Study of helminths in sheep in the Laghouat region in Southern Algeria

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Abstract

The objective of this study was to detect helminths in sheep on farms in three different zones of the Laghouat region, and to examine relationships between the prevalence of these parasites and the factors of age, sex, and area. The study was carried out over a period of four months (March to June 2019) on 77 faecal samples taken from 77 sheep. For this purpose, we used both a qualitative technique (flotation) and a quantitative technique (Mac Master). These two techniques allowed us to isolate helminths and determine the degree of infestation of sheep in the steppe region, specifically the Laghouat region. The results showed that the sheep flock studied overall was negative, with the exception of eight subjects infected with *Nematodirus* or *Strongyloides* at a rate of 7.49% each. The helminth parasite prevalence was 10.40%. Statistical analysis of the influence of specific factors revealed no significant effect ($P>0.05$) for sex, though the effects of age and area were significant ($P<0.05$). This parasite prevalence must be taken seriously to avoid its detrimental effect on animal health and the zootechnical performance of sheep flocks.

Key words: *coprology; risk factor; helminths; Laghouat; sheep; Mac Master*

Introduction

The total number of sheep in Algeria is estimated at 18.7 million individuals; accounting for 80% of all ruminants (Atchemdi, 2008). Over a long period (1961 to 2003), FAO statistics showed an increase in the sheep population in Algeria by 246%. Sheep farming provides a variety of functions both at the breeder level and at the national level. Its contribution to the national economy is significant, representing capital of more than a billion dinars (Mohammedi, 2006).

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However, more than 60% of the sheep population is raised in the steppe areas (Aidoud et al., 2006). The main vocation in the steppes is extensive breeding of sheep, goats and camels, supplemented by sporadic cereal cultivation. In the case of sheep farming, production in the steppe zones are affected by many constraints, in particular: (i) limits of climatic indices, (ii) estimated 32% forage deficit due to the degradation of steppe pathways (Aidoud et al., 2006), (iii) extensive and ancestral breeding patterns, (iv) socio-economic constraints, (v) and a wide range of pathologies, the most common of which is internal parasitism. The overall zootechnical losses (mortality, growth and reproduction) caused by these parasites in the desert regions of the world can be very significant: up to 33% of herd productivity in Senegal, and 11% in Chad and Nigeria (Van Veen, 1973).

In Algeria, the internal parasites of domestic ruminants identified macroscopically are the nematodes (22 genera), cestodes (9 genera) and trematodes (3 genera) (Mekhanche, 1988). The economic cost of parasitism has led farmers to use substances intended to reduce parasite development (Pilarczyk et al., 2015). The use of several pest control substances to combat these harmful organisms has increased significantly (Taylor and Feyereisen, 1996; Kumar Jaiswal et al., 2013). Worldwide, pest control consumption is estimated to be worth more than 2.7$ bilion per year, including $540 million for antihelmintics alone. In Algeria, this parasitism is also expensive and ranks antiparasitics in second place behind poultry protection products, especially with ivermectin (Bentounsi et al., 2009).

The objective of this study was to assess the prevalence of helminths, and the role of certain factors related to the animal and/or its environment on the type and load of parasitic infestation in sheep in the Laghouat region.

Materials and methods

Study area

Laghouat is located in the centre of the country, 400 km south of the capital Algiers. The region covers an area of 25,000 km^2 and is crossed by the Saharian Atlas Mountain chain with peaks higher than 2,000 meters (DSA, 2014), bordered from the north by Tiaret, East Djelfa, West El-Bayad and from the south by Ghardaïa. The climate is Saharan and arid with averages of 8°C in winter and 27°C in summer (Kourtel, 2013). Winters are characterized by hoar frost and summers by strong heat accompanied by sand winds. This study was conducted at three sites in the Laghouat region (Hamda, Milok, and BordjSenouci).

Study period

The study was conducted over a four-month period from March to June 2019. The research was carried at three sites

Table 1. Characteristics of the sheep studied

Characteristics		Number of animals per site			Total
		Hamda	Milok	BordjSenouci	77
Sex	Females	15	12	27	54
	Males	5	17	1	23
Age	<6 months	10	29	0	39
	6 to 12 months	0	0	14	14
	>12 months	10	0	14	24

(Hamda, Milok, BordjSenouci), administratively falling within the Laghouat commune. Coprological analysis was conducted in the parasitology laboratory of the Department of Biology, Amar Telidji Laghouat University.

