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Prevalence and ectoparasites fauna of sheep and goats flocks in Urmia suburb, Iran

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ABSTRACT

An investigation into ectoparasites of sheep and goats was carried out in the northwest region of Iran. One thousand two hundred goats and 1200 sheep in 14 flocks which were less than eight years old were subjected to examination in three sub-divided areas from April 2003 to March 2004. Ectoparasites (ticks, mites, lice, and fleas) were collected from 77 sheep (6.4%) and 119 goats (9.9%), with an overall prevalence of 8.2%. Ticks were the most frequent ectoparasites. Adult ticks (849) were collected and identified: the highest number belonged to the *Rhipicephalus bursa* (90.7% of sheep and 88.8% of goats), followed by *R. sanguineus* (6.9%), *Boophilus annulatus* (2.4%), plus *Ornithodoros lahorensis* (2.6%). All goats were infested with two species, including *R. bursa* (88.8%) and *R. sanguineus* (11.4%). Ixodid tick distributions per animal were 2.5 for sheep and 4.3 for goats. Fifty-two sheep (67.5%) and 85 goats (71.4%) were infested with three species of lice. These were *Damalina ovis* (58.8%) and *D. caprae* (71.4%), *Haematopinus species* (on sheep 76.6%, and on goats 62.2%), *Linognathus stenopsis* (36.1%), *L. ovillus* (29.4%). The seasons of highest infestation were fall and winter (50%), the least being spring and summer. Of these, two sheep (2.6%) were infested by *Sarcoptes scabiei*, maximum infestation occurring in winter. *Ctenocephalides felis felis* comprised of all the fleas collected (16.8% of goats, and 13% of sheep). Flea infestation was more widespread in fall and winter (10.2%) than in spring and summer (6.1%).

Key words: prevalence, ectoparasites, sheep, goat, Iran

Introduction

The arthropods contain over 80% of all known animal species and occupy almost every known habitat, as well as a plethora of small and little-known groups. As a result of their activity, arthropod ectoparasites may have a variety of direct and indirect effects on their hosts (WALL and SHEARER, 2001). Ectoparasites, particularly ticks, are important

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parasites because of their voracious blood-feeding activity and as vectors for various agents of diseases in both man and livestock (CUMMING, 1998; HENDRIX, 1998).

The occurrence of ectoparasites in sheep and goats flocks are frequently reported in Iran but are seldom quantified. Sheep production used to be a prominent farm activity in west Azerbaijan, but it has begun to be a commercial activity in the past decades. Over the last few years, it has become a commercial enterprise and the recent implementation of the governmental policy for encouraging production has facilitated the expansion of sheep and goats husbandry in the province. Information about ectoparasites existing in sheep and goats flocks has become necessary (ZARIF-FARD and GOUDARZI, 2000). Because of certain geographical specifications and the probable presence of different types of ectoparasites, Urmia suburb was selected for this study. In addition, sheep and goat farming is one of the main animal husbandry activities in West Azerbaijan, particularly in Urmia, Iran (AZIZI and YAKHCHALI, 2006). Furthermore, the effective long-term control of vector-borne disease, and in particular the prediction of changes in patterns of infestation, relies on our understanding the factors that could determine where vector species occur. The key element in planning integrated approaches to pest control is a good knowledge of the epidemiology of the target organism.

The main objectives of this study were to contribute to knowledge of the distribution of the most common sheep and goat ectoparasites fauna by performing epidemiological investigation in this area. We also determined the frequency of ectoparasites and correlating levels of infestations with seasons.

Materials and methods

Field study area. Urmia City, capital of West Azerbaijan province, lies in a fertile agricultural region between 37º 32´ N and 45º 04´ E, with an area of 8000 km^2. The climate is characterized by a mean annual rainfall of 73.1 mm, mean monthly relative humidity of 77%, and mean temperature ranging from -3.8 ºC to +23.4 ºC, according to the Iranian Metrological Organization (IMO, 2003-2004). The province has four distinct seasons: cold season (January to March), spring (March to June), summer (July to September), and fall (October to December). The study was carried out in the mountainous, mountainside, and plain areas of Urmia suburb (altitude 1313 m. ASL) covering 619 villages where places chosen for the study fell within a 20-100 km radius of the city centre (Fig. 1), in the northwest part of Iran (PAZHAND, 1992). An average population of 51 million sheep and 25 million goats were distributed in Iran. West Azerbaijan province has approximately 7.7% (four million) sheep and 2.3% (0.5 million) goats.

