IRINA TATIANA MORALES CASTAÑO

SISTEMÁTICA E BIOGEOGRAFIA DO GÊNERO Collaria PROVANCHER, 1872 (HEMIPTERA: MIRIDAE)

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

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Dedico este trabalho

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minha irmã Paola,
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SUMÁRIO

RESUMO

MORALES CASTAÑO, Irina Tatiana, D.Sc., Universidade Federal de Viçosa, Fevereiro de 2015. **Sistemática e Biogeografia do gênero Collaria Provancher, 1872 (Hemiptera: Miridae).** Orientador: Paulo Sergio Fiuza Ferreira. Coorientador: Igor Dimitri Forero.

Miridae é a maior família da subordem Heteroptera (Hemiptera) e se encontra distribuída em todas as regiões biogeográficas do planeta, possuindo cerca de 11.020 espécies, alocadas em 1.200 gêneros e a oito subfamílias. Collaria Provancher, 1872 pertence à tribo Stenodemini (Mirinae). As espécies do gênero estão associadas a plantas hospedeiras da família Poaceae, causando danos econômicos principalmente em pastagens, aveia, arroz, milho e trigo. Mudanças no trato agrícola, ampliação de áreas de cultivo e câmbios climáticos têm resultado no surgimento de novas espécies-praga e novos registros na distribuição geográfica das espécies do gênero. O objetivo desta tese foi realizar a revisão taxonômica do gênero Collaria (Hemiptera: Miridae) e propor hipóteses filogenéticas e biogeográficas das relações internas do grupo. Realizou-se um estudo sobre a morfologia comparada da genitália do macho e da fêmea, com sete espécies representativas da variação externa e da distribuição geográfica do gênero, apresentando-se descrições, fotos e ilustrações. Foram propostas as homologias primárias para serem testadas na análise filogenética. Foram revistas 22 coleções entomológicas com objetivo de contribuir com a taxonomia de Collaria. O trabalho apresenta redescrições e diagnoses para todas as espécies de Collaria e a descrição de uma espécie nova da região afrotropical. Estão incluidos novos dados de distribuição para as regiões afrotropical e neotropical e uma chave de identificação para as espécies. A monofilia do gênero foi testada incluindo-se 20 espécies (15 do grupo interno e cinco do grupo externo) e 67 caracteres morfológicos, utilizando-se análise de parcimônia com os programas TNT. A monofilia do gênero foi suportada por quatro sinapomorfias. Com os resultados filogenéticos e os dados de distribuição geográfica, foi feita uma análise espacial de vicariância, onde se obteve sete nódulos representados por linhas de Voronoi. Propõe-se uma relação ancestral entre as espécies Neotropicais, Neárticas e Afrotropicais, com provável origem após do rompimento de Gondwana e do estabelecimento do estreito do Panamá.

ABSTRACT

MORALES CASTAÑO, Irina Tatiana, D.Sc., Universidade Federal de Viçosa, February of 2015. **Systematics and Biogeography of genus Collaria Provancher, 1872 (Hemiptera: Miridae).** Advisor: Paulo Sergio Fiuza Ferreira. Co-advisor: Igor Dimitri Forero.

Miridae is the most diverse group of the suborder Heteroptera (Hemiptera); and is distributed in all biogeographic regions of the planet, with currently more than 11,020 described species grouped in 1,200 genera and eight subfamilies. Collaria Provancher, 1872 belongs to Stenodemini (Mirinae). The species of the genus are associated with the family of host plants Poaceae, and are responsible for significant economic damage to pastures, oats, rice, maize, and wheat crops. Changes in agriculture, expansion of cultivation areas and climate changes have resulted in the emergence of new pest species and new records in the geographical distribution of species. The objective of this thesis was to conduct a taxonomic revision of genus Collaria (Hemiptera: Miridae) and to propose phylogenetic and biogeographic hypotheses of the relationships within the group. A study of the comparative structure of the male and female genitalia was performed, based on seven species, which represent the external variation observed as well as the geographical distribution. Primary homology hypothesis was proposed and tested by phylogenetic analysis. Twenty-two entomological collections were reviewed, in order to contribute to the taxonomy of Collaria. Descriptions, illustrations, digital micrographs and diagnoses for all the species are provided; in addition, the description of a new species of the Afrotropical region is presented. New distribution data for the Afrotropical and Neotropical regions and an identification key to all species are given. The genus monophyly was tested, with 20 species (15 of the inner group and five of the outgroup) and 67 morphological characters in a parsimony analysis using the software TNT. The monophyly of the genus is supported by four synapomorphies. Based on these results, a biogeographical analysis was conducted (Spatial Analysis of Vicariance). Seven vicariant nodes represented by the Voronoi lines were found. An ancient relationship between Neotropical, Afrotropical and Neartic species, with probable origin after the breakup of Gondwana and after the establishment of Isthmus of Panama is suggested.

INTRODUÇÃO

Miridae é a maior família da subordem Heteroptera (Hemiptera) com cerca de 11.020 espécies descritas em 1200 gêneros; e apresenta uma distribuição cosmopolita, ocorrendo em todas as regiões biogeográficas do planeta (Wheeler 2001, Cassis & Schuch 2012, Jung & Lee 2012). Trata-se de uma família com grande diversidade de espécies, ampla variabilidade de habitats e hábitos alimentares. Podem ser fitófagos (atacando flores, frutos, folhas e ramos) ou predadores (obrigatórios ou facultativos) utilizados em controle biológico (Schaefer & Panizzi 2000, Wheeler 2001, Forero 2008a, Henry 2009). Algumas espécies são consideradas indicadoras de mudanças ambientais pelo fato de serem suscetíveis a certos pesticidas e reagirem a distúrbios em seus habitats (Ferreira 1999, Wheeler 2001, Henry 2009).

Representantes da família estão distribuídos em oito subfamílias: Bryocorinae, Cylapinae, Deraeocorinae, Isometopinae, Mirinae, Orthotylinae, Phylinae e Psallopinae (Schuh 1995, Schuh 2013, Cassis & Schuh 2012). Mirinae compreende aproximadamente 350 gêneros alocados em uma tribo fóssil (Scutelliferini) e seis tribos atuais: Herdoniini, Hyalopeplini, Mecistoscelini, Mirini, Resthenini e Stenodemini (Schuh 1995, Henry 2009). A tribo Stenodemini China, 1943 possui 35 gêneros e 210 espécies (Schwartz 2008). A tribo contém espécies reconhecidas pelos danos econômicos que causam nas pastagens, culturas forrageiras e de grãos (Schwartz 2008). Nesta tribo está inserido o gênero Collaria Provancher, 1872, reconhecido pelo corpo alongado, cabeça tão longa quanto larga, olhos próximos ao meio das margens laterais da cabeça, pronoto fortemente pontuado e ligeiramente estreitado atrás dos calos, e pernas longas e delgadas, revestidas por pubescência de comprimento variável (Carvalho 1945, Carvalho & Fontes 1981, Schwartz 2008).

Os habitats, hábitos alimentares e as plantas hospedeiras, para a maioria das espécies do gênero Collaria, são pouco conhecidos, exceto nos casos de importância econômica. Apresentam uma especificidade com as espécies Poaceae tais como gramas de jardim, pastagens, aveia, arroz, milho e trigo (Ferreira & Rossi 1979). Na Colômbia reportam-se trabalhos sobre as espécies Collaria scenica (Stål,1859) que causa danos às pastagens leiteiras (Barreto et al. 1996, Martinez & Barreto 1998,

Bautista et al. 2013). Barreto (2011) reportou perdas econômicas causadas por C. scenica nos sistemas de produção leiteira: 95% das fazendas da savana de Bogotá apresentam uma alta incidência e dano da praga; as perdas estão relacionadas com a redução na carga animal entre 0,2 a 2 unidades animal/ 6.400 m², e redução na produção de leite de 0.5 a 5 litros/vaca/dia. No Brasil, Menezes (1990) relatou a ocorrência de Collaria oleosa (Distant, 1883) como uma praga de gramíneas forrageiras no sudeste da Bahia; Da Silva et al. (1994) reportaram C. oleosa na cultura do trigo na região dos cerrados; Carlesii et al (1999) encontraram C. scenica sobre gramíneas nativas e cultivadas, e Ferreira et al. (2001) indicaram as espécies Collaria husseyi Carvalho,1955, C. oleosa e C. scenica como fitófagos alimentando-se principalmente de gramíneas. Wheeler (2001) reporta C. meilleurii causando danos em pastagens de Estados Unidos e C. oleosa atacando arroz, milho e trigo na América Central.

Considerando o histórico taxonômico de Collaria, sua primeira espécie foi incluída no gênero Miris, como Miris scenicus Stål, 1859. O gênero Collaria foi descrito por Provancher em 1872, juntamente com a descrição de Collaria meilleurii. O gênero Trachelomiris foi descrito por Reuter (1876) com a espécie tipo Trachelomiris oculatus; Distant (1883) descreveu a espécie T. oleosus. Mais tarde, Reuter (1905) estabeleceu Trachelomiris como sinônimo-júnior de Collaria, transferindo as espécies descritas por ele e por de Distant para este gênero. Ulher (1878) descreveu o gênero Nabidea com a espécie tipo Nabidea coracina a qual posteriormente foi transferida por Ulher (1887) para o gênero Collaria. Descrições posteriores de espécies foram feitas por Poppius (1910), que descreveu C. obscuricornis; Linnavouri (1974-1975) descreveu C. danae e C. nigra; e Carvalho (1953, 1955, 1990) descreveu as espécies C. villiersi, C. husseyi e C. boliviana.

A mais atualizada revisão do gênero foi feita por Carvalho e Fontes (1981) envolvendo as espécies do continente americano, incluindo as descrições de duas novas espécies (C. capixaba e C. guaraniana), morfologia, genitália do macho e fêmea e uma chave para identificação para as espécies neárticas e neotropicais. Carvalho & Carpintero (1989) descreveram C. manoloi e Ferreira et al. (2013a) sinonimizaram a espécie C. columbiensis com C. scenica.

Collaria tem atualmente 14 espécies, cinco com distribuição afrotropical (C. danae, C. improvisa Reuter, 1893, C. nigra, C. obscuricornis, C. villiersi); duas

neárticas (C. meilleurii, C. oculata) e sete Neotropicais (C. boliviana, C. capixaba, C. guaraniana, C. husseyi, Collaria malonoi Carvalho & Carpintero, 1989, C. oleosa e C. scenica (Schwartz 2008). Schwartz (2008) produziu o único trabalho que trata da filogenia de Collaria, baseado em apenas sete espécies, não sendo possível alcançar conclusões biogeográficas apropriadas a partir de informações de somente uma parte do grupo.

Os estudos biogeográficos em Miridae focaram principalmente em identificar centros de endemismo (Schuh 1974, 1984; Schuh & Stonedahl 1986; Schuh 1991; Lu & Zheng 1998; Schuh 2006, Forero & Schwartz 2009). Os trabalhos que fazem menção a Mirinae são escassos (Williams 2002, Cassis & Schuh 2012, Coelho 2012) e até o momento não existem estudos de hipótese filogenética e nem biogeográficos incluindo todas as espécies do gênero Collaria. Há necessidade de estudos que possam fornecer hipóteses sobre as relações filogenéticas, biogeográficas e diagnoses atualizadas das espécies de Collaria. Estas pesquisas servirão para um melhor entendimento taxonômico e evolutivo do grupo e subsidiar mais eficazmente o controle das espécies que vem causando danos econômicos.

OBJETIVOS

Geral

Revisar a taxonômia do gênero Collaria (Hemiptera: Miridae) e propor hipóteses filogenéticas e biogeográficas acerca das relações internas do grupo.

Específicos

-Realizar estudos morfológicos comparativos de genitálias masculina e feminina;

-Analisar e explorar novos caracteres morfológicos para definir o gênero e determinar sua utilidade filogenética;

-Testar a hipótese de monofilia do gênero Collaria e as relações filogenéticas intraespecíficas;

-Conduzir análises biogeográficas baseadas na filogenia do gênero e na distribuição geográfica das espécies.

MATERIAL E MÉTODOS

Consulta a coleções e determinação taxonômica

Espécies do gênero Collaria foram obtidas através de empréstimos das seguintes 22 coleções entomológicas:

AMNH	American Museum of Natural History, New York, USA.
BPBM	Bernice Pauahi Bishop Museum, Hawaii, USA.
CAS	California Academy of Sciences, San Francisco, USA.
CTNI	Colección Taxonómica de Insectos "Luis María Murillo"-CORPOICA, Tibaitatá, Colombia.
DZRS	Departamento de Zoologia, Universidade Federal do Rio Grande do Sul, Porto Alegre, Brasil.
DZUP	Coleção Entomologica Pe. Jesus Santiago Moure, Departmento de Zoologia, Universidade Federal de Paraná, Curitiba, Brasil.
ICN	Colección de Zoología – Instituto de Ciencias Naturales – Universidad Nacional de Colombia, Bogotá, Colombia.
IAVH	Colección Entomológica Instituto de Investigación de Recursos Biológicos Alexander von Humboldt, Villa de Leyva, Colombia.
KU	University of Kansas Natural History Museum, Lawrence, Kansas, USA.
MCZN	Museu de Ciências Naturais, Fundação Zoobotânica do Rio Grande do Sul, Porto Alegre, Brasil.
MCN	Coleção Zoológica Científica do Museu de Ciências Naturais do Centro Univates, Lajeado, Brasil.
MNRJ	Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brasil.
MPUJ-ENT	Museo de Pontificia Universidad Javeriana, Laboratorio Entomología, Bogotá, Colombia.
MRAC	Royal Museum for Central Africa, Tervurem, Belgium.
NMSA	Natal Museum, Pietermaritzburg, South Africa.
RBINS	Royal Belgian Institute of Natural Sciences, Brussells, Belgium.
UFES	Universidade Federal do Espirito Santo, Vitória, Brasil.

UFVB	Museu Regional de Entomologia, Universidade Federal de Viçosa, Viçosa, Brasil.
UPTC	Laboratorio de Entomología, Museo de Historia Natural "Luis Gonzalo Andrade" Universidad Pedagógica y Tecnológica de Colombia, Tunja, Colombia.
USU	Insect Collection Utah State University, USA.
USNM	National Museum of Natural History, Smithsonian Institution, Washington DC, USA.
ZMUC	Zoological Museum, University of Copenhagen, Copenhagen, Denmark.

Além dos dados obtidos das etiquetas do material examinado, procurou-se na literatura dados de distribuição geográfica. Para as espécies C.meilleurii, C.oculata e C.obscuricornis,também consultou-se o catalogo on-line Plant Bug Planetary Biodiversity Inventory Project (http://research.amnh.org/pbi/), onde se obtiveram as coordenadas geográficas de material depositado nas seguintes coleções:

CNC	Canadian National Collection of Insects. Ottawa, Canadá.
OSAC	Oregon State Arthropod Collection, Oregon State University, Oregon, Corvallis, USA.
NCSU	North Carolina State University Insect Collection, North Dakota, Fargo, USA.
UDCC	University of Delaware, Delaware, Newark,USA.
UCR	University of California, Riverside, USA.
MEMU	Mississippi Entomological Museum, Mississippi State University, Mississippi, Mississippi, USA.
MHNCM	Colección Nacional de insectos Dr. Alfredo Barrera Marín del Museo de Historia Natural de la Ciudad de México.
SANBI	South African National Biodiversity Institute IZIKO.

Estudo de espécimes

1080 espécimes do gênero foram estudados. As espécies foram identificadas utilizando chaves taxonômicas e descrições originais de Stål (1859), Provancher (1872), Reuter (1876), Distant (1883), Reuter (1893), Poppius (1910), Linnavuori (1974, 1975), Carvalho, (1953, 1955, 1990), Carvalho & Fontes (1981), e Carvalho & Carpintero (1989). Além disso, foram feitas comparações com exemplares tipos (síntipos/holótipos) quando disponíveis. As medidas (morfometria) das espécies foram baseadas na metodologia proposta por Forero (2008b) e Ferreira et al. (2013b).

As ilustrações das estruturas morfológicas foram feitas com o emprego de um estereomicroscópio com câmara clara acoplada. Se oferecem fotografias dos hábitos dorsais obtidas com um estereomicroscópio Zeiss Discovery V20 acoplado com uma câmera digital Zeiss AxioCam Mrc. As fotografias da genitalia masculina e feminina foram tiradas com uma câmera digital Olympus DP73 acoplada ao microscópio Olympus BX53.

Para as dignoses das genitálias masculina e feminina segui-se a metodologia proposta por Scudder & Schwartz (2012). Os espécimes foram relaxados em câmera húmida durante 12 horas em seguida procedeu-se a extração do ápice do abdome e inclusão em uma solução quente de acido lático a 85% com 10 gotas de água destilada. As disseções foram feitas em glicerina sob uma estereromicroscópio Leica MZ8, após, as estruturas dissecadas foram preservadas em microtubos com glicerina.

Estrutura da Revisão Taxonômica

Para cada espécie se referencia o nome, data de autoria e o museu onde se encontra(m) depositado o(s) exemplar(es), e o histórico nomenclatural. Apresentam-se a relação do material examinado, diagnose, distribuição geográfica, hospedeiros, comentários (quando cabíveis) e os mapas de distribuição.

Mapas de distribuição geográfica

Os mapas de distribuição geográfica foram construídos usando o programa ArcGis (10.2.1) e baseados nas informações dos exemplares estudados das coleções entomológicas. As localidades foram georeferenciadas usando o Global Gazetteer Version 2.1 (http://www.fallingrain.com/world) e Google Earth. Em alguns casos os dados foram postos entre parênteses para indicar que não foram tomados diretamente

do PBI database (http://research.amnh.org/pbi/maps/) ou dos dados das etiquetas dos espécimenes examinados.

Análise Filogenética

Foi estudado um total de 20 espécies, sendo cinco pertencentes ao grupo externo: Horciasinus signoreti (Stål,1859) (Mirini), Dolichomiris linearis Reuter, 1852 (Stenodemini), Steneodema andina Carvalho, 1975 (Stenodemini) e Trigonotylus tenuis Reuter, 1893 (Stenodemini). Nabidomiris longipennis Odhiambo, 1959 (Stenodemini) é considerado por Schwartz (2008) como grupo irmão do gênero Collaria, compartilhando os caracteres: região postocular alongada como um "pescoço", olho estreitamente unido a cabeça em vista dorsal, olho ovóide localizado na região mediana da cabeça.

Utilizaram-se 67 carateres morfológicos, incluindo aqueles propostos por Schwartz (2008). O método utilizado para estudar as relações filogenéticas do gênero Collaria foi à análise cladística. A análise de parcimônia foi feita através do programa TNT, versão 1.0. Todos os caracteres tiveram pesos iguais. As árvores mais parcimoniosas (MPT) foram obtidas pela busca heurística "Implicit Enumeration" com soluções exatas do "Bremer support" para o suporte dos clados. Foi definida a topologia da árvore de consenso estrita e verificados os índices de consistência (CI) e retenção (RI) de cada ramo.

Análise Biogeográfica

Utilizou-se o método "Spatial Analysis of Vicariance (SAV)" implementado no VIP (Vicariance Inference Program, Arias et al. 2011). Com os dados da análise filogenética e de distribuição geográfica das espécies foi feita uma busca heurística para obter a melhor reconstrução de barreiras "Voronoi lines" com uma grade de 2° × 2° num mapa da NASA (http://neo.sci.gsfc.nasa.gov/view.php?datasetId=MOD13A2_M_NDVI).

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RESULTADOS

A presente tese encontra-se organizada sob a forma de artigos científicos, como disposto no item 2.4 das normas para redação de teses da Universidade Federal de Viçosa. Cada artigo encontra-se formatado de acordo com as normas da revista que será submetido. Apresentam-se três capítulos no total. O capítulo II não deve ser considerado como publicação válida para fins de nomenclatura zoológica, de acordo com as normas do Código Internacional de Nomenclatura Zoológica (Cap. 3, Art. 8.2 e Art. 8.3).

CAPÍTULO I

Comparative genitalic morphology in grass-feeding plant bugs of the genus Collaria Provancher, 1872 (Hemiptera, Heteroptera, Miridae)

Manuscrito original, apresentado em formato de submissão para publicação na revista **ZOOMORPHOLOGY**

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Abstract

Collaria is a genus of grass-feeding plant bugs belonging to the tribe Stenodemini, with species distributed in the Afrotropical, Nearctic and Neotropical regions. Some of its species are considered pests of pastures, oats, rice, maize, and wheat crops. This work provides new data about the morphology of the male and female genitalia based on the study of seven species of Collaria unifying their terminology. We provide descriptions, illustrations and digital micrographs for the pygophore and endosoma of the male genitalia, and gonapophyses, and anterior and posterior walls of the female genitalia. Primary homologies are recognized and their variation between different species discussed. These characters might be useful for future phylogenetic analyses of species of Collaria.

Keywords: Mirinae, Stenodemini, genitalia, homology.

Introduction

Species of the genus Collaria Provancher, 1872 (Mirinae: Stenodemini) are grass-feeding plant bugs, some of which are considered pests of pastures, oats, rice, maize, and wheat crops (Wheeler 2001; Ferreira et al. 2013). Collaria consists of 14 valid species (Schwartz 2008; Ferreira et al. 2013; Schuh 2014), being five Afrotropical (C. danae Linnavuori, 1974; C. improvisa Reuter, 1893; C. nigra Linnavuori, 1975; C. obscuricornis Poppius, 1910; C. villiersi Carvalho, 1953), two Nearctic (C. meilleurii Provancher, 1872; C. oculata (Reuter, 1876)), and seven Neotropical (C. boliviana Carvalho, 1990; C. capixaba Carvalho & Fontes, 1981; C. guaraniana Carvalho & Fontes, 1981; C. husseyi Carvalho, 1955; C. malonoi Carvalho & Carpintero, 1989; C. oleosa (Distant, 1883), C. scenica (Stål, 1859). Collaria can be separated from other mirine grass bugs (Stenodemini) by the elongate, slender body; frons broad and smoothly merging with the clypeus, the mandibular plate produced and strongly rounded; eyes separated from the pronotum by a distance equal to twice the distal width of antennal segment I, and a ‘‘neck’’ (=collum) present; the proepisternum is strongly rounded; and females sometimes are brachypterous (Carvalho 1945; Carvalho and Fontes 1981; Schwartz 2008). Schwartz (2008) conducted a phylogenetic analysis of the Stenodemini genera in which he found Nabidomiris Poppius, 1914 as the sister group of Collaria, although the monophyly is untested and the relationships among its species are unknown.

Studies on the genitalia of Miridae began with Kullenberg (1947), who described in detail the male and female genitalia and the theory of copulation in various species. Slater (1950) studied sclerotized structures of the female genitalia and identified differences in the genital chamber. Davis (1955) studied the female reproductive tract, recognizing dorsal and ventral sclerotized pieces called the labiate plates, and Scudder (1959) proposed an interpretation of the female genitalic sclerites in the Heteroptera. Kelton (1959) studied the endosoma and parameres of male genitalia and emphasized the importance of the genitalia in taxonomy and phylogeny. Kerzhner and Konstantinov (1999), made a review of the endosoma and Konstantinov (2003) identified two aedeagal types. Lin and Yang (2005) proposed a composite origin and concomitant homology for the aedeagus. Nevertheless, this theory was rejected by Konstantinov (2007), who made a critical analysis of the terminology proposed, and reached for a singular origin of the aedeagus. Cassis

(2008) provided a discussion of character homology and terminology for the male genitalia of the Miridae. This author concluded that the use of the terms conjunctiva and vesica are inappropriate and suggests the name endosoma.

In the subfamily Mirinae, Kelton (1955) demonstrated that details of the vesica might be used in specific determinations and as indicators of relationships. Clayton (1989) described the secondary gonopore and made a redescription of the endosoma. The study of female genitalic characters is less frequent than for male genitalia, neglected as source of taxonomic characters. Fontes (1981, 1989, 1993a, 1993b, 1993c) presented diagnostic characters of female genitalia with reference to the genera Notholopus and Phytocoris. Other papers in Mirinae regarding morphological characters of male and female genitalia were presented by Clayton (1982), Henry and Kim (1984), Schwartz (1984). Yasunaga and Schwartz (2007) revised the genus Philostephanus (Mirinae), providing illustrations and names for parameres, endosoma, Bursa copulatrix, dorsal sac, anterior and posterior wall. Gapon (2014) documented and included illustrations of the entirely inflated "vesica" (endosoma) and the gynatrium of the genus Polymerus (Mirinae).

The genitalia of Stenodemini have been used as part of the description of new species (e.g., Remane and Gunther 2008; Hernández and Henry 2010; Schwartz 2012; Scudder and Schwartz 2012) or taxonomic reviews (Kelton 1966; Carvalho and Jurberg 1974, 1976; Eyles and Carvalho 1975; Carvalho and Fontes 1981; Lattin and Schwartz 1986; Scudder and Schwartz 2001). Authors have being showing different interpretations and terminologies for female and male genitalias. Furthermore, the different terminology used impedes our ability to propose and document homology statements on genitalic structures and severely affects our competence to generate robust cladistic hypotheses (Weirauch and Schuh 2011; Forero and Weirauch 2012).

The male and female genitalia of Collaria have been documented by Carvalho and Fontes (1981), tregarding the species C.capixaba, C. guaraniana, C. husseyi, C.meilleurii, C.oculata, C.oleosa and C.scenica, including the parameres, endosoma, and the bursa copulatrix, but unfortunately the illustrations are poorly detailed. Carvalho and Fontes (1981) did not provide consistent views of the structures observed (e.g., endosoma in ventral or ventro-lateral views), making the comparisons and interpretation of the structures very difficult. Furthermore,

proposing primary homology statements based on this documentation is impossible. The sclerites of the endosoma are not well illustrated in some cases, the anterior wall is not well illustrated, and the pygophore and gonapophyses are not documented. Finally, they provide little discussion of the structural variation of the genitalia. Schwartz (2008) included Collaria guaraniana, C. improvisa, C.meulleuri, C. obscuricornis, C. oculata, and C. scenica in his study, providing selected micrographs and illustrations for the endosoma, posterior wall, and dorsal labiate plate, but not for the pygophore and gonapophyses. He provided names for the structures especially for the endosoma and the posterior wall, differing in the terminology used by Carvalho and Fontes (1981), although not all structures were named.

This work is a comparative morphological study of genitalic features of representative species of Collaria from the Afrotropical, Nearctic, and Neotropical regions. The morphology of the genitalia of both sexes was carefully examined and described in detail, with the goal of exploring and recording the morphological interspecific variation of the genitalia, to provide consistency in the terminology and documentation, thus facilitating the assessment of primary homologies which could be used in a future phylogenetic analysis of Collaria.

Material and Methods

Material examined.

In order to have a broad outline of the variation in all known species of the genus Collaria we selected seven species which represent the external variation observed, as well as the geographical range, including species from the Afrotropical, Nearctic and Neotropical regions. The specimens studied were borrowed from following institutions: American Museum of Natural History, New York, USA (AMNH); California Academy of Sciences, San Francisco, USA (CAS); Taxonomic Collection of Insects “Luis María Murillo”- CORPOICA, Bogotá, Colombia (CTNI); Entomological Collection Pe. Jesus Santiago Moure of the Department of Zoology, Federal University of Paraná, Curitiba, Brazil (DZUP) (Table 1).

Table 1. Species and collection data for studied specimens of Collaria.

Species	Locality and label information	Sex and Collection
C. boliviana Carvalho 1990	Perú: Junin: San Ramón de Panga, 40 km SE Satipo, 750 m, 4.iii.1972. Col: RT & J.C Schuh Perú: Monzon Valley Tingo Maria 8.x.1954.Col Schlinger &Rose.	♂ (AMNH) ♀ (CAS)
C. capixaba Carvalho & Fontes 1981	Brazil: São Paulo: Serra da Bocaina, S Jose Barreiro 1650m, i.1969. Col: M.Alvarenga. Brazil: Paraná: Curitiba 16.ii.1966. Col: Ext.D.Z.U.P.	♂ (AMNH) ♀(DZUP)
C. improvisa Reuter 1893	South Africa: Natal: 75km WSW Estcourt, Cathedral Peaks For. 1500m. Station, 19.xii.1979. Col: S.& J.Peck	♂(AMNH) ♀(AMNH)
C. meilleurii Provancher 1872	Canada: Ontario: Dunbarton NE of Toronto, 15.vii.1975. Col: J.& W. Ivie	♂(AMNH) ♀(AMNH)
C. oculata (Reuter 1876)	United States: Maryland: Prince Georges 3mi SEof Beltsville. 12.vi.1965. Col: D.R. Smith	♂(AMNH) ♀(AMNH)
C. oleosa (Distant 1883)	Colombia: Boyacá: Guican, 28.xi.2011. Col: J. Gómez	♂ (CTNI) ♀ (CTNI)
C. scenica (Stål 1859)	Colombia: Cundinamarca: Mosquera, Tibaitatá, 1100m, 7.xii.2012. Col: J.Gómez	♂ (CTNI) ♀ (CTNI)

Terminology. For most structures of the male genitalia we follow Forero (2008, 2009), and for the structure of the endosoma Yasunaga and Schwartz (2007), Schwartz (2008) and Gapon (2014). Here we propose the following new terms: left dorsal endosomal sclerite (ldes) and right dorsal endosomal sclerite (rdes), wich are sclerotized process present in a dorsal sclerite in the medial region of the endosoma in dorsal view. In the anterior medial region of the endosoma (in ventral view), we found the medial endosomal sclerite (mes), which is the sclerotization of the right side of the secondary gonopore and sometimes beside the lobal endosomal sclerite. Schwartz (2008), proposed a genital tubercle dorsal to the paramere insertion which in this paper is designated as the prolongation of the lateroposterior margin of pygophore. For the female genitalia we follow Fontes (1981), Yasunaga and Schwartz (2007), Forero (2008, 2009), and Schwartz (2008). The following new terms are proposed: apical grooved region of the first (agrfg), and second gonapophysis (agrsg); which are apical grooved regions on the distal extremity observed in lateral view. The lateroapical margin of the interramal lobe (lam), which is redounded and sometimes has a projection of different sizes.

The following abbreviations are used (the new terms are highlighted in bold): Male: anterior opening of the pygophore (apo), cuplike sclerite (cs), lobal endosomal sclerite (les), hypophysis (hp), lateral margin of basal sensory lobe of paramere (lsl), left lateral lobe of endosoma (lll), **left dorsal endosomal sclerite (ldes),** left paramere (lp), **medial endosomal sclerite (mes),** medial margin of basal sensory lobe of paramere (msl), phallotheca (pt), posterior endosomal sclerite (pes), **prolongation of lateroposterior margin of pygophore (plp)**, ribbonlike endosomal sclerite (res), right lateral lobe of endosoma (rll), right paramere (rp), **right dorsal endosomal sclerite (rdes)**, secondary gonopore (gs), sclerite of the secondary gonopore (sgs), ventral lobe of endosoma (vl). Female: **apical grooved region of first gonapophysis (agrfg)**, **apical grooved region of second gonapophysis (agrsg),** dorsal structure of posterior wall (ds), dorsal labiate plate (dlp), dorsal margin of first gonapophysis (dmfg), dorsal margin of second gonapophysis (dmsg), carina of first gonapophysis (cfg), interramal lobe of posterior wall (irl), carina of second gonapophysis (csg), **lateroapical margin of interramal lobe (lam),** medial process of posterior wall (mp), teeth of apex of second gonapophysis (tasg), sclerotization of dorsal labiate plate (sdlp), sclerotized ring (sr), ventral margin of first gonapophysis (vmfg), ventral margin of second gonapophysis (vmsg).

Dissections. The standard technique to dissect mirid genitalia consist in the use of 10% NaOH or KOH (Forero 2008), but in this study we follow the technique described by Scudder and Schwartz (2012), in order to find ways to inflate the endosoma and to avoid destroying the structures of the genitalia, as the lactic acid is not as harsh as potash (Scudder and Schwartz 2012). The specimens were relaxed in a humidity chamber for 12 hrs. The entire abdomen was removed in both sexes and placed in a spot plate with a warm solution of full strength 85% lactic acid with 10 drops of distilled H_2O on a small electric heater at low heat (near to 45°C) until the muscles and cuticle of the abdomen were mostly liquefied and the endosoma was then inflated, projecting beyond the pygophore. The genitalia was rinsed in distilled water and transferred to 100% ETOH. Dissections were carried out in glycerin under a Leica MZ8 stereomicroscope. For males the parameres are not removed from the pygophore. Holding the pygophore with forceps, the extremity of the endosoma was pulled until completely out, and then in the majority of cases we pulled the endosoma

out of phallotheca with a pair of forceps. In females specimens we separated tergites from sternites, removed sternites II–VII from the ovipositor and separated with a forceps the first and second gonapophysis. The dorsal wall was then severed from the posterior wall with a pair of forceps (Forero 2008).

Imaging. Micrographs of genitalic structures were taken using a Zeiss Discovery V20 stereomicroscopy adapted with a Zeiss AxioCam MRc digital camera, and using Olympus BX53 microscopy with an Olympus DP73 camera. Following Forero and Weirauch (2012) the structures were placed in a small glass dish on top of a drop of KY jelly and the dish was then filled with ETOH 70 %; this setup allows for re-positioning of structures during imaging. All piecees are documented in dorsal, lateral and ventral views to facilitate visualization of the three-dimensional structures. Final images of specimens were the result of stacking about 30-50 photographs in different focus planes using the extended focus module of Zeiss AxioVision 4.8 software and Zerene Stacker software.

Results

Male genitalia

The male genitalia of Collaria follows the general pattern of the genitalia of Miridae; being composed by the pygophore, which carries two asymmetrical parameres placed laterally on the posterior margin (lp, rp Fig. 1), and the phallus that contains the aedeagus + phallobase (=articulatory apparatus). The aedeagus consists of two parts, the proximal phalloteca (pt, Fig. 2 g) and the distal endosoma, which carries membranous lobes and sclerotizations (=spicules).

Pygophore

The shape of the pygophore margins ranges from parallel and elongate (Fig. 1 a, b, d, e, f, g) to triangular (Fig. 1 c). The apex is usually slightly rounded (Fig. 1 a, b, d, e, f, g) or subtriangular (Fig. 1c), with some erect and rather short setae on its sides. The anterior opening of the pygophore (apo) has the ventral margin usually sclerotized, wide, and range from square (e.g., Fig. 1 b, g) to subrounded (Fig. 1 c). The left lateroposterior margin of the pygophore is entire (Fig. 1 a, b, f, g) or has a

prolongation (plp), which can be large (Fig. 1 d, e) or small (Fig. 1 c). The cuplike sclerite (cs) has its apex and lateral margins strongly sclerotized (Fig. 1).

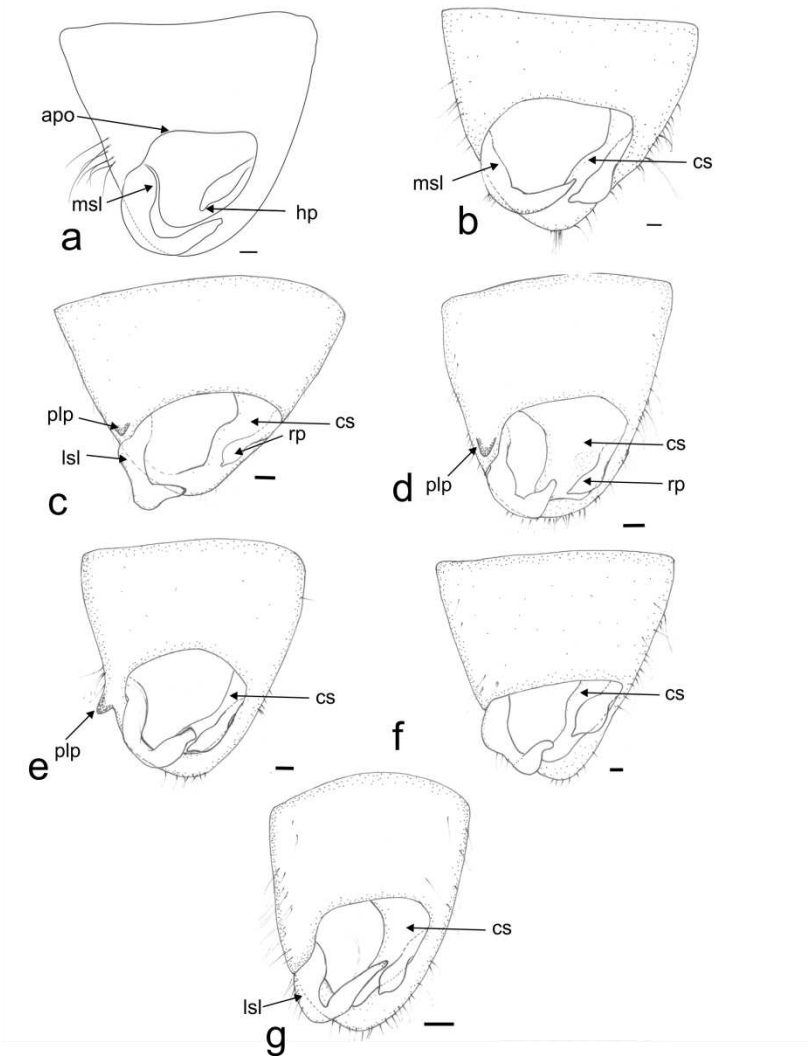

Figure 1. Phygophore in dorsal view. Collaria spp. a. C. boliviana. b. C. capixaba. c. C. improvisa. d. C. meilleurii. e. C.oculata. f. C.oleosa. g. C.scenica. Scale 0.1 mm. apo Anterior opening of pygophore, cs Cuplike sclerite, hp hypophysis, lsl lateral margin of basal sensory lobe of paramere, lp left paramere, msl medial margin of basal sensory lobe of paramere, plp prolongation of lateroposterior margin of pygophore, rp right paramere.

Parameres

They are asymmetrical, with the left one (lp Fig. 1) being larger and strongly curved, whereas the right one (rp Fig.1) is smaller. Each paramere bears an anterior or basal sensory lobe (sl) and posterior or apical shaft referred to as the hypophysis (hp) (Yasunaga & Shwartz 2007). The shape of left paramere in medial view can be sickle-shape (Fig. 1a) or sickle-shape ending in a lateral tip (Fig. 1c), and hypophysis can be: curved (Fig. 1a) or angulated with short apex (Fig. 1c). The medial margin of

basal sensory lobe (msl) of the left paramere varies from almost straight (Fig. 1 b) to clearly convex (Fig. 1 a), and the lateral margin of the basal sensory lobe (lsl) can be almost straight (Fig. 1g) or clearly convex. The right paramere (rp) is smaller than the left one, and can be: clubbed (Fig. 1c) or straight (Fig. 1a) with the apex of hypophysis small (Fig. 1 b-g) or large (Fig. 1 a).

Aedeagus

Phalloteca

The proximal phallotheca is little sclerotized and wraps the endosoma. The shape in all species is tube-like and the apical part is projected to the right left and does not show modifications (pt, Fig. 2 g).

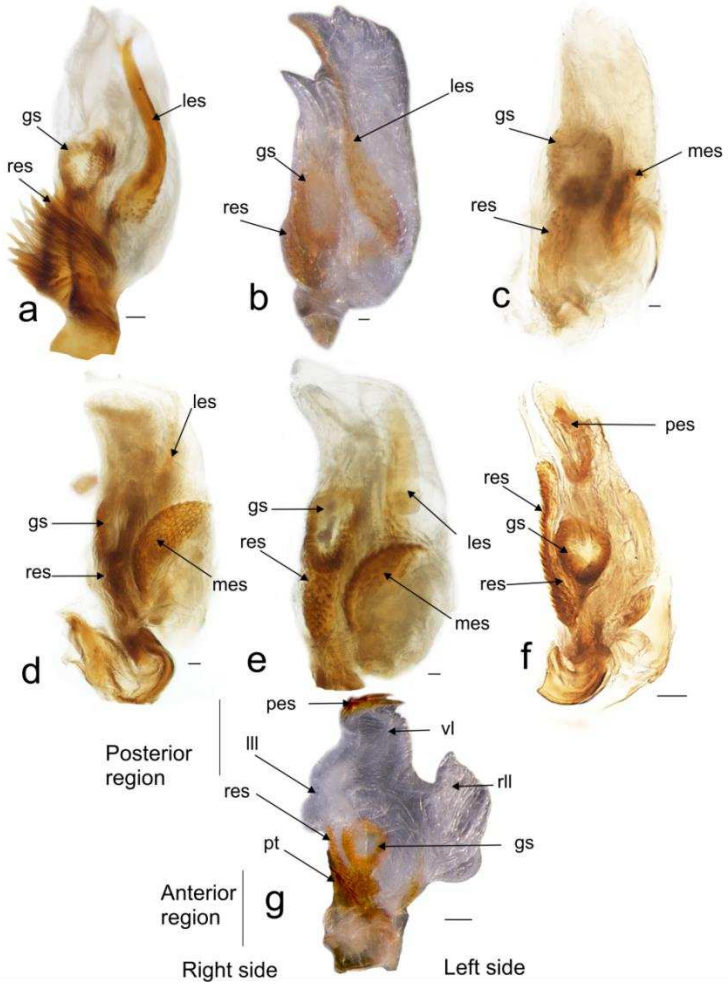

Figure 2. Endosoma in Collaria spp. a. C. boliviana. b. C. capixaba. c. C. improvisa. d. C. meilleurii. e. C.oculata. f. C.oleosa. g. C.scenica. Scale 0.1 mm. les Lobal endosomal sclerite, lll left lateral lobe of endosoma, mes medial endosomal sclerite, pt phallotheca, pes posterior endosomal sclerite, res ribbonlike endosomal sclerite, rll right lateral lobe of endosoma, gs secondary gonopore, vl ventral lobe of endosoma.

Endosoma

The endosoma is a tube-like membranous sac, with three lobes (lll, vll, rll, Fig. 2). When the endosoma was inflated it showed: two lateral lobes (right lateral lobe rll, left lateral lobe lll), and a ventral one (vl) (Fig. 2 f, g). The ventral lobe is larger than the lateral lobes (Fig. 2 f, g) or small (Fig. 2 a-e). The right lateral lobe is elongated (Fig. 2 b, f), or shorter than the ventral (Fig. 2 a, c, d, e, g). The left lateral lobe is short (Fig 2 a, b, c, f, g) but in some species it is elongate, narrow, and with a strongly curved apex (lll, Fig. 2 d, e).

