Sarcocystis spp. in chamois (*Rupicapra pyrenaica*)

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INTRODUCTION

Sarcocystis sp. (phylum Apicomplexa) is an intracellular worldwide-distributed protozoan that causes muscle parasitization [1]. The Pyrenean chamois (*Rupicapra pyrenaica)* is an ungulate belonging to the Family Bovidae that inhabits high south-western Europe mountains (Figure 1) [2]. Little is known about this parasite in wildlife of the Iberian Peninsula, and this is the first study in Pyrenean chamois. Our objectives were:

- To determine the prevalence of *Sarcocystis* spp. in the Pyrenean chamois.
- To explore different risk factors for *Sarcocystis* infection.
- To seek the tissue distribution and possible cases of aberrant migrations of the parasite and describe the lesions that it can cause, mainly in the central nervous system (CNS).
- To determine the epidemiological role of the Pyrenean chamois (*Rupicapra pyrenaica*) in the *Sarcocystis* sp. cycle in the alpine ecosystem of the Northeastern Iberian Peninsula.

Figure 1. A Pyrenean chamois *(R. pyrenaica)* .

MATERIALS AND METHODS

Sarcocystis prevalence was estimated by histological analysis of myocardium and skeletal muscles from 33 Pyrenean chamois submitted within the passive surveillance programme in the National Hunting Reserves (NHR) of the Catalan Pyrenees (Figure 2). Risk factors (sex, age, geographic area, coinfection with Pestivirus) and type of sample of *Sarcocystis* infection were analyzed. Also, a screening observation for other tissues, including the brain, was carried out, in search of parasitic cysts and possible lesions. Pearson's Chi-squared test with Yates' continuity correction and generalized linear model was used to analyze the different risk factors. Statistical significance was accepted at *p*-value<0.05.

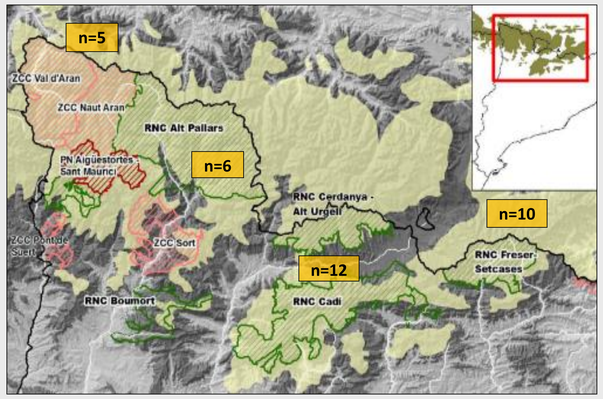

Figure 2. Number of animals analysed from *Val d'Aran, Alt Pallars, Cadí and Freser-Setcases* National Hunting Reserves (NHR), Catalan Pyrenees.

RESULTS

The overall prevalence of *Sarcocystis* infection was 69.90 %. Differences were present among prevalences between different muscle samples (Table 1). Statistically significant differences in intensity of infection were observed among age (Table 2) and geographic area (Table 3). No correlation was found between Pestivirus and *Sarcocystis* infected animals.

Table 1. Overall and muscular tissue's prevalence of *Sarcocystis* spp. in the Pyrenean chamois..

	Overall	Cardiac muscle	Skeletal muscle
Animals (n)	33	32	25
Prevalence (%) (95% CI)	69.70 (54.02 - 85.38)	65.62 (49.17 - 82.08)	56 (36.54 - 75.46)

Table 2. *Sarcocystis* spp. parasitized Pyrenean chamois animals by age. Intensity of infection was also calculated, measured as the cyst number range per cm^2 of muscular tissue sample (myocardium and skeletal muscle) and the (median).

Age (years range)	Animals (n)	Parasitized	Intensity of infection
0-1	1	0	0
1-2	2	0	0
2-3	1	0	0
3-4	1	1	5 (5)
4-5	4	3	0 - 3 (1.75)
5-6	2	2	0.5 - 5.5 (3)
>6	18	15	0 - 5 (2)

Table 3. *Sarcocystis* spp. parasitized Pyrenean chamois animals and intensity of infection (cyst number range and median) for Catalan Pyrenean NHR.

	NHR Freser-Setcases	NHR Cadí	NHR Val d'Aran	NHR Alt Pallars
Animals (n)	10	12	5	6
Parasitized	5	8	4	6
Intensity of infection	0 – 3.5 (0.25)	0 - 5 (2)	0 – 4.5 (2)	1 – 5.5 (2.5)

Sarcocystis is not generally pathogenic for the chamois when infects muscle. However, five clinical cases of sarcocystosis, in which the protozoa is colonizing other tissues and causing histological lesions, mainly the CNS, but also the skin, were described (Figure 3). A non-suppurative meningoencephalitis with gliosis and malacia areas associated to the presence of the protozoan cysts were observed in four out of five cases. In addition, one animal presented a granulomatous dermatitis, due to the suspected *Sarcocystis* sp. dermis migration. Four out of five cases were positive to RT-PCR for Pestivirus.

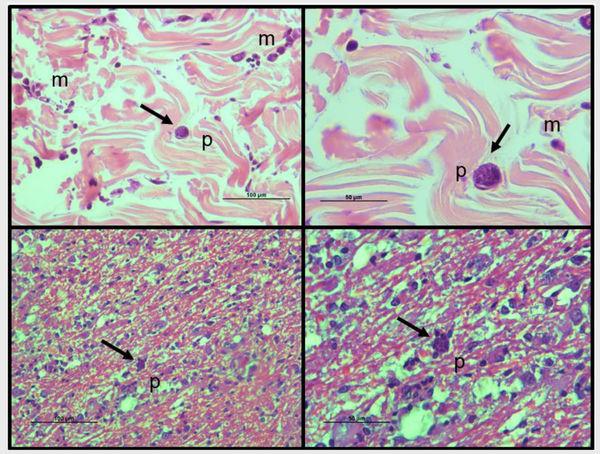

Figure 3. Sarcocystis sp. lesions caused by colonization of the skin and the brain. In the dermis (A), the parasite (p, arrow) causes a diffuse granulomatous dermatitis and a few macrophages (m) can be observed. In section (B) the Sarcocystis sp. cyst within a mononuclear cells can be seen in more detail. In the brain (C), the protozoa cause a non-suppurative meningoencephalitis. Gliosis and malacia can be observed. The parasite can be observed in more detail in the brain in section (D).

CONCLUSIONS

High prevalence of *Sarcocystis* spp. has been found in the Pyrenean chamois (*Rupicapra pyrenaica*) from South-Eastern Pyrenees. The age and geographic area have demonstrated to be risk factors for the infection. *Sarcocystis spp.* is generally non-pathogenic for the Pyrenean chamois, except in case of a small group of mainly Pestivirotic animals in which nervous system affection was described. The high infection detected indicates a high and widely distributed presence of the parasite in the Alpine ecosystem of the Pyrenees, and assesses the significant epidemiological role of this alpine ruminant as IH.

REFERENCES

[1] Dubey J.P, Calero-Bernal R, Rosenthal BM, Speer C.A, Fayer R. 2016. Sarcocystosis of Animals and Humans. *2nd edition CRC Press, Boca Raton*, 21-393.

[2] Corlatti L, Lorenzini R, Lovari S. 2011. The conservation of the chamois *Rupicapra* spp. *Mammal Review*, 41:163–74.