UNIVERSIDADE DE SÃO PAULO
MUSEU DE ZOOLOGIA

Alvaro Doria dos Santos

Estudo taxonômico das espécies brasileiras de *Charops* Holmgren, 1859 (Ichneumonidae, Campopleginae)

São Paulo
2018

ALVARO DORIA DOS SANTOS

Taxonomic study of the Brazilian species of *Charops* Holmgren, 1859 (Ichneumonidae, Campopleginae)

(Estudo taxonômico das espécies brasileiras de *Charops* Holmgren, 1859 (Ichneumonidae, Campopleginae))

Dissertation submitted to the Graduate Program of the Museu de Zoologia da Universidade de São Paulo to obtain the degree of Master of Science in Systematics, Animal Taxonomy and Biodiversity

Advisor: Dr. Carlos Roberto F. Brandão
Co-advisor: Dr. Helena Carolina Onody

São Paulo
2018

Serviço de Biblioteca e Documentação

Museu de Zoologia da Universidade de São Paulo

Cataloging in Publication

Santos, Alvaro Doria dos

Estudo taxonômico das espécies brasileiras de *Charops* Holmgren, 1859 (Ichneumonidae, Campopleginae) / Alvaro Doria dos Santos; orientador Carlos Roberto Ferreira Brandão; co-orientadora Helena Carolina Onody. São Paulo, 2018.

141 f.

Dissertação (Mestrado) - Programa de Pós-Graduação em Sistemática, Taxonomia e Biodiversidade, Museu de Zoologia, Universidade de São Paulo, 2018.

Versão original

1. Hymenoptera. 2. Ichneumonidae. 3. Taxonomia. I. Brandão, Carlos Roberto Ferreira, orient. II. Onody, Helena Carolina, co-orient. III. Título.

CDU 595.798

Nome: Santos, Alvaro Doria dos

Titulo: Estudo taxonômico das espécies brasileiras de *Charops* Holmgren, 1859 (Ichneumonidae, Campopleginae)

Dissertação apresentada ao Programa de Pós-Graduação do Museu de Zoologia da Universidade de São Paulo para obter o título de Mestre em Ciências (Sistemática, Taxonomia Animal e Biodiversidade).

Aprovado: ___ / ___ / _____

Comissão Julgadora

Prof. Dr. _____ Instituição: _____

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Julgamento: _____ Assinatura: _____

Prof. Dr. _____ Instituição: _____

Julgamento: _____ Assinatura: _____

To mom and dad

ACKNOWLEDGMENTS

I would first like to thank my advisor Dr. Carlos Roberto Ferreira Brandão for giving me the opportunity to work in his laboratory, to support my study and related research and for constant incentive.

I would also like to acknowledge my co-advisor Dr. Helena Carolina Onody for the continuous support, patience, motivation, and for sharing her experience and huge knowledge on Ichneumon wasps (I owe you tons of chocolate).

The financial support provided by CNPq (Conselho Nacional do Desenvolvimento Científico e Tecnológico) was essential for the accomplishment of this study.

I am grateful to my fellow labmates: Dr. Kelli Ramos, Dr. Monica Antunes Ulyssea, Tamires Andrade, Juliana Menezes, Éliton Vieira, Camila Pereira and Helen Ferreira for the friendly work environment and companionship.

A special thank to Ms. Livia Pires do Prado for sharing many ideias that helped to improve this study and to Dr. Gabriel Biffi for giving me various tips on photography and QGis shapes.

My sincere thanks go to Dr. Bernardo F. Santos for sending me photographs of the holotype of *Charops annulipes* Ashmead,1890*.* Also, goes to Ms. Manuel Iturriaga Monsisbay and to my colleague Joel Lastra for sending me photographs of many Ichneumonidae type specimens, including the lectotype of *Charops luctuosus* (Cresson,1865) of the Entomological Collection of the Instituto de Ecología y Sistemática in Cuba and to the various curators and researchers that sent material or received me in their laboratories.

I am grateful to Dr. Antônio Santos Silva, Ms. Francisco Eriberto and Dr. Sônia Casari for the clarification of several taxonomic problems that arose during the elaboration of this work.

I am also deeply thankful to all professors of the Systematics, Animal Taxonomy and Biodiversity MZSP Graduate program that shared their immense knowledge during the many courses I took in these two last years. To all the Museu de Zoologai staff who collaborated directly or indirectly in the preparation of this study, with a special thank to the librarian Dione Seripierri for correcting the references; Tania Lopes for helping me with text formatting; Gustavo, Ricardo, Marta and Viviane Neves for

always attending my desperate bibliographical requests; Mariana Shinohara, Marlene Rocha, Marta Grobel, Omair Tizzot and Sonia Favaro for helping me with all the bureaucracy.

A special thanks to my friends Bruno Zilberman and Rafael Sousa that shared with me their knowledge in many subjects, helping me to improve this work and in my personal growth. Also, to my friends Carolina Cuezzo, Elias Araujo, Juan Rodriguez, Juares Fuhrmann, Joice Constantini, Letizia Migliore, Mauricio Moura, Olívia Evangelista, Pedro Ivo, Rodolfo Probst, Tiago Carrijo, Thiago Tadeu and many others whom I may have forgotten but are in my heart.

Finally, I must express my very profound gratitude to my beloved girlfriend Maria, an amazing Chiropterologist, who is always providing support and encouragement that helped me to achieve my goals and to my family which provides unfailing support even when I’m not always present.

“It has been said that it is dangerous to study the parasitic Hymenoptera, for many of those who do, end up in mental institutions, become alcoholics, or are, at least, a little odd.”

Marjorie C. Townes - A. A. Girault and His Privately Printed Papers, 1972.

RESUMO

Insetos parasitoides são conhecidos pela sua distinta estratégia de vida, na qual para concluir o seu ciclo de vida necessariamente matam os seus hospedeiros. Oitenta por cento das espécies de parasitoides pertencem à ordem Hymenoptera (abelhas, formigas e vespas). Dentre as vespas parasitoides destaca-se a família Ichneumonidae, que possui mais de 25 mil espécies nominais e apresenta grande diversidade de hábitos e hospedeiros. Apesar do grande número de espécies já descritas, existe uma baixa representatividade de espécies conhecidas de regiões tropicais devido, principalmente, à escassez de estudos taxonômicos na região. O presente estudo teve por objetivo compilar as informações sobre a biologia de Ichneumonidae a partir de uma extensa revisão da literatura e realizar um estudo taxonômico das espécies de *Charops* Holmgren, 1859 (Campopleginae) que ocorrem no Brasil. Foi observado que cerca das 950 espécies de Ichneumonidae que ocorrem no Brasil, menos de 10% possuem algum registro de hospedeiro. Tais registros estão concentrados principalmente nas regiões sul e sudeste do Brasil aonde se concentra a maior quantidade de taxonomistas do país. Além disso, grande parte dos registros referem-se a hospedeiros de importância econômica nas culturas de milho, soja e algodão. Pouco se sabe sobre a interação entre parasitoides/hospedeiros em biomas naturais brasileiros. Foram encontradas 33 espécies que apresentam registro de ocorrência dúbio para o Brasil. Apesar de ser uma das subfamílias com maior número de registros de hospedeiro, Campopleginae permanece relativamente carente de estudos taxonômicos no Brasil. Um exemplo disso é o gênero *Charops* que apesar de apresentar registros para o Brasil (em nível de gênero), nunca foi estudado através de um viés taxonômico. O estudo de 614 exemplares deste gênero revelou 9 espécies novas para o Brasil, sendo estas as primeiras espécies descritas para a América do Sul. Sua distribuição geográfica conhecida foi ampliada e ilustrada em mapas de distribuição. Imagens de alta resolução e uma chave de identificação para essas espécies são fornecidas.

Palavras-chave: Brasil, Hymenoptera, hospedeiros, Ichneumonidae, taxonomia, vespas parasitoides

ABSTRACT

Parasitic insects are known for their distinct life strategy: they necessarily kill their hosts in order to complete their life cycle. Eighty percent of parasitoids species belongs to the order Hymenoptera (bees, ants and wasps). Among parasitoid wasps Ichneumonidae stands out with more than 25 thousand species and a great diversity of habits and hosts. Despite the large number of species already described, there is a low representativeness of species in tropical regions, mainly due to the lack of taxonomical studies in those areas. The objective of the present study was to compile the information on the biology of Ichneumonidae through an extensive literature review and to conduct a taxonomic study of the species of *Charops* Holmgren, 1859 (Campopleginae) occurring in Brazil. It was observed that out of the 950 species of Ichneumonidae registered in Brazil, less than 10% present some host records. These records are mainly concentrated in the south and southeast of the Brazil where the relatively largest number of taxonomists are concentrated. In addition, most of the records relate to hosts of economic importance in corn, soybean and cotton crops. Little is known about the parasitoid / host interaction in natural Brazilian biomes. Also, thirty-three species with dubious occurrence in Brazil were found. Notwithstanding Campopleginae being one of the subfamilies with the highest number of host records, taxonomical studies on it are still scarce in Brazil. An example is the genus *Charops*, which despite having recorded for Brazil at genus level, has never been studied through a taxonomic point of view. The study of 614 specimens of this genus revealed 9 new species from Brazil, being the first described for South America. Its geographical distribution record is expanded and illustrated in distribution maps. High resolution images and a key for these species are also provided.

Key-words: Brazil, Hymenoptera, hosts, Ichneumonidae, taxonomy, parasitoid wasps

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Chapter II

ABBREVIATIONS

An. Antenna
Ann. Annelus
Ar. Areola
Atcp. Anterior transverse carina of propodeum
Atms. Axillary trough of mesonotum
Atmt. Axillary trough of metanotum
Atp. Anterior tentorial pit
Bl. Bulla
Bs. Basal area
Cly. Clypeus
Cr. Cercus
Epcn. Epicnecium
Epic. Epicnemial carina
Epo. Epomia
Fcx. Fore coxa
Fl. Fore leg
Fm. Femur
Fs. Flagellar Segment
Gn. Gena
Hcx. Hind coxa
Hd. Head
Hl. Hind Leg
Hyp. Hypoepimeron
Is. Inner spur
Jx. Juxtacoxal area
Jxc. Juxtacoxal carina
Llcpr. Lateral longitudinal carina of propodeum
Lt. lower tooth
Ltg. Laterotergite
Lto. lateral ocellus
Mcx. Middle coxa
Mdo. median ocellus
Mspl. Mesopleural groove
Ml. Mid leg
Mlcpr. Median longitudinal carina of propodeum
Mscu. Mesoscutum
Msp. Malar space
Mspi. Mesepimeron
Mspl. Mesopleuron
Msps. Mesepisternum
Mss. Mesosoma
Mtp. Metapleron
Mts. Metasoma
Mvf. Mandibular ventral flange
Ont. Ovipositor Notch
Os. Outer spur
Os. Ovipositor Sheaths
Otr. Ocellar triangle
Ovi. Ovipositor
Ped. Pedicel
Pc. Perpendicular carina
Plc. Pleural carina
Prd. Propodeum
Prpl. Propleuron
Prt. Pronotum
Ps. Propodeal spiracle.
Psct. postscutellum
Pt. Petiolar area
Ptcm. Posterior transverse carina of mesothoracic venter

Ptcp. Posterior transverse carina of propodeum
Saa. Supra-antennal area
Sc. Scape
Sca. Supraclypeal area
Sct. Scutellum
Smtc. Submetapleural carina
Sp. Spiracle
St. Sternite
Ster. Sternaulus
Sup. Subpeciolar Process
Tb. Tibia
Teg. Tegula
Tgs. Tergosternal suture
Thr. Thyridium
Tr. Tarsomere
Trc. Trochanter
Trl. Trochantellus
Ut. upper tooth
Vtx. Vertex

Measurements

BWM. Basal width of mandible
DBC. Distance between 2m-cu bulla and 4/Cu vein
DBM. Distance between 2m-cu bulla and 2/M vein
DOA. Distance between ovipositor notch and ovipositor apex
DOE. Distance between lateral ocelli and eye
FFH. First flagellomere height
FFW. first flagellomere width
HF. Height of Face
ID. Interocelar distance
LFW. Length of fore wing
LM. Length of mandible
LMP. Length of mesopleuron
LO. Length of ovipositor
LOD. Lateral ocelli diameter
LRT. Length of remaining tarsomeres
LT1. Length of tarsomere 1
LTE1. Length of tergite 1
LTE2. Length of tergite 2
MS. Malar space
OA. Ovipositor notch angle
SFH. Second flagellomere height
SH. Spiracle height
SHC. Size of hind coxa
SPN. Size of propodeum neck
SW. Spiracle width
WF. Width of Face

SUMMARY

1. Chapter I - Introduction: On parasitoid wasps

In 1913 Reuter coined the term parasitoid (“Parasitoidea”) for the group of insects that he defined as “parasitic predatory insects”. Wheeler (1923) supported this term and discerned parasites from parasitoids by the last one being described as “extremely economical predators” since parasitoids kills its hosts but, before killing them, they “spare” the host as much as possible to use its resources. A parasitoid can be defined as an organism that grows inside or on a single host and kills it as a necessary part of its own development (Poulin, 2011).

There are many life strategies among the so called parasitoidism. Parasitoids can affect directly the metabolism of its host by allowing (referred as koinobiont) or inhibiting or retarding (idiobiont) its final development. Despite a few exceptions, koinobionts parasitoids usually develop inside their hosts (endoparasitoids) and idiobionts outside of their hosts (ectoparasitoids). Furthermore, koinobionts parasitoids are frequently specialists while idiobionts are normally generalists (Quicke, 1997).

Due to their nature, parasitoids are important agents of biological control, acting directly on their hosts populational fluctuation (Wallner, 1987). For this reason, many species are used in biological control programs of agricultural pests. One example is the tiny (less than 1mm) wasps of the genus *Trichogramma* Westwood,1833; egg parasitoids of ten insect orders, these wasps are applied in the biological control of important pests such as *Ostrinia* Hübner,1825 and *Spodoptera frugiperda* (Smith, 1797) (Smith, 1996; Parra & Zucchi, 2004). A successful biological program highly depends on the knowledge of the parasitoid biology (Parra, 2002) and an extensive number of experiments were made to allow the use of this wasp in the field (Parra & Zucchi, 2004).

In all terrestrial ecosystems, parasitoids have been considered as a keystone group controlling their hosts populations. Since these organisms occupy high trophic levels and usually are very specialized, they are likely to be subject to local or global extinctions (Shaw & Hochberg, 2001). Anton *et al*. (2007) studying the effect of habitat fragmentation on the population of the butterfly *Maculinea nausithou* (Bergstraesser, 1779) and its specialist parasitoid *Neotypus melanocephalus* (Gmelin, 1790) (Ichneumoninae) observed a higher genetic differentiation in *N. melanocephalus* due

to a combination of small local population sizes and haplodiploidy, showing that the parasitoid was more sensitive to habitat fragmentation than its host.

Paradoxically, parasitoid wasps are one of the most neglected groups regarding conservation studies and extinction risks (Shaw & Hochberg, 2001). Of seven orders of insects known as Parasitoids, Hymenoptera (ants, bees and wasps) stands out, representing 80% of the species (Quicke, 1997) with a great amount of these species parasitizing insect groups of economic importance (Yu *et al.*, 2016). Forbes *et al.* (2018) based on the hypotheses that most of holometabolan insects are parasitized by one or more parasitoid wasps, suggests that the diversity of these species may exceed the number of Coleoptera species by 3 times.

During the evolutionary history of Hymenoptera, parasitoidism life strategy appeared only once, probably at the beginning of the Triassic (~245mya) (Peters *et al.*, 2017). There is a high propensity that the common ancestor of Orussoidea + Apocrita was an ectoparasitoid of xylophagous Hymenoptera and Coleoptera (Gibson, 1985; Whitfield, 1992; Dowton & Austin, 2001; Peters *et al.*, 2017).

Peters *et al.* (2017) identified a major radiation (between 266-195 mya) of the clade Parasitoida (Proctotrupomorpha + [Ceraphronoidea + Ichneumonoidea]) concomitant with the diversification of its major host lineages (*e.g.*, Hemiptera, Holometabola).

Among parasitoid wasps, Ichneumonidae Latreille,1802 is the largest and the most cosmopolitan group, containing approximately 25000 described species in 1600 genera (Yu *et al*., 2016). This family is the sister group of Braconidae forming together the above-mentioned superfamily, based on of both morphological (Sharkey & Wahl, 1992) and molecular data (Derr *et al*., 1992; Dowton & Austin, 1994; Quicke, 2009) evidences.

Ichneumonidae differs from Braconidae by having the following diagnosis (Wahl & Sharkey, 1993): fore wing with 2m-cu vein present and vein 1Rs+M absent; hind wing with 1r-m opposite or apical to the separation of veins R1 and Rs; metasomal tergite 2 separated from 3 and their junction flexible (figure 1).

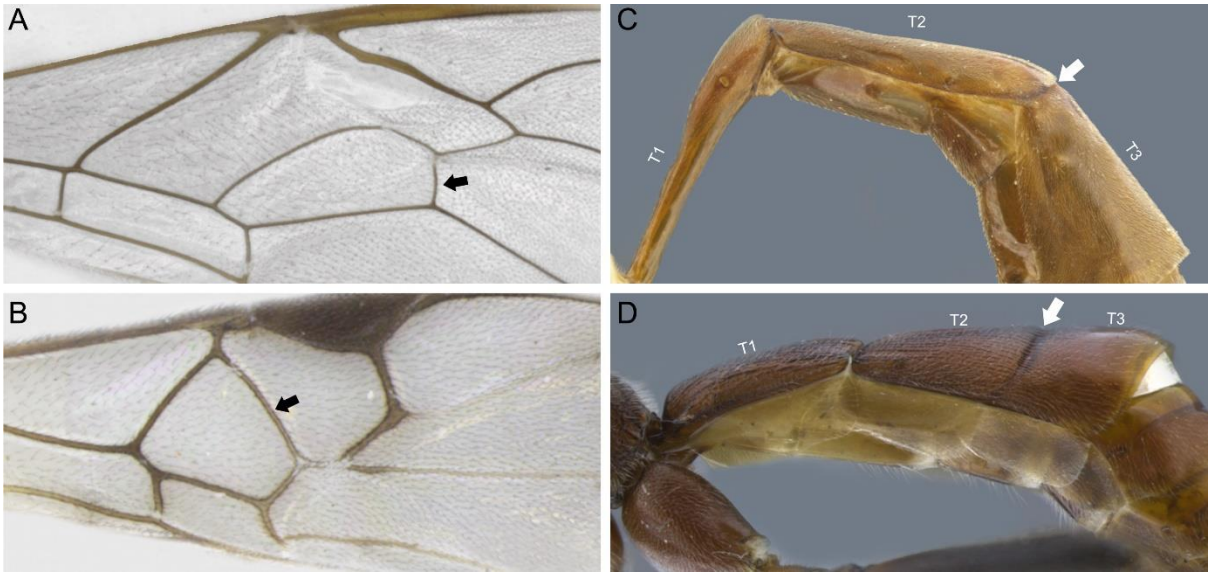

Figure 1. Diferences between Ichenumonidae and Braconidae wasps. Fore wing with 2m-cu vein present in Icheumonidae (A) and absent in Braconidae (B); vein 1Rs+M absent in Ichneumonidae (A) and present in Braconidae (B). Arrow indicating metasomal tergite 2 separated from 3 in Ichneumonidae (C) and fused in Braconidae (D).

Ichneumonidae is megadiverse with 44 subfamilies including all parasitoid life strategies (Yu *et al*., 2016). This diversity of traits allowed a relatively high diversification within this family (Peters *et al*., 2017) which is subdivided in seven informal groups of subfamilies: Xoridiformes, Labeniformes, Pimpliformes, Brachycyrtiformes, Ichneumoniformes, Orthopelmatiformes and Ophioniformes (*sensu* Quicke, 2009, 2015).

Xoridiformes and Labeniformes, both idiobiont ectoparasitoids of xylophagous insects (Coleoptera and Hymenoptera), are probably the most basal groups of Ichneumonidae (Quicke, 2009). This way of life is shared with Orusidae, the sister group of Apocrita.

The endoparasitoid koinobiont strategy appears to be the most common condition found in the other subfamilies, although many convergences led to ectoparasitism (Quicke, 2015). This habitat shifting led to specifics specializations that enable them to deal with this new environment (host gut), which may be very hostile to the presence of the parasitoid (Quicke, 1997). Endoparasitoids have the challenge to subvert hosts immune systems that is always trying to recognize the parasitoid to encapsulate and kill it (Quicke, 1997).

Passive and active strategies enabled them to overcome this problem. Passive strategies basically prevent local contact or detection by the immune system. On the other hand, active strategies inhibit the immune system through wasp venoms, teratocytes, and viruslike particles known as Polydnaviruses (Whitfield, 1997; Webb, 1998). The virus Polydnaviridae is associated with Braconidae and Ichneumonidae wasps, evolving independently on each family (Whitfield, 1997). Replicated in ovary calyx cells, the virus is injected within the wasp's egg inside the host. Inside the host, the Polydnaviruses are responsible for the failure of the immune response allowing the development of the parasitoid (Webb, 1998). This wasp/virus association is so successful that, in some cases, wasp's venom may become redundant (Dorémus *et al*., 2013).

Despite the army race between endoparasitoids and its hosts, the interior of the host presents a hostile habitat that, however, protects the parasitoid from physical damages and water loss (Quicke, 1997).

Ichneumonidae is known for its anomalous latitudinal distribution, first observed by Owen & Owen (1974); by comparing ichneumonid samples from Uganda, Sierra Leone and England they found a more diverse fauna in higher than lower latitudes. This phenomenon was studied in many papers that proposed different hypothesis (*e.g.* Janzen & Pond, 1975; Rabinowit & Price, 1976; Gauld *et al*., 1992; Sime & Brower, 1998).

However, any conclusion about ichneumonid latitudinal distribution can be hasty, since most of the diversity in tropical forests of parasitoid wasps (mainly of small sized wasps) is still unknow due primarily to a lack of taxonomical studies (Veijalainen *et al.*, 2012; Quicke 2012). Veijalainen *et al.* (2012) found 177 likely undescribed orthocentrine (koinobionts) species with low sampling efforts in Central America and Equador.

Biodiversity in Brazil is highly threatened by human activities, a distinct trait of the ongoing sixth mass extinction (Barnosky *et al*., 2011). For example, the Brazilian Atlantic Forest, home of eight thousand endemic animal and plant species, is extremly fragmented with only 7% of its original coverage remaining (Tabarelli *et al*., 2005). Increased forest and climate degradation doubled the frequency of forest fires in Amazon Forest (Alencar *et al*., 2015). More than 50% of original Cerrado area gave place to agricultural lands and pasture (Klink & Machado, 2005). Anthropogenic

actions also affect Pantanal wetlands (Harris *et al*., 2005) and the neglected Cerrado (Santos *et al.*, 2011).

A considerable number of fauna surveys accessing sundry biomes were done in Brazil (*e.g.* Kumagai & Graf, 2000; Guerra & Penteado-Dias, 2002; Tanque & Frieiro-Costa, 2011). However, many of these efforts to comprehend our Ichneumonid diversity do not treat individuals at species level, which affects the results of conservation assessments and hence decision making (Brooks *et al*., 2004).

The comparative meagerness of studies related to this family in Brazil and in South American countries motivated this study, which aims to add taxonomic and ecological knowledge to the Brazilian Ichneumonidae fauna. The state of the art of Brazilian Ichneumonidae ecology was investigated through an extensive review of the host-parasitoids records in the country presented in Chapter II. Chapter III deals with the taxonomic study of the Brazilian species of *Charops* Holgrem, 1859.

2. Chapter II - What we know about Ichneumonidae biology in Brazil: a literature review of 121 years of host/parasitoid association records

2.1. Introduction

Parasitoid wasps are highly adapted to locate their hosts. For example, their antennae and ovipositor are equipped with numerous mechano and chemosensorial sensillae (Quicke, 1997). Internal (*e.g.* hunger, physiological condition, experience, egg load) and external factors (*e.g.* light, temperature, humidity, wind, chemicals) acting on the adult female wasp have great influence on host searching and acceptance (Vinson, 1998).

After emerging from the egg, some species will search for hosts almost instantly and others experience a preoviposition period in which they do not search for hosts (Vinson, 1998). For example, *Tranosema rostrale* (Brischke, 1880) (Campopleginae) parasitoid of *Choristoneura fumiferana* (Clemens, 1865) (Lepidoptera: Tortricidae) lacks a pre-mating or preoviposition period in laboratory conditions (Seehausen *et al.*, 2016). On the other hand, another Campopleginae species, *Diadegma semiclausum* (Hellén,1949) showed a preoviposition period of almost ten hours in laboratory conditions (Pourian *et al.*, 2015).

Concerning females experience, Vinson (1998) classified three types: the first one is the innate behavior that determines to what kind of stimuli the wasp will respond. The second is the experience *per se* that improves the response of host selection over the time in which the wasp spend locating and oviposition in hosts. The third one is the associative learning allowing females to associate new cues besides the innate cues.

By studying the ichneumon wasp *Campoletis sonorensis* (Cameron, 1886) in a wind tunnel bioassay, Mcauslane *et al.* (1991) observed that this wasp showed an innate response from volatiles of damaged plants that usually are attacked by its host. Females that experienced oviposition beforehand showed an increased response from hosts and damaged plants cues stimulation than “naive” females. Also, they observed that females that had previous oviposition experience are more likely to try novel host plants.

The number of mature eggs that the female is carrying may affect the choice of potential hosts (Vinson, 1998). Ueno & Ueno (2015) studying females of *Itoplectis*

naranyae (Ashmead, 1906) observed that individuals carrying relatively more eggs are prone to broaden their range of acceptable hosts, preventing from dying before laying all her eggs.

Frass, honeydew and pheromones serve as chemical clues for the wasp to find its host location (Quicke, 1997). Other important substances known as “herbivore-induced plant volatiles” (HIPVs) produced by plants when attacked by herbivores insect are relatively easily detected by parasitoids (Vet & Dicke, 1992). Parasitoids take advantage of this clue given by the plant (which will be benefited by presence of the parasitoid) to find their host in a phenomenon known as tritrophic interaction (Vet & Dicke, 1992). Ohara *et al.* (2003) observed females of *Diadegma semiclausum* (Hellén, 1949) more attracted to host-infested cabbages than to uninfested. The source of attraction were the volatiles emitted from cabbage plants while attacked by *Plutella xylostella* (Linnaeus, 1758) larvae.

Physical cues also affect host choices. Glass beads coated with host recognition kairomone were used in a trial with the wasp *Telenomus heliothidis* Ashmead,1893, parasitoid of *Heliothis virescens* (Fabricius, 1777). Beads from different formats were offered to the wasp which preferred spherical coated beads to spheroidal “hosts” (Strand & Vinson, 1983).

As observed above, parasitoid wasps have an intricate history of coevolution with their hosts and associated plants. Unfortunately, only 5300 species (one fifth of the total of recorded Ichneumonidae species) have host records (Yu *et al.,* 2016). This number decreases to around two thousand species when we include associated plant (Yu *et al.,* 2016). Other taxonomical levels besides species share this scarcity of biological data. One example is the Nesomesochorinae subfamily with 60 described species (some of them very conspicuous), although only one biological record is recognized for this subfamily (Quicke, 2015).

Due to their trophic position, parasitoids species diversity also reflects their hosts diversity. Anderson *et al.* (2011) observed a stronger relationship between wasp’s abundance and richness and overall arthropods than other parasitoid insects and overall arthropods indicating that the first may be used as bioindicators of arthropod diversity in agricultural landscapes. Maeto *et al.* (2009) used the Braconidae wasps to monitor reforestation efforts in Indonesian degraded grasslands. Identifying parasitoid/hosts taxa increases the effectiveness of arthropod monitoring (Anderson *et*

al., 2011). Also, the knowledge on the correct association between parasitoid and its host is essential for biological control of agricultural pests, being the first of many steps for a successful biocontrol program (Parra, 2002).

2.2. Objectives

The purpose of this study was to compile and update the information about Ichneumonidae parasitoids- hosts associations in Brazil by performing an extensive literature survey.

2.3. Material and Methods

An extensive literature review of published papers was made between the years 1898 and 2018 through the online databases (Web of Science, Zoological Records, Google Scholar), Taxapad 2016 and in the Museu de Zoologia Library. The following key words (written in English and Portuguese) in different combinations were used: “natural enemies”, “biological control”, “Ichneumonidae”, “Brazil”, “Parasitoid” and “Host”. Thesis, dissertations, abstracts, extended abstracts and EMBRAPA (Empresa Brasileira de Pesquisa Agropecuária); informative pamphlets were excluded from this work to avoid repeateted data. Papers that identified parasitoids only at family level were also excluded from this work.

All information about parasitoid taxa, host family, host species, host associated plants, locality of host-parasitoid register and references were compiled. Ichneumonidae species introduced in Brazil by "Costa Lima" Quarantine Laboratory (Tambasco *et al.*, 2004) were also included in this study.

Parasitoids names are given in valid binomial or trinomial names followed by the author and year of publication. Locality records were also sorted alphabetically, following the Brazilian states abbreviations: **AC** (Acre); **AL** (Alagoas); **AM** (Amazonas); **AP** (Amapá); **BA** (Bahia); **CE** (Ceará); **DF** (Distrito Federal); **ES** (Espírito Santo); **GO** (Goiás); **MA** (Maranhão); **MG** (Minas Gerais); **MS** (Mato Grosso do Sul); **MT** (Mato Grosso); **PA** (Pará); **PB** (Paraíba); **PE** (Pernambuco); **PR** (Paraná); **PI** (Piauí); **RJ** (Rio de Janeiro); **RN** (Rio Grande do Norte); **RR** (Roraima); **RS** (Rio Grande do Sul); **RO** (Rondônia); **SC** (Santa Catarina); **SE** (Sergipe); **SP** (São Paulo); **TO** (Tocantins).

Occurrence maps of the host/parasitoid association records were made with data from original papers, using software Quantum Gis 2.8 and shape files from Instituto Brasileiro de Geografia e Estatística (IBGE).

2.4. Results and discussion

The study of Ichneumon wasps in Brazil is reasonably recent: the earliest species recorded in Taxapad (Yu *et al*., 2016) was *Macrojoppa picta* (Ichneumoninae), described by Guérin-Méneville in 1830. Between 1830 to 1900 only seventeen papers addressing Brazilian Ichneumonidae were published (Yu *et al*., 2016). The first host/parasitoid record was published in 1898 when Kriechbaumer described *Trogus pompeji* (Ichneumoninae), and included a biological note recording it as a parasite of Papilionidae in Rio de Janeiro.

The number of biological notes increased in late 30s, most of them strongly related to biological control of agricultural pests (*e.g.* Silva, 1936; Cushman, 1938; Lane & Lane, 1935; Lima, 1937a, 1937b; Hambleton, 1939; Sauer, 1939) (figure 1). In 1946, Sauer published a list of Diptera and Hymenoptera predators or parasitoids with host and associate plant data. This list was the first substantial work of Ichneumonidae (regarding its biology) in Brazil with 28 records, 23 of them with associated plant.

Between late 40s to 60s relatively few articles on the subject (Parker *et al.*, 1950; Lima, 1951, 1953; Silva *et al.*, 1968) were published. In 1939, the chemical compound DDT started to be used as an agricultural insecticide. Considered a solution for control of pests, DDT and other compounds usage became indiscriminate in agronomic cultures (Parra *et al.,* 2002). Newsom (1980) characterized this period as the dark ages of integrated pest control since most of the applied studies were focused on pesticides and most entomologists became "pesticide peddlers". With the publication of the book *Silent Spring* (Carson, 1962) about the damaging effects of DDT, the necessity to seek alternatives management forms of agricultural pests arose (Kogan, 1998).

Between early 60s to late 80s the number of papers accessing ichneumonids biology rebounded reaching more than twenty published papers generally about pests biological control. A remarkable work from this period was the catalog made by Silva *et al.* (1968) of plant living insects associated with its predators and parasitoids.

The last thirty years are characterized by a burst of host/parasitoid records not only from applied entomology (*e.g.* Silva, 1993; Graf & Marzagão,1999), but also from fundamental research (*e.g.* Zanette *et al.,* 2004; Gonzaga, *et al.,* 2010). Correct identification and understanding of the biology of Ichneumonidae, besides being essential for the success of biological programs (Parra, 2002), are important to understand the evolutionary history of this taxon.

