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4 **First report of oestrosis in aoudad from southeastern Spain**

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19 **Abstract.** In spring of 2016, we have analyzed the skull of 44 aoudads (*Ammotragus lervia*)
20 from the Sierra Espuña Regional Park (SE Spain) for the presence of oestrid larvae. *Oestrus*
21 *ovis* larvae were found in the 27,3 % of sampled hosts, with a mean intensity of 1.5 ± 6.1
22 larvae/per parasitized host (range 1-21). To our knowledge, this is the first report of oestrosis
23 affecting this host species.

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25 **Key words:** *Ammotragus lervia*, *Oestrus ovis*, Epidemiology, Sierra Espuña Regional Park,
26 Spain

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28 The sheep bot fly, *Oestrus ovis*, is an obligate parasite that is found in the nasal cavities and
29 frontal sinuses of domestic and wild ruminants worldwide (Zumpt 1965; Colwell et al. 2006).
30 Clinical signs depend on the infected area and the intensity of parasitation (e.g, the number of
31 larvae involved) and lead to respiratory problems including nasal discharge, sneezing, dyspnea
32 and even false gid, with high mortality rates when larvae migrate into the host's brain (Mozaffar
33 et al. (2013). In bighorn sheep (*Ovis canadensis*), chronic sinusitis originating from a bacterial
34 infection has been associated with oestrosis (Allen and Bunch, 1982). *Oestrus ovis* is also one of
35 the main Diptera species that cause human ophthalmomyiasis (see Panadero-Fontán and Otranto
36 (2015) for a review).

37 The epidemiology of oestrosis in domestic hosts has been studied in a number of
38 locations in Spain (Alcaide et al. 2003; Alcaide et al. 2005; Gracia et al. 2006; Paredes-Esquível
39 et al. 2009), and values for overall prevalence and mean intensity of parasitation reported in
40 these studies are given in Table 1.

41 The main goals of our study were (i) to characterize the prevalence and intensity of
42 oestrosis in aoudad (*Ammotragus lervia*) from Sierra Espuña Regional Park (SE Spain) and (ii)
43 to identify the oestrid species involved.

44 This study was carried out in the Sierra Espuña Regional Park (SERP), Murcia, SE
45 Spain (2°4'–2°14' N, 37°47'–37°57' W; 17,800 ha) (Fig. 1), a protected mountain area that
46 forms part of the Betic Mountain Ranges. Its topography is complex, with steep slopes above
47 1500 m, and its vegetation is dominated by dry-to-sub-humid meso-Mediterranean plant
48 communities. Aoudads (*Ammotragus lervia*) was introduced into SERP in 1970 when 35
49 animals from various African and European zoos were released. Subsequently, aoudads from
50 SERP have been introduced into the Canary Islands. The range of this species is currently
51 expanding in the Iberian Peninsula (Casinello et al., 2004). Nevertheless, this wild ruminant is
52 classified as “vulnerable” in its native range in North Africa (Casinello et al., 2008).

53 There are few available studies of the parasitofauna of the aoudad from this location
54 centre on sarcoptic mange (González et al. 2004) and gastrointestinal nematodes (Mayo et al.
55 2013), and, to the best of our knowledge, oestrosis has not been studied anywhere in this
56 protected area.

57 Taking advantage of a culling program carried out in the park, between March and May
58 2016, we obtained the head of 10 males and 34 female aoudads. They were kept in closed bags
59 at -20°C until necropsy, which was conducted according to the procedures described by Pérez et
60 al. (1996) (Fig. 2). The age of aoudads was determined by horns size, the number of horn
61 segments (when possible) and teeth replacement (Gray and Simpson 1985; Sáenz de Buruaga, et
62 al. 1991). Collected larvae were identified morphologically following the descriptions given by
63 Zumpt (1965), Wetzel and Bauristhene (1970) and Howard (1980). The prevalence and intensity
64 of parasitization were estimated following Bush et al. (1997). We also estimated the 95 %
65 confidence interval associated to the prevalence. We used non-parametric tests to compare
66 prevalence and intensity of parasitization in different host sex and age classes.

67 Twelve animals harboured oestrid larvae, thereby giving a prevalence of 27.3% (95%
68 CI: 14.0% - 40.0%). Four first-instar, 28 second-instar and 20 third-instar larvae were collected,

69 and all were identified as *Oestrus ovis* (Fig. 3). The mean intensity of parasitization was $1.5 \pm$
70 6.1 larvae/per parasitized host (range 1 - 21).

71 Prevalence was higher in females (30.3%) than in males (18.2%) and increased with
72 host age, although these differences were not significant ($p = 0.698$ and $p = 0.081$, for a χ^2 test
73 and Fisher's test, respectively). Males hosted more larvae than females (6.0 ± 7.1 and 1.5 ± 6.3 ,
74 respectively), but these values were like not significant (Kruskal-Wallis test, $p = 0.550$). Most of
75 the larvae (65.4%) were found within the horns sinuses but were also present in the maxilar
76 sinus (13.5%); the olfactory area (9.6%), and the frontal rostral and post-orbital sinuses (5.7%).

77 During the study period, the monthly number of first-instar larvae increased but the
78 number of third-instar larvae decreased. This suggests that during these months (March - May)
79 adult flies are active and that pupation is taking place in the substrate after mature L3 leave their
80 hosts.

81 This low prevalence value is remarkable if compared with those reported for domestic
82 sheep and goats (Table 1) and other wild host species in the Iberian Peninsula, such as the
83 Iberian ibex (*Capra pyrenaica*) 74% (Pérez et al., 1996) and the European mouflon (*Ovis*
84 *gmelini musimon*) 47% (Moreno et al., 1999). This could in part be due to the daily activity
85 periods of the aoudads, which are more active at dawn and in the late afternoon, which
86 presumably allows them to avoid contact with active adult flies (San Miguel et al., 2010), It has
87 also been suggested that aoudads are resistant to parasites (Pence, 1980).

88 To the best of our knowledge, this is the first report of oestrosis in this host species.
89 Further studies on the micro- and macroparasites affecting aoudad are still needed if we are to
90 fully understand (and so eventually mitigate and prevent) the impact of this exotic ungulate on
91 the health status of native and/or resident (both wild and domestic) fauna.

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155 **Legends**

156 **Figure 1.** a Location of the Sierra Espuña Regional Park in SE Iberian Peninsula. b Locations
157 (within the Sierra Espuña Regional Park) where aoudads were harvested.

158 **Figure 2.** Mid-sagittal cut of an aoudad skull, exposing olfactory area and frontal sinuses.

159 **Figure 3.** Dorsal view of a third-instar *Oestrus ovis* larva collected from *Ammotragus lervia*.