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Ahmed Hadef
Institute of Veterinary Sciences, University of Frères Mentouri Constantine, El Khroub, 25160, PB 56, Constantine, Algeria

Abd Elbasset Ghouar
Institute of Veterinary Sciences, University of Frères Mentouri Constantine, El Khroub, 25160, PB 56, Constantine, Algeria

Yasser Lecheheb
Institute of Veterinary Sciences, University of Frères Mentouri Constantine, El Khroub, 25160, PB 56, Constantine, Algeria

Correspondence
Ahmed Hadef
Institute of Veterinary Sciences, University of Frères Mentouri Constantine, El Khroub, 25160, PB 56, Constantine, Algeria

Egg shedding pattern of gastrointestinal strongyles in ewes grazing pasture under Mediterranean climate of north-eastern Algeria

Ahmed Hadef, Abd Elbasset Ghouar and Yasser Lecheheb

Abstract
The egg shedding dynamic of gastrointestinal strongyles was investigated in traditionally managed ewes grazing pasture in a Mediterranean area of north-eastern Algeria (El-Tarf province). According to the lambing season, 70 fecal samples were collected through six months, from November to April, to assess the monthly fecal worm egg counts (WEC) by a copromicroscopic examination. A low level of worm infection was frequently recorded, although the egg excretion exceeded with a low prevalence a count of 50 eggs per sample only during the winter season (9% and 14% in December and January, respectively). This high level, mainly observed during the first postpartum month in winter lambing ewes, seems related to the climatic conditions (precipitation), physiological stages (postpartum and suckling) and deworming moment. This study revealed that the monitoring of strongyles infection using the WEC test is essential to determine the periods of risk and to plan the anthelmintic control.

Keywords: Climate, ewes, gastrointestinal strongyles, grazing, postpartum

1. Introduction
The sheep farming is one of the agricultural sector pillars in Algeria. During its productive life, the sheep is exposed to several diseases of various etiologies. Parasites are one of the often implicated etiological agents. In Algeria, extensive farming along with climatic conditions diversity could expose sheep flocks to multiple parasitism. The economic impact of parasitic diseases, through reduced production, stunted growth and heavy mortality [1] and the cost of preventive and therapeutic protocols, justify the importance of parasitism control as an essential element of herd management [2]. Digestive strongylosis is caused by the presence and development of the larval or adult forms of *Strongylida* nematodes in the lumen or in the wall of the abomasum or intestines, following the ingestion and/or percutaneous penetration of the infective larvae [3].
In El Tarf, an agricultural province in north-eastern Algeria characterized by a humid Mediterranean climate, the fecal egg counts of gastrointestinal strongyles have been experimentally monitored all along the year in ewes without any deworming. This study has revealed two peaks of egg shedding, in the spring and the summer [4]. Furthermore, it has been suggested, following the monitoring of anemia status due to hematophagous nematodes through the use of FAMACHA© system, that grazing ewes extensively managed have been exposed to internal parasites, mostly the gastrointestinal strongyles [5]. This infestation has been considered as omnipresent all along the year in some Algerian steppe areas, and it has been recorded that autumn (September and October) and spring (March, April, and May) are the risk periods for strongyles infection [6].
The purpose of the present study was to define the pattern of digestive strongyles parasitism in ewes traditionally raised under a Mediterranean climate region (El Tarf) according to their lambing season by the establishment of their own fecal worm egg counts (WEC).

2. Materials and methods
2.1 Area and period of study
The study was carried out on a private farm located in El-Tarf province in the north-eastern Algeria (36° 44′ N 7° 55′ E and an altitude of 221m) characterized by a Mediterranean temperate climate. The study was conducted during the most rainfall months of the year corresponding to the natural breeding season (Short length day) from November 2014 to April 2015. During these months, the average temperature recorded was 13.72 °C and the

precipitation was 678 mm. This latter climate parameter reached its peak (226 mm) in the month of December, with an average temperature of 8.7 °C (Figure 1).

