

## **Biting midges (Diptera: Ceratopogonidae) in Eocene Baltic amber from the Rovno region (Ukraine)**

ELŻBIETA SONTAG, RYSZARD SZADZIEWSKI\*

Department of Invertebrate Zoology, University of Gdańsk, Piłsudskiego 46,  
81-378 Gdynia, Poland, \*e-mail: biorys@ug.edu.pl

**ABSTRACT.** The paper presents the results of an examination of 714 biting midges (Diptera: Ceratopogonidae) preserved in Baltic amber from the Rovno deposits in Ukraine. A new species - *Leptoconops rovnensis* sp. n. - is described and illustrated. 29 of the fossil species reported here have already been described from other deposits of Baltic amber: 26 of these were also found in amber from the Gulf of Gdańsk and 18 in amber from Bitterfeld (Saxony). The most common genera of biting midges in Ukrainian amber are also found in amber from Bitterfeld and the Gulf of Gdańsk, and with very much the same frequencies. The results indicate that the faunas of Ceratopogonidae enclosed in amber from Rovno, Bitterfeld and the Baltic are very similar, showing that they inhabited similar palaeoenvironments in the same palaeogeographic region.

**KEY WORDS:** Diptera, Ceratopogonidae, Baltic amber, Eocene, Rovno, Ukraine.

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### INTRODUCTION

Amber from the Rovno region of Ukraine is indistinguishable from Baltic amber from other deposits. Ukrainian amber, like Baltic amber from the Gulf of Gdańsk, is a succinite without distinguishing physical and chemical characters (MATUSZEWSKA 2010). Nowadays in the Rovno region amber is commercially mined at Klesov and near Dubrovitsa (PERKOVSKY et al. 2003, 2010). The origin of amber in Ukraine has yet to be determined. Some geologists suggest that it is Baltic amber relocated from Fennoscandia, others believe that it was formed in a separate region of the Ukrainian Shield (KOSMOWSKA-CERANOWICZ 1999, PERKOVSKY et al. 2003, 2010). Despite the numerous species shared by the faunas of Rovno and the Baltic region, their common origin is denied (DLUSSKY & PERKOVSKY 2002, PERKOVSKY et al. 2007, 2010).

Ceratopogonidae have a rich fossil record going back to the Lower Cretaceous and belong to the best known groups of insects. Studies of biting midges from Baltic amber were summarized by SZADZIEWSKI (1988) and from Bitterfeld (Saxony) amber by SZADZIEWSKI (1993). At present 108 species of biting midges from Baltic amber are reported (BORKENT 2011).

In this paper we present the results of our studies on inclusions of biting midges preserved in amber from the Rovno region of Ukraine.

#### **Acknowledgements**

We are grateful to Dr Evgeny E. Perkovsky of the Schmalhausen Institute of Zoology, National Academy of Sciences of Ukraine, Kiev, for selecting and lending biting midges from his collection and his hospitality during our visit to Kiev.

This paper is a contribution within the framework of the research grant 'Extinct and extant genera in the palaeontological record of recent families of insects' from the Ministry of Science and Higher Education of Poland NN 303 2979 37, awarded to RSz for the years 2009-2012.

#### MATERIAL AND METHODS

This study is based on an examination of 714 biting midges in 625 pieces of Baltic amber collected in the Rovno region and housed at the Schmalhausen Institute of Zoology, National Academy of Sciences of Ukraine, Kiev. The amber for examination came from the Rovno region and was collected at Klesov (K), Dubrovitsa (D) and Vladimirets (PERKOVSKY et al. 2003). Most specimens (641) were identified to generic level, and 197 to species level (Table 1). Pieces and biting midges were prepared for study as previously described by SZADZIEWSKI (1988). The morphological terms and abbreviations used in the paper follow those given earlier by SZADZIEWSKI (1988, 1996).

#### RESULTS

##### **Subfamily Leptoconopinae NOË, 1907**

##### **Genus *Leptoconops* SKUSE, 1899**

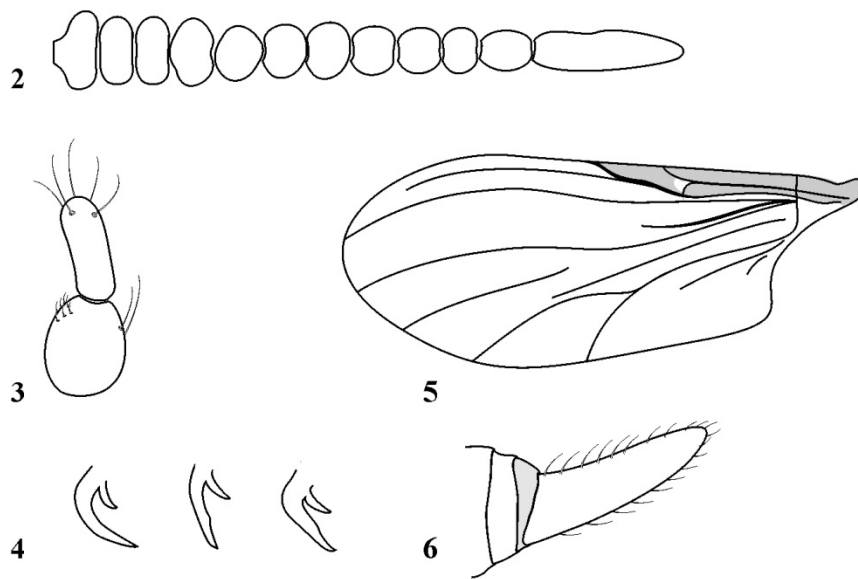
Only two females of the genus are reported. They belong to the new species described below.

##### ***Leptoconops rovnensis* sp. n.**

(Figs 1-6)

##### **Diagnosis**

Females of the new species are characteristic in having all claws with a basal tooth and 2-3 transverse proximal flagellomeres (see key).



**Figs 1-6.** *Leptoconops rovnensis*, sp. n., female: 1 – total habitus, 2 – flagellum, 3 – palpus, 4 – tarsal claws, 5 – wing, 6 – cercus.

### Description

Female. Body blackish brown, general habitus as in Fig. 1. Total length 1.66 mm. Eyes widely separated. Antenna with 12 flagellomeres, flagellum relatively short 0.37-0.38 mm. Flagellomeres 1-4 evidently transverse, 5-10 more or less spherical, 11 slightly subcylindrical and last flagellomere cylindrical, 3.3 times longer than the preceding one (Fig. 2). Proboscis short, clypeus large. Palpus short (Fig. 3). Third palpal segment swollen, about 0.04 mm long, with large open sensory depression on inner surface covered with sensilla capitata. Primitive palpal segments 4+5 slender, about 0.05 mm long. Anterior anepisternum bare, scutellum with two long submedian bristles. Tibial comb composed of 4 spines. Hind tibial spur distinct. Claws similar on all legs, equal, each with distinct tooth at base (Fig. 4). TR(I) 1.5; TR(II) 2.2; TR(III) 2.0. Wing length 0.86 mm, Costal ratio CR 0.44. Membrane covered with distinct microtrichia. Wing venation as in Fig. 5. Cerci long, 3.3 times longer than broad, slightly pointed (Fig. 6), length 0.2 mm.

