

A sphaeropsocid bark louse in Late Cretaceous amber from Siberia (Psocoptera: Sphaeropsocidae)

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A new genus and species of sphaeropsocid bark louse is described and figured from a single individual in Late Cretaceous (latest Cenomanian) amber from Agapa, western Taimyr Peninsula, northern Siberia. *Globopsocus aquilonius* n.gen., n.sp. is a relatively primitive member of the family and further demonstrates that these insects were once widespread and global, in contrast to their restricted austral distribution today. The species is distinguished from related taxa and a discussion provided regarding its phylogenetic position within Sphaeropsocidae.

Keywords: Nanopsocetae, Troctomorpha, Mesozoic, amber, Psocodea, Russia.

Un nouveau genre et espèce de sphaeropsocide est décrit et figuré à partir d'un individu de l'ambre du Crétacé terminal (Cénomanien tardif) d'Agapa, Ouest de la péninsule de Taimyr, Nord de la Sibérie. *Globopsocus aquilonius* n.gen., n.sp. est un membre relativement primitif de la famille et démontre davantage que ces insectes étaient par le passé répandus mondialement, contrairement à leur distribution actuelle restreinte à la région australe. Cette espèce est comparée aux taxa apparentés et une discussion concernant sa position phylogénétique au sein des Sphaeropsocidae est donnée.

Mots clefs: Nanopsocetae, Troctomorpha, Mésozoïque, ambre, Psocodea, Russie.

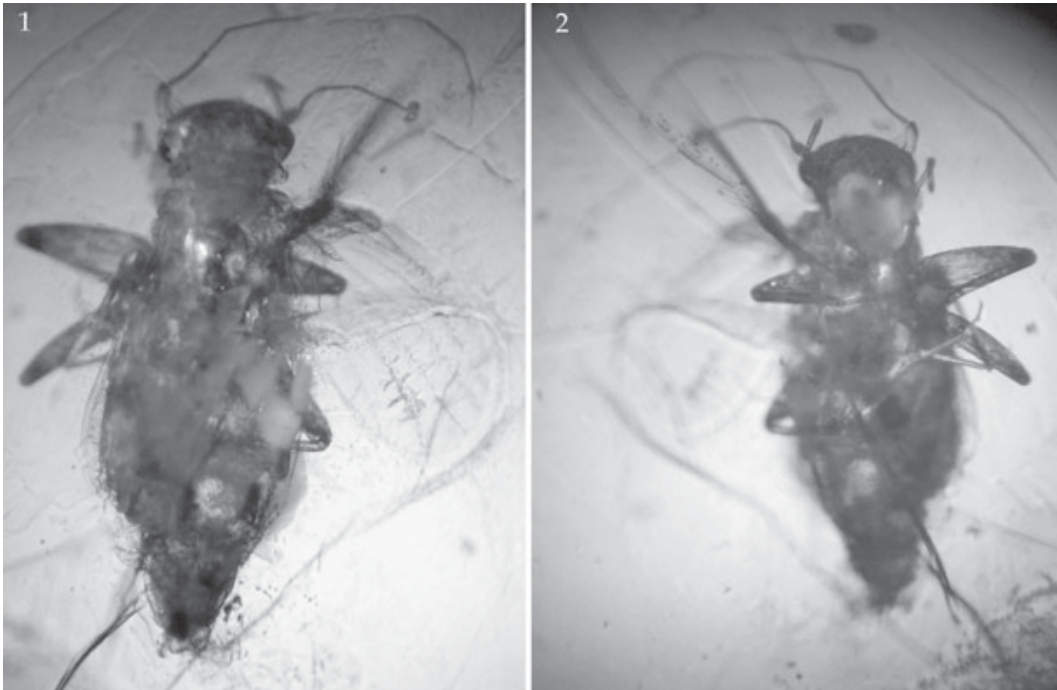
Новый род и новый вид сеноедов семейства Sphaeropsocidae описан из ископаемых смол местонахождения Агапа, верхний мел (сеноман) Таймырского полуострова, Россия. *Globopsocus aquilonius* n.gen., n.sp. является примитивным представителем семейства. Находка подтверждает широкое распространение данных насекомых в прошлом, по сравнению с ареалом, ограниченным южными материками, занимаемым ими в настоящем. Обсуждается систематическое положение нового таксона в семействе Sphaeropsocidae.

Ключевые слова: Nanopsocetae, Troctomorpha, Мезозой, янтарь, Psocodea, Россия.

