Epidemiology of *Oestrus ovis* L. infestation in sheep in Nigde province, Turkey

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SUMMARY

The objective of this study is to examine the prevalence of oestrosis caused by the *Oestrus ovis* L. in the sheep of Nigde province, Turkey. The study examines the presence of *O. ovis* larvae in 364 sheep heads collected from Nigde slaughterhouses between August 2010 and July 2011 with an average of about 30 per month. *Oestrus ovis* larvae were detected in the 82 (22.52%) out of the 364 sheep heads tested. Prevalence of *O. ovis* in the sheep was identified with regards to the months and seasons 0-60% and 11.11-49.47%, respectively. In addition, the infestation rate in the 6-9 months old sheep was found to be 23.28%, and 21.71% in the 1-2 years old sheep. While differences in the rates of infestation in terms of months and seasons were determined to be statistically significant (p<0.01), in terms of age groups it was found statistically insignificant (p>0.05). A total of 474 larvae were encountered in the infested sheep, 49 (10.33%) of those larvae were identified as L_1, 236 (49.78%) were identified as L_2, and 189 (39.87%) were identified as L_3.

Keywords: *Oestrus ovis*, epidemiology, infestation, sheep, Nigde, Turkey

RÉSUMÉ

Epidémiologie de l'infestation par *Oestrus ovis* L. chez les moutons dans la province de Nigde, Turquie

L'objectif de cette étude est d'examiner la prévalence de l'oestrose causée par les larves d'*Oestrus ovis* L. chez les moutons de la province de Nigde, Turquie. L'étude porte sur 364 têtes de recueillies dans les abattoirs entre Août 2010 et Juillet 2011, avec une moyenne d'environ 30 par mois. Les larves d'*Oestrus ovis* ont été détectées dans 82 têtes (22,5 %) sur les 364 examinées. La prévalence d'*O. ovis* a été respectivement selon les mois et les saisons de 0-60 % et de 11,1 à 49,5 %. Le taux d'infestation chez les animaux de 6 à 9 mois a été de 23,3 % et de 21,7 % chez ceux de 1 à 2 ans. Les différences dans les taux d'infestation en fonction des mois et des saisons sont statistiquement significatives (p<0,01), en termes de groupes d'âge, la différence n'est pas significative (p>0,05). Un total de 474 larves a été récolté chez les sujets infestés: 49 (10, 3 %) étaient des L1, 236 (49,8 %) des L2, et 189 (39,9 %) des L3.

Mots-clés: *Oestrus ovis*, épidémiologie, infestation, les moutons, Nigde, Turquie

Introduction

Oestrus ovis L. is a larviparous fly, whose larvae can cause myiasis in the nasal and sinusal cavities of sheep and goats. When the larvae are present in large numbers, a very severe cold like symptoms, purulent and sometimes bloody nasal discharge occurs. In addition, sneezing, head shaking, and difficulty breathing are among the visible symptoms. The larvae may sometimes reach up to the brain and cause neurological disorders. Heavier infestations may even result in death. When the adult flies attempt to deposit their larvae on the sheep and goats, the sheep and the goats take a defensive position by pressing their noses on each other's wool or the soil thus also preventing themselves from grazing freely [9, 15, 21, 23, 28].

Oestrus ovis larvae have been also occasionally found in humans where the most cases were observed in the eyes and in the nostrils. These larvae can cause catarrhal conjunctivitis, ophtalmomyiasis, and nasomyiasis. These illnesses can occurs especially in the children and people who make sheep's milk cheese. In humans the larvae can not develop beyond the first instar [10, 28].

There have been lots of researches throughout the world carried out to determine the prevalence [1, 7, 8, 12, 17, 20] and the seroprevalence [4, 6, 16, 19] of oestrosis. Yet in Turkey, the number of studies aiming to determine the existence of *O. ovis* has been more limited [5, 13, 25, 26].

The aim of this study is to find out the epidemiology of oestrosis caused by *Oestrus ovis* larvae in the sheep of Nigde province and to determine the current status of the disease in the region.

Materials and methods

STUDY AREA

This study was performed on sheep of Nigde province, located in the middle of Turkey (with an altitude of 1240 m, 37° 58' N longitude-34°41' E latitude), where oestrosis was not previously recognized. Because it has continental climate, the summers are warm and dry and the winters are cold and snowy. Annual average of precipitation is 348.8 mm, average temperature is 11.1°C and average relative humidity is 55% in Nigde.

