

Original article

# A new Planthopper (Insecta: Hemiptera: Nogodinidae) from Chiapas amber, middle Miocene of Mexico

## Une nouvelle espèce de Fulgore (Insecta : Hemiptera : Nogodinidae) de l'ambre de Chiapas, Miocène moyen du Mexique

## Eine neue Art der Fulgoroidea (Insecta: Hemiptera: Nogodinidae) vom Bernstein aus Chiapas, mittlerer Miozän (Mexiko)

Mónica M. Solórzano Kraemer<sup>a,\*</sup>, Julián F. Petrulevičius<sup>b,c</sup>

<sup>a</sup> Institut für Paläontologie, Nussalle 8, 53115 Bonn, Germany

<sup>b</sup> Entomologie, UMR CNRS 5143 (Paléontologie), Muséum national d'histoire naturelle, 45, rue de Buffon, 75005 Paris, France

<sup>c</sup> CONICET, Buenos Aires, Argentina

Received 7 March 2006; accepted 19 February 2007

Available online 24 October 2007

### Abstract

A new species of Planthopper, *Nogodina chiapaneca* sp. nov. from the Mexican Chiapas amber (southeast Mexico) is described. The new species belongs to Nogodinidae: Nogodinini: Nogodinina. This is the second nogodinid species described from Mexican amber. Both species belong to Nogodinina, a taxon with a Neotropical distribution. The only recent species of *Nogodina*, *N. reticulata*, ranges from Honduras to Brazil and is unknown from Mexico yet.

© 2007 Elsevier Masson SAS. All rights reserved.

### Résumé

On décrit une nouvelle espèce de Fulgore, *Nogodina chiapaneca* nov. sp. de l'ambre de Chiapas (Sud-Est du Mexique). La nouvelle espèce est attribuée à Nogodinidae : Nogodinini : Nogodinina. C'est la deuxième espèce de Nogodinidae décrite dans l'ambre mexicain. Les deux espèces appartiennent au Nogodinina, un taxon ayant une répartition néotropicale. La seule espèce récente de *Nogodina*, *N. Reticulata*, est répartie du Honduras au Brésil et reste inconnue jusqu'à présent au Mexique.

© 2007 Elsevier Masson SAS. All rights reserved.

### Zusammenfassung

Eine neue Art der Fulgoroidea, *Nogodina chiapaneca* nov. sp. vom Bernstein aus Chiapas (Südost Mexiko) wird beschrieben. Die neue Art gehört zu den Nogodinidae: Nogodinini: Nogodinina. Diese ist die zweite Art der Nogodinidae, die vom mexikanischen Bernstein beschrieben wird. Beide Arten gehören zu Nogodinina, einem Taxon mit Neotropischer Verbreitung. Die einzige rezente Art von *Nogodina*, *N. reticulata*, ist von Brasilien bis nach Honduras verbreitet und ist bis jetzt in Mexiko unbekannt.

© 2007 Elsevier Masson SAS. All rights reserved.

**Keywords:** Insecta; Fulgoroidea; Nogodinidae; *Nogodina chiapaneca* nov. sp.; Middle Miocene; Mexican amber; Central America

**Mots clés :** Insecta ; Fulgoroidea ; Nogodinidae ; *Nogodina chiapaneca* nov. sp. ; Miocène moyen ; Ambre Mexicain ; Amérique centrale

**Schlüsselwörter:** Insecta; Fulgoroidea; Nogodinidae; *Nogodina chiapaneca* nov. sp.; Mittlerer Miozän; Mexikanischer Bernstein; Mittelamerika

\* Corresponding author.

E-mail address: [msolorzanokraemer@gmail.com](mailto:msolorzanokraemer@gmail.com) (M.M. Solórzano Kraemer).

