido provisoriamente para *Plectris*, não se tratando, portanto, de *Alvarinus*. Lacordaire (1856) já havia indicado *A. submetallicus* e *A. subsericeus* poderiam não fazer parte de *Alvarinus*, como indicado através da hipótese gerada no presente trabalho.

Também se não se uniram à *Alvarinus*, *A. oblongus* (Moser) e *A. parvulus* (Moser). Contudo, não se uniram em agrupamentos com outras espécies dos grupos externos. Com este resultado, não é possível alocá-las em nenhum dos gêneros estudados no presente trabalho. Pelo mesmo motivo, *Alvarinus guayaquilanus*, recuperado no clado D, como grupo irmão de *Philochloenia sulcatum* + *Clavipalpus dejeani*, reunidos por duas transformações: carenas transversais da mesotíbia presentes (40:1); apódema basal da falobase longo (46:1), sustentados por um baixo suporte de Bremer (Fig. 2). Estas espécies serão tratadas como *incertae sedis*.

Alvarinus Blanchard, 1850 *sensu novo*

A análise filogenética realizada demonstrou que *Alvarinus* é um grupo polifilético. Para recuperar sua monofilia, uma nova hipótese é proposta, considerando as remoções das espécies apontadas anteriormente. Apesar do baixo valor de suporte de Bremer (Fig. 2), o gênero *Alvarinus* ***sensu novo***, indicado pelo clado E, na árvore de consenso (Fig. 1), é sustentado pela seguinte transformação: presença de aba nos parâmeros (49:1).

Observando a definição original de *Alvarinus*, um caráter foi aplicado neste estudo: face frontal do labro reta ou fracamente sinuosa (12:1), considerado por Blanchard (1850) como labro pouco emarginado. Este foi homoplástico, com baixos índices de consistência e retenção.

Os caracteres morfológicos levantados para *Alvarinus brasiliensis* e *A. setulosus* indicam que esta última é seu sinônimo júnior (Clado F, Fig. 1), o que será discutido no capítulo II. No cladograma de consenso estrito (Fig. 1), cinco espécies, *Alvarinus bahianus*, *A. canescens*, *A. rufofuscus*, *A. testaceipennis*, *Alvarinus paschoali*. **sp. nov.** e *A. varians* ocorreram em politomia nos clados G e I. Apesar das relações internas de *Alvarinus* não estarem totalmente resolvidas, no consenso estrito, foram recuperados, principalmente, dos seguintes clados: F, que reúne (*Alvarinus brasiliensis* + *A. setulosus*), com uma transformação, referente ao dente I da protíbia presente (29:1); H (Fig. 1) com (*Plectris aeneicollis* + *Alvarinus vazdemelloi* **sp. nov.**), suportado pela ausência do lobo médio na margem posterior do pronoto (29:0), caráter homoplástico em *Alvarinus hilarii* e *A. pallidipennis*. A partir dos resultados obtidos, *Plectris aeneicollis*, tratada como grupo externo, mostrou-se relacionada à *Alvarinus* por compartilhar as sinapomorfias

indicadas pela análise. A transferência desta espécie para *Alvarinus* será discutida no Capítulo II;

O clado I (Fig. 1), é suportado por seis transformações: labro parcialmente visível em vista frontal (11:1); face frontal do labro reta ou fracamente sinuosa (12:1); glálea com dentes (18:1); dentes da gálea reduzidos (19:1); esporão protibial ausente (30:0); dente I da protíbia ausente (32:0), e agrupa *Alvarinus bahianus*, *A. canescens*, *A. luridipennis*, *A. pallidipennis*, *A. hilarii*, *A. maniculatus* e *Plectris rectangula*. Este agrupamento engloba o clado K (Fig. 1), formado por *Alvarinus pallidipennis* e *A. luridipennis*, e o clado L (Fig. 1), configurado por uma politomia das espécies *A. hilarii*, *A. maniculatus* e *Plectris rectangula*, no consenso estrito. A partir dos estudos morfológicos e observação dos tipos destes táxons, foi possível constatar que *A. luridipennis* Burmeister e *A. pallidipennis* Blanchard tratam-se da mesma espécie. Esta nova combinação será detalhadamente discutida no capítulo dois. O mesmo ocorreu com as espécies presentes no clado K e F (Fig. 2). Neste caso, *Plectris rectangula*, era considerada sinônimo júnior de *A. pallidipennis*, por Frey (1969). Entretanto, analisando a descrição da espécie (Frey, 1967) e os dados referentes à localidade tipo, presente na etiqueta do material analisado, encontrou-se evidências *P. rectangula* é sinônimo júnior de *A. hilarii*.

Foram utilizados caracteres levantados a partir do material disponível, além de informações provenientes do trabalho de KATOVICH (2008), que utilizou, principalmente, informações provenientes das peças bucais dos táxons estudados. Os resultados confirmam a hipótese de KATOVICH (2008), que *Corminus* seria sinônimo júnior de *Alvarinus*. Diante do exposto, foi possível observar que *Alvarinus* Blanchard, 1850 trata-se de um gênero com 11 espécies, restrito ao território brasileiro.

CONCLUSÃO

Alvarinus Blanchad, 1850 é um grupo polifilético, na forma como se encontra. *Corminus* Burmeister, 1855 foi recuperado como sinônimo júnior de *Alvarinus*, corroborando a hipótese de Katovich (2008).

De acordo com a hipótese proposta, *Alvarinus submetallicus* Blanchard e *A. subsericeus* Blanchard não fazem parte de *Alvarinus*. A primeira será transferida para *Plectris* LePeletier & Audinet-Serville, e a segunda para *Paulosawaya* Martínez & d'Andretta.

Alvarinus oblongus (Moser), *A. parvulus* (Moser), *A. guayaquilanus* (Moser), não fazem parte do gênero *Alvarinus,* no entanto, não foi encontrado um posicionamento adequado para estas espécies.

O relacionamento interno de *Alvarinus* ainda não está totalmente bem resolvido, no entanto *A. luridipennis*, assim como, *Plectris rectangula* e *A. maniculatus*, são novas sinonímias de *A. pallidipennis* e *A. hilarii*, respectivamente. *Alvarinus setulosus* é sinônimo júnior de *A. brasiliensis*. Além disso, foi encontrada uma nova combinação, em que *Plectris aeneicollis* passa a fazer parte de *Alvarinus*.

A nossa proposta de classificação recupera a monofilia do gênero, que passa a integrar 11 espécies.

TABELAS

Tabela 1. Lista de coleções visitadas ou que emprestaram o material examinado no presente trabalho.

CEIOC	Coleção Entomológica do Instituto Oswaldo Cruz, Rio de Janeiro, Brasil (Jane Costa).
CEMT	Coleção Entomológica Universidade Federal de Mato Grosso, Cuiabá, Brasil (Fernando Zagury Vaz-de-Mello).
DZUP	Coleção Entomológica Pe. Jesus Santiago Moure do Departamento de Zoologia da Universidade Federal do Paraná, Curitiba, Brasil (Lúcia Massutti de Almeida).
DZRJ	Coleção Entomológica do Departamento de Zoologia da Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brasil (Jorge Luiz Nessimian).
EPGC	Everardo and Paschoal Grossi Collection, Nova Friburgo, Brasil (Everardo Grossi).
INPA	Instituto Nacional de Pesquisas da Amazônia (Márcio Luiz de Oliveira), Manaus, Brasil.
MLUH	Martin Luther Universität, Halle, Alemanha (Karla Schneider).
MNHN	Muséum national d'Histoire naturelle, Paris, França (Olivier Montreuil).
MNHUB	Museum für Naturkunde der Humboldt-Universität, Berlim, Alemanha (Johannes Frisch).
MNRJ	Museu Nacional do Rio de Janeiro, Rio de Janeiro, Brasil (Marcela L. Monné).
MZUSP	Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil. (Sônia Casari).
NHM	Natural History Museum, Londres, Inglaterra (Max Barcley).
NMBS	Naturhistorisches Museum Basel, Basiléia, Suíça (Eva Sprecher).

Tabela 2. Lista das espécies analisadas de *Alvarinus* Blanchard, incluindo informações sobre material tipo observado para a análise filogenética.

Espécie	Tipo	Coleção depositada
(1) *Alvarinus bahianus* (Moser 1919)	ST	MNHUB
(2) *Alvarinus brasiliensis* (Moser 1919)	ST	MNHUB
(3) *Alvarinus canescens* (Burmeister, 1855)	ST	MLUH
(4) *Alvarinus guayaquilanus* (Moser, 1921)	ST	MNHUB
(5) *Alvarinus hilarii* Blanchard, 1850	ST	MNH
(6) *Alvarinus luridipenni*s (Burmeister, 1855)	ST	MLUH
(7) *Alvarinus maniculatus* (Burmeister, 1855)	ST	MLUH
(8) *Alvarinus oblongus* (Moser, 1919)	ST	MNHUB
(9) *Alvarinus pallidipennis* Blanchard, 1850	ST	MNH
(10) *Alvarinus parvulus* (Moser, 1919)	ST	MNHUB
(11) *Alvarinus rufofuscus* (Moser, 1924)	ST	MNHUB
(12) *Alvarinus setulosus* (Moser 1919)	ST	MNHUB
(13) *Alvarinus submetallicus* Blanchard, 1850	ST	MNH
(14) *Alvarinus subsericeus* Blanchard, 1850	ST	MNH
(15) *Alvarinus testaceipennis* (Moser, 1921)	ST	MNHUB
(16) *Alvarinus varians* (Moser, 1921)	ST	MNHUB
(17) *Alvarinus* vazdemelloi **sp. nov**		DZUP
(18) *Alvarinus paschoali* **sp. nov.**		EPGC

Tabela 3. Lista de espécies analisadas do grupo externo. Traço (-) indica material não tipo.

Espécie	Tipo	Coleção depositada (Acrônimos)
(1) *Clavipalpus dejeani* Laporte, 1832	-	CE-UFPE
(2) *Isonychus sulphureus* Mannerheim, 1829	-	MZUSP
(3) *Macrodactylus subspinosus* (Fabricius, 1775)	-	DZUP
(4) *Macrodactylus suturalis* Mannerheim, 1829	-	DZRJ
(5) *Philochloenia sulcatum* Blanchard, 1850	-	MZUSP
(6) *Paulosawaya* sp. 1	-	MZUSP
(7) *Paulosawaya* sp. 2	-	MZUSP
(8) *Plectris aeneicollis* (Moser, 1921)	LT	MNHUB
(9) *Plectris castaneipennis* (Moser, 1921)	ST	MNHUB
(10) *Plectris fuscoviridis* (Moser, 1918)	ST	MNHUB
(11) *Plectris paranensis* (Moser, 1918)	ST	MNHUB
(12) *Plectris rectangula* Frey, 1967	HT	NMBS
(13) *Plectris tomentosa* LePeletier & Audinet-Serville, 1828	-	MZUSP
(14) *Plectris viridifusca* (Moser, 1918)	ST	MNHUB

Tabela 3. Matriz dos caracteres construídos para a análise filogenética de *Alvarinus* Blanchard, 1850 (Melolonthidae, Melolonthinae, Macrodactylini). Dados não aplicáveis (-);

Táxon/caráter	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53
Macrodactylus subspinosus	1	1	1	1	1	0	0	0	1	-	0	0	0	1	0	1	0	1	0	0	1	1	1	1	0	1	1	0	1	0	0	0	0	1	-	0	0	0	0	0	0	0	0	0	1	1	0	0	-	0	-	0	0
Macrodactylus suturalis	1	1	1	1	1	0	0	0	1	-	0	0	0	1	0	1	0	1	0	0	1	1	1	1	-	0	-	0	0	-	0	0	0	1	-	0	0	0	0	0	0	0	0	0	0	1	0	0	-	0	-	0	0
Isonychus sulphureus	0	1	0	0	1	0	0	1	1	-	0	0	0	1	0	1	0	1	0	0	1	1	1	0	0	1	1	1	1	0	0	1	0	1	-	0	0	0	0	0	0	1	0	0	0	0	1	0	-	0	-	0	0
Philochloenia sulcatum	0	0	0	0	1	0	1	0	0	1	1	1	0	0	-	0	1	0	-	0	0	0	0	0	1	0	-	1	1	1	1	1	0	0	0	0	0	0	1	0	1	1	0	0	1	0	0	0	-	0	-	0	0
Plectris tomentosa	0	0	0	0	0	0	1	0	1	1	0	0	1	1	0	1	1	1	0	0	0	1	0	0	0	1	0	1	1	1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	-	0	-	0	0
Plectris viridifusca	0	0	0	0	1	-	0	0	0	?	0	1	?	?	?	?	?	?	?	0	?	0	0	0	1	1	1	1	1	0	1	0	0	0	1	0	0	0	0	1	0	0	0	?	0	0	1	1	0	-	1	0
Plectris fuscoviridis	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	1	1	1	0	1	0	1	0	0	0	0	-	1	1	1	1	1	0	0	0	1	0	0	1	0	1	0	0	0	1	0	0	1	1	0	-	1	0
Plectris paranensis	0	0	0	0	1	0	1	1	0	1	0	0	1	1	0	1	1	1	0	1	1	1	0	0	0	1	0	1	1	0	1	1	1	0	1	0	0	1	0	1	1	0	0	1	0	0	0	0	-	0	-	0	0
Plectris castaneipennis	0	0	0	0	1	0	0	1	0	1	0	0	?	?	?	?	?	?	?	1	1	?	0	0	0	1	0	1	1	0	1	1	1	0	1	0	0	1	0	1	1	0	0	1	1	0	0	0	-	0	-	0	0
Paulosawaya sp. 1	0	0	0	0	1	0	0	0	0	1	0	0	1	1	0	1	1	1	0	1	0	1	0	0	0	0	-	1	1	0	1	1	1	0	1	0	0	1	0	1	1	0	0	1	0	0	0	0	-	0	-	0	0
Paulosawaya sp.2	0	0	0	0	1	0	1	0	0	?	0	0	1	1	0	1	1	0	-	1	0	0	0	0	0	1	0	1	1	0	1	1	1	0	1	0	0	1	0	1	1	0	0	1	1	0	0	0	-	0	-	0	0
Clavipalpus dejeani	0	0	0	0	1	0	1	1	0	1	1	0	1	1	0	1	1	0	-	1	0	0	0	0	1	1	0	0	1	1	1	1	1	0	1	1	0	0	1	0	1	1	1	1	1	0	1	0	-	0	-	0	0
Plectris aeneicollis	0	0	0	0	1	0	1	0	0	?	0	0	?	?	?	?	?	?	?	0	0	?	0	0	0	1	0	0	1	1	1	1	0	0	0	1	0	0	0	0	1	1	1	0	0	0	1	1	0	1	0	0	1
Plectris rectangula	0	0	0	0	0	1	1	0	0	0	1	1	1	1	1	1	1	0	-	0	0	0	0	0	0	1	0	0	0	-	0	1	0	0	0	1	1	0	0	0	1	1	1	0	0	0	1	1	0	1	1	0	1
Alvarinus hilarii	0	0	0	0	0	1	1	0	0	0	1	1	1	1	1	1	1	0	-	0	0	0	0	0	0	1	0	0	0	-	0	1	0	0	0	1	1	0	0	0	1	1	1	0	0	0	1	1	0	1	1	0	1
Alvarinus maniculatus	0	0	0	0	0	1	1	0	0	0	1	1	1	1	1	1	1	0	-	0	0	0	0	0	0	1	0	0	0	-	0	1	0	0	0	1	1	0	0	0	1	1	1	0	0	0	1	1	0	1	1	0	1
Alvarinus pallidipennis	0	0	0	0	1	1	1	1	0	0	1	1	1	1	0	1	1	1	-	0	0	0	0	0	0	1	0	0	0	-	0	1	0	0	0	1	0	0	0	0	1	1	1	0	0	0	1	1	0	1	0	0	1
Alvarinus luridipennis	0	0	0	0	1	1	1	1	0	0	1	1	1	1	0	1	1	1	-	0	0	0	0	0	0	1	0	0	0	-	0	1	0	0	0	1	0	0	0	0	1	1	1	0	0	0	1	1	0	1	0	0	1
Alvarinus canescens	0	0	0	0	1	0	1	1	0	0	1	1	1	1	0	1	1	0	1	0	0	1	0	0	0	1	0	1	0	-	0	1	0	0	0	1	0	0	0	0	1	1	1	0	0	0	1	1	0	1	0	0	1
Alvarinus rufofuscus	0	0	0	0	1	0	1	1	0	0	0	0	1	1	0	1	1	0	0	0	0	1	0	0	0	1	0	1	1	1	1	1	0	0	0	1	0	0	0	0	1	1	1	0	0	0	1	1	0	1	0	0	1
Alvarinus testaceipennis	0	0	0	0	1	0	1	0	0	0	0	0	?	?	?	?	?	?	?	0	0	?	0	0	0	1	0	1	0	-	1	1	0	0	0	1	0	0	0	0	1	1	1	0	0	0	1	1	0	1	0	0	1
Alvarinus vazdemelloi **sp. nov.**	0	0	0	0	1	0	1	0	0	0	0	0	1	1	0	1	1	1	0	0	0	1	0	0	0	1	0	0	1	1	1	1	0	0	0	1	0	0	0	0	1	1	1	0	0	0	1	1	0	1	0	0	1
Alvarinus paschoali **sp. nov.**	0	0	0	0	1	0	1	0	0	0	0	0	1	1	0	1	1	1	0	0	0	1	0	0	0	1	0	1	1	1	1	1	0	0	0	1	0	0	0	0	1	1	1	0	0	0	1	1	0	1	0	0	1
Alvarinus varians	0	0	0	0	0	0	1	0	0	0	1	1	?	?	?	?	?	?	?	0	0	?	0	0	0	1	0	1	1	1	1	1	0	0	0	1	0	0	0	0	1	1	1	0	0	0	1	1	0	-	-	0	0
Alvarinus submetallicus	0	0	0	0	1	0	0	0	0	0	0	0	?	?	?	?	?	?	?	1	0	?	0	0	0	1	1	1	1	1	0	1	0	0	0	1	0	0	1	0	1	0	0	0	1	0	0	1	-	0	-	1	0
Alvarinus parvulus	0	0	0	0	1	0	1	0	0	0	0	0	?	?	?	?	?	?	?	0	0	?	0	0	0	1	0	1	0	-	1	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	-	0	-	0	0
Alvarinus oblongus	0	0	0	0	1	0	0	0	0	0	0	0	?	?	?	?	?	?	?	0	0	?	0	0	0	1	0	1	1	1	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	-	0	-	0	0
Alvarinus subsericeus	0	0	0	0	1	0	1	1	0	0	0	0	?	?	?	?	?	?	?	1	1	?	0	0	0	1	0	1	1	0	1	1	1	0	1	0	0	1	0	1	1	0	0	1	1	0	0	0	-	0	-	0	0
Alvarinus brasiliensis	0	0	0	0	1	0	1	0	0	0	0	0	1	1	0	1	1	1	0	0	0	1	0	0	0	1	0	1	1	1	0	1	0	0	0	1	0	0	0	0	1	1	1	0	0	0	1	1	1	0	-	0	0
Alvarinus bahianus	0	0	0	0	1	0	0	0	0	0	1	1	1	1	0	1	1	0	1	0	0	1	0	0	0	1	0	1	0	-	0	1	0	0	0	1	0	0	0	0	1	1	1	0	0	0	1	1	1	0	-	0	1
Alvarinus setulosus	0	0	0	0	1	0	1	0	0	0	0	0	1	1	0	1	1	1	0	0	0	1	0	0	0	1	0	1	1	1	0	1	0	0	0	1	0	0	0	0	1	1	1	0	0	0	1	1	1	0	-	0	0
Alvarinus guayaquilanus	0	0	0	0	1	0	1	0	0	0	0	0	?	?	?	?	?	?	?	0	1	?	0	0	0	1	0	1	0	-	1	1	0	0	1	1	0	0	1	0	0	1	1	1	1	0	1	0	-	0	-	0	0

dados indisponíveis (?).

FIGURAS

Figura 1: Cladograma de consenso estrito de *Alvarinus* Blanchard, 1850 (Melolonthidae, Melolonthinae: Macrodactylini), resultante de 12 árvores, com um total de 118 passos (IC=0.43; IR=0.76). As letras indicam os clados e subclados.

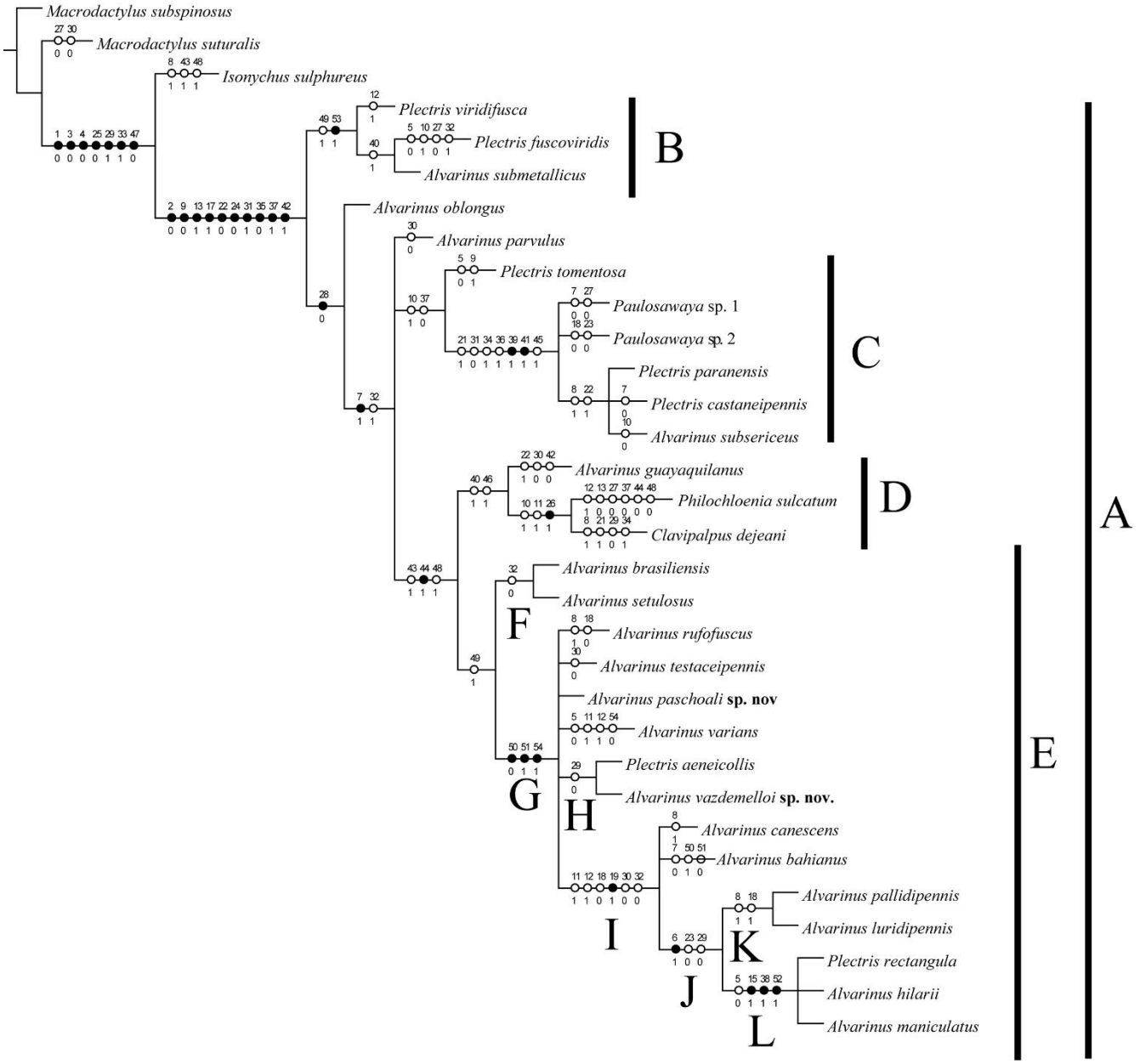
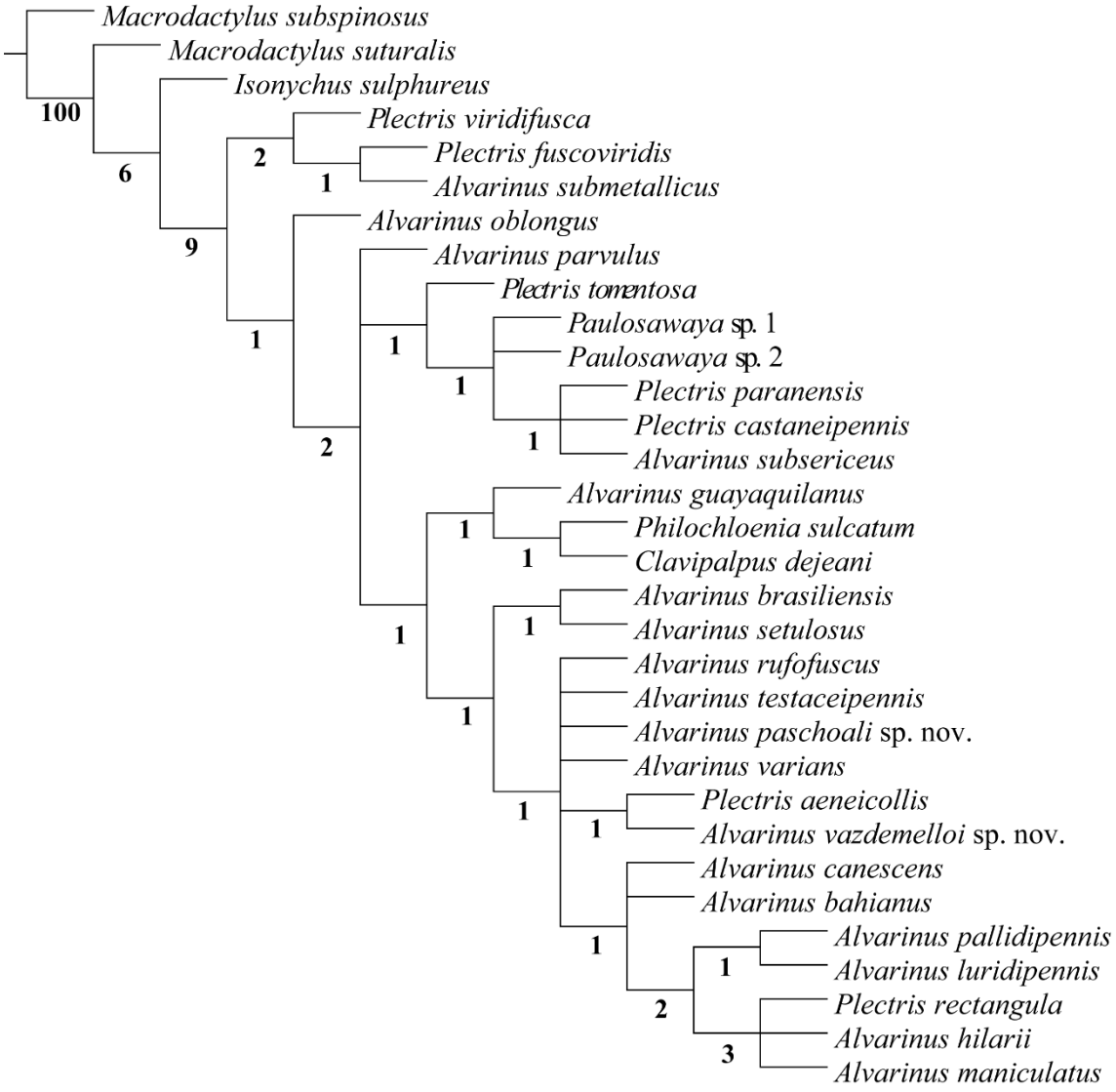
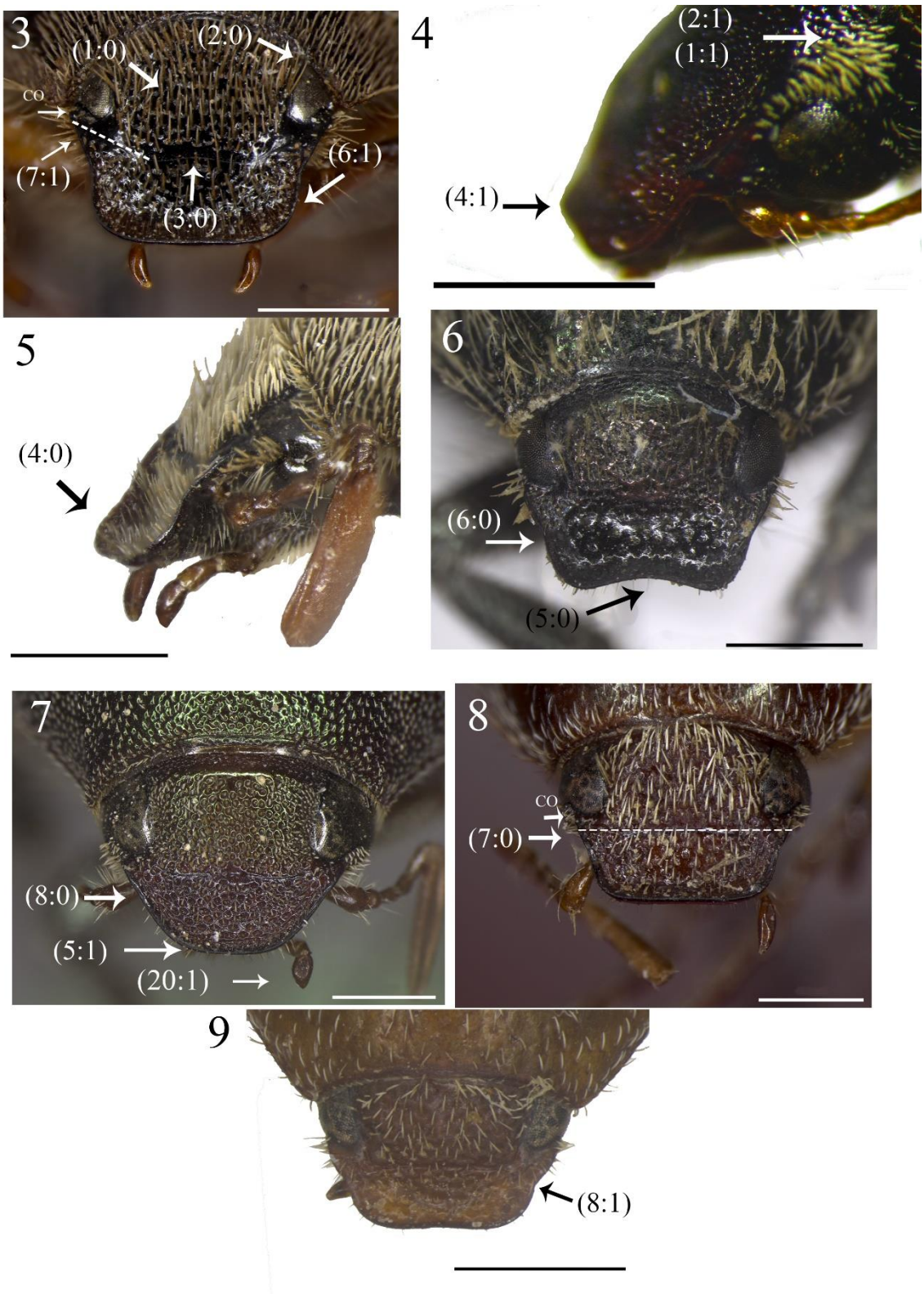