ANIMALS AND LARVA COLLECTION

The research material of the present study consists of the heads of the sheep brought to the slaughterhouse in Nigde

from Turkey. A total of 364 sheep heads (from 6-9 months to 1-2 years) were taken randomly as samples between August 2010 and July 2011, with an average of about 30 heads per month, the samples were then examined for *O. ovis* larvae.

LABORATORY EXAMINATION

The sheep heads were first given protocol numbers and grouped according to the age of the sheep. Each sheep head was put into a plastic bag and labeled accordingly, and then brought into the laboratory in a cold chain. After the skins of the heads were removed, the heads were held with a vice and cut longitudinally using an electrical saw. If present, the larvae were collected from the nasal passage, the septum, the meatus nasi medialis, the conchae, and the sinuses. The collected larvae were counted, washed with physiological saline solution and was kept in 70% alcohol solution. Then, larval stages were identified under stereomicroscope according to Zumpt [28].

STATISTICAL ANALYSIS

Prevalence rate data with regard to months, season, and age group was analyzed for significance using Chi-Square test for differences.

Results

Of 364 sheep heads surveyed, 22.52% (82) were infested with *O. ovis* (Table 1). *Oestrus ovis* prevalence was greatest in October and September with 60 and 56.25% infestation, respectively. No *O. ovis* were found in sheep heads in June (Table I).

A total of 474 larvae were found in the infested sheep. Out of those 474 larvae, 49 (10.33%) were identified as being in L_1 period, 236 (49.78%) in L_2 period, and 189 (39.87%) in L_3 period. The number of larvae found on a sheep head varied between 1 and 41, and the average number of larvae per infested sheep was 5.78 (474/82) (Table I).

The seasonal prevalence rate of *O. ovis* in the sheep varied between 11.11% and 49.47%. *Oestrus ovis* larvae detection rate was 47 sheep out of 95 (49.47%) in the autumn, 11 sheep out of 86 (12.79%) in the winter, 10 sheep out of 90 (11.11%) in the spring, and 14 sheep out of 93 (15.05%) in the summer (Table II). The differences in the infestation rates with regards to the months and the seasons were determined to be statistically significant ($p<0.01$).

Months	Number of Sheep Examined	Number of sheep infested	Infestation Rate (%)	Number of Larvae	Mean number of larvae per Sheep	*Oestrus ovis*		
						L_1	L_2	L_3
August	33	12	36.36[c]	101	8.41	13	68	20
September	32	18	56.25[b]	141	7.83	13	76	52
October	30	18	60[a]	95	5.27	3	40	52
November	33	11	33.33[d]	25	2.27	2	8	15
December	29	6	20.68[d]	25	4.16	6	13	6
January	27	2	7.40[d]	7	3.5	0	0	7
February	30	3	10[d]	28	9.33	5	12	11
March	30	5	16.66[d]	19	3.8	0	5	14
April	30	4	13.33[d]	11	2.75	0	4	7
May	30	1	3.33[d]	6	6	2	2	2
June	30	----	----	----	----	---	---	---
July	30	2	6.66[d]	16	8	5	8	3
TOTAL	364	82	22.52	474	5.78	49	236	189

a,b,c,d : The difference between groups with different letters in the same column is significant (p <0.01).
L_1: number of larvae in the first period, L_2: the number of larvae in the second period, L_3: the number of larvae in the third period

TABLE I: The prevalence of *Oestrus ovis* larvae in sheep in terms of months.

Seasons	Number of Sheep Examined	Number of Sheep Infested	%
Autumn	95	47	49.47[a]
Winter	86	11	12.79[b]
Spring	90	10	11.11[b]
Summer	93	14	15.05[b]
TOTAL	364	82	22.52

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

TABLE II: The prevalence of *Oestrus ovis* larvae in sheep with regards to seasons.

As shown in Table III, when the infestation rate is calculated for the age groups, the infestation rate for the 6-9 months old sheep is 23.28% and 21.71% for the 1-2 years old sheep. The highest prevalence rate for both age groups was observed in October. The rate of infestation in terms of age groups was observed to be statistically insignificant (p>0.05).

Of the larvae that were found in the heads of the sheep during the study, 82 were extracted from the nasal passages and septum, 72 from meatus nasi medialis, and 320 from the conchae and sinus (Table IV).

