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New neuropteran insects (*Osmylidae*, *Palaeoleontidae*, *Araripeneuridae* and *Psychopsidae*) from the Santana Formation, Early Cretaceous NE Brazil

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ABSTRACT
This paper aims to present the results of a taxonomic study with the fossil Neuroptera from the Crato Member, Santana Formation, Lower Cretaceous from Araripe Basin, Ceará, Brazil. Based on these results, it is proposed the following new taxa: *Nuddsia repatriata* n. sp. (Osmylidae), *Neurastenyx conani* n. sp. (Palaeoleontidae), *Diegopteryx raptorius* n. gen. et n. sp. (Araripeneuridae, Cratopteryxinae n. subfam.), and *Putzneura parcimoniosa* n. gen. et n. sp. (Psychopsidae). The new taxa attests the success of the Neuroptera in equatorial areas of Gondawana during the end of Mesozoic, similar to that reached in Northern Hemisphere, which is valid mainly to the Psychopsidae from Brazil, that show big-size and conspicuous colour patterns, intense pubescence, and it is associated to other endemic forms.

Key words: Neuroptera, Santana Formation, Araripe Basin, Lower Cretaceous, Brazil.

RESUMO
NOVOS NEURÓPTEROS CRETÁCEOS (OSMYLIDAE, PALAEOLEONTIDAE, ARARIPENEURIDAE E PSYCHOPSIDAE) DA FORMAÇÃO SANTANA, NE DO BRASIL. Este artigo apresenta resultados de um estudo taxonômico de fósseis de insetos do Membro Crato da Formação Santana, Bacia do Araripe, Ceará, Brasil. Com base nos resultados, os seguintes novos táxons são propostos: *Nuddsia repatriata* n. sp. (*Osmylidae*), *Neurastenyx conani* n. sp. (Palaeoleontidae), *Diegopteryx raptorius* n. gen. et n. sp. (Araripeneuridae, *Cratopteryxinae* n. subfam.) e *Putzneura parcimoniosa* n. gen. et n. sp. (Psychopsidae). Os novos táxons descritos atestam o sucesso dos Neuroptera nas áreas equatoriais do Gondwana no final do Mesozóico, semelhante àquele que possuíam no Hemisfério Norte. Para a assembleia do Brasil, destacam-se os Psychopsidae, por seu grande tamanho e presença de cor, pubescência e sua associação a um conjunto de outras formas endêmicas de Neuroptera.

Palavras-chave: Neuroptera, formação Santana, Bacia do Araripe, Cretáceo Inferior, Brasil.

INTRODUCTION

The Neuropterans are one of the commonest orders of fossil insects in terms of named species in the laminated limestones of Araripe Basin, with several morphologic, paleoecologic, and paleoethologic aspects being focused on previous works (Martins-Neto, 1991, 1992, 1994, 1997, 1998, 2005, 2006; Martins-Neto and Vulcano, 1989, 1997; Martins-Neto and Rodrigues, 2009). The present contribution provides new forms to that described, including a giant form of Neuroptera. The Araripe neuropterofauna reveals again a great diversity, close to that which today characterizes the extant groups, mainly those included in Osmylidae and Psychopsidae. Some few Neuroptera taxa described by foreign authors based on material keep out from Brazil and which holotypes are fortunately partially rescued here and redescribed, being housed in Brazilian Institutions.

MATERIAL AND METHODS

The samples here focused consist of four selected slabs recently collected in the expositions along Nova Olinda-Santana do Cariri road, 4 km from the municipal district of Nova Olinda, in the well-known laminated limestone from the Crato

Member, Santana Formation, Late Aptian in age (Figure 1A-B). The biostratigraphy of the Santana Formation was previously proposed by Coimbra *et al.* (2002).

The terminology used here is based on Martins-Neto (2002). The abbreviations cited in the text are: MA, anterior media; MP, posterior media; RA, anterior radial; RP, posterior radial; rp-ma, cross vein connecting RP with MA and ScP, posterior subcosta.

SYSTEMATIC PALEONTOLOGY

Order NEUROPTERA Olivier, 1789
Family OSMYLIDAE Leach, 1815
Subfamily GULLIMINAE Navás, 1912

Nuddsia Menon and Makarkin, 2008

Type species. *Nuddsia longiantennata* Menon and Makarkin, 2008, housed at the Staatliches Museum für Naturkunde Stuttgart, Germany, under the number SMNS 66000/263.

Nuddsia repatriata Martins-Neto n. sp.
(Figures 2A-C, 6A)