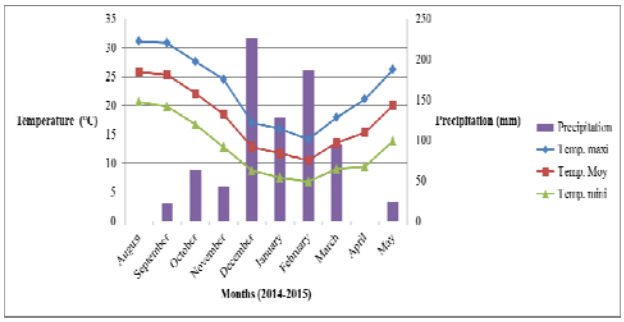

Fig 1: Climate data during period of study

2.2 Animals

All ewes (n=14) of local breed from the traditionally managed farm were identified with earrings and monitored monthly at different reproductive stages (late pregnancy and lactation) during their breeding season from November 2014 to April 2015. Flock feeding was based mainly on grazing alternated by stall feeding during very rainy days in which ewes were fed hay and straw and supplemented intermittently with concentrate depending on its availability. The use of anthelmintic to control internal parasites, not applied in pregnant ewes, took place after lambing without any control plan.

2.3 Fecal samples and colposcopic examination

A total of 70 Fecal samples were collected directly from the rectum of each ewe and packed in labeled (animal identification number, date) plastic bag. Samples were kept cooled and transported to the laboratory for coproscopic examination. This copromicroscopy was performed using the Modified Wisconsin Sugar Flotation (Sheather's solution) Technique to determine the worm egg counts (WEC) in a 3 gram of feces sample [7]. The individual worm egg count was considered as low for 0 to 10 eggs per sample and moderate for 11 to 50 eggs. A high level of worm infection requiring the use of anthelmintic was defined if there are over 50 eggs per sample.

2.4 Statistical analysis

Data analysis was performed using SPSS Statistics 17.0. The Mann-Whitney test was used to determine whether two monthly proportions of each strongyles genus differ significantly ($P<0.05$).

3. Results and discussion

3.1 Description and monthly distribution of strongyles species identified in fecal samples

In the present study, the micro coproscopic examination showed a monthly presence of strongyles eggs in the fecal samples. These eggs are indistinguishable only for some genera and so the strongyle egg count is the common parameter reported by laboratory diagnostic [8]. Therefore, only proportions of distinguished species *Nematodirus*, *Strongyloides*, and *Trichuris* were reported in Table 1.

The identification of these strongyles eggs was based on their typical forms (Figure 2). *Nematodirus* eggs are ovoid to football shaped (150–230 × 80–100 µm), containing morula with 4–8 dark, round cells; may be yellowish-brown in color (*N. battus*). *Strongyloides* eggs are thin-shelled, oval (40–60 × 20–35 µm); it already contains a first-stage larva when it is passed in feces. *Trichuris* eggs are lemon-shaped, brown, smooth-shelled (60–80×25–42 µm) and have a distinctive plug at either end [8, 9].

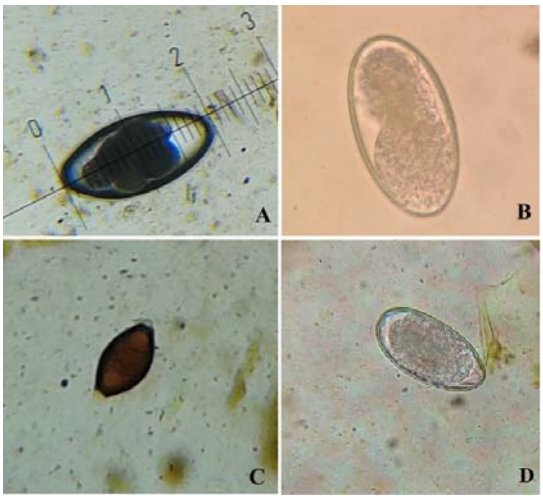

Fig 2: Sample of Strongyles eggs observed (A: egg of *Nematodirus*; B: egg of *Strongyloides*; C: egg of *Trichuris*; D: egg of *Strongyle*)

Results resumed in Table 1 reveal that *Strongyloides* genus took more important part of infective strongyles, starting from January to reach the highest proportion in April. This led to suggest that post-lambing treatments could cause selection pressure of this parasite as reported by some authors [8]. However, fecal egg counts can be influenced by a number of factors including strongyles genera, immunity of the host, and the occurrence of clinical signs [8].

