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# Occurrences of *Oestrus ovis* parasitism in necropsied sheep in the Umuarama microregion, Paraná, Brazil

Ocorrência de parasitismo por *Oestrus ovis* em ovinos necropsiados da microrregião de Umuarama - Paraná, Brasil

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## Abstract

Between January 2007 and September 2013, 71 sheep belonging to 12 farms in the Umuarama microregion, State of Paraná, were evaluated regarding presence of *Oestrus ovis* larvae, during necropsies. The farms from which these animals originated were visited and the owners and employees were interviewed. Occurrences of *O. ovis* parasitism in sheep were diagnosed for the first time on this microregion. Of the 71 animals, 12 (16.9%) were parasitized by *O. ovis*, with mean intensity of 2.25 larvae per infested head (1 to 8 larvae/infested head). There was a high correlation (0.81,  $p=0.0346$ ) between the number of larvae and the macroscopic lesions observed in these animals' nasal cavities, such that sheep with more than 3 larvae may contain mucopurulent secretions or epistaxis. From the interviews conducted, it was found that all the farm owners were applying chemical parasite control methods (helminths and/or *O. ovis*), administered to all animals in the herds every 30 days (91.6% of the producers), using derivatives of macrocyclic lactones and/or benzimidazoles/imidazothiazoles. Further studies need to be conducted in this particular region, in an attempt to elucidate the prevalence of *O. ovis* parasitism in herds.

**Keywords:** Cavitary myiasis, *Oestrus ovis*, sheep.

## Resumo

De janeiro de 2007 a setembro de 2013, foram avaliados, durante a necropsia, 71 ovinos pertencentes a 12 propriedades rurais da microrregião de Umuarama, Paraná, Brasil, quanto à presença de larvas de *Oestrus ovis*. Entre outubro e dezembro de 2013, as 12 propriedades de onde os animais eram provenientes foram visitadas, e os proprietários e funcionários foram entrevistados. A ocorrência do parasitismo por *O. ovis* em ovinos foi constatada pela primeira vez em propriedades rurais da microrregião de Umuarama, Estado do Paraná. Dos 71 animais, 12 (16,9%) estavam parasitados por *O. ovis*, com intensidade média de parasitismo de 2,25 larvas por cabeça infestada (1 a 8 larvas). Foi possível verificar correlação elevada (0,81,  $p=0,0346$ ) apenas entre o número de larvas *versus* lesões macroscópicas observadas na cavidade nasal desses animais, de modo que ovinos com mais de 3 larvas continham secreção mucopurulenta ou epístaxe na cavidade. Quando da entrevista constatou-se que todos os proprietários fazem controle químico contra parasitas (helmintos e/ou *O. ovis*) e esse controle é feito a cada 30 dias por 91,6% dos produtores, que utilizam derivados de lactonas macrocíclicas e/ou benzimidazóis/imidazotiazóis. Futuros estudos ainda precisam ser realizados nesta região, na tentativa de elucidar a prevalência de parasitismo por *O. ovis* nos rebanhos.

**Palavras-chave:** Miíase cavitária, *Oestrus ovis*, ovinos.

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## Introduction

Sheep meat is a production segment with consumer demand that is higher than what is offered in Brazil, thus leading to importation from other countries in order to fulfill internal needs (RISSI et al., 2010). In this regard, and considering the increasing challenge of producing sheep meat of sufficient quality and in quantities that meet market demands, some parasitic diseases take on major importance because of the losses that they cause to national production (MACIEL et al., 2014).

