Epidemiology of the sheep nasal bot, *Oestrus ovis* (Diptera : Oestridae), in Central Ethiopia

° J.M. YILMA* and °° A. GENET

° Department of Pathology and Parasitology, Faculty of Veterinary Medicine, Addis Ababa University, P. O. Box 34, Debre Zeit, Ethiopia
°° Boran Veterinary Clinic, Addis Ababa, Ethiopia
Fax: 251-1-33 99 33, e-mail : vet.medicine@telecom.net.et

SUMMARY

Heads of 506 sheep and goats were examined during a period of one year with the aim of determining the importance and seasonal dynamics of *Oestrus ovis* infection in Central Ethiopia. Of these, 380 (75.10 %) were found infested with different instars, the infection prevalence in sheep and goats being 77.42 % and 72.87 %, respectively. Persistently high infection prevalence occurred throughout the year without any statistically discernible difference between study months. Relative humidity and photoperiod revealed significant influence on monthly infection prevalence.

The intensity of infection in sheep (12.74 ± 1.15) was significantly higher than in goats (10.52 ± 0.65). Unlike in sheep, the larval burden in younger goats was significantly higher (p < 0.001) than the older ones, indicating the presence of age-based resistance to infection in caprine hosts. None of the measured bionomic factors seemed to affect the infection intensity. However, temperature, rainfall, relative humidity and photoperiod significantly dictate the evolution profile of the second instar. Analyses of the results, on larval evolution patterns, strongly suggest the occurrence of a maximum of 6-7 generation of flies per year in the study area.

KEY-WORDS : *Oestrus ovis* - prevalence - intensity of infection - larval evolution - Central Ethiopia - sheep - goats.

RÉSUMÉ


Afin d’étudier l’importance et la dynamique saisonnière d’*Oestrus ovis* dans le centre de l’Ethiopie, 506 têtes de moutons et de chèvres ont été examinées au cours d’une année. 380 (75,1 %) étaient infestées par l’*Oestrus ovis* à différents stades évolutifs ; la prévalence a été de 77,42 % chez les moutons et de 72,87 % chez les chèvres. Une forte prévalence a été observée tout au long de l’année sans différence statistiquement significative selon les mois. L’humidité relative et la photopériode ont eu une influence significative sur la prévalence mensuelle.

L’intensité de l’infection chez le mouton (12,74 ± 1,15) était significativement plus forte que chez la chèvre (10,52 ± 0,65). Contrairement aux moutons, les charges larvaires des chèvres jeunes étaient significativement plus élevées (p < 0.001) que chez les plus âgés, indiquant l’existence d’une résistance à l’infestation en relation avec l’âge chez les chèvres. Aucun des paramètres biologiques mesurés ne semblait avoir une influence sur l’intensité de l’infestation. Cependant, la température, la pluviométrie, l’humidité relative et la photopériode orientaient significativement le profil d’évolution des larves du deuxième âge. L’analyse des résultats, sur le plan des caractéristiques d’évolution larvaire, suggère fortement l’existence d’un maximum de 6 à 7 générations de mouches par an dans cette région.

MOTS-CLÉS : *Oestrus ovis* - prévalence - intensité de l’infestation - évolution larvaire - Ethiopie centrale - mouton - chèvre.

Introduction

*Oestrus ovis*, Linaeus 1761 (*Diptera : Oestridae*) is a well-recognized pest of sheep and goats in many parts of the world [1, 37]. In some countries, the resultant myiosis due to the presence and development of its larvae in the nasal cavities and adjoining sinuses is regarded as benign. While in others, particularly in the tropics, it is often felt as responsible for considerable decrease in productivity [23, 35]. Literature reports suggest that constant irritations produced by the oral hooks and cuticular spines of the larvae, together with certain substances excreted by them, profoundly affect the health status of infected subjects [11]. Agitation of sheep and goat flocks by larvipositing female flies, especially during high

