ORIGINAL ARTICLE

Isolation and Identification of some Species of Endoparasite Causing Infection in Captive Common Pheasants (*Phasianus colchicus.* Linné, 1758*)* in Algeria

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ABSTRACT

Background: *Parasitic infections can severely impact the health, productivity, and welfare of captive birds, yet information on their seasonal dynamics in pheasants remains scarce. This study is the first investigation of intestinal parasitism in captive common pheasants (Phasianus colchicus, Linnaeus, 1758) in Algeria, reporting the detection of Hymenolepis spp. and canid-associated parasites, including Ancylostoma spp. and Toxocara spp.* ***Objectives:*** *To assess the prevalence, abundance, and risk factors of endoparasitic infestations in captive pheasants at the Cynegetic Center of Zeralda (CCZ), Algeria.* ***Methodology:*** *Between December 2020 and June 2021, 490 composite fecal samples were collected and analyzed using flotation techniques.* ***Results:*** *A high parasite burden with significant seasonal fluctuations was observed. Parasite richness increased from five species in winter to nine in spring ($P < 0.0001$). Nematodes were the most prevalent group, followed by protozoa and cestodes. Syngamus spp. showed the highest abundance, rising from 35.29% in winter to 49.57% in spring ($P < 0.0001$). Capillaria, Ascaridia, and Heterakis spp. dominated in winter, whereas Trichuris, Eimeria, Ancylostoma, Toxocara, and Hymenolepis spp. were mainly detected in spring at lower levels. Several parasites, particularly Ancylostoma, Toxocara, and Eimeria spp., have zoonotic potential, posing risks to workers, domestic animals, and wildlife interacting with the facility.* ***Conclusion:*** *The cohabitation of multiple avian species may facilitate cross-transmission. These findings highlight the need for routine surveillance, targeted deworming, and strict biosecurity to protect staff, safeguard other captive and wild animals, and minimize zoonotic transmission.*

INTRODUCTION

The common pheasant (*Phasianus colchicus*, Linnaeus, 1758) is the most widespread game bird worldwide [1,2] Native to Asia, it was introduced to Europe by the Romans and later to North Africa, with Algeria's introduction dating back to the early 1970s. Today, it occupies a broad geographical range.[3-6] Known for its striking plumage, it is valued for both nutritional and recreational purposes.[7,8] However, overhunting and poaching have caused population declines, raising concerns for its conservation.

To address this, the Cynegetic Center of Zeralda (CCZ) launched a national program in 2020 to select populations suited to captivity. While efforts have focused on acclimatization and reproduction, managing captive pheasants remains challenging. Stress associated with captivity compromises immunity, predisposing birds to gastrointestinal parasites that impair growth, reproduction, and survival.[9-11] Risk factors such as overcrowding, hygiene, diet, and climatic conditions further favor parasitic development.[4,12] The most pathogenic parasites commonly reported in captive pheasants include Syngamus trachea, Capillaria spp., Heterakis isolonche, Ascaridia spp., and Eimeria spp.[14]

Although a few studies have examined gastrointestinal parasites in Algerian game birds[12,15] none have focused specifically on the common pheasant. In this context, the present study aims to investigate the prevalence and abundance of gastrointestinal parasites in captive pheasants at the CCZ, assess the risk factors contributing to infection, and highlight implications for **improving welfare and conserving this rare species in Algeria**.

METHODOLOGY

Study area

The study was conducted from December 2020 to June 2021, covering two seasons (winter and spring), at the Cynegetic Center of Zeralda (CCZ), located south of the Zeralda forest (36°43′05″N, 2°51′01″E), approximately 30 km west of Algiers. The CCZ is a public scientific and technological institution covering 19.75 hectares, dedicated to the production and conservation of exotic species such as the common pheasant (*Phasianus colchicus*). The region has a semi-arid climate with mild, humid winters and hot, dry summers.

Fecal sampling

A total of 280 adult pheasants, housed in 70 cages (three females and one male per cage), were included. Fresh droppings were collected monthly from each cage in the early morning. Composite samples from four birds per cage were placed in sterile, labeled plastic vials and transported to the Parasitology Laboratory of the Higher National Veterinary School of Algiers (ENSV). Samples were stored at 4 °C until analysis. In total, 490 fecal samples were examined.

