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Prevalence and intensity of *Oestrus ovis* in sheep and goats in south-eastern part of Turkey

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ABSTRACT

Oestrosis is a parasitic disease which is prevalent among sheep and goats in Mediterranean region. Slaughter house surveys to determine the prevalence and intensity of infestation by *Oestrus ovis* Linnaeus (Diptera: *Oestridae*) in sheep and goats, were conducted monthly for one year in south-eastern region of Turkey. A total of 804 heads belonging to 724 sheep and 80 goats were examined for *Oestrus ovis* larvae between May 2014 and April 2015. 72.75% of sheep heads and 50% of goat heads were seen to be infested with *Oestrus ovis* larvae. Of a total of 4723 larvae found in sheep heads, 2245 were detected to be first instars larva, 1231 second instars larva, 1247 third instars larva. Of a total of 259 larvae detected in goats, 150 were first instars larva, 79 second instars larva, 30 third instars larva. The mean of larval burden per infested animal was significantly higher in sheep (8.8±5.9) than in goat (6.5±5.0) ($P < 0.05$). Monthly distribution of first, second and third instars larvae indicate that adult flies are active between April and end of September, first instars larvae enter hypobiotic period in October. In conclusion, it was revealed that to use an effective drug against *Oestrus ovis* that will be done during reproductive period of flies should start in April and continue until the end of summer due to high rates of oestrosis, parasite treatment that will be done when reproductive period ends should be done in October and November in the southeast part of Turkey.

Key words: Control, Intensity, Myiasis, *Oestrus ovis*, Prevalance.

INTRODUCTION

Oestrosis, a nasal myiasis of sheep and goats, is caused by the larvae of *Oestrus ovis*, which develop from the first to third instars of their life cycle in the nasal cavities and frontal sinuses of affected animals. This parasite is found worldwide and it is especially widespread in Mediterranean countries of Europe and Africa (Pandey, 1989; Dorchies *et al*., 2000; Alcaide *et al*., 2003; Papadopoulos *et al*., 2006). Infestation occurs when mature larviparous females deposit tiny larvae on or in the nostrils of the host. Upon infection, instar larvae rapidly settle into the nasal cavity, nasal septum, turbinates, and ethmoid bones, pulling nutrients from the surrounding mucosa and mucosal secretions. As the larvae develop, they advance toward the frontal sinuses, eventually exiting the host, completing its pupal stage in the soil (Zumpt, 1965; Yilma and Dorchies, 1991; Cepeda-Palacios Scholl, 2000; Wall and Shearer, 2001).

Sheep and goat farmers often underestimate the importance of the clinical signs of sneezing and nasal discharge, and consider them the result of infection with other parasites such as lung worms. Nevertheless, important losses have been reported, including up to 22% in body weight, 16% in wool production and 10% in milk production (Shcherban, 1973; Ilcmann *et al*., 1986). As a zoonotic disease oestrosis can also affect humans, resulting in ophthalmomyiasis, though the disease progression differs from that seen in other animals (Soulsby, 1986; Masoodi and Hosseini, 2003; Dokur *et al*., 2015).

Various studies worldwide have reported prevalence of oestrosis between 13.7-94.6% in sheep, 17.9-88.4% in goats (Alem *et al*., 2010; Papadopoulos *et al*., 2010; Silva *et al*., 2013). No studies investigating the prevalence of the disease in goats in Turkey have been encountered however it was found as 22.52-59% in sheep in studies conducted in various regions (Gökcen and Sevgili, 2004; Uslu and Dik, 2006; Arslan *et al*., 2009; Karatepe *et al*., 2014).

The aim of this study was to monthly investigate the prevalence and intensity of infestation by *Oestrus ovis* in sheep and goats, for one year in south-east Turkey by slaughterhouse surveys.

MATERIALS AND METHODS

Study period and study area: The study was carried out in sheep and goats slaughtered at the Güler Et abattoir in Diyarbakýr province, located in south-eastern Anatolia, between May 2014 and April 2015. The sheep and goats slaughtered here come from surrounding villages over a radius of 200 km. The province is located at an altitude of 670 m and its geographical coordinates are 37 °55´ N

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longitude and 40°14´ E latitude. Annual average precipitation is 496 mm, average temperature is 15.8°C and average humidity is 55% in Diyarbakir.

