

# Rovnoecus, a New Genus of Digger Wasps (Hymenoptera, Crabronidae, Pemphredoninae) from the Rovno Amber

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Received August 4, 2008

**Abstract**—A new fossil digger wasp *Rovnoecus klesovicus* gen. et sp. nov. (Hymenoptera, Crabronidae, Pemphredoninae, Pemphredonini) is described from the Upper Eocene Rovno amber. The genus *Rovnoecus* gen. nov. is characterized by an incomplete occipital carina, partly reduced second discoidal cell, and the presence of spines on all tibiae. *Rovnoecus* gen. nov. is most similar to the fossil genus *Eoxyloecus* Budrys, 1993 from the Baltic amber. The two genera form a monophyletic group that is a sister group to the group formed by the genera *Passaloecus* Shuckard, 1837 and *Eopinoecus* Budrys, 1993. This indirectly corroborates the hypothesis of the geographically different origin of the Rovno and Baltic ambers.

**DOI:** 10.1134/S0031030109090044

**Key words:** new genus, digger wasps, *Rovnoecus*, Hymenoptera, Crabronidae, Pemphredoninae, Rovno amber.

## INTRODUCTION

The subfamily Pemphredoninae, being one of the most generalized taxa of the family Crabronidae, consists of 4 extant tribes, 37 genera, and 1022 species as well as 12 fossil genera and 16 species (Pulawski, 2008). Its most numerous and specialized tribe Pemphredonini includes 24 Recent genera and 567 species, which differ in the reduction of at least the third forewing radiomedial cell. The presence of two submarginal and two discoidal cells is a distinctive character of the subtribe Pemphredonina, which includes 4 Recent genera and 189 species. Members of the genera *Pemphredon* Latreille, 1796, *Passaloecus* Shuckard, 1837, and *Polemistus* de Saussure, 1892 are usually typical xylo-bionts, whose females build their nests in soft wood, stems with soft core, or in abandoned borings and nests of other xylobiotic insects. At the same time, members of the genus *Diodontus* Curtis, 1834 returned to nesting in soil (Budrys, 2001). Females of almost all species with known biological peculiarities pack the cells of their nests mainly with aphids. Moreover, females of *Passaloecus* and *Polemistus* use plant resinous substances (usually coniferous resin) for making internal partitions between cells and external plugs of their xylicolous nests. The main part of species of Pemphredonina is distributed in the Holarctic, Oriental, and Ethiopian regions, and only two species of *Polemistus* have been described from Neotropics and one from the Australian Region.

Up to the recent time, 13 species of digger wasps belonging to six genera of the subfamily Pemphredon-

inae (Hymenoptera, Crabronidae), the forewings of which contain two submarginal and two discoidal cells have been described from fossil resins of various ages.

*Polemistus apiformis* Antropov, 2000 was described from the Lower Cretaceous Burmese amber and *Cretoecus spinicoxa* Budrys, 1993 and *Pittoecus pauper* Evans, 1973 comes from the Upper Cretaceous Taimyr amber. The rest species, *Eoxyloecus albipalpis* Budrys, 1993, *E. palionisi* Budrys, 1993, *E. seticeps* Budrys, 1993, *E. succinicola* Budrys, 1993, *Passaloecus electrobius* Budrys, 1993, *P. microceras* Sorg, 1986, *P. munax* Sorg, 1986, *P. piletskisi* Budrys, 1993, *P. zherichini* Budrys, 1993, and *Succinoecus lituanicus* Budrys, 1993, were described from the Upper Eocene Baltic amber.

Below a new pemphredonine digger wasp is described based on a sample from the collection of Schmalhausen Institute of Zoology of the National Academy of Sciences of Ukraine (Kiev) (SIZC) that comes from the Ukryantar amber mine (Rovno). Before entering the collection in Kiev, the specimen has been incorrectly determined, which became the reason for including the family Pompilidae into the lists of Hymenoptera of the Rovno amber (Tutskij and Stepanjuk, 1999; Perkovsky et al., 2003). Only in 2004, judging from the dated label with comments, Dr. Michael S. Engel (Division of Entomology, Natural History Museum of University of Kansas, Lawrence, Kansas) assigned the specimen to the family Sphecidae (Perkovsky, 2007).