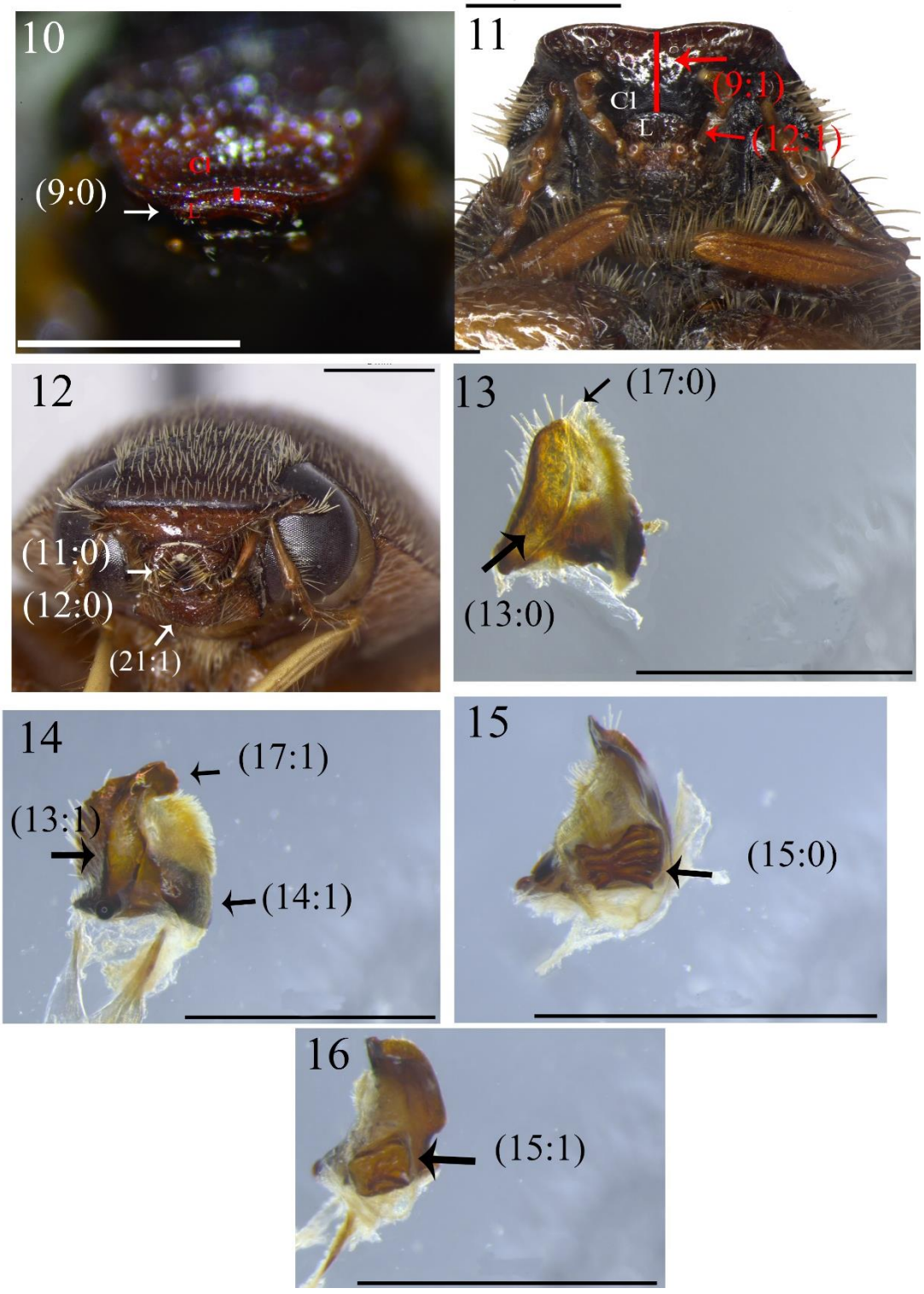
Figura 2: Cladograma de com apoio dos clados a partir do Suporte de Bremer.



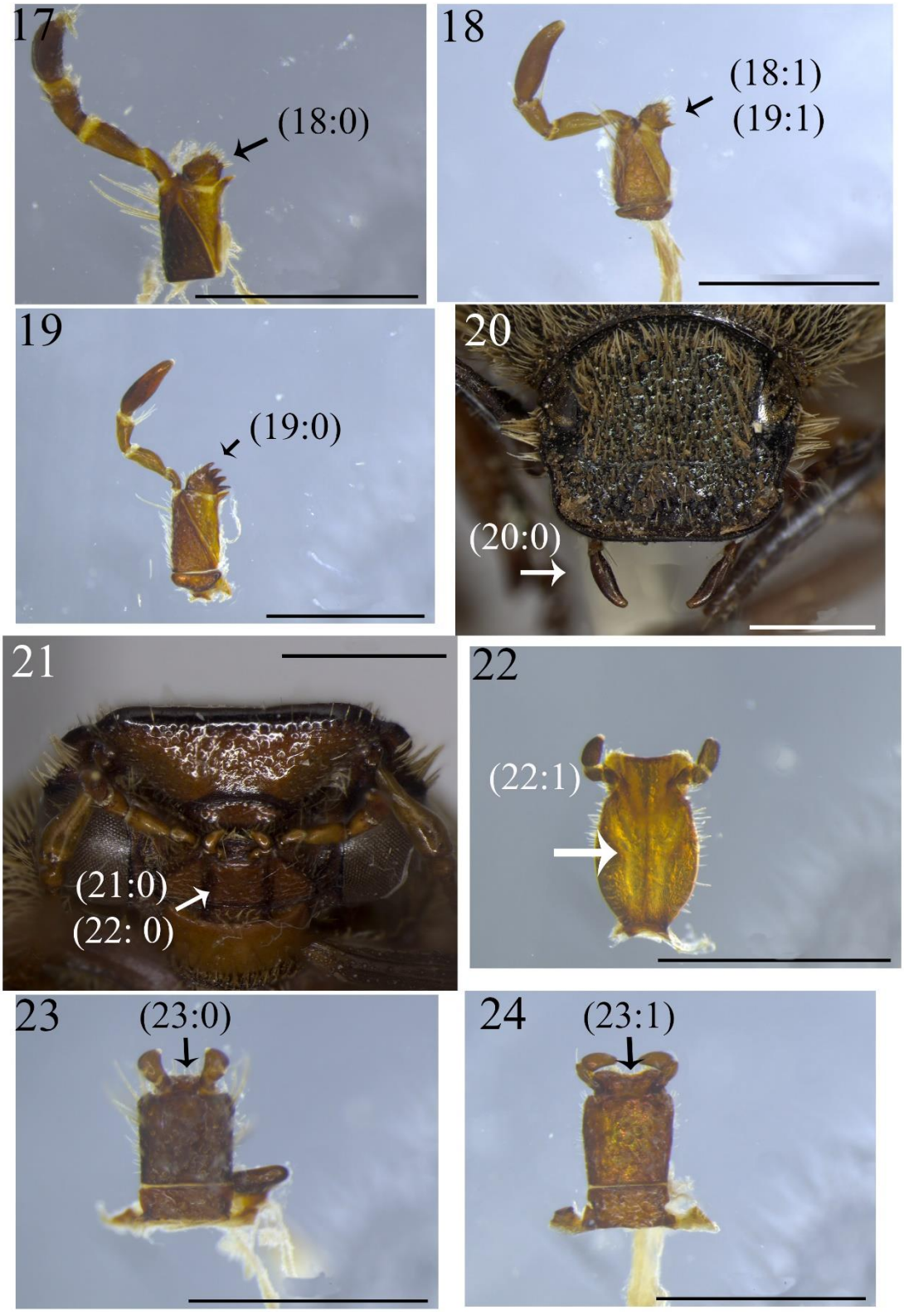
Figuras 3-9: **3.** Cabeça de *Alvarinus hilarii* Blanchard, vista dorsal. CO= *canthus ocular*. **4.** Cabeça de *Macrodactylus subspinosus* (Fabricius), vista lateral. **5.** Cabeça de *Alvarinus hilarii* Blanchard, vista lateral.; **6.** Cabeça de *Alvarinus varians* (Moser), vista dorsal; **7.** Cabeça de *Alvarinus submetallicus* Blanchard, vista dorsal; **8.** Cabeça de *Alvarinus bahianus* (Moser), vista dorsal. CO= *canthus ocular*; Escala das figuras = 1 mm.



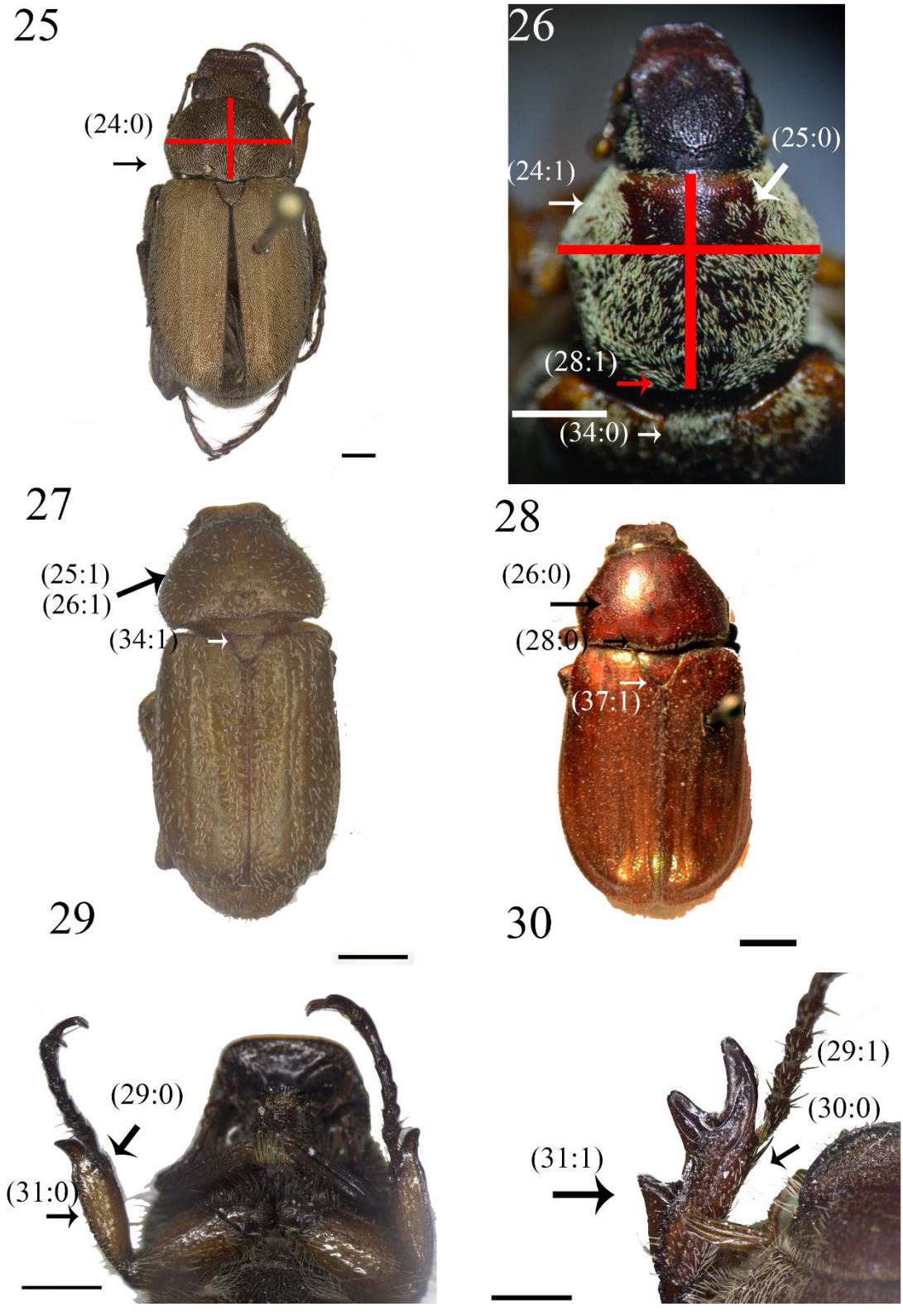
Figuras 10-16: **10.** Cabeça de *Macrodactylus subspinosus* (Fabricius), vista frontal. Cl = Clípeo; L = Labro **11.** Cabeça de *Alvarinus hilarii* Blanchard, vista ventral. Cl = Clípeo; L= Labro; **13.** Mandíbula direita de *Macrodactylus subspinosus* (Fabricius), vista ventral; **14.** Mandíbula direita de *Alvarinus brasiliensis* (Moser); **15.** Mandíbula direita de *Alvarinus pallidipennis* Blanchard, vista interna; **16**. Mandíbula direita de *Alvarinus hilarii* Blanchard, vista interna Escala = 1mm.



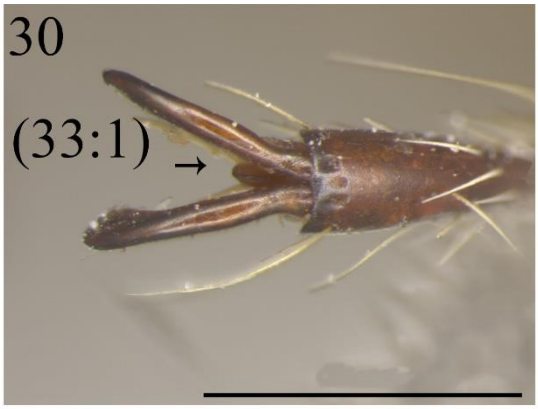
Figuras 17-24: **17.** Maxila direita de *Alvarinus hilarii* Blanchard, vista ventral; **18.** Maxila direita de *Alvarinus canescens* (Burmeister), vista ventral. **19.** Maxila direita de *Alvarinus brasiliensis* (Moser), vista ventral. **20.** Cabeça de *Alvarinus pallidipennis* Blanchard, vista dorsal. **21.** Cabeça de *Corminus canescens* (Burmeister), vista fonto-ventral. **22.** Mento de *Macrodactylus subspinosus*, vista ventral (Fabricius). **23.** Mento de *Alvarinus hilarii* Blanchard, vista ventral. **24.** Mento de *Alvarinus brasiliensis* (Moser), vista ventral. *Escala* = 1 mm

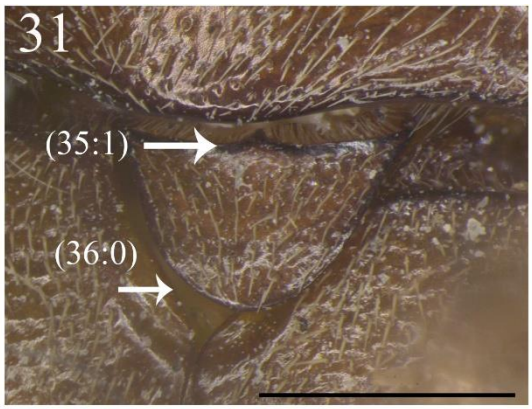


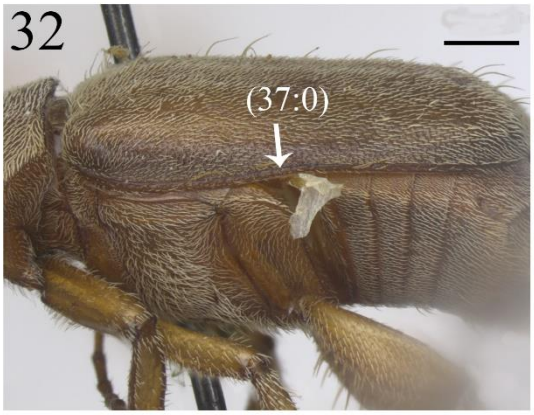
Figuras 25-30: **25.** Habitus de *Alvarinus canescens*, vista dorsal; **26.** Cabeça e pronoto de *Macrodactylus subspinosus* (Fabricius), vista dorsal; **27.** Habitus de *Alvarinus parvulus* (Moser), vista dorsal. **28.** Habitus de *Plectris viridifusca* (Moser), vista dorsal. **29.**Cabeça e protórax de *Alvarinus pallidipennis* Blanchard, vista ventral.**30.** Protíbia de *Alvarinus subsericeus* Blanchard. Escala = 1mm.

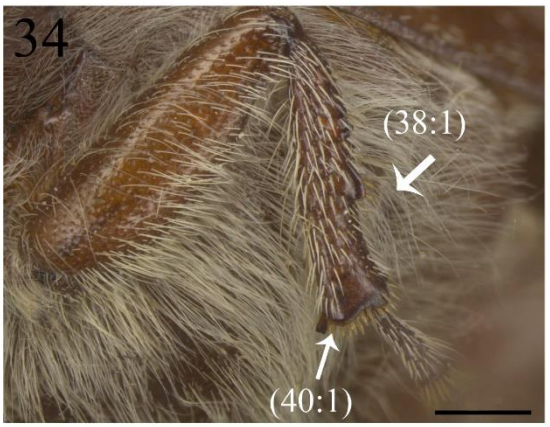


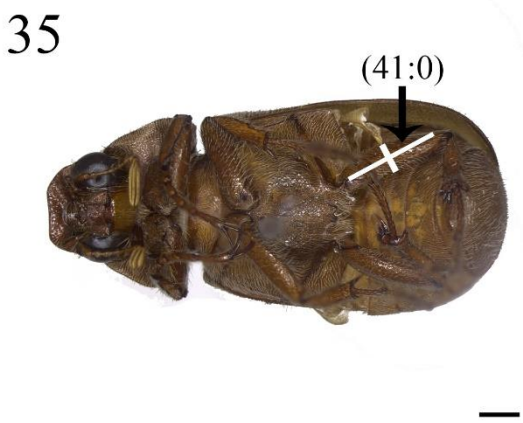
Figuras 30-36: **30.** Pré-tarso, detalhe do empódio, de *Alvarinus subsericeus* Blanchard, vista dorsal. **31.** Escutelo de *Alvarinus guayaquilanus* (Moser), vista dorsal.; **32.** Élitro de *Alvarinus canescens* (Burmeister), vista lateral.; **33.** Élitro de *Alvarinus hilarii* Blanchard, em vista lateral; **34.** Mesotíbia de *Alvarinus subsericeus* Blanchard, superfície externa; **35.** Habitus de *Alvarinus guayaquilanus* (Moser), vista ventral; **36.** Habitus de *Alvarinus bahianus*, vista ventral. Escala = 1mm.