*Oestrus ovis* L. (Diptera: Oestridae) is a cosmopolitan parasite that is responsible for cavity myiasis. Its larvae are obligate parasites of the nasal cavities and paranasal sinuses, mainly in sheep and to a smaller extent in goats (ZUMPT, 1965). Depending on the degree of parasitism, infection by sheep bot flies can affect the productive performance of the affected animals, thereby resulting in significant economic losses (ALCAIDE et al., 2003). *O. ovis* females deposit their larvae in nostrils during the hotter periods of the day, which is a cause of stress in itself, due to the irritating action of the adult flies. Afterwards, the larvae use their hooks and spikes to quickly move towards the nasal and frontal conchae (YILMA & DORCHIES, 1991). This may damage the mucosa, thereby leading to inflammation and production of mucous exudates, which makes it difficult for animals to breathe and possibly opens the way to secondary infections (DORCHIES et al., 1998). The larval cycle of this parasite (L1 to L3) in the hosts can take up to nine months in countries with temperate weather (ALCAIDE et al., 2003). In Brazil, the larval cycle is around 30 days (SILVA et al., 2012a). It ends when larvae in L3 leave the nostrils and reach the pupal stages, from which adult flies emerge. At the field level, accumulated mucus and constant sneezing are the main clinical signs of infections caused by this parasite's larvae (ANGULO-VALADEZ et al., 2011).

Despite the severe damage that can be caused by these ectoparasites, few studies about their presence in sheep herds in Brazil are available in the literature. Thus, the present study aimed to a pilot test, describing occurrences of *O. ovis* parasitism in sheep on 12 farms located in the Umuarama micro region, State of Paraná, all of which were necropsied at Maringá State University between January 2007 and September 2013.

## Materials and Methods

The first stage of this study was conducted in the Animal Pathology Department (Veterinary Medicine School of Maringá State University, UEM, Umuarama campus: 23° 45' 51" S, 53° 19' 6" O; 430 meters altitude), located in the Northwest region of Paraná State, nearly 615 km away from the State's capital, Curitiba.

Between January 2007 and September 2013, 71 mixed breed sheep (wooled or not), originated on 12 rural properties from six different cities of the Umuarama micro region: Umuarama, Cruzeiro do Oeste, Tapejara, Mariluz, Douradina and Alto Piquiri, were analyzed.

All 71 animals selected for the present study were sent to Maringá State University in order to undergo necropsies for diagnosis of

each animal's *causa mortis*. At each animal's moment of arrival an individual identification file was created, containing the following information: age, sex, breed, time of year (rain or dry season) of the necropsy. As a standard procedure during necropsies, heads from all animals were split with the aid of an electric saw and inspected for presence of *O. ovis* larvae (L1 to L3). Total larvae burdens collected from each parasitized animal were registered and subsequently preserved in 10% formaldehyde for posterior identification, following criteria described by Zumpt (1965) and Guimarães & Papavero (1999).

On a second stage of the research, between October and December 2013, the aforementioned properties (12 farms which provided necropsied animals) were visited, where owners and employees were interviewed. These interviews aimed to obtain knowledge and understanding of parasite control practices applied since 2007, as well as sheep breeding systems, since characteristics of these aspects can influence on levels of *O. ovis* parasitism on herds.

Interviewed personnel were questioned about each farm's characteristics (size and breeding system), knowledge about helminth epidemiology, *Oestrus ovis*, as well as practices adopted for controlling these parasites, such as moment of product administration, frequency of herd treatments, selected antiparasitic products, administration route, if complementary methods were associated to treatment (counts of eggs per gram of feces or FAMACHA), number of treated animals and criteria adopted for substitution of antiparasitic drugs.

Interviews were descriptive, without inquiry or census aspects. These were analyzed by means of a quantitative-descriptive analysis system, which verified simple occurrence of each answer, followed by a percentage calculation (ROSA & ARNOLDI, 2006).

In the present study, all procedures using animals complied with the Ethical Principles in Animal Research adopted by the College of Animal Experimentation (COBEA), and were approved by the Ethical Committee for Animal Welfare (protocol number 007A2/2012).

Spearman's correlation analysis with a 5% significance level was conducted, in order to verify existence of linear correlation between some variables: age, breed, season, number of observed larvae, macroscopic lesions in nasal cavities, diagnosed *causa mortis*, chemical parasite control, moment of administration and interval between administrations. Interpretation of Spearman's coefficients ranges between -1 and 1, where 0.00 to 0.30 indicates low correlation, 0.31 to 0.69 means an average correlation, and above 0.70 signifies high correlation.

