



New antlion species (Insecta, Neuroptera, Palaeoleontidae) from the Lower Cretaceous Crato Formation in northeastern Brazil



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ABSTRACT

Two new palaeoleontid species, *Baisopardus escuilliei* sp. nov. and *Baisopardus pumilio* sp. nov., are described, based on compression fossils from the Crato Formation in northeastern Brazil. The external morphology, particularly the wing venations, are analysed and compared with all genera of Palaeoleontidae. The previously proposed synonymy of *Baisopardus* with *Neurastenyx* is discussed. *Neurastenyx*, proven to be a poorly known genus based on an incomplete type fossil, is limited to its sole type species as a *Myrmeleontoidea* incertae sedis nov. sit. Consequently the genus *Baisopardus* is restored and all the other species previously included in *Neurastenyx* are transferred into *Baisopardus*.

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1. Introduction

Insects of the order Neuroptera (lacewings, antlions, etc.) are abundant and almost globally distributed today. However, most neuropteran families appear to have been more diverse in the past, particularly during the Mesozoic when myrmeleontoid (antlions) diversity reached a maximum in the Cretaceous (Rasnitsyn and Quicke 2002). The Lower Cretaceous Crato Formation in northeastern Brazil is especially spectacular for the diversity of its Neuroptera (Martins-Neto et al., 2007). Thus it is rather surprising to discover large 'antlions' representing new taxa in this outcrop. Herein we describe two large myrmeleontoid fossils from this formation, representing new taxa of the enigmatic Palaeoleontidae Martins-Neto, 1992, a small Mesozoic family that currently comprises eight to nine genera. This group was originally considered as a subfamily Palaeoleontinae of the Myrmeleontidae (followed by Martins-Neto and Vulcano, 1997; Martins-Neto, 1997; Stange, 2004); nevertheless this group was considered as a family by Dobruskina et al. (1997) and subsequent authors, even if Millet and

Nel (2010) and later Shi et al. (2012) indicated that the family diagnosis comprises no clear autapomorphy. The family could be paraphyletic or polyphyletic and its exact relationships with the Myrmeleontidae are not solved.

2. Material and method

The specimens described herein were collected at an unknown locality near Nova Olinda in the Araripe Basin, northeastern Brazil, most probably from the Nova Olinda Member. The fossils are lying directly on the split surface of the lithographic limestone, so that no further preparation was necessary.

These Crato fossils are preserved three-dimensionally in orange-brown goethite, a hydrated iron oxide (Menon and Martill, 2007). The geology and location of the Crato Formation is precised in Martill (2007) and Bechly and Makarkin (2016).

The fossils were examined and measured using an incident light stereo microscope (Olympus SZX9) and a stereo microscope (Nikon SMZ 1500), and a Leitz Wetzlar binocular microscope. Observations and photographs were taken using a Zeiss Discovery V20 stereo microscope and a Zeiss Axio Imager Z2 light microscope with a digital camera (AxioCam HRC) attached respectively. Images were then digitally compiled using Helicon Focus software, and treated using Adobe Photoshop software.

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The nomenclature of wing venation is that of Shi et al. (2012). Abbreviations for wing venation are as follow: ScP = subcosta; RA = radius anterior; RP = radius posterior; MA = media anterior; MP = media posterior; MP1 = anterior branch of MP; MP2 = posterior branch of MP, also labelled (O); CuA = cubitus anterior; CuP = cubitus posterior; A = anal veins.

3. Systematic palaeontology

Order Neuroptera Linnaeus, 1758

Family Palaeoleontidae Martins-Neto, 1992

Genus *Baisopardus* Ponomarenko, 1992a (stat. rest.)

Type species. *Baisopardus banksianus* Ponomarenko, 1992a. Other species. *Baisopardus araripensis* (Martins-Neto, 1992) (not Martins-Neto and Vulcano, 1997) syn. rest., the type species of *Neurastenyx* is *N. gigas* (Martins-Neto and Vulcano, 1997) (see Martins-Neto and Vulcano, 1997; Martins-Neto, 1997), and not *N. araripensis* as erroneously indicated by Martins-Neto and Rodrigues (2010); *Baisopardus polyhymnia* (Martins-Neto, 1997) syn. rest.; *Baisopardus cryptohymen* Heads et al., 2005 stat. rest.; *Baisopardus conani* (Martins-Neto and Rodrigues, 2010) syn. nov.; *Baisopardus escuilliei* sp. nov.; *Baisopardus pumilio* sp. nov.

