Myiasis among slaughtered animals in Kashan, Iran: descriptive a veterinary entomological problem in the tropics

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Abstract

Myiasis is a common veterinary entomology problem in many slaughterhouses in the tropics. Prevalence of myiasis among slaughtered cattle was investigated in Kashan abattoir, central Iran, in 2009. All kind of dipterous larvae that may cause myiasis were collected and identified then the prevalence of each infestation analyzed by statistical tests. The results of the study revealed a total of 4 species of dipterous larvae belonged to two families of Sarcophagidae and Oestridae. The identified species were as follows: Family Oestridae: Hypoderma lineatum (61.4%), Hypoderma ovis (12.6%), Oestrus ovis (22.7%) and Family Sarcophagidae: Wohlfahrtia magnifica (3.8%). Of the 7736 examined animals, 2.5% of goats and 0.5% of sheep were infested by any kinds of dipterous larvae. Statistical comparisons were made between sex of host species and occurrence of myiasis, infested animals and species of larvae, the infested body parts of host, and finally between the prevalence and origin of the cattle. Statistically the possibility of infestation of goats was 1.43 times more than sheep (odds ratio=1.43). These finding can be considered by officials to keep the human and animal myiasis under control. There is also need to investigate the prevalence and incidence of animal myiasis in other parts of the country to clarify the spread of infestation in the country and in the region.

Keywords: Myiasis, Oestrus ovis, Hypoderma lineatum, Hypoderma bovis, Wohlfahrtia magnifica, Iran

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Introduction

Animal health is one of the major veterinary concerns which can affect human public health in communities. Endoparasitic or ectoparasitic infestations are known as the most important veterinary problems in tropical areas such as Iran. Myiasis is a parasitic infestation affecting livestock in many parts of the world. It can define as "the infestation of live vertebrate animals with dipterous larvae, which, at least for a certain period, feed on the host's dead or living tissue, liquid body substances, or ingested food" (Zumpt, 1965). Such feeding behaviors usually cause a major damage to the host tissues if left untreated (Zumpt, 1956). Myiasis often occurs in wild animals, but it also occurs in domestic animals and even humans (Hall, 1997, Wall, 1992 and Dehghani et al. 2012). There are various types of myiasis that according to the species of fly, may involve obligate, facultative or in some cases accidental parasitic infestations. Myiasis can be classified according to the part of the body affected (Langan et al., 2004). Dermal and sub-dermal myiasis in animals due to invasion of Diptera larvae to skin tissues has economical importance to livestock industry. Nasopharyngeal myiasis in animal occur when the fly breed in nasal cavity of its host animal, in this case there are mild to serious symptoms in animal including loss of appetite, difficult breathing, snort and sneeze. However, all kind of myiasis damage animal welfare and cause significant economic losses to livestock through abortion, reduction of milk production, poor weight gain, infertility and low hide quality. Myiasis is a self-limiting infestation with minimal morbidity in the vast majority of cases (Bologna et al., 2008), although if they leave untreated may lead to death (Zumpt, 1956) and to date there have been reported some fatal cases (Cestari et al., 2007). This kind of infestation has a worldwide distribution related to the latitude the various species of flies. The incidence of myiasis usually is higher in the tropics and subtropics than cold regions.

A number of articles have been published on myiasis in Iran. The earliest studies conducted by Minar in Iran, reported an ophthalmomyiasis in a woman in Tehran (Minar, 1976). Following him many cases of human myiasis have been reported in different parts of human body, by various fly species and in different parts of the country (Janbakhsh et al., 1977, Tirgarie et al., 1977, Jdalayer et al., 1978, Karimi and Vahidi 1999, Talari et al., 2002, Hakimi and Yazdi 2002, Razmjou et al., 2007, Soleimani et al., 2009 and Salimi et al., 2010). These reports indicated that the human myiasis is always linked to the animal myiasis or unhealthy environment. Several species of different families of order Diptera are involved in animal myiasis in Iran (Khoobdil et al., 2004).

