First Record of Nematode *Trichuris* spp. from sheep in Basrah City, Southeren Iraq

Israa Mohsen Essa ¹, Ghazi Yaqoub Azzal ²

¹, ² Department of Microbiology, College of Veterinary Medicine, University of Basrah, Basra, Iraq

Abstract

*Trichuris* spp. Nematodes were isolated from slaughtered sheep in the South Regions of Iraq / Basrah. The diagnosis and description were based on morphological characteristics. Two species of *Trichuris* were found, *T. ovis* and *T. globulosa*. While *T. ovis* was most common, *T. globulosa* was relatively rare among the infested animals. Male and female nematodes were recognized as *Trichuris* spp. morphologically; however, only one male was identified as *T. globulosa*. The species of *Trichuris* spp. were distinguished through their biometrical features such as presence of cylindrical spicular sheath, protrusive vulva, length of the spicule, as well as the proximal and distal cloacal tube. Moreover, diagnosis of *Trichuris* species was confirmed by the nomenclatural acts as it has been recorded in the registration system of the Iraqi Natural History Research Center when a certain deposit number for *Trichuris* spp.:: INHM.2020Nem.1.1. They were noting the presence of *Trichuris* spp. as such the samples of nematodes were deposited in the helminth collection at the Museum of the University of Baghdad. This repository is considered as the confirmation of the diagnosis and morphological analysis.

Keywords: *Trichuris ovis*, *Trichuris globulosa*, Morphological characters, Sheep, Basra.

INTRODUCTION

Nematodes of the Genus *Trichuris* (Adenophorea: Trichuridae) Roederer 1761, is cosmopolitan and destroy a wide variety of mammalian hosts, including humans [1, 2]. The *Trichuris* genus includes medicinal and veterinary species importance; Human has been acquired by domestic animals from many countries or is shared with them [3]. *Trichuris ovis* is acaecal parasite most prevalent in ruminants irrespective of age, gender, and breed of the hosts [4]. Trichuridae nematodes are one of the most diverse and widely distributed groups of parasitic worms. It has a clear economic impact, as it may cause the death of economic animals, including sheep, which in severe cases; suffer from bloody colitis and diphtheritic caecitis, causing ulcerative and necrotic mucosal lesions. Extreme anemia and dehydration, and jaundice in animals with high worm burden can contribute to animal death [5, 6, 7]. There are more than 70 species of *Trichuris* nematodes parasitic recorded in primate mammals such as ruminants, lagomorphs, even-toed ungulates, rodents, carnivores [8, 9].
Trichuris nematodes are common in ruminant animals in many countries, especially sheep [10, 11]. Previous reports indicate that there are three species of trichurid nematodes in Europe; T. skrjabiny, T. abildgaard, and T. globulosa [12, 13]. Also, T. ovis was not limited to Europe, since it was found in India, Nigeria, and South America as well [14, 15]. Recently, the species T. globulosa was recorded in Iran [16] and in Ukraina [17]. Adults of T. ovis can be recognized by their white in colour, their characteristic, slender, long thread-like anterior portion, and a much thicker posterior end. Trichuris spp. got its name due to its thin, thread-like anterior body end, but the most common name is ovine whip worm [4]. Regarding T. ovis, life-cycle is direct; the transmission can be by the soil. The embryonic eggs could orally be ingested, and then hatched into the small intestines. The parasite larvae at the intestinal wall of the caecum and proximal colon and develop into mature worms [18, 19].

There is limited information about the T. ovis adult worm and its infection in the sheep caecum in Iraq. In Basrah, another species of nematode infection of gastrointestinal tract was studied in sheep [20]. No previous researches recorded T. ovis as an adult worm in Iraq, which leads to the limited information about the worm and its infection methods in the sheep caecum in Iraq. Therefore, the present study mainly aimed to isolate and diagnose Trichuris species in slaughtered sheep in Basrah province, Iraq.

