UNIVERSIDADE FEDERAL DO ESPÍRITO SANTO

CENTRO DE CIÊNCIAS HUMANAS E NATURAIS

PROGRAMA DE PÓS GRADUAÇÃO EM CIÊNCIAS BIOLÓGICAS (PPGBAN)

RICIERI CAMPO DALL'ORTO

TAXONOMY OF *HOCKERIA* WALKER (HYMENOPTERA: CHALCIDIDAE) FROM NEOTROPICAL REGION

VITÓRIA-ES

AGOSTO, 2022

RICIERI CAMPO DALL'ORTO

TAXONOMY OF *HOCKERIA* WALKER (HYMENOPTERA: CHALCIDIDAE) FROM NEOTROPICAL REGION

Dissertação apresentada ao Programa de Pós-Graduação em Ciências Biológicas do Centro de Ciências Humanas e Naturais da Universidade Federal do Espírito Santo, como parte das exigências para a obtenção do Título de Mestre em Ciências Biológicas na área de concentração Biologia Animal.

Orientador: Prof. Dr. Marcelo Teixeira Tavares

VITÓRIA-ES

AGOSTO, 2022

Ficha catalográfica disponibilizada pelo Sistema Integrado de Bibliotecas - SIBI/UFES e elaborada pelo autor

---

Dall'Orto, Ricieri Campo, 1987-
D144t Taxonomy of Hockeria Walker (Hymenoptera: Chalcididae) from Neotropical region / Ricieri Campo Dall'Orto. - 2022.
48 f. : il.

Orientador: Marcelo Teixeira Tavares.
Dissertação (Mestrado em Biologia Animal) - Universidade Federal do Espírito Santo, Centro de Ciências Humanas e Naturais.

1. Taxonomia. 2. Entomologia. 3. Hymenoptera parasitóides. I. Tavares, Marcelo Teixeira. II. Universidade Federal do Espírito Santo. Centro de Ciências Humanas e Naturais. III. Título.

CDU: 57

Ricieri Campo Dall'Orto

Taxonomy of Hockeria Walker (Hymenoptera: Chalcididae) from Neotropical region"

Dissertação apresentada ao Programa de Pós-Graduação em Ciências Biológicas do Centro de Ciências Humanas e Naturais, da Universidade Federal do Espírito Santo, como requisito parcial para obtenção do Grau de Mestre em Biologia Animal.

Aprovada em 31 de agosto de 2022.

Comissão Examinadora:

Prof. Dr. Marcelo Teixeira Tavares (UFES)
Orientador e Presidente da Comissão Examinadora

Prof. Dr. Frederico Falcão Salles (UFV)
Examinador Titular Interno

Profª Drª Júlia Calhau Almeida (UFV)
Examinadora Titular Externa

UNIVERSIDADE FEDERAL DO ESPÍRITO SANTO

PROTOCOLO DE ASSINATURA

O documento acima foi assinado digitalmente com senha eletrônica através do Protocolo Web, conforme Portaria UFES nº 1.269 de 30/08/2018, por
MARCELO TEIXEIRA TAVARES - SIAPE 1351213
Departamento de Ciências Biológicas - DCB/CCHN
Em 02/09/2022 às 08:57

Para verificar as assinaturas e visualizar o documento original acesse o link:
https://api.lepisma.ufes.br/arquivos-assinados/553984?tipoArquivo=O

Agradecimentos

Agradeço ao Departamento de Ciências Biológicas e ao Centro de Ciências Humanas e Naturais da Universidade Federal do Espírito Santo pela formação gratuita e de qualidade, pela concessão da licença para cursar o mestrado e por ser um ambiente acolhedor e fértil, onde me desenvolvi, profissional e pessoalmente, ao longo dos últimos 12 anos.

Agradeço aos órgãos nacionais e estaduais financiadores de pesquisa científica – CAPES, CNPq, FAPES, FAPESP e INCT-HYMPAR – pela estrutura e o investimento que permitiram que esse trabalho fosse desenvolvido.

Agradeço ao PPGBAN, à coordenação do programa, aos professores, servidores e colegas por caminharmos juntos e compartilharmos o grande desafio do curso de uma pós-graduação presencial durante a pandemia de Covid-19.

Agradeço ao meu orientador, prof. Marcelo Tavares, pelo acolhimento, generosidade, dedicação, apoio, disponibilidade, paciência, insentivo, reconhecimento e por todo conhecimento compartilhado durante o meu processo de formação no mestrado.

Agradeço à minha mãe, Célia, pela cumplicidade, carinho, cuidado e por se fazer presente em todos os momentos da minha vida. Meu farol e grande responsável por eu buscar ser uma pessoa melhor a cada dia e por eu encontrar a felicidade por onde eu vou.

Agradeço à minha avó, Nair, minha irmã, Izabela, meus sobrinhos, Alice e Arthur, e aos meus amigos e amigas mais próximos, pessoas que dão sentido ao meu caminho.

Agradeço aos colegas servidores e às colegas servidoras da UFES que, ao longo desses anos, se tornaram grandes amigas(os) e insentivadoras(es).

Agradeço ao Bruno Cancian e ao Yuri Leite, tutores no projeto de pesquisa, pela boa vontade e dedicação para o aprimoramento do trabalho, por compartilharem comigo conhecimentos e pontos de vista importantes para o meu desenvolvimento como pesquisador.

Agradeço à Chirlei Dias e à Karla Marins, grandes amigas, por me ajudarem com a etapa de montagem das pranchas.

Agradeço ao João Luíz Guedes, amigo de todas as horas, por revisar o inglês do texto.

Agradeço ao Frederico Salles, à Júlia Calhau, à Anamaria Dalmolin e à Cecília Waichert, membro e membras da banca examinadora, por aceitarem o convite para contribuírem com o aprimoramento do trabalho.

Sumário

Lista de figuras

Resumo

Hockeria Walker (Hymenoptera: Chalcididae) é distribuído mundialmente e possui 98 espécies descritas. Não há revisão mundial para espécies do gênero e indícios apontam que o táxon é polifilético. Neste trabalho, nos propomos a revisar as espécies do gênero da região Neotropical através de uma abordagem morfológica. São tratadas aqui 10 espécies, das quais quatro são espécies novas – *H.* sp1, *H.* sp2, *H.* sp3 e *H.* sp4 – e seis previamente descritas – *H. bicolor* (Halstead), *H. burdicki* Halstead, *H. burksi* Halstead, *H. eriensis* (Wallace), *H. rubra* (Ashmead) and *H. tenuicornis* (Girault). Descrições e/ou diagnoses, ilustrações e uma chave de identificação são apresentadas para as espécies estudadas. A distribuição geográfica das espécies neotropicais de *Hockeria* é apresentada em um mapa. Apresentamos, também, uma proposta de classificação das espécies do novo mundo em dois grupos de espécies, assim como discutimos as evidências morfológicas, biológicas e geográficas que nos levaram ao reconhecimento desses grupos.

Palavras-chave: Chalcidoidea, formiga-leão, Haltichellinae, Myrmeleontidae, parasitoide.

Abstract

Hockeria Walker (Hymenoptera: Chalcididae) is a worldwide genus with 98 described species. There is no world revision for *Hockeria* species and evidence indicates it as a polyphyletic group. Here it is presented a taxonomic revision of *Hockeria* from the Neotropical region based on a morphological approach. Ten species are treated, four new species – *H.* sp1, *H.* sp2, *H.* sp3 e *H.* sp4 – and six previously described – *H. bicolor* (Halstead), *H. burdicki* Halstead, *H. burksi* Halstead, *H. eriensis* (Wallace), *H. rubra* (Ashmead) and *H. tenuicornis* (Girault). It is provided descriptions and/or diagnosis, illustrations and an identification key for studied species. The geographical distribution of neotropical *Hockeria* is presented in a map. Two groups of species are proposed for New World *Hockeria* and they are based on divergent morphological features, host ranges and pattern of geographical distribution. Aspects of geographical distribution, functional morphology and biology are discussed for species of American *Hockeria*.

Key words: Chalcidoidea, ant lion, Haltichellinae, Myrmeleontidae, parasitoid.

Apresentação

Hockeria é um gênero de vespas parasitóides da família Chalcididae, com distribuição mundial e grande diversidade espécies e de hospedeiros. Há evidências da polifilia do grupo na literatura e entre as espécies do Novo Mundo, já havia sido apontada a existência de dois tipos morfológicos distintos.

Ao longo dos anos, com o desenvolvimento das atividades do Laboratório de Biodiversidade de Insetos, do Departamento de Ciências Biológicas, Centro de Ciências Humanas e Naturais, da UFES, foram reunidos muitos exemplares de *Hockeria*, inclusive exemplares que pareciam pertencer a espécies não descritas. Nesse contexto, nos propomos a revisar as espécies do gênero citadas para região Neotropical, reavaliar aspectos nomenclaturais das espécies descritas, descrever as possíveis espécies novas e formular meios que permitam a identificação adequada das espécies estudadas.

Desenvolvemos esse trabalho como meu projeto de mestrado e os principais resultados obtidos foram: o estabelecimento de dois grupos de espécies de *Hockeria* no continente americano, com base em morfologia, no registro de hospedeiros e na distribuição geográfica; a apresentação de diagnoses e/ou redescrições de seis espécies do gênero já descritas, além de descrições de quatro espécies novas a partir de material coletado no Brasil; e a produção de uma chave de identificação e ilustrações com características diagnósticas, incluindo fêmeas e machos, para todas as espécies do gênero com registro na região Neotropical.

O texto principal da dissertação foi produzido como manuscrito, em língua inglesa, com estrutura e formatação de acordo com instruções da revista de taxonomia Zootaxa (https://www.mapress.com/zt/about/submissions), onde pretendemos publicar.

Taxonomy of Hockeria Walker (Hymenoptera: Chalcididae) from Neotropical region

Introduction

Hockeria Walker is a genus of Haltichellinae (Hymenoptera: Chalcididae) worldwide in distribution, with 98 described species and it is one of the species richest genera in the subfamily (Noyes, 2019). They act as parasitoid wasps and the most commonly known hosts are Lepidoptera of several families, but there are records of species reared from Glossinidae (Diptera) in Africa, Mengenillidae (Strepsiptera) in Italy and Diprionidae (Hymenoptera) and Myrmeleontidae (Neuroptera) in Americas (Halstead, 1990; Delvare, 2017).

The genus *Hockeria* was described by Walker (1834) based on seven European species belonging to two genera. The use of the name faced instability due to misunderstanding and mistakes about the designation and identity of type species by Westwood (1839) and Kirby (1883). The present sense to the genus' identity follows that interpreted by Masi (1916). Kerrich & Menon (1949) explained many mistakes and misidentifications in the previous designation of type species and reported that two specimens of Walker's "*bispinosa*" (the species previously designated as lectotype) actually belongs to *Hockeria bifasciata* Walker. Bouček (1992) elucidated the entire history of the designation of *Hockeria*'s type species and reported that the International Commission of Zoological Nomenclature was asked to legalise the designation of *Hockeria bifasciata* Walker as type species of *Hockeria*, in order to preserve the established usage.

As many worldwide genera, synonyms of *Hockeria* included eight generic names and an updated synonymic list is available in Narendran & van Achterberg (2016). The *Hockeria* relationship in Haltichellini is also unclear. Cruaud *et al*. (2020) presented a Chalcididae topology built from ultra-conserved elements supported by morphological analysis and recovered the genus as polyphyletic. *Hockeria* species present a great morphological variation and well-marked sexual dimorphism, which difficult associating female and male (Halstead, 1990).

There are no exclusive diagnostic features shared by all species belonging to the genus. *Hockeria* is commonly defined according to shared characters by species of the genus regionally found (Bouček, 1988; Delvare, 2017) or by the absence of characters found in other Haltichellini genera (Halstead, 1990; Narendran & van Achterberg, 2016). There is no revision to world fauna of *Hockeria* species. Some regional revisions were published for Europe (Boucek 1951), USSR (Nikolskaya 1960), Japan (Habu 1960), the Near East and India (Husain and Agarwal 1982), Nearctic (Halstead, 1990), Vietnam (Narendran & van Achterberg, 2016) and United Arab Emirates (Delvare, 2017). Husain and Agarwal (1982) presented a key to the world species of *Hockeria* but no one of the New World species was included.

New World species may be recognized by having: antennal scrobe small and shallow, not reaching the median ocellus; preorbital carina weak or absent; and pronotal collar rounded dorsally (Bouček, 1992). Halstead (1990) indicated some diagnostic characters to the genus in Nearctic region, among them are vertex not forming horns, Gt1 without carina, mesoscutellum posterior margin without a median teeth and frontal carina weak, not joining with ocellar area forming an arch. The latter author did not propose groups of species

to share the Nearctic species, but he pointed out that *H. eriensis* (Wallace) and *H. bicolor* Halstead form a separated group of species.

There are eleven *Hockeria* species described in the American continent, seven of them in the Neotropical region (Arias & Delvare, 2003). In Halstead (1990) revision of Nearctic species, five of them are also recorded in the Neotropics: *H. bicolor* Halstead, *H. burksi* Halstead, *H. eriensis* (Wallace), *H. rubra* (Ashmead) and *H. tenuicornis* (Girault). Bouček & Delvare (1992) interpreted *Chalcis punctigera* Fabricius as *Hockeria punctigera*, but they suspect the species is not a component of South America fauna, once the type specimen is partially destroyed and it is similar to species of European fauna. The latter species of *Hockeria* described to the New World was *H. burdicki*, from Mexico, by Halstead (2000). There is no work dedicated to the Neotropical *Hockeria* species.

Material and methods

The amount of 462 specimens of New World *Hockeria* species were assembled from 14 collections around American continent and one from Europe, which supported this work. The following collection (preceded by acronyms based on Evenhuis, 2019) provided the material to this revision: **AMNH**, American Museum of Natural History, New York, United States; **BMNH**, British Museum of Natural History**,** London, United Kingdom; **CZMA**, Coleção Zoológica do Maranhão, Caxias, Brazil; **DCBU**, Universidade Federal de São Carlos, São Carlos, Brazil; **EMEC**, Essig Museum of Entomology, Departament of Entomological Sciences, University of California, Berkeley, United States; **IBIO**, Coleção Entomológica Adolph Hempel, Instituto Biológico, São Paulo, Brazil; **IBGE**, Coleção Zoológica da Reserva Ecológica do Instituto Brasileiro de Geografia e Estatística, Brasília, Brazil; **INPA**, Coleção Sistemática de Entomologia, Instituto Nacional de Pesquisas da Amazônia, Manaus, Brazil; **MJMO**, Museo Entomológico Dr. José Manuel Osorio, Universidad Centroccidental Lisandro Alvarado, Barquisimeto, Venezuela; **MPEG**, Departamento de Entomologia, Museu Paraense Emílio Goeldi, Belém, Brazil; **MZSP**, Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil; **TAMU**, Texas A&M University Insect Collection, College Station, United States; **UFCG**, Coleção Entomológica, Universidade Federal de Campina Grande, Campina Grande, Brazil; **UFES**, Coleção Entomológica do Departamento de Ciências Biológicas, Universidade Federal do Espírito Santo, Vitória, Brazil; **USNM**, Department of Entomological Collections, Smithsonian National Museum of Natural History, Washington, United States.

Firstly, the specimens were sorted into morphospecies based on shared morphological features as described by Winston (1990). Then, each morphospecies was compared with features of described species to check if they are described or not. The identities of described species were accessed by examining type series (specimens or images of specimens) and/or descriptions. Morphological terms follow the Hymenoptera Anatomy Ontology (HAO; Yoder et al., 2010), supplemented by Gibson (1997). The cuticular sculpture follows Harris (1979). Abbreviations used to refer to morphological structures are as follows: Fu1, Fu2, etc. for funicular flagellomere 1, 2, etc.; FV, frontovertex; MOD, maximum diameter of median ocellus; OOL,

ocular-ocellar line or minimum distance between a lateral ocellus and eye margin; POL, posterior ocellar line or minimal distance between lateral ocelli; Gt1, Gt2, etc., for gastral tergite 1, 2, etc.

Species descriptions were produced with DELTA (Description Language for Taxonomy) software package (Dallwitz, 1980; Dallwitz *et al*., 1999). Specimens were examined using a Leica 205 stereomicroscope with 16x oculars, 1.0x Planapo objective and a LED RL 5000 ring light illumination system. Illustrations were produced by an automated Leica Z16 stereomicroscope with a Leica DFG495 camera and 1.0x and 2.0x objectives, captured through the Leica Application Suite (LAS) system. Focus stacking photographs were combined using Helicon Focus v. 6 and treated and arranged into plates with Adobe Photoshop version 23.4.2 and Adobe Illustrator 26.3.1. The distribution map was prepared by SimpleMappr (Shothouse, 2010). In the map, triangles represent records and circles, examined material. In the localities when record and examined material coincide, only circles were plotted. In regions with more than one occurrence of the same species, only one of them were considered. Some points were slightly moved to avoid overlaps.

Taxonomy

Hockeria Walker 1834

Neotropical *Hockeria* diagnosis. Antennal foramen just above clypeus and lower face hardly reduced; scape almost reaching median ocellus; antennal scrobe usually small, shallow and not reaching median ocellus; scrobal surface strigate; malar sulcus weak or absent; preorbital carinae absent or weak, not recurved dorsally to join each other in the ocellar area (in a horseshoe shape); mandibular formula 2:3; pronotal carina present laterally, absent dorsally; prepectus oval with setae; mesoscutellum with posterior margin rounded or truncate, without tubercle-like or spiniform median projection apically; frenal carina with two submedian lobes or emarginate medially; propodeum with median carina absent or vestigial; Gt1 with basal median fossa, without transverse or longitudinal carinae. Compared to females, males have eye more pilose, position of antennal foramen a little higher, scape and pedicel shorter and antenna thicker.

Remarks. Body color, mesoscutellum outline (in lateral and dorsal view), shape of frenal carina, forewing color pattern, shape of metafemur and propodeal carinae (and areolae) are of great importance to delimiting *Hockeria* species because they show a significant interspecific variation. It is relevant to emphasise these features should be considered together for an effective identification of species. The use of only one feature to identify species might lead to misidentification due to intraspecific variation. In addition, the features cited above are critical to associate conspecific females and males.

Halstead (1990) suggested the Nearctic species might be separated in two groups: one group "*with narrow head, globose abdomen and arched mesoscutellum*" (including *H. eriensis* and *H. bicolor*) and another group with head thicker, gaster longer and pointed at apex (including the other described species). However, he stated that a world overview would be necessary to determine and designate species groups. In the present

study, we found the same aspects in the neotropical fauna and we propose to divide the New World *Hockeria* into two groups of species: the *eriensis* species group (with gaster short with blunt apex) and *rubra* species group (with gaster elongate with acuminate apex). In addition to the morphological differences given by Halstead (1990) and cited above, the two groups differ by the aspects of metafemur, the aspects of ventral spines and pegs of hind tarsomeres, the host range, and the geographical distribution. All these aspects are presented to each group below.

The *rubra* species group presents metafemur approximately oval with two small prominences on ventral margin (the most common shape in the species of the genus), in both sexes. In the *eriensis* species group, the females' metafemur presents a great morphological variation. In *H. bicolor* the metafemur is more similar to the species of *rubra* group because it presents two lobed ventral prominences. In *H. eriensis* females, metafemur is elongate without or with a very small ventral prominence. Females of *H.* sp.1, *H.* sp.3 and *H.* sp.4 present metafemur with one obtuse triangular median prominence, not followed by lobe, and in *H.* sp.2 the metafemur has one acute triangular median prominence, not followed by lobe, as well. Some species of *eriensis* group presents the ventral margin of metafemur similar in both sexes, but in *H. eriensis*, *H.* sp1 and *H.* sp.3 it varies. In males of these three species, the metafemur is more similar to *H. bicolor*, with two ventral promicences. In the species of *rubra* group, ventral spines and pegs of hind tarsomeres are developed and very apparent, with some great spines in each tarsomere distally (Fig. 12b). It is similar to many species of Chalcididae including those that attack Lepidoptera. In the species of *eriensis* group, ventral spines and pegs of hind tarsomeres are minute and they are restricted to a narrow band along each tarsomere (Fig. 4a).