Animals and examination procedure: In the study period, slaughterhouse was visited weekly and 724 awwasi sheep and 80 hair goat heads which just slaughtered were obtained. All of heads incised sagitally using an electric saw and examined in order to find *O. ovis* larvae in the nasal-sinus cavities according to previously described methods (Yilma and Dorchies, 1991). The larvae found in the nasal and sinus cavities were collected, counted, washed in physiological saline solution and fixed in 70% ethanol solution and identified according to keys described by Zumpt (1965).

Statistical analysis: Prevalence rate data with regard to months, season, and age group was analyzed for significance using Chi-Square test for differences. The monthly mean burden of the different larval instars was estimated as a percentage of the total larvae collected per month. Statistical comparisons were evaluated by the ANOVA test, in order to investigate monthly variations. Pearson correlation was estimated between larval burden (number of *Oestrus ovis* larvae per infected head) and climatic conditions (temperature and rainfall). All analyses were performed using the IBM SPSS 22 program for Windows Microsoft.

RESULTS AND DISCUSSION

A total of 804 sheep and goat heads were examined and 574 (71.39%) were found to be infested with *O. ovis* larvae (Fig 1, 2). Sheep (72.75%; n=534/724) were more commonly infected than goat (50%; n=40/80) and the differences infection rate between sheep and goat is significant ($P < 0.005$). Oestrosis is a parasitic disease which is prevalent among sheep and goats in Mediterranean region. However no data are available about oestrosis in Diyarbakır region where goat and sheep breeding is common. Therefore this study was conducted during one year period in order to reveal the importance of the disease in this region and the measures that could be taken. Of a total of 804 heads, 71.39% were detected to be infested with *O. ovis* larvae. When the results of our study were compared with those of the previous studies from Turkey, the prevalence of the disease in sheep were found to be higher than that reported from Kars (40.3%) (Arslan *et al*., 2009), Konya (59%) (Uslu and Dik, 2006), Sanliurfa (36.7%) (Gökcen and Sevgili, 2004), Nigde (22.52%) (Karatepe *et al*., 2014). When compared with the studies from the world, while it was higher than in Libya (51.66%) (Negm-Eldin *et al*., 2015), Greece (48.6%) (Papadopoulos *et al*., 2006), Saudi Arabia (53.5%) (Hanan, 2013) and Brazil (13.7%) (Silva *et al*., 2013), it was lower than in Central Oramina Ethipia (94.6%) (Alem *et al*., 2010) and Italy (91%) (Scala *et al*., 2001). The ratios are similar with those from Spain (71.1% and 75.9%) (Alcaide *et al*., 2003; Gracia *et al*., 2010), Morocco and Greece (69.2% and 75.9%) (Pandey and Ouhelli, 1984; Papadopoulos *et al*., 2010). No studies have been encountered investigating the prevalence of oestrosis in goats. While the prevalence of the disease among goats in our study was higher than that reported from Libya (28.33%) (Negm-Eldin *et al*., 2015), Iraq (24%) (Abo-Shehada *et al*., 2003) and Greece (38%) (Papadopoulos *et al*., 2010), it was similar with that reported from Egypt (47.3%) (Gebremedhin, 2011) and Spain (46.04%) (Alcaide *et al*., 2003). These differences between prevalence are suggested to arise from the climate, breeding systems, animal care, study periods and sample size. The results of our study indicated that oestrosis prevalence was higher among sheep than goats ($P < 0.001$). While this result was similar with most of the studies investigating sheep and goats together (Alem *et al*., 2010; Papadopoulos *et al*., 2010; Gebremedhin, 2011; Negm-Eldin *et al*., 2015), it was reported to be higher in goats (76%) than sheep (38%) in a study from Greece (Papadopoulos *et al*., 2010). The lower

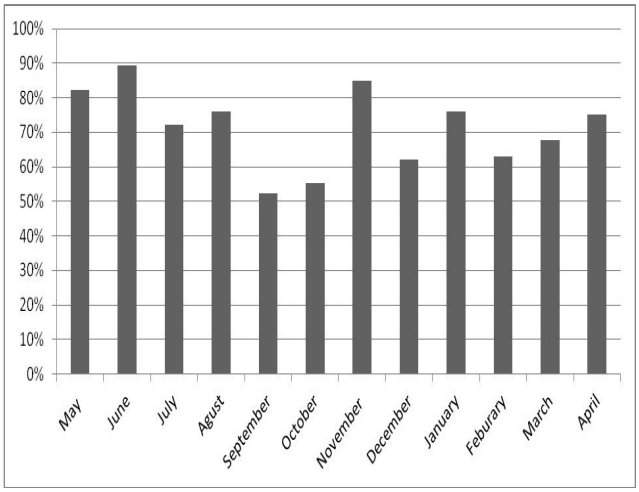

Fig 1: Prevalance of *Oestrus ovis* larvae enfestation in sheep and goats throughout the study period.

