GEOLOGICA CARPATHICA, JUNE 2008, 59, 3, 269–272

SHORT COMMUNICATION

A complete larva of a Mesozoic (Early Cenomanian) cockroach (Insecta: Blattaria: Blattulidae) from the Sisteron amber (Alpes de Haute Provence, SE France)

PETER VRŠANSKÝ

Geological Institute, Slovak Academy of Sciences, Dúbravská cesta 9, P.O. Box 106, 840 05 Bratislava, Slovak Republic; geolvrsa@savba.sk
Arthropoda Laboratory, Paleontological Institute, Russian Academy of Sciences, Profsoyuznaya 123, 117868 Moscow, Russian Federation; lab@palaeoentomolog.ru

(Manuscript received October 31, 2007; accepted in revised form March 14, 2008)

Abstract: A complete second-instar male larva of *Nula sis* gen. et sp.n., belonging to the cockroach family Blattulidae Vishniakova, 1982 is described from the Early Cenomanian amber of Sisteron in France. It reveals detailed and complete 3D morphology, with important presence of the central, 3rd ocellus, reduced in most adults and in all living cockroaches and termites, but present in some mantises. The modern distribution of unspecialized sensorial system of *sensilla chaetica* is also notable.

Key words: Early Cenomanian, SE France, evolution, fossil insects, Blattaria (=Blattodea), Blattulidae, new genus, new species, Cretaceous amber.

Introduction

Blattulidae was the dominant Mesozoic family of cockroaches during the Cretaceous, particularly in warm and humid assemblages. It comprises about 300 described species and ca. 10,000 collected specimens. In spite of their richness and cosmopolitan distribution, all individuals can be categorized within few uniform genera without subfamilial split.

The main morphology of the adults has been well known since Vishniakova (1968) and descriptions include the detailed morphology of the head and terminalia with female ovipositor (Vishniakova 1968, 1982; Wang et al. 2007b), the cercal, antennal, wing sensilla and venation variability (Vršanský 2000, 2002, 2003, 2005a; Vršanský & Ansorge 2007; Wang et al. 2007a). Nevertheless, the fine details and spatial 3D habitus and distribution of respective structures were unknown, as the only immatures from mid-Cretaceous ambers of Lebanon (a single individual) and New Jersey (two individuals) were not described (Vršanský 2004). This specimen so far represents a unique opportunity for such study.

The distribution of fine sensilla (a feature not preserved in imprint fossils) has a very special consideration.

Generally, the cockroaches from the Mesozoic ambers are extraordinarily rare. Only 3 adults (Vršanský 2003; Anisyutkin & Gorochov 2008) were described from the Lebanon and New Jersey ambers.

In SE France, amber was found in the marine blue marls (Fig. 1a), providing dark red nodules representing fragmented flows, 5–30 mm in diameter. Amber from the Salignac near Sisteron revealed 16 inclusions 12 of which represent undetermined flies (Diptera) (Perrichot et al. 2007). *Macrosiagon ebboi* Perrichot et Nel et Néraudeau, 2004, perhaps parasitic on wasps, represents one of the oldest records of wedge-shaped beetles (Perrichot et al. 2004); unidentified *Phryssonotus* Scudder, 1885 (Myriapoda, Diplopoda) (Nguyen Duy-Jacquemin & Azar 2004) and a bug *Ebboa areolata* Perrichot, Nel, Guilbert et Néraudeau, 2006 (Heteroptera: Cimicomorpha), were also found in Archingeay amber (Perrichot et al. 2006).

Systematics

Order: **Blattaria** Latreille, 1810
Family: **Blattulidae** Vishniakova, 1982
Nula gen.n.

Type species: *Nula sis* Vršanský sp.n., by monotypy.

Differential diagnosis: The present genus may be categorized within Blattulidae on the basis of its general habitus, large almost globular head with characteristic long apical antennal sensilla distributed in two main rows, and characteristic long marginal pronotal setae. The slender habitus exclude the categorization of the present fossil within the families Caloblattinidae, Raphidiomimidae, Latiblattidae and Blattellidae. Skokidae may be excluded by the absence of saltatorial hind legs, and Mesoblattinidae and Umenocoleidae by their more flattened head. Liberiblattinidae had wider antennal segments with a different distribution of shorter sensilla.