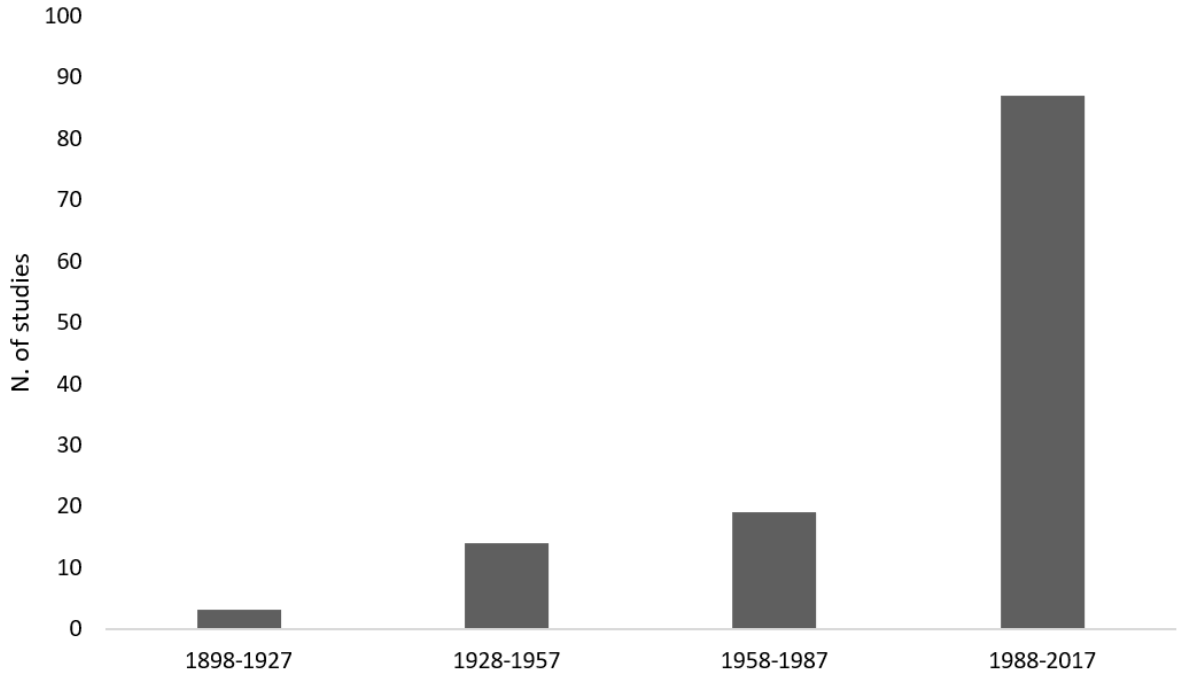

Figure 1. Number of articles on parasitoid/host associations in Brazil published in the last 120 years.

From all the 955 ichneumonids species recorded in Brazil (Yu *et al.*, 2016), 33 present dubious geographical records (table 1). In 1962, Lima published the twelfth volume of “Insetos do Brasil” (Brazilian insects) including records of some ichenumonid species from other Latin American countries, which possibly led to misinterpretation by non-Portuguese speakers. It is not clear in the book if these species do occur in Brazil and, since there are no other published records, care is necessary when recording these species in Brazil.

A total of 125 published papers were found on the literature, representing 212 biological records, associating only 88 species of 15 subfamilies of Brazilian Ichneumonidae with their hosts (tables 2 and 3).

Table 1. Ichneumonidae species with dubious geographical records in Brazil.

Subfamily	Species
Anomaloninae	*Ophionellus imitatorius* (Blanchard,1942)
	Podogaster cactorum Cushman,1927
Banchinae	*Meniscomorpha lopezi* (Blanchard,1935)
Campopleginae	*Campoletis argentifrons* (Cresson,1864)
	Campoletis curvicauda (López Cristóbal,1947)
	Campoplex daritis Schrottky,1911
	Hyposoter christenseni (Blanchard,1946)
	Hyposoter fugitivus (Say,1835)
	Hyposoter rubraniger (López Cristóbal,1947)
	Venturia bergi (Brèthes,1922)
	Venturia pastranai (Blanchard,1946)
Cremastinae	*Temelucha platensis* (Brèthes,1917)
Cryptinae	*Baryceros eucleidis* (Blanchard,1936)
	Basileucus venturii (Schrottky,1902)
	Chirotica bruchii (Brèthes,1904)
	Diapetimorpha brethesi (Schrottky,1902)
	Mastrus pastranai (Millan & de Santis,1958)
	Neocryptopteryx metriurus (Spinola,1851)
	Neocryptopteryx orientalis Blanchard,1947
	Oecetiplex borsani (Blanchard,1941)
	Polycyrtus giacomellii Schrottky,1911
	Xiphonychidion horsti (Brèthes,1916)
Pimplinae	*Apechthis bazani* (Blanchard,1936)
	Calliephialtes argentinus Blanchard,1936
	Clistopyga lopezrichinii (Blanchard,1941)
	Itoplectis niobe (Schrottky,1902)
	Neotheronia bicincta (Cresson,1865)
	Pimpla fuscipes Brullé,1846
	Scambus holmbergi (Brèthes,1904)
	Tromatobia huebrichi (Brèthes,1913)
Tersilochinae	*Stethantyx argentinensis* (Blanchard,1945)
	Stethantyx parkeri (Blanchard,1945)
Tryphoninae	*Netelia oeceticola* (Blanchard,1941)

Table 2. Hosts of Ichneumonidae recorded from the literature (see References). Subfamilies are presented in bold characters.

Parasitoid	Host Lepidoptera (otherwise stated)	Host species	Host associated plant	Locality	Reference
Anomalanoniae					
Podogaster townesi (Graf, 1983)	Pyralidae	*Hypsipyla grandella* (Zeller, 1848)	*Cedrela fissilis* Vell.	PR	Graf, 1983
Banchinae					
Diradops Townes, 1946	Noctuidae	*Miselia albipuncta* (Hampson, 1911)	*Croton floribundus* Spreng.	SP	Fernandes *et al.*, 2010
Glypta Gravenhorst, 1829	Tortricidae	*Argyrotaenia montezumae* (Walsingham, 1914)	*Gossypium* L.	SP	Sauer, 1946
Meniscomorpha Schmiedeknecht, 1907	Oecophoridae	*Stenoma catenifer* Walsingham, 1912	*Persea Americana* Mill.	MG	Nava *et al.*, 2005
	Gelechiidae	*Dichomeris* Hübner, 1818	*Croton floribundus* Spreng.	SP	Fernandes *et al.*, 2010
Sphelodon annulicornis (Morley, 1914)	Gelechiidae		*Croton floribundus* Spreng.	SP	Fernandes *et al.*, 2010
Brachycyrtinae					
Brachycyrtus cosmetus (Walkley, 1956)	Neuroptera: Chrysopidae	*Chrysopa* Leach, 1815		AL; PB	Gonçalves, 1974; Silva, 1968
Campopleginae					
Campoletis Förster, 1869	Noctuidae	*Spodoptera frugiperda* (Smith, 1797)	*Zea mays* L.	PR	Valicente & Barreto, 1999

Campoletis flavicincta (Ashmead, 1890)	Noctuidae	*Pseudaletia sequax* (Franclemont, 1951)	*Pennisetum clandestinum* Hochst. ex Chiov.	PR	Foerster, 2001
	Noctuidae	*Spodoptera frugiperda* (Smith, 1797)	*Zea mays* L.	MG; PR; RS; SP	Bortolotto *et al.*, 2014; Dequech, 2004; Cruz, *et al.,* 1997a; Cruz, *et al.*, 1997b; Figueiredo, *et al.*, 2006; Silva, *et al.*, 2012; Patel & Habib, 1984; Patel & Habib, 1987
Campoletis grioti (Blanchard, 1946)	Gelechiidae	*Phthorimaea opercuiella* (Zeller, 1873)	*Nicotiana tabacum* L.	PR	Borges *et al.*, 1983
Campoletis sonorensis (Cameron, 1886)	Noctuidae	*Chrysodeixis includens* (Walker, 1858)	*Glycine max* (L.) Merr.	RS	Moraes *et al.*, 1991
	Noctuidae	*Helicoverpa armigera* (Hübner, 1809)	*Gossypium* L.	BA	Luz *et al.*, 2018
	Noctuidae	*Rachiplusia nu* (Guenée, 1852)	*Glycine max* (L.) Merr.	RS	Moraes *et al.*, 1991
	Noctuidae	*Spodoptera frugiperda (Smith, 1797)*	*Zea mays* L.	MG; RS; SP	Camargo *et al.*, 2015
Campoplex haywardi Blanchard, 1946	Gelechiidae	*Phthorimaea opercuiella* (Zeller, 1873)	*Nicotiana tabacum* L.	PR	Borges *et al.*, 1983
Campoplex Gravenhorst, 1829	Tortricidae	*Olethreutinae* Walsingham, 1895	*Croton floribundus* Spreng.	SP	Fernandes *et al.*, 2010
Casinaria Holmgren, 1859	Apatelodidae	*Apatelodes* Packard, 1864	*Croton floribundus* Spreng.	SP	Pereira *et al.*, 2015
	Geometridae	*Glena* Hulst, 1896	*Anadenanthera colubrina* (Vell.) Brenan	SP	Pereira *et al.*, 2015

	Geometridae	*Hymenomima* conia Prout, 1931	*Croton floribundus* Spreng.	SP	Fernandes *et al.*, 2010
	Lepidoptera		*Anadenanthera colubrine* (Vell.) Brenan	SP	Pereira *et al.*, 2015
	Hesperiidae	*Elbella luteizona* (Mabille, 1877)	*Byrsonima coccolobifolia* Kunth; *Myrsine guianensis* (Aubl.) Kuntze	DF	Lepesqueur *et al.*, 2017
	Noctuidae	*Bertholdia* Schaus, 1896	*Croton floribundus* Spreng.	SP	Pereira *et al.*, 2015
	Noctuidae		*Guazuma ulmifolia* Lam.	SP	Pereira *et al.*, 2015
Casinaria plusiae (Blanchard, 1947)	Noctuidae	*Chrysodeixis includens* (Walker, 1858)	*Glycine max* (L.) Merr.	RS	Moraes *et al.*, 1991
	Noctuidae	*Rachiplusia nu* (Guenée, 1852)	*Glycine max* (L.) Merr.	RS	Moraes *et al.*, 1991
Charops Holmgren, 1859	Geometridae		*Machaerium* Pers.	SP	Pereira *et al.*, 2015
	Lasiocampidae	*Euglyphis Rivulosa* (Drury, 1773)	*Persea americana* Mill.	SP	Fischer & Patel, 1993
	Geometridae	*Cyclomia mopsaria* Guenée, 1857	*Erythroxylum microphyllum* A.St.-Hil.	SP	Marconato *et al.*, 2008
	Geometridae	*Glena* Hulst, 1896	*Erythroxylum microphyllum* A.St.-Hil.	SP	Marconato *et al.*, 2008
	Geometridae	*Iridopsis fulvitincta* (Warren, 1897)	*Erythroxylum microphyllum* A.St.-Hil.	SP	Marconato *et al.*, 2008
	Geometridae	*Oxydia vesulia* (Cramer, 1779)	*Croton floribundus* Spreng.	SP	Fernandes *et al.*, 2010
	Noctuidae	*Bagisara paulensis* (Schaus, 1898)	*Croton floribundus* Spreng.	SP	Fernandes *et al.*, 2010
Cryptophion espinozai Gauld & Janzen, 1994	Sphingidae	*Erinnyis ello* (Linnaeus, 1758)		Brasil	Gauld & Janzen, 1994

Cymodusa Holmgren, 1859	Noctuidae	*Heliothis virescens* (Fabricius, 1777)	*Gossypium* L.	SP	Sauer, 1946
Diadegma Förster, 1869	Gelechiidae	*Tuta absoluta* (Meyrick, 1917)	*Lycopersicon esculentum* Mill.	DF	Medeiros, 2011
	Plutellidae	*Plutella xylostella* (Linnaeus, 1758)	*Brassica oleracea* L.	DF	Bôas *et al.*, 2004; Branco & Medeiros, 2001
Diadegma leontiniae (Brèthes, 1923)	Plutellidae	*Plutella xylostella* (Linnaeus, 1758)	*Brassica oleracea var. botrytis* L.	PR	Marchioro & Foerster, 2016
	Plutellidae	*Plutella xylostella* (Linnaeus, 1758)	*Brassica oleracea var. italica* L.	PR	Marchioro & Foerster, 2016
	Plutellidae	*Plutella xylostella* (Linnaeus, 1758)		DF; GO	Azidah *et al.*, 2000; Wagener *et al.*, 2006
Hyposoter Förster, 1869	Geometridae	*Cyclomia mopsaria* Guenée, 1857	*Erythroxylum microphyllum* A.St.-Hil.	SP	Marconato *et al.*, 2008
	Geometridae	*Iridopsis fulvitincta* (Warren, 1897)	*Erythroxylum microphyllum* A.St.-Hil.	SP	Marconato *et al.*, 2008
	Geometridae	*Hymenomima conia* Prout, 1931	*Croton floribundus* Spreng.	SP	Fernandes *et al.*, 2010
	Geometridae	*Semaeopus* Herrich-Schäffer, 1855	*Croton floribundus* Spreng.	SP	Fernandes *et al.*, 2010
	Lepidoptera		*Gossypium* L.; *Lycopersicon esculentum* Mill.	SP	Sauer, 1946
Jomine paulista Herrera-Florez, 2017	Geometridae	*Prochoerodes* Grote, 1883	*Melampodium* L.; *Rollinia* A.St.-Hil.	SP	Herrera-Florez *et al.*, 2017
Microcharops Roman, 1910	Lasiocampidae	*Euglyphis* Hübner, 1820	*Nectandra megapotamica* Mez; *Vernonia rubriramea* Mart. ex DC.	SP	Pereira *et al.*, 2015
	Noctuidae	*Alabama argillacea* (Hübner, 1823)	*Gossypium* L.	SP	Sauer, 1946

	Noctuidae	*Bagisara paulensis* Schaus, 1898	*Croton floribundus* Spreng.	SP	Fernandes *et al.*, 2010
Microcharops anticarsiae Gupta, 1987	Lasiocampidae	*Euglyphis Fibra* (Schaus, 1890)	*Persea americana* Mill.	SP	Fischer & Patel, 1993
	Lasiocampidae	*Euglyphis Rivulosa* (Drury, 1773)	*Persea americana* Mill.	SP	Fischer & Patel, 1993
	Noctuidae	*Anticarsiae gemmatalis* Hübner, 1818	*Glycine max* (L.) Merr.	SP	Maruya *et al.*, 2001
	Noctuidae	*Anticarsiae gemmatalis* Hübner, 1819		SP	Patel & Habib, 1993; Patel & Habib, 1998
	Noctuidae	*Chrysodeixis includens* (Walker, 1858)	*Glycine max* (L.) Merr.	SP	Maruya *et al.*, 2001
Microcharops bimaculatus (Ashmead, 1895)	Noctuidae	*Anticarsia gemmatalis* Hübner, 1818	*Glycine max* (L.) Merr.	RS	Silva, 1993; Lorenzato & Corseuil, 1982; Lorenzato *et al.*, 1979
	Noctuidae	*Chrysodeixis includens* (Walker, 1858)	*Glycine max* (L.) Merr.	RS	Moraes *et al.*, 1991
	Noctuidae	*Rachiplusia nu* (Guenée, 1852)	*Glycine max* (L.) Merr.	RS	Moraes *et al.*, 1991
Microcharops longiterebra Gupta, 1987	Limacodidae		*Croton floribundus* Spreng.	SP	Fernandes *et al.*, 2010
Microcharops peronatus (Cameron, 1911)	Geometridae	*Cyclomia mopsaria* Guenée, 1857	*Erythroxylum microphyllum* A.St.-Hil.	SP	Marconato *et al.*, 2008
	Geometridae	*Macaria regulata* (Fabricius, 1775)	*Erythroxylum microphyllum* A.St.-Hil.	SP	Marconato *et al.*, 2008
	Geometridae	*Prochoerodes* Grote, 1883	*Erythroxylum microphyllum* A.St.-Hil.	SP	Marconato *et al.*, 2008
	Papilionidae	*Heraclides anchisiades capys* (Hübner, 1809)	*Citrus aurantium* L.	RJ	Silva, 1935
	Hymenoptera: Vespidae	*Polistes lanio lanio* (Fabricius, 1775)		RJ	Silva-Filho *et al.*, 2007

Venturia Schrottky, 1902	Geometridae	*Eois glauculata* (Guenée, 1858)	*Piper mollicomum* Kunth ex C.DC.	SP	Braga *et al.*, 2010
	Geometridae	*Eois tegularia* (Guenée, 1858)	*Piper amalago* L.; *Piper glabratum* Kunth	SP	Braga *et al.*, 2010
Venturia canescens (Gravenhorst, 1829)	Lepidoptera			SP	Sauer, 1946
	Pyralidae	*Anagasta kuehniella* (Zeller, 1879)		SP	Filho, 1985
Cremastinae					
Eiphosoma Cresson, 1865	Noctuidae	*Spodoptera frugiperda* (Smith, 1797)	*Zea mays* L.	MG; PR	Bortolotto *et al.*, 2014; Cruz *et al.*, 1997a;
	Pyralidae	*Phlyctaenodes* Guenée, 1854	*Amaranthus* L.; *Gossypim* L.; *Talinum* Adans.; *Portulacca* Haw.	SP	Sauer, 1946
Eiphosoma batatae Cushman, 1931	Crambidae	Pyraustinae	*Pereskia* Mill.	RJ	Lima, 1953
	Lepidoptera		*Ipomoea batatas* (L.) Lam.	BA	Cushman, 1931
Eiphosoma laphygmae Costa Lima, 1953	Noctuidae	*Spodoptera frugiperda* (Smith, 1797)	*Zea mays* L.	MA; MG	Figueiredo *et al.*, 2006; Silva *et al.*, 2008; Silva *et al.*, 2012
	Noctuidae	*Spodoptera frugiperda* (Smith, 1797)		RJ	Lima, 1953
Eiphosoma oyafusoi Onody *et al.*, 2009	Crambidae	*Diaphania hyalinata* (Linnaeus, 1767)	*Eruca sativa* Mill.	SP	Onody *et al.*, 2009
Eiphosoma vitticolle Cresson, 1865	Noctuidae	*Spodoptera frugiperda* (Smith, 1797)	*Zea mays* L.	MG; SP	Figueiredo *et al.*, 2006; Patel & Habib, 1984
Eutanygaster brevipennis Cameron, 1911	Gelechiidae		*Croton floribundus* Spreng.	SP	Fernandes *et al.*, 2010

Pristomerus Curtis, 1836	Oecophoridae	*Stenoma catenifer* Walsingham, 1912	*Persea americana* Mill.	MG	Nava *et al.*, 2005
	Pyralidae	*Elasmopalpus lignosellus* (Zeller, 1848)	*Oryza sativa* L.	SP	Sauer, 1946
Pristomerus spinator (Fabricius, 1804)	Noctuidae	*Spodoptera frugiperda* (Smith, 1797)	*Zea mays* L.	MG	Figueiredo *et al.*, 2006
Xiphosomella Szépligeti, 1905	Oecophoridae	*Cerconota anonella* (Sepp, 1855)	*Annona muricate* L.	AL	Micheletti & Filho, 2000
Cryptinae					
Agonocryptus gossypii Gupta, 1982	Coleoptera: Curculionidae	*Gasterocercodes gossypii* Pierce, 1915	*Gossypium hirsutum* L.	SP	Gupta, 1982
Agonocryptus Cushman, 1929	Coleoptera: Curculionidae	*Heilipus velamen* Boheman, 1836		RJ	Gonçalves, 1974
Baryceros bilineatus (Brullé, 1846)	Limacodidae	*Acharia nesea* (Geyer, 1833)		RS	Lima, 1937a
Bathyzonus Townes, 1970	Araneae: Uloboridae	*Uloborus* Latreille, 1806	*Eucalyptus* L'Hér.	MG	Nascimento & Gonzaga, 2015
Camera lunavenatrix Santos & Onody, 2016	Araneae: Selenopidae	*Selenops cocheleti* Simon, 1880	*Plinia cauliflora* (Mart.) Kausel; *Pinus elliottii* Engelm.	SP	Villanueva-Bonilla *et al.*, 2016
Chromocryptus diatraeae (Myers, 1931)	Crambidae	*Diatraea saccharalis* (Fabricius, 1794)		SP	Parker *et al.*, 1950
Compsocryptus melanostigma (Brullé, 1846)	Noctuidae			SP	Sauer, 1946
Cosmiocryptus Cameron, 1902	Saturniidae	*Rothschildia arethusa* (Walker, 1855)		SP	Lane & Lane, 1935
Digonocryptus crassipes (Brullé, 1846)	Coleoptera: Cerambycidae	*Anisopodus curvilineatus* White, 1855	*Ficus* L.	SP	Sauer, 1946
Digonocryptus denticulatus (Taschenberg, 1876)	Coleoptera: Cerambycidae	*Anisopodus curvilineatus* White, 1856	*Ficus* L.	SP	Sauer, 1946

Enicospilus Stephens, 1835	Hymenoptera: Vespidae	*Polistes lanio lanio* (Fabricius, 1775)		RJ	Silva-Filho *et al.*, 2007
Ethelurgus Förster, 1869	Hymenoptera: Syrphidae	*Ocyptamus stenogaster* (Williston, 1888)	*Gossypium* L.	SP	Sauer, 1946
Ethelurgus syrphicola rufipes (Brèthes, 1909)	Hymenoptera: Syrphidae	*Allograpta exotica* (Wiedemann, 1830)		PR	Lazzaril, 1985
Glodianus pallidiceps Cameron, 1911	Megalopygidae	*Megalopyge lanata* (Stoll, 1780)		RJ	Hancock, 1926
Hemiteles Gravenhorst, 1829	Hymenoptera: Braconidae	*Rogas* Nees, 1819		SP	Sauer, 1946
	Saturniidae	*Eacles imperialis* (Drury, 1773)	*Mangifera indica* L.	SP	Sauer, 1946
Hemitelina Förster, 1869	Hymenoptera: Ichneumonidae	*Campoletis flavicincta* (Ashmead, 1890)		SP	Patel & Habib, 1984
Isdromas monterai (Costa Lima, 1948)	Hymenoptera: Braconidae	*Protapanteles dalosoma* (de Santis, 1987)		SP	Lourenção *et al.*, 1989
	Dalceridae	*Anacraga* Dyar, 1905		SP	Santis, 1987
Lymeon dieloceri (Costa Lima, 1937)	Hymenoptera: Argidae	*Dielocerus diasi* Smith, 1975	*Sclerolobium aureum* Baill.	DF	Dias, 1976
	Hymenoptera: Argidae	*Digelasinus diversipes* (Kirby, 1882)	*Erythroxylum* P. Browne; *Eugenia glazioviana* Kiaersk.	MG; SP	Lima, 1937b; Boraschi *et al.*, 2005; Penteado-dias, 1991
Messatoporus elektor Santos, 2013	Hymenoptera: Pompilidae			MG	Santos & Aguiar, 2013
Messatoporus tenuiorbis Santos, 2013	Hymenoptera: Pompilidae			MG	Santos & Aguiar, 2013
Messatoporus transversostriatus (Spinola, 1840)	Hymenoptera: Pompilidae			MG	Santos & Aguiar, 2013
Messatoporus unidentatus Santos, 2013	Hymenoptera: Pompilidae			MG	Santos & Aguiar, 2013

Pachysomoides jheringi (Brauns, 1905)	Hymenoptera: Vespidae	*Polistes canadensis canadensis* (Linnaeus, 1758)		PA	Jeanne, 1979
	Hymenoptera: Vespidae	*Polistes versicolor* (Olivier, 1791)		SP	Brauns, 1905
Pachysomoides Strand, 1917	Hymenoptera: Vespidae	*Mischocyttarus cassununga* (Ihering, 1903)		MG	Soares *et al.*, 2006
	Hymenoptera: Vespidae	*Polistes versicolor* Olivier, 1791	*Citrus sinensis* (L.) Osbeck	MG	Tavares *et al.*, 2014
Pachysomoides stupidus (Cresson, 1874)	Hymenoptera: Vespidae	*Polistes lanio lanio* (Fabricius, 1775)		RJ	Silva-Filho *et al.*, 2007
Photocryptus Viereck, 1913	Hymenoptera: Pompilidae	*Auplopus militaris* (Lynch-Arribalzaga, 1873)		MG	Loyola & Martins, 2006; Zanette *et al.*, 2004
Photocryptus concinnus (Brullé, 1846)	Hymenoptera: Pompilidae	*Auplopus militaris* (Lynch-Arribalzaga, 1873)		MG	Aguiar & Santos, 2009
Photocryptus fumatus (Hancock, 1926)	Hymenoptera: Vespidae	*Santamenes novarae* (Saussure, 1867)		RJ	Hancock, 1926
Photocryptus testaceoniger (Taschenberg, 1876)	Hymenoptera: Sphecidae	*Sceliphron fistularium* (Dahlbom, 1843)		RR	Aguiar & Santos, 2009
Photocryptus testaceus (Taschenberg, 1876)	Hymenoptera: Sphecidae	*Sceliphron fistularium* (Dahlbom, 1843)		RR	Aguiar & Santos, 2009
Polycyrtus giacomellii Schrottky, 1911	Pyralidae	*Diaphania hyalinata* (Linnaeus,1767)	*Curcubita* L.	SP	Sauer, 1946
Toechorychus albimaculatus (Taschenberg, 1876)	Hymenoptera: Vespidae	*Mischocyttarus drewseni* (Saussure, 1857)		RJ	Tedesco & Aguiar, 2013
	Hymenoptera: Vespidae	*Polistes canadensis canadensis* (Linnaeus, 1758)		PA	Jeanne, 1979
Toechorychus cassunungae (Brauns, 1905)	Hymenoptera: Vespidae	*Mischocyttarus cassununga* (Ihering, 1903)		Brasil	Brauns, 1905
Toechorychus fluminensis Tedesco, 2013	Hymenoptera: Vespidae	*Mischocyttarus consimilis* Zikán, 1941		MS	Somavilla *et al.*, 2015

	Hymenoptera: Vespidae	*Mischocyttarus imitator* (Ducke, 1792)		RJ	Somavilla *et al.*, 2015
	Hymenoptera: Vespidae	*Mischocyttarus* Saussure, 1853		AM	Somavilla *et al.*, 2015
Toechorychus guarapuavus Tedesco, 2013	Hymenoptera: Vespidae	*Mischocyttarus cassununga* (Ihering, 1903)		MG	Somavilla *et al.*, 2015
	Hymenoptera: Vespidae	*Mischocyttarus imitator* (Ducke, 1792)		MG	Somavilla *et al.*, 2015
	Hymenoptera: Vespidae	*Mischocyttarus* Saussure, 1853		BA	Somavilla *et al.*, 2015
Toechorychus Townes, 1946	Nymphalidae	*Eueides isabella dianasa* (Cramer, 1782)	*Passiflora* L.	MG	Bueno & Fraga, 1988
Diplazontinae					
Diplazon laetatorius (Fabricius, 1781)	Pyralidae	*Nomophila* Hübner, 1825	*Eucalyptus grandis* W. Hill	MG	Zanuncio *et al.*, 1999
	Hymenoptera: Syrphidae	*Allograpta* Osten Sacken, 1875		SP	Parker *et al.*, 1950
	Hymenoptera: Syrphidae	*Baccha* Fabricius, 1805		RJ	Gonçalves, 1974
	Hymenoptera: Syrphidae	*Baccha clavata* (Fabricius, 1794)		SP	Sauer, 1946
	Hymenoptera: Syrphidae			RJ	Resende *et al.*, 2006
Ichneumoninae					
Amblyteles Wesmael, 1845	Noctuidae	*Feltia subterranea* (Fabricius, 1794)	*Gossypium* L.	SP	Sauer, 1946
	Noctuidae	*Spodoptera frugiperda (Smith, 1797)*	*Poaceae*	SP	Sauer, 1946
Carinodes Hancock, 1926	Noctuidae	*Agrotis ipsilon* (Hufnagel, 1766)		RS	Link & Costa, 1984

	Noctuidae	*Trachea anguliplaga* (Walker, 1858)	*Rumex obtusifolius* L.	RS	Link & Diefenthaler, 1979
Cratichneumon Thomson, 1893	Saturniidae	*Dirphia araucariae* (Jones, 1908)	*Araucaria angustifolia* (Bertol.) Kuntze	PR	Borges, 1990
Pedinopelte gravenstii (Guérin-Ménéville, 1826)	Papilionidae	*Heraclides anchisiades capys* (Hübner, 1809)	*Citrus* L.; *Citrus nobilis* L.	RJ; SC	Leite *et al.*, 2010; Silva, 1935; Silva, 1936
	Saturniidae	*Automeris* Hübner, 1819	*Citrus* L.	SP	Sauer, 1946
Thymebatis bicolor Brèthes, 1909	Noctuidae	*Agrotis* Ochsenheimer, 1816		RJ	Gonçalves, 1974
Thymebatis neotropica (Schrottky, 1910)	Noctuidae	*Agrotis* Ochsenheimer, 1817		RJ	Gonçalves, 1974
Trogus pompeji (Kriechbaumer, 1898)	Papilionidae	*Papilio scamander* Boisduval, 1836		Brasil; RJ	Wahl & Karen, 2006; Kriechbaumer, 1898
Labeninae					
Labena fiorii Graf & Marzagao, 1999	Coleoptera: Cerambycidae	*Chydarteres striatus* (Fabricius, 1787)	*Schinus* L.	PR	Graf & Marzagão, 1999
	Coleoptera: Cerambycidae	*Hedypathes betulinus* (Klug, 1825)	*Ilex paraguariensis* A. St. Hil.	PR	Graf & Marzagão, 1999
Mesochorinae					
Mesochorus discitergus (Say, 1835)	Noctuidae	*Chrysodeixis includens* (Walker, 1858)	*Glycine max* (L.) Merr.	RS	Moraes *et al.*, 1991
	Noctuidae	*Rachiplusia nu* (Guenée, 1852)	*Glycine max* (L.) Merr.	RS	Moraes *et al.*, 1991
Mesochorus Gravenhorst, 1829	Geometridae	*Eois tegularia* (Guenée, 1858)	*Piper amalago* L.	SP	Braga *et al.*, 2010
	Hymenoptera: Braconidae	*Hypomicrogaste*r	*Croton floribundus* Spreng.	SP	Fernandes *et al.*, 2010
	tortricidae	*Olethreutinae*	*Croton floribundus* Spreng.	SP	Fernandes *et al.*, 2010

	Geometridae	*Cyclomia mopsaria* Guenée, 1857	*Erythroxylum microphyllum* A.St.-Hil.	SP	Marconato *et al.*, 2008
	Lepidoptera			SP	Sauer, 1946
Metopiinae					
Colpotrochia Holmgren, 1856	Hymenoptera: Pompilidae	*Auplopus militaris* (Lynch-Arribalzaga, 1873)		MG	Zanette *et al.*, 2004
	Noctuidae	*Spodoptera frugiperda* (Smith, 1797)	*Zea mays* L.	MG	Silva *et al.*, 2012
Leurus caeruliventris (Cresson, 1868)	Gelechiidae	*Dichomeris* Hübner, 1818	*Croton floribundus* Spreng.	SP	Fernandes *et al.*, 2010
Leurus Townes, 1946	tortricidae	*Olethreutinae* Walsingham, 1895	*Croton floribundus* Spreng.	SP	Fernandes *et al.*, 2010
Metopius Panzer, 1806	Geometridae	*Glena* Hulst, 1896	*Erythroxylum microphyllum* A.St.-Hil.	SP	Marconato *et al.*, 2008
Ophioninae					
Enicospilus glabratus (Say, 1835)	Erebidae			RJ	Hancock, 1926
Enicospilus tenuigena (Kriechbaumer, 1901)	Saturniidae	*Pseudautomeris brasiliensis* (Walker, 1855)	*Ctenanthe kummeriana* Eichl.	MG	Tavares *et al.*, 2014
Ophion flavidus Brullé, 1846	Noctuidae	*Anticarsiae gemmatalis* Hübner, 1818	*Glycine max* (L.) Merr.	SP	Maruya *et al.*, 2001
	Noctuidae		*Gossypium* L.	SP	Sauer, 1946
	Noctuidae	*Spodoptera frugiperda (Smith, 1797)*	*Zea mays* L.	MG; PR; RJ; SP	Bortolotto *et al.*, 2014; Gonçalves, 1974; Patel & Habib, 1984; Silva *et al.*, 2012
	Hemiptera: Pentatomidae	*Euschistus heros* (Fabricius, 1798)	*Glycine max* (L.) Merr.	PR	Carneiro *et al.*, 2010

Ophion Fabricius, 1798	Noctuidae	*Agrotis ipsilon* (Hufnagel, 1766)		RS	Link & Costa, 1984
	Noctuidae	*Helicoverpa armigera* (Hübner, 1809)	*Gossypium* L.	SP	Sauer, 1946
	Noctuidae	*Mythimna sequax* Franclemont, 1951	*Triticum* L.	PR	Bortolotto *et al.*, 2015
	Noctuidae	*Spodoptera frugiperda (Smith, 1797)*	*Zea mays* L.	RS	Dequech, 2004
Pimplinae					
Acrotaphus chedelae Gauld, 1991	Araneae: Araneidae	*Argiope argentata* (Fabricius, 1775)		SP	Gonzaga & Sobczak, 2011
Apechthis zapoteca sarsinae (Costa Lima, 1951)	Noctuidae	*Sarsina violascens* (Herrich-Schäeffer, 1856)		RJ	Lima, 1951
Calliephialtes dimorphus Cushman, 1938	Gelechiidae	*Pectinophora gossypiella* (Saunders, 1844)		SP	Cushman, 1938; Parker *et al.*, 1950; Sauer, 1939
	Pyralidae	*Apomyelois decolor* (Zeller, 1881)	*Coffea* L.	SP	Sauer, 1939
Calliephialtes Ashmead, 1900	Gelechiidae	*Pectinophora gossypiella* (Saunders, 1844)		SP	Parker *et al.*, 1950
Clydonium gallicola (Costa Lima, 1945)	Coleoptera: Curculionidae	*Pseudomopsis peckolti* Costa-Lima, 1945		SP	Lima, 1945
Ephialtes Gravenhorst, 1829	Crambidae	*Diaphania hyalinata* (Linnaeus, 1767)	*Cucurbita* L.	SP	Sauer, 1946
	Gelechiidae	*Pectinophora gossypiella* (Saunders, 1844)	*Gossypium* L.; *Hibiscus esculentus* L.	SP	Sauer, 1946
Eruga unilabiana Pádua & Sobczak, 2017	Araneae: Linyphiidae	*Dubiaranea* Mello-Leitão, 1943		CE	Sobczak *et al.*, 2017c
Flacopimpla varelae Gauld, 1991	Araneae: Theridiidae	*Achaearanea tingo* Levi, 1963		SP	Sobczak *et al.*, 2017a