Discussion

The prevalence rate of 22.52% (82/364) observed in the study is an indication of the presence of *O. ovis* in the region. Compared with the results of 36.7% reported by Gokcen and Sevgili [13] for Sanliurfa region, 59% found by Uslu and Dik [25] in Konya region, and 40.3% reported by Arslan et al. [5] for Kars region from Turkey, the infestation rates observed in this study are lower.

Also, when the *O. ovis* prevalence results of the study are compared with the results of the studies conducted around the world (Table V), *Oestrus ovis* prevalence rate of this study is lower. The differences in the results could be attributed to various factors, such as regional climate, which has an effect the development and spread of *O. ovis*, and the differences in the care and feeding conditions. On the other hand, the results of this study are accordance only with the infestation rate of 22.6% found in Libya by Gabaj et al. [12].

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 [1, 2, 5, 7, 8, 11, 13, 20, 25, 27]. In this study, apart from June, *O. ovis* infestation was detected in all the months and the highest rates were determined for October (60%) and September (56.25%). The observed seasonal prevalence varied between 11.11% and 49.47%, with the highest prevalence being in the autumn and the lowest prevalence in the spring. The study done in Sanliurfa region had the highest *O. ovis* prevalence in July as 70.27% and the lowest in January as 15.78% [13]. In Konya region, the highest prevalence was in October as 76.9% and the lowest in January as 34.6% [25]. 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% [5]. The studies conducted around the world show the highest rate of infestation was in October [11, 14, 17, 27] and in September [18].

The differences in the infestation rates in terms of months and seasons in this study were determined to be statistically significant differences, which show similarities with the results of the study conducted in Kars region [5]. However, the study done in the region of Sanliurfa did not find any statistical significance in the infestation rate with regards to months [13].

Age	Number of Sheep Examined	Number of Sheep Infested	Infestation Rate (%)
6-9 months	189	44	23.28
1-2 years	175	38	21.71
TOTAL	**364**	**82**	**22.52**

TABLE III: The prevalence of *Oestrus ovis* in sheep in terms of age groups.

Months	Nasal passages and septum	Meatus nasi medialis	Conchae and sinuses	Total
August	10	16	75	101
September	25	17	99	141
October	8	17	70	95
November	2	12	11	25
December	----	3	22	25
January	4	1	2	7
February	10	2	16	28
March	8	2	9	19
April	3	----	8	11
May	2	----	4	6
June	----	----	----	----
July	10	2	4	16
TOTAL	**82**	**72**	**320**	**474**

TABLE IV: Location of *Oestrus ovis* larvae in the part of the head of sheep.

Country	Prevalence%	Author	Reference
Morocco	10-100	Pandey and Ouhelli, 1984	18
Zimbabwe	6-52	Pandey, 1989	17
France	65	Yılma and Dorchies, 1991	27
	43.4	Dorchies et al., 2000	11
Libya	22.6	Gabaj et al., 1993	12
Jordan	58	Abo-Shehada et al., 2000	1
Sicily	55.8	Caracappa et al., 2000	7
Mexico	30	Murgia et al., 2000	16
Italy	91	Scala et al., 2001	20
Greece	100	Papadoupolos et al., 2001	19
Germany	50.3	Bauer et al., 2002	6
	71.1	Alcaide et al., 2003	2
Spain	84.2	Gracia et al., 2010	14
	46.03	Claudia et al., 2012	8
Iran	49.7	Shoorijeh et al., 2009	22
Ethiopia	94.6	Alem et al., 2010	3

TABLE V: Select reports of prevalence of *Oestrus ovis* in sheep

The present study, also, found infestation rates of 23.28% in the 6-9 months old sheep and 21.71% in the 1-2 years old sheep. These results were determined to be statistically insignificant. Likewise, while, the study in Kars region [5] determined the infestation rate to be statistically insignificant in terms of age, the study in Konya region [25] observed a statistical significance in the rate of infestation in terms of age. The differences in the results of these two studies could be attributed to differences in the geographical regions and the differences in the animals.