Fig 2: Dorsal view of different stage of *Oeustrus ovis* larvae.

prevalence in goats may be explained with less fly strike due to their being more scattered, not crowded like sheep during feeding.

The mean monthly infection rate varied from 56.41-89.06% for sheep and from 14.28-100% for goat. (Table 1). *O. ovis* larvae detection rate was 110 sheep out of 158 (69.62%), 19 goats out of 43 (44.18%) in the autumn, 128 sheep out of 193 (66.32%), 5 goats out of 5 (100%) in the winter, 146 sheep out of 192 (76.04%), 7 goats out of 11 (63.63%) in the spring, and 150 sheep out of 181 (82.87%), 9 goats out of 20 (45%) in the summer (Table 2). The differences in the infestation rates with regards to the seasons were determined to be statistically significant ($p<0.01$) (Table 3). Most of the studies conducted around the world and in Turkey reported that *O. ovis* larvae have been identified in sheep every month of the year (Yilma and Dorchies, 1991; Dorchies, 2000; Scala *et al.,* 2001; Alcaide *et al.,* 2003; Gökcen and Sevgili, 2004; Uslu and Dik, 2006; Arslan *et al.,* 2009; Gebremedhin, 2011). In this study, *O. ovis* infestation was detected in all the months and while the highest infestation rate in sheep was found in June (89.06%) and November (87.5%), all of the goat heads examined in June, December, January and February (100%) were found to be infested with *O. ovis* larvae. The observed seasonal prevalence in sheep varied between 66.32% and 76.04%, with the highest prevalence being in the summer and the lowest prevalence in the winter. The observed seasonal prevalence in goats varied between 44.18% and 100%, with the highest prevalence being in the winter and the lowest prevalence in the autumn. The study done in Sanliurfa region had the highest *O. ovis* prevalence in sheep in July as 70.27% and the lowest in January as 15.78% (Gökcen and Sevgili,

Table 1: Number of infected (%) sheep and goat heads during the year and mean number (X±SD) of *Oestrus ovis* larvae per infected head.

		Sheep			Goats		
		Number of head examined	Number of heads/%	Mean±SD	Number of heads examined	Number of heads/%	Mean±SD
2014	May	64	53/82.81	5.9±3.0	4	3/75.0	4.3±2.1
	June	64	57/89.06	6.7±3.4	2	2/100	8.5±3.5
	July	61	48/78.68	10.6±5.3	7	1/14.28	11
	Agust	56	45/80.35	10±5.45	11	6/54.54	7.5±7.1
	September	55	32/58.18	6.6±3.9	12	3/25.0	13.3±1.5
	October	39	22/56.41	7.4±1.7	28	15/53.57	2.5±1.2
	November	64	56/87.5	8.6±4.5	3	1/33.33	15
	December	65	40/61.53	14±6.3	1	1/100	12
2015	January	66	50/75.75	14.9±7.9	1	1/100	15
	Feburary	62	38/61.29	12.9±6.9	3	3/100	6.3±3.8
	March	65	44/67.69	5.3±3.1	3	2/66.66	10±1.4
	April	63	49/77.77	3.9±2.0	5	2/40.0	7.5±0.7
	Total	724	534	8.8±5.9	80	40	6.5±5.0

Table 2: Number of heads examined per season, seasonaly prevalence of infected animals, mean number (X±SD) of *Oestrus ovis* larvae per infected head and number of first larval stage (L1), second larval stage (L2) and third larval stage (L3) found per season in sheep and goats.

Season	Number of examined heads	Enfestation rate%	Mean±SD	Number of larvae			Number of examined heads	rate%	Enfestation Mean±SD	Number of larvae		
				L1	L2	L3				L1	L2	L3
Spring	192	76.04[a]	5.03±2.7	266	245	224	11	63.63[a]	7.2±1.4	17	26	5
Summer	181	82.87[a]	9.1±4.7	470	406	465	20	45[b]	9±3.5	41	17	15
Autumn	158	69.62[b]	7.5±3.3	703	117	34	43	44.18[b]	10.2±0.9	79	11	2
Winter	193	66.32[b]	13.9±6.9	806	463	524	5	100[c]	11.1±1.2	13	25	46

a.b : The difference between groups with different letters in the same column is significant ($p<0.01$).

