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RESEARCH ARTICLE

PREVALENCE OF GASTROINTESTINAL NEMATODES IN SMALL RUMINANTBEFORE AND AFTER WINTERING IN DAKAR AND THIES (SENEGAL)

Boubacar Cissokho[1], Babacar Souleymane Sambe[1], Marc Noel Badji[1], Moussa Wane[2], Toffène Diome[1], Saliou Ndiaye[3] and Mbacké Sembene[1]

1. Laboratoire de Génomique, Département de BiologieAnimale, Faculté des Sciences et Techniques de l'Université Cheikh Anta Diop de Dakar (Sénégal).
2. Cabinet Vétérinaire WANAAVET, Thiès (Sénégal).
3. Ecole Nationale Supérieure d'Agriculture, Université de Thiès (Sénégal).

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Abstract

Livestock plays an essential role in supporting mixed production systems, particularly in traction, fertilization, and adaptation to climatic problems. However, the breeding of small ruminants on pasture limited by numerous parasites. Thus, knowledge of the parasitic fauna of small ruminants is essential for a better approach to parasite control. In this sense, this study consisted in determining the prevalence of gastrointestinal parasites of small ruminants and to evaluate the level of infestation in strongyles of the hosts in the regions of Dakar and Thies. Sampling conducted before and after the rainy season. A total of 102 small ruminants (39 goats and 63 sheep) examined. Of these, 50 hosts (31 sheep and 19 goats) sampled and analysed during the month of June and the remaining 52 (27 sheep and 25 goats) during the month of October. Parasite prevalence was higher in October (94.24%) than in June (86%). Regardless of the period, four groups of parasites identified and nematodes were the most dominant, especially Strongyles. Strongyles were more prevalent in goats (85%) than in sheep (59.4%). No difference in Strongyles infestation also observed between the two sites and during these two periods.

Introduction:-

Small ruminants (SR) have the capacity to transform low-quality fodder into meat, milk, and other by-products for natural use (Cei, 2017).In developing countries, small ruminants are a source of livelihood for rural populations (Peacock, 2005). They not only provide resources such as food, manure, and even savings but also play a social, religious, and cultural role (Alexendreet al., 2012).Moreover, their nickname of 'poor cow' shows their importance in family livestock systems (Morand-Feh, 2012). In Senegal, small ruminants contribute 22% to overall meat consumption (MEPA, 2018). In 2015, the local "hides and skins" sector exported an estimated 4,772 tonnes, 58% of which were sheep skins, 22% cattle skins and 20% goat skins according to MEPA for the same year.However, despite its economic and cultural importance, small ruminant farming faces several constraints. The most important are food and health constraints (Rinaldi et al., 2007). Amongst the health constraints, pests are a major problem and can sometimes lead to large production losses(Rinaldi et al., 2007). The current financial and agricultural losses caused by these parasites have a considerable impact on the profitability of farms (Roeber et al., 2013).Their

Corresponding Author:- Boubacar Cissokho
Address:- Laboratoire de Génomique, Département de BiologieAnimale, Faculté des Sciences et Techniques de l'Université Cheikh Anta Diop de Dakar (Sénégal).

economic cost is due to two sources: the cost of antiparasitic treatments and losses in the reproductive potential of small ruminants (reduced growth, reduced milk production), which can lead to the death of the animal (Saccareau, 2016).The main factors that interfere with SR breeding are the high prevalence of parasitic infections and the difficulty of effectively controlling gastrointestinal nematodes.They compromise livestock yield and welfare and increase mortality (Forteset al.,2013).Gastrointestinal stronglyes (SGI or Strongyles) are one of the main constraints of small ruminant farming(Ndongo, 2007).They affect their health, ranging from a simple loss of appetite to the death of several animals in the same herd(Delannoy-Normand, 2010; Dansouet al., 2021).

The objective of this study is to estimate the prevalence of gastro-intestinal parasites in sheep and goats before and after wintering in the Dakar and Thies regions.Indeed, few studies on the prevalence of helminth haveconducted in Senegal. These studies include that of Vassiliades, (1989) then Ndao et al. (1995) and in 2015 by Diouf in the region of Saint-Louis and Sambe in Dakar.

Material And Methods:-

Study sites

Our study carried out in the regions of Dakar and Thies. The region of Dakar is in the far west of the Cape Verde peninsula, on the edge of the Atlantic Ocean.It is between longitude 17°10 and 17°32 west and latitude 14°53 and 14°35 north.The region of Thies is in the west of thecountry, 70 km from Dakar, in a crown around the Cape Verde peninsula and is between 14°50 North and 17°06 West. The region of Dakar does not appear as a region with a vocation of breeding especially because of the lack of space. However, it remains the main centre for livestock marketing and consumption (Magrinet al., 2011; ANSD, 2015). The region Thies of has enormous physical, technical, and human potential to launch the livestock sector (ANSD, 2015). It concentrates several species, 886,630 heads, where almost a third (33.33%) made upof sheep.