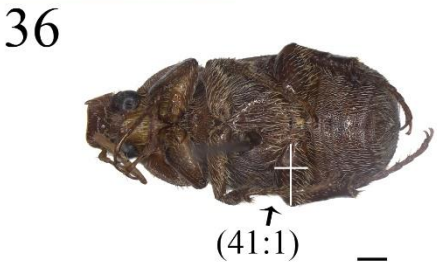




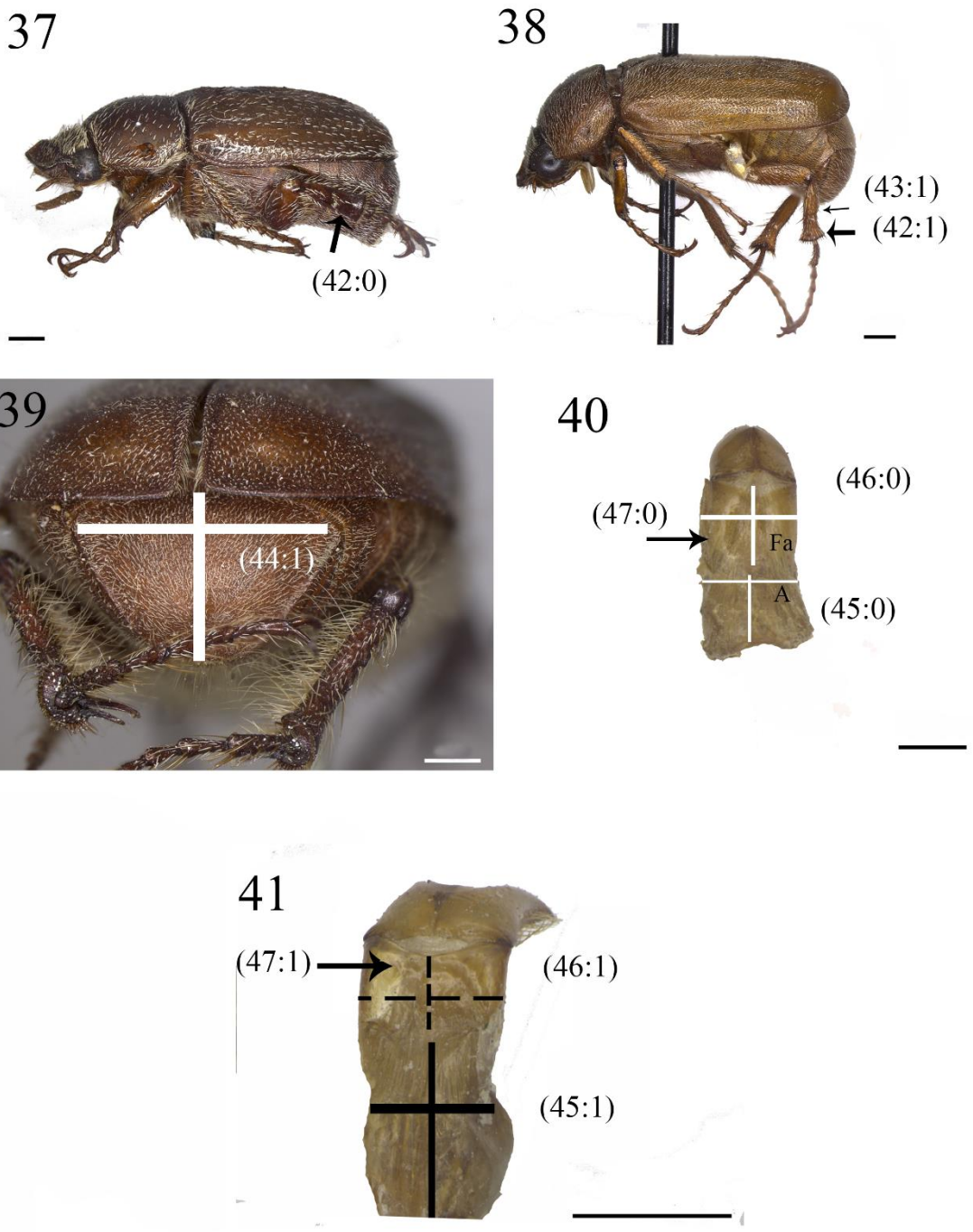




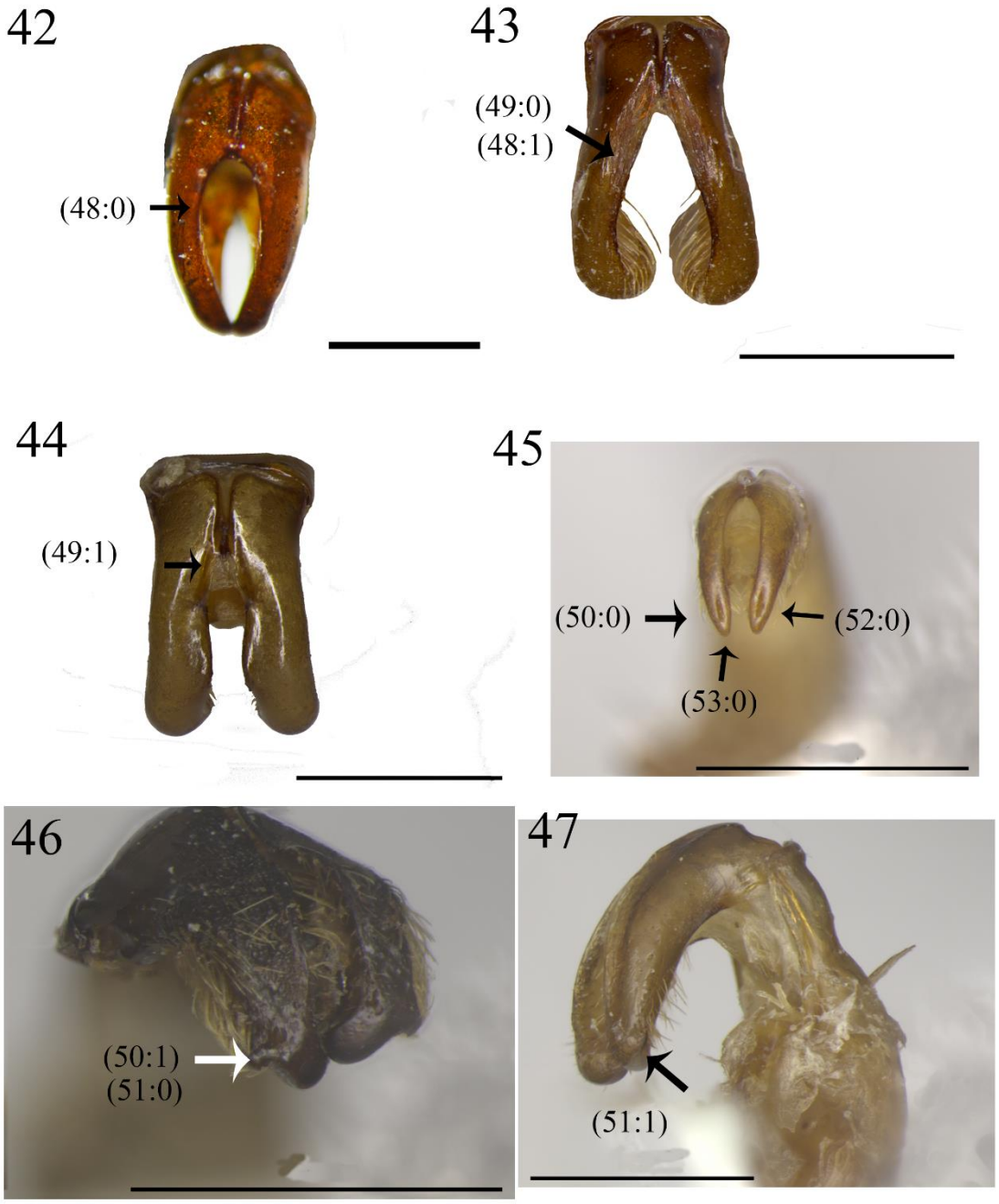




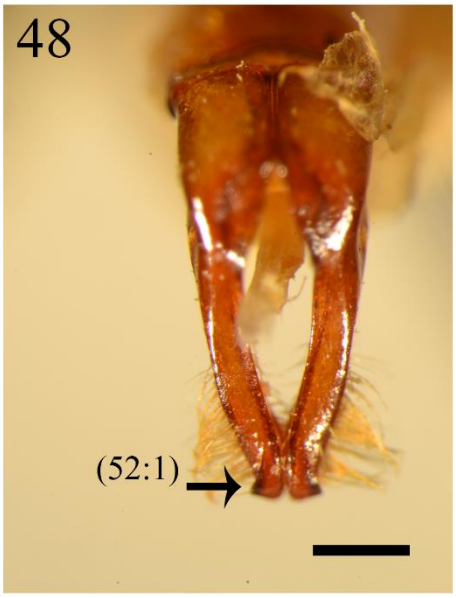
Figuras 37-41: **37.** Habitus de *Alvarinus bahianus* (Moser), vista lateral. **38.** Habitus de *Alvarinus guayaquilanus* (Moser), vista lateral; **39.** Pigídio de *Alvarinus subsericeus* Blanchard, vista frontal; **40.** Genitália de *Plectris castaneipennis* (Moser), vista dorsal. Fa= falobase, A = apódema; **41.** Genitália de *Alvarinus guayaquilanus* (Moser). Fa= falobase, A = apódema; Escala = 1mm.

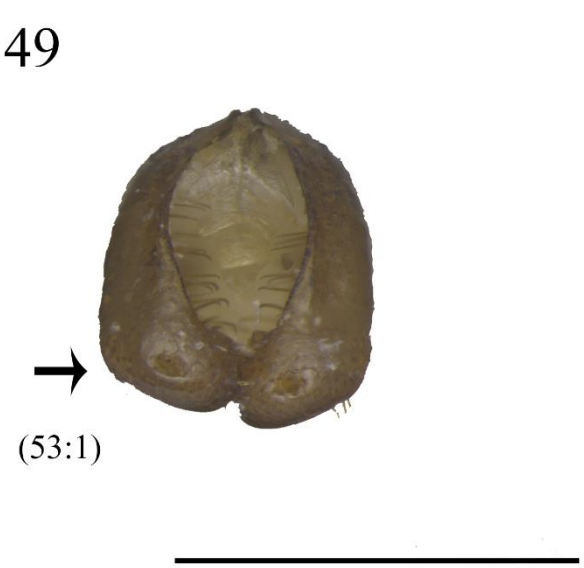


Figuras 42-46: **42.** Genitália de *Plectris paranensis* (Moser), vista dorsal.; **43.** Genitália de *Alvarinus hilarii* Blanchard, vista dorsal; **44.** Genitália de *Alvarinus bahianus* (Moser), vista dorsal; **45.** Genitália de *Alvarinus parvulus* (Moser), vista dorsal; **46.** Genitália de *Alvarinus pallidipennis* Blanchard, vista póstero-lateral.; **47. .** Genitália de *Alvarinus hilarii* Blanchard, vista lateral. Escala = 1mm.



Figuras 48-49. **48.** Genitália de *Plectris fuscoviridis* (Moser), vista dorsal.; **49.** Genitália de *Alvarinus hilarii* Blanchard, porção distal. Escala = 1mm.





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3 TAXONOMIC REVIEW OF *ALVARINUS* BLANCHARD, 1850 (COLEOPTERA, MELOLONTHIDAE, MELOLONTHINAE) WITH DESCRIPTION OF TWO NEW SPECIES.

Abstract

The taxonomy of *Alvarinus* Blanchard, 1850 is reviewed. The genus includes eleven species, while two of them are new*: Alvarinus paschoali* Albuquerque **sp. nov.** and *Alvarinus vazdemelloi* Albuquerque **sp. nov**. Lectotypes were designated for 8 species. Four new synonyms are proposed: *Alvarinus maniculatus* (Burmeister, 1855) **syn. nov.** and *Plectris rectangula* Frey, 1967 **syn. nov.** (formely synonymized with *Alvarinus pallidipenis* Blanchard, 1850) for *A. hilarii* Blanchard, 1850; *A. luridipennis* (Burmeister, 1855) **syn. nov.** for *A. pallidipennis* Blanchard, 1850; and *A. setulosus* (Moser, 1919) **syn. nov.** for *A. brasiliensis* (Moser, 1919). One new combination was made, due to the inclusion of *Plectris aeneicollis* (Moser, 1921) into *Alvarinus.* A detailed literature review, a key to *Alvarinus* species, and updated geographic distribution are provided.

Key words: Neotropical region, New World chafers; Macrodactylini.

Resumo

A taxonomia de *Alvarinus* Blanchard, 1850 é revisada. O gênero inclui 11 espécies, com duas novas: *Alvarinus paschoali* Albuquerque **sp. nov.** e *Alvarinus vazdemelloi* Albuquerque **sp. nov**. Lectótipos foram designados para oito espécies. Quatro novas sinonímias são propostas: *Alvarinus maniculatus* (Burmeister, 1855) **syn. nov.** e *Plectris rectangula* Frey, 1967 **syn. nov.** (anteriormente sinonimizado com *Alvarinus pallidipenis* Blanchard, 1850) para *A. hilarii* Blanchard, 1850; *A. luridipennis* (Burmeister, 1855) **syn. nov.** para *A. pallidipennis* Blanchard, 1850; e *A. setulosus* (Moser, 1919) **syn. nov.** para *A. brasiliensis* (Moser, 1919). Foi encontrada uma nova combinação e duas novas espécies foram encontradas para o grupo. Uma revisão detalhada da literatura, chave de

identificação para espécies de *Alvarinus*, além de dados atualizados de distribuição geográfica são apresentadas.

Palavras chave: Corós do Novo Mundo, Macrodactylini, Neotropical.

Introduction

Alvarinus Blanchard, 1850 is Neotropical genus of the Macrodactylini (Coleoptera, Melolonthidae), distributed across Brazil, Bolivia, and Argentina (Blanchard, 1850; Burmeister, 1855; Evans & Smith, 2009; Katovich, 2008). The taxon was described with four species: *Alvarinus hilarii*, *A. pallidipennis*, *A. submetallicus*, and *A. subsericeus*. According to Blanchard (1850), *Alvarinus* was characterized by: rounded body; broad clypeus; apex of labrum slightly emarginate; antennae elongate, club with three subequal lamellae; mandibles strong and obtuse; maxillae bearing teeth, galea ciliate and with spines, maxillary palpi elongate with apical palpomere thickened; labium elongate, subparalelle, with apex truncate, labial palpi short; tarsal claws developed with small slit. Lacordaire (1856) redescribed *Alvarinus* and suggested, without any taxonomic act, that *Alvarinus submetallicus* and *A. subsericeus* did not belong to *Alvarinus*. Lacordaire (1856) provided new characters to what was known of *Alvarinus* until then, such as: mentum elongate, antennae with elongate club in both sexes; prothorax transverse; elytra short, paralleled, tibia without spurs; 5th abdominal segment longer than the others; and triangular pygidium.

Authors as Gemminger & Harold (1869), Dalla Torre (1913), Blackwelder, (1944), Evans (2003), Evans & Smith (2005) mentioned in their checklists both *Alvarinus* and *Corminus*. Bates (1887), did some extent discussion of nomenclatural inconsistencies regarding *Philochloenia* Dejean, 1833, mentioning that *Philochloenia chalcea* Burmeister, 1855 was a synonym of *Alvarinus submetallicus* Blanchard, 1850. Frey (1967) transferred *P. chalcea* to *Plectris* LePeletier & Audinet–Serville, 1828, indicating that it was from Missiones (Argentina), although *Alvarinus submetallicus* is originaly from Minas Gerais (Brazil). Frey (1967) described *Plectris rectangula*, latter synonymizing it with *Alvarinus pallidipennis* (Frey, 1969).

Evans (2003) provided a checklist of New World chafers and designated several type species of Melolonthinae genera, amongst them he indicated *Alvarinus hilarii* Blanchard as type species for *Alvarinus* Blanchard. Katovich (2008), in a taxonomic and phylogenetic work of the tribe Macrodactylini, indicated, by the analysis of both type species, that *Corminus* Burmeister, 1855, with twelve species (three from Burmeister and nine from Moser), is a junior synonym of *Alvarinus*, bringing up the number of species to sixteen. For the author, the main diagnostic characters used to distinguish *Alvarinus* from other Macrodactylini are: elongated clypeus in frontal view, antennae with nine antennomeres, with 7-9 forming an elongated club, the length combined of which equals to the combined 2-6 antennomeres; semicircular labrum, quadrate premetum and with ventral surface medially lobed.

Although Katovich (2008) studied both type species of *Alvarinus* and *Corminus* in his work, before proposing *Corminus* was junior synonym of *Alvarinus*, is not possible to understand if he coded intraspecific variation of *Alvarinus hilarii*, or the variation between both type species as if they belonged to only one. After the synonymy, *Alvarinus* included 16 species.

Fuhmann & Vaz-de-Mello (2017), in a taxonomic review of Macrodactylini indicated that *Alvarinus* can be reconized by the following characters: clypeal ventral area strogly widened; pronotal anterior and posterior margins not beaded; prosternum anteriorly concave; protibia with two external teeth, without spurs; elytral striae indistinct, posterior and posterointernal margins not beaded; meso and metafermurs of male with some long spine-like setae; metatarsomere V without spine-like setae; abomen with intersegmental membrane VI-VII concealed.

Most of the original descriptions from this group are outdated, and imprecise, what does not allow their identification without type material. (KATOVICH, 2008). In this way, a more detailed study of the genus became necessary, to confirm the synonymy. Also, based on the results of the phylogeny (chapter 1), a new classification was proposed. In this paper, we aimed at reviewing the taxonomy of *Alvarinus* Blanchard.

Methods

Morphological studies

This study was conducted based on *Alvarinus* 131 adult specimens. Type and non-type material analysed were from loans and visits from the following institutions (curators in parenthesis):

CEIOC	Coleção Entomológica do Instituto Oswaldo Cruz, Rio de Janeiro, Brazil (Jane Costa).
CEMT	Coleção Entomológica Universidade Federal de Mato Grosso, Cuiabá, Brazil (Fernando Zagury Vaz-de-Mello).
DZUP	Coleção Entomológica Pe. Jesus Santiago Moure do Departamento de Zoologia da Universidade Federal do Paraná, Curitiba, Brazil (Lúcia Massutti de Almeida).
DZRJ	Coleção Entomológica do Departamento de Zoologia da Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil (Jorge Luiz Nessimian).
EPGC	Everardo and Paschoal Grossi Collection, Nova Friburgo, Brasil (Everardo Grossi).
INPA	Instituto Nacional de Pesquisas da Amazônia (Márcio Luiz de Oliveira), Manaus, Brazil.
MLUH	Martin Luther Universität, Halle, Germany (Karla Schneider).
MNHN	Muséum national d'Histoire naturelle, Paris, France (Olivier Montreuil).
MNHUB	Museum für Naturkunde der Humboldt-Universität, Berlin, Germany (Johannes Frisch).

MNRJ	Museu Nacional do Rio de Janeiro, Rio de Janeiro, Brazil (Marcela L. Monné).
MZUSP	Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil. (Sônia Casari).
NHM	Natural History Museum, London, England (Max Barcley).
NMBS	Naturhistorisches Museum Basel, Basel, Switzerland (Eva Sprecher).

For observations of external morphological characters, we used Leica MZ 6 stereomicroscope. Male genitalia was dissected by the following procedure: introducing dry specimens on hot water, to soften the tissues. After that, the abdomen was carefully detached from the specimen with entomological tweezers. When removed, the male genitalia was card mounted for further analysis.

Literature cited aType material labels were described and cited exactly how they were written. The numbers represent each label, in order of placement (top to bottom), slashes (/) separates each one of them. Their characteriscs were explained between parentheses. The information contained in different lines were separated by vertical bars (|). Non-type material information was organized according to AutoMatEx programme (Brown, 2013), and when complete displayed as it follows: sex, country, state, locality, hight (in meters), date (month in roman algorisms), collector, depository (institution acronym).

Terminology

The terminology used is according to Harris (1979) to punctuations and Lawrence et al. (2010) for general morphology. Genitalia morphology was based on Ahrens (2006).

Photographies and distributional maps

Photographies were taken with a digital camera attached to a Leica M205C automated stereomicroscope and processed with a Leica Application Suit (LAS, version 6.0).

Distributional data were informed to Google Earth 7.1.7.2606 (GOOGLE, 2016) and exported to QGIS 2.18.3 (QGIS DEVELOPMENT TEAM, 2016), where they were plotted. The maps were edited using Adobe Illustrator CS6 (2012) and Adobe Photoshop CS6 (2012).

Taxonomy

***Alvarinus* Blanchard, 1850**

Alvarinus Blanchard, 1850: 123; Lacordaire, 1856: 262 (redescription); Gemminger & Harold, 1869: 1150 (checklist); Dalla Torre, 1913: 332 (checklist); Blackwelder, 1944: 232 (checklist); Evans, 2003: 224 (checklist); Evans & Smith, 2005: 186 (checklist); Evans & Smith, 2007: 189 (checklist); Katovich, 2008 (*Alvarinus* = *Corminus*): 16; Evans & Smith, 2009: 199 (checklist); Fuhmann & Vaz-de-Mello, 2017: 14 (review); Grossi & Vaz-de-Mello, 2017 (checklist); Schoolmeesters, 2017 (checklist).

Corminus Burmeister, 1855: 39. Type species *Corminus canescens* Burmeister, 1855 (designated by Evans, 2003); Gemminger & Harold, 1869: 1145 (checklist); Dalla Torre, 1913: 325 (checklist); Blackwelder, 1944: 230 (checklist); Evans, 2003: 254 (checklist); Katovich, 2008: 16 (synonymy).

Type species. *Alvarinus hilarii* Blanchard, 1850 [designated by Evans, 2003].

Diagnosis. Clypeus strongly upturned, elongated. Labrum short, semicircular or slightly sinuate. Antennae with 9-10 antennomeres; in males, length of lamellae slightly shorter than scape, pedicel and funicle together. Protibia with two or three lateral teeth, spurs present or absent. Paramera ventrally deflected or, pieces free, as long as phallobase and apodema together, symetrical, inner margin with developed flap, sometimes reduced, internal surface concave, setose, apical region setose, external latero-apical region with or without tooth, in frontal view with convergent deflection

Redescription. Length. 6.4–10.1mm. **Body.** Elongated, densely setose, shiny, with or without metallic reflections; blackish, brownish, reddish brown or yellowish (Figs. 1A–G; 2A–H; 3A–H; 4A–H; 5A–H; 6A–H; 7A–H; 8A–F; 9A–H; 10A–H; 11A–H). **Head.** Epistomal suture well defined, slightly sinuous. Frons wider than long, foveolate punctures. Clypeus quadrangular or trapezoidal, strongly upturned, elongated, anterior margin slightly sinuate or truncate; in lateral view, lateral margins sinuated; anterior angles rounded, lateral margins constricted or not constricted, posterior angles covering or not the ocular *canthus*. Antennae with 9–10 antennomeres; in males, length of lamellae slightly or strongly shorter than scape, pedicel and funicle together. Labrum short, semicircular or slightly sinuate, not visible in dorsal view, partially visible in frontal view. Mandibles concealed beneath clypeus, not visible in dorsal view; Maxillary palpi with 4 palpomeres; palpomere IV slender and fusiform. Labium with mentum longer than wide; prementum short and fused with mentum; palpi with 3 palpomeres, apical palpomere fusiform. Gula proeminent, wider than long. **Prothorax.** Pronotum wider than long, maximum width at middle, lateral and posterior margins angled, dorsal surface slightly convex, or gibbous, anterior margin bordered, with suberect stout or adpressed setae, and posterior margin with or without lobe medially. Coxa with conspicuous carina medially. Tibia with 2 or 3 lateral teeth, spurs present or absent. Tarsi as long as or slightly longer than tibia, tarsomere I twice as long as tarsomeres II, tarsomeres II–IV short and subequal in size, tarsomeres V four times the size of the previous ones, bifid and asymmetric tarsal claws; empodia short with 2 long setae, without carena in dorsal view. **Mesothorax.** Mesoscutellum with anterior margin truncate, not bordered, posterior margin rounded. Episterna subrectangular. Epimera triangular, not reaching the mesocoxal cavities. Elytra with conspicuous costae, densely or lightly setose, with long stout setae, conspicuous or

inconspicuous eplipleura. Tibia conical, distal margin with small stout setae; 2 contiguous spurs not separated by tarsal insertion, asymmetrical in length, apex acute. **Metathorax.** Episterna reaching the mesocoxal cavities, extended between mesepimera and metepimera. Coxa medially contiguous. Two contiguous metatibial spurs not separated by tarsal insertion, asymmetrical, apex acute. **Abdomen.** In ventral view, with both stout and thin long setae. Propygidium parcially corvered by elytra. Pygidium subtrapezoidal, densely setose, punctures umbilicate. **Aedeagus.** Paramera ventrally deflected, pieces free, as long as phalobasis and apodema together, symetrical, inner margin with developed flap, sometimes reduced, internal surface concave, setose, apical region setose, external latero-apical region with or without tooth, in frontal view with convergent deflection.

***Alvarinus aeneicollis* (Moser, 1918), new combination**

(Figures 1A–G, 12)

Philochlaenia aeneicollis Moser, 1918: 127; Blackwelder, 1944: 229 (checklist).

Plectris aeneicollis (Moser): Frey, 1967: 88 (transferred *Philochlaenia aeneicollis* to *Plectris*); Evans, 2003: 305 (checklist); Evans & Smith, 2005: 258 (checklist); Evans & Smith, 2009 (checklist); Grossi & Vaz-de-Mello, 2017 (checklist); Schoolmeesters, 2017 (checklist).

Material examined. Type material, Lectotype of *Philochlaenia aeneicollis* Moser ♂ (here designated; MLUH): 1. (old white label, bordered and printed in black) Brasilia. 2. (old white label, handwritten) Philochlaenia |aeneicollis Mos | Type. 3 (red label, handwritten) LECTOTYPE ♂| Philochlaenia |aeneicollis | Moser 1918 | des. L.S.C Albuquerque | 2016. **Paralectotype** ♂ (MLUH): 1. (old white label, printed in black and handwritten) Amazonas gebiet | illegible handwrite. 2. (old white label, handwritten) aeneicollis Mos. 3. (yellow label, handwritten) Paralectotype ♂| Philochlaenia |aeneicollis | Moser 1918 | Des. L.S.C Albuquerque | 2016.

Diagnosis. Clypeus trapezoidal. Antennae with 10 antennomeres. Protibia with three teeth, with spur; Elytral suture without a row of long setae. Paramera after separation, with a smooth semicircular flap, not reaching the posterior region, latero-posterior region with developed tooth.

Description. Length. 6.4-6.7 mm. **Body.** Head and pronotum blackish, elytra yellowish (Fig. 1–C), densely setose. **Head.** Blackish . Clypeus trapezoidal, anterior margin truncate, posterior angles covering ocular *canthus* (Fig. 1C). Labrum slightly sinuate. Antennae brownish, with 10 antennomeres. Maxillary and labial palpi brownish. **Prothorax.** Pronotum blackish, gibbous, with grayish suberect stout setae, posterior margin medially lobed; Tibia with 3 teeth, with short spur (Fig. 1D). **Mesothorax.** Elytral suture without a row of long setae, epipleura conspicuous. **Metathorax.** Epimeron mostly covered by elytra. **Aedeagus.** Paramera after separation, with a smooth semicircular flap, not reaching apex (Fig. 7E-F), external latero-apical region with developed tooth (Fig. 7G).

Remarks. This taxon resembles to *Alvarinus testaceipennis* Moser and *A. pallidipennis* regarding the body color. The main difference is the clypeus, that is shorter than those species, and also the shape of paramera flaps. The accurate locality of this species was not possible to obtain.

Distribution. Brazil: Amazon river (uncertain locality) (Fig. 12).

***Alvarinus bahianus* (Moser, 1919)**

(Figures 2A-H, 12)

Corminus bahianus Moser, 1919: 39; Blackwelder, 1944: 230 (checklist); Evans, 2003: 254 (checklist); Evans & Smith, 2005: 213 (checklist).

Alvarinus bahianus; Evans & Smith, 2009: 199 (checklist); Grossi & Vaz-de-Mello, 2017 (checklist); Schoolmeesters, 2017 (checklist).

Material examined. Type material, Lectotype of *Corminus bahianus* Moser ♂ (here designated; MNHUB): 1. (old white label, printed and handwritten) Brasilia | Bahia. / 2. (old white label, handwritten in black). Corminus | bahianus | Typus Mos. / 3. (old white label, handwritten in black) bahianus Mos./ 4. (red label, printed in black) SYNTYPUS | Alvarinus | bahianus (Moser, 1919) | labelled by MNHUB 2013 / 5. (red label, bordered and printed in black). LECTOTYPE ♂, Corminus bahianus Moser, 1919 | Des. L.S.C. Albuquerque, 2016.

Non–type material. BRAZIL: Bahia, Maracás, 19.xii.1965, F. M. Oliveira 14♂ (DZUP).

Diagnosis. Clypeus trapezoidal. Antennae with 10 antennomeres. Protibia with two teeth, without spur. Elytral suture without a row of long setae. Paramera with reduced flap, latero-posterior external region with short thin setae, sparsely setose; latero-posterior region without tooth.

Description. Length. 8.5-10.1 mm. **Body.** Reddish brown, shiny, sparsely setose, in dorsal view (Fig. 2A–C). **Head.** Clypeus trapezoidal, anterior margin slightly sinuate posterior angles not covering ocular *canthus* (Fig. 2D). Antennae elongate, with 10 antennomeres, lammelae as long as funicle. Labrum semicircular (Fig. 2E). **Prothorax.**

Pronotum with surface slightly convex, with adpressed setae, and posterior margin medially lobed; Tibia with 2 teeth, without spur (Fig. 2F). **Mesothorax.** Elytral suture without a row of long setae, epipleura conspicuous. **Metathorax.** Epimeron mostly covered by elytra. **Aedeagus.** Paramera with reduced flap, extenal latero-apical region with short thin setae, without tooth.

Remarks. This species differs from the others from *Alvarinus* by the presence of short thin setae sparsely distributed on the dorsal surface of the body, clypeus posterior angles not covering ocular *canthus*, paramera with reduced flaps and without external latero-apical tooth.

Distribution. Brazil: Bahia (Maracás) (Fig. 12).

***Alvarinus brasiliensis* (Moser, 1919)**

(Figures 3A–H, 12)

Corminus brasiliensis Moser, 1919: 36; Blackwelder, 1944: 230 (checklist); Evans, 2003: 254 (checklist); Evans & Smith, 2005: 213 (checklist); Evans & Smith, 2007: 216 (checklist).

Alvarinus brasiliensis; Evans & Smith, 2009: 199 (checklist); Grossi & Vaz-de-Mello, 2016; (checklist); Schoolmeesters, 2017 (checklist).

Alvarinus setulosus; Evans & Smith, 2009: 200 (checklist); Grossi & Vaz-de-Mello, 2016 (checklist); Schoolmeesters, 2017 (checklist), **new synonym**.