Hymenoepimecis bicolor (Brullé, 1846)	Araneae: Nephilidae	*Nephila clavipes* (Linnaeus, 1767)		SP	Gonzaga *et al.*, 2010
Hymenoepimecis Viereck, 1912	Araneae: Araneidae	*Araneus omnicolor* (Keyserling, 1893)		SP	Gonzaga & Sobczak, 2007
Hymenoepimecis japi Sobczak *et al.,* 2009	Araneae: Araneidae	*Mecynogea biggiba* Simon, 1903		SP	Messas *et al.*, 2017
	Araneae: Tetragnathidae	*Leucauge roseosignata* Mello-Leitão, 1943		SP	Sobczak, 2012; Sobczak *et al.*, 2009
Hymenoepimecis jordanensis Loffredo & Penteado-Dias, 2009	Araneae: Tetragnathidae	*Leucauge volupis* (Keyserling, 1893)		MG	Gonzaga *et al.*, 2015a
Hymenoepimecis manauara Pádua & Oliveira, 2015	Araneae: Araneidae	*Leucauge henryi* Mello-Leitão, 1940		AM	Pádua *et al.*, 2016
Hymenoepimecis neotropica (Brues & Richardson, 1913)	Araneae: Araneidae	*Araneus omnicolor* (Keyserling, 1893)		SP	Sobczak *et al.*, 2012a
Hymenoepimecis robertsae Gauld, 1991	Araneae: Nephilidae	*Nephila clavipes* (Linnaeus, 1767)		SP	Gonzaga *et al.*, 2010
Hymenoepimecis silvanae Loffredo & Penteado-Dias, 2009	Araneae: Araneidae	*Araneus venatrix* (Koch, 1838)		SP	Sobczak *et al.*, 2012b
Hymenoepimecis sooretama Sobczak *et al.,* 2009	Araneae: Araneidae	*Manogea porracea* (Koch, 1838)		ES	Sobczak *et al.*, 2009
Hymenoepimecis veranii Loffredo & Penteado-Dias, 2009	Araneae: Araneidae	*Araneus omnicolor* (Keyserling, 1893)		SP	Sobczak *et al.*, 2011
	Araneae: Araneidae	*Araneus orgaos* Levi, 1991		SP	Sobczak *et al.*, 2014
Itoplectis Förster, 1869	Nymphalidae	*Methona themisto* (Hübner, 1818)	*Brunfelsia uniflora* (Pohl.) D. Don	SC	Nardi *et al.*, 2006
	Riodinidae	*Euselasia eucerus* (Hewitson, 1872)	*Eucalyptus urophylla* S. T. Blake	MG	Zanuncio *et al.*, 2009

Itoplectis brasiliensis (Dalla Torre, 1901)	Noctuidae	*Alabama argillacea* (Hübner, 1823)	*Gossypium* L.	SP	Sauer, 1946
	Tortricidae	*Bonagota cranaodes* (Meyrick, 1937)		RS	Botton *et al.*, 2002
Neotheronia Krieger, 1899	Arctiidae	*Eupseudosoma aberrans* Schaus, 1905		MG, SP	Ohashi & Filho, 1988
	Arctiidae	*Eupseudosoma involutum* (Sepp, 1855)		MG, SP	Ohashi & Filho, 1988
	Hymenoptera: Apidae	*Megachile fiebrigi* Schrottky, 1908		PR	Oliveira & Gonçalves, 2017
	Geometridae	*Brachurapteryx breviaria* (Hübner,1831)	*Croton floribundus* Spreng.	SP	Pereira *et al.*, 2015
	Nymphalidae	*Eueides isabella dianasa* (Cramer, 1782)	*Passiflora* L.	MG	Bueno & Fraga, 1988
Neotheronia lineata (Fabricius, 1804)	Lepidoptera		*Psidium guajava* L.	SP	Sauer, 1946
	Noctuidae	*Alabama argillacea* (Hübner, 1823)	*Gossypium* L.	SP	Sauer, 1946; Hambleton, 1939
Neotheronia obesa Krieger, 1905	Limacodidae	*Acharia pallescens* (Dognin, 1901)		Brasil	Mariau, 1999
Pimpla croceiventris Cresson, 1868)	Pyralidae	*Cryptoblabes gnidiella* (Millière, 1867)	*Vitis vinifera* L.	RS	Bisotto de Oliveira *et al.*, 2007
Pimpla tomyris Schrottky, 1902	Arctiidae	*Eupseudosoma aberrans* Schaus, 1905		MG, SP	Ohashi & Filho, 1988
	Arctiidae	*Eupseudosoma involutum* (Sepp, 1855)		MG, SP	Ohashi & Filho, 1988
	Noctuidae	*Sarsina violascens* (Herrich-Schäeffer, 1856)		RJ	Lima, 1951
Polysphincta janzeni Gauld, 1991	Araneae: Araneidae	*Cyclosa fililineata* Hingston 1932		SP	Gauld & Dubois, 2006

	Araneae: Araneidae	*Cyclosa morretes* Levi, 1999		ES; SP	Gonzaga *et al.*, 2015b; Kloss *et al.*, 2016a; Kloss *et al.*, 2016b
Polysphincta Gauld, 1991	Araneae: Araneidae	*Cyclosa fililineata* Hingston 1931		ES	Kloss *et al.*, 2016a; Kloss *et al.*, 2016b
Scambus Hartig, 1838	Araneae: Tephritidae	*Tomoplagia rudolphi* (Lutz & Lima, 1918)	*Vernonia polyanthes* (Spreng.) Less.	SP	Sauer, 1946
Tromatobia Förster, 1869	Araneae: Araneidae	*Araneus omnicolor* (Keyserling, 1893)		SP	Sobczak *et al.*, 2012c
Zatypota alborhombarta (Davis, 1895)	Araneae: Theridiidae	*Achaearanea tingo* Levi, 1963		SP	Gonzaga *et al.*, 2016
Zatypota riverai Gauld, 1991	Araneae: Theridiidae	*Anelosimus baeza* Agnarsson, 2006		CE	Sobczak *et al.*, 2017b
Tryphoninae					
Netelia Gray, 1860	Noctuidae	*Mocis latipes* (Guenée, 1852)	*Panicum maximum* Jacq.	SP	Lourenção *et al.*, 1982
Xoridinae					
Xorides euthrix Porter, 1975	Coleoptera: Cerambycidae	*Alphus* White, 1855	*Fagara* L.	PR	Graf, 1995

Table 3. Number of ichneumonid species with host data recorded in Brazil.

Subfamily	Species with host data	Total of known Brazilian species	Percentage of species with records
Anomalanoniae	1	22	5%
Banchinae	1	21	5%
Brachycyrtinae	1	9	11%
Campopleginae	13	47	28%
Cremastinae	7	33	21%
Cryptinae	26	314	8%
Diplazontinae	1	5	20%
Ichneumoninae	4	124	3%
Labeninae	1	17	6%
Mesochorinae	1	51	2%
Metopiinae	1	20	5%
Ophioninae	3	87	3%
Pimplinae	27	86	31%
Xoridinae	1	4	25%
Other Subfamilies	0	82	0%
Total	88	922	

Until today, the diversity of Ichneumonidae host species recorded in Brazil is limited to seven orders: Arachnida Araneae (10.32%) and Hexapoda Coleoptera (2.84%), Diptera (2.49%), Hemiptera (0.35%), Hymenoptera (11.74%), Lepidoptera (71.53%) and Neuroptera (0.71%). Besides theses orders, Yu *et al.* (2016) also lists Orthoptera, Pseudoscorpionida, Raphidioptera, Thysanoptera, Trichoptera as ichneumonid hosts in other countries. Most of our knowledge is restricted to subfamilies that parasitize agricultural pests associated with corn, soybean and cotton cultures. Therefore, it is not surprising that Campopleginae and Cremastinae are the most studied, with 28% an 21% of their species with host data, since both are koinobiont endoparasitoids of many Lepidoptera pests (Yu *et al.*, 2016). *Campoletis flavicincta, C. sonorensis, Diadegma leontiniae and Microcharops anticarsiae* are relatively well studied species of Campopleginae; in Cremastinae, most data came from the genus *Eiphosoma* parasitizing *Spodoptera frugiperda*, an important pest of many crops in the world.

Little is known on the Brachycyrtinae biology and their apparent basal position within Ichneumonidae, which larval cephalic structures may imply in an ectoparasitic idiobiont life strategy (Quicke, 2015). However, there is only one biological record of

Brachycyrtus Kriechbaumer,1880 reared from a pupa of *Mallada desjardinsi* (Navás, 1911) in Tanzania (Quicke, 2015; Kabissa *et al.*,1996). In Brazil only 9 species are registered (Yu *et al.*, 2016), with one species know as parasitoid of *Chrysopa* (table 1).

Cryptinae is the most speciose Ichneumonidae in Brazil (and in the world) with biological data for only 8% of its species. Aguiar & Santos (2009) commented on the difficult in species identification in a biological synopsis of *Photocryptus* (to which there is no published key); mostly rely on outdated and hard to obtain original descriptions. Host data for this subfamily were obtained for the following orders: Araneae, Coleoptera Lepidoptera and Hymenoptera. Patel & Habib in 1984 recorded an unidentified *Hemitelina* hiperpasitizing *Campoletis flavincta* (Campopleginae) parasitoid of *Spodoptera frugiperda* in maize crops.

Diplazontinae are known to be endoparasitoid koinobionts mostly of Diptera and Lepidoptera, but there are few records of Coleoptera, Hemiptera and Hymenoptera (Yu *et al.*, 2016). Of the 5 species occurring in Brazil, only *Diplazon laetatorius* have been recorded as parasitoid of *Allograpta*, *Baccha* (Syrphidae) and *Nomophila* (Pyralidae).

With more than 4300 described species and 124 of them occurring in Brazil, the Ichneumoninae biology remains a mystery in Brazil; only four species have host data. The total number of references (including papers without biological notes) were compiled in Taxapad (Yu *et al*., 2016) and a decrease of publications along time was observed: 17 papers published between 1898-1927 and only eight articles about this subfamily in Brazil published between 1989-2015.

Mesochorinae are known to be hiperparasitoids of Lepidoptera, Coleoptera Hymenoptera and Hemiptera parasitoids (Quicke, 2015). Although this subfamily has a relatively high number of species recorded in Brazil (51 species), *Mesochorus discitergus* is the only species with biological data. This species is parasitoid of *Rachiplusia nu* and *Chrysodeixis includens* (Moraes *et al.*, 1991). Many host data of this subfamily are still recorded only at genus level.

Fernandes *et al.* (2014) commented on the scarcity of host records of Ophioninae. The same situation was observed here, adding some articles published in the same year or right after their paper (Tavares *et al.,* 2014; Bortolotto *et al.,* 2014, 2015). Only three species have host records: *Enicospilus glabratus* (parasitoid of

Erebidae), *E. tenuigena* (parasitoid of *Pseudautomeris brasiliensis*) *Ophion flavidus* (parasitoid of *Anticarsiae gemmatalis, Spodoptera frugiperda* and *Euschistus heros)*.

The first biological studies on Pimplinae hosts focused on Lepidoptera of economic importance (Lima, 1945; Sauer, 1939, 1946). It was observed an increase in studies on the subfamily during the beginning of the 21st century. This rise of records was accompanied by changes in research scope, revealing sundry arachnids hosts (*e.g.* Gauld & Dubois, 2006; Gonzaga & Sobczak, 2007). The "Costa Lima" Quarantine Laboratory introduced *Xanthopimpla stemmator* for the biological control of *Diatraea saccharalis.*

Although documented in Brazil (Bennett, 2003; Shimbori, *et al.,* 2017; Azevedo, *et al*., 2015), Tryphoninae have only one biological record identified at genus level, a parasitoid of *Mocis latipes* (Lourenção, 1982).

The following subfamilies still do not present any host record in Brazil: Alomyinae, Ctenopelmatinae, Eucerotinae, Lycorininae, Nesomesochorinae, Orthocentrinae, Oxytorinae, Poemeniinae, Rhyssinae and Tersilochinae.

Despite not having host records of natural occurring Rhyssinae species, two species were introduced in Brazil for biological control of *Sirex noctilio* in *pinus* L. forests.

Table 4. Ichneumonidae species introduced in Brazil by the "Costa Lima" Quarantine Laboratory between 1991-2003.

Parasitoid	Biological control of	Imported from	Year
Xanthopimpla stemmator (Thunberg,1822)	*Diatraea saccharalis* (Fabricius, 1794)	USA	1991
Megarhyssa nortoni (Cresson,1864)	*Sirex noctilio* Fabricius,1793	Australia	1996,97,98, 2003
Rhyssa persuasoria (Linnaeus,1758)	*Sirex noctilio* Fabricius,1793	Australia	1997,98

Mostly biological records come from the South and Southwest Brazilian regions, areas with relatively higher taxonomy workforce (Marques & Einicker, 2006), leaving important biomes as the Pantanal (tropical wetland), Amazon rainforest, Cerrado (tropical savanna) and Caatinga (Brazilian semi arid) highly underexplored (figure 3).

This problem may begin with the correct species identification: few taxa have clear apomorphies and many subfamily diagnostics characters are homoplastic turning identification an arduous process (Quicke, 2015). Thus, the number of described

species is still far from reaching the actual number of species in tropical regions (Quicke, 2012). The use of Malaise traps samples usually reveals many unknown Ichneumonid species (Veijalainen, *et al.*, 2013). This taxonomical impediment is reflected in the identification level of the gathered data, with only sixty percent of the parasitoid/host records identified at species level.

Future studies regarding Ichneumonidae biological data in Brazil should focus on the many "undiscovered" Brazilian areas, mostly on the North and Northeast regions (figure 2) with research efforts not only on agricultural pests but on natural occurring host species. Furthermore, an increase on taxonomical studies (which includes taxonomical revisions, keys and species ilustrations) of Brazilian Ichneumonidae is necessary to facilitate parasitoid's identification leading to easier to obtain and more accurated biological data.

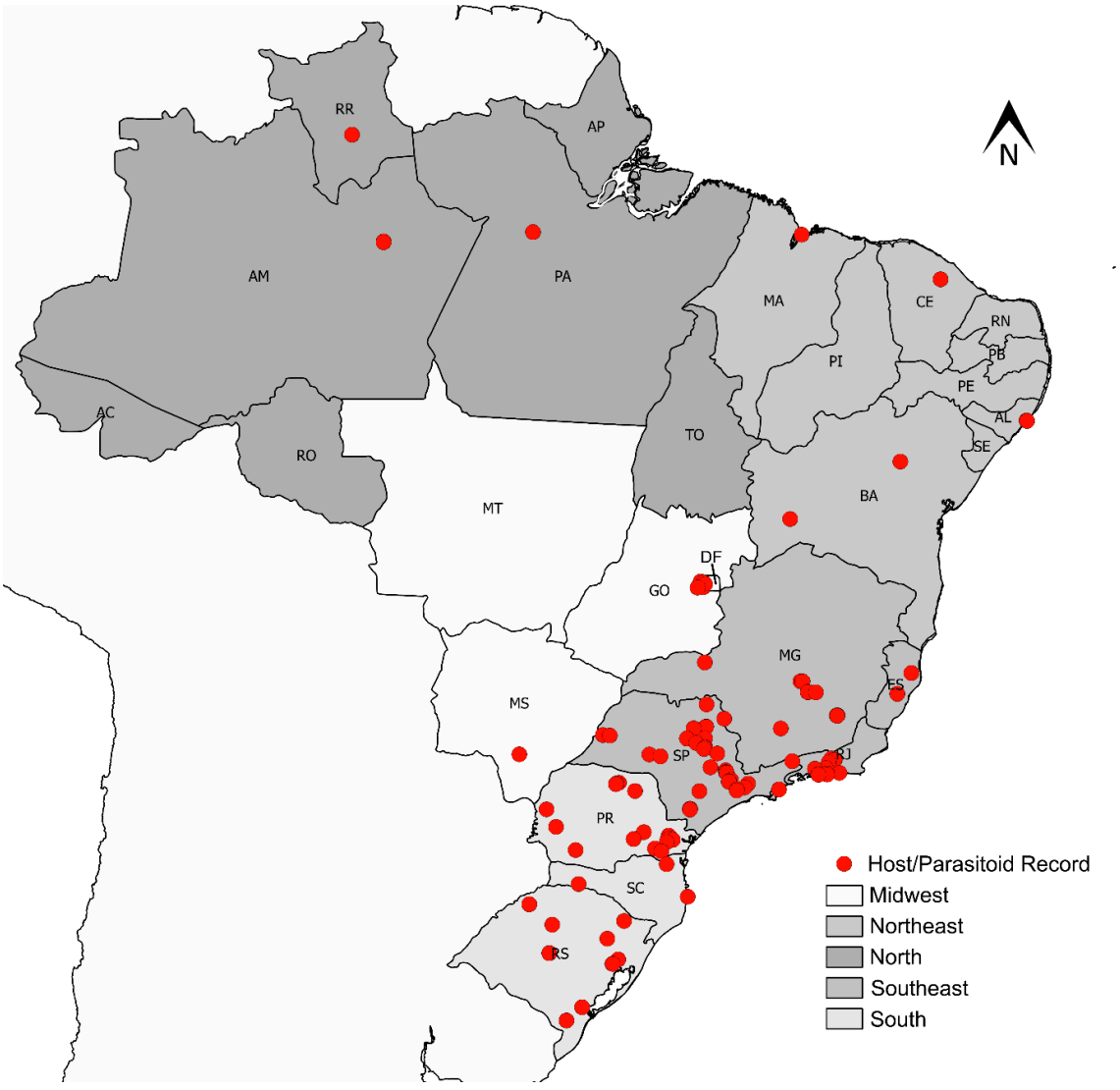

Figure 2. Distribution map of host/parasitoid association records in Brazil.

3. Chapter III - Taxonomical study of the Brazilian species of *Charops* Homlgren 1859 (Ichneumonidae, Campopleginae).

3.1. Introduction

Campopleginae (Porizontinae sensu Townes 1970a) is a cosmopolitan subfamily of Ichneumonidae which contains 66 genera and 2127 nominal species (Yu *et al*., 2016). This subfamily can be distinguished from other Ichneumonidae by the following diagnosis (Wahl & Sharkey, 1993): clypeus usually not distinctly separated from face; mandible often with ventral flange; ventroposterior corner of propleuron with strongly produced lobe touching or overlapping pronotum, mesotibial and metatibial spurs not separated from tarsomere 1 by a sclerotized bridge; sternalus of mesopleuron almost always absent or short; very rarely reaching mesocoxa; posterior transverse carina of the mesothoracic venter usually complete; propodeum usually with fairly complete set of carinae; fore wing with areolet closed or open; hind wing with vein 1/RS varying from slightly longer to shorter than vein 1rs-m; metasomal segment 1 usually long and slender, widened apically, with or without glymma, and spiracle near apex; metasoma usually weakly to strongly compressed laterally, at least apically in females; ovipositor short to long, often upcurved, dorsal subapical notch almost always present.

This subfamily has been included in the Ophioniformes group which synapomorphy is the long lateral oviducts, often longer than the ovaries (Quicke, 2015). Ophioniformes includes 16 subfamilies and it is divided in three informal groups: Lower, Middle and Higher Ophioniformes. Campopleginae belongs to the last subgroup together with Anomaloninae, Cremastinae, Hybrizontinae, Nesomesochorinae and Ophioninae (Quicke 2009, 2015). Quicke (2009), through the use of molecular and morphological data, recovered Cremastinae as sister group of the clade [Campopleginae + Nesomesochorinae].

Campopleginae are mostly endoparasitoids of immature stages of Lepidoptera, Coleoptera, Diptera, Hymenoptera (usually Symphytan families), Trichoptera and Raphidioptera (according to Aspöck, 2002; 90-95% of snake fly larvae parasitoids belong to Campopleginae) (Yu *et al.*, 2016).

As mentioned before, members of this subfamily attack many Lepidoptera pests (Yu *et al.*, 2016) which makes this group the most well studied if compared to other Ichneumonidae, regarding its applicability in biological control (Quicke, 2015). For example, there are more than 80 published papers concerning the biology of *Venturia canescens* (Gravenhorst, 1829), see Yu *et al.* (2016). Other example is the genus *Diadegma* Förster,1869, which species are very affective in the biological control of *Plutella xylostella* (Linnaeus, 1758) (Azidah *et al.,* 2000). Most Campopleginae species are solitary and typically host specific (Quicke, 2015).

As previously discussed, little is known about the diversity and ecology of Ichneumonidae in Brazil; the Campopleginae is not an exception. With 55 species and 13 genera occurring in Brazil (Yu *et al.,* 2016), most fauna surveys commonly identify Campopleginae specimens at genus level, morphospecies (*e.g.* Comério, Onody & Benassi, 2012) or even at subfamily level only (Kumagai & Graf, 2002). Some of Campopleginae genera are very large (*e.g. Dusona* with 400 species worldwide, Yu *et al.,* 2016) with poorly defined species delimitation making identification and classification of these wasps an arduous process (Gauld, 1984).

Only three taxonomical revisions were made on Brazilian genera of Campopleginae: *Campoctonus* Viereck, 1912*, Microcharops* Roman, 1910 and *Venturia* Schrottky, 1902, in which many Brazilian species were recorded (Walley, 1977; Wahl, 1986; Gupta, 1987). The genera *Jomine* Graf & Kumagai, 1998 and *Aiura* Onody & Penteado-Dias, 2006 seems to occur only in Brazil.

Charops[1] Holmgren, 1859 is a relative small and cosmopolitan genus, comprising 30 described species (Yu *et al.,* 2016). Only two species are known to occur in the Neotropical region: *C. annulipes* Ashmead (1890) and *C. luctuosus* Cresson (1865) from Mexico and Cuba respectively (Gonzalez-Moreno & Bordera, 2011; Alayo & Hernández, 1978). Although Taxapad (2016) does not register *Charops* in Brazil, its genus level occurrence has been documented in areas of the Brazilian Southwest and Paraná, in different phytophysiognomies includding Cerrado (Marconato *et al.*, 2008), Atlantic Forest (Onody & Penteado-Dias, 2009), “organic” crops (Sandonato *et al.*, 2010) and other rural areas (Kumagai & Graf, 2000; Pereira *et al.*, 2015).

Species of *Charops* are known to be koinobiont endoparasitoids of Lepidoptera larvae attacking the following families (Yu *et al.*, 2016): Arctiidae, Dilobidae,

[1] a female word from greek (χάροψ) which means bright eyes (Hopper, 1959).

Geometridae, Hesperiidae, Lycaenidae, Lymantriidae, Noctuidae, Nolidae, Nymphalidae, Papilionidae, Pieridae, Pyralidae, Sphingidae, Tortricidae, Zygaenidae.

After killing its host, they construct coccons (white with black stripes) (figure 1) which usually hang from the underside of the leaves (Gupta & Maheshwary,1970; Sathe & Chougale, 2014). Palaniswami & Pillai (1983) observed a life cycle of 22-27 days of *C. hersei* parasitising *Theretra oldenlandiae.*

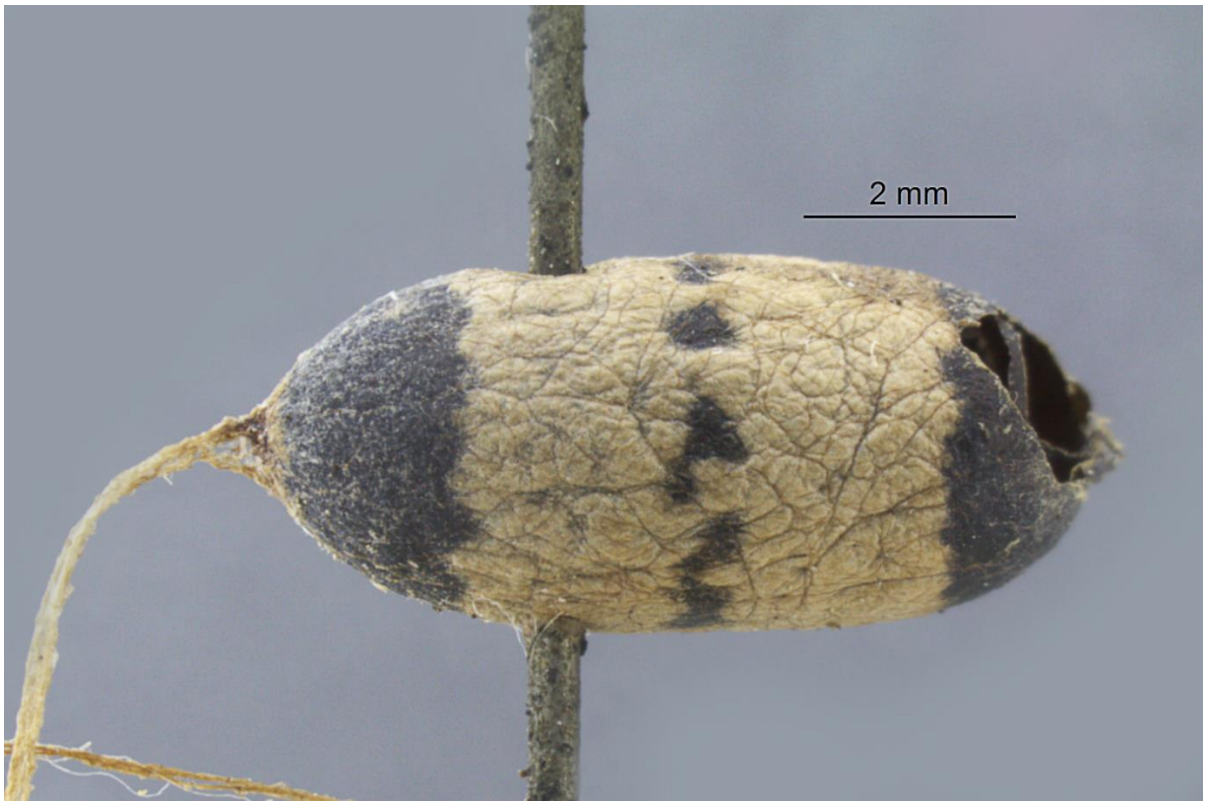

Figure 1. Coccon of *Charops* sp. n. I.

The relationship between *Charops* and other Campopleginae genera was hypothetysed by the only phylogenetics work for this subfamily (Miah & Bhuiya, 2001). Miah & Buiya (2001) placed *Charops* as sister group of *Scenocharops* Uchida,1932 and *Casinaria* Holmgren,1859 as sister group of *Charops*+*Scenocharops.* The relationship of these three genera is reflected on their very similar morphological appearance; all three genera have strongly emarginated eyes and a suture separating the first metasomal sternite from the tergite near its upper margin in lateral view.

Gravenhorst (1829) first described *Campoplex* as a subgenus of *Ophion* with 105 species. One of these species was *Ophion (Campoplex) decipiens* Gravenhorst, 1829 which was the species that Holmgren (1859) based to describe the genus

Charops. He described *Charops* jointly with the description of the above-mentioned species making it genus type by monotypy. It is important to notice that *Campoplex* was already erected to genus and Holmgren agrees with that information since he recognized *Campoplex* as genus in the same publication. However, he wrote the species name as "*Charops (Campoplex) decipiens* Gravenhorst, 1829" indicating that *Charops* was transferred from *Campoplex*. However, this may mislead the reader to think that a new subgenus was created. In his following publication Holmgren (1860) wrote the species name as *Charops decipiens* with the original name as *Campoplex decipiens*. All publications after Holmgrens (1860) continued to propagate the original combination as *Campoplex decipiens* although the correct original name is *Ophion (Campoplex) decipiens* Gravenhorst, 1829 (*e.g.* Townes *et al.*, 1965; Gupta & Maheshwary, 1970; Choi & Lee, 2008)

In 1874, Walker described *Charops luteipes* (originally cited as "*Charops* (?) *luteipes"*) being the second species of the genus and the first from Japan. Walker wasn't sure about the genus, thus the question mark between the generic and specific name. The type was considered lost by Townes in 1965 and the original description does not include a generic diagnosis making it impossible to know if it really belongs to *Charops*.

In late 19th century, two species were added to the genus: *Charops breviceps* described by Kriechbaumer (*in* Magretti, 1884) from the Afrotropical region and *Charops annulipes* Ashmead, 1890, first described from the Nearctic region. *C. annulipes* was recorded in the Neotropical region (Gonzalez-Moreno & Bordera, 2011) for the first time.

Another Afrotropical species was presented by Cameron in 1905 named *Charops spinitarsis* from Cape Colony and Stellenbosch in South Africa.

In 1906, Cameron described *Charops cariniceps*, *Trichomma brevipenne* and *T. cariniscutum*. Townes & Townes (1973) synonymized *T. cariniscutum* to *T. brevipenne* which was also transferred (and the specific name corrected) to *Charops brevipennis.*

Two years later, Szépligeti (1908) added three species to the genus*: C. ater*, *C. fuliginosus* and *C. tegularis* (synonymized under *C. spinitarsis* by Townes & Townes, 1973). Cameron described *C. malayanus* in 1909, the first species from Borneo. In 1913, Morley described *C. obtusus* from Sri Lanka. Gupta & Maheshwary (1970)

considered *C. malayanus* as a subspecies of *C. obtusus* based on the original description of the first one.

Roman (1910), examined the type series of *C. ater* and found another species which was named *C. diversipes.* In the same publication, he also described a subspecies of *C. tegularis* known as *C. tegularis obscurior* which was erected to species level (*C. obscurior*) by Townes & Townes (1973).

Also, in 1910 Szépligeti described *Agrypon atrum* from Indonesia. Townes *et al.* (1961) transferred this species to *Charops* as *Charops atra* (Szépligeti, 1910).

The first Australian species was *C. pulchripes* described by Girault in 1925. Townes (1970b) designed a lectotype and commented on the closely relationship with the Indo-Papuan species *C. brachypterum* (transfered from *Anomalon brachypterum* by Townes, Townes & Gupta, 1961). Cushman in 1927 described *C. ganges*, the first species from India, collected in Dehradun.

In 1932 Uchida described *C. taiwanus* from China and *Zacharops striatus* from Japan. Later Uchida (1941) considered *Zacharops* a subgenus of Charops. In 1945 Townes synonymized *Zacharops* to *Charops*, therefore *Z. striatus* became *C. striatus* (Uchida, 1932). Seyrig (1935) described *C. armatus*, another Afrotropical species from Tanzania.

Townes *et al.* (1961) synonymized *Charops decipiens* to *C. cantator* (DeGeer,1778) (which was transferred from *Ichneumon* by Roman in 1936), *C. bicolor* was transfered from *Agrypon*; the specific name *C. sumatrensis* was re-established from the senior synonym and transferred to *Charops* from *C. gongropelma* forming *C. sumatrensis* (Tosquinet, 1903).

In 1970, Gupta & Maheshwary studied the Indian species of *Charops.* They recorded eight species including four new: *C. aditya*, *C. hersei*, *C. nigrita* and *C. plauta*. They also described the larval morphology of *C. biocolor*, *C. obtusa obtusa*, *C. ganges*, *C. aditya* and *C. hersei*. In the same year, Maheshwary studied the fauna of Taiwan (China) and made a key for Taiwanese species.

In 2003, Sathe *et al.* (2003) described two species from India*: C. charukeshi* and *C. patmangiri.* The most recent species is *C. maroccanus* described by Horstmann in 2008 from Morocco. Choi & Lee (2008) studied the fauna from the Eastern Palaearctic Region and provided a key for its species.

Although documented in Brazil, any taxonomical study for this genus has never been made, revealing an important gap of knowledge of this genus in the Neotropical region.

3.2. Objectives

The objective of this study was to carry out a thorough taxonomic study of the Brazilian species of *Charops*, to describe and illustrate the new species, and to present distributions maps and an identification key for these species. An emended diagnosis for the genus *Charops* is also provided to include the recorded morphological diversity and a new concept of the genus.

3.3. Material and Methods

3.4. Material examined

The specimens used in this study were obtained from the Museu de Zoologia da Universidade de São Paulo (MZSP) and from visits and loans from other institutions listed below:

APTA Agência Paulista de Tecnologia dos Agronegócios (N. W. Perioto), Ribeirão Preto, SP.

CEIOC* Coleção Entomológica do Instituto Oswaldo Cruz (J. Costa), Rio de Janeiro, RJ.

CESC* Coleção Entomológica de Santa Cruz do Sul (A. Kohler) Santa Cruz do Sul, RS

CPATU* Coleção Entomológica da EMBRAPA Amazônia Oriental (M. M. Maués), Manaus, AM.

DCBU Departamento de Ecologia e Biologia Evolutiva UFSCar (A.M. Penteado-Dias), São Carlos, SP.

INPA* Instituto Nacional de Pesquisas da Amazônia (M. L. Oliveira), Manaus, AM.

MNRJ* Museu Nacional da Universidade Federal do Rio de Janeiro (F. Vivallo), Rio de Janeiro, RJ.

MPEG* Museu Paraense Emílio Goeldi, Brazil (O. Tobias), Belém, PA.

UFES Universidade Federal do Espírito Santo, Brazil (M. T. Tavares), Vitória, ES.

***visited collections**

3.5. Morphology

Morphological terminology of head, mesosoma, metasoma and wing venation follows Gauld & Wahl (2011); surface sculptures follow mostly Harris (1979) and Santos & Aguiar (2013); legs surfaces are interpreted *sensu* Aguiar & Gibson (2010).

All original descriptions of *Charops* species were consulted. Images of Neotropical type species (*Charops luctuosus* (Cresson,1865) housed at Instituto de Ecología y Sistemática, Havana, Cuba and *Charops annulipes* Ashmead,1890 housed at United States National Museum of Natural History, Washington, DC, US were also examined.