Animals

The study was carried out at three different breeding sites of the semi-extensive Rumbi breed on 77 subjects of different ages. The characteristics of the animals are presented in Table 1.

Harvest of faeces

Faeces were collected in the morning before the sheep left the farm. Each sheep wears an ear tag with an identification number. Faeces were taken from the rectum and placed directly into plastic containers. Each sample was identified with a tag indicating the name, age and sex of the animal. The samples were taken to the parasitology laboratory at Laghouat University on the same day and stored at 4°C for no more than two days.

Operating mode

At the laboratory, different techniques were used:

Qualitative method

This allows the identification of parasite species in faeces by an examination between the slide and lamina. Direct examination is not very sensitive and is rarely used in ruminants.

Various methods exist to enrich the sample (Beugnet et al., 2004). On such method is the technique of flotation in a dense 40% NaCl solution. The principle is to dilute the sample in a high density solution (flotation liquid) in order to concentrate the parasitic elements of lower density on the surface of the liquid. First, the sample was homogenized. Then, 10 g of the homogenised sample was diluted in 150 mL of classic dense solution in a wine glass. The mixture was filtered in a tea strainer, and left to rest for 10 minutes. Finally, the slide to which any possible parasite elements are attached was retrieved and observed on a slide under ×100 magnification.

Quantitative method

The classic flotation method is used, followed by a count of parasitic elements using a Mac Master cell. This cell consists of two slides separated by 1.5 mm abutments that form two chambers of 1.7 × 2.0 cm on the inner face of the upper slide, engraved with two 1 cm dimensional grids, delineating a volume of 2 × 0.15 mL. The two chambers have a volume of 2 × 0.50 mL. The Mac Master Cell flotation enrichment technique was performed as previously described (Beugnet et al., 2004).

Calculation of parasite indices

Total prevalence is calculated as the ratio of the percentage P (%) of the number of hosts infested by a given species of parasite to the total number of hosts (Margolis et al., 1982).

$P\ (\%) = HP \times 100$ (HP: hosts parasitized)

Statistical analysis

Data were entered and managed using Microsoft Excel and descriptive statistics were performed to analyse the data using SPSS version 20 statistical software. The chi-square (χ^2) test was used to assess if there was a statistically significant difference in parasite infestation between sex, age, and animal management. The level of significance was set at $P<0.05$.

Results

Microscopic observation

After the coprological examination of sheep faeces, eggs belonging to two helminth genera were detected (Figures 1 and 2).

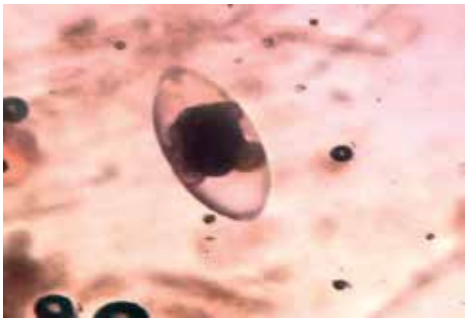

Figure 1. Large ovoid egg of *Nematodirus* with a thin and smooth shell containing a morula of 2 to 8 blastomeres observed under optical microscope (magnification ×100)

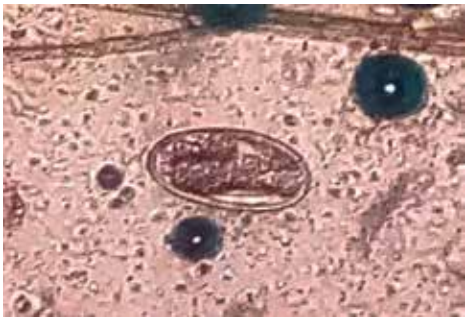

Figure 2. *Strongyloid* egg averaging 50×30 µm observed under an optical microscope (magnification ×100)

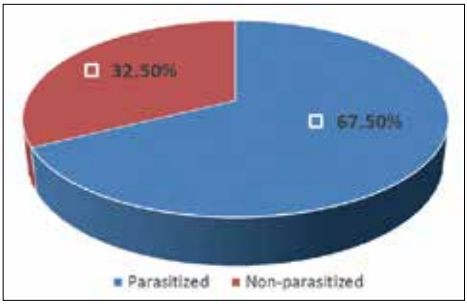

Figure 3. Overall parasite status of study subjects

Overall prevalence

After the examination of 77 faeces samples, 67.5% of samples contained at least one parasite of the species/family of interest (Figure 3).

