

Prevalence and Pathological Lesions of *Cephalopina titillator* larvae in *Camelus dromedaries* in Jigjiga, Somali Region, Eastern Ethiopia

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Abstract: The overall prevalence rate of larvae of *Cephalopina titillator* in 324 camels slaughtered in Jigjiga municipal abattoir was 73.77%, (76.47% in females and 71.08% in males). The mean larval counts in infested camels were 22.93 ± 29.69 and 21.94 ± 27.42 for males and females respectively. There were a high difference ($P < 0.001$) in the number of larvae in camels of different ages. Older camels (> 11 years) harbor higher number of larvae compared to the younger ones (≤ 5 years). A survey using questionnaire revealed that about 98.3% of the community knew the disease and gave the name "Sengale". Major gross lesions observed in infested camels were congestion of the pharyngeal mucosa filled with profuse mucous secretions, hemorrhagic lesions. The main microscopic were desquamation of epithelial lining with cellular infiltration in the mucosa and submucosa and interglandular areas with hyperplasia of also hyperplasia of goblet cells were observed. Considering the facts that the infestation can be massive, that other organs may be involved and that the larvae may remain in situ for almost a whole year, it can be concluded that the condition is an important camel ailment warranting further detailed investigations and intervention.

Key words: Camel • Control • Effect • Fafan • Infestation • Lesion

INTRODUCTION

In Ethiopia, the *Camelus dromedaries* (one humped camel) are an important livestock species in the pastoral economy because of its extraordinary ability to perform in arid and semi-arid environments where there is scanty vegetation Dinka *et al.* [1]. The normal distributions of the camels are in the Africa and Asian subtropical dry areas. Camels' ability to withstand torrid heat and extreme desiccation are of paramount importance in determining its distribution [2]. Ethiopia is one of the largest camel populated countries in the world. In Africa, it ranks third next to Somalia and Sudan. About 1,102,119 of camels found in Ethiopia, distributing in Southern, Eastern, North Eastern arid and semi-arid regions of the country mainly in Borana, Ogaden and Afar regions [3]. The camel plays a significant role as a primary source of subsistence in the lowlands of the country. It lives in wide arid and semi-arid areas, which are not suitable for crop production and less suitable for other livestock production. Therefore, in this part of the country the camel are superior to all other livestock in terms of food

security. With continuing land degradation and rapidly growing human population, the camel's importance will increase [4].

Although camels were considered in the past and for a fairly long time, as resistant to many diseases causing factors, it has been proved that camels are susceptible, the same as other livestock or even more, to the common disease causing pathogens affecting other animal species [5]. Pathogenic diseases, poor nutrition and traditional management systems as well as lack of veterinary services have hampered their full utilization, despite the importance of dromedary in the semi-arid and arid areas where the environment is harsh and hostile [6].

The oestrid fly or the camel nasal botfly *Cephalopina titillator* (*C. titillator*) is an insect that causes health hazards and severe economic losses to camel industry in many camel-producing areas of the world Oryan *et al.* [7]. No doubt, camels are very important livestock particularly in arid and semi-arid lands. Nevertheless, the control of the adult *C. titillator* and its larval instars is a must for the sake of the animal and for the human welfare Morsy *et al.* [8].

Camel nasopharyngeal myiasis is caused by larvae of *C. titillator*. The larvae of this fly are deposited in the nostrils of camels. They moult twice while attached to the nasal cavity and pharynx causing extensive irritation, tissue damage and respiratory disorders Hussein *et al.* [9].

Camel nasal myiasis (*C. titillator*) is worldwide in distribution and this parasitic infestation is most frequently associated with camel farms in tropical countries where camels are raised Oryan *et al.* [7]. Myiasis causes weakness, emaciation, growth disturbance and decreased productivity in infested animals [10]. The rate of infestation in *C. titillator* varies from country to another with a different prevalence rate of 46.7% in Iraq Gegory *et al.* [11] and 41% in Riyadh, Saudi Arabia [12].

