

Prevalence and pathology of camel nasal myiasis in eastern areas of Iran

A. Oryan¹, A. Valinezhad² and M. Moraveji³

¹ Department of Pathobiology, School of Veterinary Medicine, Shiraz University, Shiraz, Iran.

² Department of Pathology, Razi Vaccine and Serum Research Institute, Mashhad, Iran.

³ Department of Parasitology, School of Veterinary Medicine, Shiraz University, Shiraz, Iran.

Email: oryan@shirazu.ac.ir

Received 3 January 2008; received in revised form 21 February 2008; accepted 23 February 2008.

Abstract. Camel botfly, *Cephalopina titillator*, causes severe economic losses to the camel industry in many camel-producing areas of the world. A total of 1328 camels, of different age groups and of both sexes, slaughtered at Mashhad Slaughterhouse, Khorasan Razavi Province, eastern Iran were inspected for infestation with larvae of *C. titillator*. After slaughtering, the head was dissected and grossly inspected for presence of *C. titillator* larvae and other gross abnormalities. Seven hundred and seventy one camels (58.1%) were infested with this larvae and the rate of infestation was significantly greater in the colder months (69.8%) compared to those of warmer ones (36.2%) and in males (65.0%) compared to those of the female camels (45.60%). The prevalence rate was lower in camels younger than 2 years old (39.8%) compared to those of 2-6 (61.5%) and over 6 years old (62.8%).


Proper tissue sections from nasal cavity, pharynx, turbinates and frontal sinuses of 30 infested and 10 uninfested camels processed routinely for histopathological studies. The mucous membranes of the nasopharynx and frontal sinuses of the heavily infested camels were congested, swollen, edematous, occasionally haemorrhagic and infrequently occupied by copious amounts of muco-fibrinous exudates. Dark brown or black nodules were seen in the mucous membrane of these structures. The main histopathologic changes were desquamation, hydropic degeneration and hyperplasia of the mucosal epithelium with focal or diffused infiltration of lymphocytes, plasma cells, macrophages, eosinophils and fibroblasts in the mucosa and submucosal layers. Hyperemia of the blood vessels of the nasopharyngeal wall, goblet cell hyperplasia and cystic dilatation of submucosal secretory glands were also present in the heavily infested animals. This investigation was designed to record the prevalence together with gross and histopathological changes observed due to *C. titillator* in camels in eastern provinces of Iran.

INTRODUCTION

Numerous camels (*Camelus dromedarius*) are raised in the semi-arid regions in eastern part of Iran. Camel raisers try to submit the animals basically for meat consumption purpose. In some areas of Iran, people are used to consume camel meat which has good quality and is economically fair in comparison to beef and sheep.

Nasopharyngeal myiasis of camels is caused by the larvae of *Cephalopina titillator*, an obligate parasite of the Oestridea family that attacks only camels (Hussein *et al.*, 1982; Higgins, 1985). The

adult fly is widely distributed in areas where camels are found (Higgins, 1985). During part of its life-cycle, the female fly darts towards the nostrils and deposits its larvae directly into the nasal cavity. From there the larvae crawl up to the nasopharynx and sometimes the paranasal sinuses and molt twice while attached to the naso-pharyngeal and paranasal mucous membranes and cause extensive irritation and tissue damage. They remain attached to the mucous membrane of these organs for up to 11 months; during which time they feed and cause extensive irritation and tissue damage (Hussein *et al.*, 1982). The mature white or



grey third stage larvae grow up to 35 mm and up to 15 mm in the second stage, but the L1 stage is only about 0.7 mm long. These 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, fertility and hide quality (Hall & Wall, 1995; Otranto, 2001).

Infested camels lose their appetite, show difficulty in breathing, snort, sneeze, expel the larvae from their nostrils and may show abnormal behavior resembling cranial coenuriasis and they often become restless and may even stop feeding (Zumt, 1965). They infrequently may finally die from meningitis caused by secondary bacterial or viral infections (Burgemeister *et al.*, 1975; Musa *et al.*, 1989). The intensity of clinical signs depends on the amounts of damage by migrating larvae.