## 1. Introduction

Recent Nogodinidae are represented mostly in the tropical and subtropical areas of the world (Carver et al., 1991). Neotropical Nogodinids are restricted to Nogodininae: Nogodinini and Bladinini from subtropical North Argentina and Chile to Mexico (Penny and O'Brien, 2000). The diversity of fossil Nogodinidae in Latin America is not well known due to the lack of paleoentomologists and collections of fossil insects in the region. The world fossil record of the family is scarce (Carpenter, 1992; Haupt, 1956; Henriksen, 1922; Jacobi, 1937; Petrulėvičius, 2001, 2005; Rust, 1999; Szvedo and Stroiński, 1999; Szvedo et al., 2004), until now there are 11 described fossil species, among which four are described from Latin America. Three species are described for Mexican and Dominican ambers from the middle Miocene (Stroiński and Szvedo, 2000; Szvedo and Stroiński, 2001) and the third from the upper Paleocene of Northwest Argentina (Petrulėvičius, 2005). Argentinean species, *Celinapterix bellissima* Petrulėvičius, 2005, belongs to Celinapterixini Petrulėvičius, 2005 and Mexican and Dominican species, *Tonacatecutlius gibsoni* (Stroiński and Szvedo, 2000) and *Tainosia quisqueyae* Szvedo and Stroiński, 2001, to Nogodinini: Nogodinina. Recent species of Nogodinina are distributed in the inter-subtropical zones of South America, indicating a wider distribution and its probably later extinction in the Neogene of Caribbean Islands. Within Nogodinina, *Nogodina* is known from Brazil, French Guiana, Colombia, Peru, Honduras (Melichar, 1923), Panama (Metcalf, 1938), British Guiana (Metcalf, 1945), and Trinidad (Fennah, 1945) (Fig. 1). Celinapterixini is an extinct and endemic taxon from the Paleocene of Northwest Argentina, although, after the poor state of knowledge of Paleogene insects from South America, the hypothesis of endemism is preliminary.



Fig. 1. Schematic distribution of recent and fossil species of *Nogodina*. Asterisks for *Nogodina reticulata*, and letter F for *Nogodina chiapaneca* nov. sp.

Fig. 1. Distribution schématique des espèces fossiles et récentes de *Nogodina*. Astérisques pour *Nogodina reticulata* et la lettre F pour *Nogodina chiapaneca* nov. sp.

## 2. Material and methods

The specimen is housed in the Staatliches Museum für Naturkunde, Schloss Rosenstein, Stuttgart, Germany.

In order to prepare the pieces for identification, the amber was cut and polished using an “ISOMET Low-speed saw” cutting machine and a “Phoenix-Beta” polishing machine with Sic Grinding paper for metallography: Grip 800, 1200 and 2500, Microcut abrasive paper plain backing P 4000 and paperboard.

The wing venation nomenclature of Kukalová-Peck (1983, 1991) and Dworakowska (1988) is used in this study. We follow the classification of the Nogodinidae of Fennah (1978, 1984, 1987). Some characters used in the present contribution are based on Shcherbakov (1981).

## 3. Systematic palaeontology

FULGOROIDEA Kirkaldy, 1907

NOGODINIDAE Melichar, 1898 (sensu Fennah, 1978, 1984, 1987)

NOGODININA (sensu Fennah, 1978)

Genus *Nogodina* Stål, 1859

**Type species:** *Flata reticulata* Fabricius, 1803

*Nogodina chiapaneca* nov. sp.

Figs. 2–4

**Diagnosis:** The main characters of the new species are: MP stalk shorter than *Nogodina reticulata*; presence of a complete and sigmoidal crossvein from base of MP3 + 4 to CuA (considered homologous to the incomplete or stump-like crossvein in *Nogodina reticulata*) and smooth venation than in *Nogodina reticulata*.

**Derivation of name:** After the state of Chiapas, southern Mexico, where the specimen was found.

**Holotype:** Mx 392, housed in the SMNS (Staatliches Museum für Naturkunde, Schloss Rosenstein), Stuttgart, Germany.

**Type locality and horizon:** The specimen described here was collected from the Mexican Chiapas amber, which is considered to be middle Miocene in age (Rust and Solórzano Kraemer, unpublished). The locality is situated in Simojovel de Allende, a mining district located in the northern part of the state of Chiapas, 17°08'19"N, 92°42'00"W, at 600 m, approximately 50 km from the city of Tuxtla.

