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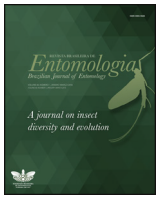

Extinct Neuropterida of Brazil (Insecta: Neuroptera, Megaloptera, Raphidioptera)

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ABSTRACT

The currently-known extinct Neuropterida fauna of Brazil comprises 18 families, 55 genera and 99 species (Neuroptera: 15 families, 49 genera, 89 species; Raphidioptera: 1 family, 2 genera, 5 species, + 1 genus *incertae sedis* with 2 species; Megaloptera: 1 family, 2 genera, 2 species; Order *incertae sedis*: 1 family, 1 genus, 1 species). All of these species have been described since 1980 and they collectively constitute the overwhelming majority of extinct Neuropterida presently known from South America. Other than one species of Permithonidae (Neuropterida *incertae sedis*) described from the Late Permian Irati Formation (Paraná Basin) of Rio Grande do Sul state, all extinct Brazilian Neuropterida taxa are known only from the Early Cretaceous Crato Formation (Araripe Basin) in Ceará and Pernambuco states. Of the 35 authors who have contributed to the descriptive literature of this fauna over the past 42 years, the work of Brazilian paleontologists Rafael Gioia Martins-Neto [1954-2010] and Maria Aparecida Vulcano-d'Andretta [1921-2018] – who together contributed to the description of 67 species – is especially notable. However, since their deaths, extinct Neuropterida have received little attention from Brazilian scientists and most later work on this fauna has been undertaken by workers outside Brazil. We provide this updated synthesis of the extinct Neuropterida of Brazil in order to centralize baseline knowledge for this fauna, to support efforts to document and conserve Brazilian fossil sites, and to encourage future work on the fauna, particularly by the next generation of Brazilian paleoentomologists.

Introduction

The superorder Neuropterida encompasses the holometabolous insect orders Neuroptera, Megaloptera, and Raphidioptera. The extinct order Glosselytrodea is also sometimes included (Grimaldi and Engel, 2005), but the phylogenetic position of this order remains unresolved. For example, Pérez-de la Fuente et al. (2022) recently considered it closer to mecopteroids than neuropteroids. The Neuropterida is an ancient lineage of holometabolous insects. Recent phylogenetic studies suggest that the three extant orders of Neuropterida differentiated during the Permian, and that the superorder was distinct from other lineages of Holometabola by the early Permian, or earlier (Winterton et al., 2018; Vasilikopoulos et al., 2020). Knowledge of the phylogenetic relationships of many extinct neuropterid taxa is still rudimentary, and, not unexpectedly, their higher classification remains unsettled and disputed. Of the approximately 40 neuropterid families that are currently recognized with some frequency, only 19 have left living representatives (Engel et al., 2018). Descriptive work on extinct Neuropterida has surged during the past 40 years and the number of described extinct species (ca. 1200) now represents approximately 18% of the number of valid extant species (ca. 6700) (Oswald, 2022). Species described from Brazil constitute a significant and important fraction of the global paleoneuropterid fauna and represent by far the largest and most diverse extinct neuropterid fauna in South America (Martins, 2019).

All Brazilian paleoneuropterid specimens have been collected from the Crato (98 spp.) and Irati (1 sp.) Formations (Fig. 1). The Early Permian Irati Formation is in the Paraná Basin, which underlies all or part of the Brazilian states of Mato Grosso do Sul, Mato Grosso, Goiás, São Paulo, Paraná, Santa Catarina, and Rio Grande do Sul. The Irati Formation is the basal unit of the Passa Dois Group and is characterized by bituminous shales derived from sediments deposited in an extensive, at least partially anoxic, epicontinental sea that was part of a broad marine transgression during parts of the Carboniferous and Permian (Zalán et al., 1990; Hachiro, 2000).

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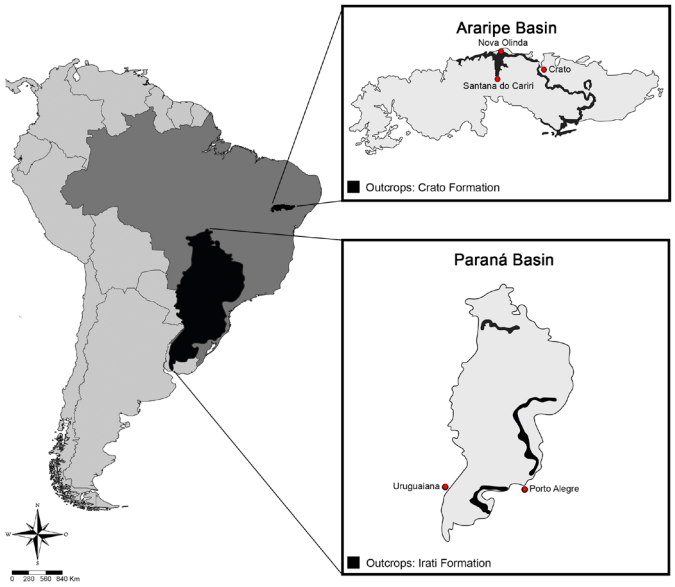

Figure 1 Map of South America showing the locations of the Araripe and Paraná Basins and the approximate locations of the outcrops of the Crato (Araripe Basin) and Irati (Paraná Basin) Formations [after Chahud (2021), Ribeiro et al. (2021)].

The Early Cretaceous Crato Formation is located in the Araripe Basin, which outcrops primarily along the slopes of the Chapada do Araripe plateau near the border of the Brazilian states of Ceará, Pernambuco, and Piauí. The Crato Formation is part of the Santana Group, and its lower part [often referred to as the Nova Olinda member, but see Ribeiro et al. (2021)] is now recognized as one of the most important Lagerstätten in the world, due to the combination of its interesting age and the exceptional preservation and diversity of its fossil fauna and flora (Fig. 2) (Martill et al., 2007). Traditionally, the sedimentary environment of the Crato Formation has been interpreted as a hypersaline lacustrine system (Varejão et al., 2019). This hypothesis has recently been elaborated on by Ribeiro et al. (2021), who provide a new paleoecological and paleoenvironmental model for the development of the formation. This model posits the deposition of faunal and floral material in long-lasting aquatic zones surrounded by periodically flooded mesophytic ecotones (a wetland system), all embedded within a region of generally xeric terrestrial habitats. The Crato Formation paleoneuropterid fauna was last extensively treated by Martins-Neto et al. (2007). That review synthesized work on the fauna up to 2005, which had primarily been undertaken by the Brazilian paleontologists Rafael Gioia Martins-Neto [1954-2010] and Maria Aparecida Vulcano d'Andretta [1921-2018] (Martins-Neto, 1990, 1992a, 1992b, 1994, 1997, 1998, 1999, 2000, 2003, 2005b; Martins-Neto et al., 2007; Martins-Neto and Rodrigues, 2009,

Figure 2 Examples of Neuroptera fossil from Crato Formation. **a)** Holotype of *Limaia conspicua* Martins-Neto & Vulcano, 1989a (Chrysopidae: Limaiinae); **b)** Holotype of *Makarkinia irmae* Machado, Freitas & Ribeiro, 2021 (Kalligrammatidae: Kalligrammatinae); **c)** Holotype of *Karenina breviptera* Martins-Neto, 1997 (Mesochrysopidae: Allopterinae); **d)** Holotype of *Cratoneura longissima* Martins-Neto, 1992b (Myrmeleontidae: Araripeneurinae); **e)** Holotype of *Diegopteryx raptoria* Martins-Neto in Martins-Neto & Rodrigues, 2010 (Myrmeleontidae: Araripeneurinae); **f)** Holotype of *Neurastenyx conani* Martins-Neto in Martins-Neto & Rodrigues, 2010 (= *Baisopardus conani*) (Palaeoleontidae); **g)** Holotype of *Blittersdorffta volkheimeri* Martins-Neto & Vulcano, 1989c (Myrmeleontidae: Pseudonymphinae); **h)** Holotype of *Palaeoleon araripensis* Martins-Neto, 1992b (= *Baisopardus araripensis*) (Palaeoleontidae); **i)** Holotype of *Paraneurastenyx ascalaphyx* Martins-Neto, 1998 (Palaeoleontidae); **j)** Holotype of *Pulchroptilonia espatifata* Martins-Neto, 1997 (Psychopsidae).

2010; Martins-Neto and Vulcano, 1989a, 1989b, 1989c, 1990a, 1990b, 1997). Most of the subsequent work on the Crato paleoneuropterid fauna has been undertaken by workers outside of Brazil from Crato fossils that have found their way into many collections around the world.

The current work has been inspired in part by Moura-Júnior et al.'s recent (2018) broad overview of Brazilian fossil insects. In that work, they emphasize not only the breadth and scientific interest of the fauna but also the need to encourage, train, and support a new generation of Brazilian paleoentomologists to continue unfinished work on the paleoentomology of Brazil. With this in mind, we present here an updated and annotated catalog of extinct Brazilian Neuropterida. It's objectives are to document the current state of the Brazilian paleoneuropterid fauna, to support efforts to further understand and conserve Brazilian fossil sites, to alert new students to the fascinating diversity of extinct Neuropterida, to encourage them to advance its study, and to identify priorities for future studies of this fauna.

Material and methods

Terminology, Taxonomy and Nomenclature

The higher classification of the Neuropterida adopted here generally follows Winterton et al. (2018) and Engel et al. (2018), so Permithonidae is treated as Neuropterida *incertae sedis*, not Neuroptera. Classification of Myrmeleontoidea follows Machado et al. (2019), Lu et al. (2022), and Lu and Liu (2022), i.e., Cratosmylidae, Nymphidae, Babinskaiidae, Nemopteridae, Palaeoleontidae, and Myrmeleontidae are treated as valid families, and Araripeneurinae, Ascalaphinae, and Pseudonymphinae are treated as subfamilies of Myrmeleontidae. Megaloptera classification follows Martins et al. (2022), and Raphidioptera classification follows Engel (2002). The lower-level (genus and species) taxonomic and nomenclatural content of the catalog are generally based on Martill et al. (2007), Moura-Júnior et al. (2018), and the Neuropterida Species of the World (Oswald, 2022). All original descriptions were re-checked.

In Supplemental Document 1 we provide an Excel spreadsheet with the following summary data on the taxa covered in this work: order, superfamily, family, species, author, year of description, attested geological formation, type specimen identifier, and reputed type specimen depository (verified only in a few cases).

To better understand the historical development of knowledge on the Brazilian paleoneuropterid fauna, we also collected data on the working locations of taxon-describing authors (i.e., Brazil, Europe, U.S.A., or Asia; data counted and listed) and the year that each species was described (data graphed as an accumulation curve). Graphics were initially generated in Excel or SimpleMappr (Shorthouse, 2010) and subsequently edited in Adobe Illustrator 2021.