There are very few reports of the infection of camels with *C. titillator* in the world. However, it seems it is a common and widespread parasite in camels of different continents and needs more scientific attention. A high incidence has been reported in Chad (Graber & Gruvel, 1964) and other parts of West Africa (Currasson, 1947) as well as Sudan (Steward, 1950; Musa *et al.*, 1989), Egypt (Ashmawy *et al.*, 1985; Al-Khateeb, 1992), Ethiopia (Daynes & Richard, 1974; Richard, 1979), Iraq (Abul Hab & Al Affass, 1977), India (Brunetti, 1923), Pakistan (Minar *et al.*, 1977), Israel (Hadani & Rouchbach, 1973; Elias *et al.*, 1982), Afghanistan (Minar *et al.*, 1977), former U.S.S.R (Kunichkin, 1975), Australia (Spratt, 1984), Saudi Arabia (Hussein *et al.*, 1983~Fatani & Hilali, 1994) and Nigeria (Desbordes & Ajogi, 1993). Except a report by Rak & Anwar (1974) that they grossly inspected a small numbers of camels in central parts of Iran, there is no other scientific published information about infection of the camels of Iran with *C. titillator*. As such the influence of seasonal variation on the prevalence of this infection in this country is also ill-defined. However, Hussein *et al.* (1983) carried out an investigation in which they

recorded the monthly prevalence of myiasis in camel in Saudi Arabia. Al-Ani *et al.* (1991) also studied the seasonal prevalence of the infestation over a 10 months period in Iraq and Desbordes & Ajogi (1993) studied the seasonal prevalence in Sokoto State, Nigeria.

Despite severe clinical signs and even death of highly infected animals little is known about the pathological effects of the botfly, *C. titillator*, in camels. In heavy infection, the breathing of the animal is greatly impaired due to blockage of the nasopharynx by larvae and/or mucofibrinous secretions (Zumt, 1965). Occasionally the larvae may reach the cranial cavity causing meningitis. Hussein *et al.* (1982) referred to the appearance of neurological signs resembling cranial coenurosis in some affected camels. It is also mentioned that the mechanical damages such as penetrating the ethmoid bone by the larvae may assist in the introduction of bacteria and viruses to the cerebrospinal canal (Leese, 1927; Zumt, 1965). Burgemeister *et al.* (1975) reported that the larvae were highly pathogenic and that the infected camels refused to eat or drink and finally died with death accelerated by meningitis followed by secondary infection.

Despite the high incidence of nasopharyngeal myiasis in many camel rearing countries, very few epidemiological surveys have been carried out to study the prevalence and the influence of seasonal variation on the prevalence of the infestation. Therefore, this study was carried out to update the information on the prevalence of *C. titillator* infection in camel and to study the influence of age and seasons on the prevalence of this larval infection in camels of Mashhad city, center of Khorasan Razavi Province, eastern Iran. In addition the gross and histopathological abnormalities associated with *C. titillator* infection in camel are also described. The results of this study may provide a rational starting point for planning treatment and control measures against the fly and the larvae and may even shed light on some aspects of the life cycle pattern and ecology of the parasite.

MATERIALS AND METHODS

This study was carried out on 1328 camels (480 females, 848 males) from the slaughterhouse of Mashhad city, Khorasan Razavi Province, east of Iran, during the period from September 2002 to August 2005. The animals were arranged in three age groups; less than two years old, 2-6 years old and over 6 years old. Generally these camels have been brought for slaughter from different eastern parts of Iran including Khorasan, Sistan and Bluchestan Provinces of Iran that are arid and semi arid areas with low annual rainfall. Numerous camels (*C. dromedarius*) are raised in these regions of Iran. Information on prior antiparasitic treatment was not available, but considering the usual management of animals in the region, the condition of the animals, and their other parasitic fauna, it was unlikely that they had received any drug against *C. titillator*. The slaughterhouse was visited two times a week. The heads of the slaughtered camels were separated from the rest of the body and then dissected sagittally and careful gross examination was performed on the nasal cavity, nasopharyngeal area, frontal sinuses and turbinate bones. These structures were carefully inspected for the presence of the first, second and third instars of *C. titillator* and possible gross abnormalities. Appropriate sections from the nasopharyngeal area, frontal sinuses, turbinate bone and meninges representing different types of lesions from 30 infected camels and 10 uninfected ones were fixed in 10% neutral buffered formalin, dehydrated in graded alcohols, embedded in paraffin,

sectioned into about 5 µm thicknesses, stained with haematoxylin and eosin and studied with a routine light microscope. Larvae of *C. titillator* were identified according to Zumpt (1965) identification criteria. The recovered larvae from each camel were collected, counted and their size was measured. The results were analyzed by student *t*-test and analysis of variance wherever appropriate (Bailey, 1984).

