

Parasite load in the Iberian ibex, *Capra pyrenaica victoriae*

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Abstract

Parasite load in the Iberian ibex, Capra pyrenaica victoriae.— Parasitic infections in the Iberian ibex are common, serious and well documented. Most studies, however, focus on the subspecies *Capra pyrenaica hispanica*, found in the south and east of the Iberian peninsula, and few studies have investigated the subspecies *Capra pyrenaica victoriae* in the centre of the peninsula. Here we add to the information about *C. p. victoriae*, analyzing samples of this subspecies in the National Park of Sierra de Guadarrama. We found parasites in 97% of samples and identified a total of 11 helminth taxa. The most abundant genus in the analysis was *Muellerius*. Despite the frequency of parasites, the general health of the population seemed good.

Key words: Iberian Ibex, Parasites, National Park, Faecal sample

Resumen

Carga parasitaria de la cabra montés, Capra pyrenaica victoriae.— Las infecciones parasitarias en las cabras montesas ibéricas son frecuentes, graves y están bien documentadas. Sin embargo, la mayoría de trabajos se centran en la subespecie *Capra pyrenaica hispanica*, distribuida por el sur y el este de la península Ibérica, mientras que hay pocos estudios dedicados a la subespecie presente en el centro de la península, *Capra pyrenaica victoriae*. Aquí aportamos información sobre *C. p. victoriae*, analizando muestras coprológicas de esta subespecie en el Parque Nacional de la Sierra de Guadarrama. Hemos encontrado parásitos en el 97% de las muestras e identificado un total de 11 taxones de helmintos. El género más abundante en los análisis ha sido *Muellerius*. En cualquier caso, la salud de la población parece, en general, buena de tal forma que las cargas parasitarias detectadas no influyen aparentemente de manera determinante en el estado de salud de la población.

Palabras clave: Cabra montés, Parásitos, Parque Nacional, Muestra fecal

Resum

Càrrega parasitària de la cabra salvatge, Capra pyrenaica victoriae.— Les infeccions parasitàries en les cabres salvatges ibèriques són freqüents, greus i estan ben documentades. Tanmateix, la major part de treballs se centren en la subespècie *Capra pyrenaica hispanica*, distribuïda

al sud i l'est de la península Ibèrica, mentre que hi ha pocs estudis dedicats a la subespècie present al centre de la península, *Capra pyrenaica victoriae*. Aquí aportem informació sobre *C. p. victoriae* després d'analitzar mostres coprològiques d'aquesta subespècie al Parc Nacional de la Serra de Guadarrama. Hem trobat paràsits en el 97% de les mostres i hem identificat un total d'11 taxons d'helmints. El gènere més abundant en les anàlisis ha estat *Muellerius*. En qualsevol cas, en general la salut de la població sembla bona, per la qual cosa les càrregues parasitàries detectades no influeixen aparentment de manera determinant en l'estat de salut de la població.

Paraules clau: Cabra salvatge, Paràsits, Parc Nacional, Mostra fecal

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Introduction

Parasitic infections in Iberian ibex are many and serious, and they are widely documented. This is borne out in the approximately 100 micro- and macroparasites described in data relating to the living populations in Spain (Pérez et al., 2006). Abomasal (*Ostertagia* spp. and *Haemonchus* spp.), intestinal (*Nematodirus* spp., *Moniezia* spp., *Eimeria* spp.), hepatic (*Fasciola hepatica* and *Dicrocoelium* spp.) (Pérez et al., 2006; Alasaad et al., 2008) and pulmonary parasites (*Protostrongylidae* sp., *Dictyocaulus* spp.) (Acevedo & Cassinello, 2009; Alasaad et al., 2009) are frequently detected in the individuals analyzed.