An emended diagnosis and description modified from Townes (1970a), Gupta & Maheshwary (1970) and Gauld (1984) is presented, updated with the current terminology and characters observed in Brazilian species of *Charops.*

All descriptions were made with the assistance of a Leica MZ12.5 stereomicroscope under a ring of white LED (6000k) light. Measurements were made under 100x magnification with the assistance of an eyepiece ruler calibrated with a Carl Zeiss calibration slide. An identification dichotomous key was made for Brazilian species of *Charops*.

Head measurements: Head lateral height was measured in lateral view between apex of lateral ocelli and superior corner of the mandible base. Malar space was measured between superior corner of the mandible base and the nearest point from the eye (figure 2C). Mandible length was measured in front view between the apex of the upper tooth and the superior corner of the mandible (figure 2B). Mandible basal width was measured in anterolateral view between inferior corner and superior corner of the mandible (figure 2C). Paraocular area is not distinguished from supraclypeal area, supra-antennal area and vertex. Width of face was measured in front view

between the eyes at anterior tentorial pit heigh (figure 3A). Height of face was measured in front view between anterior tentorial pit and antennal socket (figure 3A). Interocelar distance was measured between the nearest point of lateral ocelli (figure 3B). Lateral ocelli diameter was measured between the furthermost points of the left lateral ocellus (figure 3B). Distance between lateral ocelli and eye was measured between the nearest points of lateral ocelli and eye (figure 3B). Flagellomeres height and width were measured in dorsal view between the furthermost points of the segment (figure 3B).

Mesosoma measurements: Mesopleuron height was measured in lateral view between the lower posterior corner and higher anterior corner of mesopleuron (figure 4A). It seems that juxtacoxal carina (figures 4A, 6B) is an informative character for Brazilian species of *Charops.* Some species have the juxtacoxal carina with one perpendicular carinae, named here as first perpendicular carina (1pc), parallel to the mesepimeron, which splits from the anterior part of juxtacoxal carina and may reach pleural carina. Also, some species have subsequent perpendicular carinae after or in middle of the juxtacoxal carina. In these cases, subsequent carenae are termed 2pc, 3pc (figure 6B). It is important to notice that the terms herein are given only for convenience since they may not reflect homology of these structures. The length and width of the propodeal spiracle are measured between furthermost points of the spiracle including its borders, since it was thus easier to measure at 100x magnification. Propodeum neck was measured in lateral view between the apex of propodeum neck and lower posterior corner of metapleurum (figure 6A). Size of hind coxa was measured on its dorsal face between coxae base to apex (figure 6A). The size of tarsomeres were measured in its anterior face (figure 7A). When many specimens were available, wings were dissected, and slide mounted for more accurate measurements (figures 5A-D). Sections (abscissae) of veins are noted by a number and slash followed by the name segment (*e.g.* second segment of the fore wing cubital vein, between 1m+cu and 2cu+a, is written 2/Cu). Length of fore wing was measured between base and apex (figure 2A).

Metasoma measurements. The subpeciolar process (figure 5E) format is described as inconspicuous when its size is lower than half of the first metasomal segment diameter or conspicuous when its size is higher than half of the first segment diameter. First and second metasomal tergites (figure 5E, F) were measured in lateral

view between base to apex (figure 2A). Ovipositor size was measured in lateral view between the visible ovipositor base and its apex. The distance between ovipositor notch and ovipositor apex was measured in lateral view between the posterior edge of ovipositor notch and its apex (figure 7B). Ovipositor notch angle were measured with adaptations the method proposed by Cameron *et al.* (2014) for Ctenopelmatinae with the assistance of the software Camera protractor (figure 7B).

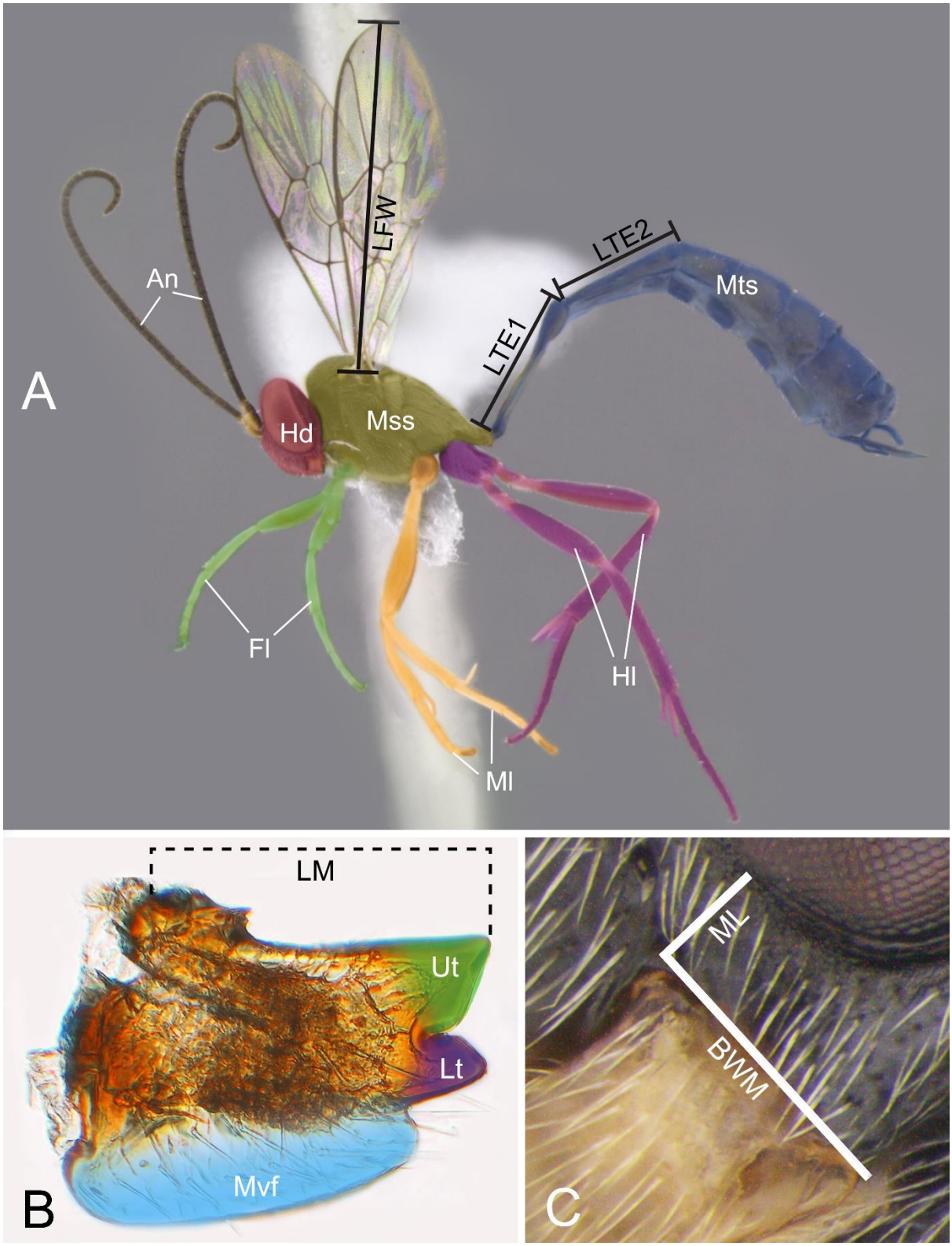

Figure 2. *Charops* sp. n. A: A, habitus in lateral view. B, mandible in frontal view. *Charops* sp. n. C: C, malar space.

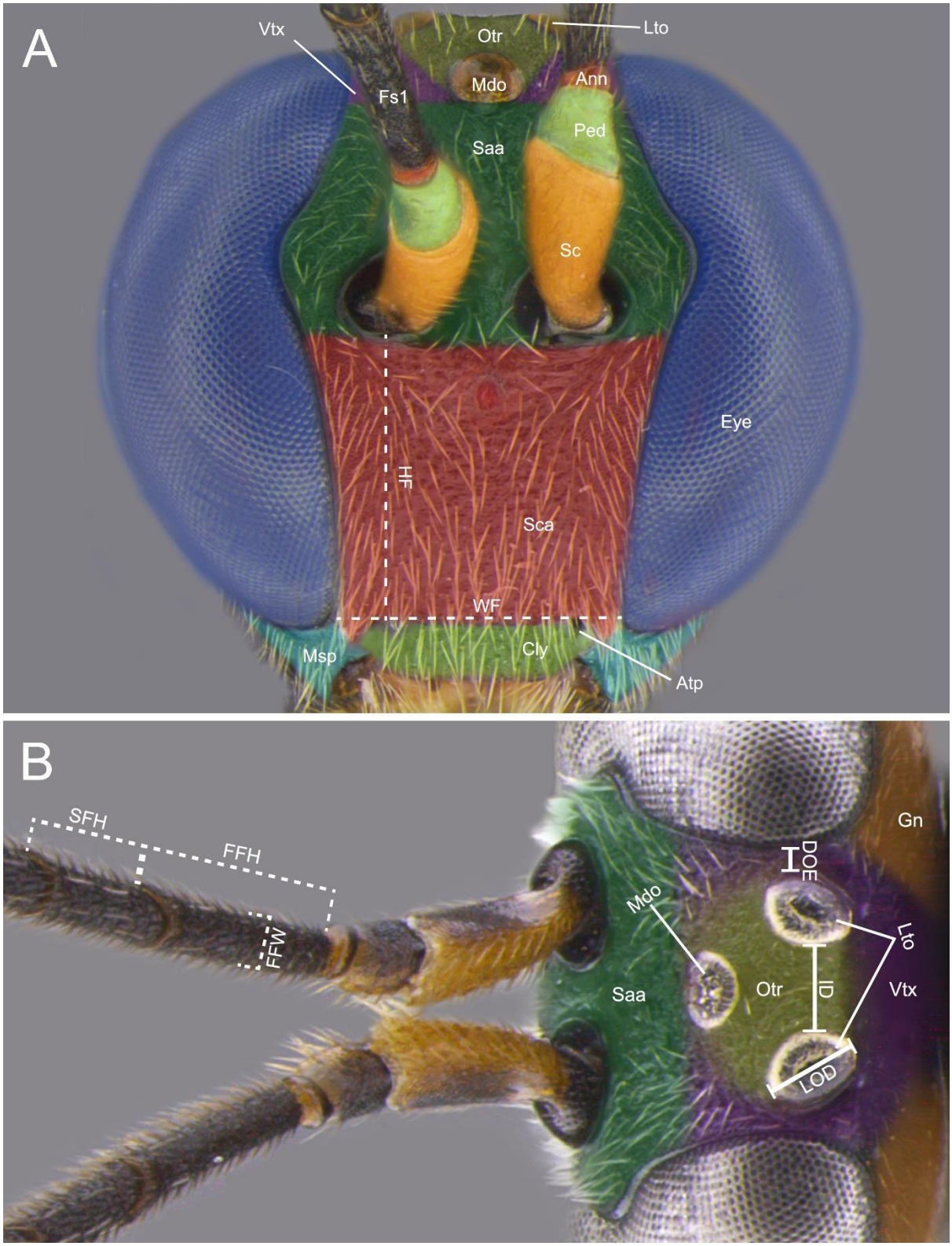

Figure 3. *Charops* sp. n. C: A, head in frontal view. B, head in dorsal view.

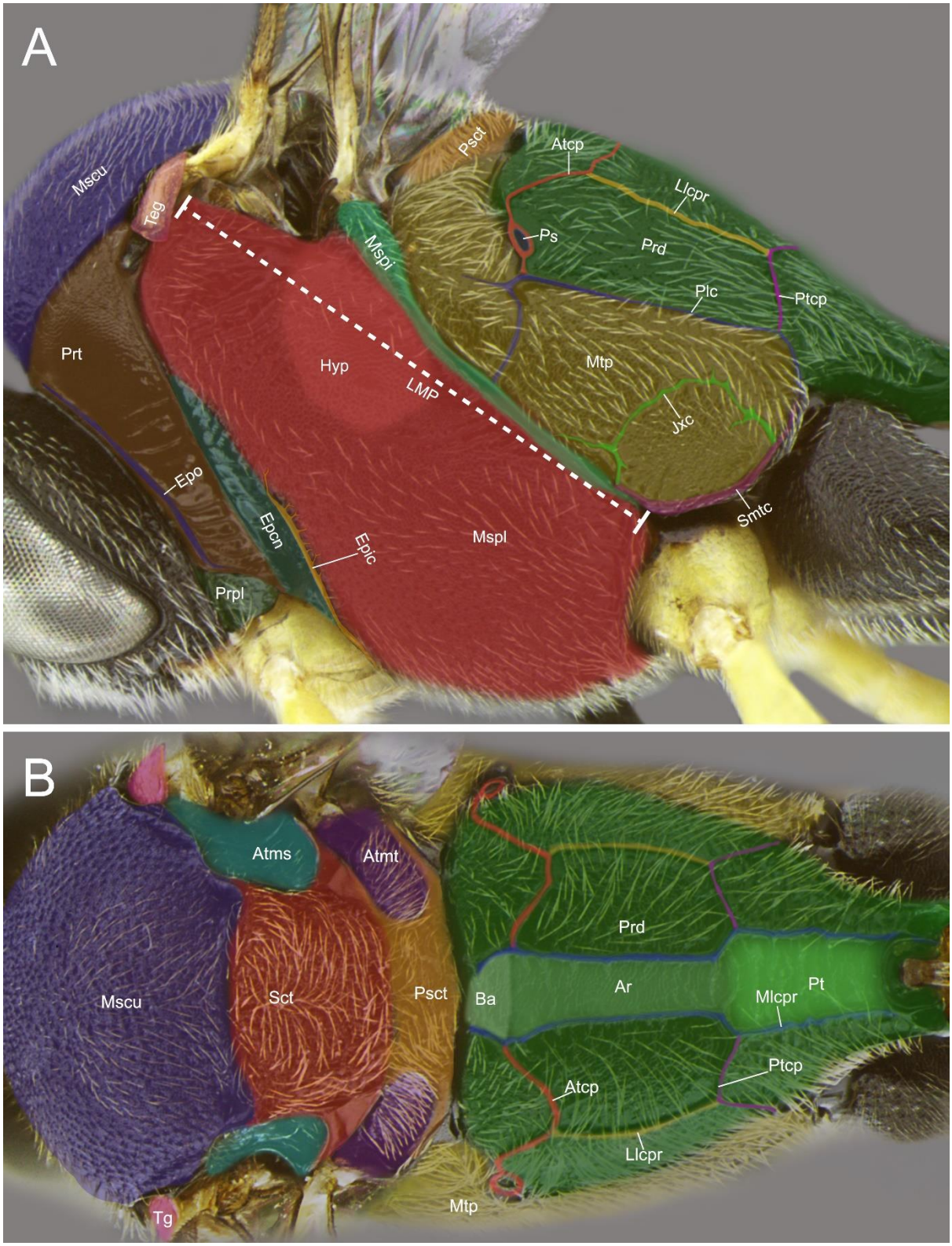

Figure 4. *Charops* sp. n. C: A, mesosoma in lateral view. B, mesosoma in dorsal view.

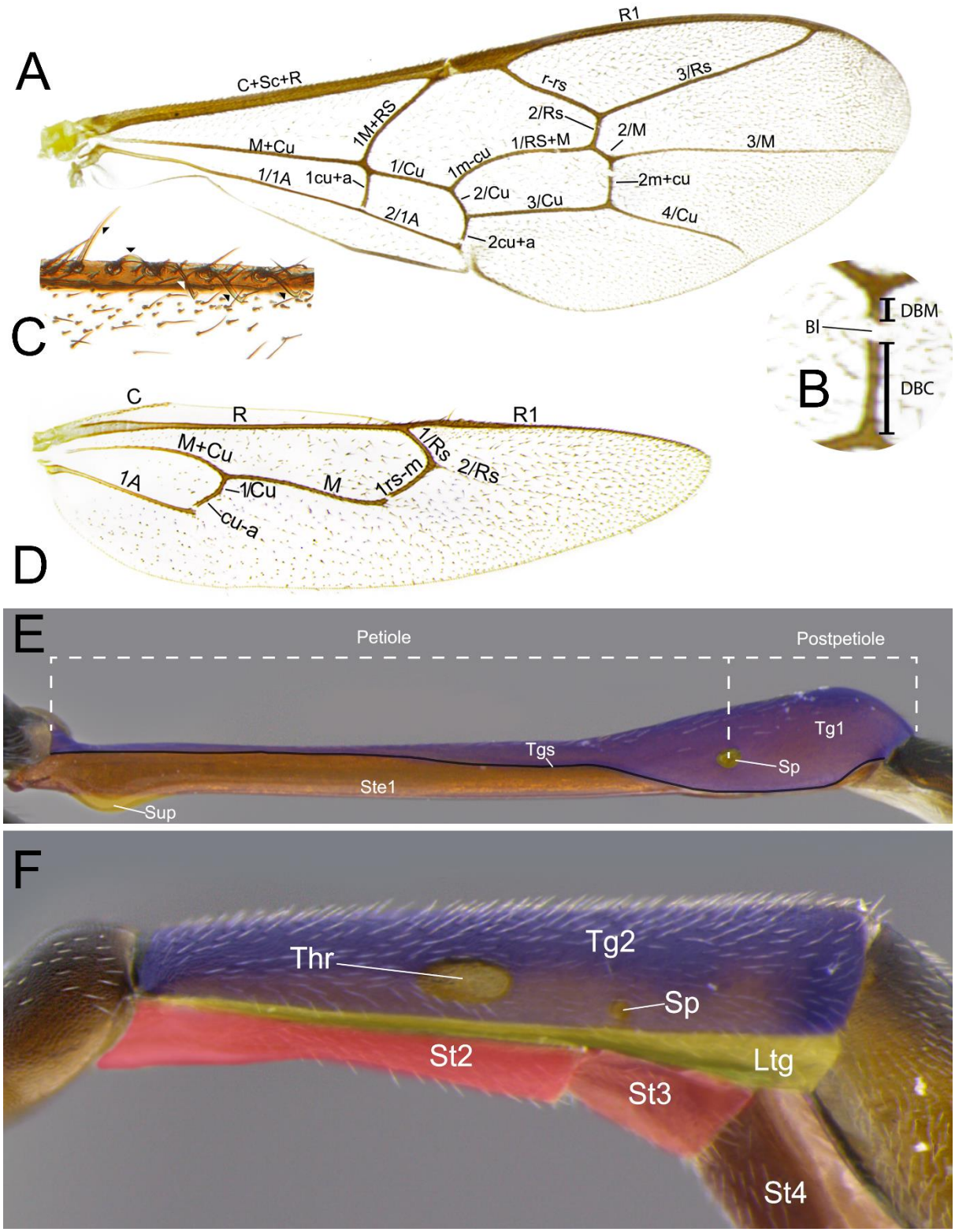

Figure 5. *Charops* sp. n. A: A, fore wing in dorsal view. B, detail of fore wing vein 2m-cu. C, hind wing detail of R1, arrows indicates hamuli. D, hind wing in dorsal view. *Charops* sp. n. C: E, first metasomal segment in lateral view. F, second metasomal segment in lateral view.

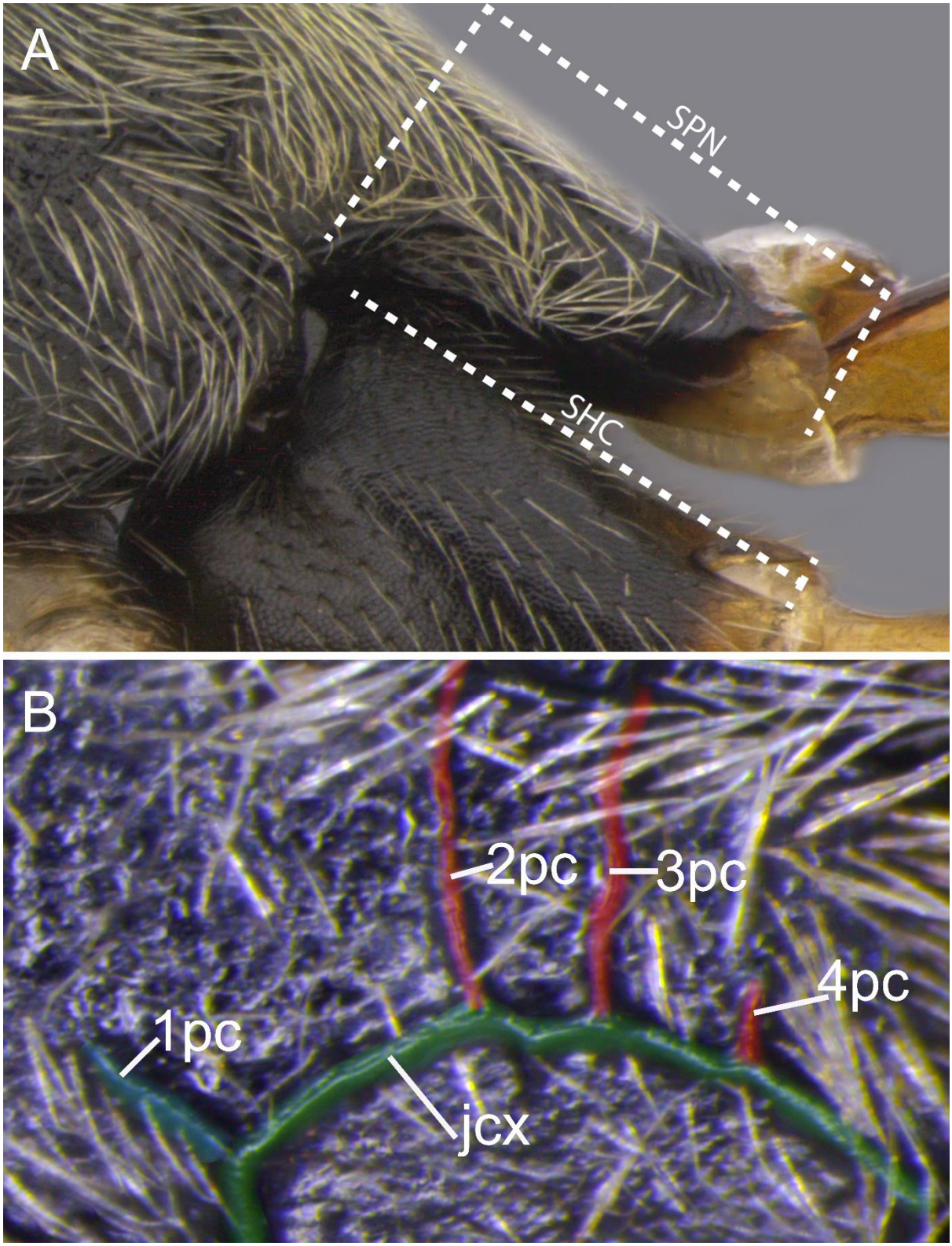

Figure 6. *Charops* sp. n. C: A, propodeum neck in lateral view. *Charops* sp. n. H: B, juxtacoxal carina in lateral view.

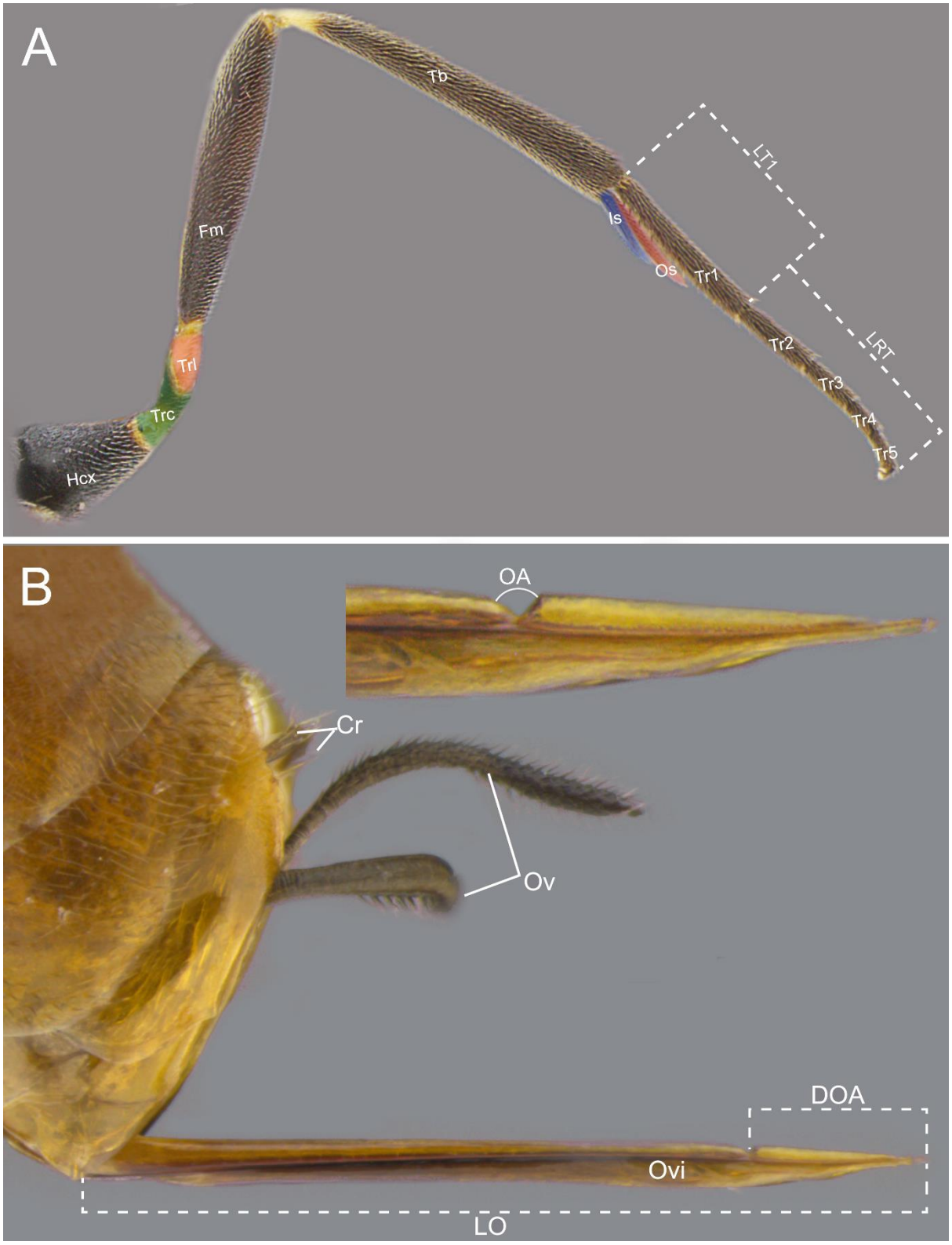

Figure 7. *Charops* sp. n. A: A, hind leg in anterior view. *Charops* sp. n. C: B, ovipositor in lateral view with detail of ovipositor notch on top right corner.

3.6. Distribution maps

Species coordinates data were obtained from specimen's labels or Google Earth. Distribution maps were made by plotting the specimen's coordinates on two columns in the software Microsoft Excel and saving the file in a .csv (comma-separated values) format. This file was imported to the free and open source software QGIS 2.18 where the coordinate points were plotted in map shapes. A public domain shape (1:50m Raster Data: Natural Earth 2) from Made with Natural Earth website was used. Small corrections and map legends were made through Photoshop CS6.

3.7. Imaging

High-resolution photographs were taken using a Leica M205C stereomicroscope attached to a Leica DFC 295 camera. The illumination system uses the "Budget" modular dome illumination proposed by Kawada & Buffington (2016) with an LED ring attached at the base. Multiple photographs of the subject were taken at different focus stages and combined using multiple stack methods through Leica LAS (Leica Application Suite V3.6.0) or Helicon Focus 6.7.1 software. Light, background corrections and plates were made using Photoshop CS6.

3.8. Results

A total of 614 specimens were examined (figure 9). For the first time *Charops* species are described in South America. Nine new Brazilian species are described in this study and an emended diagnosis for the genus *Charops* is proposed to include a new concept of the genus diversity.

3.9. Genus *Charops* Holmgren, 1859

Charops Holmgren, 1859: 324
Zacharops Viereck,1912: 646
Gongropelma Enderlein, 1921:13

Type of the Genus: *Ophion* (*Campoplex) decipiens* Gravenhorst, 1829: 596 by monotypy (=*Charops cantator* DeGeer,1778: 594)

Emended Description: relatively small to large sizes (forewing 3.1 to 8.2 mm) covered with a silvery or golden pubescence; head strongly lenticular; mandible with a ventral flange (figure 2B); mandibular teeth small with equal or subequal sizes (upper tooth broader than the lower tooth) (figure 2B); clypeus slightly convex and rounded at apex; eyes strongly emarginate opposite antennal socket (figure 8A); antennae filiform, usually not longer than half of the body; occiput subpolished andoccipital carina reaching hypostomal carina at base of mandible; mesosoma short, as long as or slightly longer than high; pronotum short, with transverse wrinkles (figure 4A); mesoscutum without discernible notaulus (figure 4B); epicnemial carina present, extending to 0.5–0.75 the height of mesopleurum (figure 4A); scutellum subquadrate and not acutely carinate laterally, covered with long pubescence (figure 4B); propodeum with or without pubescence, usually rugose to reticulate and with elliptical spiracle; median longitudinal carinae strongly present to absent; apex of propodeum close to the apex of hind coxa; legs with tarsal claws pectinate; fore wing areolet absent (figure 8C) and 2m-cu vein straight and vertical (figure 5A); metasoma long and strongly compressed; petiolar part of first segment very long, weakly up curved or straight; tergosternal suture in a dorsal position near base of petiole lateral or ventral near apex of petiole (figure 8D); postpetiole swollen and sometimes bulbous; glymma absent; ovipositor short, straight or upcurved, not projecting beyond apex of metasoma and with a distinct subapical notch (figure 7B).

Comments: *Charops* (figures 8A–D) is easily distinguished from all other Campopleginae genera by the emarginate eyes, the dorsal position of the tergosternal suture near the base of petiole, lateral or ventral near apex of petiole and absence of areolet and short ovipositor.

Charops is very similar to *Scenocharops* Uchida,1932 (figures 8 E–H), an Eastern Palearctic genus (Yu *et al.*, 2016) because they share the following features: eyes strongly emarginated, juxtacoxal carena complete, suture separating the first metasomal sternite from tergite near its upper margin in lateral view. However, *Scenocharops* presents a small petiolate areolete on the fore wing. (Yu *et al.*, 2016).

In Brazil, *Charops* can be easily misidentified as *Casinaria* Holmgren,1859 (figures 8I–L) since both genera have strongly emarginated eyes, and a suture separating the first metasomal sternite from tergite near its upper margin in lateral view. Looking closely, it is possible to discern them by *Casinaria* having a petiolate areolete on fore wings, and usually lacking a complete set of propodeal carinae and juxtacoxal carina as well.

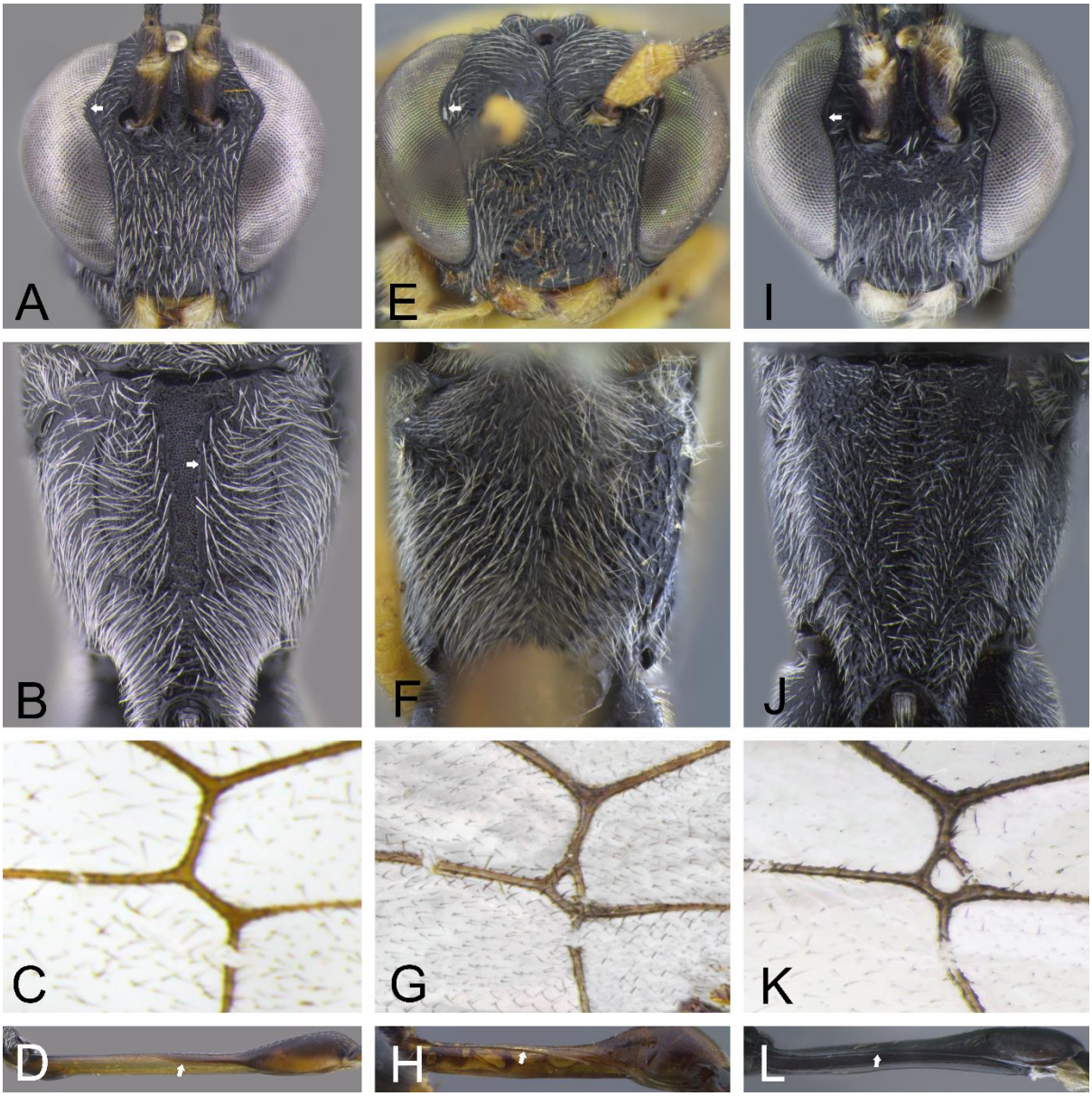

Figure 8. *Charops* sp: A, head in frontal view, arrow indicate emarginated eye. B, propodeum in dorsal view, arrow indicates median longitudinal carina. C, fore wing veins with areolet absent. D, first metasomal segment, arrow indicates tergosternal suture. *Scenocharops* sp: E, head in frontal view, arrow indicate emarginated eye. F, propodeum in dorsal view, arrow indicates median longitudinal carina. F, fore wing veins with areolet present. H, first metasomal segment, arrow indicates tergosternal suture. *Casinaria* sp: I, head in frontal view, arrow indicate emarginated eye. J, propodeum in dorsal view, arrow indicates median longitudinal carina. K, fore wing veins with areolet present. L, first metasomal segment, arrow indicates tergosternal suture.