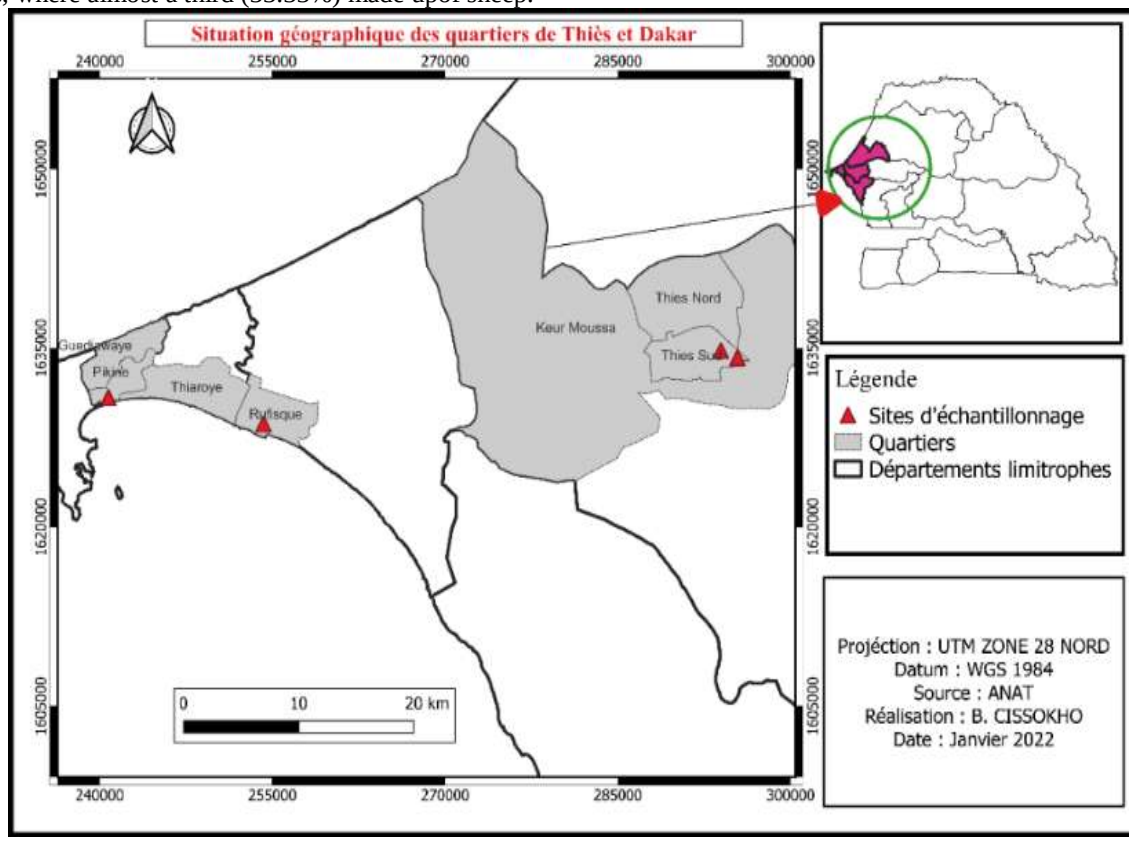

Figure 1:- Location of sampling sites.

Sampling and data collection

The faeces were sampled during the months of June (before the rainy season) and October (after the rainy season) in the small ruminant markets('darals') in Dakar and Thies.The faeces harvested randomly with the approval of the breeder just at the time of defecation using single-use latex gloves.Maximum faeces recovered and gloves then

turned over and put in a cooler.Each sample clearly identified by a label with the identifier of the animal taken. After sampling, the samples stored in the refrigerator between 4°C and 8°C while waiting for the coprological analysis. A total of 102 small ruminants examined, including 39 goats and 63 sheep. Of these, 50 hosts (31 sheep and 19 goats) sampled and analyzed during the month of June and the remaining 52 (27 sheep and 25 goats) during the month of October.

Coprological analyses

Coprological examination involves observing and counting parasite eggs in excreted faeces using the LEICA CME 1349521 Xs (3 A) binocular microscope at magnification X10, X20 and X40.

Qualitative analysis

One to two grams of faecal matter taken from each sample, placed in sterile plastic cups (height= 7.5 cm and diameter = 5 cm), and 60 ml of tap water added to the container.The whole ground with a spoon and filtered with a sieve (diameter of the 500 µm mesh). The filtrate left at rest for 45 to 60 min. The sediment was recovered and placed in 15 ml falcon tubes.These are filled with the qualitative aspect was achieved by combining the simple sedimentation technique andthe flotation technique with the Sheater solution (d=1.25-1.27). the flotation solution and slats placed on the meniscus.After 30 min the slides fixed on slides and observe under a microscope for the identification of parasitic eggs.

Quantitative analysis

Quantitative analysis conducted on samples with strongyles eggs using the Stoll sedimentation method (Stoll, 1923). The number of strongyles eggs per gram of faecal matter (or OPG) estimated by taking 3g of faecal matter from each host.These materials then put into a cup that we added 42 ml of the solution ofdeci-normal sodium hydroxide solution(4/1000). The mix homogenized and filtered with a sieve 3 times.Using a 0.6 ml pipette, each solution sampled and distributed on four different blades (0.15ml/blade) to increase sensitivity by 25 eggs/grams (Sochat, 2015).

Data Analytics

Prevalence and parasitemiaestimation

Prevalence calculated for each type of parasite using the following formula:

$$x = \frac{\text{numberofpositivecases}}{\text{totalnumberofanimalsexamined}} X\,100$$

All strongles eggs using the microscope counted on all slides of each sample, divided by four and multiplied by 100 to obtain OPG. Theparasitaemiawas classified according to the intensity of the infestation into four categories (Soulsby, 1982): none, low (up to 500 OPG), medium (501-1000 OPG) and high.

Statistical analysis

The Shapiro-Wilk test was performed to assess the normality of variables.Due to the significance of normality test, the Wilcoxon test conducted for assess difference according to host, sample period and study site. These statistical analyses carried out using software R version 4.1.3 with a significance threshold set at 5%.