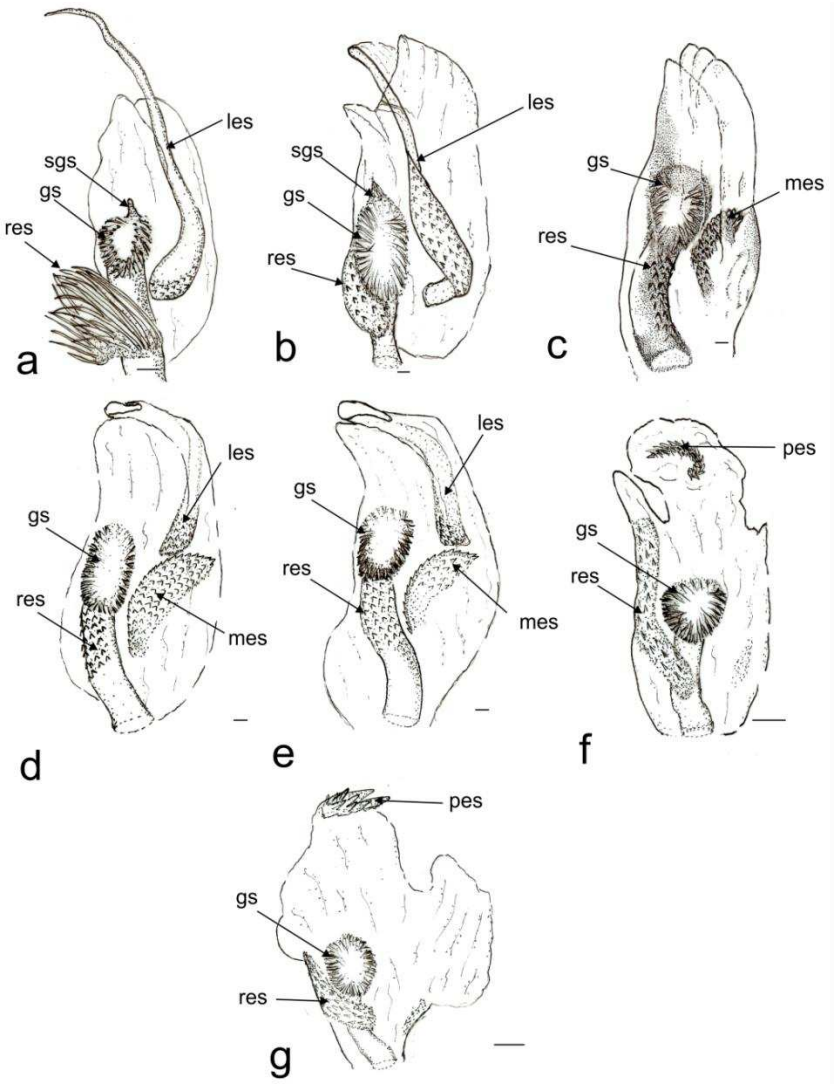

Figure 3. Endosoma in ventral view. Collaria spp. a. C. boliviana. b. C. capixaba. c. C. improvisa. d. C. meilleurii. e. C.oculata. f. C.oleosa. g. C.scenica. Scale 0.1 mm. gs secondary gonopore, les Lobal endosomal sclerite, mes medial endosomal sclerite, pes posterior endosomal sclerite, res ribbonlike endosomal sclerite, sgs sclerite of the secondary gonopore.

There are six endosomal sclerites: in ventral view we found the posterior endosomal sclerite (pes), the ribbonlike endosomal sclerite (res), the medial endosomal sclerite and the lobal endosomal sclerite (les). The posterior sclerite is found in the posterior region of th endosoma and can be c-shaped with several dorsal spines (Fig. 2, 3f) or comb-shape with about six thick spines joined at the base of different sizes (Figs. 2, 3 g). The lobal endosomal sclerite is near the periphery of the membranous lobe and with a left position in the endosoma; this sclerite has: smooth margins with microtrichia on the basal region and can be elongated (les, Figs. 2, 3 a), elongated with microtrichia in basal region (Fig. 2, 3 a, d, e), or on the basal and medial regions (Figs. 2, 3 b). The medial endosomal sclerite (mes) can be oval with serrate margins (Fig. 2, 3 c) or semicircular (= crescent) broad (Fig. 2, 3 d), or slender (Fig. 2, 3 e). The ribbonlike endosomal sclerite (res) is basal to the secondary gonopore enclosing the ductus seminis and antero-posteriorly oriented (Fig. 2, 3); can be brush-shaped with long spines (Fig. 2, 3, a), a short lobe with microtrichia (Fig. 2 b, c, d, e, g), or an expanded lobes that goes beyond the secondary gonopore (Fig. 2, 3 f). The right dorsal endosomal sclerite (rdes) can be: elongated without trichia on surface (Fig. 4a) fusiform with trichia on surface (Fig. 4b) or elliptical with trichia on surface (Fig. 4c). When is present the left dorsal endosomal sclerite (ldes) can be: fusiform with apex broad (Fig. 4a). Some species have a sclerite on its ventral surface (sgs) associated with the secondary gonopore, which can be relatively small (e.g., C. boliviana, Fig. 3a) or large (e.g., C. capixaba Fig 3b).

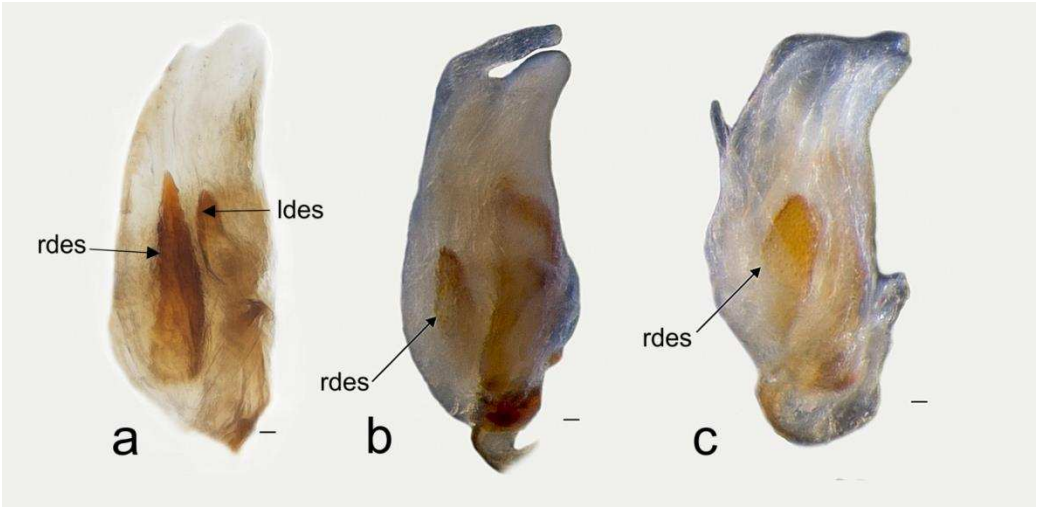

Figure 4. Endosoma in dorsal view. Collaria spp. a. C. improvisa. b. C. meilleurii. c. C. oculata. Scale 0.1 mm. ldes Left dorsal endosomal sclerite, rdes right dorsal endosomal sclerite.

Female genitalia

The abdominal segments 8 and 9 contain the external female genitalia. The ovipositor consists of two pairs of sheets formed by the first and second gonapophyses; the sternal structures associated with abdominal segments eight and nine compose the entire Bursa copulatrix.

First Gonapophysis

The first gonapophysis are enlarged, weakly sclerotized structures. The ventral margin (vmfg, Fig. 5 c) is membranous, and the dorsal one is sclerotized (dmfg, Fig. 5 c). The carina which is found sublateral to the dorsal margin of the first gonapophysis, (cfg, Fig. 5 a) reaches the apical grooved (or striated) region of the first gonapophysis (agrfg), and is strongly (Fig 5a, b, c, f, g) or weakly sclerotized (Fig. 5 d, e). The apex is sharpened with apical region grooved (agrfg) broad (Fig. 5 a, b, c, e, f, g) or acute with the grooved region narrower (Fig. 5 d).

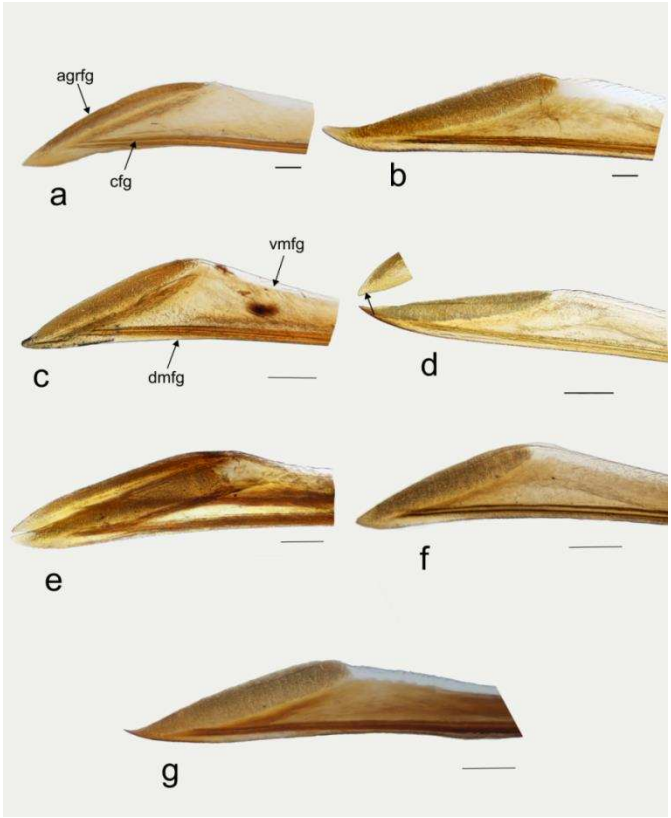

Figure 5. Apex of first gonapophysis in lateral view. Collaria spp. a. C. boliviana. b. C. capixaba. c. C. improvisa. d. C. meilleurii. e. C.oculata. f. C.oleosa. g. C.scenica. Scale 5µ. agrfg Apical grooved region of first gonapophysis, dmfg dorsal margin of first gonapophysis, cfg carina of first gonapophysis, vmfg ventral margin of first gonapophysis.

Second Gonapophysis

The second gonapophysis is smaller than first gonapophysis. It is spear shaped in lateral view, with a narrow region at base, and can be triangular (Fig. 6 a, c, e, f, g) or elongated apically (Fig. 6 b, d). The ventral margin is heavily sclerotized and smooth (vmsg, Fig. 6 a), and the dorsal margin is membranous (dmsg), being smooth (Fig. 6 a, b, d, e, g) or rugose (Fig. 6 f). The apex have teeth (tasg), varying in number, one dorsal (Fig. 6 b, c), one ventral (Fig 6 a), one dorsal and one ventral (Fig 6 e, g), or three in the apex (Fig 6 f). Thet also varying in size, being small (Fig. 6 b) or large (Fig. 6 c). The carina of t hesecond gonapophysis (csg) can be single (Fig 6 c) or double (Fig 6 a, b, d, e, f, g), reaching the apex of second gonapophysis. An apical grooved region (agrsg), present in at least in one species (Fig 6 c).

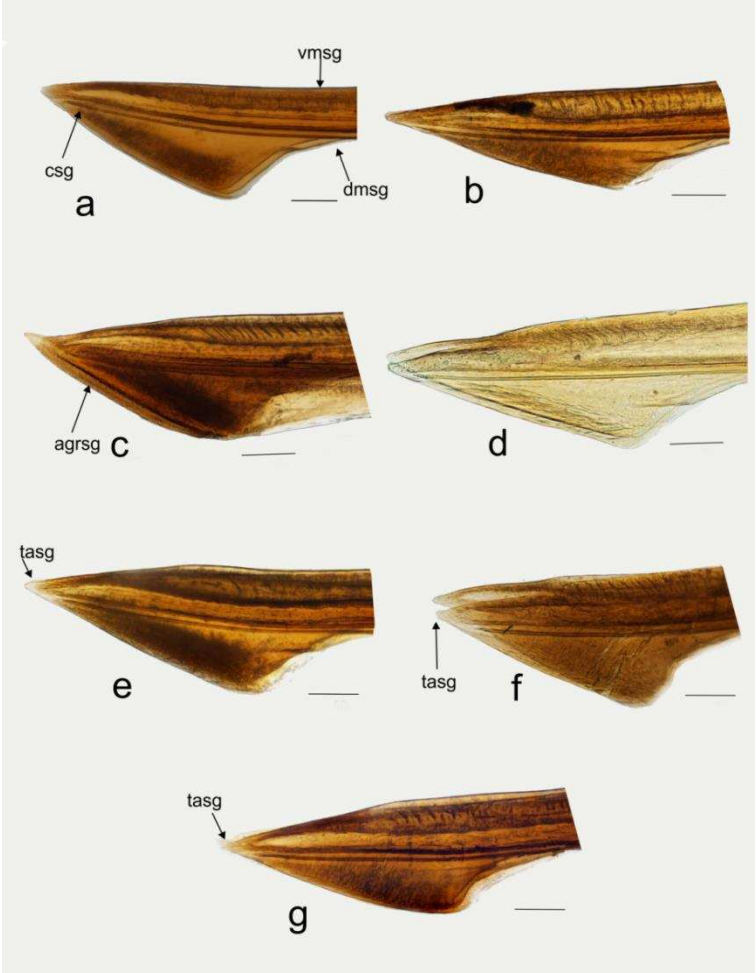

Figure 6. Apex of second gonapophysis in lateral view. Collaria spp. a. C. boliviana. b. C. capixaba. c. C. improvisa. d. C. meilleurii. e. C.oculata. f. C.oleosa. g. C.scenica. Scale 5µ. agrsg Apical grooved region of second gonapophysis, dmsg dorsal margin of second gonapophysis, csg carina of second gonapophysis, tasg teeth of apex of second gonapophysis, vmsg ventral margin of second gonapophysis.

Bursa copulatrix

The dorsal labiate plate (dlp, Fig. 7 d), has a sclerite caudal to the sclerotized rings (sdlp) (Fig. 7 b), being small (Fig. 7 a) or large (Fig 7 b-g). The sclerotized rings of the dorsal labiate plate can be oblong (rs, Fig.7a -d), or ovoid (Fig. 7 f, g). The posterior wall has interramal lobes that can be triangular (Fig. 8 a, f, g) or rounded (Fig. 8 b, c, d, e). The lateroapical margin can be rounded (Fig. 8 b, c, d, e) or with projection: large (lam, Fig 8 a) or short (Fig. 8 f, g). Medially, the dorsal saclike structure of the posterior wall can be subtriangular and small (ds, Fig.8 a, d, e), medium-sized and covering half of the medial process (ds, Fig. 8 b, f, g), or large (as large as interramal sclerite, ds, Fig. 8 c). The medial process (mp, Fig. 8 d) of the posterior wall is generally strongly sclerotized, and can have the following shapes: an Y (mp, Fig. 8 a, f) inverted T (md, Fig. 8 b, d, g), I (md, Fig. 8 e) or be absent (Fig. 8 c).

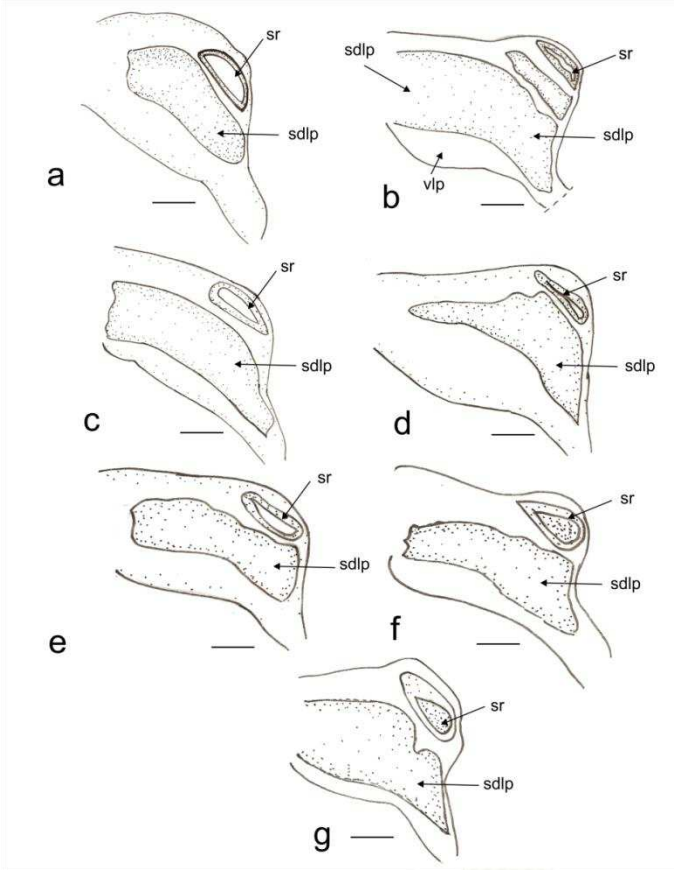

Figure 7. Dorsal labiate plate wall in Collaria spp. a. C. boliviana. b. C. capixaba. c. C. improvisa. d. C. meilleurii. e. C.oculata. f. C.oleosa. g. C.scenica. Scale 5 µ. sdlp Sclerotization of dorsal labiate plate, sr sclerotized ring.

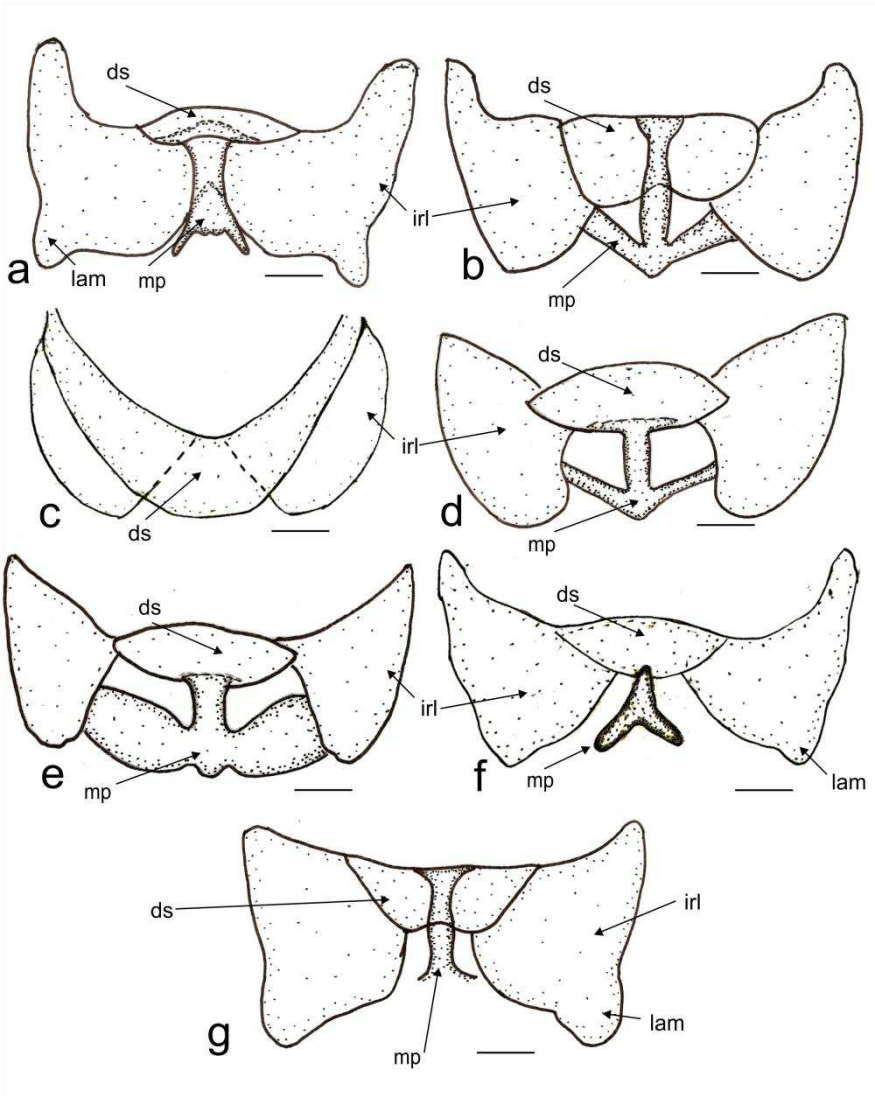

Figure 8. Posterior wall with Dorsal Structure and Medial Process. Collaria spp. a. C. boliviana. b. C. capixaba. c. C. improvisa. d. C. meilleurii. e. C.oculata. f. C.oleosa. g. C.scenica. Scale 0.1 mm. ds Dorsal structure of posterior wall, irl interramal lobe of posterior wall, lam lateroapical margin of interramal lobe, mp medial process of posterior wall.

Discussion

A detailed study on the genitalia of Collaria was showed by the illustrations, photographs and comparisons of the male and female structures of representative species of Neotropical, Neartic and Afrotropical regions. Variations and documentation of new structures in both, males (e.g. endosomal sclerites, prolongation of margin of the pygophore), and females (e.g. apex of gonapohyses) different from those recorded by Carvalho and Fontes (1981) and Schwartz (2008) constitute an informative tool that strengthens the diagnosis of the genus. Just like the description of the new structures and other documented by other authors and standardization of terms used in the morphology of the genitalia of the genus

constitute a starting point for the development of primary homologies and thus to elucidate the phylogenetic relationships of the species.

According to Carvalho and Fontes, (1981), Schwartz (2008), and the newly documented structures, the characteristic features for Collaria genitalia are summarized below: margin of the pygophore ranging from elongate to triangular, sometimes with lateroposterior margin projected in species belonging to Afrotropical and Neartic regions. Endosoma with six sclerites differening in form and position. Female with sclerotized rings of the dorsal labiate plate on the Bursa copulatrix oblong or ovoid, well developed, and dorsal structure of the posterior wall and medial process with different forms.

Terminology and structure of male and female genitalia

Interpretations of the morphological structures of the genitalia of Collaria, have varied between the decades of 1980's and 1990 's. Carvalho and Fontes (1981) used structures of the genitalia of males with names and illustrations that differ from those outlined by Carvalho and Carpintero (1989) and Carvalho (1990). These differences are presented by the manner in which each author has oriented and illustrated the genitalia of males and females. This has also been identified in other taxa, for example, Forero (2009) found that illustrations of the endosoma within the subfamily Orthotylinae were highly schematic in some of the species descriptions and had to provide more accurate drawings of the parameres, vesica, phallotheca, and genital capsule to facilitate comparisons with closely related new taxa.

Recently, the methodology of using photos has been applied to try to overcome this problem and display more clearly, precisely, and with a standardized orientation all structures of taxonomic significance in the genitalia of a given taxon (e.g., Chamorro and Lopes, 2014; Forero and Weirauch 2012). Here, we expose a representation of the morphological diversity of the genitalia of Collaria, and perceive differences in structures that would be almost impossible without extractions and observations in different orientations (e.g. dorsal, ventral positions). Therefore, the use of techniques such as photographs, can facilitate the display of components of genitalia, however it is also essential to make drawings in order to show details and interpretations.

Carvalho and Fontes (1981) used the name how “field of thorns” for sclerites in the endosoma but they did not comment the variability and on which side (right or left) of gonopore secondary they are were located. For female, they documented only a “sclerotized area of the rings” (which is part of the dorsal wall of the Bursa copulatrix), did not mention the structure of the dorsal wall proposed by other authors like Davis (1955).

Schwartz (2008) established that the male of Collaria has a basal sclerotized process on the endosoma with spiny and filamentous patches. We supported these observations, the endosoma has sclerites in all examined species in ventral view with a posterior, right and left position, and we found the sclerite in dorsal view; which had not been documented for the species of genus although being found in other Mirinae (e.g Gapon, 2014). The right dorsal endosomal sclerite (rdes) and left dorsal endosomal sclerite (ldes); were observed when looking at dorsal view of the structure in Afrotropical species like C. impovisa while in Nearctic species the only the right dorsal endosomal sclerite (rdes) is found, and in Neotropical species it is absent.

According to Schwartz (2008), the ribbonlike endosomal sclerite (res) is attached to the posterobasal portion of the ductus seminis; this sclerite is present in all the studied species of Collaria. Although the orientation is distinct between them, it is most easily observable in lateral view, where the sclerite lies in vertical position lengthened to apex in C. oleosa and C. scenica; whereas in other species is almost horizontal (like in C. capixaba, C. improvisa, C. meulleurii). To explain the variety of orientations found, we can invoke the torsion hypothesis of the endosomal spicules proposed by Cassis (2008), where the spicules or sclerites can migrate basally proximal to the endosomal membranous border with the apex twisting along the longitudinal axis of the endosoma, which probably occurred to species of Collaria.

The studies of female genitalias are less frequent than those of males, and the former usually do not present good characters to distinguish species (Ah-King et al., 2014). However, the female genitalia in Collaria has interspecific variation which allows the species discrimination. Schwartz (2008) determined the posterior wall with dorsal structure completely developed and sometimes the dorsal structure as big as the interramal sclerite. Our observations corroborate Schwartz’s appreciations, but

we include additional characters such as the lateroposterior margin of the interramal lobes of posterior wall (irl), the medial process (mp), and the first and second gonapophysis.

We herein add structures of the Collaria female genitalia not previously discussed by other authors, such as the apical grooved region and the teeth in the apex of gonapophysis. Davis (1955) mentioned that the cutting teeth are developed on the first and second gonapophyses and probably reflect the ovoposition habits of the each species, the data obtained in this study are congruent with those Davis (1955) and Fontes (1981) where the second gonapophysis has small teeth on their ventral margins near the apices.

Primary homology

We found evident primary homologies like the endosomal sclerites, parameres, and pygophore in the male, and the margin of interramal lobes, gonapophyses, and dorsal structure of posterior wall, sclerotized rings and medial process of posterior wall in females. However in other cases, these homologies were difficult to determine. We initially found it difficult to propose primary homologies for the lobes of endosoma (lll, vl, rll) of the male; because they are hard to observe and in some cases we were unable to inflate the endosoma. However, when comparing the left lobe (lll) of C. meilleuri and C.oculata with other species, we can propose primary homology between the endosomal lobes. Nonetheless, more detailed studies with different techniques to inflate the endosoma are needed in order to establish variations of form and size. According to exposed, some proposed primary homologies are tentative and need to be tested on a phylogenetic analyses.

Species groups and genitalia

Schwartz (2008) recognized Collaria as the sister group of Nabidomiris based on characters of the head, pronotum and genitalia of both sexes. Although the internal relationships of Collaria have not been tested yet using cladistic analyses, the study of the genitalia can give clues about the relationships among species. Carvalho and Fontes (1981) considered the species C. capixaba, C. oleosa, and C. guaraniana closely related, based on the endosomal structure; and C. meulleurii close to C. oculata by the head coloration and genitalia. Based on male and female

genitalias we propose that C. meulleurii and C. oculata form a natural group since they share the particular structure of the lobal endosomal sclerite, which is elongated with a strongly curved apex, medial endosomal sclerite semicircular, right dorsal endosomal sclerite fusiform and elliptical, and the shape of the medial process of posterior wall in female.

Characters that might support a Neotropical clade composed by C. boliviana, C. capixaba, C. oleosa, and C. scenica are the presence and particular structure of the endosomal sclerites, and the shape of the interramal lobes and the medial process of the posterior wall in females. Collaria oleosa is probably more related to C. scenica because of the posterior position of endosomal sclerite, unlike the hypothesis proposed by Carvalho and Fontes (1981) in which C. oleosa would be more related to C. capixaba. The Afrotropical species examined exhibits unique features such as the strongly curved left paramere and two dorsal endosomal sclerites: the left dorsal endosomal sclerite is shorter than the right dorsal endosomal sclerite. In the female, the rounded interramal lobes and medial process are absent. It is likely that other Afrotropical species might exhibit some of these characters, however additional studies on more species from this region, will provide further contribution to the taxonomy of the group.

Finally, the detailed description of the genitalia of the genus Collaria increase new characters for the description, redescription and diagnosis of the genus. Future studies should emphasize on testing the primary homologies proposed here establish the phylogenetic relationships of within the genus Collaria, and biogeographic relationships in the global range.

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CAPÍTULO II

Revision of Collaria Provancher, 1872 (Hemiptera: Miridae) with the description of a new species from the Afrotropical region

Manuscrito original, apresentado em formato de submissão para publicação na revista **ZOOTAXA**

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Abstract

Collaria (Mirinae: Stenodemini) is a genus of grass-feeding bugs with 14 recognized species. The present work includes redescriptions of species and the description of C. schwartzi **sp. nov**. The female genitalia of C. boliviana and C. villiersi, and male and female genitalias of C. improvisa and C. obscuricornis are described. New distribution records for Neotropical and Afrotropical regions are included. Finally, a key and ilustrations of male and female genitalias of all species are included.

Keys words: Heteroptera, Stenodemini, grass-feeding plant bugs, new record, male and female genitalia, taxonomy.

Introduction

The genus Collaria was proposed by Provancher (1872) for the type species C. meilleurii Provancher, 1872. Reuter (1876) described the genus Trachelomiris with the species Trachelomiris oculatus. Distant (1883) described Trachelomiris oleosus, and Reuter (1905) transferred the species of genus Trachelomiris to the genus Collaria. Ulher (1878) described Nabidea to accommodate his new species N. coracina, but it was synonymized with C. meilleurii by Ulher (1887). Descriptions of African species were made by Reuter (1893) (C. improvisa), Poppius (1910) (C. obscuricornis) and Linnavouri (1974-1975) (C. danae and C. nigra). Their

descriptions were based in general color, with no illustrations and descriptions of male and female genitalia. Carvalho & Fontes (1981) partially revised the genus, including descriptions of three new species, diagnosis and illustrations of male and female genitalias, and a key to the Nearctic and Neotropical species.

Collaria is predominantly Neotropical, with seven species (C. boliviana Carvalho 1990, C. capixaba Carvalho & Fontes 1981, C. guaraniana Carvalho & Fontes 1981, C. husseyi Carvalho 1955, C. malonoi Carvalho & Carpintero 1989, C. oleosa (Distant 1883), and C. scenica (Stål 1859) from this region. The Neartic Region is represented by two species (C. meilleurii Provancher 1872 and C. oculata (Reuter 1876)), and five species from the Afrotropical Region, are currently recognized: C. danae Linnavuori 1974, C. improvisa Reuter 1893, C. nigra Linnavuori 1975, C. obscuricornis Poppius 1910, C. villiersi Carvalho 1953. Most of the taxonomy of Collaria is based on the Neotropical and Neartic species, and there are no keys for all species of the genus. This study provides a synopsis of the genus Collaria with description of a new species from the Afrotropical region, a key to species, and information concerning geographic distribution and plant associations.

Material and Methods

Examined Specimens. A total of 1080 specimens were borrowed from the following entomological collections and examined:

AMNH	American Museum of Natural History, New York, USA.
BPBM	Bernice P. Bishop Museum, Hawaii, USA.
CAS	California Academy of Sciences, San Francisco, USA.
CTNI	Colección Taxonómica de Insectos “Luis María Murillo”-CORPOICA, Tibaitatá, Colombia.
DZRS	Departamento de Zoologia, Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil.
DZUP	Coleção Entomologica Pe. Jesus Santiago Moure do Departmento de Zoologia, Universidade Federal de Paraná, Curitiba, Brazil.
ICN	Colección de Zoología – Instituto de Ciencias Naturales – Universidad Nacional de Colombia Bogotá, Colombia.
IAVH	Colección Entomológica Instituto de Investigación de Recursos Biológicos Alexander von Humboldt Villa de Leyva, Colombia.

KU	University of Kansas Natural History Museum, Lawrence, Kansas, USA.
MCZN	Museu Ciências Naturais Fundação Zoobotanica Rio Grande do Sul, Porto Alegre, Brazil.
MCN	Coleção Zoológica Científica do Museu de Ciências Naturais do Centro Univates, Lajeado, Brazil.
MNRJ	Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil.
MPUJ-ENT	Museo de Pontificia Universidad Javeriana, Laboratorio Entomología, Bogotá, Colombia.
MRAC	Royal Museum for Central Africa, Tervurem, Belgium.
NMSA	Natal Museum, Pietermaritzburg, South Africa.
RBINS	Royal Belgian Institute of Natural Sciences, Brussells, Belgium.
UFES	Universidade Federal do Espirito Santo, Vitoria, Brazil.
UFVB	Museu Regional de Entomologia, Universidade Federal de Viçosa, Viçosa, Brazil.
UPTC	Laboratorio de Entomología, Museo de Historia Natural "Luis Gonzalo Andrade" Universidad Pedagógica y Tecnológica de Colombia, Tunja, Colombia.
USU	Insect Collection Utah State University, USA.
USNM	National Museum of Natural History, Smithsonian Institution, Washington DC, USA.
ZMUC	Zoological Museum, University of Copenhagen, Copenhagen, Denmark.

Besides of information gathered from labels, data from the online catalogue The Plant Bug Planetary Biodiversity Inventory Project (http://research.amnh.org/pbi/) were obtained for species C. meilleurii, C. oculata and C. obscuricornis.It concerns specimens held in the following collections:

CNC	Canadian National Collection of Insects. Ontario, Ottawa, Canadá.
OSAC	Oregon State Arthropod Collection, Oregon State University, Oregon, Corvallis, USA.

NCSU North Carolina State University Insect Collection, North Dakota, Fargo, USA.

UDCC University of Delaware, Delaware, Newark,USA.

UCR University of California, Riverside, USA.

MEMU Mississippi Entomological Museum, Mississippi State University, Mississippi, Mississippi, USA.

MHNCM Colección Nacional de insectos Dr. Alfredo Barrera Marín del Museo de Historia Natural de la Ciudad de México.

SANBI South African National Biodiversity Institute IZIKO.

Genitalic dissections. The genitalia was prepared following the methodology of Scudder and Schwartz (2012): the whole abdomen (male and female) was removed and immersed in a warm solution of 85% lactic acid, rinsed in distilled water and transferred to 70% ETOH. The dissections were carried out in glycerin following Forero & Weirauch (2012), under a Leica MZ8 stereomicroscope.

Imaging and measurements. A Zeiss Discovery V20 stereomicroscopy adapted with a Zeiss AxioCam MRc digital camera, and Olympus BX53 microscopy with an Olympus DP73 camera were used for obtaining photographs. Final images were stacked using Zerene Stacker. Measurements were made on Zeiss Discovery V20 stereomicroscopy (Table 1).

Terminology. We follow Schuh and Slater (1995) for the general morphology. The terminology for male and female genitalia follows Schwartz (2008) and Morales-C et al. (In prep.).

Georeferences and maps. The software ArcGis (10.2.1) was employed to generate the maps; the localities from label data were georeferenced using gazetteers (http://www.fallingrain.com) and Google Earth. In some cases these data are given in brackets to indicate that they were not directly taken from PBI database (http://research.amnh.org/pbi/maps/) and label data of examined species.

Genus Collaria Provancher, 1872

TYPE SPECIES: Collaria meilleurii Provancher, 1872 (Lectotype designed by Kelton, 1968).

Collaria Provancher 1872: 79 [n.gen.]; Carvalho 1959: 284 [catalog]; Schwartz 2008: 1179, [syn., diag., morph., phylogenetic relationships], Schuh 2002-2014 [catalog].

Trachelomiris Reuter 1876: 61, [n. gen.] (syn. by Reuter, 1905:47); Carvalho 1959: 284[catalog]; Schuh 2002-2014 [catalog].

Nabidea Uhler 1878: 397, [n. gen.] (syn. by Uhler, 1887:230); Carvalho 1959: 284 [catalog].

DIAGNOSIS: Recognized by the color of body predominantly brown or black (Figs. 1, 2), head with pale spots (Figs.1, 2), vertex sulcate, ovoid eyes at the middle of lateral margins of head (Figs. 1, 2), pronotal anterior lobe narrowed, proepisternum strongly rounded, also by the hemelytra weakly pilose, finely punctate, females macropterous (sometimes female brachypterous in Collaria villiersi), with long and pilose legs. Male genitalia with complex endosoma, usually with endosomal sclerites in ventral and dorsal views (Figs. 3, 4, 5, 6, 7) and female with well developed dorsal structure, interramal lobes of posterior wall triangular or rounded, and medial process sclerotized (Figs. 8, 9, 10, 11).

REDESCRIPTION Male: medium size (5.44 to 7.37 mm, table 1). COLORATION: brownish to blackish, with brownish or yellowish areas (Figs. 1, 2). Head: uniformly colored with black Y-shaped marking extending from longitudinal sulcus to frons, transversal pale spot (v-shaped) posterior to longitudinal sulcus or paired transverse markings lateral to longitudinal sulcus; first antennal segment usually light brown, remaining segments brownish; labial segment IV with apex dark brown; clypeus in dorsal view uniformly colored or with small black spot; mandibular, maxillary plate and buccula uniformly colored or with black spot. Pronotum: with two dark spots on humeral region, uniformly colored or with pale humeral angles; scutellum brownish to blackish; legs pale yellowish to brownish; femur pale yellowish with rounded brown spots, tibia pale brown, and tarsus brownish. Hemelytra: brownish to dark-brown with pale spots. Abdomen: brownish or blackish. STRUCTURE: Body with short to long setae, sparsely distributed. Head: slightly broader than long, or quadrate, smooth, prorrect, with sparse, long, semi-erect pilosity; with short longitudinal sulcus, mandibular plate produced and rounded; eyes ovoid at the middle of lateral margins of head, removed from collar by a distance near the length

of an eye; antenna with short or long erect setae on segments, sometimes with short bristles in segment I; segment I equal the width width of segment II, two or four times the width of II, remaining segments thin and cylindrical, antennal sockets not reaching mandibular-maxillary plate suture. Clypeus: smooth and shiny. Buccula: short (not reaching anterior margin of eyes). Labium: smooth, shiny, reaching posterior coxae, with sparse semierect, and golden pilosity. Post-ocular region with approximately the same size as the eye. Thorax: Collar with posterior suture well defined by an impressed sulcus. Pronotum clearly divided in two areas or lobes by a lateral constriction and a dorsal transversal shallow sulcus or without clearly divided areas. Pronotal anterior lobe abruptly narrowed or gradually narrowed, and lateral margin of pronotum rounded or carinate, with sparse pilosity or with abundant pilosity. Callus well delimited, convex and separated, reaching lateral margin of pronotum. Scutellum triangular, flat. Proepisternum: visible in dorsal view, rounded-convex. Hemelytra: smooth with short and sparse erect setae. Ventral side: Abdomen: smooth with semi-erect setae. Legs: covered by erect or suberect setae with length greater than thickness of segments, hind tibia with microtrichia in the apical region. GENITALIA: Pygophore: elongate or triangular with apex slightly rounded or triangular and ventroposterior margin not differentiated (Fig. 3), with left lateroposterior margin without a pointed expansion or with a pointed expansion. Parameres: left paramere falciform or ending in lateral tip, with basal internal and external margins of basal sensory lobe almost straight or clearly convex; hypophysis gradually acuminate from sensory lobe to apex, gradually acuminate to apex from 1/3 of apex, or not gradually acuminate. Right paramere with basal sensory lobe bulbous and the apex of hypophysis gradually acuminated (Fig.4). Endosoma: Lobal endosomal sclerite strongly tapered towards the apex with area elongated and microtrichia in basal and medial region (Fig. 5 a, b, c, f, g, i). Posterior endosomal esclerite, elongated with short spicules, C-shaped with thick spines or comb-shape with about six thick spines joined at the base of different sizes (Fig. 6 d, j, k). Medial endosomal sclerite oval, semicircular or fusiform (with basal region wider) (Fig. 5). Ribbonlike endosomal sclerite brush-shape with long spines; sometimes with an expanded lobe that goes beyond the secondary gonopore and with microtrichia; or short lobe with microtrichia (Fig. 5). The right dorsal endosomal sclerite elongated

without trichia on surface, fusiform with trichia on surface or elliptical with trichia on surface; left dorsal endosomal sclerite fusiform with apex broad (Fig. 5).

Female: Similar to male in coloration and STRUCTURE: but usually longer (5.98 to7.06 mm, Table 1), sometimes with brachypterous females. GENITALIA: First gonapophysis: apical grooved region weakly or strongly sclerotized and broad or acute (Fig. 8). Second gonapophysis: apex triangular smooth or striated with teeth present or absent (Fig. 9). Bursa copulatrix: dorsal labiate plate with one or two small sclerites caudal to sclerotized rings (Fig. 10). Posterior wall with triangular, rounded or subquadrate interramal lobes and sometimes with projection in lateroapical margin (Fig. 11). Dorsal structure small, or medium-sized (covering half of the interramal lobes), or large (as large as interramal lobes) (Fig. 11). Medial process strongly sclerotized, with inverted Y- shape, arrow-shaped or I-shape (Fig.11).

GEOGRAPHIC DISTRIBUTION: Widely distributed in the Neotropical, Nearctic and Afrotropical regions (Schwartz 2008).

PLANT ASSOCIATIONS: Eleven of the 15 Collaria species lack data on host-plant associations. The genus as whole has preference for Poaceae (Andropogon, Avena, Brachiaria, Calamagostris, Digitaria, Eriochloa, Eulisine, Oryza, Panicum, Pennisetum, Triticum, Setaria, Sorghum, Zea) and Fabaceae (Phaseolus) (Carvalho & Fontes 1981, Martinez & Barreto 1998, Hérnandez & Henry 2010, Schuh 2002-2014). New records have been found in Asteraceae (Solidago canadensis), Cyperaceae (Carex) and Rosaceae (Rubus) and Poaceae (Achnatherum).

DISCUSSION: Collaria is distinguished from other taxa of the tribe Stenodemini by having ovoid eyes located at the middle of lateral margins of head and by a neck with approximately the same length of one eye. Schwartz (2008), defined the genus Nabidomiris as related, and Collaria differs from it and others by having the dorsal portion of clypeus not produced and sometimes brachipterous females (e.g., Collaria villiersi). Furthermore the male with complex endosoma, usually with endosomal sclerites in ventral and dorsal view and female genitalia with well developed dorsal structure, interramal lobes of posterior wall triangular or rounded, and medial process sclerotized as described below, easily allows for the recognition of this genus.

Collaria boliviana Carvalho, 1990

(Figs. 1, 3, 4, 5, 8, 9, 10, 11)

Collaria boliviana Carvalho, 1990: 447[n. sp.]; Schwartz 2008: 1179, [diag., morph.], Schuh 2002-2014 [catalog].

DIAGNOSIS: Recognized by the head with transverse spots at sides of longitudinal sulcus, hemelytra with brownish distinctive coloration with pale spots (Fig. 1a). The endosoma of male with small sclerite on the secondary gonopore, ribbonlike endosomal sclerite brush-shaped, and lobal endosomal sclerite strongly elongated (Fig. 5a), posterior wall of female with triangular interramal lobes, dorsal structure subtriangular and medial process Y -shape (Fig. 11a).