Etymology. Referring to the conditions that sample and specimen are represented in Brazilian institution.
Holotype. Sample MPSC I - 1889, housed at the Paleontological Museum from Universidade Regional do Cariri (URCA), at Santana do Cariri municipality, Ceará, Brazil.
Type locality. Road between Nova Olinda and Santana do Cariri, 4 km from the town of Nova Olinda, Ceará State, Brazil.
Type stratum. Limestone levels, Crato Member, Santana Formation.
Age. Aptian (late Early Cretaceous).
Diagnosis. Fore wing 27 mm long and 7 mm wide. The M origin is close to the wing base; MP origin at the same level of the RP origin. CuA reach the anal area after the mid length of the wing, with secondary branches relatively long and distally dichotomous. The area between CuA and anal margin is three times wider than the MP/CuA one.
Description. Head width twice length (1.6 mm long and 3.3 mm wide); large protuberant compound eyes (1.25 mm long and 1 mm wide). Prothorax trapezoidal, 1.6 mm long (anterior margin wider than the posterior one). The mesothorax is robust and wider than head and abdomen. Abdomen long (10 mm long) and relatively narrow (2.8 mm maximal width, at the distal part (Figure 2C). Fore wing length 27 mm and 7 mm wide, with narrow costal area, filled by short, perpendicular, some they Y-shapped, small veinlets, forming a mosaic of heterogeneous cells. ScP slightly curved, distally fused with RA. RP origin close to the wing base, zigzagged at its base, after slightly sinous distally, and strongly curved at the distal part, reaching the apical area after the apex; radial basal cell (rb) as long as the subsequent one; twenty radial cells, heterogeneous; hipostigmal cell (h) long and narrow; six secondary branches, the distal two deeply multi-branched. The space between RA and RP is relatively wider than both costal and subcostal area. M origin (Figure 2B) at the wing base, forking at the same level of the RP origin to the wing base; MA long, slightly sigmoid at the proximal part, straight at the distal one, with a long distal dichotomy; MP long, quite

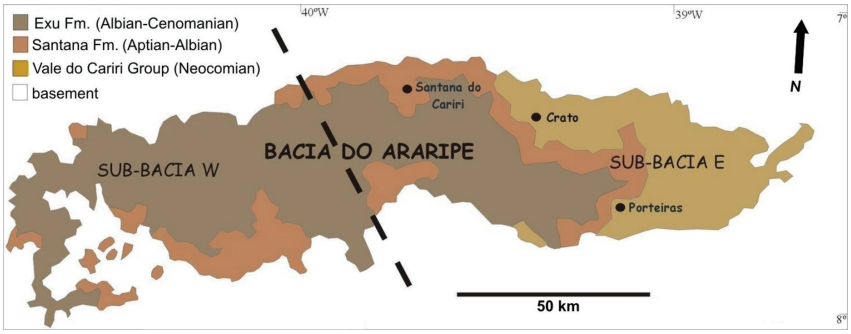

Figure 1. A. Geological context from Araripe Basin (drawing modified from Vianna and Neumann, 2002); stratigraphic units and age from Assine (1992); Ponte and Appi (1990) and Ponte and Ponte-Filho (1996). **B.** General aspect of the quarry and from the limestones beds that furnish the fossil samples.

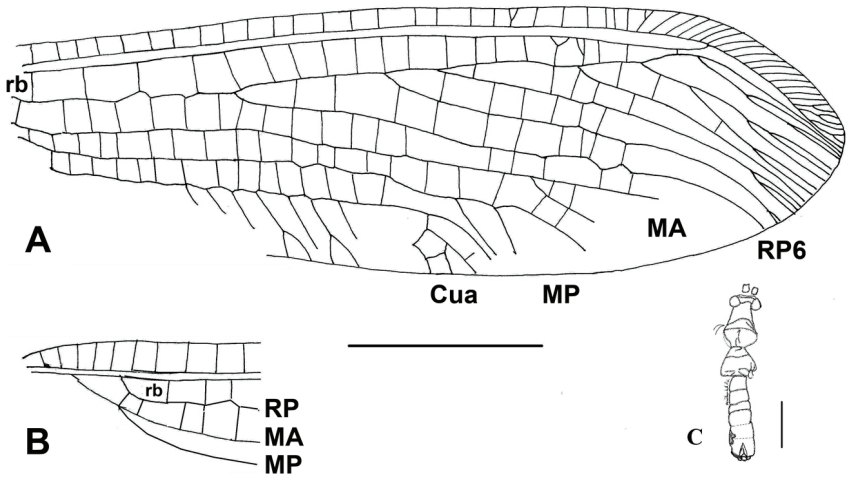

Figure 2. *Nuddsia repatriata* Martins-Neto, n. sp., holotype (MPSC-I-1889). **A**. Fore wing; **B**. Base of the fore wing. **C**. Body detail of the same specimen. Scale bar: 5 mm.

parallel to MA, also with a long distal dichotomy. CuA reach the anal margin after the mid length of the wing and with at least ten long, transverse secondary branches, with the preserved distal part of at least two dichotomous ones. The area between CuA and the anal margin is three times wider than the MP/CuA one.

Discussion. *Nuddsia repatriata* n. sp. differs from *Nuddsia longiantennata* Menon and Makarkin (2008) by having a greater wing length, CuA reaching the anal margin after the wing mid length (before in *N. longiantennata*) and CuA secondary branches distally dichotomous. The area between CuA and the anal margin is three times wider than the MP/CuA one in *N. repatriata* n. sp. (as wide as in *N. longiantennata*). Additionally, *N. repatriata* n. sp. exhibits two Y-shaped cross veins at the costal and subcostal area, quite all RP secondary branches multi-branched (the last two distal ones deeply dichotomous) and CuA with at least two secondary branches distally dichotomous. *N. longiantennata* has not preserved the wing base, so the M origin is unknown. In *N. repatriata* n., sp. the MP origin occurs at the level of RP origin (generic diagnosis). The *N. repatriata* n. sp. abdomen is at least two times longer than the *N. longiantennata* one.

