New fossil nematodes in Dominican and Baltic amber

George O Poinar Jr

Department of Zoology, Oregon State University, Corvallis, OR 97331, USA

Received: 2011; revised: 2011
Accepted for publication: 2011

E-mail: poinarg@science.oregonstate.edu
Summary: Four new species of fossil mermithids (Nematoda: Mermithidae) are described from amber: *Heydenius arachnius* n. sp. from a spider (Arachnida: Araneae) in Dominican amber, *Heydenius phasmatophilus* n. sp., from a walking stick (Phasmatodea: Phasmatidae) in Baltic amber, *Heydenius podenasae* n. sp. from a moth (Lepidoptera) in Baltic amber and *Heydenius trichorosus* n. sp. from a caddis fly (Trichoptera: Leptoceridae) in Baltic amber. With previous descriptions of fossil mermithids from Diptera, Coleoptera, Hymenoptera and Hemiptera, there are now representatives of seven insect orders as hosts of fossil mermithids. With these additional four fossils, the total number of described nematode fossils is now 90 with 70 occurring in amber.

Keywords – *Heydenius arachnius, Heydenius phasmatophilus, Heydenius podenasae, Heydenius trichorosus*, Lepidoptera, Trichoptera, Phasmatodea.
After publication of *The evolutionary history of nematodes* (Poinar, 2011), several new nematode fossils were made available to the author. These specimens, which are described in the present work, include mermithids infecting a spider in Dominican amber and a moth, caddis fly and walking stick in Baltic amber.

**Materials and methods**

The piece of amber containing the fossil spider originated from mines in the Cordillera Septentrional mountain range in the northern portion of the Dominican Republic. Dating of Dominican amber is controversial with the latest proposed age of 20-15 mya based on foraminifera (Iturralde-Vinent & MacPhee, 1996) and the earliest of 45-30 mya based on coccoliths (Cêpek in Schlee, 1999).

The amber pieces containing the caddis fly, moth and walking stick originated from the westernmost area of Russia known as the Kaliningrad Region located between Poland and Lithuania along the southeastern coast of the Baltic Sea. Baltic amber has been dated at *ca* 40-50 million years ago (Eocene) and the deposits are considered to have originated in a single subtropical-tropical forest that covered a large portion of northern Europe (Weitschat & Wichard, 2002). Observations and photographs were made with a Nikon stereoscopic microscope SMZ-10 R and Nikon Optiphot TM at magnifications up to 1000X.
Results

Subclass Dorylaimia Inglis, 1983

Order Mermithida Hyman, 1951

Superfamily Mermithoidea Braun, 1883

Family Mermithidae Braun, 1883

Genus Heydenius Taylor, 1935

This is a collective group genus established for fossil mermithids from the Tertiary period that cannot be placed in extant genera due to the absence or obstruction of pertinent characters.

*Heydenius arachnius* n. sp.

(Fig. 1)

* Specific epithet derived from the Greek *arachnaios* = of spiders

This specimen has completely emerged from and is adjacent to its spider host. It is probably a late parasitic juvenile that was almost ready to emerge naturally from the spider but left prematurely as a result of the trauma when the arachnid encountered the resin.

DESCRIPTION
Body brown, with internal air bubbles in some areas; head bluntly rounded; tail narrow but rounded at tip, with minute tail appendage; length = 17.8 mm; greatest diam. = 90 µm.

**TYPE HOST AND LOCALITY**

Juvenile spider 2.17 mm in length in a piece of amber collected from the Dominican Republic between 15 and 45 mya.

**TYPE MATERIAL**

Deposited in the Poinar amber collection (accession no. N-3-116) maintained at Oregon State University, Corvallis, OR 97331, USA.

**COMMENTS**

The nematode is extremely long in respect to its spider host. While the mermithid has exited from the host, portions of its body are still in contact with the spider. The transparent and flaccid abdomen of the host shows the parasite had utilised most available nutrients and leaves no question that the arachnid is the host. This is the second mermithid parasite of a spider in amber. The first was *H. araneus* Poinar, 2000 in Baltic amber. It is not surprising that mermithids parasitised spiders in the Tertiary since they are global parasites of these arachnids today (Poinar & Benton, 1986; Poinar & Early, 1990).

*Heydenius trichorosus* n. sp.

(Fig. 2)
* specific epithet derived from the Latin trichils for house and the Latin rosus for consume.

Two mermithids have completely exited from but are still adjacent to the body of an adult caddis fly in Baltic amber.

DESCRIPTION
Bodies of both specimens partially cleared with tan-colored tissue residue. Specimen 1: head bluntly rounded; tail tapering but rounded at tip; length = 10.1 mm; greatest diam. = 153 µm. Specimen 2: head bluntly rounded; tail narrowed at tip: length = 6.9 mm; greatest diam. = 132 µm.

TYPE HOST AND LOCALITY
Collected from the Baltic area in northern Europe between 40 and 50 mya.

TYPE MATERIAL
Deposited in the British Museum of Natural History, London under the accession number Red 100.

COMMENTS
Both nematodes are well preserved and show little sign of distortion. The head of specimen 1 is adjacent to the head of the host and portions of its body
are in contact with that of the host so there is no question that it emerged from the trichopteran, whose abdomen is transparent and flaccid. Specimen 2 is coiled at the tip of the host’s abdomen. Trichopterans are used by mermithids today as paratenic and developmental hosts (Poinar, 1975; 1981).

\* Heydenius podenasae* n. sp.

(Figs. 3, 4)

* Specific epithet named in honour of Dr. Sigitas Podenas, an amber expert, who found the specimen and donated it to the Poinar collection.