Most studies on the species, however, correspond to the subspecies *Capra pyrenaica hispanica* (Cabrera, 1914), with very few works being related to subspecies *C. p. victoriae* (Cabrera, 1914) in the central peninsula (Moreno Casero et al., 2007; Ramajo Martin et al., 2007; Barba, 2015). This work aims to characterize the pulmonary and digestive nematode fauna of *C. p. victoriae* in central Spain.

Material and methods

In 2014, we collected 40 faecal samples of an Iberian ibex population in the National Park of Sierra de Guadarrama. Collection of faecal samples is a common technique to analyze the parasite load (Pfukenyi et al., 2007; Painer et al., 2011). This analysis limits the collection of parasites to particular groups (related to the digestive tract) and generally, to certain phases (eggs or larvae) that use the digestive system as a means of dispersion of infective forms. However, the collection of samples is easier and avoids the need to capture the individual (Marreros et al., 2012).

For the sampling collection, we followed a group of Iberian ibex and immediately collected defecation from the soil (Willisch & Neuhaus, 2009). All samples were collected in autumn, when the parasite prevalence is highest (Pérez, 2001), and bagged and labelled. Faecal samples were collected in the morning, stored at temperatures < 20°C, and analyzed the same day (Painer et al., 2011).

We used Ritchie's biphasic concentration method to locate the parasites in the faeces (Allen & Ridley, 1970). This standard technique, according to Kaufmann (1996), is useful for the later microscopic analysis of trematode and nematode eggs (Luzón et al., 2008). It uses 10% formalin and ethyl ether to remove the organic matter of parasitic elements (Beltrán et al., 2003) by performing successive centrifugations (Barba, 2015). This procedure allows treatment of a considerable faeces mass, facilitating the identification of rare parasitic elements or parasites whose distribution is irregular in the faecal mass (Gibbons et al., 2009; Hendrix & Robinson, 2011). We examined 3 g of faeces (5 ml) from each sample to morphologically identify the parasites to genus level with the aid of an ocular micrometer at 40x and 100x magnification (Marreros et al., 2012). This morphological identification was performed using the keys proposed by Soulsby (1986), Kaufmann (1996), Van Wyk et al. (2004) and Gibbons et al. (2009).

Due to the morphological similarity of the eggs of *Nematodirus* and *Marshallagia* spp., we were unable to distinguish between them using the diagnostic methods applied in this study. Similarly, strongylid eggs other than *Nematodirus*/*Marshallagia* spp. were not further differentiated and should also be considered as "gastrointestinal strongylids" (Marreros et al., 2012).

Results

We detected parasitic species in all but two samples. In total, we identified 11 helminth taxa (one trematode and 10 nematodes). The most abundant genus in the analysis was *Muellerius* sp., detected in 25 of the 40 samples analyzed (66%) (table 1).

Helminths were detected in 97% of samples. Besides the genus *Muellerius* sp., the genera *Skrjabinema* sp. (42.11%) and *Nematodirus*/*Marshallagia* (23.68%) were also abundant as gastrointestinal strongylids (18.42%). The other genera detected were *Bunostomum* sp., *Teladorsagia* sp., *Trichuris* sp., *Cooperia* sp. and *Ostertagia* sp. Among bronchopulmonary nematoda, and beside *Muellerius* sp., the presence of the genus *Dictyocaulus* sp. (7.89%) was of note (table 1). We also found eggs of *Ascaris* sp. The fact that no species of this genus have been previously detected in this host suggests this is a spurious parasite, possibly explained by the goats' direct ingestion of eggs and its subsequent expulsion in faeces. *Cestodes* were not detected in the analyzed samples and only one trematode, *Dicrocoelium* sp. (prevalence 2.6%) was identified (table 1).

