KINETICS OF *OESTRUS OVIS* INFECTION AND ACTIVITY OF ADULT FLIES

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Summary:

Oestrus Ovis is a common sheep parasite in the Mediterranean region. This study was carried out in the Ebro River Valley near Zaragoza (northeast Spain) using tracer animals to describe the seasons when infestation is more likely. Based on that information and an analysis of the evolution of the parasite within the host, we suggest the most appropriate time for treatment. Adult instars appeared in May until November and there was a diapause beginning in October-November and as least until February, so it is suggested than sheep be treated with larvicide in December.

KEY WORDS : *Oestrus ovis*, sheep, epidemiology, prevalence, Spain.

Résumé : CINÉTIQUE DE L'INFECTION PAR *OESTRUS OVIS* ET ACTIVITÉ DES MOUCHES ADULTES

Oestrus ovis *est un parasite commun des moutons dans la zone méditerranéenne. Cette étude a été effectuée dans la vallée de l'Ebre près de Saragosse (nord-est de l'Espagne) employant des animaux traceurs pour determiner les saisons où l'infestation est la plus probable. Basé sur cette information et une analyse de l'évolution du parasite chez l'hôte, nous suggérons le moment le plus approprié pour le traitement. Les adultes apparaissent de mai à novembre, la diapause commençe en octobre-novembre et dure au moins jusqu'à février; ainsi, on peut suggérer que les moutons soient traités en décembre.*

MOTS CLÉS : Oestrus ovis, *mouton, épidémiologie, prévalence, Espagne.*

Oestrus ovis Linnaeus 1761 is a widely distributed sheep parasite that brings about weight loss and decreases milk production (Ilchmann *et al.*, 1986). It causes zoonosis, leading to ocular myiasis (Pampiglione *et al.*, 1997) and may complete development in humans (Lucientes *et al.*, 1997). Although it has been recognized as an important problem in our latitudes, there is a lack of information about the epidemiology of parasite development.

The goal of this study was to describe, using tracer animals, the infestation of sheep by *O. ovis* during one year to determine the risk periods and the evolution of the parasite in the host. This information can then be used to suggest the most appropriate time for treatment.

MATERIALS AND METHODS

The trial was carried in Zaragoza (northeastern Spain). We used 40 sheep that were approximately three months old at the beginning of the experiment and had been kept indoors up until then. Starting in April 1992, one group of 20 animals (the permanent group) was sent to pasture until February 1993. Every four weeks, two animals were taken from pasture and housed indoors for 14 days. After this time were slaughtered and the parasite population was analyzed.

At the same time, two lambs with similar characteristics to the previous ones (i.e., three months old and without previous contact with parasites) were sent to pasture every four weeks and then removed four weeks later and slaughtered using the same procedure as above. They were considered as control animals. Once the animals were slaughtered, the heads were cut longitudinally and the location of all larvae was described. The head was divided into two zones in terms of ventilation and according to where the L1 and L2 molts occur. All the larvae were identified as either first, second or third instar, based on the identification keys in Zumpt (1965).

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RESULTS

The mean monthly larval burdens, the percentages of first, second and third instars and the localization of larvae of *Oestrus ovis* in the head cavities of sheep in both groups (permanent and control) are reported in Table I.

Among the permanent group, 14 animals (70 %) were infected with O. *ovis* larvae. The average number of larvae per positive animal was 15.8. The maximum number of larva found in one animal was 34 larvae in

	Permanent group										Control group										
					% Zone I			% Zone II							% Zone I			% Zone II			
Month	**Mean**	**% L_1**	**% L_2**	**% L_3**	**% L_1**	**% L_2**	**% L_3**	**% L_1**	**% L_2**	**% L_3**	**Mean**	**% L_1**	**% L_2**	**% L_3**	**% L_1**	**% L_2**	**% L_3**	**% L_1**	**% L_2**	**% L_3**
May	0	0	0	0	0			0			0	0	0	0	0			0		
					0	0	0	0	0	0					0	0	0	0	0	0
Jun	9.5	31.6	68.4	0	31.6			68.4			0.5	100	0	0	100			0		
					100	0	0	0	100	0					100	0	0	0	0	0
July	2	0	100	0	50			50			22	36.4	47.7	15.9	45.5			54.5		
					0	100	0	0	100	0					80	10	10	0	79.2	20.8
Aug	0	0	0	0	0			0			2.5	0	20	80	0			100		
					0	0	0	0	0	0					0	0	0	0	20	80
Sep	14.5	55.2	34.5	10.3	58.6			41.4			14.5	34.5	51.7	13.8	48.3			51.7		
					94.1	0	5.9	0	83.3	16.7					71.4	28.6	0	0	73.3	26.7
Oct	12.5	92	8	0	96			4			4	87.5	0	12.5	100			0		
					91.7	8.3	0	100	0	0					87.5	0	12.5	0	0	0
Nov	11	90.9	9.1	0	95.5			4.5			9	100	0	0	100			0		
					95.2	4.8	0	0	100	0					100	0	0	0	0	0
Dec	29	89.6	10.4	0	91.4			8.6			3	100	0	0	100			0		
					96.2	3.8	0	20	80	0					100	0	0	0	0	0
Jan	13	73.1	26.9	0	100			0			0	0	0	0	0			0		
					73.1	26.9	0	0	0	0					0	0	0	0	0	0
Feb	19.5	87.2	12.8	0	87.2			12.8			0	0	0	0	0	0		0		
					97	3	0	20	80	0					0	0	0	0	0	0

Table I. – Monthly *Oestrus ovis* larvae of permanent and control sheeps.

