**Elaphostrongylus cervi** (Cameron, 1931) in Red deer (*Cervus elaphus*): First Record in Turkey

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**ABSTRACT**

This study was carried out to determine the presence of Elaphostrongylus cervi infection found in Red deer at Eskişehir Çatacık Red Deer Production Station between June-July 2020. Based on the red deer traces and signs in the study area, 32 fresh faeces of animals were collected from the places where the faeces density was found. Stool samples were examined for cestode rings macroscopically, and microscopically by sedimentation, saturated salt flotation, and Baermann Wetzel methods. Larvae were found in all the collected faeces. The larvae obtained by the Baerman technique were identified at the species level using the relevant literature. *E. cervi* identified in red deer with this study is the first record in our country. Thus, it will provide valuable data for the red deer in Turkey

**Keywords:** Elaphostrongylus cervi, Red deer, First record, Eskişehir

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Kızıl geyiklerde (*Cervus elaphus*) Elaphostrongylus cervi (Cameron, 1931): Türkiye’de İlk Kayıt

**ÖZ**

Bu çalışma Haziran-Temmuz 2020 tarihleri arasında Eskişehir Çatacık Kızıl Geyik Üretim İstasyonu’ndaki Kızıl geyiklerde bulunan Elaphostrongylus cervi enfeksiyonunun varlığını belirlemek amacıyla yapılmıştır. Çalışma alanında bulunan Kızıl geyik iz ve belirtilerinden hareket ederek dışkı yoğunluğunu bulduğu yerlerden hayvanlara ait 32 taze dışkı toplanmıştır. Dışkı örnekleri cestod halkaları yönünden makroskobik ve mikroskobik olarak incelenmiştir. Dışkı örnekleri cestod halkaları yönünden makroskobik olarak, sedimentasyon, doymuș tuzlu su flotasyon ve Baermann Wetzel yöntemleri ile mikroskobik olarak incelenmiştir. Toplanan dışkının hepsinde larvalar rastlanmıştır. Baermann tekniği ile elde edilen larvalar ilgili literaturlarla uyumlu türün tespiti edilmiş, Kızıl geyiklerde *E. cervi* ilk kez tespit edilmiştir. Bu sebeple Türkiye’de Kızıl Geyikler için değerli bir veri oluşturacaktır.

**Anahtar Kelimeler:** Elaphostrongylus cervi, Kızıl geyik, İlk kayıt, Eskişehir

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To cite this article: Kartal K. Eser M. GüzEL H. Elaphostrongylus cervi (Cameron, 1931) in Red deer (*Cervus elaphus*): First Record in Turkey. Kocatepe Vet J. (2020) 13(4):433-438

**Submission:** 12.08.2020  **Accepted:** 30.09.2020  **Published Online:** 10.11.2020

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INTRODUCTION

*Elaphostrongylus cervi* which is an important helminth parasite in Red Deer (*Cervus elaphus*) is found in muscles, brain and the epidural space of the spinal cord in many deer species including Caspian red deer (*Cervus elaphus maral*), Canadian deer (*Cervus elaphus canadensis*), Japanese deer (*Cervus nippon*) and roe deer (*Capreolus capreolus*). The intermediate hosts are various land snails (Mason, 1989). Mature parasites are 4-6 cm long, pale, and in thread-shaped structure. Transmission of the parasite is through the infective larvae reaching the lungs through the bloodstream. Symptoms include lung inflammation and nervous disorders in the brain (Boden 2005). This parasite is found especially in domestic, and wild ruminants in Europe, including Scotland, Australia, and North America, and has widespread (Mason 1989). Parasites have a significant impact on wildlife populations, including reproduction and survival (Anderson 1978). Although there are many studies on the wild animals in Turkey (Uslu et al. 2008, Acıcı et al. 2012, Acıcı et al. 2017, Bolukbas et al. 2012, Girisgin et al. 2018, Dik and Kılınç 2015), studies on helminth infections that infect red deer are limited (Cengiz et al. 2019). So far, there has not been a study to determine the *Elaphostrongylus cervi* infection in red deer in Turkey. With this first study in Turkey, it is aimed to determine the state of *E. cervi* infection in the red deer in Eskisehir and to contribute to the detection of the local fauna.