Unfortunately, research on veterinary entomology is not as much as medical entomology in Iran; there are a few investigations in veterinary entomology which have described the situation of myiasis among the cattle in some parts of the country. In a veterinary entomological research, Navidpour et al. reported the Old World Screw Worm, Chrysomyia bezziana, as one of the most common cattle myiasis in Iran. They also reported the first outbreak of cattle myiasis caused by C. bezziana, in south and south west of the country (Navidpour et al., 1996, 2009). In a study on the prevalence of cattle hypodermosis, Esmailnia et al. reported the cases of hypodermosis in Kazeroon abattoir in the Southern areas of Iran (Esmailnia et al., 2000). Recently Tavassoli et al. recorded the hypodermosis cases in the north areas of Iran (Tavassoli et al., 2010).

In order to protect animal and human health, this study was conducted to determine the prevalence of myiasis among slaughtered animals, discovering the larvae species and fauna of the flies responsible of myiasis in Kashan abattoir.

Materials and methods

Study area

The study was carried out among sheep and
goats slaughtered at Kashan Abattoir located in Kashan city, Isfahan province, central Iran. Kashan located in a warm and dry region and marginalized from the North and East to the desert with an altitude of 940 m, 33° 59' N longitude 51°26' E latitude. The average annual precipitation is 135 mm almost half the average rainfall in Iran and sixth precipitation of the world. It has a mean annual temperature of 14°C.

**Study animals and the larvae collection**

Heads and bodies of all slaughtered animals including sheep and goats at the abattoir were thoroughly examined for the presence of larvae of any flies. Cattle were brought there from other provinces including Kordestan, Fars, Isfahan, Qom and Lorestan. Both male and female animals were slaughtered in the abattoir. Cattle carcasses were examined one day per week in 24 times sampling at the abattoir from November 2008 to May 2009. The collections took a whole day each time at the slaughter house.

The five major sites in the heads, including nasal cavities, septum, middle meatus, conchae, and sinuses were examined for the presence of any kind of larvae. Skins and subcutaneous tissues of the whole body of cattle were thoroughly examined for the presence of dipterous larvae. The collected larvae were counted, washed in physiological saline solution (NaCl 0.9%) and preserved in a separate container for each carcass with 70% alcohol, then were transported to the Medical Entomology laboratory at Environment Health Department of Kashan University of Medical Sciences.

**Laboratory examination**

The collected larvae were processed for micro-slide preparation. The larvae were boiled in 10% potassium hydroxide (KOH) for an hour to clear the stigmal plates of posterior spiracles. The samples were then washed with distilled water and glacial acetic acid for 15 and 10 minutes respectively. They were dehydrated in ascending grades of ethyl alcohol starting from 70% to absolute alcohol for 5–10 min in each grade. Then the specimens washed in xylol and cleared in cedar oil. The larvae were mounted using canada balsam. The identification key of Zumpt (1965) was used to identify.

**Data analysis**

Statistical comparisons were made using chi square test and Pearson correlation between sex of host species and occurrence of myiasis, the infested body parts of host, infested animals and species of larvae and finally between prevalence and origin of the cattle. All analyses were performed using SPSS for windows version 15, SPSS, Inc., Chicago, IL. All values of \( p < 0.05 \) were considered significant.

**Results**

During this survey a total 7736 slaughtered cattle including 5934 sheep and 1802 goats were examined. Of the 7736 animals examined, 192 goats (2.5%) and 41 sheep (0.5%) were infested by any kinds of dipterous larvae. Myiasis was seen in 3.2% of all goats and 2.3% of all sheep at the Kashan Abattoir (Table 1). There were significant differences in myiasis occurrence and the number of slaughtered animals by using \( \chi^2 \)-square analysis (\( p < 0.037 \)). The dipterous larvae were found equally in male and female cattle (3.1%), and there was no significant association (\( p < 0.0999 \)) between percentages of myiasis and sex in both host species. The examined animals were categorized into four age groups; less than one years old, 1-2 years old, 2-3 years old and over 3 years old. The prevalence of myiasis in these age groups were 1.3%, 52.8%, 35.2% and 10.7% respectively.

There was significant association between host species and infestation, the possibility of infestation of goats was 1.43 times more than sheep (odds ratio=1.43). The infestation rates were different on cattle with myiasis. In 10.7% of cases, infestation caused by one larva, 13% by two larvae, 24% by three larvae and 52.3% by four or more than four larvae.
The myiasis cases were observed in different body parts of the both host species, 74% of slaughtered sheep and goats had cutaneous myiasis, 22% nasopharyngeal myiasis, 2% urogenital myiasis and 2% traumatic myiasis. There was no significant association between the host body parts and occurrence of myiasis.