INTRODUCTION

Bark lice of the nanopsocete family Sphaeropsocidae are rightly considered the coelacanth of the Psocoptera (Grimaldi and Engel, 2006). The family was first discovered and described on the basis of a species,

Sphaeropsocus kuenowii Hagen, 1882, occurring in middle Eocene (Lutetian) Baltic amber (Hagen, 1882). Nearly 50 years later living species were discovered in Tasmania (Hickman, 1934) and eventually the family grew to 14 modern species distributed across the austral region (Lienhard and Smithers,



Figures 1–2. Photomicrographs of holotype of *Globopsocus aquilonius* n.gen., n.sp. (PIN 3426/209). 1. Dorsal aspect. 2. Ventral aspect.

2002), with introductions into North America and Europe where one species, *Badonnelia titei* Pearman, 1953, is likely adventive rather than truly native (Grimaldi and Engel, 2006). The Tertiary species, while not common, is also not rare and has even been discovered in the contemporaneous amber of the Ukraine (Engel and Perkovsky, 2006a, 2006b). In addition, two Cretaceous species have been described in amber from Canada and Lebanon (Grimaldi and Engel, 2006).

Herein we describe a new genus and species of sphaeropsocids from Late Cretaceous (latest Cenomanian: Rasnitsyn and Quicke, 2002) amber of Siberia (Figs. 1–2). The genera of Sphaeropsocidae were revised by Grimaldi and Engel (2006) and accordingly morphological terminology (*e.g.*, wing vein identities) and format for the description follows that work. Figures were prepared by the senior author.

SYSTEMATIC PALEONTOLOGY

Family Sphaeropsocidae Kolbe, 1883
Globopsocus, new genus

Type species

Globopsocus aquilonius Azar and Engel, new species.

Diagnosis

Vertex short (similar to *Sphaeropsocites*) (Figs. 3–5); compound eyes relatively well developed (unlike all other sphaeropsocids); ocelli absent (Fig. 4). Forewings elytriform (Fig. 1); humeral angle less cordate than in Recent species (closer in shape to *Sphaeropsocoides*); apices of wing veins not meeting wing margin (similar to condition seen in *Sphaeropsocoides*) nor apically fused; stem of R longer than in *Sphaeropsocus* or *Sphaeropsocoides*; Rs originating at point near forking of M into MA and MP; R



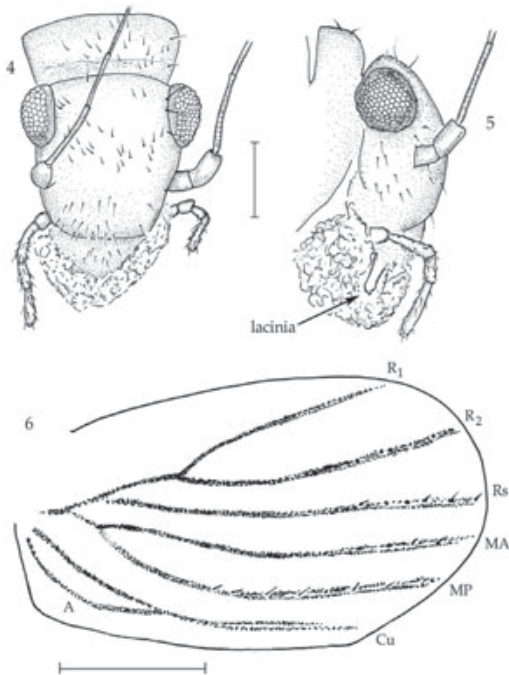
Figure 3. Habitus illustration of holotype of *Globopsocus aquilonius* n.gen., n.sp. (PIN 3426/209); scale bar = 0.25 mm. Note that one elytriform forewing has become dislodged and is opened away from the body, exposing its inner surface with the venation showing through from the outer surface turned away from the field of view (and thereby in a reversed position: *vide etiam* Fig. 1).

apomorphically forking before wing midlength into R_1 and R_2 (Fig. 6); stem of M distinct, shorter than in *Sphaeropsocoides*, basally fused with R (rather than Cu in *Sphaeropsocus*); anal vein relatively elongate (similar to *Sphaeropsocites*), not present as a short stub, apically curving to terminate near Cu; crossveins absent (Fig. 6); claval suture absent; forewings not entirely covering abdominal apex (as in some other genera). Hind wings absent.

Etymology

The new genus-group name is a combination of *globus* (Latin, meaning “ball” or “sphere”) and *Psocus*, the common stem of most psocopteran genera. The name is masculine.

Globopsocus aquilonius, new species (Figs. 1–8)



Figures 4–6. Illustrations of *Globopsocus aquilonius* n.gen., n.sp. (PIN 3426/209). 4. Head in frontal. 5. Head in lateral aspect. 6. Forewing venation. Scale bar for figures 4 and 5 = 0.15 mm; for figure 6 = 0.25 mm.

Sphaeropsocidae sp.; Rasnitsyn and Quicke, 2002: 136, fig. 164.

