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Frequency and dynamics of sheep infestation by scabies mites in the Guelma region (northeastern Algeria)

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Article Info	Abstract
Keywords : Guelma Mange mites Prevalence Seasonal pattern Sheep *Correspondance : benakhlaahmed@gmail.com Reçu le 24 mai 2018, Révisé le 04 juin 2018, Accepté le 05 juin 2018.	The present study was performed as a survey on prevalence, species composition of scabies and seasonal mange dynamic in cross-sectional study (80 sheep flocks and 1731 animals) and livestock markets (992 herds and 10028 animals) in Guelma area at the northeastern Algeria. Out of the cross-sectional study, 25% of herds and 10.45% animals were infested with one or more scabies species. <i>Sarcoptes</i> was significantly more common than <i>Psoroptes</i> in examined herds (70 % and 30% respectively, $P < 0.001$) and animals (68% and 32% respectively, $P < 0.001$). Both mange forms were completely absent during the summer and the spring. However, during the winter and the autumn, the mangy herds rates were 55% and 45%, respectively. Similarly, the prevalence of the infested sheep was 25.1% in the winter and 15.52% in the autumn. Results of the livestock markets survey supported results of our cross-sectional study. The two localities Heliopolis and Medjaz had the highest prevalence of infested animals (24.52% and 35.65%, respectively). However, Hammam Ouled Ali and Fedjouj showed the lowest frequencies (6.77% and 18.7%, respectively). The present study demonstrates the overall and seasonal occurrence of high prevalence of mange mites in sheep of the study area. Animal owners and veterinarians should jointly implement an effective plan against this pathology to limit their healthy and economic disasters.

1. Introduction

With a sheep population of more than 28 million heads, Algeria ranks fifth in the world for sheep meat production [1]. The ovine herd in Algeria, due to its extensive type of farming, especially in the northern regions, faces numerous food and/or pathological problems that do not allow it to achieve adequate production performances. Parasitoses constitute a serious problem that leads to decreased lamb growth, degrading the fatness of adult animals, reducing longevity and prolificacy of ewes [2,3]. Nevertheless, the situation of parasitic diseases in sheep is little known in Algeria. The only pathologies that have been the subject of in-depth studies hepatic and rumen flukes [4,5] and strongylosis [6]. The sheep mange disease remained by far the most frequently encountered [7]. The distribution of these microscopic mites on animals varies seasonally. As the infestation is quiescent in reservoir locations such as the armpits, groin, infraorbital fossa and ear canal during the spring, summer and early autumn [8], the most epidemics occur during the cold months [7,9]. Although, these

mites are active on the surface or in the keratinized layer of the epidermis and cause direct damage to the skin [10], they also cause indirect economic losses by decreasing reproductive and production performance [11]. Similarly, a high mortality rate can reach up to 60% of the animals [12]. Finally, sheep mange is of social importance because humans can be parasitized by *Sarcoptes scabiei* var *ovis* [11].

The evolutionary cycle of *Sarcoptes scabiei* var. *ovis* lasts about 10 to 14 days [13]. However, a longer cycle of 10 to 26 days has been reported by some authors [14, 15]. This duration may vary when different external parameters increase or decrease the parasite metabolism. Similarly, the survival of sarcoptes outside the host varies with temperature and humidity conditions and can range from a few days to three weeks [11]. This mange infestation is easily identifiable by observing the flock. Its contagion is high, which leads to its rapid spread within a herd and results in intense itching which makes the animals restless and nervous. The lesions begin on the back, the withers, then gain the sides and chest sides. Looking more closely, we observe the presence of yellowish crusts and small vesicles

called mange. The integrated struggle against this parasitism in association with other dominant parasitic diseases such as estrose and fasciolosis in a particular bioclimatic and topography conditions at the north of Algeria had been subjected to a relevant study [9]. However, information on the prevalence and risk factors for mange infestations needs to be studied in detail in order to effectively apply these control measures. Therefore, this study was conducted to estimate the prevalence of sheep mange using two surveys, the first one at the sheep herds and the second one at the sheep market at the northeastern Algeria.