All species of *eriensis* group with known hosts attack Neuroptera and among Chalcididae that parasitize this Order, the metafemur is variable (Halstead, 1990) probably related to distinct parasitoids attack strategy. Species of *rubra* group with known hosts are parasitoids of Lepidoptera, except *H. unipunctatipennis* (Girault), a Nearctic species reared from *Neodiprion excitans* (Rohwer) (Hymenoptera: Diprionidae), a pine defoliator endemic in North America. Even though this host does not belong to the same insect Order, it also has eruciform larval stage, indicating similar host larvae morphology and lifestyle, hence, similar functional morphology in parasitoids linked to attack and evasion from hosts. Therefore, it makes sense to suppose that relatively few evolutionary steps would be required to depart from a Lepidoptera parasitoid ancestor to a specialised one in parasitizing Diprionidae. Along with the morphological similarities, it helps to justify the inclusion of *H. unipunctatipennis* in "elongate gaster" species group despite host divergency.

There is a geographical pattern of species groups of *Hockeria* in the New World. Species of *eriensis* group predominate in the Neotropical region, with all known species recorded to the region and it is probably related to the host distribution. Myrmeleontidae is cosmopolitan but notably more diverse in arid and semiarid regions, commonly found in the tropics (Machado *et al.*, 2018). New *Hockeria* species were collected particularly in Brazilian savannah areas and there is only one record for one of them abroad. Halstead (1990) mentioned *H.* sp.2 as *H. eriensis* variation, but he did not make it clear where exactly those specimens came from. These two species can be distinguished mainly by body color, propodeum structure, forewing pattern, metafemur shape and Gt1 sculpture. Species of *rubra* group occur more in the Nearctic region. No species of

this group has been recorded from South America and between neotropical records, all of them are from the Southern United States and Mexico, as well as their respective known hosts. There are three records of *Hockeria* unidentified at species level in the Neotropical region. Arias & Delvare (2003) cited two species from Colombia and Araújo *et al*. (2019) one from Peruvian fauna. In the last paper, they presented a photo of a *Hockeria* male recorded and it seems to belong to *eriensis* group by presenting mesoscutelum more convex.

Below, it is presented a key and descriptions (or diagnosis) to the neotropical species of *Hockeria* belonging to each species group, including six species previously recorded to the region and four new ones.

Key to species of *Hockeria* from Neotropical region

1. Female; ovipositor present **2**
- Male; ovipositor absent **11**
2. Mesoscutellum distinctly convex in profile; gaster short with blunt apex (*eriensis* species group) **3**
- Mesoscutellum slightly convex in profile; gaster elongate with acute apex (*rubra* species group) **8**
3. Mesepimeron mainly punctulate, with fine horizontal carinae; ventral margin of metafemur with two rounded lobes of similar size; metatibia with four longitudinal carinae ..... ***H. bicolor***
- Mesepimeron costate, interstice smooth and shiny; metatibia with two or three longitudinal carinae.....**4**
4. Ventral margin of metafemur with one acute triangular median prominence, not followed by lobe ..... ***H. sp.*2**
- Ventral margin of metafemur with one small and obtuse prominence or without prominence **5**
5. Ventral margin of metafemur with one small and obtuse median prominence, followed by wide convexity, sometimes prominence or convexity indistinct; body color mainly orange brown ..... ***H. eriensis***
- Ventral margin of metafemur with one obtuse triangular median prominence, not followed by lobe; body color mainly black **6**
6. Head red orange; Gt1 dorsum coriarious-imbricate anteriorly to coarsely imbricate posteriorly, with minute punctures ..... ***H. sp.*3**
- Head mainly black **7**
7. Gt1 dorsum smooth and shine anteriorly to imbricate-coriaceous posteriorly, with minute punctures centrally ..... ***H. sp.*1**
- Gt1 dorsum mostly shallowly imbricate anteriorly to imbricate posteriorly, without punctures ..... ***H. sp.*4**
8. Metafemur 1.6 x as long as wide ..... ***H. burdicki***
- Metafemur at least 1.9 x as long as wide **9**
9. Forewing with one pale brown spot posterior to marginal vein; mesepimeron costate-punctulate ..... ***H. burksi***

- Forewing with one brown band posterior to marginal vein and another subdistal one, and one hyaline spot or strip with white setae posterior to stigmal vein; mesepimeron costate, interstice smooth and shiny **10**

10. Forewing with one rounded spot with white setae posterior to stigmal vein; Gt1 with distal third coriarious-punctulate dorsally; frenal carinae with edge slightly emarginate, with short submedian lobes ..... ***H. tenuicornis***

- Forewing with one hyaline band with fine white setae posterior to stigma vein; Gt1 smooth and shine dorsally; frenal carina with edge "V" or "U" notched, with two somewhat triangular submedian lobes ..... ***H. rubra***

11. Mesoscutellum distinctly convex in profile (*eriensis* species group)..... **12**

- Mesoscutellum slightly convex in profile (*rubra* species group)..... **17**

12. Ventral margin of metafemur with two small prominences **13**

- Ventral margin of metafemur with only one prominence **16**

13 Forewing infumate and Gt1 dorsum imbricate, with minute punctures centrally ..... ***H. eriensis***

- Forewing hyaline with weaker pattern **14**

14 Mesepimeron mainly punctulate, with fine horizontal carinae; Gt1 base polished except for lateral coriaceous, other gastral tergites coriaceous except for polished medial area of Gt2 ..... ***H. bicolor***

- Mesepimeron costate, interstice smooth and shiny **15**

15 Gt1 dorsum coriarious-imbricate anteriorly to coarsely imbricate posteriorly, with minute punctures ..... ***H. sp.*3**

- Gt1 dorsum smooth and shine anteriorly to imbricate-coriaceous posteriorly, with minute punctures centrally ..... ***H. sp.*1**

16 Ventral margin of metafemur with one acute triangular median prominence ..... ***H. sp.*2**

- Ventral margin of metafemur with one obtuse triangular median prominence; interanttenal prominence red and with a tubercle shape ..... ***H. sp.*4**

17 Forewing hyaline **18**

- Forewing clouded with an orangish tint and metafemur 1.6 x as long as high ..... ***H. burdicki***

18 Forewing with whitish setae ..... ***H. burksi***

- Forewing with brown setae **19**

19 Posterior margin of frenal carina with two rounded lobes ..... ***H. rubra***

- Posterior margin of frenal carina without lobes ..... ***H. tenuicornis***

The *eriensis* species group

Diagnosis. Mesoscutellum distinctly convex in lateral view; metafemur shape variable among species and among sexes, with one, two or without prominences in ventral margin; hind tarsomeres with spines and pegs minutes and restricted to a narrow band along each tarsomere; gaster short with blunt apex; parasitoids of

psammophilous larvae of Myrmeleontidae (Neuroptera); the species of *eriensis* group occur mainly in the Neotropics, with all species recorded to this region.

Species included. *H. bicolor* Halstead, *H. eriensis* (Wallace), *H.* sp.1, *H.* sp.2, *H.* sp.3 and *H.*sp4.

***Hockeria bicolor* Halstead**

Figs. 1a–f, 2a–d

Hockeria bicolor Halstead, 1990: 626–630. Holotype #f. USA: Tulare Co. (California) (CASC n° 15241, not examined).

Hockeria bicolor Halstead: Bouček (1992: 62; host); Arias & Delvare (2003: 139; checklist); Tavares & Aquino (2014: 148; checklist); Noyes (2019; catalogue); Tavares (2022; catalogue).

Diagnosis. Female. Body almost wholly black. Frenal carina expanded distally, emarginate, with two short submedian lobes; dorsellum with submedian carinae very close one to another, forming a very narrow median areola; propodeum with disc densely punctulate between carinae, mostly matte; median areola about 2.6 x as long as wide, sometimes submedian carinae irregular and median areola not completely delimited; mesepimeron mainly punctulate, with fine horizontal carinae; forewing hyaline, with one brown band posterior to marginal vein and another subdistal one, and a band of white setae posterior to postmarginal vein; basal cell with 1–4 setae distally; metafemur 1.91 – 2.13 x as long as high, ventral margin with two rounded lobes of similar size; metatibia with four longitudinal carinae; Gt1 smooth and shine anteriorly to imbricate-coriaceous posteriorly, with minute punctures centrally; Gt2-Gt6 with thin and short setae.

Description. FEMALE. Body length 2.53 – 3.47 mm. *Color*. Mainly black, but with orange-brown and dark-brown areas, as follows. The following orange-brown: scape, pedicell, anellus, Fu1, mandibles (except borders and teeth), maxillary and labial palpi, around the coxae-femur-tibiae joints (except between metafemur and metatibia), tarsomeres except tarsal claws, submarginal and hindwing veins, hypopygium, and ovipositor sheath. The following dark brown: Fu2 to clava, torulus, tegula, forewing veins (except submarginal), and legs (except around joints) dark-brown (Fig. 1a). Body pilosity white, but in mesoscutellum is orange-brown (Fig. 1d).

Head. Vertex with profile between lateral ocelli, in frontal view, straight, not hidden medially by median ocellus. Lateral ocellus with lateral fovea less than 0.3x the ocellar diameter. Interantenal prominence about as large as antennal foramen. Antenna with the lenght of pedicel plus flagellum combined about 2.5 x as long as the length of scape; scape not reaching the anterior margin of median ocellus. Preorbital carina present only on middle third of eye margins. Malar sulcus replaced by granulate stripe near the eye and the oral fossa; external carina present as an irregular carina at least near the oral fossa (Fig. 1c). Ratios and measurements: head W/H 1.42; scape L/W 8; pedicel L/W 2.57; anellus L/W 1.14; funicular segments L/W: Fu1 1.75; Fu2 1.63; Fu3 1.44; Fu4 1.33; Fu5 1.33; Fu6 1.11; Fu7 1.11; clava L/W 2.38; eye H/W 1.39; FV 0.46 mm; MOD 0.07 mm; POL 0.22 mm; OOL 0.06 mm.

Mesosoma. Pronotal collar and dorsum of mesoscutum with setae at most slightly longer than the diameter of its own fovea. Mesoscutellum distinctly convex; frenal carina developed as a lamina laterally, distally expanded, median edge emarginate with two short submedian lobes (Fig. 1d); frenum with median carina. Dorsellum with submedian carinae very close one to another, forming a very narrow median areola. Propodeum with disc densely punctulate between carinae, mostly matte; submedian carinae slightly arched and somewhat parallel to each other; median areola about 2.6 x as long as wide; sometimes submedian carinae irregular and median areola not completely delimited; anterolateral fovea squared or not delimited (Fig. 1e). Mesepimeron mainly punctulate, with fine horizontal carinae (Fig. 1f). Tegula with setae short and thin. Forewing hyaline, with one brown band posterior to marginal vein and another subdistal one, and a band of white setae posterior to postmarginal vein; basal cell with 1–4 setae distally (Fig. 2a). Ventral margin of metafemur with two rounded lobes of similar-size (Fig. 2b). Metatibia with four longitudinal carinae (Fig. 2c). Ratios and measurements: mesoscutum L/W 0.42; mesoscutelum L/W 1.12; forewing L/W 2.56; submarginal vein L 0.74 mm; marginal vein L 0.28 mm; stigmal vein L 0.05 mm; metafemur L/W 2.07.

Metasoma. Gaster shorter than head plus mesosoma combined, truncate (Fig. 2d). Gt1 dorsum smooth and shine anteriorly to imbricate-coriaceous posteriorly, with minute punctures centrally; Gt2 sculptured as the sides medially; Gt1-Gt6 with thin and short setae. Ratios and measurements: gaster L/W 1.73; Gt1 L 0.51 mm; Gt1+Gt2 L 0.69 mm.

MALE. Similar to female except as following described. The following dark brown: antenna, clypeus, labrum, mandibles (except margins), maxillary and labial palpus, most of coxae, femurs and tibiae, and gaster laterally. Metatibia with three carinae only. Forewing pattern fade (Fig. 1b). Ratios and measurements: body length 2.75 mm; head W/H 1.45; scape L/W 5.86; pedicel L/W 1.42; anellus L/W 2; funicular segments L/W: Fu1 1.58; Fu2 1.5; Fu3 1.33; Fu4 1.25; Fu5 1.18; Fu6 1.3; Fu7 1; clava L/W 1.44; eye H/W 1.31; FV 0.52 mm; MOD 0.09 mm; POL 0.24 mm; OOL 0.07 mm; mesoscutum L/W 0.41; mesoscutelum L/W 1.16; forewing L/W 2.51; submarginal vein L 0.93 mm; marginal vein L 0.19 mm; stigmal vein L 0.06 mm; metafemur L/W 1.82; gaster L/W 1.52; Gt1 L 0.57 mm; Gt1 + Gt2 L 0.72 mm.

Material examined. (70 #f and 151 #m). **VENEZUELA**. Mérida: 1 m#, Caracciolo Parra y Almedo, Rio Frio, 700 m, vii.2010, Malaise, Finca San Juan, Cacao (MJMO, 9532). **BRAZIL**. Pará: 1 f#, Carajás, S. Norte-Est. Serraria, 24-27.vi.1995, Malaise, F. F. Ramos col. (MPEG, 4647); 2 m#, Santana do Araguaia, 01-13.viii.1982, T. Pimentel col. (MPEG, 4661, 4662); 1 m#, Santana do Araguaia, 01-13.viii.1992, F. F. Ramos col. (MPEG, 4648); 1 m#, São João de Pirabá, Boa Esperança, 18-24.x.1990, A. L. Henriques col. (MPEG, 4660). Rondônia: 1 m#, Porto Velho, Abunã, Rio Madeira, 65°22'0,10"W 9°35'53,10"S, 28.vi-01.vii.2010, Malaise, T10, R. M., Feitosa & R. R., Silva col. (MZSP, 8636); 1 m#, *idem*, Caiçara, Rio Madeira, 65°2'53,70"W 9°35'54,40"S, 13-16.ix.2010, Malaise, T8, R. M., Feitosa & R. R., Silva col. (MZSP, 8880). Maranhão: 1 m#, Carolina, Parque Nacional Chapada das Mesas, Riacho Corrente, 47°05'W 07°04'S, 288 m, 01-10.vi.2014, Malaise, J. A., Rafael & F., Limeira col. (CZMA, 38204); 1 m#, *idem*, 10-20.vii.2013 (CZMA, 38728); 4 m#, *idem*, 20-31.viii.2013 (CZMA, 38909, 38910, 38911, 38912); 1 m#, *idem*, Parque Nacional Chapada das Mesas, Riacho Sucurui, 47°18'W 07°07'S, 240 m, 10-20.viii.2014, Malaise, J. A. Rafael & F.,

Limeira col. (CZMA, 38639); 1 m#, *idem*, 01-10.viii.2014 (CZMA, 38655); 1 m#, *idem*, 20-30.ix.2013 (CZMA, 38677); 1 m#, Caxias, Reserva Ecológica Inhamum, 43°25'W 04°54'S, 27-29.xii.2008, Malaise, F., Limeira col. (CZMA, 38608); 1 m#, *idem*, Reserva Ecológica Inhamum, 01-08.x.2008, Malaise, G. A., Cunha col. (CZMA, 38622); 1 f#, Mirador, Parque Estadual Mirador, Base da Geraldinha, 24.i.2007, Malaise, F., Limeira-de-Oliveira col. (CZMA, 32213); 1 f#, Pedrinhas, 18.x.1984, Bandeja Branca, Expedição Instituto Biológico, (IBIO, 4643); 1 f#, *idem*, 18.ix.1984 (IBIO,4644);1 f#, *idem*, 20.ix.1984, Bandeja Amarela (IBIO, 4645); 1 f#, Riachão, Fazenda Altos, 18-22.viii.2009, Malaise, F., Limeira-de-Oliveira & M. B. Aguiar Neto col. (CZMA, 32212). Piauí: 2 m#, Piracuruca, Parque Nacional de Sete Cidades, Posto do ICMBio, 41°42'W 04°05'S, 16-28.ii.2013, Malaise, F. Limeira & S. Pinto-Júnior col. (CZMA, 38936, 38938); 1 m#, *idem*, 01-14.ii.2013, J. A., Rafael & Pinto-Júnior, S. col. (CZMA, 38852); 1 m#, *idem*, 12-27.iii.2013, F., Limeira col. (CZMA, 38881); 1 f#, 6 m#, *idem*, F. Limeira & S., Pinto-Júnior col. (CZMA, 38943, 38944, 38947, 38949, 38950, 38951, 38952); 1 m#, *idem*, 16-31.i.2013, Malaise, F., Limeira & S., Pinto-Júnior col. (CZMA, 38957); 1 m#, idem, 01-10.iii.2013, Malaise, F., Limeira col. (CZMA, 39022); 1 f#, Piripiri, Parque Nacional de Sete Cidades, 41°42'W 04°05'S, 30.viii.2013, Malaise, C. R., Araújo, col. (MZSP, 40611); 1 f#, 1 m#, *idem*, 30.ix.2013 (MZSP, 40708, 40715); 1 m#, *idem*, 29.viii.2013 (MZSP, 40858); 1 f#, 1 m#, *idem*, x.2012 (MZSP, 40877, 40883); 1 f#, *idem*, 30.vii.2013 (MZSP, 41030); 2 m#, *idem*, 29.viii.2013 (MZSP, 41245, 41263). Rio Grande do Norte: 1 m#, Patu, 37°37'W 06°06'S, 30.ix.2008, Malaise, Caatinga, D. R. R., Fernandes col. (UFES, 29250). Bahia: 1 f#, 1 m#, Paulo Afonso, ESEC Raso da Catarina, 14-16.iv.2013, Moericke, Trilha Sul, A. S., Soares & E. M., Shimbori col. (MZSP, 47725, 40827). Mato Grosso: 2 f#, Chapada dos Guimarães, Parque Nacional Chapada dos Guimarães, 55°50'6,10"W 15°24'19,8"S, 11-13.iii.2008, Malaise, J. Almeida col. (MZSP, 4919, 4921); 1 f#, 1 m#, *idem*, 55°84'32"W 15,41°3743"S, 03-13.xi.2008 (MZSP, 8824, 8825);1 m#, *idem*, 10-12.vi.1991, J. A., Rafael & J., Vidal col. (INPA, 7778); 1 f#, Rondonópolis, Área Industrial Tadarimana, 24.x.1991, Moericke, Cerrado, M. T., Tavares col. (UFES, 4649); 1 m#, Tangará da Serra, Serra dos Parecis, Fazenda Aparecida da Serra, 28.v.2008, Malaise, R. Franciosi col. (MZSP, 40582). Goiás: 1 f#, 1 m#, Alto Paraíso de Goiás, Parque Nacional Chapada dos Veadeiros, 47°55'38"W 14°12'26"S, 15-25.ix.2005, Malaise, A. P., Aguiar col. (MZSP, 17604, 17316); 1 f#, idem, 07-15.ix.2005 (MZSP, 17558); 1 f#, idem, 47°44'04"W 14°07'44"S, 04.xii.2018, Malaise, Cerrado Queimado, N.W., Perioto & R.I.R., Lara col. (UFES, 47721); 1 f#, *idem*, 19.vi.2018 (UFES, 47722); 1 f#, *idem*, 47°45'00"W 14°08'34"S, 19.ii.2018, Moericke, Cerrado, N.W., Perioto & R.I.R., Lara, col. (UFES, 47723). Distrito Federal: 1 f#, Brasília, Reserva Ecológica do IBGE, 11-25.ix.1981, Tenda, Beira Mata, (IBGE, 4650); 1 f#, *idem*, 19-26.x.1979, (IBGE, 4651); 1 f#, *idem*, 21-28.x.1982, Janela, Cerradão (IBGE, 4652); 1 f#, *idem*, 24-30.ix.1982, Janela, Beira Mata (IBGE, 4653); 1 f#, *idem*, 21-28.i.1982, Malaise, BR-251, km 0 (IBGE, 4654); 1 f#, idem, 28.viii-11.ix.1981 (IBGE, 4655); 1 f#, 30.ix-07.x.1982, Janela (IBGE, 4656); 1 f#, idem, 14-21.ix.1982, (IBGE,4657); 1 m#, *idem*, 16-24.ix.1982, Malaise, (IBGE, 4658); 1 m#, idem, 7-14.x.1982 (IBGE, 4659); 1 m#, *idem*, 16-23.x.1981, Tenda (IBGE, 4663). Mato Grosso do Sul: 1 m#, Aquidauana, 56°52'49.4"W 20°41'55.9"S, 06.xii.2011-06.i.2012, Malaise, Lamas & Nihei col. (MZSP, 20524); 3 m#, *idem*, Res. Ecol. UEMS, 55°39'20.8"W 20°26'03.7"S, 11-26.ix.2011 (MZSP, 20850, 20963, 20965); 1 m#, *idem*, Fazenda Califórnia, 55°52'49.4"W 20°41'55.9"S,