Sphaeropsocidae sp.; Grimaldi and Engel, 2005: 270.

Sphaeropsocid sp.; Grimaldi and Engel, 2006: 15.

Diagnosis

As for the genus (*vide supra*).

Description

Female (measurements based on unique holotype). Minute psocopteran, total body length 1.5 mm. Head elongate, length 0.44 mm, width 0.39; vertex short; anterior tentorial pits not visible; no coronal ecdysial cleavage lines evident; ocelli absent; compound eyes relatively well developed (about 45 facets in each compound eye), diameter 0.13 mm; apical portion of clypeus,

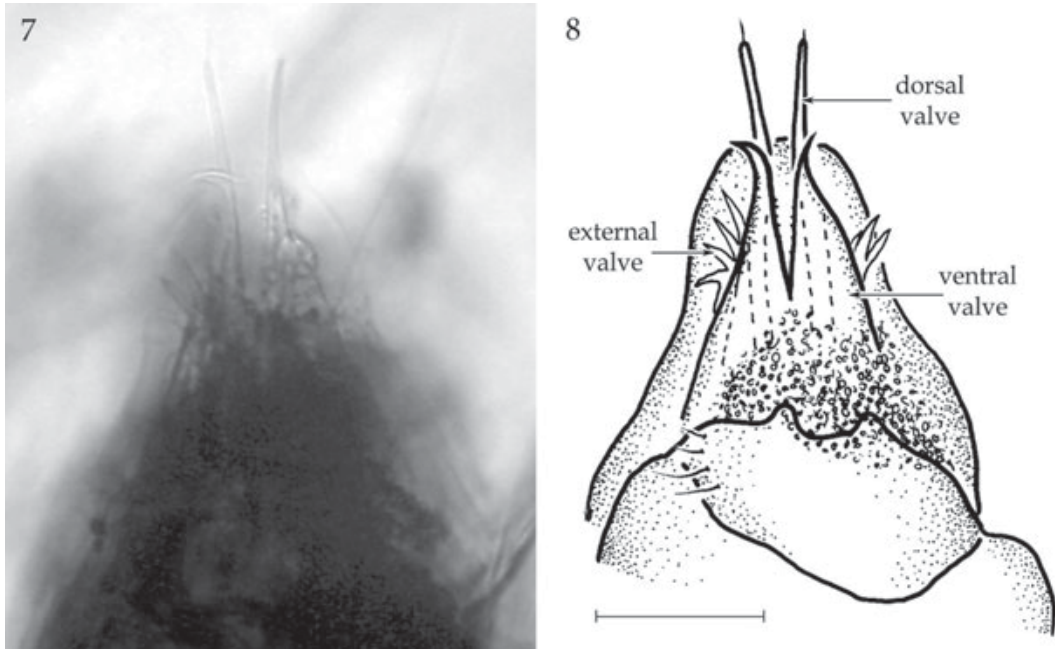


Figure 7–8. Female genitalia of *Globopsocus aquilonius* n.gen., n.sp. (PIN 3426/209), ventral aspect. 7. Photomicrograph of abdominal apex of holotype. 8. Line illustration, scale bar = 0.1 mm.

mandibles, and labium obscured by dense, white film; lacinia with four blunt, apical teeth (Fig. 5) – two very small, two slightly longer, those in middle longest; maxillary palps tetramerous, lengths of segments (longest to shortest): P_4 - P_2 - P_3 - P_1 : 0.126–0.108–0.054–0.036 mm, respectively; antenna total length 1.32 mm; scape and pedicel nearly cylindrical, respectively length 0.05 mm and 0.075 mm, respectively, both 0.048 mm in width; flagellum with 15 articles, first flagellar article longest, length 0.18 mm, apicalmost (*i.e.*, most apical of preserved length) flagellar article shortest, length 0.03 mm. Thorax relatively well developed, length 0.4 mm, width 0.35 mm, dorsally with pronotum slightly narrower than head, pronotal width 0.33 mm, mesoscutum well developed, triangular, width 0.35 mm. Legs of moderate length; all femora thick, nearly 0.36 mm in length, tibiae with two apical spurs. Tarsi trimerous, pretarsal ungue (= claw) without preapical tooth. Forewings present,

hind wings absent, forewing elytrous, carapacelike, length 0.81 mm, greatest width 0.44 mm; venation reduced, consisting of weakly developed circumambient C, R_1 , R_2 , Rs, MA, MP, Cu, and short A apically meeting Cu (Fig. 6); R bifurcated into R_1 and R_2 at 0.288 mm from wing base; R_1 0.391 mm in length, Rs separating from R at 0.16 mm from wing base; M bifurcating into MA and MP at 0.147 mm from wing base; MA 0.647 mm in length, MP 0.615 mm in length; A meeting Cu at 0.256 mm; R_1 , R_2 , Rs, MA, MP, and Cu reaching nearly to wing margin (disappearing immediately before margins, none terminate on margin). Abdomen extruded, relatively long, length 0.96 mm as preserved, otherwise globose, longer than forewings. Female genitalia well developed, composed of tree paired “valves” (*sensu* Badonnel, 1970 – NB: “external valves” in Psocoptera are not equivalent to the ill-named “third valvulae”, more appropriately called “gonoplac” in other insects) (Figs. 7–8),