The material was studied under a Carl Zeiss Stemi SV 6 stereomicroscope with a drawing unit. Nikon Coolpix 885 digital camera was used to make photographs, which were subsequently improved when necessary, using Adobe Photoshop 7.0 software. The line drawings were prepared using CorelDRAW 7 software. All measurements were made with the help of an ocular micrometer.

**I d e n t i f i c a t i o n o f t h e f o s s i l.** Petiolate abdomen with a sting, simple trochanters, midtibiae with one apical spur, simple hind basitarsus with a well-developed cleaning brush, short pronotal collar with straight posterior margin and pronotal lobes well separated from tegulae attribute the studied specimen to apoid wasps of the family Crabronidae. At the same time, scutum with clear notaui, mesopleuron without omaulus but with areolate episternal, scrobal, and hypersternal sulci, fore wings with weakly enlarged pterostigma, acute apically marginal cell, and two submarginal cells (even if margined partially with desclerotized veins), as well as short abdominal petiole with separated proximal and distal parts of the tergite I attribute it to the subfamily Pemphredoninae, tribe Pemphredonini and subtribe Pemphredonina.

#### SYSTEMATIC PALEONTOLOGY

Order Hymenoptera Linnaeus, 1758

Superfamily Apoidea Latreille, 1802

**Family Crabronidae Latreille, 1802**

**Subfamily Pemphredoninae Dahlbom, 1835**

**Tribe Pemphredonini Dahlbom, 1835**

**Subtribe Pemphredonina Dahlbom, 1835**

**Genus *Rovnoecus* Antropov, gen. nov.**

**E t y m o l o g y.** Generic name is masculine and consists of a toponym Rovno and the ending of the generic name *Passaloecus*.

**T y p e s p e c i e s.** *Rovnoecus klesovicus* sp. nov.; by monotypy and present designation.

**D i a g n o s i s.** Front flat, without median furrow and interantennal process; clypeus transverse, without long apical bristles; antennal sockets broadly separated; inner eye orbits parallel; orbital foveae absent; ocelli unmodified; occipital carina not forming complete circle, with ventral ends directed to but not reaching mandibular bases; mandibles with sharp external apical tooth and broadly rounded internal preapical lobe. Pronotal collar short and low, with transverse ridge and blunted lateral angles; scutum uniformly convex, distinctly arched above level of pronotum; admedial lines not expressed; notaui weak, not areolate, shorter than half of scutal length; adlateral lines as short weak furrows; scutum laterally without areolae or transverse carinae; mesopleurae flattened, without sparse ridges; scrobal sulcus consists of large areolae, almost reaching metapleuron; episternal sulcus consists of very large dorsal and smaller ventral areolae; hypersternau-

lus consists of large areolae, posteriorly curved dorsad; omaulus and acetabular carinae absent; subspiracular area punctuate; metapleuron separated posteriorly from propodeum by wavy ridge. Dorsal and hind parts of propodeum with large areolae. Legs slender, hind femora more than four times longer than broad; all tibiae with short and sparse spines from the outside; all tarsomeres with lateral spines, hind basitarsus also with ventral spines; foretarsal rake absent; all claws simple; arolium developed. Fore wing with two submarginal and one distinctly outlined discoidal cells (the second one is margined with desclerotized veins 2m-cu and 2Cu1); recurrent vein I received by middle of submarginal cell I; strongly discolored trace of recurrent vein II received by proximal part of submarginal cell II; cu-a antefurcal; marginal cell acute apically and touching wing margin. Hind wing with 6 hamuli; cu-a postfurcal. Length of abdominal petiole almost equal to its height; abdominal acrotergite I separated from its distal part; only tergite I with lateral carina; pygidial plate not developed.