Material examined. Type material, Lectotype of *Corminus brasiliensis* Moser ♂ (here designated; MNHUB): 1. (old white label, bordered and printed in black) Brasilia | Espirito Santo. / 2. (old white label, handwritten) Corminus | brasiliensis | Typus Mos. / 3. (red label, printed in black) SYNTYPUS | Alvarinus | brasiliensis (Moser, 1919) | labelled by MNHUB 2013. / 4. (red label, printed in black) LECTOTYPE ♂ | Corminus

brasiliensis | Moser, 1919 | Des. L.S.C. Albuquerque, 2016. **Paralectotype** ♂ (MNHUB): 1. (old white label, bordered and printed in black) Brasilia | Espirito Santo. / 2. (old white label, handwritten) brasiliensis Mos. / 3.(red label, printed in black) SYNTYPUS | Alvarinus | brasiliensis (Moser, 1919) | labelled by MNHUB 2013. / 4. (yellow label, printed in black) PARALECTOTYPE ♂ | Corminus brasiliensis | Moser, 1919 | Des. L.S.C. Albuquerque, 2016. **Paralectotype** ♂ (MNHUB): 1. (old white label, bordered and printed in black) Brasilia | Espirito Santo. / 3. (red label, printed in black) SYNTYPUS | Alvarinus | brasiliensis (Moser, 1919) | labelled by MNHUB 2013. / 4. (yellow label, printed in black) PARALECTOTYPE ♂ | Corminus brasiliensis | Moser, 1919 | Des. L.S.C. Albuquerque, 2016. **Paralectotype** ♂ (MNHUB): 1. (old white label, bordered and printed in black) Brasilia | Espirito Santo. / 2. (red label, printed in black) SYNTYPUS | Alvarinus | brasiliensis (Moser, 1919) | labelled by MNHUB 2013. / 3. (yellow label, printed in black) PARALECTOTYPE ♂ | Corminus brasiliensis | Moser, 1919 | Des. L.S.C. Albuquerque, 2016. **Paralectotype** ♂ (MNHUB): 1. (old white label, bordered and printed in black) Brasilia | Espirito Santo. / 2. (red label, printed in black) SYNTYPUS | Alvarinus | brasiliensis (Moser, 1919) | labelled by MNHUB 2013. / 3. (yellow label, printed in black) PARALECTOTYPE ♂ | Corminus brasiliensis | Moser, 1919 | Des. L.S.C. Albuquerque, 2016. **Paralectotype** ♂ (MNHUB): 1. (old white label, bordered and printed in black) Brasilia | Espirito Santo. / 2. (red label, printed in black) SYNTYPUS | Alvarinus | brasiliensis (Moser, 1919) | labelled by MNHUB 2013. / 3. (yellow label, printed in black) PARALECTOTYPE ♂ | Corminus brasiliensis | Moser, 1919 | Des. L.S.C. Albuquerque, 2016. **Paralectotype** ♂ (MNHUB): 1. (old white label, bordered and printed in black) Espir. Santo. / 2. (red label, printed in black) SYNTYPUS | Alvarinus | brasiliensis (Moser, 1919) | labelled by MNHUB 2013. / 3. (yellow label, printed in black) PARALECTOTYPE ♂ | Corminus brasiliensis | Moser, 1919 | Des. L.S.C. Albuquerque, 2016. **Paralectotype** ♂ (MNHUB): 1. (old white label, bordered and printed in black) Brasilia | Espirito Santo. / 2. (red label, printed in black) SYNTYPUS | Alvarinus | brasiliensis (Moser, 1919) | labelled by MNHUB 2013. / 3. (yellow label, printed in black) PARALECTOTYPE ♂ | Corminus brasiliensis | Moser, 1919 | Des. L.S.C. Albuquerque, 2016. **Paralectotype** ♂ (MNHUB): 1. (old white label, bordered and printed in black) Brasilia | Espir. Santo. / 2. (old white label, handwritten in black) brasiliensis Mos. / 3. (red label, printed in black) SYNTYPUS | Alvarinus | brasiliensis (Moser, 1919) | labelled by MNHUB 2013. / 4. (yellow label, printed in

black) PARALECTOTYPE ♂ | Corminus brasiliensis | Moser, 1919 | Des. L.S.C. Albuquerque, 2016. **Paralectotype** ♂ (MNHUB): 1. (old white label, bordered and printed in black) Brasilia | Espirito Santo. / 2. (red label, printed in black) SYNTYPUS | Alvarinus | brasiliensis (Moser, 1919) | labelled by MNHUB 2013. / 3. (yellow label, printed in black) PARALECTOTYPE ♂ | Corminus brasiliensis | Moser, 1919 | Des. L.S.C. Albuquerque, 2016. **Paralectotype** ♂ (MNHUB): 1. (old white label, bordered and printed in black) Brasilia | Espirito Santo. / 2. (red label, printed in black) SYNTYPUS | Alvarinus | brasiliensis (Moser, 1919) | labelled by MNHUB 2013. / 3. (yellow label, printed in black) PARALECTOTYPE ♂ | Corminus brasiliensis | Moser, 1919 | Des. L.S.C. Albuquerque, 2016. **Paralectotype** ♂ (MNHUB): 1. (old white label, bordered and printed in black) Brasilia | Espirito Santo. / 2. (white label, printed in black) Corminus | brasiliensis | Moser | fide K. Katovich (red label, printed in black) SYNTYPUS | Alvarinus | brasiliensis (Moser, 1919) | labelled by MNHUB 2013. / 3. (yellow label, printed in black) PARALECTOTYPE ♂ | Corminus brasiliensis | Moser, 1919 | Des. L.S.C. Albuquerque, 2016. **Paralectotype**♀(MNHUB): 1. (old white label, bordered and printed in black) Brasilia | Espirito Santo. / 2. (red label, printed in black) SYNTYPUS | Alvarinus | brasiliensis (Moser, 1919) | labelled by MNHUB 2013. / 3. (yellow label, printed in black) PARALECTOTYPE ♀ | Corminus brasiliensis | Moser, 1919 | Des. L.S.C. Albuquerque, 2016. **Paralectotype**♀ (MNHUB): 1. (old white label, bordered and printed in black) Brasilia | Espirito Santo. / 2. (red label, printed in black) SYNTYPUS | Alvarinus | brasiliensis (Moser, 1919) | labelled by MNHUB 2013. / 3. (yellow label, printed in black) PARALECTOTYPE ♀ | Corminus brasiliensis | Moser, 1919 | Des. L.S.C. Albuquerque, 2016. **Paralectotype**♀ (MNHUB): 1. (old white label, bordered and printed in black) Brasilia | Espirito Santo. / 2. (old white label, handwritten) Corminus | brasiliensis | Typus Mos. / 3. (red label, printed in black) SYNTYPUS | Alvarinus | brasiliensis (Moser, 1919) | labelled by MNHUB 2013. / 4. (red label, printed in black) LECTOTYPE ♀ | Corminus brasiliensis | Moser, 1919 | Des. L.S.C. Albuquerque, 2016. **Paralectotype**♀ (MNHUB): 1. (old white label, bordered and printed in black) Brasilia | Esp. Santo. / 2. (red label, printed in black) SYNTYPUS | Alvarinus | brasiliensis (Moser, 1919) | labelled by MNHUB 2013. / 3. (red label, printed in black) LECTOTYPE ♀ | Corminus brasiliensis | Moser, 1919 | Des. L.S.C. Albuquerque, 2016. **Paralectotype**♀ (MNHUB): 1. (old white label, bordered and printed in black) Brasilia | Espirito Santo. / 2. (red label, printed in black)

SYNTYPUS | Alvarinus | brasiliensis (Moser, 1919) | labelled by MNHUB 2013. / 3. (red label, printed in black) LECTOTYPE ♀ | Corminus brasiliensis | Moser, 1919 | Des. L.S.C. Albuquerque, 2016. **Paralectotype**♀ (MNHUB): 1. (old white label, bordered and printed in black) Brasilia | Esp. Santo. / 2. (red label, printed in black) SYNTYPUS | Alvarinus | brasiliensis (Moser, 1919) | labelled by MNHUB 2013. / 3. (red label, printed in black) LECTOTYPE ♀ | Corminus brasiliensis | Moser, 1919 | Des. L.S.C. Albuquerque, 2016. **Paralectotype**♀ (MNHUB): 1. (old white label, bordered and printed in black) Brasilia | Espirito Santo. / 2. (red label, printed in black) SYNTYPUS | Alvarinus | brasiliensis (Moser, 1919) | labelled by MNHUB 2013. / 3. (red label, printed in black) LECTOTYPE ♀ | Corminus brasiliensis | Moser, 1919 | Des. L.S.C. Albuquerque, 2016. **Paralectotype**♀ (MNHUB): 1. (old white label, bordered and printed in black) Brasilia | Esp. Santo. / 2. (red label, printed in black) SYNTYPUS | Alvarinus | brasiliensis (Moser, 1919) | labelled by MNHUB 2013. / 3. (red label, printed in black) LECTOTYPE ♀ | Corminus brasiliensis | Moser, 1919 | Des. L.S.C. Albuquerque, 2016. **Paralectotype**♀ (MNHUB): 1. (old white label, bordered and printed in black) Brasilia | Esp. Santo. / 2. (red label, printed in black) SYNTYPUS | Alvarinus | brasiliensis (Moser, 1919) | labelled by MNHUB 2013. / 3. (red label, printed in black) LECTOTYPE ♀ | Corminus brasiliensis | Moser, 1919 | Des. L.S.C. Albuquerque, 2016. **Paralectotype**♀ (MNHUB): 1. (old white label, bordered and printed in black) Brasilia | Esp. Santo. / 2. (red label, printed in black) SYNTYPUS | Alvarinus | brasiliensis (Moser, 1919) | labelled by MNHUB 2013. / 3. (red label, printed in black) LECTOTYPE ♀ | Corminus brasiliensis | Moser, 1919 | Des. L.S.C. Albuquerque, 2016.

Non–type material. Paraná, Prudentópolis, J. Isaak – 1♀, (MNHUB); J. Isaak – 1♀, (MNHUB); **Rio de Janeiro**, Bom Jardim, 22.xi.2002, M. Hoffmann – 1♂ (EPGC).

Diagnosis. Clypeus trapezoidal. Antennae with 10 antennomeres. Protibia with three teeth, with spur. Elytral suture without a row of long setae; proximal portion of

parameres elongated, enlarged, with rounded projections; proximal inner margin with small flap; distal portion strongly downturned, slender, apex rounded, without teeth.

Description. Length. 8.5-10.1 mm. **Body.** Reddish. Dorsal surface short stout grayish setae, ventral surface with thin grayish setae (Fig. 3A–C). **Head.** Epistomal suture slightly sinuous. Clypeus trapezoidal (rounded, in females), anterior margin slightly sinuate (Fig. 3D-E). Labrum slightly sinuate. Antennae with 10 antennomeres, lammelae as long as funicle (shorter in females). **Prothorax.** Tibia with three teeth, with spurs (Fig. 3F). **Mesothorax.** Elytral suture without a row of long setae, epipleura conspicuous. **Metathorax.** Epimeron mostly covered by elytra. **Aedeagus.** Parameres as long as phallobasis and apodema togheter; proximal portion of parameres elongated, enlarged, with rounded projections; proximal inner margin with small flap; distal portion strongly downturned, slender, apex rounded, without teeth (Fig. G–H).

Remarks. This species differs from the other species of *Alvarinus* specially the genitalia shape, which has remarkable modifications in the paramera shape, when compared with other species of *Alvarinus*. This species has the proximal portion of paramera strongly enlarged. It's distal portion is articulated, strongly downturned, and slender. By the observation of *Alvarinus brasiliensis* and *A. setulosus* syntypes, it was observed that the former is junior synonym of the first one. *Alvarinus setulosus* was described in the same publication (Moser, 1919), but after *A. brasiliensis*. The author observed that the species were similar, but noted slight differences regarding punctuation and size of clypeus.

Distribution. Brazil: Rio de Janeiro (Bom Jardim), Espírito Santo, Paraná (Prudentópolis) (Fig. 12).

***Alvarinus canescens* (Burmeister, 1855)**

(Figures 4A–H, 12)

Corminus canescens Burmeister, 1855: 40; Gemminger & Harold, 1869: 1145 (checklist); Dalla Torre, 1913: 325 (checklist); Blackwelder, 1944: 230 (checklist); Evans, 2003: 255 (checklist); Evans & Smith, 2005: 213 (checklist); Katovich, 2008: 16 (review with identification key to Macrodactylini genera).

Alvarinus canescens; Evans & Smith, 2009: 199 (checklist); Fuhmann & Vaz-de-Mello, 2017: 14 (review); Grossi & Vaz-de-Mello, 2017 (checklist); Schoolmeesters, 2017 (checklist).

Material examined. Type material, Holotype of *Corminus canescens* Burmeister ♂ (here designated; MLUH): 1. (old green label, typed in black) Nov. | Frib. / 2. (red label, handwritten in black) LECTOTYPE ♂ | Corminus canescens | Burmeister, 1855. Des. J. Fuhmann & F. Z. Vaz-de-Mello, 2017.

Non–type material. BRAZIL: **Minas Gerais**, Catagueses (Distrito de Vista Alegre), 27.viii.1906, Godoy – 1♂ (MZUSP); **Rio de Janeiro**, Nova Friburgo, no data, Beske – 1♂ (MNHUB); Nova Friburgo, xi.2004, E. J. Grossi – 2♂ (EPGC), Petrópolis, F. Ohaus – 1♂ (MNHUB); no data – 1♂ (MNHUB).

Diagnosis. Clypeus trapezoidal. Antennae with 10 antennomeres Protibia with two teeth, without spur. Elytral suture with a row of long setae. Paramera, in dorsal view, with region after separation bearing a narrow flap not reaching apical region, external latero-apical region with developed tooth.

Description. Length. 9.5-9.7 mm. **Body.** Yellowish (Figs. 4A–C). **Head.** Clypeus trapezoidal, lateral margin constricted medially, posterior angles covering ocular *canthus* (Figs. 4D-E). Labrum semicircular (Fig. 4E). Antennae with 10 antennomeres, lammelae as long as funicle. **Prothorax.** Pronotum slightly, with adpressed setae, and posterior margin medially lobed. Tibia with 2 teeth, without spur (Fig. 4F). **Mesothorax.** Elytral suture with row of long setae; Epipleura conspicuous. **Metathorax.** Epimeron mostly covered by elytra. **Aedeagus.** Paramera, in dorsal view, with region after separation bearing a narrow flap not reaching apical region, external latero-apical region with developed tooth (Figs. 4G–H).

Remarks. This species resembles to *Alvarinus paschoali* **sp. nov.**, but differs specially by the absence of protibial spur, elytral suture with a row long setae, by the shape of the paramera flap and, size of the apical tooth.

Distribution. Brazil: Minas Gerais, Cataguases (Distrito de Vista Alegre), Rio de Janeiro (Nova Friburgo, Petrópolis). (Fig. 12)

***Alvarinus hilarii* Blanchard, 1850**

(Figures 5A–H, 12)

Alvarinus hilarii Blanchard, 1850: 123; Gemminger & Harold, 1869: 1150; Ohaus, 1900: 251; Dalla Torre, 1913: 332 (checklist); Blackwelder, 1944: 232 (checklist); Evans, 2003: 224 (checklist); Evans & Smith, 2005: 186 (checklist); Evans & Smith, 2007: 189 (checklist); Katovich, 2008: 16 (review with identification key to Macrodactylini genera); Evans & Smith, 2009: 199 (checklist); Grossi & Vaz-de-Mello, 2017 (checklist); Schoolmeesters, 2017 (checklist).

Corminus maniculatus Burmeister, 1855: 40; Gemminger & Harold, 1869: 1145 (checklist); Dalla Torre, 1913: 332 (checklist); Blackwelder, 1944: 230 (checklist); Evans, 2003: 255 (checklist); Evans & Smith, 2005: 214 (checklist).

Alvarinus maniculatus (Burmeister, 1855): Evans & Smith, 2009: 199 (checklist); Grossi & Vaz-de-Mello, 2017 (checklist); Schoolmeesters, 2017 (checklist), **new synonym**.

Alvarinus pallidipennis sensu Frey, 1969, non Blanchard, 1850

Plectris rectangula Frey, 1967: 40, **new synonym**.

Material examined. Type material, Lectotype of *Alvarinus hilarii* Blanchard ♂ (here designated; MNHN).1. (old white label, small, rounded, handwritten in the back). Ouest Capitª des Mines / 2. (old white label, bordered in black, printed in black) Museum Paris | Ouest Capitª des Mines / 3. (white label, handwritten) Alvarinus hilarii Blanchard | Fide K. Katovich 03 / 4. (white label, bordered in black, printed in black) SYNTYPE | Alvarinus hilarii Blanchard, 1851. / 5. (red label, bordered and printed in black) SYNTYPE / 6. (red label, bordered and printed in black). LECTOTYPE ♂ | Alvarinus hilarii Blanchard, 1850 | Des. L.S.C. Albuquerque, 2016. **Paralectotype** ♂ (MNHN): 1. (old white label, bordered in black, printed in black) Museum Paris / 2. (white label, bordered in black, printed in black) SYNTYPE | Alvarinus hilarii Blanchard, 1851 / 3. (red label, printed in black) SYNTYPE / 3. (yellow label, bordered and printed in black) PARALECTOTYPE ♂ | Alvarinus hilarii Blanchard, 1850 | Des. L.S.C. Albuquerque, 2016. **Paralectotype** ♂ (MNHN): 1. (old green label, bordered and printed in black) Museum Paris | Ancienne Collection / 2. (old white label, bordered and printed in black) Alvarinus hilarii Blanc. Det. L.W. Saylor / 3. (white label, bordered in black, printed in black) SYNTYPE | Alvarinus hilarii Blanchard, 1851 / 4. (red label, printed in black) SYNTYPE/ 5. (yellow, bordered and printed in black). PARALECTOTYPE ♂ | Alvarinus hilarii Blanchard, 1850 | Des. L.S.C. Albuquerque, 2016. **Paralectotype** ♂ (MNHN): 1. (Old green label, rounded, handwritten in the back) Ouest des Capitª des

Mines / 2. (Old white label, bordered in black, printed in black, handwritten) Museum Paris | Brésil / 3. (white label, bordered in black, printed in black) SYNTYPE | Alvarinus hilarii Blanchard, 1851 / 4. red label, bordered and printed in black) SYNTYPE / 5. (yellow, bordered and printed in black). PARALECTOTYPE ♂ | Alvarinus hilarii Blanchard, 1850 | Des. L.S.C. Albuquerque, 2016.

Non–type material. BRAZIL: Goiás, Goiatuba, x. 1943 – 1♂ (NMBS); Jataí 1♂ (NMBS); Jataí 3 ♂ (NHM); **São Paulo** – 2 ♂ (MNHUB); Matão, 24.x.1963 - 1♂ (MZUSP); **Rio de Janeiro**, Nova Friburgo, Beske – 1 ♂ (MNHUB); Rio de Janeiro – 2 ♂ (MNHUB); **Paraná**, Jaguariaíva, 3.xii.1986, Maraba & Laroca – 1 ♂ (INPA); no data – 5 ♂ (MNHUB); no data – 2 ♂ (NHM).

Diagnosis. Clypeus quadrate. Antennae with nine antennomeres. Protibia with two teeth, without spur. Elytral suture without a row of long setae. Paramera, in dorsal view, with developed flap and longitudinal striae; external latero-apical region with reduced tooth.

Description. Length. 7.5–9.7 mm. **Body.** Densely punctuate and setose, dorsal surface with grayish stout setae, ventral surface with long, thin grayish setae (Figs. 5A–C). **Head.** Blackish. Clypeus quadrangular (Fig. 5D), apex slightly sinuate, posterior angles covering ocular *canthus*. Antennae yellowish, with 9 antennomeres (Fig. 5E). Labrum semicircular. Maxillary and labial palpi yellowish. **Prothorax.** Pronotum blackish, gibbous, with grayish suberect stout setae, posterior margin without lobe medially. Coxae blackish. Trochanter brownish. Femurs, tibia and tarsi yellowish; Tibia with two teeth, without spurs (Fig. 5F). **Mesothorax.** Elytrum blackish; inconspicuous eplipleura. **Metathorax.** Epimera mostly covered by elytra. **Aedeagus.** Region after paramera separation, with developed flap and longitudinal striae; external latero-apical region with small tooth (Figs. 5G–H).

Remarks. By the analysis of *Alvarinus maniculatus* Burmeister and *Plectris retangula* (previously known as *Alvarinus pallidipenis* junior synonym) types, was observed that

they are junior synonyms of *A. hilarii*. Both type series share key diagnostic features indicated in the diagnosis of this study. In the label of one specimen collected in Matão (São Paulo, Brazil), there is an observation that it was flying over a saúva nest. Ohaus (1900) registred this species for Sete Lagoas (Minas Gerais)

Distribution. Brazil: Bahia (Locality unknown), Goiás (Goiatuba, Jataí), Minas Gerais (Sete Lagoas); Rio de Janeiro (Nova Friburgo); São Paulo (Matão); Paraná (Jaguaraíva). (Fig. 12).

***Alvarinus pallidipennis* Blanchard, 1850**

(Figures 6A–H, 12)

Alvarinus pallidipennis Blanchard, 1850: 123; Gemminger & Harold, 1869: 1150 (checklist); Dalla Torre, 1913: 332 (checklist); Blackwelder, 1944: 232 (checklist); Evans, 2003: 224 (checklist); Evans & Smith, 2005: 186 (checklist); Evans & Smith, 2007: 189 (checklist); Evans & Smith, 2009: 200 (checklist); Grossi &Vaz-de-Mello, 2017 (checklist); Schoolmeesters, 2017 (checklist).

Corminus luridipennis Burmeister, 1855: 40; Gemminger & Harold, 1869: 1145 (checklist); Dalla Torre, 1913: 325 (checklist); Blackwelder, 1944: 230 (checklist); Evans, 2003: 255 (checklist); Evans & Smith, 2005: 214 (checklist).

Alvarinus luridipennis (Burmeister, 1855): Evans & Smith, 2009: 199 (checklist); Grossi & Vaz-de-Mello, 2017 (checklist); Schoolmeesters, 2017 (checklist), **new synonym.**

Material examined. Type material, Holotype of *Alvarinus pallidipennis* Blanchard ♂ (here designated; MNHN). 1. (old green label, handwritten in the back) 13–47. / 2. (old

white label, bordered and printed in black). Museum Paris | Matto Grosso | de Castelnau 13–47 / 3. (old white label, printed in red) COTYPE / 4. (white label, bordered and printed in black) SYNTYPE | Alvarinus pallidipennis Blanchard, 1851/ 5. (red label, bordered and printed in black) SYNTYPE./. 6. (red label, bordered and printed in black). HOLOTYPE ♂ | Alvarinus pallidipennis Blanchard, 1850 | Des. L.S.C. Albuquerque, 2016.

Non–type material. BRAZIL: São Paulo, São Paulo, 18.x.1914 – 1 ♂ (MNRJ); São Paulo, 12.x.1923 – 1 ♂ (MNRJ); São Paulo, 10.x.1924, M. Witte – 1 ♂ (MNRJ); Locality illegible, 10.III.1926, M. A. Richter – 1 ♂ (MNRJ); Campinas, Alwine Braaz V. – 1 ♂ (MNHUB); Santo André, Alto da Serra, Ohaus S. – 1 ♂ (MNHUB); **Minas Gerais**, Passa Quatro – 5 ♂ (MNRJ); Passa Quatro, 915m, J. Zikan – 1 ♂ (CEMT); **Paraná**, Rio Negro, 10.X.1924 – 1 ♂ (MNRJ); Ponta Grossa, Pedreira, X.1946; Castro, 28.x.2007, P. C. Grossi – 5 ♂.(EPGC); Castro, iv.2009, P. C. Grossi – 1 ♂ (EPGC); no data – 1 ♂ (MNRJ); no data – 8 ♂ (MNHUB); no data – 1 ♂ (EPGC).

Diagnosis. Clypeus quadrangualar; Antennae with 10 antennomeres. Protibia with 2 teeth, without spur. Elytral suture without a row of long setae. Paramera, in dorsal view, with large flap towards posterior region, external latero-apical region with developed tooth.

Description. Length. 7.0–9.5 mm. **Body.** Head and pronotum blackish, elytra yellowish (Figs 6A–C). **Head.** Blackish (Fig. 6D). Clypeus quadrangular (Fig 6D), latero-posterior margin constricted (Fig. 6E), posterior angles covering ocular *canthus*. Antennae blackish, with 10 antennomeres. Labrum semicircular. Maxillary and labial palpi brownish. **Prothorax.** Pronotum not medially lobed. Coxae, trochanters and tarsi brownish. Femur and tibia yellowish. Tibia with 2 teeth, second one reduced (Fig. 6F). **Mesothorax.** Elytra yellowish, with brownish longitudinal strip, extending to the apex (Fig. 6A); Epipleura conspicuous (Fig. 6C). **Metathorax.** Epimeron slightly covered by

elytra. **Aedeagus.** With basal half densely punctate, apical half with surface rugose and densely setose, external latero-apical region with developed tooth (Figs 6G–H).

Remarks. By the analysis of *Corminus luridipennis* Burmeister syntypes, and the results discussed in Chapter I, it was observed that it is a junior synonym of *Alvarinus pallidipennis*. Both type series share diagnostic features indicated in the diagnosis. According to Burmeister (1855), *Corminus luridipennis* syntype was collected in Minas Gerais, in "Dona Vicenza" and "Queluz". "Dona Vicenza" used to be a farm, located in Ouro Branco (Minas Gerais, Brazil). Currently the city "Queluz" is known as Conselheiro Lafaiete (Minas Gerais, Brazil). Papavero (1971) rebuilt Auguste Saint-Hilaire's expeditions routes in his book and showed that he travelled though "Queluz" and adjacent cities. Although Blanchard (1850) did not mention the exact locality where Saint-Hilaire collected *A. pallidipennis*, it may be the same of *C. luridipennis*. This species resembles *Alvarinus testaceipennis* (Moser, 1921 and *Alvarinus aeneicollis* (autor, ano) by the general body color, but differs, specially in the morphology of the male genitalia, and by the presence of a brownish longitudinal strip along the elytral suture, extending to the apex.

Plectris rectangula, described by Frey (1967), was synonymized to *Alvarinus pallidipennis* by the same author in 1969. By the analysis of the type and the results of Chapter I, it was shown that *Plectris rectangula* is junior synonym of *Alvarinus hilarii*.

Distribution. Brazil: Mato Grosso, Minas Gerais (Belo Horizonte, Caldas, Conselheiro Lafaiete, Lambari, Monte Verde, Ouro Branco, Passa Quatro), São Paulo (Campinas, Santo André, São Paulo) (Fig. 4) and Paraná (Castro, Ponta Grossa e Rio Negro) (Fig. 12)

***Alvarinus rufofuscus* (Moser, 1924)**

(Figures 7A–H, 12)

Corminus rufofuscus Moser, 1924: 162; Blackwelder, 1944: 230 (checklist); Evans, 2003: 255 (checklist).

Corminus rufofucsus Evans, 2003: 255; Evans & Smith, 2005: 214 (checklist), **new synonym**

Alvarinus rufofucsus Evans & Smith, 2009: 200 (checklist), **new synonym**

Alvarinus rufofuscus; Grossi & Vaz-de-Mello, 2017 (checklist); Schoolmeesters, 2017 (checklist).