Male. Unknown.

### Material examined

Holotype, female, K – 6587. Paratype: K – 6585, 1 female. Amber pieces 6585, 6586 and 6587 were originally parts of one big lump of amber. Syninclusion – Diptera: Chironomidae. Housed at the Schmalhausen Institute of Zoology, National Academy of Sciences of Ukraine, Kiev.

### Etymology

The specific epithet refers to Rovno, the Ukrainian town in the area with deposits of Baltic amber.

### Discussion

This is the second species of *Leptoconops* reported from Baltic amber. The female of *Leptoconops succineus* SZADZIEWSKI, 1988 described earlier has simple claws and subcylindrical proximal flagellomeres. The new species can be easily distinguished among all other fossil species in having a unique combination of the following characters: toothed tarsal claws and 2-3 transverse flagellomeres.

### Key to fossil *Leptoconops*

*Leptoconops clava* BORKENT described from a male from Upper Cretaceous Hungarian amber (BORKENT 1997) is not included in the key.

1. Costal vein long, reaching wing apex (subg. *Palaeoconops* BORKENT, 2001) .....
  - L. amplificatus* BORKENT, 2001 (female, male, Lower Cretaceous Lebanese amber)
  - L. antiquus* BORKENT, 2001 (female, Lower Cretaceous Lebanese amber)
- . Costal vein short, ending at apex of R3 (subg. *Leptoconops* s. str.) ..... 2

2. Hind tibial spur large ..... 3  
 – Hind tibial spur indistinct ..... 4  
 3. Apicolateral processes of tergite IX in male genitalia pointed .....  
     ..... *L. rossi* SZADZIEWSKI, 2004 (female, male, Lower Cretaceous Burmese amber)  
 – Apicolateral processes of tergite IX in male genitalia blunt .....  
     ..... *L. subrossicus* SZADZIEWSKI & POINAR, 2005 (male, Lower Cretaceous Burmese  
     amber)  
 4. Female claws with inner tooth ..... 5  
 – Female claws simple ..... 6  
 5. Female flagellomeres 2-11 cylindrical .....  
     ..... *L. myanmaricus* SZADZIEWSKI, 2004 (female, male, Lower Cretaceous Burmese amber)  
 – Female flagellomeres 2-11 more or less spherical .....  
     ..... *L. copiosus* BORKENT, 1996 (female, male, Upper Cretaceous New Jersey amber)  
     ..... *L. curvachelus* BORKENT, 1996 (female, Upper Cretaceous New Jersey amber)  
     ..... *L. sibiricus* SZADZIEWSKI, 1996 (female, male, Upper Cretaceous Siberian amber)  
     ..... *L. rovnensis* sp. n. (female, Eocene Baltic amber)  
 6. Cerci very short and broad .....  
     ..... *L. burmiticus* SZADZIEWSKI, 2004 (female, Lower Cretaceous Burmese amber)  
 – Cerci long and slender .....  
     ..... *L. zherikhini* SZADZIEWSKI & ARILLO, 2003 (Lower Cretaceous Spanish amber)  
     ..... *L. succineus* SZADZIEWSKI, 1988 (female, male, Tertiary, Baltic amber)  
     ..... *L. boreus* KALUGINA, 1991 (female, Upper Cretaceous Siberian amber)  
     ..... *L. primaevus* BORKENT, 1995 (female, Upper Cretaceous Canadian amber)

SUBFAMILY CERATOPOGONINAE Newman, 1834

**Tribe Culicoidini KIEFFER, 1911**

**Genus *Culicoides* LATREILLE, 1809**

*Culicoides* in Baltic amber from Rovno is common and makes up 15.5% of all the specimens of Ceratopogonidae examined. The proportion is similar in Baltic amber from the Gulf of Gdańsk (17.9%) and Saxony (20.2%) (SZADZIEWSKI 1993). We were able to identify only one species.

***Culicoides* indeterminate**

75 specimens (47 males, 28 females). DU-18, 1♂; DU-19, 1♂; K-24, 1♂; UA-107, 1♂; K-192, 1♀; K-294a, 1♀; UA-310, 1♀; K-355, 1♀; UA-397, 1♂; UA-1106, 1♀; UA-1144, 1♂; K-1158, 1♀; UA-1384, 1♂; UA-1703, 1♂; UA-1869, 1♂; K-2791, 1♀; K-2900, 1♂; K-3054, 2♂; K-3055, 1♂; K-3348, 1♀; K-3552, 1♂; K-3714, 1♂; K-3804,

1♂; K-4046, 1♂; K-4487, 1♀; K-4536a, 1♂; K-5407, 1♂; K-5417, 1♂; K-5538, 1♂; K-5935, 1♀; K-6008, 1♂; K-6044, 1♂; K-6097, 1♂; K-6218, 1♂, 4♀; K-6284, 1♂; K-6410, 1♂; K-6474, 1♂; K-6702, 1♀; K-6795, 1♀; K-7258, 1♂; K-7335b, 1♀; K-7773, 1♀; K-8389, 1♀; K-8411, 1♂; K-8420, 1♀; K-8450, 1♂; K-8451, 1♂; K-8530, 1♂; K-8539, 1♂; K-8840, 1♀; K-8976, 1♀; K-24192, 1♂; K-24432, 1♀; K-24496, 1♂; K-24719, 1♂; K-24768, 1♂; K-24941, 1♂, 1♀; K-24942, 1♂; K-24952, 1♂; K-24955, 1♀; K-25074, 1♂; K-25133, 1♂; K-25156a, 1♀; K-25295, 1♂; K-25354, 1♀; K-25558, 1♀; K-25565, 1♂; K-25572c, 1♂; K-25768, 1♂.

### *Culicoides speciosus* (MEUNIER, 1904)

#### Material examined

36 specimens (27 males, 9 females) in 21 pieces.

UA-415, 1♂; K-929, 1♂; K-1311, 1♂; K-2125, 1♂; K-2519, 2♂, 2♀; K-2520, 2♂, 4♀; K-2756, 1♂; K-2757, 1♂; K-2758, 1♂; K-2856, 6♂; K-3911b, 1♀; K-3912, 1♂; K-3913d, 1♀; K-4580, 1♂; K-5170, 1♀; K-6205, 2♂; K-6473c, 1♂; K-6636, 1♂; K-8427, 1♂; K-24765, 1♂; K-25748, 2♂.

