

# A NEW GENUS OF THE FAMILY LOCUSTOPSIDAE (INSECTA, CAELIFERA) IN THE SANTANA FORMATION (LOWER CRETACEOUS, NORTHEAST BRAZIL)

*Rafael Gioia MARTINS-NETO*

Departamento de Biologia da Faculdade de Ciências e Letras da Universidade de São Paulo, Campus de Ribeirão Preto, and in collaboration with the Universidade de Guarulhos, SP. Av. Bandeirantes, 3900, 14040-901. Ribeirão Preto SP Brasil e-mail: mtnsneto@ffclrp.usp.br

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## ABSTRACT

The new genus *Cratozeunerella* (Caelifera, Locustopsidae) and three constituent new species, *C. neotropica* n. sp., *C. nordestina* n. sp., and *C. amedegnatoi* n. sp., are described from the Santana Formation (Lower Cretaceous) of northeastern Brazil. The family Locustopsidae was hitherto represented in the Brazilian Cretaceous by two other genera: *Zessinia* Martins-Neto and *Locustopsis* Handlirsch, suggesting that the group was most successful in the Southern Hemisphere during Cretaceous times. This family is typical of the Mesozoic and the oldest record is from the Lower Triassic of Australia. The family is represented now by nine genera including more than forty species. Thirty in the genus *Locustopsis* Handlirsch, which is known from Jurassic rocks in Europe and Asia as well as from Cretaceous rocks in Asia, Africa and Brazil.

**Keywords:** Insecta, Locustopsidae, *Cratozeunerella* n. gen., Lower Cretaceous, Santana Formation, Brazil.

## RESUMEN

Se describe el nuevo género *Cratozeunerella* (Caelifera, Locustopsidae) con las nuevas especies *C. neotropica* n. sp., *C. amedegnatoi* n. sp. y *C. nordestina* n. sp. de la Formación Santana (Cretácico Inferior, nordeste de Brasil). Hasta ahora, la familia Locustopsidae era conocida en el Cretácico brasileño por dos géneros: *Zessinia* Martins-Neto y *Locustopsis* Handlirsch, lo que sugiere que el grupo alcanzó un gran éxito en el Hemisferio Sur durante el Cretácico. Esta familia es típica del Mesozoico y su registro más antiguo proviene del Triásico Inferior de Australia. En la familia se incluyen actualmente nueve géneros y más de cuarenta especies, treinta de ellas pertenecientes al género *Locustopsis* Handlirsch, conocido de materiales jurásicos de Europa y Asia, y también de materiales cretácicos de Asia, África y Brasil.

**Palabras clave:** Insecta, Locustopsidae, *Cratozeunerella* n. gen., Cretácico Inferior, Formación Santana, Brasil.

## INTRODUCTION

The family Locustopsidae was hitherto represented in the Brazilian Cretaceous by two genera and five species (Martins-Neto, 1990). Here, three new species of a new genus are described considerably extending both the geographical and the stratigraphical distribution of the family. The group is surprisingly abundant and diverse (at the generic taxonomic level), suggesting that it was most successful in the Southern Hemisphere during

Cretaceous times. In this paper, a new genus closely related to *Zeunerella* Sharov, 1968 is described. The fossil insects described here are represented by relatively complete, well preserved specimens, which came from the crato Member, the lowest unit of the Santana Formation (Araripe Basin, Northeast Brazil, Lower Cretaceous, Upper Aptian/ Lower Albian). The local palaeontology and stratigraphy have been summarized in Martins-Neto (1991; 1996). The morphological nomenclature follows Kukalova-Peck (1991).