Family PALAEOLEONTIDAE Martins-Neto, 1992

Neurastenyx Martins-Neto and Vulcano, 1997

Type species. *Neurastenyx araripensis* Martins-Neto and Vulcano, 1997, by original designation. Species included also *Neurastenyx gigas* Martins-Neto and Vulcano, 1997; *Neurastenyx polyhymnia* Martins-Neto, 1997; *Neurastenyx cryptohymen* n. comb.; and *Neurastenyx conani* n. sp.

Neurastenyx conani Martins-Neto n. sp. (Figures 3A, 6B)

Etymology. Alluding to the anti-hero Conan the Barbarian, created by Robert E. Howard.

Holotype and only specimen. Isolated fore wing (CPCA 3575; Figure 6B), housed at Centro de Pesquisas da Chapada do Araripe – CPCA/DNPM, Crato municipality, Ceará State, Northeast Brazil.

Type locality, type stratum, and age. The same as *Nuddsia repatriata* n. sp.

Diagnosis. Big-sized neuropteran, fore wing with more than 50 mm long and presents a conspicuous color pattern. Fore wing with the first proximal RP secondary branch close to the wing base, distally multi-branched. MP1 with five long distal secondary branches, distally with small dichotomies; the oblique vein is present (o) MP2+CuA not reaching the mid length of the wing. CuP, short, zigzagged, distally fused to MP2+CuA trougth a cross vein (cua-cup). Anal area with a very small and protuberant anal field.

Description. Fore wing 58 mm long and 13 mm wide. Costal area relatively narrow (little wider than the subcostal area), slightly widening toward the apex, filled by pectinated transverse undichotomous veinlets. ScP distally fused to RA. RP origin very close to the wing base: nine secondary branches, the seven distal ones (adopting RP1 as the most distal one, will be RP1 to RP7) sigmoid and all just distally with a small dichotomy; RP8 deeply dichotomous as well as RP9; RP8 origin very far from RP7, close to the wing base. MA long, distally curve, unbranched, undichotomous; MP1 quite parallel to MA with six relatively long, distally dichotomous secondary branches; MP2+CuA1 relatively short, reaching the anal area before the mid-length wing, with five transversal secondary branches, three of which distally dichotomous. Oblique vein (o) is conspicuous at the level of the most proximal MP2+CuA1 secondary branch. CuP very short, restricted to the wing base, connected to MP2+CuA1 throught two transversal cross veins, one at the point of the beginning of the last proximal MP2+CuA1 secondary branch and the distal extremity of *o*, and another parallel and above it. CuP with four short secondary branches, the most proximal longer and curved. A very small and protuberant anal area. Conspicuous color pattern is present in the whole wing.

Discussion. *Neurastenyx conani* n. sp. shares with the known *Neurastenyx* species the presence of a conspicuous oblique vein (o), big-sized fore wing, short CuP, Banksian-line on the RP secondary branches, RP proximal secondary branch close to the wing base, and M origin at the wing base.

N. conani n. sp. differs from *N. araripensis* Martins-Neto and Vulcano, 1997 for having the oblique vein aligned with the

most proximal MP2+CuA branch. In *N. araripensis* (Figure 3E) this oblique vein ends after this branch. *N. conani* n. sp. is also distinct this aspect is from *N. polyhymnia* (Figure 3G), which has the oblique vein ending before the most proximal MP2+CuA. Those two species are also distinct from *N. conani* by a very narrow space between MA and MP2+CuA (medial area), and a reduced number of MP2+CuA secondary branches (four in *N. polyhymnia* and six in *N. conani* n. sp.). The *N. gigas* Martins-Neto, 1997 differs of *N. conani* for having a notably elongate body and big-sized wing length.

Neurastenix cryptoneura n. comb.
Baisoparduas cryptoneura Heads *et al.*, 2005

Heads *et al.* (2005), when describes *Baisopardus cryiptoneura*, from the same Crato Member, synonymies all the *Neurastenyx* species to the Russian genus *Baisopardus* Ponomarenko, based apparently on an complete material, but in which the basal part of the wings, essential for diagnostic characters, was lacking (Ponomarenko, 1992). Other form of *Baisopardus,* the species *B. banksianus* Ponomarenko, 1992, from Russian Early Cretaceous, was based on two isolated hind wings, in which is missing the conspicuous oblique vein, the MP is clearly not fused to CuA and the CuP that the characteristics is straight (Figure 2B). All these morphological parameters are absent from the *Neurastenyx* species, indicating that *Baisopardus cryptoneura* cannot belong to that genus, showing also that the *Neurastenyx* species cannot be synonymized to *Baiosopardus* as proposed by Heads *et al.* (2005).

Heads *et al.* (2005) indicate the presence of a subcostal area filled by several pectinated cross veins (Figure 2C), inexistent in the especimen here described, and that exhibits only a wing corrugation at this area. For otherwise, *B. cryptoneura* shares with *Neurastenyx* the presence of a conspicuous cross vein on the fore wing, possible to see on the published photograph of Heads *et al.* (2005) however not drawn, a relatively short cubital area and a multi-branched proximal secondary branch of RP, characteristics that definitively remove *B.cryptoneura* from *Baisopardus* and includes it on *Neurastenyx*.