#### Comments

Described from the Gulf of Gdańsk and subsequently from Bitterfeld (SZADZIEWSKI 1988, 1993). This is the first record of the species in amber from the Rovno deposits.

### Tribe Ceratopogonini NEWMAN, 1834

#### Genus *Brachypogon* KIEFFER, 1899

*Brachypogon* in Baltic amber from Rovno comprises 8.5% of the Ceratopogonidae examined as compared to the 14.4% in Baltic amber from the Gulf of Gdańsk and the 2.7% from Saxon deposits. Two species are identified in the genus.

#### *Brachypogon* indeterminate

24 (5 males, 19 females). UA-607, 1♀; K-645, 1♀; D-1013a, 1♀; UA-1596, 1♀; K-1847, 1♀; K-2526, 1♀; K-2600a, 1♀; K-2698, 1♀; K-3083, 1♂; K-3820, 1♂; K-4494, 1♀; K-4966, 1♂; K-5338a, 1♀; K-5345, 1♂; K-5783, 1♂; K-5801, 1♀; K-6419, 4♀; K-7728, 1♀; K-8301, 1♀; K-8566, 1♀; K-9225b, 1♀.

#### *Brachypogon balticus* SZADZIEWSKI, 1988

#### Material examined

3 (2 males, 1 female) in 2 pieces. UA-1732 – 1♂; K-3559, 1♀, 1♂.

#### Comments

Described from Gulf of Gdańsk amber but not reported from Bitterfeld. The first record of the species in amber from the Rovno deposits.

***Brachypogon prominulus* (MEUNIER, 1904)**

**Material examined**

34 (7 males, 27 females), in 32 pieces. UA-734, 1♀; K-883, 1♀; K-1214, 1♀; K-1215, 1♀; K-1274, 1♀; UA-1284, 1♀; K-1336, 1♀; UA-1883b, 1♂; K-2690, 1♂; K-3082, 1♀; K-3439, 1♀; K-3446, 1♀; K-4630, 1♂; K-5912, 1♀; K-6229, 1♀; K-6560, 1♀; K-6561a, 1♀; K-6836b, 1♀; K-7424, 1♀; K-7813, 1♀; K-7818, 1♀; K-8113, 1♀; K-8354, 1♂; K-9165, 1♀; K-24482, 1♂; K-24670, 1♀; K-25093, 1♀; K-25302, 1♂, 1♀; K-25812, 1♀.

Described from Gulf of Gdańsk amber and subsequently from Bitterfeld (SZADZIEWSKI 1988, 1993). This is the first record of the species in amber from the Rovno deposits. It is the commonest species in Gulf of Gdańsk amber, representing 10.5% of all biting midges examined. It is also common (4.8%) in amber from Rovno.

**Genus *Ceratopogon* MEIGEN, 1803**

The genus *Ceratopogon* in Baltic amber from Rovno is a dominant group, comprising 31.8% of the specimens examined. This genus is also common in amber from the Gulf of Gdańsk (25.3%). We identified seven species, previously known from the Gulf of Gdańsk and/or Bitterfeld.

***Ceratopogon* indeterminate**

196 (45 males, 151 females). K-66, 1♀; K-67, 1♀; UA-96, 2♂, 1♀; K-138, 1♀; UA-199, 1♀; K-216, 1♀; K-321, 1♀; UA-390, 1♀; UA-399, 1♀; UA-400, 1♀; UA-416, 1♀; K-421, 1♀; K-425, 1♀; UA-486, 1♀; K-514, 1♀; K-546, 1♀; UA-573, 1♀; K-602f, 1♀; K-615, 2♀; K-620a, 1♀; UA-642, 1♀; UA-660, 2♀; UA-665, 1♀; UA-686, 1♀; K-707, 1♀; UA-737, 1♂; K-784, 1♀; UA-838, 1♂, 1♀; K-846, 1♀; K-848, 2♀; K-849, 3♀; K-856, 1♀; UA-1189, 1♀; UA-1284, 1♀; K-1291, 1♂; K-1360, 1♀; UA-1391, 1♂; K-1511, 1♀; KF-1603, 1♀; UA-1621, 1♀; UA-1662, 1♀; UA-1668, 1♀; UA-1743, 1♂; UA-1759a, 1♀; UA-1912, 1♀; UA-2012, 1♀; UA-2013, 1♀; K-2014, 1♀; K-2014, 1♀; K-2041, 1♀; D-2093, 1♀; D-2094, 1♀; K-2123, 1♀; K-2154, 1♂; UA-2245, 1♀; K-2701, 1♂; K-2705, 1♀; K-3001, 1♀; K-3063, 1♀; K-3071, 1♂; K-3259, 1♀; K-3570, 1♂; K-3735, 1♀; K-3736, 1♂; K-3803, 1♀; K-3805, 1♀; K-3830, 1♂; K-3835, 1♀; K-3865, 1♀; K-3893, 1♂; K-3915, 1♀; K-4074, 1♀; K-4167, 1♀; K-4328, 2♂; K-4368, 1♀; K-4398, 1♂; K-4421, 1♀; K-4627, 1♂; K-4734ab, 1♀; K-4740, 1♀; K-4760, 1♀; K-4808, 1♂; K-4824, 2♂, 1♀; K-4856, 1♂; K-4857, 1♀; K-4869a, 1♀; K-4882, 1♀; K-4895, 1♀; K-4943, 1♂; K-4945, 1♀; K-5020, 1♀; K-5099, 1♀; K-5183, 1♂; K-5198, 3♀; K-5298, 1♀; K-5345, 2♂; K-5562, 1♀; K-5886, 1♀; K-5929, 1♀; K-6038, 1♂; K-6094, 1♀; K-6208, 4♀; K-6221a, 1♀; K-6234, 1♀; K-6421, 1♀; K-6530, 1♂; K-6568, 1♀; K-6573, 1♂; K-6660, 1♀; K-6806, 1♂; K-6848, 1♀; K-6849, 1♀; K-6850, 1♀; K-6851, 1♀; K-6954b, 1♀; K-6963, 1♀; K-6971, 1♀; K-7085, 1♀; K-7202, 1♀; K-7372a,

1♀; K-7529, 1♀; K-7591, 1♀; K-7592, 1♀; K-7643, 1♀; K-7655, 1♀; K-7720, 1♀; K-7755, 1♂; K-7810, 1♂; K-7900, 1♀; K-8115, 1♀; K-8139, 1♀; K-8324, 1♀; K-8347, 1♀; K-8386, 1♂; K-8460, 1♂; K-8564, 1♂, 1♀; K-8598, 1♀; K-8843, 1♀; K-8862, 1♀; K-8904, 1♀; K-8947, 1♀; K-9011, 1♀; K-9121, 1♀; K-9230, 1♀; K-9245, 1♀; K-9246, 1♀; K-9248, 1♂, 1♀; K-24136, 1♀; K-24162, 1♀; K-24213, 1♀; K-24343, 1♂; K-24484, 1♀; K-24510, 1♂; K-24628, 1♂; K-24735, 1♂, 1♀; K-24774, 1♀; K-24907, 1♀; K-25027, 1♀; K-25116, 1♀; K-25170, 1♂; K-25252, 1♂; K-25384, 1♀; K-25385, 1♀; K-25397, 1♂; K-25512, 1♂; K-25542, 1♀; K-25552, 1♀; K-25622, 1♀; K-25624, 1♀; K-25629, 1♀; K-25668, 1♀; K-25725, 1♀; K-25740, 1♂; K-25810, 1♀; K-25811, 1♀; K-25821, 1♀.