Sample size. The 14 flocks were selected over the area, which had been previously divided into three sub-areas. In each sub-area, sheep and goats to be tested were randomly selected and examined. The selected samples, which constituted six flocks, were in the mountainous area, four flocks were on hilly terrain and four flocks were on plains (Table1).

For each flock, data (flock location, management system, daytime, tag number, breed) were collected and recorded in individual files.

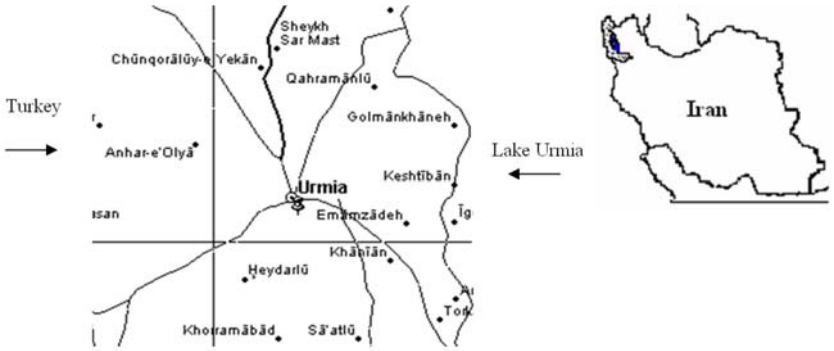

Fig.1. Map of sampling areas and farm positive to investigate ectoparasites on sheep and goats, Urmia suburb, Iran

Table 1. Geographical distribution of field study area based on sampling areas, number of flocks, and small ruminant (sheep and goats) in Urmia suburb

Nº of flocks	Geographical condition			Nº of animals in focks	
	Mountainous	Hilly	Plain	Sheep	Goats
2	+	-	-	150	150
2	+	-	-	150	150
2	+	-	-	150	150
3	-	+	-	175	175
1	-	+	-	150	150
2	-	-	+	250	250
2	-	-	+	175	175
Total 14	+	+	+	1200	1200

The flocks examined followed traditional husbandry practices, with animals grazing during the daytime in less than three seasons of the year (spring, summer, and fall). Animals were mainly crossbreed and indigenous.

Parasitological procedures. Tick collection was usually done in the early mornings and in the evenings from the body of the animal and never from the ground, in order to minimize accidental occurrences from other livestock. Hard ticks were collected individually (goats

and sheep) using alcohol by dabbing the tick and the surrounding skin to remove embedded living ticks. Care was taken to ensure that the mouthparts were not left behind during the traction with thumb forceps (BOWMAN, 1999). Ixodid tick numbers were recorded and ticks were placed into 70% ethanol in glass vials. The vials were individually labelled with the date and place of collection. Data recorded included the predilection site of the ticks (head, ear, neck, axilla, shoulder, back, belly, udder, anogenital area, flanks, front and rear legs, fat tail, and tail). Management practices followed (extensive or intensive); stage of tick collected (larva, nymph, adult); age and sex of the animals, and recent use of acaricide (s). Samples sent from the field to the Parasitology laboratory for identification were also used for mapping the tick fauna of the Urmia suburb.

Deep skin scraping is one of the most common diagnostic tools used in evaluating animals with dermatological problems. Before the skin was scraped the blade was dipped in a drop of mineral oil on the slide. During the scraping process, 6-8 cm^2 was scraped. Upon clinical findings, the skin was scraped for mites that lived in tunnels (e. g. Sarcoptes species) until capillary ooze occurred from the area (HENDRIX, 1998). Brushing over moistened, white blotting paper helped to identify flea Infestation (WALL and SHEARER, 2001). The most practical means of detecting lice was generally inspection of sheep with primary sample units of animals and secondary units of fleece pertaining to multiple body sites and collecting the lice from the body regions (head, neck, flanks, front and rear legs, and belly), (KETTLE and LUKIES, 1984; JAMES and MOON, 1999; WALL and SHEARER, 2001; WARD and ARMSTRONG, 2000).