2. Materials and methods

2.1. The study area

The present study was conducted in Guelma area at the following localities: Roknia, Bouati, Ouled Ali Hammem, Heliopolis, El Fedjoui, Medjaz Amar, Hammem Debagh and Ain Hessainia (Figure 1). This region It is located at the extreme north-east of Algeria, at 36 ° 27'58 "North Latitude and 7 ° 26'2" East Longitude. Topographically, Guelma is an area of the average altitude of 256 meters above sea level and average annual rainfall of 647 mm with a mean temperature of 21 ° C [16]. The relief of this area is broken down into mountains (37.82%), plains (27.22%), hills and foothills (26.29%) and others (8.67%). The total land used for agriculture is 42 499 430 (ha) which is about 17.8% of the total area. The area used for grazing constitutes 77.5% of the total area [16]. The total human population is estimated at 506,007 inhabitants [16]. Livestock numbers in the region are represented by 88,300 cattle, 45,300 sheep, 60,500 goats and 1980 horses. So, this locality is ranked 20th in the country according to the number of small ruminants.

2.2. Study animals and design

This study was conducted on two aspects. The cross-sectional study was performed in 80 sheep farms and a total of 1731 sheep of local breeds belonging to search the presence of different mange forms. The study animals and herds were selected by systematic random sampling technique in the respective areas. Sampling was done between august 2015 and may 2016 in a single month by season, namely January for winter (20 herds and 466 animals), May for spring (20 herds and 425 animals), November for fall (20 herds and 415 animals) and August for the summer (20 herds and 425 animals). In the second part, the investigation on the prevalence of sheep mange was carried out monthly between october 2015 and september 2016 at the livestock market of Guelma. Total of 992 herds, whose 10028 sheep were inspected. The sample size was determined according to Thrusfield (2005) with 95% confidence interval and 5% absolute precision

[17]. In the case of the livestock market study, the expected prevalence rate of sheep mange was 4.85% [4]. The sample size required was 707. In fact, a total of 10028 sheep were selected from the target population which is largely representative. However, due to lake of studies on the relative prevalence of sheep mange in the farms of the study region, so the expected prevalence rate was taken as 50% and the sample size required were 384. Thus, to increase precision and to get more accurate, the sample size was taken as 1731 sheep.

2.3. Animal examination and sample collection

During the flock inspection, we look for animals with skin lesions such as crusts, alopecia and clinical signs of itching. Samples for laboratory tests were collected from suspected mange cases as well as from the apparently healthy animals. The detection of *sarcoptes* was carried out following the technique described by Euzéby *et al.*, (1981) [18].

2.4. Statistical analysis

The affected herds rate by was expressed as a percentage. The numerator includes the number of farms with at least one mangy animal; the denominator represents the total number of examined herds. Similarly, the prevalence of affected animals is calculated as percentage. The numerator includes the number of animals with clinical signs of mange which are confirmed by the detection by laboratory examination; the denominator represents the total number of examined animals. The comparison between the frequency of sarcoptic and psoroptic mange, as well as the study of the frequency association between mange cases and the potential risk factors (season, animal origin) were analyzed using Chi-square Test.

3. Results and discussion

3.1. Cross-sectional study at sheep farms

3.1.1. General prevalence of mangy animals and herds

The present study showed a total rate of infection by different species of mange in the examined herds and animals were about 25% (20/80) and 10.45% (181/1731) (**Fig. 1**). Our results are similar to those reported by Demissie *et al.* (2000) [12]. However, they were lower than the rates recorded by Athamna *et al.* (2014) in at the extreme northeastern of Algeria and Salifou *et al.*, (2013) at the West Africa (4, 19). Also, our results are clearly higher to those reported by Asghar *et al.* (2011), Enquebahr and Etsay (2010), Desie *et al.* (2010) and Seid *et al.*, (2016) with a prevalence of infested sheep ranged between 0.95% à 2.8% [20-22]. The difference in percentage mange disease between the present study and the other described

one may be related to the difference in the strain of animals, sample size, immune state, as well as the atmospheric temperature difference between the study areas.