A total of 474 larvae were collected from the 82 sheep that were infested. Of these larvae, L_1 was encountered the least with a prevalence rate of 10.33%, and L_2 was detected the most with a rate of 49.78%. Apart from the month of June for which no infestation was detected, L_3 was observed in all the months, on the other hand, no L_2 larvae were detected in January and no L_1 larvae were detected in January, March, and April. The lowest temperature was in January (0.6°C) in this region. The absence of larvae during June may be related to dryness. L_2 and L_3 larvae were observed
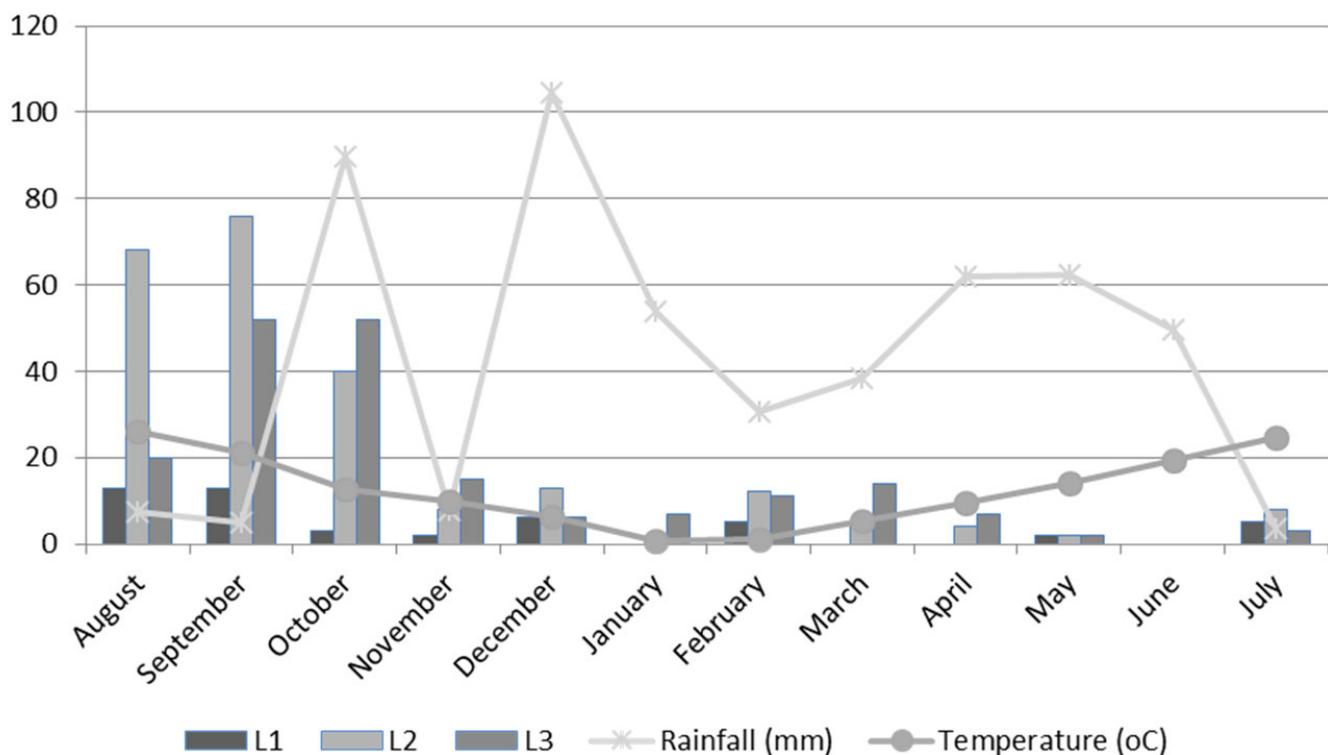
FIGURE 1: Monthly changes of larvae of *Oestrus ovis* (L_1, L_2, L_3) compared to monthly average temperature and monthly average rainfall

the most in August, September and October during which period the temperature ranged between 12.5°C and 26°C and rainfall ranged between 7.4mm and 89.7mm (Figure 1). Besides, the larvae were less observed in the sheep when the monthly average temperature was lower than 10°C in winter and spring. Heavier infestations occurred in autumn and summer. Most of the studies reported that the L_1 has the highest rate of prevalence among the detected larvae [2, 7, 11, 13, 14, 20, 24, 25], the researchers attribute those results to the possibility of extended development time in the biology of *O. ovis* depending on hypobiosis as a result of the season and climatic conditions [11, 20, 24]. In contrast, in this study and in Arslan et al. [5]'s study, L_1 has the lowest rate of prevalence. The present study, L_1 larvae were not January, March, April and June. Monthly prevalences show that a period of hypobiosis could not be present in this region because numbers the L_2 and L_3 are usually higher than numbers of L_1.