RESULTS

Prevalence of infestation

Examination of the nasal cavity, pharynx, larynx, turbinates and sinuses of 1328 camels during the study period (September 2002 to August 2005) revealed that 771 of the camels (58.1%) were infested with instars of *C. titillator*. As is shown in table 1 the prevalence of infestation from September to March that is identical to the cold seasons (Autumn and Winter) in this country was significantly higher (69.9%) than warm seasons (36.0%) ($P < 0.05$). As is stated in table 2 the rate of infestation was significantly higher in males (65.0%) compared to those of female animals (45.6%) ($P < 0.05$). The prevalence of infestation was also significantly higher in animals of 2-6 years old (61.7%) and older than 6 years age groups (62.0%) compared to those of less than 2 years old animals (39.8%) ($P < 0.05$). The minimum and maximum numbers of *C. titillator* found per camel were 6 and 136 respectively with a mean of 23.2 larvae per camel in cold seasons and 3 and 74 with a mean of 14.4 for warm seasons.

Table 1. Prevalence of *Cephalopina titillator* infection in camel based on cold and warm months of the year

| Age (year) | Warm seasons | | | Cold seasons | | | Total | | |
|------------|--------------|----------|------------|--------------|----------|------------|-----------|----------|------------|
| | inspected | infected | prevalence | inspected | infected | prevalence | inspected | infected | prevalence |
| 0.6-2 | 96 | 16 | 16.7 | 130 | 74 | 56.9 | 226 | 90 | 39.8 |
| 2-6 | 209 | 85 | 40.7 | 619 | 434 | 68.5 | 828 | 511 | 61.7 |
| > 6 | 159 | 66 | 41.5 | 115 | 96 | 83.5 | 274 | 170 | 62.0 |
| total | 464 | 167 | 36.0 | 864 | 604 | 69.9 | 1328 | 771 | 58.1 |

Table 2. Prevalence of *Cephalopina titillator* infection in camel based on age (year) and sex

| Age (year) | Total | | | Males | | | Females | | |
|------------|-----------|----------|----------------|-----------|----------|------|-----------|----------|------|
| | Inspected | Infected | Prevalence (%) | inspected | infected | (%) | inspected | infected | (%) |
| 0.6-2 | 226 | 90 | 39.8 | 130 | 51 | 39.2 | 96 | 38 | 39.6 |
| 2-6 | 828 | 511 | 61.7 | 555 | 379 | 68.3 | 273 | 132 | 48.4 |
| Over 6 | 274 | 170 | 62.0 | 163 | 121 | 74.2 | 111 | 49 | 44.1 |
| Total | 1328 | 771 | 58.1 | 848 | 551 | 65.0 | 480 | 219 | 45.6 |

Gross examination

The infestation was restricted to the nasopharyngeal cavity and turbinates; the nasal cavity was congested and plugged by thick, dark-colored mucus in which some larvae were entangled. Many larvae were still active and crawling about freely, however, while some were loosely attached, others adhered firmly to the pharyngeal mucosa by their hooks and when removed, firm reddish nodules marked the sites of attachment. The mucous membrane was swollen, hemorrhagic and partly edematous. Several dark brown or black nodules were also noted in other parts of the nasopharyngeal mucosa representing earlier foci of attachment. These nodules were hard in consistency and contained calcareous material, probably of parasitic origin. A few larvae were seen deep in the turbinate bones and ethmoid area. The damage varied greatly with the number of migrating larvae.

Histopathological findings

The microscopic changes depended on the severity of attack and the stage of the larval development. The main microscopic lesions were desquamation, hydropic degeneration of mucosal epithelium with hyperplasia of goblet cells. Infiltration of lymphocytes, plasma cells, macrophages, eosinophils and fibroblasts was seen focally or diffusely in mucous and sub-mucosal tissues. The blood vessels of the pharyngeal wall of the infected camels were hyperemic. Cystic dilatation and degeneration of the sub mucosal glands which contained a few mononuclear cells mixed with variable amounts of eosinophilic materials were also seen in some of the infected camels.

In more chronically affected animals, the cellular infiltration of the pharyngeal wall was significantly reduced. Various reparative processes were encountered, including formation of granulation tissue, fibroblastic proliferation, angiogenesis, scar tissue formation, atrophic changes and focal calcification.

DISCUSSION

The present study showed that *C. titillator* is a common parasite of camels in the eastern province of Iran. The overall rate of infestation among 1328 inspected camel heads was 58.1%. The prevalence of infestation was lower in the warm seasons of the year from April to September compared to cold seasons from October to March. However, all three stages of larvae were found in each month of the year. This indicates that the flies may be found all year around, but in varying level of abundance. We did not determine the relative proportions of first stage larvae, so it is difficult to suggest the time of the year when the flies are most active in breeding. However, the highest prevalence rates were found from October to March. Reports from neighboring countries showed that the fly is a common parasite of camel over there (Abul-Hab & Al-Affas, 1977; Al-Ani *et al.*, 1991; Fatani & Hilali, 1994). Hussein *et al.* (1983) found a 67.6% infestation rate in Saudi Arabia. It is also known that the incidence of this parasite in camels in other countries is usually high. The prevalence of infestation is reported to be 100% in Ethiopia (Richard, 1979) and 74%, 81%, 47% and 52% from the

Sudan, Egypt, Iraq and Saudi Arabia respectively (Steward, 1950; Abul Hab & Al Affass, 1977; Fatani & Hilali, 1994). These infestation rates indicate that the flies are capable of thriving in hot climates.

