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New record of *Hexamermis* sp. (Nematoda: Mermithidae) parasiting *Rhaphigaster nebulosa* Poda (Hemiptera: Pentatomidae) (*)

Abstract - The nematodes of the Mermithidae family are obligatory parasites of arthropods, principally insects. A mermithid of the genus *Hexamermis* Steiner, was found parasiting *Rhaphigaster nebulosa* Poda, present on hazelnut plants in the Piedmont region. This insect can be recorded as a new host of *Hexamermis* sp. and of entomopathogenic nematodes. Considerations regarding the taxonomy of the *Hexamermis* genus are also reported.

Riassunto - *Nuova segnalazione di* Hexamermis *sp. (Nematoda: Mermithidae) entomoparassita di* Rhaphigaster nebulosa *Poda (Hemiptera: Pentatomidae).*

I nematodi della famiglia Mermithidae sono parassiti obbligati degli artropodi, principalmente di insetti. Un mermitide del genere *Hexamermis* Steiner, è stato trovato parassitizzare *Rhaphigaster nebulosa* Poda, raccolta su piante di nocciolo in Piemonte. Tale insetto viene segnalato per la prima volta quale ospite di *Hexamermis* sp. e più in generale di nematodi entomopatogeni. Vengono inoltre riportate alcune considerazioni circa la tassonomia di questo genere.

Key words: bugs, EPN, hazelnut.

INTRODUCTION

Nematodes are usually considered pests for several reasons such as being known as human and vertebrate parasites and dangerous phytophagous. However there are a small but significant number of beneficial entomopathogenous nematodes (EPN) often parasitically associated with insects. In fact they are used as biological control agents of pest insects especially in greenhouses (Ferrari *et al.*, 2000).

The mermithids are a large and important group of these nematodes, however their application is not common and they are considered more as biological agent regulators (Hernandez-Crespo & Santiago-Alvarez, 1997). Mermithids are obligatory parasites of arthropods, principally insects, and are almost always lethal to their hosts. They are usually specific to a single species or to one or two families of them.

Mermithids have since been reported from Hymenoptera (Passera, 1974), Lepidoptera (Triggiani, 1984-1985), Diptera (Paoletti & Poinar, 1985) but they are found in many other orders.

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Immature stages of Mermithidae were found in the haemocoele of different species of Hemiptera as *Leptocoris augur* (Fabr.), *Slaterocoris breviatus* (Kngt.), *S. stygicus* (Say), *S. atritibialis* (Kngt) (Dhiman & Ghayyur, 1993; Reid, 1974;). Thus from the literature no Pentatomidae are reported as hosts of Mermithidae and also *Rhaphigaster nebulosa* Poda wasn't previously known to be the host of this or any other EPN.

MATERIALS AND METHODS

During a project about Hemiptera pest of hazel wood in Benevallo (Cuneo) *R. nebulosa* was collected using the frappage method.

A nematode was found parasiting this insect, it was present in the abdomen which was completely empty due to the feeding activity of entomopathogenic nematode. The nematode was identified under the microscope (Leica 12 x100) after preparation in glycerin and formaldeid 4%, and using the De Grisse-Cobb' methods (1969) for preparing and mounting the slide.

DESCRIPTION

Filiform in shape with a smooth cuticle, the specimen was quite a long nematode, even for a juvenile. Its length was 13 cm and its width was 0.5 mm; the cuticle was relatively thick (5µm) and with clearly visible crisscross fibres below the epidermis (fig. 1), possessing two distinct crossed layers of spiral fibres. Body narrowing slightly in the head region which has six flat cephalic papillae: these ones were arranged on one plane. Mouth opening terminal; amphids small and weakly cuticularized located behind the lateral cephalic papillae. The mouth was very small and narrow similar to a bacterial feeder and the head has no particular structures (figs. 2a, b) except the ones reported above. The body has six or eight longitudinal cords, and the digestive tract is similar to free-living nematodes usually for juvenile stages.