Nula differs from *Elisama* Giebel, 1856; *Eublattula* Handlirsch, 1939; *Svabula* Vršanský, 2005a; *Xonpepetla* Cifuentes-Ruiz et Vršanský, 2006; *Habroblattula* Wang, Liang et Ren, 2007 and *Macaroblattula* Wang, Ren et Liang, 2007 in being slim. *Tarakanula* Vršanský, 2003 differs in having a comparatively smaller head and in being more slender. *Blattula* Handlirsch, 1906 has a comparatively narrow pronotum and smaller head and is not recorded after the Tithonian — thus its occurrence late in the Mesozoic is unlikely. *Nula* also has an irregular carination of tibiae, small articulation of the foreleg, and irregular ridge in hind femora (autapomorphies). Of a similar age is *Kridla* Vršanský, 2005b, known from a single isolated hindwing coming from an unusual find from a drilling core from East Siberia, which also, unlike *Nula*, appears to belong to a more robust species. *Vrtula* Vršanský, 2008 is a robust and significantly elongated aberrant taxon.

Description: Head large, with very large compound eyes and three distinct discrete, plain ocelli, of which the median ocellus is slightly smaller. Antenna fine and long, with very distinct scape and pedicel, and with at least 44 segments in the second immature stage. Mandible comparatively small, with sharp asymmetrical teeth. Pronotum of this immature stage small, not concealing the head. Pro-, meso- and metanotum with strong setae at margin. Legs cursorial, fore and hindlegs long, mid-legs comparatively shorter. Fore coxa short, femora long. Fore tarsus with numerous fine chaeta. All tibiae with numerous carination and with a lot of chaeta. Hind femur with broken longitudinal ridge. Abdomen comparatively narrow, terminal plate with few chaeta.

Remarks: The extreme conservativeness of the family comprises immature stages. Additionally all the amber fossils represent genera different from the genera known from the imprint fossils, pointing to a different ecology of the amber and imprint fossil source areas. Thus the erection of a new genus appears safe.

Derivation of name: After *nula* (zero), sustaining suffix — la for the representatives of this family. Alluding to the incompleted life cycle of the present individual.

Nula sis gen. et sp.n.
(Fig. 1b)

Holotype: SIS-17.2. Deposited in the amber collection of the Earth History Department, National Museum of Natural History, Paris. A complete male immature.

Type locality: Salignac, near Sisteron, Department Alpes de Haute Provence, SE France.

Stratigraphic horizon: Upper Cretaceous, Lower Cenomanian fide Perrichot et al. (2004).

Description: Head width 1.44 mm, eye width 0.29 mm. Width of the antennal socket 0.17 mm. Scape and pedicel length 0.13, 0.15 mm respectively; antennal width ca. 0.07 mm. Each segment with row of 5–7 sensilla. Segments 3–17 (22) with one row, more terminal segments with two rows. Mandible 0.13 mm long, 0.38 mm wide (Left 0.17 mm; right 0.21 mm).

Pronotum ca. 1.2 mm wide, with four marginal seta, mesonotum little wider (ca. 1.4 mm) also with four marginal seta long at least 0.19 mm; metanotum long, with at least 6 shorter marginal seta.

Articulation of fore leg very short, with coxa length 0.3 mm; trochanter small (0.19/0.12 mm); femur, tibia and tarsus comparatively long 0.75/0.17 mm; 0.54/0.12 mm; 0.75 mm. Femur with doubled ridge. Pretarsus with two symmetrical claws. Three terminal, four median (two rows) and a single basal long chaeta are present. Arolium round.

Mid leg robust, trochanter large (0.29/0.13 mm); femur wide (1.04/0.35 mm) with at least five chaeta on distal, 15 on proximal, 9+9 in two rows of median side (all ventral); tibia (0.87/0.12 mm) with numerous chaeta at margin, and with sporadic series of strong spurs long up to 0.29 mm.