Remark. The holotype of *Baisopardus banksianus* (specimen PIN 1989/51) shows some differences with the paratype (PIN 3064/2436): the holotype corresponds to a longer wing; if both have five darker zones along apico-posterior margin plus one at the point of fusion between ScP and RA, the most apical one is reaching RP in the paratype while it is far from this vein in the holotype, and the most anterior one is reaching RP in the holotype while it is far from this vein in the paratype. These differences could be specific, but only the discovery of more specimens with the same patterns of colours will allow concluding on this point.

***Baisopardus escuilliei* sp. nov.**

(Figs. 1–6)

Etymology. Named after François Escuillié who allowed us to study the type specimen.

Type material. Holotype specimen WDC-CCFB-10 (an incomplete body without the two left wings, head and leg), stored in the collection of Wyoming Dinosaur Center-Crato, Wyoming, USA.

Horizon and locality. Chapada do Araripe, northeastern Brazil; probably upper Aptian, Nova Olinda member of Crato Formation.

Diagnosis. Based on wing characters; forewing relatively short, 42 mm long, uniformly dark red without darker bands of colour; RP origin very close to wing base: ten secondary branches of RP, more or less sigmoidal and all only with a small apical dichotomy; presence of an anterior Banksian fold bf between the six most distal branches of RP; oblique vein (O) aligned with base of CuA2; area of CuA2 longer than wide; CuP short with only four posterior pectinations.

Description. Holotype: body length (from prothorax to apex abdomen) 36.5 mm. Head not preserved; thorax poorly preserved, but prothorax apparently quadrate, as broad as long, 4.0 mm long and 4.0 mm wide; legs not fossilized; one forewing and one hindwing preserved, uniformly dark orange, with veins brown but no darker zone; forewing long and relatively narrow, 43.0 mm long and 11.5 mm wide; no nygmata; costal area relatively narrow, slightly wider than subcostal area, slightly widening toward wing apex, filled by numerous veinlets, simple in part basal of fusion of ScP with RA, dichotomously divided in distal part of area; ScP distally fused to RA; no crossveins between ScP and RA; RP(+MA) origin very close to wing base: ten secondary branches of RP, more or less sigmoid and all just distally with a small dichotomy; presence of a pseudo-vein (anterior Banksian fold or bf) between the six most distal branches of RP, this vein bf is constituted by subhorizontal portions of the branches of RP that are more strongly concave than the other parts of the same branches, separated by very short neutral crossveins (fig. 6); MA long, distally curved, and dichotomously branched; MP forked into MP1 and an short and strong posterior oblique vein (O = MP2) ending on CuA, 5.5 mm from wing base; MP1 well parallel to MA and simple; vein (O) aligned with basal part of CuA2; CuA divided into CuA1 and CuA2 6.25 mm from wing base; CuA1 with five posterior branches, defining an area longer than wide; CuA2 divided into six posterior branches, defining also an area longer than wide; CuP 5.8 mm long and pectinate, connected to CuA1, CuP with four short secondary branches; anal area small.

Hindwing 41 mm long, 10.5 mm wide, only slightly shorter and narrower than forewing; the main difference with the forewing is the absence of oblique vein 'O', MP divided into MP1 and MP2 close to wing base; other veins nearly identical to those of the forewing.

Abdomen slender and long, ca. 35.0 mm long, 3.5 mm wide; genital structures not enough well preserved to determine sex.

Discussion. The diagnosis of the Palaeoleontidae was revised by Heads et al. (2005) and Menon and Makarkin (2008), with the



Fig. 1. *Baisopardus escuilliei* sp. nov., holotype WDC-CCFB-10, photograph of habitus (scale bar represents 5 mm).

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