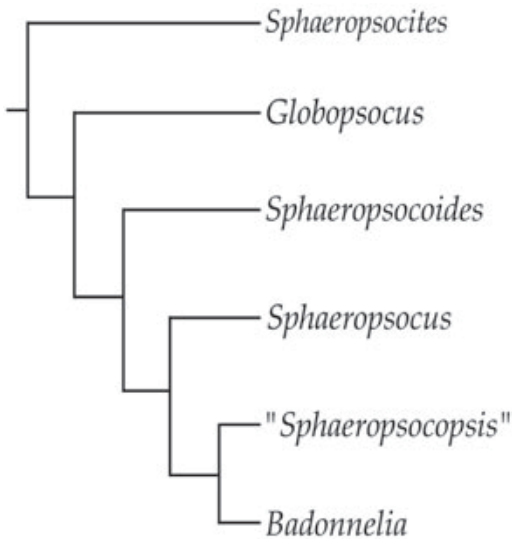


Figure 9. Phylogeny of Sphaeropsocidae, updated from Grimaldi & Engel (2006). Refer to Discussion for an elaboration of characters indicating the placement of *Globopsocus* in their system.

ventral valves elongate and conical, dorsal valves elongate and needle-like, longer than ventral valves, external valves multilobed (Fig. 8); subgenital plate (partly visible) with "egg guide" composed of pair of small, paramedian tubercles bordering small medial depressed and hollowed section (Fig. 8).

Holotype

PIN 3426/209; Late Cretaceous (Late Cenomanian), Dolganian Formation, northern Siberia, western Taimyr Peninsula, Nizhnyaya Agapa River. The holotype is deposited in the Paleontological Institute, Russian Academy of Sciences, Moscow. The amber piece is in relatively poor condition after having been stored in castor oil for many years (Figs. 1–2), but has now been placed between two cover slips with Canada balsam as described by Azar *et al.* (2003).

Etymology

The specific epithet is the Latin term *aquilonius*, meaning "northern".

DISCUSSION

Globopsocus is significant in several respects but perhaps most importantly in its phylogenetic placement and biogeographic implications. The genus nicely places in an intermediate position between the Early Cretaceous *Sphaeropsocites* from Lebanon and the only other Late Cretaceous sphaeropsocid, *Sphaeropsocoides*, from Canada. Using the characters employed by Grimaldi and Engel (2006) the Siberian fossil apparently intercalates itself on the branch between *Sphaeropsocites* and *Sphaeropsocoides* (Fig. 9), sharing with the latter the derived conditions of the arched humeral area of the forewing (albeit weakly so in comparison to *Sphaeropsocoides* and other genera) and the loss of crossveins and the claval suture. *Globopsocus* primitively shares with *Sphaeropsocites* the relatively small head vertex and a well-developed anal vein. The termination of A near CuA, the apical forking of R, and the relatively well-developed compound eyes (albeit still reduced by comparison to many modern psocopterans) are all considered secondarily-derived features of *Globopsocus*. Overall, the genus is not without some notable similarities to *Sphaeropsocoides* in Canadian amber (Grimaldi & Engel 2006). Given the relative geographic positions, ages, and relative phylogenetic affinities of these taxa such similarities are hardly surprising.

While modern sphaeropsocids are natively confined to the austral region (although some have been introduced into the Northern Hemisphere, even the apparently "native" *B. titei* is likely adventive: Grimaldi and Engel, 2006), the fossil record indicates a once widespread lineage. However, the fossil sphaeropsocids form a grade to the modern species and crown-group Sphaeropsocidae are perhaps truly Gondwanan (Grimaldi and Engel, 2006). Nonetheless, the discovery of *Globopsocus* further documents the broad range of Cretaceous sphaeropsocids and the

diverse habitats they once must have occupied relative to modern species.

The diversity of Sphaeropsocidae during the past was most assuredly greater than we observe and encompassed vast regions of the globe. Given the glimpses into sphaeropsocid diversity provided by *Globopsocus*, *Sphaeropsocoides*, and *Sphaeropsocites*, it seems only a matter of time before members of the family are discovered in other Cretaceous amber deposits such as those of New Jersey, France, Spain, and Myanmar.

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