## Results

Between 2007 and September 2013, a total of 71 sheep were necropsied at the Pathology Department of Maringá State University, Umuarama campus. According to the owners, none of them presented any symptoms suggestive of *O. ovis* parasitism before dying, such as sneezing, head tilts, loud breathing, purulent nasal secretion or agglomeration of animals in the hottest periods of day, attempting to avoid adult flies. Therefore, there was no suspicion of sheep bot fly larvae infection in any of the animals that died and were later sent to be necropsied.

Among these 71 sheep, 12 (16.9%) were infected by larvae (L1 to L3) of *O. ovis*. A total of 27 larvae were recovered. One and eight were the number minimum and maximum of larvae recovered in one animal, respectively. The mean parasitism rate was 2.25 larvae per animal. These were located in the nasal cavities or frontal sinuses of the sheep. At the necropsies, purulent exudates were observed in the nasal cavities of three animals that presented three larvae each. Epistaxis and mucopurulent secretion were observed in one animal that had been parasitized by eight *O. ovis* larvae in the frontal sinuses. The other sheep that were infected by this ectoparasite did not present any noteworthy macroscopic changes during the necropsies (Table 1). Spearman's correlation analysis showed that high correlations could only be made between the macroscopic lesions observed in the nasal cavities and the number of larvae detected (correlation of 0.81,  $p=0.0346$ ), such that the animals with higher infection were those that presented macroscopic lesions. The correlation values obtained for the remaining variables were considered low (less than 0.12,  $p=0.6856$ ).

Among the 12 farms that sent animals to be necropsied at the university, only two did not have any sheep infected by *O. ovis* (Table 1). It is important to emphasize that no deaths occurred due to parasitism by *O. ovis*. In these specific cases, the causes of death most commonly diagnosed were *Haemonchus* parasitism and pneumonia. Only one death did not have a diagnosed cause (Table 1).

Regarding the interviews conducted on these farms, all twelve owners recognized that parasites cause losses to their herds, and some kind of treatment was applied in all cases. However, 75% (9) of them were only controlling helminth infections, while 16.6% (2) treated their animals for helminths and *O. ovis* simultaneously and 8.3% (1) treated them for helminths and sporadically for *O. ovis* (Table 2). It is important to emphasize that the animals parasitized by this parasite were diagnosed on farms on which control measures against helminths and *O. ovis* were applied simultaneously and on those with sporadic *O. ovis* control measures. Occurrences of signs suggestive of *O. ovis* infection in the herds (sneezing and/or

nasal exudates) were confirmed by 83.3% of the sheep farmers. In 16.6% of the cases, these signs were observed frequently, while none of the farm owners claimed that they never saw animals sneezing or presenting nasal secretions.

Amongst the chemical groups used for controlling these parasites over the past seven years, 83.3% of the farms used macrocyclic lactone derivatives, while six of them used benzimidazoles or imidazothiazoles. However, more than one answer was possible for this question: the owners that used benzimidazoles or imidazothiazoles constantly (every 30 or 60 days) rotated these active agents with macrocyclic lactones, following their own criteria. The most commonly used administration route selected was oral (83.3%), followed by subcutaneous (16.7%). Among the producers who used orally administered products, none of them implemented correct fasting procedures for the animals before or after administration of compounds (Table 2).

Regarding the decision on when to administer parasiticide medications, 91.6% (11) of all the producers claimed that they followed a self-made prophylactic calendar, with 30-day intervals between drug administrations. Only one of them (8.4%) waited for symptoms to appear in the sheep in order to start treatment, and this led to 50 or 60-day intervals between one application and the next. Furthermore, on 100% of the farms, all the animals in the herds were medicated at the same time (Table 2).