Four species of fly larvae were identified belonging to two families; Family Oestridae: Hypoderma lineatum (61.4%), Hypoderma ovis (12.6%), Oestrus ovis (22.7%), and Family Sarcophagidae: Wohlfahrtia magnifica (3.8%). Hypoderma lineatum was the most common species larvae identified in the study (Table 2). A total of 171 larvae belong to the genus Hypoderma were removed from the hides of infested cattle. Identification based on morphological characters showed that 83.6% were H. lineatum and 16.3% H. bovis. All H. lineatum larvae were found only on goats, while H. bovis were found equally on goats and sheep. A total 53 larvae identified as Oestrus ovis, which 66% of them were found on goats and 34% on sheep. During the study period, the larvae of Wohlfahrtia magnifica were found only on sheep.

Results of the current study showed no statistically significant associations in the prevalence of myiasis in sheep and goats from different origins. Accordingly, highest prevalence of myiasis was recorded in cattle from Qom followed by Isfahan, Fars, Kordestan provinces, whereas the lowest was observed in Lorestan Province (Table 2).

### Table 1. Frequency distribution of Myiasis based on cattle species.

<table>
<thead>
<tr>
<th>Myiasis</th>
<th>Cattle</th>
<th>Sheep n (Percent)</th>
<th>Goats n (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td></td>
<td>1761 (97.7)</td>
<td>5742 (96.8)</td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td>41 (2.3)</td>
<td>192 (3.2)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>1802 (100)</td>
<td>5934 (100)</td>
</tr>
</tbody>
</table>

### Table 2. Frequency distribution of Myiasis based on origin provinces (Iran).

<table>
<thead>
<tr>
<th>Province</th>
<th>Hypodermia lineatum</th>
<th>Oestrus ovis</th>
<th>Hypodermia bovis</th>
<th>Wohlfahrtia magnifica</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kurdestan</td>
<td>17 (7.3)</td>
<td>15 (6.4)</td>
<td>6 (2.5)</td>
<td>-</td>
<td>38 (16.3)</td>
</tr>
<tr>
<td>Fars</td>
<td>36 (15.5)</td>
<td>3 (1.3)</td>
<td>9 (3.8)</td>
<td>-</td>
<td>48 (20.7)</td>
</tr>
<tr>
<td>Isfahan</td>
<td>27 (11.6)</td>
<td>22 (9.4)</td>
<td>3 (1.3)</td>
<td>-</td>
<td>61 (26.1)</td>
</tr>
<tr>
<td>Qom</td>
<td>58 (24.9)</td>
<td>12 (5.1)</td>
<td>10 (4.3)</td>
<td>-</td>
<td>80 (34.4)</td>
</tr>
<tr>
<td>Lorestan</td>
<td>5 (2.1)</td>
<td>1 (0.4)</td>
<td>-</td>
<td>9 (3.8)</td>
<td>6 (2.5)</td>
</tr>
<tr>
<td>Total</td>
<td>143 (61.4)</td>
<td>53 (22.7)</td>
<td>28 (12)</td>
<td>9 (3.8)</td>
<td>233 (100)</td>
</tr>
</tbody>
</table>