Collection and Institution Abbreviations

The following collection and institution abbreviations are used throughout this work, particularly in citations to putative primary type repositories contained in the main catalog text. The putative type repositories so cited have been taken primarily from information provided in the original descriptions of the individual species. It is clear, however, that events that have occurred since the original publication of many of those species have rendered their original type repository statements incorrect. This is especially true for the large number of species described by Rafael Gioia Martins-Neto and/or Maria Aparecida Vulcano-d'Andretta – approximately two-thirds of the species included in this catalog – due to post mortum changes in the locations of the collections that were under their supervision during their active years of description. The present locations/repositories of all the types designated by these two authors are currently in need of reverification. Because the magnitude of that task was beyond the scope of the current work – the locations of many of those types still being unknown – the main catalog entries for Martins-Neto and Vulcano species here retain the original type-depository citations found in their original descriptions; this is a matter of simple of expediency. When attempting to locate the types of species described by these two authors, users of this catalog are advised to also read the Discussion section 'Fossil Neuropterida Collections in Brazil', below, for additional information on what is currently known about the dispositions of the main corpora of the Martins-Neto and Vulcano collections.

AMNH - American Museum of Natural History, New York, New York, U.S.A.

CAMSM - Sedgwick Museum of Earth Sciences, Cambridge, England.

CCNH/UFABC - Centro de Ciências Naturais e Humanas, Universidade Federal do ABC, Santo André, São Paulo, Brazil.

CPCA - Centro de Pesquisas da Chapada do Araripe, Crato, Ceará, Brazil.

CV/MZUSP - Coleção Maria Aparecida Vulcano, São Paulo, São Paulo, Brazil (recently incorporated into the Museu de Zoologia da Universidade de São Paulo/MZUSP).

DNPM - Seção de Paleontologia da Divisão de Geologia e Mineralogia do Departamento Nacional da Produção Mineral, Rio de Janeiro, Rio de Janeiro, Brazil.

IGc/USP - Coleção de Paleontologia do Instituto de Geociências, Universidade de São Paulo, São Paulo, São Paulo, Brazil.

INHSP - Illinois Natural History Survey Paleontology Collection, Urbana-Champaign, Illinois, U.S.A.

MHNEC - Musée d'Histoire Naturelle et d'Ethnographie de Colmar, France.

MNHN - Muséum National d'Histoire Naturelle, Paris, France.

MN-UFRJ - Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Rio de Janeiro, Brazil.

MPFT - Museu de Paleontologia "Força da Terra", São Paulo, São Paulo, Brazil.

MPSC - Museu de Paleontologia Plácido Cidade Nuvens, Universidade Regional do Cariri, Santana do Cariri, Ceará, Brazil.

MZUSP - Museu de Zoologia da Universidade de São Paulo, São Paulo, São Paulo, Brazil.

NODAI - Tokyo University of Agriculture, Japan.

OMNH - Osaka Museum of Natural History, Osaka city, Osaka, Japan.

PC-CE - Private collection of Cristian Pella, Crevoladossola, Verbano Cusio Ossola, Italy.

RGMN - Coleção Rafael Gioia Martins-Neto, Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto, Universidade de São Paulo, Ribeirão Preto, São Paulo, Brazil.

SBPr - Sociedade Brasileira de Paleoartropodologia, Ribeirão Preto, São Paulo, Brazil.

SMNK - Staatlisches Museum für Naturkunde, Karlsruhe, Germany.

SMNS - Staatliches Museum für Naturkunde, Stuttgart, Germany.

UFRGS - Universidade Federal do Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brazil.

URM - Herbarium at the Universidade Federal de Pernambuco, Recife, Pernambuco, Brazil.

WDC - Wyoming Dinosaur Center-Crato, Wyoming, U.S.A.

Results

Catalog of Extinct Brazilian Neuropterida

Catalog entries are formatted as follows. All entries for valid taxa are arranged alphabetically within the next-higher valid taxon. All valid taxon entries include the scientific name of the taxon, followed by its author(s) and date. Entries for genera contain the currently-recognized valid taxon name (with type species), followed by a list of all known

invalid synonyms, and a list of treatments for valid species known from Brazil. Entries for species contain the currently-recognized valid species name, followed by a list of all known invalid synonyms (if any), type locality, type horizon, type material (including type specimen identifier, when available), reputed depository collection (in parenthesis), and taxonomic notes (where instructive).

Class **Insecta** Linnaeus, 1758
Subclass **Pterygota** Brauer, 1885
Infraclass **Neoptera** Martynov, 1923
Superorder **Neuropterida** Boudreaux, 1979

Order **Megaloptera** Latreille, 1802

Family **Corydalidae** Leach in Brewster, 1815

Subfamily ***incertae sedis***

Genus ***Cratocorydalopsis*** Jepson & Heads, 2016
Cratocorydalopsis Jepson & Heads, 2016: 136. Type species. *Cratocorydalopsis brasiliensis* Jepson & Heads, 2016: 136 (by original designation).

Brazilian species

Cratocorydalopsis brasiliensis Jepson & Heads, 2016
Type locality. Precise location unknown, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: SMNS 66000-247 (SMNS).
Taxonomic notes. Martins-Neto et al. (2007) mentioned this specimen as a new genus and species.

Genus ***Lithocorydalus*** Jepson & Heads, 2016
Lithocorydalus Jepson & Heads, 2016: 139. Type species. *Lithocorydalus fuscata* Jepson & Heads, 2016: 139 (by original designation).

Brazilian species

Lithocorydalus fuscata Jepson & Heads, 2016
Type locality. Precise location unknown, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: SMNS 66000-248 (SMNS).
Taxonomic notes. Martins-Neto et al. (2007) mentioned this specimen as a new genus and species.

Order **Neuroptera** Linnaeus, 1758

Superfamily **Chrysopoidea** Schneider, 1851

Family **Corydasialidae** Wichard, Chatterton & Ross, 2005

Genus ***Cratochrysa*** Martins-Neto, 1994
Cratochrysa Martins-Neto, 1994: 272. Type species. *Cratochrysa willmanni* Martins-Neto, 1994: 273 (by original designation).
Taxonomic notes. Martins-Neto (1994) originally placed *Cratochrysa* in Mesochrysopidae, but later (Martins-Neto, 1997) reassigned it to Chrysopidae *incertae sedis*, then (Martins-Neto, 2003) to the chrysopid subfamily Cratochrysinae. Wichard et al. (2005) described the family Corydasialidae in Megaloptera, and in the same year Nel et al. (2005b) treated *Cratochrysa* as Neuroptera *incertae sedis*. More recently, Liu et al. (2017) assigned the genus to Corydasialidae and considered the family as more closely related to Chrysopoidea than to Megaloptera.

Brazilian species

Cratochrysa martinsnetoi Nel, Delclòs & Hutin, 2005b
Type locality. Santana do Cariri, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: MNHN-DHT R. 63844 (Borschukewitz collection, MNHN).

Cratochrysa sublapsa Martins-Neto, 1997
Type locality. Precise location unknown, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CV-327a, b (CV/MZUSP).
Taxonomic notes. The holotype of *C. sublapsa* was originally described as a paratype of *Limaia conspicua* Martins-Neto & Vulcano (1989a).

Cratochrysa willmanni Martins-Neto, 1994
Type locality. Pedra Branca Quarry, Nova Olinda-Santana do Cariri road, at 4 km from Nova Olinda municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: UnG/1T-07 (IGc/USP).

Family **Chrysopidae** Schneider, 1851

Subfamily **Limaiinae** Martins-Neto & Vulcano, 1989a

Genus ***Limaia*** Martins-Neto & Vulcano, 1989a
Limaia Martins-Neto & Vulcano, 1989a: 192. Type species. *Limaia conspicua* Martins-Neto & Vulcano, 1989a: 192 (by original designation).

Brazilian species

Limaia adicotomica Martins-Neto, 1997
Type locality. Precise location unknown, probably between Nova Olinda and Santana do Cariri municipalities, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: AMNH 44402 (AMNH).
General notes. The holotype and other specimens have been returned to Brazil and are deposited in the MZUSP (Behrensmeyer and Turner, 2013).

Limaia conspicua Martins-Neto & Vulcano, 1989a
Type locality. Precise location unknown, near Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: GP/lT-1625 (mold, IGc/USP), CD-1-80 (Desirèe collection, contermold, MN-UFRJ); Paratype: CV-500 (CV/MZUSP).
Taxonomic notes. *Limaia conspicua* paratype CV-327 was subsequently designated as the holotype of *Cratochrysa sublapsa* Martins-Neto, 1997.

Genus ***Mesypochrysa*** Martynov, 1927
Mesypochrysa Martynov, 1927: 764. Type species. *Mesypochrysa latipennis* Martynov, 1927: 765 (by original designation).

Caririchrysa Martins-Neto & Vulcano, 1989a: 196. Type species. *Caririchrysa criptovenata* Martins-Neto & Vulcano, 1989a: 196 (by original designation).
Lembochrysa Ren & Guo, 1996: 469. Type species. *Lembochrysa minuscula* Ren & Guo, 1996: 471 (by original designation).

Brazilian species

Mesypochrysa confusa (Martins-Neto & Vulcano, 1989a)

Caririchrysa confusa Martins-Neto & Vulcano, 1989a
Type locality. Precise location unknown, near Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CV-269 (CV/MZUSP).

Mesypochrysa criptovenata (Martins-Neto & Vulcano, 1989a)

Caririchrysa criptovenata Martins-Neto & Vulcano, 1989a
Type locality. Fazenda Tatajuba, Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil (Martins-Neto, 1997).
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CV-2466 (CV/MZUSP).

Mesypochrysa skulda (Martins-Neto, 2003)

Caririchrysa skulda Martins-Neto, 2003
Type locality. Pedra Branca Quarry, Nova Olinda-Santana do Cariri road, at 4 km from Nova Olinda municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: MPFT-I-016 (MPFT); Paratypes: GPII T-1675 (IGc/USP), RGMN-T008 (SBPr).
Taxonomic notes. *Caririchrysa skulda* was transferred to *Mesypochrysa* by Archibald and Makarkin (2014).

Chrysopidae ***Incertae sedis***

Genus ***Araripechrysa*** Martins-Neto & Vulcano, 1989a
Araripechrysa Martins-Neto & Vulcano, 1989a: 195. Type species. *Araripechrysa magnifica* Martins-Neto & Vulcano, 1989a: 195 (by original designation)
Taxonomic notes. The taxonomic placement of *Araripechrysa* is unsettled in recent literature, with some authors placing it in the subfamily Limaiinae [or family Limaiidae] (e.g., Martins-Neto and Vulcano, 1989a; Nel et al., 2005b), and others treating it as Chrysopidae *incertae sedis* (e.g., Makarkin, 1997; Archibald and Makarkin, 2014; Khramov et al., 2015; Lu et al., 2018; Zhang et al., 2020). In this catalog we follow the latter course.