Infestations impair animals' welfare, reduce host physiological functions, destroy host tissues and cause significant economic losses to livestock through abortion, reduction of milk production and losses in terms of weight gain, infertility and low hide quality [10].

Even though the existence of the disease has been reported from different parts of the country limited work has been done to determine status and effect of the disease in *C. dromedaries*. So far, there is limited published data and documented information on *C. titillator* infestation for pastoral and agro-pastoral areas of Somali Regional State. Thus, the aim of the present study is to estimate the prevalence and assess the lesions of *C. titillator* larvae infestation in camels slaughtered at Jigjiga municipal abattoir.

MATERIALS AND METHODS

Study Area: The present study was conducted in Jigjiga municipal abattoir and two purposively selected districts of Fafan zone, namely Jigjiga and Gursum for the prevalence and questionnaire survey respectively. Fafan zone is one of the eleven administrative zones of the (Ethiopian Somali Regional State) ESRS. The zonal and also regional capital, Jigjiga city, is located 630 km southeast of Addis Ababa. The total land cover is 40,861 km² of which the rangeland extends over 36, 629 km² [13]. About 52.6%, 31% and 7% of the landscape of the zone can be categorized as flat to gentle slopes, hills and steep slope, respectively. Midland (1500–2300 m.a.s.l.) agro-ecology constitutes about 95% of the Fafen Zone [14]. Temperature of the area is generally high all the year round with mean minimum and maximum values being around 20°C and 35°C, respectively. The mean annual

rainfall is 660 mm and bimodal. The camel population of the region is estimated at 1,078,000 from which 81,221 are found in Fafan Zone [15].

Study Animals: The study was done on 324 indigenous breeds of *Camelus dromedaries* (including 188 male and 136 females) reared under pastoral management system which allows free grazing, usually mixed with livestock from other villages and slaughtered in Jigjiga municipal abattoir. All the animals had been kept under traditional system and owned by the local people.

Study Design: A cross-sectional study design was conducted from November 2015-May 2016 to determine the prevalence of larvae of *C. titillator* and its pathological lesions in camels slaughtered in Jigjiga municipal abattoir.

Sample Size Determination and Sampling Method: The number of camels included in this study was determined by taking previous prevalence report of camel nasal myiasis (*C. titillator*) by Bekele [16] which is 71.7% in and around Jigjiga areas. Then the sample size was calculated as per the method described by Thrusfield [17] with 5% acceptable error and 95% confidence level. Hence, by inserting 71.7% expected prevalence into the formula the total number camels included in the study was found to be 312. Hence, 324 animals were included in the study. All camels slaughtered on each visit day in Jigjiga municipal abattoir were included for the study.

Questionnaire Survey: Semi-structured questionnaire were prepared in order to determine risk factors associated with *C. titillator* infestation as well as the clinical signs observed by the owners. The questionnaire survey was conducted from seven (7) villages from which camels were raised in a Gursum district and Jigjiga Livestock Market where camels are brought for slaughter at Jigjiga municipal abattoir. Respondents for the questionnaire survey were selected purposively based on the owners association with camels for many years.

Abattoir Survey: Three to four days visit was made per week for ante mortem inspection and postmortem examination of slaughtered animals. During ante mortem inspection, the age, sex, origin, body condition and general condition of each individual animal was assessed and recorded. Animal age was categorized as ≤ 5 year, 6-10 year and ≥ 11 years based on tooth wear pattern according to Khan *et al.* [18]. The body condition scoring for camel

was carried out based on, the scoring that was conducted by looking at the back and flank and then classified as poor (0), medium (1) and good (2) Faye *et al.* [19].