Results:-

Qualitative and quantitative analyses of faeces

Prevalence of gastrointestinal parasites

Of 63 sheep, 56 (88.89%) was infested with at least one parasite. The prevalence in June is 83.87%, compared to 93.75% in October. And 36 out of 39 goats (92. 31%) was parasitized. Thus, the parasite prevalence in June was 89.47% and in 95% October.

Four groups wereobserved during the two sampling periods (fig 2 and fig 3), in both sheep and goats, namely the group of nematodes (Nemathelminths), coccidia (Protozoa), trematodes (Plathelminths) and cestodes (Plathelminths).However, the cestode group appears only in goats in june and only in sheep in october.Injune (fig2A) the prevalence of nematodes is higher with 58% followed by coccidia 28% and trematodes 14%.Even in October (fig 2B), nematodes are the most dominant groups, followed by coccidia, trematodes and late cestode, with a prevalence of 73%, 14%, 9% and 4% respectively.

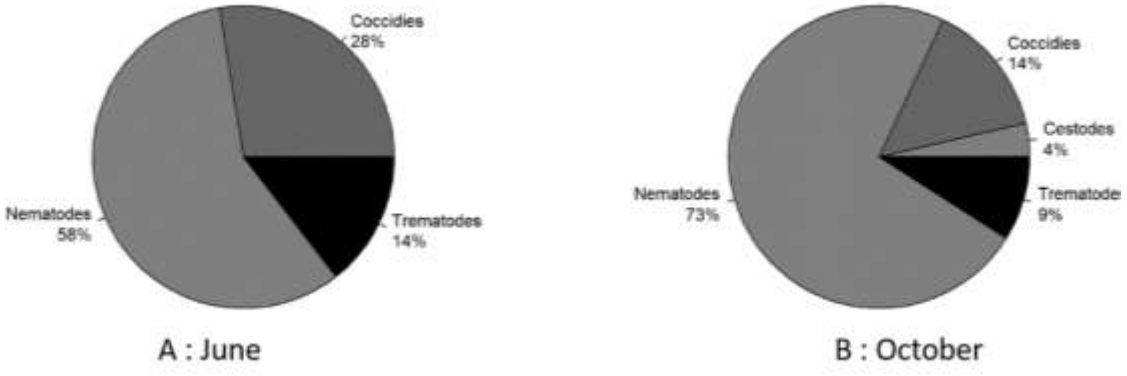

Figure 2:-Distribution of parasite groups in sheep according to the two periods.

Figure 3A shows a higher prevalence in nematodes (74%) followed by coccidia and trematodes with 12% each and cestodes that are less frequent (2%).As well, in October (fig3B), nematode prevalence was 80%, coccidia prevalence was 15%, and trematode prevalence was 5%.

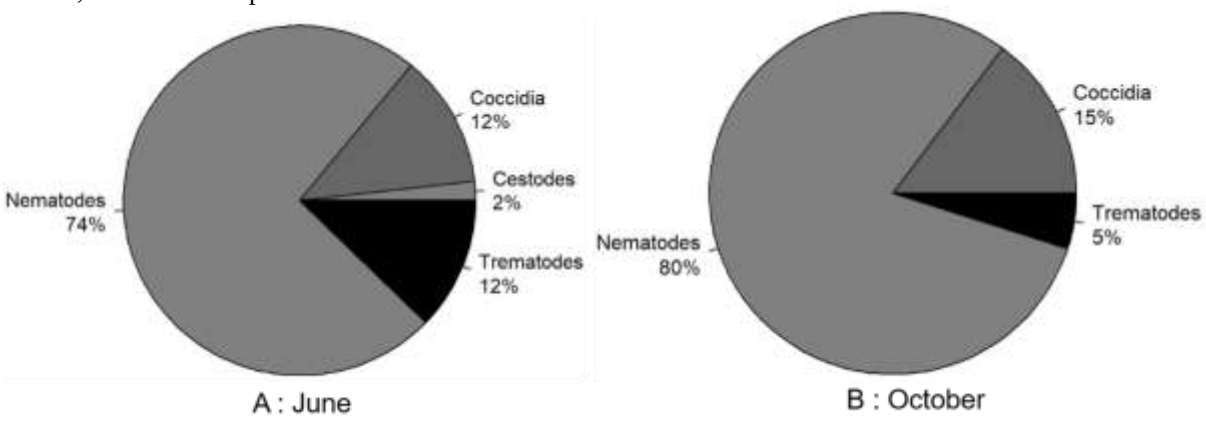

Figure 3:-Distribution of parasite groups in goats according to the two periods.

We observed three branch lines (fig4) that infest small ruminants throughout the period. The nemathelminth branch was the most diversified with a total of twelve parasites (strongyles, strongyloides, Capilaria sp., Cooperia sp., Trichuris sp., Oesophagastonum sp., Nematodirius sp., Skrjabinema sp., Toxocara sp., Chabertia sp., Ostergia sp. et Bunostomum sp.). It wasdominated by Strongyles and Strongyloids during both periods, with prevalences of 48.4% and 41.9% in June and 59.4% and 56.2% in octoberrespectively.Nevertheless, Ostertagiasp.had a prevalence of 48%, not negligible in october.Protozoa represented by Eimeria sp. oocysts infest sheep during both periods with prevalence's 61.3% in June and 50% in october.