Examination of ectoparasites. Unfed adult hard ticks used in the morphological study were examined by light microscope and each morphological character was measured and recorded.

Hairs collected by coat brushing and plucking were mounted in liquid paraffin, and examined microscopically for evidence of ectoparasites (WALL and SHEARER, 2001). For lesions caused by lice, the detritus was scraped into an ointment tin using the cover as a scraper and then the scrapings were examined under a stereoscope. The scrapings which contained much debris with no lice and mites were digested by potassium hydroxide (10% KOH) for 20 min and centrifuged (BOWMAN, 1999).

The observed ectoparasites (ticks, mites, lice, and fleas) were identified according to the keys of CLIFFORD et al. (1964), WALL and SHEARER (2001), and WALKER et al. (2003).

Meteorological data. The mean monthly temperature, relative humidity, and rainfall were obtained from the IMO from April 2003 to March 2004.

Results

The results of this study over four seasons in Urmia suburb are presented in Tables 2 and 3. Of 77 sheep and 119 goats studied, 110 (56.1%) were infested with a total of 849 ticks. Of infested animals 196 (8.2%), 153(78.1%) were females and 43 (21.9%) males.

Table 2. Frequency of ectoparasites (ticks, mite, lice, and flea) in relation to the frequency in flocks of sheep and goats.

Infested animal (N°)	Specimens of ectoparasites	Frequency (%)
Sheep (77)	*Rhipicephalus bursa*	90.7
	Rhipicephalus sanguinus	6.9
	Boophilus annulatus	2.4
	Ornithodoros lahorensis	2.6
	Damalina ovis	58.8
	Haematopinus spp.	76.6
	Linognathus ovillus	29.4
	Sarcoptes scabiei	2.6
	Ctenocephalides felis felis	13.0
Goats (119)	*Rhipicephalus bursa*	88.8
	Rhipicephalus sanguinus	11.4
	Haematopinus spp.	62.2
	Damalina caprae	71.4
	Linognathus stenopsis	36.1
	Ctenocephalides felis felis	16.8

Laboratory investigation indicated that several kinds of arthropods (hard ticks, soft tick, mite, lice, and flea) existed and that ticks were the most frequent ectoparasites. Adult ticks (849) were collected and identified: the highest number belonged to the *Rhipicephalus bursa* (90.7% of sheep and 88.8% of goats), followed by *R. sanguineus* (6.9%), *Boophilus annulatus* (2.4%) plus *Ornithodoros lahorensis* (2.6%). All goats were infested with two species that included *R. bursa* (88.8%) and *R. sanguineus* (11.4%). The result showed that hard tick infestation on fat tail in sheep (55.8%) and tail in goats (96.3%) were the most prevalent, whereas ear and testis on goats (2%) and ear on sheep (2.3%) with other body regions having minor importance. Their respective total ixodid tick indices (number of ticks per animal) were 2.5 for sheep and 4.3 for goats. According to age and sex, the heaviest infestation rate was observed on female sheep and goats with 5-year-old sheep and goats, 13% and 2 13.5%, respectively. However, the lowest infestation rate was recorded on male sheep and goats less than one year of age, 5.2% and 4.2%, respectively. There was a seasonal variation in the prevalence of ticks, with its predominance in summer, although the parasite did occur throughout the year. Its occurrence in spring and summer was similar, but in the fall it was very low.

Of these, two sheep (2.6%) were infested by *Sarcoptes scabiei*, with maximum infestation occurring in winter. *Psoroptes ovis* scab mites have not been detected in this area.

Fifty-two sheep (67.5%) and 85 goats (71.4%) were infested with three species of lice. These were *Damalina ovis* (58.8%) and *D. caprae* (71.4%), *Haematopinus* species (sheep 76.6% and goats 62.2%), *Linognathus stenopsis* (36.1%), *L. ovillus* (29.4%). Infestation with more than one species of lice was also seen. The highest infested seasons were fall and winter (50%) and the lowest were spring and summer.

Table 3. Identified specimens of hard ticks divided according to age, sex, and body sites distribution in sheep and goats.