**Description:** Specimen with body (part of head), and right and left forewings and hindwings mainly complete.

**Body:** Vertex about four times as broad as long without median carina; anterior margins angulately produced; lateral margins straight and parallel; posterior margin arcuate. Frons with median carina distinct and lateral margins slightly elevated. Pronotum, 0.7 times longer than vertex; with median carina; anterior margin almost straight, surpassing level of middle of eyes; posterior margin arcuate; parallel only in lateral lobe and laterally slightly elevated. Mesonotum, 0.7 times broader than long with weak median and lateral carinae; lateral carinae curved, reaching posterior margin of mesonotum;

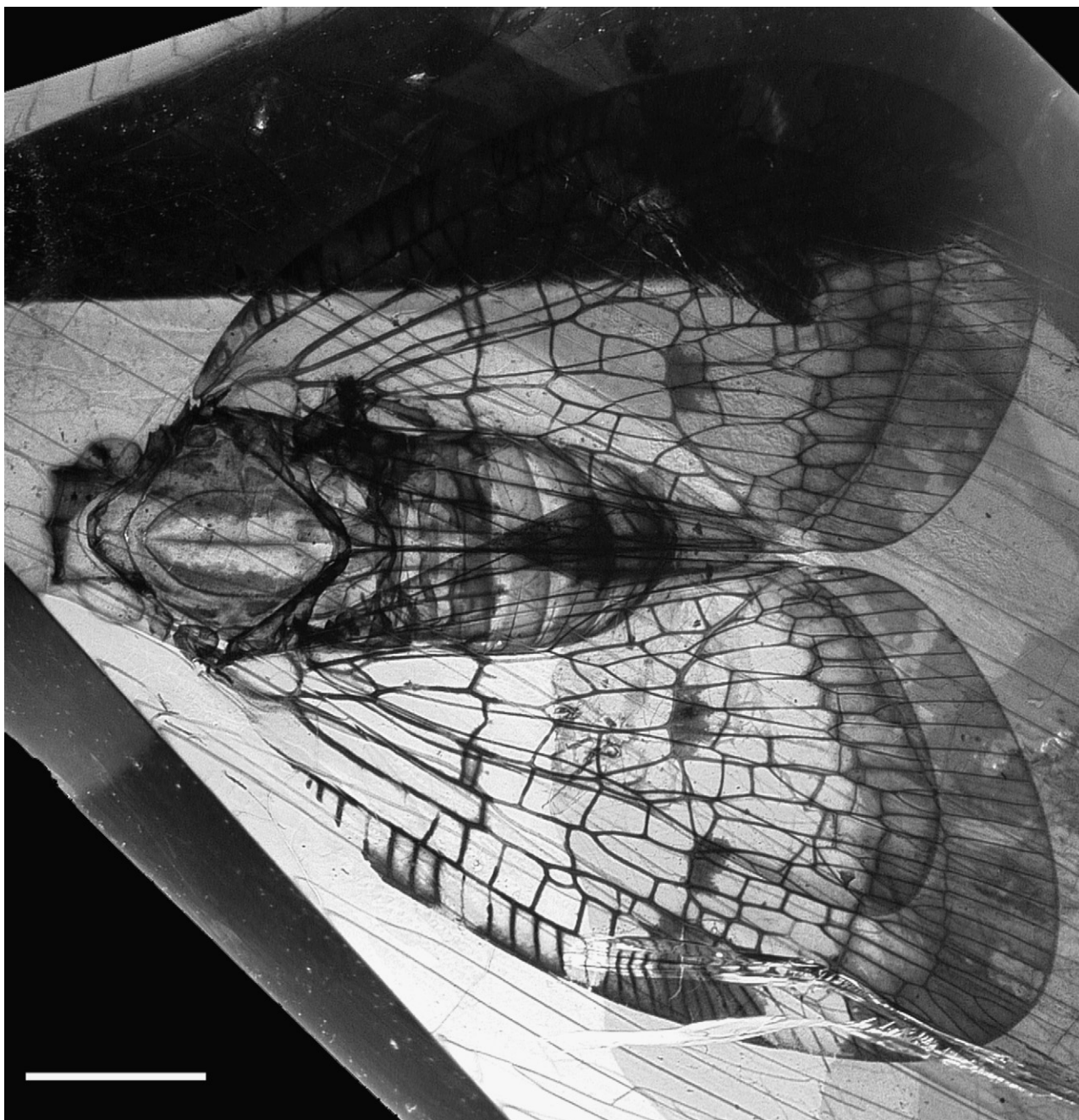


Fig. 2. *Nogodina chiapaneca* nov. sp. in dorsal view; holotype specimen Mx 392; Middle Miocene; Chiapas amber, Mexico. Photograph of the habitus. Scale = 2 mm.