Laboratory analysis

Each sample was first examined macroscopically for odor, color, consistency, and the presence of blood, mucus, or tapeworm proglottids. Coprological examination was performed using the flotation technique[16] with sodium chloride solution (density 1.20). Slides were observed under a light microscope at ×100 and ×400 magnification to identify eggs, oocysts, and larvae. Parasite identification was based on morphological keys.[17]

Ethical considerations:

All procedures complied with institutional and international guidelines for animal welfare (EU Directive 2010/63/EU and ARRIVE recommendations). As this study was based solely on fecal sampling without direct animal manipulation, no ethical approval was required.

Data and statistical analysis

Parasitological data were analyzed seasonally according to total richness (TR), relative abundance (RA %), and prevalence (P %). TR was defined as the number of parasite species detected per season. RA was calculated as RA% = (ni × 100) / Ni, where *ni* is the number of individuals of a given species and *Ni* the total number of individuals recorded. Prevalence was determined as P% = (n / N) × 100, where *n* is the number of positive samples and *N* the total analyzed. Parasite species were classified as dominant (>50%), satellite (15–50%), or rare (<15%) following.[18]

Statistical analyses were conducted using Quantitative Parasitology Software Version 3.0.[19] Seasonal variations were tested using chi-square (χ^2) tests, and when significant, Student's *t*-tests were applied. A *P* value < 0.05 was considered statistically significant.

RESULTS

The study characterized the richness and distribution of gastrointestinal parasites in captive common pheasants. The analyses revealed significant seasonal variations, both in the diversity of the identified species and in their relative abundance and prevalence, highlighting the impact of environmental factors on parasitic infestations.

Parasite Richness:

Parasite richness differed significantly between seasons (P< 0.0001). Nine species were identified overall, with higher diversity in spring (nine species) compared to winter (five species) (Figure 1).

Relative Abundance

The relative abundance of gastrointestinal parasites showed marked seasonal variations (P < 0.0001) (Table 1). *Syngamus sp.* was the most abundant parasite in both seasons, with a higher proportion in spring. *Capillaria sp.* and *Ascaridia sp.* were also frequent, while other species such as *Trichuris sp.*, *Eimeria sp.*, and *Heterakis sp.* were less abundant. *Ancylostoma sp.*, *Toxocara sp.*, and *Hymenolepis sp.* were detected only in spring, at very low levels.

Prevalence

Parasite prevalence differed significantly between seasons (P < 0.0001) (Table 2). Overall, nematodes were the most frequent, with *Trichuris sp.* and *Capillaria sp.* showing the highest prevalence in spring. In winter, parasite occurrence was generally low, with only a few cases of *Capillaria sp.* and *Ascaridia sp.*. Other species, including *Ancylostoma sp.*, *Toxocara sp.*, *Hymenolepis sp.*, and *Heterakis sp.*, were detected at low levels.