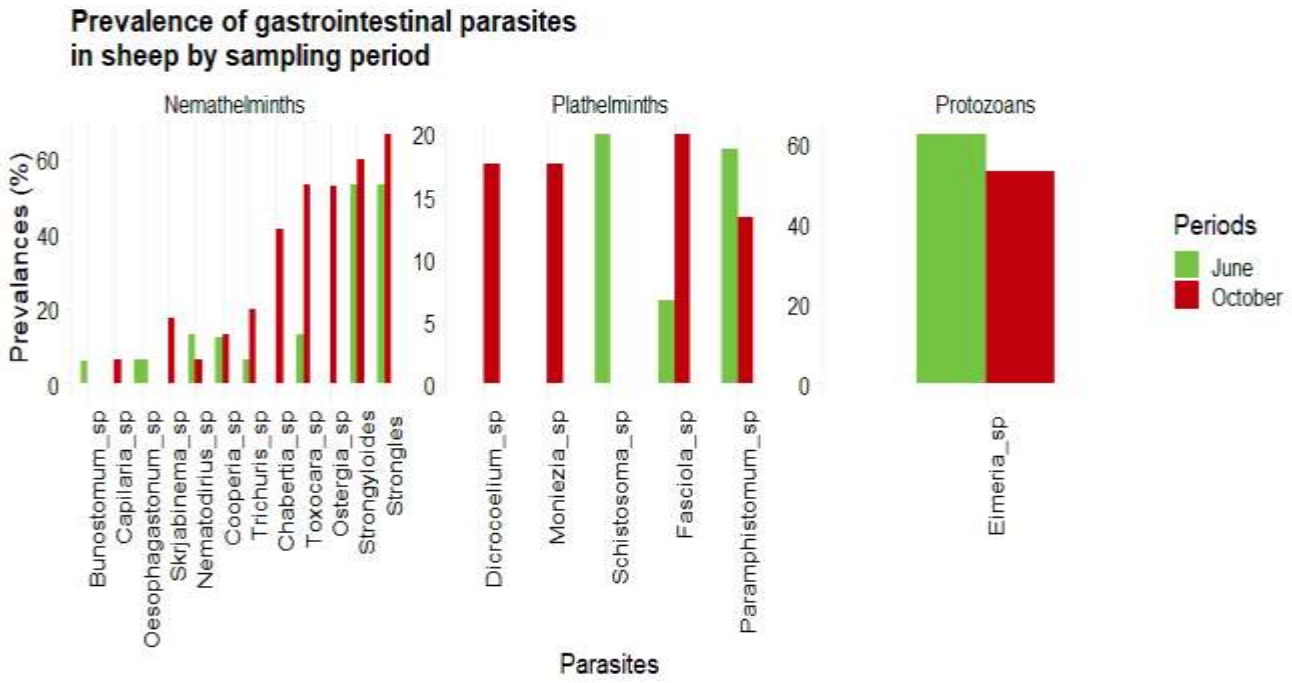

Figure 4:- Prevalence of gastrointestinal parasites in sheep by sampling period.

In goats we also observed these three branches (Fig 5), whatever the period.Thenemathelminthswere the most diversified with ten parasites(strongyles, strongyloides, Cooperia sp., Trichuris sp., Oesophagastonum sp., Nematodirius sp., Skrjabinema sp., Toxocara sp., Chabertia sp. andOstertagia sp.) and strongles had a prevalence of around 95% in october and 75% in june. But also, Strongyloides and Ostertagia sp. had prevalences above 50% regardless of sampling time. Followed by plathelminths with five parasites, all with prevalence below 50% except for Paramphistomumsp, which had a significant threshold (50%). In the end the protozoa represented mainly by oocysts, having prevalence greater than 60% during the two periods.

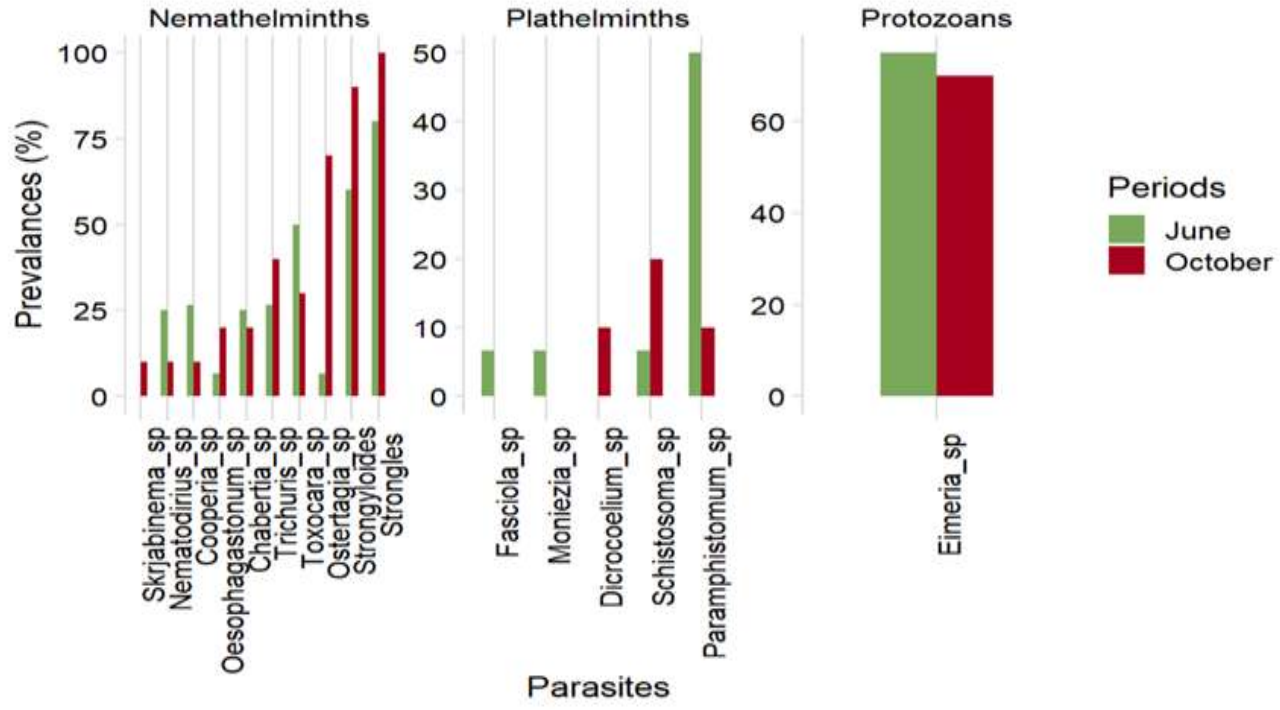

Figure 5:- Prevalence of gastrointestinal parasites in goats according to the sampling period.