Fig. 2. *Nogodina chiapaneca* nov. sp. ; spécimen holotype Mx 392 ; Miocène moyen ; ambre de Chiapas, Mexique. Photographie de l'habitus. Échelle = 2 mm.

medial and coloured line in normal position of medial carina; medial carina could be present in posterior part of mesonotum; mesonotum, 2.6 times longer than vertex plus pronotum; scutellum, 0.7 times longer than wide.

Forewings: hyaline.

Right forewing complete: with a rounded antero-apex forming a plane semicircular shape; length, 10 mm; width, 5.8 mm; strong venation; basal cell (of Shcherbakov, 1981) short, broad and quadrangular rounded in shape, where all other longitudinal veins arise (from Sc to Cu); CA and CP1 + 2 curved; area between CP1 + 2 and CA developed and with

numerous veins, 25 from base to ScP; six complete crossveins between ScP + RA and CP1 + 2, two from ScP and CP1 + 2; ScP + RA and RP emerging from a same point from the basal cell; ScP diverging from RA basal to the bifurcation of RP and MA, 5 mm from wing base; RA rejoins ScP forming an elliptical cell; ScP reach CP1 + 2 at same point that of RA, 6.3 mm from wing base; ScP sigmoid reaching wing margin 7 mm from the wing base; RP1 + 2 passing into the anterior margin (just in the antero-apical angle) of the wing; two crossveins between RA + ScP to RP, seven from RA to RP, three from RP to MP1 + 2, one from RP to MP1, one from

