

**Flatbugs from Paleogene limnic sediments. I. Messel maar  
(Heteroptera: Aradidae)**

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**ABSTRACT.** The oil shales of the famous Messel maar in Hessen, Germany are well known for their extremely rich fossil flora and fauna. They are of Lower Middle Eocene age (about 48 million years) and contain also a highly diverse insect fauna. In addition to previous publications on some taxa belonging to the Heteropteran infraorders Pentatomomorpha, Cimicomorpha and Gerromorpha, three species of the Pentatomomorphan family Aradidae (flat bugs) are described and figured: *Neuroctenus kotejai* sp. n., *Neuroctenus messelensis* sp. n. and *Mezira eocenica* sp. n.

**ZUSAMMENFASSUNG.** Die Ölschiefer der berühmten Grube Messel in Hessen, Bundesrepublik Deutschland sind weltbekannt für die extrem reichen Fossilfunde an Pflanzen und Tieren. Diese Schichten werden dem unteren Mittel-Eozän zugerechnet, deren Alter rd. 48 Millionen Jahre beträgt und eine besonders artenreiche Insektenfauna enthalten. In Ergänzung zu bereits publizierten Beschreibungen von Taxa aus den Infraordnungen Pentatomomorpha, Cimicomorpha und Gerromorpha werden in der vorliegenden Arbeit erstmals drei Arten der Familie Aradidae (Rindenwanzen) beschrieben und abgebildet: *Neuroctenus kotejai* sp. n., *Neuroctenus messelensis* sp. n. and *Mezira eocenica* sp. n.

**KEY WORDS:** Heteroptera, Aradidae, Paleogene, Lower Middle Eocene, Messel maar, new species

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INTRODUCTION

The Messel maar is located close to the small village of Messel, about 9 km NE of Darmstadt (Hessian State, S Germany). It is an ancient opencast mine in which oil shales were quarried until the end of 1971 (Fig. 1). These oil shales originated from sludge deposits at the bottom of a freshwater lake that existed some ~48 million years ago. The locality was

included in the World Heritage List of the UNESCO in 1995, mainly because of its mammalian fossils, which became world-famous because they are frequently completely articulated and exhibit excellent soft-tissue preservation. There is also an important record of fossil insects which comprises a highly diverse fauna of primarily terrestrial insects whereas aquatic insects are quite rare (e.g. LUTZ 1990, 1991; HÖRNSCHEMEYER 1994; HÖRNSCHEMEYER & WEDMANN 1994; WEDMANN & HÖRNSCHEMEYER 1994; TRÖSTER 1991, 1992a, 1993a-c, 1994a, b, 1999; WEDMANN 1994; WAPPLER 2004; WAPPLER & ENGEL 2003).

Nevertheless, a small number of heteropteran insects have so far been reported from the Messel maar: Gerromorpha (WAPPLER & ANDERSEN 2004); Cimicimorpha (WAPPLER 2003); Pentatomomorpha (KINZELBACH 1970).

In the present paper three new species of the Pentatomomorphan family Aradidae are described and figured, which are the first representatives of this family from the Messel oil shales known to date.

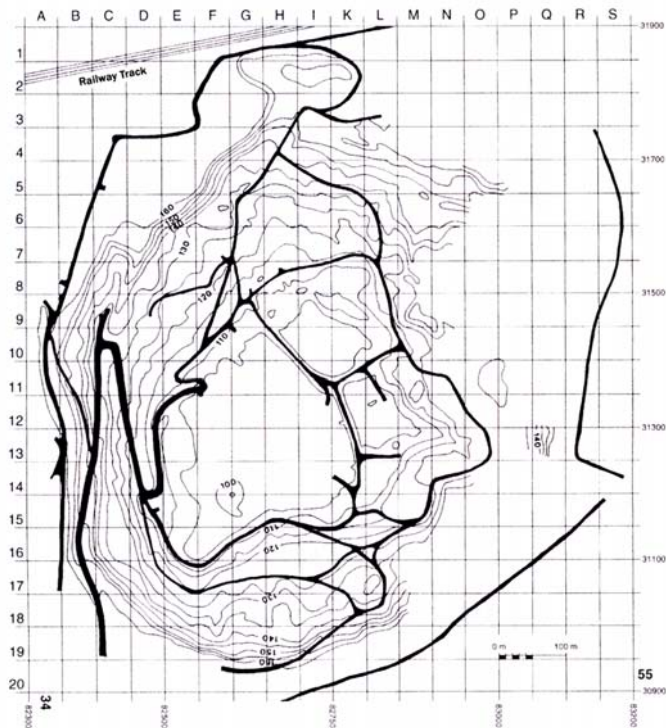
#### **Acknowledgments**

Sincere thanks go to Dr. S. WEDMANN (Göttingen) for directing our attention to the Messel specimens from the Senckenberg collection. Furthermore we thank PD Dr. D.F. MERTZ (Mainz) for providing the new and still unpublished radiometric age data for the Messel maar. We are also grateful to Dr. S. SCHAAL (Frankfurt) and Dr. G. GRUBER (Darmstadt) for providing access to the collections, Dr. J. GORCZYCA for inviting us to contribute to this volume and to the anonymous reviewers who helped to improve the manuscript.