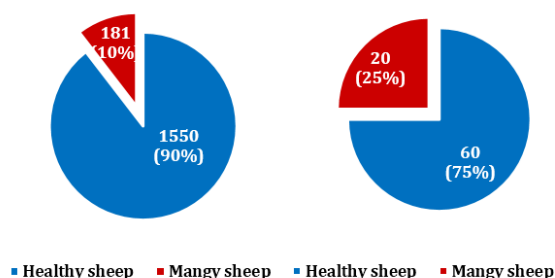


Fig. 1: Frequency and prevalence of infested herds (left) sheep (right) by mange.

3.1.2. Prevalence of different mange types

The sarcoptic mangy herds represent a significantly higher rate when they are compared to those with psoroptic mange (70% vs. 30% respectively, $P < 0.001$) (Table 1). Similarly, the prevalence of these two pathologies in the studied animals showed that the sarcoptic mange was significantly more common than psoroptic mange (68 vs. 32% respectively, $P < 0.001$) (Table 1). Our results corroborate those reported in Algeria by Athamna (2003) and to those reported by Mitra, *et al.* (1993) in India, Rahbari *et al.* (2009) in Iran, Tadesse (2011) and Asghar *et al.*, (2011) in Ethiopia [20, 23, 24, 25, 26]. The psoroptic mange comes in second position and chorioptic mange was totally absent. This last one if it exists, it occurs only sporadically [23]. The high frequency of herds and animals affected by sarcoptic mange is related to the highly contagious nature of *Sarcoptes scabiei* [12]. However, it should be noted that psoroptic mange remains the most common form of sheep mange in some countries, such as, Argentina [27], the United States [28, 29], Ireland [30], France [31], Great Britain [32], Romania [33], Spain [34] and Tunisia [35].

Table. 1: Prevalence of infested herds and sheep by different types of mange

		Herds (n=80)	Sheep (n=1731)	χ^2 Sig.
Mange forms	Sarcoptic	14 (70%)	123 (68%)	***
	Psoroptic	6 (30%)	58 (32%)	
Mangy herds/sheep		20 (25%)	181 (10.45%)	

***: $P < 0.001$

3.1.3. Effect of the season

The Fig. 2 illustrates the seasonal prevalence of mange in herds and animals. The present study showed a significant seasonal effect on mangy herds and animals ($P < 0.001$). Both sarcoptic and psoroptic mange forms were completely absent in examined sheep flocks during the summer and the spring. According to [36, 37], a latent phase of disease in healthy flocks often confirmed at summer season. During the autumn and the winter seasons, the affected sheep herds rate was 45% (9/20) and 55% (11/20, respectively. As for the prevalence of mangy animals, it was especially high during the winter 25.1% (117/466) compared to the autumn 15.52% (64/415) (Fig. 3).

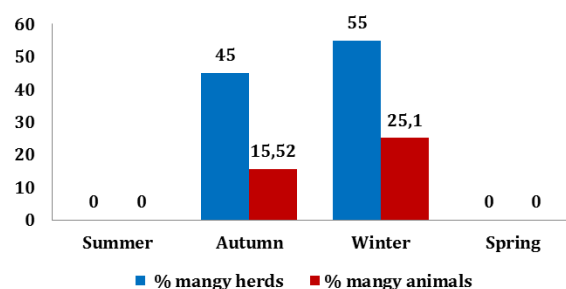


Fig. 2: Seasonal prevalence of mangy herds and sheep

These observations are consistent with the biological peculiarities of mites, which have less resistance during the summer months due to their sensitivity to dehydration [12, 38, 39]. In Morocco, Mouelhi (1977) and Dakkak and Ouhelli (1986) and in Saudi Arabia, Wasfi and Hashim (1986) also report that sarcoptic mange is much more common in autumn and winter than in other seasons [40, 41, 42]. At the study area, the sheep flocks are often maintained in extensive livestock system. The diet aspects are often overlooked by breeders and animals only have straw and occasionally little barley especially during the winter. So, the animal can't cover its maintenance and production needs or even withstand to various affections [43]. Thus, mange finds a favorable ground for its extension on deficient animals [21, 22, 39]. Likewise, some factors favoring the spread of mange, like precarious housing, defective hygiene, transhumance or concentration of sheep piled up in poorly ventilated and dirty sheepfolds. In addition, large numbers of animals gathered at animal markets and the transboundary pass of uncontrolled animals. Such conditions have proved favorable to the transmission of the disease spot, as is the case reported by random animal collection as that occurs in the Kingdom during the Hajj seasons [20].

