Journal of Agriculture, Food, Environment and Animal Sciences
Tarım, Gıda, Çevre ve Hayvancılık Bilimleri Dergisi
http://www.jafeas.com, ISSN: 2757-5659

J. Agric. Food, Environ. Anim. Sci.
6(1): 258-263, 2025

First Record of *Gordius spp. (Nematomorpha: Gordiidae)* in Southwestern Iran: Morphology, Behavioral Patterns, and Ecological Implications

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Research Article

Article History:
Received:02 February 2025
Accepted:12 May 2025
Published online: 01 June 2025

***Keywords*:**
Nematomorpha
Gordius Spp.
Freshwater Parasitism
Iran
Taxonomy
Scanning electron microscopy

ABSTRACT

The first confirmed recording of the gordiid hairworm (Nematomorpha: Gordiidae), belonging to the genus Gordius, is reported from Chaharmahal and Bakhtiari Province in southwestern Iran. A single adult female specimen was found and then examined using light microscope methods. The features identified, including smooth cuticle, cylindrical shape, bilateral symmetry, and absence of posterior lobes, confirmed its membership to the genus Gordius. The geographical range of Nematomorpha has extended to the Middle East as per previous reports. The current paper provides ecological information, distinguishing features, and comparative assessment with similar studies from Türkiye and Europe. Scanning electron microscopy (SEM) is recommended in future studies to determine the species accurately and reveal previously unknown diversity within the phylum.

To Cite : Ghorani M, Eslami F, Baberi NAS, Zamzam SH, Rezapanah M, Soleimani S., 2025. First Record of Gordius spp. (Nematomorpha: Gordiidae) in Southwestern Iran: Morphology, Behavioral Patterns, and Ecological Implications. Agriculture, Food, Environment and Animal Sciences, 6(1): 258-263.

INTRODUCTION

The phylum Nematomorpha, also known as the horsehair worms, consists of approximately 300 species. They show a parasitic larval stage in the arthropods and an aquatic free-living adult stage (Schmidt-Rhaesa et al., 2003; Poinar, 2008). Significantly, the freshwater group, particularly the genus Gordius, is characterized by the unique life cycle and the ability to alter the behavioral traits of the host organisms (Storer and Usinger, 1965).

Hairworms typically parasitize Orthoptera and other insects, compelling their terrestrial hosts to seek water, where the parasite emerges (Barber and Poulin, 2002). Adults can be found in aquatic environments such as streams, ponds, and springs (Poinar, 2001; Smith, 2001, Hanelt et al., 2005; Poinar, 2008). Despite their fascinating biology, records of Nematomorpha are rare in many parts of the world due to underreporting and cryptic ecological behavior (Thomas et al., 2002). Until the current work, there was a lack of published evidence relating to Gordius spp. in the south-west region of Iran (Poinar, 2001; Schmidt-Rhaesa, 1997; Schmidt-Rhaesa et al., 2003; Poinar, 2008). We report the first confirmed finding of female Gordius spp. from Dimeh Fountain, supported by morphological analysis (Aydemir, et al., 1996; Schmidt-Rhaesa, 1997; De Villalobos et al., 1999; Paçal and Baş, 2008; Şaşi and Giannetto, 2016).

MATERIAL and METHOD

Study Area

The Dimeh Fountain is located in the Kouhrang area of Chaharmahal and Bakhtiari Province in Iran (Şaşi, 2004). The area has seasonally changing hydrologic flow, which is influenced by rainfall and the irrigation needs of agriculture. Data were collected in October 2020.

Specimen Collection and Examination

A single adult worm was observed to be exiting the fountain. The specimen was manually picked, then preserved, and finally analyzed using light microscopy. Different structural features were determined, including body morphology, cuticular patterns, posterior anatomy, and sex-specific features (Bolek et al., 2013).

