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Gastrointestinal Helminths of *Oryx dammah* (Cretzschmar, 1826) and *Gazella dorcas* (Linnaeus, 1788) in Special Wildlife Reserve of Gueumbeul (Senegal)

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Abstract

In Senegal, within the context of safeguarding threatened wildlife species, the Special Wildlife Reserve of Gueumbeul was chosen to host the first populations of *Gazella dorcas* and *Oryx dammah* in the 1980s and 1990s. However, their survival depends on close monitoring of their health status, an aspect that is poorly documented in Senegal. The objective of this study was to contribute to improving knowledge about helminth in antelopes raised in this reserve. To this end, fecal samples were collected during the dry and wet seasons and subjected to microscopic examination to detect helminth eggs and larvae. Prevalence rates of 75% and 68.6% were observed in the *Oryx dammah* and *Gazella dorcas*, respectively ($\chi^2 = 0.21$, p-value = 0.64, $p > 0.05$). A higher infestation rate of 100% was observed during the rainy season. Nematodes were more prevalent, accounting for 98% of cases, compared to trematodes and cestodes. Strongyles were also more prevalent, at 85%. The identified parasitic species were *Oesophagostomum spp*. (13.5%), *Trichurius spp*. (7%), *Strongyloides spp*. (4%), *Nematodirus spp*. (3%), *Haemoncus spp*. (2.2%), *Trichostrongylus spp* (1%), *Toxocara spp*. (2%), *Dicrocoelium spp*. (1%), and *Moniesia spp*. (1%). Polyparasitism, involving at least two nematode species, was observed in 86.8% of cases. *Oryx dammah* exhibited a higher level of egg shedding compared to *Gazella dorcas*, with mean OPG values of 3700 and 370, respectively. Despite the methodological limitations encountered, high infestation rates, a diversity of parasitic species, and a higher parasitic load were observed in Oryx than in Gazelles.

Keywords

Helminths, *Oryx dammah*, *Gazella dorcas*, Gueumbeul, Senegal

1. Introduction

Arid and semi-arid zones, although relatively poor in species, are home to a range of iconic antelopes adapted to the constraints of these extreme environments [1]. These species are key components of Saharan-Sahelian biodiversity, the region to which Senegal belongs. The natural dynamics of these populations are severely compromised by habitat degradation, poaching, human activities, climatic events such as droughts, and disease. The majority of infectious diseases, which affect public health, livestock, and food security, originate from wildlife [2] [3]. Diseases such as parasitic infestations can be transmitted directly or indirectly through contaminated water, soil, meat, or excrement, affecting other wild and domestic animals, or humans [4]. Africa is the continent that has lost the greatest number of higher vertebrate species, particularly birds and large mammals, compared to other Palearctic regions [1]. At the end of the 1980s, *Gazella dorcas* was still found in all the countries of the Sahel-Saharan strip, with the exception of Senegal. However, its numbers had been substantially reduced, and it was then considered threatened or endangered throughout the region. *Oryx dammah* formerly residing in the semi-desert areas of Africa, is now a species whose survival depends on captive populations. The last wild populations disappeared in the 1970s and 1980s. Faced with this situation, Senegal has undertaken reintroduction and conservation programs aimed at safeguarding these threatened or endangered species. In the context of reintroducing these species, the Special Wildlife Reserve of Gueumbeul was chosen to host the first antelope's populations. The internationally recognized Gueumbeul Reserve serves primarily as an acclimatization and breeding center for Sahelian-Saharan wildlife reintroduced to Senegal. It is a cornerstone of national initiatives to restore species extinct in the north of the country. The first reintroductions involved the *Gazella dama mhorr* in 1984, followed by the *Oryx dammah* in 1999 and the *Gazella dorcas* in 2007. However, the long-term survival of these wild ungulates depends on monitoring their health status, an aspect that is very poorly documented in Senegal. Elsewhere, many studies have emphasized the importance of regularly monitoring parasites and parasitic diseases in wild ungulates [2] [4]-[10]. It is in this context that this study was conducted in order to contribute to improving knowledge about helminth infections of antelopes raised in the Special Wildlife Reserve of Gueumbeul. The aim was to identify the helminth species isolated from fecal matter, to determine the infestation rates and to assess the severity of the infestation.

