

A New Species of Ibaliid Wasp in Baltic Amber (Hymenoptera: Ibalidae)

MICHAEL S. ENGEL¹ AND ZHIWEI LIU²

ABSTRACT: A second species of ibaliid wasp (Cynipoidea: Ibalidae) from Baltic amber is described and figured and represents the first record of the genus *Ibalia* Latreille from the Eocene. *Ibalia* (*Ibalia*) *electra* Engel and Liu, new species is described on the basis of a single individual preserved in middle Eocene (Lutetian) Baltic amber and exhibits typical features and synapomorphies of the genus *Ibalia*, subgenus *Ibalia*. The species is distinguished from its congeners.

KEY WORDS: Cynipoidea, Ibalinae, *Ibalia*, taxonomy, paleontology, Baltic region, Tertiary

The Ibalidae are a small and presumably archaic family of Cynipoidea (Euhymenoptera: Proctotrupomorpha) (Nordlander *et al.*, 1996; Liu and Engel, 2010). Known species of the family have been recently revised by Liu and Nordlander (1992, 1994), Fergusson (1992), Liu (1998), Hansen (2010), and Liu and Engel (2010). Despite the estimated antiquity of the Ibalidae, being perhaps as old as the Late Jurassic (Nordlander *et al.*, 1996; Ronquist, 1995; Liu, 1998; Liu *et al.*, 2007), fossils of the family have not been forthcoming. Brues (1910) described the genus *Protoibalia* for a fossil species from the Eocene-Oligocene boundary of Florissant, Colorado, but it has subsequently been transferred to the Liopteridae where it is of uncertain placement (Rasnitsyn, 1980; Ronquist and Nordlander, 1989). Nel (1996) recorded a forewing of an ibaliid from the Miocene deposits near Sainte Reine, France but the specimen could not be placed any further than genus. More recently, Liu and Engel (2010) reported a remarkably well preserved ibaliid in middle Eocene Baltic amber and included the species in a revised cladistic analysis of the entire family. In their analysis *Archaeibalia succinica* Liu and Engel was basal to all other ibaliids and was classified in a distinctive subfamily within the lineage (Liu and Engel, 2010) (Table 1).

Herein we record and describe a second Baltic amber species of Ibalidae (Fig. 1). The new species is noteworthy not only as the second record of an amber fossil ibaliid, but in that it is the first record of the genus *Ibalia* Latreille from the Eocene. The age, origin, and paleofauna of Baltic amber have been reviewed by Weitschat and Wichard (2002, 2010).

Systematic Paleontology

Genus *Ibalia* Latreille
Subgenus *Ibalia* Latreille

Ibalia (*Ibalia*) *electra* Engel and Liu, new species
(Figs. 1–3)

DIAGNOSIS: The new species can be distinguished from other *Ibalia* proper by its unique venation: forewing with r-rs forming 140° angle with the distal abscissa of M;

¹ Division of Entomology (Paleoentomology), Natural History Museum, and Department of Ecology & Evolutionary Biology, 1501 Crestline Drive – Suite 140, University of Kansas, Lawrence, Kansas 66045; Corresponding author: msengel@ku.edu.