TRIASSIC			JURASSIC			CRETACEOUS		KNOWN SPECIES										
L	M	UPPER	LOWER	MIDDLE	UPPER	LOWER	U											
						BER	VAL	HA	BA	AP	AL	EN	T	C	SA	CM		
																		<i>Praelocustopsis mirabilis</i> (1)
																		<i>Triassolocusta leptoptera</i> (4)
																		<i>Schwinzia sola</i> (3)
																		<i>Plesioschwinzia thalassofila</i> (3)
																		<i>Plesioschwinzia reticulata</i> (3)
																		<i>Locustopsis spectabilis</i> (2)
																		<i>Locustopsis cockerelli</i> (2)
																		<i>Locustopsis uvarovi</i> (2)
																		<i>Locustopsis gracilis</i> (2)
																		<i>Locustopsis constricta</i> (2)
																		<i>Locustopsis lacei</i> (2)
																		<i>Locustopsis cubitalis</i> (2)
																		<i>Locustopsis bucklandi</i> (2)
																		<i>Locustopsis ferganensis</i> (1)
																		<i>Locustopsis shurabi</i> (1)
																		<i>Locustopsis anatolica</i> (1)
																		<i>Locustopsis maculosa</i> (3)
																		<i>Locustopsis elegans</i> (3)
																		<i>Locustopsis dobbertinensis</i> (3)
																		<i>Locustopsis bernstorffi</i> (3)
																		<i>Locustopsis elongata</i> (3)
																		<i>Locustopsis magnifica</i> (3)
																		<i>Locustopsis reducta</i> (3)
																		<i>Locustopsis pulchella</i> (3)
																		<i>Locustopsis lacera</i> (3)
																		<i>Locustopsis gyra</i> (3)
																		<i>Locustopsis procera</i> (3)
																		<i>Locustopsis sipelli</i> (3)
																		<i>Locustopsis meckenburgica</i> (3)
																		<i>Locustopsis kruegeri</i> (3)
																		<i>Locustopsis karatavica</i> (1)
																		<i>Locustopsis? germani</i> (3)
																		<i>Locustopsis araripensis</i> (5)
																		<i>Locustopsis cretacea</i> (5)
																		<i>Locustopsis africanus</i> (6)
																		<i>Zeunerella arborea</i> (1)
																		<i>Parapleurites gracilis</i> (1)
																		<i>Parapleurites sibiricus</i> (1)
																		<i>Parapleurites</i>
																		<i>Conocephalella capito</i>
																		<i>Zessinia pulcherrima</i> (5)
																		<i>Zessinia caririensis</i> (5)
																		<i>Zessinia reticulata</i> (5)
																		<i>Cratozeunerella neotropica</i> n.sp.(5)
																		<i>Cratozeunerella amedegnatoi</i> n.sp.(5)
																		<i>Cratozeunerella nordestina</i> n.sp.(5)

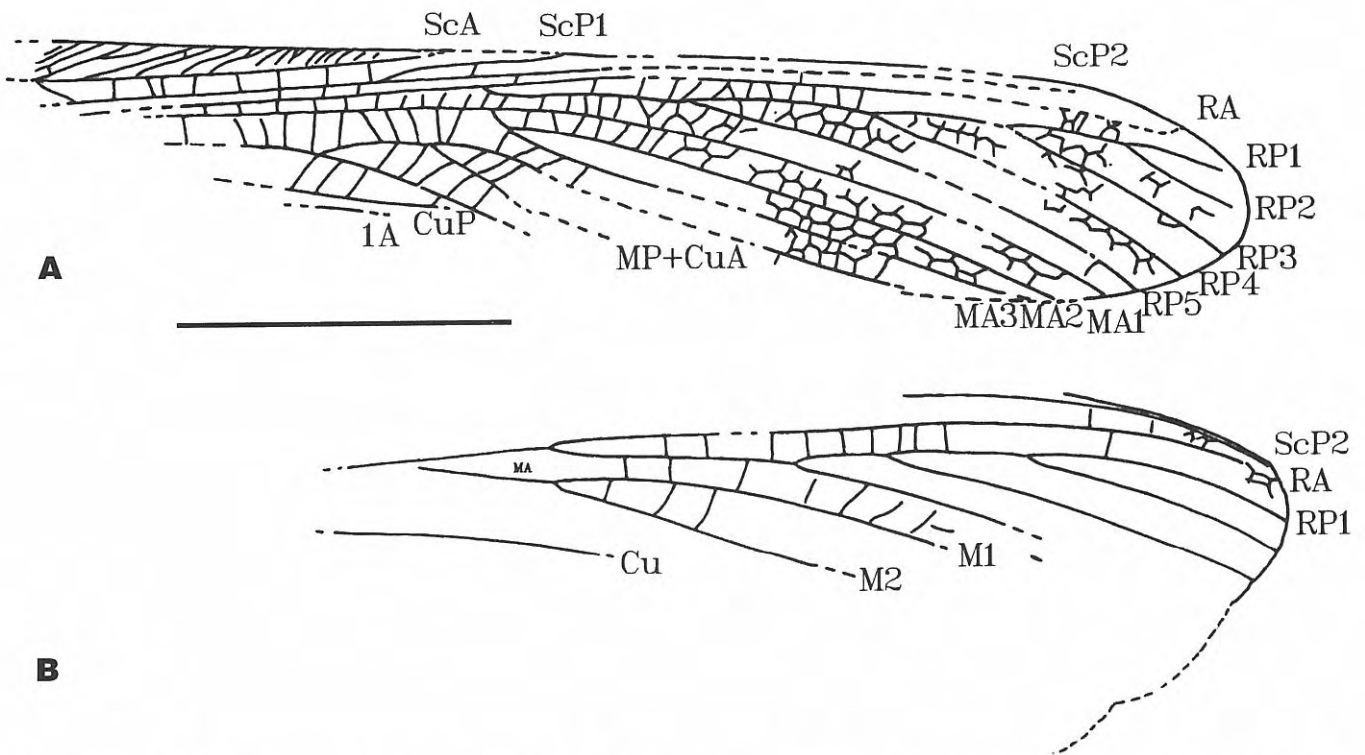
Figure 1. Distribution of the genus of the family Locustopsidae in the geological record, based in Zessin (1983), Martins-Neto (1990) and Ansorge (1991). 1: Asia; 2: England; 3: Germany; 4: Australia; 5: Brazil and 6: Africa.