Postmortem and Histopathological Examination: The post mortem examination was carried out on the heads of the slaughtered camels after its separation from the rest of the body. The skull was opened sagittally to expose the different regions of nasal and pharyngeal cavities, the labyrinth of the ethmoid bone, the turbinates, the lower nasal meatus and the pharynx. This all were inspected carefully for the presence of *C. titillator* larvae and the recovered larvae from each camel head were counted. Similarly the these sites were observed thoroughly for possible gross abnormalities according to VMTD [20], which included lesion distribution, contour, texture, shape, size and color. Tissues with lesions were sampled for histopathological examination. The lesion part of the tissue including the normal part was cutted to the size of 2 cm and placed in the universal bottle containing 10% buffered formalin. The volume of the formalin was ten times larger than the size of the tissue samples according to Talkuder [21]. The sampled tissues were then transported to the National Animal Health and Diagnostic Institute Center (NAHDIC) for histopathological processing using standard protocol.

Data Analysis: All collected data was coded, entered and stored into Microsoft excel until analysis and analysis was done using STATA statistics version 11. The prevalence was determined by the rate of the number of infested animals and total number of animal examined using descriptive statistics. Association between hypothesized risk factors like age, sex and body condition scores was related using Chi-square test and $P < 0.05$ was considered as statistically significant in all cases. The mean larvae count differences among the different risk factors were analyzed using ANOVA analysis for variance and covariance. The gross as well as histopathological findings were described using qualitative methods.

RESULTS

Result of Questionnaire Survey: According to the result of questionnaire survey almost all of the respondents 59 (98.3%) out of 60% reported that they knew the disease and gave the name “Sengale”. Among these respondents, 88.3% of them indicated that the *C. titillator* infestation is not age dependent and it affects all age groups of

Table 1: Summary of respondents responses for the questionnaire survey (n=60)

Questions	Response	Frequency	Percent (%)
Do you know sengale	Yes	59	98.3
	No	1	1.67
Is sengale is sex dependent	Yes	1	1.67
	No	59	98.3
Is sengale is age dependent	Yes	7	11.7
	No	53	88.3
Age group	Young	0	0.00
	Adult	5	8.33
	Old	2	3.33
	All ages	53	88.3
Do you know about the cause?	Yes	8	13.7
	No	52	86.3
Do you treat your camels infected with sengale	Yes	10	16.7
	No	50	86.3
Is sengale is seasonally distributed?	Yes	7	11.7
	No	53	88.3
Does sengale cause death of your camel?	Yes	6	10
	No	54	90.
Number of animals infected in the herd	Most of them	35	58.3
	Half of hem	8	13.3
	Few of them	5	8.33
	All of them	1	1.67

camels as indicated in the Table 1 below. Similarly, 98.3% of the respondent also reported that the disease is not sex dependent. Even though 86.3% of the respondents indicated that they do not know about the cause and did not treat their camels from sengale, 16.6% indicted that they treat their camels in traditional ways by watering with natural salty water from bullale mineral salty water in Jarar Zone once a year and they believe that this water can cure the disease. After drinking this water, the camels get rid of most of the matured larvae by sneezing.

Result of Prevalence Study: Among 324 camels examined in the present study, 239(73.8%), 71.1% males and 76.5% females was found harboring the larvae of *C. titillator* in their nasopharyngeal cavity with the mean larval count of 22.4. The difference in the rate of infection across different camel age groups, sex and body condition was statistically insignificant ($p > 0.05$). The mean larval counts in infested camels were 22.9 ± 29.7 and 21.9 ± 27.4 for males and females respectively. There were a ($p < 0.001$) in the number of larvae in camels of different ages. However, there were no difference ($P > 0.05$) in the number of larvae among camels of different body condition and sex (Table 2).