**C o m p a r i s o n.** All known recent genera of the subtribe Pemphredonina differ from *Rovnoecus* gen. nov. in the forewings with two distinctly expressed recurrent veins and, correspondingly, in the two completely outlined discoidal cells. Furthermore, *Passaloecus* Shuckard, 1837 (both recent and fossil species) and *Polemistus* de Saussure, 1892 differ in the complete occipital carina and absence of external tibial spines. *Polemistus* also differs in the anteriorly narrowed head with inner eye orbits converging in the lower part of the face, long setae at the lower part of temples, transverse flagellomeres, and well-developed omaulus. *Diodontus* Curtis, 1834 and *Pemphredon* Latreille, 1796 differ from *Rovnoecus* gen. nov. in the coarser sculpture of mesopleuron with an incomplete episternal sulcus and oblique hypersternaulus and in the more or less expressed pygidial plate in female. *Pemphredon*, also differs in the abdominal petiole that is distinctly longer than high.

Most of fossil genera of the subtribe Pemphredonina also have distinctly outlined discoidal cell II, excluding *Eopinoecus* Budrys, 1993 from Baltic amber, which differs from *Rovnoecus* gen. nov. in the completely reduced recurrent vein II, complete occipital carina, tridentate mandibles without a rounded internal lobe, and tibiae without external spines.

Although wing venation of *Cretoecus* Budrys, 1993 is unknown, because the wings of the holotype have not been preserved, this genus differs from *Rovnoecus* gen. nov. in the complete occipital carina, thin scrobal sulcus, simply carinate episternal sulcus without large areolae, and in the absence of hypersternaulus.

*Succinoecus* Budrys, 1993 differs from *Rovnoecus* gen. nov. in the complete circle occipital carina, tridentate mandibles without rounded internal lobe, absence of hypersternaulus, fore and mid tibiae without external spines, and in the hindwings with five hamuli.

*Eoxyloecus* Budrys, 1993 is similar to *Rovnoecus* gen. nov. in the incomplete occipital carina, mandibles with rounded internal lobe, strongly developed episternal, scrobal, and hypersternal sulci, and the presence of external tibial spines, but it differs from it in the long apical bristles of the clypeus, comparatively thicker legs, and well-developed foretarsal rake.

*Pittoecus* Evans, 1973 differs from *Rovnoecus* gen. nov., as well as from other genera of the subtribe Pemphredonina in the straight acute mandibles without visible ventral and apical teeth, mesopleurae without sulci, dentate claws, and in recurrent vein II received by submarginal cell II near its external angle. Finally, *Prolemistus* Antropov, 2000 differs from the new genus in the convex front overhanging antennal sockets, occipital carina with lower angles forming sharp prominences, bidentate mandibles without rounded internal lobe, and in the thin episternal and scrobal sulci and absence of hypersternaulus. Furthermore, in both genera pterostigma is distinctly enlarged, which is not typical of the members of the subtribe Pemphredonina.

**R e m a r k s.** Despite some superficial resemblance of these recent and fossil pemphredonine genera they form different phylogenetic branches inside the tribe.

First of all, the Cretaceous genera *Pittoecus* and *Prolemistus*, having unmodified mandibles, not areolate weakly developed or absent mesopleural sulci, and distinctly enlarged pterostigma stay apart from the rest genera, and they probably should be isolated in a separate subtribe.

At the same time, Eocene *Eopinoecus* from the Baltic amber and *Rovnoecus* gen. nov. from the Rovno amber, differing in the not enlarged pterostigma and developed episternal, scrobal and hypersternal sulci consisting of more or less large areolae, should be obviously attributed to the subtribe Pemphredonina, though they are not sister groups. In particular, *Eopinoecus*, having complete circle occipital carina and almost spineless tibiae, is more intimate with *Passaloecus*, while *Rovnoecus* gen. nov. with its ventrally interrupted occipital carina and distinctly developed tibial spines, with *Eoxyloecus*. Completely reduced recurrent vein II of *Eopinoecus* demonstrates its comparatively higher specialization than of *Rovnoecus* gen. nov., in which the process of reducing of recurrent vein II is only in its initial stage. Finally, mandibles with three apical teeth of *Eopinoecus* may testify to its aptitude to gnaw up nests in soft wood itself, while mandibles with rounded internal lobe, which is a characteristic feature of recent *Passaloecus* and *Polemistus* as well as of *Rovnoecus* gen. nov., to their use of preexisting cavities and coniferous resin for making partitions between cells in their xylicolous nests.

