

# BURSHTYNOGENA FERECI GEN. AND SP. NOV. (EPHEMEROPTERA: HEPTAGENIIDAE) FROM EOCENE BALTIC AMBER

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**Abstract.**— *Burshtynogena fereci* gen. and sp. nov. from Eocene Baltic amber is described and illustrated. *Burshtynogena* gen. nov. differs from other known Heptageniidae genera by the combination of the following characters: pterostigmatic area only with simple, not anastomosed veins; furcasternal protuberances of mesothorax almost rectangular; hind wing narrow (the width/length ratio = 0.45) with well developed venation; tarsal claws dissimilar on all legs; subgenital plate small, narrow, poorly developed, shallow sinuous; subanal plate with slightly concave posterior margin.



**Key words.**— Ephemeroptera, Heptageniidae, *Burshtynogena*, *Burshtynogena fereci*, Eocene, Baltic amber.

## INTRODUCTION

Fossil amber fauna of Heptageniidae Needham, 1901 includes ten species. The very first record of fossil remains of this family was published by Demoulin (1956), who described *Electrogenia dewalschei* Demoulin, 1956 from Baltic amber and attributed it to the subfamily Arthropleinae Balthasar, 1937 (at present this genus together with the Holarctic genus *Arthroplea* Bengtsson, 1908 have been attributed to a separate family Arthropleidae Balthasar, 1937). Demoulin (1968) has described seven species of Heptageniidae from Oligocene Baltic amber from winged stages and attributed them to three modern genera, viz. *Heptagenia* Walsh, 1863 (five species), *Rhithrogena* Eaton, 1881 (one species) and *Cinygma* Eaton, 1885 (one species). Kluge (1986) has reported about the finding of fossil remains of a male imago of extant species *Kageronia fuscogrisea* (Retzius, 1783) in Late Eocene Baltic amber. Finally, Sinitshenkova (2000) has described a new genus and species *Amerogena macrops* Sinitshenkova, 2000 from two specimens of female imagoes from Late Cretaceous New Jersey amber. Only one species of Heptageniidae has been described from amber in the larval stage, namely *Succinogenia larssoni* Demoulin, 1965 from Oligocene Baltic amber

(Demoulin, 1965). Descriptions and illustrations of larvae and imagoes of several fossil heptageniids, designated as "*Rhithrogena* sp.", "*Stenonema* sp." and "Heptageniidae" were published by Demoulin (1968), Lewis and Wehr (1993), Wichard and Weitschat (1998).

In this paper the description and illustration of the female subimago of *Burshtynogena fereci* gen. and sp. nov. from Eocene Baltic amber are presented. The combination of distinguishing characters, which allow separating the new genus from other genera of the family Heptageniidae (from *Cinygma* and *Rhithrogena* s. l.) is given.

Morphological terminology follows Edmunds and Traver (1954), and Kluge (1994).

## TAXONOMY

### Heptageniidae Needham, 1901

#### *Burshtynogena* gen. nov.

**Type species.** *Burshtynogena fereci* sp. nov., by present designation.

**Diagnosis.** Female subimago. *Burshtynogena* gen. nov. is distinguished from all other genera of Heptageniidae



Figures 1–3. *Burshtynogena fereci* sp. nov., holotype (No 2182), female subimago. (1) Body in ventral view, (2) head, prothorax and mesothorax in ventral view (BSp – basisternum of prothorax, FSp – furcasternum of prothorax, BSm – basisternum of mesothorax, FSm – furcasternum of mesothorax, MIFS – median impression of furcasternum), (3) left fore leg. Scale bars = 1 mm.

by the following features: pterostigmatic area only with simple, not anastomosed veins; furcasternal protuberances of mesothorax almost rectangular; hind wing narrow (the width/length ratio = 0.45) with well developed venation; tarsal claws dissimilar on all legs; subgenital plate small, narrow, poorly developed, shallow sinuous; subanal plate with slightly concave posterior margin.

**Etymology.** The generic name of *Burshtynogena* gen. nov. is derived from “burshtyn” or “bursztyn” – Ukrainian and Polish name of amber, and generic name *Rhithrogena*. The gender is female.