Table 2: Prevalence and number of *C. titillator* larvae based on age, sex and body condition

Risk factors	Number examined	Number positive	Prevalence (%)	Chi-square	P-value	Mean number of larvae \pm SD
Age group						
≤ 5 years	22	17	77.3	1.07	0.59	12.8 \pm 19.1 ^a
6-10 year	176	133	75.6			17.9 \pm 23.6 ^b
≥ 11 year	126	89	70.6			30.6 \pm 34.4 ^c
Sex						
Female	136	104	76.5	0.89	0.35	21.9 \pm 27.4
Male	188	135	71.1			22.9 \pm 29.7
BSC						
Good	135	101	74.8	0.65	0.72	25.7 \pm 30.8
Medium	157	113	71.1			19.7 \pm 27.1
Poor	32	25	78.1			23.1 \pm 26.7

a-c means in the same column with different subscripts are different at (P<0.001).

Gross Lesions: Among infested camels examined in the Jigjiga municipal abattoir, the infestation was restricted to the nasopharyngeal cavity and turbinates. In these sites many larvae were still active and crawling about freely, however, the damage or gross lesions in affected area depended largely on the degree of infestation and when some were loosely attached, others adhered firmly to the pharyngeal mucosa by their hooks and when removed, firm reddish nodules markedly apparent the sites of attachment. In the attachment area of the larvae many black spots were seen on the mucosal surface wherever the larvae were located also black or brown nodules were observed on different parts of nasopharyngeal mucosa representing earlier foci of attachment (Figure 1A), but congestion of pharyngeal mucous membrane and profuse mucous secretion were observed in most of the cases, especially when the camels were heavily infested. Hemorrhagic lesions were also observed grossly

(Figure 1B). A higher proportion of lesions occurred in camels with higher number of larvae.

Microscopic Lesions: The main microscopic lesions observed were desquamation of epithelial lining with diffuse infiltration of mononucleated inflammatory cells (lymphocytes and macrophages) in the mucosa and submucosa layers and also hyperplasia of goblet cells were observed (Figure 2 A and B). Desquamated epithelium with hydropic degeneration, hyperplasia of epithelial lining with remarkable increase in the goblet cells were commonly observed microscopic lesions. Eosinophils are diffusely infiltrated with remarkable amount in the mucosa, sub mucosa and interglandular epithelial lining (Figure 2C). Little inflammatory cell infiltration in the submucosa and interglandular areas were also observed in some cases. In addition congested vessels (venules and capillaries) in the sub mucosa layer with mild hemorrhage into the surface were also examined (Figure 2 D).

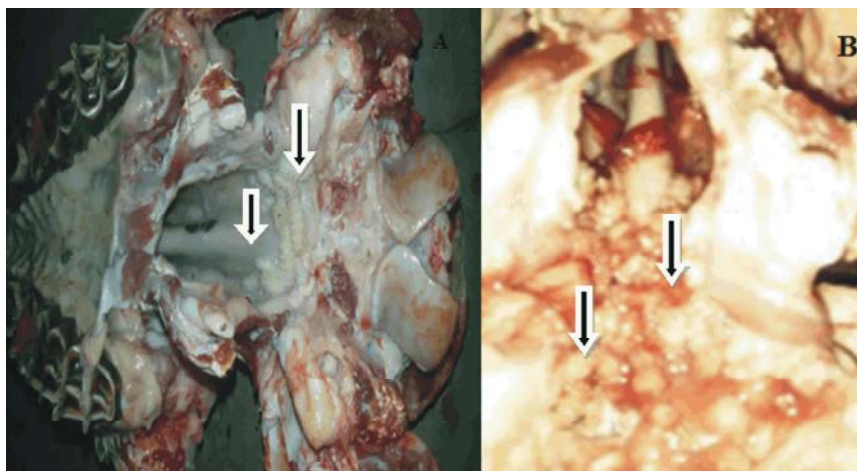


Fig. 1: A. Larvae of *C. titillator* attached to the pharyngeal mucosa of camels and mucus B. hemorrhagic lesions in the attachment sites and larvae.