N. conani, the new species above described shares with *N. cryptoneura* n. comb. an identical colour pattern (not present in the others known species, like *Baisopardus banksianus* Ponomarenko). However it differs in a set of distinctive characteristics: fore wing greater (58 mm long and 13 mm wide in *N. conani* n. sp.), and ScP and RA not proximally fused (at least not at the same level as in *N. cryptoneura*). If such a kind of fusion exists in *N. conani* it could be too much before of the most RP proximal secondary branch and quite at the same level where it occurs in *N. cryptoneura*, apart from others not preserved ones in *N. cryptoneura* as the CuP zigzagged, the very small anal area with a protuberant anal field and cua-cup connecting the distal part of CuP at MP2+CuA (however not present on *Baisopardus banksianus*). These set of distinctive characteristic allow us to segregate *N. conani* and *N. cryptoneura*, elevating to five the known species of *Neurastenyx*.

Parapalaeoleon Menon and Makarkin, 2008 (Figure 3D) and *Paraneurastenyx* Martins-Neto, 1998 (Figure 3F) are also distinct for the discussed *Neurastenix* species.

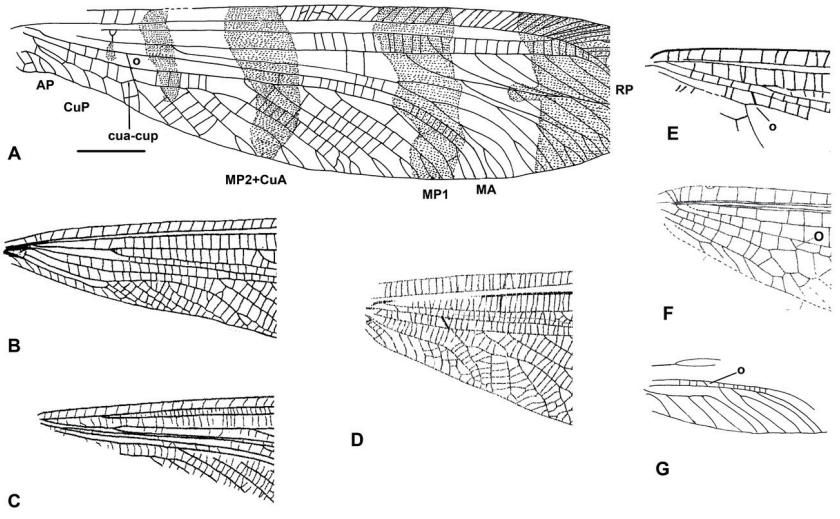

Figure 3. A. *Neurastenyx conani* Martins-Neto n. sp., holotype (CPCA 3575). **B**. *Baisoptera banksianus* Ponomarenko, 1992 (partially reproduced from Ponomarenko, 1992); **C**. *"Baisoptera" cryptoneura* Heads *et al.*, 2005 (partially reproduced from Heads *et al.*, 2005); **D**. *Parapalaeoleon magnus* Menon and Makarkin, 2008 (partially reproduced from Menon and Makarkin, 2008); *Neurastenyx araripensis* Martins-Neto and Vulcano, 1997 (partially reproduced from Martins-Neto and Vulcano, 1997); **F**. *Neurastenyx ascalaphyx* Martins-Neto, 1998 (partially reproduced from Martins-Neto, 1998); **G**. *Neurastenysx polyhymnia* Martins-Neto, 1997 (partially reproduced from Martins-Neto, 1997). Scale bars: 5 mm.

Family ARARIPENEURIDAE Martins-Neto, 2002
Subfamily CRATOPTERYXINAE n. subfam.

Type genus. *Cratopteryx* Martins-Neto and Vulcano, 1989, designated here. Other included genus: *Diegopteryx* n. gen.
Diagnosis. Mid-sized araripeneurid with fore wing length between 14 to 25 mm. Antenna long (30 to 40% of the fore wing length), distally clavated. Intraradial cells (cir.) not conspicuously greater than the subsequent one.
Discussion. Cratopteryxinae n. subfam. differ of the closest subfamily Araripeneurinae Martins-Neto, 2002 for having a relatively small intraradial cell (notably

elongated in Araripeneurinae) allied to a notably long antenna, smaller than the mesothorax in Araripeneurinae.

Diegopteryx Martins-Neto n. gen.

Type species. *Diegopteryx raptorius* Martins-Neto n. sp., here designated.
Etymology. Alluding to *Diego*, from Spanish etymology, the chosen, and *pteryx*, wing.
Diagnosis. Hind wing with costal veinlets Y-shapped. ScP base sigmoid, distally fused to RA. Radial basal cell (rb) very small, followed by two subsequent cells notably long. MA origin at R, far from MP origin. CuA forked in CuA1 and CuA2, at the same level of MA origin. CuP transverse, distally fused to CuA2.
Discussion. *Diegopteryx* greatly differs from its closest related genus *Cratopteryx* Martins-Neto and Vulcano, 1989, sharing the relatively long and clavate antenna (longer than the wing width or the thorax length), not found in other known Araripe myrmeleontoid genera; by having a forked CuA, and CuP distally fused to CuA2; rb notably small and two central radial cells very great, occupying circa 1/3 of the hind wing length.