2. Materials and Methods

2.1. Study Area

The study was conducted in the Special Wildlife Reserve of Gueumbeul, a 720-hectare fenced reserve. Established in 1983, it is located on the road to Gandiol, approximately 15 kilometers south of Saint-Louis, Senegal (**Figure 1**). The reserve serves as an experimental enclosure for several endangered species. A 340-hectare flood basin separates the two forest strips of the reserve (approximately 380 hectares). The reserve is home to African spurred tortoises, *Gazella dama mhorr, Gazella dorcas, Oryx dammah*, warthogs, pale foxes, wild dog, and patas monkeys. The *Gazella dorcas* are kept in enclosures of approximately 100 square meters, while *Oryx dammah* are kept in semi-captivity within the reserve.

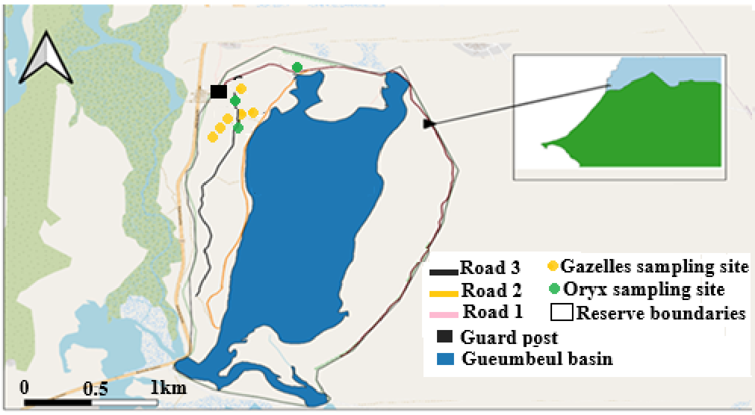

Figure 1. Study area.

2.2. Sampling and Collection

The study was conducted between June and September 2025 on *Oryx dammah* (**Figure 2(a)**) and *Gazella dorcas* (**Figure 2(b)**). Fecal samples were collected during both the dry and wet seasons from these two antelope species. The freshest feces were collected from the ground to form the samples. A group of 20 *Gazella dorcas*, raised in captivity in 7 enclosures, was sampled. At one-week intervals, samples were taken from randomly selected fresh piles of feces in each enclosure. A total of 70 samples were obtained, 56 collected during the dry season and 14 during the rainy season. For the *Oryx dammah*, raised in semi-captivity, the sample was taken from 71 individuals. Fecal samples were collected from three aggregation sites. At each site, three samples were taken from different randomly selected piles of feces. A total of 36 samples were collected, 24 during the dry season and 12 during the rainy season. It was assumed that the number of samples taken randomly was representative of all the antelope herds. The samples, kept refrigerated, were transported to the Veterinary Clinic Laboratory of the Higher Institute of Agricultural and Rural Training at Alioune Diop University of Bambey for coprological analysis.

Figure 2. (a) *Oryx dammah* and (b) *Gazella dorcas* of the RSFG.

2.3. Stool Examination

A total of 106 fecal samples from *Gazella dorcas* (**Figure 3(a)**) and *Oryx dammah* (**Figure 3(b)**) were examined microscopically to detect the various eggs and larvae of gastrointestinal parasites. The flotation enrichment method was used to detect parasite eggs.

Indeed, approximately 5 g of fecal samples were placed in an analysis container containing 70 ml of a saturated saline solution. The mixture was then homogenized and filtered through a sieve into a second container. Tubes were filled to the brim with this mixture and then covered with coverslips, ensuring no air bubbles were trapped. After incubation for approximately 30 minutes, the coverslips were removed with forceps and placed on a slide. The slides were then examined under a light microscope. Parasite detection was done by visual inspection and is based on reference books of [11]-[13]. To assess the degree of infestation, the number of eggs per gram (EPG) was determined by egg counting technique McMaster, in fecal samples that were detected to be infected [14] [15].