Thus, the process of evolution of the Eocene genera of the subtribe Pemphredonina discovered in Baltic and Rovno ambers was isolated to a certain degree, thus supporting the opinion (Dlussky and Perkovsky, 2002;

Perkovsky et al., 2007) about geographically independent origin of these fossil resins.

*Rovnoecus klesovicus* Antropov, sp. nov.

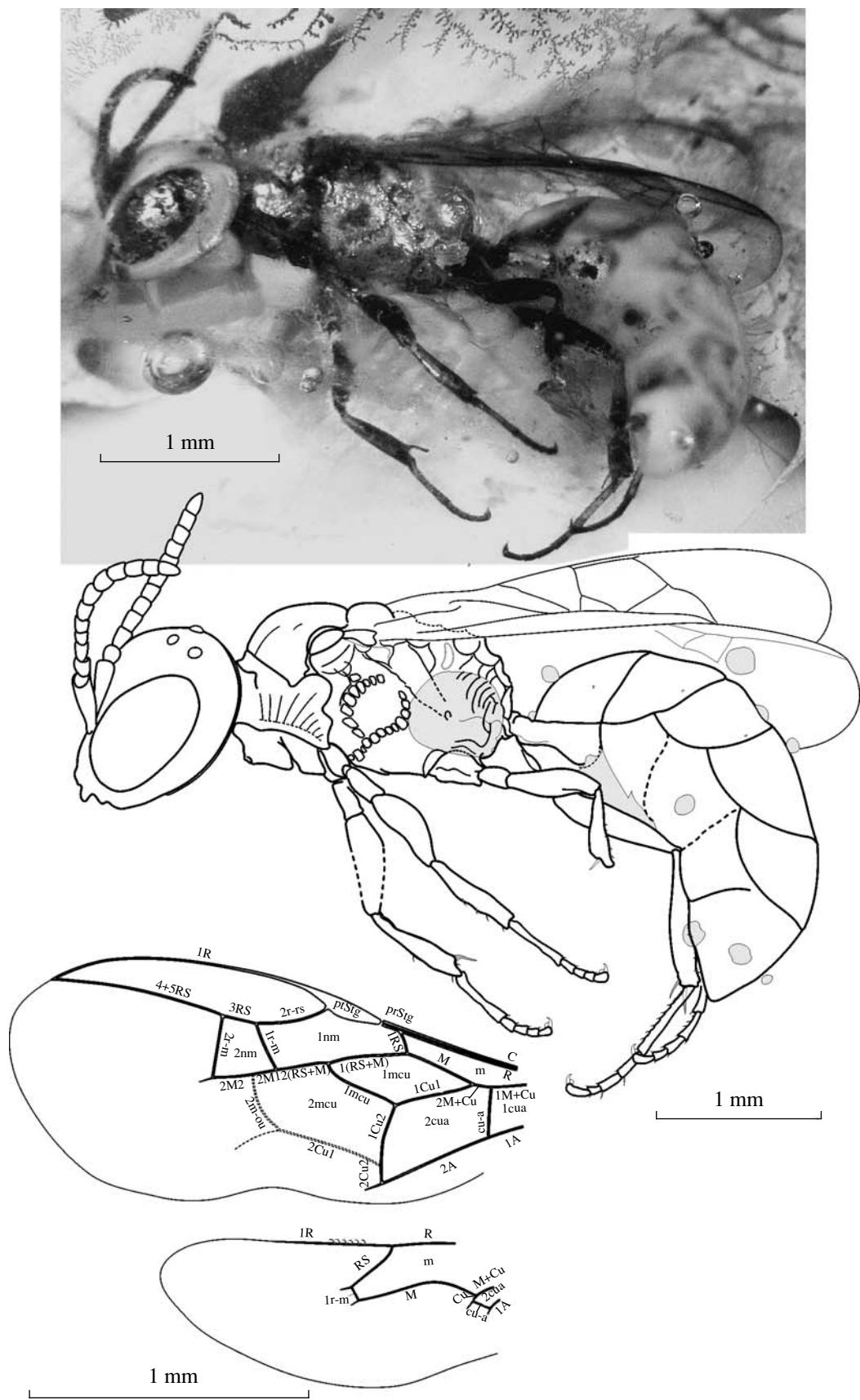
**E t y m o l o g y.** Species name is a toponym.