06.viii-06.ix.2012 (MZSP, 21056); 1 m#, *idem*, 55°39'20.8"W 20°25'59.0"S, 11-26.xii.2011 (MZSP, 21081); 1 m#, *idem*, 29.x-14.xi.2012 (MZSP, 21084); 3 m#, *idem*, Res. Ecol. UEMS, 55°39'20.8"W 20°25'59.0"S, 26.ix-11.x.2011 (MZSP, 21110, 21111, 21112); 3 m#, *idem*, 27.viii-11.ix.2011, Malaise (MZSP, 20542, 20544, 20545); 2 m#, Bodoquena, Fazenda Califórnia, 56°52'54" 20°41'49.9", 06-21.x.2012, Malaise, Lamas & Nihei col. (MZSP, 20551, 20742); 2 f#, 9 m#, *idem*, 56°52'49.4"W 20°41'55.9"S, 21.vii-06.viii.2012 (MZSP, 20600, 20601, 20603, 20606, 20607, 20616, 20618, 20619, 20621, 20644, 20649); 1 m#, *idem*, 21.vi-06.vii.2012 (MZSP, 20632); 1 m#, *idem*, 06-21.vii.2012 (MZSP, 20710); 9 m#, Corumbá, 16.i.2012, Malaise, SISBIOTA, Pantanal, C., Araújo col. (UFES, 31625, 31630, 31632, 31635, 31636, 31637, 31638, 31640, 31642); 3 f#, 21 m#, *idem*, 01.i.2012 (UFES, 31655, 31718, 31719, 31720, 32721, 31722, 31723, 31730, 31731, 31732, 31733, 31735, 31737, 31738, 31739, 31740, 31741, 31742, 31743, 31744, 31745, 31746, 31747, 31748); 2 m#, *idem*, 31.i.2012 (UFES, 31653, 31771); 4 f#, 1m#, *idem*, 17.xii.2011 (UFES, 31680, 31686, 31694, 31702, 31703); 1 m#, *idem*, 17.xi.2011 (UFES, 31770); 1 f#, 7 m#, *idem*, 15.ii.2012 (UFES, 31752, 31753, 31755, 31756, 31757, 31759, 31760, 31761); 2 f#, 1 m#, Porto Murtinho, Fazenda Retiro Conceição, Trilha da Mata Bruta, 57°16'W 20°59'S, 01-15.xi.2012, Malaise, SISBIOTA, CNPq/Fapesp, Lamas & Nihei col. (MZSP, 40438, 40465, 40493); 1 f#, *idem*, 10-25.i.2012 (MZSP, 40568); 3 f#, 2 m#, *idem*, 11-26.xii.2011, Malaise, Lamas & Nihei col. (MZSP, 40932, 40935, 40938, 40945, 40953); 1 f#, 3 m#, *idem*, 10.i-25.ix.2012 (MZSP, 41056, 41058, 41059, 41062); 1 f#, 2 m#, *idem*, Trilha da Espinheira, 25.i-29.iii.2012 (MZSP, 41419, 41434, 41437). Minas Gerais: 1 f#, Araporã, Fazenda da Facudade de Agronomia, 08.viii.2002, C. H., Marchiori col. (UFES, 27033); 1 f#, *idem*, 01.v.2002 (UFES, 27034); 1 f#, *idem*, 03.x.2002 (UFES, 27035); 1 f#, Chapada Gaúcha, Parque Nacional Grande Sertão Veredas, 45°43’17"W 15°10’29"S, 14.viii.2018, Malaise, Cerrado, N. W., Perioto & R. I. R., Lara col. (UFES, 47232) Espírito Santo: 1 f#, Cariacica, Reserva Biológica Duas Bocas, Pau Amarelo, 21-30.x.2005, Malaise, A. P., Aguiar col. (UFES, 5068); 1 f#, Laranja da Terra, Joatuba, Fazenda Betzel, 40°58'W 19°50'S, 570-610 m, 02-10.xii.2013, Malaise, M. T., Tavares col. (UFES, 47724); 1 f#, 1 m#, Marechal Floriano, Sítio da Dona Lúcia, km 65, 40°50.869'W 20°23.570'S, 14-28.iii.2015, Malaise, J.P.M., Hoppe, col. (UFES, 41492, 41493); 2 f#, Santa Teresa, Estação Biológica de Santa Lúcia, 40°31'44"W 19°58'25"S, 13.x.2008, Malaise, M. T., Tavares col. (UFES, 4872, 4877) São Paulo: 1 f#, 8 m#, Descalvado, Fazenda Itaúnas, 47°37'26"W 21°54'05"S, 6.x-3.xi.2005, Cerrado, N. W., Perioto col. (UFES, 30304, 30318, 30320, 30371, 30373, 30379, 30386, 30412, 30414); 1 f#, Ibitinga, Seringal, 16.xi.1984, Moericke (IBIO, 4646); 10 f#, 21 m#, Luiz Antônio, Estação Ecológica Jataí, 47°48'28.2"W 21°37'17.7"S, 530-550 m, 14.xii.2006-30.ix.2009, Malaise, Cerrado, N. W., Perioto col. (UFES, 32746, 32918, 33202, 33271, 33288, 33337, 33401, 33442, 33467, 33471, 33580, 33625, 33628, 33842, 33896, 34361, 34421, 34429, 34454, 34559, 34733, 34768, 34804, 34830, 34832, 34833, 34836, 34864, 34883, 34889); 1 m#, São Carlos, Faz. Canchim, 16.i.1990, Moericke, Cerrado, N. W., Perioto col. (DCBU, 1045); 1 m#, Teodoro Sampaio, vii.1985, Oliveira col. (BMNH, 8587). Rio Grande do Sul: 1 f#, Quaraí, Estância São Roberto, 22.xi.1985, R., Cure col. (INPA, 8035).

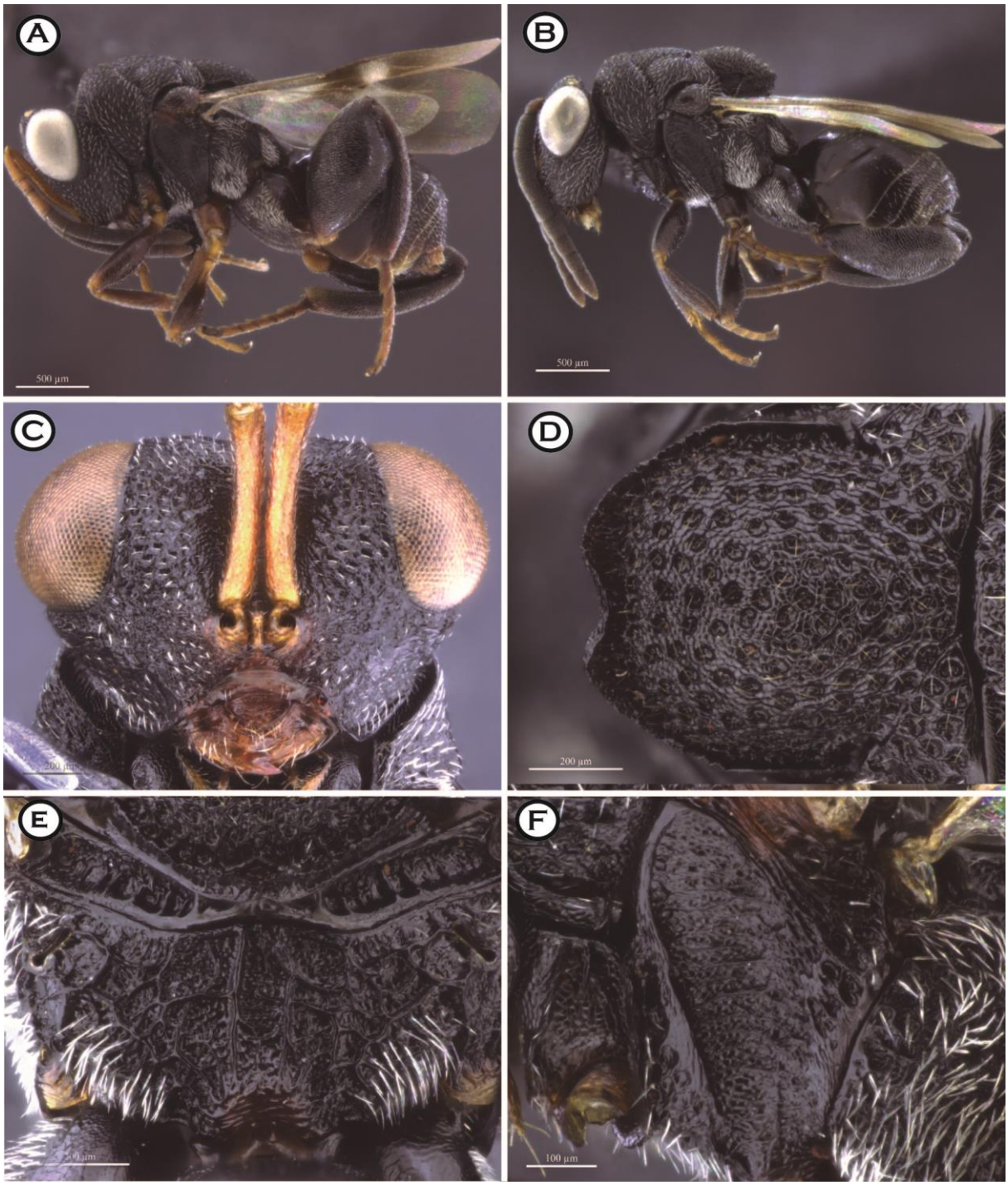

FIGURE 1a–f. *Hockeria bicolor*, female: **a**, habitus, lateral; male: **b**, habitus, lateral; female: **c**, head, frontal; **d**, mesoscutellum, dorsal; **e**, propodeum; **f**, pro, meso and metapleuron.

FIGURE 2a−d. *Hockeria bicolor*, female: **a**, forewing; **b**, metafemur, outer face; **c**, metatibia, ventral; **d**, gaster, lateral.

Host. *Euptilon* sp. (Nemoleontinae: Glenurini) and *Ululodes quadrimaculata* (Ascalaphinae: Ululodini) (Neuroptera: Myrmeleontidae) (Halstead, 1990).

Geographical distribution. Canada, United States, Mexico, Costa Rica, Venezuela*, Brazil (Pará*, Rondônia*, Maranhão*, Piauí*, Rio Grande do Norte*, Bahia*, Mato Grosso*, Mato Grosso do Sul*, Goiás*, Distrito Federal*, Minas Gerais*, Espísito Santo*, São Paulo e Rio Grande do Sul*).

Remarks. Female of *H. bicolor* is the most distinctive between the species with short and truntace gaster for body length smaller, less setae on body surface and metafemur with two ventral lobes. Males of *H. bicolor* are similar to males of *H. eriensis* and *H.* sp. 3 by the body color and the metafemur shape. However, the formers are very similar to females and, except by metafemur shape, all the features pointed to females are also usefull to diffentiate them. Examined specimens of *H. bicolor* present a little variation in body color, frenal carina teeth, shape of propodeum median areola and propodeum sculpture.

***Hockeria eriensis* (Wallace)**

Figs. 3a–f, 4a

Stomatoceras rubra eriensis Wallace, 1942: 31. Holotype #f. USA: Presque Isle (Pennsylvania) (CMNH, not examined).

Stomatoceras rubrum eriense Wallace: Peck (1951: 585; emendation).

Hockeria eriensis (Wallace): Burks *in* Stefan (1959: 304; status, combination); Peck (1963: 848; catalogue); Halstead (1990: 622; key, diagnosis); Arias & Delvare (2003: 139; checklist); Noyes (2019; catalogue); Tavares (2022; catalogue).

Diagnosis. Female. Body mainly orange brown. Lateral fovea of lateral ocellus with lateral margin irregular; scape exceeding the anterior margin of median ocellus; malar sulcus irregular and virtually complete, distinct at least near the eye; external carina partly present to complete; submedian carinae of propodeum divergent and angled between the limit of anterior third and anterior half; basal cell of forewing with 3 lines of setae; metafemur 2.97 – 3.14 x as long as high, ventral margin with one small and obtuse median prominence, followed by wide convexity, sometimes prominence or convexity indistinct; metatibia with two longitudinal carinae, sometimes carinae inconspicuous and incomplete; Gt1 dorsum imbricate, with minute punctures centrally.

Description. FEMALE. Body length 4.00 – 4.57 mm. *Color*. Mainly orange brown, with darker areas, as follows. The following dark brown to black: from Fu3 to clava, mandible margin and teeth, anterior margin of mesoscutum, anterior and lateral margins of axilla, metanotum, anterior submedian spot on propodeum, mesoepisternal ventral shelf and metafemural comb of denticles. Fore and mid legs from dark orangish-brown to brown. Body pilosity white (Fig. 3a).

Head. Vertex with profile between lateral ocelli, in frontal view, concave, not hidden medially by median ocellus. Lateral ocellus with lateral fovea with lateral margin irregular. Interantenal prominence about as large as antennal foramen. Antenna with the lenght of pedicel plus flagellum combined about 2.2 x as long as the length of scape; scape exceeding the anterior margin of median ocellus. Preorbital carina distinguished on upper two thirds of eye margins. Malar sulcus irregular and virtually complete, distinct at least near the eye; external carina partly present to complete (Fig. 3c). Ratios and measurements: head W/H 1.33; scape L/W 9.1; pedicel L/W 2.36; anellus L/W 1.16; funicular segments L/W: Fu1 2; Fu2 1.79; Fu3 1.57; Fu4 1.43; Fu5 1.36; Fu6 1.29; Fu7 1.23; clava L/W 1.69; eye H/W 1.23; FV 0.8 mm; MOD 0.14 mm; POL 0.37 mm; OOL 0.11 mm.

Mesosoma. Pronotal collar and dorsum of mesoscutum with setae at least 2 times as long as the diameter of its own fovea. Mesoscutellum distinctly convex; frenal carina developed as a lamina laterally, distally expanded, median edge with wide notch, botton of the notch laminar and almost straight, with two somewhat triangular submedian lobes; frenum with median carina (Fig. 3d). Dorsellum with median areola about as high as wide. Propodeum with disc punctulate-rugulose between carinae, with some shiny and almost smooth areas; submedian carinae divergent and angled between the limit of anterior third and anterior half; median areola

about 1.7 x as long as wide; anterolateral fovea large and irregular, divided in two halfs by a longitudinal or transverse carina (Fig. 3e). Mesepimeron costate, interstice smooth and shiny. Tegula with setae short and thin. Forewing hyaline, with one brown spot posterior to marginal vein; basal cell with 3 lines of setae. Ventral margin of metafemur with one small and obtuse median prominence, followed by wide convexity, sometimes prominence or convexity indistinct (Fig. 3f). Metatibia with two longitudinal carinae, sometimes carinae inconspicuous and incomplete. Ratios and measurements: mesoscutum L/W 0.58; mesoscutelum L/W 1.06; forewing L/W 2.37; submarginal vein L 1.42 mm; marginal vein L 0.53 mm; stigmal vein L 0.12 mm; metafemur L/W 2.97.

Metasoma. Gaster shorter than head plus mesosoma combined, truncate. Gt1 dorsum imbricate, with minute punctures centrally; Gt2 sculptured as the sides medially; Gt1-Gt6 with thick and short setae. Ratios and measurements: gaster L/W 1.44; Gt1 L 1.1 mm; Gt1+Gt2 L 1.34 mm.

MALE. Similar to female except as following described. Body color mainly black, but with legs and gaster anterolaterally brown. Forewing pattern infumate. Metafemur less elongate and with two ventral prominences (Fig. 3b). Head W/H 1.33; scape L/W 7.73; pedicel L/W 1.3; anellus L/W 2.05; funicular segments L/W: Fu1 1.6; Fu2 1.45; Fu3 1.3; Fu4 1.32; Fu5 1.29; Fu6 1.24; Fu7 1.07; clava L/W 1.5; eye H/W 1.22; FV 0.85 mm; MOD 0.15 mm; POL 0.43 mm; OOL 0.12 mm; mesoscutum L/W 0.55; mesoscutelum L/W 0.91; forewing L/W 2.69; submarginal vein L 1.34 mm; marginal vein L 0.36 mm; stigmal vein L 0.1 mm; metafemur L/W 2.2; gaster L/W 1.37; Gt1 L 0.91 mm; Gt1 + Gt2 L 1.17 mm.

Material examined. *Paratypes*. **UNITED STATES**. Pennsylvania: 2 f#, 2 m#, Erie, Presque Isle., 18.vii-23.viii.1941, Paratypes USNM nº 56291, G. E., Wallace col. (USNM, 17753, 17754, 17755, 17756). Non-type material. (16 #f and 11#m). **UNITED STATES**. Washington: 1 f#, Pullman, 10.v.1965, Myrmelontid pupa, J., Eves col. (USNM, 17896). Wisconsin: 1 f#, Saulk, 1958, Summer, Ant Lion cocoon, R. L., Pienkowski col. (USNM, 17895). New York: 1 m#, Huntington, Kalbfleisch Field Station, 01-15.viii.1962, Malaise, P. H., Arnaud col. (BMNH, 8583); 2 f#, *idem*, Saranac Lake, 26.viii.1916 (USNM, 17886, 17887). Nebraska: 1 m#, Ketih, Cedar Point Biol. Sta., 20-25.vii.1988, J. G., Rozen & E., Quinter col. (AMNH, 21951). Maryland: 1 f#, 1 m#, Clinton, 09-13.vii.1958, Myrmeleon immaculatus, Spiegler col. (USNM, 17889, 17890). Delaware: 1 f#, Harrington, 12.viii.1960, Host cocoon from sand, E., MacLeod col. (USNM, 17893). Nevada: 1 f#, Lyon, 29.vii.1904 (USNM, 17888). Ohio: 1 m#, Hoking Co., 23.iii.1960, Ex. Myrmaleon immaculatus, B. H., Kennedy col. (USNM, 17897). Missouri: 1 f#, St. Louis, 1945, Ex. larva ant-lion, Id. Lot nº 45-13438, 468, P., Rau col. (USNM, 17894). Arizona: 1 m#, Cochise, Chiricahua Mts, 16-20.vii.1982, M. A., Cazier col. (AMNH, 21984); 1 m#, *idem*, Pima, 15 mi NW Sells, 27.iv.1990, J. G., Rozen col. (AMNH, 21958); 1 m#, *idem*, Pinal, 6 mi NE Red Rock, 11.v.1988, J. G., Rozen &, I., Stupakoff col. (AMNH, 21959). New Mexico: 1 f#, Grant, 11 mi SE of Mangas, Rte 1800, 108°22.408'W 32°45.385'N, 04.ix.2001, J. G., Rozen & E. S., Wyman col. (AMNH, 21975); 1 f#, *idem*, Hidalgo, 6 mi NE Red Rock, 13.v.1988, J. G., Rozen col. (AMNH, 21980). Texas: 1 m#, Anderson Co., Salmon, 01-08.vii.1974, Malaise, H. R., Burke col. (TAMU, 12305). Florida: 1 m#, Gainesville, Pine Hill States, 21.ix.1973, H. V., Weems Jr. col. (USNM, 17892). **MEXICO**. Sonora: 1 f#, 3 mi. W. Minas Nuevas, el. 450 m, nr. Alamos, 17.ix.1977,

Malaise, Schlinger col. (EMEC, 4686). Guanajuato: 1 f#, 2 mi. W. Dolores Hidalgo, 05.vii.1985, J., Wooley &, Z., Wolnerowich col. (TAMU, 12307). Colima: 1 f#, 23 mi. N. Manzanillo, 26.viii.1970, Malaise, J. S., Wasbauer col. (EMEC, 4685). Chiapas: 1 f#, Cintalapa, 28 mi. W., 25.vi.1965, H. R., Burke col. (TAMU,12306).