***Ceratopogon bitterfeldi* SZADZIEWSKI, 1993**

**Material examined**

One male. K-24693, 1♂.

**Comments**

Described from Bitterfeld amber and subsequently determined from the Gulf of Gdańsk (Hoffeins collection, 1 male, unpublished data). This is the first record of the species in amber from the Rovno deposits.

***Ceratopogon eminens* MEUNIER, 1904**

**Material examined**

1 male. UA-194, 1♂.

**Comments**

Described from Baltic amber from the Gulf of Gdańsk but not from Bitterfeld (SZADZIEWSKI 1993). The first record of the species in amber from Rovno.

***Ceratopogon forcipiformis* MEUNIER, 1904**

**Material examined**

17 (15 males, 2 females) in 12 pieces. K-847, 1♂; K-849, 1♂; K-938, 2♂, 1♀; UA-1708, 1♂; UA-1777, 1♂; UA-2010, 1♂; K-2420, 2♂, 1♀; K-2991, 1♂; K-5046, 1♂; K-8894, 1♂; K-24906, 1♂; K-25217, 2♂.

**Comments**

Described from Baltic amber from the Gulf of Gdańsk and subsequently reported from Bitterfeld (SZADZIEWSKI 1988, 1993). This is the first record of the species in amber from the Rovno deposits.

***Ceratopogon grogani* SZADZIEWSKI, 1988**

**Material examined**

3 males in 3 pieces. K-4413a, 1♂; K-8947, 1♂; K-24243, 1♂.



**Comments**

Described from Baltic amber from the Gulf of Gdańsk; not reported from Bitterfeld. The first record of the species in amber from the Rovno deposits.

***Ceratopogon hennigi* SZADZIEWSKI, 1988**

**Material examined**

3 males in 3 pieces. K-3003, 1♂; K-9105, 1♂; K-24998, 1♂.

**Comments**

Described from Baltic amber from the Gulf of Gdańsk and subsequently from Bitterfeld (SZADZIEWSKI 1988, 1993). This is the first record of the species in amber from the Rovno deposits.

***Ceratopogon margaritae* SZADZIEWSKI, 1988**

**Material examined**

2 males in 2 pieces. K-8643, 1♂; K-25470, 1♂.

**Comments**

Described from Gulf of Gdańsk amber but not from Bitterfeld. The first record of the species in amber from the Rovno deposits.

***Ceratopogon tertiaricus* SZADZIEWSKI, 1988**

**Material examined**

4 males in 3 pieces. K-1934, 1♂; K-25028, 2♂; K-25339, 1♂.

**Comments**

Described from Gulf of Gdańsk amber but not reported from Bitterfeld. This is the first record of the species in amber from the Rovno deposits.

**Genus *Eohelea* PETRUNKEVITCH, 1957**

This fossil genus in Baltic amber from Rovno deposit makes up 7.8% as compared to 4.6% in amber from the Gulf of Gdańsk and 2.4% from Saxon deposits. The specimens examined (13 males, 37 females in 36 pieces) belong to six species previously known from Baltic amber.

***Eohelea indeterminate***

3 (2 males, 1 female). K-3028, 1♂, 1♀; K-5924, 1♂.

***Eohelea fossicola* SZADZIEWSKI, 1993**

**Material examined**

3 (2 males, 1 female) in 1 piece. K-7054, 2♂, 1♀.

**Comments**

Described from Saxon deposits but not reported from the Gulf of Gdańsk. This is the

first record of the species in amber from Rovno. It is also the first record of an unknown male in the species. This male is indistinguishable from known males of *Eohelea gedanicola* and *E. sinuosa*.

***Eohelea gedanica* SZADZIEWSKI, 1988**

**Material examined**

13 (7 males, 6 females) in 5 pieces. UA-693, 1♂, 1♀; K-4324, 1♂, 1♀; K-4325, 1♂, 1♀; K-4326, 4♂, 2♀; K-8567, 1♀.

**Comments**

Known from Baltic amber only from Gulf of Gdańsk deposits (SZADZIEWSKI 1988). The first record of the species in amber from Rovno.

***Eohelea grogani* SZADZIEWSKI, 1988**

**Material examined**

1 female. UA-906, 1♀.

**Comments**

Known only from Gulf of Gdańsk amber (SZADZIEWSKI 1988). The first record of the species in amber from the Rovno deposits.

***Eohelea miocaenea* SZADZIEWSKI, 1993**

**Material examined**

1 female, K-40, 1♀.

**Comments**

Described from Saxon deposits and subsequently reported in amber from the Gulf of Gdańsk (SONTAG 2001). The first record of the species in amber from the Rovno deposits.

***Eohelea petrunkevitchi* SZADZIEWSKI, 1984**

**Material examined**

7 (7 females) in 7 pieces. K-237, 1♀; K-2714, 1♀; K-3926, 1♀; K-5016, 1♀; K-5509, 1♀; K-24827, 1♀; K-25671, 1♀.

**Comments**

Described from Gulf of Gdańsk amber and subsequently reported from Bitterfeld (SZADZIEWSKI 1988, SONTAG 2001). The first record of the species in amber from the Rovno deposits.

***Eohelea sinuosa* (MEUNIER, 1904)**

**Material examined**

22 (2 males, 20 females) in 19 pieces. DU-12, 1♀; UA-187, 1♀; UA-271, 1♀; UA-

476, 1♀; K-668, 1♀; K-690, 1♀; UA-792a, 1♀; K-1641, 1♀; K-2060, 1♀; D-2092, 1♀; K-2184, 1♀; K-2515, 2♂, 2♀; K-2781, 1♀; K-2808, 1♀; K-3329, 1♀; K-5839, 1♀; K-8082, 1♀; K-24365, 1♀; K-25641, 1♀.

**Comments**

Described from Baltic amber from the Gulf of Gdańsk and subsequently reported from Bitterfeld (SZADZIEWSKI 1988, 1993). This is the first record of the species in amber from the Rovno deposits.