Figure 3. (a) Faeces of *Gazella dorcas* and (b) *Oryx dammah*.

2.4. Statistical Analysis

The data were processed using R Studio software version 1.4.1103. The statistical analysis consisted of using chi-square tests to study the relationship between the different infestation rates of antelopes. The tests were based on the null hypothesis, namely the absence of a significant difference between the infestation rate and the variables. Thus, the lower the p-value, the more the observed relationship was incompatible with the null hypothesis, and consequently, the more significant the test was considered. A 5% probability of rejecting this hypothesis when it was true was used in this study.

3. Results

3.1. Infestation Rate

Of the 106 samples submitted for coprological examination, 75 were positive for at least one parasite species, representing a prevalence of 70.7%. Among the positive samples, 67 contained at least two parasite species. Regarding Oryx, of the 36 samples obtained, 27 were positive, representing a prevalence of 75%. For the Gazelles, of the 70 samples analyzed, 48 were positive, representing a prevalence of 68.6%. Although the infestation rate was higher in the Gazelles, statistical analysis did not reveal a significant difference ($\chi^2 = 0.21$, p-value = 0.64, $p > 0.05$). All samples collected during the rainy season contained at least one parasite species, representing a rate of 100%. Of the 80 samples taken during the dry season, 49 were positive, representing an infestation rate of 61.2%.

3.2. Identified Parasitic Species

Of the 75 positive samples, nematodes were the most prevalent, accounting for 98% of cases, compared to trematodes and cestodes. Among the nematodes, strongyles were the most common, occurring in 85% of cases. The parasitic species identified within the nematode group were: *Oesophagostomum spp.* (11.5%), *Trichurius spp.* (7%), *Strongyloides spp.* (4%), *Nematodirus spp.* (3%), *Haemoncus spp.* (2.2%), *Trichostrongylus spp.* (1%), and *Toxocara spp.* (4%). *Dicrocoelium spp.* (1%) was the only trematode species observed, and *Moniesia spp.* (1%) was the only cestode species (**Figure 4**). Significant polyparasitism, involving at least two nematode species, was observed in 86.8% of cases.