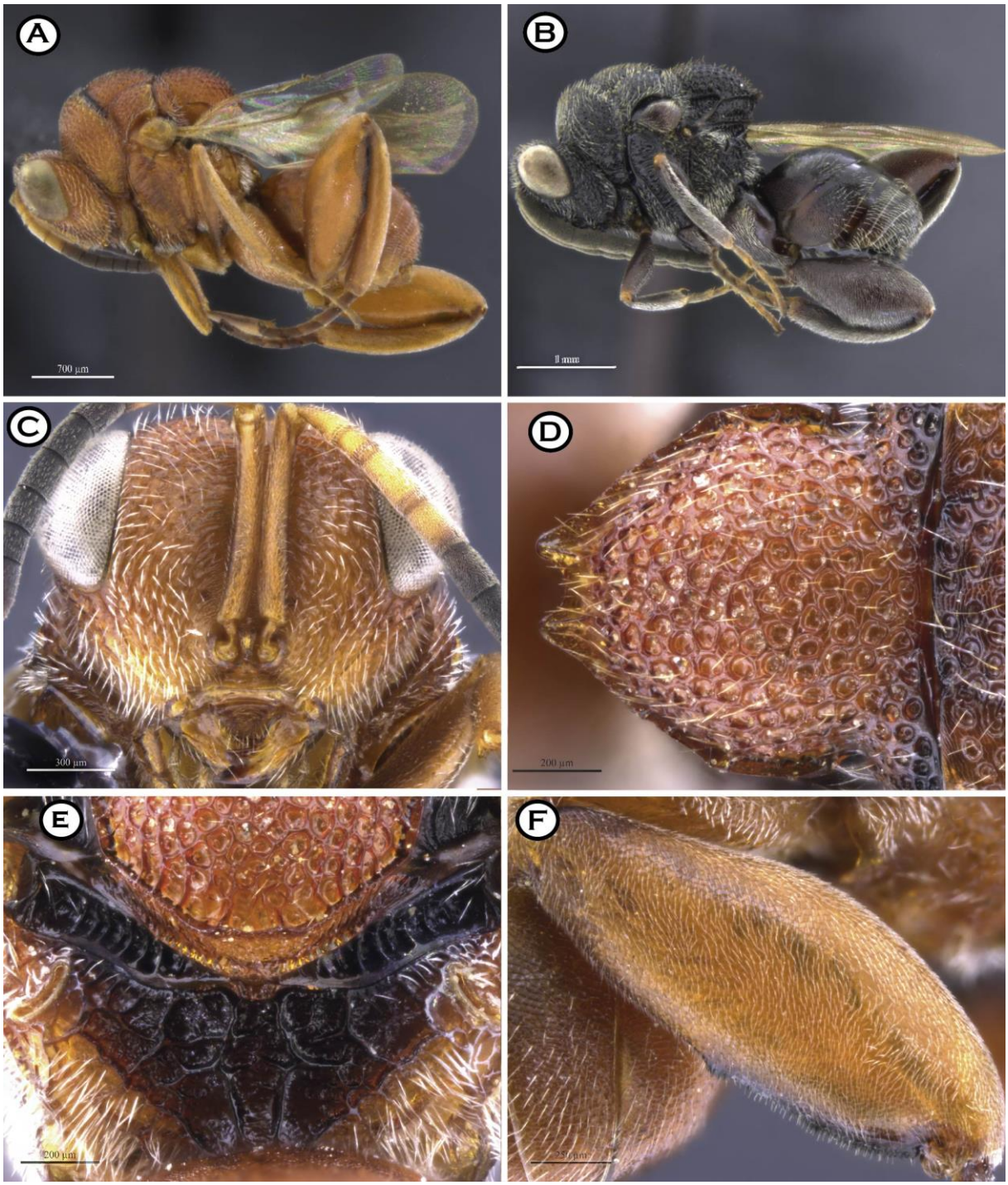

FIGURE 3a–f. *Hockeria eriensis*, female: **a**, habitus, lateral; male: **b**, habitus, lateral; female: **c**, head, frontal; **d**, mesoscutellum, dorsal; **e**, propodeum; **f**, metafemur, outer face.

FIGURE 4a. *Hockeria eriensis*, female: **a**, hind tarsomeres.

Host. *Myrmeleon immaculatus* (Wallace, 1942). *Myrmeleon* sp., *M. exitialis*, *M. arizonicus* (Myrmeleontinae: Myrmeleontini) and *Eremoleon* sp. (Nemoleontinae: Glenurini) (Neuroptera: Myrmeleontidae) (Halstead, 1990).

Geographical distribution. United States, Mexico, Dominican Republic, Guatemala and Venezuela.

Remarks. Females *H. eriensis* and *H. rubra* have the body almost entirely orange brown, but the gaster short with truncate apex, typical of *eriensis* group, and the exclusive metafemur shape of *H*. eriensis makes it simple to differentiate these two species. Beside the body color and the metafemur shape, *H. eriensis* differs from females of the remaining species of *eriensis* group by: submedian carinae of propodeum divergent and angled between the limit of anterior third and anterior half; and Gt1 dorsum imbricate, with minute punctures centrally. Some females present darker body color, varying from orange-brown to brown. Males of this species may be distinguished of *H. bicolor, H.* sp1 and *H.* sp.3 males by propodeum and Gt1 sculpture, similar to females, and forewing infumate.

***Hockeria* sp.1**
Figs. 5a–f

Diagnosis. Female. Body color mainly black. Distal edge of frenal carina with wide notch, botton of the notch without lamina, with two somewhat convergent submedian lobes; propodeum with disc densely punctulate between carinae, mostly matte, with submedian carinae divergent and angled between the limit of anterior third and anterior two-fifths, and anterolateral fovea large and irregular, divided in two halfs by a longitudinal or transverse carina; metafemur 2.30 – 2.47 x as long as high, ventral margin with one obtuse triangular median prominence, not followed by lobe.

Description. FEMALE. Body length 3.88 – 4.00 mm. *Color*. Body mainly black, but with orange brown and dark brown areas, as follow. The following orange brown: scape, pedicell, anellus, Fu1, Fu2, antennal torulus, clypeus, labrum, mandibles (except margin and teeth), maxillary and labial palpi, tegula, wing veins, hypopygium and ovipositor sheath. The following dark brown: trochanters, pro and mesotibia, metatibia on dorsalmargin, tarsi, and Gt1–Gt6 laterally. Body pilosity white (Fig. 5a).

Head. Vertex with profile between lateral ocelli, in frontal view, concave, not hidden medially by median ocellus. Lateral ocellus with lateral fovea about 0,5 x the ocellar diameter. Interantenal prominence distinctly larger than antennal foramen. Antenna with the lenght of pedicel plus flagellum combined about 2.2 – 2.3x as long as the length of scape; scape just reaching the anterior margin of median ocellus. Preorbital carina distinguished on upper two thirds of eye margins. Malar sulcus replaced by a granulate-shallow puntate stripe; external carina absent, replaced by narrow coriaceous-unpunctate stripe. Ratios and measurements: head W/H 1.32; scape L/W 8.89; pedicel L/W 2.66; anellus L/W 1; funicular segments L/W: Fu1 2; Fu2 1.73; Fu3 1.45; Fu4 1.25; Fu5 1.17; Fu6 1.08; Fu7 1.09; clava L/W 2; eye H/W 1.33; FV 0.75 mm; MOD 0.13 mm; POL 0.39 mm; OOL 0.1 mm.

Mesosoma. Pronotal collar and dorsum of mesoscutum with setae at least 2.0 x as long as the diameter of its own fovea. Mesoscutellum distinctly convex; frenal carina not developed as lamina laterally, distally expanded, median edge with wide notch, botton of the notch without lamina, with two somewhat convergent submedian lobes; frenum with median carina (Fig. 5c). Dorsellum with median areola about as high as wide. Propodeum with disc densely punctulate between carinae, mostly matte; submedian carinae divergent and angled between the limit of anterior third and anterior two-fifths; median areola about 1.7 x as long as wide; anterolateral fovea large and irregular, divided in two halfs by a longitudinal or transverse carina (Fig. 5d). Mesepimeron costate, interstice smooth and shiny (Fig. 5e). Tegula with setae short and thick. Forewing hyaline, with one brown band posterior to marginal vein and another subdistal one, and a spot of postmarginal vein; basal cell with 1–2 lines of setae adjacent to submarginal vein. Ventral margin of metafemur with one obtuse triangular median prominence, not followed by lobe (Fig. 5f). Metatibia with two longitudinal carinae. Ratios and measurements: mesoscutum L/W 0.51; mesoscutelum L/W 1.07; forewing L/W 3.01; submarginal vein L 1.25 mm; marginal vein L 0.32 mm; stigmal vein L 0.06 mm; metafemur L/W 2.47.

Metasoma. Gaster shorter than head plus mesosoma combined, truncate. Gt1 dorsum smooth and shine anteriorly to imbricate-coriaceous posteriorly, with minute punctures centrally; Gt2 sculptured as the sides medially; Gt1-Gt6 with thick and long setae. Ratios and measurements: gaster L/W 1.5; Gt1 L 1 mm; Gt1+Gt2 L 1.32 mm.

MALE. Similar to female except as following described. Body color mainly black, including antenna, tegula e gaster ventrally, but with orange brown areas, as follows. The hindwing veins, joints proximities of legs and tarsomeres orange brown. Forewing pattern weaker. Ventral margin of metafemur with two prominences (Fig. 5b). Ratios and measurements: body length 3.4 mm; head W/H 1.33; scape L/W 5.2; pedicel L/W 1; anellus L/W 1.75; funicular segments L/W: Fu1 1.47; Fu2 1.4; Fu3 1.27; Fu4 1.29; Fu5 1.23; Fu6 1.38; Fu7 1.28; clava L/W 2.17; eye H/W 1.3; FV 0.69 mm; MOD 0.12 mm; POL 0.34 mm; OOL 0.09 mm;

mesoscutum L/W 0.5; mesoscutelum L/W 1.04; forewing L/W 2.63; submarginal vein L 1.13 mm; marginal vein L 0.23 mm; stigmal vein L 0.09 mm; metafemur L/W 2.05; gaster L/W 1.42; Gt1 L 0.83 mm; Gt1 + Gt2 L 1 mm.

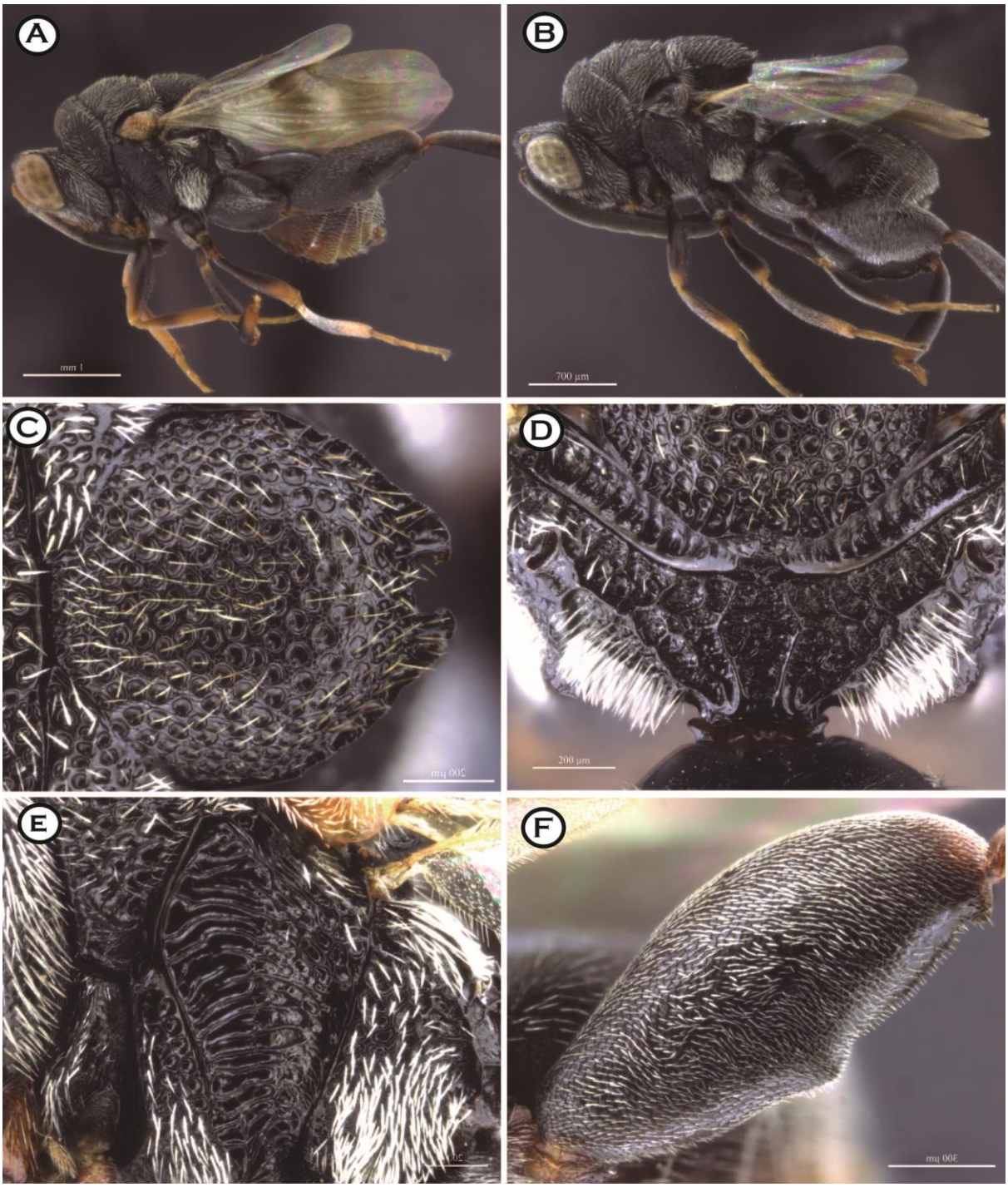

FIGURE 5a−f. *Hockeria* sp.1, female: **a**, habitus, lateral; male: **b**, habitus, lateral; female: **c**, mesoscutellum, dorsal; **d**, propodeum; **e**, pro, meso and metapleuron; **f**, metafemur, outer face.

Material examined. (4 #f and 9 #m). **BRAZIL**. Piauí: 1 f#, 8m#, Piripiri, Parque Nacional de Sete Cidades, 41°42'W 04°05'S, 28.viii-30.ix.2013, Malaise, C.R., Araujo col. (MZSP, 40533, 40534, 40703,

40707, 40773, 40840, 40850, 40854, 40857). Paraíba: 1 f#, Santa Terezinha, Fazenda Tamanduá, 19.ix.2011, Mata Ciliar, E.L.S., Brito col. (UFCG, 46020). Minas Gerais: 1 m#, Chapada Gaúcha, Parque Nacional Grande Sertão Veredas, 45°43'16"W 15°10'30"S, 05.vi.2018, Malaise, Cerrado, N.W., Perioto & R.I.R., Lara col. (UFES, 47139). São Paulo: 1 f#, Luiz Antônio, Estação Ecológica Jataí, 47°47'28.2"W 21°35'17.7"S, 550 m, 26.xi.2008, Malaise, Cerrado, N.W., Perioto col. (UFES, 33284); 1 f#, Salesópolis, E.B. Boraceia, 45°46'W 23°37'S, 23.x-24.xi.2008, Malaise, Fernandes col. (MZSP, 40830).

Host. Unknown.

Geographical distribution. Brazil (Piauí*, Paraíba*, Minas Gerais* and São Paulo*).

Remarks. Females of *H.* Sp.1 are similar to females of *H.* Sp.4 by body color and metafemur with a single ventral lobe, but differences in frenal carina, propodeum and Gt1 sculture help to differentiate these two species. *H.* Sp.1 female has distal edge of frenal carina with wide notch, botton of the notch without lamina, with two somewhat convergent submedian lobes; propodeum with disc densely punctulate between carinae, mostly matte; and Gt1 dorsum smooth and shine anteriorly to imbricate-coriaceous posteriorly, with minute punctures centrally. Males of *H.* Sp.1 are similar to males of *H. bicolor, H. eriensis* and *H.* sp.3 for presenting metafemur ventra margin with two lobes, but *H.* Sp.1 male might be identified by propodeum and Gt1 sculpture, similar to females of the same species.

***Hockeria* sp.2**

Figs. 6a–f

Hockeria eriensis (Wallace): Halstead (1990: 622) (variation).

Hockeria eriensis (Wallace): Uchôa & Missirian (2014: 314; host, misidentification).

Diagnosis. Female. Body color mainly orange brown, but with brown areas. Distal edge of frenal carina with wide notch, botton of the notch laminar and almost straight, with two somewhat triangular submedian lobes; propodeum with disc shallowly punctulate to coriarious between carinae, with some smooth and shiny areas; metafemur 2.00 – 2.10 x as long as high, ventral margin with one acute triangular median prominence, not followed by lobe.

Description. FEMALE. Body length 3.38 – 4.38 mm. *Color*. Body mainly orange brown, but with brown, dark-brown and black areas, as follows. The following orange brown: antenna (except clava apex), tegula, hindwing veins, pro and meso legs, (except tarsal claws), metafemur distally, metatibia, metatarsus and hypopygyum. The following dark-brown: claval apex, mandibular teeth, pronotum centrally, mesonotum, propodeum, tarsal claws and gaster dorsolaterally. Metafemural comb of denticles black. Body pilosity white (Fig. 6a).

Head. Vertex with profile between lateral ocelli, in frontal view, concave, hidden medially by median ocellus. Lateral ocellus with lateral fovea about 0.5 x the ocellar diameter. Interantenal prominence distinctly larger than antennal foramen. Antenna with the lenght of pedicel plus flagellum combined about 2.3 x as long as the length of scape; scape just reaching the anterior margin of median ocellus. Preorbital carina distinguished

on upper two thirds of eye margins. Malar sulcus mostly represented by a narrow granulate stripe near the eye; external carina absent, replaced by narrow coriaceous-unpunctate stripe. Ratios and measurements: head W/H 1.28; scape L/W 11.14; pedicel L/W 2.55; anellus L/W 1.77; funicular segments L/W: Fu1 2.09; Fu2 1.73; Fu3 1.91; Fu4 1.33; Fu5 1.23; Fu6 1.08; Fu7 0.92; clava L/W 1.77; eye H/W 1.33; FV 0.74 mm; MOD 0.12 mm; POL 0.37 mm; OOL 0.1 mm.

Mesosoma. Pronotal collar and dorsum of mesoscutum with setae at least two times as long as the diameter of its own fovea. Mesoscutellum distinctly convex; frenal carina not developed as lamina laterally, distally expanded, median edge with wide notch, botton of the notch laminar and almost straight, with two somewhat triangular submedian lobes; frenum with median carina (Fig. 6d). Dorsellum with median areola about twice as high (long) as wide. Propodeum with disc shallowly punctulate to coriarious between carinae, with some smooth and shiny areas; submedian carinae divergent and angled between the limit of anterior third and anterior two-fifths; median areola about 1.7 x as long as wide; anterolateral fovea leaf-shaped (Fig. 6e). Mesepimeron costate, interstice smooth and shiny. Tegula with setae short and thick. Forewing hyaline, with one brown band posterior to marginal vein and another subdistal one, and a spot of inconspicuous white setae posterior to postmarginal vein; Basal cell with 1 – 2 lines of setae adjacent to submarginal vein. Ventral margin of metafemur with one acute triangular median prominence, not followed by lobe (Fig. 6f). Metatibia with two longitudinal carinae. Ratios and measurements: mesoscutum L/W 0.48; mesoscutelum L/W 1; forewing L/W 2.77; submarginal vein L 1.36 mm; marginal vein L 0.3 mm; stigmal vein L 0.11 mm; metafemur L/W 2.1.

Metasoma. Gaster shorter than head plus mesosoma combined, truncate. Gt1 dorsum coriarious-imbricate anteriorly to coarsely imbricate posteriorly, with minute punctures; Gt2 sculptured as the sides medially; Gt1-Gt6 with thick and long setae. Ratios and measurements: gaster L/W 1.34; Gt1 L 0.95 mm; Gt1+Gt2 L 1.07 mm.