Diegopteryx raptorius Martins-Neto n. sp. (Figures 4, 7A-B)

Etymology. Alluding to the raptor habit of the forelegs.
Holotype and only specimen. Housed at Centro de Pesquisas da Chapada do Araripe – CPCA/DNPM, Crato municipality, Ceará State, Northeast Brazil, under the number CPCA 3576a and 3576b.
Type locality, type stratum, and age. The same from the previous discussed forms.
Diagnosis. The main morphology is the same of the genus. Fore wing 25 mm long and 8 mm wide; hind wing 21 mm long and 6 mm wide; antenna 9 mm long, distally clavate. Intensely pubescent legs.
Description. Distally clavate, monoliform antenna, 9 mm long. Robust and prominent thorax, and legs covered by relatively long and dense setae. Fore wing 25 mm long and 8 mm wide. Hind wing 21 mm long and 6 mm wide, with costal area relatively narrow, widening toward apex, filled by several veinlets, several ones Y-shapped, and the distal ones dichotomous. ScP distally fused to RA; ScP base conspicuously sigmoid; subcostal area with only one transverse basal cross vein (scp-ra). RP origin close to the wing base; radial basal cell (rb) very small, smaller than the subsequent ones; second and third radial cell the biggest and wider, occupying circa 1/3 of the wing lenght; hipostigmal cell (h) elongate, wider at its proximal part; ten secondary RP branches, some of them with a small dichotomy. MA originates at R, close to the wing base. MP origin at wing base. CuA forked in CuA1 and CuA2, relatively short, reaching the anal margin at less than 1/3 of the wing length. CuP short, distally fused to CuA2.
Discussion. *Diegopteryx raptorius* n. sp. greatly differs from all other close related Araripe neuropterans for having a set of autapomorphies in the hind wing morphology, like the radial basal cell (rb) very small, followed by two subsequent cells notably long, greater than those found in *Cratopteryx robertosantosi* Martins-Neto and Vulcano, 1989, as well as in *C. nemopteroides* Martins-Neto, 2002. The MA origin occurs at R, far from MP origin (at the wing base in both *C. robertosantosi* and *C. nemopteroides*); CuA forked in CuA1 and CuA2, at the same level of MA origin (unforked, straight and parallel to MP and MA in both *C. robertosantosi* and *C. nemopteroides*); CuP transverse, distally fused to CuA2 (parallel to CuA in both *C. robertosantosi* and *C. nemopteroides*).

Family PSYCHOPSIDAE Handlirsch, 1906

Putzneura Martins-Neto gen. n.

Type species. *Putzneura parcimoniosa* Martins-Neto n. sp.
Etymology. Latinized from the Germany *putz*, adornment, and from *putz* or *putzgrila*, Portuguese colloquial speech from Mooca, district of São Paulo municipality, São Paulo State, Brazil, that means a big, splendid thing, and *neura*, from Neuroptera: so, an ornamented and great Neuroptera.
Diagnosis. Big-sized psychopsid neuropteran (*vena triplica* present) with fore wing longer than 80 mm; costal veinlets pectinated just distally dichotomously branched; ScP distally fused to RA, and

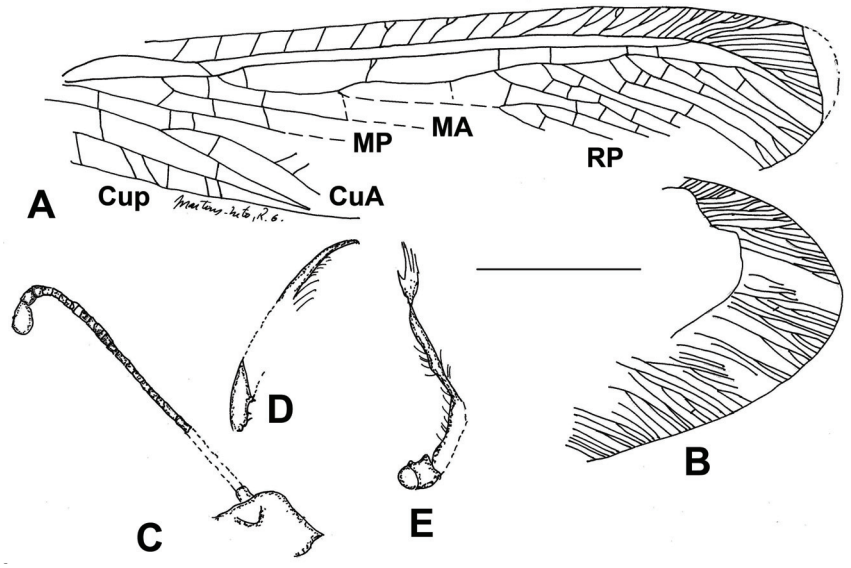

Figure 4. *Diegopteryx raptorius* Martins-Neto n. sp., holotype (CPCA 3576). **A.** Hind wing detail. **B.** Fore wing apex detail; **C.** Antenna detail; **D.** Hind leg detail; **E.** Middle leg detail. Scale bar: 5 mm.

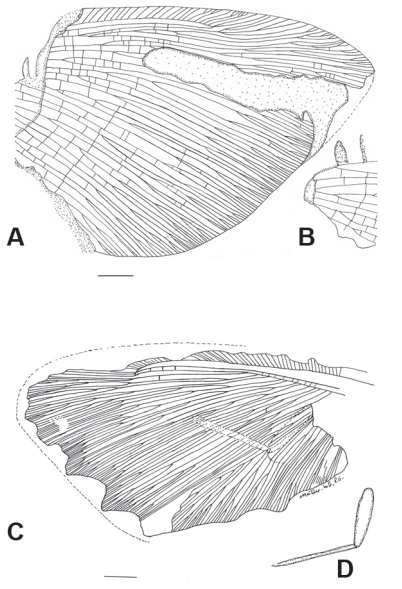

Figure 5. A-B. *Putzneura parcimoniosa* Martins-Neto, n. sp., holotype (CPCA 3577): **A.** distal part of the fore wing detail; **B.** base of the preserved wing of the same specimen; **C.** *Pulchroptilonia espatifata* Martins-Neto, 1997, drawn from the supplementary material RGMN-T-011 (not furnished in Martins-Neto, 1997). Scale bar: 5 mm.