MATERIAL and METHODS

This study was carried out between June-July 2020 in Eskisehir (Figure 1). Based on the traces and signs of red deer in the Catacik region of Eskisehir, 32 fresh fecal samples belonging to animals from the places where the faeces density was found were taken into transparent nylon bags and recorded by numbering. The faeces obtained were brought to laboratory.

Stool samples were examined for cestode rings macroscopically, and microscopically by sedimentation, saturated salt flotation, and Baermann Wetzel methods. (Thienpont and et al. 1986). Light microscope (Olympus CX31-Olympus Imaging System LC30) was used for the identification of larvae obtained by Baerman technique. Total body length, maximum body width, tail length (from the anus to tail tip), tail extension length, and dorsal spine length were measured in a total of 50 dorsal spiny larvae in lactophenol solution.

RESULTS

In the study, it was determined that the dorsal spiny larvae, whose morphometric measurements were made, belonged to the *E. cervi* species. Looking at the morphometric measurements of the dorsal-spined larvae, the average total length was 408 µm, the width was 20 µm, the tail was 38 µm, tail extension length was 9.23 µm, and dorsal spine was 2.69 µm. (Table 1).
Table 1. Measures (in µm) of dorsal-spined larvae recovered from red deer (*Cervus elaphus*).

| References                  | This study | Baruš and Blazek 1973 | Kurzer and Prosl 1975 | English et al. 1985 | Demiaszkiewicz 1986 | Rézáč 1990 | Vicente and Gortázar 2001 | Morandi et al., 2006 | Panayotova-Pencheva and Alexandrov 2008 |
|-----------------------------|------------|-----------------------|-----------------------|---------------------|----------------------|------------|---------------------------|----------------------|----------------------------------------|
| Total length                | Mean 408   | 342-408               | 364-452               | 391-460             | 382-463              | 390-459    | 365-425                   | 390-430              | 377-473                                |
|                             | Min-Max 377-437 | 342-408               | 364-452               | 391-460             | 382-463              | 390-459    | 365-425                   | 390-430              | 377-473                                |
| Width                       | Mean 20    | 18-20                 | 17-21                 | 16-21               | 16-24                | 19         | 16-23                     | 18-20                | 18-24                                  |
|                             | Min-Max 16-26 | 18-20                 | 17-21                 | 16-21               | 16-24                | 19         | 16-23                     | 18-20                | 18-24                                  |
| Tail extension length       | Mean 9.23  | 7.8-1-9.98            | 18-20                 | 17-21               | 16-24                | 19         | 16-23                     | 18-20                | 18-24                                  |
|                             | Min-Max 7.8-1-9.98 | 18-20                 | 17-21                 | 16-21               | 16-24                | 19         | 16-23                     | 18-20                | 18-24                                  |
| Dorsal Spine                | Mean 2.69  | 2.08-2.79             | 2.69                  | 2.08-2.79           | 2.08-2.79            | 2.08-2.79  | 2.08-2.79                 | 2.08-2.79            | 2.08-2.79                              |
|                             | Min-Max 2.08-2.79 | 2.08-2.79           | 2.08-2.79            | 2.08-2.79           | 2.08-2.79            | 2.08-2.79  | 2.08-2.79                 | 2.08-2.79            | 2.08-2.79                              |
| Tail                        | Mean 38    | 34-42                 | 34-42                 | 34-42               | 34-42                | 34-42      | 34-42                     | 34-42                | 34-42                                  |
|                             | Min-Max 26-35 | 35-50                 | 35-50                 | 35-50               | 35-50                | 35-50      | 35-50                     | 35-50                | 35-50                                  |