Figure 6 showed pest prevalence in both regions. The same branches were present in both localities, they were nemathelminths, protozoa and plathelminths. However, the prevalence of the strongyles and oocysts were the most important in sheep and in Thies.

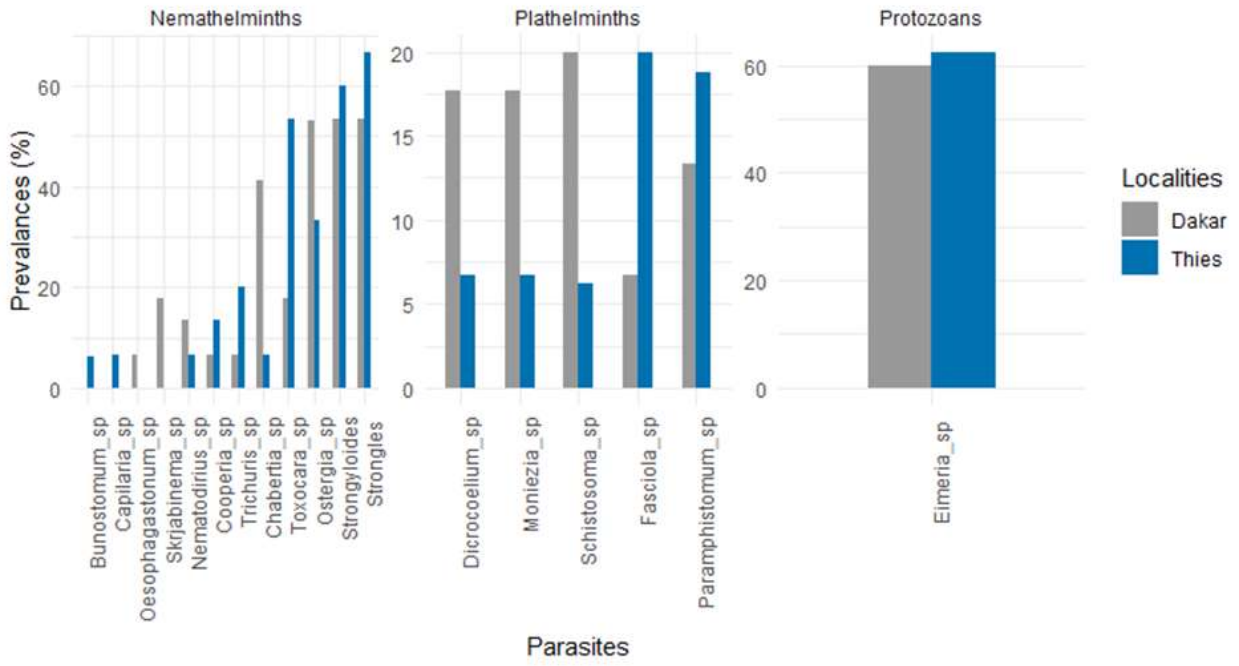

Figure 6: Prevalence of gastrointestinal parasites in sheep by sampling location

The strongyles and oocysts (Fig 6) had prevalence of more than 60% in the locality of Thies, while in Dakar they were around 50-60%.In nematodes, Bunostomum sp. and Capillaria sp. observed only in Thies while the Oesophagastomum sp and Skrjabinemaspfound in Dakar. The plathelminths represented by five parasites, all present in the two localities with prevalence's between 5% and 20%.

Prevalence of parasites in goats was higher in Thies than in Dakar (fig 7).