December. The average annual infestation (including negative animals) was 11.1 larvae, distributed as 8.5 L1, 2.45 L2 and 0.15 L3.

In the control group, 10 animals (50 %) had *O. ovis* larvae. The average number of larvae per positive animal was 11.1, and the maximum number in one animal was 41, in July. The average annual infestation (including negative animals) was 5.5 larvae per month, distributed as 2.9 L1, 1.8 L2 and 0.8 L3.

DISCUSSION

According to our results, the first generation of flies could appear in May, and probably, the numbers are still not very high. As the season progressed, the temperature was warmer and the adult flies were abundant, the conditions were good and the instars developed quickly. The controls slaughtered in July had more parasites and the proportions of the different larval populations were more similar and located in both zones.

In animals sacrificed in August, the low number of larvae in the controls and the absence of parasitized animals in the permanent group could indicate that there were few adults. This decrease in the adult stages in the warmer season has also been observed in southwestern France (Yilma & Dorchies, 1991) and Morocco (Pandey & Ouhelli, 1984). Temperature is the main factor determining the activity of *O. ovis* flies (Cepeda-Palacios & Scholl, 2000; Rogers & Knapp, 1973; Grunin, 1957). On the other hand, the lack of L1 larvae in controls would indicate that the conditions for development in the host were very favorable and that the endogenous cycle was developing very quickly. That is supported by the fact that the whole population in the control group was already found in Zone II, with L2 and L3 instars.

The conditions for the development of *O. ovis* are very favorable in September. The animals are parasitized and the cycle develops quickly in the host. Infection increased in both groups and there were more larvae in all three stages. The larvae were equally distributed in both Zones, with early instars predominating in the anterior zones and the later instars in the posterior zones. In the controls, the infestation pattern was identical to that obtained in animals in July.

In October there were adult flies. Nonetheless, the high percentage of L1 in both groups, located in the more anterior parts, could indicate that development was slowing down in an important proportion of the larvae. According to our results, it appeared that flies disappeared in November and then, the adult population was quite low.

In the permanent group, infestation was higher in December. There is evidence for an increase in the number of larvae as animals grow older, indicating that no protective immunity is developed (Abo-Shehada *et al*., 2000). The animals in the permanent group slaughtered in December had been outside since April, and got older as the trial continued.

From October to February, the environmental conditions were not very favorable for the development of *O. ovis* in the host. The larval population was mostly located in the anterior portions and mostly represented by L1 in both groups. During this period, the proportion of larvae remained fairly constant. According to Dorchies & Alzieu (1997), when the percentage representation of L1 is above 80 %, we can refer to a diapause in the instar. The proportion of L1 was above 80 % from October to February. According to the regional climate, larval retention is produced when it is cold or during the hot or dry season (Dorchies & Alzieu, 1997; Yilma & Dorchies, 1991). In this regard, in our area (northeastern Spain), diapause would occur starting in October-November and as least until February, in response to unfavorable climate conditions, especially a decrease in temperature. Unfortunately we lack of follow-up during March and April, as it is the moment when larvae develop again, but according to the Veterinary Services in the area, and depending on the temperatures, animals did not show symptoms of infestation from November to mid-March.

Regarding the diapause, the retained larva population in the control group was L1, but L1 and L2 in the permanent group. In our study the age and the possible exposure to the parasite were different in both groups, so the response to infestation could also be different. This arrest as L1 and L2 also appears in studies from France (Dorchies *et al*., 2000; Yilma & Dorchies, 1991). According to Tabouret *et al.* (2001), *O. ovis* begins to develop when the percentage of each of the three stages are similar. Dorchies & Alzieu (1997) indicate that *O. ovis* develops when the parasite population is 40-70 % L1, 10-40 % L2 and 10-30 % L3, very similar to those obtained in our study from June to September. Besides, during this period the larvae were equally distributed in both zones.

In conclusion, the results indicate that in our study area, there was a diapause beginning in October-November and as least until February and adult flies were present from May until November with a decrease in the hot season. Flight periods were very similar to those pointed out by Jacquiet & Dorchies (2002) for warm occidental areas of Europe, but lower than in Alcaide *et al.* (2003), in southwestern Spain. Under these conditions, larvicide treatment should be applied in winter (December) when there are no adult flies and the low temperatures are harmful for the pupas (*i.e.*, most *O. ovis* is in the host).

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