REDESCRIPTION Male: COLORATION: light brown with black and pale yellowish areas. Head: brown with paired transverse markings laterally to longitudinal sulcus. Eyes, mandibular plate, maxillary plate and apex of buccula, black; labium brown with black apex. Clypeus with a black spot. Antennal segments brown. Thorax: Pronotum: brownish, calli and black lateral margins with central pale line reaching basal margin of pronotum, two rounded black spots on humeral angles. Collar pale. Proepisternum brownish with a red or pale dorsolateral spot, and yellowish margins. Scutellum black. Hemelytra brownish with pale spots: the sub-basal and median region of embolium and the external region of cuneus, pale; internal margin of cuneus, black; hemelytral membrane, grayish. Ventral side: dark brown, ostiolar peritrema with pale brown margins, abdomen with yellowish median spots and a black spot at the apex of pygophore. STRUCTURE: Head: slightly broader than long, antenna with short erect setae; segment I 0.8 times the width of head (table 1) and slightly thickened (approximately twice the width of segment II); II, 3 times longer than I (table 1), remaining segments thin and cylindrical. Thorax: Pronotum with golden pilosity long, sparse and semi-erect. MEASUREMENTS: see Table 1. GENITALIA: Pygophore: elongated with apex slightly rounded and ventroposterior margin not differentiated (Fig. 3a). Parameres: left paramere falciform, with medial and lateral margins of basal sensory lobe almost straight, sickle-shaped in medial view, hypophyisis curved, right paramere straight (Fig. 3a). Endosoma: with small sclerite on the secondary gonopore; ribbonlike endosomal sclerite brush-shaped with abundant spines and filamentous joined at base, lobal

endosomal sclerite strongly tapered towards the apex with michrotrichia on the basal region (Fig. 5a).

Female (description): Similar to male in structure and coloration (Fig. 1a), but larger and more robust, with dark brown abdomen. MEASUREMENTS: see Table 1. GENITALIA: First gonapophysis: with apical grooved region weakly sclerotized and broad, and sharpened apex (Fig. 8a). Second gonapophysis: apex triangular and smooth with one teeth ventral (Fig. 9a). Bursa copulatrix: dorsal labiate plate with small sclerite caudal to sclerotized rings (Fig. 10a). Posterior wall with triangular interramal lobes and large projection in lateroapical margin, anterior region of interramal lobes narrow and projected into a blunt tip (Fig. 11a). Dorsal structure subtriangular and small. Medial process strongly sclerotized and shaped as an inverted Y(Fig.11a).

GEOGRAPHIC DISTRIBUTION: Northeaestern of Bolivia, Pacific and Andean region of Colombia (Carvalho 1990). New records from southeastern Brazil, eastern Ecuador, and central region of Peru (Fig. 12).

PLANT ASSOCIATIONS: unknown.

DISCUSSION: Collaria boliviana is similar to C. guaraniana in coloration of hemelytra, but it is distinguished by the spots on head, the endosoma of male with small sclerite on the secondary gonopore, ribbonlike endosomal sclerite brush-shaped, lobal endosomal sclerite strongly elongated (Fig. 5a), posterior wall of female with triangular interramal lobes, dorsal structure subtriangular, and medial shaped as an inverted Y (Fig. 11a).

Examined material. Paratype: 1f#: **BOLIVIA: Beni**, Rurrenabaque, [14°28'0"S; 67°34'0"W], x.1956, J.Carvalho (MNRJ). Other material: **BOLIVIA: La Paz,** 4 m # 2 f# Tumupasa: 14°9'0"S; 67°55'0"W, 1921, Mulford, (SMNH). 2 m # 5 f# La Paz: 12°58'0"S; 67°1'0"W, 1921, L.Pena (SMNH). **BRAZIL: Minas Gerais:** 1 m # Viçosa: [20°45'0"S; 42°52'60"W], 29.iv.1990, G.A.R. Melo, (UFVB). **COLOMBIA: Boyacá:** 3 m# 1 f# Pauna: Manote bajo, La Rochela [5°39'31"N; 73°58'53"W], 26.iv.1979, I. de Arevalo (ICN). **Chocó:** 2 m# 3 f#, Palestina: Quebrada Docordo 110 km N. Palestina Rio San Juan [4°9'0"N; 74°4'0"W], 25.i.1971, B.Malkin, (AMNH). **Meta:** 1 f# Arame: San Juan de Arame: [3°20'47"S; 73°53'22"W], 24.ix.1987, (ICN). 1 f# Restrepo: [4°15'0"N; 73°34'0"W], 2.x.1965, J.A.Ramos, (USNM). **Putumayo:** 1 f# Mocoa: 15.mi.SW. Mocoa [1°8'56"N; 76°38'52"W], 1.iii.1955, E.I. Schlinger & E.S. Ross, (CAS). 1 f# Santa Rosa: Kofan Indian Village, Head waters Rio San Miguel [0°43'46"N; 76°35'29"W], 2.x.1970, P.Buchard, B. Malkin, (AMNH). **Santander:** 2 f# Cañaverales: [6°4'60"N; 73°13'0"W], 4.xi.1978, I. de Arevalo, (ICN). 2 m# Virolín: Margen Rio Guillerm: [6°4'60"N; 73°13'0"W], 15.iii.1981, (ICN). **Valle del Cauca:** 1 m# Cali: 40. mi of Cali [3°26'14"N; 76°31'21"W], 6.iii.1955, E.I. Schlinger & E.S. Ross, (CAS). 1 m# Tulúa: Jardín Botánico "Juan Maria Cespedes" [4°5'12"N; 76°12'0"W], 24.viii.1996, D. Forero, (MPUJ-ENT). **ECUADOR: Pastaza:** 1 m# 2 f# Shell Mera: [1°30'0"S; 78°2'60"W], 14.v.1971, B.Malkin, (AMNH). 1 m# 1 f# Puyo: [1°28'0"S; 77°58'60"W], 1-8.x.1970, J.&. M.Sedlacek, (BPMB). **Santo Domingo de**

los Tsáchilas: 1 m# 1 f# Santo Domingo: [0°26'0"S; 76°38'W], 11.x.1970, J.&. M.Sedlacek, (BPMB). **PERU: Huanuco:** 1 f# Aucayacu: Javier Prado: [8°55'53"N; 76°6'48"W], 1.vi.1967, S.Risco & A.F.Archer, (AMNH). 3 m# 4 f# Tingo Maria: Monson Valley: [9°17'22"S; 76°0'32"W], 8.x.1954, E.I. Schlinger & E.S. Ross, (CAS). 3 m# Tingo Maria: Yurac, 67 mi. E. Of Tingo Maria: [9°17'22"S; 76°0'32"W], 4.iv.1954, E.I. Schlinger & E.S. Ross, (CAS). 1 f# Tingo Maria: 8k S Tingo Maria Cueva de Las Pavas: [9°17'22"N; 76°0'32"W], 18.iV.1977, W.J. Hanson, (USU). **Junin:** 3 m# 2 f# San Ramón de Pangoa: 40 km SE Satipo [11°26'12"S; 74°29'06"W], 4.iii.1972, R.T. & J.C. Schuh, (AMNH). **Ucayali:** 1 m# Pucallpa: pools and swamps [8°22'57"S; 74°32'17"W], IV.1962, J. Schunke, (KU).

Collaria capixaba Carvalho & Fontes, 1981

(Figs. 1, 3, 4, 5, 8, 9, 10,11)

Collaria capixaba Carvalho & Fontes, 1981: 14 [n. sp.], Schuh 2002-2014 [catalog].

DIAGNOSIS: Distinguished by Y-shaped black mark on head, hemelytra brownish to pale yellowish with characteristic spots (Fig. 1b), endosoma of male with small sclerite on the secondary gonopore (Fig. 5b); lobal endosomal sclerite strongly tapered towards the apex (Fig. 5b), posterior wall of female with rounded interramal lobes, dorsal structure covering half of the medial process, and medial process arrow-like (Fig. 11b).

REDESCRIPTION Male: COLORATION: brownish, with gray and black areas. Head: brown; Y-shaped black mark extending from longitudinal sulcus to frons, and two black spots in neck. Eyes dark-brown, mandibular plate, maxillary plate, and apex of buccula, brownish; labium brown with black apex. Clypeus with a black spot. Antennal segments I, pale-yellow, segments II-IV brown. Thorax: Pronotum: light brown, callus and anterior lateral margins of pronotum, dark brown; two rounded black spots on humeral angles. Collar pale. Proepisternum brownish. Scutellum brown with a pale yellowish longitudinal line. Hemyelitra brownish to pale yellowish with a greater dark spot in the apical half of clavus and irregular patches on corium; median region of embolium and external region of cuneus pale, internal and median region of cuneus, and hemelytral membrane, dark brown. Ventral side: brown, ostiolar peritrema with pale brown margins, abdomen with yellowish median spots, and a black spot at the apex of pygophore. STRUCTURE: Head: slightly broader than long, antenna with long erect pilosity, densely pilose, length shorter than segments thickness; segment I 1.2 times the width of head, and approximately twice the width of II; segment II 4 times longer than I (table 1).

Thorax: Pronotal anterior lobe abruptly narrowed with golden long sparse and erect pilosity. MEASUREMENTS: see Table 1. GENITALIA: Pygophore: elongated with apex slightly rounded and ventroposterior margin not differentiated (Fig. 3b). Parameres: left paramere falciform with the internal margin of basal sensory lobe clearly convex and external margin of basal sensory lobe almost straight; hypophysis gradually acuminated. Right paramere straight (Fig. 4b). Endosoma: with small sclerite on the secondary gonopore (Fig. 5b); ribbonlike endosomal sclerite with a short lobe or area beneath secondary gonopore covered with michrotrichia (Fig. 5b), lobal endosomal sclerite strongly tapered towards apex with michrotrichia on basal and medial regions (Fig. 5b).

Female: Similar to male in structure and coloration, but larger and more robust (table 1) and with light brown abdomen. MEASUREMENTS: Table 1. GENITALIA: First gonapophysis: with apical grooved region weakly sclerotized and broad, and sharpened apex (Fig. 8b). Second gonapophysis: apex triangular with one dorsal teeth and smooth (Fig. 9b). Bursa copulatrix: dorsal labiate plate with a large sclerite caudal to sclerotized rings (Fig. 10b). Posterior wall with rounded interramal lobes and anterior angle of the interramal lobes narrow, projected to blunt tip (Fig.11b). Dorsal structure covering half of the medial process (Fig. 11b). Medial process strongly sclerotized and arrow-like (Fig. 11b).

GEOGRAPHIC DISTRIBUTION: Southeastern and southern Brazil (Fig. 12) (Carvalho & Fontes, 1981).

PLANT ASSOCIATIONS: Grasses, without specific data (Carvalho & Fontes, 1981).

DISCUSSION: Collaria capixaba is similar to C. guaraniana in general coloration, antennae and pubescence of legs. C. capixaba can be distinguished by the smaller size, head spots, male genitalia with a large sclerite on secondary gonopore, and the lobal endosomal sclerite with spicules on basal and median regions.

Examined material. Holotype: 1 m#, **BRAZIL: Espirito Santo:** Castelo: [20°36'0"S; 41°12'0"W], xi.1976, Aloarenga, (MNRJ). Paratypes: 1 m# 1 f#, **BRAZIL: Espirito Santo:** Castelo: [20°36'0"S; 41°12'0"W], xi.1976, Aloarenga, (MNRJ). Other material: **BRAZIL: Espirito Santo:** 1 m# Domingos Martins: Est. Pedra Azul, [25°55'0"S; 41°0'53"W], 2.ix.2003, C.O. Azevedo, (UFES). 1 m# Linhares: [19°25'0"S; 40°4'0"W], Xii.1986, J. Carvalho, (MNRJ). **Minas Gerais:** 1 f# Barreira: Delfim Moreira: [22°49'60"S; 41°17'60"W], ii.1971, F.M.Oliveira, (AMNH). 1 m# Pedra Azul: [16°1'0"S; 41°16'0"W], xi.1970, F.M.Oliveira, (AMNH). **Paraná:** 2 f# Antonina: Reserva Sapitanduva [25°26'60"S; 48°43'0"W], 31.x.1986, Profaupar, (DZUP). 24 m# 13 f# Curitiba:

[25°25'0"S; 49°15'0"W], 16.ii.1966, C.Ext. DZUP, (DZUP). 2 m# 2 f# Jundiaí do Sul: Fazenda Monte Verde [23°26'60"S; 50°16'60"W], 4.xi.1986, Profaupar, (DZUP). 3 m# 6 f# Telemaco Borda: Reserva Samuel Klabin [24°21'0"S; 50°37'0"W], 10.xi.1986, Profaupar, (DZUP). **Rio Grande do Sul:** 1 m# 1 f# Canguçu: Rincão da Roncha Interior da Mata, [31°23'60"S; 52°40'60"W], 9.iv.2003, (DZRS). 11 m# 15 f# Derrubadas: P.E.Turvo, 27°15'0"S; 53°52'0"W, 21.x.2004, L.Schmidt & L.Podgaisky, (MCNZ). 1 m# 1 f# Ilopolis: [28°55'60"S; 57°8'60"W], 10.xi.2003, (MCN/UNIVATES). 1 f# Palmares do Sul: Ilha Grande: 30°16'0"S; 50°31'0"W, 10.iv.2003, Equipe Probio, (MCNZ). 4 m# 4 f# Putinga: [29°0'0"S; 52°08'60"W], 27.i.2003, (MCN/UNIVATES). 1 m# Triunfo: Parque Copesul: 29°55'60"S; 51°43'0"W, 21.x.2003, A.Barcellos & L. Schmidt, (MCNZ). **São Paulo:** 3 m# 3 f# Serra da Bocaina: San Jose de Barreiro: [21°23'60"S; 47°28'0"W], 4.xi.1965, F.M. Oliveira, (DZUP). 1 m# 1 f# Serra da Bocaina, San Jose de Barreiro: [23°2'30"S; 44°39'42"W], i.1966, M. Alvarenga, (AMNH).

Collaria danae Linnavuori, 1974

(Fig. 1)

Collaria danae Linnavuori 1974: 18 [n.sp.], Schuh 2002-2014 [catalog].

DIAGNOSIS: Distinguished by general pale yellowish coloration and clypeus with a black spot (Fig. 1).

REDESCRIPTION Male: COLORATION: pale yellowish. Head: yellowish. Eyes and mandibular plate, black; maxillary plate and apex of buccula, brown, labium brown with black apex. Anterior region of clypeus with black spot. Frons with black adjacent part. Antennal segments: I pale yellow and blackish apex dark, II-IV brown. Thorax: Pronotum: brown, callus, collar and lateral margins light brown; inner region of callus with longitudinal pale brown line reaching basal margin of pronotum. Proepisternum ligth brown. Scutellum brownish. Hemyelitra brown, clavus dark brown, corium light brown, embolium and external region of cuneus pale; internal and median margins of cuneus and hemelytral membrane, brownish. Ventral side: yellowish, ostiolar peritrema with pale brown margins, abdomen yellowish and a black spot at the apex of pygophore. STRUCTURE: Head: equal as broad as long; pilosity of antenna shorter than diameter of segment; length of antennal segment I similar to width of head (table 1), and equal to II; segment II 3 times longer than segment I (table 1). Thorax: Pronotum with anterior lobe abruptly narrowed (Fig. 1c), with abundant golden long sparse and erect pilosity. MEASUREMENTS: see Table 1.

Female: unknown.

GEOGRAPHIC DISTRIBUTION: This species is known from the south region of Côte d'ivoire (Ivory Coast) (Fig. 13) (Linnavuori 1974).

PLANT ASSOCIATIONS: unknown.

DISCUSSION: Collaria danae resembles C. villiersi but differs by the pale yellowish coloration and a distinctive black spot on clypeus. Only one type-specimen was studied and the genitalia was not dissected to avoid destroying the integrity of this unique specimen.

Material examined. Holotype: 1 m# **CÔTE D'IVOIRE (IVORY COAST): Region des Lagunes:** Abijan: Lamto Research Station: [5°20'28"N; 28°01'W], 18.viii.1965, Gillon, (AMNH).

Collaria guaraniana Carvalho & Fontes, 1981

(Figs. 1, 3, 4, 5, 8, 9, 10, 11)

Collaria guaraniana Carvalho & Fontes 1981: 16, [n.sp.], Schwartz 2008: 1179, [diag., morph.], Schuh 2002-2014 [catalog].

DIAGNOSIS: Distinguished from other species by the head with a black bifurcate (Y-shaped) spot on frons (Fig. 1d); hemelytra with a dark spot on clavus and irregular dark patches on corium (Fig. 1d), endosoma with large sclerite on the secondary gonopore (Fig. 5c); and lobal endosomal sclerite strongly tapered towards apex (Fig. 5c).

REDESCRIPTION Male: COLORATION: brownish with pale-yellow and black areas. Head: brownish with Y-shaped black mark extending from longitudinal sulcus to frons, a black transversal line between the eyes and two black spots on the neck. Eyes dark brown; mandibular plate, maxillary plate, and apex of buccula, black; labium brown with black apex. Clypeus with a black longitudinal spot. Antennal segments brownish, segment I pale brown. Thorax: Pronotum: brownish; callus and anterior lateral margins of pronotum, black; inner region of callus, pale brown; two rounded black spots on humeral angles. Collar pale. Proepisternum black, with pale line in margin. Scutellum brown with a longitudinal pale yellow. Hemelytra dark-brown with a dark spot ion clavus and irregular dark patches on corium; median region of embolium and external region of cuneus, pale; internal and median margin of cuneus and hemelytral membrane, brownish. Ventral side: dark brown, ostiolar peritrema with pale brown margins; abdomen with brownish median spots and a

black spot at the apex of pygophore. STRUCTURE: Head: as broad as long, antenna pilose segments length shorter than diameter; segment I, approximately equal to width of head (table 1), twice the width of II; segment II, 3 times longer than I (table 1). Pronotum: anterior lobe abruptly narrowed (Fig. 1d), with golden pilosity, long, sparse and erect. MEASUREMENTS: see Table 1. GENITALIA: Parameres: left paramere falciform with medial and lateral margins of basal sensory lobe almost straight, right paramere with basal sensory lobe bulbous and the apex of hypophysis, small (Fig. 4c). Endosoma: with large sclerite on secondary gonopore (Fig. 4c); ribbonlike endosomal sclerite with short lobe or area beneath secondary gonopore covered with microtrichia (Fig. 4c), lobal endosomal sclerite strongly tapered towards apex with an area with microtrichia on basal region (Fig. 4c).

Female: Similar to male in color and size. MEASUREMENTS: Table 1. GENITALIA: Bursa copulatrix: dorsal labiate as in Fig. 9c. Posterior wall with triangular interramal lobes (Fig.10c). Dorsal medium structure, covering half of the medial process (Fig. 10c). Medial process strongly sclerotized and shaped as an inverted Y (Fig. 10c).

GEOGRAPHIC DISTRIBUTION: Southern Brazil (Carvalho & Fontes 1981).

PLANT ASSOCIATIONS: Grasses, without specific data (Carvalho & Fontes, 1981).

DISCUSSION: Collaria guaraniana is similar to C. capixaba in general coloration, anntenal and leg pubescence, but C. guaraniana is longer than C. capixaba, the endosoma of male has a lobal endosomal sclerite with spicules below one third of the bulbous region and female with posterior wall with subquadrate interramal lobes and medial process shaped as an inverted Y. Only the type series was reviewed, however it lacks exact localities data. For this reason, more field collections in search for this species are necessary to produce better series with accurate host-plant data.

Material examined. Holotype: 1 m# **BRAZIL: Paraná:** 1950, Staurinauski, (MNRJ). Paratypes: 2 m# 1 f#, **BRAZIL: Paraná:** 1950, Staurinauski, (MNRJ).

Collaria husseyi Carvalho, 1955

(Figs. 1, 3, 4, 5, 10, 11)

Collaria explicata Carvalho 1945: 180 [Descr., syns.]

Collaria husseyi Carvalho 1955: 222 [n.sp.], Carvalho 1959: 284 [catalog]; Schuh 2002-2014 [catalog].

DIAGNOSIS: Recognized by the coloration pattern of the head (Fig. 1e), antenna with abundant long erect pilosity, spots on hemelytra, endosoma of male with large sclerite on the secondary gonopore (Fig. 5d); and lobal endosomal sclerite short with spines on surface (Fig. 4d, 5d).

REDESCRIPTION Male: COLORATION: brown with dark brown areas. Head: yellowish with paired transverse markings laterally to longitudinal sulcus and two black spots on neck. Eyes black; mandibular plate, maxillary plate, and apex of buccula, yellowish; labium yellowish with black apex. Clypeus yellowish. Antennal segments: I pale brown, II-IV brownish. Thorax: Pronotum brownish, callus and antero-lateral margins black; inner region of callus pale brown; two rounded black spots on humeral angles. Collar pale. Proepisternum black, with pale yellow line on margin. Scutellum brownish with pale yellow longitudinal line and two pale spots on the basal angles, and the apex. Hemelytra brownish with dark brown spot on clavus; pale irregular patches on corium, median region, embolium, and external region of cuneus; internal, and median margins of cuneus, and membrane light-brown. Ventral side: dark brown, ostiolar peritrema with pale brownish margins, abdomen with reddish median spots, and black spot at apex of pygophore. STRUCTURE: Head: as broad as long, antenna with long erect pilosity longer than thickness of antennal segments; segment I approximately as long as width of head (table 1), twice the width of II; segment II, 4 times longer than I (table 1). Thorax: Pronotum with anterior lobe abruptly narrowed, and long, sparse, erect golden pilosity. MEASUREMENTS: see Table 1. GENITALIA: Parameres: left paramere falciform with medial and lateal margins of basal sensory lobe almost straight and gradually acuminated to hypophysis from 1/3 of apex; right paramere straight (Fig. 4d). Endosoma: with large sclerite on the secondary gonopore (Fig. 5d); ribbonlike endosomal sclerite with short lobe beneath secondary gonopore covered with microtrichia (Fig. 5d), lobal endosomal sclerite short with spines on surface (Fig. 5d).

Female: Similar to male in color and size. MEASUREMENTS: Table 1. GENITALIA: Bursa copulatrix: dorsal labiate as in Fig. 10d. Posterior wall with subquadrate interramal lobes (Fig.11d). Dorsal medium structure, covering half of the medial process (Fig. 11c). Medial process strongly sclerotized and arrow-like (Fig. 11d).

GEOGRAPHIC DISTRIBUTION: This specie is known from southeastern Brazil (Fig. 12) (Carvalho & Fontes, 1981).

PLANT ASSOCIATIONS: Grasses without specific data (Carvalho & Fontes, 1981).

DISCUSSION: Collaria husseyi is similar to C. oleosa based on the yellow pale coloration, with dark brown areas, and antenna and legs with abundant long erect pilosity, but differs in having the segment II of antenna 4 times longer than segment I and by the male genitalia with posterior endosomal sclerite enlongated with short spicules. Only the holotype and paratypes collected in 1947 were located, which makes it necessary to perform more collections in search for this species in order to produce better series and to know host plants.

Examined material. Holotype: 1 f# **BRAZIL: Minas Gerais:** Carmo do Rio Claro: [20°58'0"S; 46°07'0"W], ix.1947, J.Carvalho, (MNRJ). Paratypes: 1 m# 2 f# **BRAZIL: Minas Gerais:** Carmo do Rio Claro: [20°58'0"S; 46°07'0"W], ix.1947, J.Carvalho, (MNRJ). Other material: **BRAZIL: Santa Catarina:** 1 m# 1 f# Nova Teutonia: 27°03'0"S; 52°23'60"W, 12.iv.1966, F.Plauman, (SMNH).

Collaria improvisa Reuter, 1893

(Figs. 1, 3, 4, 5, 6, 7, 8, 9, 10, 11)

Collaria improvisa Reuter 1893: 208 [n.sp.]; Carvalho 1959: 284 [catalog]; Schwartz 2008: 1179, [diag., morph.], Schuh 2002-2014 [catalog].

DIAGNOSIS: Recognized by the head coloration (Fig. 1f), antennal segment I two times the width of segment II, the endosoma with oval medial sclerite with microtrichia on surface, right dorsal endosomal sclerite elongated with smooth surface, and left dorsal endosomal sclerite with apex broad, fusiform and smooth (Fig. 5e, 6e).

REDESCRIPTION Male: COLORATION: dark brown with black and pale yellowish areas. Head: brownish, with a transverse v-shaped pale spot posterior to sulcus, two dark brown spots around antennal scape, two black spots on middle of

vertex and on margin of neck. Eyes light brown; mandibular plate, maxillary plate, and apex of buccula, black; labium brown with black apex. Clypeus black. Antennal segments black with antennal scape, pale. Thorax: Pronotum brownish with pale line reaching the disc; callus and lateral margins pale-yellow; inner region of callus pale brown; two elongated black spots on humeral angles of disc. Collar pale-yellow. Proepisternum with pale spot on dorsal region, reddish on median region, and pale on the margin. Scutellum black and brown with a longitudinal pale-yellow line and pale apex. Hemelytra brownish; clavus dark brown; embolium, and external region of cuneus pale; internal margin of cuneus and hemelytral membrane dark brown. Ventral side: black, ostiolar peritrema with pale brownish margins, abdomen yellowish with a black spot at the apex of pygophore. STRUCTURE: Head: as broade as long, antenna with dense pilosity with longer than thickness of segments; segment I 0.9 times the width of head (table 1) and two times the width of II; segment II, 2.5 times longer than I (table 1). Pronotum: anterior lobe gradually narrowed, glabrous and carinated lateral margin. MEASUREMENTS: see Table 1. GENITALIA: Pygophore: triangular; apex semi-triangular (Fig. 3c), with a projected left lateroposterior margin (Fig. 3c). Parameres: left paramere falciform ending in a lateral tip with the medial margin of basal sensory lobe almost straight and lateral margin of basal sensory lobe clearly convex; hypophysis with sharp lateral projection (Fig. 4e); right paramere as in Fig. 4e. Endosoma: with medial endosomal sclerite oval with microtrichia on surface (Fig. 5e); ribbonlike endosomal sclerite with a short lobe or area beneath secondary gonopore covered with microtrichia (Fig. 5e), right dorsal endosomal sclerite elongated with smooth surface, left dorsal endosomal sclerite fusiform with apex broad and smooth (Fig. 6a).

Female (description): Similar to male in color and size. MEASUREMENTS: Table 1. GENITALIA: First gonapophysis: with apical grooved region strongly sclerotized and acute, (Fig. 8c).Second gonapophysis: apex triangular, striated, with a ventral teeth (Fig. 9c). Bursa copulatrix: dorsal labiate plate with small sclerite caudal to sclerotized rings (Fig. 10e). Posterior wall with rounded interramal lobes (Fig. 11e). Dorsal structure covering half of the interramal lobes, medial process absent (Fig.11e).

GEOGRAPHIC DISTRIBUTION: Northeastern Africa (Sudan), Eastern Africa (Madagascar, Tanzania, Seychelles Islands), and Southern Africa (South Africa) (Fig. 13) (Schuh 2002-2014).

PLANT ASSOCIATIONS: unknown.

DISCUSSION: Collaria improvisa is easily distinguished from C. obscuricornis and C. schwartzi sp. n. by the transverse V-shaped pale stripe on head, pale-yellow collar, brownish spots on hemelytra, and by male and female genitalia. We examined specimens from Southern Africa (South Africa), but the species is also recorded from Northern and Eastern Africa, thus indicating that further collecting is needed not only to expand the known range for this species, but also to known plants associations.

Material examined: SOUTH AFRICA: KwaZulu-Natal: 1 f# Bloukrans: 20 miles ENE Plettenberg [28°49'0"S; 29°52'0"E], 14.i.1951, Brunk, (MNRJ). 1 f# Eshowe: Zululand [28°52'60"S; 31°28'0"E], 15.iii.1951, A.L.Capener, (MNRJ). 1 m# 1 f# Estcourt: 75km WSW Estcourt, Cathedral Peaks Forest Station 29°0'0"S; 29°52'60"E, 19.xii.1979, S. & J.Peck, (AMNH). **Western Cape:** 1 m# 1 f# Kirstenbosh Gardens: Cape Town [38°98'S; 18°48'E], 15.ix.2004, Schuh et al., (AMNH). 1 m# 1 f# Mossel Bay: 34°10'60"S; 22°07'60"E, ii.1922, R.E. Turner, (MRAC).

Collaria malonoi Carvalho & Carpintero, 1989

(Fig. 1, 4, 5)

Collaria malonoi Carvalho & Carpintero 1989: 1102 [n.sp., descr.]; Schuh 2002-2014 [catalog].

DIAGNOSIS: Recognized by a transversal stripe between the eyes and pronotum with two rounded brown spots (Fig. 1g) and endosoma with lobal endosomal sclerite strongly tapered towards apex with with microtrichia in basal and medial regions (Fig. 4f, 5f).

REDESCRIPTION Female: COLORATION: brownish, with black and brownish areas. Head: dark brown, with paired transverse markings lateral to longitudinal sulcus and two black spots around of antennal scape. Eyes brownish; mandibular plate, maxillary plate and apex of buccula brownish; labium brown with black apex. Clypeus brownish. Antennal segments brownish. Thorax: Pronotum dark brown; callus and lateral margins light brown; longitudinal line pale on inner region, disc with two small rounded brown spots on humeral angles. Collar pale. Proepisternum

dark brown with pale margin. Scutellum brown with pale-yellow longitudinal line and black spots on the margin. Hemelytra brownish. Ventral side: brownish; ostiolar peritrema with margins pale brownish, abdomen brownish. STRUCTURE: Head: broader than long, antennal pilosity shorter than diameter of segments; antennal segment I slightly shorter than width of head (table 1) and twice the width of II; segment II 3 times longer than I (table 1). Pronotum: anterior lobe abruptly narrowed, rugose-punctate with golden, sparse, erect pilosity. MEASUREMENTS: Table 1.

Male: (unreviewed, taken from original description): Similar to female in color. GENITALIA: Parameres: left paramere falciform with basal sensory lobe almost straight; hypophysis gradually acuminate (Fig. 4f), right paramere as in Fig. 4f. Endosoma: lobal endosomal sclerite strongly tapering towards apex with microtrichia in basal and medial regions (Fig. 5f); ribbonlike endosomal sclerite with short lobe or area beneath secondary gonopore covered by small spines (Fig. 5f).

GEOGRAPHICAL DISTRIBUTION: Known from Buenos Aires, Argentina (Fig. 12) (Carvalho & Carpintero 1989).

PLANT ASSOCIATIONS: unknown.

DISCUSSION: Collaria manoloi is easily separated from the remaining species of Collaria by the brownish coloration of the body, transversal stripe between the eyes and pronotum with two brown rounded and small spots. C. guaraniana is similar in coloration (Fig. 1g), but this specie is easily separated from C. malonoi by the bifurcated (Y-shaped) spot on head, antenna with long erect pilosity and hemelytra with distinctive dark brown coloration. Only one paratype was studied and the genitalia was not dissected.

Examined material. Paratype: 1 f# **ARGENTINA: Buenos Aires:** Ezeiza: [34°51'15"S; 58°31'29"W], ii.1972, J.&W. Ivie, (MNRJ).

Collaria meilleurii Provancher, 1872

(Figs. 1, 3, 4, 5, 6, 8, 9, 10, 11)

Collaria meilleurii Provancher 1872: 79 [n.sp., descr.]; Carvalho 1959: 284 [catalog.]; Schwartz 2008: 1179, [diag., morph.], Schuh 2002-2014 [catalog].

Nabidea coracina Uhler 1878: 398 [n. sp., syn. by Uhler, 1887:230]

Trachelomiris meilleurii Van Duzee 1887: 70 [catalog],Van Duzee 1892: 27 [list.]

DIAGNOSIS: Recognized by the dark coloration (Fig.1h), yellow V-shaped spot on head, antenna with semi-erect short spines, the endosoma of male with lobal endosomal sclerite elongated (Fig. 5g) medial endosomal sclerite semicircular (Fig. 5g) and right dorsal endosomal sclerite fusiform (Fig. 6b).

REDESCRIPTION Male: COLORATION: black, with grayish areas. Head: black, with transversal pale spot v-shaped posterior to longitudinal sulcus. Eyes pale brown; mandibular plate, maxillary plate and apex of buccula, black; labium brown with black apex. Clypeus black. Antennal segments dark brown, segment I pale. Thorax: Pronotum and collar black; longitudinal line in the inner region of callus, pale; two rounded black spots on humeral angles. Proepisternum black with a yellow pale line on margin. Scutellum black. Hemelytra brownish with dark spot on clavus, irregular dark patches in median region; embolium and external region of cuneus pale; internal and median margins of cuneus and hemelytral membrane, brownish. Ventral side: black; ostiolar peritrema with pale brown margins; abdomen with yellowish median spots and black spot at the apex of pygophore. STRUCTURE: Head: as broad as long, antenna with short trichia; segment I slightly thickened, 1.3 times the width of head (table 1), segment II 5 times longer than I (table 1). Pronotum: clearly divided in two areas or lobes by a lateral constriction and a dorsal transversal shallow sulcus; with golden sparse and erect pilosity. MEASUREMENTS: Table 1. GENITALIA: Pygophore: elongated, apex slightly rounded and ventroposterior margin not differentiated (Fig. 3d), with a left projected lateroposterior margin (Fig. 3d). Parameres: left paramere falciform ending in lateral tip with the internal margin of basal sensory lobe almost straight and external margin of basal sensory lobe clearly convex; the hypophysis with a sharp lateral projection (Fig. 4g); right paramere as in Fig. 4g. Endosoma: with lobal endosomal sclerite strongly tapered towards the apex and microtrichia in basal and medial region (Fig. 5g), medial endosomal sclerite semicircular with microtrichia on surface (Fig. 5g); the ribbonlike endosomal sclerite with short lobe or area beneath secondary gonopore covered with small spines (Fig. 5e), right dorsal endosomal sclerite fusiform with trichia on surface (Fig. 6b).

Female: Similar in structure and coloration to male, but larger and slightly robust and abdomen is light brown. MEASUREMENTS: Table 1. GENITALIA: First gonapophysis: with broad apical grooved region (Fig. 8d). Second gonapophysis: as in Fig. 7d. Bursa copulatrix: dorsal labiate plate with small sclerite caudal to sclerotized rings (Fig. 10f). Posterior wall with rounded interramal lobes (Fig. 11f). Dorsal structure small and medial process arrow-like (Fig.11f).

GEOGRAPHIC DISTRIBUTION: Neartic, Canada and United States (Fig. 14) (Schwartz 2008).

PLANTS ASSOCIATIONS: Poaceae (Calamagostris canadensis) (Carvalho & Fontes, 1981, Schuh 2002-2014). New records: Asteraceae (Solidago canadensis), Poaceae (Achnatherum), Rosaceae (Rubus) and Cyperaceae (Carex).

DISCUSSION: This species resembles Collaria villiersi by black coloration, but differs by antennal segments with short semi-erect spines, hemelytra brownish with a dark spot, and genitalia of male and female.

Examined material: CANADA: Alberta: 1 m# Wainwright 52.83333, -110.86666, 27.vii.1957, A. and J. Brooks, (AMNH_PBI00398596) (CNC). 1 f# High Prairie 55.43333, -116.48333, 22.vi.1961, A. R. Brooks, Wallis, (AMNH_PBI00398593), (CNC). 1 f# Valleyview, 55.06666,-117.28333, 10.viii.1961, A. R. Brooks, Wallis, (AMNH_PBI00398595), (CNC). **Manitoba:** 1 m# East Braintree 49.61666; -95.61666, 30.vi.1972, L.A. Kelton., (AMNH_PBI00398626), (CNC). 1 m# Husavick 50.56258; -96.99390, 7.vii.1910, J. B. Wallis, (AMNH_ENT00065299), (CNC). 1 m# Riding Mountain National Park, Boreal Island Nature Trail, 77 km N of Minnedosa on Rt 10 50.87410; -100.05757, 20.viii.1993, M.D. Schwartz, (AMNH_PBI00394792), (CNC). 1 m# Binscarth 50.61666;-101.28333, 18.vii.1974, Brooks and Wallis, (AMNH_PBI00398618), (CNC). 1 m# Pilot Mound 49.20000; -98.90000, 31.vii.1958, A. and J. Brooks, (AMNH_PBI00398614), (CNC). 1 m# Aweme 49.72000; -99.60000, 24.vii.1930, R. M. White, (AMNH_PBI00398609), (CNC). 1 m# 49.16666; -100.05000, 28.vii.1958, A. and J. Brooks, (AMNH_PBI00398612), (CNC). 1 m# Riding Mountain National Park, Clear Lake 50.65789; -99.99365, 12.viii.1958, J. G. Chillcott, (AMNH_PBI00398620), (CNC). **New Brunswick:** 1 m# 1 f# Halcomb 46.93319; -65.94749, 17.vii.1951, E. E. Gilbert, (AMNH_PBI0000724147), (OSAC). 1 m# Kouchibouguac National Park 46.87000;-64.98000, 25.vii.1977, D.J. Brown, (AMNH_PBI00398732), (CNC). 1 f# Wolf Lake 45.25000; -66.26670, 13.viii.1966, L.A. Kelton, (AMNH_PBI00398744), (CNC). 1 m# Chamcook 45.11635; -67.06281, 8.viii.1957, G. E. Shewell, (AMNH_PBI00398733), (CNC). **Nova Scotia:** 1 m# Kentville 45.06666;-64.50000, 16.vii.1976, L.A. Kelton, (AMNH_PBI00398736), (CNC). 1 m# Lockeport 43.69810; -65.12300, 25.vii.1958, J. R. Vockeroth, (AMNH_PBI00398739), (CNC). **Ontario:** 1 n# Prince Edward Census Division 9 mi NW of Bloomfield 44.07571; -77.32766, 17.vii.1995, J. R. Vockeroth, (AMNH_ENT00068237), (AMNH). 1 m# Wiarton 44.73689; -81.13626, 16.vii.1976, G. Thorpe, (AMNH_PBI00398698), Carex sp., Cyperaceae, (CNC). 1 m# 20 mi N of Red Lake 51.17652; -93.68776, 11.viii.1960, Kelton and Whitney, (AMNH_PBI00398678), (CNC). 1 f# St. Lawrence Islands National Park, Grenadier Island Center 44.38913; -75.89793, 16.vii.1995, E. Wilson, (AMNH_PBI00398693), (CNC). 1 n# Lanark County: White Lake 45.31000; -76.52000, 7.vii.1998, R. L. Snyder (UDCC_TCN00013956), (UDCC). 1 m# Marmora 44.48333; -77.68333, 23.vii.1992, C. Boyle, (AMNH_PBI00398660), (CNC). 1 m# Chalk River 46.01666; -77.45000, 20.vii.1961, G. Brumpton, (AMNH_PBI00398664), (CNC). 1 m# Cobourg, lakeshore 43.95413; -78.17035, 11.vii.1981, D. J. E. Brown, (AMNH_PBI00398663), (CNC). 1 m# Algonquin Provincial Park 45.83333; -78.50000, 13.viii.1967, J. F. Brimley, (AMNH_PBI00398673), (CNC). 1 m# Oakwood near Lindsay 44.34819; -78.79372, 18.vii.1965, J. and W. Ivie, (AMNH_ENT00068217), (AMNH). 1

f# Dunbarton NE of Toronto 43.81130; -79.09732, 15.vii.1965, J. and W. Ivie, (AMNH_ENT00068222), Asteraceae (AMNH).1 m# Virgil 43.22000; -79.13000, 9.vii.1955, L.A. Kelton, (AMNH_PBI00398638), (CNC). 1 f# Dalston 44.48110; -79.68344, 6.ix.1961, Kelton and Brumpton, (AMNH_PBI00398650), (CNC). 1 m# North Bay 46.30000; -79.45000, 14.vii.1961, G. Brumpton, (AMNH_PBI00398666), (CNC). 1 m# New Liskeard 47.50000; -79.66666, 19.vii.1961, G. Brumpton, (AMNH_PBI00398665), (CNC). 1 f# Burtch 43.05000; -80.27000, 11.vii.1961, L.A. Kelton, (AMNH_PBI00398649), (CNC). 1 m# Vienna 42.68000; -80.80000, 3.vii.1962, G. Thorpe, (AMNH_PBI00398697), Rubus sp., Rosaceae, (CNC).1 f# Sudbury 46.43474; -81.00652, 1.i.1889, E. P. Van Duzee, (AMNH_PBI00398700), (CNC). 1 m# Appin 42.80000; -81.65000, 19.vi.1962, Kelton and Brumpton, (AMNH_PBI00398639), (CNC). 1 f# Ipperwash 43.20805; -81.97639, 11.vii.1962, Kelton and Thorpe, (AMNH_PBI00398656), (CNC). 1 f# Pelee Island 41.76333; -82.68916, 3.vii.1931, G. S. Walley, (AMNH_PBI00398699), (CNC). 1 f# Sault Ste. Marie 46.52000; -84.33000, 27.vii.1960, Kelton and Whitney, (AMNH_PBI00398679), (CNC). 1 m # 5 mi E of Willard Lake 49.82357; -93.63459, 10.viii.1960, Kelton and Whitney, (AMNH_PBI00398681), (CNC).1 m# Finland 48.85000; -93.91666, 11.vii.1960, S. M. Clark, (AMNH_PBI00398668), (CNC). 1 m# Lake of the Woods, Harris Hill 48.95565; -94.54166, 3.viii.1960, Kelton and Whitney, (AMNH_PBI00398686), (CNC). **Ontario:** 1 m#, 1 f# Toronto: Dumbarton NE of Toronto [43°49'09"N; 79°25'0"W], 15.vii.1965, (AMNH). **Prince Edward Island:** 1 f# Cavendish, Harris Hill 44.07571; -77.32766, 14.viii.1959, J.A.Slater, (AMNH_ENT00067782), (AMNH). **Quebec:** 1 f# Richmond 45.66687; -72.14991, 4.viii.1961, G. Brumpton, (AMNH_PBI00398713), (CNC). 1 f# Lac Mondor, Ste. Flore 46.61666; -72.76666, 3.viii.1951, E. G. Munroe, (AMNH_PBI00398729), (CNC). 1 m# Sainte-Agathe 46.03333; -74.28333, 9.viii.1961, G. Brumpton, (AMNH_PBI00398714), (CNC). 1 m# Hudson Heights 45.45000; -74.15000, 24.vii.1956, Lindberg, (AMNH_PBI00398724), (CNC). 1f# Lac Nominingue 46.38333 ; -75.01666, D. Davenport, (AMNH_ENT00068254), (AMNH). 1 m# Hudson Heights 45.45000; -74.15000, 24.vii.1956, Lindberg, (AMNH_PBI00398724), (CNC). 1 m# Hull 45.44264; -75.70676, (AMNH_PBI00398730), Achnatherum sp. Poaceae (CNC). **Saskatchewan:** 1 m# White Fox 53.45000; -104.08333, 25.vii.1950, L.A.Konotopetz, (AMNH_PBI00398602), (CNC). 1 f# Holbein 53.23333; -106.20000, 3.ix.1954, A. R. Brooks, Wallis, (AMNH_PBI00398603), (CNC). 1 f# Prince Albert 52.96666; -108.38333, 23.vii.1959, A. and J. Brooks, (AMNH_PBI00398598), (CNC). 1 f# Stockholm [50°39'00"N; 102°18'12"W], 27.vii.1954, Brooks and Wallis, (AMNH_PBI00398605), (Canadian National Collection of Insects, Agriculture and Agri-Food Canada). 1 m# Amsterdam 50.65000; -102.30000, 22.viii.1954, Brooks and Wallis, (AMNH_PBI00398599), (CNC). 1 f# Hudson Bay 52.85000; -102.38333, 26.viii.1954, Brooks and Wallis, (AMNH_PBI00398604), (CNC). 1 m# Torch River 53.85000; -103.10000, 14.vii.1950, L. A. Konotopetz, (AMNH_PBI00398601), (CNC). 1 m# Christopher Lake 53.56666; -105.83333, 15.vii.1959, A. and J. Brooks, (AMNH_PBI00398597), (CNC). **USA: Connecticut:** 1 f# Tolland: Tolland Twp., Kingsbury Ave. 41.86566; -72.42578, 29.vii.1973, Steve Jasek, (AMNH_ENT00068250) (AMNH). 1 f# Litchfield: T Kent Falls 41.77583; -73.40972, 28.vii.1973, J.A. Slater, (AMNH_ENT00068295) (AMNH). 1 m# Windham: Yale Myers Forest [41°58'11"N; 71°48'47"W], 17.vii.1976, J.A. Slater, (AMNH_ENT00068288) (AMNH). **Delaware:** 1 n# New Castle: Newark 39.71444; -75.75861, 24.vi.1998, N. Cai, (UDCC_TCN00013955) (UDCC). **Illinois:** 1 f# Lake: Antioch 42.47722; -88.09556, 5.vii.1932, Frison et al., (AMNH_ENT00068298) (AMNH). 1 f# Champaign: Urbana 40.11056; -88.20722, 25.vi.1942, J. A. Slater, (AMNH_ENT00068255) (AMNH). 1 m# Piatt: 3 mi N of White Heath 40.10727; -88.44639, 16.vi.1963, David R. Smith, (AMNH_PBI0000724139) (OSAC). **Indiana:** 1 f# Marion: Marion County, no specific locality 39.76833; -86.15556 , 18.viii.1925, W. S. B. [W. S. Blatchley], (NCSU_ENT00177753) (NCSU). **Iowa:** 1 m# 1 f# Polk City: Mitchellville, Thomas Mitchel Co. Park 41.66861; -93.35750, 29.vi.1980, (AMNH). 1 m# 1 f# Near to corner to Dubuque: Mitchellville, Thomas Mitchel Co. Park [44° 13' 23"N; 74° 50' 19" W, 2.viii.1960, S. Medina (SMNH). 1 f# Polk: Mitchellville, Thomas Mitchell County Park [41°40'07"N], 29.vi.1980, K. and R. Schmidt, (AMNH_ENT00068234) (AMNH). **Kentucky:** 3 m# 2 f# Anderson Co: Rt. 248, 2.8 mi. N Rt. 62, Taylor Build lake [38N 00' 27"; 85W 01' 41"], 6.vi.1985, T. Henry and A.G. Wheeler, (SMNH). **Maine:** 1 m# Hancock: Mount Desert Island 44.34889; -68.34472, 20.vii.1929, (AMNH_ENT00068239) (AMNH). 1 n# Hancock: Mount Desert Island 44.34889; -68.34472, 20.vii.1929, (AMNH_ENT00068241) (CNC). **Massachusetts:** 1 m# Barnstable: Woods Hole 41.52639; -70.67361, 20.vii.1929, C. W. Johnson, (AMNH_ENT00068286) (AMNH). 1 m# Middlesex: Holliston 42.20000; -71.42500, 20.vii.1929, N. Banks, (AMNH_ENT00068269) (AMNH). **Michigan:** 1 f# Huron: 43.79934;-82.99427, 16.vii.1949, R. R. Dreisbach, (AMNH_ENT00068302) (AMNH). 1 f# Cheboygan: 45.64694; -84.47444, 16.vii.1949, J.D. Lattin, (AMNH_PBI0000724144) (OSAC). 1 f# Antrim: 44.89001; -85.07394,