#### **MATERIAL AND METHODS**

The fossil specimens described are deposited in the collections of the Senckenberg Research Institute in Frankfurt (SMF) and the Hessian State Museum in Darmstadt (HLMD). The specimens were studied by immersing the oil-shale slab in glycerine, which also prevents oxidation. All measurements were taken with an ocular micrometer; structures were measured as preserved. The insects of the Messel Formation are embedded in soft, finely laminated organic rich clays that have strongly been compressed during diagenesis (oil-shale). Therefore, they are preserved as compression fossils with only minor relief (e.g. LUTZ 1990; SCHAAL & ZIEGLER 1992). Biostratigraphically, Messel represents the European Mammal Reference Level MP11. Recently,  $^{40}\text{Ar}/^{39}\text{Ar}$  dating of basalt fragments from the diatreme breccia underlying the lake sediments revealed an age of approx. 47.5 Ma (D.F. MERTZ, pers. comm. 2004).

The suprageneric classification of Aradidae follows USINGER & MATSUDA (1959) and HEISS (2001).



**Fig. 1.** Topographic map of the Messel maar (from SCHAAL & MÖLLER 1991). Numbers reflect the altitude above sea level in meters, the thick lines represent paths through the pit. The specimens investigated were collected in the grid squares E 8/9; G 8; H 13/14.

## SYSTEMATICS

Order Hemiptera LINNAEUS, 1758

Suborder Heteroptera LATREILLE, 1810

Infraorder Pentatomomorpha LESTON, PENDERGRAST et SOUTHWOOD, 1954

Superfamily Aradoidea BRULLÉ 1836

Family Aradidae BRULLÉ, 1836

Subfamily Mezirinae OSHANIN, 1908

### **Genus *Neuroctenus* FIEBER, 1860**

**Type species:** *Neuroctenus brasiliensis* Mayr, 1866.

*Neuroctenus kotejai* sp. n.  
(Fig. 2 A, B)

**Material examined**

Holotype, macropterous female, SMF MeI 11628, a complete individual, dorsoventrally compressed, body and appendages are finely granulate.

**Geographic distribution**

Grube Messel near Darmstadt (Hessian State, S Germany). Messel Formation; 0.81-1.51 m over marker horizon  $\alpha$ , grid square E 8/9.

**Stratigraphic occurrence**

Lower Middle Eocene (Lower Lutetian, ELMA Geiseltalian, MP11, 47.5 Ma).

**Measurements (in mm)**

Length 4.86; length of antennae 1.22 (0.20; 0.27; 0.29; 0.46); width of pronotum 1.53, length 0.86; width of scutellum 0.61, length 0.63; width of abdomen 2.01, length 2.59.

**Diagnosis**

The presently described species of *Neuroctenus* are the only Eocene ones from Western Palaearctics known to date. There are no extant closely related species. *N. kotejai* sp. n. is distinguished from *N. messelensis* sp. n. by its larger size, its longer and slender antennae and the more widely rounded abdomen.

**Description**

Head: About as long as wide across eyes. Clypeus fusiform and broadly rounded at apex, reaching slightly beyond antennal segment I. Antenniferous tubercles blunt. Antennae slender about 1.55 times as long as width of head, segment I shortest but widest, barrel-shaped; II and III of nearly equal length, cylindrical, IV is longest, fusiform. Postocular lobes rounded.