## Discussion

Occurrences of *Oestrus ovis* parasitism among sheep in the Umuarama microregion of the State of Paraná was confirmed based on the presence of parasites in the nasal cavities and/or frontal sinuses of the animals, observed during necropsy. Studies on this illness in Brazil were previously conducted in Bagé, State of Rio Grande do Sul, by Ribeiro et al. (1990), who analyzed 144 sheep heads over a one-year period. They observed parasitism in 85.4% of the cases and recovering 1639 larvae: 68.6% L1, 12.3% L2 and

**Table 1.** History of 12 sheep, which were necropsied and diagnosed with *Oestrus ovis* larvae, from the micro region of Umuarama/PR, Brazil.

Animal	Property	Year	Origin	Age (month)	Race	Season	Number of larvae (L1 to L3)	Location of larvae	Macroscopic observations in the nasal cavity	Cause of death
1232	3	2007	Umuarama	10	Crossbred	Rainy	2	frontal sinus	nothing	<i>Haemonchus</i>
23	2	2009	Umuarama	15	Crossbred	Dry	3	frontal sinus	pus	pneumonia
76	4	2010	Tapejara	10	Santa Inês	Dry	1	frontal sinus	nothing	<i>Haemonchus</i>
98	7	2010	Umuarama	24	Crossbred	Rainy	1	nasal cavity	nothing	<i>Haemonchus</i>
12	10	2010	Umuarama	>36	Crossbred	Rainy	1	frontal sinus	nothing	pneumonia
4	1	2011	Umuarama	3	Crossbred	Rainy	3	frontal sinus	nothing	<i>Haemonchus</i>
9	2	2011	Curzeiro do Oeste	>36	Crossbred	Dry	3	frontal sinus	nothing	pneumonia
10	9	2012	Alto Piquiri	4	Ile de France	Rainy	1	nasal cavity	nothing	<i>Haemonchus</i>
45	5	2012	Mariluz	28	Crossbred	Rainy	1	frontal sinus	nothing	<i>Haemonchus</i>
769	7	2013	Umuarama	12	Crossbred	Rainy	8	frontal sinus	epistaxis	<i>Haemonchus</i>
965	8	2013	Umuarama	8	Santa Inês	Dry	2	frontal sinus	nothing	<i>Haemonchus</i>
1023	11	2013	Umuarama	8	Ile de France	Rainy	1	nasal cavity	nothing	not determined

**Table 2.** Characterization of the 12 farms who sent animals to be necropsied at the State University of Maringá, in the micro region Umuarama/PR, Brazil.

Information	Answer			
System	Intensive	Semi-intensive	Extensive	More than one system
	0	0	0	12 (100.0%)
Chemical control of parasites	Only against helminths	Only against <i>Oestrus ovis</i>	Against helminths and <i>Oestrus ovis</i> simultaneously	Against helminths and sporadically against <i>Oestrus ovis</i>
	9 (75.0%)	0	2 (16.6%)	1 (8.3%)
Presence of sneezing and runny nose in herd animals	yes, often	yes, sporadically	no	-
	2 (16.6%)	10 (83.3%)	0	-
Chemical groups used *	Macrocyclic lactones	benzimidazoles /Imidati-zoles	organophosphates and othres	Alternation between different groups
	10 (83.3%)	5 (41.6%)	1 (8.3%)	0
Route used*	Oral		Injectable (subcutaneous)	
	10 (83.3%)		2 (16.7%)	
Fasting solid before and after administration (via oral)	yes		no	
	0		12 (100.0%)	
Time of application of drugs	When an animal comes to death	Presence of signals (anemia, diarrhea, nasal discharge)	prophylactic calendar	FAMACHA method or by counting of EPG**
	0	1 (8.4%)	11 (91.6%)	0
Interval between applications	each 30 days	each 50-60 days	More than 60 days	Depended on the results of laboratory tests
	11 (91.6%)	1 (8.4%)	0	0
Animals treated /day	By animal category	All animals in the herd	More infected / infested	-
	0	12 (100.0%)	0	-

\*Was allowed more than one response per owner. \*\*EPG = Eggs per gram of feces.