Infested animal	Age (year)	Sex		Specimens of adult ticks	Fed ticks (No.)	Body sites (Unfed ticks No.)									
		Male	Female			e	s	ab	a	ft	t	f	p	u	v	te
Sheep	<1	4	11	*Rhipicephalus bursa*	152	1	4	4	1	42	-	23	2	14	7	-
	1-2	5	22	*Rhipicephalus sanguinus*	54	-	-	-	-	2	-	-	-	-	-	-
	3-4	0	16	*Boophilus annulatus*	0	-	-	-	-	2	-	-	-	-	-	-
	5-6	0	13													
	7-8	1	5		0											
Goats	<1	5	2	*Rhipicephalus bursa*	218	4	-	-	-	-	140	14	-	8	4	1
	1-2	12	37	*Rhipicephalus sanguinus*	120	-	-	-	-	-	32	-	-	-	-	-
	3-4	4	29													
	5-6	6	16													
	7-8	6	2													
Total		43	153		544	4	4	4	1	46	172	37	2	22	11	1

e - ear, s - shoulder, ab - abdomen, a - anus, ft - fat tail, t - tail, f - flank, p - prepuce, u - udder, v - vulva, te - testis

Ctenocephalides felis felis comprised all fleas collected (16.8% of goats and 13% of sheep). Old animals were more heavily infested than young ones, and infestation increased in older animals (3-7 year of age). Infestation was observed on males (2.6%) and females (12.8%). Flea infestation was more widespread in fall and winter (10.2%) than in spring and summer (6.1%). Female animals were more heavily infested for three-year-old sheep (11.7%) and three-year-old goats (8.4%) than male goats more than four years old (4.2%).

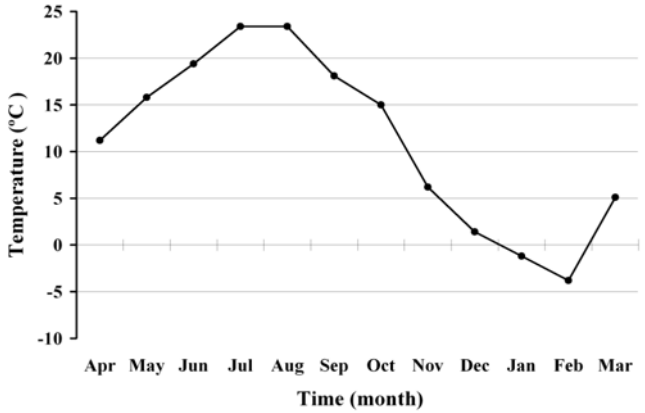

Fig. 2. Mean monthly temperature for Urmia city from April 2003 to March 2004

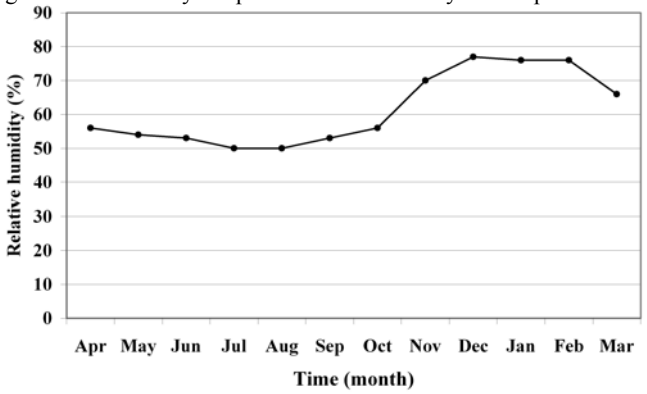

Fig. 3. Relative humidity for Urmia suburb from April 2003 to March 2004

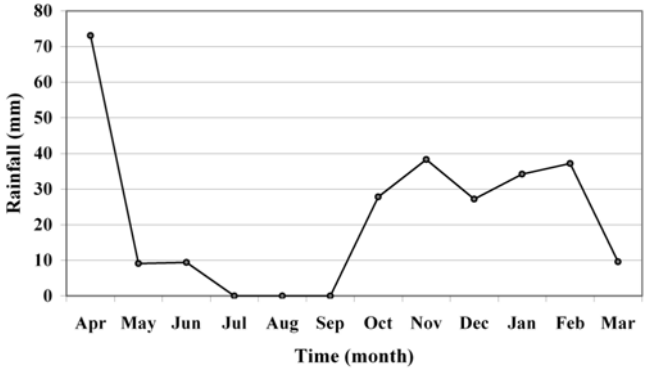

Fig. 4. Mean monthly rainfall for Urmia suburb from April 2003 to March 2004

All the samples were negative for scab mites, myiasis, sheep ked (*Melophagus ovinus*), nasal bot fly larvae, and larvae of blowflies. Results are shown in Table 2 and 3.