The results of the study show that the average number of larvae per infested sheep was determined to be 5.78. Compared with the similar studies in Turkey and in the rest of the World, in terms of numbers of larvae per infested sheep, the results of this study are comparable to 4.5 in Kars [5], 6.3 in Iran [22], 6.8 in Ethiopia [3], and 6.7 in Morocco [18]. On the other hand, the results are lower than 23.92 larvae per sheep reported in Konya [25], 24.8 [27] and 10.86 [11] in France, 9.4 in Sicily [7], 19 in Italy [20], 37.9 [14] and 10.2-11.46, 18.54 [2, 8] in Spain. This difference might be due to the differences in the climate of the regions.

Conclusion

In conclusion, with this study, the prevalence of oestrosis in the sheep of Nigde province from Turkey has been identified and determined for the first time and *O. ovis* larvae were detected in 22.52% of the sheep examined. This survey indicates that except during June, with values about 39.87%, during the remainder of the year the relative percentages of L_3 indicate a year-round development. Therefore, there is further risk of oestrosis in this region. Finally, in order to lower infestation rate of oestrosis it would be necessary to use an effective and persistent drug against *O. ovis*.

In order to prevent future economic losses caused by *O. ovis* in sheep farming in Turkey, wider epidemiological studies should be carried out. Thus, the appropriate preventative measures can be taken in order to achieve eradication of the disease.

Acknowledgements

References

1. - ABO-SHEHADA M.N., ARAB B., MEKBEL R., WILLIAMS D., TORGERSON P.R.: Age and seasonal variations in the prevalence of *Oestrus ovis* larvae among sheep in northern Jordan. *Prev. Vet. Med.*, 2000, **47**, 205-212.

2. - ALCAIDE M., REINA D., SANCHEZ J., FRONTERA E., NAVARRETE I.: Seasonal variations in the larval burden distribution of *Oestrus ovis* in sheep in the southwest of Spain. *Vet. Parasitol.*, 2003, **118**, 235-241.

3. - ALEM F., KUMSA B., DEGEFU H.: *Oestrus ovis* larval myiasis among sheep and goats in central Oromia, Ethiopia. *Trop. Anim. Health Pro.*, 2010, **42**, 697-703.

4. - ANGULO-VALADEZ C.E., SCALA A., GRISEZ C., PREVOT F., BERGEAUD J.P., CARTA A. CEPEDA-PALACIOS R., ASCENCIO F. TEREFE G., DORCHIES P., JACQUIET P.: Specific IgG antibody responses in *Oestrus ovis* L. (Diptera : Oestridae) infected sheep: Associations with intensity of infection and larval development. *Vet. Parasitol.*, 2008, **155**, 257-263.

5. - ARSLAN M.O., KARA M., GICIK Y.: Epidemiology of *Oestrus ovis* infestations in sheep in Kars province of north-eastern Turkey. *Trop. Anim. Health Pro.*, 2009, **41**, 299-305.

6. - BAUER C., STENG G., PREVOT F., DORCHIES P.: Seroprevalence of *Oestrus ovis* infection in sheep in southwestern Germany. *Vet. Parasitol.*, 2002, **110**, 137-143.

7. - CARACAPPA S., RILLI S., ZANGHI P., DI MARCO V., DORCHIES P.: Epidemiology of ovine oestrosis (*Oestrus ovis* Linne 1761, Diptera : Oestridae) in Sicily. *Vet. Parasitol.*, 2000, **92**, 233-237.

8. - CLAUDIA P.E., RICARDO R., MIRIAM M., DAVID B., MIGUEL L.L., ÁNGEL M.M.: The influence of sheep age group on the seasonal prevalence of oestrosis in the island of Majorca. *Vet. Parasitol.*, 2012, **186**, 538-541.

9. - COLEBROOK E., WALL R.: Ectoparasites of livestock in Europe and the Mediterranean region. *Vet. Parasitol.*, 2004, **120**, 251-274.

10. - DINÇER S.: İnsan ve Hayvanlarda Myiasis, In: M.A. ÖZCEL, N. DALDAL (éd.): Parazitoloji'de Artropod Hastalıkları ve Vektörler, Türkiye Parazitoloji Derneği Yayın No. 13, İzmir, 1997, 169-234.