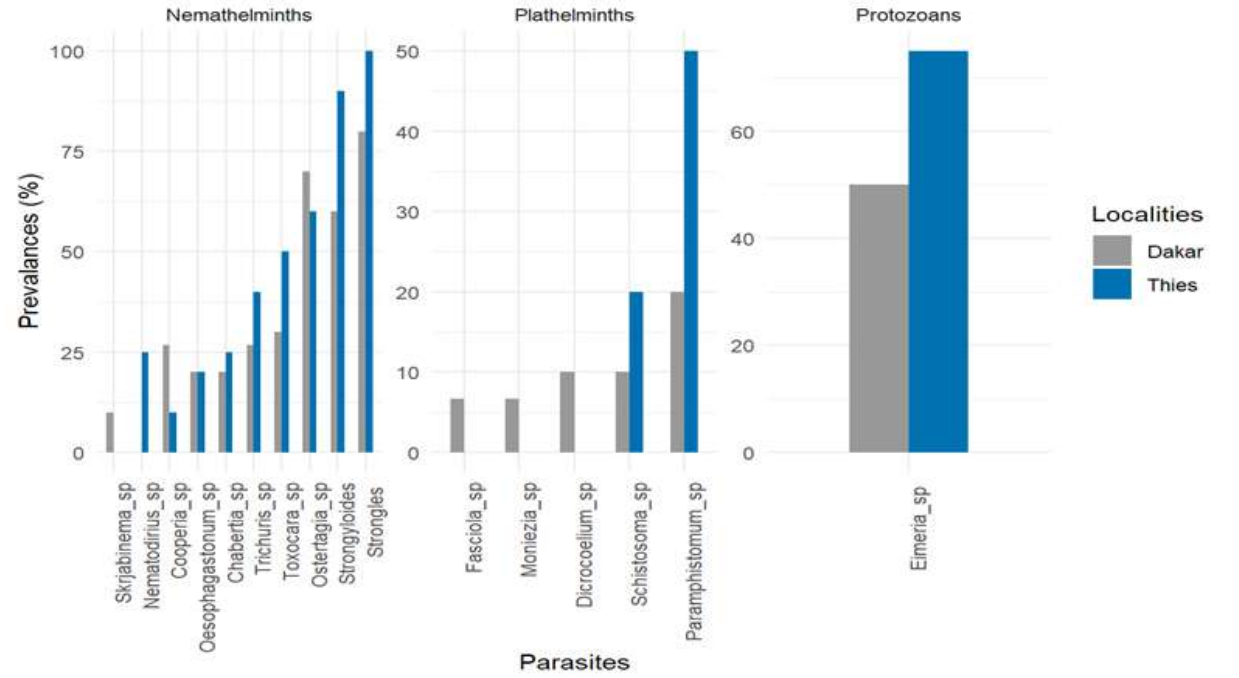

Figure 7:- Prevalence of gastrointestinal parasites in goats according to sampling site.

Nevertheless, we observed the same branch lines in the two localities (fig 7), namely the nemathelminths(twelve), the plathelminths (five) and the coccidias (one). The strongyles, the Strongyloides, the Toxocara sp. were the most important nematodes in Thies both disc Ostertagia sp., Chabertia sp. and Skrjabinema sp. infested more Dakar goats.The strongyles, strongyloidssp, Toxocarasp were the most important nematodes in Thies so much said that Ostertagiasp, Chabertiasp and Skrjabinemasp infested more Dakar goats.Oocysts observed more in Thies than in Dakar.TheParamphistoms and the liver fluke were more in Thies than in Dakar. From this observation the region of Thies is the one that had the most parasitized goats.

Strongyles parasitaemia

Figure 8 showed that the difference in the parasitaemiasheep between the two locations was non-significant regardless of the sampling period.

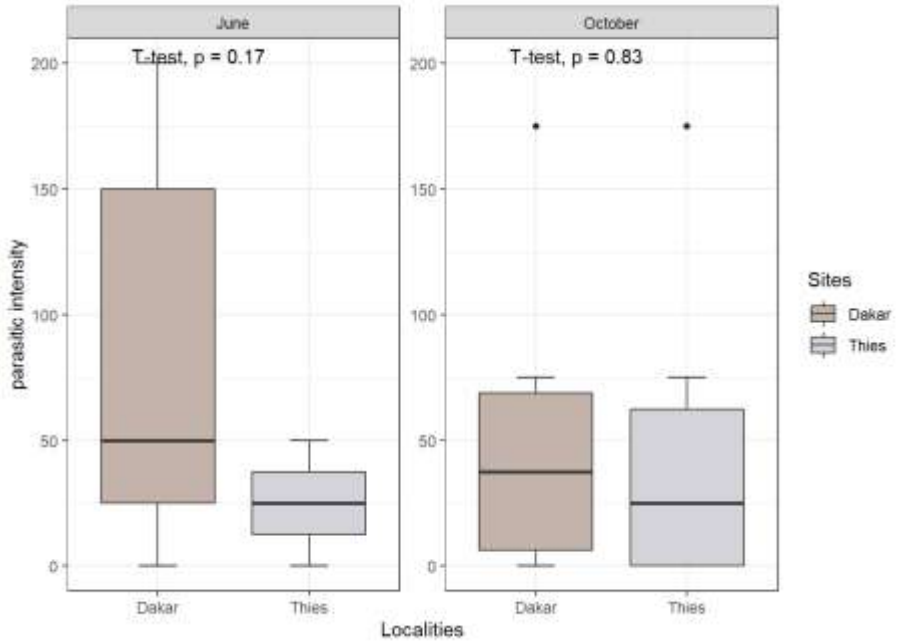

Figure 8 A:-Boxplots of strongyles parasite loads in sheep as a function of sampling site during both periods.

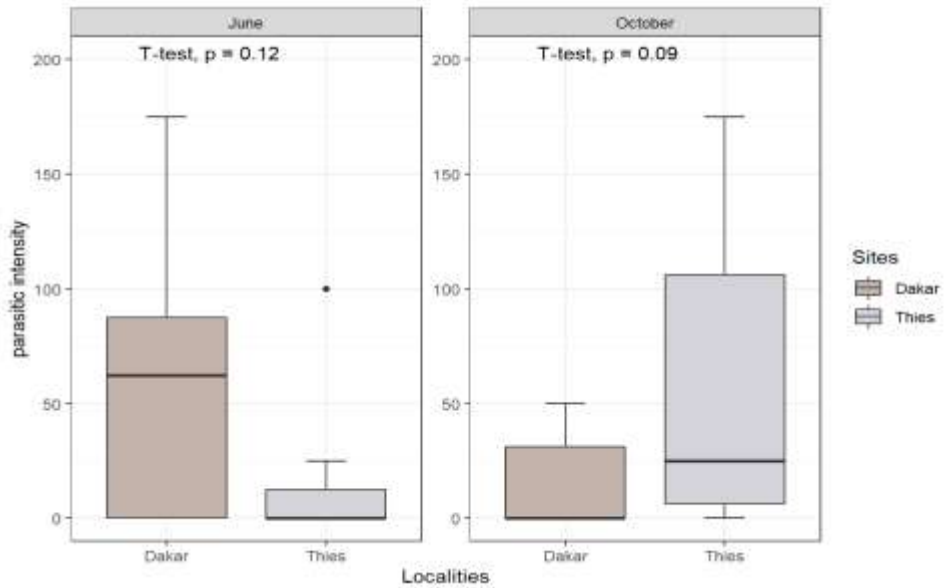

Figure 8 B:- Boxplots of strongyles parasite loads in goats as a function of sampling site during both periods during both periods.