RESULTS and DISCUSSION

Results

The sample was identified as a female Gordius genus with a length of approximately 45.0 cm and a diameter of 1.4 to 2.2 mm. It had an elongated, cylindrical, unsegmented body with bilateral symmetry and a smooth cuticular layer. The posterior extremity was simple and rounded, without lobes or ornamental structures, consistent with the morphological features of female Gordius. The cloacal aperture was terminal, and there were no cuticular areoles.

The specimen morphology was typical of the genus, being coiled and filamentous in nature, resembling a tangled cord. The UTM of Dimeh Fountain in Easting was 424974.00 m E and for Northing was 3595277.00 m N. (Figure 1 and 2).

Figure 1. The adult Gordian worm

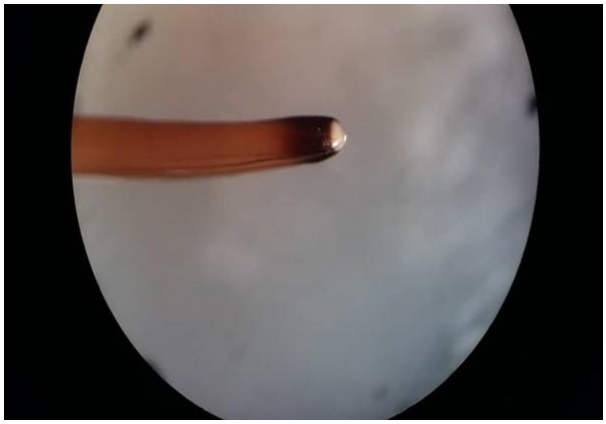

Figure 2. Microscopic image of the female Gordius terrestris isolated from Dimeh Fountain

DISCUSSION

The presence of Gordius spp. in the south-western part of Iran accounts for the sparse records of Nematomorpha in the area (Anaya et al., 2019). Species-level determination was not confirmed using microscopy alone, yet the features described are consistent with the diagnostic characters at the genus level (Poinar, 2008). This finding is notable in conjunction with previously reported distributions in Türkiye, particularly in Antalya, Ankara, Samsun, and Western Anatolia, and in other European countries like Scotland, Germany, and Austria (Hanelt and Janovy, 1999). These findings suggest a wider, though inadequately documented, range of freshwater hairworm diversity on the Eurasian continent (Fair, et al., 2010). This finding of an adult female in isolation indicates the potential for either restricted local distribution or unreported ecological activities. Further investigation on aquatic insect fauna and possible paratenic hosts may offer key information on the local life cycle of Gordius spp. Conclusion This is the

first recorded observation of Gordius spp. in southwestern Iran. (Cochran et al., 1999; Kinziger et al., 2002; Ruiz and Figueroa, 2005; de Villalobos et al., 2008). The morphological features observed in the specimen confirm its placement within the genus, although species-level identification awaits further study using tools such as SEM or molecular diagnostics (Hanelt et al., 2005). This finding broadens the known geographic range of freshwater hairworms and emphasizes the importance of additional surveys in the region (Thomas et al., 2002, Ponton et al., 2006).

CONCLUSION

The role of earthworms in the transmission of G. terrestris remains uncertain, with two potential scenarios: earthworms acting as dead-end hosts, never ingested by the definitive arthropod host, or earthworms serving as parthenic hosts in the transmission of G. terrestris to an unknown definitive arthropod host. Notably, sister species to G. terrestris infect millipedes, and within the Gordius cf. robustus clade, they act as the definitive host. This suggests that G. terrestris could also infect millipede Hanelt definitive hosts (Sharifi et al., 2014; Hanelt et al., 2015). Given that millipedes are fossorial detritivores and occasionally include dead animals in their diet, our objective is to assess the role of earthworms in G. terrestris transmission and explore millipedes and other arthropods to identify the definitive host for this earthworm.

Further studies using modern tools such as scanning electron microscopy (SEM) are strongly recommended to advance our understanding of this group. These studies would significantly expand our knowledge of Nematomorpha, provide accurate information on its distribution, and enhance our detailed understanding of its presence not only in Iran but also in the region.

Conflict of Interest

The authors have declared that there are no competing interests.

Authors Contribution

The authors contribute equally to the research

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