MATERIALS AND METHODS

Samples collection

Three hundred and sixty caecum samples were collected randomly from the central slaughterhouses in different areas in Basrah province including Karmat Ali, Al-Jumhuriya, Al-Mawfakia, Al-Abasiya, Al-Jubaylah, and Al-Hakimiah during 2019 to 2020. Complete information was collected about the important sources and breeding location of the animals (sheep), which help in determining the origin of the infection. The samples were brought to the parasite research laboratory of the University Basrah/ Veterinary Medicine.

Laboratory study

Examination and collection of parasites

The cecum was incised longitudinally by using special surgical tools. The presence of parasitic worms is investigated either by examining the feces in the cecum or in the cecal epithelium to which the worm attaches. Helminths were obtained through the use of modified techniques [18, 21]. Nematodes were isolated from cecum in the laboratory, the cecum contents emptied into a bucket, the cecum mucosa was washed separately in clean water, and all the parasites were kept, the isolated worms were washed several times with distilled water and then transferred to sterile plastic containers, and These worms were preserved in 70% alcohol, were dried in glycerol alcohol (10 parts glycerol and 90 parts 70% alcohol) [14]. Then the preserved nematodes were processed on glass slides in anhydrous glycerol. Slides were observed under a light optical microscope, and images were taken under a search microscope at ×4, ×10, and ×40.

Fixation and preservation

Nematodes were fixed immediately after collection for 24 hours in 70% alcohol. A mixture of 70% ethyl alcohol as well as the glycerol was used to streamline the parasites. Gender species
females and males were described, and nematodes were microscopically recognized by the standard taxonomic keys [5, 7, 22]. The morphology of the spicules was the key characters used for the identification of male nematodes and photographed where appropriate. After identification, the following measurements were made for many worms: body length, spicule length, esophageal length; these features were measured using an eyepiece graticule mounted in 10× eyepiece and 40× objectives, calibrated initially using a stage micrometer and presented as the range (measurements micrometers) [7].

**Taxonomic identification based on morphological studies of Trichuris spp.**

The phenotypic characteristics of isolated worms (length and colour) were recorded. The worm length was measured with a standard ruler; Trichuris Nematode males were selected from all examination caecum; lactophenol was used to clear the spicules under a microscope in the male worms, as described by [23]. Each worm was examined for morphometrical spicule parameters. The sample was sent for registration and confirmation of diagnosis and classifications. This Nematoda and the nomenclatural acts it registered in the registration system of the Iraqi Natural History Research Center.

**RESULTS**

*Trichuris spp.* genus nematodes were found to be a spread parasite that infects sheep in Basra/Iraq. The intensity of the parasite presence was from 1 to 30 parasites per cecum. The species of *T. ovis* and *T. globulosa* were found in most positively infected sheep. The species of *T. globulosa* was rarely detected. The morphological characteristics of the adult species *Trichuris* spp. showed that there was clearly the creamy white colour and their slender filiform, anterior end comprising about three-fourths of the complete body length this study (Figures 1, 2).

![Figure (1): Adult Trichuris spp. attached with mucosa cecum organ](image1)

![Figure (2): Adult Trichuris spp. inpetridish with normal saline](image2)

Collected *Trichuris* genus nematodes have anterior thin, long, translucent parts, rather than a thicker, short, and usually white posterior part (Figures 3, 4).
The males have a slightly spiral tail end (Figure 3); whereas, the tail end of females was slightly curved (Figure 4). Females are significantly longer than males. The ratio of anterior to posterior body parts varied significantly (3:1) in females and (2.8:1) in males. The female body at the posterior end was significantly wider than male bodies. The characteristics of morphological and metric species (body size, form and structure) were considered as typical differential in both adult males and females sexual morphism is very distinct in body size, the sexual apparatus, and tail-end structure (Table 1).