Hind legs comparatively fine, with long femur (1.44/0.42 mm) bearing a strong, irregular longitudinal ridge, with 6 chaeta. Anterior margin with 8, posterior with 5 chaeta. Tibia wide (0.17 mm), with spurs long up to 0.37 mm. Seven distinct sterna present.

Remarks: One chaeta on the mid-tibia apparently originates deeply under the cuticle.

Antennae are broken at segments 43 and 44 respectively, so it is not possible to assume the total number of segments and their total length.

Derivation of name: *sis* is after Latin "if you like it", also a suffix and shortened locality Sisteron.

Discussion

The head unconcealed by the pronotum is a common feature of the first two instar stages of primitive living cockroaches (of Mesozoic origin), and since there are no significant differences in morphology among Blattulidae and these living cockroaches, there are no contraindications for such assignment of the present species. Thus, if the second

Fig. 1a. Geological scheme of the locality (modified after Haug et al. 1964 and Perrichot et al. 2004).

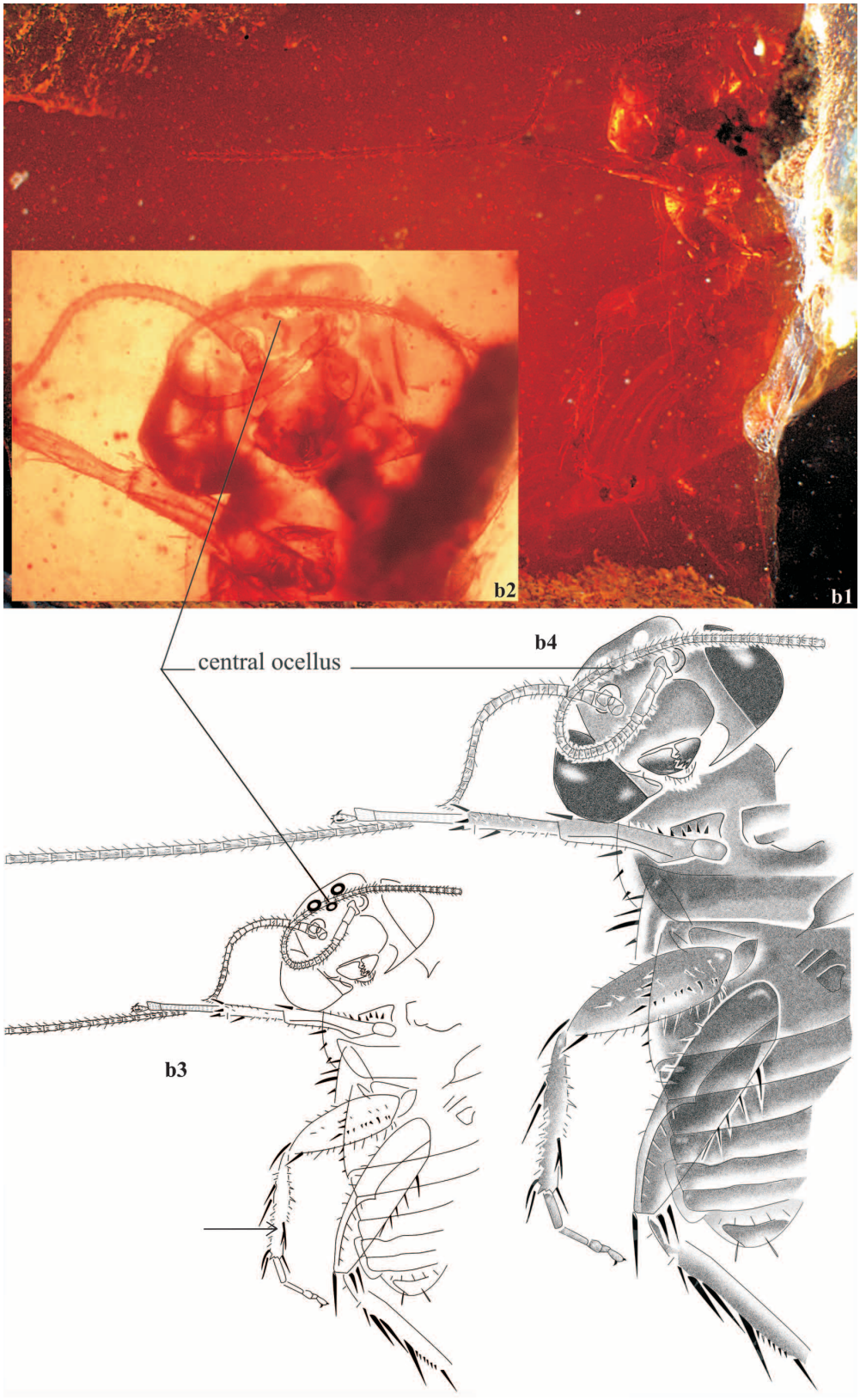

Fig. 1b. Four different projections of *Nula sis* Vršanský, sp.n. (all ventral views). **Holotype** SIS-17.2. (deposited in the amber collection from the Earth History Department, National Museum of Natural History, Paris). A complete larva of second instar. Salignac, near Sisteron, Alpes de Haute Provence, SE France. Early Cenomanian Late Cretaceous. **b1** — total ventral view; **b2** — detail of head in transmitting light; **b3** — sketch abstraction; **b4** — reconstruction. Arrow shows a spine originating deep below the cuticle. Total length of the individual (without legs): 3.5 mm.

instar is 3.5 mm long, applying the Dyar's rule of succeeding instars sizes multiplied by 1.4×, the first instar should be 2.5 mm long, which are similar sizes of first two immatures of *Blattula brevicaudata* Vishniakova, 1968 from the Late Jurassic of Karatau in Kazakhstan. *B. brevicaudata* adults have a wingspan of ca. 7.5 mm. If we continue, the third instar would be 4.9 mm long (around 5 mm in *B. brevicaudata*), the fourth 6.9 mm and the fifth 9.7 mm. Thus, the number of instars can be predicted to be 4–6 (similar to the studied but undescribed Blattulidae from the sedimentary record) and the size of the adult 6–10 mm, with the most probable wing length about 7 mm.