9.vii.1949, R. R. Dreisbach, (AMNH_ENT00068419) (AMNH). 1 m# Muskegon: 43.29558, -86.14413 10.viii.1946, R. R. Dreisbach, (AMNH_ENT00068289) (AMNH). **Minnesota:** 1 f# St. Louis: Duluth 46.78327; -92.10658, 17.viii.1960, Kelton and Whitney, (AMNH_PBI00398778) (AMNH). 1 m# Ramsey: Saint Anthony Park 44.97805; -93.19083, 1.vii.1921, H. H. Knight, (AMNH_PBI00398773)(CNC). 1 f# Clearwater: Lake Itasca 47.23990; -95.20757, 2.ix.1950, Jean Laffoon, (AMNH_ENT00068258) (CNC). **New Hampshire:** 1 m# Grafton: Franconia 44.22694; -71.74833, Mrs. A.T. Slosson, (AMNH_ENT00068271) (AMNH). 1 f# Merrimack: W. Hopkinton 43.19194; -71.74806, 21.vii.1954, J. A. Slater, (AMNH_ENT00065299) (AMNH). 1 m# Coos: Lancaster [44°29'29"N; 71°34'52"W], 15.vii.1908, Timberlake, (UCR_ENT00060086) (UCR). 1 f# Coos: Colebrook 44.49074; -71.57947, 7.ix.1986, Larochelle and Lariviere, (AMNH_PBI00398762) (CNC). 1 m# Coos: Pittsburg (on Rt 3) 45.05110; -71.39190, 7.ix.1986, Larochelle and Lariviere, (AMNH_PBI00398749) (CNC). **New York:** 1 m# 1 f#7 mis. so. Town of long lake [44°13' 23"N; 74° 50' 19" W], 26.viii.1956, J.C. Schaffner (SMNH). 1 n# Adirondack Mountains 44.00028; -74.50028, (UDCC_TCN00013954) (UDCC). 1 f# 42.8; -75.8, (AMNH_ENT00068300) (AMNH). 1 m# Erie: Lancaster: 42.90056; -78.67056, 9.vii.1889, E. P. Van Duzee,(AMNH_PBI00398775)(CNC). **Pennsylvania:** 1 f# Monroe: near Long Pond 41.01666; -75.46666, 18.vii.1998, M. D. Schwartz, (AMNH_PBI00394795) (CNC). **Vermont:** 1 f# Bennington: Searsburg 42.89041; -72.95236, 14.vii.1987, Larochelle and Lariviere, (AMNH_PBI00398767) (CNC). 1 f# Windham: Townshend State Park 43.04113; -72.69205, 13.viii.1987, Larochelle and Lariviere, (AMNH_PBI00398770) (CNC). 1 f# Windsor: Woodstock 43.62417; -72.51889, A. P. Morse, (AMNH_ENT00068278) (AMNH). 1 f# Lamoille: Wolcott Pond 44.56671; -72.42699, 6.ix.1987, Larochelle and Lariviere, (AMNH_PBI00398772)(AMNH). 1 f# Orleans: Newport 44.93639; -72.20556, 12.ix.1891, A. P. Morse, (AMNH_ENT00068299)(AMNH). 1 f# Grand Isle: Newport 44.72250; -73.29278, A. P. Morse, (AMNH_ENT00068280) (AMNH). 1 f# Franklin: E of Alburg 44.97086; -73.21048, 6.ix.1986, Larochelle and Lariviere, (AMNH_PBI00398764) (CNC).**Washington:** 2 m# Montpelier: North Branch Nature Center Area 44° 13' 23" N; 74° 50' 19" W, 12.vii.2008, G.F. Hevel, (SMNH). **West Virginia:** 1 f# Tucker: Blackwater Falls State Park, 1 mi SW of Davis 39.06430; -79.29430, 28.vii.1977, L. and N. Herman, (AMNH_ENT00068212) (CNC). 1 m# Tucker: Davis 39.12845; -79.46030, 21.vii.1986, Larochelle and Lariviere, (AMNH_PBI00398751)(CNC). **Wisconsin:** 1 f# Door: Chambers Island 45.19899; -87.36302, 2.vii.1930, E. P. Breakey, (AMNH_PBI0000724148) (OSAC). 1 f# Shawano: Chambers Island 44.78796; -88.61227, 29.vii.1951, D. H. Habeck, (NCSU_ENT00177749) (NCSU).

Collaria nigra Linnavuori, 1975

(Fig. 2)

Collaria nigra Linnavuori 1975: 17 [n.sp.]; Schuh 2002-2014 [catalog].

DIAGNOSIS: Distinguished by the general coloration predominantly black with brownish areas and by the pale color in the humeral regions of pronotum (Fig. 2a).

REDESCRIPTION Male: COLORATION: blackish. Head: blackish, longitudinal sulcus with V-shaped median spot behind it and triangular lateral spot behind both eyes ochraceous. Eyes yellowish, mandibular plate, maxillary plate and apex of buccula black; labium brown with black apex. Clypeus black. Frons brownish with a black adjacent part. Antennal segments dark brown, with segment I pale with dark brown apex. Thorax: Pronotum and collar darkish; callus and anterior lateral margins light brown; inner region of callus black. Proepisternum black. Scutellum black. Hemyelitra black; embolium and external region of cuneus, pale; internal margin and

medial cuneus and hemelytral membrane, dark brown. Ventral side: black; ostiolar peritrema margins pale brown, abdomen black with yellowish spots. STRUCTURE: Head: almost as broad as long, antenna with short pilosity, length equal to thickness of segments; segment I approximately equal to width of head (table 1), twice the width of II; segment II 3 times longer than I (table 1). Thorax: Pronotum with anterior lobe gradually narrowed with prominent humeral angles, lateral margin carinated and golden long sparse and erect pilosity. MEASUREMENTS: see Table 1.

Female: unknown.

GEOGRAPHIC DISTRIBUTION: Known from Oromiya Kilil, Ethiopia (Fig. 13). (Linnavuori 1975).

PLANT ASSOCIATIONS: unknown.

DISCUSSION: Collaria nigra is similar with C. villiersi based on the dark coloration (Fig. 1), but this specie is easily separated from C. villiersi by having lateral margins of pronotum light brown and black hemelytra. Only the holotype (male) was located, and the genitalia was not dissected.

Examined material. Holotype: 1 m# **ETHIOPIA: Oromiya Kilil:** [Shashamanni: Wondo Cloud Forest: 7°12'0"N; 38°36'0"E], 8.vi.1963, R.Linnavouri, (AMNH).

Collaria obscuricornis Poppius, 1910

(Figs. 2, 3, 4, 5, 6, 8, 9, 10, 11)

Collaria obscuricornis Poppius 1910: 30 [n.sp.]; Carvalho 1959: 285 [catalog]; Schuh 2002-2014 [catalog].

DIAGNOSIS: Recognized by shiny body and brownish general coloration (Fig. 2b), the spots on the head, smooth medial endosomal sclerite and fusiform (Fig. 4h); right dorsal endosomal sclerite elongated, and left dorsal endosomal sclerite fusiform (Figs. 3h, 4h, 5c).

REDESCRIPTION Male: COLORATION: shiny, brownish with black areas. Head: blackish, transversal pale spot (v-shaped) posterior to longitudinal sulcus, two triangular spots between eyes, both yellowish. Eyes brownish; mandibular plate, maxillary plate and apex of buccula, black; labium brown with black apex. Clypeus black. Frons with black adjacent part. Antennal segments brownish.Pronotum:

brownish, collar yellowish, callus and lateral margins of pronotum, dark brown; inner region of callus, black; two distinct large rounded spots behind callus, black. Proepisternum with pale spot in dorsal region, dark brown in median region and yellowish in margin. Scutellum black with a pale longitudinal spot. Hemelytra brownish, clavus and membrane, dark brown; embolium, cuneus and median region, brownish. Ventral side: black, margins of ostiolar peritrema pale brown; abdomen black. STRUCTURE: Head: slightly broader than long (table 1), antennal segment I, 0.9 times the width of head (table 1), two times the width II; segment II, 3 times longer than segment I (table 1). Pronotum with anterior lobe gradually narrowed and golden long sparse and erect pilosity. MEASUREMENTS: see Table 1. GENITALIA: Pygophore: triangular, apex triangular and ventroposterior margin not differentiated (Fig. 3e), with left lateroposterior projected margin (Fig. 3e). Parameres: left paramere falciform, at apical half angulated with short apex; medial margin of basal sensory lobe almost straight and lateral margin of basal sensory lobe clearly convex; the hypophysis with a sharp lateral projection (Fig. 4h), right paramere as in Fig. 4h. Endosoma: medial endosomal sclerite fusiform with wide basal region and smooth (Fig. 5h); the ribbonlike endosomal sclerite with short lobe or area beneath secondary gonopore covered with microtrichia (Fig. 5h), right dorsal endosomal sclerite elongated with trichia on surface, and left dorsal endosomal sclerite fusiform with apex acute and smooth (Fig. 6c).

Female (description): Similar in structure and coloration to male, but slightly longer (table 1). MEASUREMENTS: Table 1. GENITALIA: First gonapophysis: with broad apical grooved region (Fig. 8e). Second gonapophysis: apex triangular, with one teeth (Fig. 9e). Bursa copulatrix: dorsal labiate plate with small sclerite caudal to sclerotized rings (Fig. 10g). Posterior wall with rounded interramal lobes, and anterior angle narrow projected to a blunt tip (Fig. 11g). Dorsal structure small and medial process absent (Fig.11g).

GEOGRAPHIC DISTRIBUTION: Known only from Eastern Africa (Tanzania) (Schuh 2002-2014). New records from: Southern Africa (South Africa) and Central Africa (Democratic Republic of the Congo) (Fig. 13).

PLANT ASSOCIATIONS: unknown.

DISCUSSION: Collaria obscuricornis is easily distinguished from C.improvisa by the shiny body, transversal pale spot (V-shaped) posterior to longitudinal sulcus, dark brown spots on hemelytra, medial endosomal sclerite of endosoma in male and by the posterior wall in female.

Examined material: DEMOCRATIC REPUBLIC OF THE CONGO: Sud-Kivu: 1 m# Lwiro: 47 km N. Of Bukavu: [2°14'24"S; 28°47'50"E], 4.i.1958, E.S.Ross & R.E. Leech, (CAS). **TANZANIA: Arusha:** 1 m# 1 f# Arusha 5 mi. S. Of Momela Lodge [3°22'0"S; 36°40'60"E], 9.i.1970, M.E. Irwin & E.S. Rows, (CAS). **SOUTH AFRICA: Kwazulu Natal:** Barnard: Natal, Umhlali -29.46667; 31.21667, 1.i.1900, M.E. Irwin & E.S. Rows, (SAM-HEM-A000761) (SANBI). **Eastern Cape:** Coldstream, Humansdorp Division -33.95; 23.71667, 1.ii.1921, Tucker R, (SAM-HEM-A000760) (SANBI). **Western Cape:** Knysna, C.C -34.03333; 23.03333, 1.x.1910, Péringuey L, (SAM-HEM-A000760) (SANBI).

Collaria oculata (Reuter, 1876)

(Figs. 2, 3, 4, 5, 6, 8, 9, 10, 11)

Trachelomiris oculatus Reuter 1876: 61[n.sp.];

Collaria oculata Carvalho 1959: 285 [catalog]; Schuh 2002-2014 [catalog].

DIAGNOSIS: Recognized by the brownish general coloration (Fig. 2), embolium wider than the thickness of antennal segment I, endosoma with lobal endosomal sclerite strongly tapered towards the apex (Fig. 5i), medial endosomal sclerite semicircular (Fig. 5i) and right dorsal endosomal sclerite elliptical (Fig. 6d).

REDESCRIPTION Male: COLORATION: brownish, with yellowish and black areas. Head: brown with paired transverse markings lateral to longitudinal sulcus, and two black longitudinal patches around the eyes and neck. Eyes yellowish, mandibular plate black; maxillary plate and apex of buccula, brownish; labium brown with black apex. Clypeus brownish. Antennal segments brownish; segment I yellowish, apical portion of segments III and IV, black. Thorax: Pronotum dark brown, with longitudinal pale line reaching the disc; callus and lateral margins dark brown; inner region of callus pale brown; two rounded black spots on humeral angles. Collar brownish. Proepisternum black with reddish line on margin. Scutellum brown with pale longitudinal line and two pale spots on basal angles and apex. Hemelytra brownish; clavus dark brown; median region and corium with brownish patches; embolium and internal region of cuneus pale; internal margin of cuneus and hemelytral membrane brownish. Ventral side: dark brown with reddish patches, ostiolar peritrema with light brown margins, median region of abdomen with

brownish spots and black spot at the apex of pygophore. STRUCTURE: Head: as broader as long (table 1), antenna with short erect pilosity shorter than thickness of segments; antennal segment I, 1.2 times the width of head (table 1), two times the width of II; segment II 2.5 times longer than I (table 1). Thorax: Pronotum with anterior lobe abruptly narrowed with golden long sparse and erect pilosity. MEASUREMENTS: see Table 1. GENITALIA: Pygophore: elongated, apex slightly rounded and ventroposterior margin not differentiated (Fig. 3f), with left projected lateroposterior margin (Fig. 3f). Parameres: left paramere falciform with the medial margin of basal sensory lobe almost straight and lateral margin of basal sensory lobe clearly convex; the hypophysis gradually acuminate to apex from 1/3 of apex (Fig. 4i), right paramere as in Fig. 3i. Endosoma: with lobal endosomal sclerite strongly tapered towards the apex with microtrichia in basal region (Fig. 5i), medial endosomal sclerite semicircular with microtrichia on surface (Fig. 5i); ribbonlike endosomal sclerite with a short lobe or area beneath secondary gonopore covered with with microtrichia (Fig. 5i), right dorsal endosomal sclerite elliptical with trichia on surface (Fig. 6d).

Female: Similar to male in color, but slightly longer. MEASUREMENTS: Table 1. GENITALIA: First gonapophysis: with broad apical grooved region (Fig. 8f). Second gonapophysis: as in Fig. 9f. Bursa copulatrix: dorsal labiate plate with small sclerite caudal to sclerotized rings (Fig. 10h). Posterior wall with rounded interramal lobes (Fig. 11h). Dorsal structure small and medial process arrow like shaped (Fig.11h).

GEOGRAPHIC DISTRIBUTION: Eastern region of Canada, central region of United States and Mexico (Fig. 14) (Schwartz 2008).

PLANT ASSOCIATIONS: Panicum huachuacae (Poaceae) (Carvalho & Fontes, 1981).

DISCUSSION: Collaria oculata differs of C. mieilleurii by antennal segments with short erect pilosity and hemelytra with distinctive coloration, embolium wider than the thickness of antennal segment I, and genitalia of male and female.

Examined material: CANADA: Ontario: 1 f# Nepean, Piney Forest, Lafontaine House 45.31754; -75.73024, 27.vii.1991, M. D. Schwartz, (AMNH_PBI00394800) (CNC). **MEXICO: Chiapas:** Pichucalco: [16°31'60"N; 91°16'60"W], 3.viii.1980, Schaffner, 1 m# (MNRJ). **Veracruz-Llave:** 1 f# Huatusco de Chicuellar: [19°8'60"N; 96°57'0"W], 17.vii.1980, Schaffner, (MNRJ). **Veracruz:** 1 n# Catemaco: 8 mi NE Catemaco 19.30;-96.70, 3.vii.1971, Murray & D. Clark & R. & J. Hart & Schaffner, (GBIF370312852) (MHNCM). **USA: Alabama:** 1 f# Talladega Nat. Forest 33.55833; -

85.70972, 19.v.1998, J. A. MacGown, (MEMU_ENT00104452) (MEMU). **Arkansas:** 1 m# Little River, Ashdown 33.67412; -94.13985, 26.vii.1906, M. D. Schwartz, (AMNH_ENT00068786) (AMNH). 1 f# Yell, 3 mi W of Havana 35.11412; -93.58151, 28.vi.1978, W. H. Cross, (MEMU_ENT00104449) (MEMU). 1 f# Conway, Petit Jean State Park 35.11305; -92.94972, 5.viii.2008, R. L. Blinn, (NCSU_ENT00177636) (NCSU). **Connecticut:** 1 m# New London, Stonington Township, Barn Island 41.33500; -71.90600, 6.ix.1976, Slater, Ford, O'Donnell, (AMNH_ENT00068733) (AMNH). 1 f# New Haven, Cheshire 41.49889; -72.90111, 20.vi.1959, J. A. Slater, (AMNH_ENT00068701) (AMNH). **Delaware:** 1 m# New Castle, Blackbird State Forest 38.73996; -75.38978, 31.viii.2006, J. A. Goldstein, (UDCC_TCN00018374) (UDCC). 1 f# New Castle, Newark 39.71444; -75.75861, 17.vii.1927, H. L. Dozier, (UDCC_TCN00013959) (UDCC). 1 f# Sussex, Selbyville 38.45861; -75.22416, 29.viii.1932, H. L. Dozier, (UDCC_TCN00013961) (UDCC). **Florida:** 1 f# Alachua, Gainesville, Austin Cary Forest 30.41129; -81.90701, 15.vii.1966, L. A. Hetrick, (NCSU_ENT00177611) (NCSU). 1 m# Duval, Jacksonville 30.33194; -81.65583, 15.vii.1966, Mrs. A.T. Slosson, (AMNH_ENT00068774) (AMNH). 1 f# Highlands, Sebring 27.49555; -81.44083, C. T. Parsons, (AMNH_ENT00068772) (AMNH). 1 m# Pinellas, Belleair 27.93056; -82.76424, Mrs. A.T. Slosson, (AMNH_ENT00068776) (AMNH). 1 f# Leon, Tallahassee 30.43830; -84.28070, 10.vii.1973, C. W. O'Brien, (AMNH_ENT00068713) (AMNH). **Illinois:** 1 f# Pope, Herod 37.58028; -88.43611, 4.viii.1924, DeLong and Mohr, (AMNH_ENT00068785) (AMNH). **Iowa:** 1 f# Boone, Ledges State Park 41.98333; -93.88667, 26.vi.1951, J. A. Slater, (AMNH_ENT00068654) (AMNH). **Kentucky:** 1 m# 1 f# Ballard Co: Rt. 473 Monkeys Eyebrown [37°11'16"N; 88°59'47"W], 20. vi. 2001, T. Henry and A.G. Wheeler, (SMNH). **Louisiana:** 1 f# Natchitoches, Kisatchie National Forest, Red Bluff Campground 31.94892; -92.81048, 22.v.1982, E. G. Riley, (NCSU_ENT00177580) (NCSU). **Maine:** 1 f# Franklin, Wilton, 44.59177; -70.23780, 1.ix.1986, E. G. Riley, (AMNH_PBI00394799) (AMNH). **Maryland:** 1 m# 1 f# Beltsville: Prince Georges Co: 3 mi SE of Beltsville [39°2'5"S; 76°54'2"W], 12.vi. 1965, D.R. Smith, (AMNH). 1 n# Kent, Langford, Chesapeake Farms, 39.17972; -76.18111, 25.viii.1997, C. R. Bartlett, (UDCC_TCN00013963) (UDCC). 1 n# Anne Arundel, Bay Ridge, 38.93769; -76.45521,(AMNH_ENT00068763) (AMNH). 1 f# Prince George's, Beltsville 39.03472; -76.90778, 5.vi.1966, D. R. Smith, (AMNH_ENT00068720) (AMNH). 1 f# Montgomery, Great Falls 39.00222; -77.24639, Banks, (AMNH_ENT00068782) (AMNH). 1 n# Allegany, 39.63286; -78.39216, 6.vi.1998, C. R. Bartlett, (UDCC_TCN00013965) (UDCC). **Massachusetts:** 1 f# Nantucket 41.28333; -70.09944, 7.xi.1900, A. P. Morse, (AMNH_ENT00068799) (AMNH). 1 f# Middlesex: Holliston 42.20000; -71.42500, N. Banks, (AMNH_ENT00068794) (AMNH). **Mississippi:** 1 f# Oktibbeha: Starkville 33.45028; -88.81833, 1.vii.1975, W. H. Cross, (MEMU_ENT00104448) (MEMU). **Missouri:** 1 f# Barry: Roaring River State Park 36.55091; 93°45' 32"W], 8.vi.1980, R. L. Blinn, (NCSU_ENT00177576) (NCSU). 1 m# Crawford: Steelville 37.96810; -91.35487, 24.v.1980, R. L. Blinn, (NCSU_ENT00177575) (NCSU). 1 m# Gasconade: Mint Spring [Seep] Natural Area 38.20082; -91.53728, 2.vii.1986, R. L. Blinn, (NCSU_ENT00177571) (NCSU). 1 m# Boone: Grindstone Natural Area 38.92973; -92.31811, 6.v.1981, R. L. Blinn, (NCSU_ENT00177574) (NCSU). **New Hampshire:** 1 f# Coos: Gorham 44.38778; -71.17361, 30.viii.1958, J. A. Slater, (AMNH_ENT00068711) (AMNH). **New Jersey:** 1 f# Essex: Great Piece Meadows 40.89777; -74.30972, 8.v.1910, J. A. Slater, (AMNH_ENT00068751) (AMNH). **New York:** 1 f# Columbia: Chatham 42.36417; -73.59528, 30.viii.1904, A. P. Morse, (AMNH_ENT00068801) (AMNH). 1 f# Putnam: Carmel 41.43000; -73.68060, 13.viii.1910, (AMNH_ENT00068805) (AMNH). 1 f# Kings: Lott Wood, Flatbush (on Long Island) 40.61027; -73.93250, 25.vii.1893, J.L. Zabriskie, (AMNH_ENT00068802) (AMNH). **Newfane:** 1 m# Kings: S. Newfane 42.93806; -72.70583, Miss Bryant (AMNH_ENT00068781) (AMNH). **North Carolina:** 1 m# Montgomery: Uwharrie National Forest, USFSR-554, 1 mi E of jct with USFSR-597 35.44262; -80.05105, 25.vi.1993, R. L. Blinn (NCSU_ENT00177591) (NCSU). 1 f# Anson: SR-1748, .5 mi N. Hwy-74 34.95197; -79.87904, 30.v.1995, R. L. Blinn (NCSU_ENT00177627) (NCSU). 1 f# Chatham: White Pines Nature Preserve 35.61484; -79.15923, 25.vi.1991, R. L. Blinn (NCSU_ENT00177588) (NCSU). 1 f# Wake: NCSU Lake Wheeler Res. Farm 36.00000; -79.00000, 27.viii.2009, R. L. Blinn (NCSU_ENT00177567) (NCSU). 1 m# Wake: Raleigh, North Carolina State University, Centennial Campus 35.77564; -78.66559, 10.ix.1994, C. R. Bartlett (NCSU_ENT00177630) (NCSU). 1 f# Cumberland: South River at Hwy 242, Centennial Campus 34.88350; -78.52317, 30.vii.1993, R. L. Blinn (NCSU_ENT00177606) (NCSU). 1 m# Wayn: Cliffs of the Neuse State Park 35.23954; -77.88500, 30.iv.1959, D. A. Young (NCSU_ENT00177649) (NCSU).1 f# Onslow: SR 1106 & SR 1105 34.7; -77.4, 27.vi.1996, R. L. Blinn, (NCSU_ENT00177617) (NCSU). 1 m# Craven: Havelock 34.87900; -76.90100, Harris & Wray, (NCSU_ENT00177670) (NCSU). 1 f# Ashe: Jefferson 36.42092; -

81.47496, F. Sherman (NCSU_ENT00177657) (NCSU). 1 m# Burke: Linville Falls 35.95028; -81.92666, Z. P. Metcalf (NCSU_ENT00176584) (NCSU). 1 f# Buncombe: Swannanoa 35.49924; -83.68050, 20.vi.1916, R. W. Leiby, (NCSU_ENT00177662) (NCSU). 1 m# Swain: GSMNP, Bone Valley Creek [35°29' 58"N; 83°40'57"W], 24.vii.1964, J. F. Cornell, (NCSU_ENT00177648) (NCSU). **Oregon:** 1 f# Benton: Corvallis 44.57000; -123.27500, 1.viii.1982, J. D. Lattin, (AMNH_PBI0000724149) (OSAC). **Pennsylvania:** 1 f# Monroe: Delaware Water Gap 40.96750; -75.12250, 1.viii.1982, Mrs. A.T. Slosson, (AMNH_ENT00068796) (AMNH). 1 n# Centre: State College, Penn State 40.79333; -77.86028, 25.vii.1904, (CSUC_TCN00010207) (CSUC). 1 n# Allegheny, Pittsburgh [40°26'27"N; 79°59'53"W], 1.viii.1905, (CSUC_TCN00010208) (CSUC). **Tennessee:** 1 n# Blount, GSMNP ATBI Plot Cades Cove, Wildcat Branch 35.8; -84, 28.v.2004, A. J. Mayor and V. Taylor (NCSU_ENT00177535) (NCSU). **Vermont:** 1 m# Windsor, Woodstock 43.62417; -72.51889, 28.v.2004, A. P. Morse (AMNH_ENT00068777) (AMNH). **Virginia:** 2 m# 2 f# Suffolk Co. [36°43'42"N; 76°35'01"W], 13.vi.1983, T. Henry, Panicum sp. Poaceae (SMNH). **Virginia:** 1 m# Falls Church, Falls Church 38.88222; -77.17138, 16.vii.1900, N. Banks (AMNH_ENT00068758) (AMNH). 1 f# Chesapeake, Hickory 36.63204; -76.20737, 3.vii.1903, A. P. Morse, (AMNH_ENT00068804) (AMNH). 1 f# Giles, Mount Lake Biological Station 37.37476; -80.52273, 25.vi.1962, T. Daggy, (NCSU_ENT00177639) (NCSU). **West Virginia:** 1 f# Randolph, Adolph 38.74393; -80.04501, 3.vii.1986, Larochelle and Lariviere, (AMNH_PBI00394797) (CNC). 1 m# Pendleton, Seneca Creek 38.71589; -79.54716, 26.vi.1966, O. R. Taylor, (AMNH_ENT00068732) (AMNH).

Collaria oleosa (Distant, 1883)

(Figs. 2, 3, 4, 5, 6, 8, 9, 10, 11)

Trachelomiris oleosus Distant 1883: 238, [n.sp.], Carvalho & Dolling 1976: 803 [Disc. of type],

Collaria explicata Uhler 1887: 230, [n.sp. (syn. by Carvalho, 1959:285],

Collaria oleosa Carvalho 1959: 285, [catalog], Hérnandez & Henry 2010: 97 [syn., diag.], Schuh 2002-2014 [catalog].

Collaria husseyi: Schuh, 1995: 1006 (Cuba in error). Hérnandez & Stonedahl, 1997: 22 (Cuba in error).

DIAGNOSIS: Recognized by the dark brown to fusco-testaceous general coloration with pale and black areas (Fig. 2d), head with Y-shaped black spot on frons, endosoma with c-shaped posterior endosomal sclerite (Fig. 5j), posterior wall of female genitalia with triangular interramal lobes with short projection on lateroapical margin (Fig. 10i).

REDESCRIPTION Male: COLORATION: dark brown to fusco-testaceous. Head: brown, with Y-shaped black marking extending from longitudinal sulcus to frons, two black patches around the antenna and two lateral black spots in the neck. Eyes, mandibular plate, maxillary plate and apex of buccula brownish; labium brown with black apex. Clypeus uniformly colored (brownish). Antennal segments brownish to

black with segment I light brown. Thorax: Pronotum brownish; callus and lateral margins dark brown; inner region of callus pale brown; two rounded black spots on humeral angles; collar pale;longitudinal line on pronotum (sometimes absent), pale. Proepisternum black with a yellowish line in margin. Scutellum black or brownish, with pale longitudinal line. Hemelytra brownish; clavus, corium (internal region), and hemelytral membrane brownish; embolium and external region of cuneus pale; internal margin of cuneus black. Ventral side: black; ostiolar peritrema with pale brown margins; abdomen yellowish with a black spot at the apex of pygophore. STRUCTURE: Head: as broader as long, antenna with short erect pilosity, antennal segment I 1.2 times the width of head (table 1), two times the width of II; segment II 3 times longer than segment I (table 1). Thorax: Pronotum with anterior lobe abruptly narrowed with golden sparse and erect pilosity. MEASUREMENTS: Table 1. GENITALIA: Pygophore: elongated, apex slightly rounded and ventroposterior margin not differentiated (Fig. 3g). Parameres: left paramere falciform, an apical half curve, medial margin of basal sensory lobe almost straight and lateral margin clearly convex, right paramere straight (Fig. 4j). Endosoma: with the ribbonlike endosomal sclerite with an expanded lobe that reaches further the secondary gonopore covered with microtrichia (Fig. 5j), posterior endosomal sclerite c-shaped with thick spines (Fig. 5j).

Female: Similar to male in color, but slightly longer. MEASUREMENTS: Table 1. GENITALIA: First gonapophysis: with broad apical grooved region (Fig. 8g). Second gonapophysis: as in Fig. 9g. Bursa copulatrix: dorsal labiate plate with small sclerite caudal to sclerotized rings (Fig. 10i). Posterior wall with triangular interramal lobes with a short projection in the lateroapical margin (Fig. 11i). Dorsal structure covering half of interramal lobes and medial process shaped as an inverted Y (Fig.11i).

GEOGRAPHIC DISTRIBUTION: Widely distributed in the Neotropical Region, ranging from North to South America (United States, Mexico, Guatemala, El Salvador, Honduras, Nicaragua, Cuba, Jamaica, Costa Rica, Panama, Colombia, Venezuela, Ecuador, Peru, Brazil and Paraguay) (Carvalho & Fontes 1981). New records from: Haiti, Dominican Republic, Trinidad and Tobago and Argentina (Fig. 15).

PLANT ASSOCIATIONS: Fabaceae: Phaseolus vulgaris. Poaceae: Andropogon guayanus, Avena sativa; Brachiaria decumbens; Digitaria decumbens; Digitaria sanguinalis; Eriochloa polystachya, Oryza sativa; Panicum maximum, Panicum muticum; Panicum numidianum; Triticum vulgare; Setaria setosa; Sorghum vulgare; Zea mays (Carvalho & Fontes, 1981; Hérnandez & Henry 2010, Schuh 2002-2014).

DISCUSSION: Collaria oleosa is similar to C. capixaba by the coloration of head brown, with Y-shaped black marking extending from longitudinal sulcus to frons, but it is distinguished by the general coloration and endosome with posterior endosomal sclerite C-shaped. We did not examinate and dissected the holotype, because we did not have access to the specimen deposited in the NHM. However, we worked with abundant material corresponding to the description by Carvalho and Fontes (1981). The revised specimens vary in color depending on the geographic location. In central and northern South America, the specimens are darker, whereas in southern South America they have paler coloration. The head spots can also vary in coloration. Carvalho and Fontes (1981) defined that this specie is recognized by the black maxillary plate in females, but in this work we found that the black maxillary plate is shared with other species of genus, therefore it cannot be considered as diagnostic.

Examined material: ARGENTINA: Misiones: 1 m# El Dorado: Puerto Mado [26°23'60"S; 54°37'60"W], 3.xi.1964, A.Kovacs, (AMNH). **BRAZIL: Amazonas:** 1 m# Careiro: lac Redondo 3°48'32"S; 60°20'19"W, 11.ii.1964, G. Marlier, (RBINS). **Espirito Santo:** 33 m# 12 f# Afonso Claudio: 20°4'60"S; 41°7'60"W, 18.xii.2011, A. Moura, Panicum maximum (Poaceae), (UFVB). 2 m# 2 f# Agua Doce do Norte: 18°24'02"S; 40°58'35"W, 3.x.2012, J.A. Molino, (UFVB). 27 m# 33 f# Baixo Gandu: [19°31'0"S; 41°1'0"W], 9.ix.1970, C.Elias, (DZUP). 10 m# 12 f# Colatina Itapina: [19°31'60"S; 40°49'60"W], 21.x.1970, Tadeu & C. Elias, (DZUP). 1 m# 2 f# Santa Teresa: [19°55'0"S; 40°36'0"W], 27.v.1966, C. Elias, (DZUP). 1 m# Linhares: Reserva Florestal CVRD [19°25'0"S; 40°4'0"W], xii.1986, J.Carvalho, (MNRJ). **Goias: Rio Verde:** 1 m# 1 f# [17°43'0"S; 50°55'60"W], xii.1986, J.Carvalho, (MNRJ). **Mato Grosso do Sul:** 2 m# 1 f# Campo Verde: 30 k direção de Primavera do Leste [20°25'0"S; 54°4'0"W], vi.2004, P. Silve, (UFVB). **Minas Gerais:** 1 m# 1 f# Barbacena: [21°13'60"S; 43°46'0"W], 25.vi.1980, Rogerio, (UFVB); 1 f# Barbacena: [21°13'60"S; 43°46'0"W], 16.ii.1962, M.Alvarenga, (DZUP). 1 f# Ipatinga: [19° 30' 0"S; 42° 31' 60"W], 5.i.1989, J. Zanuncio, (UFVB). 1 m# 1 f# Paineiras: [18°53'60"S; 45°31'0"W], 6.v.1961, M.Alvarenga, (DZUP). 1 m# 1 f# Ponte Nova: [15°55'60"S; 41°42'0"W], 20.xi.1979, Planalsucar, (UFVB). 1 m# Rio Claro: [22°25'0"S; 45°16'0"W], vi.1943, J. Carvalho, (UFVB). 2 f# Senador Firmino: [20°55'0"S; 43°6'0"W], 9.iv.2001, P.Fiuza, (UFVB). 1 m# 5 f# Varginha: [21°33' 0"S; 45°25'60"W], ix.1961, M.Alvarenga, (DZUP). 2 f# Viçosa: Corrego do Paraiso/Mata daPrefeitura [20°45'0"S; 59°6'18"W], 10.ii.1982, D. Martins, (UFVB); 3 m# 3 f# 3.xi.1986, H. Ramon, (UFVB); 10 m# 10 f# 7.ii.1974,P. Fiuza, (DZUP); 6 m# 7 f# 6.xii.1978, P. Fiuza & Rossi, (UFVB). **Paraná:** 1 m# 1 f# Foz do Iguaçu: [25°330"S; 54°34'60"W], 3.xii.1966, Exc.Dept.Zoo, (DZUP). **Rio de Janeiro:** 5 m# 3 f# Imbariê: [22°37'40"S; 43°11'57"W], ix.1961, M.Alvarenga, (DZUP). 15 m# 17 f# Mendes: [22°31'34"S; 43°43'29"W], 29.ix.1996, P.Fiuza, (UFVB). 1 m# 1 f# Muriqui: Mangaratiba [22°56'60"S; 44°1'60"W], x.1961, M.Alvarenga, (DZUP). 1 m# Santo Antônio do Imbé: S.M.Madalena [21°58'60"S; 41°52'60"W], i.1961, M.Alvarenga, (DZUP). 1 m# Teresópolis: [22°25'60"S; 42°58'60"W], 29.v.1998, Mejdolami, (MNRJ). 1 f# Valença: [22°14'31"S; 43°42'5"W], i.2001, Mascarenhai, (MNRJ). **Rio Grande do Sul:** 4 m# 10 f# Ilopolis: [28°55'60"S; 57°7'0"W], 6.xii.2003, (MCN/UNIVATES). 2 f# Montenegro: 29°41'60"S; 51°28'0"W, 20.xii.1977, (MCNZ). 6