Figure 6. A. *Nuddsia repatriata* Martins-Neto, n. sp., holotype (MPSC-I-1889); B. *Neurastenyx conani* Martins-Neto n. sp., holotype (CPCA 3575). Scale bar: 5 mm.

costal area distally relatively narrow. RP, MA, and MP secondary branches densely and deeply dichotomous, but not conspicuously pectinated. Intense cross veins pattern, sometimes aligned, absent from the distal part of subcostal area between ScP and RA.

Discussion. The Family Psychopsidae has extent representatives in Australia, South Africa, and South Asia, apart from more than a dozen fossil genera, especially concentrated in the Mesozoic of Asia.

The fossil record begins in Triassic, when it is found in Australia, with *Triassopsychops* Tillyard and *Protopsychops* Tillyard (New, 1988) and at Virginia, United States (Fraser *et al.* 1996). *Angaropsychops* Martynova is known for the Upper Jurassic of Transbaikalia (Martynova, 1949), *Baisopsychops* Makarkin, 1992, to the Lower Cretaceous of Siberia, *Embaneura* Zalessky, 1953, *Grammopsychops* Martynova, 1954, and *Kagapsychops* Fujiyama, 1978 to the Upper Cretaceous of Kazakhstan, the last one also known for the Lower Cretaceous of Japan. *Arctopsychops* Makarkin, 1994, for Russian one.

For the European Jurassic is known *Apeirophlebia* Handlirsch, 1908, *Liassopsychops* Bode, 1953 and *Archepsychops* Tillyard, 1919. Other genera are also known for the Baltic amber (McLeod, 1970), and for the Asian Miocene (Makarkin, 1991). Recently, Jepson *et al.* (2009) describes four England Lower Cretaceous psychopsid genera: *Valdipsychops, Cretapsychops, Micropsychops,* and *Psichopsites.*

The first record for a Brazilian fossil genus is *Pulchroptilonia* Martins-Neto, 1997 (not *Pulchroptionia* as misspelled by Jepson *et al.*, 2009), described to the same Santana Formation here discussed. The *Putzneura* n. gen. here designed greatly differs from *Pulchroptilonia* Martins-Neto in having ScP distally fused to RA, coastal area relatively narrow before ScP/RA fusion, no trace of trichosors, macro or microtrichia, and intense cross vein pattern, alternating aligned and unaligned transverse cross veins rows. Additionally,