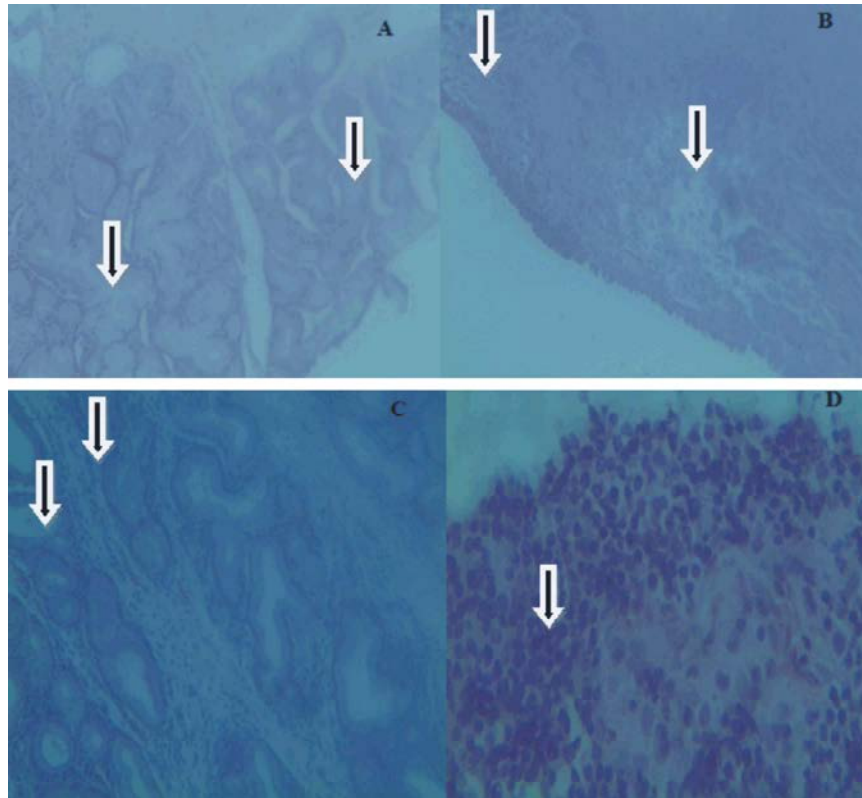


Fig. 2: A. Hyperplasia of goblet cells (10x) B. Desquamated epithelium (4X) C. Hyperplasia of goblet cells and periglandular infiltration with mononuclear cells and eosinophils (10x) D. Mononuclear inflammatory cell infiltration in the mucosa and submucosa with congested vessels (40x).

DISCUSSION

The questionnaire survey carried out in the present study indicated almost all of the respondents 59/60 (98.3%) disclosed that they knew the disease and gave the name “Sengale”. Among the respondents, 88.3% indicated that the disease is not age dependent and affects all age groups. However, this is inconsistency with report of Bekele [16] in which majority of the respondents (93%) stated that “Sengale” is a disease of adult camels. Similarly majority of the respondents reported the disease is not sex and season dependent and affects both sexes throughout the year. This is in line with the questionnaire report of Bekele [16] who reported all the respondents indicated the disease affects both sexes throughout the year as once a camel infected, the infestation persisted for life.

The present study showed that the overall prevalence of the disease in and around Fafen Zone of Somali Regional State of Ethiopia was 73.77%. This finding is in line with the report of Bekele [16] who reported 71.7% prevalence in the area. But, higher prevalence than the

present finding was reported by Richard [22] and Kassa [23] who reported prevalence of 100% and 99.3% in Jigjiga and Diredawa respectively. This difference in prevalence might be due to variation in sampling factors (number of samples and the method used), geographical location and season of the study, management of animal husbandry and the use of drugs by the owners for their camels among the studies. In spite of the differences, most of studies suggested that *C. titillator* is one of the common parasites in camels.