### Table (1): Morphometric parameters of *T. ovis* and *T. globulosa* from sheep

<table>
<thead>
<tr>
<th>Characters</th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><em>T. ovis</em></td>
<td><em>T. ovis</em></td>
</tr>
<tr>
<td>Length of body (mm)</td>
<td>57.77 ± 1.51</td>
<td>49.73 ± 1.35</td>
</tr>
<tr>
<td>Anterior to posterior body parts ratio</td>
<td>3.0 : 1</td>
<td>2.2 : 1</td>
</tr>
<tr>
<td>Width of body at the anterior end (μm)</td>
<td>198.52 ± 6.19</td>
<td>186.98 ± 5.60</td>
</tr>
<tr>
<td>Width of body at the posterior end (μm)</td>
<td>912.06 ± 17.42</td>
<td>720.90 ± 7.37</td>
</tr>
</tbody>
</table>

The anterior body part consists of a small round mouth with thin lips (Figure 5A), followed by the esophagus, which is recognized by long, occupying (Figure 5B). The specific morphology of the *Trichuris* genus, the structure cuticle surface, is slightly gentle transverse striations (Figure 6).

The adult females' have the genital tract connected by a vulvar opening, which showing an oviduct with eggs as a single profile in and bearing fully developed eggs (Figure 7). Recognized of the vagina *T. ovis* was long, muscular, and curved. The vulva itself extrudes as two lips of slightly posteriorly bent cylindrical cuticular protrusion. This protrusion is covered with numerous spines (Figure 8A). In most of *T. ovis* females, eggs were arranged in several rows (Figure 8C), or accumulated in the middle or distal part of the vagina (Figure 8B).
Eggs of *Trichuris spp.* are lemon-shaped with a plug at each of the poles, measuring approximately (70.4-82.3×34.5-45.4μm) as length and width respectively (Figure 9). The posterior end of the female body was significantly wider than male bodies. The posterior extremity was slightly curved (Figure 10).
The adult males of *T. ovis* can be distinguished by the posterior end, characterized by the slightly spiral bent tail and the spicule was long with a specular sheath covered with spines and which spirally coiled with a single spicule, having expanded proximal and a pointed distal end (Figure 11). While in *T. globulosa*, it is the plainly rounded tail, the spicular sheath had a slightly stretched globular expansion at its distal end and was covered with closely set spines (Figure 12). To identify *T. ovis* and *T. globulosa*, we took into account the following morphological features; in males, the structure of the tail end, namely the spicule and the spicule sheath.
The parts of tail end male *T. ovis* were shown, which consists of (A) the distal end of spicule, (B) spicule, and (C) proximal end of spicule (Figure 13). The parts of tail end male *T. globulosa* were consists of (A) distal end of the spicule, (B) spherical dilation for a distal end of spicule sheath, (C) proximal end of the spicule, (D) spicule, (E) spines at spicule sheath, and (F) cylindrical protrusion at the apex of the spherical dilation with spicule sheath (Figure 14).

This work and the nomenclatural acts it contains have been registered in the registration system of the Iraqi Natural History Research Center: Trichuridae: (Abidg, 1795, INHM: 2020 Nem. 1.1), and the Museum / University of Baghdad, samples of nematodes have also been deposited in the helminth collection of the same museum where it is considered to confirm the diagnosis and Morphological analysis. Through our current study we found that one more character-specific of *T. globulosa* males. It was not previously described in the literature, and, in our opinion, can facilitate its identification. It is the cylindrical protrusion at the apex of the spherical dilation of the withdrawn spicule sheath (Figure 15). This character is absent in *T. ovis* males that are morphologically very similar to those of *T. globulosa*. The length of the cylindrical protrusion was 81.43 ± 2.67 μm, and its width was 61.59 ± 0.45μm. Summarizing the results, it can be noted that nematodes of the genus Trichuris are common in domestic sheep in the southe regions of Iraq Trichuris nematodes of sheep here are represented by two species, *T. ovis* and *T. globulosa*, which *T. ovis* is more prevalent.
DISCUSSION