### Discussion

The results of this study revealed presence of at least two families and a minimum of four species of flies inducing myiasis in Kashan Abattoir with all prevalence 3%. Hypoderma lineatum and H. bovis, which cause hypodermosis in livestock, were on slaughtered animals in Kashan. Hypodermosis is an economically important infestation among cattle in the world (Soulsby, 1986), although it is under control in many European and North American Countries (Boulard,
2002). Before using chemotherapy and fly control, cattle hypodermosis rate was very high in some countries for instance almost 80% in Czech and Slovak Republics, 49.2% in Greece, 85% in Italy, 52.3% in Spain, 40% in United Kingdom, 32-43% in Romania and 1.9-68% in Turkey (O’Brien, 1997; Zeybek, 1988; El-Metenawy and Zayed, 1992). The infestation rate has been reported 35.5% and 23.5% in a slaughter house and in the field respectively in Pakistan (Ul-Hasan et al., 2008). In China the hypodermosis is highly distributed and in some areas the infestation rate is reported up to 100% (Yin et al., 2003). While the prevalence of hypodermosis was 2.08% in the current study, it has reported earlier 10.86% from Northwest of the country and 3% from Kazeroon in the South (Tavassoli et al., 2008, Esmailnia et al., 2000). Hypoderma lineatum was the most common hypodermosis agent in this study, the results agree with the findings from the study in the Southern parts of Iran. Hypoderma bovis has been reported as a dominate species in the Northwest of Iran; this finding was similar with the results obtained from the studies in Turkey (Merdivenci, 1963, Mimioglu, 1966, Sayin and Meric, 1976, Karatepe and Karatepe, 2008). This similarity is the most probable attribute to the fact that the northwest of Iran and Turkey share the same climate. Likewise, as Kashan in the center of Iran has warm and dry climate like Kazeroon in the South, therefore the result of our study are in agreement with the result obtained from the studies of Esmailnia et al. in 2000. Although, there are some evidence from experimental studies suggested that H. lineatum can not develop in goat hosts (Colwell and Otranto, 2006); we found all H. lineatum larvae only on slaughtered goats. The authors of the article have been found L3 of H. lineatum on wild goats in Kashan area (unpublished data) which is an evidence of existing of a sylvatic cycle of the species in the area.

The sheep botfly, Oestrus ovis (Family: Oestridae), is widespread in many countries where sheep and goats are raised. Previous studies showed a various prevalence values of O. ovis larvae in sheep and goats in different countries for instance 24% in Jordan (Abo-Shehada et al., 2003), 67% in Algeria (Benakhla et al., 2004), 93.6% in Tunisia (Kilani et al., 1986), 21.9% in Zimbabwe (Pandy, 1989) and 22.6% in Libya (Gabaj et al., 1993). The prevalence of O. ovis in cattle in European countries has been reported from 21.9% to 97.18% (Yilma and Dorchies, 1991, Caracappa et al., 2000, Dorchies et al., 2000, Reina et al., 2002, Bauer et al., 2002, Colebrook and Wall, 2004). In the present study, the prevalence of O. ovis was in the second place among the other infestations with prevalence 22.7%. However this parasitic infestation is common in sheep and goats in Iran. In a comparable study in Fars Abattoirs the prevalence of infestation reported 49.7% in sheep (Jafari Shoorijeh et al., 2009). Although, some authors mentioned that the infestation rate of O. ovis is always higher in sheep than in goats (Papadopoulos et al., 2006), on the contrary we found goats infestation nearly twice than sheep in this study. In Libya, the prevalence of O. ovis was recorded 22.6% in sheep and 18.4 % in goats (Gabaj et al., 1993), while it was 34% in sheep and 66% in goats in this study. However, the result of an investigation in Ethiopia agrees with our result (Yilma and Genet, 2000). In addition, O. ovis is the most common cause of human ophthalmomyiasis. Janbakhsh et al. reported a case of human ophthalmomyiasis in Tehran (Janbakhsh et al., 1977) and it is also recorded in a British soldier in Afghanistan (Stacey and Blanch, 1998).

The fleshfly, Wohlfahrtia magnifica (family Sarcophagidae) has been considered as an important obligatory parasite in the wounds of human and animals. Wohlfahrtiosis is found from Europe (mainly in Southern and Eastern Europe) and Mediterranean basin to North Africa and Asia (Zumpt, 1965, Hall and Farkas, 2000 and Hall et al., 2009). In this study, overall 3.8% of all myiasis was caused by W. magnifica and found only in sheep. The
similar result has been recorded from an investigation in an Italian farm with 3% infested sheep and no parasitized goats (Giangaspero et al., 2010). In Israel W. magnifica is known as parasite of domestic animals including dog, goat, sheep, camel, horse and cat (Schnur et al., 2009). It was also recorded in an outbreak in Greece with a great economical impact on the livestock sectors (Sotirakí et al., 2002). Wohlfahrtia magnifica was recorded as the only species in wounds of sheep in a study in Hungry (Farkas et al., 1997), as it had been reported earlier in sheep from Azerbaijan in northwest Iran by Iranian investigators (Janbakhsh et al., 1975). Human myiasis caused by W. magnifica has been reported from many countries. Mohammadzadeh et al. reported a case of human gingival myiasis from a four year old mental retarded boy from Bushehr Province in Iran (Mohammadzadeh et al., 2008). There are also reports describing human cases of urogenital myiasis due to W. magnifica in both male and female (Delir et al., 1999 and Edalat, 2010). It is also recorded human Ophthalmo myiasis due to W. magnifica in Iran (Chams et al., 1992). Furthermore, in a thorough investigation, Ghasemi reported human wound myiasis during the wartime between Iran and Iraq (Ghasemi, 1988). All these reports showed that the species take action as an important myiasis agent in the country.