Prevalence of encountered parasites

Protozoa were the most common parasites with a prevalence of 59.74%, followed by helminths with 10.40% (Figure 4).

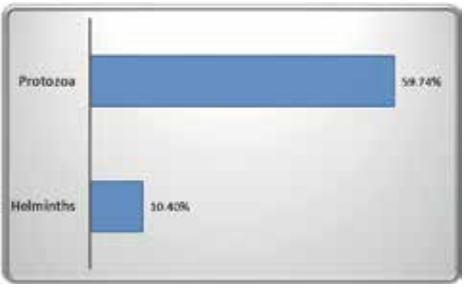

Figure 4. Prevalence of identified parasites

Parasite frequency by species/ family of interest

Of the 77 tested animals, the prevalence of *Nematodorius* and *Strongyloides* was 7.79% for each, and *Protozoa* was 59.74% (Figure 5).

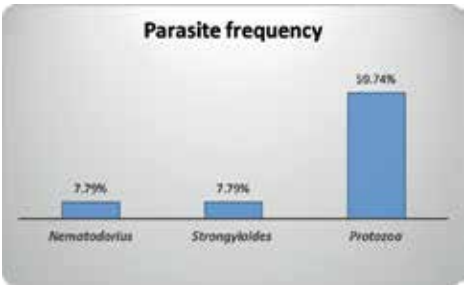

Figure 5. Parasite frequency

Distribution of overall parasitism prevalence by population characteristics

According to zone

The distribution of overall parasitism in the three study areas showed that subjects in the Hamda area were more infested by parasites (82.8%) than in the

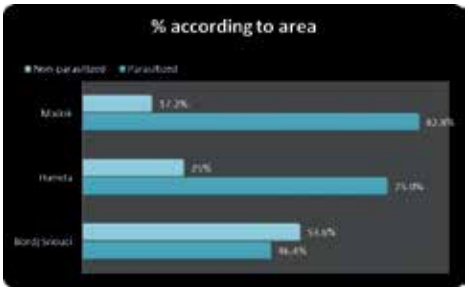

Figure 6. Distribution of overall prevalence by sampling area

other areas (Figure 6). The difference in distribution was significant (χ2=9.26, *P*=0.01).

According to the sex

The parasitism rate in males (91.3%) was higher than in females (57.4%) (Figure 7). Statistical analysis revealed that the difference was significant (χ2=8.45, *P*=0.004).

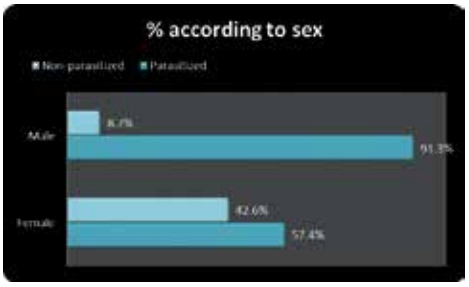

Figure 7. Prevalence of overall parasitism by sex

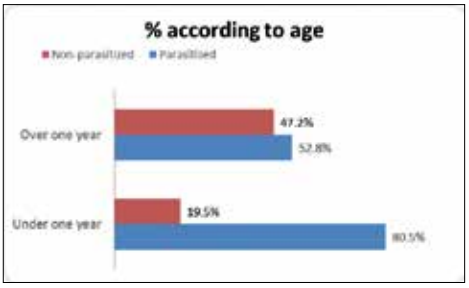

Figure 8. Prevalence of parasitism by age

According to the age

The rate of infestation by age, shown in Figure 8, indicates that the infestation rate of animals under one year of age (80.5%) was significantly higher (χ2=6.71, *P*=0.01) than that of animals over one year.

Distribution of helminth (Nematodorius and Strongyloid) prevalence by characteristics of the target population

By sex

Only females were positive for helminths, with a prevalence of 14.8%, though this difference was not significant (Figure 9).