**H o l o t y p e:** SIZC K-12, ♀, Rovno amber, Klesov, Pugach open-pit mine, Late Eocene. Sample, measuring  $16 \times 14 \times 7$  mm, includes almost completely preserved female, only right dorsal part of the head is damaged by a deep crack. The sample is deposited in the collection of the Schmalhausen Institute of Zoology of National Academy of Sciences of Ukraine (Kiev).

**D e s c r i p t i o n.** Female (Fig. 1). The front is flat below and weakly convex above, without interantennal process and expressed medial furrow; the inner eye orbits are almost parallel; the clypeus is weakly developed, with a scarcely developed shallow median concavity at almost truncate apical margin; the distance between the antennal sockets is approximately equal to the distance between the socket and nearest eye orbit; the vertex is uniformly weakly convex; the ocelli are in obtuse-angled triangle; the distance between the lateral ocelli is longer than between the ocellus and the nearest eye orbit; the temple is shorter than eye; malar space narrow; external apical tooth of mandible sharp and longer than breadth of oval internal lobe; labrum and palpi invisible; all flagellomeres are  $1\frac{1}{4}$  to  $1\frac{1}{3}$  times (and apical joint almost twice) as long as their maximum thickness. Pronotal collar much lower than scutum; mesopleuron weakly convex; episternal, scrobal, and hypersternal sulci consist of large shallow areolae; hypersternaulus posteriorly strongly curved upwards, almost reaching scrobal sulcus. All femora not thickened, fore and mid femora approximately 3.5 times as long as thick, the hind femur is more than four times longer than its maximum thickness; the tarsi are unmodified; the arolium is not longer than the claws.

The head (except eyes, ocelli, mandibles, and antennae) and main part of the abdomen are covered with milky coating, concealing sculpture of their surface. The scutum and scutellum have dense delicate punctures and smooth interspaces equal to their diameter; anteriorly, the scutum has sparse smoothed longitudinal striae. The mesopleuron on the areas is free from areolae with dense delicate punctures and smooth interspaces equal to their diameters; punctures of the mesopleuron above are larger than below. The metapleuron anteriorly and in the middle is smooth; posteriorly, near the propodeum, it is weakly obliquely striate. Dorsally and posteriorly, the propodeum has large deep areolae divided by sharp ridges. Dorsally, abdominal tergite I has large sparse punctures and small punctures between them; the interspaces between punctures are smooth and shiny.

The body pubescence is not expressed; long bristles on the clypeus and temples, as well as foretarsal rake, are absent.



**Fig. 1.** *Rovnoecus klesovicus* Antropov, sp. nov., female, holotype: general appearance and wing venation.

The body is mostly black. The fore tibiae are reddish basally and laterally, the hind tibiae are reddish basally and apically, and the fore tarsomeres, except the apical one, and the mid and hind basitarsi are also reddish; the wing veins are dark brown, forewing recurrent vein II is discolored, not darker than the wing membrane.

**M e a s u r e m e n t s , mm.** Length of the head, 0.80; thorax with propodeum, 1.72; abdomen, 2.23; forewing, 3.32; hindwing, 2.16. Veins (minimum distance between their ends) of the forewing: R, 0.97; ptStg, 0.29; prStg, 0.07; 1R, 0.91; 2r-rs, 0.26; 3RS, 0.13; 4 + 5RS, 0.62; 1RS, 0.08; 1r-m, 0.18; 2r-m, 0.23; 1(RS+M), 0.28; 2(RS+M), 0.19; 2M1, 0.09; 2M2, 0.15; M, 0.26; 1m-cu, 0.28; 2M + Cu, 0.07; 1Cu1, 0.28; 1Cu2, 0.22; cu-a, 0.17; 2Cu2, 0.06; 2A, 0.42; 2m-cu, 0.22; 2Cu1, 0.38; veins of the hindwing: 1R, 0.42; RS, 0.21; 1r-m, 0.06; M, 0.42; Cu, 0.02; cu-a, 0.07.

**M a t e r i a l .** Holotype.

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