Brazilian species

Araripechrysa magnifica Martins-Neto & Vulcano, 1989a
Type locality. Precise location unknown, near Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CV-1547 (CV/MZUSP); Paratypes: CV-1184, CV-1186, CV-1546 (CV/MZUSP).

Family **Mesochrysopidae** Handlirsch, 1906

Subfamily **Allopterinae** J. Zhang, 1991

Genus ***Dryellina*** Martins-Neto & Rodrigues, 2009
Dryellina Martins-Neto & Rodrigues, 2009: 16. Type species. *Dryellina placida* Martins-Neto & Rodrigues, 2009: 17 (by original designation).

Brazilian species

Dryellina placida Martins-Neto & Rodrigues, 2009

Dryellina especiosa Martins-Neto, 2009 (unavailable)
Type locality. Nova Olinda-Santana do Cariri road, at 4 km from Nova Olinda municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type species. Holotype: MPSC I 1204 (MPSC).

Genus ***Karenina*** Martins-Neto, 1997
Karenina Martins-Neto, 1997: 74. Type species. *Karenina breviptera* Martins-Neto, 1997: 74 (by original designation).
Armandochrysopa Nel, Delclòs & Hutin, 2005b: 13. Type species. *Armandochrysopa borschukewitzi* Nel, Delclòs & Hutin, 2005b: 13 (by original designation).
Taxonomic notes. *Karenina* was originally described in Ascalaphidae, but was later transferred to Allopteridae (Nel et al., 2005b). The genus currently resides in Mesochrysopidae based on Makarkin and Menon's (2005) synonymization of Allopteridae under Mesochrysopidae. Yang et al. (2012) synonymized *Armandochrysopa* under *Karenina*.

Brazilian species

Karenina borschukewitzi (Nel, Delclòs & Hutin, 2005b)

Armandochrysopa borschukewitzi Nel, Delclòs & Hutin, 2005b
Type location. Santana do Cariri, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: MNHN-DHT R.55201 (Borschukewitz collection, MNHN).

Karenina breviptera Martins-Neto, 1997
Type locality. Precise location unknown, probably between Nova Olinda and Santana do Cariri municipalities, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: AMNH-44411 (AMNH).
General notes. According to Behrensmeyer and Turner (2013), the holotype has been returned to Brazil and is deposited in the MZUSP, nevertheless it is currently deposited in the CCNH/UFABC.

Karenina cuneiformis Nakamine, 2021
Type species. Precise location unknown, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: OMNH TI 530 (OMNH).

Karenina leilana Makarkin & Menon, 2005
Type species. Near Nova Olinda municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: SMNS 65506 (SMNS).

Karenina longicollis Makarkin & Menon, 2005

Type species. Near Nova Olinda municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: SMNS 65505 (SMNS).

Genus ***Triangulochrysopa*** Nel, Delclòs & Hutin, 2005b
Triangulochrysopa Nel, Delclòs & Hutin, 2005b: 36. Type species. *Triangulochrysopa sanzi* Nel, Delclòs & Hutin, 2005b: 36 (by original designation).
Taxonomic notes. *Triangulochrysopa* was originally described in Allopteridae (Nel et al., 2005b); it is treated here in Mesochrysopidae based on Makarkin and Menon's (2005) synonymization of Allopteridae under Mesochrysopidae.

Brazilian species

Triangulochrysopa formosa Menon & Makarkin, 2008
Type locality. Precise location unknown, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: SMNS 66000/ 271 (SMNS).
Taxonomic notes. Bechly et al. (2001) mentioned this specimen as an unnamed neuropteran.

Superfamily **Ithonoidea** Newman, 1853

Family **Ithonidae** Newman, 1853

Genus ***Cratovoluptia*** Martins-Neto & Rodrigues, 2009
Cratovoluptia criptoneura Martins-Neto & Rodrigues, 2009: 16. Type species. *Cratovoluptia* Martins-Neto & Rodrigues, 2009: 16 (by original designation).
Taxonomic notes. *Cratovoluptia* was originally described in Osmylidae; it was reassigned to Ithonidae by Winterton et al. (2019).

Brazilian species

Cratovoluptia criptoneura Martins-Neto & Rodrigues, 2009
Type locality. Nova Olinda-Santana do Cariri road, at 4 km from Nova Olinda municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CPCA 3562 (CPCA).

Genus ***Principiala*** Makarkin & Menon, 2007
Principiala Makarkin & Menon, 2007: 744. Type species. *Principiala incerta* Makarkin & Menon, 2007: 745 (by original designation).

Brazilian species

Principiala incerta Makarkin & Menon, 2007
Type locality. Precise location unknown, near Nova Olinda municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: SMNK PAL 5352 (SMNK); Paratype: SMNS 66000/255 (SMNS).

Superfamily **Mantispoidea** Leach in Brewster, 1815

Family **Berothidae** Handlirsch, 1906

Subfamily ***Incertae sedis***

Genus ***Araripeberotha*** Martins-Neto & Vulcano, 1990a
Araripeberotha Martins-Neto & Vulcano, 1990a: 620. Type species. *Araripeberotha fairchildi* Martins-Neto & Vulcano, 1990a: 621 (by original designation)
Taxonomic notes. *Araripeberotha* was originally described in the berothid subfamily Cyrenoberothinae; it was treated as Berothidae *incertae sedis* by Machado et al. (2022).

Brazilian species

Araripeberotha fairchildi Martins-Neto & Vulcano, 1990a
Carириberotha fairchildi (Martins-Neto & Vulcano, 1990a)
Type locality. Precise locality unknown, probably near Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CD-1-36 (Desirèe collection, MN-UFRJ).

Genus ***Carириberotha*** Martins-Neto & Vulcano, 1990a
Carириberotha Martins-Neto & Vulcano, 1990a: 621. Type species. *Carириberotha martinsi* Martins-Neto & Vulcano, 1990a: 622 (by original designation)
Taxonomic notes. *Carириberotha* was originally described in the berothid subfamily Cyrenoberothinae; it was treated as Berothidae *incertae sedis* by Machado et al. (2022).

Brazilian species

Carириberotha martinsi Martins-Neto & Vulcano, 1990a
Araripeberotha martinsi (Martins-Neto & Vulcano, 1990a)
Type locality. Near Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CV-2070 (CV/MZUSP).

Superfamily **Myrmeleontoidea** Latreille, 1802

Family **Babinskaiidae** Martins-Neto & Vulcano, 1989b

Genus ***Babinskaia*** Martins-Neto & Vulcano, 1989b
Babinskaia Martins-Neto & Vulcano, 1989b: 383. Type species. *Babinskaia pulchra* Martins-Neto & Vulcano, 1989b: 383 (by original designation).

Brazilian species

Babinskaia formosa Martins-Neto & Vulcano, 1989b
Type species. Precise location unknown, near Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: GP/IT-1628 (mold-IGc/USP), CV-1545 (contermold-CV/MZUSP).

Babinskaia pulchra Martins-Neto & Vulcano, 1989b
Type species. Precise location unknown, near Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).

Type material. Holotype: CV-1548 (CV/MZUSP).

Genus ***Neliana*** Martins-Neto, 1992a
Nelia Martins-Neto & Vulcano, 1989c: 316. Type species. *Nelia maculata* Martins-Neto & Vulcano, 1989c: 316 (by original designation) [nomen praeoccupatum, *Nelia* Hayward, 1953 (Lepidoptera: Nymphalidae)].
Neliana Martins-Neto, 1992a: 118. Type species. *Nelia maculata* Martins-Neto & Vulcano, 1989c: 316 (by original designation) [nomen novum pro *Nelia* Martins-Neto & Vulcano, 1989c].

Brazilian species

Neliana impolluta Martins-Neto, 1997
Type locality. Fazenda Tatajuba, Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: RGMM-TO19 (RGMN).

Neliana maculata (Martins-Neto & Vulcano, 1989c)
Nelia maculata Martins-Neto & Vulcano, 1989c
Type locality. Precise location unknown, near Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CV-1777 (CV/MZUSP).

Genus ***Parababinskaia*** Makarkin, Heads & Wedmann, 2017
Parababinskaia Makarkin, Heads & Wedmann, 2017: 153. Type species. *Parababinskaia elegans* Makarkin, Heads & Wedmann, 2017: 153 (by original designation).

Brazilian species

Parababinskaia elegans Makarkin, Heads & Wedmann, 2017
Type locality. Precise location unknown, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: INHSP 1508 (INHSP).

Genus ***Paraneliana*** Jouault & Nel, 2021
Paraneliana Jouault & Nel, 2021: 204. Type species. *Paraneliana sennlaubi* Jouault & Nel, 2021: 205 (by original designation).

Brazilian species

Paraneliana sennlaubi Jouault & Nel, 2021
Type locality. Near Nova Olinda municipality (7.2° S, 39.4° W), Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: 16013 (Markus Sennlaub collection, MHNEC).

Family **Cratosmylidae** Myskowiak, Escuillié & Nel, 2015
Taxonomic notes. The taxonomic status of Cratosmylidae is unsettled in recent literature, with some authors recognizing Cratosmylidae as a separate family (e.g., Makarkin et al., 2017; Archibald and Makarkin, 2020; Lu et al., 2022), and other authors incorporating 'cratosmylid' taxa into different circumscriptions of Nymphidae (e.g., Menon et al., 2005; Myskowiak et al., 2016; Winterton et al., 2019). While the matter is currently not well resolved, herein, we treat *Araripenymphes* and *Cratosmylus* in Cratosmylidae following Lu et al. (2022).

Genus ***Araripenymphes*** Menon, Martins-Neto & Martill, 2005
Araripenymphes Menon, Martins-Neto & Martill, 2005: 12. Type species. *Araripenymphes seldeni* Menon, Martins-Neto & Martill, 2005: 12 (by original designation).

Brazilian species

Araripenymphes seldeni Menon, Martins-Neto & Martill, 2005
Type locality. Nova Olinda municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: SBPr-I-2365 (SBPr).

Genus ***Cratosmylus*** Myskowiak, Escuillié & Nel, 2015
Cratosmylus Myskowiak, Escuillié & Nel, 2015: 27. Type species. *Cratosmylus magnificus* Myskowiak, Escuillié & Nel, 2015: 28 (by original designation).

Brazilian species

Cratosmylus magnificus Myskowiak, Escuillié & Nel, 2015
Type locality. Precise location unknown, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: WDC-CCFB-8 (WDC).