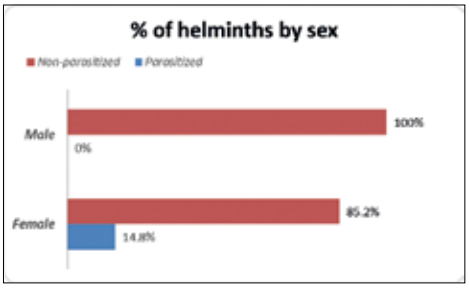

Figure 9. Prevalence of helminths by sex

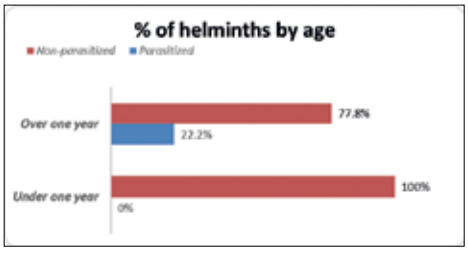

Figure 10. Prevalence of helminths by age

By age

Positive results were restricted only to subjects over 1 year of age, with a prevalence of 22.2% (Figure 10), and this difference in this age group was significant (χ2=10.16, *P*=0.001).

By sampling area

The results of the analyses in the three sampling areas revealed an increase in the prevalence of parasitism as a function of the number of adults selected in each zone, since no adults were sampled in Milok. Bordjsenouci showed a prevalence of 21.4%, followed by Hamda at 10% (Figure 11). Statistical analysis revealed a significant difference ($\chi 2=7.03$, $P=0.03$).

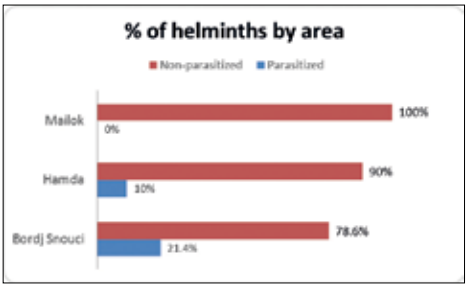

Figure 11. Helminth prevalence by sampling area

Results of the egg calculation by the Mac Master cell

After detection of positive subjects by the flotation method, the use of the Mac Master cells for egg calculation by reading the two fields revealed a low parasite load, which excluded the use and evaluation of the treatment, as an objective listed at the beginning of our study.

Discussion

This preliminary study on sheep helminths and the factors influencing their presence in a steppe region allowed us to obtain information on the composition of the parasite fauna present in the region during a specific period. Our choice of this animal species is justified by their economic and social importance.

The results obtained by the coprological examination using the two qualitative and quantitative methods in this study showed a limited parasite presence in adults for the parasites of interest. Of the 77 sheep studied, 8 adults were infested with at least one of the two nematode genera (*Strongyloide* and *Nematodirus*) with a general prevalence rate of 10.40%. This relatively low rate is thought to be related to the unfavourable conditions for parasites in the Laghouat region (generally dry climate) and to the sampling period which did not coincide with the egg excretion period (June, July) (Lakehal et al., 2021). Similar studies performed on gastrointestinal strongyloides in a steppe region for one year (Bentounsi et al., 2012) indicated that the maximum egg excretion coincided with the months of June-July.

The present study revealed the presence of two genera of helminths: *Nematodirus* and *Strongyloides*. The prevalence rate of *Nematodirus* was 7.49%, which is similar to reports from Iran (14%) (Naem and Gorgani, 2011). However, the present result is higher than reports from the Congo (0.6%) (Bagalwa et al., 2012), but lower than the prevalence observed in Tiaret (27%) (Boulkaboul and Moulaye, 2006) and Laghouat (28%) (Dib and Ben Aissa, 2015). *Nematodirus* is a frequent parasite during spring and early summer (period encompassed in this study). Eggs have a particularly strong resistance to desiccation and frost and can survive for more than 2 years on pastures. Temperatures that rise above 10°C will stimulate rapid hatching of many larvae over a short period of time (Autef, 2008).

Coprology also revealed the presence of *Strongyloides*, with a prevalence similar to *Nematodiruses* (7.49%). Our result is similar to that recorded in Iran (6%) (Garedaghi and Bahavarni, 2013) and Tiaret (5%) (Boulkaboul and Moulaye, 2006), but higher than that recorded in Pakistan (4.42%) (Rezzaq et al., 2014), and lower than the prevalence recorded in Tunisia (Akkari et al., 2012), with values of 58.35%. These loads are higher in the

rainy season. Contamination occurs through colostrum ingestion and by transcutaneous transmission in humid environments.