### SYSTEMATIC PALAEONTOLOGY

#### Family *Locustopsidae* Handlirsch, 1906

Despite some major reviews, the family Locustopsidae is still in need of much discussion because it includes genera with inconsistently resolved phylogenetic

relations. Thus, along with advances in research on the group in the Santana Formation, the phylogenetic relations of the genera will be discussed. Nowadays, nine genera are accepted: *Praelocustopsis* Sharov (1 sp., Triassic, Australia); *Triassolocusta* Tillyard (1 sp., Triassic, Australia); *Schwinzia* Zessin (1 sp., Lower Jurassic, Germany); *Plesioschwinzia* Zessin (2 sp., Lower



**Figure 2.** A-B) *Cratozeunerella neotropica* n. sp., holotype, camera lucida drawing of A) fore-wing; B) hind-wing. Scale bar 5mm. Terminology: **A**, anal; **CuA** cubital anterior; **CuP** cubital posterior; **MA**, media anterior; **MP** media posterior; **RA**, radial anterior; **RP**, radial posterior; **ScA**, subcostal anterior; **ScP**, subcostal posterior.

Jurassic, Germany); *Locustopsis* Handlirch (30 sp., Lower Jurassic - Cenomanian Europe, Asia, Africa and Brazil); *Parapleurites* Brauer, Redtenbacher & Gangbauer (2 sp., Middle Jurassic, Siberia); *Conocephalella* Strand (1 sp., Upper Jurassic, Germany); *Zessinia* Martins-Neto (3 sp., Aptian/Albian, Brazil) and *Zeunerella* Sharov (1 sp., Cenomanian, Mongolia) (see Fig. 1). Ansoerge (1991) described a new *Locustopsis* species from Egypt, (Lower Cretaceous), based only on the hind-wing morphology, which was, however, unlike comparable material from Brazil. The Brazilian and African species are the only record of the group in the Mesozoic of Southern Hemisphere. Lewis (1974) published a short note about four specimens of fossil grasshoppers from the Ruby River Basin (Oligocene) in Southwestern Montana, relating them to the genus *Zeunerella* Sharov. However, these specimens have not received a formal treatment discussing this identification. Gomes Pallerola, in Ansoerge (1991) noted possible locustopsids in the Cretaceous sediments from Montsech, Spain.

### *Cratozeunerella* n. gen.

**Type-species:** *Cratozeunerella neotropica* n. sp. designated here with.

**Derivatio nominis:** Crato, the regional unit, and *Zeunerella*, the most similar genus.

**Diagnosis** (see Fig. 2 for abbreviations)

Similar to *Zeunerella* Sharov, 1968 in possessing **ScA** long, reaching almost to the origin of **RP**. Branches of **RP** not reaching anterior margin; **MA2** originating on the base of the posterior branch of **MA1**. Base of **CuA** and **CuA2** in the form of a single curved vein, the distal third of which branches anteriorly into a bifurcated **MP+CuA1**. *Cratozeunerella* n. gen. Differs from *Zeunerella* Sharov in the costal area between **C** and **ScA**, being basally narrower than in its distal part and **ScA** in *Zeunerella*, but broader and with the subcostal field with cross-veins in *Cratozeunerella* n. gen.