This mermithid was in the process of emerging from a Baltic amber moth. The posterior portion of the body is still inside the moth.

**DESCRIPTION**

Body white; cuticle smooth; exposed body portion 2.8 mm in length; greatest diam.= 145 µm.

**TYPE HOST AND LOCALITY**

A moth (Lepidoptera)(length = 8 mm) in a piece of amber from the Baltic area in northern Europe between 40 and 50 mya.
**TYPE MATERIAL**

Deposited in the Poinar amber collection (Accession No. N-3-114) maintained at Oregon State University.

**COMMENTS**

Extant lepidopterans are parasitised by mermithid nematodes (Poinar, 1975; Nikdel et al., 2011) although it is rare to find nematodes emerging from adult hosts. They usually emerge from the mature caterpillar.

*Heydenius phasmophilus* n. sp.

(Figs. 5, 6)

This specimen is a parasitic stage. The head is rounded however a loose cuticle that is flattened at the tip gives the impression of a pointed head.

**DESCRIPTION**

Body brown, mostly flattened, covered with partially shed cuticle; head region tapering but rounded at tip; tail acute but without tail appendage; slight protuberances near midbody (42%) appear as folds of ensheathing cuticle; total length = 5.25 mm; greatest diam. (including shed cuticle)= 0.161 mm.
**TYPE HOST AND LOCALITY**

Adult female *Balticophasma* sp. (Phasmatodea: Phasmatidae)(Length = 9.7 mm) in a piece of amber from the Baltic area in northern Europe between 40 and 50 mya.

**TYPE MATERIAL:** Deposited in the Ron Cauble amber collection, Albany, CA.

(Adult status is based on a pair of cerci located near the tip of the ventral side of the abdomen)

**COMMENTS**

It is rare for a parasitic juvenile to leave its host before maturity so it is likely the host was damaged and the nematode escaped into the surrounding resin as a result of the trauma. A brown secretion covering part of the ventral surface of the host’s abdomen is located just opposite the mermithid. A predator may have attacked the phasmid, puncturing the abdomen and leaving a hole through which the developing nematode emerged. The mermithid was probably undergoing its second moult. In the grasshopper parasite *Amphimermis acridorum* Baker & Poinar (1994) attacking the Australian acridid, *Phaulacridium vittatus* (Sjöstedt), the second moult occurred 5-10 days after entry, when the mermithid was 2-12 mm in length (Baker & Poinar, 1994).

*Cascofilaria baltica* Poinar (2011)
In a previous work describing the filarial nematode, *Cascofilaria baltica* Poinar (2011) in Baltic amber, the illustration provided (Fig. 96, pg. 85) was that of the Dominican amber *C. parva*. The correct photo of *C. baltica* adjacent to its black fly vector is provided here (Fig. 7).

**Conclusions**

Together with previously known insect orders of fossil mermithid (Diptera, Hymenoptera, Hemiptera, and Coleoptera)(Poinar, 2011), the new host orders presented here (Trichoptera, Lepidoptera and Phasmatodea) make a total of seven insect orders with representatives parasitized by mermithids.

Just these mermithid-host associations alone show why the Nematoda are the only group of soft-bodied internal parasites with a reasonable fossil record. These fossils provide minimum dates for the appearance of mermithid clades at various locations and times in the past. They also show minimum dates when parasitic associations between mermithids and other invertebrates, especially insects, were established.

While the oldest records of mermithids are Early Cretaceous species parasitising members of the dipterous families Ceratopogonidae and Chironomidae (Poinar, 2011), the fossil record of these parasites probably extends back to the Paleozoic. With the present additions, there are now 95 known fossil nematode species, 70 of which occur in amber.

**Acknowledgements**
The author thanks Sigitas Podenas for donating *Heydenius podenasae* n. sp. to the Poinar amber collection, Ron Cauble for the loan of *H. phasmatophilus* n. sp., Clair Mellish, The Natural History Museum, London, for the loan of *H. trichorosus* n. sp. and Roberta Poinar for comments on an earlier version of this paper.

**References**


*Revue de Nématologie* 13, 403-410.


Munich, Germany, Verlag Dr. Friedrich Pfeil, pp. 1-256.


Nachweis der Gattung *Triaenodes* (Trichoptera: Leptoceridae) **Mittelung**

*Geologisch-Palaeontologisches Institut Universität Hamburg* 89, 149-158.
Figures

Fig. 1. Heydenius arachnius n. sp. adjacent to its spider host in Dominican amber. (Scale bar = 0.9 mm.)

Fig. 2. Two specimens of Heydenius trichophilus n. sp. adjacent to their trichopteran host, Triaenodes balticus, in Baltic amber. (Scale bar = 1.4 mm.)

Fig. 3. Heydenius podenasae n. sp. (arrow) protruding from a moth in Baltic amber. (Scale bar = 1.6 mm.)

Fig. 4. Detail of Heydenius podenasae n. sp. protruding from a moth in Baltic amber. (Scale bar = 260 µm.)

Fig. 5. Heydenius phasmophilus n. sp. (arrow) adjacent to its phasmatid host, Balticophasma sp. in Baltic amber. (Scale bar = 2.1 mm.)

Fig. 6. Detail of Heydenius phasmophilus n. sp. in Baltic amber. (Scale bar = 390 µm.)

Fig. 7. The filarid Cascofilaria baltica Poinar (arrow) (accession no. SY-1-172) adjacent to a female blackfly (Simuliidae) in Baltic amber. (Scale bar = 425 µm.)