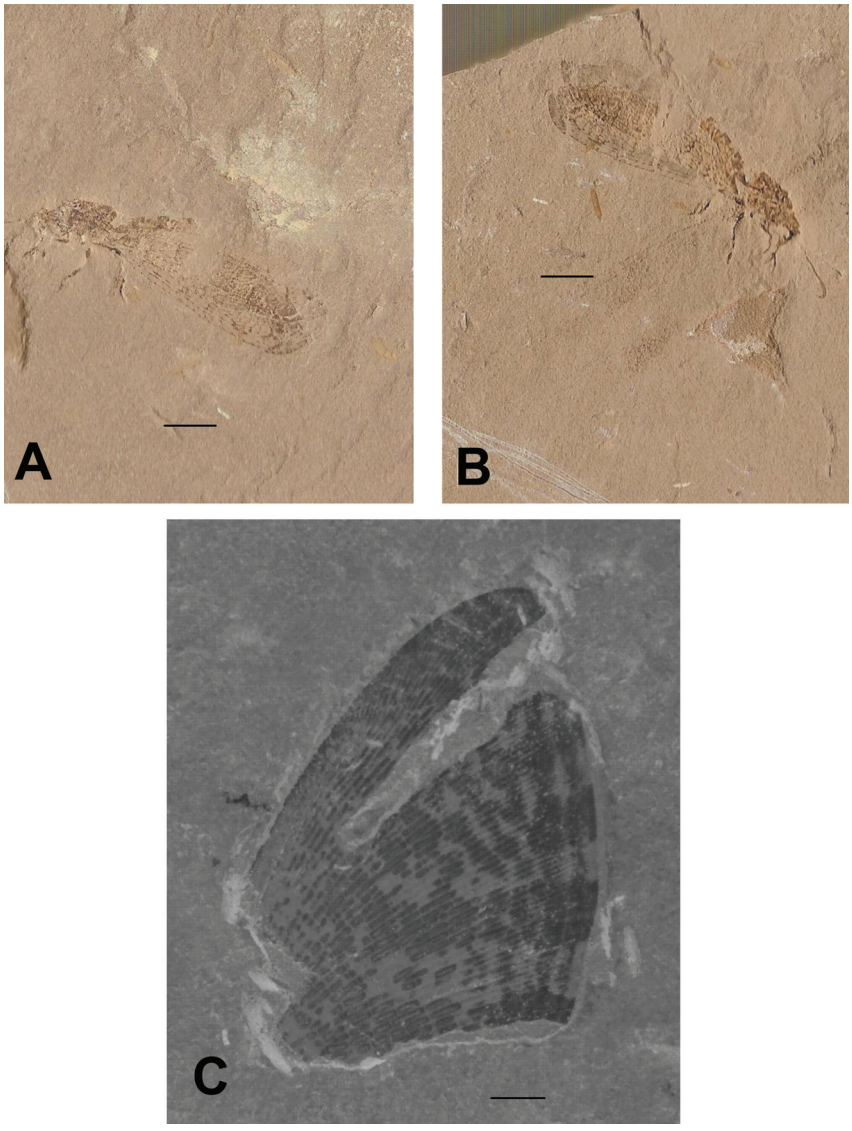

Figure 7. A-B. *Diegopteryx raptorius* Martins-Neto n. sp., holotype (CPCA 3564), part (A), and counterpart (B), respectively; **C.** *Putzneura parcimoniosa* Martins-Neto, n. sp., holotype (CPCA 3577). Scale bar: 5 mm.

Putzneura is probably the biggest known Psychopsidae, with a preserved apical fragment of the fore wing (52 mm long and 42 mm wide), that judging the ScP/RA distal fusion, represent less of the the mid-length, so attaining 95-105 mm if complete. Another parameter, the length/width ratio in complete known wings of the family indicates a rate between 2.5 to 3. Taking into account this parameter the wing length of *Putzneura* could measure nearly 113 to 127 mm. All those characters make the new species here described consistent and distinct of all other known psychopsids, recent or fossils, and the second biggest Neuroptera (as well as Insecta) from Araripe (the first is *Makarkinia adamsi* Martins-Neto, 1997).

Putzneura parcimoniosa Martins-Neto n. sp.
(Figures 5A, 7C)

Etymology. Latinized from parcimonious, allusive to the fragmentation state that does not reveal all of its morphology.

Holotype. An isolate fore wing (CPCA 3577), housed at Centro de Pesquisas da Chapada do Araripe – CPCA/DNPM, Crato municipality, Ceará State, Northeast Brazil.

Type locality, type stratum, and age. As for *Nuddsia repatriata* n. sp..

Diagnosis. As for the genus.

Description. Apical and triangular fore wing fragment, 52 mm long and 42 mm wide. ScP distally fused to RA. Vena triplica present. Preserved costal area narrow, filled by undichotomous pectinate until close the ScP/RA fusion, slightly longer and with small distal dichotomy after it. RP secondary branch deeply dichotomous, part of them reaching the costal area close to the SCP/RA fusion, others encompassing the entire acuminate apex. Intense cross veins pattern, sometimes aligned, but absent at subcostal area, distal part of the area between ScP and RA, at least in the preserved wing.

FINAL COMMENTS

The Psychopsidae is an insect from a well-successful group that apparently does not suffer with the stressing conditions from Cretaceous/Paleogene boundary. They appear at Triassic times in Gondwana areas, with forms of controversial affinities, and from what there is no consensus about its real relations with the family. In addition, it diversifies during the Jurassic, mainly in Northern Hemisphere and become still more abundant in Cretaceous.

Like the forms here described, the Psychopsidae-like taxa are characterized by big-sizes, a profuse, close enervation, conspicuous color patterns, dense covering by trichosors, and macro and microtrichia.

Ethologically the group is also peculiar due to its extremely wide costal area, which allows to mimetize an enlarged thorax while resting. The intense pubescency and color pattern probably make them unattractive for their possible predators.

Other interesting aspect in the presence of Psychopsidae at Cretaceous levels of Araripe Basin is its bigger size when compared to those insects known

at the same time in Northem Hemisphere. In Brazil they are accompanied by some endemic Neuroptera groups, as Makarkiniidae, in an apparent sympatry with Chrysopidae, Nemopteridae, Myrmeleontidae, Ascalaphidae, Sisyridae, Berothidae, and Ithonidae.

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REFERENCES

ASSINE, M.L. 1992. Análise estratigráfica da bacia do Araripe, Nordeste do Brasil. *Revista Brasileira de Geociências*, **22**(3):289-300.

COIMBRA, J.C.; ARAI, M.; CARREÑO, A.L. 2002. Biostratigraphy of Lower Cretaceous microfossils from the Araripe Basin, northeastern Brazil. *Geobios,* **35**(6):687-698.

FRASER, N.C.; GRIMALDI, D.A.; OLSEN, P.E.; AXSMITH, B. 1996. A Triassic Lagerstätte from eastern North America. *Nature,* **380**:615-619.

HEADS, S.W.; MARTILL, D.M.; LOVERIDGE, R.F. 2005. An exceptionally preserved antlion (Insecta, Neuroptera) with colour pattern preservation from the Cretaceous of Brazil. *Palaeontology,* **48**(6):1409-1417.

JEPSON, J.E.; MAKARKIN, V.N.; JARZEMBOWSKI, E.A. 2009. New lacewings (Insecta: Neuroptera) from the Lower Cretaceous Wealden supergroup of Southern England. *Cretaceous Research*, **30**(2009):1325-1338.

MAKARKIN, V.N. 1991. Miocene Neuroptera from the North Caucasus and Sikhote-Alin Mts. *Paleontologicheskiy Zhurnal,* **1991**(1):57-68.