### Discussion

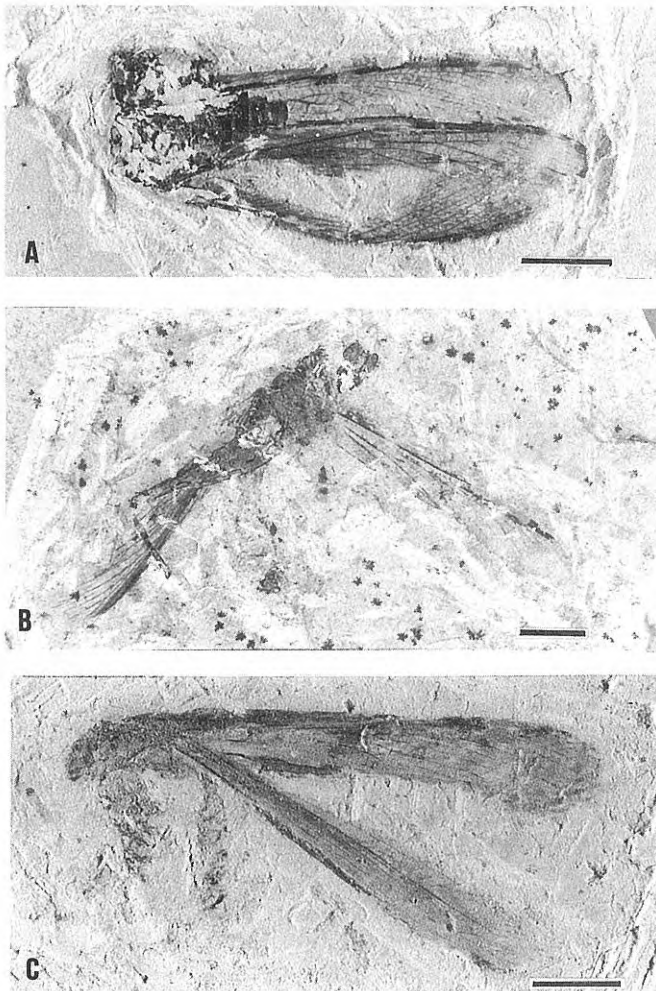
This genus is separated from *Zeunerella* Sharov by the shape of the costal and subcostal areas: the costal area between **C** and **ScA** is basally narrower than in its distal part in *Zeunerella* Sharov. This unique character is probably an autapomorphy within this family. This character is not shared by *Cratozeunerella* n. gen., strongly suggesting that *Cratozeunerella* n. gen. is a closely related new genus. *Cratozeunerella* n. gen. differs from all locustopsids having **ScP** with only one branch.

### *Cratozeunerella neotropica* n. sp.

Figs. 2, 3A

**Derivatio nominis:** from the Neotropics.

**Holotype:** UnG-030, housed in the Palaeontological Collection of the Geosciences Department, Guarulhos



**Figure 3.** A) *Cratozeunerella neotropica* n. sp., holotype; B) *Cratozeunerella amedegnatoi* n. sp., holotype; C) *Cratozeunerella nordestina* n. sp., holotype. Scale bar 5mm.

University (UnG), São Paulo, Brazil. Only the holotype is known.

#### Locus and stratum-typicum

Outcrop of Tatajuba farm (Martins-Neto, 1996) Santana do Cariri, Ceara State, Northeast Brazil. Upper part of the Crato Member, laminated limestone level, lowest unit of the Santana Formation, Lower Cretaceous (Upper Aptian/Lower Albian) Araripe Basin.

#### Diagnosis

As for the genus. Fore-wing about 23 mm long and 3.5 mm wide. **RP** with five branches. Hind-wing: **RP** with four branches; **MA** forks opposite the origin of **RP**.

#### Description

Fore-wing (Fig. 2A) 23.1 mm long and 3.4 mm maximal width. **ScA** long, ending in the costal margin one third of the distance along its length, and filled by several pectinate branches. Costal area between **C** and **ScA** wide at its proximal position, narrowing toward costal margin. **ScP1** is a short, sigmoidal vein; **ScP2** possibly long, curved, ending in the apical margin (only the basal part is preserved). **RA**

long, slightly curved, distally not preserved; the origin of **RP** is anterior to the mid-length level of the tegmen, slightly posterior to the end of **ScA**, divided into five branches. Fork of **MA** opposite the origin of **RP**; **MA1** long, slightly curved; **MA2** and **MA3** with the same length, slightly curved too; **MP+CuA** three-branched, the more proximal one longer; only the bases of **MP+CuA2** and **MP+CuA3** are preserved; the preserved part of **CuP** is quite straight; **1A** poorly preserved. Hind-wing venation (Fig. 2B): **RP** with four branches; **MA** forks opposite the origin of **RP** with two branches of the same length.