fly activity seasons, and following infestation, the subsequent sneezing and copious secretion of mucus from the nostrils adversely affect feeding activities [37]. ILCHMANN et al., [17] reported losses ranging from 1.1 - 4.6 kg of meat, 200-500 g of wool and up to 10 % of milk yield. It has also been demonstrated that weight gains of lambs improve in the absence of O. ovis infestation [16], and mortality among animals recently introduced into endemic area [4]. DORCHIES et al., [10] assert the association of lung abscesses and interstitial pneumonia with O. ovis infestation. In addition, infestation due to O. ovis was reported to predispose animals to pleuropneumonia [27]. A less extreme, though economically significant, problem arises because olfaction in infested rams may be impaired, making them less able to detect estrous in and impregnate receptive ewes [2].

Substantial literatures describing the public health importance of O. ovis are also available [3, 8, 9, 14, 20, 21, 24, 28, 34]. The infection of man with first instar of O. ovis often leads to the development of external ophthalmomyiosis, at times results in complete loss of vision. The condition is said to be particularly important in endemic areas where the population density of sheep is lower than that of man [7].

Generally, there exist a considerable variation in geographic distribution and severity of infestation due to O. ovis. In Ethiopia, where sheep and goat production is important, information on the epidemiology and importance of O. ovis is scanty. This paper attempts to describe the results of a study on the importance and seasonal dynamics of O. ovis. The investigation was conducted in Debre Zeit, Central Ethiopia, an area that represents a region of the country with huge small ruminant population.

Materials and Methods

THE STUDY AREA AND HUSBANDRY SYSTEM

The present study was carried out in Debre Zeit area (East Shewa Zone), Central Ethiopia, predominantly representing a medium altitude (’Woynadega’) climatic zone. The area is located at 9°N-40°E, 1850 m asl. at the margin of the Great Rift Valley, some 45 km south of Addis Ababa (Fig. 1). The mean annual temperature is 19.1°C and the area receives a rainfall of 845 mm per annum. The presence of a number of crater lakes in the area markedly influences its climate.

Mixed crop-livestock farming is the dominant feature of the agriculture in the area. The livestock husbandry practice is typically traditional-extensive type where animals of all age groups grazed and watered together. Crop residues are supplemented during the dry season when nutritional conditions become sub-optimal.

ANIMALS

From July 1994 to June 1995, a regular weekly visit to a local export slaughterhouse allowed examination of a total of 506 animals (248 sheep and 258 goats), aged between 6 months and 2.5 years, originated from a radius of about 50 km of the surroundings of Debre Zeit. Based on their phenotypic recognition, animals originated outside the area of concern were excluded from the study. The sampling technique employed was, thus, a random purposive type. The age of each animal was then estimated based on dental eruption formula [33] and categorized into two groups, as below and above 1.5 years of age, in order to assess the presence of age related difference between measured parameters.

EXAMINATION PROCEDURES

Individual heads of slaughtered sheep and goats were separated from the carcass, put into a plastic bag and immediately transported to the Faculty of Veterinary Medicine, Addis Ababa University, for closer and detailed examination. The skin on the dorsal face was removed and longitudinal section made with a hand saw parting the head into two symmetrical parts. Larvae of O. ovis from each dissected head were then carefully searched, separately collected in 70 % ethanol, identified as to their stages of development using standard keys and counted [35, 37].

MEASURED PARAMETERS

Computer-based primary analysis was done on data sets entered in Microsoft Excel 97 spreadsheet and the following monthly parameters (epidemiological feature indicators) were computed.

\[
\text{Infection Prevalence} (\%) = \frac{\text{Number of } O. \text{ ovis infected subjects}}{\text{Total number of examined animals}} \times 100
\]

\[
\text{Intensity of infection} = \frac{\text{Total larval count}}{\text{Total number of infected subjects}} \pm \text{SE}
\]

\[
\text{Larval Evolution profile} = \frac{\text{Count of } i^{th} \text{ instar}}{\text{Total count of all instars}} \times 100
\]

WEATHER DATA

Detailed information on temperature (Tmin, Tmax, and Tmean), rainfall, relative humidity and photoperiod of the study area, for the duration of this investigation, were obtained from the records of the Debre Zeit Agricultural Research Center.