Results of the current study revealed that the most infested animals came from Qom Province (34.4%), whereas the least were from Lorestan Province (Table 2). Accordingly, the prevalence of infestations was 26.1%, 20.7%, and 16.3% from Isfahan, Fars and Kordestan provinces respectively. All animals with wohlfahrtiosis, as it was only in sheep, came from Isfahan, while we had no cases of wohlfahrtiosis from the other mentioned providences. The majority cases of hypodermosis were recorded among the slaughtered sheep and goats which came from Qom Province with prevalence 24.9% and 5.1% due to H. lineatum and H. ovis respectively. However, H. lineatum observed only in goats from all mentioned providences. In contrast, we observed H. ovis with the exactly same prevalence in both host species. The most prevalence of O. ovis was observed in both sheep and goats from Isfahan Province (9.4%), while the least infestation with just one case recorded from Lorestan (0.4%). Despite of differences in prevalence of myiasis in slaughtered animals from different origins, there was no statistically significant variation between the prevalence of myiasis and origins of livestock.

This study revealed the intermediate prevalence of some myiasis agents among the imported livestock to Kashan. There are some fly families which cause myiasis in livestock and occasionally in humans. Although the adult flies are not parasitic, but fly control can reduce the agents of myiasis. Environmental sanitation is always an important measure in fly control and is considered as the key factor to prevent of this infestation in communities. The majorities of previous studies emphasized that there are some associations between the animal and the human myiasis that posed the important of treatment of animal or human infestations as a significant prevention method of myiasis control in communities. However, it cannot be denied the role of veterinary inspections and necessity of promoting animal health. In conclusion, there is a need for more comprehensive veterinary and entomological studies in order to identify endemic and non-endemic areas in the country and the region. The results of this study would be valuable for the officials to keep the human and animal myiasis under control.

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Conflict of interest

There is no conflict of interest in this paper.

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بررسی میاپیس در میان دام های ذیح شده در کشتارگاه کاشان

به عنوان توصیف یک مشکل حشره شناسی دام پزشکی در مناطق گرمیسر

روح ا... دهقانی ۱، مهندیس، دندانپزشکی کاشان
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۲، مهندیس ۲، دانشگاه علوم پزشکی کاشان

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چکیده

میاپیس یکی از مسائل حشره شناسی دام پزشکی در کشتارگاه‌ها میباشد. در این بررسی شروع میاپیس در بین دام‌های ذیح شده در کشتارگاه کاشان در سال ۱۳۸۹ مورد بررسی قرار گرفت. تمام انواع لارو در کشتارگاه در دو پلوکسه و استفاده گردید و در سه بند دارای شاخص دارای میاپیس در پلوکسه اول و دوم. نتایج بررسی وجود جهار کنونه در بین دام‌ها و استفاده از کشتارگاه در بین دام‌ها نشان داد. از خانواده سارکوزده گونه واقعی و میاپیس مبتلا به وجود جهار کنونه و موجود درپلیس و استرس اول و دوم. خانواده سارکوزده گونه واقعی و میاپیس مبتلا به این جهانه در دو سال گردید. از این میان‌‌بندی و دوم ستاد عفونت‌ها و در پلوکسه با وجود میاپیس در بین دام‌ها و استرس اول و دوم. خانواده سارکوزده گونه واقعی و میاپیس مبتلا به این جهانه در دو سال گردید.

واژگان کلیدی: میاپیس، واقعی، میاپیس مبتلا، کشتارگاه، دام پزشکی