#### Discussion

Similar to *Zeunerella arborea* Sharov, 1968 principally in **MP+CuA** morphology (fore-wing). *Cratozeunerella neotropica* n. sp. differs from *Z. arborea*, however, by having five branches of **RP** (there are three branches of **RP** and three intercalary veins in *Z. arborea*). Another distinctive character is the fork of **M** in the hind-wing, opposite the origin of **RP** in *C. neotropica* n. sp., but near of the origin of **RP** in *Z. arborea*. Furthermore, *C. neotropica* n. sp. has a supplementary branch of **RP** in the hind-wing.

#### *Cratozeunerella amedegnatoi* n. sp.

Figs. 3B, 4A

**Derivatio nominis:** named in honour of the French Caelifera specialist, Dr. C. Amedegnato, Museum National d'Histoire Naturelle (Paris).

**Holotype:** CD-I-127, Desirée Collection (CD), housed in Departamento Nacional da Produção Mineral (DNPM) Palaeontological Collection. Only the holotype is known.

#### Locus and stratum-typicum

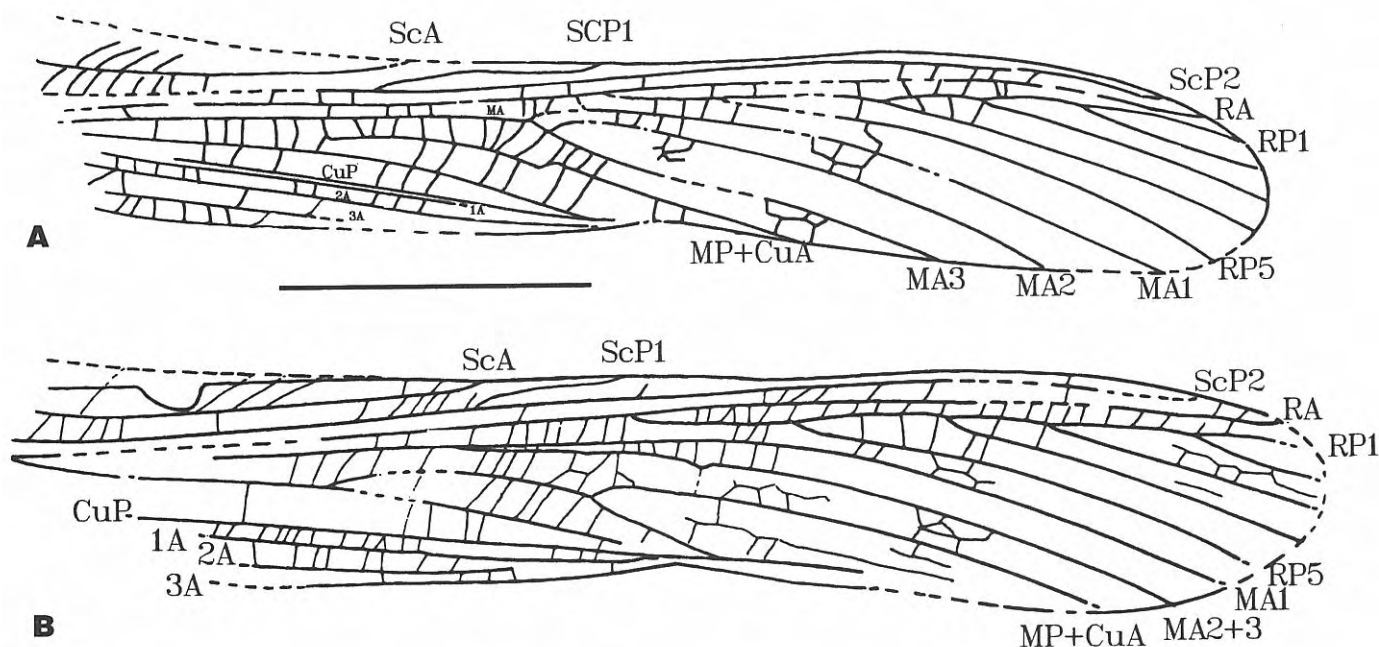
Locality unknown, probably near Santana do Cariri in the Ceara State. Crato Member, laminated limestone level, lowest unit of the Santana Formation. Lower Cretaceous (Upper Aptian/Lower Albian). Araripe Basin.