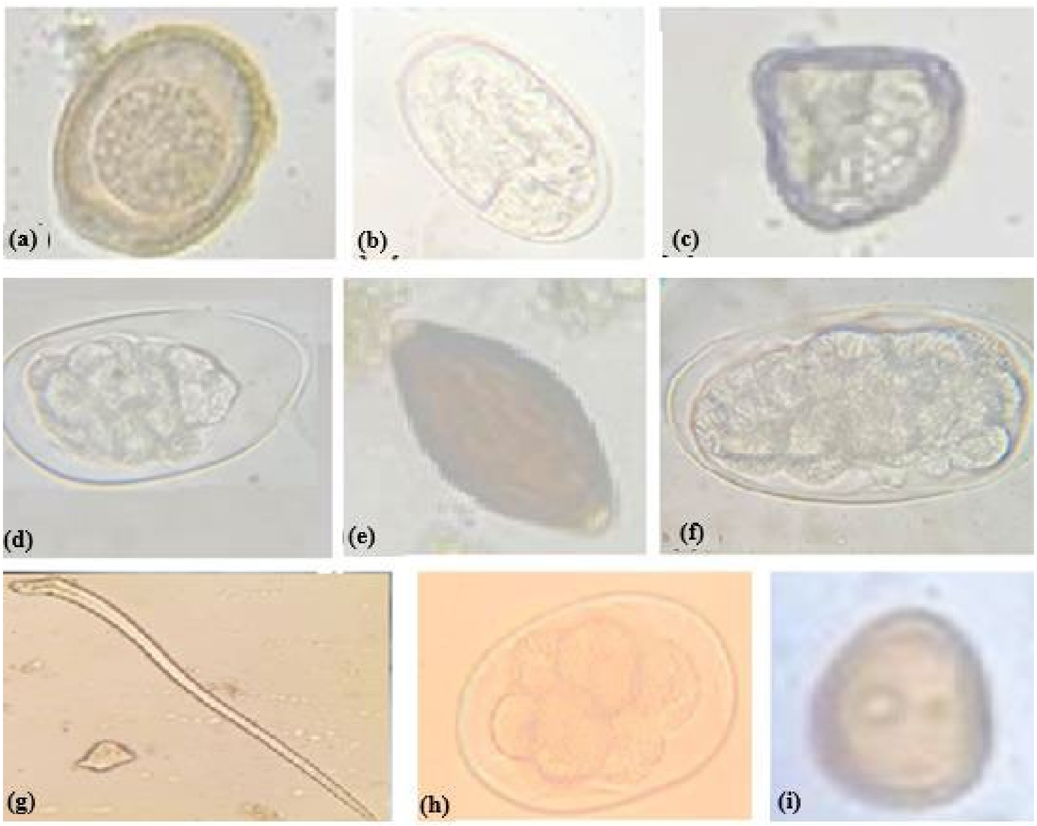

Figure 4. Helminth eggs obtained from faecal samples in *Oryx dammah* and *Gazella dorcas*: (a) *Toxocara spp.*, (b) *Strongyloides spp.*, (c) *Moniezia spp.*, (d) *Nematodirus spp.* (e) *Trichuris spp.*, (f) *Trichostrongylus spp.*, (g) *Oesophagostomum spp.*, (h) *Haemoncus spp.*, (i) *Dicrocoelium spp.*

3.3. Severity of Infestation

The severity of the infestation was assessed on the positive samples. Examination of fecal matter revealed that *Oryx dammah* have a higher level of egg excretion, with a mean OPG value of 3700, greater than 600, whereas in *Gazella dorcas*, the mean OPG value is 370, less than 600.

4. Discussion

The aim of this study was to identify parasitic species and determine infestation rates and levels of infestation by gastrointestinal parasites in captive and semi-captive *Gazella dorcas* and *Oryx dammah* in the Wildlife Reserve of Gueumbeul. Fecal samples, stored at +4˚C, were examined microscopically within 24 to 48 hours to detect eggs and larval forms of helminths.