Material examined. Type material, Lectotype of *Corminus rufofuscus* Moser ♂ (here designated; MNHUB): 1. (White old label, printed) B. Timbuhy | Espirito Sto. | 3.12.98 / 2. (old white label, handwritten). Corminus | rufofuscus | Type Mos. / 3. (old white label, handwritten) rufofuscus Mos. / 4. (red label, printed in black) SYNTYPUS | Alvarinus | rufofuscus (Moser, 1924) | labelled by MNHUB 2013 / 5. (red label, handwritten in black). LECTOTYPE ♂, Corminus | rufofuscus Moser, 1924. | Des. L.S.C. Albuquerque, 2016.

Non–type material. BRAZIL: Minas Gerais, Viçosa, 19-23.x.2013, Alquio – 1♂ (EPGC).

Diagnosis. Clypeus trapezoidal; Antennae with 10 antennomeres. Protibia with three teeth, with spur. Elytral suture without a row of long setae. Paramera with large flap towards the posterior region, latero-posterior region with developed tooth.

Description. Length. 9.4-9.5 mm. **Body.** Brownish (Figs. 7A–C). **Head.** Clypeus trapezoidal, lateral margin constricted medially, posterior angles covering ocular *canthus* (Fig. 7D). Antennae with 10 antennomeres. Labrum slightly sinuous (Fig. 7E).

Prothorax. Pronotum with surface slightly convex, with adpressed setae, and posterior margin medially lobed; tibia with 3 teeth and small spur (Fig. 7F). **Mesothorax.** Epipleura conspicuous. **Metathorax.** Epimeron mostly covered by elytrum. **Aedeagus.** Paramera with large developed flap, external latero-apical region with short thin setae and developed tooth (Fig. 7G–H).

Remarks. *Alvarinus rufofuscus* resembles to *Alvarinus canescens* and *A. paschoali* **sp. nov**. but differs specially by the size of paramera flap, which is enlarged when compared to that species.

Distribution. Brazil: Espírito Santo (Fundão), Minas Gerais (Viçosa) (Fig.13).

***Alvarinus testaceipennis* (Moser, 1921)**

(Figures. 8A–F, 12)

Corminus testaceipennis Moser, 1921: 155; Blackwelder, 1944: 230 (checklist); Evans, 2003: 255 (checklist); Evans & Smith, 2005: 214 (checklist).

Alvarinus testaceipennis; Evans & Smith, 2009: 200 (checklist); Grossi & Vaz-de-Mello, 2017 (checklist); Schoolmeesters, 2017 (checklist).

Material examined. Type material, Holotype of *Corminus testaceipennis* Moser ♂ (here designated; MNHUB): 1. (old white label, printed and handwritten in the back) Brasilia | Minas Gerais. 2. (old white label, handwritten). Corminus | testaceipennis | Type Mos./ 3. (old white label, handwritten) testaceipennis Mos./ 4. (red label, printed in black) SYNTYPUS | Alvarinus | testaceipennis (Moser, 1921) | labelled by MNHUB 2013/ 5.

(red label, handwritten). HOLOTYPE ♂ | Corminus | testaceipennis | Moser, 1921| Des. L.S.C. Albuquerque, 2016.

Diagnosis. Clypeus trapezoidal. Antennae with 10 antennomeres. Protibia with three teeth; Elytral suture without a row of long setae. Paramera after separation, with a developed striate flap, latero-apical region with short thin setae, external latero-apical region with developed tooth.

Description. Length. 7.5 mm. **Body.** Head and pronotum blackish, elytra yellowish (Figs. 8A–B). **Head.** Blackish. Clypeus trapezoidal, anterior angles broadly rounded (Fig. 8C), posterior angles covering ocular *canthus*. Antennae blackish, with 10 antennomeres. Labrum slightly sinuous. Maxillary and labial palpi yellowish. **Prothorax.** Pronotum blackish, gibbous, with grayish suberect stout setae, and posterior margin medially lobed. Protibia with three teeth (Fig. 8D). **Mesothorax.** Elytra yellowish, with conspicuous epipleura. **Metathorax.** Epipleura conspicuous. Epimeron slightly covered by elytra. **Aedeagus.** Paramera after separation, with developed striate flap (Fig. 8E), latero-apical region with short thin setae, apical region of ventral surface densely setose (Fig. 8F), external latero-apical region with developed tooth.

Remarks. *Alvarinus testaceipennis* is similar to *A. pallidipennis* and *A. aeneicollis* by the general color. It differs from the other species of *Alvarinus* by the clypeus broadly rounded anterior angles, dorsal surface of paramera strongly striate and apical region of ventral surface densely setose.

Distribution. Brazil: Minas Gerais (Fig. 12).

***Alvarinus varians* (Moser, 1921)**

(Figures 9A–H, 12)

Corminus varians Moser, 1921: 155; Blackwelder, 1844: 230 (checklist); Evans, 2003: 255 (checklist); Evans & Smith, 2005: 214 (checklist).

Alvarinus varians; Evans & Smith, 2009: 200 (checklist); Grossi & Vaz-de-Mello, 2017 (checklist); Schoolmeesters, 2017 (checklist).

Material examined. Type material, Lectotype of *Corminus varians* Moser ♂ (here designated; MNHUB): 1. (old white label, printed black) Brasilia. 2. (old white label, handwritten). Corminus | varians | Type Mos./ 3. (red label, printed in black) SYNTYPUS | Alvarinus | varians (Moser, 1921) | labelled by MNHUB 2013/ 4. (red label, handwritten). LECTOTYPE ♂ | Corminus | varians | Moser, 1921| Des. L.S.C. Albuquerque, 2016. **Paralectotype** ♂ 1. (old white label, printed in black) Brasilia. / 2. (old white label, handwritten) varians Mos. / 3. (red label, printed in black) SYNTYPUS |Alvarinus | varians (Moser, 1921) | labelled by MNHUB 2013. / 4. (yellow label, printed in black). PARALECTOTYPE ♂, Corminus varians | Moser, 1919 | Des. L.S.C. Albuquerque, 2016

Diagnosis. Clypeus trapezoidal. Antennae with 10 antennomeres. Protibia with three teeth, with spur. Elytral suture without a row of long setae. Paramera after separation, with flap, distal portion with short thin setae, external latero-apical region strongly produced.

Description. Length. 7.5-7.7 mm. **Body.** Head and pronotum greenish, elytra yellowish, with metallic reflections (Figs. 9A–C). **Head.** Clypeus trapezoidal, anterior margin strongly sinuate, posterior angles covering ocular *canthus* (Fig. 9D). Antennae blackish, with 10 antennomeres, antennal club shorter than funicle. Labrum slightly sinuous (Fig. 9E). Maxillary and labial palpi yellowish. **Prothorax.** Pronotum with grayish long suberect thin setae, and posterior margin medially lobed. Protibia with three teeth, with spurs (Fig. 9F). **Mesothorax.** Elytra yellowish or blackish; Epipleura conspicuous.

Metathorax. Epimeron slightly covered by elytra. **Aedeagus.** Paramera after separation, with flap, distal portion with short thin setae, external latero-apical region strongly produced (Figs. 9G–H).

Remarks. *Alvarinus varians* is different from all species of *Alvarinus* specially regarding its metallic reflections, clypeus with anterior margin strongly sinuate, Paramera after separation, with flap, distal portion with short thin setae, external latero-apical region strongly produced.

Distribution. Brazil (uncertain locality) (Fig. 12).

***Alvarinus paschoali* sp nov.**

(Figures 10A–H, 12)

Etymology. This species is named after Dr. Paschoal Coelho Grossi, which contributed with important material to the present research.

Material examined. Type material, Holotype: BRAZIL: Bahia: Encruzilhada, [-15474444, -40838056], 840mm, 12.xii.2007, Grossi, Parizzoto & Rafael, light trap – 1♂ (EPGC). **Paratypes: BRAZIL**: Bahia: Encruzilhada, [-15474444, -40838056], 840mm, 12.xii.2007, Grossi, Parizzoto & Rafael, light trap – 2♂ (EPGC).

Diagnosis. Clypeus trapezoidal. Antennae with 10 antennomeres. Protibia with three teeth, with spur. Elytral suture with a row of long setae. Paramera with flaps slightly sinuous flap, latero-apical region with short thin setae; external latero-apical region with slightly reduced tooth.

Description. Length. 9.0-9.2 mm. **Body.** Yellowish (Figs 10A–C). **Head.** Clypeus trapezoidal, latero-posterior antes slightly constricted, posterior angles covering ocular *canthus* (Fig. 10D). Antennae yellowish, with 10 antennomeres. Labrum semicircular. Maxillary and labial palpi yellowish. **Prothorax.** Pronotum with surface slightly convex, with adpressed setae, and with posterior margin medially lobed; Tibia with 3 teeth and a small spur (Fig. 10E–F). **Mesothorax.** Elytral suture with a row of long setae, elytra yellowish with brownish macula on anterior lateral sides, below humeral callus (Fig. 10C), epipleura conspicuous. **Metathorax.** Epimeron mostly covered by elytra. **Aedeagus.** Paramera with large and slightly sinuous flap not reaching apex, latero-apical region with short thin setae; apical outer edge with one small tooth (Fig. 10G-H).

Remarks. This species resembles to *Alvarinis rufofuscus* and *A. canescens* by the general shape. It differs from the other species, specially from *A. rufofuscus*, because of the presence of a sinuous flap in the paramera, and sligthtly smaller tooth.

Distribution. Brazil: Bahia (Encruzilhada) (Fig. 12).

***Alvarinus vazdemelloi* sp. nov.**

(Figures 11A–H, 12)

Etymology. This species is named after Dr. Fernando Zagury Vaz-de-Mello, which contributed with important material to the present research and to fruitful collaboration.

Material examined. Type material, Holotype. BRAZIL: Paraná: Ponta Grossa, Parque Estadual de Vila Velha, 15.xi.1965, Moure & Marinoni – 1♂ (DZUP). **Paratype. BRAZIL:** Paraná: Ponta Grossa, Parque Estadual de Vila Velha, 15.xi.1965, Moure &

Marinoni – 1 ♂ (DZUP). **Paratypes. BRAZIL:** Minas Gerais: Parque Nacional Serra da Canastra, [-20224722, -46555000], 1414mm, 06.xii.2007, M. F. Souza – 2 ♂ (EPGC).

Diagnosis. Clypeus trapezoidal. Antennae with 10 antennomeres. Protibia with three teeth, with spur. Elytral suture without a row of long setae. Paramera, after separation, with large flap, enlarged medially, not reaching apex, striate surface; latero-apical region with short thin setae and developed tooth.

Description. Length. 7.6-7.7 mm. **Body.** Blackish (Figs 11A–C). **Head.** Antennae brownish. Clypeus trapezoidal, posterior angles covering ocular *canthus* (Fig. 11D). Antennae with 10 antennomeres (Fig. 11E). Labrum slightly sinuous (Fig. 11E). Maxillary and labial palpi blackish (Fig. 11E). **Prothorax.** Pronotum with surface slightly convex, with semierect setae; posterior margin medially lobed. Tibia with 3 teeth, with small spur (Fig. 11F). **Mesothorax.** Epipleura conspicuous. Epimeron mostly covered by elytra. **Aedeagus.** Paramera, after separation, with large flap, enlarged medially, not reaching apex, striate surface (Fig. 11G); latero-apical region with short thin setae and developed tooth (Fig. 11H).

Remarks. This species resembles to *Alvarinus hilarii*, but differs specially by the trapezoidal clypeus, presence of 10 antennomeres, and protibial spurs. In charpter one, this species was recovered as sister group of *Alvarinus aeneicollis* by the absence pronotum medial lobe (posterior margin).

Distribution. Brazil: Minas Gerais (São Roque de Minas), Paraná (Ponta Grossa) (Fig. 12).

Identification key to *Alvarinus* Blanchard, 1850 species *sensu novum*

1. Clypeus quadrangular (Fig.5D); body, in dorsal view, with semi-erect long setae (Fig. 4C); pronotum posterior margin not lobate medially (Fig. 5A)…….……2

1'. Clypeus trapezoidal (Fig. 2D); body, in dorsal view, with semi-erect or adpressed long setae (Fig. 2C); pronotum with posterior margin lobate medially (Fig. 4A)…….……3

2. Antennae with nine antennomeres; clypeus posterior angles not contricted (Fig. 5D) ……..…… *Alvarinus hilarii* Blanchard.

2'. Antennae with 10 antennomeres; clypeus posterior angles constricted (Fig. 6E) ..... *Alvarinus pallidipennis* Blanchard.

3. Clypeus posterior angles covering ocular *canthus*; body yellowish or blackish……..…….4

3'. Clypeus posterior angles not covering ocular *canthus*; body reddish……..……...….. *Alvarinus bahianus* (Moser).

4. Paramera without latero-apical projections……*Alvarinu brasiliensis* (Moser)

3'. Paramera with latero-apical projections…….…….……5

5. Body with metallic reflections (Fig. 9A) ….……*Alvarinus varians* (Moser)

5'. Body without metallic reflections……..7

6. Paramera with developed flap (Fig. 5G)…….……..8

6' Paramera with reduced flap (Fig. 3G)…….*Alvarinus brasiliensis* (Moser)

7. Protibia with III tooth absent, elytra with a row of long setae towards elytral suture ……...…….. *Alvarinus canescens* (Burmeister).

7'. Protibia with III tooth present elytra without a row of long setae towards elytral suture ……..…… *Alvarinus aeneicollis* (Moser)

8. Protibial spur absent (Fig. 5F)……..…… *Alvarinus testaceipennis* (Moser).

8'. Protibial spur present (Fig. 7F).....9

9. Clypeus with lateral margin strongly constricted (Fig. 7D)……..…… *Alvarinus rufofuscus* (Moser)

9'. Clypeus with lateral not or slightly constricted……..……..… *Alvarinus paschoali* **sp. nov.**

Species removed from *Alvarinus* Blanchard *sensu novo*.

***Alvarinus guayaquilanus* (Moser, 1921)**

(Figs. 13A–G)

Corminus guayaquilanus Moser, 1921: 156; Blackwelder, 1944: 230 (checklist); Evans, 2003: 255 (checklist); Evans & Smith, 2005: 213 (checklist).

Alvarinus guayaquilanus; Evans & Smith, 2009: 199 (checklist).

Material examined. Type material, Holotype of *Corminus guayaquilanus* Moser ♂ (here designated; MNHUB): 1. (old white label, printed in black) Guyaquil | Ecuador | v. Buchwald leg. / 2. (old label, handwritten) Corminus | guayaquilanus | type Mos. / 3. (red label in black) SYNTYPE ♂ | Corminus | guayaquilanus | Moser, 1921. / 4. (red label, printed in black) HOLOTYPE ♂ Des. L. S C. Albuquerque, 2017

Diagnosis. Body yellowish (Figs 13A–C). Clypeus trapezoidal (Fig. 13D); Labrum sinuate; Protibia with two teeth (Fig. 13E); Scutellum with anterior margin projected medially; Mesotarsomere I, two times length of Mesotarsomere II; Metatarsomere I more than two times de length of metatarsomete II (Fig. 13C); Paramera not ventrally deflected, in dorsal view, without flap, posterior portion ditatated (Figs. 13F–G).

Remarks. This species differs from *Alvarinus* specially by the scutellum with anterior margin projected medially, metatarsomere I more than two times de length of metatarsomete II and paramera not ventrally deflected, in dorsal view, without flap, posterior portion ditatated. In charpter I, this taxon was more closely related to *Clavipalpus dejeani* Laporte, 1832 and *Philochloenia sulcatum* Blanchard, 1850.

Distribution. Ecuador (Guayaquil).

***Alvarinus oblongus* (Moser, 1919)**

(Figs. 14A–F)

Corminus oblongus Moser, 1919: 38; Blackwelder, 1944: 230 (checklist) Evans, 2003: 255 (checklist); Evans & Smith, 2005: 214 (checklist).

Alvarinus oblongus; Evans & Smith, 2009: 200 (checklist); Grossi & Vaz-de-Mello, 2017 (checklist); Schoolmeesters, 2017 (checklist).

Material examined. Type material, Lectotype of *Corminus oblongus* Moser ♂ (here designated; MNHUB): 1. (old white label, printed in black) Theresopolis | St. Cathar. / 2. (old white label, handwritten) Corminus | oblongus | Typus Mos. / 3. (red label, printed in black) SYNTYPUS | Alvarinus | oblongus (Moser, 1919) | labelled by MNHUB 2013. / 4. (red label, printed in black). LECTOTYPE ♂, Corminus oblongus | Moser, 1919 | Des. L.S.C. Albuquerque, 2016. **Paralectotype** ♂ 1. (old white label, printed in black) Theresopolis | St. Cathar. / 2. (old white label, handwritten) oblongus Mos. / 3. (red label, printed in black) SYNTYPUS | Alvarinus | oblongus (Moser, 1919) | labelled by MNHUB 2013. / 4. (yellow label, printed in black). PARALECTOTYPE ♂, Corminus oblongus | Moser, 1919 | Des. L.S.C. Albuquerque, 2016.

Non–type material. BRAZIL: Santa Catarina, Águas Mornas – 1 ♀ (MNHUB).

Diagnosis. Body dark brown (Figs. 14A-C). Clypeus trapezoidal (Fig. 14D); Labrum slightly sinuate. Prolegs with two teeth and short spurs. Parameres as long as phallobasis with apodema together, narrow, distal portion rounded, without tooth, and strongly downturned (Figs 14E–F).

Remarks. This species differs from the others specially by the shape of paramera, with is slender, without flap and teeth. Also distal portion of paramera is strongly downturned, similar to *Alvarinus parvulus*. When described, this species was recorded

to Theresopolis (Santa Catarina), which change the name to Águas Mornas in 1961 (Prefeitura Municipal de Águas Mornas, 2017). *Alvarinus oblongus*, according to the results in chapter, was not retrieved within *Alvarinus* Blanchard ***sensu novo***. Now is placed as *incertae sedis*.

Distribution. Brazil: Santa Catarina (Águas Mornas).

***Alvarinus parvulus* (Moser, 1919)**

(Figures 15A–F)

Corminus parvulus Moser, 1919: 40; Blackwelder, 1944: 230 (checklist); Evans, 2003: 255 (checklist); Evans & Smith, 2005: 214 (checklist).

Alvarinus parvulus; Evans & Smith, 2009: 200 (checklist); Grossi & Vaz-de-Mello, 2016 (checklist); Schoolmeesters, 2017 (checklist).

Material examined. Type material, Lectotype of *Corminus parvulus* Moser ♂ (here designated; MNHUB): 1. (old white label, bordered, printed in black and handwritten) Brasilia | Goyas. / 2. (old white label, handwritten). Corminus | parvulus | Type Mos. / 3. (old white label, handwritten) parvulus Mos./ 4. (red label, printed in black) SYNTYPUS | Alvarinus | parvulus (Moser, 1919)/ 5. (red label, bordered and printed in black) SYNTYPE./. 6. (red label, handwritten). LECTOTYPE ♂ | Corminus parvulus |. Moser 1919 | Des. L.S.C. Albuquerque, 2016.

Diagnosis. Body yellowish, shiny, densely punctuate and setose (Figs 15A–C). Clypeus with posterior angles not covering *canthus* (Fig 15D). Paramera shorter then phallobasis and apodema together, slender, without flap and external tooth, distal portion strongly downturned (Figs 15D–F).

Remarks. Like *Alvarinus oblongus*, according to the results in chapter I, *A. parvulus* was not retrieved within *Alvarinus* Blanchard ***sensu novo***. Also is placed as *incertae sedis*.

Distribution. Brazil (Goiás).

***Plectris subsericeus* (Blanchard, 1850), new combination**

(Figures 16A–D)

Alvarinus subsericeus Blanchard, 1850: 123; Lacordaire, 1856: 263; Blackwelder, 1944: 232; Evans, 2003: 224; Evans & Smith, 2005: 187; Evans & Smith, 2009: 200.

Material examined. Type material, Lectotype of *Alvarinus subsericeus* Blanchard ♂ (here designated; MNH): 1. (old green label, rounded, handwritten in the back) 7855 | 34 2. (old white label, handwritten). 9583. / 3. (old white label, printed in black and handwritten) MUSÉUM PARIS | Santa Cruz| d'Orbiginy/ 4. (red label, printed in black) SYNTYPE | *Alvarinus* | *subsericeus* Blanchard, 1851/ 5. (red label, printed in black) SYNTYPE./. 6. (red label, printed in black). LECTOTYPE ♂ | *Alvarinus subsericeus* |. Blanchard, 1850 | Des. L.S.C. Albuquerque, 2017. **Palectotype of** ♂ 1. (old green label, rounded). / 2. (old white label, printed in black and handwritten) MUSÉUM PARIS | Sica Sica | d'Orbiginy/ 3. (red label, printed in black) SYNTYPE | *Alvarinus* | *subsericeus* Blanchard, 1851/ 4. (red label, printed in black) SYNTYPE./. 5. (red label, printed in black). PARALECTOTYPE ♂ | *Alvarinus subsericeus* |. Blanchard, 1850 | Des. L.S.C. Albuquerque, 2017.

Diagnosis. Reddish brown (Fig 16A–B). Frons convex (Fig. 16C). Clypeus semicircular. Maxillary palpi IV ovate. Protibia with three teeth and developed spur. Mesotibia with external area bearing teeth, posterior margin sinuate (Fig. 16E)

Remarks. According to the results in chapter I, this species is close to species that belong to *Plectris* LePeletier & Audinet-Seville, 1828.

Distribution. Bolivia (Santa Cruz and Sica Sica).

***Plectris submetallicus* (Blanchard, 1850)**

(Figures 17A–E)

Alvarinus submetallicus Blanchard, 1850: 123; Bates, 1887: 152 (review); Blackwelder, 1944: 232 (checklist); Bates, 1887: 152 (Evans, 2003: 224 (checklist); Evans & Smith, 2005: 186 (checklist); Evans & Smith, 2009: 200 (checklist) Grossi & Vaz-de-Mello, 2017 (checklist); Schoolmeesters, 2017 (checklist).

Philochloenia chalcea Burmeister, 1855; Bates, 1887: 152 (review); Evans, 2003: 224 (checklist); Evans & Smith, 2005: 187 (checklist); Evans & Smith, 2009: 200 (checklist).

Philochlaenia chalcea Burmeister, 1855: 30; Blackwelder, 1944: 229 (checklist).

Plectris chalcea (Burmeister, 1855) Frey, 1967: 84 (key to *Plectris*)

Material examined. Type material, Lectotype of *Alvarinus sumetallicus* Blanchard ♂ (here designated; MNHN). 1. (old green label) / 2. (old white label, bordered and printed in black). Museum Paris | Matto Grosso | de Castelnau 1847 / 3. (red label, printed in black). LECTOTYPE Alvarinus submetallicus Blanchard, 1850 | Des. L.S.C. Albuquerque, 2017. **Paralectotype** ♂ (MNHN): 1. (old green label) / 2. (old white label, bordered in black, printed in black and handwritten) Museum Paris | Brésil | de Castelnau / 2. (white label, bordered in black, printed in black) SYNTYPE | Alvarinus submetallicus Blanchard, 1851 / 3. (red label, printed in black) SYNTYPE / 3. (yellow label, bordered and printed in black) PARALECTOTYPE ♂ | Alvarinus submetallicus Blanchard, 1850 | Des. L.S.C. Albuquerque, 2017. **Paralectotype** ♂ (MNHN): 1. (old green label) / 2. (old white label, bordered in black, printed in black and handwritten) Museum Paris | Brésil | de Castelnau / 2. (white label, bordered in black, printed in black) SYNTYPE | Alvarinus

submetallicus Blanchard, 1851 / 3. (red label, printed in black) SYNTYPE / 3. (yellow label, bordered and printed in black) PARALECTOTYPE ♂ | Alvarinus submetallicus Blanchard, 1850 | Des. L.S.C. Albuquerque, 2017. **Paralectotype** ♂ (MNHN): 1. (old green label) / 2. (old white label, bordered in black, printed in black and handwritten) Museum Paris | Brésil | de Castelnau / 2. (white label, bordered in black, printed in black) SYNTYPE | Alvarinus submetallicus Blanchard, 1851 / 3. (red label, printed in black) SYNTYPE / 3. (yellow label, bordered and printed in black) PARALECTOTYPE ♂ | **Paralectotype** ♀ (MNHN): 1. (old green label) / 2. (old white label, bordered in black, printed in black and handwritten) Museum Paris | Brésil | de Castelnau / 2. (white label, bordered in black, printed in black) SYNTYPE | Alvarinus submetallicus Blanchard, 1851 / 3. (red label, printed in black) SYNTYPE / 3. (yellow label, bordered and printed in black) PARALECTOTYPE ♀ | Alvarinus submetallicus Blanchard, 1850 | Des. L.S.C. Albuquerque, 2017.

Diagnosis. Body with metallic reflections (Figs. 17A–C). Head and pronotum greenish. Clypeus trapezoidal (Clypeus rounded, in females), anterior margin truncate (Fig. 17C). Antennae with 10 antennomeres, lamellae as long as funicle (slightly shorter, in females). Protibia with two teeth and developed spur. Paramera as long as phallobasis and apodema together, with narrow flap not reaching distal portion, posterior angles slightly out-turned (Figs 17D-E).

Remarks. Although *Alvarinus submetallicus* does not seem to be closely related to *Plectris tomentosa* LePeletier & Audinet-Serville, 1828, type species of *Plectris*, it belongs to a lineage currently allocated in this genus. Here we suggest the results from charpter II shows that

Discussion.

By the phylogenetic analysis of *Alvarinus* species in Chapter I, we concluded that *Alvarinus submetallicus* Blanchard and is related to a lineage currently allocated within *Plectris* LePeletier & Audinet-Seville, 1828. *A. subsericeus* Blanchard (1850), was also found to be related with *Plectris*, therefore, those species were transferred to this taxon. *Plectris submetallicus* (Blanchard) differs from *Alvarinus* by the clypeus slightly upturned, labrum sinuate, completely visible in frontal view, apical maxillary palpomere slightly ovate, paramera long, phallobase longer than apodema. *Plectris subsericeus* does not seem to be related to *A. submetallicus*, and resembles species from another group of species in *Plectris*. Additionally, *Alvarinus subsericeus* differs from *Alvarinus* species by the presence of tibiae with three well-developed teeth, presence of long protibial spurs, and frons not coplanar with clypeus. *Alvarinus aeneicollis* was transferred from *Plectris* because shares diagnostic features with *Alvarinus*.

A. guayaquilanus is registred to Guayaquil (Ecuador) and, in charpter one, was recovered as being related to *Clavipalpus dejeani* Laporte, 1829 and *Philochloenia sulcatum* Blanchard, 1850. The main differeces of *A. guayaquilanus* from *Alvarinus* Blanchard *sensu novum* is by metatarsomere I two times the length of metatarsomere II. absence of paramere flap, paramere not ventrally deflected and absence of paramere latero-apical tooth. Regarding *A. oblongus* and *A. parvulus*, in charpter I, were recovered outside *Alvarinus sensu novum* and differs from *Alvarinus* by the absence of paramere flap, paramere not ventrally deflected; distal portion strongly downturned. For that reason, *Alvarinus guayaquilanus* (Moser), *A. oblongus* (Moser) A. *parvulus* and were placed as *incertae sedis* in Melolonthinae.