The following morphological traits are important to distinguish Brazilian species: number of flagellomeres, sculpturation pattern of the propodeum, shape of supraclypeal area and color patterns.

Color shades of specimens highly variates according to storage methods and collection data. Usually freshly collected specimens have a bright color (easily observed in yellow tones). One specimen of *Charops* sp. n. H from Rio de Janeiro collected in 1947 has strong color modification due to effects of Creosote. Natural color gradients are also observed, for example, in *Charops* sp. n. C which hind legs color varies between plain orange brown to dark brown. However, color patterns appear to be species-specific.

The proportion between fore wings veins 2/RS and 2/M at first sight appears to be stable. However, it showed a strong not clinal intraspecific variation. The strenght of wrinkles also showed a notable intraspecific variation.

Charops is already recorded for Curitiba, Espirito Santo, Mato Grosso do Sul Minas Gerais e São Paulo states and it is recorded for the first time in Acre, Amazonas, Bahia, Mato Grosso, Piauí, Rio Grande do Sul and Roraima states.

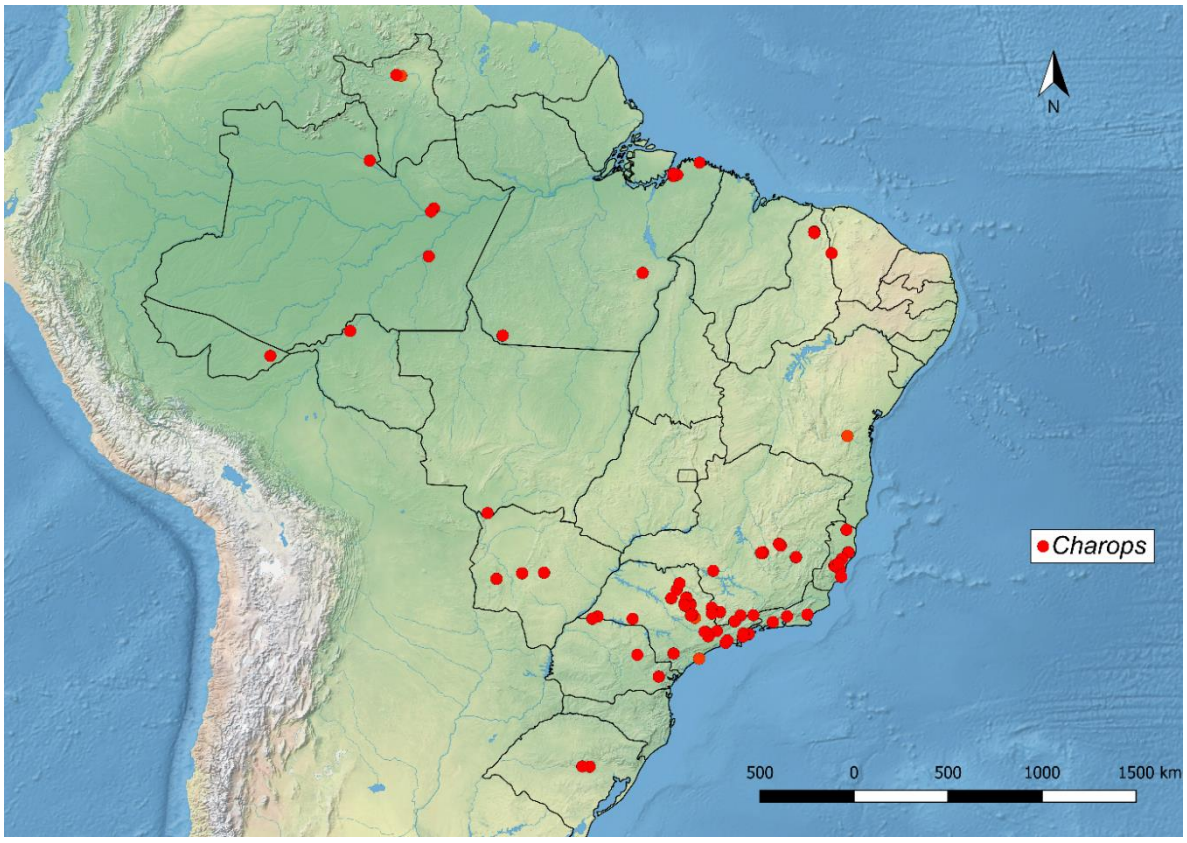

Figure 9. Distribution map of the studied specimens of *Charops.*

3.10. Key to the Brazilian species of the genus *Charops*

1. Propodeum with transverse wrinkles on its petiolar area (figure 10A).....**2**
- Propodeum without transverse wrinkles on its petiolar area (figure 17B).....**6**

(1) 2. Malar space 0.25–0.33x the size of basal width of mandible; mid femur dark orange or brown **3**
- Malar space more than 0.36–0.68x the size of basal width of mandible; mid femur pale or bright yellow **4**

(2) 3. Width of supraclypeal area 1.12–1.18x the height of supraclypeal area; scape and pedicel bicolor, anteriorly yellow and posteriorly brown.....***C.* sp. n. A**
- Width of supraclypeal area more than 1.20–1.37x the height of supraclypeal area; scape dark brown with a thin pale-yellow line on its apex; pedicel dark brown .....***C.* sp. n. B**

(2) 4. Scape and pedicel anteriorly yellow (figure 12A) .....***C.* sp. n. C**
- Scape dark brown with a thin pale-yellow line on its apex (figure 13A).....**5**

(4) 5. Mid coxae black; hind tarsomeres entirely black (figure 13H).....***C.* sp. n. D**
- Mid coxae pale yellow; hind t2 to t4 pale yellow (figure 14H).....***C.* sp. n. E**

(1) 6. Median longitudinal carinae of propodeum incomplete, not reaching petiolar area (Figure 15B) .....***C.* sp. n. F**
- Median longitudinal carinae of propodeum different from above.....**7**

(6) 7. Antennae with less than 44 flagellomeres; median longitudinal carina of propodeum faint and incomplete, not reaching postscutellum (figure 16B) ***C.* sp. n. G**
- Antennae with more than 45 flagellomeres; median longitudinal carina of propodeum strong and complete (figures 17B, 18B).....**8**

(7) 8. Upcurved ovipositor (figure 17G); Antennae with less than 49 and more than 45 flagellomeres.....***C.* sp. n. H**

- Straight ovipositor (figure 18G); Antennae with more than 50 flagellomeres ***C.* sp. n. I**

3.11. *Charops* sp. n. A

(figures 10A–H, 19)

Diagnosis. supraclypeal area rectangular; width of supraclypeal area 1.11–1.18x the size of height of supraclypeal area; antenna with 32–33 flagellomeres; mesopleuron with strong transverse wrinkles; juxtacoxal carinae complete with perpendicular carinae absent or vestigial; median longitudinal carina of propodeum complete; scape and pedicel anteriorly yellow; mid femur with edges pale-yellow and pale to dark orange mid part.

Holotype female. Forewing 3.3 cm. *Head*. Densely punctuated and covered with hairs; lateral height of head 0.84x the size of mesopleuron; mandibles short and stout, apex 0.83x as wide as base, upper tooth broader than the lower tooth; malar space 0.25x as long as basal width of mandible; inner margin of eyes slightly convergent near clypeus; supraclypeal area rectangular; width of supraclypeal area 1.15x the size of height of supraclypeal area; lateral ocellus separated from eye by 0.26x its own diameter; interocelar distance 1.36x the diameter of lateral ocelli; interocelar area with sparse small hairs; antenna with 32 flagellomeres; width of first flagellomere 5.8x its height; height of second flagellomere 0.54x the height of first flagellomere; last flagellomere cone shaped and rounded apex; occipital area slightly imbricate.

Mesosoma. Pronotum dorsolaterally imbricate, laterally and ventrolaterally polished with transverse wrinkles; epomia present almost reaching the base of mesoscutum; mesoscutum finely punctate; scutellum and post scutellum densely covered with hairs; mesopleuron dorsolaterally foveolate with strong transverse wrinkles and covered with sparse hairs; hypoepimeron denudate with transverse wrinkles; epicnemial carina present reaching only basal part of mesopleuron; mesopleuron ventrolaterally foveolate without wrinkles and sparse hairs; sternaulus absent; posterior transverse carina of mesosternum straight not produced near the coxae area; metapleuron punctuate and with its posterior part densely covered with hairs; juxtacoxal carinae complete with perpendicular carinae vestigial; juxtacoxal area imbricate; pleural carinae complete; spiracle elliptical with its width 0.41x the spiracle

height; propodeum hairy and foveolate; strong transverse wrinkles between petiolar area and posterior part of areola; vestigial wrinkles between middle part of areola and basal area; lateral longitudinal carina of propodeum incomplete not reaching propodeum neck; median longitudinal carina of propodeum complete; propodeum neck 0.6x the size of hind coxae.

Legs. Fore legs coxae with a slim lateral carinae; t1 0.69x the size of remaining tarsomeres; mid legs with t1 0.80x the the size of remaining tarsomeres; hind legs with 0.88x the remaining tarsomeres.

Wings. Hyaline and covered with small hairs; forewing vein 1cu-a arising after of 1M+Rs; vein 2/Cu 0.81x the size of 2cu-a; vein 1/Rs+M curved; bulla of 1/Rs+M placed after its midlength near 2/M; 2/RS 0.3x as long as 2/M; bulla of 2m-cu placed near 2/M 0.23x the distance between the bula and 4/Cu vein; hind wing vein 1-Rs forming a curve with 1r-m angle; hind wing with 5 hamuli.

Metasoma. Tergites imbricate; first tergite with sparse hair, first sternite glabrous with subpetiolar process inconspicuous; tergite 2 0.80x the length of tergite 1; remaining tergites and sternites finely punctuate covered with small hairs; thyridium tear shaped; ovipositor sheath covered with long hairs; ovipositor straight,1.14mm; ovipositor notch deep distant from apex 0.21x the size of ovipositor; ovipositor notch angle 99º; ovipositor ventral valve with a lobe near apex.

Color. Pubescence silver. *Head*: black; palpi pale-yellow; mandibles pale-yellow with brown teeth; occeli pale brown; antenna dark brown, scape and pedicel bicolor, anteriorly yellow and posteriorly brown. *Mesosoma*: black; tegula and fore legs pale-yellow; mid legs with brown and pale-yellow coxae, trochanter and trochantellus pale-yellow, femur with edges pale-yellow and dark orange in mid part, tibia to t4 pale-yellow, t5 pale brown; hind legs mostly dark brown with light brown trochanter, trochantellus dark yellow, anterior part of femur and tibia pale-yellow, tibial spurs pale-yellow. *Metasoma*: first segment with anterior part dark brown, mid part pale-yellow and postpeciole brown, slightly darker posteriorly; tergite 2 dorsally dark brown and ventrally light brown, distinct black mark posteriorly, thyridium pale-yellow; remaining tergites with similar pattern as the first; sternites 2 and 3 light brown; remaining sternites pale-yellow with dark brown marks; ovipositor sheaths and cerci black, ovipositor orange brown.

Variation: Forewing 3.3 to 3.7 mm. lateral height of head 0.83–1.0x the size of mesopleuron; mandibles apex 0.71–1.0x as wide as base; malar space 0.25–0.56x as basal width of mandible; width of supraclypeal area 1.11–1.18x the size of height of supraclypeal area; lateral ocellus separated from eye by 0.23–0.35x its own diameter; interocelar distance 1.16–1.36x the diameter of lateral ocelli; antenna sometimes with 33 flagellomeres; width of first flagellomere 4.6–5.8x its height; height of second flagellomere 0.48–0.54x the height of first flagellomere; spiracle width 0.36–0.62x the spiracle height; propodeum neck 0.6–0.8x the size of hind coxae. fore t1 0.69–0.74x the size of remaining tarsomeres; mid legs with t1 0.77–0.89x the size of remaining tarsomeres; hind legs with t1 0.79–0.88x the remaining tarsomeres; vein 2/Cu 0.81–1x the size of 2cu-a; 2/RS 0.69–0.9x as long as 2/M; bulla of 2m-cu placed near 2/M 0.2–0.4x the distance between the bula and 4/Cu vein; tergite 2 0.77–0.87x the length of tergite 1; ovipositor size1.0–1.14mm; ovipositor notch distant from apex 0.19–0.23x the size of ovipositor; ovipositor notch angle 90º–105º; fore femur sometimes pale orange; mid femur sometimes pale orange, first metassomal segment with mid part sometimes dark brown.

Male: Very similar to female, except by the width of supraclypeal area 1.02–1.11x the size of height of supraclypeal area; lateral ocellus separated from eye by 0.28–0.41x its own diameter; interocelar distance 1.2–1.4x the diameter of lateral ocelli; width of first flagellomere 4.3–5.2x its height; height of second flagellomere 0.57–0.59x the height of first flagellomere; fore legs t1 0.70–0.81x the size of remaining tarsomeres; mid legs with t1 0.64–0.78x the the size of remaining tarsomeres; metasomal tergites 5–8 entire black; gonoforceps and cercus also black.

Biology: Host unknow, attracted to light.

Comments: Very similar to *Charops* sp. n. B from which it can be differentiated by the bicolor scape and pedicel, anteriorly yellow and posteriorly brown (Vs scape dark brown with a thin pale-yellow line on its apex; pedicel dark brown) and width of supraclypeal area 1.11–1.18x the size of height of supraclypeal area (Vs width of supraclypeal area 1.20–1.37x the size of height of supraclypeal area).

Material examined: Holotype: ♀ (APTA), **BRASIL: São Paulo**, Luís Antônio, Est. Ecológica de Jatai, Mata Ciliar, Arm. Luminosa, 21º36’47” S, 47º49’04” W Ponto 1/2, 18.iv.2009. R.I.R Lara & Equipe col. *Paratypes*: 15 ♀, 4 ♂ (APTA), same data as

holotype; 71 ♀ 57 ♂ 2? (APTA), same data except 02.ix.2009, 11.xi.2009, 12.iii.2008, 12.xi.2008, 13.i.2009, 13.viii.2008, 14.x.2008, 15.iv.2009, 18.vi.2008, 19.viii.2009, 19.xii.2007, 23.xii.2008, 24.x.2009, 25.xi.2009, 26.iii.2008, 27.ii.2008, 27.v.2009, 27.xi.2008, 28.i.2009, 28.ii.2009, 30.i.2008, 30.ix.2009, 30.vii.2008, 7.v.2008, 9.vi.2008; 1 ♂ (DCBU 199824), same data except 21º35'46"S, 47º48'19,3"W, Armadilha Malaise ponto 1, 23.x.2016, A.S. Soares col; 1 ♀ (DCBU 121898), same data except 21º36,58'S, 47º48,24'W, Armadilha Malaise 01 (538m), 21.ii.2015, A.S. Soares col; 2 ♂ (DCBU 191362, 191336), same data except 21º35'46"S, 47º48'19,3"W, Armadilha Malaise ponto 1 - 600m, 30.ix.2008. 1 ♀ (DCBU 59277), Iguape, ESEC Juréia - Itatins, 24º31'7.8"S 47º12.5'7"W, Armadilha Malaise 05, 19.i.2010, N. W. Perioto e eq cols.; 2 ♀ (DCBU115165, 115178), Brasil: SP, Pontal, Usina Bela Vista, 20º54'48"S 48º08'0.3"W, Armadilha Malaise (502m), 01.x.2010, I. F Melo. col.; 1 ♂ (DCBU 63952), Rio Claro, Floresta Estadual de RIo Claro, 22º 24 ' 47.7" S 47º30'58.9"W, Armadilha Malaise 04, 30.xi.2009, A. S. Soares col.; 3 ♀ (DCBU 82639, 82627, 76207), Ribeirão Grande, Parque Estadual de Intervales, 24º16' 23.6"S 48º25'21.8"W, Armadilha Malaise 5, 22.iii.2010, N.W. Perioto e eq. cols; 1 ♀ (DCBU 172228), same data except 23.vii.2010; 1 ♀ (DCBU 65655), Brasil: SP, São Carlos, Faz[enda] Macaubas - Mata, 21º50'50"S 47º52'W, Armadilha Malaise, 10.i.2007, E. M. Shimbori col; 1 ♀ (DCBU 110406) Teodoro Sampaio, Parque Estadual do Morro do Diabo, 22º30'12"S 52º02'57"W, Armadilha Malaise, 17.vii.2011, P. R. Lopes col.; 1 ♀ (DCBU 115676) same data except 22º36'17.4"S 52º18'7.9" W, Armadilha Malaise 04 (297m), 16.xii.2009, N. W. Perioto e eq. cols; 1 ♀ (MZSP), **Mato Grosso do Sul**, Bodoquena, Fazenda California - Topo, 20º41'55.9"S 56º52'49.4"W, 22.xi - 06.xii.2011 Malaise 06, Lamas, Nihei & eq. col.; 1 ♂ (DCBU 84096), Campo Grande, Fazenda Escola UCDB - pasto, 20º24'9.6"S 54º36'47.32"W, Armadilha Malaise 02, 01-30.vi.2010, J. B. B. Oliveira col.; 1 ♀ (DCBU), **Minas Gerais**, Sete Lagoas Malaise 10-17.xi.1999 I. Cruz col. 1 ♀ (DCBU 148201), same data except Embrapa Milho e Sorgo, 19º28'18"S 44º10'40.8"W, Armadilha Malaise - 742m, 12 - 22.vi.2011; 1 ♀ (DCBU 207489), same data except 03-14.iii.2011; 1 ♀ (DCBU 202047), same data except 14.v.2011; 1 ♀ (MZSP), **Paraná**, Colombo Canguiri, 910 m, 25º22'44.65"S 49º07'53.30"W, vi.2014, Malaise M.Savaris & S.Lampert cols.; 1 ♂ (DCBU 122406), **Rio de Janeiro**, Casemiro de Abreu, Reserva Biológica União, 22º24'31"S 42º01'54"W, Varredura - ponto 5 (55m), 13.xii.2010, R. F. Monteiro col.

3.12. *Charops* sp. n. B

(figures 11A–H, 20)

Diagnosis. inner margin of eyes convergent near clypeus; supraclypeal area rectangular; width of supraclypeal area 1.20–1.37x the size of height of supraclypeal area; propodeum with strong transverse wrinkles on petiolar area; scape dark brown with a thin pale-yellow line on its apex; pedicel dark brown; mid femur dark orange or brown.

Holotype female. Forewing 3.4 cm. *Head*. Densely punctuated and covered with hairs; lateral height of head 0.88 the size of mesopleuron; mandibles short and stout, apex 0.8x as wide as base and the upper tooth broader than the lower tooth; malar space 0.29x as long as basal width of mandible; inner margin of eyes convergent near clypeus; supraclypeal area rectangular; width of supraclypeal area 1.37x the size of height of supraclypeal area; lateral ocellus separated from eye by 0.3x its own diameter; interocelar distance 1.3x the diameter of lateral ocelli; interocelar area with sparse small hairs; antenna with 31 flagellomeres; width of first flagellomere 4.8x its height; height of second flagellomere 0.52x the height of first flagellomere; last flagellomere cone shaped with a rounded apex, occipital area slightly imbricate.

Mesosoma. Pronotum dorsolaterally imbricate, laterally and ventrolaterally polished with transverse wrinkles; epomia present almost reaching the base of mesoscutum; mesoscutum finely punctate; scutellum and post scutellum densely covered with hairs; mesopleuron dorsolaterally foveolate with strong transverse wrinkles and covered with sparse hairs; hypoepimeron denudate with transverse wrinkles; epicnemial carina present, reaching only mid part of mesopleuron; mesopleuron ventrally foveolate without wrinkles and sparse hairs; sternaulus absent; posterior transverse carina of mesosternum straight not produced near the coxae area; metapleuron punctuate and with its posterior part densely covered with hairs; juxtacoxal carinae complete and strong impressed with perpendicular carinae vestigial; juxtacoxal area imbricate; pleural carinae complete; spiracle elliptical with its width 0.5x the spiracle height; propodeum hairy and foveolate; strong transverse wrinkles on petiolar area; areola and basal area with vestigial wrinkles; lateral longitudinal carina

of propodeum incomplete not reaching propodeum neck; median longitudinal carina of propodeum complete; propodeum neck 0.83x the size of hind coxae.

Legs. Fore legs t1 0.81x the size of remaining tarsomeres; mid legs with t1 1.01x the the size of remaining tarsomeres; hind legs with t1 0.88x the remaining tarsomeres; tarsal claws pectinate from base to center.

Wings. Hyaline and covered with small hairs; forewing vein 1cu-a arising after of 1M+Rs; vein 3/Cu placed at midlenght of 2/Cu and crossvein 2cu-a; vein 1/Rs+M curved; bulla of 1/Rs+M placed after its midlength near 2/M; 2/RS 0.83 as long as 2/M; bulla of 2m-cu placed near 2/M 0.2x the distance between the bula and 4/Cu vein; hind wing vein 1-Rs forming a curve with 1r-m angle; hind wing with 5 hamuli.

Metasoma. Tergites imbricate; first tergite with sparse hairs, first sternite glabrous with subpetiolar process inconspicuous; tergite 2 0.80x the length of tergite 1; remaining tergites and sternites finely punctuate covered with small hairs; thyridium elliptical almost rounded rectangular; ovipositor sheath covered with long hairs; ovipositor straight with 0.98mm; ovipositor notch not deep, distant from apex 0.16x the size of ovipositor; ovipositor notch angle 120.6º; ovipositor ventral valve with a lobe near apex.

Color. Pubescence silver. *Head*: black; palpi pale-yellow; mandibles dark-yellow with brown teeth; ocelli brown; antenna dark brown, scape dark brown with a thin pale-yellow line on its apex; pedicel dark brown. *Mesosoma*: black; tegula dark brown; fore legs pale-yellow with t5 brown; mid legs with black coxae, trochanter and trochantellus pale-yellow, femur with edges pale-yellow and brown in mid part, tibia to t4 pale-yellow, t5 brown; hind legs mostly black with dark yellow trochantellus. *Metasoma*: first segment with anterior part black, mid part dark brown and postpeciole black; tergite 2 dark brown; thyridium pale brown; sternite 2 light brown with its extremities pale brown; remaining tergites dorsally black and ventrally orange brown; remaining sternites pale-yellow with dark brown marks; ovipositor sheaths and cerci black, ovipositor orange brown.

Variation: Forewing 3.1 to 3.7 mm. lateral height of head 0.88–0.93x the size of mesopleuron; mandibles apex 0.80–1.05x as wide as base; malar space 0.23–0.29x as basal width of mandible; width of supraclypeal area 1.20–1.37x the size of height of supraclypeal area; lateral ocellus separated from eye by 0.21–0.3x its own diameter;

interocelar distance 1.08–1.18x the diameter of lateral ocelli; antenna with 31–33 flagellomeres; width of first flagellomere 4.7–5.6x its height; height of second flagellomere 0.51–0.57x the height of first flagellomere; spiracle width 0.44–0.62x the spiracle height; propodeum neck 0.78–0.83x the size of hind coxae. fore leg with t1 0.71–0.81x the size of remaining tarsomeres; mid legs with t1 0.85–1.01x the size of remaining tarsomeres; hind legs with t1 0.85–0.91x the remaining tarsomeres; vein 2/Cu 0.81–1x the size of 2cu-a; 2/RS 0.69–0.9 as long as 2/M; bulla of 2m-cu placed near 2/M 0.2–0.4x the distance between the bula and 4/Cu vein; tergite 2 0.75–0.83x the length of tergite 1; ovipositor size 0.96–1.1mm; ovipositor notch distant from apex 0.16–0.24x the size of ovipositor; ovipositor notch angle 95º–120º; mid femur sometimes pale orange, first metassomal segment with mid part sometimes dark brown.

Male: Very similar to female, except by the lateral height of head 0.86–0.89x the size of mesopleuron; mandibular apex 0.72–1x as wide as base; malar space 0.29–0.37x as long as basal width of mandible; width of supraclypeal area 1.16–1.25x the size of height of supraclypeal area; spiracle width 0.5–0.62x the spiracle height; propodeum neck 0.63–0.86x the size of hind coxae; fore t1 0.72–0.78x the size of remaining tarsomeres; mid t1 0.8–0.9x the size of remaining tarsomeres; hind t1 0.74–0.91x the size of remaining tarsomeres; tergite 2 0.75–0.82x the length of tergite 1; 2/RS 0.5–0.77x the size of 2/M; hind legs with t2–t4 or t3–t4 pale-yellow; metasomal tergites 1–2 and 5–8 darker the female; gonoforceps and cercus also black.

Biology: Host unknow.

Comments: Very similar to *Charops* sp. n. A from which it can be differentiated by the scape dark brown with a thin pale-yellow line on its apex; pedicel dark brown (Vs the bicolor scape and pedicel, anteriorly yellow and posteriorly brown) and width of supraclypeal area 1.20–1.37x the size of height of supraclypeal area (Vs width of supraclypeal area 1.11–1.18x the size of height of supraclypeal area).

Material examined: Holotype: ♀ (DCBU 262244), **BRASIL: Pará,** Jacareacanga, Pousada Thaimaçu - Mata, 09º03'21"S 56º35'09"W, Armadilha Malaise (164m) 19.ix.2015 - Rio São Benedito, M. M. B. Lutz & J. C. M. Lutz cols. *Paratypes*: 6 ♀, 12 ♂ 1? (DCBU 262144, 262156, 262183, 262213, 262220, 262229, 262230, 262233-262235, 262240, 262241, 262251, 262253, 262255, 262260, 262264, 262265,

262278) same data as holotype; 3 ♀, 5 ♂ (DCBU 99027, 99030, 99031, 99038,106309, 106315, 106320, 106325) same data as holotype except 25.vii.2015, 09º03'20.9"S 56º 35'9.7"W; 1 ♂ (DCBU 98868) same data except 14.vi.2015.

3.13. *Charops* sp. n. C

(Figures 12A–H, 21)

Diagnosis. Inner margin of eyes parallel near clypeus; supraclypeal area subquadrate; propodeum with its petiolar area with complete wrinkles, areola and basal area with vestigial wrinkles; metasomal tergite 2 with a distinct black stripe on its posterior part.

Holotype female. Forewing 4.7 mm. *Head*. Densely punctuated and covered with hairs; lateral height of head 0.83x the size of mesopleuron; mandibles short and stout, apex 0.73x as wide as base and the upper tooth broader than the lower tooth; malar space 0.42x as long as basal width of mandible; inner margin of eyes parallel near clypeus; supraclypeal area subquadrate; width of supraclypeal area 1.14x the size of height of supraclypeal area; lateral ocellus separated from eye by 0.26x its own diameter; interocelar distance 0.93x the diameter of lateral ocelli; interocelar area with sparse small hairs; antenna with 39 flagellomeres; width of first flagellomere 4.4x its height; height of second flagellomere 0.59x the height of first flagellomere; last flagellomere cone shaped with a rounded apex, occipital area slightly imbricate.

Mesosoma. Pronotum dorsolaterally imbricate, laterally and ventrolaterally polished with transverse wrinkles; epomia present reaching the base of mesoscutum; mesoscutum punctate; scutellum and post scutellum densely covered with hairs; mesopleuron dorsolaterally reticulate with complete wrinkles and covered with hairs; hypoepimeron denudate with strong wrinkles; epicnemial carina present reaching only basal part of mesopleuron; mesopleuron ventrally foveolate without wrinkles and covered with hairs; sternaulus absent; metapleuron punctuate and covered with hairs with its posterior part densely covered with hairs; juxtacoxal carinae complete with first perpendicular carinae vestigial; pleural carinae complete; spiracle elliptical with its width 0.35x the spiracle height; propodeum hairy and reticulose; petiolar area with complete wrinkles, areola and basal area with vestigial wrinkles; lateral longitudinal

carina of propodeum incomplete not reaching propodeum neck; median longitudinal carina of propodeum complete; propodeum neck 0.73x the size of hind coxae.

Legs. Fore legs coxae with a slim lateral carinae; t1 0.73x the size of remaining tarsomeres; mid legs with t1 0.83x the size of remaining tarsomeres; hind legs with t1 0.80x the remaining tarsomeres.

Wings. Hyaline and covered with small hairs; forewing vein 1cu-a arising after of 1m+rs; vein 3/cu placed near 2/cu; 2/cu 0.86x the size of 2cu+a; 1/rs+m curved; bulla of 1/rs+m placed after its midlength near 2/m; 2/rs 0.42x as long as 2/m; bulla of 2m-cu placed near 2/m 0.37x the distance between the bula and 4/cu vein; hind wing vein 1-rs forming a curve with 1r-m angle; hind wing with 5 hamuli.

Metasoma. Tergites imbricate; first tergite with sparse hairs, first sternite glabrous with subpetiolar process inconspicuous; tergite 2 0.81x the length of tergite 1; remaining tergites and sternites finely punctuate covered with small hairs; ; thyridium rounded; ovipositor sheath covered with long hairs; ovipositor straight with 1.09 mm; ovipositor notch not deep, distant from apex 0.23x the size of ovipositor; ovipositor notch angle 105.22º; ovipositor ventral valve with an inconspicuous lobe near apex.

Color. Pubescence golden. *Head*: black; palpi pale-yellow; mandibles pale-yellow with brown teeth; ocelli orange brown; antenna dark brown, scape and pedicel bicolor, anteriorly dark yellow and posteriorly brown. *Mesosoma*: black; tegula, fore and mid legs pale-yellow with t5 brown; mid legs with brown and pale-yellow coxae, trochanter and t4 pale-yellow, t5 brown; hind legs coxae and trochanter orange brown, trochantellus to t5 dark brown; dorsal part of femur dark brown and ventral part orange brown.

Metasoma: first segment orange brown, dorsal part of postpetiole dark brown; tergite 2 dorsally dark brown and ventrally orange brown with a distinct black stripe on its posterior part, thyridium light orange brown; sternite 2 light orange brown; remaining tergites dorsally black and ventrally orange brown; remaining sternites dark yellow; ovipositor sheaths and cerci black, ovipositor dark yellow.

Variation: Forewing 4.5–5.2 mm. lateral height of head 0.79–0.87x the size of mesopleuron; mandibular apex 0.66–0.81x as wide as base; malar space 0.40–0.52x as long as basal width of mandible; width of supraclypeal area 1.14–1.20x the size of height of supraclypeal area; lateral ocellus separated from eye by 0.18–0.35x its own

diameter; interocelar distance 0.88–1.07x the diameter of lateral ocelli; antenna with 38–40 flagellomeres; width of first flagellomere 4.09–5.22x its height; height of second flagellomere 0.53–0.59x the height of first flagellomere; spiracle width 0.33–0.46x the spiracle height; propodeum neck 0.73–0.86x the size of hind coxae. t1 0.69–0.73x the size of remaining tarsomeres; mid legs with t1 0.76–0.83x the size of remaining tarsomeres; hind legs with t1 0.75–0.81x the remaining tarsomeres; 2/Cu 0.81–1.14x the size of 2cu+a; 2/RS 0.36–0.62x as long as 2/M; bulla of 2m-cu placed near 2/M 0.46x the distance between the bula and 4/Cu vein; tergite 2 0.89x the length of tergite 1; ovipositor size 1.22–2.48 mm; ovipositor notch not deep, distant from apex 0.16–0.28x the size of ovipositor; ovipositor notch angle 91.89–108.32º; hind legs color vary between plain orange brown to dark brown, sometimes forming a gradiente between these two colors.

Biology: Host unknow.

Comments: male unknown.