Similarly, in goats (fig 8B), there was no significant difference in mean parasitic parasitaemiabetween Dakar and Thies regardless of the study period.

Within each locality, there was no significant difference in strongylesparasitic loads between June and October for both sheep (fig 9A) and goats (fig 9B).

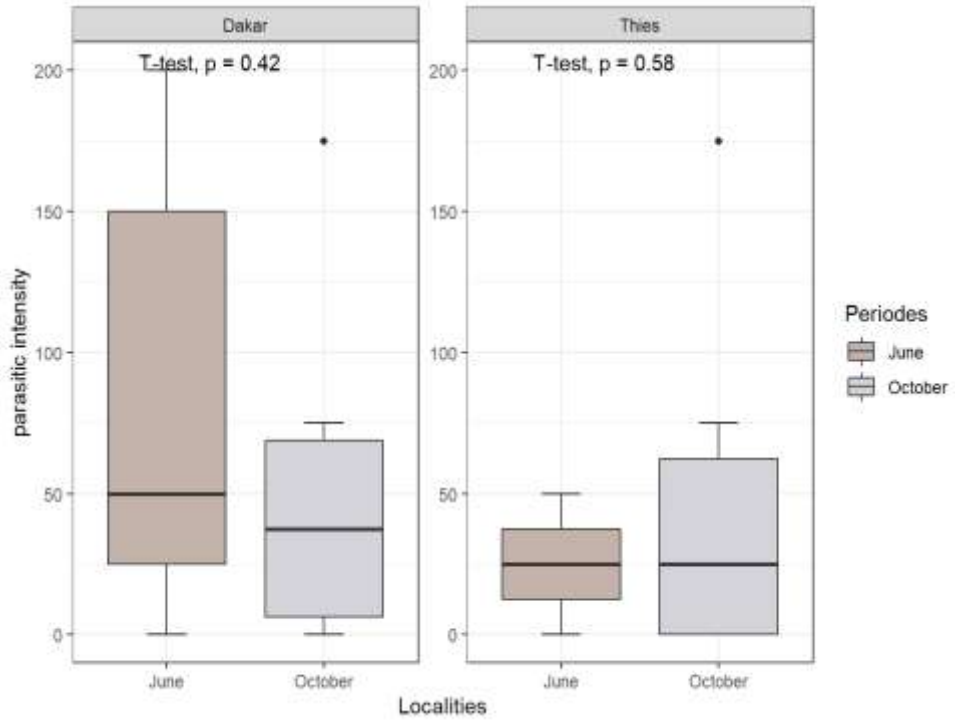

Figure 9A:-Boxplots of strongyles parasite loads in sheep as a function of time and in each site.

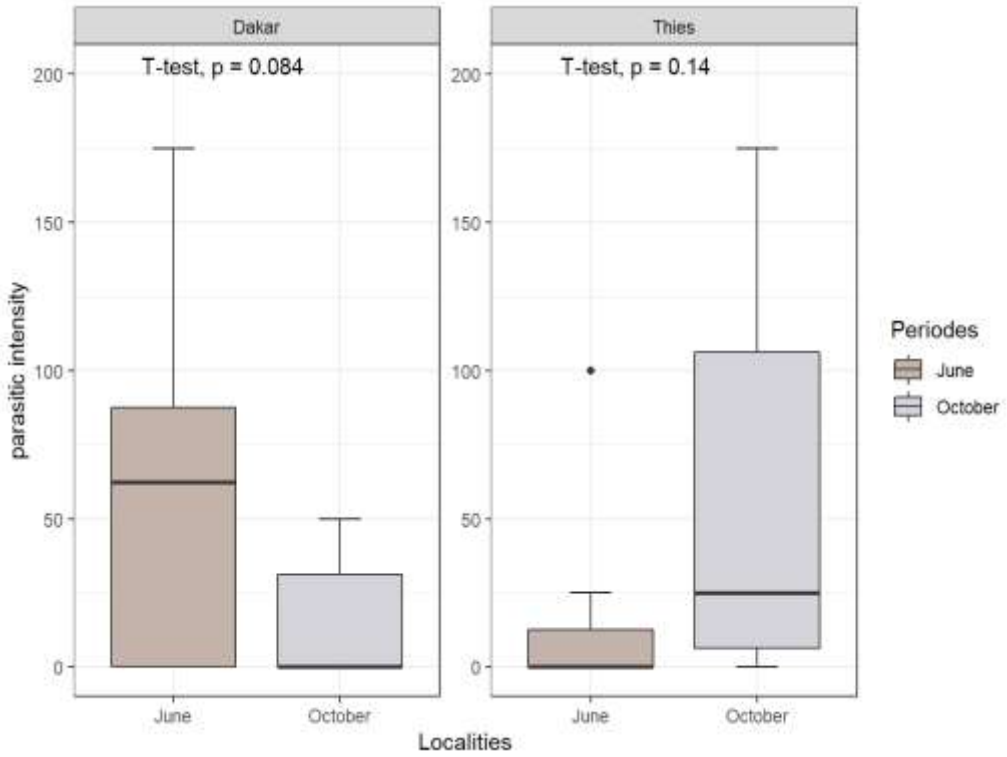

Figure 9B:-Boxplots of strongyles parasite loads in goats as a function of time and in each site.