The presence of the central ocellus is of special consideration, since this structure has been discovered in cockroaches of the family Caloblattinidae Vršanský et Ansorge in Vršanský (2000) and considered to be plesiomorphic only recently (Vršanský 2008a). It was though to have reduced in the Blattulidae, since in the rich Late Jurassic (Vishniakova 1968) and Early Cretaceous record from China it has not been observed (Wang et al. 2007a,b). Nevertheless, the central ocellus is present in the present larva and also in at least one derived species (Anisyutkin & Gorochov 2008) and thus this structure must be reduced during the ontogenetic development of most Blattulidae. Ocelli of *Nula* were probably plain, as in the adult of *Ocelloblattula ponomarenkoi* Anisyutkin & Gorochov, 2008.

The precise level of recognition of distribution of numerous sensilla indicates that the senses of the Mesozoic cockroaches were modern, virtually indistinguishable from the living species. The sensilla were certainly different, unspecialized (Vršanský et al. 2001), but their number and distribution was identical with modern ones.

Acknowledgments: I thank Vincent Perrichot, Didier Néraudeau (Univ. Rennes 1), Dany Azar (Lebanese University and NMNH Paris), Leonid Anisyutkin (Zoological Institute, St. Petersbourg) and Jozef Michalík (Geological Institute, Bratislava) for extensive help during the study and for revision of the manuscript. I also thank Ľubka Puškelová for technical support. Supported by VEGA 6002, MVTS; Literary Fund. This paper is a contribution to the French ANR Project AMBRACE (No. BLAN07-1-184190).

References

Anisyutkin L.N. & Gorochov A.V. 2008: A new genus and species of the cockroach family Blattulidae from Lebanese Amber (Dictyoptera, Blattina). *Paleontol. J.* 42, 1, 43–46.

Haug E., Kilian W., Bertrand L., Zürcher P., Martin D., Gubler Y., De l'Apparent A.F., Goguel J., Lanteaume M. & Lemoine M. 1964: Carte géologique au 1 : 80,000e: Digne, n° 212 (3rd edition).