**Genus *Fossihelea* SZADZIEWSKI, 1988**

11 specimens (3 males, 8 females) in 10 pieces of amber found in the material examined.

***Fossihelea* indeterminate**

2 (1 male, 1 female). K-155, 1♂; K-8623, 1♀.

***Fossihelea gracilitarsis* (MEUNIER, 1904)**

**Material examined**

8 (2 males, 6 females) in 7 pieces. K-1053, 1♀; K-1136, 1♀; K-2250, 1♂; K-4902, 1♀; K-4910ab, 1♂, 1♀; K-5635, 1♀; K-25227, 1♀.

**Comments**

Known from the Gulf of Gdańsk (SZADZIEWSKI 1988) and subsequently reported from Bitterfeld (male, unpublished data). The first record of the species in amber from the Rovno deposits.

***Fossihelea miocaenica* SZADZIEWSKI, 1993**

**Material examined**

1 female. K-8789, 1♀.

**Comments**

Known only from the Bitterfeld deposits (SZADZIEWSKI 1993). This is the first record of the species in amber from the Rovno deposits.

**Genus *Gedanohelea* SZADZIEWSKI, 1988**

5 specimens (1 male, 4 females) in 3 pieces of amber found in the material examined.

***Gedanohelea* indeterminate**

2 females. K-878d, 2♀.

***Gedanohelea loewi* SZADZIEWSKI, 1988**

**Material examined**

3 (1 male, 2 females) in 2 pieces. K-880a, 1♂, 1♀; K-6015 a, 1♀.

**Comments**

Described from Gulf of Gdańsk amber. The first record of the species in amber from the Rovno deposits.

**Genus *Mantohoelea* SZADZIEWSKI, 1988**

Three specimens (1 male, 2 females) in two pieces of amber found in the material examined.

***Mantohoelea laca* (MEUNIER, 1904)****Material examined**

3 (1 male, 2 females). K-5761, 1♂, 1♀ in copula; K-24600, 1♀.

**Comments**

Known only from Gulf of Gdańsk amber (SZADZIEWSKI 1988). This is the first record of the species in amber from the Rovno deposits.

**Genus *Meunierohoelea* SZADZIEWSKI, 1988**

19 specimens (3 males, 16 females) in 19 pieces of amber found in the material examined.

***Meunierohoelea* indeterminate**

18 (2 males, 16 females). DU-30, 1♀; K-153, 1♀; UA-624, 1♀; K-1308, 1♀; UA-1849, 1♀; D-1963, 1♂; UA-2327, 1♀; K-2681a, 1♀; K-3863, 1♂; K-4575b, 1♀; K-4654, 1♀; K-5454, 1♀; K-5729, 1♀; K-6070, 1♀; K-6306, 1♀; K-7823, 1♀; K-8935, 1♀; K-24329, 1♀.

***Meunierohoelea nielseni* SZADZIEWSKI, 1988****Material examined**

1 male. K-7512, 1♂.

**Comments**

Described from Baltic amber from the Gulf of Gdańsk and subsequently reported from Bitterfeld (SZADZIEWSKI 1988, 1993). This is the first record of the species in amber from Rovno.

**Genus *Monohelea* KIEFER, 1917**

17 specimens (7 males, 10 females) in 14 pieces of amber found in the material examined.

***Monohelea* indeterminate**

3 (2 males, 1 female). K-2280, 1♂; K-7428, 1♂, 1♀.

***Monohelea clunipes* (LOEW, 1850)****Material examined**

14 (5 males, 9 females) in 12 pieces. UA-1722, 1♀; UA-1848, 1♂; K-2044, 1♂; D-

2095, 1♀; K-3022, 1♀; K-4525, 1♂, 1♀; K-4588, 1♀; K-4866, 1♀; K-6578, 1♀; K-7726, 1♂; K-24564, 1♀; K-24962, 1♂, 1♀.

**Comments**

Described from the Gulf of Gdańsk and reported in amber from Bitterfeld (SZADZIEWSKI 1988, 1993). The first record of the species in amber from Rovno.

**Genus *Nannohelea* GROGAN & WIRTH, 1980**

Three specimens (1 male, 2 females) were found in three pieces of amber in the material examined.

***Nannohelea* indeterminate**

2 females. K-3905, 1♀; K-6238a, 1♀.

***Nannohelea grogani* SZADZIEWSKI, 1988**

**Material examined**

1 male, K-24934, 1♂.

**Comments**

Known only from amber from the Gulf of Gdańsk (SZADZIEWSKI 1988). The first record of the species in amber from the Rovno region.

**Genus *Serromyia* MEIGEN, 1818**

11 specimens (5 males, 6 females) found in nine pieces of amber in the material examined.

***Serromyia* indeterminate**

7 (3 males, 4 females). K-840, 1♀; K-4148, 1♂; K-4364, 1♂; K-5227, 1♀; K-8932, 1♀; K-25756, 1♂, 1♀.

***Serromyia spinigera* (LOEW, 1850)**

**Material examined**

2 females in one piece. K-6258, 2♀.

**Comments**

Described from Baltic amber from the Gulf of Gdańsk and reported in Saxon amber (SZADZIEWSKI 1988, 1993). This is the first record of the species in amber from Rovno.

***Serromyia succinea* SZADZIEWSKI, 1988**

**Material examined**

2 males in 2 pieces. K-7511, 1♂; K-5157, 1♂.

**Comments**

Described from Baltic amber from the Gulf of Gdańsk. The first record of the species in amber from Rovno.

**Genus *Stilobezzia* KIEFFER, 1911**

24 specimens (10 males, 14 females) in 24 pieces of amber were found in the material examined.

***Stilobezzia* indeterminate**

21 (9 males, 12 females). UA-139, 1♀; UA-151, 1♀; DU-164, 1♂; UA-274, 1♀; K-1422, 1♀; K-1491, 1♂; UA-1843, 1♂; D-2196, 1♀; K-2282, 1♂; K-2882, 1♀; K-4078, 1♂; K-4488, 1♀; K-4748, 1♂; K-5142, 1♀; K-5635, 1♀; K-6034, 1♀; K-6633, 1♂; K-7695, 1♂; K-8490, 1♀; K-8532, 1♀; K-25564, 1♂.

***Stilobezzia falcata* (MEUNIER, 1904)****Material examined**

3 (1 male, 2 females) in 3 pieces. UA-1107, 1♂; K-2858, 1♀; K-4295a, 1♀.

**Comments**

Described from the Gulf of Gdańsk and subsequently reported from Bitterfeld (SZADZIEWSKI 1988, 1993). This is the first record of the species in amber from Rovno.

**Tribe Heteromyiini*****Physohelea* GROGAN & WIRTH, 1979*****Physohelea obtusa* (MEUNIER, 1904)****Material examined**

2 males. K-116, 1♂; K-159, 1♂.