m# 8 f# Putinga: [29°0'0"S; 52°8'60"W], 26.xii.2003, (MCN/UNIVATES). 1 f# Triunfo: 29°55'60"S; 51°43'0"W, 27.x.1977, (MCNZ). **São Paulo:** 1 m# Guanabara: Represa Rio Grande: [22°52'0"S; 42°2'60"W], Xii.1980, Werner & Alvarenga, (DZUP). **COLOMBIA: Antioquia:** 1 f# Yarumal: [6°57'53"N; 75°25'13"W], 16.xii.1999, G. Abril & F. Yepes, (UFVB). **Boyacá:** 12 m# 40 f# Caldas: [5°33'12"N; 73°51'56"W], 2009, P. Osorio, (UFVB). 1 f# Guadualito: PNN Cocuy Yarumales [5°35'32"N; 74°13'8"W], iii.1998, C. Zarate, (ICN). 3 m# 3 f# Guican: [6°27'55"N; 72°24'74"W], 28.xi.2011, P. Osorio & J. Gómez, (MPUJ-ENT). 1 f# Jenesano: [5°23'20"N; 73°22'5"W], 10.x.2006, J.Arias, (UPTC). 1 m# 1 f# Maripi: [5° 33' 7"N; 74° 0' 31"W], 27.iv.79, I. de Arevalo, (ICN). 2 f# Moniquirá: [5°43' 39"N; 72°21' 8"W], 16.ix.2007, H.Alvarado, (UPTC). 1 m# La Cumbre [5°43'39"N; 72°21'8"W], 3.ii.1978, I. de Arevalo, (ICN). 4 m# 1 f# Pauna: Monte Bajo La Rochela: [5°39'31"N; 73°58'57"W], 26.iv.1979, I. de Arevalo, (ICN). 1 m# Togui: Vda Funcionaly [5°23'26"N; 73°31'0"W], 2.ii.1978, I. de Arevalo, (ICN). 7 m# 6 f# Umbita: [5°12'28"N; 73°27'52"W], 2009, P. Osorio, (UFVB). 1 m# 2 f# 1n# Villa de Leyva: [5°38'00"N; 73°31'00"W], ix.1998, D. Forero (IAVH). **Cundinamarca:** 3 f# Anolaima: [4°39'26"N; 74°22'7"W], 30.ix.1989, C.Hernandez & D.Herrera, (MPUJ-ENT). 2 m# 1 f# Bogotá: [4°35'60"N; 74°4'60"W], 2.xi.1971, A. Abouchar, (ICN); Suba Loma San Jose 11.iv.1974, J. Perea, 1 f# (ICN). 1 m# 3 f# Fusagasugá: Cerca al reten Chinauta [4°20' 38"N; 74°22'4"W], 17.v.1986, R. Ovalle, (MPUJ-ENT). 3 m# 2 f# Guaduas: Cerca al río San Francisco [5°4'10"N; 74°35'53"W], 21.iii.2007, R. Ovalle, (MPUJ-ENT). 1 m# 1 f# Junin: [4° 47' 45"N; 73°39'51"W], 2009, P.Osorio, (UFVB). 1 f# La Capilla: [5°5'60"N; 73°27'0"W], 24.x.1970, F. Torres, (ICN). 1 f# La Vega: Finca La Primavera [4°40'60"N; 74°31'0"W], 21.ii.74, I. de Arevalo, 3 m# (ICN). 16.v.2006, (MPUJ-ENT). 1 m# 1 f# Medina: Granja experimental [4°30' 43"N; 73°21'5"W], 27.vii.1986, Sistematica, (ICN),1 m# 1 f# Riberas Río Gasaguan [4°30'43"N; 73°21'5"W], 16.x.1989,M.García, (ICN). 20 m# 20 f# Mosquera: Tibaitatá: [4°22'60"S; 74°28'60" W], iv.1997, 26.vii.2008, (CTNI). 1 f# Santa Helena: [5°21'1"N; 73°54'19"W], Vii.1997, M. Carrasco, (UFVB). 10 m# 8 f# Sasaima: [4°53'53"N; 74°26'13"W], 6.iii.1976, R. Restrepo, (ICN). 10 m# 8 f# Tena: [4°53'53"N; 74°26'13"W], 6.iii.1976, R. Restrepo, (ICN). 1 m# 2 f# Tena: Laguna de Pedro Palo [4°39'26"N; 74°22'7"W], 14.iii.1976, R. Lopez, (ICN); 1 m# Granja del Padre Luna, 24.ii.2000, M.Ospina, (ICN). 4 m# 3 f# Villeta: [5°0'53"N; 74°28'29"W], 20.iv.1968, R.Restrepo, (ICN); 5 m# 9 f# 28.ix.1976, J. Blanco, (ICN). **Huila:** 2 f# La Plata: Meremberg [2°23'30"N; 75°53'30"W], 22.iv.1984, (ICN). **Meta:** 4 m# 7 f# Acacias: Vereda San Jose [3°59'15"N; 73°45'24"W], 2.xii.1985, C. Tovar, (ICN). 1 f# Guamal: Hacienda Achivury [3°52'48"N; 73° 45'56"W], 10.xii.1985, E. Lopez, (ICN). 1 f# La Macarena: Reserva La Macarena [2°11'17"N; 73°47'55"W], 19.vii.1991, G.Amat, (MPUJ-ENT). 1 f# Villavicencio: [4°9'12"N; 73°38'6"W], B. Gonzalez, (ICN). **Santander:** 2 m# 1 f# Barbosa: [5°55'57"N; 73°37'16"W], 3.x.2006, M. Palacio, (UPTC). 1 m# Virolín: Rio Luz [6°4'44"N; 73°13'45"W], 1.iv.1978, I. Agudelo, (ICN). **Tolima:** 1 f# Armero: [5°1'54"N; 74°53'27"W], 15.viii.1976, M. Gaitan (ICN). 8 f# Icononza: Vereda El Palmar [4° 10' 48"N; 74° 32' 10"W], 20.iii.1978, R.Restrepo, (ICN). **Valle del Cauca:** 1 f# Palmira: Instituto Colombiano Agropecuario [3°32'22"N; 76°18'13"W], 21.ii.1985, F.Garcia, (AMNH). 3 m# 2 f# Tulúa: Jardín Botánico "Juan Maria Cespedes" [4°5'12"N; 76°12'0"W], 2.i.2013, I.Morales, (UFVB). **COSTA RICA: San José:** 1 m# 1 f# San Jose [9°55'60"N; 84°4'60"W], Viii.1980, N.L.H.Krauss, (AMNH). **CUBA: La Habana:** 1 m#1 f# La Habana: Penalver-Cotorro (laguna) [23°5'9"N; 82°13'33"W], 17.v.1990, G. Haghebaert, (RBINS). **Cienfuegos:** 1 m# 1 f# Soledad [22°28'0"N; 80°28'0"W], i.1927, C.T. & B.B. Brues, (AMNH). **ECUADOR: Pichincha:** 1 m# 1 f# Valle de San Rafael: [0°9'0"S; 78°28'0"W], 29.vi.1995, D.Forero, (MPUJ-ENT). **Santo Domingo de los Tsáchilas:** 1 m# 1 f# Santo Domingo: [0°15'15"S; 79°10'19"W], 5.iii.1973, M. Deyrup, (AMNH); 3 f# 13.i.2013, M.Vélez, (UFVB). **Sucumbios:** 1 f# Limoncocha: [0°26'0"S; 76°38'W], 23.iii.1974, D.Engleman, (MNRJ). **Zamora Chinchipe:** 1 m# 1 f# Yantzaza: Zamora [3°49'40"S; 78°45'34"W], iii.1965, L.F. Pana, (MNRJ). **EL SALVADOR: Usulutan:** 1 f# Usulutan: Los Olomega [13°20'60"N; 88°27'0"W], 8.ii.1960, J. Bechyné, (ISNB). **La Libertad:** 1 m# 1 f# San Andrés: [13°49' 11"N; 89°24' 41"W], 4.ix.1975, R.M. Baranowski, (AMNH). **GUATEMALA: Chimaltenango:** 1 m# 1 f# Yepocapa: El Amparo [14°30'15"N; 90°57'25"W], 4.x.1941, (AMNH). **Guatemala:** 1 f# Guatemala: 40 km W of Guatemala City [14°37'16"N; 90°31'37"W], 18.viii.1954, E.S.Ross, (MNRJ). **HAITI: Sud:** 1 f# Camp Perrin: [18°19'0"N; 73°52'0"W], 8.x.1927, Darlington, (AMNH). **HONDURAS: Colon:** 1 m# 1 f# Manati [15°52'60"N; 86°16'0"W], (RBINS). **Francisco Morazan:** 1 m# 1 f# Tegucigalpa: [14°5'60"N; 87°13'0"W], 4.ix.1975, N.L.H.Krauss, (AMNH). **JAMAICA: Parish of Saint Ann:** 1 m# 1 f# Saint Ann's Bay: [18°25'60"N; 77°12'0"W], 11.xii.1970, R.M. Baranowski & J.A. Slater, (AMNH). **MEXICO: Tabasco:** Teapa [17° 33'0"N; 92°57'0"W], 3 m# 4 f# (RBINS). **NICARAGUA: Jinotega:** 2 m# 2 f# Jinotega [13°5'60"N; 86°0' 0"W], Viii.1989, A. Reinboldt, (MNRJ). **PANAMÁ: Panamá:** 1 m# 1 f# Chame: Cerro Campana [8°34'60"N; 79°52'60"W], 1.xii.1974, J.A. Slater & J. Harrington,

(AMNH). **Colon:** 1 f# Coco Solo [9°22'12"N; 79°52'54"W], 20.xii.1972, D.Engleman, (MNRJ). **PARAGUAY: Guaira:** 1 m# 1 f# Villarrica: [25°45'0"N; 56°25'60"W], 3.xi.1931, R.P.Hussey, (MNRJ). **PERU: Loreto:** 1 m# 1 f# Pucallpa: Km 3 Tournavista Rd., 34 km w Pucallpa [3°27'49"S; 72°55'21"W], 23.xii.1971, R.T. & J.C. Schuh, (AMNH). **Huanuco:** 1 f# Tingo Maria: Monson Valley [9°17'22"S; 76°0'32"W], 9.x.1954, E.I. Schlinger, (MNRJ). **DOMINICAN REPUBLIC: Duarte:** 1 m# 1 f# Villa Riva: [19°10'60"N; 69°55'0"W], 9.x.1954, E.I. Schlinger, (AMNH). **La Altagracia:** 1 f# Nisibon: [18°52'60"N; 68°46'60" W], 3.v.1978,L. Woorduff, (AMNH). **TRINIDAD AND TOBAGO: Arima:** 1 f# Arima: Arima Valley [10°37' 60"N; 61°16'60"W], 22.x.1964,Rozen & Wygodzinsky, (AMNH). **USA: Florida:** 1 m# 1 f# Broward Estates: 1.3 mi N of Lake Worth Rd. On Rte 441 [26°7'32"N; 80°11'36"W], 20.ii.1980, M.D. Schwartz, (AMNH). **Puerto Rico:** 1 m# Aibonito [18°8'24"N; 66°15'58" W], (AMNH). **VENEZUELA: Carabobo:** 1 m# Puerto Cabello [10°28'23"N; 68°0'45"W], 6.x.1993, Sievers, (MNRJ). **Miranda:** 1 m# 2 f# San Diego: [10°20'60"N; 66°57'0"W], Viii.1964, P.Anduze, (MNRJ).

Collaria scenica (Stål, 1859)

(Figs. 2, 3, 4, 5, 6, 8, 9, 10, 11)

Miris scenicus Stål 1859: 254 [n.sp.],

Trachelomiris scenicus Reuter 1876: 61 [note], Berg 1883: 8 [note]

Collaria scenica Reuter 1909:12 [descr.], Carvalho 1959: 286 [catalog], Carvalho & Fontes 1981: 26 [Descr.], Schwartz 2008: 1179, [diag., morph.], Schuh 2002-2014 [catalog].

Collaria columbiensis Carvalho 1984:12; (syn. by Ferreira et al. 2013)

DIAGNOSIS: Recognized by the brownish general coloration with black and pale areas, pale V-shaped spot behind sulcus (Fig. 2e), posterior endosomal sclerite with a row of about six thick spines (Fig. 5k), and posterior wall of female with triangular interramal lobes with short projection in lateroapical margin (Fig. 11j).

REDESCRIPTION Male: COLORATION: brownish with black and pale areas. Head: black with transversal V-shaped pale spot posterior to longitudinal sulcus, two pale patches between eyes and two black lateral spots in neck. Eyes brownish; mandibular plate, maxillary plate and apex of buccula, black; labium brown with black apex. Clypeus black with pale spot at base. Antennal segments brownish to black with segment I light brown. Pronotum: dark brown; callus and lateral margins black; inner region of callus pale; two black rounded spots on humeral angles; collar and longitudinal line of pronotum pale. Proepisternum black with a yellowish line in margin. Scutellum black with pale longitudinal line. Hemelytra, clavus, corium (internal region), and membrane dark brown; embolium and external region of

cuneus, pale. Ventral side: black; ostiolar peritrema margins pale; abdomen yellowish with a black spot at the apex of pygophore. STRUCTURE: Head: as broad as than long, antenna with short pilosity, antennal segment I 1.2 times the width of head (table 1), two times the width of II; segment II 3 times longer than I (table 1). Thorax: Pronotum with anterior lobe abruptly narrowed and golden sparse and erect pilosity. MEASUREMENTS: Table 1. GENITALIA: Pygophore: elongated, apex slightly rounded and ventroposterior margin not differentiated (Fig. 3h). Parameres: left paramere falciform, curved at apical half, medial basal sensory lobe clearly convex and lateral margin of basal sensory lobe almost straight, right paramere as Fig. 4k. Endosoma: ribbonlike endosomal sclerite with short lobe or area beneath secondary gonopore covered with microtrichia (Fig. 5k), posterior endosomal sclerite with a row-shaped of about six thick spines (Fig. 5k).

Female: Similar to male in color, but slightly longer. MEASUREMENTS: Table 1. GENITALIA: First gonapophysis: with broad apical grooved region (Fig. 8h). Second gonapophysis: as in Fig. 9h. Bursa copulatrix: dorsal labiate plate with small sclerite caudal to sclerotized rings (Fig. 10j). Posterior wall with triangular interramal lobes with short projection in lateroapical margin (Fig. 11j). Dorsal structure, covering half of interramal lobes and I-shaped medial process (Fig.11j).

GEOGRAPHIC DISTRIBUTION: Recorded from South America (Colombia, Brazil, Uruguay and Argentina) (Fig. 12) (Carvalho & Fontes 1981).

PLANT ASSOCIATIONS: Poaceae: Echinocloa colonum, Eleusine indica, Digitaria sanguinalis, Panicum maximum, Pennisetum clandestinum (Martínez & Barreto, 1998).

DISCUSSION: Collaria scenica is easily distinguished from C. oleosa by the brownish general coloration; head with V-shaped pale spot, posterior endosomal sclerite row-shaped in male and posterior wall with triangular interramal lobes with short projection in lateroapical margin of female.

Examined material: ARGENTINA: Buenos Aires: 1 f# Lujan [34°34'13"S; 59°6' 18"W], 18.xii.1938, J.Drake, (UFVB). 1 m# 1 f# Buenos Aires [34°36'14"S; 58°22'24"W], N.Kormiler, (AMNH). **Tucuman:** 1 m# Tucuman: [34°36'14"S; 58°22'24"W], Xii.1949, Wygodzinsky, (MNRJ). **BRAZIL: Bahia:** 1 m# 1 f# Entre Rios [11°55'60"S; 38°4'60"W], (RBINS). **Mato Grosso:** 1 f# Diamante: [16°31'0"S; 53°13'0"W], 12.ii.65, S.Laroga, (DZUP). **Minas Gerais:** 2 f# Lavras: [21°13'60"S; 45°0'0"W], 7.v.2012, V.Silva, (UFVB). 1 m# 4 f# Viçosa: [20°45'0"S; 42°52'60"W], 6.xii.1978, P. Fiuza & Rossi, (UFVB). **Paraná:** 2 m# 2 f# Castro: [24°46'60"S; 50°0'0"W], iii.1966, (MNRJ). 1 f# Curitiba: [25°25'0"S; 49°15'0"W], 4.iv.1967, (DZUP). 7 m# 8 f# Guarapuava: Cedeteg

Unicentro [25°22'60"S; 58°22'24"W], 25.iv.2007, Profaupar, Avena sativa (Poaceae), P.Chaves, (UFVB); 1 m# 2 f# Est.Aguas Santa Clara, 4.xi.1986, (DZUP). 1 f# São José dos Pinhais: ser. Mar Br 277 [25°31'0"S; 49°13'0"W], 6.x.1986, Profaupar, (DZUP). **Rio Grande do Sul:** 1 f# Cachoeirinha: [29°56'60"S; 51°4'60"W], 22.xi.1980, H. Gastal, (MCNZ). 1 m# 1 f# Esmeralda: E.Ecol. Aracuri [28°3'0"S; 51°12'0"W], 3.ix.1981, J.Grazia, (DZRS). 1 f# Gravatai: Area de GM [29°56'60"S; 50°58'60"W], 25.xi.1999, J.Soledar, (MCNZ). 25 m# 20 f# Ilopolis: [28°55'60"S; 57°7'0"W], 10.xi.2003, (MCN/UNIVATES). 23 m# 8 f# Putinga: [29°0'0"S; 52°8'60"W], 6.xii.2003, (MCN/UNIVATES). 8 f# Rio Grande: Estação Ecologica Taim [32°1'60"S; 52°4'60"W], 17.iii.1982, J.Grazia, (MCNZ). **COLOMBIA: Antioquia:** 12 m# 6 f# Don Matias [6°29'23"S; 75°25'46"W], 16.iv.1999, G. Abril & F. Yepes, (UFVB). 11m# 4 f# Yarumal [6°57'53"S; 75°25'13"W], 16.xii.1999, G. Abril & F. Yepes, (UFVB). **Boyacá:** 15 m# 9 f# Belén [5°57'59"S; 72°54'31"W], 2009, P. Osorio, (UFVB). **Cundinamarca:** 6 m# 10 f# Chia [4°52'0"S; 74°4'0"W], iv.1997, F. Amarillo, Pennisetum clandestinum (Poaceae), (UFVB). 20 m# 20 f# Mosquera: Tibaitatá: [4°22'60"S; 74°28'60"W], iv.1997, 26.vii.2008, (CTNI). 1 m# Venecia: [4°22'60"S; 74°28'60"W], iv.1997, 26.vii.2008, (ICN).

Collaria schwartzi sp.n. Morales, Ferreira & Forero 2015

(Figs. 2, 3, 4, 5, 6, 7, 8, 9, 10, 11)

DIAGNOSIS: Distinguished by the male antennal segment I 4 times the width of other segments (Fig. 2), with medial endosomal sclerite oval with microtrichia on surface (Fig. 5l, 7a), right and left dorsal endosomal sclerite elliptical (Fig. 6e, 7b), posterior wall of female with rounded interramal lobes (Fig. 11k), dorsal structure small, and medial process shaped as an inverted Y (Fig.12k).

DESCRIPTION: Male (holotype): COLORATION: brownish with black and pale yellowish areas. Head: dark brownish; with a V-shaped transversal pale spot posterior to longitudinal sulcus and two spots behind the eyes. Eyes brown; mandibular plate, maxillary plate and apex of buccula, black; labium yellowish with black apex. Clypeus black. Antennal segments: scape yellowish, segment I black, segments II-IV brown. Thorax: pronotum and collar brownish, callus with dark brown lateral margins, inner region of callus reddish brown marbling and pale longitudinal line; two rounded black spots on humeral angles; lateral margins and humeral angles, pale yellowish. Proepisternum black with pale margins. Scutellum, with yellow-pale longitudinal line and pale apex. Hemelytra yellow to straw colored, with dark brown spot in regions of clavus (near to scutellum); internal region of corium extending from the posterior half of claval suture to the base of cuneus, dark brown; external region of embolium and median region of cuneus, brownish; hemelytral membrane, dark brown. Ventral side: black; ostiolar peritrema margins yellowish; median region of abdomen with a black spot; apex of pygophore, black. Legs: pale yellowish; pro- and meso coxae dark brown with pale spots; trochanter

pale; posterior coxa dark brown to pale in apex, femur pale with rounded brown spots; tibia pale brown and tarsus brownish. STRUCTURE: Head: as broader than as long, smooth; Antenna densely pilose with interspersed short pilosity; length of long pilosity greater than the width of segments; segment I strongly thickened (4 times the width of segment II), remaining segments thin and cylindrical. Antennal segment I, 0.8 times the width of head (table 1); segment II 2.5 times longer than I (table 1). Eyes, inner margin slightly sinuous and rounded in posterior margin. Buccula short and antennal sockets not reaching mandibular-maxillary plate suture. Labium smooth shiny with golden sparse semi erect short pilosity, reaching meta coxae; segment I thick, approximately twice the width of segment II, bringing the head base. Thorax: Pronotum with anterior lobe gradually narrowed and lateral margin carinated with long sparse and erect golden pilosity. Pronotal collar well delimited and separated from the pronotum by smooth sulcus with shallow and sparse scores. Callus, convex and well delimited and separated reaching the margin of pronotum; with granulations arranged in an internal bacillary forming irregular patches. Mesoescutum concealed by the posterior margin of the pronotum. Scutellum triangular plane with rough transversal lines and granulated. Proepisternum visible in dorsal view, rounded. Hemelytra smooth with short and sparse erect setae. Ventral side: Abdomen smooth, with semi-erect setae. MEASUREMENTS: see Table 1. GENITALIA: Pygophore: triangular, apex triangular and ventroposterior margin not differentiated (Figs. 3i, 7c), with a left projected lateroposterior margin (Figs. 3i, 7c). Parameres: left paramere in medial view sickle-shape with the medial margin of basal sensory lobe clearly convex and lateral margin of basal sensory lobe almost straight; the hypophysis gradually acuminate to apex (Fig. 4l, 7d), right paramere as in Fig. 7e. Endosoma: with medial endosomal sclerite oval with microtrichia on surface (Fig. 5l, 7a); the ribbonlike endosomal sclerite with short lobe or area beneath secondary gonopore covered with trichia(Fig. 5i, 7a), right dorsal endosomal sclerite elliptical with trichia on surface and left dorsal endosomal sclerite elliptical and with trichia on surface (Fig. 6e, 7b).

Female: (Allotype): Similar to male in color and size, but slightly longer, antennal segment I two times the width of segment II. MEASUREMENTS: Table 1. GENITALIA: First gonapophysis: with broad apical grooved region (Fig. 8i). Second gonapophysis: apex triangular and with one teeth (Fig. 9i). Bursa copulatrix: dorsal

labiate plate with two small sclerites caudal to sclerotized rings (Fig. 10k). Posterior wall with rounded interramal lobes, and anterior angle narrow projected to blunt tip (Fig. 11k). Dorsal structure small and medial process shaped as an inverted Y (Fig.11k).

ETYMOLOGY: This species was named in honor of Michael Schwartz, for his productive taxonomic work on Miridae, especially with subfamily Mirinae.

PLANT ASSOCIATIONS: Unknown.

GEOGRAPHIC DISTRIBUTION: Ranging from Central Africa (Republic of The Congo) to Eastern Africa (Tanzania and Malawi) (Fig. 13).

DISCUSSION: Collaria schwartzi sp. nov. can be easily distinguished from all known Collaria species by the male medial endosomal sclerite oval, right and left dorsal endosomal sclerites elliptical, and the width of segment antennal I in male. This species resembles members C. improvisa Reuter, 1893 with regard to the male genitalia. Collaria schwartzi sp. nov. has the left lateroposterior margin of the pygophore with a prolongation similar to that of C. improvisa (Morales-C et al. In prep.). The dorsal sclerite of endosoma is small, with two sclerites with spicules on surface (without spicules on surface in C. improvisa).

Parameres are similar in all species of the genus (Carvalho & Fontes, 1981), except C.improvisa, C.obscuricornis and C.villiersi, which have the apical curvature strongly angled in realation to the body of the paramere. The right paramere in C. shcwartzi has a broadly rounded protrusion on sensory lobe as in other species of genus (Carvalho & Fontes, 1981; Morales-C et al In prep.). The most similar species to C. schwartzi is C. improvisa, but it is know records are closer to C. obscuricornis throughout most of its range. C. improvisa is distribuited in South and East Africa and C. obscuricornis in East Africa (Linnavuori, 1974). The known localities where C. obscuricornis and C. improvisa where collected and that are closer to Mbeya, the type locality of C. schwartzi are Arusha and Kilinmanjaro in Tanzania.The non-continuous distribution found in Afrotropical species is probably due to poor specimen collection in this region.

Examined material. Holotype: 1 m# **TANZANIA: Mbeya:** Mbeya: Mount Rungwe, SW: [8°54'0"S; 33°27'0"E], 20.viii.1980, M.Stolze & N. Scharff, (ZMUC). **Paratypes:** 2 m# **TANZANIA: Mbeya:** Mbeya: Mount Rungwe, SW: [8°54'0"S; 33°27'0"E], 20.viii.1980, M.Stolze & N. Scharff, (ZMUC). **Allotype:** 1 f# **MALAWI: Zomba:** Zomba: Zomba Plateu: [15°22'60"S;

35°19'60"E], 12-14.xii.1980, M.Stolze & N. Scharff, (NMSA). Other material: **MALAWI: Mzimba:** 1 m# 1 f# Mzuzu: Viphya Mountains [11°27'29"S; 34°0'54"E], 5-8.xii.1980, Stuckenberg & Londt, (NMSA). **Zomba:** Zomba: Zomba Plateu: [15°22'60"S; 35°19'60"E], 12-14.xii.1980, M.Stolze & N. Scharff, 1 m# (NMSA). **REPUBLIC OF THE CONGO: Nord-Kivu:** 2 m# Rwindi: [0°47'5"S; 29°17'16"E], 21.ix.1957, M.Stolze & N. Scharff, (CAS).

Collaria villiersi Carvalho, 1953

(Figs. 2, 4, 5, 6, 8, 9, 10, 11)

Collaria villiersi Carvalho 1953: 3 [n.sp.], Carvalho 1959: 286 [catalog], Schuh 2002-2014 [catalog].

DIAGNOSIS: Recognized by the fuscous to black coloration (Fig. 2g), yellowish lateral margins of collar, endosoma with medial oval endosomal sclerite (Fig. 4m); right dorsal endosomal sclerite elongated and left dorsal endosomal sclerite fusiform (Fig. 6f), female genitalia with posterior wall with rounded interramal lobes (Fig. 11 l), medium dorsal structure and median process shape as an inverted Y (Fig. 10l).

REDESCRIPTION Male: COLORATION: fuscous to black. Head: dark brown with transversal pale spot (V-shaped) posterior to longitudinal sulcus. Eyes black; mandibular plate, maxillary plate and apex of buccula, black; labium yellowish with black apex. Clypeus black. Antennal segments brownish and segment I pale. Thorax: Pronotum black; lateral margins of collar, yellowish. Proepisternum black. Scutellum black. Hemelytra brownish with a dark brown spot in median region; clavus embolium and pale anterior region of cuneus, internal margin of cuneus and hemelytral membrane, dark brown. Ventral side: black with reddish spots; ostiolar peritrema margins reddish. STRUCTURE: Head: slightly broader than long, antenna with short erect pilosity; length of antennal segment I approximately two times the width of head (table 1), width two times the II; segment II 2 times longer than I (table 1). Thorax: Pronotum with anterior lobe abruptly narrowed, with lateral margin carinated and golden, sparse, erect pilosity. MEASUREMENTS: Table 1. GENITALIA: Parameres: left paramere falciform ending in lateral tip with the medial margin of basal sensory lobe almost straight and lateral margin of basal sensory lobe clearly convex; hypophysis with sharp lateral projection (Fig. 4m), right paramere as in Fig. 4m. Endosoma: with medial endosomal sclerite oval and smooth (Fig. 5m); the ribbonlike endosomal sclerite with short lobe or area beneath secondary gonopore covered with microtrichia (Fig. 5m), right dorsal endosomal sclerite elongated with

trichia on surface and left dorsal endosomal sclerite fusiform with apex acute and with trichia on surface (Fig. 6f).

Female (description): Similar to male in color and size, differing by the yellowish color in abdomen. MEASUREMENTS: Table 1. GENITALIA: First gonapophysis: with acute apical grooved region (Fig. 8j). Second gonapophysis: apex triangular with one tooth (Fig. 9j). Bursa copulatrix: dorsal labiate plate with small sclerite caudal to sclerotized rings (Fig. 10l). Posterior wall with rounded interramal lobes, and anterior angle narrow projected to a blunt tip (Fig. 11 l). Dorsal structure, medium, and medial process shaped as an inverted Y (Fig.11 l).

GEOGRAPHIC DISTRIBUTION: This specie is known from Western Africa (Ivory Coast, Ghana, Senegal) (Fig. 13). (Schuh 2002-2014)

PLANT ASSOCIATIONS: unknown.

DISCUSSION: Collaria villiersi is similar to C.nigra in the uniform coloration of pronotum (Fig. 2a,g), but is easily separated from C. nigra by the yellowish lateral margins of collar, endosoma with medial endosomal sclerite oval, right dorsal endosomal sclerite elongated, and left dorsal endosomal sclerite fusiform.

Examined material. Paratypes: 1 m# **CÔTE D'IVOIRE (IVORY COAST): Dix-Huit Montagnes:** Man: Mont Tonkoui: [7°27'0"N; 7°39'0"E], 20.ix, J.Carvalho, (MNRJ). Other material: **GHANA: Eastern Region:** 1 f# Koforidua: Apapam – Atewa Range Forest Reserve [6°4'60"N; 0°15'0"E], 23.vii.1967, D.Leston, (AMNH).

IDENTIFICATION KEY TO THE SPECIES OF COLLARIA

1 Pronotum black with pale humeral angles (Fig. 2 a)... Collaria nigra

- Pronotum differently colored (Figs. 1, 2)... 2

2 Dorsum of head uniformly colored, except black spot on clypeus (Fig. 1c)... Collaria danae

- Dorsum of head with other distinct pale or dark markings (Figs. 1, 2)... 3

3 General body color black (Figs. 1 h, 2g)... 4

- General body color brown (Figs. 1, 2)... 5

4 Pronotum black with lateral margins of collar yellowish (Fig. 2 g); antenna with short thin setae; endosoma with right and left dorsal sclerites (Fig. 6 f); lobal endosomal sclerite absent (Fig. 5 m); medial endosomal sclerite bare (Fig. 5 m);

median process of female posterior wall shaped as an inverted Y (Fig. 11 l)... Collaria villiersi

- Pronotum black with velvety humeral angles (Fig. 1 h); antenna with semi-erect short trichia; endosoma only with right dorsal sclerite (Fig. 6 b); lobal endosomal sclerite present (Fig. 5 g); medial endosmal sclerite covered by short trichia (Fig. 5 g); median process of female posterior wall arrow-shaped (Fig. 11 f)... Collaria meilleurii

5 Pronotum glabrous or almost glabrous... 6

- Pronotum with distinct sparse pilosity... 7

6 Male medial endosomal sclerite elongated and smooth (Fig. 5 h); right dorsal endosomal sclerite with trichia on surface (Fig. 6 c); apex of left dorsal endosomal sclerite acute (Fig. 6 c); female dorsal structure much shorter than interramal lobes (Fig. 11 g)... Collaria obscuricornis

- Male medial endosomal sclerite short and covered by trichia (Fig. 5 e); right dorsal endosomal sclerite smooth (Fig. 6 a); apex of left dorsal endosomal sclerite broad (Fig. 6 a); female dorsal structure as long as interramal lobes (Fig. 11 e)... Collaria improvisa

7 Head with a Y-shaped spot on frons (Fig. 1b, d; 2 d)... 8

- Head with a V-shaped pale stripe behind posterior margin of eyes (Figs. 2 e, f) or with a transversal stripe between the eyes (Fig.1 a, e, h; 2 c)... 10

8 Mandibular plate, maxillary plate, and buccula with black spots; sclerite on male secondary gonopore large (Fig. 5 c)... Collaria guaraniana

- Mandibular plate, maxillary plate, and buccula uniformly brown; sclerite on male secondary gonopore small or absent (Fig. 5)... 9

9 Sclerite on secondary gonopore small (Fig. 5 b); lobal endosomal sclerite present (Fig. 5 b); posterior endosomal sclerite absent; interramal lobes of female posterior wall rounded (Fig. 11 b)... Collaria capixaba

- Sclerite on secondary gonopore absent (Fig. 5 j); lobal endosomal sclerite absent (Fig. 5 j); posterior endosomal sclerite present (Fig. 5 j); interramal lobes of female posterior wall triangular (Fig. 11 i)... Collaria oleosa

10 Head with a transverse V-shaped stripe behind posterior margin of eyes (Fig. 2 e, f)... 11

- Head with a transversal stripe between the eyes (Fig. 1 a, e, g; 2 c)... 12

11 Male antennal segment I with two times the width of II; posterior endosomal sclerite present (Fig. 5k); medial endosomal sclerite absent (Fig. 5 k); right and left dorsal endosomal sclerites absent; interramal lobes of female posterior wall triangular (Fig. 11 j)... Collaria scenica

- Male antennal segment I with four times the width of II; posterior endosomal sclerite absent (Fig. 5 l; 7a); medial endosomal sclerite present (Fig. 5l; 7a); right and left dorsal endosomal sclerites present (Fig. 5 l; 7 b); interramal lobes of female posterior wall rounded (Fig. 11 k)... Collaria schwartzi **sp. nov.**

12 Clypeus in dorsal view with a black spot (Fig. 1 a); hemelytra dark brown with two lateral pairs of irregular pale spots proximally (Fig. 1 a); endosoma with sclerite on secondary gonopore small (Fig. 5 a); ribbonlike endosomal sclerite brush-shaped, with abundant spines and filaments at base (Fig. 5 a); lobal endosomal sclerite extremely elongated, distinctly surpassing apex of endosoma (Fig. 5 a)... Collaria boliviana

- Clypeus uniformly yellowish to brownish; hemelytra light brown to brown and differently marked; endosoma with sclerite on secondary gonopore absent (Fig. 5 d, i, f); ribbonlike endosomal sclerite differently shaped, armed only with small trichia (Fig. 5 d, i, f); lobal endosomal sclerite shorter, at most slightly passing apex of endosoma (Fig. 5 d, i, f)... 13

13 Embolium with two times the width of antennal segment I (Fig. 2 c); medial endosomal sclerite present (Fig. 5 i); right dorsal endosomal sclerite present (Fig. 6 d)... Collaria oculata

- Embolium narrower or at most as wide as antennal segment I (Fig. e, g); medial endosomal sclerite absent (Fig. d, f); dorsal endosomal sclerites absent... 14

14 Antennal segment I with pilosity shorter than diameter of segment; hemelytra entirely light brown (Fig. 1 g); endosoma with sclerite on secondary gonopore absent (Fig. 5 f); lobal endosomal sclerite with trichia on basal and medial regions (Fig. 5 f)... Collaria manoloi

- Antennal segment I with pilosity longer than diameter of segment; hemelytra light brown with paler markings (Fig. 1 e); endosoma with sclerite on secondary gonopore large (Fig. 5 d); lobal endosomal sclerite with trichia along entire surface (Fig. 5 d)... Collaria husseyi

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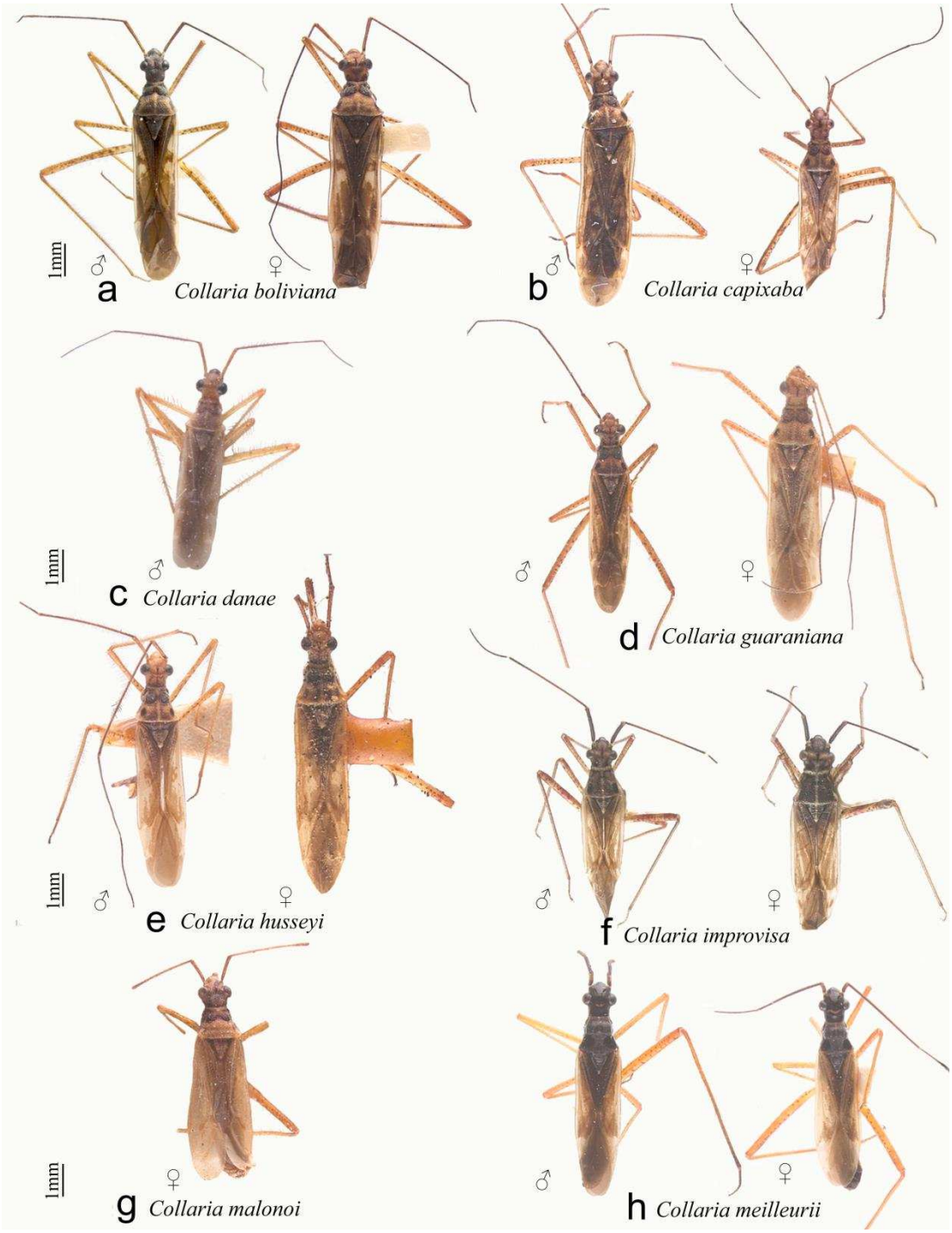

Figure 1. Photographs of the dorsal habitus of Collaria. Scale 1mm.

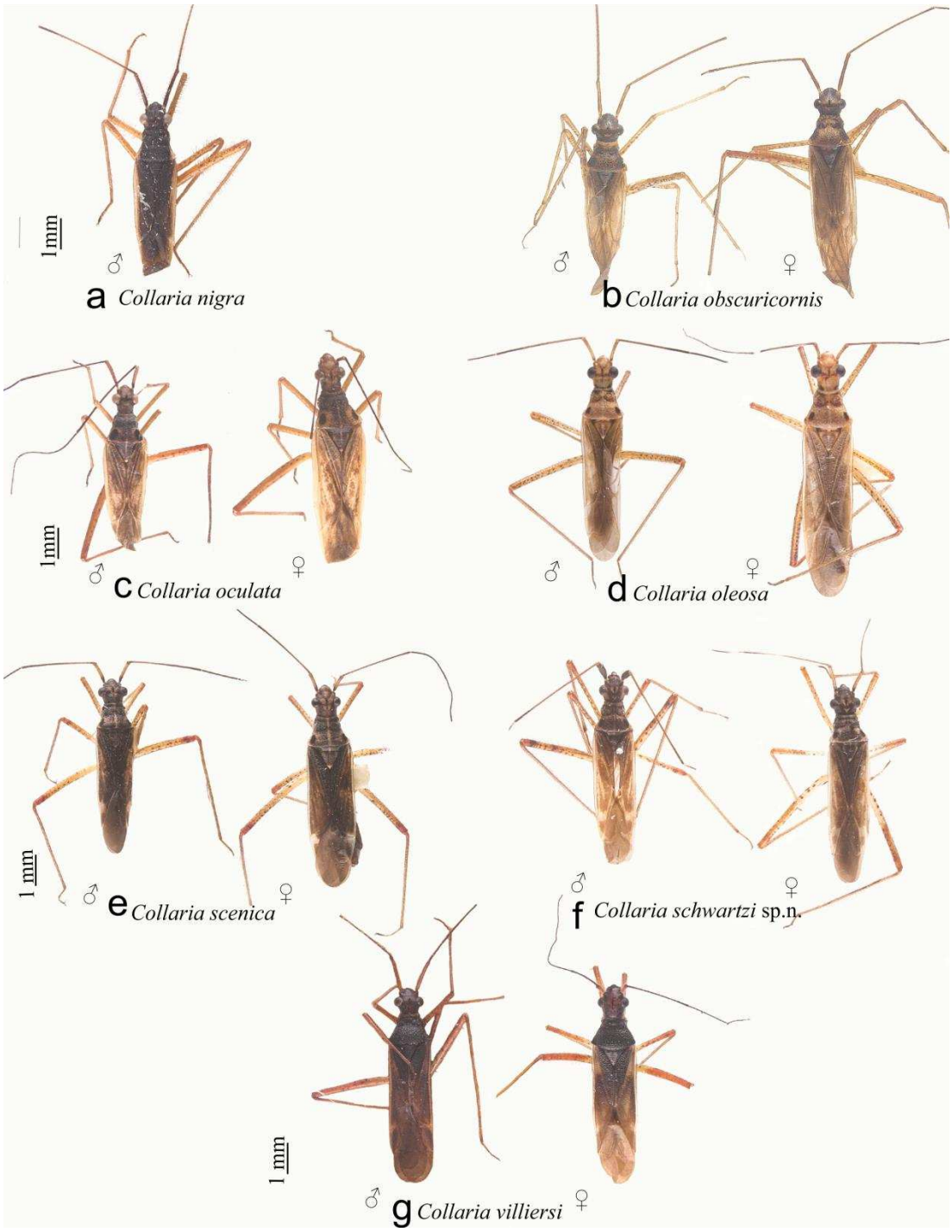

Figure 2. Photographs of the dorsal habitus of Collaria. Scale 1mm.

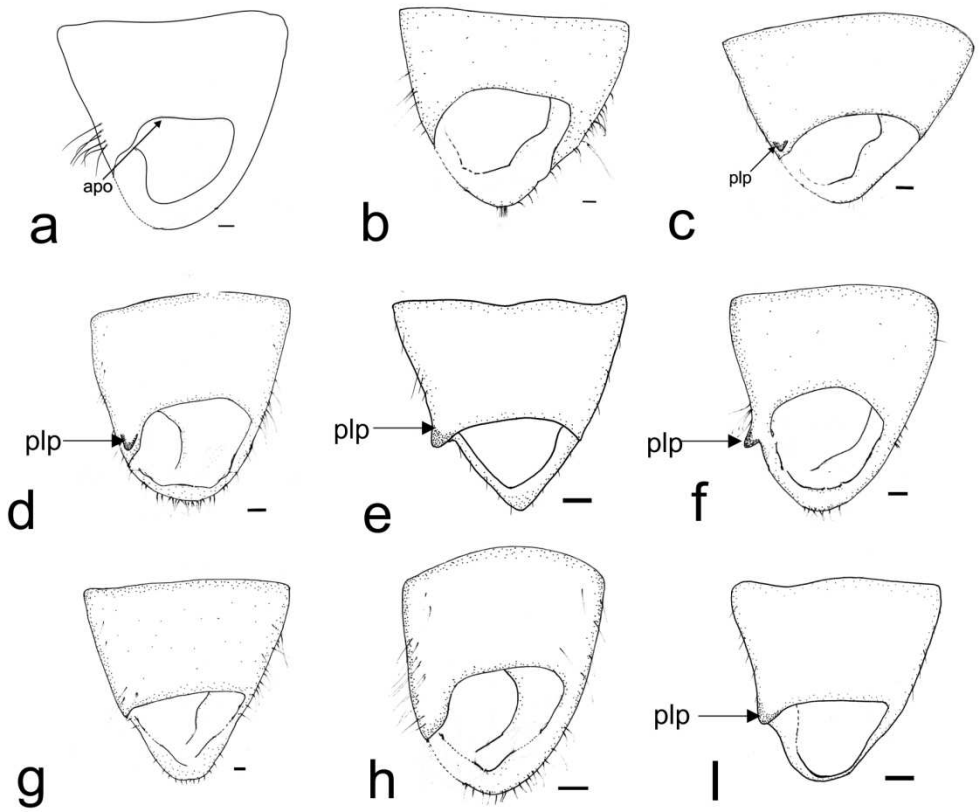

Figure 3. Pygophore in dorsal view. Collaria spp. Scale 1 mm. a. C. boliviana, b. C. capixaba, c. C. improvisa, d. C. meilleurii, e. C. obscuricornis, f. C. oculata, g. C. oleosa, h. C. scenica, i. C. schwartzi **sp. nov**, Anterior opening of pygophore (apo), prolongation of lateroposterior margin of pygophore (plp).