In the rest of the present work, only the pattern of total gastrointestinal strongyles will be treated.

Table 1: Proportions of different strongyles species determined by egg form during months of study

Strongyles species	November[(a)]	December[(b)]	January[(c)]	February[(d)]	March[(e)]	April[(f)]
Nematodirus spp	0% [c]	4%	3%[a,d,e]	0%[c]	2%	0%[c]
Strongyloides spp	0%[c,e,f]	2%[c,e,f]	22%[a,b,d,e]	11%[c,f]	17%[a,b,f]	56%[a,b,c,d,e]
Trichuris spp	0%	3%	1%	10%	0%	2%
Other *Strongyles*	100%[c,e,f]	91% [c]	74%[a,b,d]	79%[c]	81%[a]	42%[a]

In each row, a significant difference ($P<0.05$) between monthly proportions of each strongyles species was noted by the corresponding exponential lower case letter.

3.2 Pattern of the strongyles infection during rainy months

A worm egg count is an indicator of the worm burden in the host and an indication of the pasture contamination. In several temperate and steppe areas, a good relationship between fecal egg counts and strongyles worm burdens was established in sheep and goats [10].

The pattern of average fecal worm egg counts (WEC) was reported in Figure 3. This graph shows a seasonal variation of egg shedding expressed by their increasing during the rainy

months commencing from December to reach their peak during January, corresponding to a possible winter rise. This result was in discordance with those recorded in the same province where a spring (March and April) and summer (August and July) peaks of egg counts were revealed in 5 ewes raised under a semi-intensive system and not dewormed during the whole study year [4]. However, the present study was carried out during only six months of the year without including summer months. In Algerian steppe area, the kinetic of fecal egg counts showed two peaks of egg shedding, in spring and autumn [6, 11, 12]. In this area, the possible winter and summer hypobiosis was studied [13]. This contradiction between our result and those recorded in steppe area could be explained by the difference between the mild, moist winter (during January, the averages of temperature and precipitation were 11.7 °C and 127 mm, respectively) characterizing the Mediterranean climate of the present study area (Figure 1) and the cold winter in steppe area [12, 13]. In this latter region, the limitation of animal's movement due to winter harsh climatic conditions and their kept in the sheepfold could be a reason of parasites losses at different exogenous stages (eggs, larvae) which could lead to possible hypobiosis [12]. Contrary, in the littoral area of present study, sheep grazed pasture continuously even in rainy weather, alternated by stall feeding for few days. The possible effect of precipitation on fecal egg counts was similarly noted in a study conducted under tropical climate in the province of Matanzas (Cuba) in which the fecal egg counts reached their highest values during the rainy season [14].

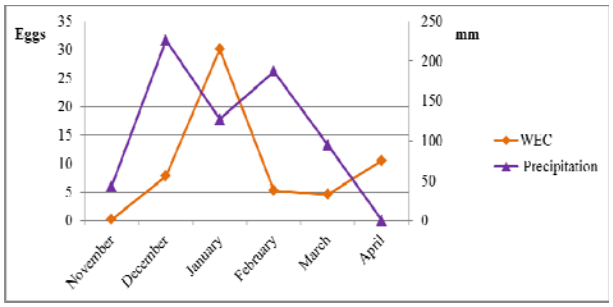

Fig 3: Pattern of average worm egg counts during months of study

Following January rise, the level of excretion had markedly diminished and it was stabilized from February to March so as to re-increase towards the last month of this study (April) succeeding enhancement of environmental climatic conditions (temperature and precipitation, Figure 1 and Figure 3). We suggest, since this latter spring increase in egg shedding, that nematode parasitism in Algerian steppe and Mediterranean littoral areas could have a common period of high worm infection risk "the spring" when climatic conditions and the grass thrust become favorable to the surge of worm burdens both in the host and pasture.

3.3 Pattern of worm egg count levels according to ewes lambing periods

A low prevalence of high WEC levels (greater than 50 eggs) was only observed during the winter season (December and January, 9% and 14% respectively). This result leads to conclude that strongyles infestation in ewes varied through low to moderate levels (Figure 4), which is close to results found in steppe area where a 14% of positive cases were recorded during the year [12]. Consequently, it appears according to fecal egg counts dynamics that the deworming practice is useless in the case of low-risk infection [15].