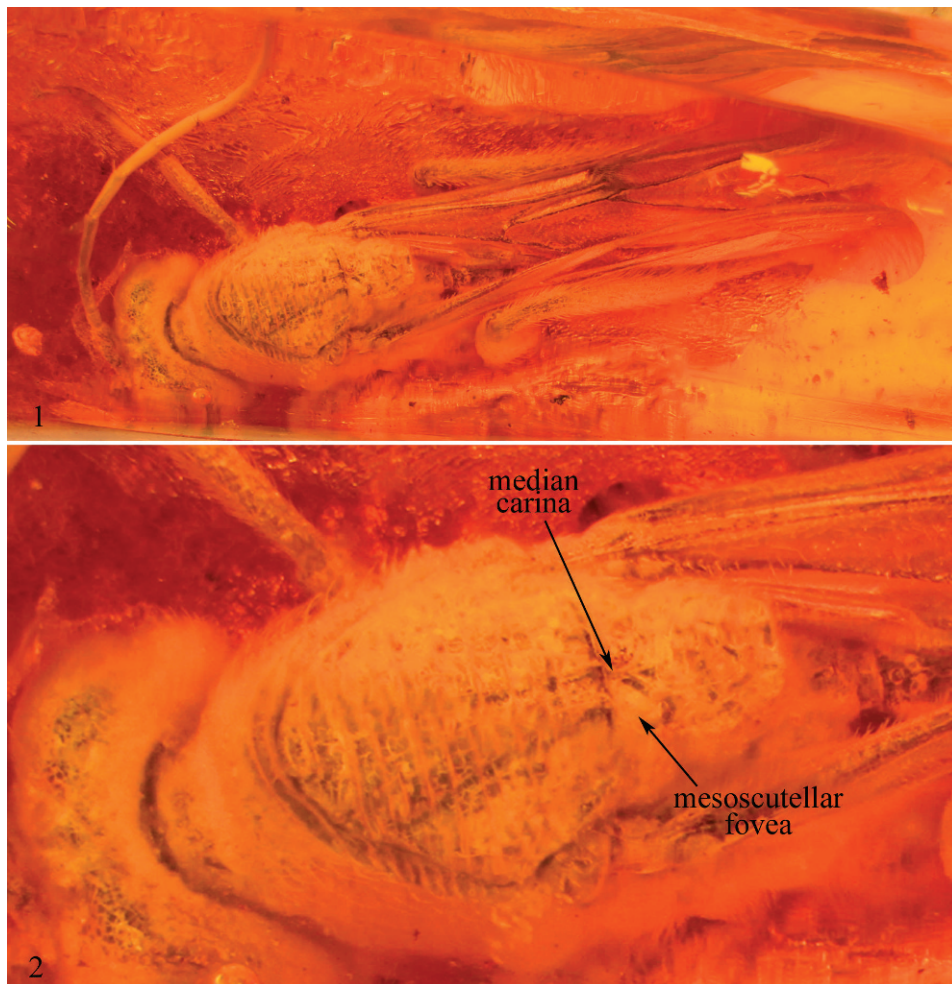
² Biological Science Department, Eastern Illinois University, 600 Lincoln Avenue, Charleston, IL 61920 (zliu@eiu.edu).

Table 1. Living and fossil diversity of Ibaliiidae. The fossil genus *Protoibalia* Brues (1910) has been transferred to Liopteridae by Rasnitsyn (1980) and Ronquist and Nordlander (1989).

Family IBALIIDAE Ashmead	
Subfamily †ARCHAEIBALIINAE Liu & Engel	
Genus † <i>Archaeibalia</i> Liu & Engel	
† <i>A. succinica</i> Liu & Engel	Baltic amber (Eocene)
Subfamily EILEENELLINAE Kovalev	
Genus <i>Eileenella</i> Fergusson	
<i>E. catherinae</i> Fergusson	Papua New Guinea
Subfamily IBALIINAE Ashmead	
Genus <i>Heteribalia</i> Sakagami	
<i>H. confluens</i> (Maa)	N. Vietnam
<i>H. nishijimai</i> Sakagami	Hokkaido, Japan
<i>H. divergens</i> (Maa)	Jiangsu & Shanghai, China
<i>H. subtilis</i> (Maa)	Taiwan
<i>H. aureopilosa</i> (Maa)	Fujian, China
Genus <i>Ibalia</i> Latreille	
Subgenus <i>Tremibalia</i> Kierych	
<i>I. (T.) mirabilis</i> Yasumatsu	Taiwan
<i>I. (T.) japonica</i> Matsumura	Hokkaido & Honshu, Japan & South Korea
<i>I. (T.) hunanica</i> Liu & Nordlander	Hunan, China
<i>I. (T.) kalimantanica</i> Liu	Kalimantan, Borneo
<i>I. (T.) anceps</i> Say	Nearctic
<i>I. (T.) ornata</i> Belizin	Shaanxi, China & Russian Far East
<i>I. (T.) jakowlewi</i> Jacobson	W. Palearctic
Subgenus <i>Ibalia</i> Latreille	
† <i>I. (I.) electra</i> Engel & Liu, n. sp.	Baltic amber (Eocene)
<i>I. (I.) aprilina</i> Kerrich	Honshu & Kyushu, Japan
<i>I. (I.) rufipes</i> Cresson	Holarctic
<i>I. (I.) montana</i> Cresson	W. Nearctic
<i>I. (I.) kirki</i> Liu & Nordlander	Arizona, USA
<i>I. (I.) arizonica</i> Liu & Nordlander	Arizona, USA
<i>I. (I.) ruficollis</i> Cameron	Chihuahua, Mexico & Arizona, USA
<i>I. (I.) leucospoides</i> (Hochenwarth)	Holarctic
Subgenus <i>Incertae sedis</i>	
† <i>I.</i> sp. (Nel, 1996)	Cantal, France (Miocene)