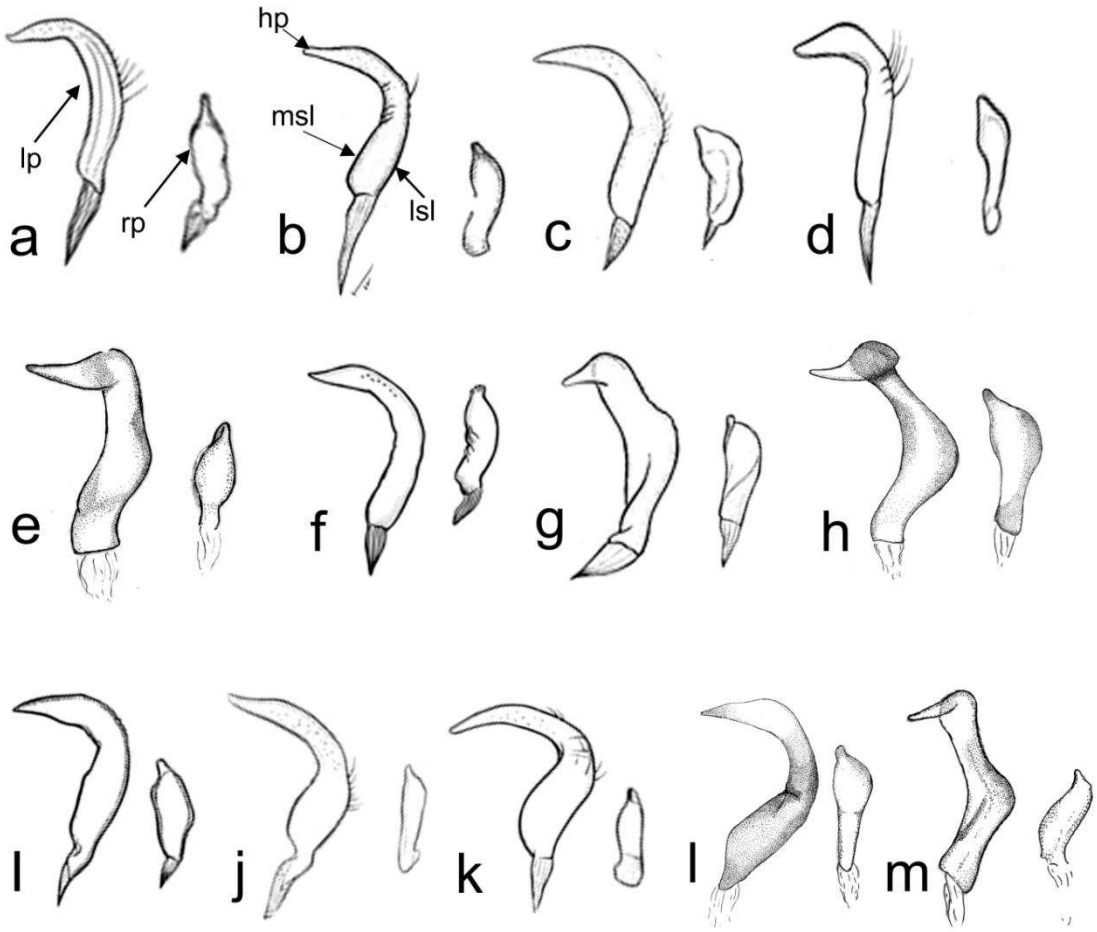

Figure 4. Male left and right parameres of Collaria spp. a. C. boliviana (modified from Carvalho, 1990), b. C. capixaba, c. C. guaraniana, d. C. husseyi, e. C. improvisa, f. C. malonoi (modified from Carvalho & Carpintero, 1989), g. C. meilleurii, h. C. obscuricornis, i. C. oculata, j. C. oleosa, k. C. scenica l. C. schwartzi **sp. nov.**, m. C. villiersi. (Figs. b, c, d, f, g, i, j, k, modified from Carvalho & Fontes, 1981). Hypophysis (hp), lateral margin of basal sensory lobe of paramere (lsl), left paramere (lp), medial margin of basal sensory lobe of paramere (msl), right paramere (rp) .

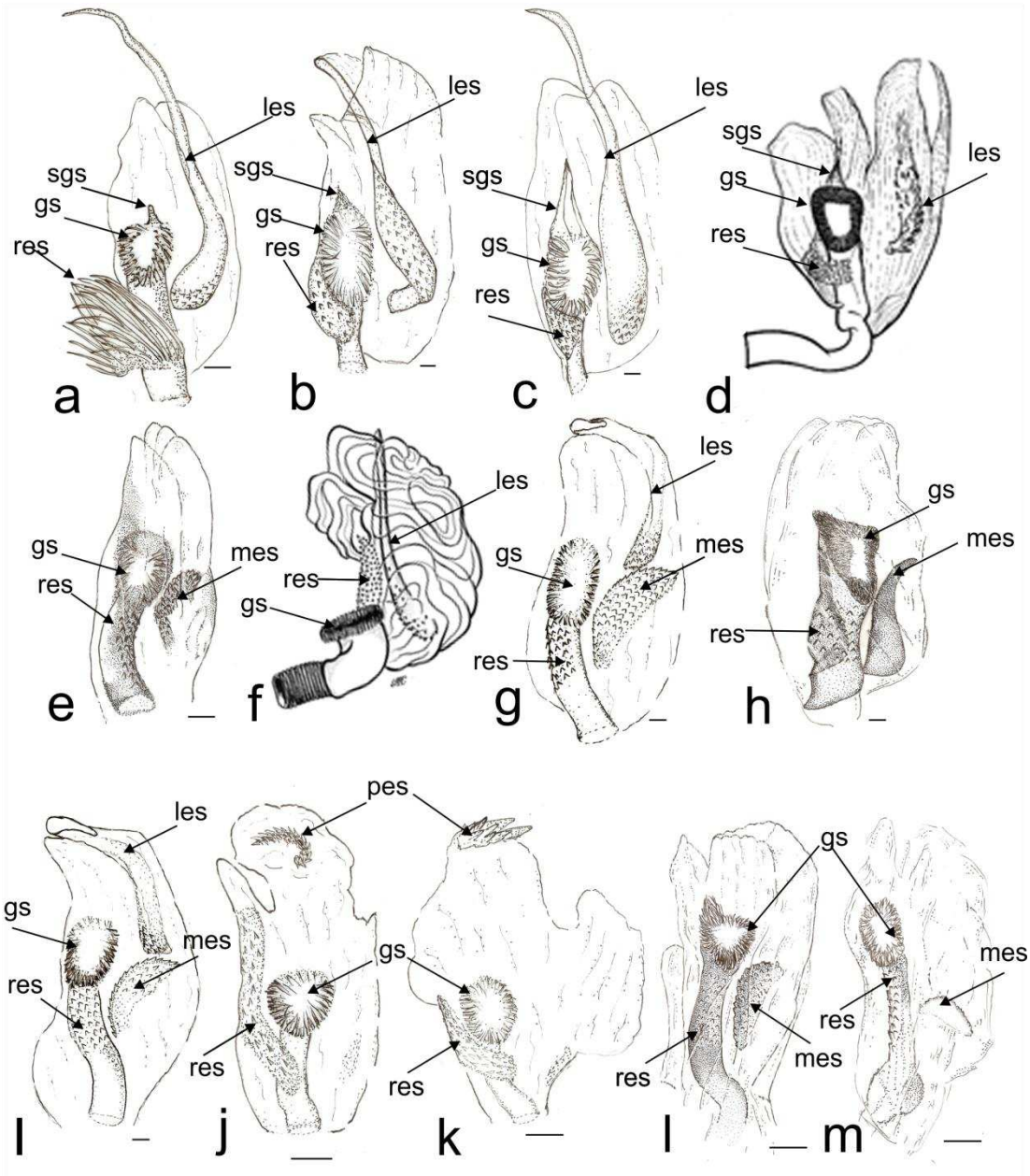

Figure 5. Male endosoma in ventral view. Scale 1 mm. a. C. boliviana, b. C. capixaba, c. C. guaraniana, d. C. husseyi (modified from Carvalho & Fontes, 1981), e. C. improvisa, f. C. malonoi (modified from Carvalho & Carpintero, 1989), g. C. meilleurii, h. C. obscuricornis, i. C. oculata, j. C. oleosa, k. C. scenica, l. C. schwartzi **sp. nov.**, m. C. villiersi. Lobal endosomal sclerite (les), medial endosomal sclerite (mes), posterior endosomal sclerite (pes), ribbonlike endosomal sclerite (res), secondary gonopore (gs), sclerite of the secondary gonopore (sgs).

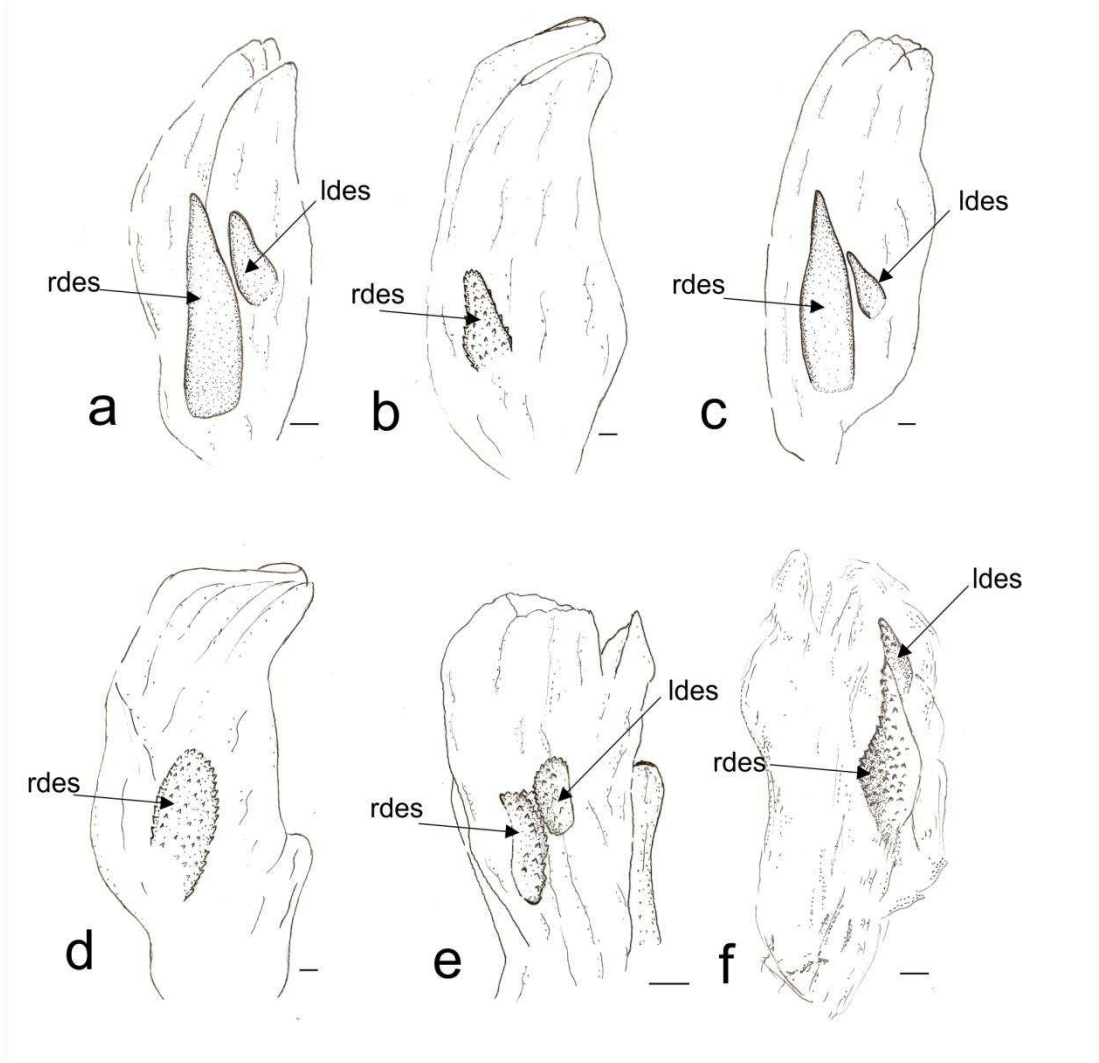

Figure 6. Male endosoma in dorsal view. Scale 1 mm. a. C. improvisa, b. C. meilleurii, c. C. obscuricornis, d. C. oculata, e. C. schwartzi **sp. nov.**, f. C. villiersi. Left dorsal endosomal sclerite (ldes), right dorsal endosomal sclerite (rdes).

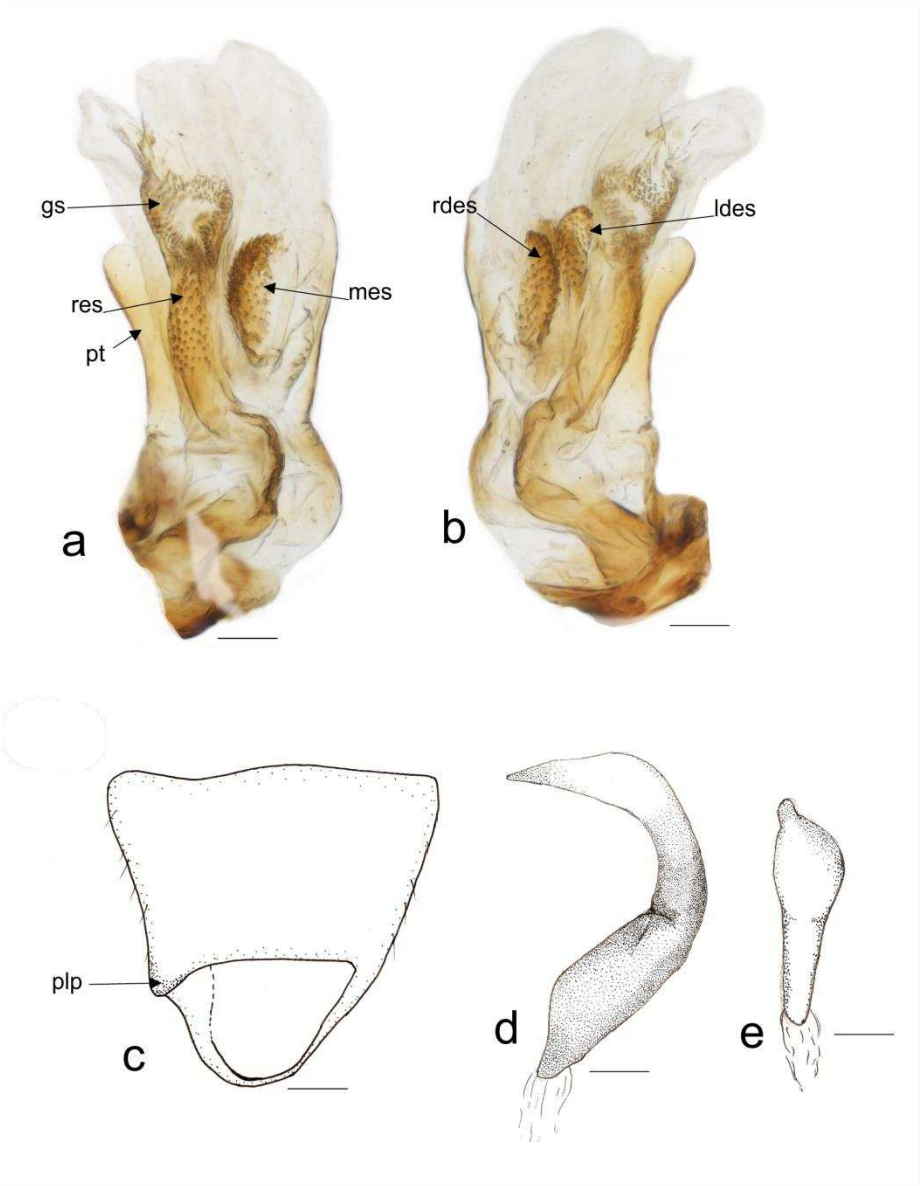

Figure 7. Male genitalia of Collaria schwartzi **sp. nov.** Scale 1 mm. a. Endosoma ventral view, b. Endosoma dorsal view c. Pygophore, d. Left paramere, e. Right paramere. Medial endosomal sclerite (mes), Left dorsal endosomal sclerite (ldes), right dorsal endosomal sclerite (rdes), ribbonlike endosomal sclerite (res), secondary gonopore (gs), sclerite of the secondary gonopore (sgs).

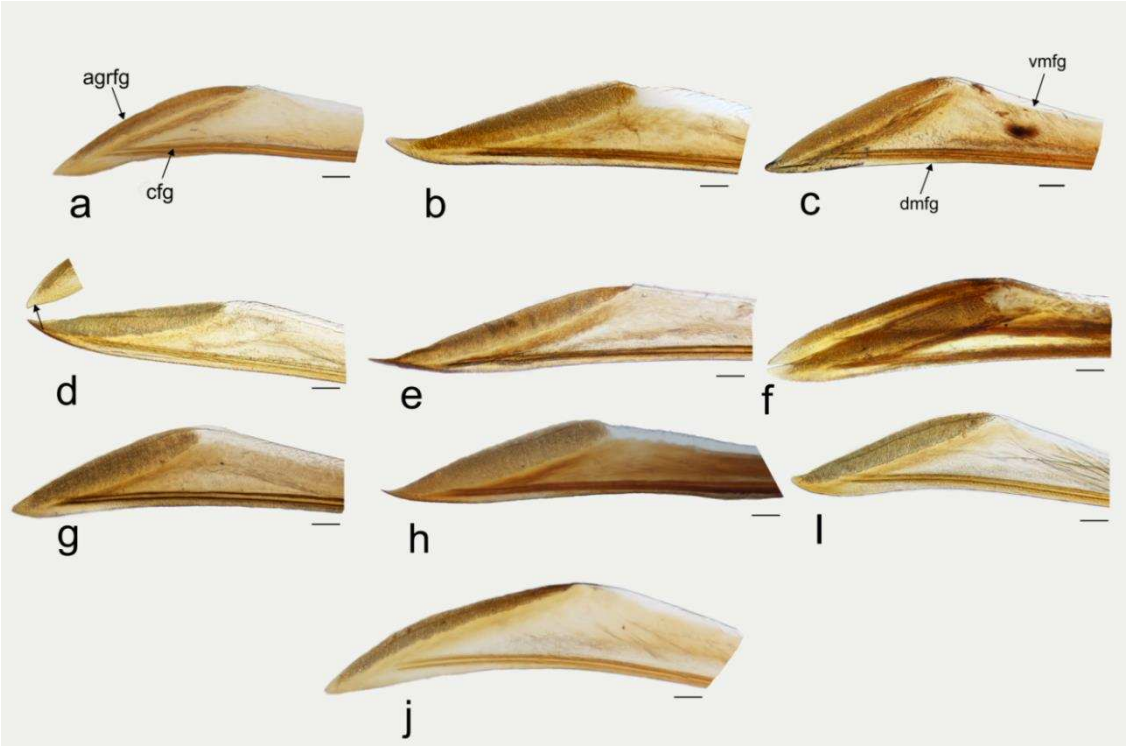

Figure 8. Apex of first gonapophysis in lateral view. Collaria spp. Scale 5µ. a. C. boliviana, b. C. capixaba, c. C. improvisa, d.C. meilleurii, e. C. obscuricornis, f. C. oculata, g. C. oleosa, h. C. scenica, i. C. schwartzi **sp. nov.**, j. C. villiersi. Apical grooved region of first gonapophysis (agrfg), dorsal margin of first gonapophysis (dmfg), carina of first gonapophysis (cfg), ventral margin of first gonapophysis (vmfg).

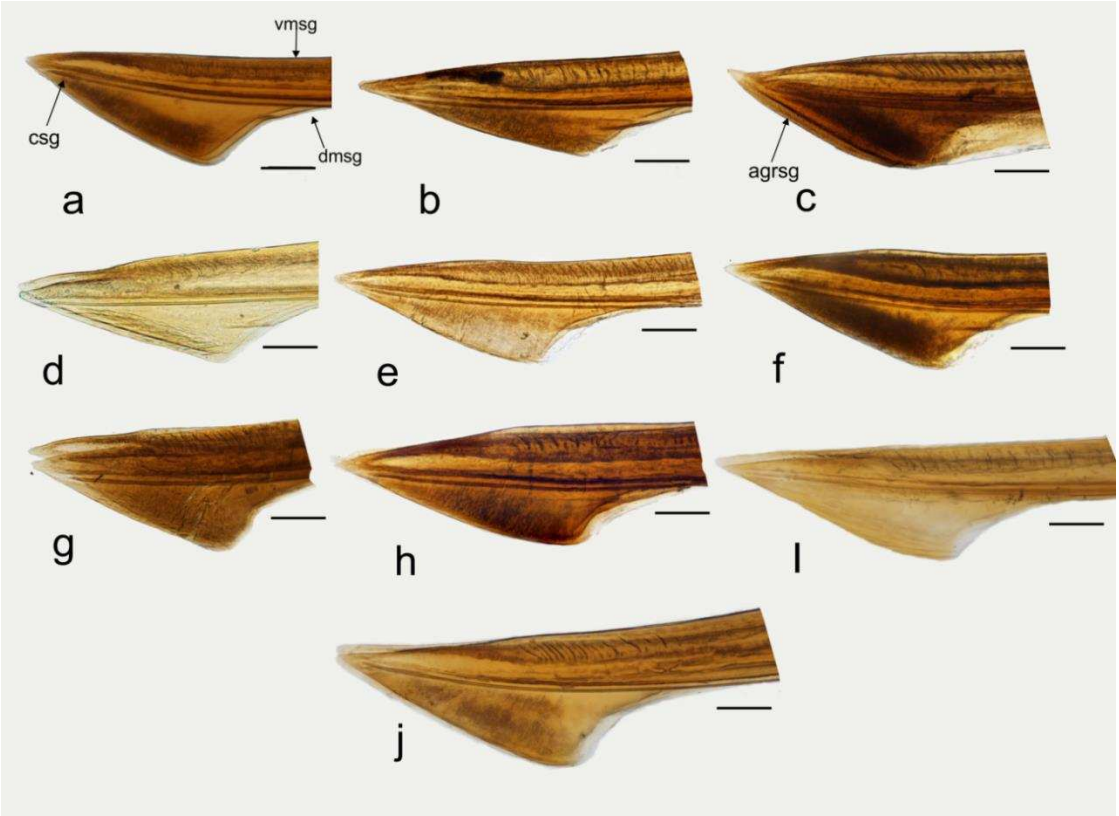

Figure 9. Apex of second gonapophysis in lateral view. Collaria spp. Scale 5µ. a. C. boliviana, b. C. capixaba, c. C. improvisa, d.C. meilleurii, e. C. obscuricornis, f. C. oculata, g. C. oleosa, h. C. scenica, i. C. schwartzi **sp. nov.**, j. C. villiersi. Apical grooved region of second gonapophysis (agrsg), dorsal margin of second gonapophysis (dmsg), carina of second gonapophysis (csg), ventral margin of second gonapophysis (vmsg).

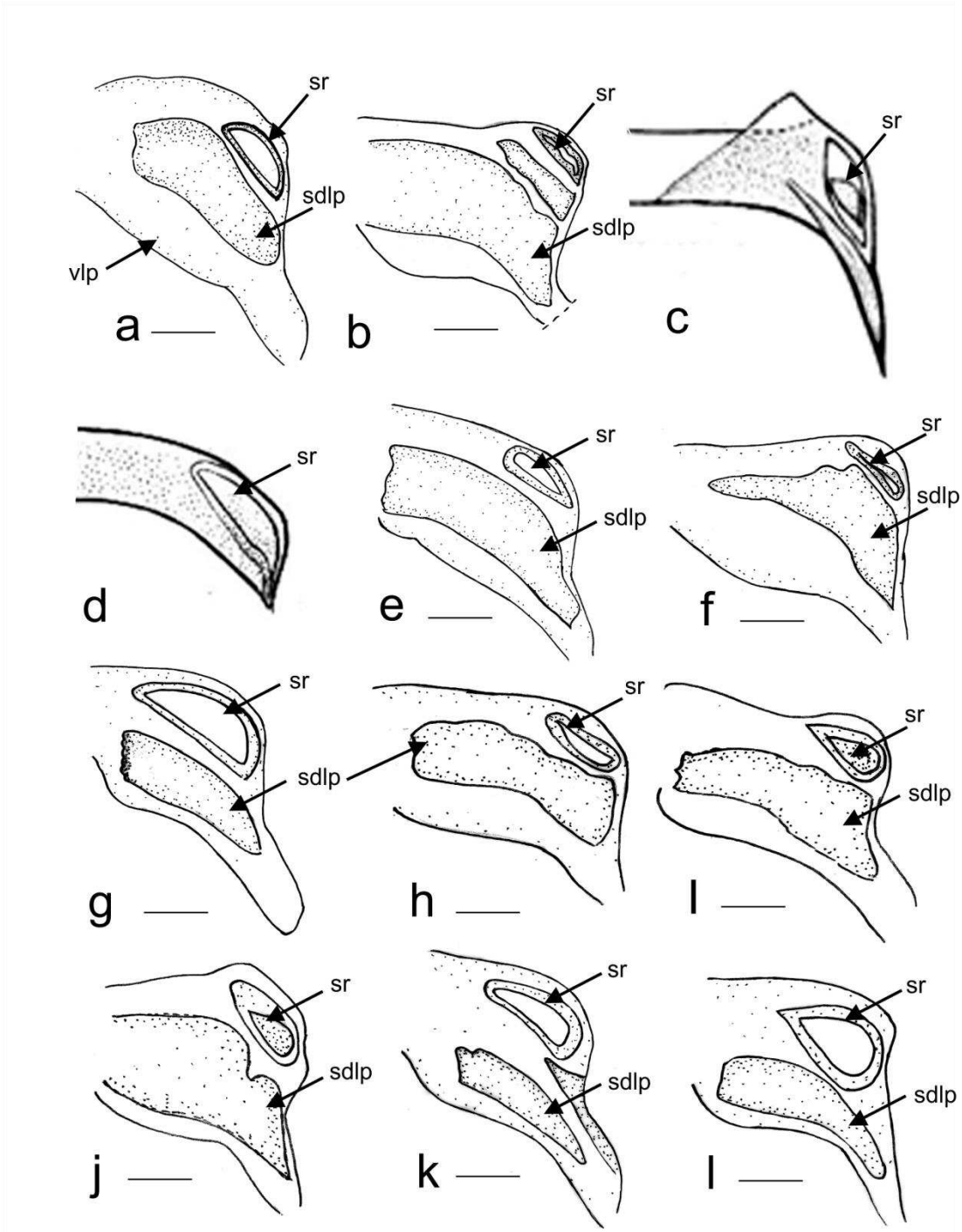

Figure 10. Dorsal labiate plate with sclerotized rings. Scale 1 mm. a. C. boliviana, b. C. capixaba, c. C. guaraniana, d. C. husseyi (c,d modified from Carvalho & Fontes, 1981), e. C. improvisa, f. C. meilleurii, g. C. obscuricornis, h. C. oculata, i. C. oleosa, j. C. scenica, k. C. schwartzi **sp. nov.**, l. C. villiersi. Sclerotization of dorsal labiate plate (sdlp), sclerotized ring (sr), ventral labiate plate (vlp).

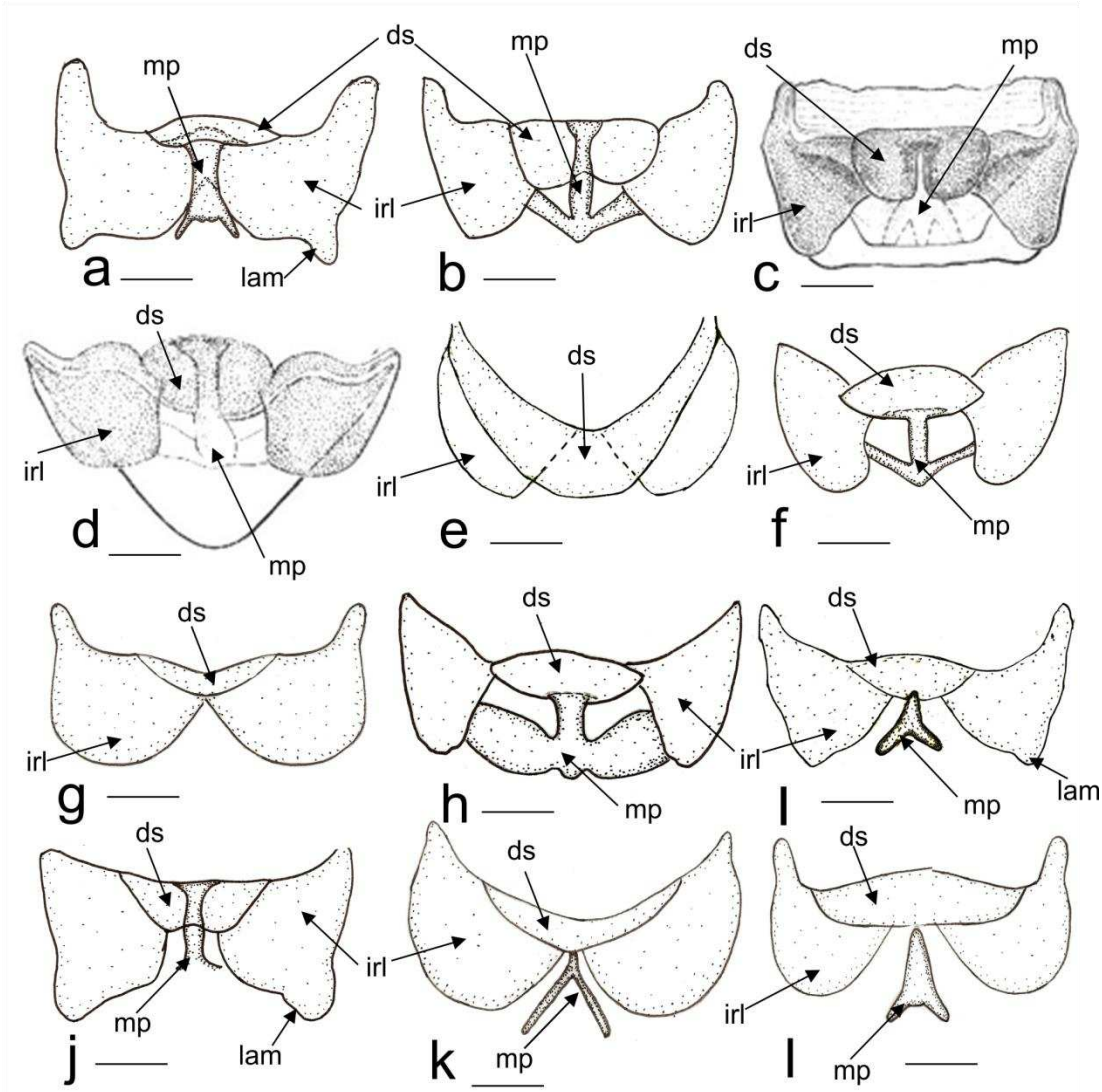

Figure 11. Posterior wall of Collaria spp. C. boliviana, b. C. capixaba, c. C. guaraniana, d. C. husseyi (c,d modified from Carvalho & Fontes, 1981), e. C. improvisa, f. C. meilleurii, g. C. obscuricornis, h. C. oculata, i. C. oleosa, j. C. scenica, k. C. schwartzi **sp. nov**., l. C. villiersi. Dorsal structure of posterior wall (ds), interramal lobe of posterior wall (irl), lateroapical margin of interramal lobe (lam), medial process of posterior wall (mp).

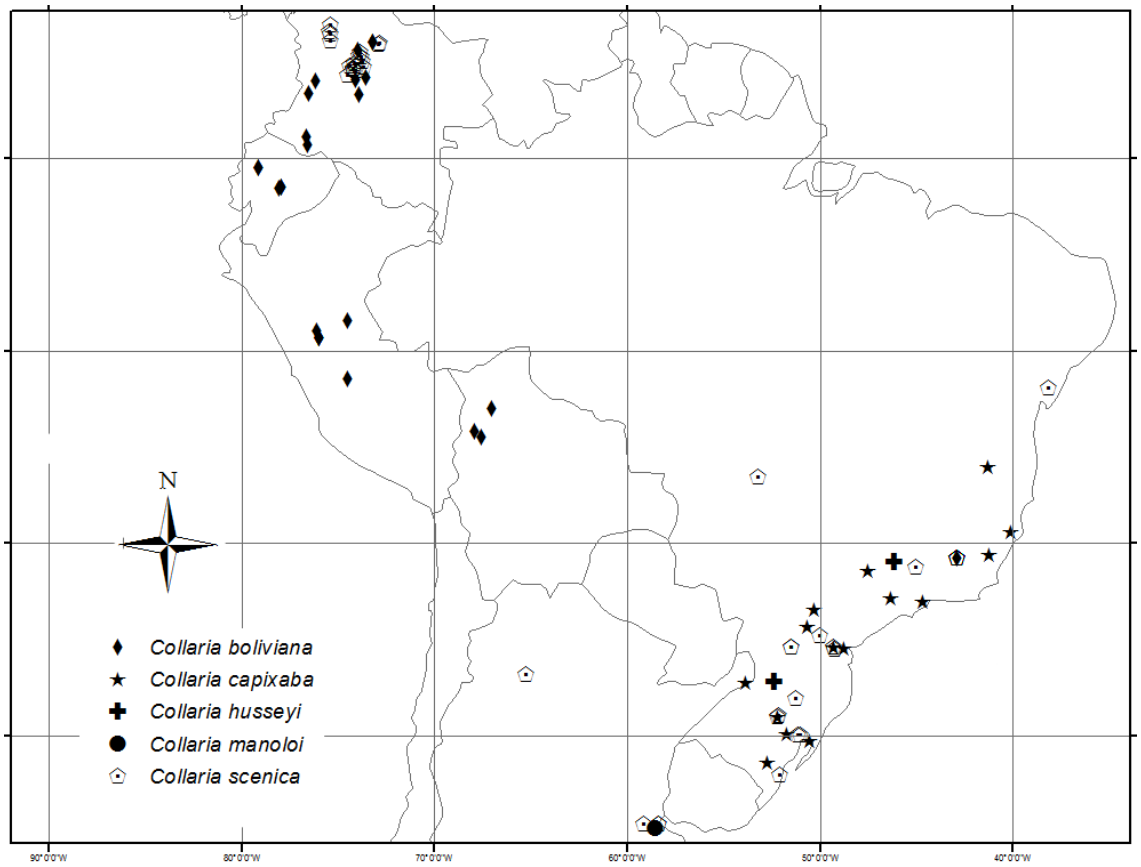

Figure 12. Distribution map for Collaria boliviana, Collaria capixaba, Collaria husseyi, Collaria malonoi and Collaria scenica.

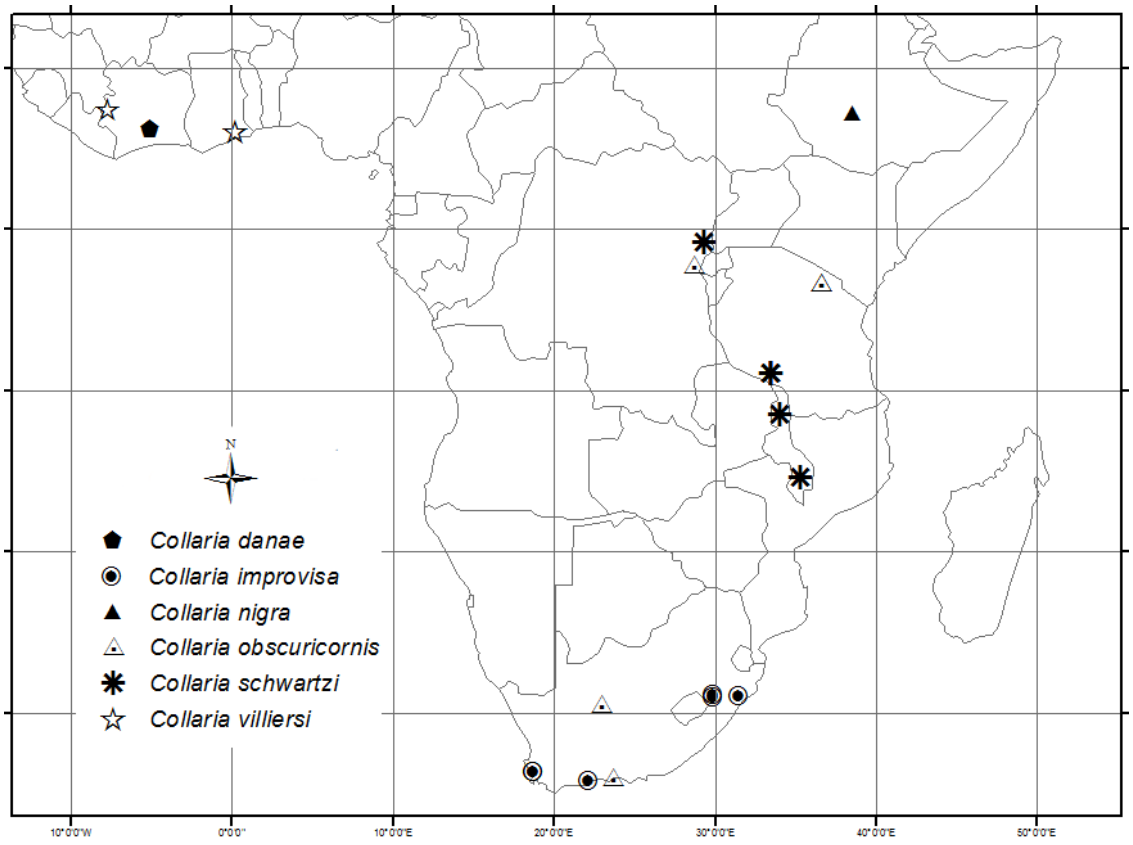

Figure 13. Distribution map for Collaria danae, Collaria improvisa, Collaria nigra, Collaria obscuricornis, Collaria schwartzi **sp.nov** and Collaria villiersi.

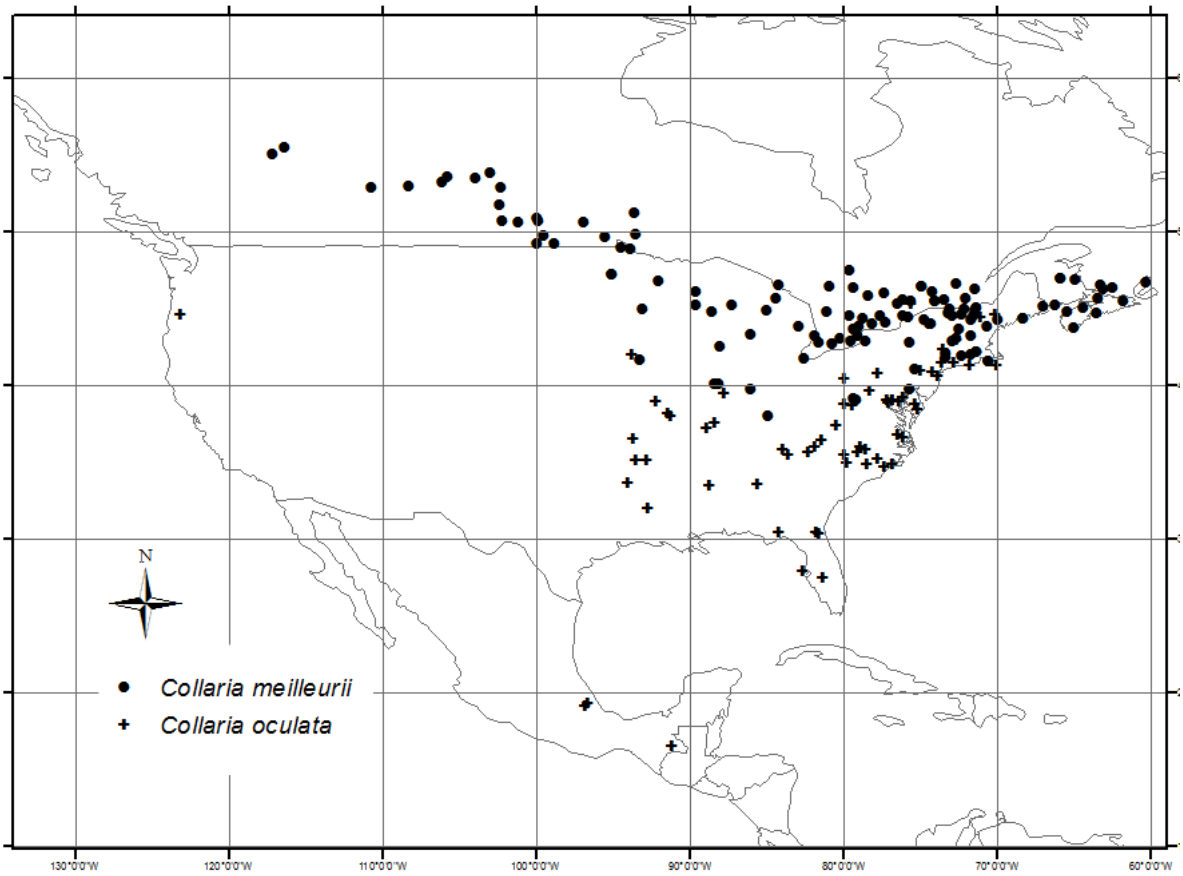

Figure 14. Distribution map for Collaria meilleurii and Collaria oculata.