Latreille P.A. 1810: Considérations générales sur l'ordre naturel des animaux composant les classes des Crustacés, des Arachnides et des Insectes avec un tableau méthodique de leurs genres disposés en familles. *Schoell*, Paris, 1–444.

Nguyen Duy-Jacquemin M. & Azar D. 2004: The oldest records of Polyxenida (Myriapoda, Diplopoda): new discoveries from the Cretaceous ambers of Lebanon and France. *Geodiversitas* 26, 4, 631–641.

Perrichot V., Nel A. & Néraudeau D. 2004: Two new wedge-shaped beetles in Albo-Cenomanian ambers of France (Coleoptera: Ripiphoridae: Ripiphorinae). *Eur. J. Entomol.* 101, 4, 583–589.

Perrichot V., Nel A., Guilbert E. & Néraudeau D. 2006: Fossil Tingoidea (Heteroptera: Cimicomorpha) from French Cretaceous amber, including Tingidae and a new family, Ebboidae. *Zootaxa* 1203, 57–68.

Perrichot V., Néraudeau D., Nel A. & De Ploëg G. 2007: A reassessment of the Cretaceous amber deposits from France and their palaeontological significance. *African Invertebrates* 48, 1, 213–227.

Vishniakova V.N. 1968: Mesozoic cockroaches with an external ovipositor and pecularities of their reproduction (Blattodea). 55–86. In: Rohdendorf B.B. (Ed.): Jurassic Insects of Karatau. *Nauka*, Moscow 1–252 (in Russian).

Vishniakova V.N. 1982: Jurassic cockroaches of the family Blattulidae fam. nov. (Insecta: Blattida). *Paleontol. J.* 2, 69–79 (in Russian).

Vršanský P. 2000: Decreasing variability-from the Carboniferous to the Present! (Validated on independent lineages of Blattaria). *Paleontol. J.* 34, Suppl. 3, 374–379.

Vršanský P. 2002: Origin and the Early Evolution of Mantises. *Amba Projekty* 6, 1, 1–16.

Vršanský P. 2003: Unique assemblage of Dictyoptera (Insecta-Blattaria, Mantodea, Isoptera, Mantodea) from the Lower Cretaceous of Bon Tsagaan Nuur in Mongolia. *Entomol. Probl.* 33 (1–2), 119–151.

Vršanský P. 2004: Cretaceous Gondwanian Cockroaches (Insecta, Blattaria). *Entomol. Probl.* 34, 1–2, 49–54.

Vršanský P. 2005a: Lower Cretaceous cockroaches and mantids (Insecta: Blattaria, Mantodea) from the Sharin-Gol in Mongolia. *Entomol. Probl.* 35, 2, 163–167.

Vršanský P. 2005b: Insect in a drilling core–cockroach *Kridla stastia* sp.nov. from the Verkhne-Bureinskaya Depression in Eastern Russia. *Entomol. Probl.* 35, 2, 115–116.

Vršanský P. 2008a: Central ocellus of extinct cockroaches (Blattaria: Caloblattinidae). *Zootaxa* (in print).

Vršanský P. 2008b: New blattarians and a review of dictyopteran assemblages from the Lower Cretaceous of Mongolia. *Acta Palaeontol. Pol.* 53, 1, 129–136.

Vršanský P. & Ansorge J. 2007: Lower Jurassic cockroaches (Insecta: Blattaria) from Germany and England. *African Invertebrates* 48, 1, 103–126.

Vršanský P., Quicke D.L.J., Rasnitsyn A.P., Basibuyuk H., Ross A., Fitton M. & Vidlička Ľ. 2001: The oldest fossil insect sensilla. *Amba Projekty* 5, 1, 1–8.

Wang T., Liang J.-H. & Ren D. 2007a: Variability of *Habroblattula drepanoides* gen. et. sp. nov. (Insecta: Blattaria: Blattulidae) from the Yixian Formation in Liaoning, China. *Zootaxa* 1443, 17–27.

Wang T., Liang J.-H., Ren D. & Shi C. 2007b: New Mesozoic cockroaches (Blattaria: Blattulidae) from Jehol Biota of western Liaoning in China. *Ann. Zool.* 57, 3, 483–495.