In addition, *Sarcoptes* mites rate involvement in herds was statistically predominant for the autumn and the winter (40% and 30%, respectively) compared with that for *Psoroptes* (5% and 25%, respectively) ($P < 0.001$) (Fig. 3). In this fact, the frequency of sarcoptic mange herds decreased during the transition period from autumn

to winter, unlike to the pattern of changes of herds infested with psoroptic mange, which increased in the winter compared with autumn ($P < 0.0001$).

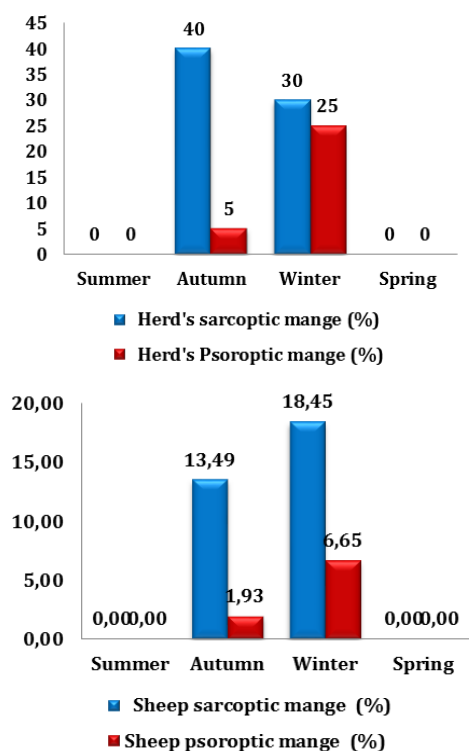


Fig. 3: Seasonal prevalence of infested herds (left) and sheep (right) by different mange forms

Regarding the seasonal changes of the different mange forms in the studied sheep, this results also show that the frequency of the affected animals was significantly dependent on season ($P < 0.001$). Thus, the prevalence of the animals suffering from sarcoptic mange was higher during the autumn (13.49%) and the winter (18.45%) compared to those infested with psoroptic mange (1.93% and 6.65%, respectively). Our study showed a contradictory point of view with Al-Ezzy *et al.*, (2015), that infestation with *Psoroptes ovis*, *Chorioptes ovis* and *Sarcoptes scabiei* was not affected by gender and sea son [44].

3.1.4. Effect of animal origin

It should be remained that the study of sheep mange incidence by regions can't be performed for the two seasons of spring and summer because of the negative diagnosis of this pathology during these periods.

For the autumn and the winter, the frequency of mangy animals according to the study regions showed a significantly non-random distribution ($P < 0.01$ and $P < 0.05$). Indeed, the two localities Heliopolis and Medjaz had the highest prevalence of infested animals (24.52% and 35.65%, respectively). However, the two localities Hammam

Ouled Ali and Fedjouj have the lowest frequencies of infested animals (6.77% and 18.7%, respectively) (Fig. 4).

The analysis of the results with respect to frequency of the tow mange forms mange in the study area showed a significantly nonrandom distribution in the different localities of Guelma department ($P < 0,001$) (Fig. 4). In fact, during the autumn, animals originating from Heliopolis are the most infested with *Sarcoptes* (24.52%), whereas animals from the Hammam Ouled Ali locality are the only ones infested with *Psoroptes* (6.67%). During the winter season, animals from Ain Hessainia are the most infested with sarcoptic mange (20.2%), although the animals from Medjaz Amar were the most prevalent for psoroptic mange (21.4%).

This study sound to be the first to describe the prevalence of sheep mange in different localities of Guelma department. It appeared that scab disease in sheep at the study area remains a truly neglected infectious disease. This investigation could serve as a tool for further studies of this important and widespread parasitic disease.