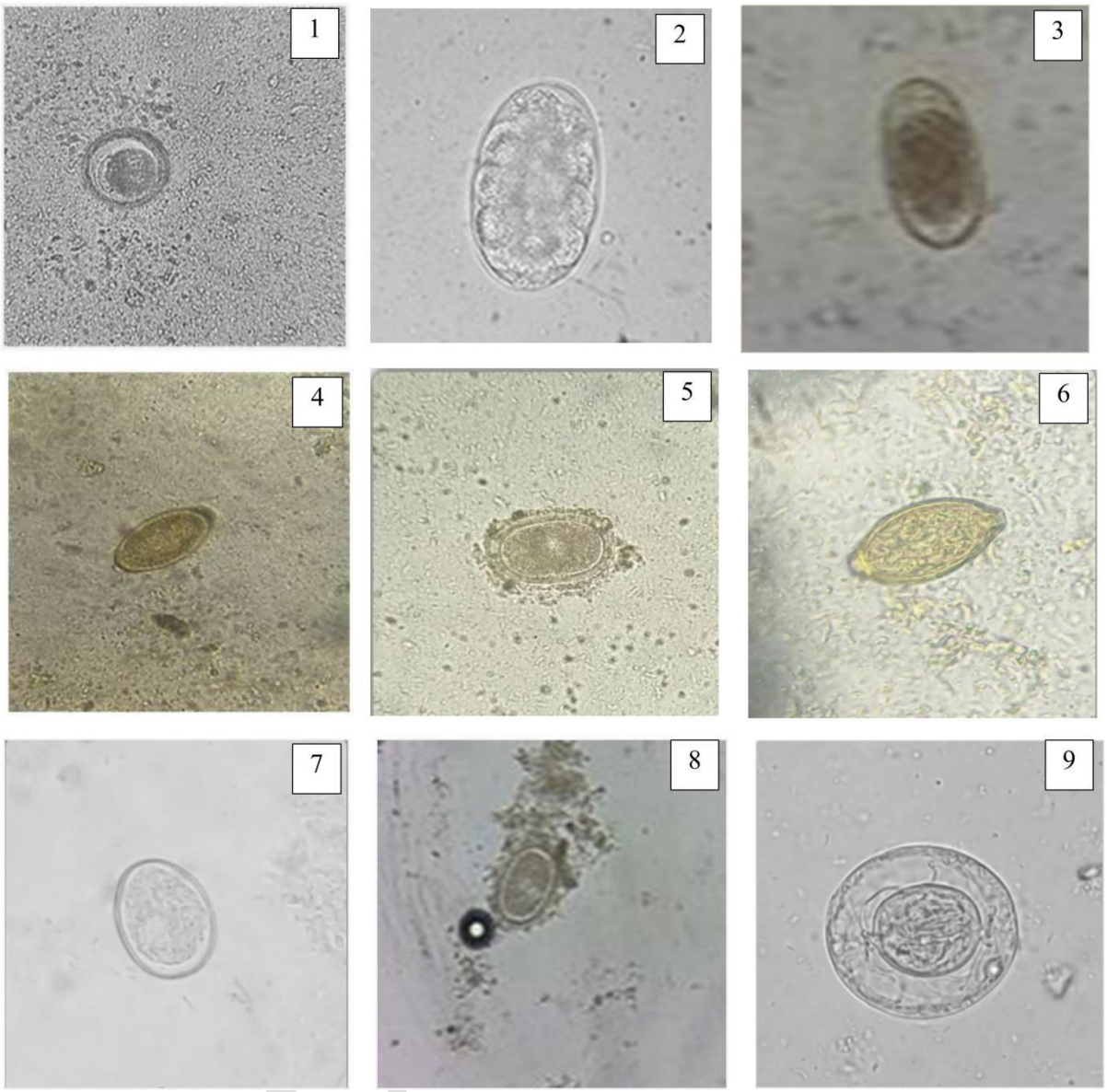

Fig. 1: Parasites identified in droppings of common pheasants from CCZ, observed at 400× magnification (Laboratory of Parasitology, ENSV-Algiers, 2021).

(1) Toxocara sp., (2) Ancylostoma sp., (3) Syngamus sp., (4) Trichuris sp., (5) Ascaridia sp., (6) Capillaria sp., (7) Eimeria sp., (8) Heterakis sp., (9) Hymenolepis sp.

Table 1: Relative abundances (RA %) of parasite species of common pheasant by season

Parasite species	Winter (ni)	Winter (RA %)	Spring (ni)	Spring (RA %)	P-value
Ancylostoma sp.	0	0	2	1.71	P=0.03
Syngamus sp.	6	35.29	58	49.57	P<0.0001
Toxocara sp.	0	0	3	2.56	P=0.001
Capillaria sp.	5	29.41	13	11.11	P<0.0001
Heterakis sp.	2	11.76	2	1.71	P<0.0001
Ascaridia sp.	3	17.65	15	12.82	P<0.0001
Eimeria sp.	0	0	8	6.84	P<0.0001
Trichuris sp.	1	5.88	15	12.82	P<0.0001
Hymenolepis sp.	0	0	1	0.85	P=0.2

ni: Infected number; RA: Relative abundance in percent (%); P-value indicates significance between Winter and Spring

Table 2: Prevalence of parasites identified in common pheasants by season.

Parasite species	Winter IH	Winter P (%)	Winter Category	Spring IH	Spring P (%)	Spring Category	P-value
Ancylostoma sp.	0	0	/	2	2.86	Rare	P<0.0001
Syngamus sp.	1	1.43	Rare	10	14.29	Rare	P<0.0001
Toxocara sp.	0	0	/	3	4.29	Rare	P<0.0001
Capillaria sp.	4	5.57	Rare	13	18.57	Satellite	P<0.0001
Heterakis sp.	1	1.43	Rare	1	1.43	Rare	P=0.1
Ascaridia sp.	3	4.29	Rare	10	14.29	Rare	P<0.0001
Eimeria sp.	0	0	/	8	11.43	Rare	P<0.0001
Trichuris sp.	1	1.43	Rare	14	20.00	Satellite	P<0.0001
Hymenolepis sp.	3	0	/	1	1.43	Rare	P=0.02

IH: Infested host; P: Prevalence in percent (%)

DISCUSSION

Our study confirms the susceptibility of captive common pheasants to gastrointestinal parasitism, with nematodes representing the dominant group. Seasonal variation was evident, with higher diversity, prevalence, and abundance recorded in spring, reflecting the influence of climatic factors on parasite transmission.