The mean monthly temperature (Fig. 2), relative humidity (Fig. 3), and rainfall (Fig. 4) values for the Urmia city is presented according to the IMO. In general, there was steady increase in the mean monthly temperature to a peak at +23.4 ºC, which then steadily decreased. The mean monthly relative humidity showed a minimum between July and August of 50% and a high during December of 77%. Rainfall was absent during the period July to September in Urmia city.

Discussion

This longitudinal study, extending over four seasons, considered the spectrum of ectoparasites species involved, the levels of infestations, and the seasonal epidemiology of these ectoparasites.

With regard to the present study on the ticks, ixodid ticks were present on the animals throughout the year, being most abundant in summer and the least in fall, whereas *Ornithodoros lahorensis* (2.6%) was only found during the fall and until late winter. The prevalence and general indices of some ticks showed differences related to the locality of their hosts. Seasonal changes in the general indices of some ectoparasites paralleled seasonal changes in the relative abundance of their hosts. These findings thus lend support for the peak activity of hard ticks, which is from June to July in the western and north-western regions of Iran (MAZLUM, 1971; TAVASOLI and RAHBARI, 1998). Although ticks were present on the small ruminant population throughout the year, their numbers seemed to increase particularly after the rainy seasons (including spring and fall) with higher temperatures and lower relative humidity, and absence of rainfall during the period July to September, 2003. Hence, rainfall was considered the most important climatic factor that influenced the seasonal variation in numbers. This is in accordance with the findings of other studies in different parts of Iran. Likewise, tick species identified were previously found on sheep and goats in the same region, with the exception of *Boophilus annulatus* (2.4%) on sheep. *Hyalomma* spp. and *Haemaphysalis* spp. were not found in the present study, in contrast to previous reports. The highest number of identified tick species belonged to *Rhipicephalus bursa*. This finding is not in accordance with RAHBARI (1995) who reported that *R. sanguineus* was the most prevalent tick in this part of Iran.

According to LEMOS et al. (1985) ticks attacked both kinds of animal, those with their bodies fully protected by wool and those without wool. The numbers of ticks on the animals in these two categories did not differ significantly, suggesting that whether wool covered the body completely or left parts of the body uncovered, this did not affect infestation.

In an earlier study, MAZLUM (1971) and HASHEMI-FESHARKI et al. (1994) found tick infestations were common in this part of Iran. In contrast, the absence from winters 2003-2004 of *Hyalomma* spp. and *Haemaphysalis* spp., described as absence of theileriosis and

the widespread distribution of *R. bursa* in this period, suggested that *R. bursa* may have an important role for babesiosis in this area. However, more researches are needed to confirm these findings. Nevertheless, no differences were found between the mountainous and hilly areas, although their comparison with the plains was not possible because of the small number of flocks.

In the present study, infestation rate of *Sarcoptes scabiei* was very low in ewe and was observed only in the winter, when the lesions were on the head, neck, and face. With regard to this finding, this mite did not represent one of the most serious welfare concerns amongst sheep farmers, because it was compulsory to dip all sheep in the fall. In addition, organophosphate-based dips have been offered as a broad spectrum control against all the ectoparasites in this region, and dipping remains the most common method of the prevention and treatment of *S. scabiei*. In the same studies by CHAKRABARTI (1994) and NEOG et al. (1992) prevalence of infection was higher in young and female animals, as well as in the winter. Additionally, NADALIAN et al. (1989) in an investigation into sheep mites reported that the infestation rate of *Sarcoptes scabiei* was 13.2% in central parts of Iran.