Biological aspects of the genus remain poorly known. Burmeister (1855) described that collected *Alvarinus pallidipennis* at dawn. According to his journal, he was in Ouro Branco (type locality of the species) in November of 1851 (Burmeister, 1852). It was possible to observe, in labels and collections, that *Alvarinus* species were mostly collected between October and December. *A. pallidipennis* has the widest distribution, being found in Central, Southeastern and Southern Brazil.

With this work, we are able to understand more about the distribution of *Alvarinus* across Brazil. Until the present work, the species were only recorded from Bahia, Goiás, Rio de Janeiro and Espírito Santo. New localities were found, and now is also registered in Mato Grosso, Mato Grosso do Sul, Paraná, and São Paulo.

Acknowledgments

I would like to thank Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) for the doctorate grant; Matthias Seidel (National Museum, Prague), who gently facilitated the study of *Corminus* sytypes deposited in Martin Luther Universität Halle-Wittenberg, Halle, Germany (MLUH). Dr. Celso F. Martins (UFPB) for allowing the use of photography equipment; Carolina N. Liberal (UFPB) for helping with the photographs; and the curators cited in Material and Methods.

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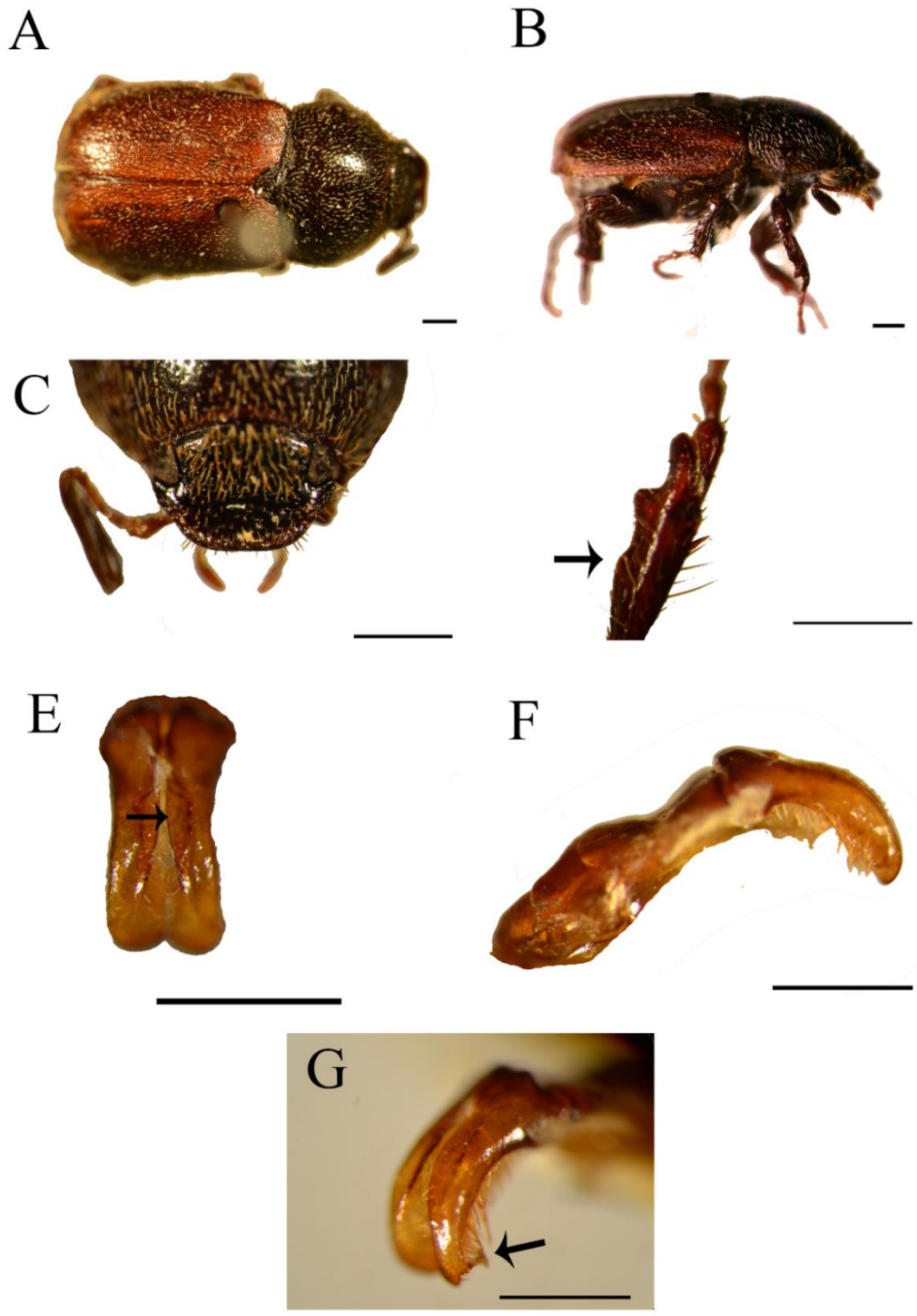
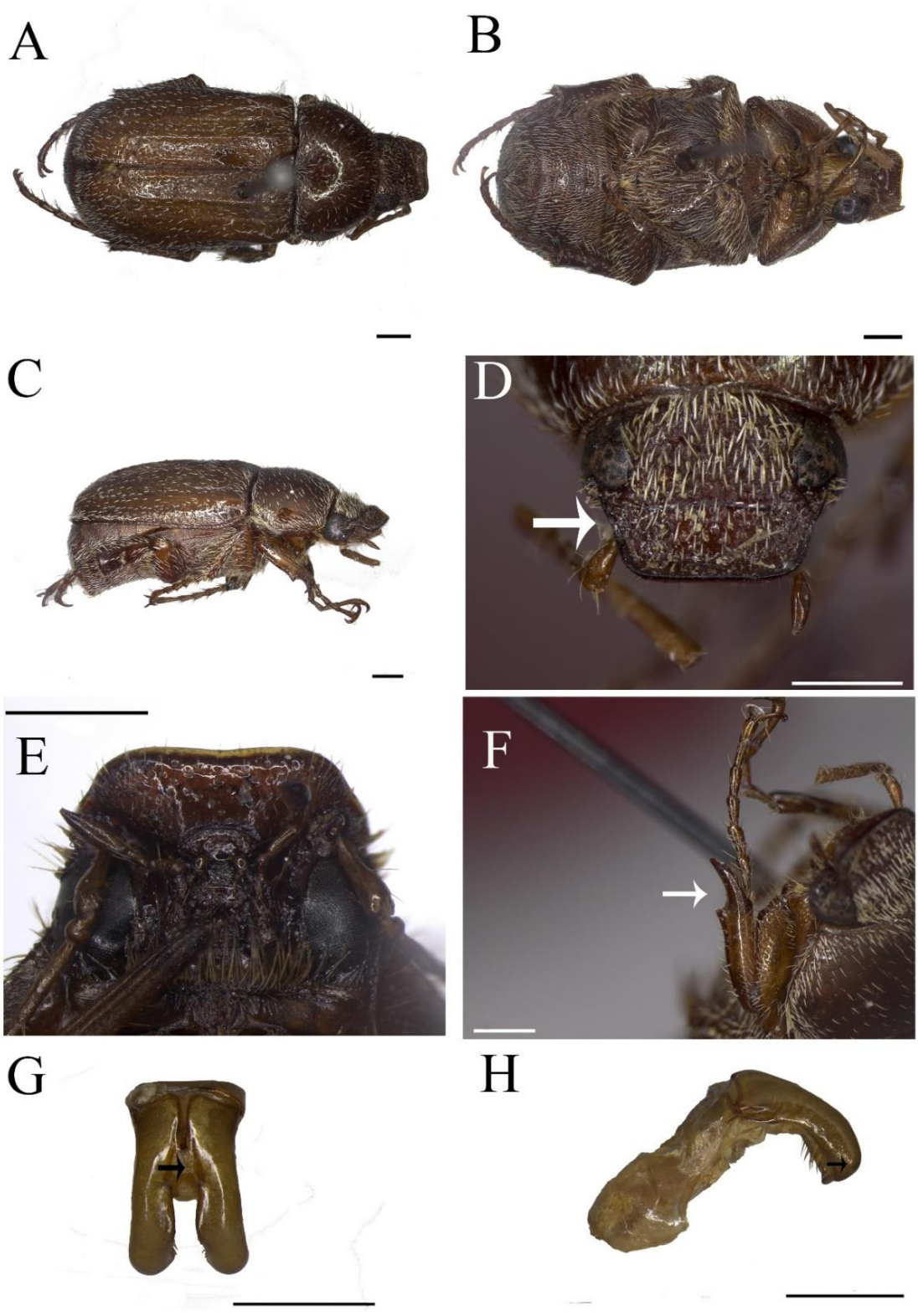
FIGURES

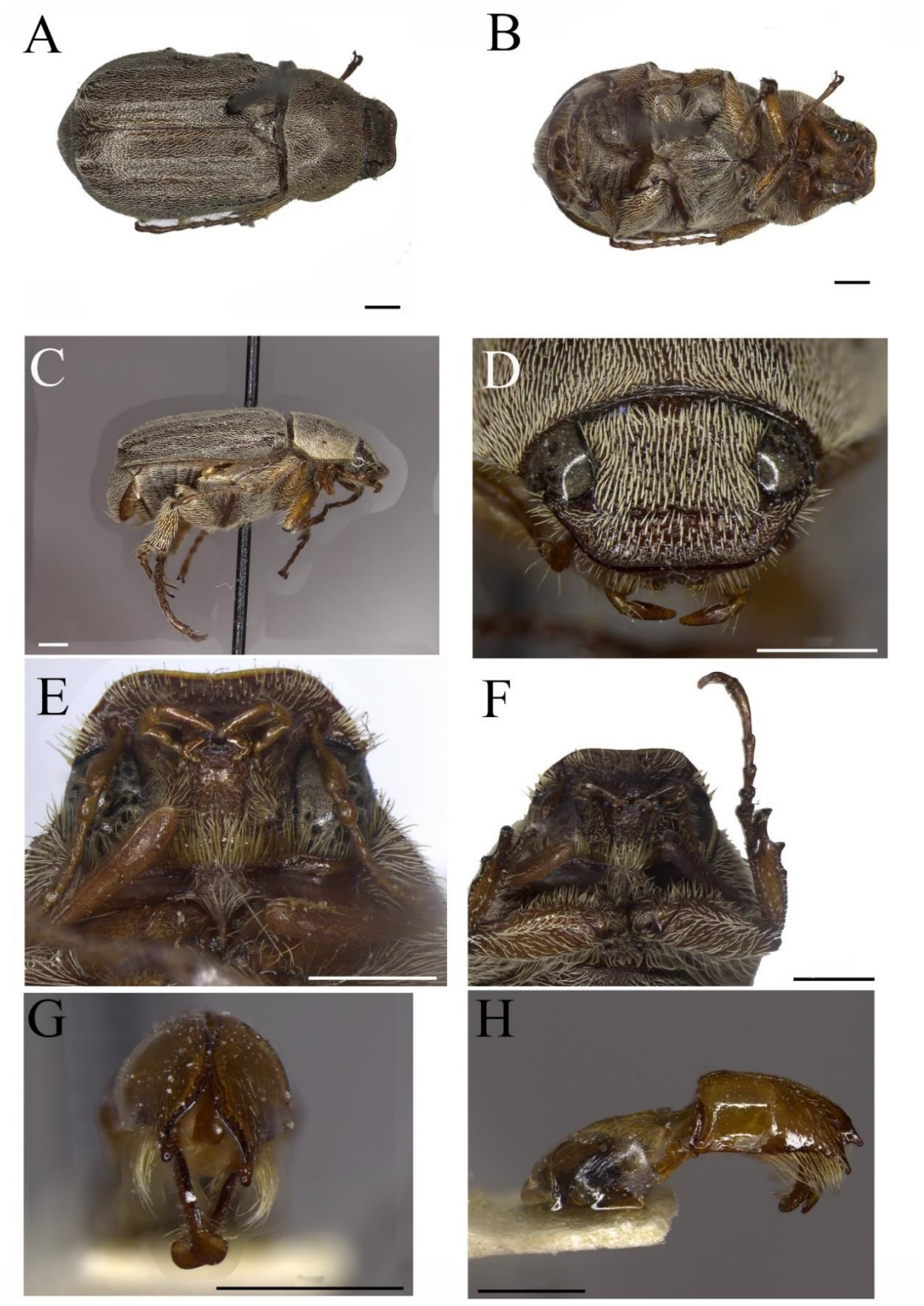
Figure 1A-G. A. *Alvarinus aeneicollis* (Moser) male habitus (dorsal view); **B.** Male habitus (lateral view); **C.** Head (dorsal view). **D.** Protibia, arrow indicating tibia with three teeth. **E.** Aedeagus (dorsal view, paramera), arrow indicating paramera flap. **F.** Aedeagus (lateral view) (paramera + phallobase + apodema). **G.** Aedeagus (dorsal view, paramera), black arrow indicating latero-apical tooth. Scale = 1mm.



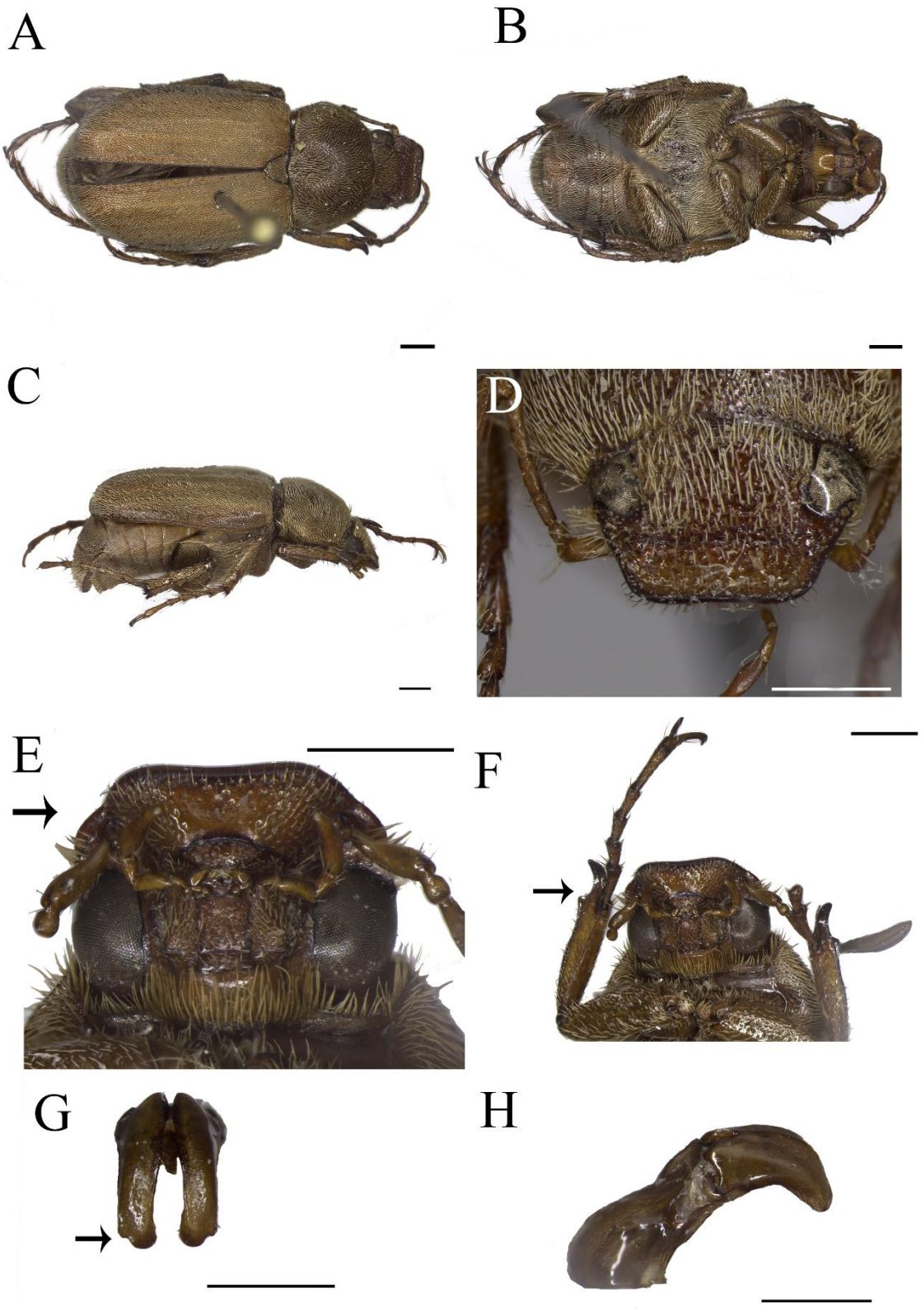
Figures 2A-F. A. *Alvarinus bahianus* (Moser) male habitus (dorsal view); **B.** Male habitus (ventral view); **C** Male habitus (lateral view); **D.** Head (dorsal view), arrow indicating clypeus posterior angles not covering ocular *canthus*. **E.** Head (ventral view); **F.** Protibia, arrow indicating tibia with two teeth. **G.** Aedeagus (dorsal view, paramera), arrow indicating paramera small flap. **H.** Aedeagus (lateral view) (paramera + phallobase + apodema). Scale = 1mm.



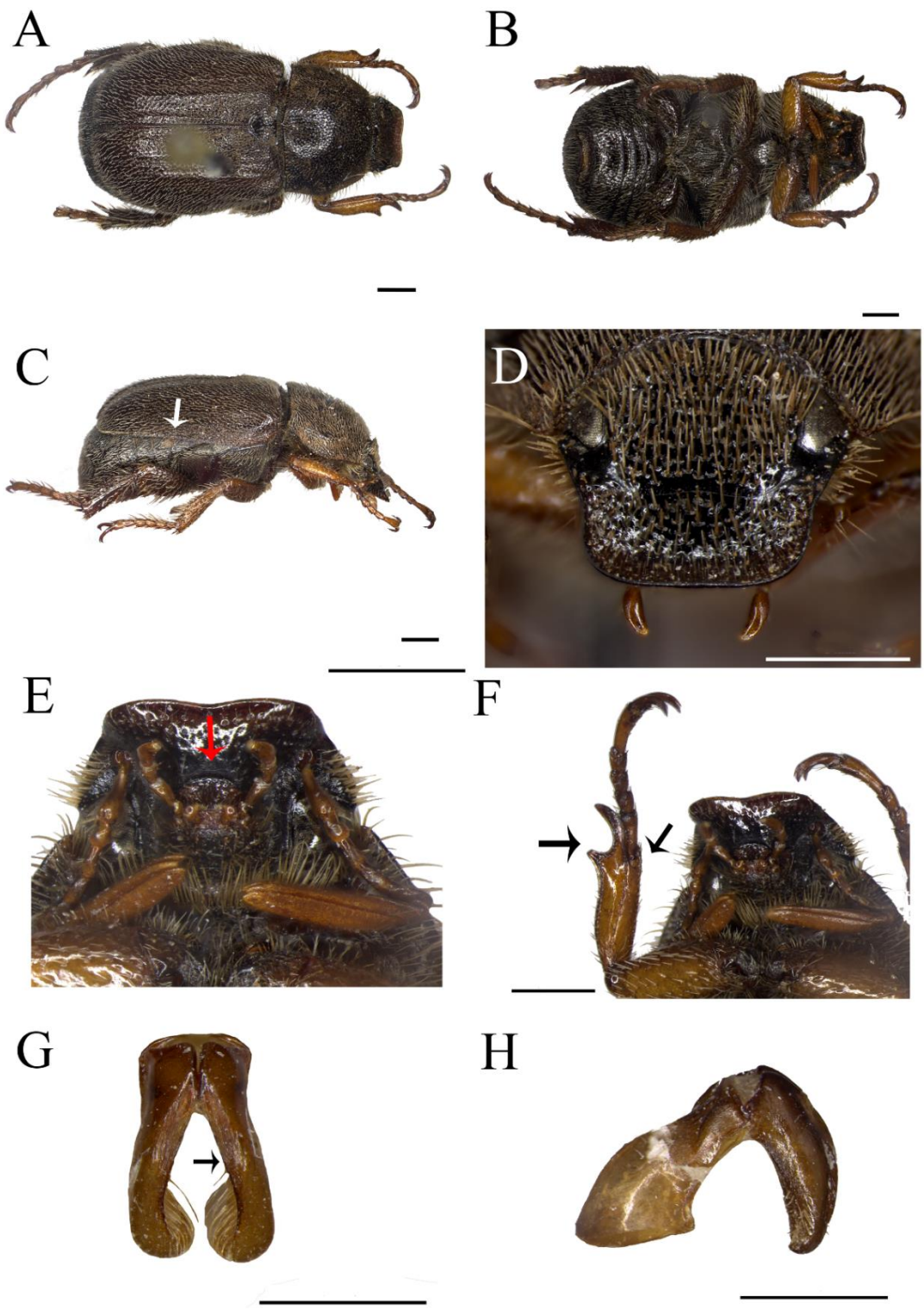
Figures 3A-H. A. *Alvarinus brasiliensis* (Moser) male habitus (dorsal view); **B.** Male habitus (ventral view); **C** Male habitus (lateral view); **D.** Head (dorsal view). **E.** Head (ventral view); **F.** Protibia, arrow indicating tibia with three teeth. **G.** Aedeagus (dorsal view, paramera). **H.** Aedeagus (lateral view) (paramera + phallobase + apodema). Scale = 1mm.



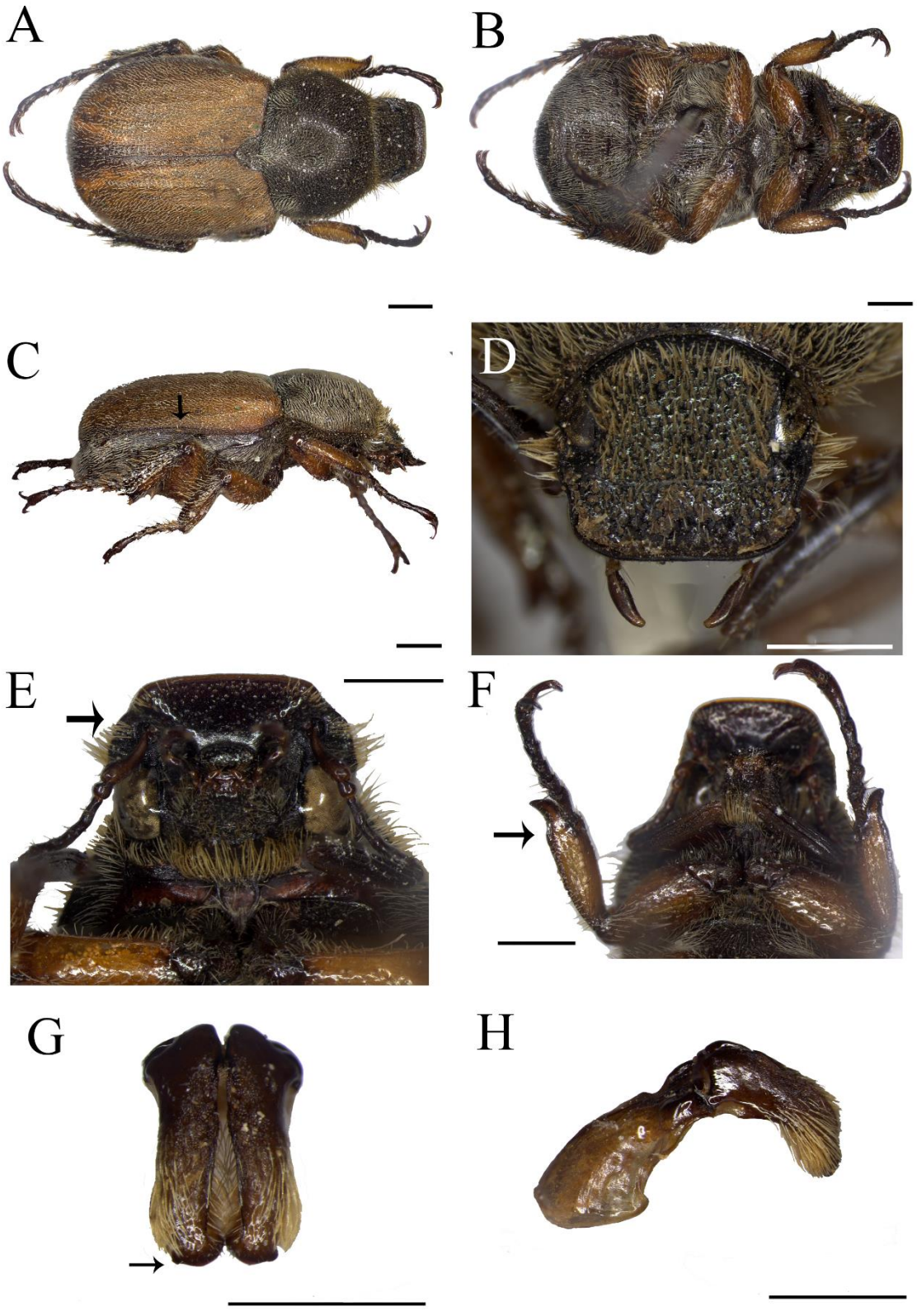
Figures 4A-H. A. *Alvarinus canescens* (Burmeister) male habitus (dorsal view); **B.** Male habitus (ventral view); **C** Male habitus (lateral view); **D.** Head, in dorsal view. **E.** Head (ventral view). **F.** Head and pronotum in ventral view, arrow indicating two protibial teeth. **G.** Aedeagus (dorsal view, paramera), black arrow indicating latero-apical tooth. **H.** Aedeagus (lateral view) (paramera + phallobase + apodema). Scale = 1mm.