Family **Myrmeleontidae** Latreille, 1802

Subfamily **Araripeneurinae** Martins-Neto & Vulcano, 1989b

Genus ***Araripeneura*** Martins-Neto & Vulcano, 1989b
Araripeneura Martins-Neto & Vulcano, 1989b: 371. Type species. *Araripeneura regia* Martins-Neto & Vulcano, 1989b: 371 (by original designation).

Brazilian species

Araripeneura crassatella (Martins-Neto & Vulcano, 1997)
Cariririneura crassatella Martins-Neto, 1994 (unavailable)
Cariririneura crassatella Martins-Neto & Vulcano, 1997
Type locality. Fazenda Tatajuba, Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CV-2461 (CV/MZUSP); Paratype: CV-2708 (CV/MZUSP).

Araripeneura damianii (Martins-Neto, 1992a)
Cariririneura damianii Martins-Neto, 1992a
Type locality. Fazenda Tatajuba, Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: GP/lT-1624 (IGc/USP); Paratypes: DGM-6283-1, DGM-6284-1 (DNPM).

Araripeneura gracilis Martins-Neto & Vulcano, 1989b
Type locality. Precise locality unknown, near Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).

Type material. Holotype: CV-332 (CV/MZUSP).

Araripeneura regia Martins-Neto & Vulcano, 1989b
Caririneura regia (Martins-Neto & Vulcano, 1989b)
Type locality. Precise locality unknown, near Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CV-1543 (CV/MZUSP); Paratype: CV-1539 (CV/MZUSP).

Araripeneura urda Martins-Neto, 2003
Type locality. Pedra Branca Quarry, Nova Olinda-Santana do Cariri road, at 4 km from Nova Olinda municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: MPFT-I-OlO (MPFT).

Genus ***Caldasia*** Martins-Neto & Vulcano, 1989b
Caldasia Martins-Neto & Vulcano, 1989b: 378. Type species. *Caldasia cretacea* Martins-Neto & Vulcano, 1989b: 378 (by original designation).

Brazilian species

Caldasia cretacea Martins-Neto & Vulcano, 1989b
Type locality. Precise locality unknown, near Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CV-2076 (CV/MZUSP).

Genus ***Caririneura*** Martins-Neto & Vulcano, 1989b
Caririneura Martins-Neto & Vulcano, 1989b: 378. Type species. *Caririneura microcephala* Martins-Neto & Vulcano, 1989b: 379 (by original designation).

Brazilian species

Caririneura macrothoracica Makarkin, Wedmann & Heads, 2018
Type locality. Precise locality unknown, Chapada do Araripe, Ceará state, northeast Brazil
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: INHSP 1525 (INHSP).

Caririneura microcephala Martins-Neto & Vulcano, 1989b
Type locality. Precise locality unknown, near Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CV-1537 (CV/MZUSP).

Genus ***Cratoalloneura*** Martins-Neto, 1992a
Alloneura Martins-Neto & Vulcano, 1989b: 385. Type species. *Alloneura acuminata* Martins-Neto & Vulcano, 1989b: 386 (by original designation) [nomen praeoccupatum, *Alloneura* Rondani, 1856 (Diptera: Pipunculidae)]. *Cratoalloneura* Martins-Neto, 1992a: 118. Type species. *Alloneura acuminata* Martins-Neto & Vulcano, 1989b: 386 (by original designation) [nomen novum pro *Alloneura* Martins-Neto & Vulcano, 1989b].

Brazilian species

Cratoalloneura acuminata (Martins-Neto & Vulcano, 1989b)
Alloneura acuminata Martins-Neto & Vulcano, 1989b
Type locality. Precise locality unknown, near Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CV-1181 (CV/MZUSP); Paratype: CV-1182 (CV/MZUSP).

Cratoalloneura verdandia Martins-Neto, 2003
Type locality. Pedra Branca Quarry, Nova Olinda-Santana do Cariri road, at 4 km from Nova Olinda municipality, Chapada do Araripe, Ceará State, Northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: MPFT-I-013 (MPFT).

Genus ***Cratoneura*** Martins-Neto, 1992b
Cratoneura Martins-Neto, 1992b: 808. Type species. *Cratoneura longissima* Martins-Neto, 1992b: 809 (by original designation).

Brazilian species

Cratoneura dividens Martins-Neto, 1994
Type locality. Pedra Branca Quarry, Nova Olinda-Santana do Cariri road, at 4 km from Nova Olinda municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: UG/IT-45 (IGc/USP).

Cratoneura longissima Martins-Neto, 1992b
Type locality. Fazenda Tatajuba, Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: UnG/1T-04 (IGc/USP).

Cratoneura minor Makarkin, Wedmann & Heads, 2018
Type locality. Precise locality unknown, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: INHSP-1522 (INHSP).

Cratoneura pulchella Martins-Neto, 1992b
Type locality. Fazenda Tatajuba, Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: UnG/IT-05 (IGc/USP).

Genus ***Cratopteryx*** Martins-Neto & Vulcano, 1989b
Cratopteryx Martins-Neto & Vulcano, 1989b: 380. Type species. *Cratopteryx robertosantosi* Martins-Neto & Vulcano, 1989b: 380 (by original designation).

Brazilian species

Cratopteryx nemopteroides Martins-Neto, 2003
Caririneura nemopteroides (Martins-Neto, 2003)
Type locality. Pedra Branca Quarry, Nova Olinda-Santana do Cariri road, at 4 km from Nova Olinda municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).

Type material. Holotype: MPFT-I-004 (MPFT).

Cratopteryx robertosantosi Martins-Neto & Vulcano, 1989b
Type locality. Precise locality unknown, near Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CV-1538 (CV/MZUSP).

Genus ***Diegopteryx*** Martins-Neto in Martins-Neto & Rodrigues, 2010
Diegopteryx Martins-Neto in Martins-Neto & Rodrigues, 2010: 5. Type species. *Diegopteryx raptorial* Martins-Neto in Martins-Neto & Rodrigues, 2010: 5 (by original designation).

Brazilian species

Diegopteryx raptoria Martins-Neto in Martins-Neto & Rodrigues, 2010
Type locality. Nova Olinda-Santana do Cariri road, at 4 km from Nova Olinda municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CPCA 3576a (mold-CPCA), CPCA 3576b (contermold-CPCA).
General notes: The types were originally deposited in the CPCA, but current information suggests that they are now in the CCNH/UFABC.

Genus ***Paracaririneura*** Martins-Neto & Vulcano, 1997
Paracaririneura Martins-Neto & Vulcano, 1997: 66. Type species. *Paracaririneura priscila* Martins-Neto & Vulcano, 1997: 66 (by original designation).

Brazilian species

Paracaririneura priscila Martins-Neto & Vulcano, 1997
Paracaririneura priscila Martins-Neto, 1994 (unavailable)
Type locality. Fazenda Tatajuba, Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CV-6110 (CV/MZUSP).

Subfamily **Ascalaphinae** Latreille, 1802

Genus ***Cratoscalapha*** Martins-Neto & Vulcano, 1997
Cratoscalapha Martins-Neto & Vulcano, 1997: 67. Type species. *Cratoscalapha electroneura* Martins-Neto & Vulcano, 1997: 67 (by original designation).

Brazilian species

Cratoscalapha electroneura Martins-Neto & Vulcano, 1997
Cratoscalapha electroneura Martins-Neto, 1994 (unavailable)
Type locality. Fazenda Tatajuba, Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CV-2711 (CV/MZUSP).

Subfamily **Pseudonymphinae** Martins-Neto, 1992a

Genus ***Bleyeria*** Martins-Neto, 1992a
Bleyeria Martins-Neto, 1992a: 126. Type species. *Bleyeria nordestina* Martins-Neto, 1992a: 127 (by original designation).

Brazilian species

Bleyeria nordestina Martins-Neto, 1992a
Type locality. Fazenda Tatajuba, Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: GP/IT-1676 (IGc/USP).

Genus ***Blittersdorffia*** Martins-Neto & Vulcano, 1989b
Blittersdorffia Martins-Neto & Vulcano, 1989b: 375. Type species. *Blittersdorffia pleoneura* Martins-Neto & Vulcano, 1989b: 375 (by original designation).

Brazilian species

Blittersdorffia dicotomica Martins-Neto, 1990
Type locality. Fazenda Tatajuba, Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CV-6012 (CV/MZUSP).
Blittersdorffia pleoneura Martins-Neto & Vulcano, 1989b
Type locality. Precise locality unknown, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CD-I-002 (Desirèe collection, MN-UFRJ).

Blittersdorffia polyplusia Martins-Neto, 1997
Type locality. Precise location unknown, probably between the municipalities of Nova Olinda and Santana do Cariri, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: AMNH-43288 (AMNH).
General notes. The holotype and other specimens have been returned to Brazil and are deposited in the MZUSP (Behrensmeyer and Turner, 2013).

Blittersdorffta pulcherrima Martins-Neto & Vulcano, 1997
Type locality. Fazenda Tatajuba, Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CV-2080 (CV/MZUSP).

Blittersdorffta volkheimeri Martins-Neto & Vulcano, 1989c
Blittersdorffta volkheimeri Martins-Neto, 1994 (unavaiable)
Type locality. Nova Olinda-Santana do Cariri road, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: GP/IT-1629 (IGc/USP).

Genus ***Pseudonymphes*** Martins-Neto & Vulcano, 1989b
Pseudonymphes Martins-Neto & Vulcano, 1989b: 376. Type species. *Pseudonymphes araripensis* Martins-Neto & Vulcano, 1989b: 376 (by original designation).

Brazilian species

Pseudonymphes araripensis Martins-Neto & Vulcano, 1989b
Type species. Precise location unknown, near Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil.

Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CV-1542 (CV/MZUSP).
Taxonomic notes. *Pseudonymphes araripensis* paratype CV-214 was subsequently designated as the holotype of *Pseudonymphes ponomarenkoi*.

Pseudonymphes brunherottae Martins-Neto, 1994
Type locality. Precise location unknown, near Nova Olinda municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: UG/1T-44 (IGc/USP).

Pseudonymphes ponomarenkoi Martins-Neto, 1992a
Type locality. Precise location unknown, near Santana do Cariri municipality, Chapada do Araripe, Ceará State, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CV-214 (CV/MZUSP).
Taxonomic notes. The holotype of *P. ponomarenkoi* is also a paratype of *P. araripensis*.

Pseudonymphes zambonii Martins-Neto, 1998
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: RGMN-TIO (RGMN).

Family **Nemopteridae** Burmeister, 1839

Subfamily ***Incertae sedis***

Genus ***Cratocroce*** Nel & Pella, 2020
Cratocroce Nel & Pella, 2020: 338. Type species. *Cratocroce araripensis* Nel & Pella, 2020: 338 (by original designation).