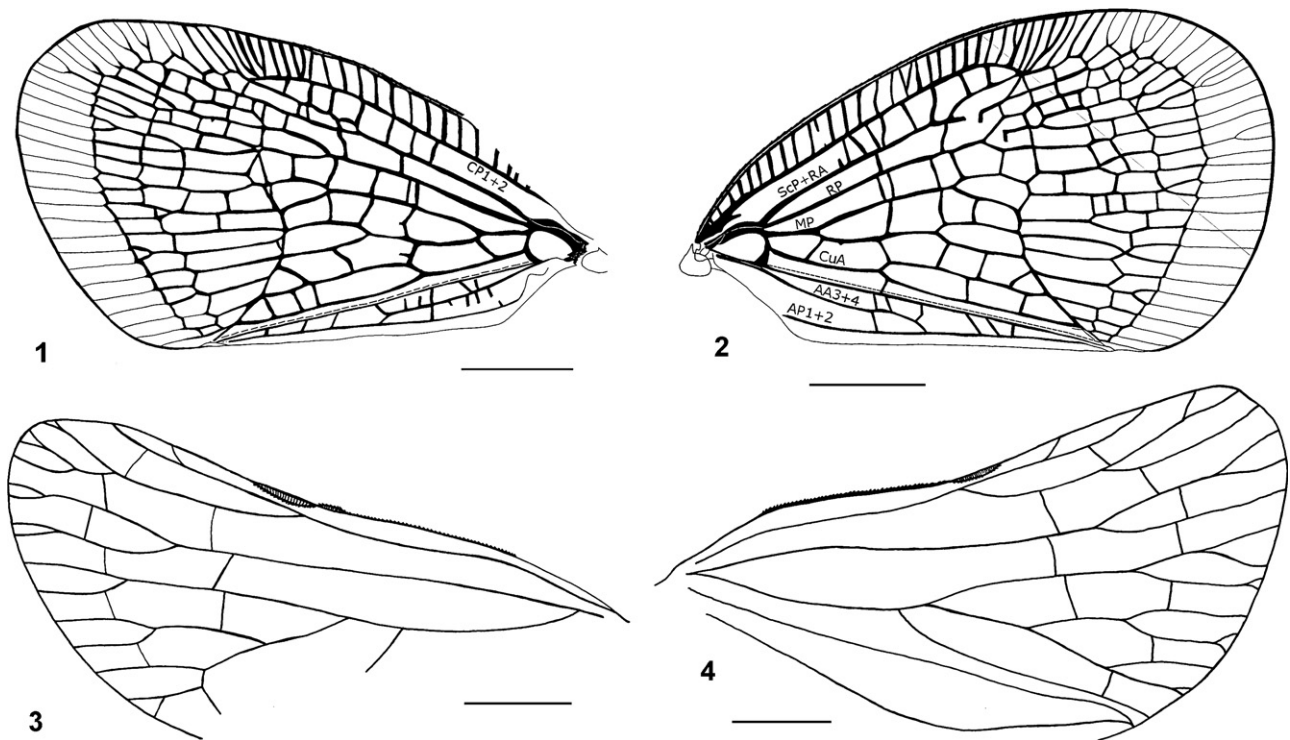


Fig. 3. *Nogodina chiapaneca* nov. sp., holotype; 1, left forewing; 2, reconstruction of the right forewing, where antero-apical part was drawn in different plane than the rest of the wing; 3, left hindwing; 4, right hindwing. Interpretation of the wing venation. Scale = 2 mm.

Fig. 3. *Nogodina chiapaneca* nov. sp. ; holotype ; 1, aile antérieure gauche ; 2, reconstruction de l'aile antérieure droite ou la partie ante-apicale a été désignée sur un plan différent du reste ; 3, aile postérieure gauche ; 4, aile postérieure droite. Interprétation de la nervation des ailes. Échelle = 2 mm.

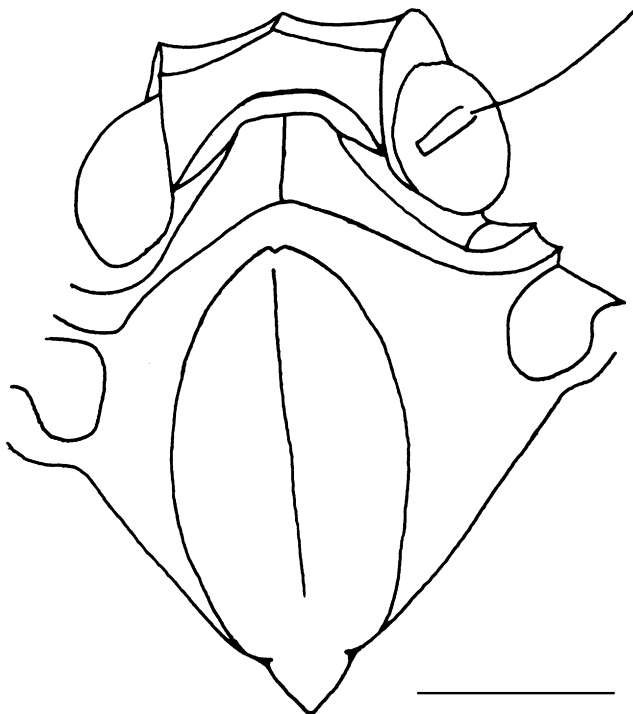


Fig. 4. *Nogodina chiapaneca* nov. sp., holotype; head and thorax in dorsal view. Scale = 1 mm.

Fig. 4. *Nogodina chiapaneca* nov. sp., holotype ; tête et thorax en vue dorsale. Échelle = 1 mm.