Table 3: Prevalence of *Oestrus ovis* infection and mean number (X±SD) of *Oestrus ovis* larvae per infected head in sheep and goats with age and sex .

	Sheep			Goats		
	Number of examined heads	Number of heads/%	Mean±SD	Number of heads examined	Number of heads/%	Mean±SD
Female	312	228/73.07	9.6±6.2	37	18/48.64	8.0±5.6
Male	412	306/74.27	8.7±5.9	43	22/51.16	5.22±4.1
6-12 M	349	247/70.77	9.1±5.9	41	18/43.90	6.1±4.6
12-36 M	375	287/76.53	8.6±5.9	39	22/56.41	6.9±5.3

2004). In Konya region, the highest prevalence was in October as 76.9% and the lowest in January as 34.6% (Uslu and Dik, 2006). For the region of Kars, the highest rate of infestation was in April as 71.8% and the lowest in September as 25.7%, seasons wise; spring had the highest infestation rate as 54.3% (Arslan *et al.*, 2009). The studies conducted around the world show the highest rate of infestation was in October (Pandey and Ouhelli, 1984; Gebremedhin, 2011; Hanan, 2013; Karatepe *et al.*, 2014) and in September (Masoodi and Hosseini, 2003).

Differences in infestation rates and larval burden per infested animal were found statistically insignificant with regard to age and sex in sheep and goats ($P > 0.05$). While our results were similar with those of Biu ve Nwesu (1999), Murguia *et al.* (2000), Abo-Shehada *et al.* (2003) and Arslan *et al*. (2009), Shoorijeh *et al.* (2009), Gebremedhin (2011) and Negm-Eldin *et al.* (2015) reported that the differences in infestation rates between males and females is important. While Papadopoulos *et al.* (2010) and Silva *et al*. (2013) reported no difference between infestation rates with regard to age, Arslan *et al.* (2009), Uslu and Dik (2009) and, Negm-Eldin *et al.* (2015) reported higher rates above 3 years.

The mean of larval burden per infested animal was significantly higher in sheep (8.8±5.9) than in goat (6.5±5.0) ($P < 0.05$). The highest mean intensity per infested animal was in January (14.9±7.9) in sheep and September (15.0) in goat. Of a total of 4723 larvae found in sheep heads, 2245 (47.53%) were detected to be first instars larva, 1231(26.06%) second instars larva, 1247 (26.04%) third instars larva. Of a total of 259 larvae detected in goats, 150 (57.91%) were first instars larva, 79 (30.50%) second instars larva, 30 (11.58%) third instars larva. While first and second instars larvae are seen in all months in sheep and goats, third instars larvae were not detected in October and November. While our results in sheep were found to be lower than those reported by Uslu and Dik (2006) and, Papadopolus *et al.* (2010) they were higher than those reported by Arslan *et al.* (2009), Silva *et al.* (2013), Karatepe *et al.* (2014), Negm-Eldin *et al.* (2015) and Hidalgo *et al.* (2015). Mean larval burden in goats was similar with that reported by Papodopolus *et al.* (2010) and lower than reported by Gebremedhin (2011). In our study, first-stage larvae accounted for most of the larvae obtained in October (94%) and November (89.71%). This is similar to findings in the southwest of France, Konya and Kars (Yilma and Dorchies, 1991; Uslu and Dik, 2006; Arslan *et al.*, 2009). Monthly distribution of all larvae collected from sheep and goats with regard to periods, and mean monthly temperature and rainfall distribution are shown in Fig 3. While a significant