**Comments**

Described from the Gulf of Gdańsk and subsequently reported from Bitterfeld (SZADZIEWSKI 1988, female, unpublished data). The first record of the species in amber from the Rovno region.

**Genus *Neurohelea* KIEFFER, 1925****Material examined**

5 (1 male, 4 females) in 5 pieces.

***Neurohelea* indeterminate**

3 (1 male, 3 females). K-1438, 1♀; K-2480, 1♀; K-25529, 1♂.

***Neurohelea cothurnata* (MEUNIER, 1904)****Material examined**

2 females. K-47a, 1♀; K-3337, 1♀

**Comments**

Known only from Baltic amber from the Gulf of Gdańsk (SZADZIEWSKI 1988). The first record of the species in amber from Rovno.

**Tribe Palpomyiini**

**Genus *Palpomyia* MEIGEN, 1818**

Three indeterminate specimens (1 male, 2 females) in three pieces of amber were found in the material examined: UA-143, 1♀; K-314, 1♀; K-5309, 1♂.

**Genus *Bezzia* KIEFFER, 1899**

***Bezzia eocenica* SZADZIEWSKI, 1988**

**Material examined**

2 females. K-4881, 1♀; UA-939, 1♀.

**Comments**

Known only from Baltic amber from the Gulf of Gdańsk (SZADZIEWSKI 1988). The first record of the species in amber from Rovno.

**Subfamily Forcipomyiinae**

**Genus *Forcipomyia* MEIGEN, 1818**

The genus *Forcipomyia* is one of the three dominants in the materials studied, making up a total of 11.3%. Its percentage in Baltic amber from the Gulf of Gdańsk is similar (16.0%), but it is much more common (32.1%) among inclusions in Saxon deposits (Table 3). The specimens examined were determined to generic level only.

**Material examined**

81 (27 males, 54 females) in 78 pieces. WD-23, 1♀; UA-27, 1♂; K-39a, 1♀; K-157, 1♀; UA-219, 1♀; K-627, 1♀; UA-802, 1♀; UA-838, 1♀; UA-848, 1♂; K-867, 1♀; UA-893, 1♂; UA-1134, 1♀; UA-1470, 1♀; UA-1992, 1♀; D-2005, 1♀; UA-2044, 1♂; K-2049, 1♂; K-2097a, 1♂; UA-2183, 1♀; 964/2258, 1♀; UA-2267, 1♀; K-2292, 1♂; 964/2326, 1♂; K-2421, 1♂; K-2811, 1♀; K-2825, 1♀; K-2852, 1♀; K-2869a, 1♀; K-2873, 1♂; K-2874, 1♂; K-2952, 1♂; K-3373, 1♂; K-3971, 1♀; K-4086, 1♀; K-4258, 1♂; K-4264, 1♀; K-4265, 2♂; K-4591, 1♀; K-4657, 1♀; K-5169, 1♀; K-5229, 3♀; K-5439, 1♂; K-5521, 1♀; K-5637, 1♂; K-5758, 1♀; K-5977d, 1♀; K-5979, 1♀; K-6023, 1♀; K-6307, 1♀; K-6445, 1♀; K-6493a, 1♂; K-6502a, 1♀; K-6641, 1♂; K-6798, 1♀; K-6881, 1♂; K-8111, 1♀; K-8279, 1♀; K-8346, 1♀; K-8456c, 1♀; K-8628, 1♀; K-8749, 1♂; K-9076, 1♀; K-9179, 1♀; K-24102, 1♀; K-24211, 1♀; K-24336, 1♀; K-24430, 1♀; K-24491, 1♀; K-24569d, 1♂; K-24739, 1♂; K-24872, 1♀; K-25140, 1♂; K-25388, 1♀; K-25432, 1♀; K-25476, 1♀; K-25528, 1♂; K-25567, 1♀; K-25659, 1♂.

### Subfamily Dasyheleinae

#### *Dasyhelea* KIEFFER, 1911

Only four poorly preserved specimens (1 male, 3 females) were found in the material examined: K-8131, 1♀; K-8521, 1♀; K-24306, 1♀; K-25307, 1♂.

### DISCUSSION

30 species were determined among 714 specimens of biting midges preserved in Baltic amber from Ukraine. Only one species – *Leptoconops rovnensis* – is described as new, but 29 are known from other deposits of Baltic amber. 26 of these species are common to the biting midge fauna from the Gulf of Gdańsk, and 18 are common to Bitterfeld amber fauna, while 15 are common to the fauna of both the Gulf of Gdańsk and Bitterfeld (Table 1). The present study shows clearly that the biting midge fauna preserved in Ukrainian amber from the Rovno deposits does not differ from previously known faunas from other deposits of Baltic amber (Table 1).

**Table 1.** Biting midges from different deposits of Baltic amber.

No.	Species	Gulf of Gdańsk	Bitterfeld	Rovno
1	<i>Alluaudomyia succinea</i> SZADZIEWSKI, 1988	+		
2	<i>Atrichoogon eocenicus</i> SZADZIEWSKI, 1988	+		
3	<i>Bezzia eocenica</i> SZADZIEWSKI, 1988	+		+
4	<i>Brachypogon balticus</i> SZADZIEWSKI, 1988	+	+	+
5	<i>Brachypogon eocenicus</i> SZADZIEWSKI, 1988	+		
6	<i>Brachypogon gedanicus</i> SZADZIEWSKI, 1988	+		
7	<i>Brachypogon henningseni</i> SZADZIEWSKI, 1988	+		
8	<i>Brachypogon miocaenicus</i> SZADZIEWSKI, 1993		+	
9	<i>Brachypogon polonicus</i> SZADZIEWSKI, 1988	+		
10	<i>Brachypogon prominulus</i> (MEUNIER, 1904)	+	+	+
11	<i>Ceratoculicoides danicus</i> SZADZIEWSKI, 1988	+		
12	<i>Ceratopalpomyia eocenica</i> SZADZIEWSKI, 1988	+		
13	<i>Ceratopogon bitterfeldi</i> SZADZIEWSKI, 1993	+	+	+
14	<i>Ceratopogon ceranowiczi</i> SZADZIEWSKI, 1988	+		
15	<i>Ceratopogon crypticus</i> SZADZIEWSKI, 1988	+		