#### Diagnosis

Fore-wing about 25 mm long and 3 mm wide; **MP+CuA** two-branched.

#### Description

Fore-wing (Fig. 4A) 24.9 mm long and 3.2 mm wide; **ScA** long reaching the costal margin one third of the distance along the wing base, with few cross-veins. **ScP1** relatively long and sigmoid; **ScP2** long, curved, ending in the apical margin with few preserved cross-veins; **RA** long, slightly curved: origin of **RP** at same level as end of **ScP**, divided into five branches. Fork of **MA** anterior to the origin of the **RP** vein. **MA1** long, curved; **MA2** slightly longer than **MA3**; **MP+CuA** two-branched: **MP+CuA+2** longer, angulated in its middle length (vestigial branch?); **MP+CuA3** curved. **CuP** distally fused with **MP+CuA3**; **1A** very near to **CuP**, parallel to it; **2A** and **3A** partially preserved, both parallel to **1A** and **CuP**.



**Figure 4.** A) *Cratozeunerella amedegnatoi* n. sp. holotype, camera lucida drawing of fore-wing; B) *Cratozeunerella nordestina* n. sp., holotype, camera lucida drawing of fore-wing. Symbols as for Fig. 2. Scale bar 5 mm.

#### Discussion

Similar to *Cratozeunerella neotropica* n. sp., differing however in **MP+CuA** being three-branched in *C. neotropica* n. sp., but two-branched in *C. amedegnatoi* n. sp. Additionally, the **RP** origin is opposite the end of **ScP1**, unlike *C. neotropica* n. sp. where the origin of **RP** is anterior to the apex of the **ScP1**. The fore-wing of *C. amedegnatoi* n. sp. is slightly longer and narrower than in *C. neotropica* n. sp.

#### *Cratozeunerella nordestina* n. sp.

Figs. 3C, 4B

**Derivation nominis:** latinized form of northeast.

**Holotype:** UnG-31 housed in the Palaeontological Collection of the Geosciences Department, Guarulhos University (UnG), S.,o Paulo, Brazil. Only the holotype is known.

#### Locus and stratum-typicum

The same as for *C. neotropica* n. sp.

#### Diagnosis

Fore-wing 25 mm long and 4.5 mm wide. **MP+CuA** three-branched and **RP** origin opposite from **ScP1**; **MA**; two-branched.

#### Description

Fore-wing (Fig. 4B) 25 mm long and 4.5 mm wide. **ScA**, **ScP2** and **RA** as for previously described species. **ScP1**, is a relatively short vein, slightly curved. **RP** origin at the same level as the end of **ScP1**, with five branches; **MA** forks at same level as the end of **ScA**, anterior to the level of **RP** and

**ScP1** origins. **MA** two-branched; **MA1**, long and curved, ending at apical margin; **MA2+3** long, shorter than **MA1**, curved, ending at the limit of the apical margin; **MP+CuA** three-branched; **MP+CuA1+2** long and curved; **MP+CuA1** longer than the others, **MP+CuA2** much shorter than **MP+CuA1**, **MP+CuA3** slightly sigmoid; **CuP** quite straight; **1A** fused distally with **CuP**; **2A** slightly curved; **3A** not preserved.

#### Discussion

Similar to *C. neotropica* n. sp., in the three-branched **MP+CuA**; similar to *C. amedegnatoi* n. sp. in the origin of **RP** at the same level as the end of **ScP1**; *C. nordestina* n. sp. differs, however, by having **MA** two-branched (it is three-branched in *C. neotropica* n. sp. and *C. amedegnatoi* n. sp.). Additionally the **MP+CuA** branches of *C. nordestina* n. sp. are more divergent than in the other species and **ScP1** is relatively shorter.

#### Remarks

The **MA2+3** branch of *C. neotropica* n. sp. has just a break at around one third of its length, which is significant. This break is probably the vestigial point of the fork of **MA**, from which the true **MA2** and **MA3** veins originated. This particular character, if consistent in other specimens, probably could justify the creation of a new genus for this species.

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