11. - DORCHIES PH., BERGEAUD J.P., TABOURET G., DURANTON C., PREVOT F., JACQUIET Ph.: Prevalence and larval burden of *Oestrus ovis* (Linne, 1761) in sheep and goats in northern mediterranean region of France. *Vet. Parasitol.*, 2000, **88**, 269-273.

12. - GABAJ M.M., BEESLEY W.N., AWAN M.A.Q.: *Oestrus ovis* myiasis in Libyan sheep and goats. *Trop. Anim. Health Pro.*, 1993, **25**, 65-68

13. - GOKCEN A., SEVGILI M.: Prevalence and larval burden of *Oestrus ovis* in Awassi sheep from the Sanliurfa region of Turkey. *Indian Vet. J.*, 2004, **81**, 1168-1169.

14. - GRACIA M.J., LUCIENTES J., PERIBANEZ M.A., CASTILLO J.A., CALVETE C., FERRER L.M.:

Epidemiology of *Oestrus ovis* infection of sheep in northeast Spain (mid-Ebro Valley). *Trop. Anim. Health Pro.*, 2010, **42**, 811-813.

15. - KETTLE D.S.: Medical and Veterinary Entomology, Cambridge University Press, UK, 1992.

16. - MURGUIA M., RODRIGUEZ J.C., TORRES F.J., SEGURA J.C.: Detection of *Oestrus ovis* and associated risk factors in sheep from the central region of Yucatan, Mexico. *Vet. Parasitol.*, 2000, **88**, 73-78.

17. - PANDEY V.S.: Epidemiology of *Oestrus ovis* infection of sheep in the highveld of Zimbabwe. *Vet. Parasitol.*, 1989, **31**, 275-280.

18. - PANDEY V.S., OUHELLI H.: Epidemiology of *Oestrus ovis* infection of sheep in Morocco. *Trop. Anim. Health Pro.*, 1984, **16**, 246-252.

19. - PAPADOPOULOS E., PREVOT F., JACQUIET Ph., DURANTON C., BERGEAUD J.P., KALAITZAKIS E., DORCHIES Ph.: Seasonal variation of *Oestrus ovis*-specific antibodies in sheep and goats mixed flocks in Greece. *Vet. Parasitol.*, 2001, **95**, 73-77.

20. - SCALA A., SOLINAS G., CITTERIO C.V., KRAMER L.H., GENCHI C.: Sheep oestrosis (*Oestrus ovis* Linne 1761, Diptera : Oestridae) in Sardinia, Italy. *Vet. Parasitol.*, 2001, **102**, 133-141.

21. - SCHMIDT G.D., ROBERTS L.S.: Foundations of Parasitology, Times Mirror/Mosby College Publishing, 1989.

22. - SHOORIJEH S.J., NEGAHBAN S., TAMADON A., BEHZADI M.A.: Prevalence and intensity of *Oestrus ovis* in sheep of Shiraz, southern Iran. *Trop. Anim. Health Pro.*, 2009, **41**, 1259-1262.

23. - SOULSBY E.J.L.: Helminths, Arthropods and Protozoa of Domesticated animals. Seventh Edition, Bailliere Tindall, London, 1986.

24. - TABOURET G., JACQUIET P., SCHOLL P., DORCHIES P.: *Oestrus ovis* in sheep: improvement in control through knowledge of relative third-instar populations. *Vet. Res.*, 2001, **32**, 525–531.

25. - USLU U., DIK B.: Prevalence and intensity of *Oestrus ovis* in Akkaraman sheep in the Konya region of Turkey. *Med. Vet. Entomol.*, 2006a, **20**, 347-349.

26. - USLU U., DIK B.: Bir koyunda cok sayıda *Oestrus ovis* (Linnaeus, 1761, Diptera : Oestridae) larvasından kaynaklanan kavikol myiasis olgusu. *T. Parazitol. Derg.*, 2006b, **30**, 132-134.

27. - YILMA J.M., DORCHIES P.: Epidemiology of *Oestrus ovis* in southwest France. *Vet. Parasitol.*, 1991, **40**, 315-323.

28. - ZUMPT F.: Myiasis in Man and Animals of the Old World, Butterworths, London, 1965.