MP1 + 2 to MP3 + 4, one from MP1 + 2 to MP3, one from MP2 to MP3; increased number of crossveins forming many little cells in antero-distal part of the wing; MP with a short common stem (in comparison to *Nogodina reticulata*), after it bifurcates into MP1 + 2 and MP3 + 4, and these into MP1, MP2, and MP3, MP4; an aligned row of crossveins between MP to CuP (that break up the longitudinal veins MP at basal distal half of wing); CuA with a long stem bifurcating into CuA1 + 2 and CuA3 + 4; CuA plus CuA1 + 2 sinuous, and bifurcating into CuA1 and CuA2 (fractured by the row of crossveins); complete and sigmoidal crossvein from base of MP3 + 4 to CuA; one crossvein between MP3 + 4 and CuA1 + 2 (m-cu crossvein of Shcherbakov, 1981), two from MP4 and CuA1 + 2, one from CuA1 + 2 to CuA3 + 4, one from CuA2 to CuA3 + 4, one from CuA3 + 4 to CuP; apical row of almost aligned transverse veinlets; 20 veins reaching wing margin from ScP to RP (inclusive), 12 from MA to MP (inclusive), seven from CuA to CuP; CuP straight; CuP ending before the postero-distal apex of the wing, forming a long and closed clavus; AA3 + 4 sinuous and reaching AP1 + 2 (with an acute angle) just after the half of the clavus; AP1 + 2 somewhat parallel to posterior wing margin and ending at the end of clavus in the posterior margin; three crossveins between CuP and AA3 + 4, three from CuP to AP3 + 4, one from AA3 + 4 to AP1 + 2.

Left forewing with costal anterior part not completely preserved (only differences with right wing); length, 11 mm;

width, 6 mm; area between CP1 + 2 and CA developed and with numerous veins, 23 preserved from base to ScP; three complete crossveins between ScP + RA and CP1 + 2, four from ScP and CP1 + 2, four from ScP to RA; RA rejoins ScP forming an elliptical cell crossed by four crossveins and closed by a crossvein; RA, ScP and CP1 + 2 does not reach at same point, crossing of ScP and CP1 + 2, 7.2 mm from wing base; ScP slightly sigmoid reaching wing margin 8.3 mm from the wing base; one crossveins between RA + ScP to RP, one from RA to RP, eight from RA to RP; one crossvein from MP4 and CuA1 + 2, two from CuA2 to CuA3 + 4, any crossvein from CuA3 + 4 to CuP; 17 veins reaching wing margin from ScP to RP (inclusive), 13 from MA to MP (inclusive), five from CuA to CuP; AA3 + 4 slightly sinuous; six crossveins between CuP and AA3 + 4, one complete and four incomplete from AA3 + 4 to AP1 + 2.

Hindwings: Coupling lobe developed; vanus not visible; ScP + RA bifurcates distal to the coupling lobe; ScP reach the wing margin like a crossvein; RP bifurcates from ScP + RA below the coupling lobe; one crossvein between RA and RP; five and three RP terminal veins in left wing and right wings, respectively; MP bifurcating at the level of ScP with four and three terminal veins in left and right wings, respectively; two crossveins between RP and MP; CuA with several branches with 11 terminal veins in right wing (8? in left wing); two crossveins between MP and CuA; CuP somewhat straight and curved at distal end.

**Discussion:** The new species can be included in the Nogodinidae: Nogodininae because they possess a broad basal cell. The other family possessing this broad basal cell is Ricaniidae. The new species could not be included in the Ricaniidae because of two characters, i.e. RA passing into the anterior margin (basal to the antero-apical angle) of wing, and postero-apical angle more or less distant from the apex of the clavus. The Ricaniidae have the apomorphic states of these characters, i.e. RA passing into antero-apical angle of wing, and postero-apical angle immediately beyond apex of clavus (Shcherbakov, 1981).

The Nogodinidae sensu Fennah (1978, 1984, 1987) are composed of two subfamilies and their definition is based on characters of the ovipositor, tarsi and wing venation. The Gastriniinae have the ScP + R fused for a long distance to the CP, MP diverging distally, absence of basal cell and CuA without branches.

The Nogodininae are composed of six tribes sensu Fennah (1978, 1984), i.e. Epacriini, Bladinini, Varciini, Pisachini, Lipocallini, and Mithymnini. Epacriini and Bladinini are excluded because the new species has a row of unaligned transverse veinlets distal of RP-MP and MP-CuA crossveins. Lipocallini are excluded because they present steeply tectiform tegmina, with costal margin strongly produced anteriorly below the eye, and venation finely reticulated (Fennah, 1984). The Varciini and Pisachini from Australasia could be excluded because they have the forewings with the apical row of veins bifurcated. The Mithymnini could be excluded because of their CP submarginal, and specialized wings. *Nogodina chiapaneca* nov. sp. could be included into Nogodinini: Nogodinina