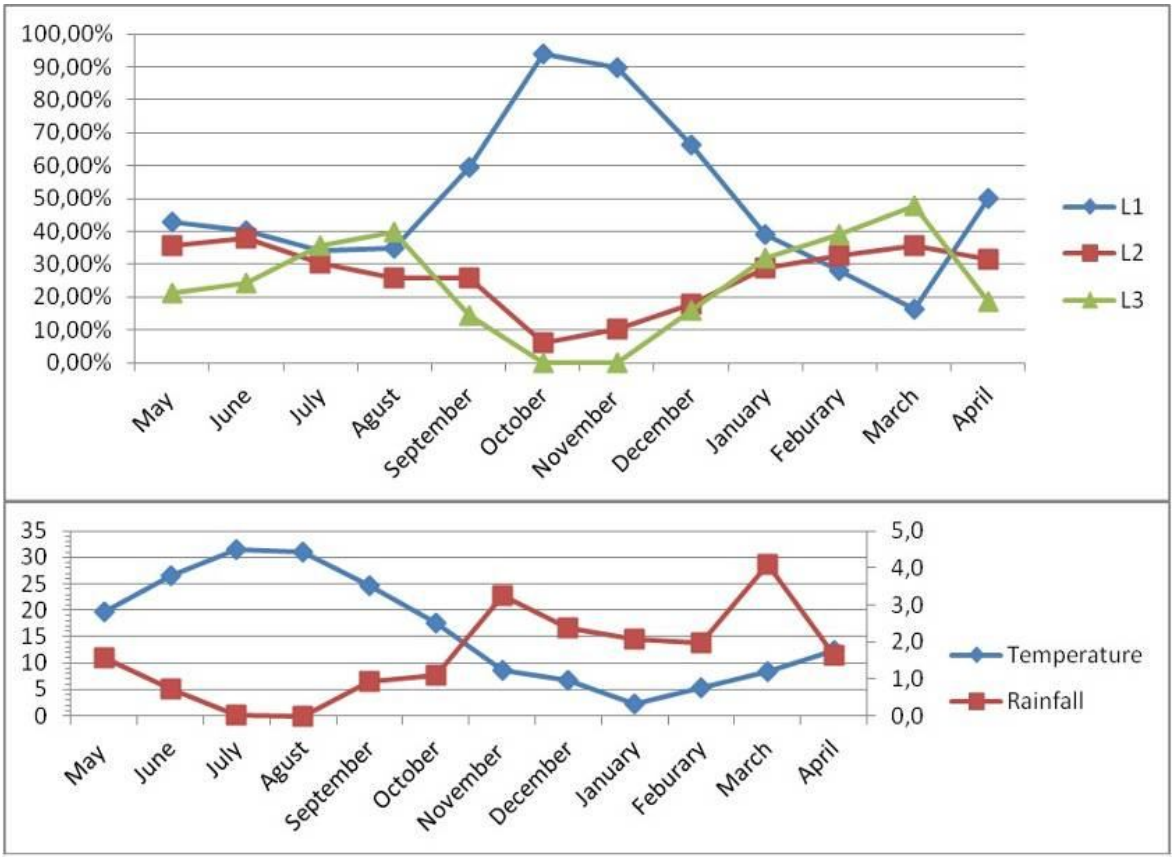

Fig 3: Mean monthly percentages of first larval stage, second larval stage and third larval stage of *Oestrus ovis* in heads of sheep and goats and average temperature and rainfall per month in Diyarbakır.

increase was observed in the percentage of first instars larvae in September (60%) (24.7 °C and 0.91 mm), this percentage was detected to be maximum in October (94%) (17.5 °C and 1.10 mm) and gradually decrease until March (16%) (8.3 °C and 4.09 mm). The percentage of first stage larvae was positively correlated with monthly rainfall (r = 0.096, P < 0.05) while no significant correlation was observed regarding the temperature (P > 0.05). The percentage of second stage larvae showed a significant decrease October (6%) (17.5°C and 1.10 mm). An increase was detected in the percentage of second instars larvae from November (10.28%) (8.5°C and 3.25 mm) to March (36%) (8.3°C and 4.09 mm). The percentage of second stage larvae was negatively correlated with monthly rainfall (r = -0.086, P < 0.05) while no significant correlation was observed regarding the temperature (P > 0.05). The percentage of third instars larvae significantly decreased beginning from September (14%) (24.7°C and 0.91 mm). Third instars larvae were not detected in October and November. An increase started in the percentage of third instars larvae in December (15.93%) (6.6°C and 2.36mm) and peaked in March (48%) (8.3°C and 4.09 mm). The correlation between percentage of third instars larvae and monthly temperature, monthly rainfall was not found statistically significant (P > 0.05).Positive correlation between the ratio of first instar larvae and rain, negative correlation between the ratio of second instar larva and rain were similar with the study of Alcaide *et al.* (2003) from Spain. Monthly distribution of first, second and third instars larvae indicate that adult flies are active between April and end of September, first instars larvae enter hypobiotic period in October.

In conclusion, infection by *O. ovis* is an important problem in the region considered. There appear to be two seasons of increased infestation, one with uninterrupted development of larval instars (spring-summer) and another with a diapause in development in the coldest months (autumn-winter). To control and eradicate *O. ovis*, it would be necessary to use systemic insecticides such as avermectin at the beginning of the hypobiotic period in October or November.

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