During the study period, lambing occurred during autumn (October and November) and winter (December and January) seasons (43% and 57% respectively, Figure 4). Consequently to farmer traditional worm control, post parturient ewes were grouped and dewormed consecutively to their lambing period, at the first postpartum week for autumn lambing ewes (November deworming) and at one month postpartum later in winter lambing (February deworming), excepting two ewes treated after two months after lambing. This worm control practice could explain the high level (> 5o eggs) of fecal egg counts of periparturient ewes and its important prevalence (14%) during January (Figure 4) corresponding to the first postpartum month of a 57% of ewes. Furthermore, ewes with a moderate level (10 to 50 eggs) were frequently noticed during this month (about 80%). The lower level of egg shedding recorded during November and the absence of the high-risk infection from February (Figure 4) such as previously showed by the WEC pattern (Figure 3) could be due to the moment of deworming.

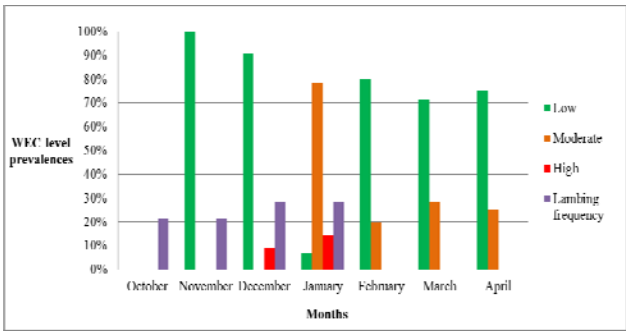

Fig 4: Monthly distribution of egg shedding levels

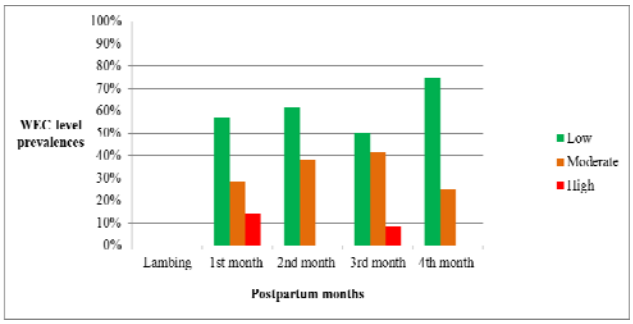

Fig 5: Level of egg shedding during postpartum months

The winter rise of strongyles egg excretion, observed just after lambing or the "post parturient rise", could be due to the interaction between two important factors, physiological stage and climatic conditions during lambing periods. The effect of lactation on WEC levels was previously noted in traditional grazing systems [14].

The reproductive status of ewes in early lactation characterized by a hormonal immunosuppressive effect [16] and a nutritional stress [17] could cause immunity relaxation and expose consequently the post parturient ewes to high risk of infestation as presented by the highest WEC level observed mainly during the first postpartum month (Figure 5). This state was probably aggravated by climatic conditions of the study area in which very high rainfall and adequate temperature were not effective to put the strongyles in hypobiosis. Similarly to our result, in northern Tunisia, a border region of the study area, an infection peak was recorded during November and December, months which

coincide with the lambing period [18].

After period succeeding the February deworming in which the egg shedding reached a lower level (Figure 4), the re-increase of WEC and re-occurrence of high infection level at the third postpartum month (Figure 5) could be related to the season effect (spring rise), the end of anthelmintic remanence and the maintain of the negative effect of lactation on ewes immunity as a result of a late and spontaneous weaning practiced in traditional flock management.

4. Conclusion

In the present study, a seasonal variation of gastrointestinal egg shedding was revealed. During the winter season, a marked increase of WEC, mainly in the first month postpartum, could indicate a possible post parturient rise. Therefore, we suggest that the climatic conditions, physiological stage and deworming management are the most determinant factors of strongyles infection pattern. The control of gastrointestinal strongyles life cycle using fecal worm egg count appears to be crucial to plan the anthelmintic control. This latter should be adjusted according to the field specific climatology and the reproductive status of ewes.

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