Enrichment of the feces in a dense sodium chloride solution allowed for the identification and counting of helminth eggs. Identification was based on egg morphology, and the level of infestation was assessed by determining the number of eggs per gram of feces. The results showed that 75% and 68.6% of the samples examined, from *Oryx dammah* and *Gazella dorcas* respectively, harbored one or more helminths. *Oryx dammah* raised in semi-captivity had a higher infestation rate than captive-bred *Gazella dorcas*. Several authors have reported that animals living in the wild often exhibit greater parasite diversity and load than those kept in captivity. Increased exposure to intermediate hosts and more favorable environmental conditions would contribute to parasite development and increase the likelihood of infestation of definitive hosts [16]. However, [17] and [18] reported low infestation rates and a high diversity of helminths in mountain gazelles (*Gazella gazella*) of Hatay in Türkiye. The study revealed infestation of both *Oryx dammah* and *Gazella dorcas* by nematodes, trematodes, and cestodes. Among the nematodes, strongyles were the most common. Regarding cestodes, only *Moniezia spp*. was observed in the samples, and *Dicrocoelium spp*. among the trematodes. The diversity of parasitic species observed is comparable to that reported in studies of captive-bred Gazelles populations [19]. The results reveal that nematodes are predominant compared to cestodes and trematodes. Studies have reported similar results, suggesting a higher frequency of nematodes [11]. The high frequency of nematodes is thought to be due to the fact that many of these parasites have direct life cycles and are easily transmitted through the ingestion of larvae present in grass and soil. Furthermore, studies on semi-captive populations of *Gazella subgutturosa* have reported infestation by helminths such as *Dicrocoelium dendriticum*, *Marshallagia marshalli, Skrjabinema ovis,* and *Trichuris spp*. [7] [20]. In addition, strongyle infestations in captive populations of *Gazella leptoceros* in Belgium have been reported by [21]. Besides Strongyles, infestations by helminths such as *Nematodirus spathiger*, *Tricostrongylus vitrinus*, and *Ostertagia ostertagia* have been reported by [21] [22]. The infestation rate was significantly higher during the rainy season, in August and September. The finding did not agreement with the report of [23] [24], who reported that seasonal variation in parasitic infection among the zoo animals in the garden. This result can be explained by the evolution of the climatic conditions in the study area during the two seasons. Indeed, the temperature and humidity are favorable to the development of free-living parasite stages. During this period, *Oryx dammah* are more exposed to ingesting these parasite forms in the pastures. The semi-captive grazing of *Oryx dammah* would explain their higher parasite load compared to *Gazella dorcas* raised in captivity in enclosures. However, it should be noted that their habitats are not regularly cleaned, which could promote the development of helminth eggs and their subsequent infectiveness. Furthermore, although their infestation rate is high (68.6%), their average OPG is less than 600, indicating a less severe level of infestation compared to the *Oryx dammah*. Furthermore, [18] reported a low number of parasite eggs on fecal samples from *Gazella gazella* from Hatay, Türkiye. Indeed, *Gazella dorcas* are regularly dewormed upon capture and transfer to enclosures, treatments which are effective in maintaining the average OPG below 600. The anthelmintics commonly administered to the gazelles appear to have blocked the development cycle of the Strongyles. Consequently, few adult, mature Strongyles are present in their digestive tracts, with a low number of eggs laid and excreted. In contrast, the *Oryx dammah* are raised in semi-captivity and therefore do not benefit from deworming treatments like the gazelles. Moreover, the Oryx have more contact with other wild animals in the reserve. They share the same grazing lands and watering holes with wild herbivores during the rainy season. This coexistence may have increased the transmission frequency of certain parasites. In contrast, the Gazelles are more isolated from these wild animals and are fed peanut hay harvested from their enclosures, which could explain their lower OPG compared to the Oryx. The latter are more susceptible to developing clinical signs related to a high parasite load, such as diarrhea, anemia, submandibular edema, and weight loss.

Factors such as shared water sources and grazing lands can promote the parasite life cycle and increase the likelihood of parasite transmission. Many parasites isolated from wild animals can cross the species barrier to infect humans and domestic animals [25]. In our study, Toxocara eggs would originate from wild carnivores in the reserve and could be a risk to staff. An intermediate host is not required for this infection, direct transmission can occur through fecal contamination [26]. However, it should be noted that our sampling method had limitations. Indeed, the samples were not individual in the Gazelles and in the Oryx. Furthermore, in the Gazelles, the population size was small compared to the number of fecal samples obtained by ground collection.

5. Conclusion

Parasitic infestations have a direct impact on the welfare of wild animals. Performing coprological examinations of feces from the *Oryx Dammah* and *Gazella dorcas* to detect and identify gastrointestinal parasite species is crucial for the conservation of these species. This study contributes to improving knowledge about these helminths in endangered gazelles raised in captivity and semi-captivity in the Special Wildlife Reserve of Gueumbeul. It is the first study on helminths in these wild animals in Senegal. Despite methodological limitations, high infestation rates, a diversity of parasite species, and a high parasite load were observed in these wild animals, particularly in the Oryx compared to the Gazelles. However, individual sampling would have allowed for an even broader parasitic spectrum and a better assessment of parasite dynamics. This study represents a first step towards identifying zoonotic helminths in Oryx and Gazelles. Studies focusing on different wild species, individually sampled, would improve the accuracy of the results obtained. In this regard, this study highlights methodological aspects that need improvement in future research on the reserve's wild animals. We suggest that deworming treatments be carried out during the dry season when the Oryx receive supplemental feed. After estimating the total weight of the subjects, the appropriate dose of anthelmintic could be mixed with the concentrated feed served. For gazelles, treatment could be administered during capture and transfer periods.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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