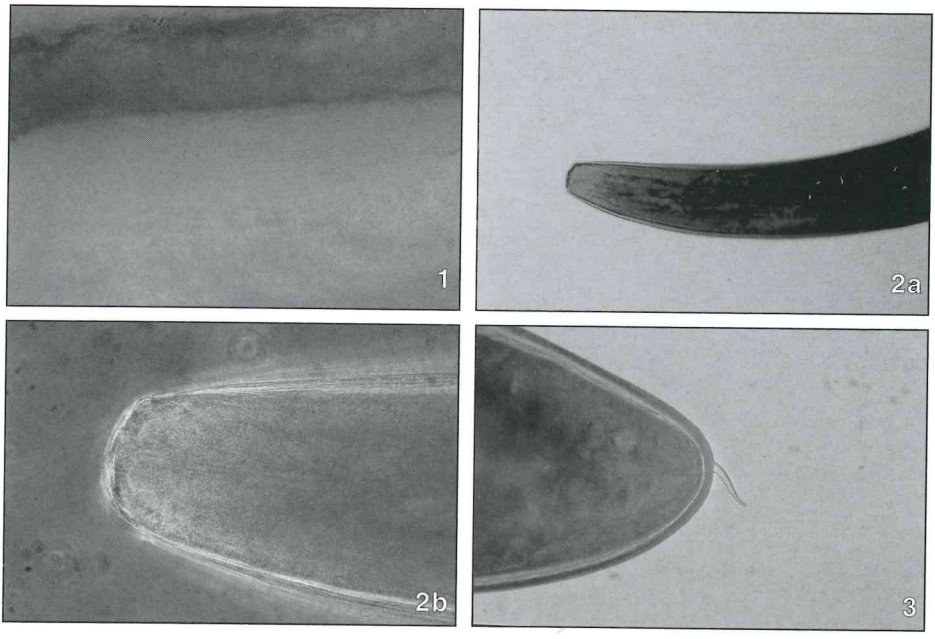
The tail was bluntly rounded with terminus bearing appendage (15µm) (fig. 3).

For all these reasons, the specimen recorded was identified as belonging to the family of Mermithidae and to the genus *Hexamermis* Steiner, probably *H. albicans* (Von Siebold), which was reported on an Italian checklist (Manfredi *et al.*, 1995) only in a *Quercus trojana* forest in Puglia into the larvae of the Lepidoptera Tortricidae *Archips crataegana* Hb. and *Aleimma loeflingiana* L. (Triggiani, 1984-1985).

DISCUSSION

There are few mermithids of this genus reported from Hemiptera; for example Steiner (1925) described *H. microamphidis* Steiner from the Hemiptera *Helopeltis antonii* (Sign.) a pest of tea in Indonesia. In 1985 Poinar and Linares described this genus from the Hemiptera Cercopidae *Aeneolamia varia* Fab., an economically important pest of sugar cane. Another Hemiptera but belonging to the Coreidae family *Serinetha angur* Fabr. was found parasitised by *Hexamermis* sp. (Dhiman, 1984). However *R. nebulosa* and no other Pentatomidae was recorded as a host neither of this genus nor of other Mermithidae .

From the taxonomic point of view is very difficult to describe the different species of *Hexamermis*. Actually, about 20 different species and 11 species inquirenda are known (Kaiser, 1991). Morphologically they are similar but the biology and the ecology of all these species is almost unknown. For this reason it is difficult to identify with a certain degree of precision the species especially when they are from a new host with a taxonomical position far from the previously recorded one.



Figs 1-3 - Crisscros fibres below the epidermis (1). Head end of *Hexamermis* specimen (2a). Detail of the head (2b). Tail end with appendage (3).

The specimen found, from the morphological data, is probably *H. albicans* but it is difficult to identify it exactly for other different reasons plus the ones above. Firstly, the collected specimen was in a juvenile stage without genital apparatus that is important for identification. In addition there is restricted literature about the mermithids which attack Rhynchota. In fact, *H. albicans* is often reported to be found in new hosts but the authors report the same perplexity we had to nominate the nematode belong to the species *albicans* but with an ecology so different.

This finding highlights the problem about species identification in relation to different hosts. Biomolecolar techniques can be an important and useful instrument to understand the systematic and the evolution of this important group of entomopahtogenic nematodes, which can be used as biological pest controls.

The most notorious EPN are, *Steinernema* spp. and *Heterorhabditis* spp., used all over for biological control of phytophagous insects (Rovesti, 1993), however also the Mermithidae family is active like EPN. For example *Agamermis decaudata* Cobb, Steiner and Christie is an agro-biological agent of Horthoptera. Hernandez-Crespo and Santiago-Alvarez (1997) also reported *Hexamermis serenensis* as a common biological agent regulating *Dociostaurus maroccanus* (Thunberg).

No EPN was recorded on *R. nebulosa* previously. The adults of these bugs can lay the eggs on hazelnut plants, but this insect rarely feeds on the nuts (Viggiani & Mazzone, 1976). The damage caused by *R. nebulosa* is often negligible, however it can be a suitable host for EPN that can attack other related genera. Further investigations are necessary to better understand the taxonomy and biology of this mermithid and to know its role as a biological agent in controlling this or other bugs of hazelnuts.

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