Sheep and goats were infested by *Damalina ovis*, *Damalina caprae* around the neck and back areas, *Haematopinus* spp. on sheep and goats, *Linognathus stenopsis* on goats, and *L. ovillus* on both the covered areas of the face of sheep. Infestation with more than one species of louse was also seen, with the highest infested season being winter and the least spring. These findings were in close agreement with MURRAY (1968), NADALIAN et al. (1989) and MAZAYA and HELMY (2001). Sheep biting lice are host specific ectoparasites that spread mainly by direct contact (HEATH et al., 1995), if left uncontrolled, these lice could reduce wool quantity and quality, and cause defects in sheep leather (WILKINSON et al., 1982; KETTLE and LUKIES, 1982; HEATH et al., 1995). *D. ovis* has been shown to be able to complete a life cycle on goats (HALLAM, 1985). In practical terms goats are unlikely to be important in causing infestations in sheep. The absence of lice during the dry season as a result of environmental influences was observed on sheep and goats. This finding is in accordance with MURRAY (1968) who suggested that significant lice mortalities may also be caused by rapid reversal of temperature gradients in the fleece as sheep walk from shade into sunlight. Moreover, amount of fleece and shearing were powerful regulating influences, which removed most of the population. It also exposes the remaining lice to environmental influences (high temperature and high solar radiation during summer) and many more die subsequently. Neither of these two parasites, lice and ticks, was treated alone but were always treated in combination with other ectoparasites. This may be a result of conventional dipping practice, where most commercially available dips will treat more than one parasite. Furthermore, lice seem to require the presence of wool for development and survival and this would explain their presence on sheep in the winter, which are covered fully with wool.

In this study, *Ctenocephalides felis felis* was identified, similar to the findings of KILONZO and KHAMA (1989), and YERUHAM et al. (1989).

Conclusion

This study, extending over four seasons, took into consideration the spectrum of ectoparasites species involved, levels of infestations and seasonal epidemiology.

In general, the individual climatic conditions of this area and the importance of the animal wealth in the national economy are all factors that call for more efforts to study the ectoparasites problem. The study of small ruminant ectoparasites is important, not only for livestock but also for humans, since fleas, mites and ticks also parasitize humans, especially those who work in close contact with the affected animals. Much is currently known about ectoparasites infestation of livestock in Iran. In contrast to the frequency of occurrence of these parasites, infestation is not taken into consideration very seriously by farmers, which calls for an extension work to be carried out in this area, a fact that represents an obstacle to the control measures. Therefore, further studies are needed to estimate what economic losses are caused by these parasites and to establish measures for their control.

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SAŽETAK

Istraživanje ektoparazita ovaca i koza provedeno je u sjeverozapadnom predjelu Irana. Pretraženo je 1200 ovaca i 1200 koza mlađih od osam godina iz 14 stada s tri područja, od travnja 2003. do ožujka 2004. Ektoparaziti (krpelji, grinje, uši i buhe) bili su sakupljeni sa 77 ovaca (6,4%) i 119 koza (9,9%) s ukupnom učestalošću od 8,2%. Najčešće su bili dokazani krpelji. Adulti krpelja (849) determinirani su kako slijedi: najveći broj je bio vrste *Rhipicephalus bursa* (u 90,7% ovaca i 88,8% koza), zatim *R. sanguineus* (6,9%), *Boophilus annulatus* (2,4%) i *Ornithodoros lahorensis* (2,6%). Koze su bile invadirane s 2 vrste krpelja, uključujući *R. bursa* (88,8%) i *R. sanguineus* (11,4%). Raspodjela iksodidnih krpelja po životinji bila je 2,5 u ovaca i 4,3 u koza. 52 ovce (67,5%) i 85 koza (71,4%) bilo je invadirano s tri roda uši. To su bile *Damalinia ovis* (58,8%) i *D. caprae* (71,4%), *Haematopinus* sp. (na ovcama 76,6%, na kozama 62,2%), *Linognathus stenopsis* (36,1%), *L. ovillus* (29,4%). Najveća invadiranost ustanovljena je u jesen i zimi (50%), a najmanja u proljeće i ljeti. Dvije ovce (2,6%) bile su invadirane vrstom *Sarcoptes scabiei*, s najčešćom invadiranosti zimi. Sve sakupljene buhe bile su vrste *Ctenocephalides felis* (u 16,8% koza i 13% ovaca). Invazija buhama bila je proširenija u jesen i zimi (10,2%) nego u proljeće i ljeti (6,1%).

Ključne riječi: učestalost, ektoparaziti, ovca, koza, Iran