Table 1. Parasites detected in Iberian ibex. The table shows taxa and prevalence (P) obtained (number of eggs or larvae/total sample) (x100)

Tabla 1. Parásitos detectados en la cabra montés ibérica. La tabla muestra la prevalencia (P) obtenida (número de huevos o larvas/muestra completa) (x100).

| Taxa | P(%) | Taxa | P(%) |
|-------------------------|-------|--|-------|
| <i>Dicrocoelium</i> sp. | 2.63 | <i>Nematodirus</i> / <i>Marshallagia</i> sp. | 23.68 |
| <i>Cooperia</i> sp. | 2.63 | <i>Skrjabinema</i> sp. | 42.11 |
| <i>Ostertagia</i> sp. | 8.5 | Gastrointestinal <i>Strongyloides</i> | 18.42 |
| <i>Dictyocaulus</i> sp. | 7.89 | <i>Teladorsagia</i> sp. | 10.53 |
| <i>Muellerius</i> sp. | 65.79 | <i>Trichuris</i> sp. | 2.63 |
| <i>Bunostomum</i> sp. | 2.1 | | |

Discussion

Several studies have analyzed parasites in an Iberian ibex population (*Capra pyrenaica victoriae*) in the central Iberian peninsula, particularly the work developed by Ramajo Martin et al. (2007) in Salamanca (west central Spain), Moreno Casero et al. (2007) in Extremadura, and Barba (2015) in Sierra de Guadarrama. The total number of genera in our study was similar to these previous works despite the scarce number of samples analyzed and we detected two genera not previously mentioned for the subspecies. However, we did not detect cestodes, as occurred in two of the other studies where they showed a high prevalence (Moreno Casero et al., 2007; Ramajo Martin et al., 2007). These differences may be explained by the fact that these two studies were based on the detection of adults through the analysis of tissues (mainly muscle), while our methodology focused on the coprological analysis of samples (Luzón et al., 2008). Although sedimentation is the best method to detect eggs, most cestodes release the eggs in gravid proglottids, so they are very difficult to detect using traditional coprological techniques (Garijo et al., 2005).

The number of infected individuals in our study, however, was high, with 97% of individuals showing at least one parasite compared to other studies where the maximum percentage reached 72%. The techniques used for the concentration of parasites in the samples may have influenced this difference: we used Ritchie's biphasic concentration method while Ramajo Martin et al. (2007) used zinc sulfate flotation methods and the Parfitt method (1958). Our values are even higher than the 92% of individuals detected in the study of Moreno Casero et al. (2007), possibly indicating a greater degree of parasitosis in the population in the Sierra de Guadarrama.

Trematoda was limited to 3% of specimens. This value is higher than that detected in the Andalusian population but lower than the data obtained in previous works in this subspecies (Moreno Casero et al., 2007).

Muellerius sp. (Muller, 1889) was the most abundant genus detected in our study. This genus was also abundant in populations of *C. p. hispanica* (Pérez, 2001) and *C. p. victoriae* (Moreno Casero et al., 2007) in central Spain and in other species of the genus *Capra* (Marrerros et al., 2012), but it has not been detected in the northern *C. p. victoriae* populations (McCraw & Menzies, 1986).

It is the first time that the presence of genera *Cooperia* and *Dyctiocaulus* is cited for populations of *C. p. victoriae*. *Dyctiocaulus* has been described for the subspecies *C. p. hispanica* (Pérez et al., 2001) and other species of the genus *Capra* (Marrerros et al., 2012) and the genus *Cooperia*, usual in domestic goats, has not been previously described for wild species. On the other hand, we did not detect other genus detected in other studies, such as *Haemonchus*, *Trichostrongylus*, *Oesophagostomum* (Moreno Casero et al., 2007).

Overall, Nematoda were more abundant in populations of *C. p. hispanica* than in *C. p. victoriae*. However, the diversity of species was greater in *C. p. victoriae* than in the *C. p. hispanica* subspecies.

Our findings add to the knowledge on intestinal and pulmonar parasites of *Capra pyrenaica victoriae* and show that although there are qualitative and quantitative differences between Iberian ibex subspecies, these do not seem particularly relevant.

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