18.9% L3. In the municipality of Encruzilhada do Sul, also in Rio Grande do Sul, sheep parasitized by this ectoparasite were also observed (OLIVEIRA et al., 1999). In the State of Santa Catarina, southern region of Brazil sheep bot flies were also diagnosed, but it is worth noting that when average temperatures fell below 9.8 °C (49.64 °F), no *O. ovis* larvae were detected in the animals (RAMOS et al., 2006). Studies conducted by Cansi et al. (2011), Schenkel et al. (2012) and Silva et al. (2012a, 2013) reported presence of this parasite in the States of Goiás, Mato Grosso and São Paulo (central-western, central-western and southeastern regions of Brazil, respectively).

Even though the present study did not ascertain the prevalence of *O. ovis* parasitism in herds in the microregion analyzed, the low average intensity of larvae per animal observed in the necropsied sheep over the course of these seven years (2.25 larvae per animal) can be explained by the responses obtained in the interviews that were conducted. According to 75% of the sheep farmers, helminths are the main priority when it comes to parasite control. Moreover, 11 out of the 12 producers performed suppressive treatments on their herds at 30-day intervals, alternating between macrocyclic lactones and benzimidazoles/imidazothiazoles (in which all the

animals in each herd were treated at once). In any case, further epidemiological and/or efficacy studies still need to be conducted in this region, in an attempt to elucidate the prevalence of *O. ovis* parasitism in these herds.

The influence of sheep breed on the degree of parasitism has been greatly studied in relation to helminths. In a general manner, animals bred for their wool are less resistant to nematode infections than are breeds without wool (AMARANTE et al., 2004; BRICARELLO et al., 2005). However, regarding *O. ovis* larvae, this hypothesis does not seem to present any similar relationship (SILVA et al., 2012b). In one trial conducted by SILVA et al. (2012b), it was not possible to determine any difference in parasitism levels regarding *O. ovis* larvae between animals of the Santa Inês breed (no wool) and Ile de France breed (wool producer).

Even though sheep bot fly larval infections can lead to clinical signs in parasitized animals, no sheep died due to *O. ovis*. The cause of death of 12 animals parasitized by *O. ovis* was related to high *Haemonchus* burdens or pneumonia. According to Ribeiro (2007) and Schenkel et al. (2012), even if a given herd presents high intensity and prevalence of the larvae of this parasite infecting the animals, mortality remains rare and usually occurs because

of secondary factors. This reinforces the idea that these flies may lead to losses in herds in a subclinical level, but further studies still need to be conducted to confirm this.

The lesions caused by *O. ovis* are mostly mild, as diagnosed in particular animals of the present study (mucopurulent nasal exudates). The epistaxis observed in one of the sheep was probably caused by movement of parasites in the nasal cavities. According to Angulo-Valadez et al. (2011), the parasites become attached to the mucosa using oral hooks and then secrete salivary substances/antigens which cause a local hypersensitivity reaction. Furthermore, the severity of the lesions observed is directly related to the larval burden present in the sheep's nasal cavities. The results from Spearman's correlation analysis obtained in the present study (0.81,  $p=0.0346$ ) reinforce this observation.

An important epidemiological point is made in the report by Guimarães & Papavero (1999), that showed that *O. ovis* occurrences in new areas may be related to expansion of sheep and goat rearing in different regions of the country. This hypothesis is supported by Cansi et al. (2011), Schenkel et al. (2012) and Silva et al. (2012b), who diagnosed the presence of sheep bot flies for the first time in the Federal District (central-western region of Brazil) and in the States of Mato Grosso and São Paulo (central-western and southeastern regions, respectively).

## Conclusion

Occurrences of *Oestrus ovis* parasitism in sheep were observed for the first time in the Umuarama microregion, State of Paraná, southern region of Brazil. There was a high correlation (0.81,  $p=0.0346$ ) between the number of larvae and the macroscopic lesions observed in these animals' nasal cavities, such that sheep with more than 3 larvae may contain mucopurulent secretions or epistaxis. Further studies still need to be conducted in this particular region, in an attempt to elucidate the prevalence of *O. ovis* parasitism in herds.

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