anterior portion of first free abscissa M (=basalis) forming a strongly acute angle with Rs + M; Sc + R parallel to Rs + M (Fig. 3); hind wing with 2 hamuli. The species also lacks longitudinal carinae/costae on the occiput, has transverse ridges on the mesoscutum (Fig. 2), and mesoscutellar foveae separated by a tranverse costa (Fig. 2).

DESCRIPTION: **Female.** Total body length (as preserved) ca. 11.9 mm; forewing length 8.8 mm. Integument apparently dark throughout, although coloration poorly preserved (specimen with microscopic separation from amber giving usual silver metallic appearance). Antenna with 11 flagellomeres; second flagellomere longer than first flagellomere. Vertex and occiput without costae (Fig. 2); dorsal interocular distance 1.67 mm; lateral ocelli separated by about ocellar diameter. Dorsal pronotal area short, anterior flange of pronotum glabrous; mesoscutal medial length 1.83 mm; mesoscutellar medial length 0.97 mm; mesoscutellar foveae smooth, separated by distinct median carina (Fig. 2); mesoscutellum scabrous, with distinct transverse



Figs. 1–2. Photomicrographs of holotype of *Ibalia (Ibalia) electra* Engel and Liu, new species. 1. Dorsal aspect of holotype as preserved. 2. Detail of mesosoma (note also the absence of longitudinal carinae on the occiput).

costae centrally. Metabasitarsus more than twice length of remainder of metatarsus (i.e., metatarsomeres II–V). Fore- and hind wings hyaline, infumate only at apex of costal cell, within submarginal cell, within areolet, and at extreme base of marginal cell (Fig. 1); r-rs forming 140° angle with distal abscissa of M; anterior portion of first free abscissa of M (=basalis) forming a strongly acute angle with Rs + M; Sc + R parallel to Rs + M; rs-m nearly orthogonal to distal abscissa of M; two hamuli on hind wing.

HOLOTYPE: ♀, middle Eocene (Lutetian), blaue Erde, Baltic amber; deposited in the collection of Jürgen Velten, Idstein, Germany. Specimen preserved among numerous fracture planes rendering direct frontal, lateral, and ventral views difficult to impossible; metasomal apex broken at surface of amber; specimen most clearly visible dorsally (Fig. 1).

ETYMOLOGY: The specific epithet is based on the Greek term, *elektron*, meaning “amber”.

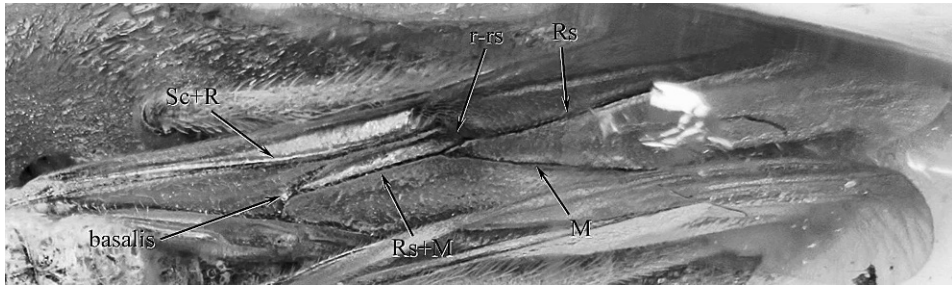


Fig. 3. Detail of forewing venation of holotype of *Ibalia (Ibalia) electra* Engel and Liu, new species.