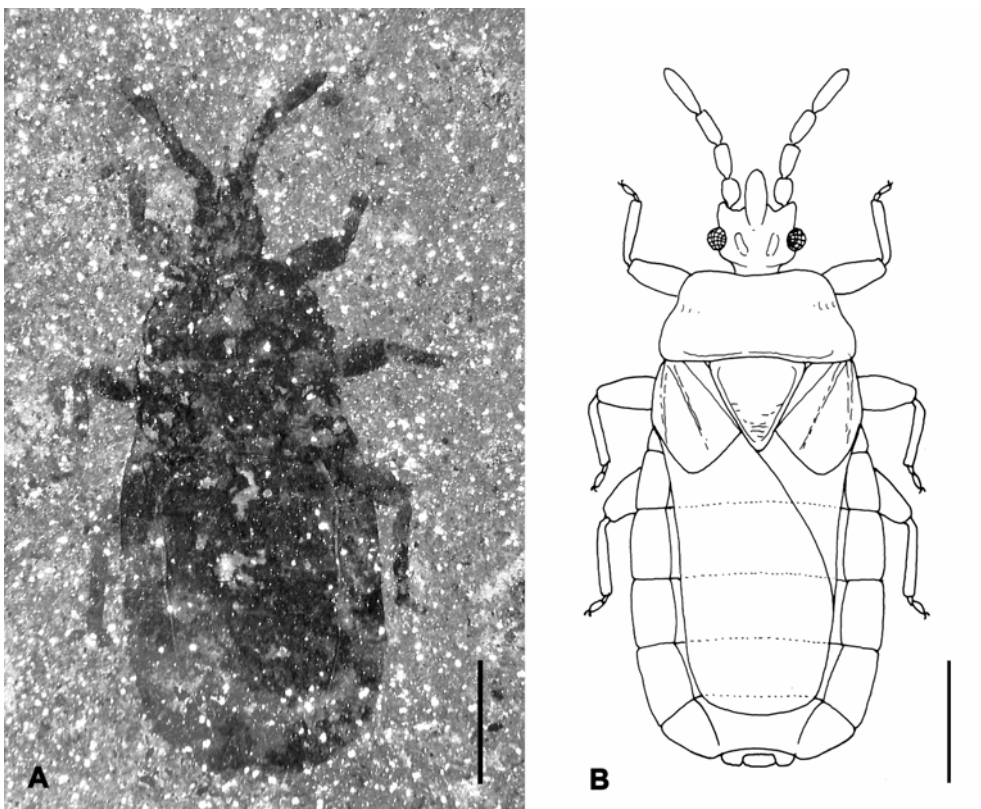
Pronotum: Trapezoidal, almost twice as wide as long, anterior and posterior margins nearly straight, lateral margins sinuate and converging anteriorly; disk rather flat with an obliterating shallow transverse depression.

Scutellum: Triangular, 1.25 times as long as wide at base; lateral margins carinate, apex narrowly rounded, transversely striate.

Hemelytra: Corium longer than scutellum, reaching  $\frac{1}{3}$  of mediotergite III. Although the membrane is not preserved, the structure of the thorax indicates clearly, that the specimen was macropterous.

Abdomen: Ovate, lateral margins evenly rounded, posterolateral angles of dorsal laterotergites (Dltg) II–VI not projecting, Dltg VII triangular, tergite VIII small and transverse, IX visible from above. Dltg II and III are seemingly not fused. Surface of connexivum finely granulate.

Legs: Femora fusiform; tibiae cylindrical, slender; tarsi two-segmented.



**Fig. 2.** A - photomicrograph of *Neuroctenus kotejai* sp. n., holotype (SMF MeI 11628); B - habitus reconstruction, dorsal view; Scale bar 1 mm.

### **Etymology**

This interesting species is dedicated to the late Prof. JAN KOTEJA, the estimated Polish Paläoentomologist.

## DISCUSSION

This and the following species belong to the species rich genus *Neuroctenus* FIEBER 1860, which has a world wide distribution in subtropical and tropical regions. Only few species inhabit today the East-Palaeartic region and none is known from the Western Palaeartics (HEISS 2001).

*Neuroctenus messelensis* sp. n.

(Fig. 3 A, B)

**Material examined**

Holotype, macropterous male, SMF MeI 6113, a nearly complete individual, dorsoventrally compressed.

**Geographic distribution**

Grube Messel near Darmstadt (Hessian State, S Germany). Messel Formation; 0.30-0.70 m over marker horizon  $\alpha$ , grid square G 8.

**Stratigraphic occurrence**

Lower Middle Eocene (Lower Lutetian, ELMA Geiseltalian, MP11, 47.5 Ma).

**Measurements (in mm)**

Length 4.28; length of antennae 0.85 (0.12 : 0.18 : 0.24 : 0.31); width of pronotum 1.31, length 0.86; width of scutellum 0.73, length 0.53; width of abdomen 1.90, length 2.59.

**Diagnosis**

*Neuroctenus messelensis* sp. n. is the second fossil species of the genus and is distinguished from *N. kotejai* sp. n. by its smaller size, shorter antennae and a more slender abdomen.

