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Short communication

The influence of sheep age group on the seasonal prevalence of oestrosis in the island of Majorca

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ABSTRACT

Oestrosis is highly prevalent in Mediterranean countries. Understanding the life cycle of *Oestrus ovis* is crucial to design effective control measures of this myiasis, largely based on the use of macrocyclic lactones. We carried out a survey of ovine oestrosis in the island of Majorca (Spain) and found that 46.03% of animals were infested in a 13-month period. Interestingly, we found significant differences in oestrosis prevalences in winter and autumn when separating the animals by group of age ($P < 0.001$). Pearson correlation analysis showed that prevalence in lambs younger than 4 months was significantly affected by changes in air temperature ($P < 0.05$), but this association was not significant in adult sheep ($P = 0.081$). Chronic infestations or unsystematic treatments may explain confusing results in adult sheep. Observing the evolution of the disease in young lambs, we determined that the hypobiotic period took place from October to February and the beginning of fly activity occurred between May and June. Interannual variations in oestrosis prevalence indicate the need of monitoring the disease to establish the appropriate timing of treatments. We hypothesize that lambs are better indicators of the seasonality of oestrosis than their older counterparts. Furthermore, we propose that observing *O. ovis* infestations in young lambs can be used as an efficient early warning system of fly activity, to be applied in future control programs.

1. Introduction

During *Oestrus ovis* life span, female flies deposit up to 500 larvae into the nostrils or eyes of their hosts, typically domestic ruminants. Under optimal conditions, larval development inside the host lasts 25–35 days (Colwell et al., 2006). However, during colder months parasites reduce their metabolism, remaining quiescent in the host in a hypobiotic or diapause stage for up to 9 months (Hall and Wall, 1995). In areas where *O. ovis* undergoes hypobiosis, large scale systematic treatments in late autumn or winter are considered efficient to control the disease (Jacquiet and Dorchies, 2002).

A thorough knowledge of *O. ovis* epidemiology and life cycle is crucial to design efficient control strategies. However, the conflicting results reported on the number of generations in Mediterranean countries (Tabouret et al., 2001) made it difficult to design effective control measures. Most surveys of ovine oestrosis have been carried out in adult goats and sheep (Arslan et al., 2009; Dorchies et al., 2000; Yilma and Dorchies, 1991), or lambs older than 6 months (Scala et al., 2001). In the present study, we studied the prevalence of *O. ovis* infestation in sheep and lambs and

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found differences that may provide us with important clues to understand the biology of *O. ovis* in a Mediterranean environment.

2. Materials and methods

From January 2009 to January 2010, a longitudinal study of ovine oestrosis was conducted in the main slaughter house of the island of Majorca (where approximately 50% of commercialized sheep are killed). Majorca is the capital and also the largest island of the Balearic archipelago, which is located to the north-west of the Mediterranean sea at a longitude of 2°39′03″E and a latitude 39°34′14″N. Weather is typical of a Mediterranean region, with temperate climate and a mean annual rainfall of 450 l/m^2. Mean monthly temperature values were obtained from the website of the Agroclimatic Information System of Spain (SIAR, according to their initials in Spanish).

We examined animals that arrived to the island's main slaughter house from 95 farms, located in 33 localities. Two groups of animals were selected, based on their age: sheep (older than 1 year) and lambs (younger than 4 months). Age in adult specimens was confirmed by the appearance of permanent dentition; whereas information regarding age of lambs was obtained from information provided by farmers. Animals were examined at weekly or monthly intervals, depending on availability. All animals studied had been grazed on pastures from extensive farms. Heads were cut off each carcass and then incised sagittaly for examination of nasal cavities. Then, the different parts of the nasal structure were carefully removed and further dissection and examination was carried out in sinuses and turbinates (Yilma and Dorchies, 1991). When *O. ovis* specimens were found, these were transferred to plastic flasks containing 70% alcohol and transported to the laboratory for identification purposes. Species identification required the use of morphological keys by Zumpt (1965). The larval stage of the specimens was also recorded according descriptions by Cepeda-Palacios et al. (1999).