First stage *E. cervi* larvae have rhabditiform type esophagus. The excretory hole is in the anterior ventral of the body. Genital primordium is found in the last 1/3 of the body. The tail has a characteristic shape. They have a distinct triangular spine on the dorsal side parallel to the tail tip (Figure 2).
DISCUSSION and CONCLUSION

The red deer are ruminants that roam wildly in limited areas or are reared in certain protected environments in Turkey. Although there are many studies on the wild animals in Turkey (Uslu et al. 2008, Acici et al. 2012, Acici et al. 2017, Bolukbas et al. 2012, Girisgin et al. 2018, Dik and Kühnc 2015), studies on helminth infections that infect red deer are limited (Cengiz et al. 2019). So far, there has not been a study on E. cervi infection in Turkey. This first study in Turkey reports the E. cervi infection in red deer in Eskisehir. First stage E. cervi larvae were found in all 32 stool samples. There are many studies abroad on E. cervi supported by both stool and necropsy examinations. (Hutsch et al. 2020, Panayotova-Pencheva and Alexandrov 2011, Alberti et al. 2011, Demiaszkiewicz et al. 2016, Sutherland 1976, Bregoli et al. 2006, Valcárcel and Garcia Romero 2002).

It was reported that 16.6% of the Red deer examined in Poland were infected with Elaphostrongylus sp (Hutsch et al. 2020). In another study, it was noted that 76.7% of the red deer were infected with E. cervi (Demiaszkiewicz et al. 2016).

In a study conducted in Italy, it was reported that 45.2% of the red deer were infected with E. cervi (Alberti et al., 2011). In the stool examination of 110 Red deer in Bulgaria, 75 (68%) of them were found to be infected with E. cervi. In the same study, E. cervi was found in the lung tissue of 5 deer by the necropsy (Panayotova-Pencheva and Alexandrov 2011).

In a study conducted on the red deer in New Zealand, it was reported that mature E. cervi were found in connective tissue associated with skeletal muscles and its larvae in the lungs, causing various pathological lesions in these tissues (Sutherland, 1976). In Italy, mature E. cervi were diagnosed in the submeningeal region for the first time in the red deer with neurological symptoms, and cerebral nematodiagnosis was reported (Bregoli et al. 2006).

In a study conducted in Spain, it was reported that 31.5% of the red deer were infected with mature E. cervi in the central nervous system, and E. cervi was recorded for the first time in the central nervous system of red deer in Spain (Valcárcel and Garcia to Romero. 2002).

Eskişehir province, where the study was conducted, is suitable for the survival of slugs for an intermediate host to helminth infections, considering that it has a continental and humid climate under the influence of the Black Sea and Central Anatolia. The field where the study was conducted is not suitable for water slugs, but because of the dry areas suitable for land slugs, it only strengthens the possibility of E. cervi infections in deer. (Kuligowska and Demiaszkiewicz 2010). E. cervi also causes neurological lesions in small ruminates. Therefore, the grazing of domesticated small ruminates in areas where deer are present indicates that the disease with a high prevalence in deer may also transmit to small ruminates (Alberti et al. 2011, Handeland et al. 2000).

The literature research has proven that this species has not been reported in Turkey before. E. cervi, diagnosed in Red deer with this study, is reported for the first time with this study. Therefore, this research will provide valuable data for the red deer in Turkey. More research is needed to determine the parasitic fauna of the red deer that live wildly in limited areas or are reared in certain protected environments in our country.

ACKNOWLEDGMENTS

This study was supported by the Scientific Research Projects Coordination Unit of Anadolu University (Project number: 2005S062).

Ethical statement: No ethical committee approval is required as the experimental animal is not used.
To carry out this research, the permission of the Ministry of Agriculture and Forestry dated 05/05/2020-E.19084 was obtained.

 Conflict of interest : The authors declare that they have no conflict of interest.

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