STATISTICAL ANALYSIS

Stat-View, a computer based statistical software package was used to carry out different statistical analysis. The presence of possible variation in monthly infection prevalence rates and larval evolution patterns between and within species and age groups were depicted by Chi-square ($\chi^2$) statistics. Similarly, the variation in monthly intensity of infection was assessed using Student’s t-Test (paired) statistics. The combined effects of recorded bionomic factors on the measured parameters were assessed using Multiple Regression statistics. For the purpose of this study, 90 % probability level (P < 0.1) was considered significant.
FIG. 1. — Map showing the location of the study area. Animals considered in the present investigation were originated from a radius of 50 km from Debre Zeit.
Results

INFECTION PREVALENCE

From the total 506 sheep and goats examined in this study, 380 (75.10 %) were found infected with different larval stages of *O. ovis*. Relatively lower infection prevalence (73.97 %) occurred in younger subjects than in older animals (78.81 %) (Table I). The minimum and maximum prevalence values recorded were 57.50 % and 88.37 % in January and July, respectively (Fig. 2a).

Of the total 248 sheep examined, 192 (77.42 %) were found infected with different instars of *O. ovis* (Table I). The monthly infection prevalence varied from 50 % in October to 99.33 % in September and November. There was no significant variation (p > 0.05) in infection prevalence between young (78.40 %) and older (75.58 %) sheep (Fig. 2b).

Out of the total 258 goats examined, 188 (72.87 %) were found infected with larvae of *O. ovis* (Table I). With the exception for January and February, the monthly infection prevalence always exceeded 50 %. Older subjects revealed higher (87.50 %) infection prevalence than their younger counterparts (70.80 %). The monthly prevalence variation in younger subjects generally followed an apparently similar pattern to the overall scenario described above for both sheep and goats (Fig. 2c).

Generally, the overall as well as age-based infection prevalence for both species appeared to be persistently high throughout the year and no statistically discernible difference was noted between study months. On the other hand, assessment of the confounding bionomic factors by multiple regression analysis revealed the presence of significant influence of relative humidity (p = 0.0466, r² = 0.9) and photoperiod (p = 0.0736, r² = 0.9).

INTENSITY OF INFECTION

The overall mean larval burden was higher in sheep (12.74 ± 1.15, range 1-222) than in goats (10.52 ± 0.65, range 1-48). The highest intensity of infections was obtained during May in sheep (37.21 ± 13) and June in goats (25.56 ± 3.77). The mean monthly infection level exceeded 10 larvae for 8 months (March through October) in sheep and for only 5 months (June through October) in goats (Fig. 3a).

For most months of the year, the mean counts of the first instar were more than double than the counts for other instars recovered both from sheep and goats (Fig. 3b,c). A similar trend was also observed in monthly variation as well as in proportion of larval stages between younger and older subjects.

Analysis of the monthly mean larval counts indicated that there were significant variations between sheep and goats, and between similar age categories in these hosts (p < 0.0001). Unlike in sheep, significant difference (p < 0.001) in intensity of infection was detected between young and older goats. However, there was no significant variation in pooled mean burden between the two age categories (Icalc. = 1.349, p = 0.204431). Similarly, no statistically appreciable effects of all measured bionomic factors on intensity of *O. ovis* infection were detected.

LARVAL EVOLUTION PROFILE

The proportion of first instar increased at three occasions during the year: in January and February, in April and May and between August and October. Conversely, the evolution profiles of the other two instars was marked by an apparent decrease during these periods (Fig. 4). Statistical analysis of results showed that all measured bionomic factors had strong confounding influence (p < 0.05, r² = 0.8) on the second instar.