Our study indicated that the percentage of infected camels in cold seasons was higher than warm seasons. Fatani & Hilali (1994) reported in Saudi Arabia the monthly prevalence of the second and third instars of *C. titillator*. They showed that these larval stages decreased during April, May, June and July; during this period the adult fly and the first instars were present. They stated that the reasons for the low prevalence in warm seasons could be due to the small size of the first stage larvae that may be overlooked and absence of the larger sized, second and third stages larvae.

It is stated that the larval period in the nasal cavity, turbinates and frontal sinuses of the camel to be 11 months (Urquhart *et al.*, 1989; Desbordes & Ajogi, 1993). Some of the camels of the Group less than 2 years old were younger than a year and it is possible that they were born after the active season of the flies and were not exposed to infestation up to that time. It is not clear why the male camels were more infected than females. Normally the owners 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*. Similarity of the prevalence in the males and females less than 2 years old group will support this hypothesis. In fact the animals of this group were still immature and were not able to participate in the transportation duties and were mostly kept with their mothers close to the nomadic Assyrians' homes.

In spite of the high incidence of camel nasal botfly, little is known about its clinical and pathological effects. Except in severe infestations, few symptoms are reported to be the outcome of this larval infection (Hadani & Rouchbach, 1973). However the present observation indicates quite clearly that the oestrides can account for significant pathology. At first severe inflammatory and

degenerative changes occur, leading to extensive damage of the nasopharyngeal tissues. Later, the damaged parts undergo healing with fibrosis, scarring, atrophy and calcification. These changes may occur concurrently in the same animal because of the prolonged irritation and feeding activities of the larvae. 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. Because the impacts of camel nasal botfly on the respiratory function, feeding, health and productivity of the animals are not fully understood, so it is necessary to study the other aspects of this disease specially its economical importance in future.

Acknowledgement. The authors are grateful to Alireza Sadeghnia and Shahrokh Sarmadi from the Mashhad branch of the Razi Vaccine and Serum Research Institute, Mashhad, Khorasan razavi Province eastern Iran for their technical assistance. They also would like to thank the abattoir officials of the slaughterhouse for their assistance.

REFERENCES

- Abul-Hab, J. & Al-Affass, N.N. (1977). Seasonal occurrence of the domestic camel botfly *Cephalopina titillator*, Diptera, Oestridae in Central Iraq. *Bulletin of the Biological Research Centre (Baghdad)* **8**: 97-104.
- Al-Ani, F.K., Khamas, W.A., Zenad, K.H. & Al-Shareefi, M.R. (1991). Camel nasal myiasis: clinical, epidemiological and pathological studies in Iraq. *Indian Journal of Animal Sciences* **61(6)**: 576-578.
- Al-Khateeb, R.M.M. (1992). Biological Studies on *Cephalopina titillator* infesting camels in Egypt. MSc Thesis, Cairo University, pp: 98.