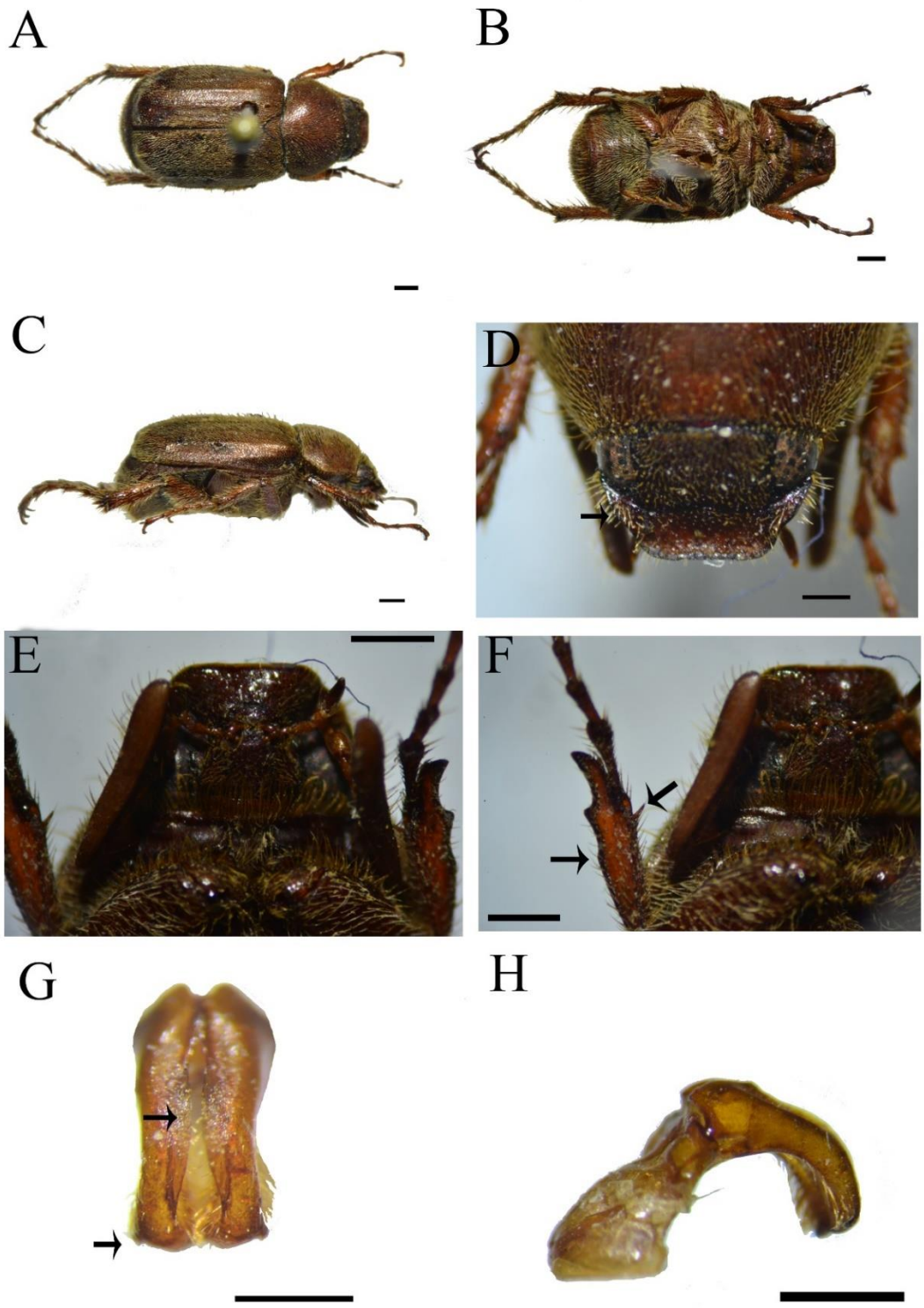
Figures 5A-H. A. *Alvarinus hilarii* Blanchard male habitus (dorsal); **B.** Male habitus (ventral view); **C** Male habitus (lateral view); **D.** Head, in dorsal view. **E.** Head (ventral), red arrow indicating labrum shape. **F.** Head and pronotum in ventral view, arrows indicating protibial teeth and absence of spur. **G.** Aedeagus (dorsal view, paramera), black arrow indicating paramera flap. **H.** Aedeagus (lateral view), (paramera + phallobase + apodema). Scale = 1mm.



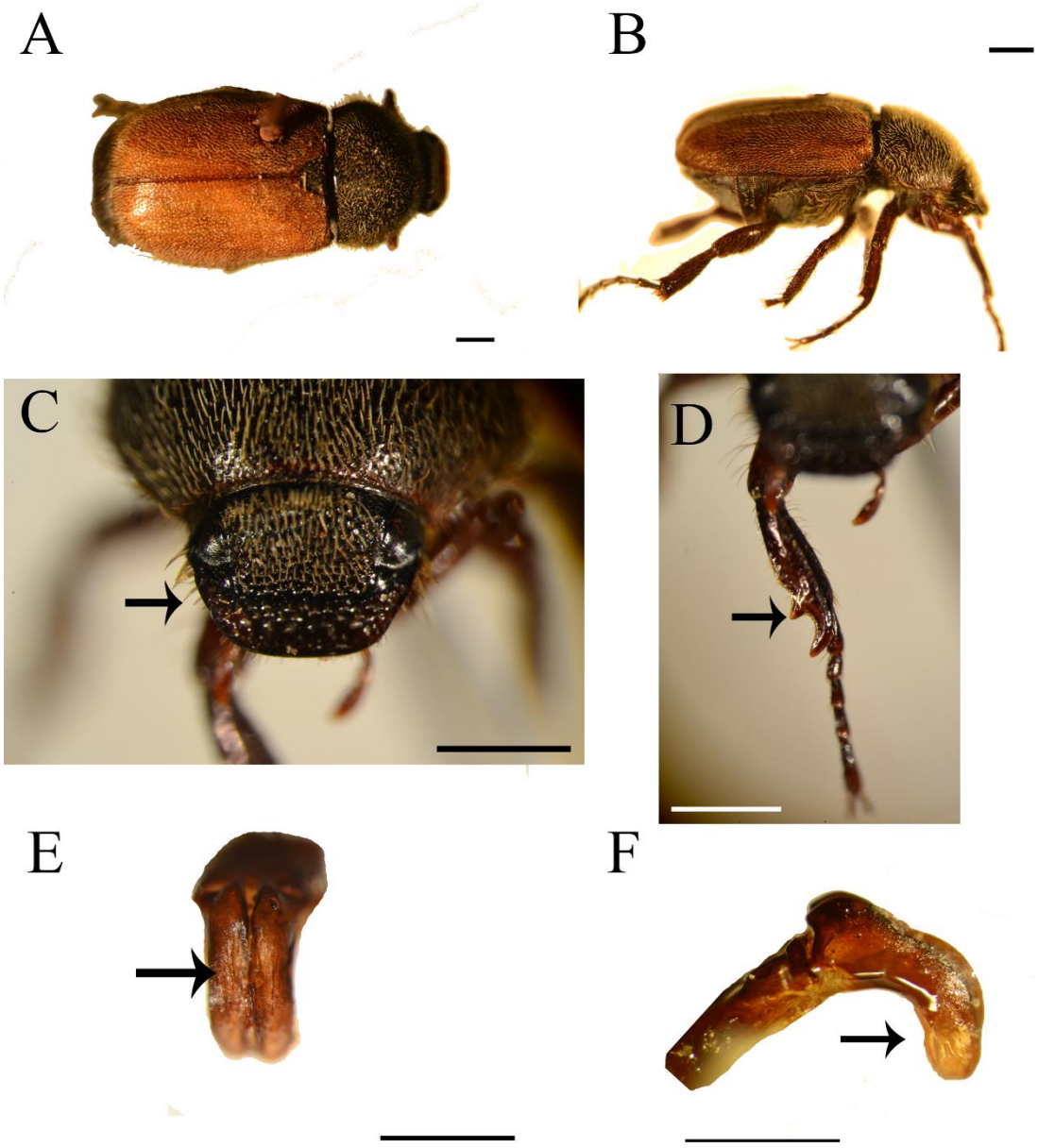
Figures 6A-H. A. *Alvarinus pallidipennis* Blanchard male habitus (dorsal); **B.** Male habitus (ventral view); **C** Male habitus (lateral view); **D.** Head, in dorsal view. **E.** Head (ventral view) black arrow indicating lateral margin constricted. **F.** Head and pronotum in ventral view, arrow indicating reduced protibial tooth. **G.** Aedeagus (dorsal view, parameres), black arrow indicating latero-apical tooth. **H.** Aedeagus (lateral view) (paramera + phallobase + apodema). Scale = 1mm.



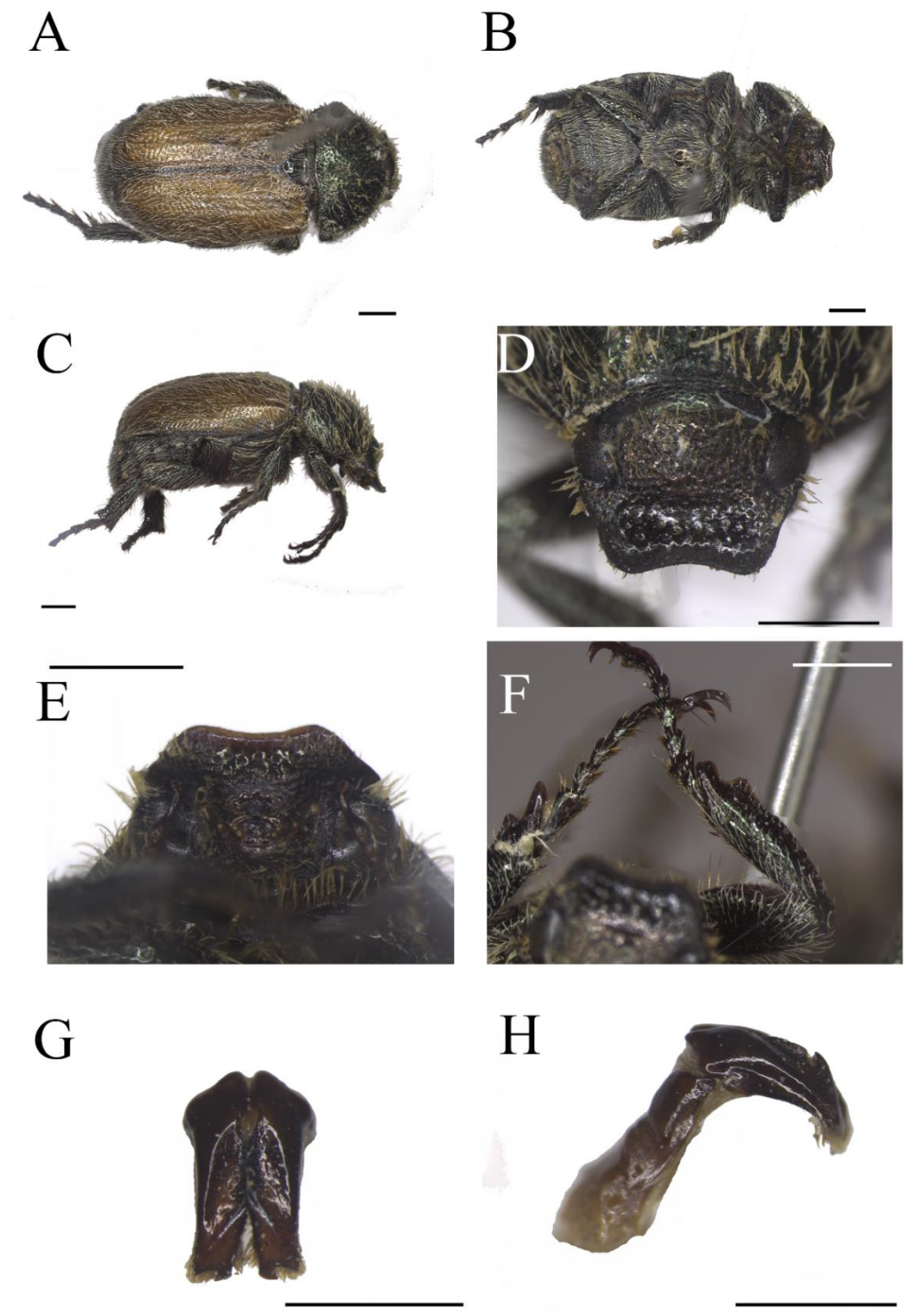
Figures 7A-H. A. *Alvarinus rufofuscus* (Moser) male habitus (dorsal view); **B.** Male habitus (ventral view); **C.** Male habitus (lateral view); **D.** Head (dorsal view), black arrow indicating lateral margin constricted. **E.** Head (ventral view). **F.** Protibia, arrows indicating tibia with three teeth, and protibial spur present; **G.** Aedeagus (dorsal view, paramera), arrow indicating paramera with enlarged and striate flap. **H.** Aedeagus (paramera + phallobase + apodema). Scale = 1mm.



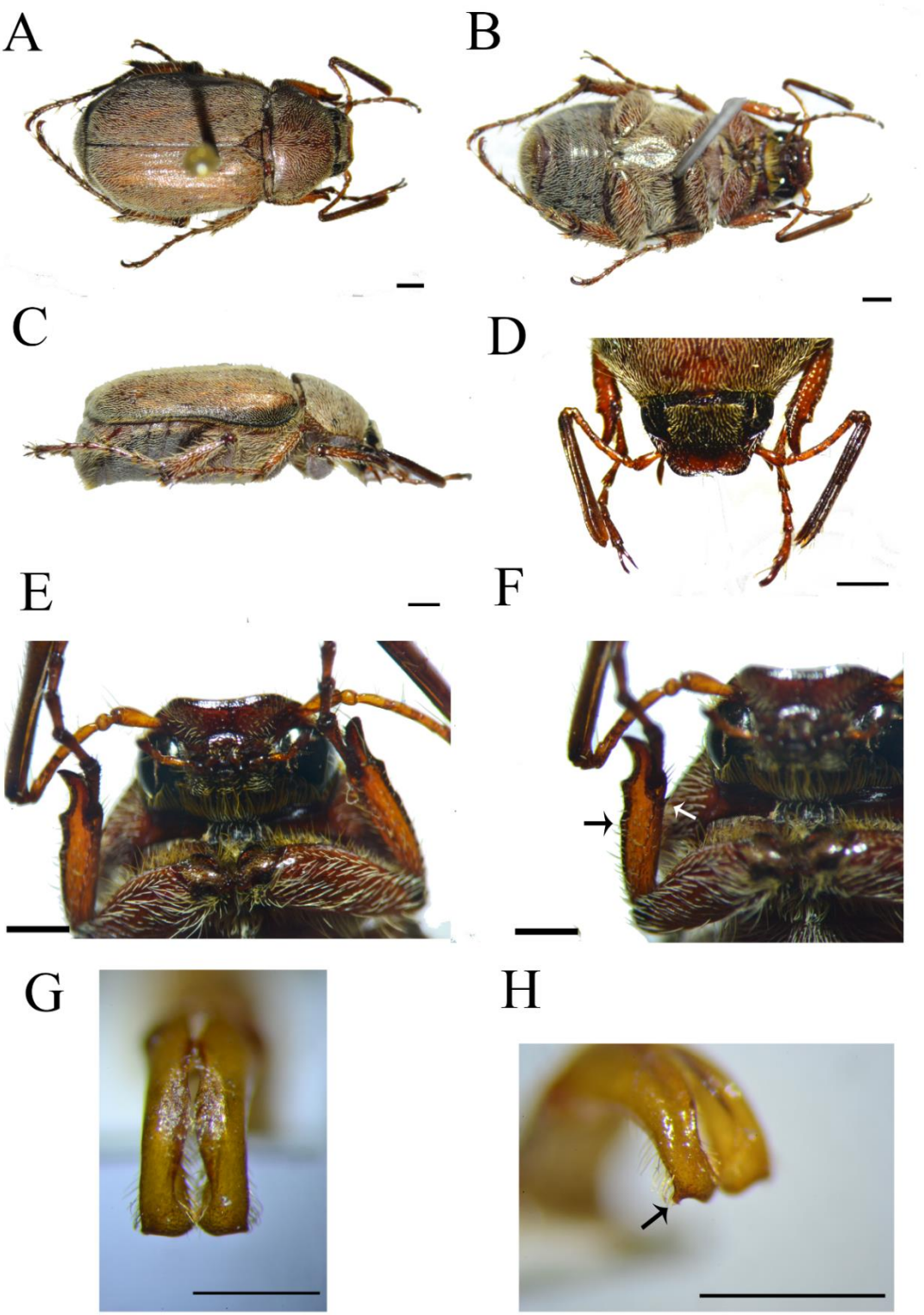
Figures 8A-F. A. *Alvarinus testaceipennis* (Moser) male habitus (dorsal view); **B.** Male habitus (lateral view); **C.** Head (dorsal view), arrow indicating clypeus shape, different from *Alvarinus pallidipennis* Blanchard. **D.** Protibia, arrow indicating tibial teeth; **E.** Aedeagus (dorsal view, paramera), arrow indicating paramera with enlarged and striate flap. **F.** Aedeagus, arrow indicating long thin setae ventrally (lateral view) paramera + phallobase + apodema). Scale = 1mm.



Figures 9A-H. A. *Alvarinus varians* (Moser) male habitus (dorsal view); **B.** Male habitus (ventral view); **C** Male habitus (lateral view); **D.** Head (dorsal view). **E.** Head (ventral view); **F.** Protibia.; **G.** Aedeagus (dorsal view, paramera), arrow indicating paramera with enlarged and striate flap. **G.** Aedeagus (lateral view) paramera + phallobase + apodema). Scale = 1mm.



Figures 10A-H. A. *Alvarinus paschoali* sp. nov. male habitus (dorsal view); **B.** Male habitus (ventral view); **C** Male habitus (lateral view); **D.** Head (dorsal view), black arrow indicating lateral margin constricted. **E.** Head (ventral view). **F.** Protibia, arrows indicating tibia with three teeth; **G.** Aedeagus (dorsal view, paramera), arrow indicating paramera flap. **H.** Aedeagus, arrow indicatin latero-apical tooth (antero-lateral view) (paramera + phallobase + apodema). Scale = 1mm.



Figures 11.A-H. A. *Alvarinus vazdemelloi* sp. nov. male habitus (dorsal view); **B.** Male habitus (ventral view); **C** Male habitus (lateral view); **D.** Head (dorsal view), black arrow indicating lateral margin constricted. **E.** Head (ventral view). **F.** Protibia, arrows indicating tibia with three teeth; **G.** Aedeagus (dorsal view, paramera), arrow indicating paramera flap. **H.** Aedeagus (lateral view) (paramera + phallobase + apodema). Scale = 1mm.

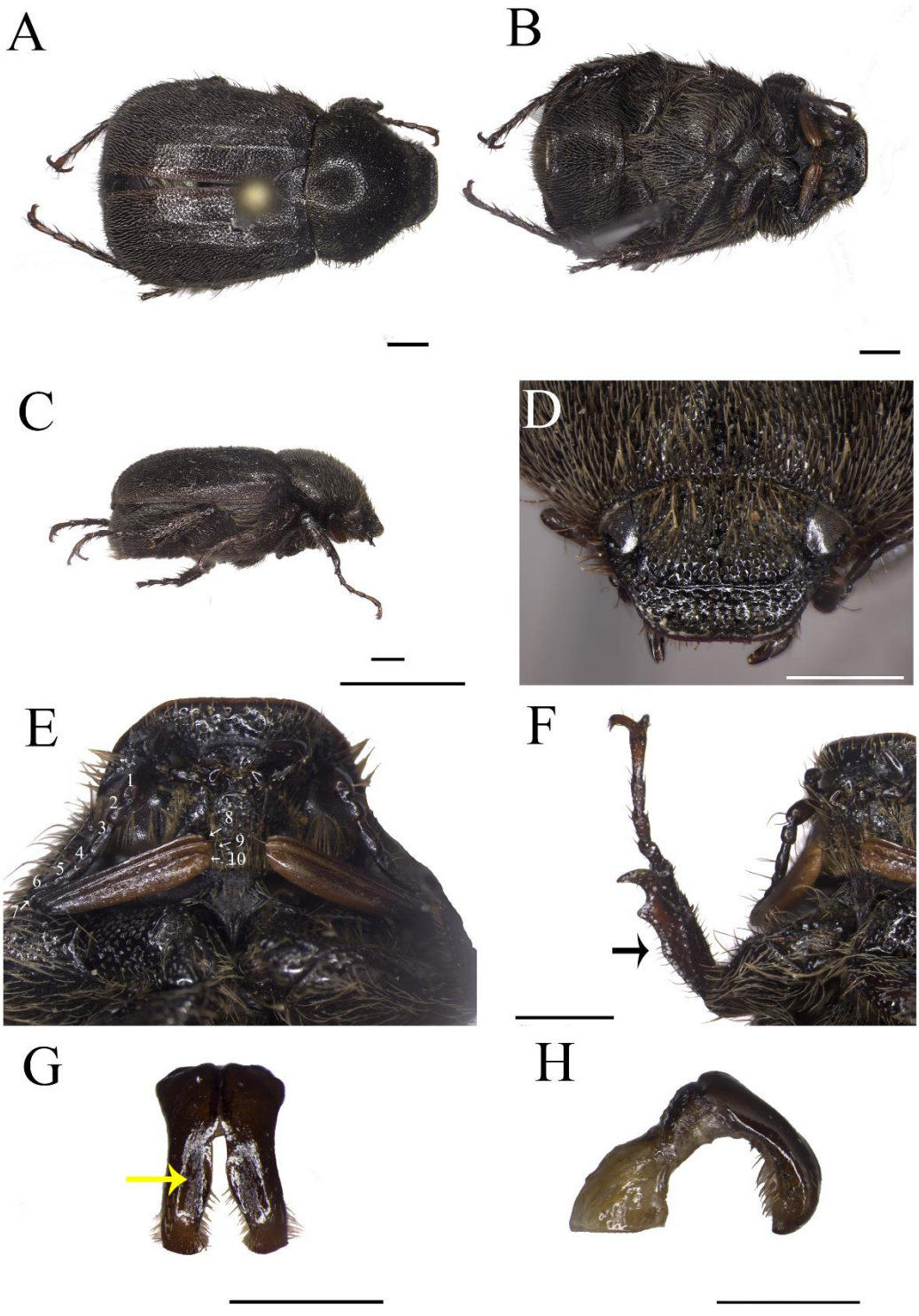
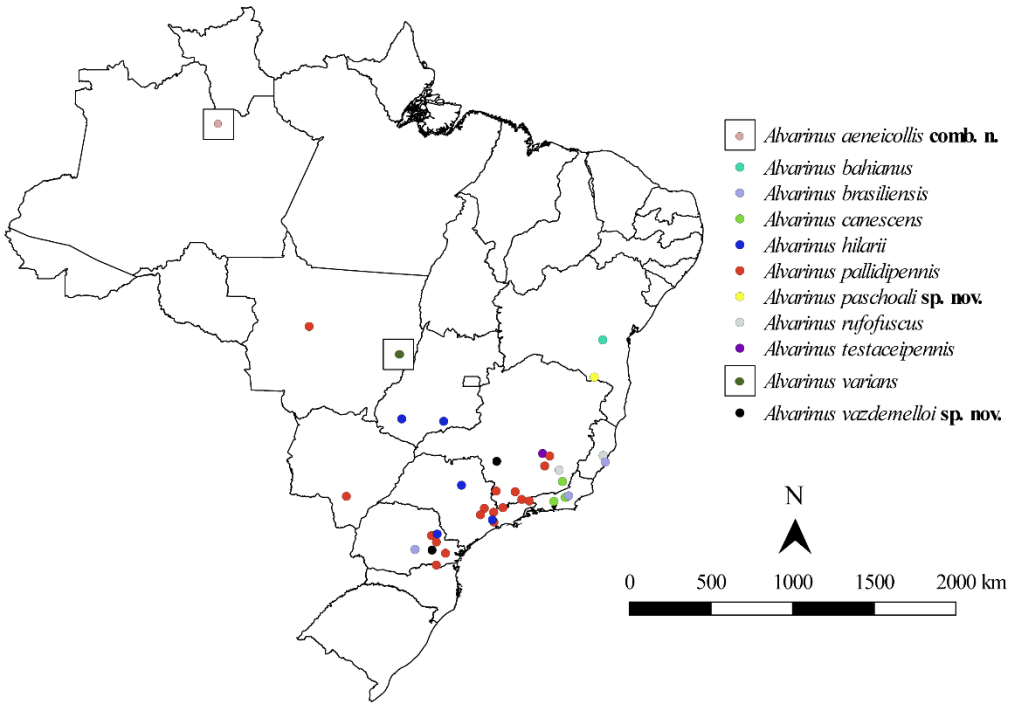
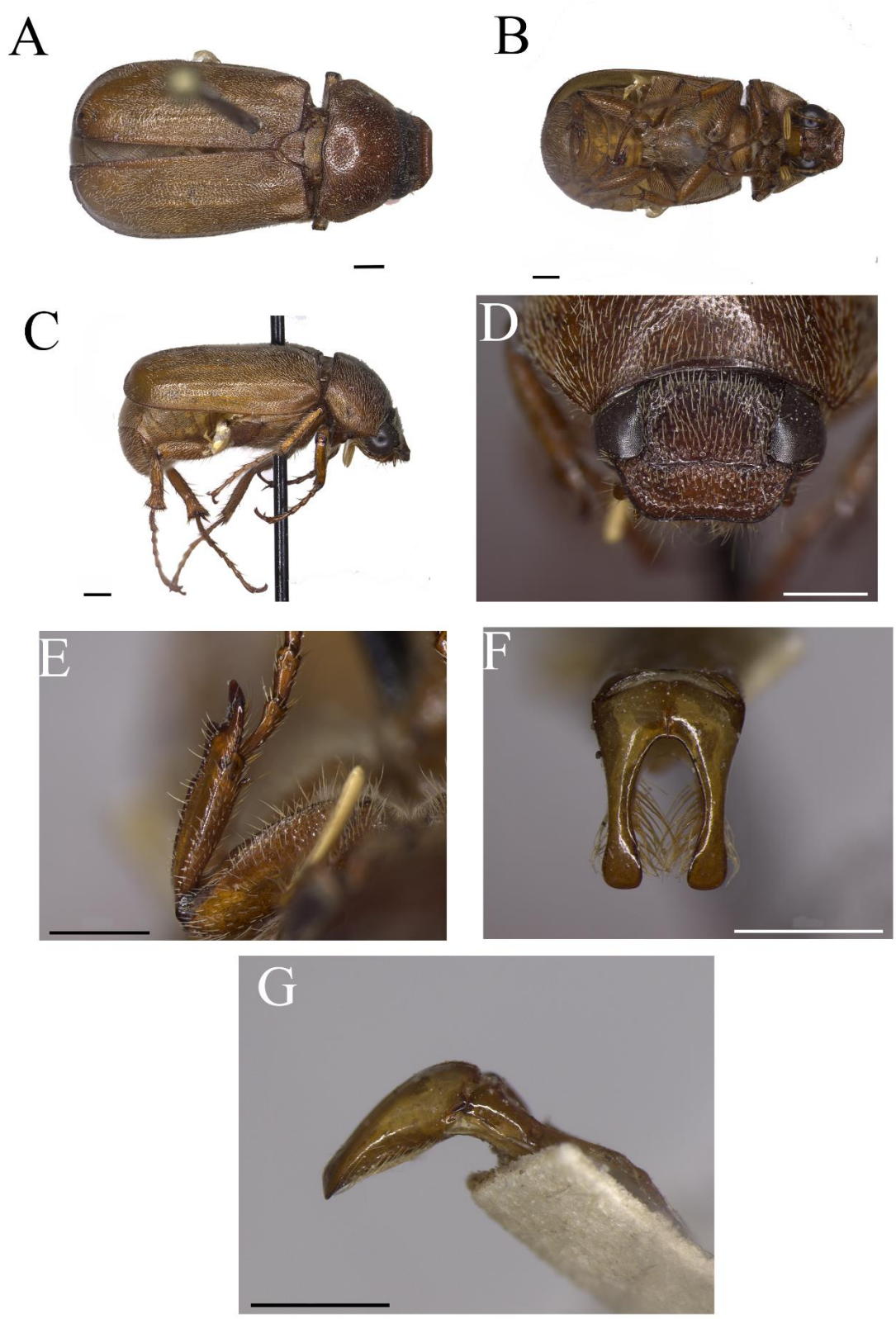