Material examined: Holotype: ♀ (DCBU), **BRASIL: Minas Gerais,** Sete Lagoas Malaise 10-17.iv.2000 I. Cruz col. *Paratypes*: 1 ♀ (DCBU), same data as holotype; 1 ♀ (DCBU), same data except 01-13.iii.2004; 1 ♀ (DCBU), same data except 11-12.ix.2000; 2 ♀ (DCBU), same data except 12-26.vi.2000; 1 ♀ (DCBU), same data except 12-26.xi.1999; 2 ♀ (DCBU), same data except 12-27.iii.2000; 2 ♀ (DCBU), same data except 12-27.iii.2000; 1 ♀ (DCBU), same data except 13.iii.2000; 11 ♀ (DCBU), same data except 13.iii.2000; 2 ♀ (DCBU), same data except 13.iv.2000; 2 ♀ (DCBU), same data except 14-28.ii.2000; 1 ♀ (DCBU), same data except 19.iv-02.v.2000; 1 ♀ (DCBU), same data except 23.viii-06.ix.2000; 1 ♀ (DCBU), same data except 26.vi-10.vii.2000; 8 ♀ (DCBU), same data except 27.iii-10.iv.2000; 1 ♀ (DCBU), same data except 27.vii-08.viii.2000; 1 ♀ (DCBU), same data except 28.ii.13.iii.2000; 1 ♀ (DCBU), same data except 29.v-12.vi.2000; 1 ♀ (DCBU), same data except 8-22.viii.2000; 1 ♀ (MZSUP), Andradas, Fazenda Bela Vista, 22º04'40.3"S 46º35'53.7"W Armadilha Malaise, 01.ix.2009; 6 ♀ (DCBU 4449, 4450, 4451, 4435, 4436, 4437), **São Paulo**, Luís Antônio, Estação. Ecológica de Jatai 21º35'S 47º48'W armadilha malaise 1 e 2, 12.iv.2007, N.Perioto col.; 9 ♀ (DCBU 201358, 228118, 201351, 201354, 201355, 201350, 201347), Teodoro Sampaio, Parque Estadual Morro do Diabo 22º 36'16"S 52º18’04”W, Armadilha Malaise (414m), 16.x.2010, N.W.Perioto e equipe col. *Other specimens***:** 1 ♀ (UFES 48896) **Espírito Santo**, Cariacica, Res[erva] Biol[ógica]

Duas Bocas, 16-17.ix.2006, Malaise, R. Kawada & eq. Leg.; 1 ♀ (UFES 124481) same data except 05.xii.1996, (v) Aspirada, C. O. Azevedo col.; 1 ♀ (UFES 96618) Pinheiros, Res[erva] Biol[ógica] Córrego do Veado Trilha Jaboti, 18º21'S 40º10'W, 27.xi-06.xii.2011, Malaise 7, M. T.Tavares & eq col.; 1 ♀ (UFES 96618) Guarapari - Restinga P. E. Paulo César Vinha, 20º36'S 40º25'W, 4m Mata 7, 02-09.xi.2006, Malaise (msc02), B. Araujo & M. Santos leg.; 8 ♀ (DCBU 151310, 140335, 140338, 153594, 153595, 153597, 153600, 153722) Linhares, FLONA [Floresta Nacional] dos Goytacazes,19º25'51.8S 40º4'10.2"S, Armadilha Malaise 4, (21m), 28.ix-27.IX.2009, V. L. R. M. Benassi col.; 1 ♀ (UFES 95605, 94239) S[an]ta M[aria] de jequitibá faz[enda] Clarindo Krüger 20º04'27.9"S 40º44'51.3"W, 29.xi-06.xii.2002, Malaise B5, Tavares, Azevedo & eq. col.; 1 ♀ (UFES 47996) João Neiva, Sítio Monte Negro, 7 - 3.vii.2007, Malaise, F. Rampinelli & eq. Leg.; 5 ♀ (MZSP) **Mato Grosso do Sul**, Bodoquena, Faz[enda] Califórnia (Ciliar) 20º41'49.9"S 56º52'54"W, 06-21.viii.2012, 21.x - 06.xi.2012, 21.vii - 06.viii Malaise 04, Lamas, Nihei & eq. cols.; 4 ♀ (DCBU 84601, 84040, 83986, 223991) Campo Grande, Fazenda Escola UCDB - pasto, 20º24'13.16"S 54º36'45.69"W, Armadilha Malaise 01, 01-30.vi.2010, J. B. B. Oliveira col; 1 ♀ (DCBU 143642) **Minas Gerais,** Bom Repouso, Boa Vereda de Cima - Capelinha, 22º27'01.8"S 45º13'36.7"W Armadilha Malaise 02, 02.ix.2009, I. F. Melo col.; 4 ♀ (DCBU 143419, 143416, 143418, 148505) Borda da Mata, Sítio São Romano, S 22º 17' 13.2 W 46º 12' 26.3", Armadilha Malaise - 1006m, 23.xi.2009, I. F. Melo col.; 4 ♀ (DCBU 150961, 150956, 150958, 145770), Jacutinga, Morro da Forquilha, 22º21'40.5"S 46º35'28.2"W Armadilha Malaise 5 (1017m), 17.ix.2010, 11.ii.2010 I. F. Melo col.; 3 ♀ (DCBU 145510, 144340, 145511) Conceição do Mato Dentro, S. Serpentina, 19.02495ºS 43.39019ºW, Canga Área 2, 17-27.iv.2011, 18-28.iii.2009 RR Silva & EZ Albuquerque cols.; 21 ♀ (DCBU 144790, 144793, 144792, 143640, 148507, 143001, 142971, 146938, 146936, 46012, 102593, 102614, 102616, 102649, 46027, 46003, 64044, 59693, 155314, MZSP) Timóteo, Parque Estadual do Rio Doce, 19º39'28.3"S 42º34'22.5"W, Armadilha Malaise, many dates, A. J. Santos col.; 1 ♀ (INPA) **Paraná**, Castro, Pq. Est. do Guartelá, -24.33455 S, -50.1532 W, 1000m, 10.xi.2007 - Malaise J. Rafael & P G. Rossi; 2 ♀ (MZSP) Colombo Canguiri, 910 m, 25º22’44.65”S 49º07’53.30”W, i-iii.2015, Malaise M.Savaris & S.Lampert cols.; 2 ♀ (DCBU 122201, 122200) **Rio de Janeiro**, Casemiro de Abreu, Reserva Biológica União, 22º24'31"S 42º01'54"W, Varredura - ponto 5 (55m), 13.xii.2010, R. F. Monteiro

col.; 1 ♀ (DCBU 110582) Itatiaia, PARNA [Parque Nacional] de Itatiaia, 22º26'16.8"S 44º36'41.4"W, Armadilha Malaise 2 - 987m, 8 xi.2011, R. F. Monteiro col.; 1 ♀ (DCBU 213288) Teresópolis Parque Nacional da Serra dos Orgãos, 22º29'37"S 43º00'07"W, Armadilha Malaise 01 (419m), 03.xi.2009, R. F. Monteiro col.; 1 ♀ (MZSP) **São Paulo**, Assis, ESEC de Assis, 22º36'44.5"S 50º22'43.8"W, Armadilha Malaise 01, 26.ii.2009, A. S. Soares col.; 4 ♀ (MZSP) Bertioga, P[arque] Est[adual] Restinga de Bertioga Trilha Cachoeira, Malaise, 23º45'15"S 45º55'46"W/3º45'35"S 45º56'10"W 21.xi.2012 - 5.i.2013, Biffi, Cesar & Fuhrmann col.; 14 ♀ (DCBU, MZSP) Campos do Jordão, Usina Santa Izabel, 22º44'S 45º30'W, Malaise (1000 m), many dates, S.A.G. Gomes & eq col.;1 ♀ (DCBU 199823) Descalvado, Faz. Itaúras, Malaise 3-15.xii.2000; 2 ♀ (DCBU 82727, 42708) Descalvado Mata-mesófila, malaise, 09.x.1999 08.i.2000.; 6 ♀ (DCBU 110406, 98176, 70995, 98059, 56047, 80342) Descalvado, Fazenda Escaramuça-Mata ciliar, 21º 54' 05" S 47º 37' 26" W, Armadilha Malaise (654m) 04.ii.2009, A. M. Penteado-Dias col.; 2 ♀ (DCBU 45940, 49406) Jaboticabal, UNESP - Horto Florestal, 21º14'08"S 48º17'04"W, Armadilha Malaise (677m), 11.xii.2008, Araújo col.; 2 ♀ (DCBU 64191, 79250) Jundiaí, Reserva Biológica da Serra do Japi, Sub-Bosque/ Eucalipto, 23º14'14.4"S 46º53'33.1"W, Armadilha Malaise 3, 22.XII.2009 /26.vi.2012, A. S. Soares & C. Vilela cols.; 23 ♀ (DCBU 18528, 65632, 65663, 65681, 65688, 66008, 102691, 116488, 191628, 193723, 193726, 193727, 198772-198777, 198784, 198793, 198795, 215295, 215298) Luís Antônio, Est. Ecológica de Jatai 21º35'44.8"S 47º48'10.7"W armadilha malaise, many dates and collectors.; 1 ♀ (DCBU 206915) Matão,Fazenda Cambuhy - mata ciliar (elev. 529m) 21º37'37.8"S 48º32'11.1"W, 07.v.2009.; 1 ♀ (DCBU 206913) Nazaré Paulista, 12-16.viii.2001, B. H, Dietz.; 1 ♀ (DCBU) Pico do Jaraguá, 27.ix.1988, R.L.C. Baptista & A.P. Chaves, col.; 6 ♀ (DCBU, MZSP) Ribeirão Grande, Parque Estadual de Intervales, 24º16'23.6"S 48º25'21.8"W, Armadilha Malaise 5, many dates N.W. Perioto e eq. cols; 6 ♀ (DCBU) Rio Claro, Floresta Estadual de RIo Claro, 22º24 ' 39.5"S 47º 30' 59.6"W, 657m, Armadilha Malaise 5, 30.xi.2009/ 22.xi.2009 A. S. Soares col.; 2 ♀ (DCBU 183723, 110430) Salesópolis, Est[ação] Biol[ógia de] Boracéia, Malaise; 8 ♀ (DCBU 130374, 228095, 228087, 216769, 228086, 216778, 216770, 194891) São Carlos, Fazenda Canchim - EMBRAPA Mata sede 21º57'56"S 47º50'37"W Malaise 1 (830m), 03.vii.1995, L.A. Joaquim col.; 6 ♀ (DCBU 194889, 228113, 228081, 228080, 212100, 212088) São Carlos, UFScar - Bosque, 21º59' 04"S 47º52'51"W, Armadilha Malaise, 17.iv.2007, E.

M. Shimbori col.; 2 ♀ (DCBU 216796, 216793) São Luiz do Paratinga, PESM - Núcleo Santa Virgínia, 23º19'17.9"S 45º5'42.9"W, Armadilha Malaise 04, 23.xi.2009, N. W. Perioto e eq. cols.; 21 ♀ (APTA, DCBU) Teodoro Sampaio, Parque Estadual do Morro do Diabo, 22º36' 18.4"S 52º18'10.2"W, Armadilha Malaise 05 (414m), many dates, N. W. Perioto e eq. cols.; 12 ♀ (DCBU, MZSP) Ubatuba, PESM - Núcleo Picinguaba, Armadilha Malaise 2, many dates, N.W.Perioto e equipe col/ E.F. Santos & C Scott-Santos.

3.14. *Charops* sp. n. D

(Figures 13A–H, 22)

Diagnosis. supraclypeal area subquadrate; width of supraclypeal area 0.91x the size of height of supraclypeal area; antenna with 33–34 flagellomeres; propodeum with strong transverse wrinkles on petiolar area; median longitudinal carina of propodeum complete; scape black with a thin pale-yellow line on its apex; pedicel black; hind legs mostly black with dark yellow trochantellus and anterior part of tibia.

Holotype female. Forewing 4.0 cm. *Head*. Densely punctuated and covered with hairs; lateral height of head 0.89x the size of mesopleuron; mandibles short and stout, apex 0.80x as wide as base and the upper tooth broader than the lower tooth; malar space 0.52x as long as basal width of mandible; inner margin of eyes parallel near clypeus; supraclypeal area subquadrate; width of supraclypeal area 0.91x the size of height of supraclypeal area; lateral ocellus separated from eye by 0.2x its own diameter; interocelar distance 1x the diameter of lateral ocelli; interocelar area with sparse small hairs; antenna with 34 flagellomeres; width of first flagellomere 4.8x its height; height of second flagellomere 0.61x the height of first flagellomere; last flagellomere cone shaped with a rounded apex, occipital area slightly imbricate.

Mesosoma. Pronotum dorsolaterally imbricate, laterally and ventrolaterally polished with transverse wrinkles; epomia present almost reaching the base of mesoscutum; mesoscutum finely punctate; scutellum and post scutellum densely covered with hairs; mesopleuron dorsolaterally foveolate with strong transverse wrinkles and sparse covered with hairs; hypoepimeron denudate with transverse wrinkles; epicnemial carina present, reaching only basal part of mesopleuron; mesopleuron ventrally foveolate without wrinkles and sparse hairs; sternaulus absent;

posterior transverse carina of mesosternum straight not produced near the coxae area; metapleuron punctuate and with its posterior part densely covered with hairs; juxtacoxal carinae complete and strong impressed with perpendicular carinae absent or vestigial; juxtacoxal area imbricate; pleural carinae complete; spiracle elliptical with its width 0.5x the spiracle height; propodeum hairy and foveolate; strong transverse wrinkles on petiolar area; areola and basal area with vestigial wrinkles; lateral longitudinal carina of propodeum incomplete not reaching propodeum neck; median longitudinal carina of propodeum complete; propodeum neck 0.69x the size of hind coxae.

Legs. Fore legs coxae with a slim lateral carinae; t1 0.69 x the size of remaining tarsomeres; mid legs with t1 0.83x the the size of remaining tarsomeres; hind legs with t1 0.77x the remaining tarsomeres.

Wings. Hyaline and covered with small hairs; forewing vein 1cu-a arising after of 1M+Rs; vein 3/Cu placed at midlenght of 2/Cu and crossvein 2cu-a; vein 1/Rs+M curved; bulla of 1/Rs+M placed after its midlength near 2/M; 2/RS 0.41 as long as 2/M; bulla of 2m-cu placed near 2/M 0.33x the distance between the bula and 4/Cu vein; hind wing vein 1-Rs forming a curve with 1r-m angle; hind wing with 5 hamuli.

Metasoma. Tergites imbricate; first tergite with sparse hairs, first sternite glabrous with subpetiolar process conspicuous; tergite 2 0.84x the length of tergite 1; remaining tergites and sternites finely punctuate covered with small hairs; thyridium elliptical almost rounded rectangular; ovipositor sheath covered with long hairs; ovipositor straight with 0.98mm; ovipositor notch not deep, distant from apex 0.19x the size of ovipositor; ovipositor notch angle 99.76º; ovipositor ventral valve with a lobe near apex.

Color. Pubescence silver. *Head*: black; palpi pale-yellow; mandibles pale-yellow with brown teeth; ocelli brown; antenna dark brown, scape black with a thin pale-yellow line on its apex; pedicel black. *Mesosoma*: black; tegula and fore legs pale-yellow with t5 brown; mid legs with brown and pale-yellow coxae, trochanter and t4 pale-yellow, t5 brown; hind legs mostly black with dark yellow trochantellus and anterior part of tibia. *Metasoma*: first segment with anterior part dark brown, mid part dark yellow and postpeciole brown, slightly darker posteriorly; tergite 2 dorsally dark brown and ventrally light brown, thyridium brown; sternite 2 light brown; remaining tergites dorsally

black and ventrally brown; remaining sternites pale-yellow with black marks; ovipositor sheaths and cerci black, ovipositor brown.

Variation. Forewing 3.2 to 4.2 mm; mandibles apex 0.71–1.0x as wide as base; malar space 0.45–0.56x as long as basal width of mandible; width of supraclypeal area 0.91–1.04x the size of height of supraclypeal area; lateral ocellus separated from eye by 0.2–0.33x its own diameter; interocelar distance 0.70–1.07x the diameter of lateral ocelli; antenna with 33–34 flagellomeres; width of first flagellomere 4–5x its height; height of second flagellomere 0.52–0.68x the height of first flagellomere; spiracle width 0.44–0.55x the spiracle height; propodeum neck 0.66–0.84x the size of hind coxae; fore legs t1 0.69–0.79x the size of remaining tarsomeres; mid legs with t1 0.71–0.87x the the size of remaining tarsomeres; hind legs with t1 0.73–0.85x the remaining; 2/RS 0.41–0.57 as long as 2/M; bulla of 2m-cu placed near 2/M 3.5–4.2x the distance between the bula and 4/Cu vein; tergite 2 0.78–0.86x the length of tergite ovipositor with 0.98–1.22mm; ovipositor notch, distant from apex 0.17–0.22x the size of ovipositor; ovipositor notch angle 86º–110º.

Male: Very similar to female, except by the following: lateral height of head 0.82–0.88x the size of mesopleuron; mandibular apex 0.71–1.0x as wide as base; malar space 0.4–0.6x as long as basal width of mandible; width of supraclypeal area 0.85–1.11x the size of height of supraclypeal area; spiracle width 0.45–0.6x the spiracle height; propodeum neck 0.65–0.78x the size of hind coxae; fore t1 0.65–0.78x the size of remaining tarsomeres; mid t1 0.74–0.9x the size of remaining tarsomeres; hind t1 0.73–0.84x the size of remaining tarsomeres; tergite 2 0.67–0.85x the length of tergite 1; 2/RS 0.41–0.66x the size of 2/M; hind legs with t2–t4 or t3–t4 pale-yellow; metasomal tergites 1–2 and 5–8 darker the female; gonoforceps and cercus also black.

Biology: Erinnyis ello (Linnaeus, 1758), attracted to light.

Comments: Very similar to *Charops* sp. n. E, from which it can be differentiated by the black pedicel (Vs pedicel mostly black with a pale-yellow mark) and black hind tarsomeres (Vs hind t2 to t4 pale-yellow). Also, *Charops* sp. n. E has relatively more complete wrinkles on the propodeum. *Charops* sp. n. D is similar to C. sp. n. F from which it can be differentiated by the black hind tarsomeres (Vs hind t2 to t4 pale-yellow), median longitudinal carina of propodeum complete (Vs median longitudinal

carina of propodeum incomplete) and propodeum with complete wrinkles (Vs and propodeum without complete wrinkles).

Material examined: Holotype: ♀ (APTA), **BRASIL: São Paulo**, Luís Antônio, Estação. Ecológica de Jatai, Mata Ciliar, Arm. Luminosa, 21º36'47"S, 47º49'04"W Ponto 1/2, 27.v.2009. R.I.R Lara & Equipe col. *Paratypes*: 39 ♀ 14 ♂ 1? (APTA) same data as holotype except 01.iv.2009, 12.xi.2008, 13.viii.2008, 14.x.2008, 17.ix.2008, 18.vi.2008, 2.ix.2009, 23.xii.2008, 25.xi.2009, 26.iii.2008, 27.v.2009, 28.i.2009, 28.ii.2009, 7.v.2008, 9.vi.2008.

3.15. *Charops* sp. n. E

(Figures 14A–H, 20)

Diagnosis. malar space 0.45x as long as basal width of mandible; width of supraclypeal area 01.11x the size of height of supraclypeal area; antenna with 35 flagellomeres; propodeum with its petiolar area with complete wrinkles; areola and basal area reticulate with vestigial wrinkles; median longitudinal carina of propodeum complete; scape black with a thin brown line on its apex; pedicel black, with a pale-yellow mark; hind legs mostly black with t2 to t4 pale-yellow.

Holotype female. Forewing 4.2 mm. *Head*. Densely punctuated and covered with hairs; lateral height of head 0.84x the size of mesopleuron; mandibles short and stout, apex 0.83x as wide as base and the upper tooth broader than the lower tooth; malar space 0.45x as long as basal width of mandible; inner margin of eyes parallel near clypeus; supraclypeal area subquadrate, width of supraclypeal area 01.11x the size of height of supraclypeal area; lateral ocellus separated from eye by 0.23x its own diameter; interocelar distance 0.92x the diameter of lateral ocelli; interocelar area with sparse small hairs; antenna with 35 flagellomeres; width of first flagellomere 4.11x its height; height of second flagellomere 0.62x the height of first flagellomere; last flagellomere cone shaped with a rounded apex, occipital area slightly imbricate.

Mesosoma. Pronotum dorsolaterally imbricate, laterally and ventrolaterally polished with transverse wrinkles; epomia present reaching the base of mesoscutum; mesoscutum finely punctate; scutellum and post scutellum densely covered with hairs; mesopleuron dorsolaterally reticulate with weak complete wrinkles and covered with

hairs; hypoepimeron denudate with weak wrinkles; epicnemial carina present, reaching posterior part of pronotum; mesopleuron ventrally foveolate without wrinkles and covered with hairs; sternaulus absent; posterior transverse carina of mesosternum forming two small teeth produced near the coxae area; metapleuron punctuate and covered with hairs with its anterior part densely covered with hairs; juxtacoxal carinae weak and complete with perpendicular carinae absent; juxtacoxal area reticulate; pleural carinae complete; spiracle elliptical with its width 0.33x the spiracle height; propodeum covered with sparse hairs and reticulose; petiolar area with complete wrinkles; areola and basal area reticulate with vestigial wrinkles; lateral longitudinal carina of propodeum incomplete not reaching propodeum neck; median longitudinal carina of propodeum complete; propodeum neck 0.71x the size of hind coxae.

Legs. Fore legs with; t1 0.74x the size of remaining tarsomeres; mid legs with t1 0.68x the size of remaining tarsomeres; hind legs with t1 0.77x the size of remaining tarsomeres; tarsal claws pectinate from base to center.

Wings. Hyaline and covered with small hairs; forewing vein 1cu-a arising below 1M+Rs; vein 2/Cu 1.18x the size of 2cu-a; vein 1/Rs+M curved; 2/RS 1.12x the size of 2/M; bulla of 2m-cu placed near 2/M by 0.3x its distance of 4/cu; hind wing vein 1-Rs forming a curve with 1r-m angle; hind wing with 5 hamuli.

Metasoma. Tergites imbricate; first tergite with sparse hair, first sternite glabrous with subpetiolar process inconspicuous; tergite 2 0.76x the length of tergite 1; remaining tergites and sternites punctuate covered with small hairs; thyridium elliptical; ovipositor sheath covered with long hairs; ovipositor straight with 1.11mm; ovipositor notch distant from apex 0.21x the size of ovipositor; ovipositor notch angle 88º; ovipositor ventral almost straight near apex; ovipositor ventral valve with a lobe near apex.

Color. Pubescence silver. *Head*: black; palpi pale-yellow; mandibles pale-yellow with brown teeth; occeli pale brown; antenna dark brown, scape black with a thin brown line on its apex; pedicel black, with a pale-yellow mark. *Mesosoma*: black; tegula pale-yellow, fore and mid legs pale-yellow with t5 black; hind legs mostly black with pale-yellow trochantellus, t2 to t4 pale-yellow, t5 black. *Metasoma*: first segment with pale-yellow sternite and dark brown; tergite 2 black, thyridium brown; remaining tergites

dorsally black and ventrally brown; remaining sternites pale-yellow with black marks; ovipositor sheaths and cerci black, ovipositor pale-yellow.

Variation: Forewing 3.4–4.2mm; lateral height of head 0.82–0.87x the size of mesopleuron; mandibles apex 0.83–0.95x as wide as base; malar space 0.45–0.5.5x as long as basal width of mandible; width of supraclypeal area 0.91–1.11x the size of height of supraclypeal area; lateral ocellus separated from eye by 0.21–0.27x its own diameter; interocelar distance 0.87–92x the diameter of lateral ocelli; width of first flagellomere 3.75–4.37x its height; height of second flagellomere 0.6–0.66x the height of first flagellomere; spiracle elliptical with its width 0.33–0.45x the spiracle height; propodeum neck 0.71–0.85x the size of hind coxae; fore legs with; t1 0.73–0.76x the size of remaining tarsomeres; mid legs with t1 0.68–0.82x the size of remaining tarsomeres; hind legs with t1 0.70–0.79x the size of remaining tarsomeres*;* vein 2/Cu 1–1.27x the size of 2cu-a; 2/RS 0.7–1.3x the size of 2/M; bulla of 2m-cu placed near 2/M by 0.18–0.27x its distance of 4/cu; tergite 2 0.71–0.83x the length of tergite 1.

Biology: Oxydia vesulia (Cramer, 1779) (Fernandes *et al.*, 2010)

Comments: Male of this species remains unknown. The proximity between this species and *Charops* sp. n. D has already commented above. *Charops* sp. n. E is very similar to *Charops* sp. n. F from which it can be differentiated by the median longitudinal carina of the propodeum complete (Vs median longitudinal carina of propodeum incomplete) and propodeum with complete wrinkles (Vs and propodeum without complete wrinkles).

Material examined: Holotype: ♀ (DCBU) **Brasil: São Paulo**, Matão, Cambuhy Farm (elev. 575m) 21º37’21.66”S 48º31’49.58”W, 17.vii.2000 reared from Oxydia vesulia (Geometridae). *Paratypes*: 1♀ 1? (DCBU) same data as holotype except 25.ii.2000, pupa encontrada em Croton floribundus.;1 ♀ (DCBU 191354) Luís Antônio, Est. Ecológica de Jatai, 21º35’46”S, 47º48’19,3”W, Armadilha Malaise ponto 1 - 600m, 30.ix.2008, A.S. Soares col.; 1 ♀ (MZSP) **Mato Grosso do Sul**, Aquidauana, Res[erva] Ecol[ógica] UEMS vegetação Aberta, Flor[esta] Est[acional] Decidual, 20º25'59.0"S 55º39'20.8"W 11 - 26 ix.2012, Malaise 8, Lamas, Nihei & eq. col.; 13 ♀ (DCBU 71346, 85563, 86006, 71370, 66800, 66812, 71767, 71766, 71358, 71357, 71262, 71261, 66738) **Piauí**, Piracuruca Parque Nacional das Sete Cidades,

04º04'27"S 41º42'22"W, Armadilha Malaise 01, 23.iv.2013, Caatinga, C. R. Araújo e eq. cols.

3.16. *Charops* sp. n. F

(Figures 15A–H, 22)

Diagnosis. supraclypeal area subquadrate; width of supraclypeal area 0.97–1.06x the size of height of supraclypeal area; juxtacoxal carinae weak and complete; propodeum without wrinkles; median longitudinal carina of propodeum incomplete reaching only basal area and areola.

Holotype female. Forewing 3.85 mm. *Head*. Densely punctuated and covered with hairs; lateral height of head 0.93x the size of mesopleuron; mandibles short and stout, apex 0.8x as wide as base and the upper tooth broader than the lower tooth; malar space 0.64x as long as basal width of mandible; inner margin of eyes parallel near clypeus; supraclypeal area subquadrate; width of supraclypeal area 0.97x the size of height of supraclypeal area; lateral ocellus separated from eye by 0.30x its own diameter; interocelar distance 0.92x the diameter of lateral ocelli; interocelar area with sparse small hairs; antenna with 32 flagellomeres; width of first flagellomere 4.8x its height; height of second flagellomere 0.61x the height of first flagellomere; last flagellomere cone shaped with a rounded apex, occipital area slightly imbricate.

Mesosoma. Pronotum dorsolaterally imbricate, laterally and ventrolaterally polished with transverse wrinkles; epomia present reaching the base of mesoscutum; mesoscutum finely punctate; scutellum and post scutellum densely covered with hairs; mesopleuron dorsolaterally reticulate with weak incomplete wrinkles and covered with hairs; hypoepimeron denudate, reticulate; epicnemial carina present, reaching only basal part of mesopleuron; mesopleuron ventrally foveolate without wrinkles and covered with hairs; sternaulus absent; posterior transverse carina of mesosternum forming small two teeth produced near the coxae area; metapleuron punctuate and covered with hairs with its posterior part densely covered with hairs; juxtacoxal carinae weak and complete with perpendicular carinae absent or vestigial; juxtacoxal area reticulate; pleural carinae complete; spiracle elliptical with its width 0.54x the spiracle height; propodeum covered with sparse hairs and reticulose; petiolar area with weak

wrinkles; areola and basal area reticulate without wrinkles; lateral longitudinal carina of propodeum incomplete not reaching propodeum neck; median longitudinal carina of propodeum incomplete reaching only basal area and areola; lateral longitudinal carina of propodeum incomplete starting from the propodeum neck and ending on the posterior transverse carina of propodeum; propodeum neck 0.73x the size of hind coxae.

Legs. Fore legs with; t1 0.70x the size of remaining tarsomeres; mid legs with t1 0.66x the size of remaining tarsomeres; hind legs with t1 0.77x the size of remaining tarsomeres.

Wings. Hyaline and covered with small hairs; forewing vein 1cu-a arising below 1M+Rs; vein 3/Cu placed at midlenght of 2/Cu and crossvein 2cu-a; vein 1/Rs+M curved; 2/RS small 0.64x the size of 2/M; bulla of 2m-cu placed near 2/M by 0.22x its distance of 4/cu; hind wing vein 1-Rs forming a curve with 1r-m angle; hind wing with 5 hamuli.

Metasoma. Tergites imbricate; first tergite with sparse hair, first sternite glabrous with subpetiolar process inconspicuous; tergite 2 0.76x the length of tergite 1; remaining tergites and sternites punctuate covered with small hairs; thyridium elliptical; ovipositor sheath covered with long hairs; ovipositor straight with 0.94mm; ovipositor notch distant from apex 0.23x the size of ovipositor; ovipositor notch angle 76º; ovipositor ventral almost straight near apex; ovipositor ventral valve with a lobe near apex.

Color. Pubescence silver. *Head*: black; palpi pale-yellow; mandibles pale-yellow with brown teeth; occeli pale brown; antenna dark brown, scape black with a thin brown line on its apex; pedicel black. *Mesosoma*: black; tegula and fore legs pale-yellow with t5 black; mid legs with brown and pale-yellow coxae, trochanter t4 pale-yellow, t5 black; hind legs mostly black with dark yellow trochantellus, t2 to t4 whitte, t5 black. *Metasoma*: first segment with light brown sternite and black tergite; tergite 2 black, thyridium brown; remaining tergites dorsally black and ventrally brown; remaining sternites pale-yellow with black marks; ovipositor sheaths and cerci black, ovipositor brown.

Variation: Forewing 3.85–4.3mm; lateral height of head 0.88–0.93x the size of mesopleuron; mandibles apex 0.72–0.8x as wide as base; malar space 0.64–0.68x as

long as basal width of mandible; width of supraclypeal area 0.97–1.06x the size of height of supraclypeal area; lateral ocellus separated from eye by 0.28–0.30x its own diameter; interocelar distance 0.87–92x the diameter of lateral ocelli; spiracle elliptical with its width 0.41–0.54x the spiracle height; propodeum neck 0.69–0.73x the size of hind coxae; fore legs with; t1 0.63–0.70x the size of remaining tarsomeres; mid legs with t1 0.73–0.66x the size of remaining tarsomeres; hind legs with t1 0.72–0.77x the size of remaining tarsomeres*;* 2/RS small 0.40–0.64x the size of 2/M; bulla of 2m-cu placed near 2/M by 0.22–0.25x its distance of 4/cu; tergite 2 0.76–0.79x the length of tergite 1; ovipositor with 0.94–1.13mm; ovipositor notch distant from apex 0.23–0.24x the size of ovipositor.

Biology: Host unknow.

Comments: male of this species remains unknown. *Charops* sp. n. F is similar to C. sp. n. D from which it can be differentiated by hind t2 to t4 pale-yellow (Vs the black hind tarsomeres), median longitudinal carina of propodeum incomplete (Vs median longitudinal carina of propodeum complete) and propodeum without complete wrinkles (Vs propodeum with complete wrinkles).

Material examined: Holotype: ♀ (MZSP 52018), **BRASIL: Mato Grosso do Sul**: Bodoquena, Faz. California (Ciliar) 20º41'49.9"S 56º52'54"W, 21.vii-06. viii.2012 Malaise 04, Lamas, Nihei & eq. cols. *Paratype*: ♀ (MZSP?), Brasil: MS: Aquidauana, Res Eco UEMS vegetação Fechada, Floresta Estacional Decidual, 20º26'03.7"S 55º39'20.8"W 26.vii-11. viii.2012, Malaise 7 Lamas, Nihei & eq. Col.

3.17. *Charops* sp. n. G

(Figures 16A–H, 22)

Diagnosis. inner margin of eyes parallel near clypeus; supraclypeal area subquadrate width of supraclypeal area 1.08x the size of height of supraclypeal area; antenna with 42 flagellomeres; juxtacoxal carinae complete with perpendicular carinae absent or vestigial; median longitudinal carina of propodeum faint and incomplete, not reaching postscutellum; body black except for palpi, fore, mid legs and ovipositor.

Holotype female. Forewing 6 mm. *Head*. Densely punctuated and covered with hairs; lateral height of head 0.83x the size of mesopleuron; mandibles short and stout,

apex 0.78x as wide as base and the upper tooth broader than the lower tooth; malar space 0.57x as long as basal width of mandible; inner margin of eyes parallel near clypeus; supraclypeal area subquadrate; width of supraclypeal area 1.08x the size of height of supraclypeal area; lateral ocellus separated from eye by 0.37x its own diameter; interocelar distance 0.72x the diameter of lateral ocelli; interocelar area with sparse small hairs; antenna with 42 flagellomeres; width of first flagellomere 4.4x its height; height of second flagellomere 0.49x the height of first flagellomere; last flagellomere cone shaped with a rounded apex, occipital area slightly imbricate.

Mesosoma. Pronotum reticulate, ventrolaterally with transverse wrinkles; epomia present reaching the base of mesoscutum; mesoscutum punctate; scutellum and post scutellum densely covered with hairs; mesopleuron dorsolaterally reticulate with weak incomplete wrinkles and covered with hairs; hypoepimeron denudate with weak wrinkles; epicnemial carina present, reaching only basal part of mesopleuron; mesopleuron ventrally foveolate without wrinkles and covered with hairs; sternaulus absent; posterior transverse carina of mesosternum forming two teeth produced near the coxae area; metapleuron punctuate and covered with hairs with its posterior part densely covered with hairs; juxtacoxal carinae complete with perpendicular carinae absent or vestigial; juxtacoxal area reticulate; pleural carinae complete; spiracle elliptical with its width 0.38x the spiracle height; propodeum hairy and reticulose; petiolar area, areola and basal area reticulate without wrinkles; lateral longitudinal carina of propodeum incomplete starting from the propodeum neck and ending on the posterior transverse carina of propodeum; median longitudinal carina of propodeum incomplete, not reaching postscutellum and weak on its basal area; propodeum neck 0.75x the size of hind coxae.