MALE. Similar to female except as following described. Body color mainly black with dark-brown and orange-brown areas, as follows. The following dark-brown: antenna, legs, except joints proximities, tarsomeres, except tarsal claws, metacoxa, metafemur, metatibia, except apex, forewing veins, gaster anterolaterally. Joints proximities of legs, tarsomeres and hindwing veins orange-brown. Forewing pattern weaker (Fig 6c). Ratios and measurements: body length 3.48 mm; head W/H 1.21; scape L/W 6; pedicel L/W 1.18; anellus L/W 1.63; funicular segments L/W: Fu1 1.37; Fu2 1.33; Fu3 1.29; Fu4 1.24; Fu5 1.18; Fu6 1; Fu7 0.85; clava L/W 1.55; eye H/W 1.34; FV 0.66 mm; MOD 0.12 mm; POL 0.34 mm; OOL 0.08 mm; mesoscutum L/W 0.49; mesoscutelum L/W 1.04; forewing L/W 2.78; submarginal vein L 1.09 mm; marginal vein L 0.26 mm; stigmal vein L 0.07 mm; metafemur L/W 1.82; gaster L/W 1.28; Gt1 L 0.86 mm; Gt1 + Gt2 L 0.97 mm.

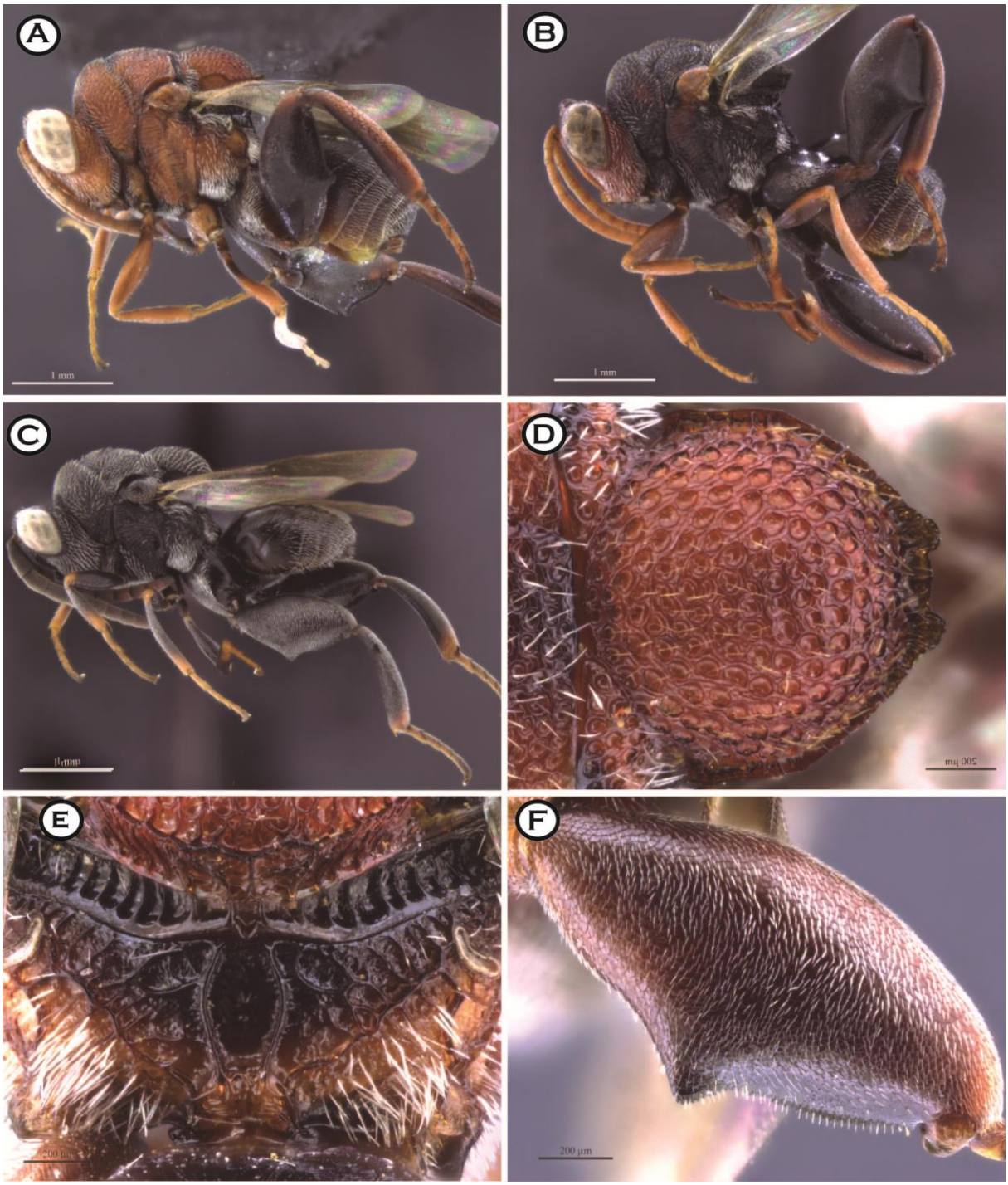

FIGURE 6a−f. *Hockeria* sp.2, female: **a**, habitus, lateral; **b**, habitus, lateral (body color variation); male: **c**, habitus, lateral; female: **d**, mesoscutellum, dorsal; **e**, propodeum; **f**, metafemur, outer face.

Material examined. (41 #f and 112 #m). **BRAZIL**. Maranhão: 1 m#, Caracol, Parque Nacional Serra das Confusões, Andorinha, 43°33'W 09°08'S, 515 m, 10-20.viii.2014, Malaise, J. A., Rafael & F., Limeira col. (CZMA, 38562); 6 m#, *idem*, Parque Nacional Serra das Confusões, Riacho dos Bois, 43°29'W 09°13'S, 575 m, 01.ix.2013-20.vii.2014, Malaise, J. A., Rafael, F., Limeira-de-Oliveira & T. T. A., Silva col. (CZMA, 37831, 38439, 38440, 38445, 38455, 38514); 1 m#, *idem*, 43°29'W 09°13'S, 575 m, 28-29.ii.2014, Armadilha Suspensa, J. A., Rafael & F., Limeira col. (CZMA, 39040); 3 m#, Carolina, Parque Nacional Chapada das

Mesas, Riacho Sucuruiu, 47°18'W 07°07'S, 240 m, 10.x.2013-20.viii.2014, Malaise, J. A., Rafael & F., Limeira col. (CZMA, 38634, 38698, 38776); 1 m#, Caxias, Reserva Ecológica Inhamum, 43°25'W 04°54'S, 27-29.xii.2008, Malaise, F., Limeira col. (CZMA, 38607); 1 m#, Mirador, Parque Estadual Mirador, Base da Geraldina, 20-24.xii.2006, Malaise, F., Limeira-de-Oliveira col. (CZMA, 32210); 1 m#, Oeiras, Faz. Pedra Talhada, 13-17.xi.1991, Brandão & Moutinho col. (MZSP, 4683). Piauí: 1 m#, Piracuruca, Parque Nacional de Sete Cidades, Posto do ICMBio, 41°42'W 04°05'S, 01-10.iii.2013, Malaise, F. Limeira col. (CZMA, 38884); 1 m#, *idem*, 41°42'34"W 04°05'57"S, 15-30.vi.2013, J. A., Rafael, F., Limeira-de-Oliveira & T. T. A., Silva col. (CZMA, 38050). Mato Grosso: 1 m#, Chapada dos Guimarães, Pq. Nac. Chapada dos Guimarães, 55°84'32"W 15,41°3743"S, 03-13.xi.2008, Malaise, Almeida col. (MZSP, 8831). Goiás: 1 m#, Alto Paraíso de Goiás, Pq. Nacional Chapada dos Veadeiros, 47°55'38"W 14°12'26"S, 11-13.ix.2005, Moericke, A. P., Aguiar col. (MZSP, 17270); 1 m#, *idem*, 15-21.ix.2005, Malaise (MZSP, 17671); 2 f#, 2 m#, *idem*, 47°46'W 14°08'S, 14.viii-18.xii.2018, Malaise, Cerrado, N. W., Perioto & R. I. R., Lara col. (UFES, 47496, 47741, 47742, 47763); 11 f#, 19m#, *idem*, 47°44'W 14°07'S, 08.v.2018-21.v.2019, Cerrado queimado (UFES, 47726, 47727, 47728, 47729, 47730, 47731, 47732, 47733, 47743, 47744, 47745, 47746, 47747, 47748, 47749, 47750, 47751, 47752, 47753, 47754, 47755, 47756, 47757, 47758, 47759, 47760, 47761, 47762, 47764, 47765). Distrito Federal: 1 f#, Brasília, Reserva Ecológica do IBGE, 47°51'02"W 19°55'58"S, 16-18.iv.1980, Campo limpo (UFES, 4675). Mato Grosso do Sul: 5 f#, 6 M#, Aquidauana, 16.iii-19.vi.2001, Myrmeleon sp., G. L. B., Missirian col. (UFES, 4669, 4671, 4672, 4673, 4674, 4676, 4677, 4678, 4679, 4680, 4681); 10 m#, *idem*, 55°39'20.8"W 20°25'59"S, 11.viii.2011-26.ix.2012, Malaise, Lamas & Nihei col. (MZSP, 20538, 20711, 20775, 20896, 20970, 20975, 21010, 21017, 21039, 21099); 1 f#, 1 m#, Três Lagoas, Faz. Floresta, 13.ix.1964, Janela, Exp. Departamento de Zool. (MZSP, 4668, 4682). Minas Gerais: 8 f#, 5 m#, Chapada Gaúcha, Parque Nacional Grande Sertão Veredas, 45°43'W 15°10'S, 19.vi.2018-02.i.2019, Malaise, Cerrado, N. W., Perioto & R. I. R., Lara col. (UFES, 47170, 47212, 47310, 47734, 47735, 47736, 47737, 47738, 47739, 47740, 47766, 47767, 47768). São Paulo: 1 f#, Descalvado, Fazenda Itaúnas, 47°37'26"W 21°54'05"S, 19.i.2006, Solo Citrus, Cerrado, N. W., Perioto col. (UFES, 30298); 12 f#, 51 m#, Luiz Antônio, Estação Ecológica Jataí, 47°47’28.2”W 21°35’17.7”S, 550 m, 07.xii.2006-08.xii.2009, Malaise, Cerrado, N. W., Perioto col. (UFES, 33188, 33219, 33286, 33287, 33380, 33386, 33463, 33475, 33528, 33553, 33577, 33587, 33614, 33620, 33646, 33676, 33705, 33802, 33807, 33812, 33869, 33870, 33874, 33882, 33912, 33927, 33955, 34092, 34138, 34191, 34207, 34259, 34275, 34315, 34326, 34330, 34398, 34412, 34419, 34443, 34447, 34488, 34520, 34547, 34578, 34595, 34629, 34641, 34714, 34754, 34756, 34759, 34771, 34800, 34816, 34916, 34943, 34979, 34989, 34997, 35019, 35021, 35022); 1 m#, Teodoro Sampaio, xii.1977, M., Alvarenga col. (MZSP, 4684).

Host. *Myrmeleon brasiliensis* (Neuroptera: Myrmeleontidae: Myrmeleontinae: Myrmeleontini) (Uchôa & Missirian, 2014).

Geographical distribution. Brazil (Maranhão*, Piauí*, Mato Grosso*, Goiás*, Distrito Federal*, Mato grosso do Sul*, Minas Gerais* and São Paulo*).

Remarks. Females of *H*. Sp.2 might be differentiated from the other species by body color and for presenting ventral margin of metafemur with one acute triangular median prominence, not followed by lobe, unique among New World Hockeria. There are two distinct color pattern among females of *H*. Sp.2, one with body color predominantly brown (Fig. 6a) and the other with red orange head and dark body (Fig 6b), similar to the color pattern found in *H.* sp.3, but this last females has thorax entirely black and in *H*. Sp.2, at least part of thorax is brown pleural or dorsally. Both color patterns present the same diagnostic characters of the species and a part of examined females presenting intermediate body color. Males of *H*. Sp.2 also might be recognised by the acute triangular median prominence in metafemur margin.

***Hockeria* sp.3**
Figs. 7a–f

Diagnosis. Female. Body color mainly black with head red orange. Malar sulcus replaced by a granulate-shallow punctate stripe; distal edge of frenal carina with wide notch, botton of the notch laminar and almost straight, with two round and upturned submedian lobes; median areola of propodeum about 2.6 x as long as wide, with anterolateral fovea rectangular; metafemur 2.18 – 2.30 x as long as high, ventral margin with one obtuse triangular median prominence, not followed by lobe.

Description. FEMALE. Body length 3.9 – 4.55 mm. *Color*. Body mainly black, but with orange brown and red orange areas, as follow. The following orange brown: antenna, clypeo, labrum, mandibles (except margins and teeth), distal quarter of pro and mesofemur, protibia, distal half of mesotibia, tarsomeres (except claws), hypopygyum and ovipositor sheath. Head red orange, except posteriorly. Body pilosity white (Fig. 7a).

Head. Vertex with profile between lateral ocelli, in frontal view, concave, hidden medially by median ocellus. Lateral ocellus with lateral fovea about 0.5 x the ocellar diameter. Interantenal prominence distinctly larger than antennal foramen. Antenna with the lenght of pedicel plus flagellum combined about 2.2 – 2.3 x as long as the length of scape; scape just reaching the anterior margin of median ocellus. Preorbital carina distinguished on upper two thirds of eye margins. Malar sulcus replaced by a granulate-shallow punctate stripe; external carina absent, replaced by narrow coriaceous-unpunctate stripe. Ratios and measurements: head W/H 1.19; scape L/W 8.44; pedicel L/W 2.5; anellus L/W 1.58; funicular segments L/W: Fu1 2.5; Fu2 1.69; Fu3 1.69; Fu4 1.54; Fu5 1.46; Fu6 1.31; Fu7 1.15; clava L/W 2; eye H/W 1.38; FV 0.8 mm; MOD 0.14 mm; POL 0.36 mm; OOL 0.1 mm.

Mesosoma. Pronotal collar and dorsum of mesoscutum with setae at least 2 x as long as the diameter of its own fovea. Mesoscutellum distinctly convex; frenal carina developed as a lamina laterally, distally expanded, median edge with wide notch, botton of the notch laminar and almost straight, with two round and upturned submedian lobes; frenum with median carina (Fig. 7c). Dorsellum with median areola about twice as high (long) as wide. Propodeum with disc punctulate-rugulose between carinae, with some shiny and almost smooth areas; submedian carinae slightly arched and somewhat parallel to each other; median areola about 2.6 x as long as wide; anterolateral fovea rectangular (Fig. 7d). Mesepimeron costate, interstice smooth and shiny.

Tegula with setae long and thick. Forewing hyaline, with one brown spot posterior to marginal vein; basal cell with 1 – 2 lines of setae adjacent to submarginal vein (Fig. 7e). Ventral margin of metafemur with one obtuse triangular median prominence, not followed by lobe. Metatibia with two longitudinal carinae. Ratios and measurements: mesoscutum L/W 0.58; mesoscutelum L/W 1.07; forewing L/W 2.69; submarginal vein L 1.51 mm; marginal vein L 0.39 mm; stigmal vein L 0.11 mm; metafemur L/W 2.3.

Metasoma. Gaster shorter than head plus mesosoma combined, truncate. Gt1 dorsum coriarious-imbricate anteriorly to coarsely imbricate posteriorly, with minute punctures; Gt2 sculptured as the sides medially; Gt1-Gt6 with thick and long setae (Fig. 7f). Ratios and measurements: gaster L/W 1.26; Gt1 L 0.96 mm; Gt1+Gt2 L 1.32 mm.

MALE. Similar to female except as following described. Body color mainly black, but with dark brown and orange brown areas, as follows. The following dark-brown: clypeus, mandibles margin and teeth, labrum margin and gaster anterolaterally dark-brown. Torulus, labrum, mandibles, maxillary and labial palpus, articulation proximities of legs, except between metacoxa and metafemur and metafemur and metatibia, orange brown. Forewing pattern weaker. Ventral margin of metafemur with two prominences (Fig. 7b). Ratios and measurements: body length 4.14 mm; head W/H 1.25; scape L/W 5.15; pedicel L/W 0.91; anellus L/W 2.16; funicular segments L/W: Fu1 1.72; Fu2 1.56; Fu3 1.37; Fu4 1.26; Fu5 1.29; Fu6 1.24; Fu7 1.13; clava L/W 1.27; eye H/W 1.3; FV 0.8 mm; MOD 0.13 mm; POL 0.41 mm; OOL 0.1 mm; mesoscutum L/W 0.5; mesoscutelum L/W 0.98; forewing L/W 2.52; submarginal vein L 1.33 mm; marginal vein L 0.3 mm; stigmal vein L 0.09 mm; metafemur L/W 1.96; gaster L/W 1.57; Gt1 L 0.81 mm; Gt1 + Gt2 L 1.16 mm.

Material examined. (5 #f and 9 #m). **BRAZIL**. Maranhão: 1 m#, Caxias, Reserva Ecológica Inhamum, Margem direita, 15-19.xi.2005, Malaise, G. A., Cunha col. (CZMA, 32211); 3 m#, *idem*, 11.xi-19.xii.2005 (CZMA, 38593, 38611, 38832). Piauí: 1 f#, Piripiri, Parque Nacional de Sete Cidades, 41°42'W 04°05'S, 30.vii.2013, Malaise, C.R., Araujo col. (MZSP, 41024). Mato Grosso: 3 m#, Chapada dos Guimarães, 10-12.vi.1991, J. A., Rafael & J., Vidal col. (INPA, 7780, 7995, 7996). Goiás: 3 f#, Alto Paraíso de Goiás, Parque Nacional Chapada dos Veadeiros, 47°44'W 14°07'S, 06.xi.2018, Malaise, Cerrado queimado, N. W., Perioto & R. I. R., Lara col. (UFES, 47769, 47770, 47771); 2 m#, *idem*, 47°46'W 14°08'S, 06.xi.2018 Cerrado (UFES, 47772, 47773).

Host. Unknown.

Geographical distribution. Brazil (Maranhão*, Piauí*, Mato Grosso* and Goiás*).

Remarks. Females of *H.* Sp.3 might be distinguished between females *H.* Sp.1 and *H.* Sp.4 by the head red orange, two round and upturned submedian lobes in distal edge of frenal carina and median areola of propodeum about 2.6 x as long as wide, with anterolateral fovea rectangular. Females of *H.* Sp.3 might be differentiate of females of *H.* Sp.2 with similar color pattern for ventral lobe of metafemur small and obtuse and propodeum structure. Males of this species may be distinguished from males of *H. bicolor*, *H. eriensis* and *H.* Sp.1 by propodeum structure and submedian lobes of frenal carina, similar to the female.