because of its subapical row of aligned crossveins and vein MP with a long basal stalk (Fennah, 1978). Within Nogodinini, Vutinina could be excluded because of its vein MP with a short stalk or arising from basal cell as two branches. Within the Nogodinina, almost all genera, (*Biolleyana*, *Neovarcia*, *Varciopsis*, *Orthothyreus*, *Tainosia*<sup>†</sup> and *Tonacatecutlius*<sup>†</sup>) have the vein ScP + RA stalked, unless genus *Nogodina*, which has the vein R arising from the same point. The new species shares with *Nogodina* the vein R arising from the same point and also the front with median carina distinctly marked. *Nogodina* has only one species, i.e. *Nogodina reticulata*. The new species differs from *Nogodina reticulata* in its shorter MP stalk, presence of a complete and sigmoidal crossvein from MP3 + 4 to CuA, and in smooth venation. In *Nogodina reticulata* the stalk is longer and the crossvein from MP to CuA is reduced frequently to an incomplete vein going from CuA to half of the length of the distance to MP and more frequently reduced to a stump in CuA. As the MP stalk is shorter in the new species, this vein reaches the MP3 + 4.

All other fossil Nogodinidae are unrelated to the new species as they belong to other groups of Nogodinidae. *Tritophania patruelis* (Jacobi, 1937) and *Eobladina antiqua* (Haupt, 1956) recorded from Europe, belong to Bladinini (Szwedo and Stroiński, 2001). Also the genus *Henriksenopterix* (Eocene of Denmark) (Petrulevičius, 2005), of uncertain position, has some derived characters (i.e., the RA1 + 2 sigmoid and the middle part of CA, CP1 + 2 slightly concave (posteriorly curved) and vein MP supernumerary) that exclude any relationship with the new species.

#### 4. Conclusions

The specimen described herein is of particular interest because the Nogodinidae have a very poor fossil record. Despite the historical lack of paleoentomologists in South America, the diversity of fossil Nogodinidae is high with respect to the world record (4 out of 11), which seems to indicate a higher preserved diversity in the region.

The presence of this new species of *Nogodina* and previous new genera and species in Mexican and Caribbean Dominican amber indicate likely that Nogodinina was previously more widespread than today. The absence of the recent species of *Nogodina* in Mexico could be an artifact due to the scarce collection and poor knowledge of recent insects in the region. A detailed prospection of recent entomofauna in Chiapas rainforest is needed for better knowledge of the diversity and biogeographical relationships with Central and South America.

#### Acknowledgements

We thank CONICET (National Research Council of Argentina; PIP CONICET 6393), CONACyT (National Research Council of Mexico) and Institut für Paläontologie (Bonn, Germany) (especially to J. Rust) for the funds provided for this research. This study was carried out during the second author's stage as invited researcher at the Département des sciences de la Terre (Dir. C. De Muizon), Muséum national

d'histoire naturelle, Paris, France. Thanks are also to J. Szwedo, J. Rust and M.C. Digiani for discussion, for providing photographs of recent specimens of *Nogodina*. To J. Deckert from Museum für Naturkunde (Berlin) and G. Bechly (SMNS curator) for the loan of the specimen for study.