MARTINS-NETO, R.G. 1991. Sistemática dos Ensifera (Insecta, Orthopteroida) da Formação Santana, Cretáceo Inferior do Nordeste do Brasil. *Acta Geologica Leopoldensia*, **32**(14):3-162.

MARTINS-NETO, R.G. 1992. Neurópteros (Insecta: Planipennia) da Formação Santana (Cretáceo Inferior), Bacia do Araripe, Nordeste do Brasil. VII. Palaeoleontinae, nova subfamília de Myrmeleontidae e descrição de novos táxons. *Revista Brasileira de Entomologia*, **36**(4):803-815.

MARTINS-NETO, R.G. 1994. Neurópteros (Insecta, Planipennia) da Formação Santana (Cretáceo Inferior), Bacia do Araripe, Nordeste do Brasil. IX - Primeiros resultados da composição da fauna e descrição de novos taxa. *Acta Geologica Leopoldensia*, **39**(1):269-288.

MARTINS-NETO, R.G. 1997. Neurópteros (Insecta, Planipennia) da Formação Santana (Cretáceo Inferior), Bacia do Araripe, Nordeste do Brasil. X - Descrição de novos taxa (Chrysopidae, Babinskaiidae, Myrmeleontidae, Ascalaphidae e Psychopsidae). *Revista da Universidade de Guarulhos, Série Ciências Exatas e Tecnológicas*, **2**(4):68-83.

MARTINS-NETO, R.G. 1998. Neurópteros (Insecta, Planipennia) da Formação Santana (Cretáceo Inferior), Bacia do Araripe, Nordeste do Brasil. XI - Descrição de novos táxons de Myrmeleontidae (Palaeoleontinae e Pseudonymphinae). *Revista da Universidade Guarulhos, Série Ciências Biológicas e da Saúde*, **3**(5):38-42.

MARTINS- NETO, R.G. 2002. The Santana Formation paleoentomofauna reviewed. Part I - Neuropteroida (Neuroptera and Raphidioptera): systematic and phylogeny, with description of new taxa. *Acta Geologica Leopoldensia*, **25**(55):35-66.

MARTINS- NETO, R.G. 2005. New Neuroptera (Nymphidae and Araripeneuridae) from Santana Formation (Lower Cretaceous, Araripe Basin, northeast Brazil). *Gæa Journal of Geoscience*, **1**(1):5-10.

MARTINS-NETO, R.G. 2006. Insetos fósseis como bioindicadores em depósitos sedimentares: um estudo de caso para o mesozóico sul-americano. *Revista Brasileira de Zoociências*, **8**(2):155-183.

MARTINS-NETO, R.G.; RODRIGUES, V.Z. 2009. New Neuroptera (Insecta, Osmylidae and Mesochrysopidae) from the Santana Formation, Lower Cretaceous of northeast Brazil. *Gæa Journal of Geoscience*, **5**(1):15-20.

MARTINS-NETO, R.G.; VULCANO, M.A. 1989. Neurópteros (Insecta, Planipennia) da Formação Santana (Cretáceo Inferior) Bacia do Araripe, Nordeste do Brasil. II - Superfamília Myrmeleontoidea. *Revista Brasileira de Entomologia*, **33**(2):367-402.

MARTINS-NETO, R.G.; VULCANO, M.A. 1997. Neurópteros (Insecta, Planipennia) da Formação Santana (Cretáceo Inferior). Bacia do Araripe, Nordeste do Brasil. VIII descrição de novos taxa de Myrmeleontidae, Ascalaphidae e Nemopteridae. *Revista da Universidade de Guarulhos, Série Ciências Biológicas*, **2**(5):64-81.

McLEOD, E.D. 1970. The Neuroptera of the Baltic Amber. I. Ascalaphidae, Nymphidae, and Psychopsidae. *Psyche*, **77**(2):147-180.

MENON, F.; MAKARKIN, V.N. 2008. New fossil lacewings and antlions (Insecta, Neuroptera) from the Lower Cretaceous Crato Formation of Brazil. *Palaeontology,* **51**:149-162.

NEW, T.R. 1988. The Psychopsidae (Insecta: Neuroptera) of Australia and the Oriental region. *Invertebrate Taxonomy* **2**(7):841-883

PONOMARENKO, A.G. 1992. Neuroptera (Insecta) from the Lower Cretaceous of Transbaikalia. *Paleontological Journal*, **3**:43-50.

PONTE, F.C.; APPI, C.J. 1990. Proposta de revisão da coluna litoestratigráfica da Bacia do Araripe. *In*: CONGRESSO BRASILEIRO DE GEOLOGIA, 36, Natal, *Anais,* **1**:211-226.

PONTE, F.C.; PONTE-FILHO, F.C. 1996. *Estrutura geológica e evolução tectônica da Bacia do Araripe, Brasil*. Departamento Nacional da Produção Mineral, Delegacia do Ministério de Minas e Energia, Pernambuco e Ceará, 68 p.

VIANNA, M.S.S.; NEUMANN, V.H.L.M. 2002. Membro Crato da formação Santana, Chapada do Araripe, Ceará: riquíssimo registro da fauna e flora do Cretáceo. *In:* C. SCHOBBENHAUS; D.A. CAMPOS; E.T. QUEIROZ; M. WINGE; M.L. BERBERT-BORN (ed.), *Sítios geológicos e paleontológicos do Brasil*. Brasília, DNPM, p. 113-120.

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