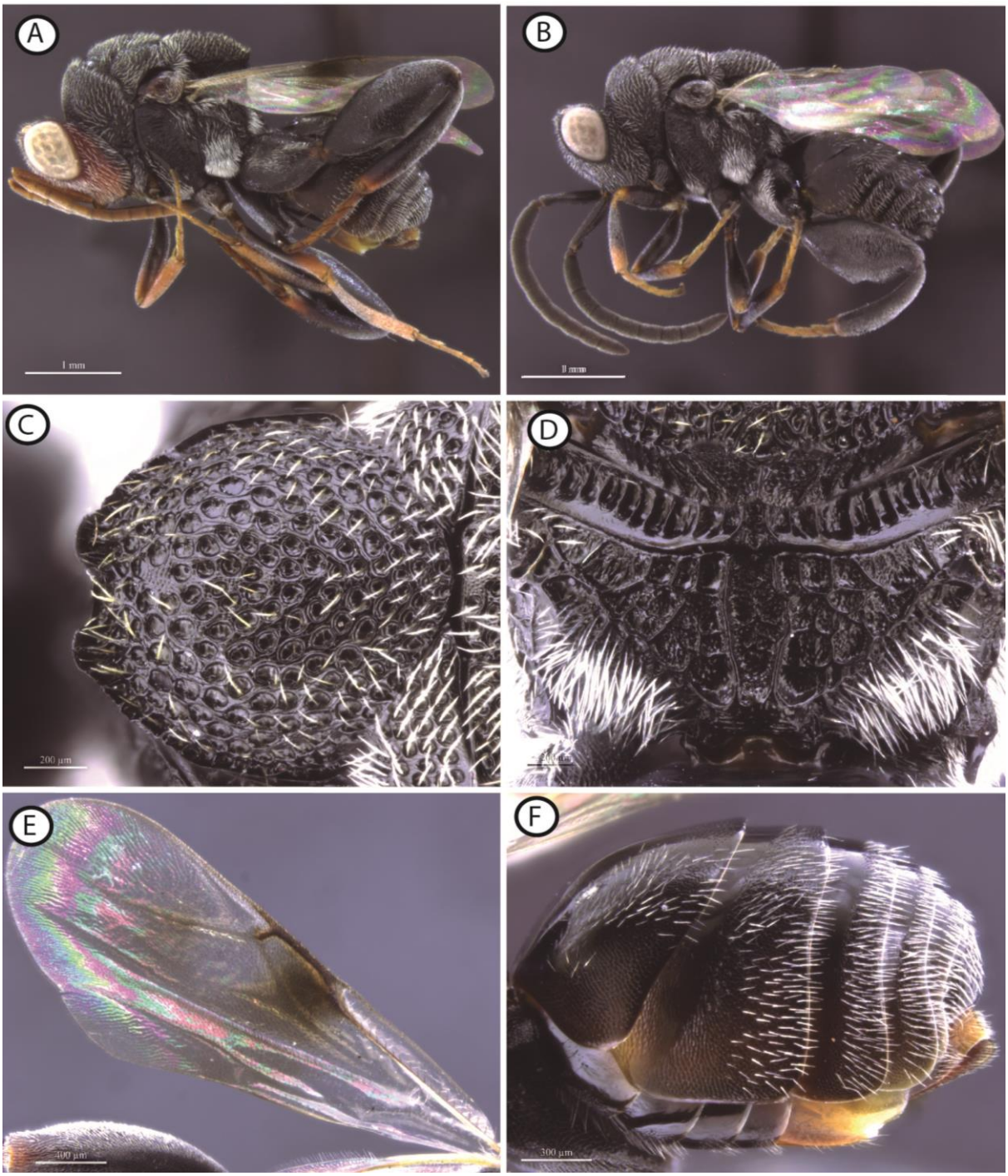

FIGURE 7a−f. *Hockeria* sp.3, female: **a**, habitus, lateral; male: **b**, habitus, lateral; female: **c**, mesoscutellum, dorsal; **d**, propodeum; **e**, forewuing; **f**, gaster, lateral.

***Hockeria* sp.4**
Figs. 8a–f

Diagnosis. Female. Body color mainly black. Distal edge of frenal carina with wide notch, botton of the notch laminar and almost straight, with two short submedian lobes; dorsellum with median areola slight wider than high; propodeum disc punctulate-rugulose between carinae, with some shiny and almost smooth areas;

metafemur 2.23 x as long as high, ventral margin with one obtuse triangular median prominence, not followed by lobe; Gt1 dorsum mostly shallowly imbricate anteriorly to imbricate posteriorly, without punctures.

Description. FEMALE. Body length 4.19. *Color*. Body mainly black, but with orange brown and dark brown areas, as follows. The following orange brown: inner side of protibia, pro and mid leg joints. The following dark brown: antenna, torulus, clypeus, labrum, mandibles (except teeth), legs, GT1–Gt6 laterally. Body pilosity white (Fig. 8a).

Head. Vertex with profile between lateral ocelli, in frontal view, concave, not hidden medially by median ocellus. Lateral ocellus with lateral fovea about 0.5 x the ocellar diameter. Interantenal prominence distinctly larger than antennal foramen. Antenna with the lenght of pedicel plus flagellum combined about 2.3 x as long as the length of scape; scape just reaching the anterior margin of median ocellus. Preorbital carina present only on middle third of eye margins. Malar sulcus mostly represented by a narrow granulate stripe near the eye; external carina absent, replaced by narrow coriaceous-unpunctate stripe (Fig. 8c). Ratios and measurements: head W/H 1.32; scape L/W 8.44; pedicel L/W 2; anellus L/W 1.33; funicular segments L/W: Fu1 2; Fu2 1.64; Fu3 1.46; Fu4 1.23; Fu5 1.31; Fu6 1.08; Fu7 1.17; clava L/W 2.27; eye H/W 1.38; FV 0.72 mm; MOD 0.12 mm; POL 0.31 mm; OOL 0.09 mm.

Mesosoma. Pronotal collar and dorsum of mesoscutum with setae at least 2 x as long as the diameter of its own fovea. Mesoscutellum distinctly convex; frenal carina developed as a lamina laterally, distally expanded, median edge with wide notch, botton of the notch laminar and almost straight, with two short submedian lobes; frenum with median carina (Fig. 8e). Dorsellum with median areola slight wider than high. Propodeum with disc punctulate-rugulose between carinae, with some shiny and almost smooth areas; submedian carinae divergent and angled between the limit of anterior third and anterior two-fifths; median areola about 1.7 x as long as wide; anterolateral fovea leaf-shaped (Fig. 8f). Mesepimeron costate, interstice smooth and shiny. Tegula with setae short and thick. Forewing hyaline, with one brown spot posterior to marginal vein; basal cell with 1 – 2 lines of setae adjacent to submarginal vein. Ventral margin of metafemur with one obtuse triangular median prominence, not followed by lobe. Metatibia with two longitudinal carinae. Ratios and measurements: mesoscutum L/W 0.54; mesoscutelum L/W 1.03; forewing L/W 3.2; submarginal vein L 1.34 mm; marginal vein L 0.36 mm; stigmal vein L 0.09 mm; metafemur L/W 2.23.

Metasoma. Gaster shorter than head plus mesosoma combined, truncate. Gt1 dorsum mostly shallowly imbricate anteriorly to imbricate posteriorly, without punctures; Gt2 sculptured as the sides medially; Gt1-Gt6 with thick and short setae. Ratios and measurements: gaster L/W 1.65; Gt1 L 0.86 mm; Gt1+Gt2 L 1.12 mm.

MALE. Similar to female except as following described. Body color mainly black with dark-brown and orange-brown areas. The following dark-brown: interantennal proeminence, torulus, mandibles, except margin, and tarsal claws. Joints proximities of legs, except between metacoxa and metafemur and metafemur and metatibia, tarsomeres, except talsal claws, and gaster laterally orange brown. Forewing pattern weaker.

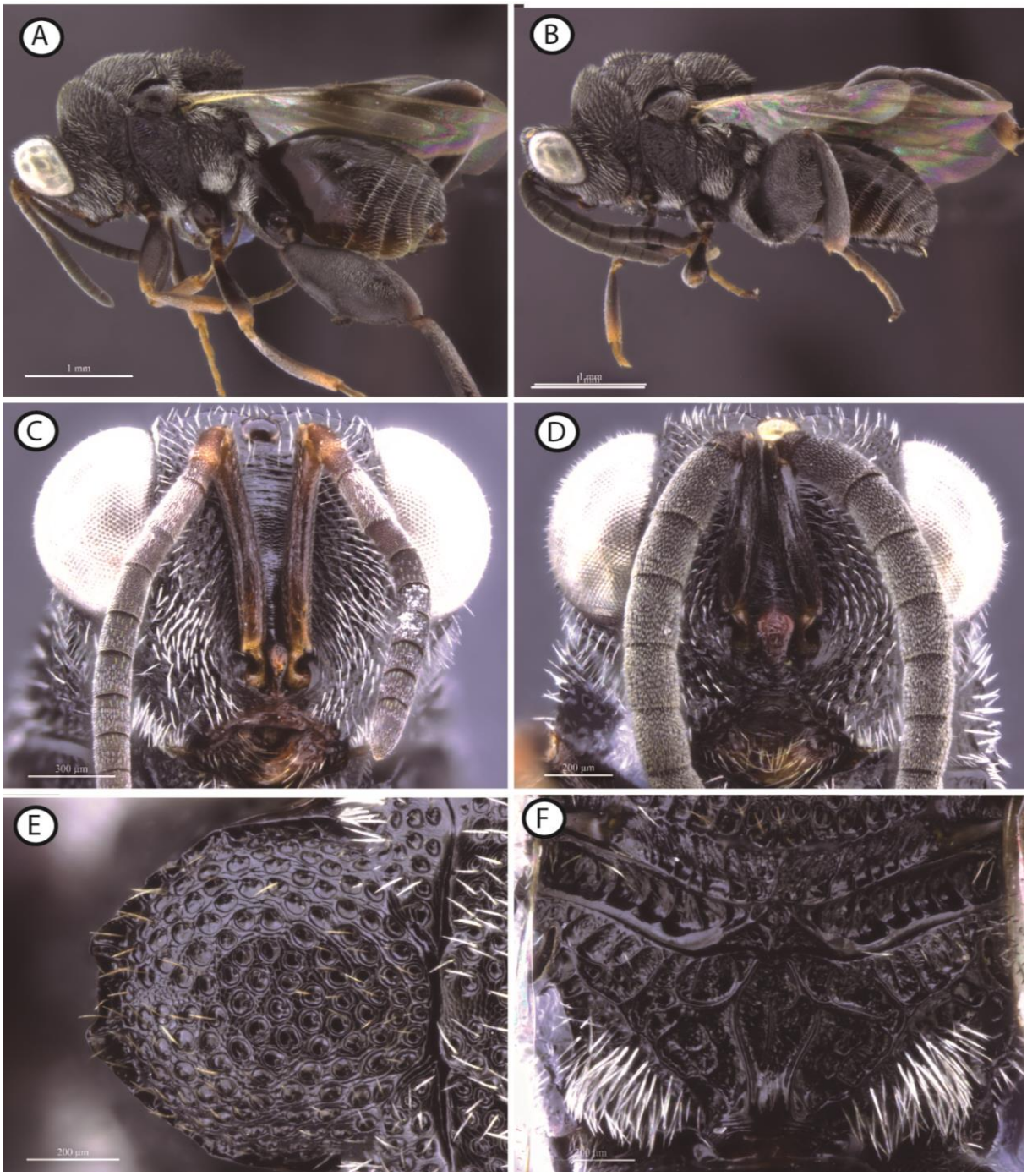

FIGURE 8a−f. *Hockeria* sp.4, female: **a**, habitus, lateral; male: **b**, habitus, lateral; female: **c**, head, frontal; male: **d**, head, frontal; female: **e**, mesoscutellum, dorsal; **f**, propodeum.

Interantennal proeminence color red and with a tubercle shape (Figs 8b, 8d). Ratios and measurements: body length 3.9 mm; head W/H 1.42; scape L/W 4.58; pedicel L/W 1.27; anellus L/W 1.64; funicular segments L/W: Fu1 1.41; Fu2 1.35; Fu3 1.18; Fu4 1.12; Fu5 1.13; Fu6 1.07; Fu7 0.92; clava L/W 1.36; eye H/W 1.37; FV 0.71 mm; MOD 0.13 mm; POL 0.33 mm; OOL 0.09 mm; mesoscutum L/W 0.53; mesoscutelum L/W 0.96; forewing L/W 2.64; submarginal vein L 1.25 mm; marginal vein L 0.28 mm; stigmal vein L 0.07 mm; metafemur L/W 1.94; gaster L/W 1.37; Gt1 L 0.74 mm; Gt1 + Gt2 L 1.05 mm.

Material examined. (1 #f and 2 #m). **BRAZIL**. Rondônia: 1 m#, Nova Mamoré, Parque Estadual Guajará-Mirim, Rio Formoso, 64°38'88"W 10°19'26"S, 22.x.1995, J., Vidal & L., Aquino col. (INPA, 7716); 1 f#, Porto Velho, Mutum, Rio Madeira, 65°2'57,60"W 9°35'29,50"S, 14-16.ix.2010, Malaise, R. M., Feitosa & R. R., Silva col. (MZSP, 8742); 1 m#, *idem*, Área Abuna, Rio Madeira, 65°22'44"W 09°36'36"S, Malaise, F. R., Fernandes col. (MZSP, 41039).

Host. Unknown.

Geographical distribution. Brazil (Rondônia*).

Remarks. Females of *H*. Sp.4 are very similar to females of *H*. Sp.1 for present similar body color, mainly black, and one obtuse triangular median prominence in ventral margin of metafemur. They might be distinguished by differences in frenal carina, propodeum and Gt1 sculture. Females of *H*. Sp.4 present distal edge of frenal carina with wide notch, botton of the notch laminar and almost straight, with two short submedian lobes; propodeum disc punctulate-rugulose between carinae, with some shiny and almost smooth areas; and Gt1 dorsum mostly shallowly imbricate anteriorly to imbricate posteriorly, without punctures (see *H*. Sp.1 remarks). Males of *H*. Sp.4 might be differentiate by interantennal prominence with tubercle shape, exclusive feature among all studied species including females and males, and metafemur similar to female with one obtuse lobe in ventral margin.

The *rubra* species group

Diagnosis. Mesoscutellum slightly convex in lateral view; metafemur with two prominences in ventral margin; gaster elongate with acute apex; hind tarsomeres with spines and pegs developed and very apparent, with some great spines in each tarsomere distally; parasitoids of eruciform larvae/pupae of Lepidoptera or Hymenoptera; the species of *rubra* group occur mainly in the Neartic region, the neotropical records are restricted to North America.

Species included. *H. brevipennis* Halstead, *H. burdicki* Halstead, *H. burksi* Halstead, *H. hainesi* Halstead, *H. micra* Halstead, *H. rubra* (Ashmead), *H. tenuicornis* (Girault), *H. unipunctatipennis* (Girault).

***Hockeria burdicki* Halstead**

Hockeria burdicki Halstead, 2000: 52–54. Holotype #f. Mexico: Chamela Research Station (Jalisco) (CASC, not examined).

Hockeria burdicki Halstead: Arias & Delvare (2003: 139; checklist).

Diagnosis. Female. Body mainly black, but with orange-red areas. Scrobe deeply concave with tranverse carinae; thorax slightly convex in lateral view; posterior margin of frenal carina rounded, with two upturned minute lobes; propodeum disc between carinae shiny and slightly rugose, with submedian longitudinal carinae and a couple of vague transverse carinae; metafemur 1.6 x as long as high; gaster 2.5 x as long as high, apex subaccuminate, with Gt1 dorsum smooth and polished except for lateral coriaceous and setose area, Gt2 with

polished median area. Male is darker than female, with forewing pattern infumate and with an orangish tint; Gt1 dorsum punctate and coreaceous (Halstead, 2000).

Host. Unknown.

Geographical distribution. Mexico.

Remarks. *H. burdicki* might be differentiate for any other species of New World *Hockeria* for present a metafemur 1.6 x as long as high, in both sex. Females of *H. burdicki* are similar to *H. tenuicornis* females. *H. burdicki* might be distinguished for body color mainly black, forewing with a rectangular-shaped unclounded area, rather than an elliptical-shaped area, and metafemur with an unique ratio (Halstead, 2000).

***Hockeria burksi* Halstead**

Figs 9a–f, 10a

Hockeria burksi Halstead, 1990: 637–639. Holotype #f. USA: Tulare (California) (CASC nº15245, not examined).

Hockeria burksi Halstead: Arias & Delvare (2003: 139; checklist); Noyes (2019; catalogue).

Diagnosis. Female. Body mainly black and legs mainly orange-brown; outer side of metafemur black. Antenna 2.0 – 2.1 x as long as the length of scape; malar sulcus absent; external carina present near the oral fossa to complete; sulcus of frenal carina distally not expanded, with edge distal shape slightly emarginate to emarginate, with two short submedian lobes; dorsellum without submedian carina or median areola; median areola of propodeum about 1.9 x as long as wide; mesepimeron costate-punctulate; forewing hyaline, with one pale brown spot posterior to marginal vein; metafemur 1.80 – 1.90 x as long as high; Gt1 dorsum imbricate-punctulate.

Description. FEMALE. Body length 3.88 – 4.52 mm. *Color*. Mainly black, but with orange brown, dark brown and yellow areas, as follows. The following orange brown: scape, pedicell, anellus, Fu1, mandibles, except margin and teeth, tegula, legs, except outer side of pro and metatibias, anterior half of metacoxa, outer side of metafemur, inner side of metatibia and tarsal claws, forewing veins, except submarginal, hypopygium and ovipositor sheath. Other flagellomeres, interantennal prominence, torulus, mandibular margin and teeth, and tarsal claws dark-brown. Submarginal vein of forewing and hindwing veins yellow. Body pilosity white (Fig. 9a).

Head. Vertex with profile between lateral ocelli, in frontal view, straight, not hidden medially by median ocellus. Lateral ocellus with lateral fovea less than 0.3 x the ocellar diameter. Interantenal prominence about as large as antennal foramen. Antenna with the lenght of pedicel plus flagellum combined about 2.0 – 2.1 x as long as the length of scape; scape just reaching the anterior margin of median ocellus. Preorbital carina present only on middle third of eye margins. Malar sulcus absent; external carina present near the oral fossa to complete (Fig. 9b). Ratios and measurements: head W/H 1.34; scape L/W 9.29; pedicel L/W 1.42; anellus L/W 1.28; funicular segments L/W: Fu1 1.75; Fu2 1.56; Fu3 1.56; Fu4 1.44; Fu5 1.33; Fu6 1.22; Fu7 1.25; clava L/W 2.11; eye H/W 1.23; FV 0.49 mm; MOD 0.08 mm; POL 0.28 mm; OOL 0.04 mm.

Mesosoma. Pronotal collar and dorsum of mesoscutum with setae at least 2 x as long as the diameter of its own fovea. Mesoscutellum slightly convex; frenal carina developed as a lamina laterally, distally not expanded, median edge slightly emarginate to emarginate, with two short submedian lobes; frenum with submedian or median Y-shaped carina (Fig. 9d). Dorsellum without submedian carina or median areola.

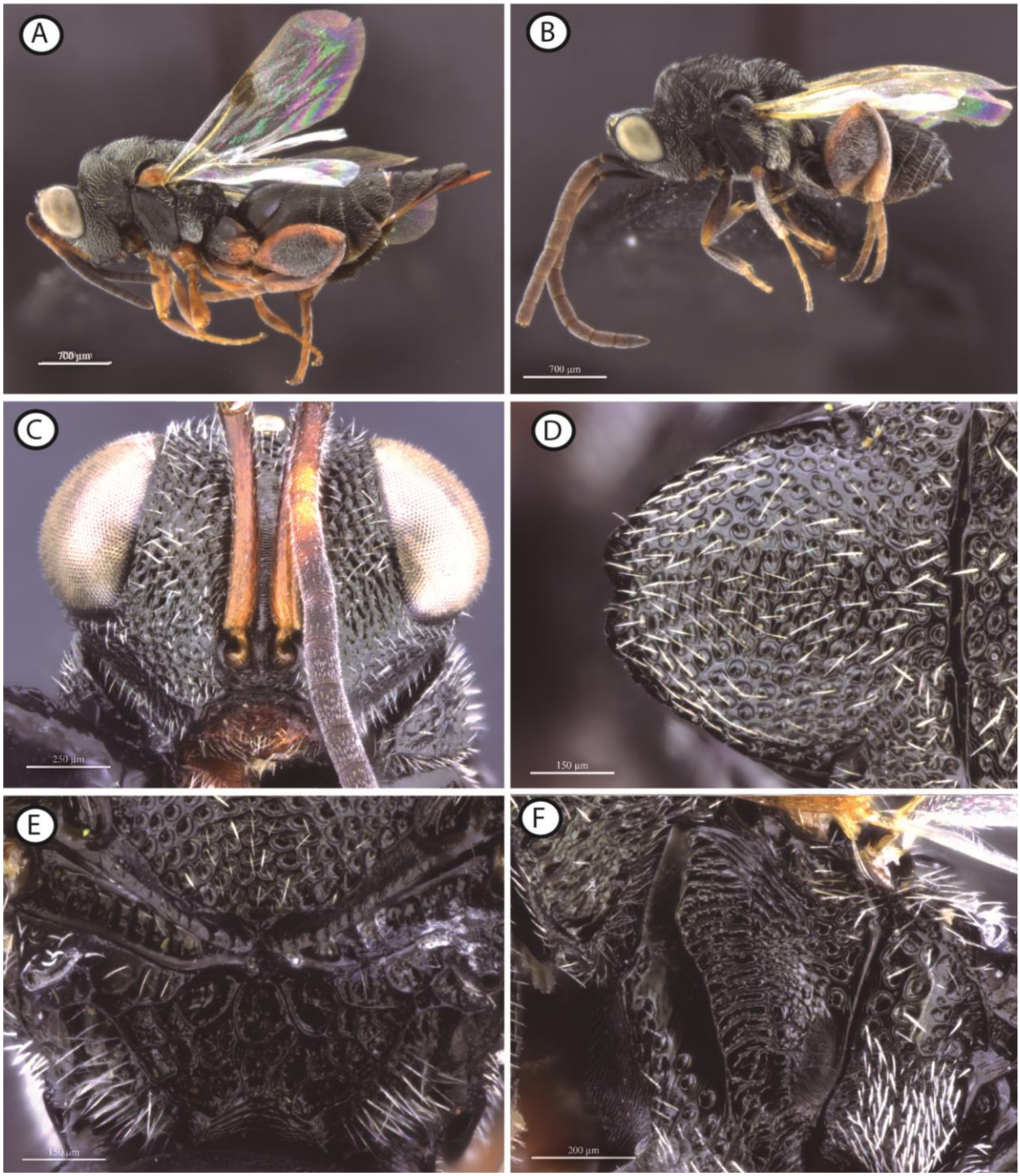

FIGURE 9a–f. *Hockeria burksi*, female: **a**, habitus, lateral; male: **b**, habitus, lateral; female: **c**, head, frontal; **d**, mesoscutellum, dorsal; **e**, propodeum; **f**, pro, meso and metapleuron.