Brazilian species

Cratocroce araripensis Nel & Pella, 2020
Type locality. Precise locality unknown, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: PC-CE0048 (PC-CE).

Genus ***Cratonemopteryx*** Martins-Neto, 1992a
Megalopteryx Martins-Neto & Vulcano, 1989b: 389. Type species. *Megalopteryx auda* Martins-Neto & Vulcano, 1989b: 389 (by original designation) [nomen praeoccupatum, *Megalopteryx* Trautschold, 1890 (Agnatha: Pteraspidiformes: Psammosteidae]
Cratonemopteryx Martins-Neto, 1992a: 118. Type species. *Megalopteryx auda* Martins-Neto & Vulcano, 1989b: 389 [nomen novum pro *Megalopteryx* Martins-Neto & Vulcano, 1989b].

Brazilian species

Cratonemopteryx audax (Martins-Neto & Vulcano, 1989b)
Megalopteryx audax Martins-Neto & Vulcano, 1989b
Type locality. Precise locality unknown, near Santana do Cariri municipality, Chapada do Cariri, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CV-1187 (CV/MZUSP).

Cratonemopteryx robusta (Martins-Neto & Vulcano, 1989b)
Megalopteryx robusta Martins-Neto & Vulcano, 1989b
Type locality. Precise locality unknown, near Santana do Cariri municipality, Chapada do Araripe, Ceará state, Northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CV-999 (CV/MZUSP).

Cratonemopteryx speciosa Martins-Neto & Vulcano, 1997
Cratonemopteryx speciosa Martins-Neto, 1994 (unavailable)
Type locality. Fazenda Tatajuba, Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CV-6112 (CV/MZUSP).

Genus ***Krika*** Martins-Neto, 1992b
Krika Martins-Neto, 1992b: 812. Type species. *Krika pilosa* Martins-Neto, 1992b: 812 (by original designation).

Brazilian species

Krika pilosa Martins-Neto, 1992b
Type locality. Fazenda Tatajuba, Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: UnG/1T-06 (IGc/USP).

Genus ***Roesleriana*** Martins-Neto, 1997
Roesleria Martins-Neto & Vulcano, 1989b: 387. Type species. *Roesleria exotica* Martins-Neto & Vulcano, 1989b: 387 (by original designation) [nomen praeoccupatum, *Roesleria* Badonnel, l963 (Psocoptera: Elipsocidae)]
Roesleriana Martins-Neto, 1997: 69. Type species. Roesleria exotica Martins-Neto & Vulcano, 1989b: 387 (by original designation) [nomen novum pro *Roesleria* Martins-Neto & Vulcano, 1989b].

Brazilian species

Roesleriana exotica (Martins-Neto & Vulcano, 1989b)
Roesleria exotica Martins-Neto & Vulcano, 1989b
Type locality. Precise locality unknown, near Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: GP/IT-1627 (IGc/USP).

Family **Nymphidae** Rambur, 1842

Subfamily ***incertae sedis***

Genus ***Olindanymphes*** Martins-Neto, 2005b
Olindanymphes Martins-Neto, 2005b: 5. Type species. *Olindanymphes makarkini* Martins-Neto, 2005b: 5 (by original designation).

Brazilian species

Olindanymphes headsi Makarkin, 2022
Type locality. Precise locality unknown, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: INHSP 1510 (INHSP).
General notes. Makarkin (2022) noted that the holotype will be sent to an appropriate Brazilian institution for permanent deposition.

Olindanymphes makarkini Martins-Neto, 2005b
Type locality. Pedra Branca Quarry, Nova Olinda-Santana do Cariri road, at 4 km from Nova Olinda municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: MPFT-I-030 (SBPr).

Genus ***Rafaelnymphes*** Myskowiak, Huang, Azar, Cai, Garrouste & Nel, 2016
Rafaelnymphes Myskowiak, Huang, Azar, Cai, Garrouste & Nel, 2016: 216. Type species. *Rafaelnymphes cratoensis* Myskowiak, Huang, Azar, Cai, Garrouste & Nel, 2016: 216 (by original designation).

Brazilian species

Rafaelnymphes cratoensis Myskowiak, Huang, Azar, Cai, Garrouste & Nel, 2016
Type locality. Precise locality unknown, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: WDC-CCFB-9 (WDC).

Genus ***Santananymphes*** Martins-Neto, 2005b
Santananymphes Martins-Neto, 2005b: 7. Type species. *Santananymphes ponomarenkoi* Martins-Neto, 2005b: 7 (by original designation).

Brazilian species

Santananymphes ponomarenkoi Martins-Neto, 2005b
Type locality. Pedra Branca Quarry, Nova Olinda-Santana do Cariri road, at 4 km from Nova Olinda municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: MPFT-I-031 (SBPr).

Family **Palaeoleontidae** Martins-Neto, 1992b

Genus ***Araripeleon*** Millet & Nel, 2010
Araripeleon Millet & Nel, 2010: 49. Type species. *Araripeleon alphonsei* Millet & Nel, 2010: 49 (by original designation).

Brazilian species

Araripeleon alphonsei Millet & Nel, 2010
Type locality. Precise locality unknown, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: SMNK 2358 PAL (SMNK).

Genus ***Baisopardus*** Ponomarenko, 1992
Baisopardus Ponomarenko, 1992: 65. Type species. *Baisopardus banksianus* Ponomarenko, 1992: 65 (by original designation).

Brazilian species

Baisopardus araripensis (Martins-Neto, 1992b)
Palaeoleon araripensis Martins-Neto, 1992b
Neurastenyx araripensis (Martins-Neto, 1992b)
Type locality. Fazenda Tatajuba, Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: UnG/1T-03 (IGc/USP).

Baisopardus conani (Martins-Neto in Martins-Neto & Rodrigues, 2010)
Neurastenyx conani Martins-Neto in Martins-Neto & Rodrigues, 2010
Type locality. Nova Olinda-Santana do Cariri road, at 4 km from Nova Olinda municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CPCA 3575 (CPCA).
General notes: The holotype was originally deposited in the CPCA; current information indicates that it is present in the CCNH/UFABC.

Baisopardus cryptohymen Heads, Martill & Loveridge, 2005
Neurastenyx cryptohymen (Heads, Martill & Loveridge, 2005)
Type locality. Precise locality unknown, near Nova Olinda municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: SMNS 65470 (SMNS).

Baisopardus escuilliei Myskowiak & Nel, 2016
Type locality. Precise locality unknown, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: WDC-CCFB-10 (WDC).

Baisopardus polyhymnius (Martins-Neto, 1997)
Neurastenyx polyhymnia Martins-Neto, 1997
Type locality. Precise location unknown, probably between Nova Olinda and Santana do Cariri municipalities, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: AMNH-44412 (AMNH).
General notes. The holotype and other specimens have been returned to Brazil and are deposited in the MZUSP (Behrensmeyer and Turner, 2013).

Baisopardus pumilio Myskowiak & Nel, 2016
Type locality. Precise locality unknown, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: MNHN.F.53345 (MNHN).

Genus ***Neurastenyx*** Martins-Neto & Vulcano, 1997
Neurastenyx Martins-Neto & Vulcano, 1997: 67. Type species. *Neurastenyx gigas* Martins-Neto & Vulcano, 1997 (by original designation).

Brazilian species

Neurastenyx gigas Martins-Neto & Vulcano, 1997
Neurastenyx gigas Martins-Neto, 1994 (unavailable)
Baisopardus gigas (Martins-Neto & Vulcano, 1997)
Type locality. Fazenda Tatajuba, Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CV-2836 (CV/MZUSP).

Genus ***Paraneurastenyx*** Martins-Neto, 1998
Paraneurastenyx Martins-Neto, 1998: 39. Type species. *Paraneurastenyx ascalaphyx* Martins-Neto, 1998: 40 (by original designation).

Brazilian species

Paraneurastenyx ascalaphyx Martins-Neto, 1998
Neurastenyx ascalaphyx (Martins-Neto, 1998)
Type locality. Pedra Branca Quarry, Nova Olinda-Santana do Cariri road, at 4 km from Nova Olinda municipality, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: RGMN-T09 (RGMN).
General notes: The holotype was originally deposited in the RGMN; current information indicates that it is present in the CCNH/UFABC.

Genus ***Parapalaeoleon*** Menon & Makarkin, 2008
Parapalaeoleon Menon & Makarkin, 2008: 156. Type species. *Parapalaeoleon magnus* Menon & Makarkin, 2008: 156 (by original designation).

Brazilian species

Parapalaeoleon magnus Menon & Makarkin, 2008
Type locality. Precise locality unknown, near Nova Olinda municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: SMNS 66000/ 268 (SMNS).

Family **Rafaelianidae** Engel & Nel, 2017

Genus ***Rafaeliana*** Nel, Garrouste, Bechly, Pohl & Escuillié, 2006
Rafaelia Nel, Bechly, Garrouste, Pohl & Escuillié, 2005a: 846. Type species. *Rafaelia maxima* Nel, Bechly, Garrouste, Pohl & Escuillié, 2005a: 846 [nomen praeoccupatum, *Rafaelia* Townsend, 1917 (Diptera)].
Rafaeliana Nel, Garrouste, Bechly, Pohl & Escuillié, 2006: 190. Type species. *Rafaelia maxima* Nel, Bechly, Garrouste, Pohl & Escuillié, 2005a: 846 (by original designation). [nomen novum pro *Rafaelia* Nel, Bechly, Garrouste, Pohl & Escuillié, 2005a].

Brazilian species

Rafaeliana maxima (Nel, Bechly, Garrouste, Pohl & Escuillié, 2005a)
Rafaelia maxima Nel, Bechly, Garrouste, Pohl & Escuillié, 2005a
Type locality. Precise locality unknown, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: WDC-CCFB-001 (WDC); Paratype: WDC-CCFB-002 (WDC).

Rafaeliana minima (Nel, Bechly, Garrouste, Pohl & Escuillié, 2005a)
Rafaelia minima Nel, Bechly, Garrouste, Pohl & Escuillié, 2005a
Type locality. Precise locality unknown, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: SMNK 2359 (SMNK); Paratypes: B 124 (NODAI), without number (SMNS).