## References

- Carpenter, F.M., 1992. Superclass hexapoda. In: Moore, R.C., Kaesler, R.L. (Eds.), Treatise on invertebrate paleontology (R), Arthropoda 4, 3/4. The Geological Society of America. Boulder and University of Kansas Press, Lawrence, pp. 1–655.
- Carver, M., Gross, G.F., Woodward, T.E., 1991. Hemiptera. In: Naumann, I.D., et al. (Eds.), The insects of Australia. A textbook for students and research workers, Second ed., Vol. 1. Melbourne University Press, Victoria, pp. 429–509.
- Dworakowska, I., 1988. Main veins of the wings of Auchenorrhyncha. Entomologische Abhandlungen. Staatliches Museum für Tierkunde Dresden 52, 63–108.
- Fennah, R.G., 1945. In: The Fulgoroidea or lanternflies of Trinidad and adjacent parts of South America. Proceedings of the United States National Museum 95, 411–521.
- Fennah, R.G., 1978. The higher classification of the Nogodinidae (Homoptera: Fulgoroidea) with the description of a new genus and species. Entomologists' Monthly Magazine 113, 113–119.
- Fennah, R.G., 1984. Revisionary notes on the classification of the Nogodinidae (Hemiptera, Fulgoroidea) with descriptions of new genera and a new species. Entomologists' Monthly Magazine 120, 81–86.
- Fennah, R.G., 1987. In: A new subfamily of Nogodinidae (Homoptera: Fulgoroidea) with the description of a new species of *Gastrinia*. Proceedings of the Entomological Society of Washington 89, 363–366.
- Haupt, H., 1956. Beitrag zur Kenntnis der Eozanen Arthropodenfauna des Geiseltales. Nova Acta Leopoldina, NF 18, 1–90.
- Henriksen, K.L., 1922. Eocene insects from Denmark. Danmarks Geologiske Undersøgelse 2, 5–34.
- Jacobi, A., 1937. Eine neue Bernsteinzikade (Rhynchota: Homoptera). Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin 15, 188–189.
- Kukalová-Peck, J., 1983. Origin of the insect wing and wing articulation from the arthropodan leg. Canadian Journal of Zoology 61, 1618–1669.
- Kukalová-Peck, J., 1991. Fossil history and the evolution of hexapod structures. In: Naumann, I.D., et al. (Eds.), The Insects of Australia. A textbook for students and research workers, Second ed., Vol. 1. Melbourne University Press, Victoria, pp. 141–179.
- Melichar, L., 1923. Homoptera (Acalionidae, Flatidae et Ricaniidae). Genera Insectorum 182, 1–185.
- Metcalf, Z.P., 1938. The Fulgorina of Barro Colorado and others parts of Panama. Bulletin of the Museum of Comparative Zoology at Harvard College 82, 277–423.
- Metcalf, Z.P., 1945. Fulgoroidea (Homoptera) of Kartabo, Barica District, British Guiana. Zoologica 30, 125–143.
- Penny, N.D., O'Brien, L.B., 2000. A synopsis of the Neotropical Nogodinidae (Hemiptera; Fulgoromorpha). Abstracts of the XXI International Entomological Congress, Foz do Iguaçu, Brazil 2, p. 913.
- Petrulėvičius, J.F., 2001. Insectos del Paleógeno del Noroeste de la Argentina. Sistemática, tafonomía y paleosinecología. PhD thesis, Universidad Nacional de La Plata, Argentina (unpublished).
- Petrulėvičius, J.F., 2005. First fossil record of Nogodinidae in South America; a planthopper from the upper Paleocene of Argentina. Systematics and taphonomy. Palaeontology 48, 299–308.
- Rust, J., 1999. Biologie der Insekten aus dem ältesten Tertiär Nordeuropas. Habilitationsschrift, Biologische Fakultät der Georg-August-Universität Göttingen (unpublished Thesis).
- Shcherbakov, D.Y., 1981. Diagnostics of the families of the Auchenorrhyncha (Homoptera) on the basis of the wings. 1. Forewing. Entomological Review 60, 64–81.
- Stroiński, A., Szwedo, J., 2000. *Tonacatecutlius gibsoni* gen. and sp. nov. from the Oligocene/Miocene Mexican amber (Hemiptera: Fulgoromorpha: Nogodinidae). Annales Zoologici 50, 341–345.
- Szwedo, J., Stroiński, A., 1999. Redescription of *Tritophania patruelis* Jacobi, 1938 from Eocene Baltic amber (Hemiptera, Nogodinidae). Annales Zoologici 49, 203–207.
- Szwedo, J., Stroiński, A., 2001. *Tainosia quisqueyae* gen. and sp. nov. from the Oligocene/Miocene Dominican amber (Hemiptera: Fulgoroidea: Nogodinidae). Genus 12, 29–34.
- Szwedo, J., Bourgoin, Th., Lefebvre, F., 2004. Fossil planthoppers (Hemiptera: Fulgoromorpha) of the world. An annotated catalogue with notes on Hemiptera classification. Studio 1, Warszawa, 1–208.