The relationship between the sex of sheep and the parasitism rate was not significant in this study (very low number of males compared to females). Saidi et al. (2022) noticed the same in camels.

The study of the relationship between the age of the sheep with the rate of parasitism revealed that positive results were limited in subjects over one year old with a prevalence of 22.2%, whereas no positive subjects were detected (0%) in lambs (less one-year-old), contrary to the reports of several authors, notably Saidi et al. (2009), who stated that lambs are more sensitive than adults due to the immaturity of their immune system. Physiologically, it is known that young sheep are more susceptible to parasite infestation than sheep over 1 year old (Saidi et al., 2009). This finding during the present study is thought to be related to the climatic conditions of this year and the (long) life cycle for *Nematodirus* and the maximum egg depletion period (July did not coincide with our sampling period) (Meradi, 2012). These factors subsequently influence the distribution of parasitism prevalence according to the number of adults at each sampling site, with BordjSnouci first with an infestation rate of (21.4%) where there were 28 adults, then Hamda with (10%) represented by 10 adult subjects and finally Mailok with (0%) where sampling was carried out only in lambs.

During quantitative analysis using the Mac Master cell on helminth-positive subjects by the flotation method and after identification of the eggs of the genus (*Nematodirus* or *Strongyloid*), a very low parasite load was obtained, which is the reason for the decrease in egg excretion by these *Strongyloids* during the period of our sampling. In this regard, similar results were obtained at Batna (Meradi, 2012).

Despite the low faecal egg excretion rates, we must remain alert to the *Nematodirus* load. Some authors found that a rate of 200 OPG (oocysts per gram) of this parasite matched a load of 6,000 worms. They should be classified as dangerous, especially for young in which pathogenicity may be high (Boulkaboul and Moulaye, 2006).

Conclusion

The study results showed that the farms visited and the animals examined were indeed infested by parasites. Coprological analysis revealed an overall helminth infestation rate of 10.41%. *Nematodiruses* and *Strongyloides* were the only helminth genera found, with a prevalence of 7.49% each. In the vast majority of cases, the infested subjects hosted these two parasites together. Quantification of the number of eggs excreted using the Mac Master Cell in positive subjects resulted in a very low parasite load for the two detected genera. The study of the influence of certain risk factors showed that age and study area had a significant influence on the rate of parasitism, while sex did not.

In conclusion, this study improves our knowledge on parasites infesting the sheep population in the Laghouat region. It should be noted that even moderate parasitism causes a significant decrease in productivity, which in consequence affects the profitability of sheep farming. More investigations on this subject are needed in the future.

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Studija helminta u ovaca u Laghouat regiji u južnom Alžiru

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Cilj ovoga rada je bio istražiti helminte na farmama ovaca u tri različite zone Laghouat regije, kao i proučiti vezu između prevalencije tih parazita i određenih čimbenika poput dobi, spola i područja. Naša studija provedena je tijekom razdoblja od 4 mjeseca (od ožujka do lipnja 2019. godine) na 77 uzoraka fecesa uzetih od 77 ovaca. U ove smo svrhe rabili kvalitativnu tehniku flotacije i drugu, kvantitativnu tehniku - Mac Master. Ove dvije tehnike omogućile su nam izdvojiti helminte i odrediti stupanj infestacije ovaca u stepskoj regiji, ili preciznije u regiji Laghouat. Podatci su pokazali da je proučavano stado ovaca pretežito bilo negativno uz izuzetak 8 jedinki u kojih je otkrivena prisutnost parazita *Nematodirus* i *Strongyloides* u postotku od 7,49 % za svaku vrstu. Prevalencija parazita helminta bila je 10,40 %. Statistička analiza utjecaja određenih čimbenika otkrila je da spol nije imao značajnijeg učinka ($P>0,05$). Međutim, učinak dobi i područja uzorkovanja bio je značajan ($P<0,05$). Zaključno, zabilježenu prevalenciju parazita potrebno je ozbiljno razmotriti da bi se izbjegao negativni učinak na zdravlje životinja i zootehničke pokazatelje stada ovaca.

Ključne riječi: *koprologija, faktor rizika, helminti, Laghouat, ovce, Mac Master*