Superfamily **Osmyloidea** Leach in Brewster, 1815

Family **Osmylidae** Leach in Brewster, 1815

Subfamily **Gumillinae** Navás, 1912

Genus ***Nuddsia*** Menon & Makarkin, 2008
Nuddsia Menon & Makarkin, 2008: 151. Type species. *Nuddsia longiantennata* Menon & Makarkin, 2008: 151 (by original designation).
Burmaleon Myskowiak, Huang, Azar, Cai, Garrouste & Nel, 2016: 218. Type species. *Burmaleon magnificus* Myskowiak, Huang, Azar, Cai, Garrouste & Nel, 2016: 219 (by original designation).
Taxonomic notes. Menon and Makarkin (2008) described *Nuddsia* based on a type species from the Crato Formation of Brazil. Myskowiak et al. (2016) described *Burmaleon* based on a type species from Burmese amber. Winterton et al. (2019) synonymized *Burmaleon* under *Nuddsia* based primarily on wing venational characters.

Brazilian species

Nuddsia longiantennata Menon & Makarkin, 2008
Type locality. Precise locality unknown, near Nova Olinda municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: SMNS 66000/263 (SMNS).

Nuddsia repatriata Martins-Neto in Martins-Neto & Rodrigues, 2010
Type locality. Nova Olinda-Santana do Cariri road, at 4 km from Nova Olinda municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: MPSC 1-1889 (MPSC).

Superfamily **Psychopsoidea** Handlirsch, 1906

Family **Kalligrammatidae** Handlirsch, 1906

Subfamily **Kalligrammatinae** Handlirsch, 1906

Genus **Makarkinia** Martins-Neto, 1997
Makarkinia Martins-Neto, 1997: 74. Type species. *Panfilovia adamsi* Martins-Neto, 1992a: 128 (by original designation).

Brazilian species

Makarkinia adamsi (Martins-Neto, 1992a)
Panfilovia adamsi Martins-Neto, 1992a
Type locality. Precise location unknown, probably between Nova Olinda and Santana do Cariri municipalities, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CD-1-125 (Desirèe collection, MN-UFRJ).

Makarkinia irmae Machado, Freitas & Ribeiro, 2021
Type locality. Três Irmãos Quarry, Nova Olinda municipality (07°05'30"S; 3940'46"W), Chapada do Araripe, Ceará state, Northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CCNH-103 (CCNH/UFABC).

Makarkinia kerneri Bechly & Makarkin, 2016
Type locality. Precise location unknown, near Nova Olinda municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: SMNS 70287 (SMNS).

Family **Psychopsidae** Handlirsch, 1906

Genus ***Pulchroptilonia*** Martins-Neto, 1997
Pulchroptilonia Martins-Neto, 1997: 70. Type species. *Pulchroptilonia espatifata* Martins-Neto, 1997: 71 (by original designation).

Brazilian species

Pulchroptilonia espatifata Martins-Neto, 1997
Type locality. Fazenda Tatajuba, Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: RGMN-TOlO (RGMN); Paratype: RGMN-TO11 (RGMN).
General notes: The holotype was originally deposited in the RGMN; current information indicates that it is present in the CCNH/UFABC.

Genus ***Putzneura*** Martins-Neto in Martins-Neto & Rodrigues, 2010
Putzneura Martins-Neto in Martins-Neto & Rodrigues, 2010: 5. Type species. *Putzneura parcimoniosa* Martins-Neto in Martins-Neto & Rodrigues, 2010: 7 (by original designation).

Brazilian species

Putzneura parcimoniosa Martins-Neto in Martins-Neto & Rodrigues, 2010
Type locality. Nova Olinda-Santana do Cariri road, at 4 km from Nova Olinda municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CPCA-3577 (CPCA).

Neuroptera ***Incertae sedis***

Genus ***Brasilopsychopsis*** Rumbucher, 1995
Brasilopsychopsis Rumbucher, 1995: 52. Type species. *Brasilopsychopsis kandleri* Rumbucher, 1995: 52 (by original designation).
Taxonomic notes. Rumbucher (1995) described *Brasilopsychopsis* in Hemerobiidae. However, based on images included in the original description, it is likely that this species is not related to Hemerobiidae, so herein we place this genus as Neuroptera *incertae sedis*.

Brazilian species

Brasilopsychopsis kandleri Rumbucher, 1995
Type locality. Precise location unknown, Chapada do Araripe, Pernambuco state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Unknown. Probably, Rumbucher collection.

Genus ***Cratopsychopsis*** Rumbucher, 1995
Cratopsychopsis Rumbucher, 1995: 52. Type species. *Cratopsychopsis maiseyi* Rumbucher, 1995: 52 (by original designation).
Taxonomic notes. Rumbucher (1995) described *Cratopsychopsis* in Hemerobiidae. However, based on images included in the original description, it is likely that this species is not related to Hemerobiidae, so herein we place this genus as Neuroptera *incertae sedis*.

Brazilian species

Cratopsychopsis maiseyi Rumbucher, 1995
Type locality. Precise location unknown, Chapada do Araripe, Pernambuco state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Unknown. Probably, Rumbucher collection.

Genus ***Cratosisyrops*** Martins-Neto, 1997
Cratosisyrops Martins-Neto, 1997: 71. Type species. *Cratosisyrops gonzagai* Martins-Neto, 1997: 71 (by original designation).
Taxonomic notes. Martins-Neto (1997), in the original description of *Cratosisyrops*, compared the genus to genera of Sisyridae, but did not confidently place it to family.
Perkovsky and Makarkin (2015) agreed that the preserved characters of the holotype do not allow a confident family determination.

Brazilian species

Cratosisyrops gonzagai Martins-Neto, 1997
Type locality. Precise location unknown, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CV-1536 (CV/MZUSP).

Order **Raphidioptera** Martynov, 1925

Subfamily **Baissopteridae** Martynova, 1961

Genus ***Austroraphidia*** Willmann, 1994
Austroraphidia Willmann, 1994: 177. Type species. *Raphidia brasiliensis* Nel, Séméria & Martins-Neto, 1990: 27 (by original designation).

Brazilian species

Austroraphidia brasiliensis (Nel, Séméria & Martins-Neto, 1990)
Raphidia brasiliensis Nel, Séméria & Martins-Neto, 1990
Type locality. Precise location unknown, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: IPM-R54102 (Nell collection, MNHN).

Genus ***Baissoptera*** Martynova, 1961
Baissoptera Martynova, 1961: 80. Type species. *Baissoptera martinsoni* Martynova, 1961: 80 (by original designation).
Arariperaphidia Martins-Neto & Vulcano, 1990b: 243. Type species. *Arariperaphidia rochai* Martins-Neto & Vulcano, 1990b: 245 (by original designation).
Cratoraphidia Martins-Neto & Nel, 1993: 426. Type species. *Cratoraphidia pulchra* Martins-Neto & Nel, 1993: 427 (by original designation).
Rudiraphidia Ren, 1997: 175. Type species. *Baissoptera liaoningensis* Ren, 1994: 132 (by original designation).
Taxonomic notes. Engel (2002) synonymized *Cratoraphidia,* and *Rudiraphidia* with *Baissoptera*; Bechly and Wolf-Schwenninger (2011) synonymized *Arariperaphidia* with *Baissoptera.*

Brazilian species

Baissoptera brasiliensis Oswald, 1990
Type locality. Near Nova Olinda municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: AMNH 43287 (AMNH); Paratype: AMNH 44400/44407 (AMNH).
General notes. The holotype and other specimens have been returned to Brazil and are deposited in the MZUSP (Behrensmeyer and Turner, 2013).

Baissoptera lisae Jepson, Ansorge & Jarzembowski, 2011

Type locality. Precise location unknown, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CAMSM X.50155.2 (Wunderlich collection, CAMSM).

Baissoptera pulchra (Martins-Neto & Nel, 1993)
Cratoraphidia pulchra Martins-Neto & Nel, 1993
Type locality. Fazenda Massapê, near Nova Olinda municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: GP/1T-1673 (IGc/USP).

Baissoptera rochai (Martins-Neto & Vulcano, 1990b)
Arariperaphidia rochai Martins-Neto & Vulcano, 1990b
Type locality. Precise location unknown, near Santana do Cariri municipality, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CV-5010 (CV/MZUSP); Paratypes: CV-328, CV-331 (CV/MZUSP).

Family ***Incertae sedis***

Genus ***Caririraphidia*** Martins-Neto, 2003
Caririraphidia Martins-Neto, 2003: 45. Type species. *Caririraphidia sertaneja* Martins-Neto, 2003: 46 (by original designation).

Brazilian species

Caririraphidia reticulata Martins-Neto, 2003
Type locality. Precise location unknown, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: RGMN-163 (RGMN).

Caririraphidia sertaneja Martins-Neto, 2003
Type locality. Precise location unknown, probably between the Nova Olinda and Santana do Cariri municipalities, Chapada do Araripe, Ceará state, northeast Brazil.
Type horizon. Crato Formation, Santana group, Araripe Basin, Early Cretaceous (Aptian).
Type material. Holotype: CD-I-l21 (Desirèe collection, MN-UFRJ).

Neuropterida ***Incertae sedis***

Family **Permithonidae** Tillyard, 1922

Genus ***Permipsythone*** Pinto & Ornellas, 1980
Permipsythone Pinto & Ornellas, 1980: 156. Type species. *Permipsythone panfilovi* Pinto & Ornellas, 1980: 156 (by original designation).

Brazilian species

Permipsythone panfilovi Pinto & Ornellas, 1980
Type locality. km 79 of Porto Alegre-Uruguaiana road, Rio Grande do Sul state, south Brazil.
Type horizon. Irati Formation, Passa Dois group, Paraná Basin, Early Permian (Kungurian).
Type material. Holotype: MP-I-5260 (UFRGS).

Discussion

Neuropterida

The currently-known extinct Neuropterida fauna of Brazil comprises 18 families, 55 genera, and 99 species (Table 1; which also contains detailed counts of genera and species by order and family). At the ordinal level, most species-level diversity is contained in the order Neuroptera (89 spp., 90% of total), with fewer species attributable to other orders: Raphidioptera (7 spp., 7%), Megaloptera (2 spp., 2%), and *incertae sedis* (1 spp., 1%). The relative proportions of Neuroptera and Megaloptera to the total extinct fauna are similar to the proportions of these orders in the extant Neuropterida fauna of Brazil (Neuroptera: 432 spp., 95%; Megaloptera: 24 spp., 5%) (Machado, 2023; Martins, 2023). Extant Raphidioptera are absent from Brazil. Accumulation curves for the number of valid extinct Brazilian Neuropterida, and its individual orders, are given in Fig. 3. The superordinal curve is strongly influenced by the greater diversity of the order Neuroptera and has grown at a fairly steady rate since the first extinct Brazilian neuropterid was described in 1980. The orders Megaloptera and Raphidioptera add relatively little to overall extinct species diversity numbers and have grown at slower rates.