16	<i>Ceratopogon eminens</i> MEUNIER, 1904	+		+
17	<i>Ceratopogon forcipiformis</i> MEUNIER, 1904	+	+	+
18	<i>Ceratopogon gedanicus</i> SZADZIEWSKI, 1988	+		
19	<i>Ceratopogon grogani</i> SZADZIEWSKI, 1988	+		+
20	<i>Ceratopogon hennigi</i> SZADZIEWSKI, 1988	+	+	+
21	<i>Ceratopogon kotejai</i> SZADZIEWSKI, 1993		+	
22	<i>Ceratopogon margaritae</i> SZADZIEWSKI, 1988	+		+
23	<i>Ceratopogon miocaenicus</i> SZADZIEWSKI, 1993		+	
24	<i>Ceratopogon nanalobus</i> BORKENT & GROGAN, 1995	+		
25	<i>Ceratopogon paraeminens</i> BORKENT & GROGAN, 1995	+		
26	<i>Ceratopogon piotrowskii</i> SZADZIEWSKI, 1988	+		
27	<i>Ceratopogon pisinnus</i> BORKENT & GROGAN, 1995	+		
28	<i>Ceratopogon remmicolus</i> SZADZIEWSKI, 1988	+		
29	<i>Ceratopogon ritzkowskii</i> SZADZIEWSKI, 1988	+		
30	<i>Ceratopogon subeminens</i> SZADZIEWSKI, 1993		+	
31	<i>Ceratopogon succinicolus</i> SZADZIEWSKI, 1993		+	+
32	<i>Ceratopogon tertiaricus</i> SZADZIEWSKI, 1988	+		
33	<i>Culicoides balticus</i> SZADZIEWSKI, 1988	+		
34	<i>Culicoides ceranowiczi</i> SZADZIEWSKI, 1988	+	+	
35	<i>Culicoides dasyheleiformis</i> SZADZIEWSKI, 1988	+		
36	<i>Culicoides eoselficus</i> SZADZIEWSKI, 1988	+		
37	<i>Culicoides gedanensis</i> SZADZIEWSKI, 1988	+		
38	<i>Culicoides prussicus</i> SZADZIEWSKI, 1988	+		
39	<i>Culicoides speciosus</i> (MEUNIER, 1904)	+	+	+
40	<i>Culicoides subgedanensis</i> SZADZIEWSKI, 1993		+	
41	<i>Culicoides succivarius</i> SZADZIEWSKI, 1988	+		
42	<i>Dasyhelea eodicyptoscenica</i> SZADZIEWSKI, 1988	+		
43	<i>Dasyhelea gedanica</i> SZADZIEWSKI, 1988	+		
44	<i>Dasyhelea miocaenica</i> SZADZIEWSKI, 1993		+	
45	<i>Dasyhelea stanislavi</i> SZADZIEWSKI, 1988	+		
46	<i>Eohelea fossicola</i> SZADZIEWSKI, 1993		+	+
47	<i>Eohelea gedanica</i> SZADZIEWSKI, 1988	+		+
48	<i>Eohelea grogani</i> SZADZIEWSKI, 1988	+		+
49	<i>Eohelea miocaenea</i> SZADZIEWSKI, 1993	+	+	+
50	<i>Eohelea petrunkevitchi</i> SZADZIEWSKI, 1984	+	+	+
51	<i>Eohelea sinuosa</i> (MEUNIER, 1904)	+	+	+
52	<i>Forcipomyia berendti</i> SZADZIEWSKI, 1988	+		
53	<i>Forcipomyia bifidicola</i> SZADZIEWSKI, 1993		+	

54	<i>Forcipomyia eobreviflagellata</i> SZADZIEWSKI, 1988	+		
55	<i>Forcipomyia eocostata</i> SZADZIEWSKI, 1988	+	+	
56	<i>Forcipomyia eophytoheleana</i> SZADZIEWSKI, 1988	+	+	
57	<i>Forcipomyia eotrichoheleana</i> SZADZIEWSKI, 1988	+		
58	<i>Forcipomyia gedanicola</i> SZADZIEWSKI, 1988	+	+	
59	<i>Forcipomyia henningseni</i> SZADZIEWSKI, 1988	+		
60	<i>Forcipomyia krzeminskii</i> SZADZIEWSKI, 1988	+		
61	<i>Forcipomyia kulickae</i> SZADZIEWSKI, 1988	+		
62	<i>Forcipomyia lyneborgi</i> SZADZIEWSKI, 1988	+		
63	<i>Forcipomyia miocaenica</i> SZADZIEWSKI, 1993		+	
64	<i>Forcipomyia piriformis</i> (MEUNIER, 1904)	+		
65	<i>Forcipomyia pseudomicrohelea</i> SZADZIEWSKI, 1988	+		
66	<i>Forcipomyia subgedanicola</i> SZADZIEWSKI, 1993		+	
67	<i>Forcipomyia succinea</i> SZADZIEWSKI, 1988	+		
68	<i>Forcipomyia succinicola</i> SZADZIEWSKI, 1993		+	
69	<i>Forcipomyia tuberculosa</i> SZADZIEWSKI, 1993		+	
70	<i>Forcipomyia turbinata</i> (MEUNIER, 1904)	+	+	
71	<i>Forcipomyia uncula</i> (MEUNIER, 1904)	+	+	
72	<i>Forcipomyia unculiformis</i> SZADZIEWSKI, 1993		+	
73	<i>Fossihelea gracilitarsis</i> (MEUNIER, 1904)	+	+	+
74	<i>Fossihelea miocaenica</i> SZADZIEWSKI, 1993		+	+
75	<i>Gedanohelea loewi</i> SZADZIEWSKI, 1988	+		+
76	<i>Gedanohelea succinea</i> SZADZIEWSKI, 1988	+		
77	<i>Gedanohelea wirthi</i> SZADZIEWSKI, 1988	+		
78	<i>Leptoconops rovensis</i> sp. n.			+
79	<i>Leptoconops succineus</i> SZADZIEWSKI, 1988	+		
80	<i>Mallochohelea martae</i> SZADZIEWSKI, 2005	+		
81	<i>Mantohelea gedanica</i> SZADZIEWSKI, 1988	+	+	
82	<i>Mantohelea laca</i> (MEUNIER, 1904)	+		+
83	<i>Metahelea serafini</i> SZADZIEWSKI, 1998	+		
84	<i>Meunierohelea gedanicola</i> SZADZIEWSKI, 1988	+		
85	<i>Meunierohelea miocaenica</i> (SZADZIEWSKI, 1993)		+	
86	<i>Meunierohelea nielseni</i> SZADZIEWSKI, 1988	+	+	+
87	<i>Meunierohelea wirthi</i> SZADZIEWSKI, 1988	+		
88	<i>Monohelea baltica</i> SZADZIEWSKI, 1988	+		
89	<i>Monohelea clunipes</i> (LOEW, 1850)	+	+	+
90	<i>Nannohelea eocenica</i> SZADZIEWSKI, 1988	+		
91	<i>Nannohelea grogani</i> SZADZIEWSKI, 1988	+		+