Discussion

The findings of the present study disclosed that an overall high prevalence of *O. ovis* infection (75.10 %) occur in sheep and goat flocks in Debre Zeit area, central Ethiopia, suggesting the importance and endemicity of the disease in the region. This finding is relatively higher than the observations previously made in other countries: 30.2 % in Nigeria [31], 48.8 % in Chad [13], 30.2 % and 16.2% in Southern India [27], 73.4 % in South Africa [15], 69.2 % in Morocco [25],
FIG. 2. — Infection prevalence of *Oestrus ovis* in sheep and goats in Debre Zeit area, Central Ethiopia.
Fig. 3. — Monthly mean intensity of *O. ovis* infection in sheep and goats originated from Debre Zeit and its surroundings. a) overall mean burden per positive sheep and goat is indicated, b) intensity of different instars recovered from sheep and c) from goats.
21.9% in Zimbabwe [26]. However, higher prevalence rates were recorded in some other countries: 91.5% in Southern United States [32], 80.9% in Haryana [6].

Unlike in goats, high larval burden was obtained in older sheep and the difference between age groups is significant in the latter. In addition, sheep started to accumulate higher larval burden as early as March while in goats this occurred late in July. This signifies the absence of age-based resistance in sheep and that goats may develop resistance to subsequent re-infections during fly activity seasons. A similar observation was made by TESFAYE [30] who reported that apparently similar infection prevalence occurred in sheep and goats in highlands of Ethiopia, but the intensity of infection increases with age in sheep and the vise versa holds true in goats. However, CHHABRA and RUPRAH, [6] explained the variation as related to the specific behaviors of goats, which is not often confined to a flock, but choose its own pasture, staying wherever its appetite or inclination leads. This behavior of goats, marked by decreased flocking instinct might, thus, decrease the larval deposition capabilities of the female O. ovis fly to a large number of animals at a time.

Similarly, FALLIS [12] and JAGANNATH [18] considered that age is not an important influencing factor as they have reported higher infection levels in older sheep and goats than in lambs and kids.

Several factors influence O. ovis larval population in the nasal cavities of its host, the most important being climate, which affects the number of flies to which animals are exposed [22]. In temperate countries, the number of fly generations per annum rarely exceeds one [19, 33]. In dry tropical regions where the disease assumes its most important status, infection by larvae of O. ovis may occur throughout the year as the climate during most months of the year favor fly emergence, mating and larviposition. Occurrence of relatively high proportion of first instar generally suggest either an intense infection is taking place and high fly activity season, or a gradual accumulation larvae due to retarded growth in situations of unfavorable seasons [29]. Analysis of data from the present study strongly suggest that April and May are months of high fly activity season. However rigorous infection and larval development could occur throughout the year with two major interruptions. The latter include the period during January and March, and the months from August through October, signifying moments of apparent retarded larval growth and decreased fly activity. The segment of the larval evolution pattern, which occurred at the end of the big rains (August to October) particularly followed a similar pattern reported at the time of over-wintering under a temperate European climate by YILMA and DORCHIES [35]. However, the finding of all larval instars throughout the year indicated that complete inhibition of larval development (diapause) do not occur in the study area. Assuming a minimum generation time of a month in a conducive environment, as suggested by BREEV et al., [5] and YILMA [36], a maximum of 6-7 generations of flies are anticipated to occur in the Central Ethiopia. The evolution of the second instar was particularly shown to be influenced by climatic factors. This finding may be explained by the fact that the intermediate larval stage is the best indicator of the evolution profile of O. ovis larval populations as previously asserted by YILMA and DORCHIES [35].

Acknowledgements

The authors thank the administrator and personnel of the Debre Zeit Abattoir for their kind provision of study specimens. Our thanks are due to Ato Wossenu Abersa and Ato Alemayehu Meshesha for their efficient technical assistance. We are also grateful to the French Veterinary Mission in Ethiopia for allocating fund that partly covered Dr GENET ASMELASH’S stipend during the study.
References