**Description**

Head: Shorter than wide across eyes. Clypeus fusiform, rounded at apex, exceeding anterior margin of antennal segment I. Antennae slender, about 1.30 times as long as width of head, segment I shortest but widest, barrel-shaped; II and III cylindrical, IV is longest,

fusiform. Eyes semiglobose, protruding laterally. Postocular lobes of head rounded but not reaching outer margin of eyes.

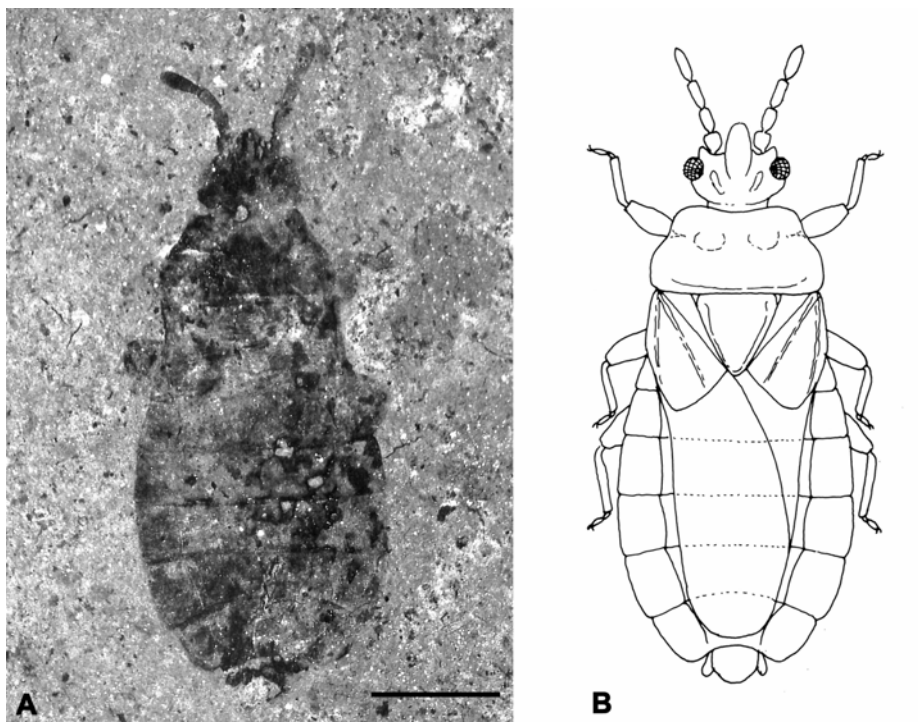
Pronotum: Trapezoidal, almost twice as wide as long, anterior and posterior margins slightly concave medially, lateral margins sinuate, anterolateral angles rounded; disk rather flat, with two ovate smooth callosities.

Scutellum: Triangular, about 1.38 times as long as wide at base; lateral margins slightly carinate, apex rounded, disk irregularly wrinkled.

Hemelytra: Shape and structure of the thorax indicate, that although the membrane is not preserved, the specimen was macropterous. Corium longer than scutellum, lateral margins subparallel at base.

Abdomen: Elongate ovate, lateral margins rounded, posterolateral angles of Dltg II-VI not projecting, that of Dltg VII rounded; Dltg II and III not fused. Paratergites VIII club-shaped, shorter than the globular pygophore.

Legs: Femora slightly incrassate, tibiae cylindrical but only preserved in fragments.



**Fig. 3.** A - photomicrograph of *Neuroctenus messelensis* sp. n., holotype (SMF MeI 6113); B - habitus reconstruction, dorsal view; Scale bar 1 mm.