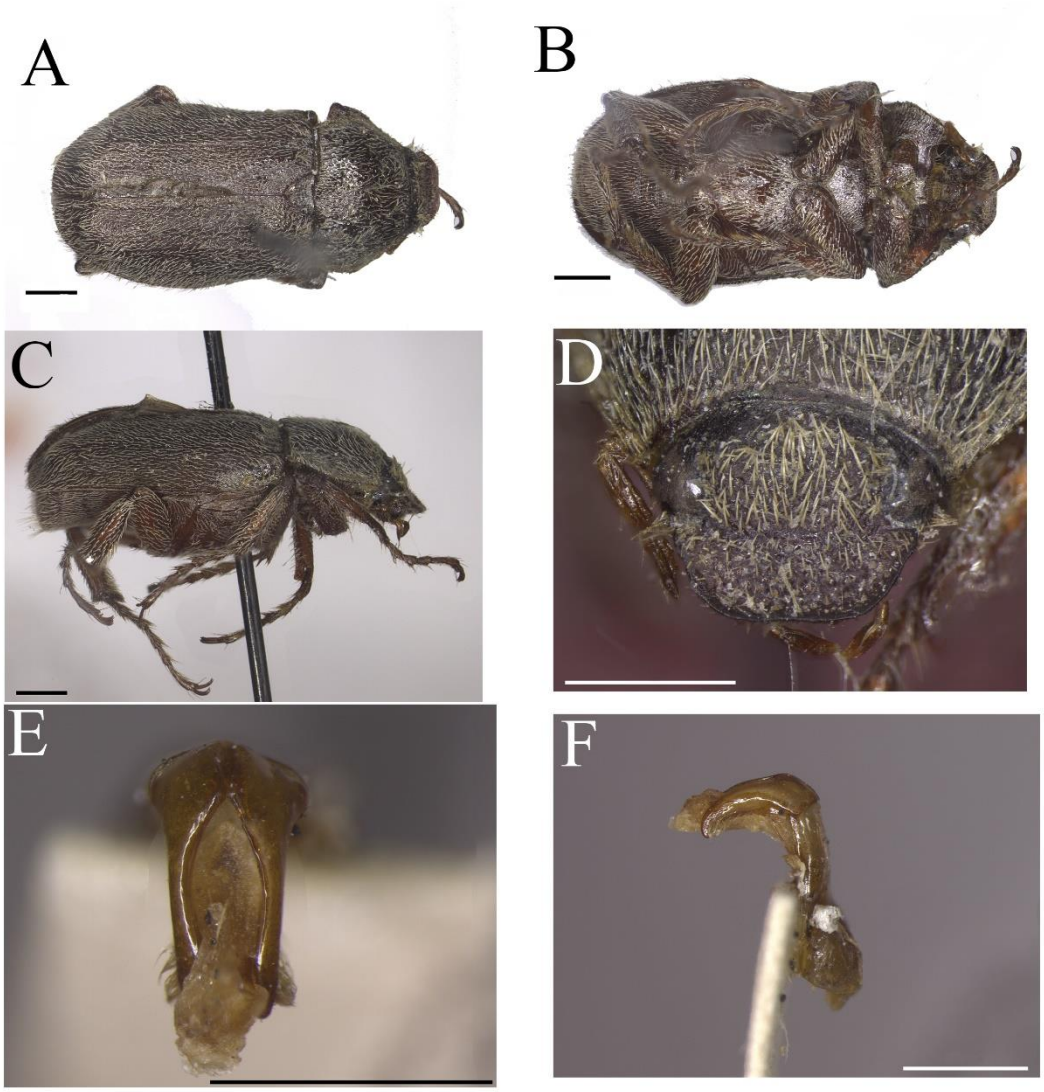
Figure 12. Geographic distribution map of *Alvarinus* Blanchard, 1850.



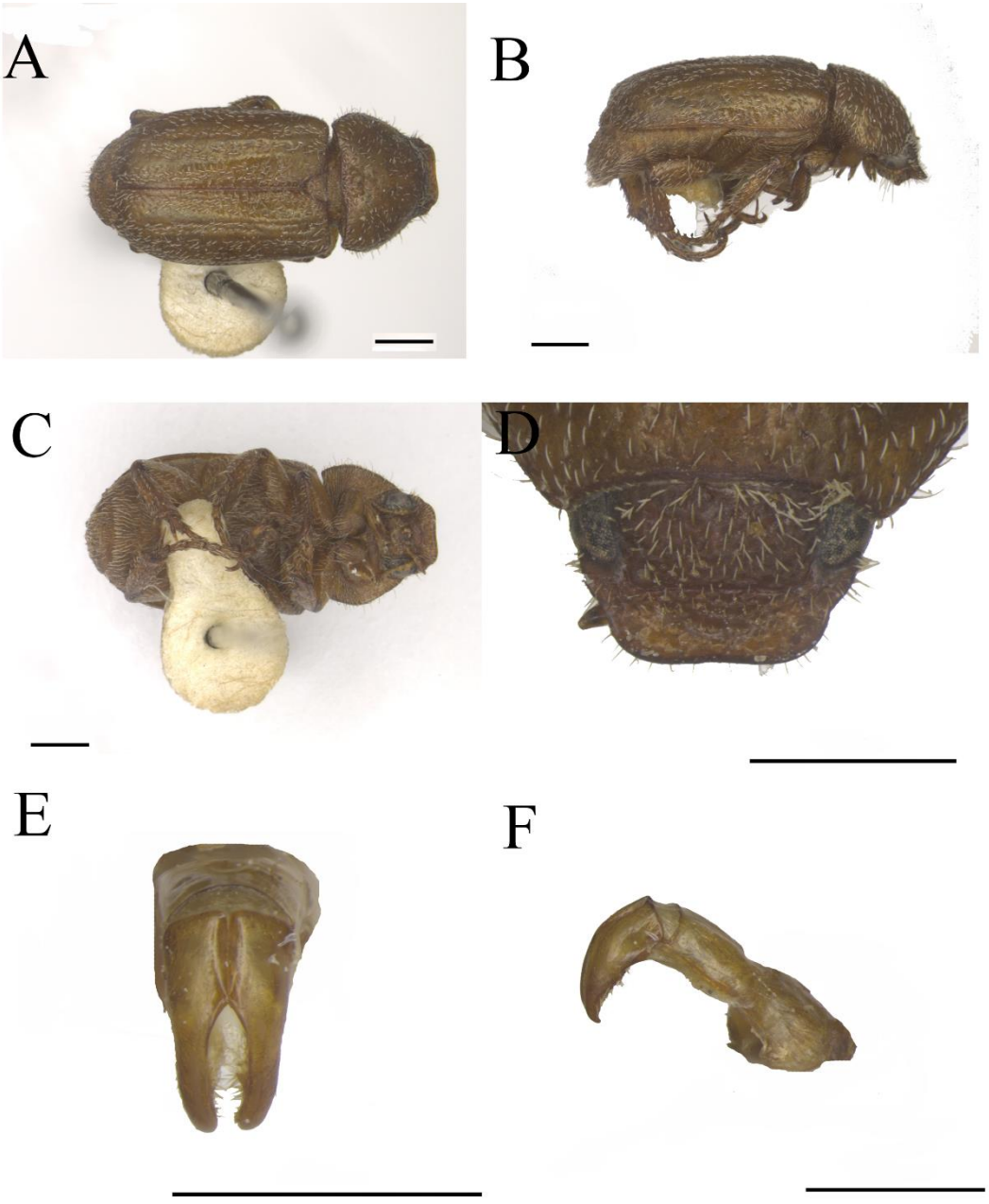
Figures 13.A-G. A. *Alvarinus guayaquilanus* (Moser). male habitus (dorsal view **B.** Male habitus (ventral view); **C** Male habitus (lateral view); **D.** Head (dorsal view), black arrow indicating lateral margin constricted. **E.** Protibia; **F.** Aedeagus (dorsal view, paramera). **G.** Aedeagus (lateral view) (paramera + phallobase + apodema). Scale = 1mm



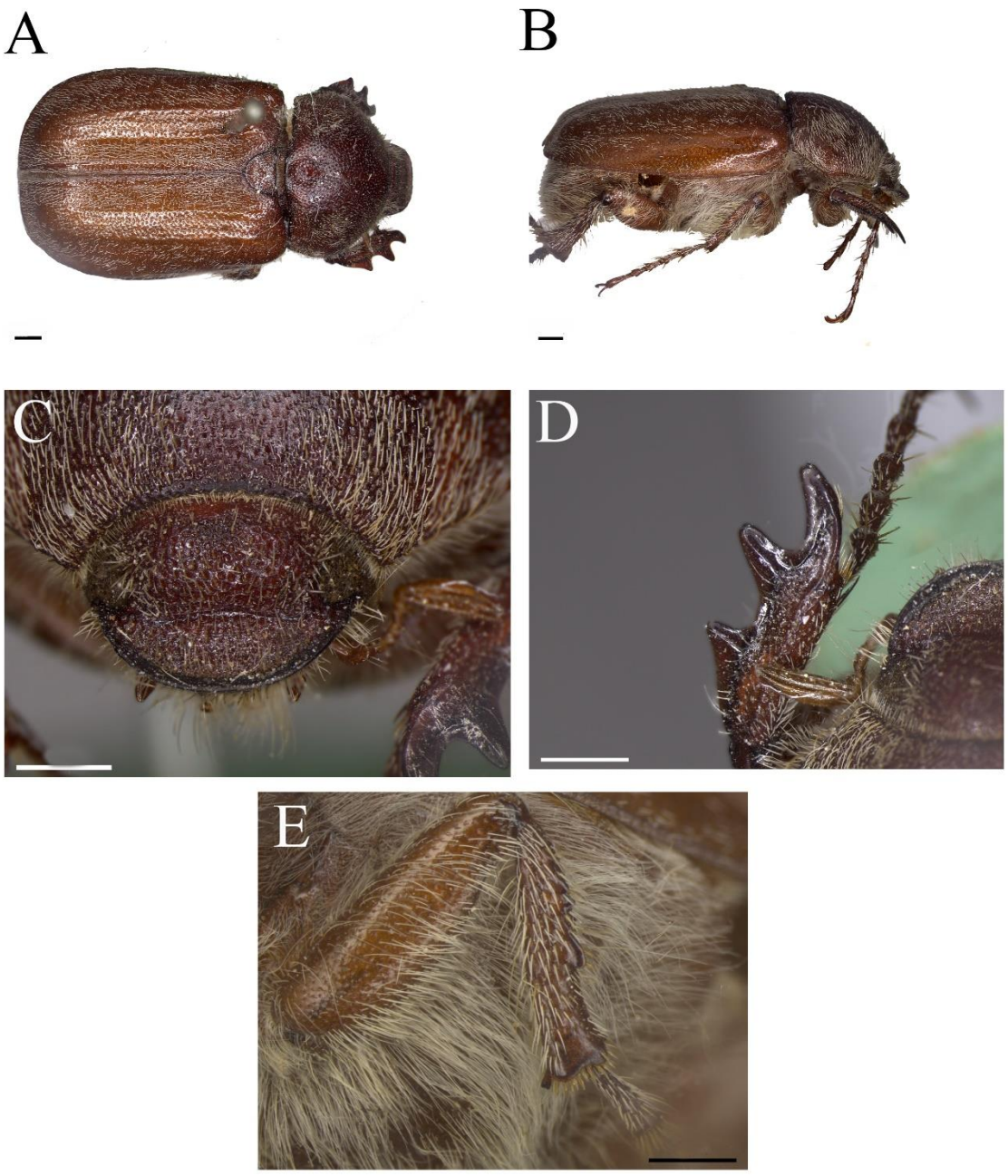
Figures 14.A-F. A. *Alvarinus oblongus* (Moser). male habitus (dorsal view **B.** Male habitus (ventral view); **C** Male habitus (lateral view); **D.** Head (dorsal view), black arrow indicating lateral margin constricted; **E.** Aedeagus (dorsal view, paramera). **F.** Aedeagus (lateral view) (paramera + phallobase + apodema). Scale = 1mm



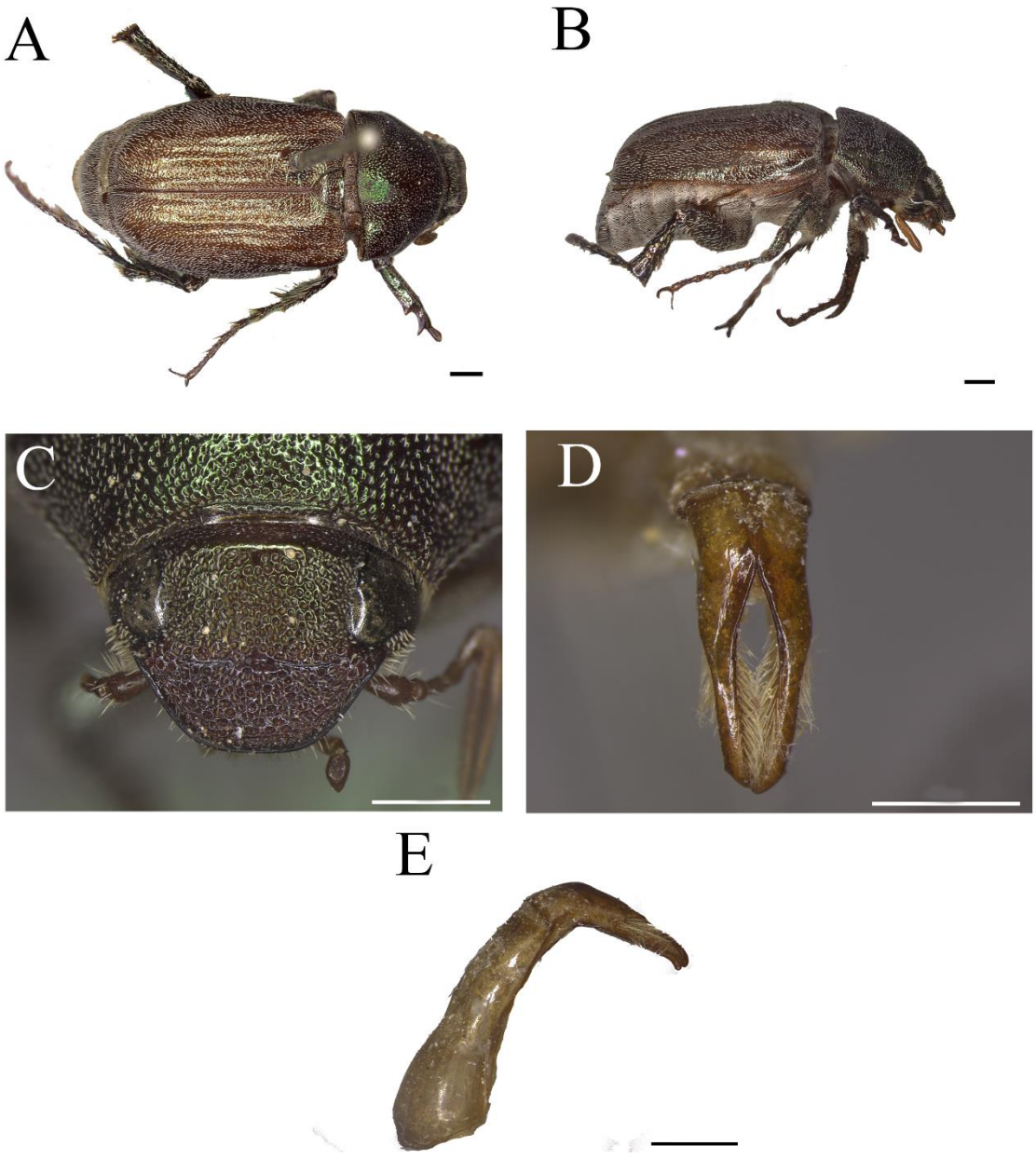
Figures 15.A-F. A. *Alvarinus parvulus* (Moser). male habitus (dorsal view **B.** Male habitus (ventral view); **C** Male habitus (lateral view); **D.** Head (dorsal view); **E.** Aedeagus (dorsal view, paramera), arrow indicating paramera flap. **F.** Aedeagus (lateral view) (paramera + phallobase + apodema). Scale = 1mm



Figures 16.A-E. A. *Plectris subsericeus* (Blanchard). male habitus (dorsal view **B.** Male habitus (lateral view); **C. Head** (dorsal view); **D.** Protibia. Scale = 1mm



Figures 17.A-E. A. *Plectris submetallicus* (Blanchard). male habitus (dorsal view **B.** Male habitus (lateral view); **C. Head** (dorsal view); **D.** Aedeagus (dorsal view, paramera). **E.** Aedeagus (lateral view) (paramera + phallobase + apodema). Scale = 1mm



TABLES

Table 1. *Alvarinus* Blanchard species, with new combinations, new synonyms and new species. HT: Holotype; LT: Lectotype; ST: Syntype.

Species	Male	Female	Type	Collection
(1) *Alvarinus aeneicollis* (Moser, 1918) **new combination**	X	-	LT	MNHUB
(2) *A. bahianus* (Moser 1919)	X	-	H	MNHUB
(3) *A. brasiliensis* (Moser 1919)	X	X	LT	MNHUB
= *A. setulosus* (Moser, 1919)	X	X	ST	MNHUB
(4) *A. canescens* (Burmeister, 1855)	X	-	HT	MLUH
(5) *A. hilarii* Blanchard, 1850	X	-	LT	MNH
=*Alvarinus maniculatus* Burmeister, 1855 **new synonym**	X	-	ST	MLUH
=*Plectris rectangula* Frey, 1967, **new synonym**	X	-	HT	NMBS
(6) *A. pallidipennis* Blanchard, 1850	X	-	HT	MNH
=*A. luridipenni*s (Burmeister, 1855) **new synonym**	X	-	ST	MLUH
(7) *A. paschoali* **sp. nov.**			HT	EPGC
(8) *A rufofuscus* (Moser, 1924)	X	-	HT	MNHUB
=*Corminus rufofucsus* Evans, 2005, **new synonym**				
=*Alvarinus rufofucsus* Evans, 2005, **new synonym**				
(9) *A. testaceipennis* (Moser, 1921)	X	-	LT	MNHUB
(10) *A. vazmeloi* **sp. nov.**	X	-	HT	CEMT
(11) *A. varians* (Moser, 1921)	X	-	LT	MNHUB

4 CONCLUSÃO

Alvarinus Blanchad, 1850 foi recuperado como um grupo polifilético, na forma como se encontra. Foi confirmada a hipótese de Katovich (2008), que *Corminus* Burmeister, 1855 é sinônimo júnior de *Alvarinus*.

De acordo com a análise filogenética conduzida, *Alvarinus submetallicus* Blanchard e *A. subsericeus* Blanchard não fazem parte de *Alvarinus*. Desta forma, a primeira foi transferida para *Plectris* LePeletier & Audinet-Serville, e a segunda para *Paulosawaya* Martínez & d'Andretta.

Os posicionamentos de *Alvarinus oblongus* (Moser), *A. parvulus* (Moser), *A. guayaquilanus* (Moser) estão pouco elucidados, e a nova hipótese mostra que estas espécies não fazem parte de *Alvarinus.*

O relacionamento interno de *Alvarinus* ainda não está totalmente resolvido, no entanto *A. luridipennis*, assim como, *Plectris rectangula* e *A. maniculatus,* são novas sinonímias de *A. pallidipennis* e *A. hilarii*, respectivamente. *Alvarinus setulosus* é sinônimo júnior de *A. brasiliensis*. Além disso, foi encontrada uma nova combinação, em que *Plectris aeneicollis* passa a fazer parte de *Alvarinus*.

A classificação proposta por este trabalho recupera a monofilia do gênero, que passa a unir 11 espécies e é agrupada pela seguinte transformação: presença de aba nos parâmeros.

Na revisão taxonômica, redescritas nove espécies de *Alvarinus*: *Alvarinus aeneicollis, A. bahianus, A. brasiliensis, A. canescens, A. hilarii, A. pallidipennis, A. rufofuscus, A. testaceipennis* e *A. varians*. Também, foram designados lectótipos para oito táxons: *Alvarinus aeneicollis, A. bahianus, A. brasiliensis, A. hilarii, A. pallidipennis, A. rufofuscus, A. testaceipennis* e *A. varians*.

A distribuição geográfica do grupo foi expandida para as seguintes espécies: *Alvarinus bahianus* (BA [Maracás]); *A. brasiliensis* (PR [Prudentópolis]; ES; RJ [Bom Jardim]); *A. canescens* (MG [Vista Alegre]; RJ [Nova Friburgo, Petrópolis]); *A. hilarii*

(BA; GO [Goiatuba, Jataí]; MG [Sete Lagoas]; RJ [Nova Friburgo]; SP [Matão]; PR [Jaguaraíva]; *A. pallidipennis* (MT; MG [Belo Horizonte, Caldas, Conselheiro Lafaiete, Lambari, Monte Verde, Ouro Branco, Passa Quatro]; SP [Campinas, Santo André, São Paulo]; PR [Castro, Ponta Grossa, Rio Negro]); e *A. rufofuscus* (ES [Fundão]; MG [Viçosa]).

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APÊNDICE A

Normas para preparação do manuscrito para a Zootaxa

Preparation of manuscripts

1) *General.* All papers must be in English. Authors whose native language is not English are encouraged to have their manuscripts read by a native English-speaking colleague before submission. Nomenclature must be in agreement with the *International Code of Zoological Nomenclature* (4th edition 1999), which came into force on 1 January 2000. Author(s) of species name must be provided when the scientific name of any animal species is first mentioned (the year of publication needs not be given; if you give it, then provide a full reference of this in the reference list). Authors of plant species names need not be given. Metric systems should be used. If possible, use the common font New Times Roman and use as little formatting as possible (use only **bold** and *italics* where necessary and indentions of paragraphs except the first). Special symbols (e.g. male or female sign) should be avoided because they are likely to be altered when files are read on different machines (Mac versus PC with different language systems). You can code them as m# and f#, which can be replaced during page setting. The style of each author is generally respected but they must follow the following general guidelines.

2) The **title** should be concise and informative. The higher taxa containing the taxa dealt with in the paper should be indicated in parentheses: e.g. A taxonomic revision of the genus *Aus*(Order: family).

3) The **name(s) of all authors** of the paper must be given and should be typed in the upper case (e.g. ADAM SMITH, BRIAN SMITH & CAROL SMITH). The address of each author should be given in *italics* each starting a separate line. E-mail address(es) should be provided if available.

4) The **abstract** should be concise and informative. Any new names or new combinations proposed in the paper should be mentioned. Abstracts in other languages may also be included in addition to English abstract. The abstract should be followed by a list of **key**

words that are not present in the title. Abstract and key words are not needed in short correspondence.

5) The arrangement of the **main text** varies with different types of papers (a taxonomic revision, an analysis of characters and phylogeny, a catalogue etc.), but should usually start with an **introduction** and end with a list of **references**. References should be cited in the text as Smith (1999), Smith & Smith (2000) or Smith *et al.* (2001) (3 or more authors), or alternatively in a parenthesis (Smith 1999; Smith & Smith 2000; Smith *et al*. 2001). All literature cited in the text must be listed in the references in the following format (see a sample page here in PDF).

A) **Journal paper**:
Smith, A. (1999) Title of the paper. *Title of the journal in full*, volume number, page range.

B) **Book chapter**:
Smith, A. & Smith, B. (2000) Title of the Chapter. *In*: Smith, A, Smith, B. & Smith, C. (Eds), *Title of Book*. Publisher name and location, pp. x–y.

C) **Book**:
Smith, A., Smith, B. & Smith, C. (2001) *Title of Book*. Publisher name and location, xyz pp.

D) **Internet resources**
Author (2002) Title of website, database or other resources, Publisher name and location (if indicated), number of pages (if known). Available from: http://xxx.xxx.xxx/ (Date of access).

Dissertations resulting from graduate studies and non-serial proceedings of conferences/symposia are to be treated as books and cited as such. Papers not cited must not be listed in the references.

Please note that:

(1) **journal titles must be written in full (not abbreviated)**

(2) **journal titles and volume numbers are followed by a ","**

(3) **page ranges are connected by "n dash", not hyphen "-", which is used to connect two words.**

For websites, it is important to include the last date when you see that site, as it can be moved or deleted from that address in the future.

On the use of dashes: (1) Hyphens are used to link words such as personal names, some prefixes and compound adjectives (the last of which vary depending on the style manual in use). (2) En-dash or en-rule (the length of an 'n') is used to link spans. In the context of our journal that means numerals mainly, most frequently sizes, dates and page numbers (e.g. 1977–1981; figs 5–7) and also geographic or name associations (Murray–Darling River; a Federal–State agreement). (3) Em-dash or em-rule (the length of an 'm') are used far more infrequently, and are used for breaks in the text or subject, often used much as we used parentheses. In contrast to parentheses an em-dash can be used alone; e.g. What could these results mean—that Niel had discovered the meaning of life? En-dashes and em-dashes should not be spaced.

6) Legends of **illustrations** should be listed after the list of references. Small illustrations should be grouped into plates. When preparing illustrations, authors should bear in mind that the journal has a matter size of 25 cm by 17 cm and is printed on A4 paper. For species illustration, line drawings are preferred, although good quality B&W or colour photographs are also acceptable. See a guide here for detailed information on preparing plates for publication.

7) **Tables**, if any, should be given at the end of the manuscript. Please use the table function in your word processor to build tables so that the cells, rows and columns can remain aligned when font size and width of the table are changed. Please do not use Tab key or space bar to type tables.

8) **Keys** are not easy to typeset. In a typical dichotomous key, each lead of a couplet should be typed simply as a paragraph as in the box below:

1 Seven setae present on tarsus I ; four setae present on tibia I; leg I longer than the body; legs black in color ... Genus A
- Six setae present on tarsus I; three setae present on tibia I; leg I shorter than the body; legs brown in color ... 2

2 Leg II longer than leg I ... Genus B
- Leg II shorter than leg I ... Genus C

Our typesetters can easily convert this to a proper format as in this PDF file.

Deposition of specimens

Whenever possible, authors are advised to deposit type specimens in national or international public museums or collections. Authors are also advised to request registration numbers of deposited material in advance of the acceptance of papers to avoid unnecessary delay of publication. Some countries (e.g. Australia) require that primary type specimens be deposited in collections of the country of origin; authors are advised to take this into consideration.

Submission

Please follow the above basic guidelines and check if your manuscript has been prepared according to the style and format of the journal. Authors are encouraged to submit manuscripts by e-mail as attachments to the subject Editors responsible for your taxa or subject areas; manuscripts on small insect orders without subject editors should be submitted to Dr **Ernest Bernard** (ebernard@utk.edu); manuscripts on other invertebrate taxa without subject editors should be submitted to the Chief editor.

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