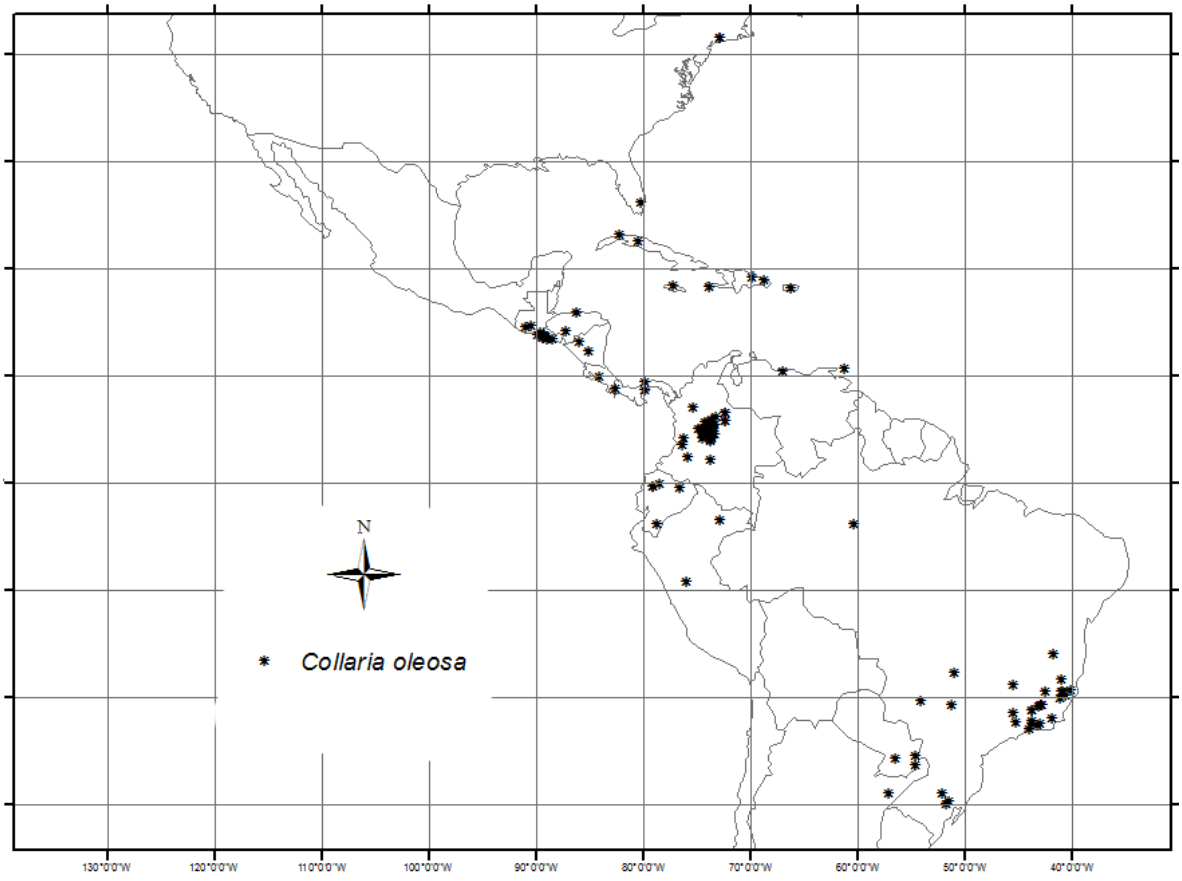

Figure 15. Distribution map for Collaria oleosa.

Table 1. Measurements of species of Collaria. Ant I: Antennal segment I, Ant II: Antennal segment II, Ant III: Antennal segment III, Ant IV: Antennal segment IV, Pron: Pronotum, Lab: Labium, Scut: Scutellum, HFem: Hind Femur, HTib: Hind Tibia, HTar: Hind Tarsus, IntOcDi: Interocular distance.

		Length													**Width**					
Species		Body	Head	Ant I	Ant II	Ant III	Ant IV	Pron	Cuneus	Lab	Scut	HFem	HTib	Htar	Body	Head	IntOcDi	Pron	Cuneus	Scut
Collaria boliviana																				
Female (N= 10)	Mean	7.06	1.08	0.9	2.87	2.29	1.25	0.89	0.86	3.1	0.78	2.71	3.63	0.84	1.47	0.96	0.47	1.34	0.42	0.75
	SD	0.43	0.06	0.27	0.33	0.45	0.33	0.12	0.11	0.2	0.06	0.47	0.79	0.11	0.2	0.12	0.07	0.22	0.08	0.1
	Min.	6.4	0.97	0.5	2.35	1.23	0.7	0.61	0.69	2.7	0.67	1.67	2.04	0.67	1.09	0.68	0.28	0.86	0.3	0.58
	Max.	7.82	1.17	1.25	3.46	2.88	1.8	1.05	1.07	3.3	0.85	3.39	4.75	0.99	1.68	1.07	0.53	1.54	0.6	0.91
Male (N= 10)	Mean	6.18	0.96	1.12	3.2	-	-	0.87	0.76	2.9	0.69	2.64	3.59	0.85	1.23	0.94	0.43	1.25	0.35	0.72
	SD	0.6	0.15	0.18	0.24	-	-	0.12	0.05	0.2	0.05	0.85	0.28	0.11	0.13	0.04	0.04	0.06	0.03	0.07
	Min.	5.05	0.63	0.68	2.77	-	-	0.65	0.65	2.6	0.62	0.4	3.09	0.63	0.98	0.87	0.38	1.17	0.31	0.55
	Max.	6.91	1.15	1.29	3.53	-	-	1.03	0.85	3.3	0.79	3.55	4.15	1.07	1.46	1.01	0.5	1.36	0.41	0.78
Collaria capixaba																				
Female (N= 8)	Mean	6.53	0.96	0.95	2.95	-	-	0.89	0.79	2.8	0.78	2.87	3.87	0.78	1.46	0.94	0.94	1.39	0.37	0.85
	SD	0.51	0.11	0.14	0.25	-	-	0.09	0.07	0.5	0.09	0.23	0.47	0.03	0.16	0.05	0.05	0.12	0.04	0.13
	Min.	5.74	0.84	0.66	2.66	-	-	0.74	0.69	1.9	0.62	2.7	3.24	0.72	1.24	0.88	0.88	1.23	0.3	0.61
	Max.	7.19	1.19	1.1	3.37	-	-	0.99	0.86	3.3	0.91	3.34	4.55	0.83	1.64	1	1	1.53	0.41	1.04
Male (N=8)	Mean	6.22	1.01	0.9	3.16	2.04	1.62	0.86	0.71	2.6	0.68	2.57	3.51	0.81	1.4	0.93	0.45	1.31	0.35	0.71
	SD	0.32	0.06	0.19	0.32	0.09	0.29	0.08	0.07	0.2	0.05	0.37	0.67	0.06	0.15	0.04	0.02	0.05	0.03	0.05
	Min.	5.65	0.94	0.57	2.59	1.93	1	0.71	0.58	2.3	0.6	1.96	2.54	0.7	1.19	0.85	0.41	1.27	0.32	0.62
	Max.	6.71	1.09	1.17	3.59	2.24	1.89	0.94	0.79	2.9	0.73	3.1	4.33	0.9	1.61	0.98	0.48	1.39	0.39	0.76
Collaria danae																				
Male (N= 1)	Value	6.01	0.95	0.91	2.56	2.21	1.52	0.8	0.82		0.61	2.31	3.76		0.42	0.94	0.41	1.12	0.42	0.62

Collaria guaraniana																			
Female (N= 1)	Value	7.29	1.19	1.16	3.19	2.43	1.88	0.96	0.8	2.8	0.74	2.31	4.27	0.78	1.64	1.02	0.52	1.49	0.39	0.77
Male (N= 1)	Value	6.34	1.03	0.9	2.43	1.96	-	0.86	0.79	2.8	0.62	2.6	4.05		1.3	1.02	0.45	1.25	0.37	0.7
Collaria husseyi																			
Female (N= 1)	Value	8.31	1.4	1.22	-	-	-	1.08	1.01	3	0.75	4.34	4.41	0.64	1.67	1.1	0.48	1.53	0.47	0.76
Male (N= 1)	Value	7.37	1.11	0.74	3.88	2.7	2.19	0.98	0.83	3	0.81	2.01	3.03	0.89	1.47	1.04	0.44	1.4	0.43	0.95
Collaria improvisa																			
Female (N= 3)	Mean	5.46	0.96	0.96	2.22	-	-	0.8	0.69	2.4	0.5	2.08	3.38	0.64	1.33	0.95	0.51	1.28	0.35	0.61
	SD	0.15	0.05	0.16	0.17	-	-	0.03	0.1	0	0.03	0.61	0.44	0.27	0.04	0.01	0.07	0.05	0.05	0.07
	Min.	5.31	0.9	0.78	2.05	-	-	0.78	0.6	2.4	0.47	1.45	3.03	0.37	1.29	0.94	0.45	1.25	0.3	0.55
	Max.	5.6	0.99	1.07	2.39	-	-	0.84	0.8	2.5	0.53	2.66	3.87	0.91	1.37	0.96	0.59	1.33	0.4	0.68
Male (N= 2)	Mean	5.12	0.88	0.95	2.31	-	-	0.75	0.58	2.1	0.45	2.06	3.12	-	1.15	0.87	0.46	1.15	0.25	0.48
	SD	0.29	0.01	0.01	0.37	-	-	0.03	0.04	0.3	0.05	0.13	0.23	-	-	0.03	0.04	0.06	-	0.09
	Min.	4.91	0.87	0.94	2.04	-	-	0.73	0.56	1.9	0.41	1.97	2.95	-	-	0.85	0.43	1.1	-	0.42
	Max.	5.32	0.88	0.96	2.57	-	-	0.77	0.61	2.3	0.48	2.15	3.28	-	-	0.89	0.48	1.19	-	0.55
Collaria manoloi																			
Female (N= 1)	Value	6.28	0.98	0.75	2.47			0.86	0.8	-	0.67	-	-	-	1.79	1.04	0.49	1.37	0.36	0.79
Collaria meilleurii																			
Female (N=2)	Mean	6.78	5.43	0.6	0.68	-	-	3.38	1.33	0.4	2.95	0.69	2.73	-	-	1.08	1.09	0.96	-	0.71
	SD	0.51	0.5	0.02	0.01	-	-	0.25	0.01	0	0.13	0.05	1.11	-	-	0.26	0.03	0.08	-	0.01
	Min.	6.42	5.08	0.59	0.67	-	-	3.21	1.33	0.4	2.86	0.65	1.94	-	-	0.9	1.07	0.9	-	0.7
	Max.	7.14	5.79	0.62	0.68	-	-	3.56	1.34	0.5	3.04	0.72	3.51	-	-	1.27	1.11	1.02	-	0.72
Male (N= 2)	Mean	6.36	1.06	0.77	4.02	-	-	0.98	0.86	2.6	0.69	-	-	-	1.44	1.04	0.55	1.24	0.35	0.72
	SD	0.24	0.03	0.01	0.27	-	-	0.04	0.12	0.1	0.01	-	-	-	0.05	0.06	0.05	0.01	0.04	0

	Min.	6.19	1.04	0.76	3.83	-	-	0.95	0.78	2.6	0.68	-	-	-	1.4	1	0.51	1.23	0.33	0.72
	Max.	6.53	1.08	0.78	4.21	-	-	1.01	0.95	2.7	0.7	-	-	-	1.47	1.08	0.58	1.24	0.38	0.72
Collaria nigra																				
Male (N= 1)	Value	5.66	0.9	1.21	3.45	2.18	-	0.84	0.78	-	0.64	2.65	4.27	0.96	1.32	1.06	0.55	1.34	0.35	0.68
Collaria obscuricornis																				
Female (N= 1)	Value	6.76	4.92	0.53	1.24	-	-	3.12	1.43	0.8	0.89	3.04	4.44	-	-	0.94	1.04	0.84	-	0.81
Male (N= 2)	Mean	5.59	0.84	1.02	3	-	-	1.99	1.29	0.8	0.53	2.29	3.85	-	-	0.97	0.51	0.79	-	0.56
	SD	0.33	0.04	0.09	0.38	-	-	0.16	0.08	0.1	0.06	0.21	0.63	-	-	0.11	0.03	0.04	-	0.01
	Min.	5.36	0.81	0.96	2.73	-	-	1.88	1.23	0.7	0.49	2.14	3.4	-	-	0.9	0.49	0.76	-	0.55
	Max.	5.83	0.87	1.09	3.27	-	-	2.1	1.35	0.9	0.57	2.43	4.29	-		1.05	0.53	0.81	-	0.56
Collaria oculata																				
Female (N= 2)	Mean	6.67	5.21	0.44	0.63	-	-	2.42	0.94	1.5	0.86	2.67	0.74	-	-	1.09	0.94	1.75	-	0.4
	SD	0.64	0.1	0.06	0.11	-	-	0.08	0.01	0	0.22	0.18	0.01	-	-	0.07	0.03	0.71	-	0.08
	Min.	6.21	5.14	0.4	0.55	-	-	2.36	0.94	1.4	0.71	2.54	0.74	-	-	1.04	0.92	1.25	-	0.34
	Max.	7.12	5.28	0.48	0.71	-	-	2.47	0.95	1.5	1.02	2.79	0.75	-	-	1.14	0.96	2.26	-	0.45
Male (N= 2)	Mean	5.44	4.33	0.39	0.72	-	-	2.66	0.8	1.2	0.67	0.65	0.69	-	-	0.92	0.86	1.89	-	2.37
	SD	0.34	0.06	0.01	0.11	-	-	0.16	0.01	0	0.03	0.04	0.08	-	-	0.05	0.02	0.17	-	0.2
	Min.	5.2	4.29	0.38	0.64	-	-	2.55	0.79	1.2	0.65	0.62	0.63	-	-	0.88	0.85	1.77	-	2.23
	Max.	5.68	4.37	0.4	0.8	-	-	2.77	0.81	1.2	0.69	0.67	0.74	-	-	0.95	0.88	2.01	-	2.51
Collaria oleosa																				
Female (N= 10)	Mean	6.74	1.04	0.74	2.32	1.96	1.36	0.88	0.84	2.7	0.73	2.74	3.22	0.68	1.39	0.96	0.46	1.43	0.33	0.81
	SD	0.29	0.08	0.15	0.33	0.31	0.14	0.05	0.11	0.2	0.06	0.27	0.47	0.12	0.1	0.02	0.02	0.07	0.05	0.07
	Min.	6.08	0.92	0.49	1.62	1.44	1.16	0.78	0.65	2.4	0.62	2.35	2.33	0.39	1.23	0.93	0.43	1.36	0.25	0.7
	Max.	7.11	1.15	0.92	2.73	2.55	1.68	0.95	0.99	2.9	0.79	3.17	3.97	0.81	1.54	0.99	0.49	1.53	0.42	0.92

Male (N= 9)	Mean	5.71	0.89	0.77	2.52	1.87	1.23	0.79	0.7	2.3	0.6	2.64	3.21	0.7	1.02	0.88	0.41	1.2	0.29	0.65
	SD	0.14	0.1	0.1	0.45	0.13	0.18	0.05	0.08	0.1	0.03	0.37	0.64	0.1	0.14	0.04	0.03	0.1	0.05	0.06
	Min.	5.44	0.69	0.68	1.52	1.58	0.79	0.69	0.55	2.2	0.57	1.81	2.14	0.59	0.8	0.78	0.36	1.09	0.23	0.55
	Max.	5.94	1	0.98	2.94	2.03	1.44	0.86	0.84	2.5	0.67	3.1	4.1	0.86	1.18	0.93	0.44	1.38	0.36	0.75
Collaria scenica																				
Female (N= 10)	Mean	5.98	0.91	0.57	1.8	1.58	1.1	0.78	0.8	2.3	0.66	2.51	2.95	0.7	1.25	0.94	0.46	1.35	0.34	0.75
	SD	0.18	0.04	0.06	0.29	0.23	0.19	0.04	0.09	0.1	0.06	0.14	0.4	0.15	0.12	0.02	0.03	0.07	0.04	0.03
	Min.	5.76	0.84	0.5	1.21	1.39	0.83	0.71	0.69	2.1	0.57	2.21	2.23	0.48	1.05	0.91	0.43	1.25	0.3	0.69
	Max.	6.2	0.96	0.7	2.21	1.98	1.35	0.84	0.99	2.4	0.76	2.72	3.4	0.9	1.46	0.98	0.52	1.44	0.4	0.8
Male (N= 10)	Mean	4.76	0.69	0.49	1.64	1.33	-	0.6	0.61	1.9	0.54	2.1	2.6	0.58	0.87	0.8	0.38	1.06	0.23	0.61
	SD	0.26	0.1	0.07	0.42	0.19	-	0.07	0.09	0.2	0.04	0.18	0.43	0.12	0.1	0.05	0.01	0.05	0.03	0.05
	Min.	4.38	0.53	0.38	0.92	1.1	-	0.49	0.42	1.7	0.5	1.79	1.64	0.41	0.7	0.68	0.37	1	0.19	0.52
	Max.	5.04	0.81	0.63	2.08	1.7	-	0.7	0.76	2.2	0.63	2.35	3.06	0.82	0.98	0.84	0.41	1.14	0.27	0.69
Collaria schwartzi sp. nov																				
Female (N= 2)	Mean	6.57	1.06	0.89	2.94	-	-	0.83	0.81	2.7	0.61	3.23	3.47	-	1.66	1	0.53	1.32	0.4	0.66
	SD	0.15	0.06	0.06	0.07	-	-	0.05	0.11	0.1	0.06	0.17	0.93	-	-	0	0.01	0.01	-	0.11
	Min.	6.46	1.02	0.85	2.89	-	-	0.8	0.74	2.6	0.57	3.11	2.81	-	-	1	0.52	1.31	-	0.58
	Max.	6.67	1.11	0.93	2.99	-	-	0.87	0.89	2.8	0.66	3.35	4.13	-	-	1	0.53	1.33	-	0.73
Male (N= 4)	Mean	5.97	0.95	1.11	2.84	2.35	1.4	0.76	0.77	2.6	0.55	2.53	3.94	0.88	1.27	0.96	0.47	1.23	0.33	0.61
	SD	0.21	0.06	0.09	0.41	0.49	0.07	0.06	0.07	0	0.03	0.37	0.34	0.13	0.06	0.05	0.04	0.05	0.04	0.08
	Min.	5.7	0.87	0.98	2.4	1.82	1.32	0.68	0.69	2.6	0.51	1.97	3.63	0.74	1.18	0.92	0.43	1.17	0.28	0.49
	Max.	6.15	1	1.18	3.19	2.95	1.48	0.81	0.87	2.7	0.58	2.75	4.34	1.02	1.33	1.02	0.5	1.29	0.37	0.66
Collaria villiersi																				
Female (N= 1)	Value	5.97	0.97	0.64	3.16	-	-	0.85	0.74	2.8	0.51	2.42	3.96	0.77	1.32	0.95	0.49	1.33	0.32	0.6
Male (N= 1)	Value	5.98	0.84	1.05	2.26	-	-	0.79	0.85		0.58	2.4	3.94	0.77	1.37	0.93	0.46	1.29	0.35	0.63

CAPÍTULO III

Phylogeny and biogeography of grass-feeding plant bugs of the genus Collaria Provancher (Hemiptera, Miridae).

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Running title: Systematics and Biogeography of Collaria.

Abstract

Collaria is a genus of grass-feeding plant bugs belonging to the tribe Stenodemini and has 15 recognized species, distributed in the Afrotropical, Nearctic and Neotropical regions. Phylogenetic relationships within Collaria have never been studied. Here, they are investigated using a cladistic analysis of 67 morphological characters including male and female genitalia, with the 15 species of genus as the ingroup and five other species of Miridae as the outgroup. Analyses with all species and partial analyses were conducted. Tree searches were performed with the software TNT. As a result of the phylogenetic analysis the genus is found to be monophyletic and supported by four synapomorphies: erect setae on antennal segment I, head in dorsal view with transversal pale spot (V-shaped) posterior to longitudinal sulcus, pronotal lateral margin rounded and left paramere in ventral surface at apex without any teeth or tubercule. Based on these results, a biogeographical analysis was conducted (Spatial Analysis of Vicariance), considering distributional records for each species. We found

seven vicariant nodes and the hypothetical barriers for the clade were represented by the Voronoi lines in America and Africa. The biogeographical analysis of genus Collaria suggest that the disjunct distributions are result of the vicariant event after the breakup of Gondwana and a dispersal event that occurred 18 Ma ago, after the establishment of Isthmus of Panama.

Additional keywords: Neotropical, Neartic, Afrotropical, grass-feeding plant bug, genitalia, Vicariant barrier.

Introduction

Miridae is the most diverse group of Heteroptera (Hemiptera), with currently more than 11020 described species in 1200 genera with a cosmopolitan distribution (Wheeler 2001; Cassis and Schuh 2012; Jung and Lee 2012). This family exhibits great morphological diversity, remarkable trophic plasticity, and plays a key role in natural systems and agroecosystems, both as herbivores and predators (Wheeler 2001; Jung and Lee 2012). Mirids are of interest in insect conservation biology as indicators of the vitality or changes in ecosystems, mainly because they are susceptible to many insecticides and are vulnerable to habitat disturbances (Wheeler 2001).

There are few phylogenetic analyses of Miridae; the first one was made by Schuh (1974) who published the first phylogeny of family based on morphological data. In 1976 the same author proposed the higher-level relationships of the Miridae, dividing it in six subfamilies and eight tribes. Schuh et al. (2009) proposed higher-level relationships within the Cimicomorpha and the last phylogenetic study on the Miridae was conducted by Jung and Lee (2012), where they found thatn three clades recovered in all analyses (Stenodemini; Mirinae and Phylinae) were sister group to all the remaining mirid taxa.

Eight subfamilies are recognized; Mirinae being the most speciose with almost 4000 described species (Cassis and Schuh 2012, Schuch 2013). The genus Collaria Provancher belongs to Stenodemini (Mirinae) and it is responsible for significant economic damage in the New World to pastures, oats, rice, maize, and wheat crops

(Wheeler 2001; Ferreira et al. 2013, Bautista et al. 2013). Collaria has 15 valid species, distributed predominantly in the Neotropical Region, in the Afrotropical Region, and to a lesser extent in the Nearctic Region. Until the moment, no hypothesis has been postulated related to the biogeography of this group. All species of genus, aparrently share the following, among other characters: eyes at the middle of the head, anterior portion of the clypeus rounded, a ‘‘neck’’ (=collum) present, proepisternum strongly rounded, endosoma of males with five endosomal sclerites, female posterior wall with interramal lobes triangular or rounded, and the medial process strongly sclerotized (Schwartz 2008).

Based on morphological characters, including male and female genitalia, Schwartz (2008) conducted a phylogenetic analysis of the Stenodemini genera, in which he found Collaria as the sister group of Nabidomiris Poppius, 1914. However, he did not evaluate the monophyly of each one of genera, assuming the monophyly of Collaria based on two synapomorphies that have not been evaluated by his cladistics analysis. Therefore, the phylogenetic relationships within Collaria remain unknown. The purpose of this paper is to test the monophyly of the genus, to elucidate the relationships among its species, and analyze the distribution patterns of the species within the framework of a historical biogeographic event-based method.

Materials and methods

Taxa

The ingroup was composed by 15 species according to the taxonomic revision of Morales et al. (in prep.). The outgroup included four species (Nabidomiris longipennis, Steneodema andina, Trigonotylus tenuis, and Dolichomiris linearis) belonging to other Stenodemini genera, and one species of the tribe Mirini (Horciasinus signoreti). Nabidomiris longipennis was included because Nabidomiris is regarded as the sister group of Collaria (Schwartz 2008).

Character description

For the analysis 67 morphological characters were used, taken from the vestiture, coloration, head and thorax. For the present study we coded the characters of male and

female genitalia according with terminology and structures proposed by Morales-C et al (in prep.) (Table 1). Descriptions of characters follow Sereno (2007). Characters 4, 5, 8, 19, 23, 25, 27, 28, 34, 35, 44, 50 were previously used by Schwartz (2008), and we proposed 27 new characters. Characters were mostly binary, those coded as multistate (31.40 %) were treated as non-additive. Inapplicable data account for 9 % of the total information coded in the matrix. Missing data were indicated by a question mark ("?") and inapplicable data were indicated by a hyphen mark ("-"). The data matrix is provided in Table 2.

Table 1. List of morphological characters and states used in the cladisctic phylogenetic analysis of Collaria

Vestiture (Fig. 1)

1. Hemelytra, vestiture in dorsal view: (0) setae only; (1) setae mixed with microtrichia.
2. Head, antennal segment I in dorsal view: (0) setae (Fig. 1E); (1) microtrichia (Fig. 1C).
3. Head, vestiture on the antennal segment I, density: (0) densely setose (Fig. 1B); (1) sparsely setose (Fig. 1G).
4. Head, setae in the antenna segment I, length: (0) shorter than diameter of segment (Fig. 1B); (1) longer than diameter of segment (Fig. 1J) (Character 13 in Schwartz 2008).
5. Head, setae on antennal segment I: (0) suberect (Fig. 1L); (1) erect (Fig. 1E) (Character 14 in Schwartz 2008).
6. Length of setae in metatibia: (0) shorter than diameter of metatibia (Fig. 1N); (1) longer than diameter of metatibia (Fig. 1M).
7. Density of pubescence in metatibia: (0) dense (Fig. 1M); (1) not dense (Fig. 1N).
8. Disposition of Setae in metatibia: (0) suberect (Fig. 1N); (1) erect (Fig. 1M) (Character 18 in Schwartz 2008).
9. Metatibia, cuticule in apicoventral region: (0) smooth; (1) with microtrichia.
10. Metatibia, rows of setae in ventral surface: (0) absent; (1) present.

Coloration (Fig. 1)

11. Head, coloration in dorsal view: (0) uniformly colored (Fig. 1I); (1) black marking, pale with a dark Y-shaped extending from longitudinal sulcus to frons (Fig. 1G); (2) dark with transversal pale spot (v-shaped) posterior to longitudinal sulcus (Fig. 1F); (3) paired transverse markings lateral to longitudinal sulcus (Fig. 1H).
12. Coloration of clypeus in dorsal view: (0) uniformly colored (Fig. 1G); (1) with black spot (Fig. 1I).
13. Coloration of mandibular plate: (0) uniformly colored (Fig. 1L); (1) with black spot in apical region (Fig. 1K).
14. Coloration of maxillary plate: (0) uniformly colored (Fig. 1L); (1) with black spot in apical region (Fig. 1K).
15. Coloration of buccula: (0) uniformly colored; (1) with black spot in apical region.
16. Coloration of pronotum in dorsal view: (0) with two dark spots on humeral region (Fig. 1G); (1) uniformly colored (Fig. 1K); (2) with pale humeral angles (Fig. 1E); (3) with dark humeral angles (Fig. 1D).

17. Coloration of clavus: (0) uniformly colored, (1) with spots.

Head (Fig. 1)

18. Anteocular portion in dorsal view: (0) longer than half of total length of the head (Fig. 1A); (1) shorter than half of total length of the head (Fig. 1F); (2) equal or longer than half of total length of the head (Fig. 1I).

19. Eye, position in relation to the head, dorsal view: (0) at the middle of the head, distant from anterior margin of pronotum by about a length of an eye (Fig. 1A); (1) adjacent to anterior margin of pronotum (Fig. 1C) (Character 8 in Schwartz 2008).

20. Antenna, segment I in male, width: (0) equal the width of II segment (Fig. 1I); (1) two times the width of II segment (Fig. 1G); (2) four times the width of II segment (Fig. 1J).

21. Antenna, segment II in male: (0) not expanded apically; (1) expanded apically.

22. Anterior projection of Clypeus: (0) absent; (1) beyond the base of clypeus.

23. Eye shape dorsal view: (0) round; (1) ovate (Character 9 in Schwartz 2008).

24. Longitudinal medial sulcus on frons: (0) absent; (1) present.

25. Clypeus in lateral view: (0) produced and bulbose (Fig. 1K); (1) rounded (Fig. 1L); (2) flat (Character 5 in Schwartz 2008).

Thorax (Fig. 1)

26. Collar, in dorsal view: (0) posteriorly well defined by an impressed sulcus; (1) not completely delimited.

27. Structure of pronotal lateral margin: (0) rounded; (1) carinate (Character 26 in Schwartz 2008).

28. Structure of proepisternum in lateral view: (0) rounded (Fig. 1L); (1) strongly rounded (Fig. 1K); (2) obsolete (Character 27 in Schwartz 2008).

29. Width of embolium in dorsal view: (0) less than the width antennal segment I; (1) two times antennal segment I.

30. Pronotum lobes: (0) clearly divided in two areas, or lobes, by a lateral constriction and a dorsal transversal shallow sulcus (Fig. 1F); (1) not divided in two areas or lobes (Fig. 1B).

31. Cuneus: (0) as long as wide; (1) longer than wide.

Male Genitalia (Figs. 2,3)

32. Shape of pygophore in dorsal view: (0) elongated (Fig. 2A); (1) triangular (Fig. 2B).

33. Shape of apex of pygophore in dorsal view: (0) slightly rounded; (1) semi-triangular.

34. Shape of ventroposterior margin of apex of pygophore: (0) not expanded; (1) broadly expanded (Character 32 in Schwartz 2008).

35. Left lateroposterior margin of the pygophore, dorsal view: (0) entire (Fig. 2A); (1) with a prolongation of lateroposterior margin (Fig. 2B) (Character 33 in Schwartz 2008).

36. Right lateroposterior margin of the pygophore, dorsal view: (0) entire; (1) with a prolongarion of right lateroposterior margin (Fig. 2C).

37. Prolongation of left lateroposterior margin of the pygophore: (0) large (Fig. 2D); (1) small (Fig. 2B).

38. Medial margin of basal sensorial lobe of left paramere: (0) almost straight (Fig. 2G); (1) clearly convex (Fig. 2F).

39. Lateral margin of basal sensorial lobe of left paramere: (0) almost straight (Fig. 2F); (1) clearly convex (Fig. 2G).

40. Shape of left paramere in medial view: (0) sickle-shape; (1) sickle-shaped ending in lateral tip; (2) Y-shaped.

41. Left paramere at apical half: (0) curve; (1) bifurcated (Fig. 2E); (2) angulated with short apex (Fig. 2F).

42. Left paramere, ventral surface at apex: (0) without any teeth or tubercles; (1) with a teeth or tubercles (Fig. 2H).
43. Shape of right paramere in lateral view: (0) clubbed (Fig. 2I); (1) straight (Fig. 2J); (2) curved.
44. Shape of lobal endosomal sclerite: (0) absent; (1) elongated (Fig. 3A); (2) short (Character 42 in Schwartz 2008).
45. Structure of lobal endosomal sclerite: (0) with microtrichia in basal region (Fig. 3A); (1) with microtrichia in basal and medial region (Fig. 3A); (2) spines on surface.
46. Shape of posterior endosomal sclerite: (0) absent; (1) C-shaped (Fig. 3D); (2) comb-shape (Fig. 3E).
47. Structure of posterior endosomal sclerite: (0) with spines (Fig. 3D); (1) row of about six thick spines (Fig. 3E).
48. Shape of medial endosomal sclerite: (0) absent; (1) oval (Fig. 3G); (2) semicircular (crescent moon) (Fig. 3C); (3) fusiform (with basal region wide) (Fig. 3F).
49. Structure of medial endosomal sclerite: (0) smooth (Fig. 3F); (1) with microtrichia on surface (Fig. 3C).
50. Shape of ribbonlike endosomal sclerite: (0) absent; (1) brush- shape (Fig. 3A); (2) with an expanded lobe that go further the secondary gonopore (Fig. 3D); (3) short lobe beneath secondary gonopore (Fig. 3F) (Character 43 in Schwartz 2008).
51. Structure of ribbonlike endosomal sclerite: (0) with long spines (Fig. 3A); (1) with michrotrichia (Fig. 3F).
52. Shape of right dorsal endosomal sclerite: (0) absent; (1) elongated (Fig. 3J); (2) fusiform (3) elliptical (Fig. 3I).
53. Structure of right dorsal endosomal sclerite: (0) with trichia on surface (Fig. 3I); (1) smooth (Fig. 3J).
54. Left dorsal endosomal sclerite: (0) absent; (1) fusiform with apex broad (Fig. 3J); (2) fusiform with apex acute (Fig. 3K); (3) elliptical (Fig. 3L).
55. Structure of left dorsal endosomal sclerite: (0) with trichia on surface (Fig. 3L); (1) smooth (Fig. 3K).
56. Sclerite on ventral surface of endosoma associated with the secondary gonopore: (0) absent; (1) small (Fig. 3A); (2) large (Fig. 3B).

Female genitalia (Fig. 4)

57. Apical grooved region of the first gonapophysis, lateral view: (0) absent; (1) broad; (2) narrow.
58. Margin of apex of first gonapophysis: (0) smooth (Fig. 4A); (1) with grooves limited to this area (Fig. 4C).
59. Apex of first gonapophysis with fold on ventral margin: (0) absent (Fig. 4B); (1) present (Fig. 4C).
60. Structure of the apex of second gonapophysis: (0) smooth (Fig. 4B); (1) with teeth (Fig. 4F).
61. Apex of ventral region of the second gonapophysis, lateral view: (0) smooth (Fig. 4D); (1) apical grooved (striated) region (Fig. 4F).
62. Sclerotization of dorsal labiate plate caudal to rings: (0) absent; (1) present.
63. Length of interramal lobes of posterior wall: (0) shorter than sclerite interramal; (1) equal or longer than sclerite interramal.
64. Shape of interramal lobes of the posterior wall: (0) triangular (Fig. 4J); (1) rounded (Fig. 4H); (2) subquadrate (Fig. 4K); (3) elongated.
65. Lateroapical margin of interramal lobes: (0) entire; (1) with large projection (Fig. 4G); (2) with short projection (Fig. 4J).

66. Size of dorsal structure of posterior wall: (0) absent; (1) small (Fig. 4H); (2) medium (covering half of the medial process) (Fig. 4I).
67. Shape of medial process of the posterior wall: (0) absent; (1) Y- inverted-shaped (Fig. 4G); (2) arrow like shaped (Fig. 4H); (3) I shaped.

Phylogenetic analysis

The tree was rooted with Horciasinus signoreti. The optimality criterion used in the phylogenetic analysis was parsimony. The first analysis was conducted including all species (all species analysis), using TNT version 1.1 (Goloboff et al. 2008), where we search for exact solutions using branch-and-bound with Implicit Enumeration, because we have a small data-set (Goloboff et al. 2008). Bremer support (BS) (Bremer 1994) was calculated as absolute values. Consistence index (CI) and retention index (RI) were calculated for the trees. A second analysis was conducted with the same strategy looking for tree resolution, excluding Collaria danae and Collaria nigra (partial analysis) because these species are represented only by the holotype and thus the genitalia was not dissected, which resulted in a matrix with much missing data.

Table 2. Character matrix for the cladistic analysis of Collaria.

	0	10	20	30	40	50	60
Horciasinus signoreti	0010001001	0100031210	1010200201	0110110002	1120–0–0–0	–0–0–00111	0102013
Dolichomiris linearis	0000001100	0000010110	0101211001	1010110000	1020–0–0–0	–0–0–02000	0013000
Stenodema andina	0000001110	0000011011	0001111001	100000–100	1110–0–0–0	–0–0–22011	0101011
Nabidomirislongipennis	0010010000	0111001001	0001001101	1010100001	2120–0–0–3	1300–01001	0100011
Trigonotylus tenuis	1110001010	0000010111	0001111001	1111110011	2120–0–0–0	–0–0–22001	0102000
C. boliviana	0010111110	3111101101	0001100101	100000–000	001100–0–1	00–0–11001	0100101
C. capixaba	0001111110	1000001201	0001100101	100000–100	001110–0–3	10–0–11001	0101012
C. danae	0010110110	0110011200	0001100101	1???????????	????????????	????????????	????????
C. guaraniana	0010110110	1111101200	0001100101	100000–000	001100–0–3	10–0–2–00?	? ?00011
C. husseyi	0011110110	3000001100	0001100101	1???????000	001220–0–3	10–0–2–00?	? ?02012
C. improvisa	0011100110	2000001101	0001101101	1110101011	2000–0–113	1111102001	1101020
C. malonoi	0010110110	300000010-	0001100101	1???????000	001100–0–3	10—0??????	????????
C. meilleurii	0110000110	2000001101	0001100100	1000101011	201110–213	1200–01001	0101002
C. nigra	0010110110	2100021201	0001101101	1???????????	????????????	????????????	????????
C. obscuricornis	0011100110	2000001201	0001100101	1110101011	2000–0–303	1112101001	0101000
C. oculata	0010101110	3010001101	0001100111	1000101000	001100–213	1300–01001	0101003
C. oleosa	0010110110	1000001201	0001100101	100000–100	0010–100–2	10–0–01001	0100211
C. scenica	0010100110	2000001101	0001100101	100000–100	0010–210–3	10–0–01001	0100212
C. sp.nov	0001111110	2000001102	0001101101	1000101100	0000–0–113	1303001001	0101001
C. villiersi	0011111110	2000011201	0001100101	1???????011	2000–0–103	1102002001	0101001

Biogeographical analysis

Data treatment

The biogeographical analysis was generated using Spatial Analysis of Vicariance (SAV) a method that implements the ideas of Hovenkamp (1997, 2001). This method attempts to reconstruct taxon biogeographical history by examining disjunct sister pairs

(i.e., barriers), with inputs being a cladogram and distributions of the terminals (Mollineri and Salles, 2013). The analysis was implemented in VIP (Vicariance Inference Program) (Arias 2010, Arias et al. 2011). It employed the phylogeny obtained for Collaria species based on the analysis without C. danae and C. nigra (partial analysis) because the resulting cladogram was not fully resolved (see below). The geographical coordinates were obtained from label data of museum specimens or from PBI database (http://research.amnh.org/pbi/maps/). Locality data that were not georefenced were given a latitude and longitude using the Global Gazetteer 2.2 (http://www. fallingrain.com/world/index.html) and Google Earth®.

Analysis parameters

Only data of the ingroup and the outgroup species were analyzed in VIP. A grid of 2° × 2° was used (maximum fill = 0) in a NASA World Vegetation map (obtained from http://neo.sci.gsfc.nasa.gov/view.php?datasetId=MOD13A2_M_NDVI) to represent distributions as absence/presence data in each cell. With of the goal of obtaining better reconstructions of disjunct pairs, a heuristic search was carried out with 1000 iterations and under the default settings OR reconstruction, the overlap was changed to 10%, the cost of distribution removal 1.5, cost of partial removal (activated) 0.75, and the barrier was represented by Voronoi lines.

Results

Phylogeny

Collaria is a monophyletic group (in both analyzes) and the synapomorphies that distinguish it are: erect setae on antennal segment I (character 5, state 1), head in dorsal view with transversal pale spot (V-shaped) posterior to longitudinal sulcus (character 11, state 2), pronotal lateral margin rounded (character 27, state 0), and left paramere in ventral surface at apex without any teeth or tubercles (character 42, state 0). Two most parsimonious cladograms resulted from the all species analysis and partial analysis produced a single most parsimonious tree. All species analysis and partial analysis trees differ in the relationship of Collaria capixaba: for the all species tree, C. capixaba is the sister species of C. meilleurii + C.oculata (C. sp. nov (C. villiersi(C.improvisa+

C.obscuricornis) (Fig. 5). In the partial analyzes C. capixaba is the sister species of C.husseyi (Fig. 6). The partial analyses tree resolves the relationship of C. oleosa + C. scenica as sister species of C. malanoi (C.capixaba+C.husseyi) (C.boliviana+C.guaraniana).

The first analysis of all species of Collaria produced two equally parsimonious trees. The strict consensus has 181 steps, a consistency index of 51, and a retention index of 51 (Fig. 5).

Nodes of major clades are named A-M. Main characters supporting these nodes are indicated as follows:

Node A: Collaria forms a monophyletic group supported by two synapomorphies (BS/ = 2): erect setae on antennal segment I (character 5, state 1) and head in dorsal view with transversal pale spot (V-shaped) posterior to longitudinal sulcus (character 11, state 2), and forming two groups, Collaria nigra as a sister group of node B.

Node B: Pronotal lateral margin rounded (character 27, state 0).

Node C: Medial margin of basal sensorial lobe of left paramere clearly convex: (character 38, state 1) and lateroapical margin of interramal lobes with short projection (character 65, state 2).

Node D: Shape of lobal endosomal sclerite, elongated (character 44, state 1).

Node E: Head in dorsal view with paired transverse markings lateral to longitudinal (character 11, state 3), antenna, segment I in male equal in width of II, (character 20, state 1), large sclerite on ventral surface of endosoma associated with the secondary gonopore (character 56, state 2).

Node F: No dense setae on metatibia (character 7, state 1), rounded shape of interramal lobes of the posterior wall (character 64, state 1).

Node G: Left lateroposterior margin of the pygophore in dorsal view with a prolongation of lateroposterior margin (character 35, state 1), and dorsal structure of posterior wall absent (character 66, state 0).

Node H: Setae in metatibia shorter than diameter of segment (character 6, state 0).

Node I: Shape of right paramere in lateral view: clubbed (character 43, state 0), and absent lobal endosomal sclerite (character 44, state 0).

The consensus tree is extensively resolved. The only polytomy is among outgroups (Fig. 5) in which relationships among Dolichomiris, Stenodema, and Trigonotylus could not be resolved. Although the aim of the analysis was not focused on the resolution of generic relationships, we found Nabidomiris as the sister group of Collaria, confirming the finding of Schwartz (2008).

The second analysis, when the species C. danae and C. nigra are not included, produced a single most parsimonious tree of 175 steps, a consistency index of 54 and retention index of 55 (Fig. 6).

The following clades are recovered in this analysis. Node A: Collaria forms a monophyletic group supported by four synapomorphies: erect setae on antennal segment I (character 5, state 1), head in dorsal view with transversal pale spot (V-shaped) posterior to longitudinal sulcus (character 11, state 2), structure of pronotal lateral margin rounded (character 27, state 0), left paramere in ventral surface at apex without any teeth or tubercles (character 42, state 0).

Node B: dorsal structure of posterior wall absent (character 66, state 0).

Node C: left lateroposterior margin of the pygophore, in dorsal view: entire (character 35, state 0).

Node D: Setae in metatibia shorter than diameter of segment (character 6, state 0), shape of lobal endosomal sclerite: elongated (character 44, state 1).

Node E: setae in the antennal segment I longer than diameter of segment (character 4, state 1) shape of right paramere in lateral view: clubbed (character 43, state 0).

Node F: medial margin of basal sensorial lobe of left paramere clearly convex (character 38, state 1), lateroapical margin of interramal lobes with short projection (character 65, state 2).

Node G: head in dorsal view with paired transverse markings lateral to longitudinal sulcus (character 11, state 3), lobal endosomal sclerite: elongated (character 44, state 1), sclerite on ventral surface of endosoma associated with the secondary gonopore: large (character 56, state 2). As in the first analysis, the tree is resolved, the only polytomy is at node G (Fig. 6) and Collaria is supported by four synapomorphies (Fig. 6).