Legs. Fore legs with; t1 0.71x the size of remaining tarsomeres; mid coxae with several wrinkles on dorsal view; mid legs with mid t1 0.84x the size of remaining tarsomeres; hind legs with t1 0.86x the size of remaining tarsomeres.

Wings. Hyaline and covered with small hairs; forewing vein 1cu-a arising after of 1M+Rs; vein 3/Cu placed at midlenght of 2/Cu and crossvein 2cu-a; vein 1/Rs+M curved; bulla of 1/Rs+M placed after its midlength near 2/M; 2/RS small 0.63x the size of 2/M; bulla of 2m-cu placed near 2/M by 0.4x its distance of 4/cu; hind wing vein 1-Rs forming a curve with 1r-m angle; hind wing with 5 hamuli.

Metasoma. Tergites imbricate; first tergite with sparse hair, first sternite glabrous with subpetiolar process inconspicuous; tergite 2 0.74x the length of tergite 1; remaining tergites and sternites punctuate covered with small hairs; thyridium elliptical almost rounded rectangular; ovipositor sheath covered with long hairs; ovipositor straight with 1.22mm; ovipositor notch distant from apex 0.32x the size of ovipositor; ovipositor notch angle 101º; ovipositor ventral valve without a lobe near apex.

Color. Pubescence gold. *Head* black palpi pale-yellow; mandibles black with mandible flange yellowish black; occeli reddish brown; antenna black; scape black with a thin brown line on its apex; pedicel black. *Mesosoma*: black; fore legs with black coxae; pale-yellow between trochanter and t4; t5 black; mid legs with black coxae, trochanter and trochantellus pale-yellow; femur pale-yellow with ventral black mark, tibia pale-yellow with sparse black setae and a transverse row of black setae near its apex; t1 pale-yellow, t2 to t4 pale brown with black marks; t5 entire black; hind legs entire black between coxae to half of t1; lower half of t1 to t4 pale-yellow; t5 black. *Metasoma*: entire black except for yellowish inferior edges of the tergites and reddish-brown ovipositor.

Comments: male unknown.

Material examined: Holotype: ♀ (DCBU 119805), **BRASIL: São Paulo**: Ribeirão Grande, Parque Estadual de Intervales, 24º16'28"S 48º25'14.8"W, Armadilha Malaise, 20.xii.2010, N. W. Perioto e eq cols.

3.18. *Charops* sp. n. H

(Figures 17A–H, 23)

Diagnosis. Forewing 5.9–7.1 mm; antenna with 46–47 flagellomeres; juxtacoxal carinae complete with first perpendicular carinae vestigial, second, third and fourth perpendicular carinae present, reaching pleural carina; ovipositor upcurved.

Holotype female. Forewing 6.8 mm. *Head*. Densely punctuated and covered with hairs; lateral height of head 0.74x the size of mesopleuron; mandibles short and stout, apex 0.72x as wide as base and the upper tooth broader than the lower tooth; malar space 0.44x as long as basal width of mandible; inner margin of eyes parallel near clypeus; supraclypeal area subquadrate; width of supraclypeal area 0.94x the size of

height of supraclypeal area; lateral ocellus separated from eye by 0.43x its own diameter; interocelar distance 0.88x the diameter of lateral ocelli; interocelar area with sparse small hairs; antenna with 47 flagellomeres; width of first flagellomere 3.5x its height; height of second flagellomere 0.60x the height of first flagellomere; last flagellomere cone shaped with a rounded apex, occipital area slightly imbricate.

Mesosoma. Pronotum dorsolaterally imbricate, laterally and ventrolaterally polished with transverse wrinkles; epomia present reaching the base of mesoscutum; mesoscutum punctate; scutellum and post scutellum densely covered with hairs; mesopleuron dorsolaterally reticulate several complete wrinkles and covered with hairs; hypoepimeron denudate with strong wrinkles; epicnemial carina present, reaching the posterior part of pronotum; mesopleuron ventrally foveolate without wrinkles and covered with hairs; sternaulus absent; posterior transverse carina of mesosternum forming two conspicuous teeth produced near the coxae; metapleuron punctuate and covered with hairs with its posterior part densely covered with hairs; juxtacoxal carinae complete with first perpendicular carinae vestigial, second, third and fourth perpendicular carinae present, reaching pleural carina; juxtacoxal area reticulate; pleural carinae complete; spiracle elliptical with its width 0.47x the spiracle height; propodeum hairy and reticulose; petiolar area, areola and basal area with vestigial wrinkles; lateral longitudinal carina of propodeum incomplete not reaching propodeum neck; median longitudinal carina of propodeum complete; propodeum neck 0.96x the size of hind coxae.

Legs. Fore legs coxae with a slim lateral carinae; t1 0.73x the size of remaining tarsomeres; mid legs with t1 0.75x the size of remaining tarsomeres; hind legs with t1 0.83x the remaining tarsomeres.

Wings. Hyaline and covered with small hairs; forewing vein 1cu-a arising after of 1M+Rs; vein 3/Cu placed near 2/Cu; vein 1/Rs+M curved; bulla of 1/Rs+M placed after its midlength near 2/M; 2/RS 0.40x as long as 2/M; bulla of 2m-cu placed near 2/M 0.46x the distance between the bula and 4/Cu vein; hind wing vein 1-Rs forming a curve with 1r-m angle; hind wing with 5 hamuli.

Metasoma. Tergites imbricate; first tergite with sparse hairs, first sternite glabrous with subpetiolar process inconspicuous; tergite 2 0.89x the length of tergite 1; remaining tergites and sternites finely punctuate covered with small hairs; thyridium

rounded; ovipositor sheath covered with long hairs; ovipositor upcurved with 2.02 mm; ovipositor notch not deep, distant from apex 0.16 x the size of ovipositor; ovipositor notch angle 52º; ovipositor ventral valve with a lobe near apex.

Color. Pubescence golden. *Head*: black; palpi pale-yellow; mandibles pale-yellow with brown teeth; ocelli orange brown; antenna dark brown, scape and pedicel bicolor, anteriorly yellow and posteriorly brown. *Mesosoma*: black; tegula and fore and mid legs pale-yellow with t5 brown; mid legs with brown and pale-yellow coxae, trochanter and t4 pale-yellow, t5 brown; hind legs coxae black with dark yellow trochanter and trochantellus femur with dorsal part dark brown and ventral part orange brown, tibia to t5 dark brown, tibial spurs dark yellow *Metasoma*: first sternite light brown; first tergite orange brown ; tergite 2 dorsally black and ventrally orange brown with a distinct black stripe on its posterior part, thyridium pale brown; sternite 2 dark yellow; remaining tergites dorsally black and ventrally orange brown; remaining sternites dark-yellow; ovipositor sheaths and cerci black, ovipositor reddish brown.

Variation: Forewing 5.9–7.1 mm. Lateral height of head 0.70–0.84x the size of mesopleuron; mandibular apex 0.72–0.90x as wide as base; malar space 0.4–0.61x as long as basal width of mandible; width of supraclypeal area 0.80–1.17x the size of height of supraclypeal area; lateral ocellus separated from eye by 0.43–0.78x its own diameter; interocelar distance 0.73–0.88x the diameter of lateral ocelli; antenna with 46–47 flagellomeres; width of first flagellomere 3.25–4.3x its height; height of second flagellomere 0.53–0.64x the height of first flagellomere; spiracle width 0.42–0.58x the spiracle height; propodeum neck 0.81–1.01x the size of hind coxae. t1 0.69–0.82x the size of remaining tarsomeres; mid legs with t1 0.71–0.80x the size of remaining tarsomeres; hind legs with t1 0.64–0.94x the remaining tarsomeres; 2/RS 0.36–0.62x as long as 2/M; bulla of 2m-cu placed near 2/M 0.46x the distance between the bula and 4/Cu vein; tergite 2 0.89x the length of tergite 1; ovipositor size 1.22–2.48 mm; ovipositor notch not deep, distant from apex 0.16–0.28x the size of ovipositor; ovipositor notch angle A 52–75º; mid coxae color vary between pale yellow to black, hind legs also vary between orange brown and dark brown.

Biology: Host unknow.

Comments: Male unknown. Very similar to *Charops* sp. n. I from which it can be differentiated by ovipositor upcurved (Vs ovipositor straight) and hind tarsomeres black (Vs hind t2 to t4 pale-yellow).

Material examined: Holotype: ♀ (DCBU 262238), **BRASIL: Pará**, Jacareacanga, Pousada Thaimaçu - Mata, 09º03'21"S 56º35'09"W, Armadilha Malaise (164m) 19.ix.2015 - Rio São Benedito, M. M. B. Lutz & J. C. M. Lutz cols. *Paratypes*: 1 ♀ (DCBU 262263), same data as holotype; 1 ♀ (DCBU 262291), same data as holotype except 09º02'47"S 56º35'16"W,15.ii-26.iii.2016; 1 ♀ (DCBU 199825), **Acre**: Porto Velho, EMBRAPA - Remanescente florestal, 10º01'42.8"S 67º40' 57.3"W, Armadilha Malaise 1 - 167m 24.viii.2016, E. N. Silva e equipe cols; 1 ♀ (INPA), **Amazonas**, Barcelos, Rio Demeni Pirico, 00º19'30"S 62º47'21"W. Armadiha Malaise em Igarapé, viii.2008, A. Silva & R. Machado col; 1 ♀ (MZSP 21064), **Ceará**, Crateus, Serra das Almas- Grajau, 05º07'05"S 40º52'25"W, 03-08.vi.2009, Brandão & Eq col; 1 ♀ (DCBU 140059) **Minas Gerais**: Sete Lagoas , Embrapa Milho e Sorgo, 19º25'27.1"S 44º8'59"W, Armadilha Malaise - 704m, 25.i - 04.ii.2011, I. Cruz col; 1 ♀ (DCBU) same data except 27.iii-10.iv.2000; 1 ♀ (DCBU) same data except 28.ii-13.iii. 2000; 1 ♀ (DCBU 143421) Timóteo, Parque Estadual do Rio Doce, 19º39'30.7"S 42º34'32.2"W, Armadilha Malaise, 266m, 18.x.2010, A. J. Santos col. 1 ♀ (INPA) **Mato Grosso**, Pantanal 14-17.vi.1991, Malaise J.A. Rafael & J. VidalBrasil: 1 ♀ (MNRJ) **Rio De Janeiro**, Estrada Rio-São Paulo Km 47, 8.ix.1947, Zikán col.; 1 ♀ (DCBU 177047) **São Paulo**, Jundiaí, Reserva Biológica da Serra do Japi, 23º13.92'S 46º 56.50'W Armadilha Malaise 4 (1.197m), 08.v.2010, A. S. Soares &eq cols. 1 ♀ (DCBU 115173), Pontal, Usina Bela Vista, 20º54'48"S 48º08'0.3"W, Armadilha Malaise (502m), 01.x.2010, I. F Melo. col. 1 ♀ (DCBU 76209) Ribeirão Grande, Parque Estadual de Intervales, 24º16'23.6"S 48º25'21.8"W, Armadilha Malaise 5, 22.iii.2010, N. W. Perioto e eq cols.; 1 ♀ (DCBU 155036) same data except 20.xii.2010; 1 ♀ (DCBU 194890) Teodoro Sampaio, Parque Estadual Morro do Diabo 22º36'17"S 52º18’5.8”W, Armadilha Malaise 3 (414m), 15.iv.2010, N. W. Perioto e equipe col.

3.19. *Charops* sp. n. I

(Figures 18A–H, 23)

Diagnosis. Forewing 6.8–8 mm; antenna with 51–53 flagellomeres; supraclypeal area subquadrate; width of supraclypeal area 1.07x the size of height of supraclypeal area; juxtacoxal carinae complete with first perpendicular carinae reaching pleural carina, ovipositor straight.

Holotype female. Forewing 7.8 mm. *Head*. Densely punctuated and covered with hairs; lateral height of head 0.76x the size of mesopleuron; mandibles short and stout, apex 0.86x as wide as base and the upper tooth broader than the lower tooth; malar space 0.38x as long as basal width of mandible; inner margin of eyes parallel near clypeus; supraclypeal area subquadrate; width of supraclypeal area 1.07x the size of height of supraclypeal area; lateral ocellus separated from eye by 0.15x its own diameter; interocelar distance 0.90x the diameter of lateral ocelli; interocelar area with sparse small hairs; antenna with 51 flagellomeres; width of first flagellomere 3.75x its height; height of second flagellomere 0.51x the height of first flagellomere; last flagellomere cone shaped with a rounded apex, occipital area slightly imbricate.

Mesosoma. Pronotum dorsolaterally imbricate, laterally and ventrolaterally polished with transverse wrinkles; epomia present reaching the base of mesoscutum; mesoscutum punctate; scutellum and post scutellum densely covered with hairs; mesopleuron dorsolaterally reticulate, with several complete wrinkles and covered with hairs; hypoepimeron denudate with faint wrinkles; epicnemial carina present, reaching only mid part of mesopleuron; mesopleuron ventrally foveolate without wrinkles and covered with hairs; sternaulus absent; posterior transverse carina of mesosternum forming two conspicuous teeth produced near the coxae; metapleuron punctuate and covered with hairs with its posterior part densely covered with hairs; juxtacoxal carinae complete with first perpendicular carinae reaching pleural carina, second, third and fourth perpendicular carinae present, reaching pleural carina; juxtacoxal area reticulate; pleural carinae complete; spiracle elliptical with its width 0.4x the spiracle height; propodeum hairy and reticulose; petiolar area, areola and basal area with vestigial wrinkles; lateral longitudinal carina of propodeum incomplete not reaching propodeum neck; median longitudinal carina of propodeum complete; propodeum neck 0.77x the size of hind coxae.

Legs. Fore legs coxae with a fine lateral carinae; t1 0.79x the size of remaining tarsomeres; mid legs with t1 0.82x the size of remaining tarsomeres; hind legs with t1 0.82x the remaining tarsomeres.

Wings. Hyaline and covered with small hairs; forewing vein 1cu-a arising after of 1M+Rs; vein 2/Cu 1.59x the size of 2cu-a; vein 1/Rs+M curved; bulla of 1/Rs+M placed after its midlength near 2/M; 2/RS 0.35x as long as 2/M; bulla of 2m-cu placed near 2/M 0.28x the distance between the bula and 4/Cu vein; hind wing vein 1-Rs forming a curve with 1r-m angle; hind wing with 5 hamuli.

Metasoma. Tergites imbricate; first tergite with sparse small hairs, first sternite glabrous with subpetiolar process inconspicuous, sinunous on its anterior part and almost straight on its posterior part; tergite 2 0.85x the length of tergite 1; remaining tergites and sternites finely punctuate covered with small hairs; thyridium rounded; ovipositor sheath covered with hairs; ovipositor straight, with 1.66 mm; ovipositor notch not deep, distant from apex 0.38 x the size of ovipositor; ovipositor notch angle 113º; ovipositor ventral valve with a lobe near apex.

Color. Pubescence golden. *Head*: black; palpi yellow; mandibles yellow with brown teeth; ocelli pale yellow; antenna dark brown, scape and pedicel bicolor, anteriorly yellow and posteriorly brown. *Mesosoma*: black; tegula, fore legs yellow with t5 brown; mid legs with black and yellow coxae, trochanter and t4 yellow, t5 brown; hind legs coxae black with light brown trochantellus, femur to t5 brown, tibial spurs light brown. *Metasoma*: first sternite light brown; first tergite brown; tergite 2 dorsally dark brown and ventrally orange brown with a distinct black stripe on its posterior part, thyridium pale brown; sternite 2 dark yellow; remaining tergites dorsally black and ventrally orange brown; remaining sternites dark-yellow; ovipositor sheaths and cerci black, ovipositor orangish brown.

Variation: Forewing 6.8–8 mm. Lateral height of head 0.70–0.84x the size of mesopleuron; mandibular apex 0.73–0.8x as wide as base; malar space 0.38–0.51x as long as basal width of mandible; width of supraclypeal area 1.05–1.1x the size of height of supraclypeal area; lateral ocellus separated from eye by 0.15–0.33x its own diameter; interocelar distance 0.70–1.05x the diameter of lateral ocelli; antenna with 51–53 flagellomeres; width of first flagellomere 3.75–4.07x its height; height of second flagellomere 0.51–0.57x the height of first flagellomere; spiracle width 0.36–0.45x the

spiracle height; propodeum neck 0.76–0.86x the size of hind coxae. t1 0.69–0.79x the size of remaining tarsomeres; mid legs with t1 0.76–0.85x the size of remaining tarsomeres; hind legs with t1 0.79–0.82x the remaining tarsomeres; vein 2/Cu 1.59–2x the size of 2cu-a; 2/RS 0.28–0.40x as long as 2/M; bulla of 2m-cu placed near 2/M 0.19–0.4x the distance between the bula and 4/Cu vein; tergite 2 0.82–0.88x the length of tergite 1; ovipositor size 1.66–2.02 mm; ovipositor notch not deep, distant from apex 0.38–0.47x the size of ovipositor; ovipositor notch angle 113–131º; color vary between bright yellow to pale yellow.

Biology: Host unknow.

Comments: Male of this species remains unknown. Very similar to *Charops* sp. n. H from which it can be differentiated by straight ovipositor (Vs ovipositor upcurved) and t2 to t4 pale-yellow (Vs black hind tarsomeres black hind).

Material examined: Holotype: ♀ (MPEG) **BRASIL: Pará**, Belém, Mocambo [Reserva ao lado de Belém possui o Lago da água Preta], Malaise, 16.ix.2011, Rocha, J.; Santos, I.; Lobo, D.PIBIC.; *Paratypes*: 1 ♀ (MPEG) same data as holotype.; 1 ♀ (MPEG) same data except 26.vii.2011.; 1 ♀ (MPEG) Belém, Tenoné, 23.vi.1999.; 1 ♀ (MPEG) Morelândia, 4 - 7.vii.1988, malayse, J. Dias.; 1 ♀ (MPEG) Parauapebas, 23.viii.1992, Malayse, B. Mascarenhas.; 1 ♀ (MPEG) São João de Pirabas, Boa Esperança, 18-24.x.1990, armadilha suspensa 10m, A.L. Henriques.; 3 ♀ (MPEG) Tenoné, Parque crocodilo zoo, Isca Mutum, 27.x.1999/30.vii.1999, J.M.F. Ribeiro.; 1 ♀ (DCBU 186492) **Amazona**, Manaus 2f3 km 23, 22.x.1986.; 1 ♀ (INPA) 26km NE Manaus Reserva Ducke, 10.xi.1988, J. A. Rafael, Arm. Suspensa 20m.; 1 ♀ (INPA) Novo Aripuanã, Res. Soka, 17-25.viii.1999 - Malaise, J. F. Vidal & A. L. Henriques col.; 1 ♀ (UFES 92517) **Espírito Santo**, Santa Teresa Est[ação] Biol[ógica] Santa Lúcia, 13-17.x.2008, Tavares, M. T. & eq. col.; 5 ♀ (DCBU) **Minas Gerais**, Sete Lagoas Malaise, 13-27.iii.2000, 15-30.v.2000, 29.v-12.vi.2000, 19 - 29.xii.2011, 11-12.ix.2000 I. Cruz col..; 1 ♀ (DCBU 150388) São Roque de minas, Serra da Canastra, S 20º 18' 48.4" W 46º 31'46.1", Malaise 03 (850m), 04.x.2009, J. F. Nunes col.; 3 ♀ (MZSP) **Mato Grosso do Sul**, Aquidauana, Res[erva] Ecol[ógica] UEMS veg[etação] Aberta, Floresta Estacional Decidual, 20º25'59.0"S 55º39'20.8"W 11.v-26.v.2012, 11.v-26.v.2012, Malaise 8, Lamas, Nihei & eq. col.; 1 ♀ (APTA) **São Paulo**, Luís Antônio, Est. Ecológica de Jatai, Mata Ciliar, Arm. Luminosa, 21º36’47”S, 47º49’04”W Ponto 2,

23.xii.2008. R.I.R Lara & Equipe col.; 1 ♀ (DCBU), São Carlos UFSCar - Cerrado Malaise 21º58'S 47º53'W 20.x.1998 A.M. Penteado-Dias col.; 1 ♀ (DCBU 135578), **Rondônia** , Porto Velho, Reserva do Cuniã, 8º50'18.97"S 63º52'21"W - 158,15m, Armadilha Malaise, 26.i.2011, A. S. Soares col.; 1 ♀ (INPA) **Roraima**, Ilha de Maracá, 21-30.xi.1987, Malaise, J. A. Rafael e equipe col.

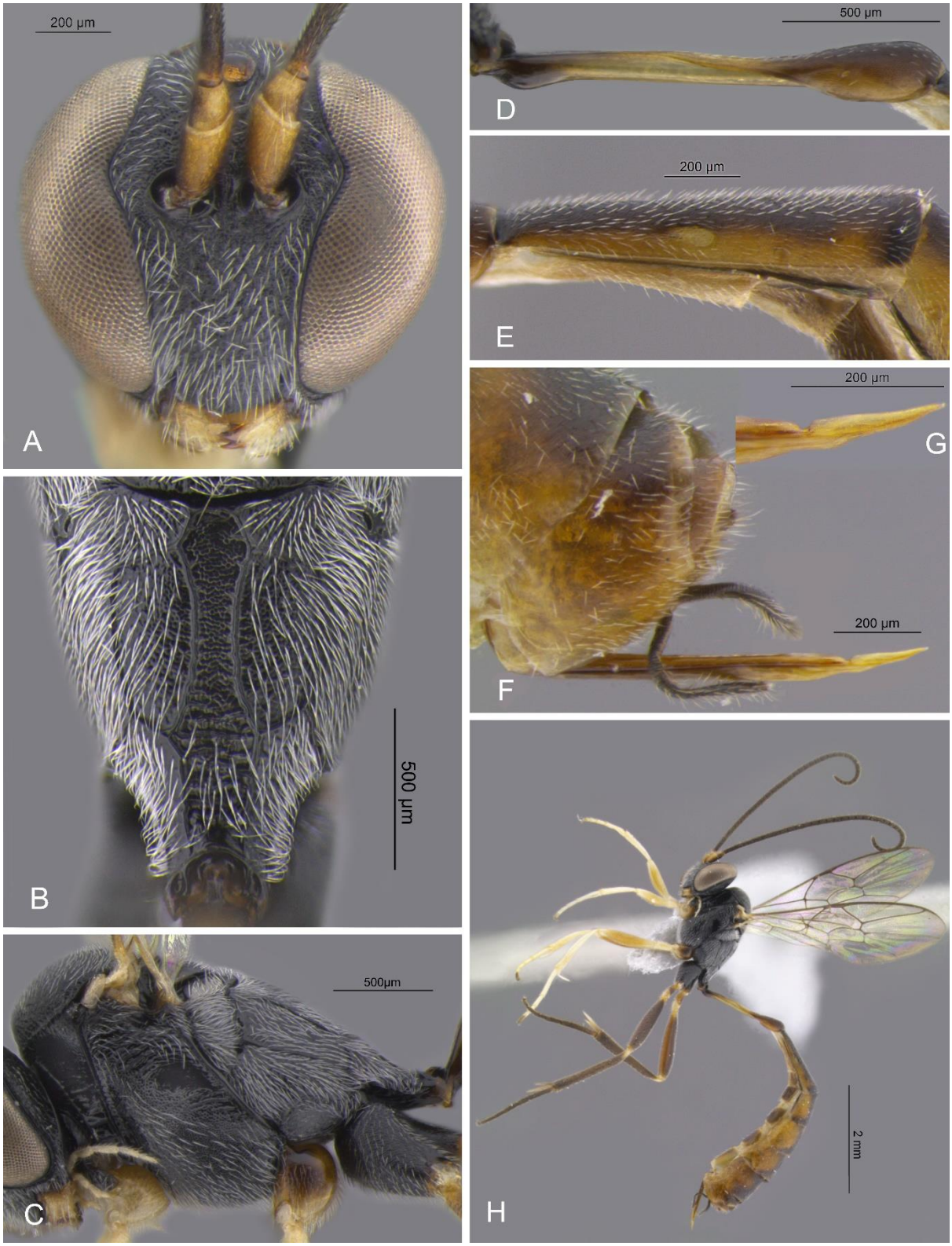

Figure 10. *Charops* sp. n. A. HOLOTYPE. Female. A, head in latero-frontal view. B, propodeum in latero-dorsal view. C, mesosoma in lateral view. D, first metasomal segment in lateral view. E, second metasomal segmente in lateral view. F, ovipositor in lateral view. G, ovipositor notch in lateral view. H, habitus in lateral view.

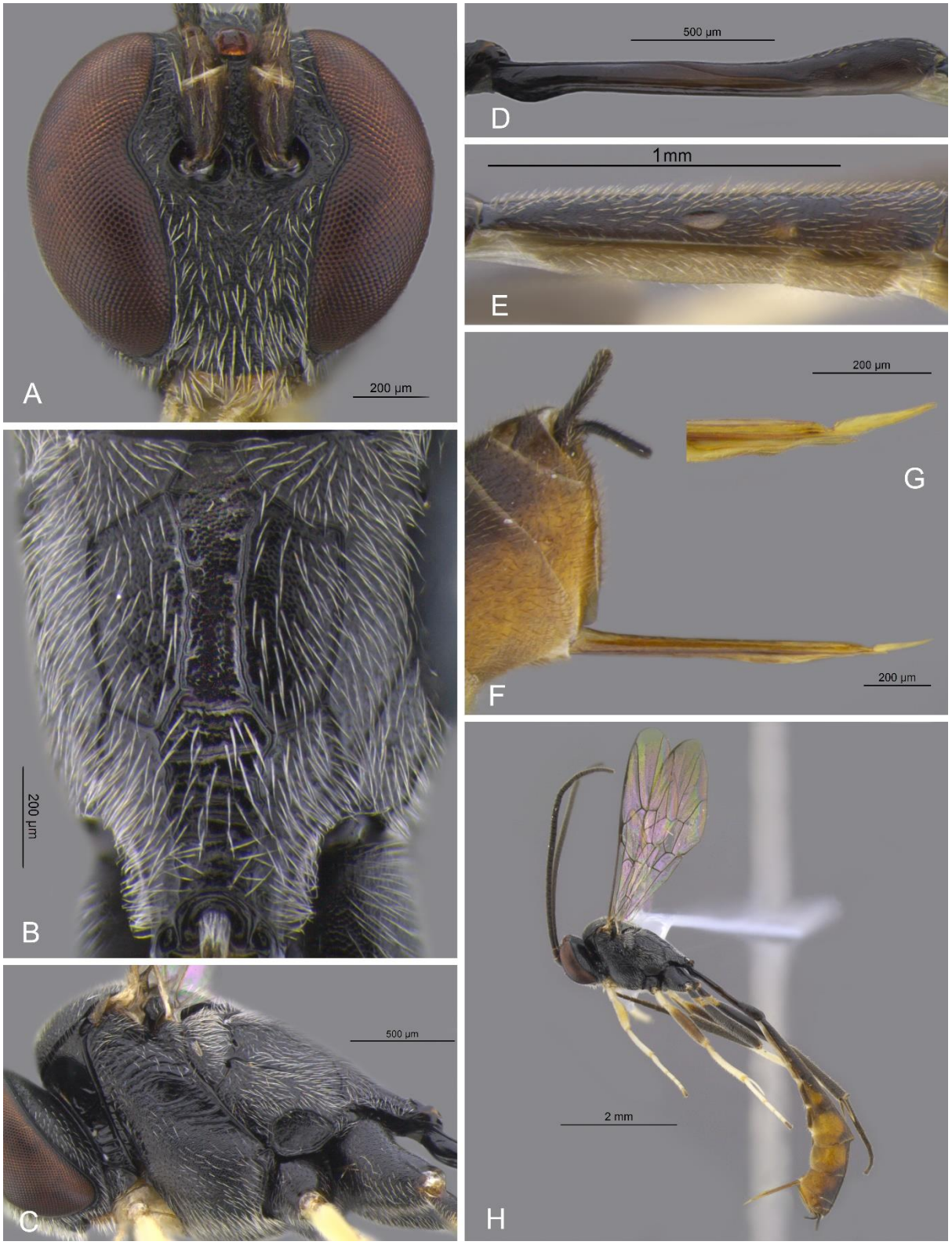

Figure 11. *Charops* sp. n. B. HOLOTYPE. Female. A, head in latero-frontal view. B, propodeum in latero-dorsal view. C, mesosoma in lateral view. D, first metasomal segment in lateral view. E, second metasomal segmente in lateral view. F, ovipositor in lateral view. G, ovipositor notch in lateral view. H, habitus in lateral view.

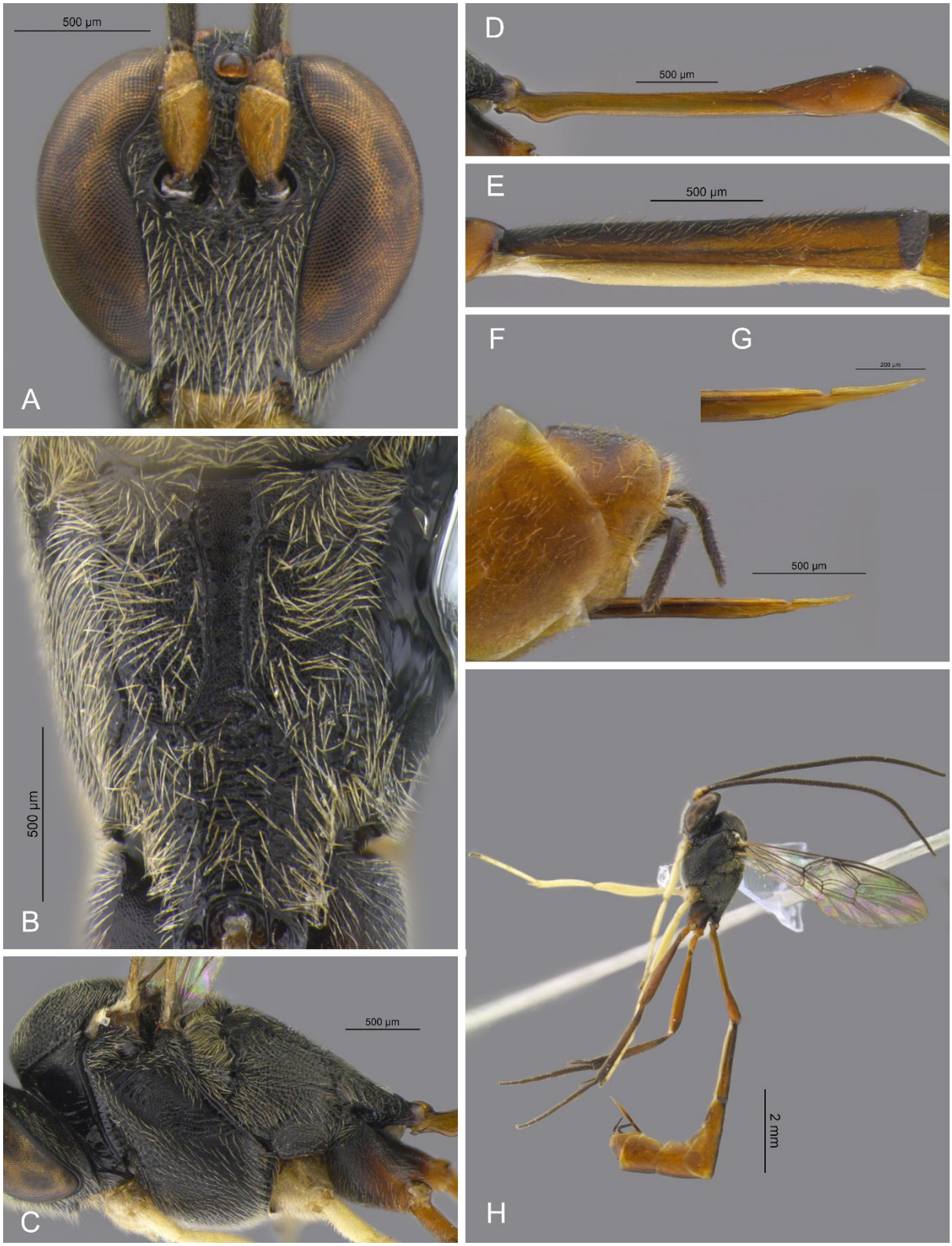

Figure 12. *Charops* sp. n. C. HOLOTYPE. Female. A, head in laterofrontal view. B, propodeum in dorsal view. C, mesosoma in lateral view. D, First metasomal segment in lateral view. E, second metasomal segmente in lateral view. F, ovipositor in lateral view. G, ovipositor notch in lateral view. H, habitus in lateral view.