Discussion

The orientation of r-rs as parallel to the distal abscissa of M found in most cynipoids is assumed to be primitive in comparison to the obvious synapomorphic state in *Ibalia* proper, i.e., r-rs forming an almost right angle with the distal abscissa of M (Liu and Engel, 2010). The condition found in the new species, r-rs forming a 140° angle with the distal abscissa of M, is obviously an intermediate state of the transformation series of this particular character in Cynipoidea, suggesting that *I. electra* represents the sister group to the remainder of the species of *Ibalia* s. str. Nonetheless, the new species bears more resemblance to the gymnosperm-associated subgenus *Ibalia* s. str., sharing with it several common characteristics not found in the other subgenus (*Tremibalia* Kieynch), including the vertex without longitudinal carination (Fig. 2), the anterior portion of the first free abscissa of M (=basalis) of the forewing forming an acute angle with Rs + M, and the hind wing with two hamuli. Based on this putative phylogenetic position, it is possible that the new species was a parasitoid of hosts living in coniferous wood. It is greatly hoped that more perfectly preserved material may eventually be discovered, permitting a more thorough characterization of the species and coding for phylogenetic analysis. Regardless, it is clear that the species represents *Ibalia* s.str. and thereby extends the age of this clade back to at least the mid-Eocene.

Acknowledgments

We are grateful to J. Velten for bringing this material to our attention and permitting its study, to two anonymous reviewers for their careful study of the manuscript, and to the Kansas Entomological Society for waiving the cost of color reproduction for figures 1 and 2 presented herein. This is a contribution of the Division of Entomology, University of Kansas Natural History Museum.

Literature Cited

- Brues, C. T. 1910. The parasitic Hymenoptera of the Tertiary of Florissant, Colorado. Bulletin of the Museum of Comparative Zoölogy 54(1):3–125, +1 pl.
- Fergusson, N. 1992. A remarkable new genus and species of Cynipoidea (Hymenoptera) from Papua New Guinea. Journal of Natural History 26(3):659–662.
- Hansen, L. O. 2010. The family Ibalidae (Hymenoptera, Cynipoidea) in Norway. Norwegian Journal of Entomology 57(2):139–141.

- Liu, Z. 1998. A new species of *Ibalia* from Borneo, with a revised phylogeny and historical biogeography of Ibalidae (Hymenoptera: Cynipoidea). *Journal of Hymenoptera Research* 7(2):149–156.
- Liu, Z., and M. S. Engel. 2010. Baltic amber Ibalidae (Hymenoptera: Cynipoidea): A new genus with implications for the phylogeny and historical biogeography of the family. *Systematic Entomology* 35(1):164–171.
- Liu, Z., M. S. Engel, and D. A. Grimaldi. 2007. Phylogeny and geological history of the cynipoid wasps (Hymenoptera: Cynipoidea). *American Museum Novitates* 3583:1–48.
- Liu, Z., and G. Nordlander. 1992. Ibalid parasitoids of siricid woodwasps in North America: Two new *Ibalia* species and a key to species (Hymenoptera: Cynipoidea). *Proceedings of the Entomological Society of Washington* 94(4):500–507.
- Liu, Z., and G. Nordlander. 1994. Review of the family Ibalidae (Hymenoptera: Cynipoidea) with keys to genera and species of the world. *Entomologica Scandinavica* 25(4):377–392.
- Nel, A. 1996. Le premier représentant fossile du genre *Ibalia* dans le Miocène supérieur du Cantal (France) (Hymenoptera, Cynipoidea). *Bulletin de la Société Entomologique de France* 101(2):141–143.
- Nordlander, G., Z. Liu, and F. Ronquist. 1996. Phylogeny and historical biogeography of the cynipoid wasp family Ibalidae (Hymenoptera). *Systematic Entomology* 21(2):151–166.
- Rasnitsyn, A. P. 1980. Origin and evolution of Hymenoptera. *Trudy Paleontologicheskogo Instituta Akademii Nauk SSSR* 174:1–192. (In Russian.)
- Ronquist, F. 1995. Phylogeny and early evolution of the Cynipoidea (Hymenoptera). *Systematic Entomology* 20(4):309–335.
- Ronquist, F., and G. Nordlander. 1989. Skeletal morphology of an archaic cynipoid, *Ibalia rufipes* (Hymenoptera: Ibalidae). *Entomologica Scandinavica, Supplement* 33:1–60.
- Weitschat, W., and W. Wichard. 2002. *Atlas of Plants and Animals in Baltic Amber*. Verlag Friedrich Pfeil, München, Germany. 256 pp.
- Weitschat, W., and W. Wichard. 2010. Baltic amber. *In* D. Penney (ed.). *Biodiversity of Fossils in Amber from the Major World Deposits*, pp. 80–115. Siri Scientific Press, Manchester, UK. 304 pp.