Biogeography

The VIP analysis resulted in one possible reconstruction with 11 disjunct sister pairs, 2 removing nodes and with a cost of 7 (Fig.7). One disjunction (node 1, Figs. 7, 8a) is presented between the Neotropical (Clade C) - Nearctic (Clade A) and Afrotropical (Clade B) regions. One disjunction (node 2, Figs. 7, 8b) between the Neotropical and Afrotropical regions was recovered for clades B (C. sp. nov (C. villiersi (C.obscuricornis+ C.improvisa) and A (C. oculata+ C.meilleurii). Node 3 (clade B Figs. 7, 8c) represents one disjunction between C. sp. nov and (C. villiersi (C.obscuricornis+ C.improvisa), and the node 4 (Figs. 7, 8d) represents one disjunction between C. villiersi (C.obscuricornis+ C.improvisa). Three disjunctions in the Neotropics were recovered, node 5 (Figs. 7, 8e) (C. malanoi (C.husseyi + C.capixaba) (C.guaraniana + C.boliviana), node 6 (Figs. 7, 8f) (C.husseyi + C.capixaba) (C.guaraniana + C.boliviana) and node 7 (Figs. 7, 8g) (C.guaraniana + C.boliviana).

Discussion

Phylogeny

According to Palacino-Rodríguez et al. (2014), there is a great debate in cladistics analyses because the missing data have probably an important effect in the resolution of tree. In phylogenetic analyses missing data are characters that cannot be coded for a given taxon because the information for some reason is not available, which is concordant with our analyses with, two trees of different topologies (Fig. 5, 6). According to Dos Santos and Falaschi (2007) the problems emerging from missing data are innumerable: resulted cladograms are often poorly resolved - especially consensus trees-, taxa with missing information usually "float" into different positions during cladogram search, there is an impact on support measures, as bootstrap and jackknife, and there are significant effects in the accuracy of topologies, even though some advocates that missing entries do not decrease phylogenetic accuracy.

Wiens (2003) defined an alternative hypothesis in which the so-called missing data problem for incomplete taxa simply reflects sampling of too few characters in these taxa to accurately place them on the tree, the level of completeness alone should not

guide the exclusion of taxa (contrary to common practice), and these results may explain why empirical studies have sometimes found little relationship between the completeness of a taxon and its impact on an analysis. However our results are contrary to Wiens (2003), because we found better resolution in the partial analysis that removed two taxa with a high amount of missing data.

The use of coloration patterns as phylogenetic characters have been a controversial topic, because the color characters may vary intraspecifically due to environmental, ontogenetic, and dietary factors, as well as genetic variation or fading in museum specimens, and the possible conflict between the colour signal with the morphological signal in the phylogenetic reconstruction (Arrekul and Quicke, 2006). However, the coloration patterns have been used in some works with insects (e.g., Berniker and Weirauch 2012; Forero et al. 2013, Palacino-Rodríguez et al. 2014) and they have resulted in hypothesis with greater phylogenetic resolution, suggesting that colour characters should be more used in phylogeny (Zrzavý and Nedvěd 1997, 1999). Collaria exhibits a variety of coloration on the head, generally with spots, and these characters are useful in species identification, providing also phylogenetic signal for resolution of the relationship among species of the genus.

Song and Bucheli (2010) suggest that genitalic characters can be as useful to phylogenetic analysis as any other character set, but they suggest a careful examination in every study. According to Arnqvist and Thornhill (1998), the genitalia have low levels of dependence on environmental conditions, morphology of the genitalia typically differs even between closely related species, and are highly influenced by sexual selection (Córdoba-Aguilar 2000). Recognizing the variety of genitalic structures in Collaria, we tested these in a phylogenetic analysis (Table 1) and found only one character (character 42, state 0) as synapomorphy in the partial analysis. This result differs from those found by Song and Bucheli (2010). The genitalia in Collaria, includes various sclerites on male endosoma and female posterior wall, which are primarily homologous based on position and structure, but in the phylogenetic analysis the characters occur as homoplasies, probably as a consequence of accelerated and divergent sexual selection pressures (Song and Bucheli 2010; Palacino-Rodríguez et al. 2014).

Biogeography

The Node 1 identified by VIP showed a barrier (Fig. 8a) and, according to Sanmartín and Cronquist (2004), the distribution patterns in the Southern Hemisphere were shaped to a large extent by the sequential breakup of Gondwana and the associated vicariance events. South America began to separate from Africa in the Early Cretaceous (135 MYA) (Teixeira et al. 2013). This is consistent with the work of Wheeler (2001); where the family Miridae probably has the primary speciation following the angiosperms rise to dominance in the world's vegetation during the upper Cretaceus, this being responsible for the patterns of geographical distribution of species and higher clades.

After of set of events that resulted in the complete break-up of the Gondwana supercontinent that took place between 160 and 30 million years ago (Ma), and the result was the separation of Africa, Antarctica, Australia, India, Madagascar, New Zealand and South America (Almeida et al. 2012). We found the node 2 (Figs. 7, 8b), which is a barrier in the Amazon and Atlantic forests represented by open vegetation formations since the Miocene and a complete isolation since at least the Pliocene, Silva and Noll (2014), Batalha-Filho et al. (2013) and Sigrist and Carvalho (2009) also found similar results, which is also congruent with VIP analysis. However, the Nearctic distribution (clade A, Figs. 7, 8b) is best explained by dispersal through the Isthmus of Panama, indicating an expansion of these species to the north of the continent possibly due to dispersal between the Pliocene and Pleistocene, after the establishment of Isthmus of Panama (Morrone 2014). The enabled the expansion of C. oculata despite the fact that the species diversity generally decresases with increasing latitude and Mirids are among the insects groups clearly underrepresented in the Artic regions of Canada (Wheeler 2001). The explanation for the disjunction between the Nearctic clade and its sister group as a result of the break-up for Gondwana and a barrier in the Amazon and Atlantic forests of south America would require a number ad hoc hypotheses of extinction events of African lineages of Collaria, but the history of Miridae (and the genus Collaria) is poorly preserved in the fossil record, and according to Almeida et al. (2012) the extinctions are not the type of event historical biogeography can easily test.

In the Afrotropical region the node 3 (clade B Figs. 7, 8c) split the species Collaria sp. nov and C. villiersi (C. obscuricornis+ C. improvisa). This node occurs in East Africa, which falls into the Zambezian Region, on the seasonally dry western and southern edge. According to Taylor et al. (2014), this region, could have been originated during the Late Miocene, when the uplift of the central African plateau separated these montane and coastal forests from the main Guineo-Congolian forest of west and central Africa through extensive mountains, and the stratovolcanoes formed the highest nodes of relief across this East African plateau forming one of the major centers of endemism in Africa (Azeria et al. 2007; Linder et al. 2012). This is reported also for other taxonomic groups (Saether &Torbjon 2003; Azeria et al. 2007; Dijkstra 2007).

Node 4 (Figs. 7, 8d) represents a disjunction between C. villiersi restricted to the west Africa or Congolian region and C.obscuricornis+ C.improvisa distributed in the Zambezian and Southern African regions. A possible historic explanation for this pattern concerns the Miocene (5-23 Ma), which was "one of the most defining periods of Africa's geological and climatological history". Initially, the continental divide was low and rainforest stretched between coasts, but uplift in eastern Africa (12, 10 and 7 Ma), thus eastern and western rainforests began to separate by 17-18 Ma and finally by 10 Ma, although gallery forests may have allowed partial contact later on; during the Pliocene and early Pleistocene a major uplift also created the Great Rift Valley and the Congo Basin (Dijkstra 2007). This event could have divided the continent into eastern and western regions, and this disjunction in western Africa is naturally dominated by the almost continuous Guineo-Congolian lowland rainforest, which has a gradual transition of riverine forests and woodland in peripheral areas (Dijkstra 2007).

Node 5 (Figs. 7, 8e) represents a disjunction between C. malanoi and C. husseyi+ C. capixaba, C. guaraniana+ C. boliviana. This event could be explained by the vicariance between Chaco and Parana, which can be linked to the connection of the Paranaíba and Paraná basins in the Palaeocene (Morrone 2014). The nodes 6 and 7 (Figs. 7, 8 f, g), represent vicariant events between C. husseyi + C. capixaba and C.guaraniana + C.boliviana. Following the biogeographical areas postulated by Amorim and Pires (1996), the species C. husseyi + C. capixaba and C. guaraniana are distributed in Atlantic forest, whereas C. boliviana is widely distributed in the Andes,

south-western Amazon and Atlantic forest. The vicariant events in these nodes could be explained by a split between the Amazonian and Atlantic forest regions, suggesting an ancient division between these two areas (Silva and Noll 2014). The Amazon and Atlantic forests, following the biogeographical areas postulated by Amorim and Pires (1996), have been separated by open vegetation formations since the Miocene (Batalha-Filho et al. 2013) and have been completely isolated since at least the Pliocene (Silva and Noll 2014).

Information on the distribution of species has mostly been scattered in natural history collections, scientific publications or monographs, and the biogeographical inferences in general are affected by incomplete taxonomic and distributional knowledge (Arias 2010; Kreft and Jetz 2010). In this sense, it is necessary to collect of specimens in areas with obvious lack of information, and compare between the distribution patterns of other taxa and sister group relationships, which may enable a more precise identification of possible events and patterns they have generated (Silva and Noll 2014).

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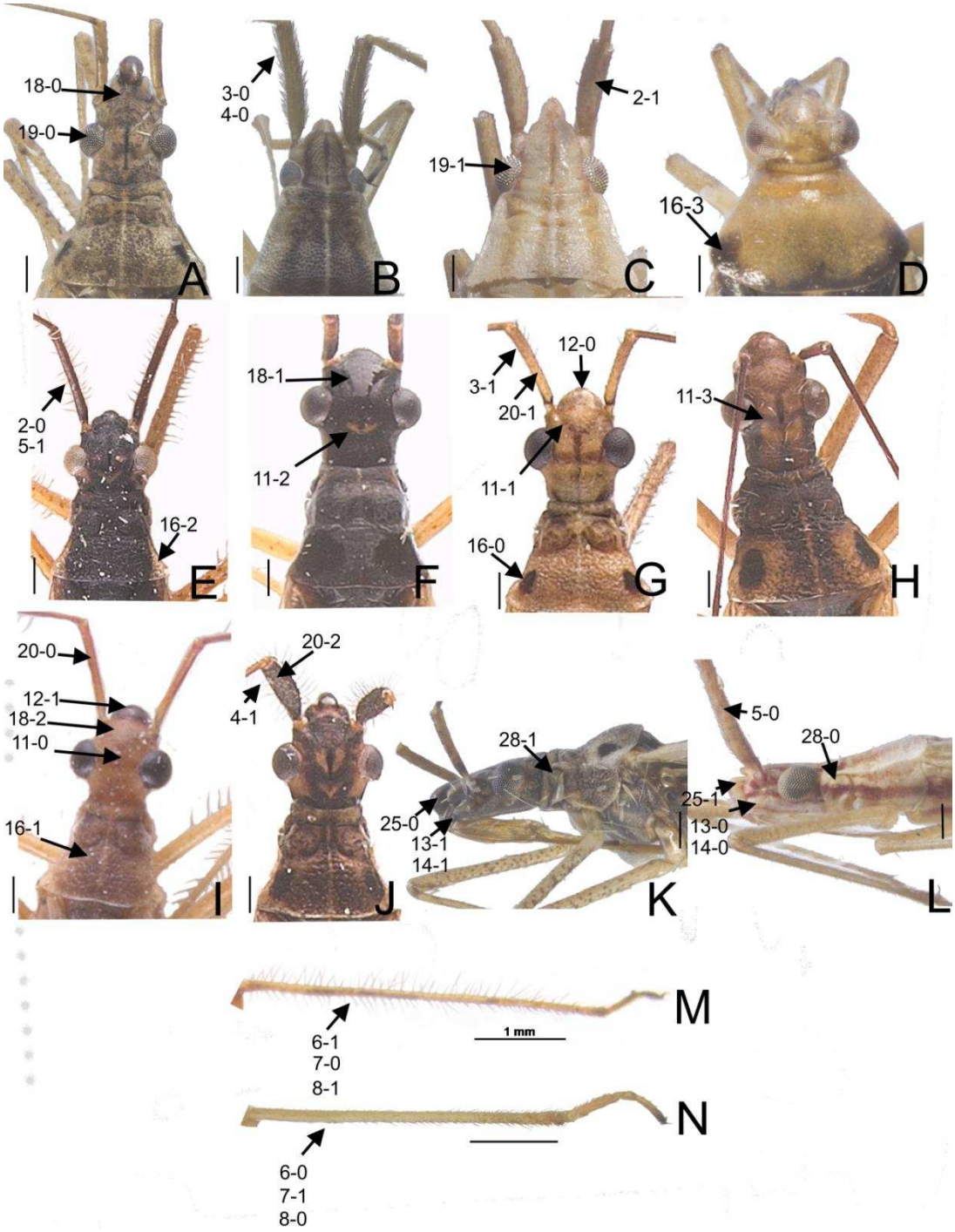

Figure 1. Characters used in the cladistic analysis of Collaria. Numbers correspond to characters and character states. Head and pronotum in dorsal view. A. Nabidomiris longipennis. B. Stenodema andina. C. Trigonotylus tenuis. D. Horciasinus signoreti. E. Collaria nigra. F. Collaria meilleurii. G. Collaria oleosa. H. Collaria oculata. I. Collaria danae. J. Collaria sp. Head and pronotum in lateral view: K. Nabidomiris longipennis. L. Trigonotylus tenuis. Posterior leg in lateral view: M. Collaria nigra. N. Trigonotylus tenuis. Scale bars 1mm.

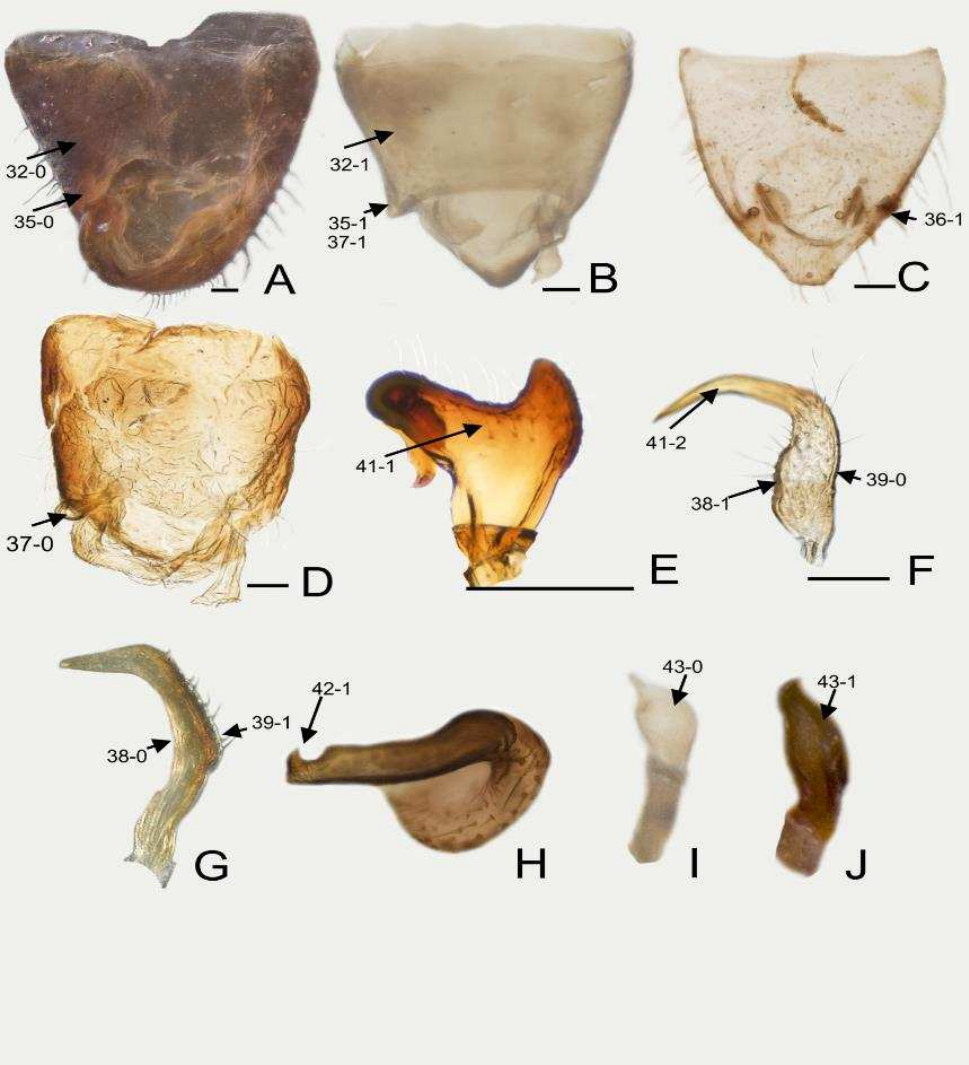

Figure 2. Genitalia of male. Pygophore in dorsal view: A. Collaria boliviana. B. Collaria obscuricornis. C. Trigonotylus tenuis. D. Nabidomiris longipennis. Parameres: E. Horciasinus signoreti. F. Stenodema andina. G. Collaria obscuricornis. H. Trigonotylus tenuis. I. Collaria obscuricornis. J. Collaria oculata. Scale bars1mm.

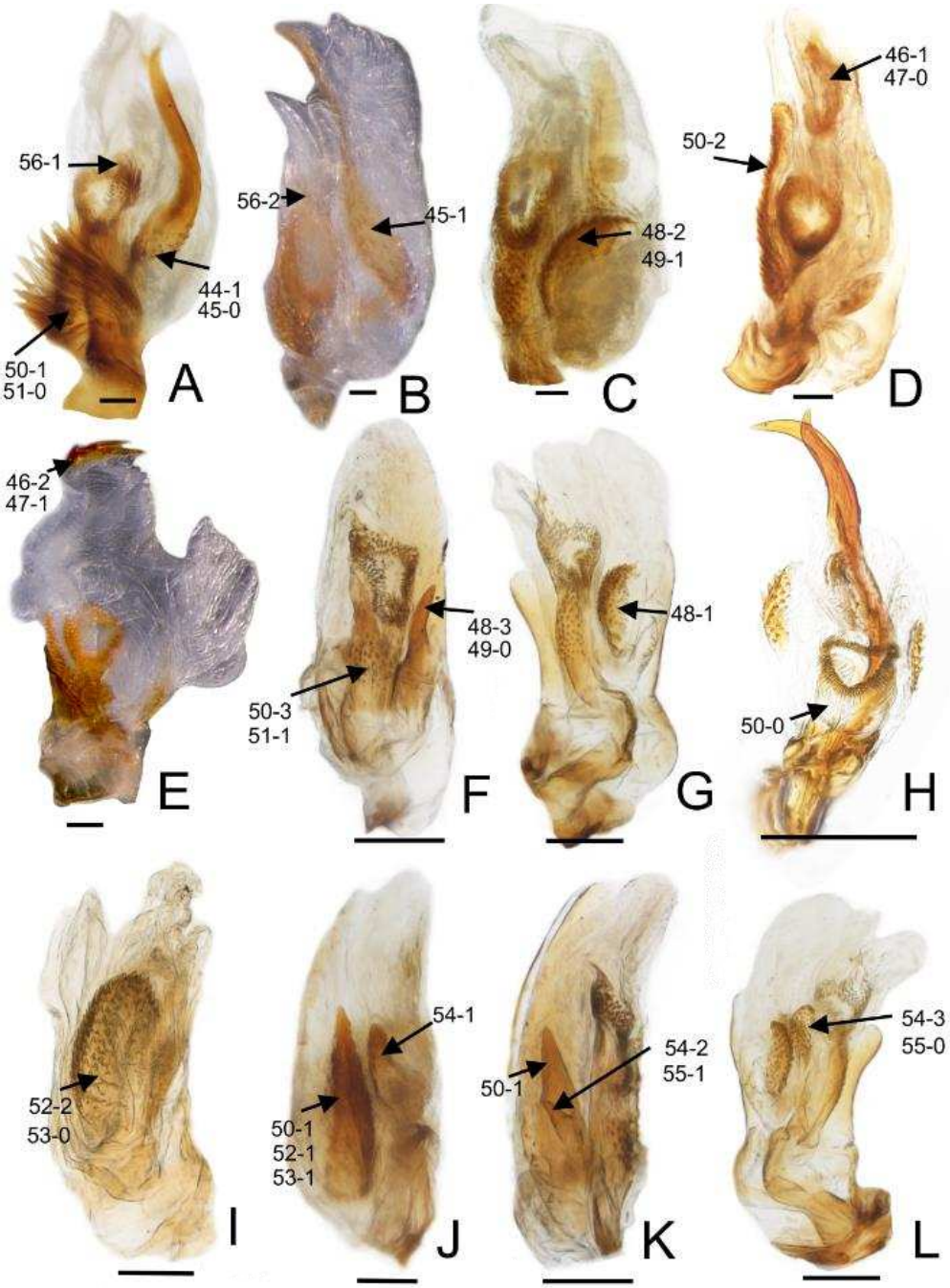

Figure 3. Genitalia of male. Endosoma in ventral view: A. Collaria boliviana. B. Collaria capixaba. C. Collaria oculata. D. Collaria oleosa. E. Collaria scenica F. Collaria obscuricornis. G. Collaria sp. H. Horciasinus signoreti. Endosoma in dorsal view: I. Nabidomiris longipennis. J. Collaria improvisa K. Collaria obscuricornis. L. Collaria sp. Scale bars 1mm.

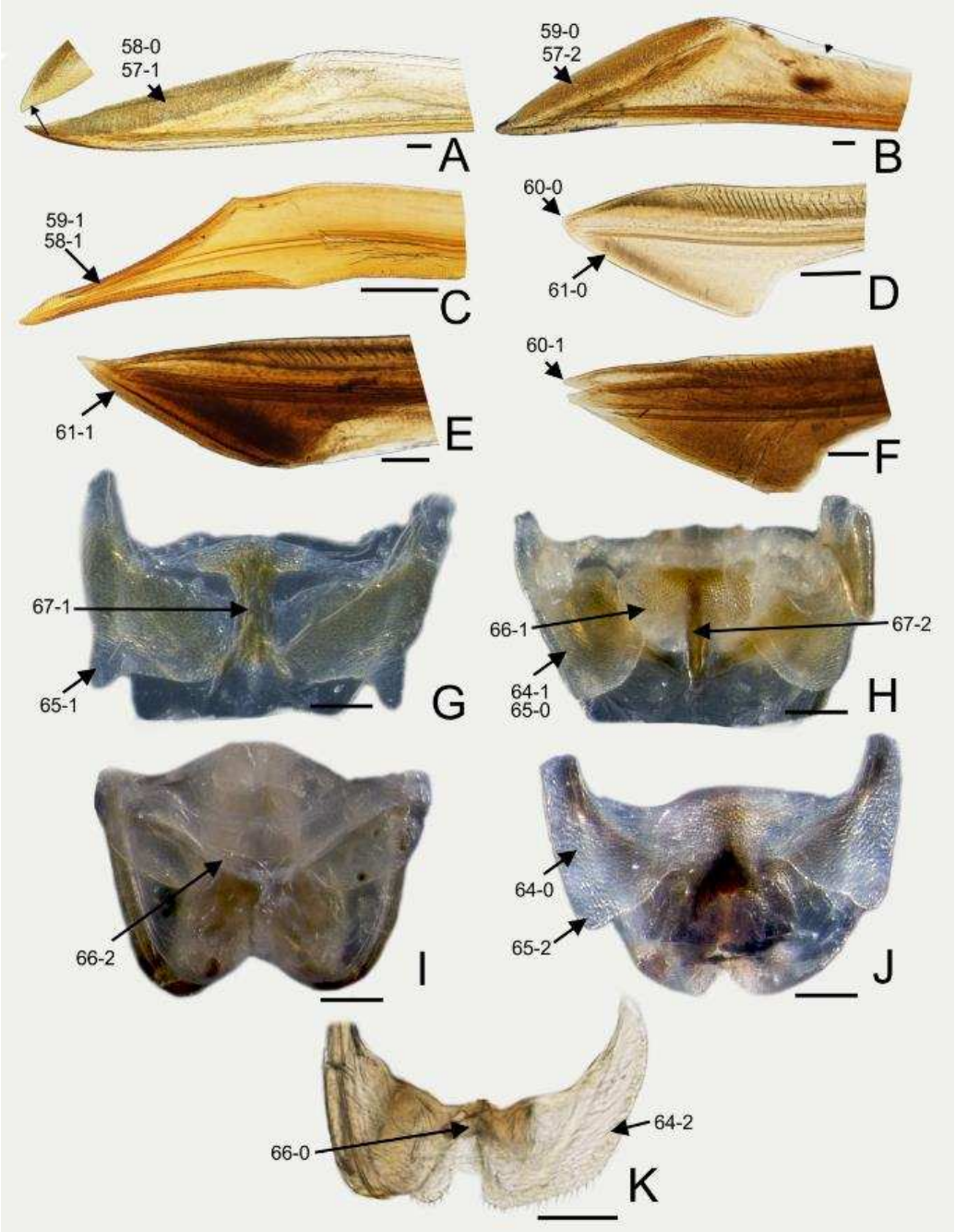

Figure 4. Genitalia of female. Apex of first gonapophysis in lateral view: A. Collaria meilleurii. B. Collaria boliviana. C. Horciasinus signoreti. D. Dolichomiris linearis. Apex of second gonapophysis in lateral view: E. Collaria improvisa F. Collaria oleosa. Posterior wall: G. Collaria boliviana H.Collaria capixaba I.Collaria improvisa J. Collaria oleosa. K. Trigonotylus tenuis. Scale bars 1mm.

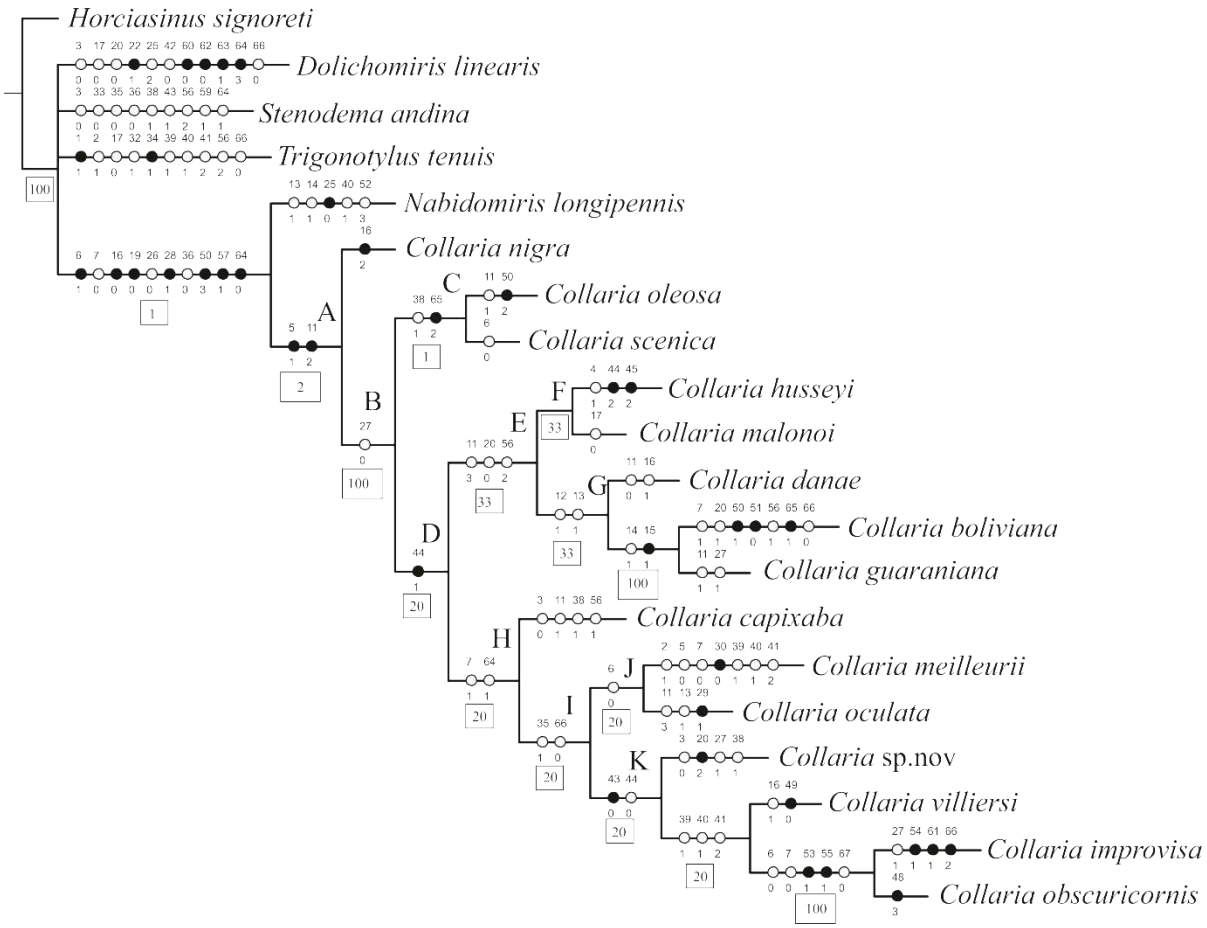

Figure 5. Strict consensus of two trees found for Collaria species based on an analysis with all species (187 steps, CI = 51, Ri = 51). Filled circles represent unique changes, open circles represent multiple changes. Values for the Bremer support are in squares below branches.

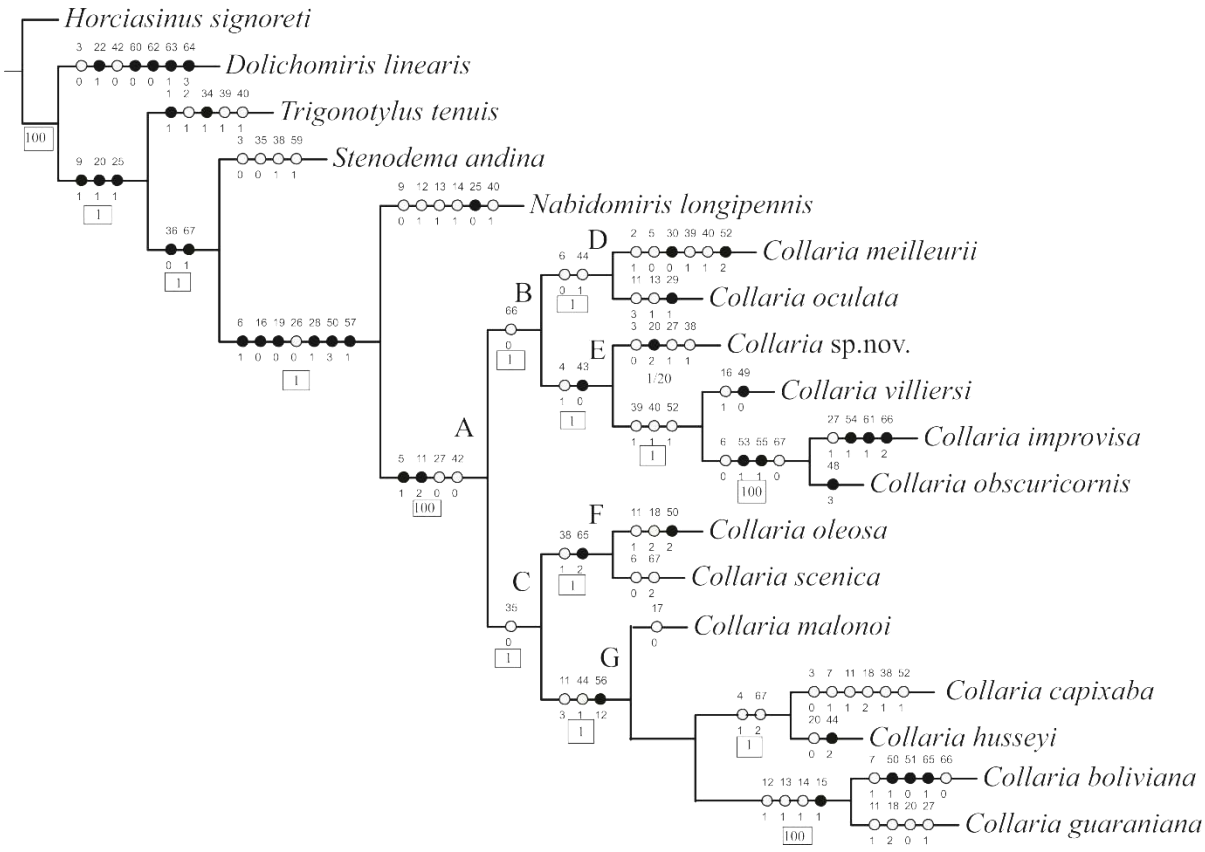

Figure 6. The most parsimonious tree found for Collaria species based on an analysis without C. danae and C. nigra (175 steps, CI = 54, Ri = 55). Filled circles represent unique changes, open circles represent multiple changes. Values for the Bremer support are in squares below branches.

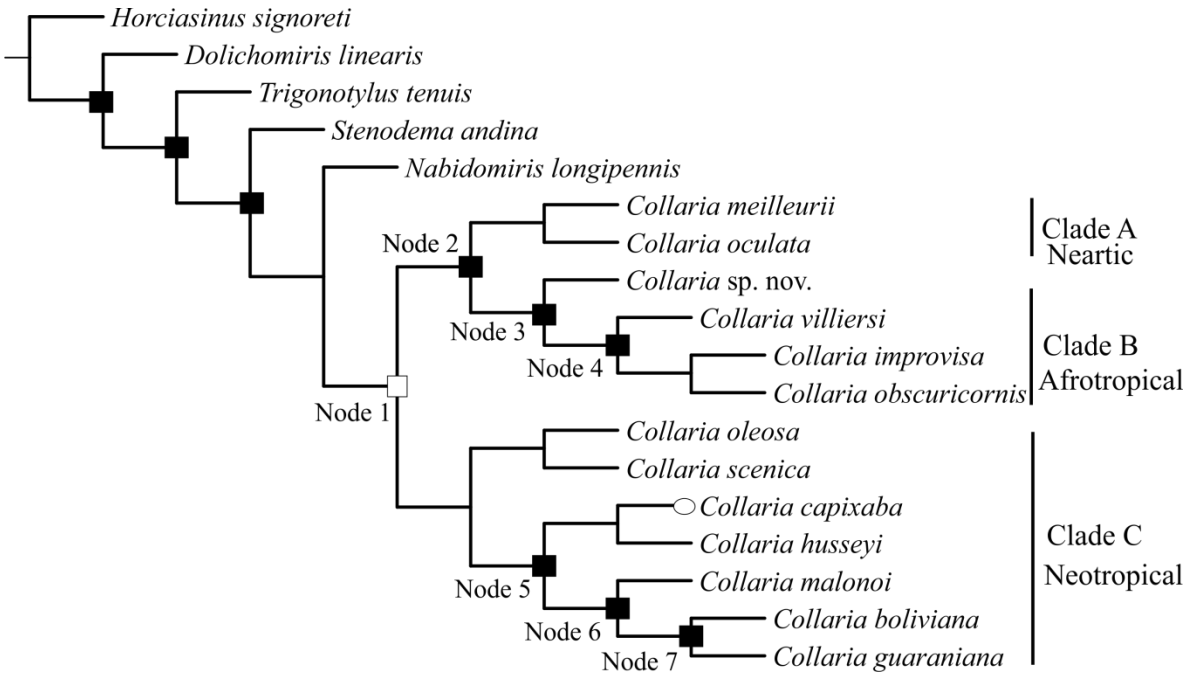

Figure 7. Vicariant nodes obtained from the VIP analysis for Collaria using a 2.0° × 2.0° grid. Clade A Nearctic region, Clade B Afrotropical region, Clade C Neotropical region. Black squares represent nodes with allopatric distribution, white squares represent nodes with allopatric distribution and removed, and white circles represent taxa with removed distribution.

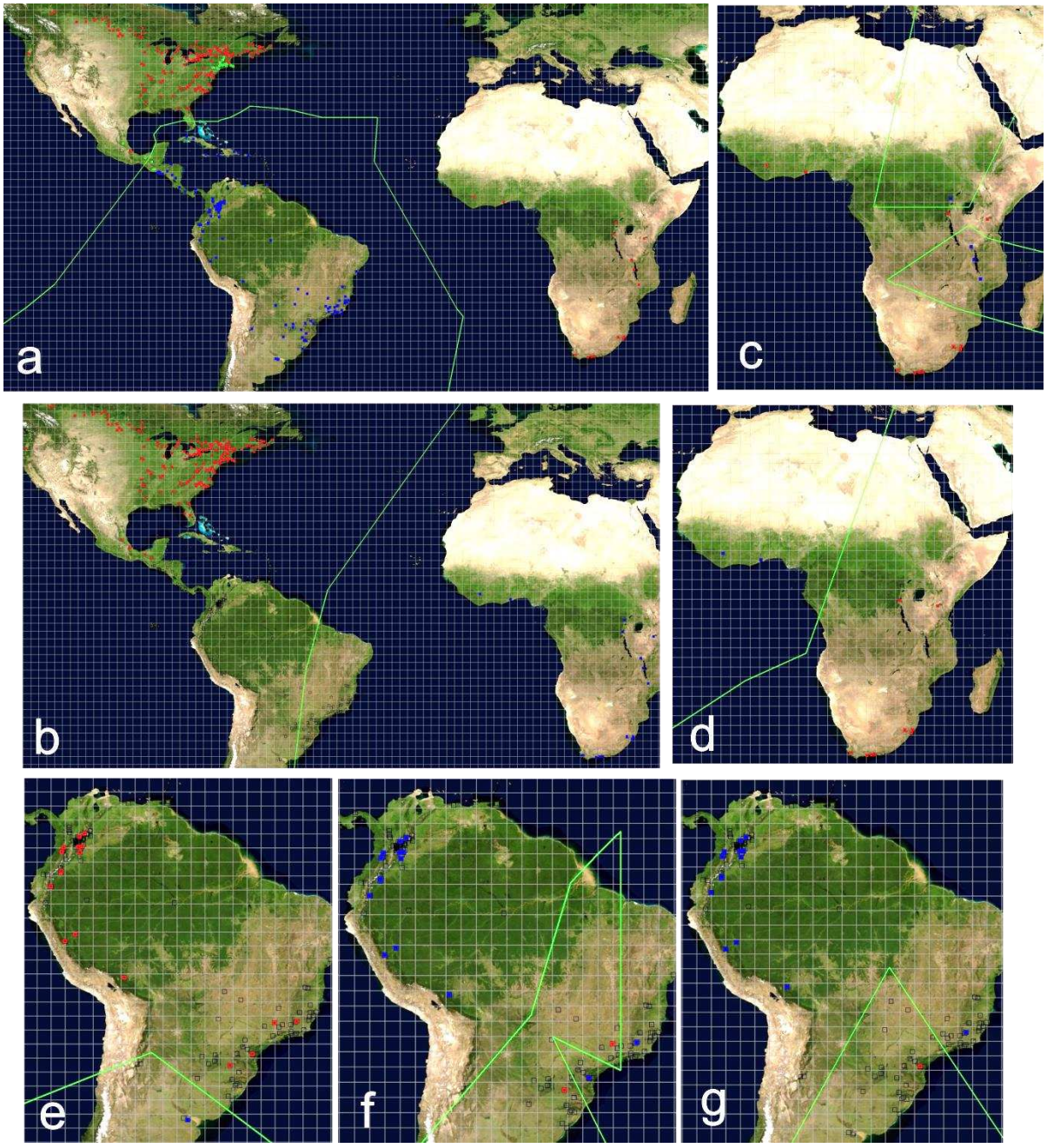

Figure 8. Hypothetical barrier generated by the VIP from Collaria species, a-g graphical representation of disjunct distributions; lines represent Voronoi lines. (Map from http://neo.sci.gsfc.nasa.gov/view.php?datasetId=MOD13A2_M_NDVI).

CONCLUSÕES GERAIS

A partir do estudo comparativo da genitália feminina e masculina de Collaria, e com a utilização de uma metodologia recentemente proposta para fazer uma melhor observação da genitália, foram apresentadas ilustrações detalhadas e fotografias em diferentes posições, com objetivo de descrever de forma completa estas estruturas.

Foram propostos uma nova terminologia e novos caráteres diagnósticos. Nos machos foram descritos os escleritos dorsais do endosoma, o prolongamento da margem lateroposterior do pigóforo; e nas fêmeas, o ápice da gonapófise e a margem lateroapical dos lóbulos interramais. A genitália é destacada como uma ferramenta útil para efetuar classificação de espécies, gêneros e agrupamentos supragenéricos.

A partir do estudo comparado da morfologia da genitália, homologias primárias foram reconhecidas e discutidas, e posteriormente, foram usadas como uma ferramenta para inferir relações filogenéticas entre os táxons.

Na revisão taxonômica baseada em morfologia, além da informação de caracteres previamente disponíveis, foram explorados novos caracteres, como a coloração do corpo e da cabeça. A partir do conhecimento da morfologia e da variação da genitália do macho e da fêmea documentada, foram apresentadas redescrições para todas as espécies e descrições da genitália para as espécies afrotropicais: Collaria improvisa, C. obscuricornis e C.villiersi. Para a espécie C. boliviana foi feita a descrição da genitália da fêmea. Adicionalmente foi feita a descrição de uma espécie nova para a região afrotropical.

São apresentados mapas de distribuição atualizados com novos registros para as espécies C. boliviana, C. oleosa e C. obscuricornis. Uma chave baseada em machos e fêmeas foi elaborada incluindo todas as espécies do gênero, evitando assim, futuros equívocos taxonômicos.

A monofilia do gênero foi suportada por quatro sinapomorfias, as quais constituem caráteres morfológicos diferentes dos que tradicionalmente haviam sido utilizados. Ainda que se tivesse a disponibilidade de todas as espécies do gênero, uma das limitações na análise filogenética residiria na inclusão de duas espécies africanas. Por serem holótipos, não foi possível fazer a dissecção das genitálias. Desta maneira a análise é afetada pelas informações ausentes.

A análise biogeográfica baseada numa análise espacial de vicariância sugere uma provável origem do gênero após o rompimento de Gondwana e do estabelecimento do estreito do Panamá. Isto permite explicar a distribuição atual das espécies de Collaria (Neotropical, Neártica e Afrotropical). Contudo, a descrição de uma nova espécie e os novos registros, reforçam a necessidade da ampliação das coletas especialmente na região Afrotropical e de novos dados de associações com plantas, a fim de complementar o conhecimento da diversidade do grupo.