The nine species identified, compared with the five observed in winter, indicate a relatively high level of parasitic diversity at CCZ. This richness is greater than that reported in other Algerian studies[15,12] and comparable to findings in France[20] and Pakistan.[21] Such diversity highlights the role of environmental conditions, particularly humidity and temperature, in sustaining parasite cycles.[22, 23]

Several of the parasites detected are well-known pathogens in galliform birds.[5,11,24,25,26,27,28] **Syngamus trachea**, responsible for syngamosis, is highly pathogenic in young pheasants and was among the most abundant species in our study.[29] Its prevalence was particularly high in spring, when humidity and intermediate hosts (earthworms, mollusks) favor transmission. ***Capillaria* spp.**, also common in pheasants, cause intestinal lesions that compromise growth and performance, with higher prevalence in spring as previously reported.[30-33] In addition, ***Ascaridia* spp.** And ***Heterakis* spp.** were detected. These nematodes are widespread in game birds[34], with Ascaridia contributing to reduced feed conversion and Heterakis acting as a vector for *Histomonas meleagridis*, a protozoan causing blackhead disease.

Hymenolepis spp. was detected exclusively during the spring season, with a low infestation rate of 1.43%, which aligns with previous reports indicating that species such as *H.* cantaniana and *H.* carioca are generally not highly pathogenic in game birds.[19] These cestodes are typically acquired through ingestion of intermediate hosts such as insects, and although their prevalence is low, infections could potentially affect nutrient absorption and growth under intensive rearing conditions. *Environmental and zoonotic parasites*

Interestingly, we detected **Ancylostoma spp.** and **Toxocara spp.**, which are specific to canids and not normally found in pheasants. Their presence likely results from contamination by stray dogs around CCZ. Eggs of these nematodes are highly resistant, persisting in the soil and surviving adverse climatic conditions; rainfall and runoff may facilitate their dissemination inside enclosures. These findings indicate an environmental source of infection that may affect not only pheasants but also other animal species in the center. Furthermore, both parasites are of major zoonotic concern, causing diseases with significant public health implications.[35]

The observed variations in both prevalence and abundance of parasites can be explained by a combination of climatic conditions and management practices. The semi-arid climate of the study region, with humid springs, favors parasite development and transmission. The high prevalence of *Syngamus trachea* and *Capillaria spp.* in spring reflects enhanced survival of eggs and increased exposure of birds to intermediate or paratenic hosts. Similarly, cestode transmission is favored by insect abundance in this season. Poor hygiene of cages, feeders, and waterers likely contributed to fecal-oral transmission and persistence of parasites, consistent with earlier findings in game bird facilities.[13,14] By contrast, the lower prevalence of *Eimeria spp.* is probably linked to acquired immunity in adult pheasants, which reduces clinical manifestations despite the presence of oocysts.

Implications and perspectives

Our results demonstrate the coexistence of host-specific parasites with opportunistic species of environmental origin. While *Syngamus trachea*, *Capillaria spp.*, *Ascaridia spp.*, *Heterakis spp.*, and *Hymenolepis spp.* represent a direct health and welfare threat to pheasants, *Ancylostoma* and *Toxocara spp.* underline the risks of cross-contamination between wildlife, domestic carnivores, and game birds. This dual parasitic pressure necessitates improved management

practices, stricter hygiene, and control of stray animals around the facility. Future studies using molecular tools could refine parasite identification and provide better insight into transmission dynamics and zoonotic risks.

CONCLUSION

This study is the first investigation of intestinal parasitism in captive common pheasants (*Phasianus colchicus,* Linnaeus, 1758) in Algeria. Nematodes were the dominant parasites, but cestodes and protozoa were also identified. The detection of *Hymenolepis* spp. and canid-associated parasites (*Ancylostoma* spp. And *Toxocara* spp.) underlines the importance of improved parasite monitoring and management to protect both pheasant health and public health.

Declarations

Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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