*Burshtynogena fereci* sp. nov.  
(Figs 1–3)

**Description.** Female subimago (Fig. 1). Measurements: body – 8.8 mm; fore wing length – 7.64 mm; fore wing width – 2.8 mm; hind wing length – 2.12 mm; hind wing width – 0.93 mm; maximum length of caudal filaments – 10.5 mm.

General color of body yellow, with some brownish smudges on head and thorax. Head with diffuse spots on facial keel. Eyes relatively small. Ocelli dark apically. Antennae slightly brownish.

Thorax light, yellowish-grey. Anterior part of mesonotum with strong mesonotal suture and with well visible deep lateroparapsidal suture. Posterior part of thorax invisible. Prosternum without transverse ridge. Furcasternal protuberances of mesothorax almost rectangular (Fig. 2). Median impression of furcasternum narrowed anteriorly. Wings opaque. Fore wing with venation typical of Heptageniidae (two pairs of cubital intercalaries present; the shorter pair being located anteriorly near *CuA*). Venation of fore and hind wings well developed. Hind wing with costal projection, narrow (the width/length ratio = 0.45). Legs unicolorous pale. Patella-tibial suture distinct in all legs (Figs 1, 3). All tarsi clearly 5-segmented. Proportion of tarsal segments (measurements of tarsal segments of right legs, which preserved best of all are given): right fore leg (T1 = 0.24; T2 = 0.24; T3 = 0.24; T4 = 0.10; T5 = 0.24); right middle leg (T1 = 0.22; T2 = 0.14; T3 = 0.14; T4 = 0.07; T5 = 0.17); right hind leg (T1 = 0.15; T2 = 0.14; T3 = 0.12; T4 = 0.14; T5 = 0.22). The length of tarsal segments on the right and left fore legs are different due to post mortem change (Figs 1, 3). Claws dissimilar with one pointed and one blunt claw on all legs.

Abdominal segments yellowish, terga slightly darker than sterna. Subgenital plate small, narrow, poorly developed, posterior margin shallow sinuous. Subanal plate with slightly concave posterior margin. Two caudal filaments light, yellowish colored.

Male and female imagoes, male subimago, and nymph are unknown.

**Relationships.** *Burshtynogena fereci* gen. and sp. nov. clearly belongs to the family Heptageniidae by having

two pairs of intercalar veins in cubital field of fore wing, 5-segmented tarsi and by lack of terminal filament. The availability of a clear deep mesonotal suture, median impression of furcasternum narrowed anteriorly, shallow sinuous of subgenital plate, and the lack of transverse ridge of the prosternum, points to a close relationship of *Burshtynogena fereci* gen. and sp. nov. to *Cinygma* and *Rhithrogena* s. l. (incl. *Cinygmula*) (Tshernova, 1974, 1980, Tshernova and Belov, 1982, Tshernova et al. 1986, Kluge, 1988). In contrast to this fossil genus, female subimagoes of extant genera mentioned, possess a large and well developed subgenital plate. *Burshtynogena fereci* gen. and sp. nov. markedly differs from those genera also by the shape and proportions of the hind wing (in extant *Cinygmini* Kluge, 1988 and *Rhithrogenini* Lestage, 1917 the width/length ratio of hind wing makes up at least 0.58–0.60). The presence of simple cross veins in the pterostigmatic area clearly separates *Burshtynogena fereci* gen. and sp. nov. from the genus *Cinygma* (Tomka and Zurwerra 1985). The shape of the furcasternal protuberance in extant *Cinygmini* and *Rhithrogenini* is diverse, but in contrast to *Burshtynogena fereci* gen. and sp. nov. a more or less irregular oval shape with wide proximal part prevails. *Burshtynogena fereci* gen. and sp. nov. clearly differs from fossil *Amerogena* by the small eyes that are typical of most Heptageniidae, and by the well developed venation of hind wings.

The structure of the posterior part of mesonotum in the described specimen of *Burshtynogena fereci* gen. and sp. nov. is invisible, thus it is impossible to study the mutual arrangement of lateroparapsidal and medioparapsidal sutures (see Kluge 1988). Taking into consideration the above mentioned, the definite systematic position of *Burshtynogena* gen. nov. relative to *Cinygmini* and *Rhithrogenini* remains undecided.