FIGURE 10a. *Hockeria burksi*, female: **a**, metafemur, outer face.

Propodeum with disc punctulate-rugulose between carinae, with some shiny and almost smooth areas; submedian carinae divergent and angled between the limit of anterior third and anterior two-fifths; median areola about 1.9 x as long as wide; anterolateral fovea squared (Fig. 9e). Mesepimeron costate-punctulate (Fig. 9f). Tegula with setae long and thin. Forewing hyaline, with one pale brown spot posterior to marginal vein; basal cell fully setose. Ventral margin of metafemur with one rounded (sometimes obtuse) median lobe, followed by a wide rounded lobe or convexity (Fig. 10a). Metatibia with three carinae. Ratios and measurements: mesoscutum L/W 0.49; mesoscutelum L/W 1.19; forewing L/W 2.45; submarginal vein L 0.94 mm; marginal vein L 0.15 mm; stigmal vein L 0.06 mm; metafemur L/W 1.9.

Metasoma. Gaster longer than head plus mesosoma combined, acuminate. Gt1 dorsum imbricate-punctulate; Gt2 sculptured as the sides medially; Gt1-Gt6 with thin and short setae. Ratios and measurements: gaster L/W 2.31; Gt1 L 0.58 mm; Gt1+Gt2 L 0.73 mm.

MALE. Similar to female except as following described. Body color mainly black, but with dark-brown and orange-brown areas, as follows. The following dark-brown: scape, pedicel, legs, joints proximities, tarsomeres, except tarsal claws, and gaster ventrolaterally. Joints proximities of legs and flagelomere orange-brown. Metafemur color is very similar to female. Forewing pattern hyaline with whitish setae (Fig. 9b). Ratios and measurements: body length 2.94 mm; head W/H 1.26; scape L/W 5.1; pedicel L/W 1; anellus L/W 2; funicular segments L/W: Fu1 1.73; Fu2 1.8; Fu3 1.79; Fu4 1.71; Fu5 1.62; Fu6 1.46; Fu7 1.25; clava L/W 1.36; eye H/W 1.32; FV 0.59 mm; MOD 0.11 mm; POL 0.31 mm; OOL 0.06 mm; mesoscutum L/W 0.54; mesoscutelum L/W 1; forewing L/W 2.56; submarginal vein L 0.87 mm; marginal vein L 0.24 mm; stigmal vein L 0.07 mm; metafemur L/W 1.85; gaster L/W 1.4; Gt1 L 0.7 mm; Gt1 + Gt2 L 0.85 mm.

Material examined. (2 #f and 1 #m). **UNITED STATES**. Califórnia: 2 f#, Riverside Co., Menifee Vly. (hills on W end), 117°13'W 33°39'N, 1800 ft, 20.vii-01.xi.1980, Malaise, J. B., Wooley, J. D., Pinto & J.,

LaSalle col. (TAMU, 12303, 12304); 1 m#, San Diego, 5 mi. E Borrego, 24.iv.1980, J. B., Wooley (TAMU, 12301).

Host. Unknown.

Geographical distribution. United States and Mexico.

Remarks. Females of *H. burksi* might be distinguished from the other species of *rubra* group by body color mainly black and legs mainly orange-brown with outer side of metafemur black. Mesepimeron costate-punctulate. Forewing hyaline, with one pale brown spot posterior to marginal vein. Gt1 dorsum imbricate-punctulate. Males of *H. burksi* might be distinguished by forewing pattern hyaline with whitish setae and metafemur color similar to females.

***Hockeria rubra* (Ashmead)**

Figs. 11a–f, 12a–b

Stomatoceras rubra Ashmead, 1894: 332, Syntype #f (to be designated as lectotype). USA: Texas (USNM, examined).

Stomatocera rubra Ashmead: Dalla Torre (1898: 396, catalogue).

Stomatoceras ruber Ashmead: Schmiedeknecht (1909: 59, catalogue).

Stomatoceras rubrum rubrum Ashmead: Peck (1951: 585, catalogue).

Hockeria rubra (Ashmead): Burks in Stefan (1959: 304; combination); De Santis (1979: 70; catalogue); Halstead (1990: 631, male description); Arias & Delvare (2003: 139); Noyes (2019; catalogue).

Diagnosis. Female. Body mainly orange brown. Antenna with the lenght of pedicel plus flagellum combined about 2.2 x as long as the length of scape; malar sulcus replaced by a granulate-shallow punctate stripe; external carina complete; sulcus of frenal carina distally expanded, with edge distal shape with a "V" or "U" notch, with two somewhat triangular submedian lobes; dorsellum with median areola slight wider than high; propodeum with disc rugulose and smooth and shiny between carinae; submedian carinae slightly arched and somewhat parallel to each other; forewing hyaline basally, with one brown band posterior to marginal vein and another subdistal one, and one hyaline band with white setae posterior to stigma vein; metafemur 1.98 – 2.00 x as long as high; Gt1 dorsum mostly smooth and shiny dorsally, punctulate dorsolaterally.

Description. FEMALE. Body length 5.48 – 5.76 mm. *Color*. Body mainly orange brown to brown, but with black areas, as follows: mandibular teeth, metafemural comb of denticles, tarsal claws, and apex of ovipositor sheath. Body pilosity white (Fig. 11a).

Head. Vertex with profile between lateral ocelli, in frontal view, straight, not hidden medially by median ocellus. Lateral ocellus with lateral fovea less than 0.3 x the ocellar diameter. Interantenal prominence distinctly larger than antennal foramen. Antenna with the lenght of pedicel plus flagellum combined about 2.2 x as long as the length of scape; scape just reaching the anterior margin of median ocellus. Preorbital carina distinguished on upper two thirds of eye margins. Malar sulcus replaced by a granulate-shallow punctate stripe; external carina complete (Fig. 11c). Ratios and measurements: head W/H 1.21; scape L/W 10.5; pedicel L/W

3.5; anellus L/W 1.9; funicular segments L/W: Fu1 2.6; Fu2 2.5; Fu3 2.5; Fu4 2.4; Fu5 2.2; Fu6 2.1; Fu7 1.7; clava L/W 2.6; eye H/W 1.38; FV 0.78 mm; MOD 0.10 mm; POL 0.41 mm; OOL 0.10 mm.

Mesosoma. Pronotal collar and dorsum of mesoscutum with setae at least 2 x as long as the diameter of its own fovea. Mesoscutellum slightly convex; frenal carina developed as a lamina laterally, distally expanded, median edge with a "V" or "U" notch, with two somewhat triangular submedian lobes; frenum with submedian or median Y-shaped carina (Fig. 11d). Dorsellum with median areola slight wider than high. Propodeum with disc rugulose and smooth and shiny between carinae; submedian carinae slightly arched and somewhat parallel to each other; median areola about 2 x as long as wide; anterolateral fovea small and semicircular (Fig. 11e). Mesepimeron costate, interstice smooth and shiny. Tegula with setae short and thick. Forewing hyaline basally, with one brown band posterior to marginal vein and another subdistal one, and one hyaline band with white setae posterior to stigma vein; basal cell fully setose (Fig. 11f). Ventral margin of metafemur with one rounded (sometimes obtuse) median lobe, followed by a wide rounded lobe or convexity (Fig. 12a). Metatibia with three carinae. Ratios and measurements: mesoscutum L/W 0.47; mesoscutelum L/W 1.12; forewing L/W 2.65; submarginal vein L 1.33 mm; marginal vein L 0.35 mm; stigmal vein L 0.09 mm; metafemur L/W 1.99.

Metasoma. Gaster longer than head plus mesosoma combined, acuminate. Gt1 dorsum mostly smooth and shiny dorsally, punctulate dorsolaterally; Gt2 mostly smooth and shiny medially; Gt1-Gt6 with thin and short setae. Ratios and measurements: gaster L/W 2.17; Gt1 L 0.99 mm; Gt1+Gt2 L 1.25 mm.

MALE. Similar to female except as following described. Body color mainly black, but with mandibles, tarsomeres, except tarsal claws, wing veins and gaster laterally brown. Forewing pattern hyaline with brown setae (Fig. 11b). Ratios and measurements: body length 3.57 mm; head W/H 1.42; scape L/W 4.44; pedicel L/W 1; anellus L/W 1.88; funicular segments L/W: Fu1 1.61; Fu2 1.56; Fu3 1.53; Fu4 1.63; Fu5 1.67; Fu6 1.47; Fu7 1.38; clava L/W 1.33; eye H/W 1.42; FV 0.67 mm; MOD 0.09 mm; POL 0.39 mm; OOL 0.07 mm; mesoscutum L/W 0.44; mesoscutelum L/W 1.03; forewing L/W 2.08; submarginal vein L 1.01 mm; marginal vein L 0.24 mm; stigmal vein L 0.06 mm; metafemur L/W 1.82; gaster L/W 1.36; Gt1 L 0.5 mm; Gt1 + Gt2 L 0.65 mm.

Material examined. Syntypes: #f (in good conditions to be designated as Lectotype, examined), labeled "Tex." "Texas Belfrage" "Type Nº 2178 USNM" "479" (USNM, 17885); #f (without head and metasoma, to be designed as paralectotype, images examined), labeled "Tex." "Texas Belfrage" "Type Nº 2178 USNM" "Stomatoceras rubra Ash." (USNM). Non-type material. (17 #f and 11 #m). **UNITED STATES**. California: 3 f#, San Diego, National City, 15.v.1913 (USNM, 17866, 17867, 17868). Arizona:1 f#, Pinal Co., Florence, 27.vii.1917 (USNM, 17871); 1 f#, Pima, 5 mi E. Sahuarita & Corona de Tucson, 07.viii.1991, J. G., Rozen, K. C., Rozen & N., Pember col. (USNM, 21944); 1 f#, Yavapai Co., 8mi NW Wickenburg (Mericopa Co.), viii.1993, Rozen col. (AMNH, 21948); 1 f#, Cochise Co., Bisbee, 1429 Franklin St., 109°55.83W 31°24.11N, 16.xi.1997, N. D., Menke col. (USNM, 17874). New Mexico: 1 f#, Hidalgo, 1.6 mi N of Rodeo, 23.viii.2005, J. S., Ascher col. (AMNH, 21974). Texas: 1 f#, 2 m#, Frio Co., 6 mi. SE Pearsall, 07.vii.1972, Taken on Ambrosia psilostachya, E. E., Grissel & J., Smith col. (TAMU, 12312). Florida: 1 f#, 1 m#, Gainesville, RockCrnr, 1983-1984, Malaise, col. (BMNH, 8580, 8582); 2 f#, 2 m#, *idem*, Pine Hill States, 12.ix-11.x.1973,

Malaise, H. V., Weems col. (USNM, 17873, 17875, 17876, 17878); 1 f#, 2 m#, *idem*, Doyle Conner Building, 08.ix-19.ix.1973, Malaise, H. V., Weems col. (USNM, 17872, 17877, 17879); 1 m #, *idem*, Doyle Conner Building, 02.xi.1973, Malaise, E. E., Grissel col. (USNM, 17880). **MEXICO**. Chihuahua: 4 f#, 2 m#, 10.x.1951-03.xii.1953, O., Smith col. (USNM, 17869, 17870, 17881, 17882, 17883, 17884).

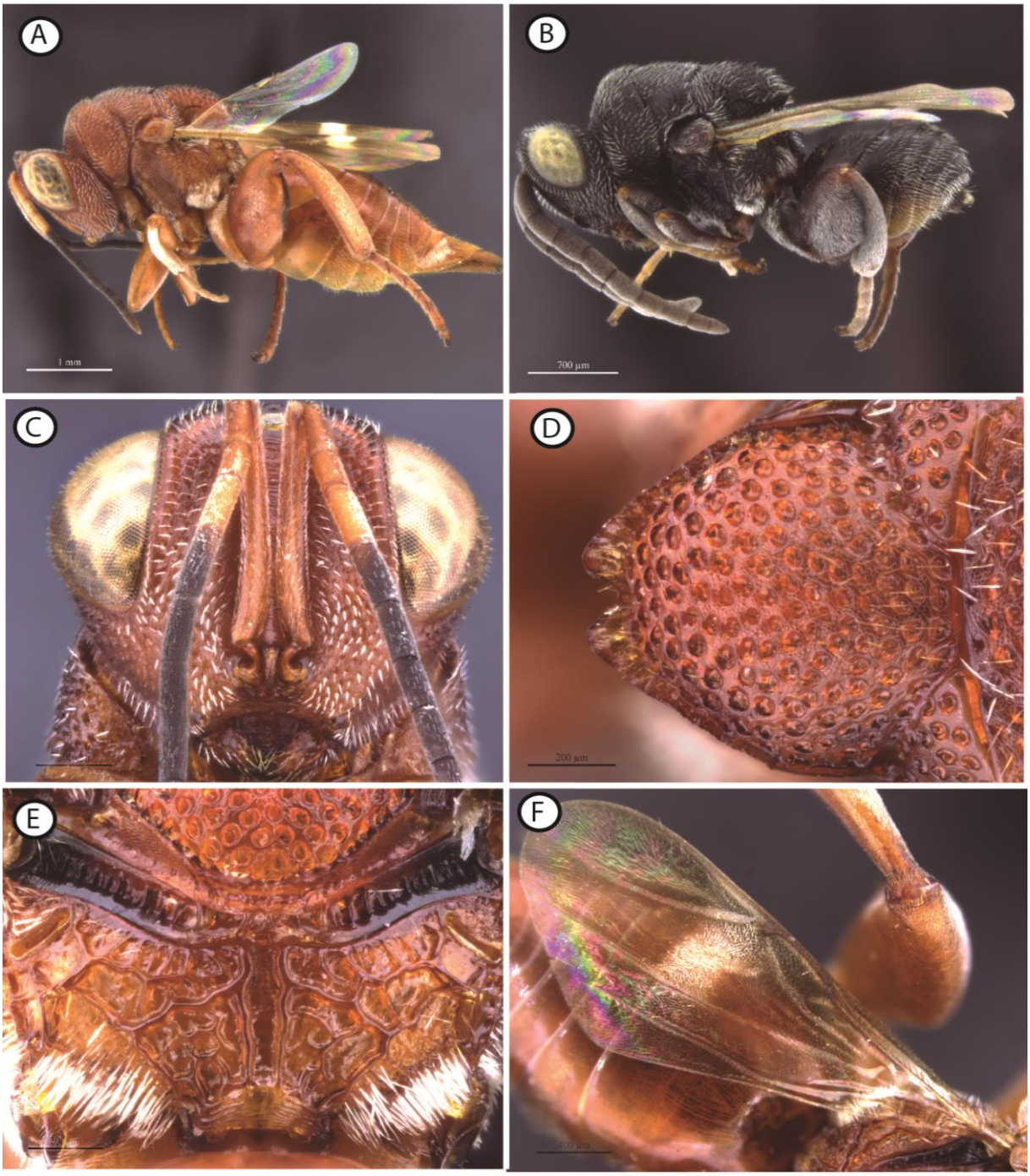

FIGURE 11a–f. *Hockeria rubra*, female: **a**, habitus, lateral; male: **b**, habitus, lateral; female: **c**, head, frontal; **d**, mesoscutellum, dorsal; **e**, propodeum; **f**, forewing.

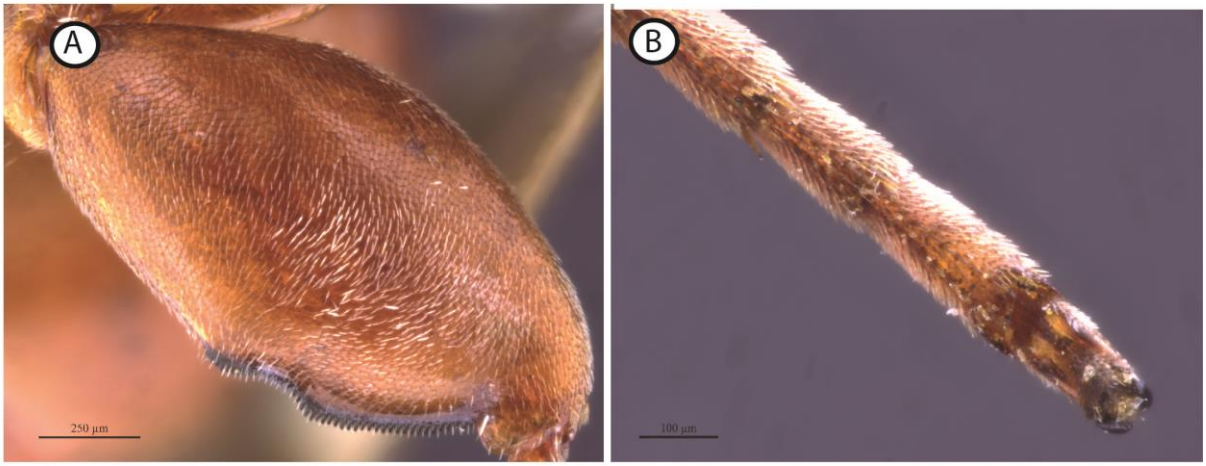

FIGURE 12a−b. *Hockeria rubra*, female: **a**, metafemur, outer face; **b**, hind tarsomeres.

Host. *Harrisina brillians* (Lepidoptera: Zygaenidae) (De Santis, 1979; Halstead, 1990).

Geographical distribution. United States and Mexico.

Remarks. Females of *Hockeria rubra and H. eriensis* shared the body color mainly orange brown, but the former of the gaster longer and acuminate, typical of *rubra* group, and metafemur with to ventral lobes makes it simple to differentiate these two species (see *H. eriensis* remarks). Beside the body color, *H. rubra* differs from the females of the remaining species of rubra group by propodeum with disc rugulose and smooth and shiny between carinae, submedian carinae slightly arched and somewhat parallel to each other; forewing hyaline basally, with one brown band posterior to marginal vein and another subdistal one, and one hyaline band with white setae posterior to stigma vein; and Gt1 dorsum mostly smooth and shiny dorsally, punctulate dorsolaterally. Halstead (1990) mentioned one of the syntypes listed above as a holotype and the existence of Paratypes in USNM and AMNH. Ashemaed (1894) described this species based on female and wrote "*Types two #f specimens from Arizona in colI. American Entomological Society* [nowadays in AMNH] *and two #f in U. S. National Museum from Texas.* Ashmead did not designate holotype in the original description. The lectotype will be designate in the publication of this revision.

***Hockeria tenuicornis* (Girault)**

Figs

Stomatoceras tenuicornis Girault, 1918: 127, female.

Stomatoceras tenuicorne Girault: Peck (1951: 585; catalogue, misspelling).

Hockeria tenuicornis (Girault): Peck (1963: 849; combination); Halstead (1990: 633, key, male description); Arias & Delvare (2003: 139, checklist); Noyes (2019; catalogue).