92	<i>Neurohelea cothurnata</i> (MEUNIER, 1904)	+		+
93	<i>Palpomyia erikae</i> SZADZIEWSKI, 1993		+	
94	<i>Palpomyia jantari</i> SZADZIEWSKI, 1988	+		
95	<i>Palpomyia riedeli</i> SZADZIEWSKI, 1988	+		
96	<i>Palpomyia succinea</i> SZADZIEWSKI, 1988	+		
97	<i>Physohelea obtusa</i> (MEUNIER, 1904)	+	+	+
98	<i>Serromyia alphea</i> (HEYDEN, 1870)	+	+	
99	<i>Serromyia anomalicornis</i> (LOEW, 1850)	+		
100	<i>Serromyia polonica</i> SZADZIEWSKI, 1988	+		
101	<i>Serromyia ryszardi</i> BORKENT, 1990	+		
102	<i>Serromyia sinuosa</i> BORKENT, 1990	+		
103	<i>Serromyia spinigera</i> (LOEW, 1850)	+	+	+
104	<i>Serromyia succinea</i> SZADZIEWSKI, 1988	+		+
105	<i>Stilobezzia falcata</i> (MEUNIER, 1904)	+	+	+
106	<i>Stilobezzia kutscheri</i> SZADZIEWSKI, 1993		+	
107	<i>Stilobezzia saxonica</i> SZADZIEWSKI, 1993		+	
108	<i>Stilobezzia wirthicola</i> SZADZIEWSKI & GROGAN, 1998		+	
109	<i>Wirthohelea trifida</i> SZADZIEWSKI, 1988	+		
	<b>Total</b>	<b>88</b>	<b>43</b>	<b>30</b>

In the material examined males make up 35.0%, as in Baltic amber from the Gulf of Gdańsk (37.4%) and in the recent fauna (SZADZIEWSKI 1988). On average there are 1.14 specimens of Ceratopogonidae per piece of amber, a value much the same as that calculated for Baltic amber (1.16) by SZADZIEWSKI (1988).

*Ceratopogon*, *Culicoides* and *Forcipomyia* are the most common genera in Ukrainian amber, as in amber from Bitterfeld and the Gulf of Gdańsk (Tables 2, 3). The differences in proportions at the generic level are indistinct (Fig. 7). The quantitative components of the faunal elements are very subjective because the material has been very heavily selected (by resin trapping, fossilisation, transportation, deposits and collectors). For example, the differences between the generic rates of inclusions in two collection from the Gulf of Gdańsk – those at the Museum of Amber Inclusions (MAI) and those studied by SZADZIEWSKI (1988) – are much greater than between the collections from Rovno (examined here) and from the Gulf of Gdańsk (SZADZIEWSKI 1988) (Fig. 7).

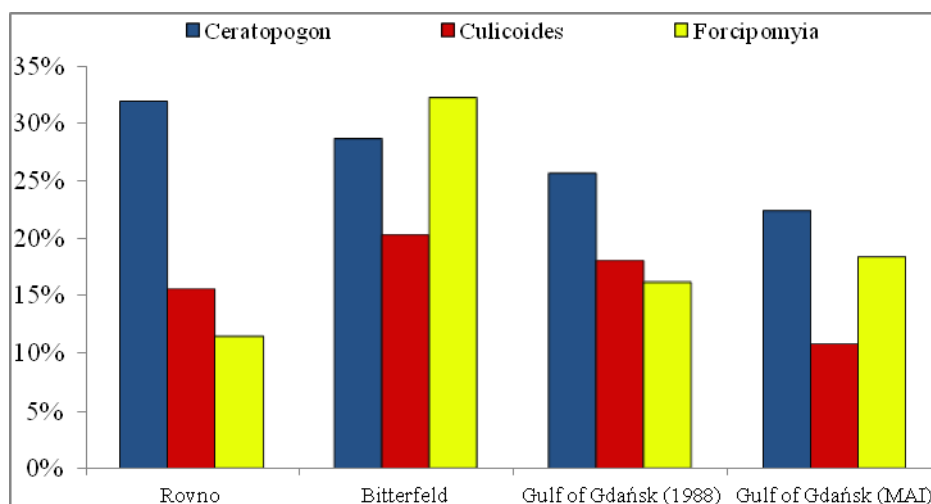
The results of our studies indicate that the faunas of Ceratopogonidae enclosed in amber from Rovno, Bitterfeld and the Baltic area are very closely related and that they inhabited a similar palaeoenvironment in the same palaeogeographic region.

**Table 2.** Specimens of Ceratopogonidae in samples of amber from Rovno deposits.

Genera	Males	Females	Total	%
<i>Ceratopogon</i>	74	153	227	31.8%
<i>Culicoides</i>	74	37	111	15.5%
<i>Forcipomyia</i>	27	54	81	11.3%
<i>Brachypogon</i>	14	47	61	8.5%
<i>Eohelea</i>	13	37	50	7.0%
<i>Stilobezzia</i>	10	14	24	3.4%
<i>Meunierohelea</i>	3	16	19	2.7%
<i>Monohelea</i>	7	10	17	2.4%
<i>Fossihelea</i>	3	8	11	1.5%
<i>Serromyia</i>	5	6	11	1.5%
<i>Gedanohelea</i>	1	4	5	0.7%
<i>Neurohelea</i>	1	4	5	0.7%
<i>Dasyhelea</i>	1	3	4	0.6%
<i>Mantohelea</i>	1	2	3	0.4%
<i>Nannohelea</i>	1	2	3	0.4%
<i>Palpomyia</i>	1	2	3	0.4%
<i>Bezzia</i>	-	2	2	0.3%
<i>Leptoconops</i>	-	2	2	0.3%
<i>Physohelea</i>	2	-	2	0.3%
indet.	12	50	73	10.2%
<b>Total</b>	<b>250</b>	<b>453</b>	<b>714</b>	

**Table 3.** Proportions of predominant biting midges from different deposits of Eocene Baltic amber (SZADZIEWSKI 1988, 1993; present data). Abbreviation: MAI – Museum of Amber Inclusions, University of Gdańsk.

Genera	Deposits of Baltic amber			
	Rovno	Bitterfeld	Gulf of Gdańsk	Gulf of Gdańsk (MAI)
<i>Ceratopogon</i>	31.8%	28.6%	25.5%	22.3%
<i>Culicoides</i>	15.5%	20.2%	17.9%	10.7%
<i>Forcipomyia</i>	11.3%	32.1%	16.0%	18.3%
<i>Brachypogon</i>	8.5%	2.7%	14.4%	13.5%
<i>Eohelea</i>	7.0%	2.4%	4.6%	7.3%
<i>Stilobezzia</i>	3.4%	3.3%	2.7%	4.8%



**Fig. 7.** Predominant genera of biting midges from different deposits of Baltic amber (for explanation, see Table 3).

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Received: December 12, 2011

Accepted: December 20, 2011