### Etymology

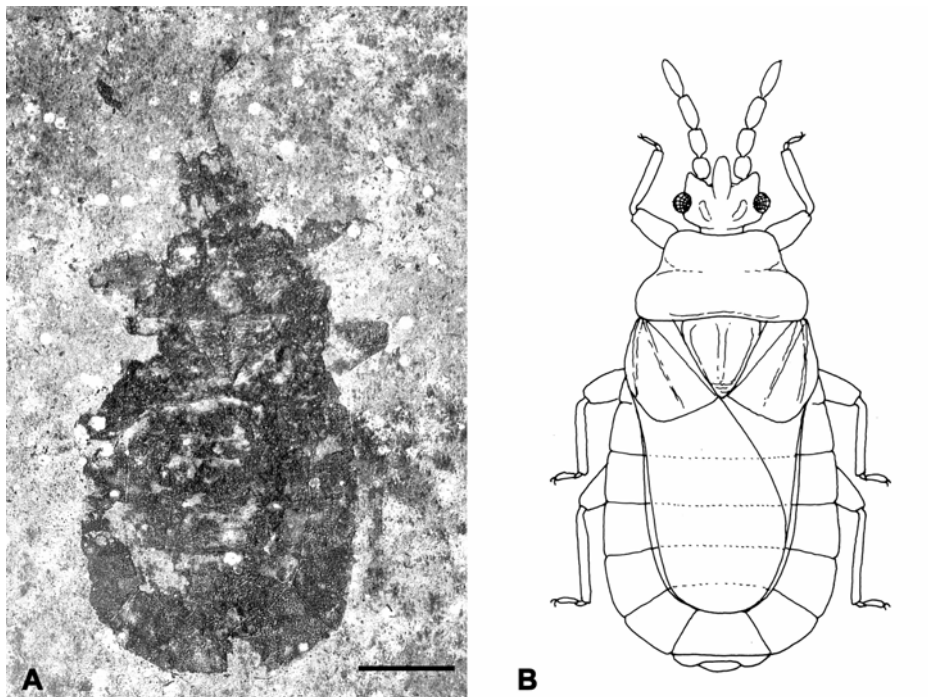
Named after the type locality Messel, where this and many other Heteroptera were found.

### DISCUSSION

*Neuroctenus messelensis* sp. n. differs from *N. kotejai* sp. n. by smaller size, a more slender habitus and a different structure of head and antennae. There seems no evident relationship to extant taxa, although its habitus is similar to the Oriental *N. affinis* group of species.

### Genus *Mezira* AMYOT et SERVILLE, 1843

**Type species:** *Mezira granulata* AMYOT et SERVILLE, 1843.



**Fig. 4.** A - photomicrograph of *Mezira eocenica* sp. n., holotype (HLMD-Me 15771); B - habitus reconstruction, dorsal view; Scale bar 1 mm.

***Mezira eocenica* sp. n.**

(Fig. 4 A, B)

**Material examined**

Holotype, macropterous female, HLMD-Me 15771, a nearly complete individual, dorsoventrally compressed, with body and appendages coarsely granulated.

**Geographic distribution**

Grube Messel near Darmstadt (Hessian State, S Germany). Messel Formation; 0.59 m over marker horizon M, grid square H 13/14.

**Stratigraphic occurrence**

Lower Middle Eocene (Lower Lutetian, ELMA Geiseltalian, MP11, 47.5 Ma).

**Measurements (in mm)**

Length 5.55; length of antennae 1.31 (0.13 : 0.33 : 0.40 : 0.45); width of pronotum 1.95, length 0.98; width of scutellum 0.71, length 0.87; width of abdomen 2.74, length 2.97.

**Diagnosis**

There is only one fossil Eocene *Mezira* species described so far (*M. succinica* USINGER, 1941 from Baltic Amber), which is of much larger size (7.45 mm), has longer antennae and the juga are contiguous in front of the clypeus.

**Description**

Head: Seemingly shorter than wide across eyes. Clypeus conical, reaching as far as antennal segment I. Antennae slender, about 1.5 times as long as width of head, segment I shortest but widest, barrel-shaped; II and III cylindrical, IV is longest, fusiform. Postocular lobes rounded, not projecting.

Pronotum: Trapezoidal, almost twice as wide as long, anterior margin moderately concave, anterolateral angles rounded; lateral margins subparallel at base, then sinuate and strongly converging anteriorly; disk rather flat, with coarse fine granulation

Scutellum: Triangular, somewhat longer than wide; apex narrowly rounded, lateral margins carinate; disk transversely rugose with a feeble longitudinal carina.

Hemelytra: As stated for the previous taxa, the thoracal structures are that of a macrop-  
terous specimen, although the membrane is not preserved. Corium longer than scutellum,  
subangularly rounded posteriorly.

Abdomen: Flat, ovate, slightly longer than its maximum width; Dltg II – VII wide, their  
posterolateral angles not projecting; Dltg II and III probably fused, Dltg VIII narrow and  
wide, tergite IX visible from above.

Legs: Femora incrassate, tibiae long and slender but further details not discernible.

### Etymology

*Mezira eocenica* sp. n. refers to its age, originating from Lower Middle Eocene period.

### DISCUSSION

The genus *Mezira* is the most diverse genus of the family Aradidae containing at pre-  
sent about 170 species showing a world wide distribution predominantly in the subtropical  
and tropical regions. There is only one recent species *Mezira tremulae* (GERMAR, 1822)  
known from Western Palaearctics and a fossil one described from Baltic Amber (*Mezira*  
*succinica* USINGER, 1941).

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