Prevalence of oestrosis was calculated monthly as the number of animals positive to the infestation divided by the total number of specimens examined. Monthly larval burden was calculated as a percentage of each parasitic stage (L1, L2 and L3) from the total parasitic load in infested sheep. Prevalence of infestation in sheep and lambs was compared using the *chi square* test. The strength of the linear relationship between the monthly temperature and the prevalence of the two species was estimated with the Pearson correlation coefficient, that shows in a range of −1 to 1 (being 0 no correlated and −1 inversely correlated) the goodness of the correlation at a level of significance (P).

3. Results and discussion

The total oestrosis prevalence in 190 sheep and 364 lambs, examined from January 2009 to January 2010, was 46.03%. Chi-square tests showed no significant differences ($P > 0.05$) in overall prevalence values in sheep (51.58%) and lambs (43.13%). Nevertheless, we found that young animals were more susceptible to the infestation by L1 parasitic stage (82.28%) than sheep (67.90%) and that mean intensity of infestation was higher in lambs (11.46 larvae/head) than in sheep (10.2 larvae/head). These results were not surprising considering that first stage larvae are the main target of the sheep immune system (Bart and Minar, 1992). According to Marchenko and Marchenko (1989), adult sheep acquire an immune response to *O. ovis* larvae, through repetitive infestations, whereas lambs remain more susceptible. We observed other important differences in the epidemiology of the disease between these groups. The beginning of the flight-larviposition activity of *O. ovis* occurred between May and June 2009, when temperatures rose from 19.57 °C to 23.57 °C. This was characterized by a dramatic increase in prevalence values in lambs (from 15.4% to 94.7%). Prevalence remained high until December forming a plateau in the curve of prevalence (Fig. 1). These values decreased in January 2010, when only 15% of the lambs examined were positive to the infestation. In the case of sheep, there was also an increase of infestation rates in June, but the curve of prevalence showed several peaks of infestation (Fig. 1) that are not consistent with an uninterrupted flying season. According to Cepeda-Palacios and Scholl (2000), fly activity in *O. ovis* only occurs when temperatures exceed 20 °C. This explains the low infestation rates found in lambs (<10%) from January to May, when temperatures were below 20 °C (Fig. 1). On the other hand, infestation rates in sheep were higher than 50%, even when mean temperatures were around 10 °C in winter (Table S1). Chi-square tests showed significant differences among infestations rates in sheep and lambs in winter ($\chi^2 = 69.93$, $P < 0.001$, $df = 1$), and autumn months ($\chi^2 = 18.65$, $P < 0.001$, $df = 1$). It is possible that prevalence of oestrosis in adult sheep were altered by infestations acquired during previous months or by the antiparasitic treatments applied by the owners, a situation unlikely for young lambs, only few months old. The Pearson correlation showed a strong association between temperature values and infestation rates in lambs ($r = 0.677$, $P < 0.05$), during the entire study period. In contrast, this coefficient was low in adult sheep, showing poor association between temperatures and prevalence values ($r = 0.548$, $P = 0.081$) (Fig. 1).

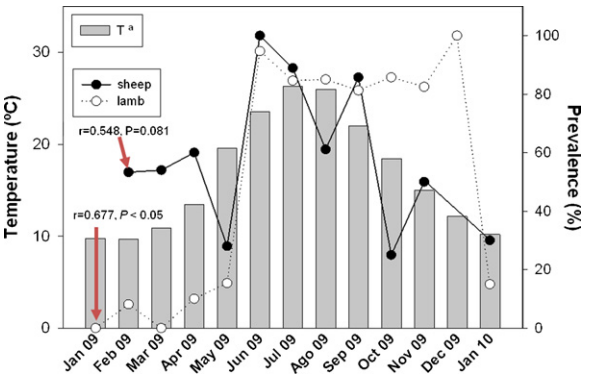

Fig. 1. Monthly oestrosis prevalence in sheep and lambs, with relation to temperature values throughout the study period, in Majorca. Pearson correlation coefficient is symbolized by "*r*". From January to May, temperatures recorded were below 20 °C.