**Type.** Holotype: female subimago in Eocene Baltic amber with well preserved head, thorax, abdomen, wings, legs and caudal filaments, clearly visible from lateral and ventral side; dorsal side of specimen body is hardly visible; housed in the Museum of Amber Inclusions, Department of Invertebrate Zoology, University of Gdańsk, Gdynia, inventory number 2182, pieces of amber donated to the Museum by Janusz Feręc, on 20 III 2000.

**Etymology.** The species is named after Mr Janusz Feręc who kindly has donated the holotype to the amber collection of Museum of Amber Inclusions at the Department of Invertebrate Zoology of University of Gdańsk.

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## REFERENCES

- Demoulin, G. 1956. *Electrogenia dewalschei* n. gen. n. sp., Ephéméroptère fossile de l'amber. Bulletin et Annales de la Société Royale d'Entomologie de Belgique 92(3-4):95-100.
- Demoulin, G. 1965. Contribution à la connaissance des Ephéméroptère de l'amber oligocène de la Baltique. Entomologische Meddelelser, 34: 143-153.
- Demoulin, G. 1968. Deuxième contribution à la connaissance des Ephéméroptère de l'amber oligocène de la Baltique. Deutsche Entomologische Zeitschrift, 15(1-3): 233-276.
- Edmunds, G. F., Jr. and J. R. Traver. 1954. The Flight Mechanics and Evolution of the Wings of Ephemeroptera, with Notes on the Archetype Insect Wing. Journal of Washington Academy of Sciences, 44: 390-400.
- Kluge, N. J. 1986. [Recent species of mayflies (Ephemeroptera, Heptageniidae) in Baltic amber]. Poleontologicheskii Zhurnal, 2: 111-112. (in Russian).
- Kluge, N. J. 1988. [Revision of genera of the family Heptageniidae (Ephemeroptera). I. Diagnoses of tribes, genera and subgenera of the subfamily Heptageniinae]. Entomologicheskoe obozrenie, 67(2): 291-313. (in Russian).
- Kluge, N. J. 1994. Pterothorax structure of mayflies (Ephemeroptera) and its use in systematics. Bulletin de la Société entomologique de France, 99(1): 41-61.
- Lewis, S. E. and W. C. Wehr. 1993. Fossil mayflies from Republic. Washington Geology, 21: 35-37.
- Sinitshenkova, N. D. 2000. New Jersey amber mayflies: the first North American Mesozoic members of the order (Insecta; Ephemeroptera). In: Studies on fossil in amber, with particular reference to the Cretaceous of New Jersey. David Grimaldi (ed.). Backhuys Publishers, Leiden: 111-125.
- Tomka, I. and A. Zurwerra. 1985. Key to the genera of the Heptageniidae (Ephemeroptera) of the Holarctic, Oriental and Ethiopian region. Entomologische Berichte Luzern, 14: 113-125.
- Tshernova, O. A. 1974. [The generic composition of may-flies of the family Heptageniidae (Ephemeroptera) in the Holarctic and Oriental region]. Entomologicheskoe obozrenie, 53(4): 801-813. (in Russian).
- Tshernova, O. A. 1980. [On a little known mayfly genus *Cinygma* Eaton (Ephemeroptera, Heptageniidae)]. Entomologicheskoe obozrenie, 59(1): 107-113. (in Russian).
- Tshernova, O. A. and V. V. Belov. 1982. [On systematics of imago of the Palaearctic mayflies of the genus *Cinygmula* McDunnough, 1933 (Ephemeroptera, Heptageniidae)]. Entomologicheskoe obozrenie, 61(2): 278-296. (in Russian).
- Tshernova, O. A., Kluge N. J., Sinitshenkova N. D. and V. V. Belov. 1986. [The Order Ephemeroptera – Mayflies]. In: Opredeletel' nasekomykh Dal'nego Vostoka SSSR. Tom 1. Pervichnobsokrylye, drevnekrylye, s nepolnym prevrashcheniem. Nauka, Leningrad: 99-142. (in Russian).
- Wichard, W. and W. Weitschat. 1996. Wasserinsekten im Bernstein – eine paläobiologische Studie. Entomologische Mitteilungen Löbbecke-Museum + Aquazoo, Düsseldorf, Beiheft 4, 122 pp.

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