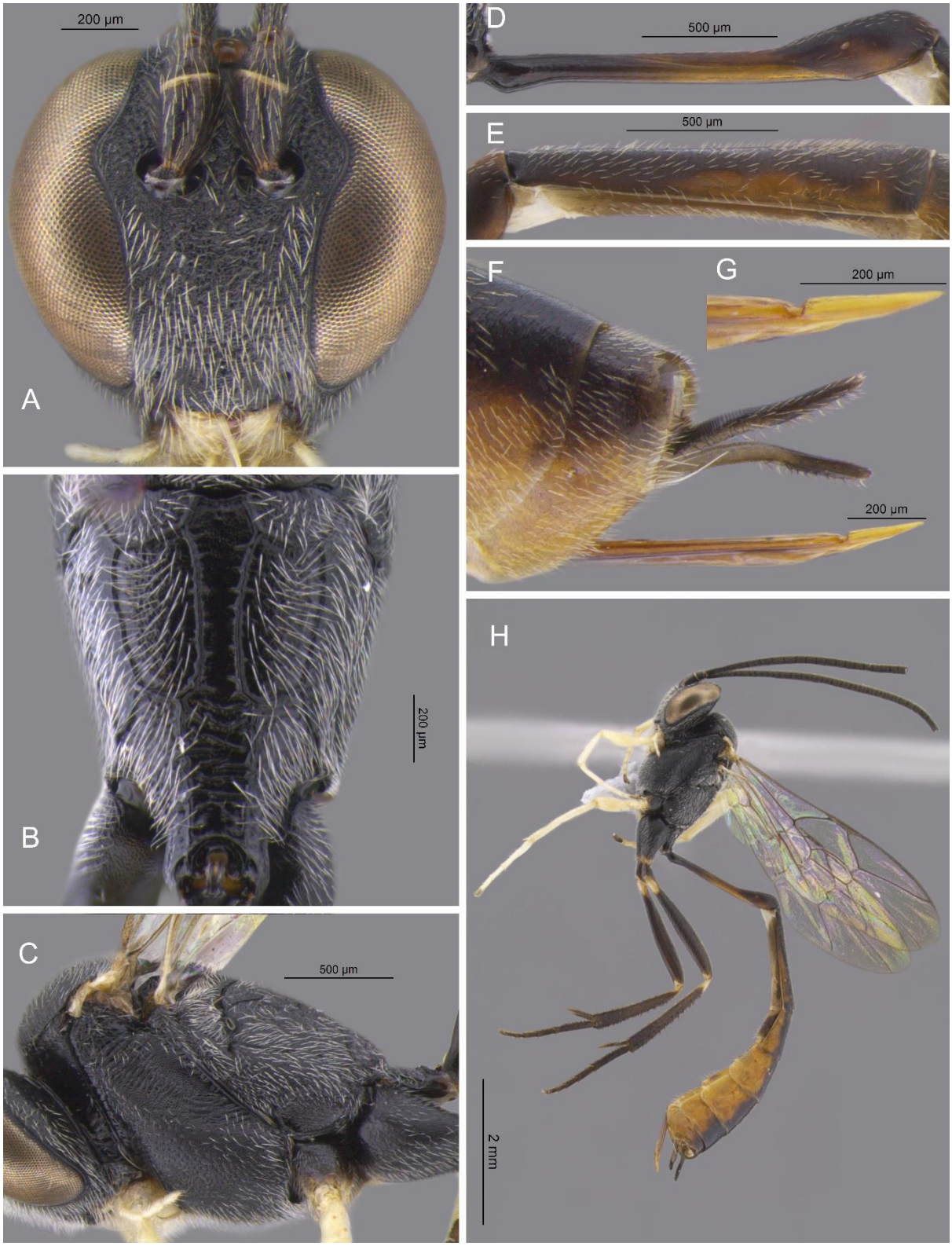

Figure 13. *Charops* sp. n. D. HOLOTYPE. Female. A, head in laterofrontal view. B, propodeum in dorsal view. C, mesosoma in lateral view. D, first metasomal segment in lateral view. E, second metasomal segmente in lateral view. F, ovipositor in lateral view. G, ovipositor notch in lateral view. H, habitus in lateral view.

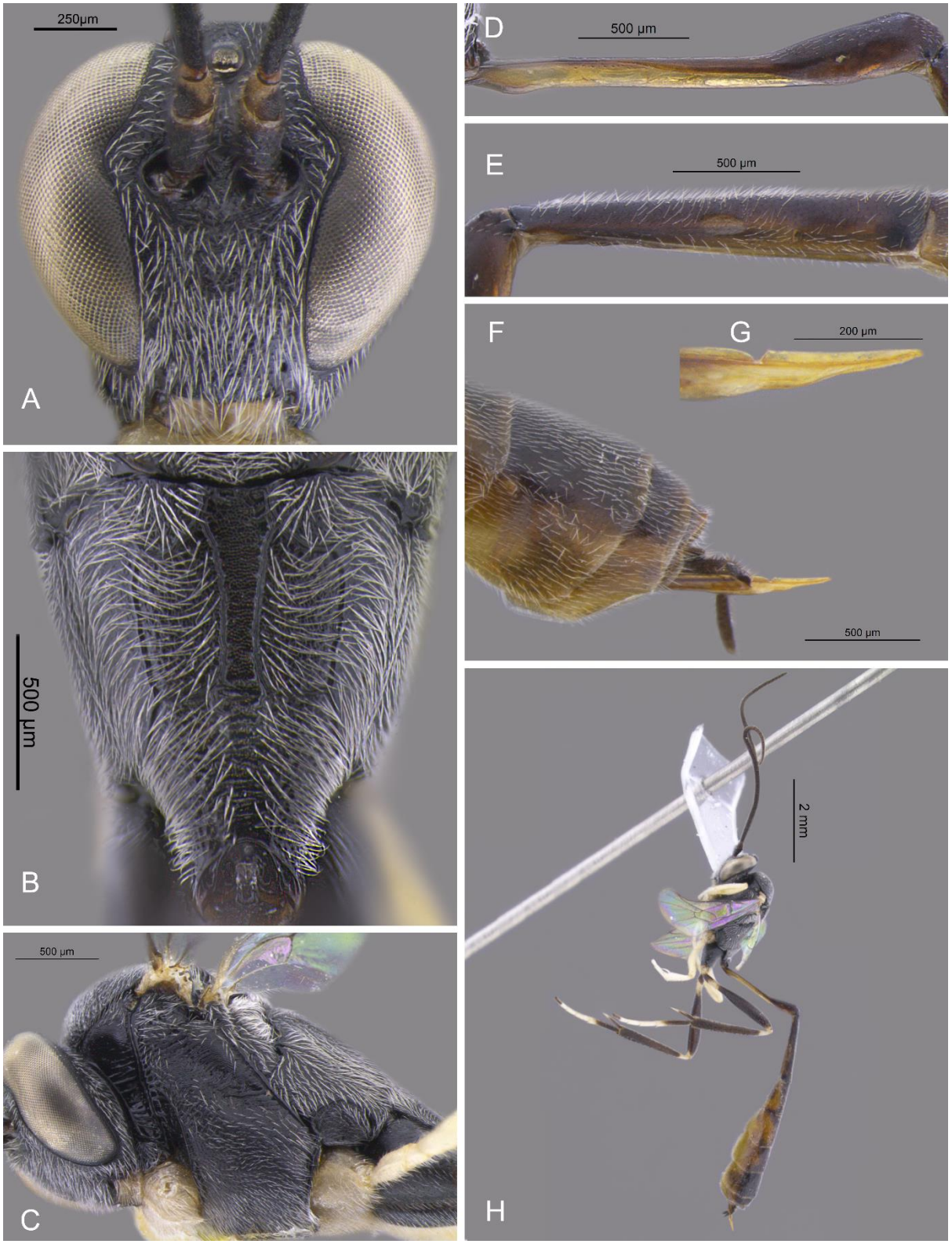

Figure 14. *Charops* sp. n. E. HOLOTYPE. Female. A, head in laterofrontal view. B, propodeum in dorsal view. C, mesosoma in ventrolateral view. D, first metasomal segment in lateral view. E, second metasomal segmente in lateral view. F, ovipositor in lateral view. G, ovipositor notch in lateral view. H, habitus in lateral view.

Figure 15. *Charops* sp. n. F. HOLOTYPE. Female. A, head in frontal view. B, propodeum in dorsal view. C, mesosoma in lateral view. D, first metasomal segment in lateral view. E, second metasomal segmente in lateral view. F, ovipositor in lateral view. G, ovipositor notch in lateral view. H, habitus in lateral view.

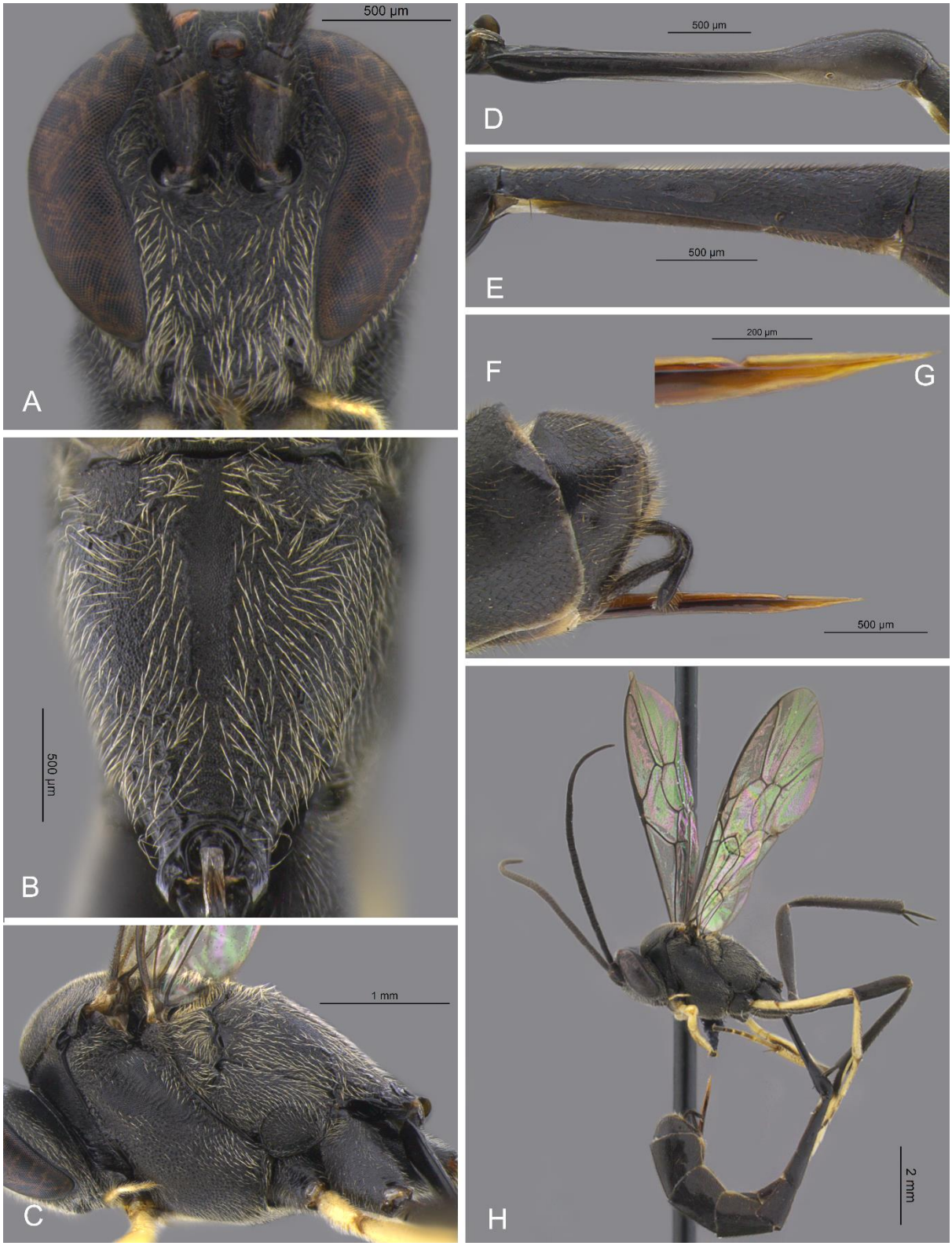

Figure 16. *Charops* sp. n. G. HOLOTYPE. Female. A, head in frontal view. B, propodeum in dorsal view. C, mesosoma in lateral view. D, first metasomal segment in lateral view. E, second metasomal segmente in lateral view. F, ovipositor in lateral view. G, ovipositor notch in lateral view. H, habitus in lateral view.

Figure 17. *Charops* sp. n. H. HOLOTYPE. Female. A, head in frontal view. B, propodeum in dorsal view. C, mesosoma in lateral view. D, first metasomal segment in lateral view. E, second metasomal segmente in lateral view. F, ovipositor in lateral view. G, ovipositor notch in lateral view. H, habitus in lateral view.

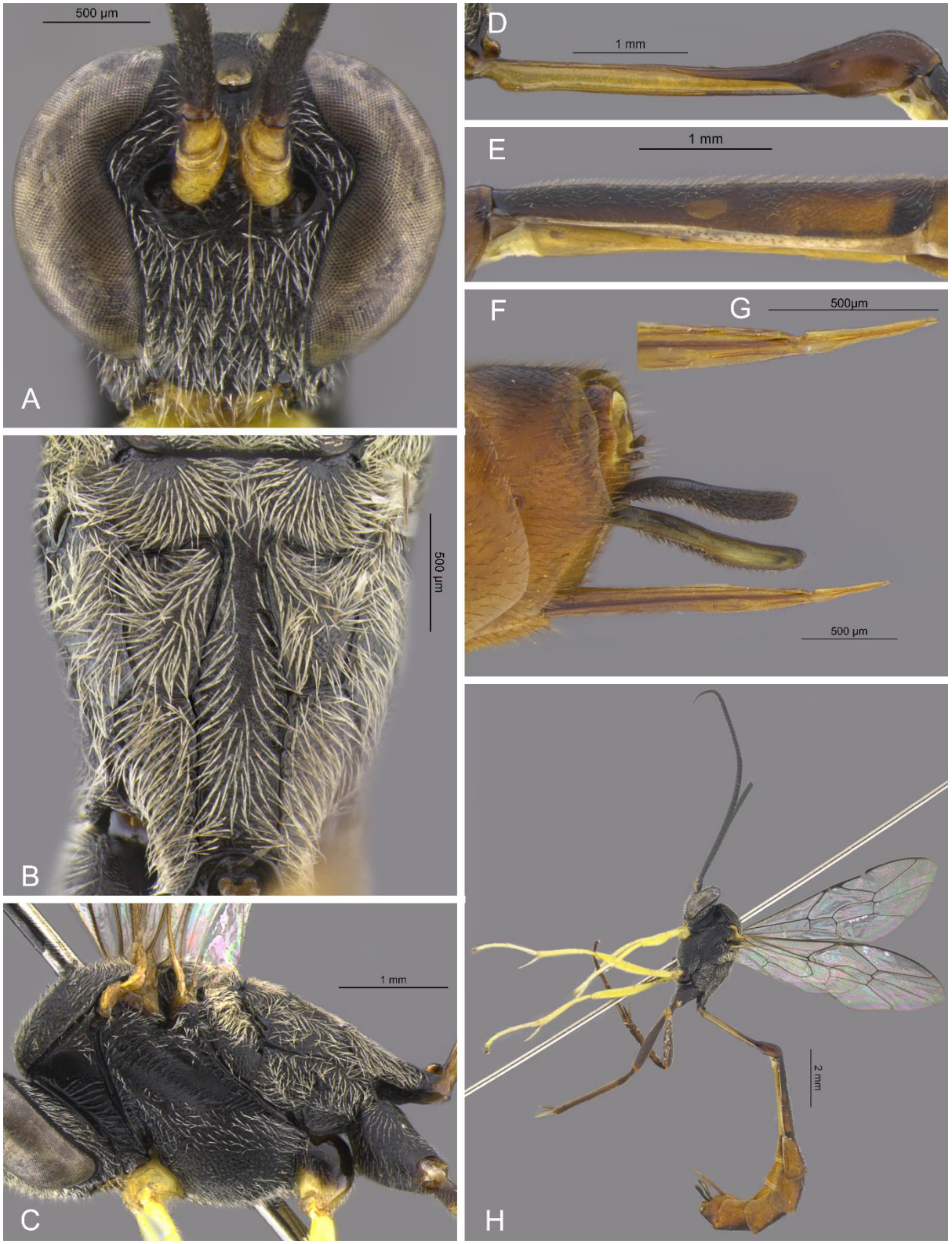

Figure 18. *Charops* sp. n. I. HOLOTYPE. Female. A, head in frontal view. B, propodeum in laterodorsal view. C, mesosoma in lateral view. D, first metasomal segment in lateral view. E, Second metasomal segmente in lateral view. F, ovipositor in lateral view. G, ovipositor notch in lateral view. H, habitus in lateral view.

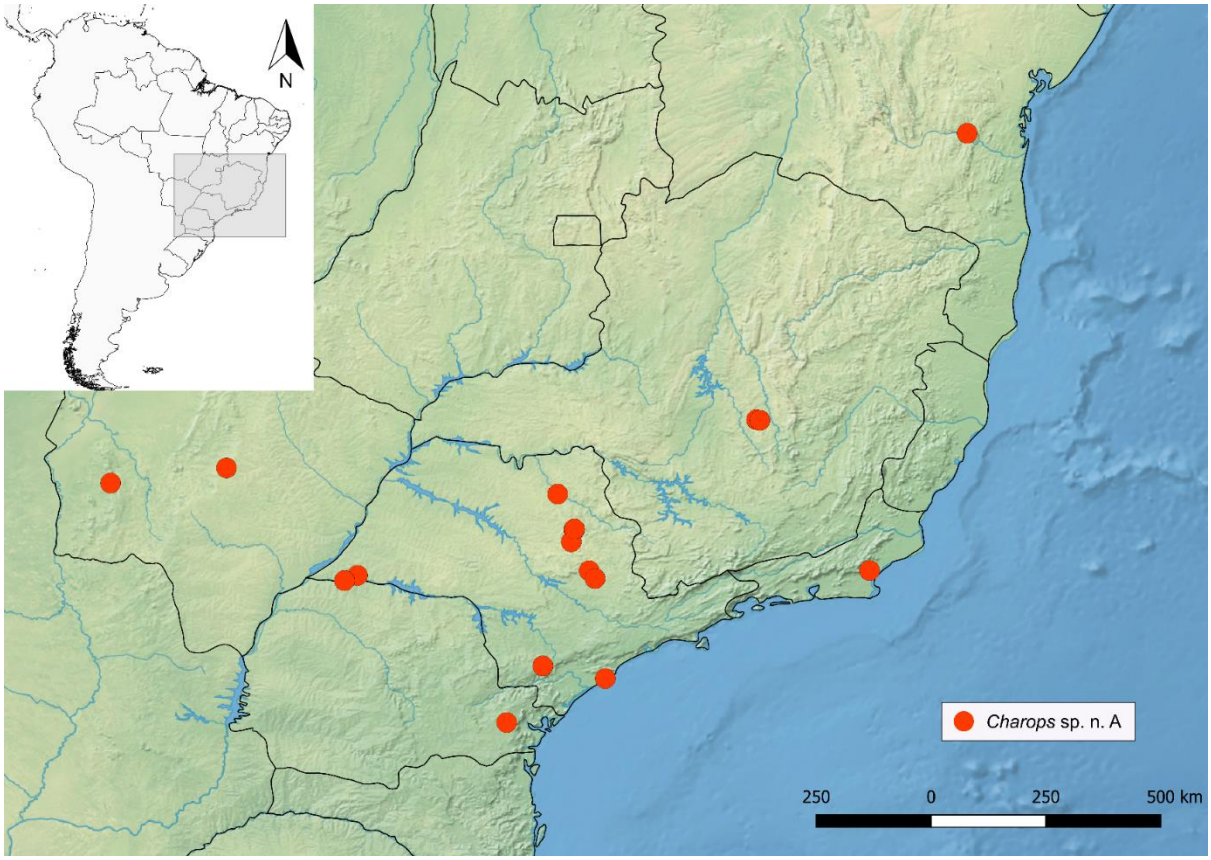

Figure 19. Distribution map of *Charops* sp. n. A.

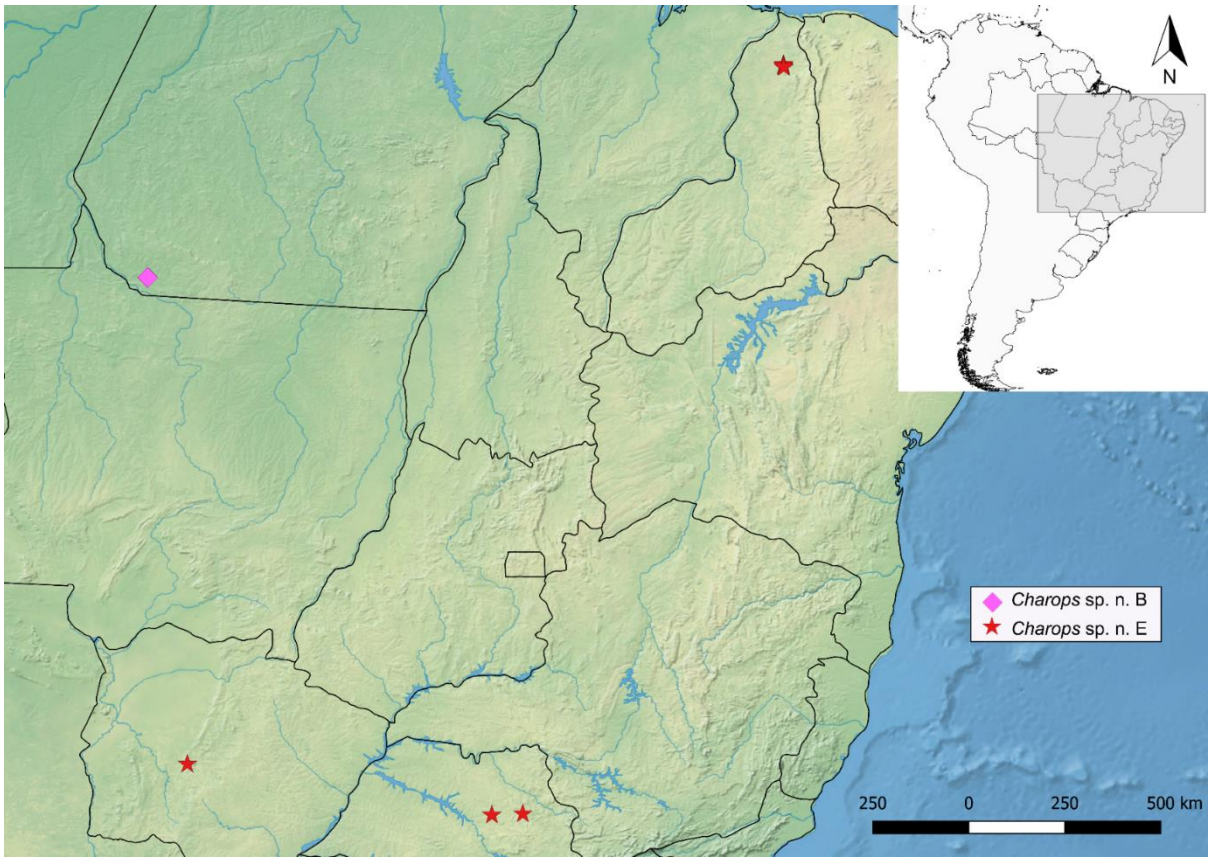

Figure 20. Distribution map of *Charops* sp. n. B, *Charops* sp. n. E.

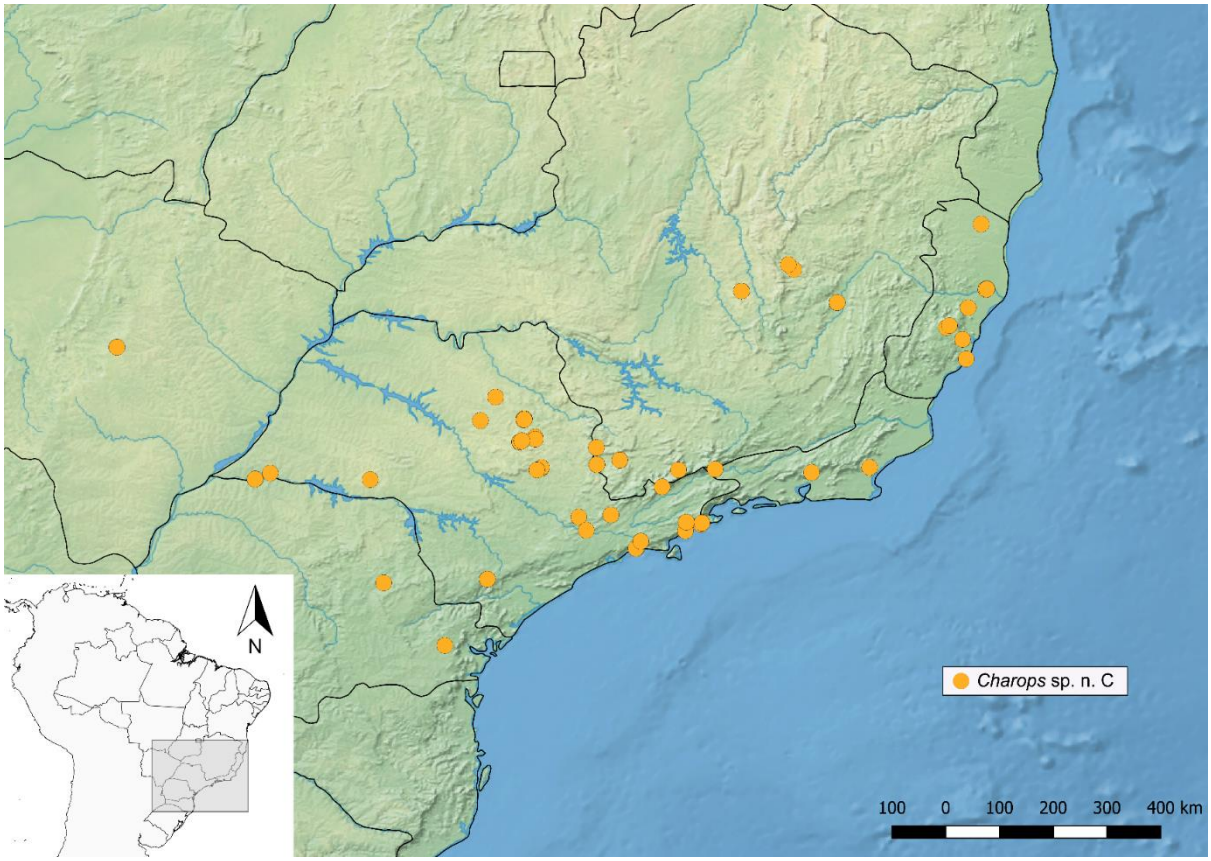

Figure 21. Distribution map of *Charops* sp. n. C.

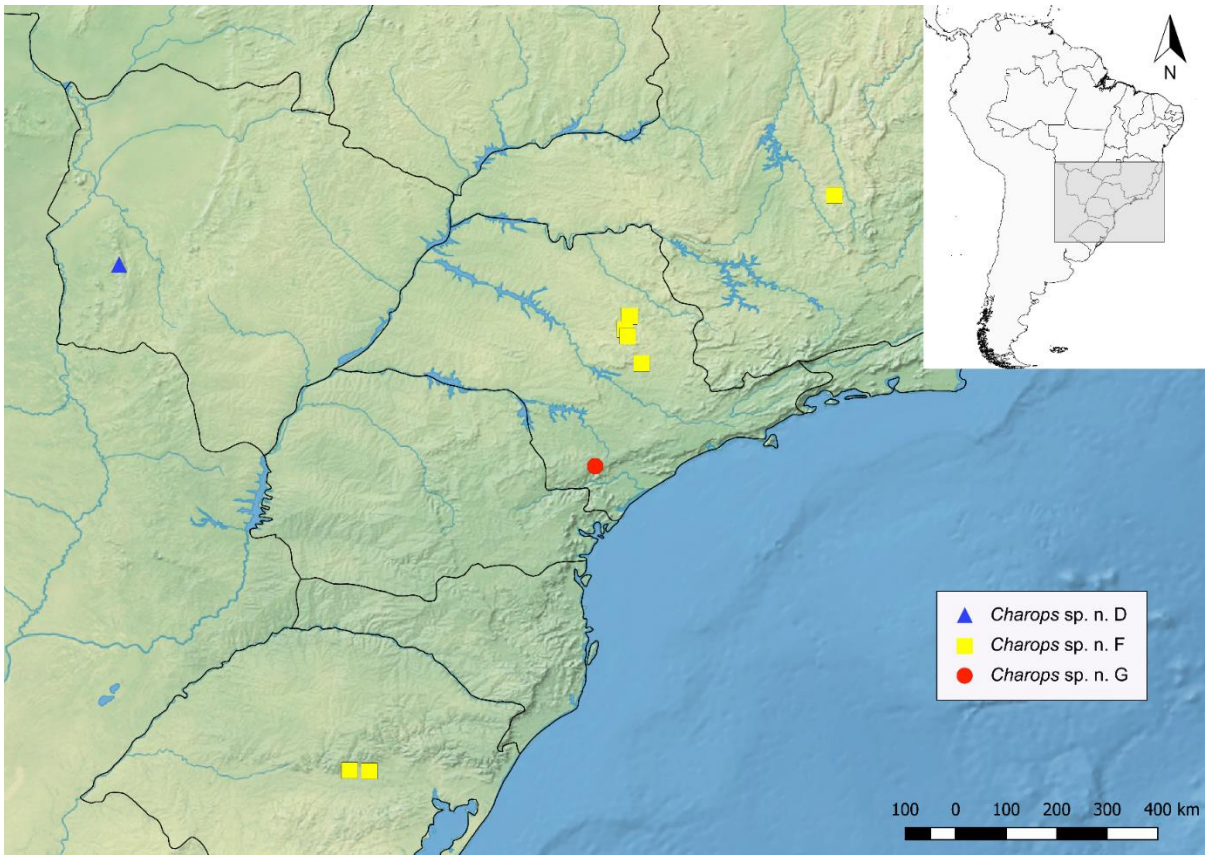

Figure 22. Distribution map of *Charops* sp. n. D, *Charops* sp. n. F and *Charops* sp. n. G.

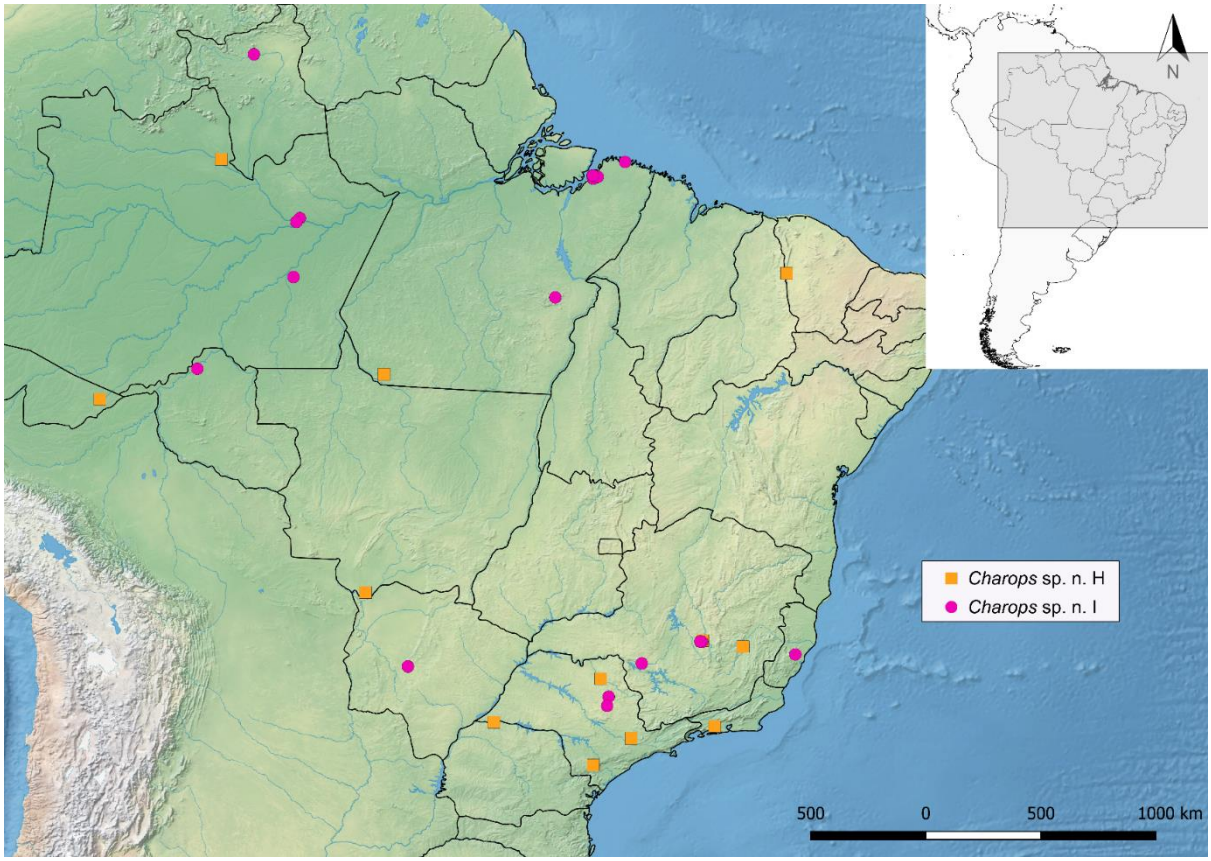

Figure 23. Distribution map of *Charops* sp. n. H, *Charops* sp. n. I.

4. Conclusions

- Ichneumonidae fauna is poorly known in Brazil both taxonomically and biologically;

- Thirty-three Ichneumonidae species have dubious ocurrence records in Brazil;

- Less than 10% of the Ichneumonidae Brazilian species have host records and nothing is known about ten of 24 subfamilies occurring in the country. Future surveys in the underexplored areas may reveal new biological records and species;

- Distribution range of *Charops* genus in Brazil was extended and now includes Acre, Amazonas, Bahia, Mato Grosso, Piauí, Rio Grande do Sul and Roraima states;

- The nine new species of *Charops* described in this study are the first ones recorded in Brazil and South America;

- A new concept of the genus *Charops* was presented to accommodate the morphological diversity of the new species described;

- Number of flagellomeres, sculpturation pattern of the propodeum, shape of supraclypeal area and color patterns are the best morphological characters that distinguish Brazilian species.

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