Diagnosis. Female. Body color mainly orange but with black areas. Mesoscutellum slightly convex in lateral view; forewing with a white setose area elliptical; ventral margin of metafemur with two lobes; gaster elongate,

accuminate, Gt1 dorsum polished, coreaceous laterally and dorsoposteriorly. Males has posterior margin of frenal carina rounded without two lobes; Gt1 base polished, densely punctate medially, gastral tergites mainly coreaceous (Halstead, 1990).

Host. *Rhyacionia zozana* (Lepidoptera: Tortricidae) (Halstead, 1990).

Geographical distribution. United States and Mexico.

Remarks. Forewing like *H. rubra* except white setose area elliptical. Gt1 polished, coriaceous laterally and dorsoposteriorly. The female of *H. tenuicornis* is most similar to *H. rubra* though it is distinguished by its black and orange body color, ovopositor shape and clouded pattern of forewing (Halstead, 1990).

Additional species of *Hockeria* cited to Neotropical Region

***Hockeria punctigera* (Fabricius)**

Chalcis punctigera Fabricius, 1804: 167. Holotype #f. South America (?). (NHMD, not examined).

Antrocephalus punctigerus (Fabricius): Howard (1894: 81; combination, misidentification); De Santis (1979: 71; catalogue).

Hockeria punctigera (Fabricius): Bouček & Delvare (1992: 31-32; combination, taxonomy, description); Arias & Delvare (2003: 139; checklist); Noyes (2019; catalogue); Tavares (2022; catalogue).

Remarks. Bouček & Delvare (1992) reviewed the type specimen of *H. punctigera* and they considered that the species might not belong to the Neotropical region because it presents similarities with species of European fauna. The lectotype is badly damaged and has not been available for study. According to redescription and ilustrations presented by Bouček & Delvare (1992) it was not possible to recognise the species among the material studied in this work.

Hockeria insignis* (Blanchard) *nom. nudum

Stomatoceras insignis Blanchard, 1940: 25. [no type or description presented]

Hockeria insignis Blanchard: De Santis (1967: 207; catalogue, combination); (Noyes, 2019; *nomen nudum*).

Remarks. This species was mentioned by Blanchard (1940) but it was not described. Because of this, it is treated as *nom. nudum*.

Discussion

Considering the set of morphological differences perceived among species groups of *Hockeria* approached above, it is reasonable to assume at least part of theirs are related to attack of distinct host groups. While eruciform larvae feed on leaves and are usually found associated with this vegetation, Myrmeleontidae larvae are psammophilous predators with powerful jaws and parasitoid wasps are attached to host mandibles at time of egg inoculation (Wallace, 1942; Delvare, 2017). Thus, the shortened gaster typical of *eriensis* group could

be explained as adaptation to the smaller surface available for oviposition because females are constrained at this time. The differences found in spines of hind tarsomeres between species groups could be related to the importance of its structure in supporting female body during oviposition. In species of *rubra* group, the robust aspect of spines of hind tarsomeres may have a function in the grip on the substrate or even on the surface of host pupae. In species of *eriensis* group, the most delicate aspect of these spines may be linked to the conditions in which female oviposits. The changes of metafemur shape observed in species of *eriensis* group also could be understood as adaptive responses to attacking a divergent insect host. It seems to be aimed at females and a possible explanation is that they attack hosts.

Wallace (1942) described the behaviour of *H. eriensis* when its females are attacking an antlion (Myrmeleontidae; Neuroptera). The latter author pointed out that, briefly, after finding the host in the typical sandy soil depression, the parasitoid wasp positions itself facing upwards, lifts its wings slightly and spreads its posterior legs, allowing itself to be captured by the host mandibles. Quickly, it inserts its ovipositor into the larvae prothorax, as a self-defense mechanism. This action promptly provides the releasing of the wasp from the ant lion jaws. *Lasiochalcidia* is a Haltichellinae genus specialised in parasitization of antlions (Bouček, 1988). Among species of this genus, there are two different strategies applied by females to attack the hosts, which depend on the morphology of hind legs. The robust hind-legged species hold the larvae mandibles between the metafemur and metatibia during oviposition. The slender hind-legged species allow themselves to be captured by the antlion larvae (Delvare, 2017), similar to the behaviour recorded in *H. eriensis*. Many *Lasiochalcidia* species have a short gaster, similar to that presented by the species belonging to the *eriensis* group. This feature may be interpreted as an evolutionary convergence between these different genera of Haltichellinae, developed by coevolution with the same host group.

Specimens of all new species described in this study were collected in Brazilian territory and all of them clearly belong to the *eriensis* species group. We found a host record only for *H.* sp.2, which emerged from *Myrmeleon brasiliensis* pupae and is cited as *H. eriensis* by Uchôa & Missirian (2014). That host record corroborates the existence of a group of species specialised as parasitoids of Myrmeleontidae in the New World, and the evidence discussed above leads us to consider the possibility that the *eriensis* group belongs to a distinct genus. Nevertheless, there is a lack of cladistic support to emancipate that species group to a genus rank. In Cruaud *et al*. (2020) preferred topology proposing the new high classification of Chalcididae, *Hockeria* species used in analysis grouped to species of different genera in Haltichellini (*Oxycoryphe*, *Uga* e *Antrocephalus*). *H. bicolor* and *H. eriensis* specimens grouped with an unidentified *Hockeria* species, from Mexico, and *H. magna*, an Old World one. This is the most consistent phylogenetic evidence about genus polyphyly. However, other New World species were not included in the analysis and to infer the reclassification of American *Hockeria* species is not possible based on this research. We still have no clues if the New World *Hockeria* presents a common American ancestor lineage that evolved in two groups in response to morphological specialisations for attacking different host groups, or if they would be two independent

Haltichellini lineages that entered in the American continent. In fact, we do not propose to answer this question here and all the aspects discussed above are to support the proposal of the two species groups.

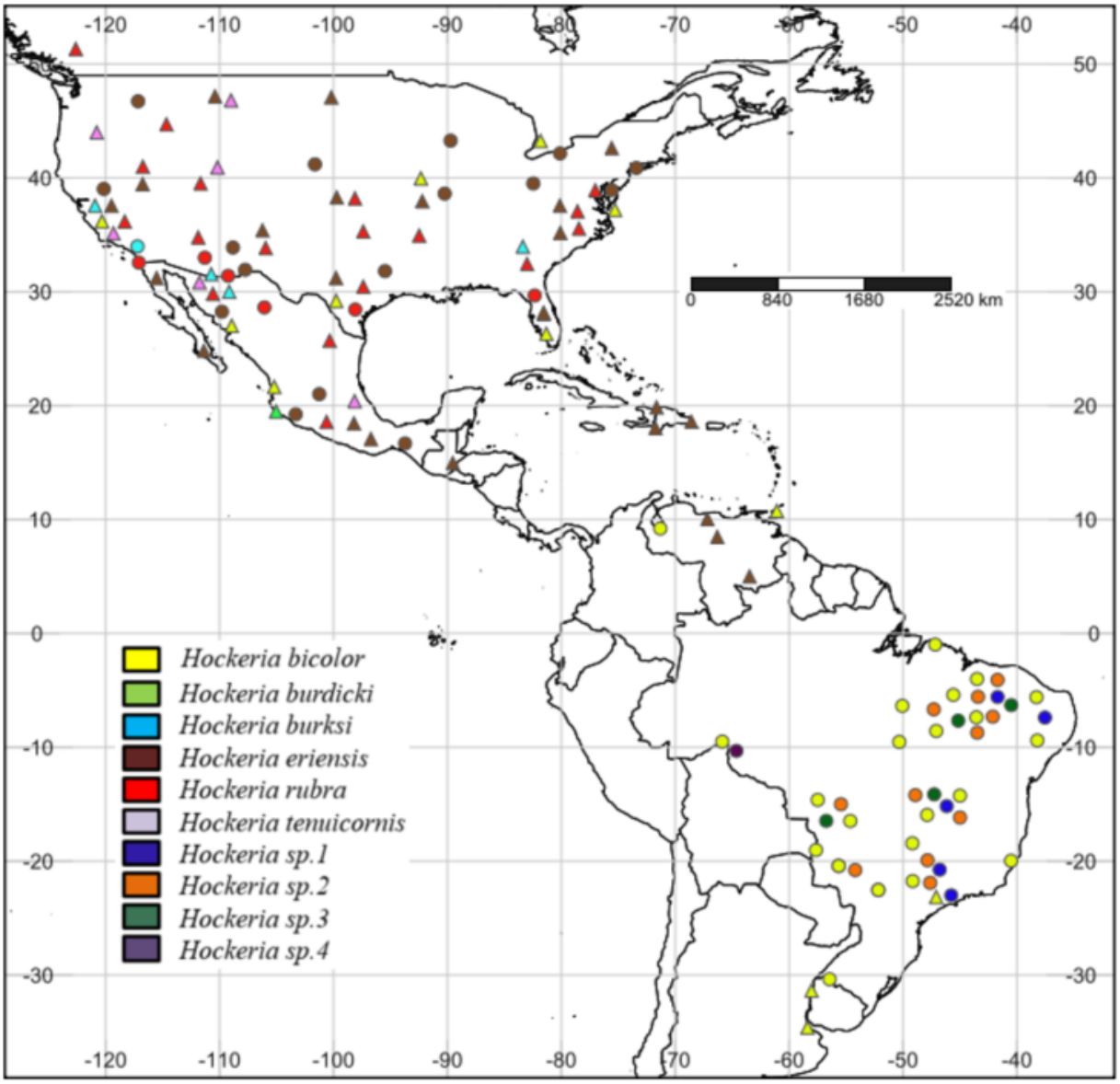

FIGURE 12 Distribution map of *Hockeria* species from Neotropical region in the New World.

This paper brings a relevant contribution for the New World Chalcididae and helps for the understanding of *Hockeria*, one of the genera pointed out for authors as taxonomic garbade in this family. We separate American species of *Hockeria* into two groups morphologically well established, corroborated by geographical distribution pattern and host range. We increase the species richness of the genus with four new species described and we present diagnosis and/or redescriptions for neotropical species previously described. We expand the distribution record of *Hockeria* in South America, especially in Brazil, with new records for 14

states and Federal District, including the five geographical regions of the country. New studies with phylogenetic focus are necessary to clarify the taxonomic status of the *Hockeria* species groups from the New World, but we believe our work will be useful for any future research dedicated to American species of the genus.

References

Arias, D.C. & Delvare, G. (2003) Lista de los géneros y especies de la família Chalcididae (Hymenoptera: Chalcidoidea) de la región Neotropical. *Biota Colombiana*, 4 (2), 123–145. [http://revistas.humboldt.org.co/index.php/biota/article/view/129]

Ashmead, W.H. (1894) Descriptions of New Parasitic Hymenoptera. (Paper No. 1). *Transactions of the American Entomological Society*, 21 (3), 318–344. [https://www.jstor.org/stable/25076627]

Ashmead, W.H. (1904) Classification of the chalcid flies of the superfamily Chalcidoidea, with descriptions of new species in the Carnegie Museum, collected in South America by Herbert H. Smith. *Memoirs of the Carnegie Museum*, 1, 225–551. [https://doi.org/10.5962/bhl.title.10341]

Blanchard, E.E. (1940) Descripcion de dos Himenópteros (Chalcid.) parasitos de larvas de *Strobelia baccharidis* Rond. *Revista de Museo de La Plata (Nueva Serie)*, 2: 93-98.

Bouček, Z. (1951) The first revision of the European species of the family Chalcididae. *Acta Entomologica Musei Nationalis Pragae*, 27, suppl. 1, 1–108.

Bouček, Z. (1988) *Australasian Chalcidoidea (Hymenoptera)*: A biosystematic revision of genera of fourteen families, with a reclassification of species. CAB International, Wallingford, and, Cambrian News Ltd; Aberystwyth, p. 832.

Bouček, Z. (1992) The New World genera of Chalcididae. *Memoirs of the American Entomological Institute*, 53, 49–117 + 443–466.

Bouček, Z. & Delvare, G. (1992) The identities of species described or classified under *Chalcis* by J.C. Fabricius. *Memoirs of the American Entomological Institute*, 53, 11–48 + 443–466.

Cruaud, A., Delvare, G., Nideleta, S., Saunea, L., Ratnasinghamc, S., Chartoisa, M., Blaimerd, B. B., Gatese, M., Bradyf, S. G., Faureg, S., van Noorth, S., Rossia & J., Rasplus, J. (2020) Ultra-Conserved Elements and morphology reciprocally illuminate conflicting phylogenetic hypotheses in Chalcididae (Hymenoptera, Chalcidoidea). *Cladistics*, 37, 1−35

Dalla Torre, K.W. von (1898) Chalcidiae et Proctotrupidae. *Catalogus Hymenopterorum*, 5, 1–598. [https://biodiversitylibrary.org/page/10935980]

Dallwitz, M. J. (1980) A general system for coding taxonomic descriptions. *Taxon*, 29, 41−46.

Dallwitz, M.J., Paine, T.A. & Zurcher, E.J. (1999) onwards. User's guide to the DELTA Editor. Available from https://www.delta-intkey.com (accessed Sep 2021)

De Santis, L. (1979) Catálogo de los himénopteros calcidoideos de América al sur de los Estados Unidos. Comisión de Investigaciones Cientificas Provincia de Buenos Aires, Buenos Aires. 488p.

Delvare, G.; Copeland, R.S. (2018) Four-horned wasps, description of some remarkable *Dirhinus* (Hymenoptera, Chalcididae) from Kenya, with a discussion on their taxonomic placement. *Zootaxa*, 4374(3), 301–349
[https://doi.org/10.11646/zootaxa.4374.3.1]

Delvare, G. (2017) Order Hymenoptera, Family Chalcididae. *Arthropod Fauna of the UAE*, 6, 225–274.

Evenhuis, N.L. (2019) The insect and spider collections of the world. Available from: http://hbs.bishopmuseum.org/codens/ (accessed 2020).

Fabricius, J.C. (1804) *Systema Piezatorum*, 2: xiv+30+440pp

Gibson, G.A.P. (1997) Morphology and Terminilogy, *In:* Gibson, G.A.P.; Huber, J.Y. & Woolley, J.B. (Eds.). Annotated keys to the genera of Nearctic Chalcidoidea (Hymenoptera). National Research Council, Ottawa. Pp.16–44 [https://cdnsciencepub.com/doi/pdf/10.1139/9780660166698].

Girau1t, A.A. (1918) New and old West Indian and North America Chalcid-flies (Hym.). *Entomological News*, 29, 125-131.
[https://biostor.org/reference/3749]

Habu, A. (1960) A revision of the Chalcididae (Hymenoptera) of Japan with description of sixteen new species. *Bulletin of National Institute of Agricultural Sciences*, Tokyo, 11: 131-363

Halstead, J.A. (1990) Revision of *Hockeria* Walker in the Nearctic Region with descriptions of males and five new species (Hymenoptera: Chalcididae). *Proceedings of the Entomological Society of Washington*, 92 (4), 619–640.
[https://biostor.org/reference/71456]

Halstead, J.A. (2000) A new species of *Hockeria* Walker from Mexico (Hymenoptera: Chalcididae). *Pan-Pacific Entomologist*, 76 (1), 52–54. [https://biostor.org/reference/244802]

Harris, R.A. (1979) A glossary of surface sculpturing. *Occasional Papers in Entomology*, 28, 1–32.
[https://doi.org/10.5281/zenodo.26215]

Husain, T. & Agarwal, M.M. (1982) Taxonomic studies on Haltichellinae of India (Hymenoptera: Chalcididae) PT.I. Haltichellini. *Oriental Insects*, 16: 313-336.

Kerrich, G.J. & Menon, M.G.R. (1949) On the identiy of *Chalcis pusilla* Fabricius and some problems of nomenclature on the Chalcididae. *Entomologist's Monthly Magazine*, 85: 207-211.

Kirby, W.F. (1883) Remarks on the genera of the subfamily Chalcidinae, with synonymic notes and descriptions of new species of Leucospidinae and Chalcidinae. *Journal of the Linnean Society*, 17: 53-78, plates 3, 4.

Machado, R.J.P., Gillung, J. P., Winterton, S. L., Garzón-Orduña, I. J., Lemmon, A. R., Lemmon, E. M., Oswald, J.D. (2019) Owlflies are derived antlions: anchored philogenomics support a new phylogeny classification of Myrmeleontidae (Neuroptera). *Systematic Entomology*, 44, 418‑450. [https://doi.org/10.1111/syen.12334]

Masi, L. (1916) Materiali per una fauna dell'Arcipelago Toscana. XI. Calcididi del Giglio. Prima serie: Toryminae, Leucospidinae, Chalcidinae, Eurytominae partim. (Tav. XII) *Annali del Museo Civico di Storia Naturale di Genova*, 47:54-122.

Narendran, T.C., Achterberg, C. van (2016) Revision of the family Chalcididae (Hymenoptera, Chalcidoidea) from Vietnam, with the description of 13 new species. *ZooKeys*, 576: 1-202. [https://doi.org/10.3897/zookeys.576.8177]

Nikol'skaya, M.N. (1960) Chalcididae and Leucospidae in central Asia (Hymenoptera, Chalcidoidea). Trudy Zoologicheskogo Instituta. *Akademiya Nauk SSSR*, Leningrad. 27: 220-246

Noyes, J.S. (2019) Universal Chalcidoidea Database. World Wide Web electronic publication. Available from: http://www.nhm.ac.uk/chalcidoids (accessed 15 August 2022).

Peck, O.C. (1951) Chalcididae. *In*: Muesebeck, C.F.W., Krombein, K.V., Townes, H.K., (Eds.), Hymenoptera of America North of Mexico, Synoptic Catalog. *Agriculture Monograph, U.S. Department of Agriculture*, 2, pp. 584–593. [https://doi.org/10.5962/bhl.title.65057]

Peck, O.C. (1963) A Catalog of the Nearctic Chalcidoidea (Insecta: Hymenoptera). *Canadian Entomologist*, Suppl., 30, 1092 pp.

Steffan, J.R. (1959) Les chalcidiens parasites de fourmilions (I). *Vie et Milieu, Paris*, 10, 303–317. [https://wwwphp.obs-banyuls.fr/Viemilieu/images/Archives_1950-2002/vie-et-milieu/VOLUME_1959_10_fasc3.pdf]

Tavares M.T. (2022) Chalcididae. *In*: *Catálogo Taxonômico da Fauna do Brasil*. PNUD. Available from: http://fauna.jbrj.gov.br/fauna/faunadobrasil/76874 (acessed 02 August 2022)

Tavares, M.T., Aquino, D. (2014) Chalcididae. In: Roig-Juñent S, Claps L, Morrone J (Eds) Biodiversidad de artrópodos argentinos. 1, 4. San Miguel de Tucumán: Universidad Nacional de Tucumán, Facultad de Ciencias Naturales, pp.548.

Uchoa, M.A., Missirian, G.L.B. (2014) *Myrmeleon brasiliensis'* parasitoids (Neuroptera: Myrmeleontidae) in the South Pantanal, Brazil. *Florida Entomologist*, 97 (1), 313–316. [http://dx.doi.org/10.1653/024.097.0149]

Walker, F. (1834) Monographia Chalciditum. (Continued.). *Entomological Magazine*, 2 (1), 13–39.

Wallace, G. E. (1942) Observations on the life of a new cha1cidoid wasp, an internal parasite of antlion larvae. *Annals of Carnegie Museum*, 29, 31–40. [https://biostor.org/reference/205392]

Westwood, J.O. (1839) Hymenoptera. Introduction to the modern classification of insects founded on the natural habits and corresponding organisation; with observations on the economy and transformations of the different families. *Proc. Ent. Soc. Lond*. 6: 83-84.

Winston, J. E., (1999) *Describing species: practical taxonomic procedure for biologists*. Columbia University Press, New York. 518 pp.

Yoder, M. J.; Mikó I.; Seltmann K. C.; Bertone M. A.; Deans A. R. (2010) A Gross Anatomy Ontology for Hymenoptera. *PLoS One*, 5 (12).

Zanella, F. C. V., Oliveira, M. L., Gaglianone, M. C. (2000) Standardizing lists of locality data for examined specimens in systematics and biogeography studies of New World taxa. *Biogeographica*. 76 (4) : 145-160.