It is also observed that there is no difference in the infestation rate of *C. titillator* ($p>0.05$) between female and male camels, among camels of different age groups and body condition. This finding is in agreement with the report of Shakerian *et al.* [24] and [25] who stated no significant difference in the prevalence infestation between males and females. However, the present finding is not in line with the report of Bekele [16] who stated a statistically significant difference in infestation among female and male camels, different ages and body condition. Therefore, it seems that this study indicated the sex of examined animals has no effect on infestation

by *C. titillator* which is inconsistent with the report of Oryan *et al.* [7] who expressed camel owners normally use the male camels in transportation. It happens that male camels make journeys of hundreds of kilometers and visit many new places and are easily exposed to new epidemic areas of *C. titillators*. Kassa [23] indicated that female camels' infestation may arise from management system of the nomads, in that females are not kept far away from their villages and this may expose female camels to heavier fly challenge in the valleys near the villages by saying females are particularly prone to be affected. On the other hand the male moves far away from the fly challenges in the course of their continuous movement as pack animals. Finally females are under continuous stress which may suppress their immunity. The difference can ascribed to discrepancy in the sample number of the males and females, methods of inspection and geographical location.

Unlike the report of [25] who reported a significantly higher prevalence of *C. titillator* infestation in camels with poor body condition compared to medium and good body condition, there was no significant difference among camels of different body condition in the present study.

In the present study a high difference ($p < 0.001$) in the number of larvae in camels of different ages were observed. In agreement with the results from the other studies [7, 9], the present study indicated that the older camels were more infested compared to those of younger. *C. titillator* is a chronic condition and the persistence of the larvae in situ for almost a whole year was reported in Saudi Arabia Hussein *et al.* [9]. The older camels may be more tolerant of the flies and allow the deposition of the eggs around the nostrils, whereas the younger animals actively seek to prevent the flies settling around the nostrils.

However, in the present study there were no statistically significant difference ($P > 0.05$) in the number of larvae among camels of different sex and body condition. This is consistent with Bekele [16] in Jigjiga, who reported mean larval count difference in female and male and among camels of different body condition. Despite this Kassa [23], in Dire Dawa reported that the difference in the number of larvae between male and female is not significant ($p > 0.05$).

The major gross pathological changes observed such as copious mucous secretions, hemorrhages, black spots and also congestion of mucous membrane are consistent with the gross findings of [22], Kassa [23] and that of Bekele [16]. The conical spines of the second and third stages of larvae may cause lesions while they are

attaching and detaching in different areas of mucous membrane. Conspicuously many larvae were still active and crawling about freely, however, some were loosely attached; others were still adhered firmly to the pharyngeal mucosa by their hooks was observed. This is line with the gross examination report of [26] who indicated the presence of active larvae, some are free and others attached loosely and firmly.

Microscopic lesions observed in this study such as formation of lymphoid nodules in the submucosa, desquamation of the epithelium with inflammatory cell infiltration in the submucosa and interglandular areas and hyperplasia of goblet cells are in accordance with Oryan *et al.* [7] who reported the main microscopic lesions such as desquamation, hydropic degeneration of mucosal epithelium with hyperplasia of goblet cells. Infiltration of lymphocytes, plasma cells, macrophages, eosinophils and fibroblasts focally or diffusely in mucous and sub-mucosal tissues. The blood vessels of the pharyngeal wall of the infected camels were hyperemic.

CONCLUSION

The present study indicated that *C. titillator* was widely prevalent in dromedary camels extensively managed in Jigjiga and Gursum districts of Fafen Zone with the high prevalence rate of 73.77%. It had been observed that camel nasal myiasis (Sengale) is an important health problem in the study area by affecting the well-being and productivity of camels leading to reduced benefit from camel herding. The gross and microscopic lesions observed in the affected tissues indicated *C. titillator* infestation cause severe effect to the host. Considering the facts that the infestation can be massive, that other organs may be involved and that the larvae may remain in situ for almost a whole year, it would not be too presumptuous to incriminate the condition as an important camel ailment warranting further detailed investigations. Thus, the control of the adult *C. titillator* and its larval instars is a must to exploit full benefit of camel herding. It also necessitates studying the other aspects of this disease especially its economic importance in the future.

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