Previously, the morphometric characters of many *Trichuris* species were analyzed [17, 24]. Produced key to seven whipworm species from ruminants in North America were including *T. ovis* and *T. skrjabini* [25]. During the present study, was distinguished two species of *Trichuris* as *T. ovis* and *T. globulosa* was distinguished isolated from South Iraqi sheep cecum, as it detected that the main diagnostic characters are body length, spicule length and width, spicule shaft diameter and the length of the ejaculatory duct [25, 26]. According to previous studies of various authors, sheep commonly host four *Trichuris* species: *T. ovis*, *T. globulosa*, *T. skrjabini* and *T. capreoli* [27, 28]. However, doubts have arisen regarding the relevance of *T. globulosa*. On the basis of morphological characteristics, it is shown that discovered the presence of only *T. globulosa* males and *T. ovis* females in the same host [29]. The absence of *T. ovis* males and *T. globulosa* females in the same host suggested sexual reproduction between both species, and thus, they represent only one species. Therefore, these authors believe that *T. ovis* and *T. globulosa* are synonymous. This is what our current study agreed upon *T. globulosa* in my
study was observed in the same host present the presence of only *T. globulosa* males and *T. ovis* male and females. While in this study, a higher and more pronounced with details drawings of *Trichuris globulosa* was done, as will as different the general morphological pattern in the male reproductive system. Identification of closely related species is challenging. This is due in part to the phenotypic plasticity of the organisms themselves, host-induced variation, the lack of morphological features, and the extensive overlap in morphometric characteristics among species [26]. Moreover, some identical isoenzyme patterns were found through isoenzyme electrophoretic studies [29]. Despite the fact that *Trichuris* nematodes are common endoparasites in wild ruminants, especially in roe deer, much less attention is given to species found in these hosts in comparison to those found in farm animals. All-female nematodes in this study were morphologically identified as *T. ovis*, while only one male was identified as *T. globulosa*.

Rickard and Bishop were suggested the following characters as suitable for species determination (male specimens): short spicule with rounded tips and large caudal papillae and long ejaculatory duct [25]. The most recent review of *T. discolor* can be found. *T. discolor* been reported worldwide, especially in cattle [24]. Findings of *T. discolor* in wild sheep are reported rarely [30, 31]. Furthermore, *T. discolor* occurs as well in the caecum and colon of ox, zebra, buffalo and goat [32].

Our study provides the first morphological analysis of *Trichuris* nematodes found in sheep of Basrah [12]. In the past, especially in the last century and earlier, the different nematode species were described solely by morphological characters. Morphological details of *T. ovis* and diagnostic structures although the bacillary band can be differentiated from the remaining transversal striated cuticle were examined using light microscopy [33, 34]. Since the bacillary bands are not known for all *Trichuris* species, it is possible that the real importance of this structure will be assessed only when new studies with detailed descriptions, illustrations, and photographs are provided. *Trichuris ovis* and *T. globulosa* has been differentiated by based on the size of the spines on the distal expansion of the everted spicule sheath (those on the distal expansion of the sheath being larger than the rest in *T. globulosa* and vice versa in *T. ovis*) However, no size difference was observed in the spines of the spicule sheath in the male specimens of *T. ovis* examined herein [35]. The males of the two species could be differentiated with reference to the shape of the proximal end of the spicules and also of the distal expansion of the everted spicule sheath. Further, no cuticular inflation was noticed near the head end, as recorded by Farleigh [36]. From the existing species of genus *Trichuris* Roederer, 1761, the present specimens were found to be very close to the description of *Trichuris ovis* as it is steated [37]. As regards its morphological characters, including the total length, maximum breadth, size of the spicule, anterior end, etc. However, some intraspecific variations in size ratio have been recorded in the present specimens, which are of minor taxonomic. However, most authors indicated that *T. ovis* are the most prevalent species, explaining it with the faster development cycle of this parasite [15, 38]. In our opinion, the local dominance of *T. ovis* can be explained by favourable environmental conditions for the development of embryonic stages of parasites. The morphological similarity of *T. globulosa* and *T. ovis* males, and also the fact that it is not always possible to isolate males of one species inspired us to obtain new data on the significantly different morphometric characteristics of males and females of studied *Trichurus* species. We established that, in addition to sex-related characters, it is necessary to
take into account the morphological features of the metric indices of cuticle formations on their body surface. It is clear from the study that ruminants of Iraq make no exception from the rest of the world regarding *Trichuris ovis* infection. Therefore it is believed that the present study will be of some use to avoid this confusion regarding the identification of this parasite.

**REFERENCES**