Discussion:-

This study allowed us to appreciate the parasitic fauna of sheep and goats, which is quite diverse in the study sites.It also shows overall parasite prevalence of 88.89% (56/63) in sheep and 92.32% in goats.Moreover, the level of parasitism after overwintering is higher, with a prevalence of 93.75% in sheep and 95% in goats.Therefore, the prevalence of the parasite differentiated according to the season on the one hand and the goats are the most infested on the other hand.The same situationobserved in the North-South areas of Senegal by Vassiliades et al. (1982, 1984).During the rainy season, the development of parasites reaches its peak(Vassiliades, 1989; Scheuerle, 2009). However, during the dry season contamination decreases sharply in the pastures. This could be due to climatic conditions that are unfavourable to the continuity of the parasite life cycle and the environment becomes less infectious (Abbott et al. 2012). Thus, the metabolism of the parasites slowed down (hypobiosis), which attenuates the fecundity of the females (Scheuerle, 2009; Meradjiet al., 2015). The return of optimal climatic conditions for parasites leads to a production of thousands of eggs per day per female in some strongyles (Roeber et al., 2013). But also,even though goats are more infested, no significant difference in parasite loads observed between periods, localities in sheep and in goats. The lack of significant difference could be due to a similarity in farming systems, which are of the peri-urban type in both localities. However, goats often have a higher parasite load and are more clinically sensitive. On the other hand, Ndao et al.(1995) found that sheep had a higher parasite intensity in the sylvo-pastoral zone.

Our study also showed the presence of four groups of parasites (nematodes, coccidia, trematodes and cestodes) in these two localities. These groups observed by Vassiliades, (1994) in Louga and Diouf, (2015) in North-East Senegal. These same groups of parasites observed in Côte d'Ivoire by Birindwa et al. (2020) and in Benin by Faihunet al. (2017), but also in Colombia by Pinilla León et al. (2019). The presence of these groups is due to the fact that they are the main helminths and protozoa, which are pathogenic to domestic ruminants (Thienpontet al., 2003).The dominance observed in nematodes is because these parasites have a direct cycle and are important in tropical regions (Belem et al., 2001; Muluneh et al., 2014). Furthermore, they are the main internal parasites of small grass-fed ruminants (Mandonnetet al., 2005; Davies et al., 2006).

We observed twelve nematodes in sheep and ten in goats. However, the most frequent in both goats and sheep are the strongyles, strongyloides. In this sense, in the North-East of Senegal, Diouf, (2015) found only strongyles in the nematode group. In contrast, in Togo Bastiaensen et al. (2003) found six nematodes (Capilariasp, Cooperiasp, Trichuris sp and Oesophagastonumsp), but did not find strongyles or strongyloids. This could cause by a high diversity of livestock sources in Senegal (Magrinet al., 2011) or by the influence of sample size and/or season. From this observation, it can say that in Senegal, there is a significant diverse population of IGNs.

Plathelminths consisting of four trematodes (Fasciola sp, Paramphistomumsp, Schistosoma sp, and Dicrocoeliumsp) and a single cestode (Monieziasp). All these parasites infest small ruminants (sheep and goats). Nevertheless, the season would be a factor discriminating the rate of parasitism in goats, but also the locality would play an important role in the hosts. The same trematodes found by Bastiaensenet al, (2003). However, our results show that the genus Dicroelium found at the end of the wintering period in both species. This disagrees with Bastiaensenet al. (2003), who found the genus Dicroeliumonly in goats (one positive sample). However, some authors such as Faihunet al. (2017) found in Benin eggs of Fasciola sp and Paramphistomum sp. The genus Moniezia is the only parasite representing cestodes in small ruminants during both seasons. Indeed, authors such as Ali shah et al. (2021) and Diouf, (2015) have also found that the genus Moniezia is the most common parasite of small ruminants in the tropics. However, Ndom et al. (2016) found four cestodes during necropsies of small ruminants in Senegal. This parasitic diversity results from the fact that the Dakar and Thies regions are the main receptacles for livestock in Senegal (Magrinet al., 2011).

The only protozoa observed in our study are oocysts of Eimeria sp, which infest goats and sheep. However, they show significant relative prevalence before overwintering in sheep and after overwintering in goats. This could be the fact that the species of the genus Eimeria that infest sheep are different from those that parasitise goats (Mohamadenet al., 2018). As a result, depending on the season, there could be a dominance of species infested with goats and/or sheep.

Conclusion:-

The aim of this study was to investigate the prevalence of gastrointestinal parasites in small ruminants in the Thies and Dakar regions before and after the rainy season. The aim was to gain a better understanding of the parasitic fauna of sheep and goats in these two regions. This allowed us to show that the prevalence of parasites in small ruminants is higher just after the rainy season (October). Nematodes, mainly Strongyles, are the most important parasites in small ruminants followed by coccidia, trematodes and cestodes. In short, we have twelve nematodes, four trematodes, a coccidia and a cestode.No differences in parasite load also observed within sheep and cattle during these two periods and for each locality. In perspective, it would be interesting:i) to extend the study to the main areas of small ruminant breeding during the two seasons in Senegal; ii) to use recent and more advanced methods for a better assessment of pest loads; (iii) to carry out identifications of parasites at the L3 stage iv) molecular identification and genetic characterisation of the most pathogenic: Haemonchuscontortus

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