- Ashmawy, K.I., Fahmy, M.M. & Hilali, M. (1985). Incidence and seasonal variations of the larvae of *Cephalopina titillator* infesting camels (*Camelus dromedarius*) in Egypt. Proc. XIIth Syposia of the Scandinavian Society of Parasitology. Tromsø, Norway, 17-19 June, 1985. Abo Akademi, Finland, pp: 43-44.
- Bailey, N.T.J. (1984). Statistical Methods in Biology. English University Press, London, pp: 43-44.
- Brunetti, E. (1923). Pipunculidae Syrphidae, Conopidae, Oestridae. *Fauna of British India, Diptera* **3**: 424.
- Burgemeister, R., Leyk, W. & Gössler, R. (1975). Incidence of parasitoses, bacterial and viral diseases in dromedaries of southern Tunisia. *Deutsche Tierärztliche Wochenschrift* **82(9)**: 352-354.
- Currason, G.G. (1947). Le Chameau et ses Maladies. *Journal of Comparative Pathology and Therapeutics*, pp.132 and 137, Vigot Freres, Paris.
- Daynes, P. & Richard, D. (1974). Note about helminths (and some other parasites) of the dromedary in Ethiopia. *Revue d'Elevage et de Médecine Veterinaire des Pays Tropicaux* **27(1)**: 53-56.
- Desbordes, O. K. & Ajogi, I. (1993). Seasonal prevalence of *Cephalopina titillator* myiasis in camels (*Camelus dromedarius*) in Sokoto State Nigeria. *Veterinary Parasitology* **50**: 161-164.
- Elias, E., Smuts, M.M.S. & Rauchbach, K. (1982). A note on the camel nasal larvae (*Cephalopina titillator*) in the Negev desert. *Refuah Veterinarith.* **39(4)**: 171-173.
- Fatani, A. & Hilali, M. (1994). Prevalence and monthly variations of the second and Third instars of *Cephalopina titillator* (Diptera: Oestridae) infesting camels (*Camelus dromedarius*) in the Eastern Province of Saudi Arabia. *Veterinary Parasitology* **53**: 145-151.
- Graber, M. & Gruvel, J. (1964). Etude des myiasis des animaux domestique et sauvages d'Afrique Equatoriale. *Revue d'Elevage et de Médecine Veterinaire des Pays. Tropicaux* **17**: 535-544.
- Hadani, A. & Rauchbach, K. (1973). The occurrence of myiasis in domestic animal in Israel. *Deutsche Tierärztliche Wochenschrift* **80**: 137-139.
- Hall, M.J.R. & Wall, R. (1995). Myiasis of humans and domestic animals. *Advances in Parasitology* **35**: 257-334.
- Higgins, A.J. (1985). The camel in health and disease. *British Veterinary Journal* **141**: 197-216.
- Hussein, M.F., El-Amin, F.M., El-Tayeb, N.T. & Basmae'il, S.M. (1982). The pathology of nasopharyngeal myiasis in Saudi Arabian camels (*Camelus dromedaries*). *Veterinary Parasitology* **9**: 253-260.
- Hussein, M.F., Hassan, H.A.R., Bilal, H.K., Basmae'il, S.M., Younis, T.M., Al-Motlaq, A.A.R. & Al-Sheikh, M.A. (1983). *Cephalopina titillator* infection in Saudi Arabian camels. *Zentralblatt für Veterinärmedizin. Reihe B. Journal of Veterinary Medicine. Series B* **30**: 553-558.
- Kunichkin, G.I. (1975). Polostnoi ovod verblyudov i mery bor'by snim. *Veterinaria, Moscow* **9**: 77-79.
- Leese, A.S. (1927). Treatise on the one-humped camel in health and in disease. Stamford, Lincolnshire, Hynes and Son, pp: 272.
- Minar, J., Olejnicek, J. & Amin, A. (1977). On some Oestridae, Hypodermatidae and Hippoboscidae Diptera from Afghanistan. *Folia Parasitologica Prague* **24(1)**: 92-93.
- Musa, M.T., Harrison, M., Ibrahim, A.M. & Taha, T.O. (1989). Observation on Sudanese camel nasal myiasis caused by the larvae of *Cephalopina titillator*. *Revue d'Elevage et de Médecine Veterinaire des Pays Tropicaux* **42(1)**: 27-31.
- Otranto, D. (2001). The immunology of myiasis: Parasite survival and host defense strategies. *Trends in Parasitology* **17 (4)**: 176-182.
- Rak, H. & Anwar, M. (1974). Some Diptera larvae causing myiasis in Iran. *Entomologist's Monthly Magazine* **110**: 79-80.
- Richard, D. (1979). Dremedary pathology and production. IFS (International



- Foundation for Science). Workshop on Camel, Khartoum, 18-20 December. Provisional Report No. 6, 409-429.
- Soliman, K.N. (1965). Parasites of camels, *Camelus dromedaries*, in Egypt with special references to same in Sudan. Proceedings of 3rd Annual Veterinary Medical Association, Cairo, pp:385.
- Spratt, D.M. (1984). The occurrence of *Cephalopina titillator* in camels in Ausralia. *Journal of the Australian Entomological Society* **23(3)**: 229-230.
- Steward, J.S. (1950). Notes on some parasites of camels (*C. dromedarius*) in the Sudan. *Veterinary Record* **62**: 835-837.
- Urquhart G.M., Armour, J., Duncan, J.L., Dunn, A.M. & Jennings, F.W. (1989). Cephalopina. In: *Veterinary Parasitology*, Longman, pp: 162-163.
- Zumpt, F. (1965). *Myiasis in Man and Animal in the Old World*. Vol. 15, Butterworth, UK, London, pp: 267.