Neuroptera

This order contains most of the extinct fauna, with 15 families, 49 genera, and 89 species (Table 1). The three most diverse families are Myrmeleontidae (29 spp.), Paleoleontidae (10), and Mesochrysopidae (7). The other 12 families collectively contain 43 additional species, but no more than six species in any family. There are two particularly notable differences between the extinct and extant Neuroptera faunas of Brazil. First, Myrmeleontidae are the most diverse family in the extinct fauna (29% of fauna), while Chrysopidae are most diverse in the extant fauna (182 spp, 42%; Myrmeleontidae are second with 88 spp., 20%)

Table 1
Extinct Neuropterida of Brazil: genus and species counts by order and family.

Order Family	Genera (#gen.)	Species (#spp.)
Order Megaloptera	**2**	**2**
Family Corydalidae	2	2
Order Neuroptera	**49**	**89**
Family Babinskaiidae	4	6
Family Berothidae	2	2
Family Chrysopidae	3	6
Family Corydasialidae	1	3
Family Cratosmylidae	2	2
Family Ithonidae	2	2
Family Kalligrammatidae	1	3
Family Mesochrysopidae	3	7
Family Myrmeleontidae	12	29
Family Nemopteridae	4	6
Family Nymphidae	3	4
Family Osmylidae	1	2
Family Palaeoleontidae	5	10
Family Psychopsidae	2	2
Family Rafaelianidae	1	2
Family *incertae sedis*	3	3
Order Raphidioptera	**3**	**7**
Family Baissopteridae	2	5
Family *incertae sedis*	1	2
Order *incertae sedis*	**1**	**1**
Family Permithonidae	1	1
Total (Superorder Neuropterida)	**55**	**99**

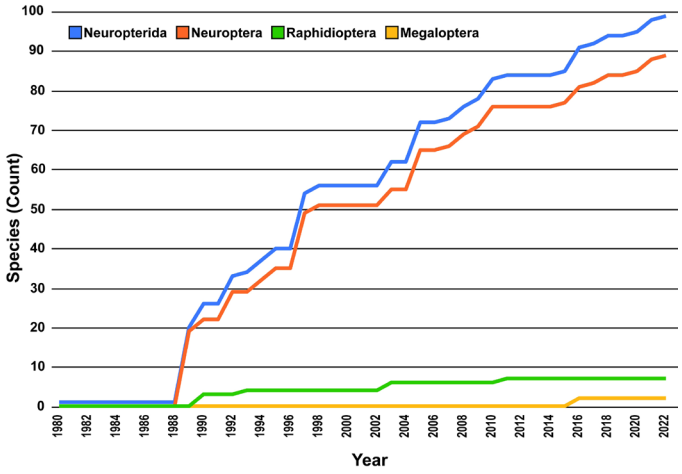

Figure 3 Accumulation curve for valid species of extinct Brazilian Neuropterida.

(Machado and Martins, 2022; Martins and Machado, 2023); given the known primary habitat preferences of extant Myrmeleontidae and Chrysopidae, this result is consistent with both the hypothesis that the depositional environment of the Crato Formation was bordered by arid terrestrial habitats (favored by Myrmeleontidae) and the general observation that modern Brazilian ecosystems are dominated by tropical forest habitats (favored by Chrysopidae), with smaller areas of arid habitat. And second, the extinct fauna contains representatives of several families – Ithonidae, Nemopteridae, Nymphidae, and Psychopsidae – that are lacking in the known extant fauna of Brazil; this identifies lineage extinction as an important factor influencing the composition of the extant neuropteran (and consequently, neuropterid) fauna of Brazil.

Raphidioptera

To date, the Crato Formation has yielded a modestly diverse snakefly fauna consisting of 1 family, 2 genera, and 5 species, plus 2 additional species in one *incertae sedis* genus (Table 1). First described in 1990 (as three different species, in three different papers by different authors! -- Martins-Neto and Vulcano, 1990b; Nel et al., 1990; Oswald, 1990), the Crato Raphidioptera remain the southernmost documented records of the order and the only records of the order (extinct or extant) known from the Southern Hemisphere. These taxa are of special biogeographic importance in documenting the formerly larger range of the order Raphidioptera and help validate the interpretation of the unusual distribution of extant snakeflies – western North America and the Palearctic – as having been shaped in part by extinction processes, especially at the end of the Cretaceous (Aspöck, 1998; Aspöck et al., 2012).

Megaloptera

Only two extinct Megaloptera species (both Corydalidae *incertae sedis*) are currently known from Brazil. Although not numerous, these Crato taxa are of special interest biogeographically as two (of only three) extinct Megaloptera species (and the only extinct Corydalidae) currently known from the southern Hemisphere [see Martins et al. (2022)].

Lithostratigraphy

At the species level, 99% (98 spp.) of the currently-known extinct paleoneuropterid fauna of Brazil has been recovered from the Early Cretaceous Crato Formation (Araripe Basin) of northeastern Brazil (Fig. 1); only 1% (1 sp.) is known from the Early Permian Irati Formation (Paraná Basin) of southern Brazil (Fig. 1).

Non-neuropterid insect fossils are currently known from 12 additional lithostratigraphic formations in Brazil (Moura-Júnior et al., 2018). Of these, the Itararé, Teixeira Soares, and Rio do Sul Formations (all from the Paraná Basin) are of Carboniferous age, so may predate the apparent initial differentiation and diversification of the Neuropterida in the Permian. Although some recent time-calibrated phylogenies suggest the possibility of a pre-Permian origin of the Neuropterida (Winterton et al., 2018; Vasilikopoulos et al., 2020), the remaining nine, post-Carboniferous, formations seem more likely candidates for future fossil neuropterid discoveries. The oldest of these is the Late Permian Rio do Rasto Formation (Paraná Basin), which could possess early neuropterids similar to that of the Irati Formation.

Most extinct neuropterid species worldwide (and in Brazil) are known from the Mesozoic, and it seems likely that formations of this age will continue to yield the majority – and broadest taxonomic diversity – of future Brazilian neuropterid fossils. As in many parts of the world, deposits of Triassic and Jurassic age are poorly represented in Brazil and the only known insect-bearing horizons of this age are found in the Santa Maria Formation (Paraná Basin) (Moura-Júnior et al., 2018). Insect-bearing deposits of Cretaceous age are somewhat more common. In addition to the proven Crato Formation, the following two sequences hold great potential for future insect fossil discoveries, including possible Neuropterida: Areado Formation (Sanfranciscana Basin, southeastern Brazil) and Codó Formation (Pará-Maranhão Basin, northeastern Brazil) (Martins-Neto, 2005a; Moura-Júnior et al., 2018).

The final five known insect-bearing formations in Brazil are of Cenozoic (mostly Paleogene) age: Tremembé (Taubaté Basin, southeastern Brazil), Fonseca (Fonseca Basin, southeastern Brazil), Entre-Córregos (Aiuruoca Basin, southeastern Brazil), Piraçununga (Paraná Basin), and Serra de Santa Helena (Sanfranciscana Basin, southeastern Brazil). These formations could also yield additional fossil Neuropterida. However, the diversity of higher taxonomic groups represented in these formations is expected to be less than that of Mesozoic deposits, and would be expected to closely match the families of the extant Brazilian Neuropterida fauna.

History of Description

In 1980 Brazilian authors Irajá Pinto and Lilia Ornellas described the first species of extinct Brazilian Neuropterida – *Permipsythone panfilovi* (Permithonidae). Last year, Russian author Makarkin (2022) described the latest (but certainly not last!) species – *Olindanymphes headsi* (Nymphidae). These dates and authors bracket the relatively short 42-year period that comprises the descriptive history of this important fauna (Fig. 3). To date, 35 different authors have contributed to the descriptive literature on the Brazilian paleoneuropterid fauna (Table 2). Most of these authors are based in Europe (21), with smaller numbers based in Brazil (8), Asia (3), and the United States (2). The first 25-30 years of descriptive treatments were undertaken primarily by the Brazilian authors Martins-Neto and Vulcano, with a smaller number of contributions from European and American authors [e.g., Nel et al. (1990), Oswald (1990)]. However, near and following the death of Martins-Neto in 2010, the relative number of non-Brazilian contributions increased significantly – as no Brazilian authors had yet risen to continue the efforts of Martins-Neto and Vulcano and as more Crato fossils found their way into collections around the world and became more accessible to other researchers. Currently, the primary types of extinct Brazilian Neuropterida are distributed in collections, by region, approximately as follows: Brazil (68%), Europe (19%), United States (11%), and Asia (2%).

Table 2
Extinct Neuropterida of Brazil: home regions and species count attributable to (co)authors of original descriptions.

Author	Home Region	Order		
		Neuroptera (#spp.)	Raphidioptera (#spp.)	Megaloptera (#spp.)
Ansorge, Jörg	Europe	–	1	–
Azar, Dany	Asia	1	–	–
Bechly, Günter	Europe	3	–	–
Cai, Chenyang	Asia	1	–	–
Delclòs, Xavier	Europe	2	–	–
Escuillié, François	Europe	3	–	–
Freitas, André	Brazil	1	–	–
Garrouste, Romain	Europe	3	–	–
Heads, Saw	U.S.A.	4	–	2
Huang, Diying	Asia	1	–	–
Hutin, Arnaud	Europe	2	–	–
Jarzembowski, Edmund	Europe	–	1	–
Jepson, James	Europe	–	1	2
Jouault, Corentin	Europe	1	–	–
Loveridge, Robert	Europe	1	–	–
Machado, Renato	Brazil	1	–	–
Makarkin, Vladimir	Europe	15	–	–
Martill, David	Europe	2	–	–
Martins-Neto, Rafael	Brazil	62	5	–
Menon, Federica	Europe	7	–	–
Millet, Johann	Europe	1	–	–
Myskowiak, Justine	Europe	4	–	–
Nakamine, Hiroshi	Asia	1	–	–
Nel, André	Europe	16	2	–
Ornellas, Lilia	Brazil	1	–	–
Oswald, John	U.S.A.	–	1	–
Pella, Cristian	Europe	1	–	–
Pinto, Irajá	Brazil	1	–	–
Pohl, Burkhard	Europe	2	–	–
Ribeiro, Guilherme	Brazil	1	–	–
Rodrigues, Viviane	Brazil	2	–	–
Rumbucher, Kürt	Europe	2	–	–
Séméria, Yves	Europe	–	1	–
Vulcano, Maria	Brazil	27	1	–
Wedmann, Sonja	Europe	3	–	–

Important Fossil Neuropterida Collections in Brazil

Martins-Neto Collection–For the past decade a substantial impediment to continuing effective work on the extinct Brazilian Neuropterida fauna has been lack of access to the collection of fossils assembled by Rafael Martins-Neto [see short biography by Hessel et al. (2010)]. Martins-Neto was, until 2001, a lecturer in paleontology in the Department of Biology of the Faculdade de Filosofia, Ciências e Letras de Ribeirão (FFCLRP) at the Universidade de São Paulo (USP). While at USP, Martins-Neto maintained a working collection of fossils in his lab. That collection contained specimens that personally belonged to Martins-Neto, together with specimens that he had obtained on loan from other institutions (e.g., CPCA, AMNH). Martins-Neto often referred to this working collection collectively as the 'RGMN' collection. The specimens contained in this collection were the primary focus of his descriptive work, and the collection thus came to include many primary types.