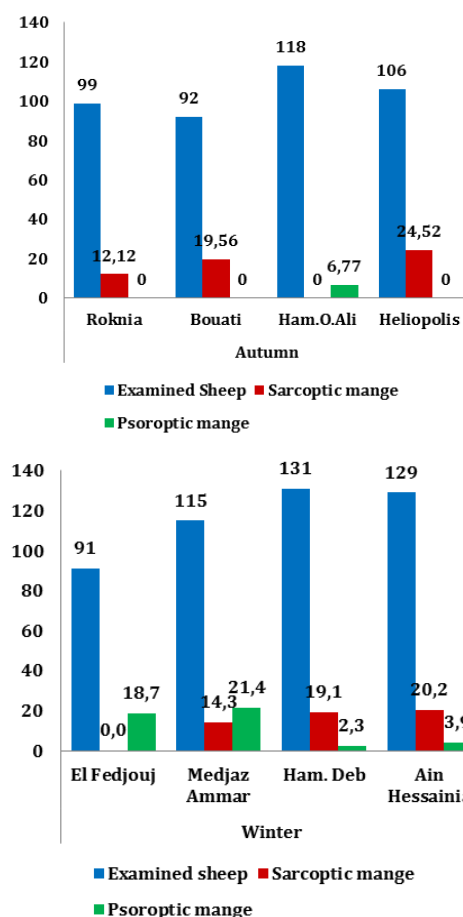


Fig. 4: Prevalence of different forms of sheep mange during the autumn (up) and the winter (down) in different localities of the study area

3.2. Survey at the livestock market

The table 2 showed the results of the investigation on mange infestation of animals and herds run into

Guelma's livestock market. The overall prevalence of mangy sheep herds and animals was 11.4% (113/992) and 5.1% (509/10028), respectively. The patterns of monthly prevalence changes of infested flocks and sheep were generally transposable. It was characterized by high prevalence of herd infestation between December and March (28.4 to 30.7%) with slight decline in February (17.8%). The herd infestation was generally low for October, November, April and May (3.3 to 7.6%) and was completely nil between June and September. The monthly evolution of the frequency of sick animals displayed a clearly increase from October (1.2%) reaching a maximum in February (15.8%) and then decreased progressively until a complete disappearance of the disease between June and September. It should be noted that during the February, the rate of affected farms decreased while a peak prevalence of infested animals was observed.

Table. 2: Monthly evolution of frequencies and rates of farms and animals suffering from mange according to the survey undertaken at the livestock market.

Month s	Examine d herds	Affecte d herds	Affected herds (%)	Examined animals	Affecte d animals	Affected animals (%)
Oct	61	2	3,3	669	8	1,2
Nov	69	4	5,8	554	19	3,4
Dec	70	21	30,0	714	28	3,9
Jan	95	27	28,4	1102	82	7,4
Feb	107	19	17,8	1103	174	15,8
Mar	101	31	30,7	998	115	11,5
Apr	92	7	7,6	751	61	8,1
May	57	2	3,5	643	22	3,4
Jun	85	0	0,0	759	0	0,0
Jul	81	0	0,0	951	0	0,0
Agu	99	0	0,0	859	0	0,0
Sep	75	0	0,0	925	0	0,0
Total						
/ mean	992	113	11,4	10028	509	5,1

The recorded rate of sheep herds infestation at Guelma's livestock market was lower than those reported by Athamna *et al.*, (2014) in a neighboring department at the north eastern of Algeria and at the West Africa (Salifou *et al.*, 2013) [7, 19]. This high sheep flock contamination would be due to the lack of organized and sustained prevention action. However, rates as low as ours were reported in Greece and Sudan [45, 46]. The disease would be very rare in Spain and Italy [47, 48], even nonexistent in Belgium [49]. Regarding the prevalence of the disease in the animals presented at the livestock market (5.1%), it is lower than that observed in El-Tarf region [7], and in some countries such as: 58.8% in Senegal [50] and 23 to 28% in Nigeria [51].

4. Conclusion

This study demonstrated the occurrence and medium prevalence of sheep mange in

bioclimatic conditions of Guelma area at the northeastern of Algeria when compared to previous reports of this disease in Algerian humid agroecological zone. Two mange mites genera were identified; *Sarcoptes* and *Psoroptes* with predominance of sarcoptic infestation. This parasitic affection occurs seasonally with more cases during wet season and a total absence during the dry season. So, an associated effort between animal owners and veterinarians should consider a well-reasoned integrating control of the external and internal parasites (particularly fascioliasis and estrosis) coordinated to public awareness about the economic importance and rigorous treatments of this disease.

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