Following his departure from USP in 2001, Martins-Neto moved his working collection to his home. He founded a small, local scientific society (SBPr), and began referring to that society – located at his home – as the repository for the collection's specimens, including its type holdings. After brief associations with several other institutions during the latter part of his academic career [e.g., Universidade Federal de Alfenas, Centro de Ensino Superior de Juiz de Fora; Universidade Federal de Juiz de Fora; see Garcia (2010)], Martins-Neto moved to Crato in January 2010, where he lived until his death on 6 August 2010.

At the time of his death, Martins-Neto's working collection was located in his home, and following his death at least most of it was quietly transferred to the Crato office of the former Brazilian agency Departamento Nacional da Produção Mineral (DNPM; which was later renamed the Agência Nacional de Mineração, ANM). The transferred materials included many specimens originally borrowed from the DNPM's former Centro de Pesquisas da Chapada do Araripe (CPCA), specimens previously loaned from other institutions, and materials from Martins-Neto's personal collection. These materials included many, but apparently not all, of the neuropterid type specimens designated by Martins-Neto in his sole-authored publications.

The materials remained in the DNPM/ANM's possession – largely unknown and inaccessible to the scientific community – until the permanent deactivation of the ANM's Crato office in 2020. Recently, through an agreement with the ANM's Department of Paleontology, this important collection has been transferred to the Universidade Federal do ABC, Santo André, São Paulo, under the care of one of us (GCR), where work on its cataloging and reorganization is ongoing and

from which it will be made accessible to the scientific community. Many of the type specimens contained in the collection were not clearly labeled as such by Martins-Neto and will need to be identified through detailed comparisons with relevant taxonomic literature. Many specimens previously obtained on loan by Martins-Neto from other collections also still require a return to their original source collections. Until the recuration of this collection has been completed, it will not be possible to confidently identify which type specimens may still be unaccounted for.

Vulcano Collection–Another important fossil Neuropterida collection in Brazil is the Maria Aparecida Vulcano Collection. Maria Vulcano was a pioneer in the study of fossil Crato insects, and her personal collection of Crato fossils was housed in her home in São Paulo at the time of her death in 2018. This collection, which is believed to contain many of the type specimens designated in the publications co-authored by Martins-Neto and Vulcano, has recently been donated by the Vulcano family to the Museu de Zoologia da Universidade de São Paulo (MZUSP). At the present time however, the collection is in the process of being reorganized, so it is not yet accessible for scientific study. Because of this temporary inaccessibility, it is not yet possible to reverify which putative Vulcano-collection type specimens still reside in that collection.

National Museum of Rio de Janeiro–On 2 September 2018 a devastating fire almost completely destroyed the National Museum of Rio de Janeiro [MN-UFRJ; see Escobar (2018), Rodrigues-Carvalho et al. (2021)]. All of the Neuropterida specimens of both fossil and extant species that were physically present in the collection on that date must be considered permanently destroyed. Primary type specimens formerly held in this collection may be considered for possible replacement with neotypes under the standard conditions outlined in the relevant articles of the Code. But, it is possible that some specimens that belong to this collection, including some primary type specimens, which were out on loan at the time of the fire, may still be extant.

Priorities for the Future

Researcher Training–The deaths of Martins-Neto and Vulcano left a void in Brazilian expertise in the study of extinct Neuropterida. The training of a new generation of students with knowledge and experience in this area is a high priority in order to initiate and sustain future studies on this fauna. This priority is currently being addressed through the training of new Brazilian students in the labs of some of the coauthors on this paper. In addition to training individual new researchers, there is a need to develop and foster regional paleoentomological research groups in different parts of Brazil, which can facilitate access to the fossil materials present in different collections, undertake new collections, and serve as social and scientific foci to stimulate, encourage, and carry out research.

Collections and Surveys–Paleoentomological research is critically dependent on access to collections of fossils and knowledge about what those collections contain. Documentation concerning the existence and location of Brazilian neuropterid fossils is currently fragmentary, making research on these materials difficult. Better data, and systems supporting more ready access to such data, on current neuropterid fossil collections is needed in order to advance research on these materials. High priorities for documentary work in this area include the collections formerly assembled by Martins-Neto (now partly in the Universidade Federal do ABC, Santo André, São Paulo) and Vulcano (recently incorporated into the Museu de Zoologia da Universidade de São Paulo [MZUSP]), with a particular emphasis on documentation of the location and status of nomenclatural type specimens. Preliminary surveys of other paleontology collections in Brazil for neuropterid fossil specimens are also needed to identify existing source materials that could be utilized in future revisionary and descriptive studies.

As noted above, knowledge of the paleoneuropterid fauna of Brazil is highly skewed toward materials collected from the exceptionally productive Crato Formation. New collections from other formations are needed to provide a more complete picture of the evolutionary history of Brazilian Neuropterida. While additional material from pre- and post-Cretaceous formations would be valuable and instructive, we suggest that priorities for new collections focus particularly on the Cretaceous Areado and Codó Formations. The documented neuropterid diversity of the Crato Formation suggests that these formations could yield abundant fossil neuropterid taxa, and such discoveries would not only enhance knowledge of paleoneuropterid taxon diversity but would also provide new opportunities for analytical and comparative studies examining faunas of relatively similar age across different geographies and depositional environments.

Revisionary and Descriptive Studies–The significant slope of the current accumulation curve for fossil Brazilian Neuropterida (Fig. 3) suggests that knowledge of the taxon diversity of this fauna is still very incomplete and its scientific treatment is still in a productive descriptive phase. Nevertheless, with almost 100 species now described, priorities for future substantive taxon-focused studies should begin to transition from primarily descriptive works to works that embed new descriptive content within the context of broader revisionary and interpretive treatments. To the extent possible, such works should focus on subclades of related taxa, and should begin to integrate knowledge of the Brazilian paleoneuropterid fauna with that of similar faunas from regions outside Brazil. Importantly, future revisionary work should also seek to better integrate knowledge of extinct taxa with known elements of the extant Brazilian neuropterid fauna. Paleoneuropterid taxa that seem particularly ripe for reexamination in several of these contexts include the Raphidioptera, Megaloptera, Chrysopoidea, and Myrmeleontoidea.

While all Brazilian paleoneuropterids described to date have been of the adult life stage, at least one larva (a myrmeleontoid) is known (Martins-Neto et al., 2007). Given their rarity, and their potential to contribute new knowledge to biological and ecological aspects of the evolution of the larger Brazilian Neuropterida fauna, descriptive and interpretive work on immature stages should be prioritized as opportunities arise.

Analytical and Comparative Studies–As the size and knowledge of the Brazilian paleoneuropterid fauna continues to grow its data become of increasing interest for future analytical and comparative studies. Priorities in this area for future work include the incorporation of Brazilian paleoneuropterids into broader studies of global biogeography, neuropterid phylogeny, and regional paleoecology.

Biogeographically, extinct Brazilian Raphidioptera are of special interest as the southernmost known representatives of their clade (either extinct or extant), and Brazilian paleo-Megaloptera are among the very few Megaloptera (and only Corydalidae) species currently known from the southern continents (remnants of former Gondwanaland). The incorporation of these records into biogeographic studies of the Raphidioptera and Megaloptera are of continuing interest, and discoveries of new Brazilian fossils in these orders would be of much interest. Detailed global biogeographic studies of most of the major clades of Neuroptera have yet to be undertaken, but Brazilian records can be expected to be of considerable interest and importance as those research areas mature.

The exceptional preservation of many extinct Brazilian neuropterid taxa, particularly those derived from fine-grained Crato sediments (which often preserve some three-dimensionality among body parts), enhances their potential value for incorporation into morphology-based

phylogenetic analyses. It can be anticipated that the development of additional techniques to further capitalize on this retained three-dimensional structure will continue to increase the value of these fossils for future phylogenetic reconstructions.

As the taxon diversity of Brazilian paleoneuropterids further increases, the clade becomes more and more suitable and informative for incorporation into interpretations of the paleoecology of ancient depositional settings and their environs. While such interpretations are predicated on the reliability of projecting the ecological preferences of extant lineages millions of years into the past, the apparently ancient and highly-conserved morphologies of many neuropterid lineages lends general support to the idea that broad ecological/habitat preferences within many neuropterid lineages may also be conserved over very long periods of time. The strong presence of myrmeleontoids (whose extant species are numerically dominant in arid environments) in the Crato fauna is consistent with and supports the interpretation of the location of the Crato depositional setting within a broader region of general aridity. It will be interesting to see, as knowledge of the extinct Brazilian neuropterid fauna continues to expand (particularly the Crato fauna), if neuropterid taxa are useful for supporting interpretations of other dimensions of the paleoecology of ancient Brazilian environments.

Collecting, Collections and Collaboration–In concluding, we would like to note here the existence of several Brazilian laws that regulate the collection, movement, and deposition of fossils originating in Brazil. Decree 4.416 (Brasil, 1942) specifies that all Brazilian fossils belong to the union, and collecting such specimens requires authorization from the Agência Nacional de Mineração (ANM). Decree 98.830 (Brasil, 1990) – as regulated by Ordinance 55 of the Ministério da Ciência, Tecnologia e Inovação (MCTI) – specifies that non-Brazilians who wish to collect biological or palaeontological materials within Brazil must have a permit from the MCTI, and an established partnership with a recognized Brazilian scientific institution. Decree 98.830 also stipulates that type specimens of fossil taxa, and other specimens 'whose permanence in the country are of national interest,' cannot be exported. For additional details see Cisneros et al. (2022).

These laws provide a broad sociopolitical framework within which work on Brazilian fossils can be carried out. Within this framework, we emphasize here our belief in the importance and value of establishing collaborations among individuals working at many different institutions, both within and outside Brazil. Such collaborations increase the quality and value of research through the synergistic interactions of the knowledge and experience of their participants. As we seek to revitalize work on the Brazilian paleoneuropterid fauna we invite contacts from interested colleagues around the world who would like to participate with us in this effort.

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Conflicts of interest

The authors declare no conflicts of interest.

Author contribution statement

All the authors contributed to designing the study, analyzing the data, and writing the text. CCM prepared the images and table.

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Supplementary Material

The following online material is available for this article:

Extinct Neuropterida_Brazil.