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GASTROINTESTINAL PARASITES OF DUCK (*Cairina moschata*) REARED AT THE EXPERIMENTAL FARM OF THE CENTER FOR RESEARCH IN ECOLOGY, ABIDJAN, CÔTE D'IVOIRE

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ABSTRACT

Gastrointestinal nematodes are important parasitic infections that may affect poultry health and production. A coproscopic study was conducted on 80 adult ducks (40 males and 40 females) raised under a semi-intensive system at the experimental farm of the Center for Research in Ecology (CRE) in Treichville, Abidjan, Côte d'Ivoire. Individual faecal samples were examined using sedimentation, flotation, and egg-counting techniques (McMaster method). Three nematode egg morphotypes were detected, corresponding to *Ascaridia* sp., *Trichuris* sp., and eggs morphologically compatible with *Trichostrongylus*, with an overall prevalence of 13.75% (11/80 birds). Prevalence was numerically higher in males (17.5%) than in females (10.0%), but this difference was not statistically significant (Fisher's exact test, p = 0.518). *Trichostrongylus*-compatible eggs were detected exclusively in males (17.5% vs 0%), and this sex-related distribution was statistically significant (p = 0.0117). Among positive ducks, egg excretion intensity followed the opposite pattern: females excreted significantly more eggs than males for both *Ascaridia* sp. (median 619 vs 368 EPG; Mann–Whitney exact test, p = 0.0238) and *Trichuris* sp. (median 586.5 vs 334 EPG; p = 0.00606), whereas total egg excretion per duck did not differ significantly between sexes (median 1,155.5 vs 1,020 EPG; U = 9.0, p = 0.412). Prevalence and excretion intensity can therefore vary independently, and at times in opposite directions, between sexes. These data provide a baseline for gastrointestinal nematodes in ducks raised under semi-intensive conditions in Côte d'Ivoire and point to the value of regular coproscopic monitoring, with prevalence and intensity reported separately, for parasite surveillance.

Keywords: *Cairina moschata*; Côte d'Ivoire; Gastrointestinal Nematodes; Prevalence; Intensity; Parasitology

1 INTRODUCTION

In our local poultry farms, environment, management conditions and hygiene can influence both the presence of helminths and faecal egg shedding [2]. This exposure increases the prevalence of these parasites, which can impair the health status and productivity of the host [3, 4, 5], and prevalence itself is known to vary considerably according to the poultry production system [6]. Duck farming is no exception to this pattern, yet this activity contributes to the supply

of animal protein and to household income [7, 8]. Most parasitological research on poultry in sub-Saharan Africa has focused on domestic chickens, while ducks have received comparatively less attention. Previous studies have documented gastrointestinal helminths in domestic ducks and ducks in Africa and elsewhere [9], but data on *C. moschata* in Côte d'Ivoire remain limited. In this context, the present study investigated gastrointestinal nematode egg detection in *C. moschata* reared at the experimental farm of the Centre de Recherche en Écologie (CRE), Abidjan, Côte d'Ivoire. Specifically, the study aimed to identify the nematode genera or egg morphotypes detected in faecal samples, determine prevalence according to sex, and compare faecal egg shedding, expressed as eggs per gram of faeces (EPG), between males and females.

2 MATERIAL AND METHODS

2.1 Study Site and Animals

The survey was carried out at the CRE experimental farm in the municipality of Treichville, within the Autonomous District of Abidjan, Côte d'Ivoire (5°18′12″ N, 4°00′33″ W). Treichville lies on the southern part of Petit Bassam island, fringed by the Ébrié lagoon, with Marcory to its east, Le Plateau and Port-Bouët to its north and south, and Yopougon to its west [9, Figure 1]. The farm keeps a permanent flock of *C. moschata* under semi-intensive management, with birds given access to covered outdoor runs and a controlled feeding regime. In July 2023, eighty clinically healthy adult ducks (40 males and 40 females), all drawn from this single flock, were enrolled in the study. None had received anthelmintic treatment during the 90 days preceding sampling.

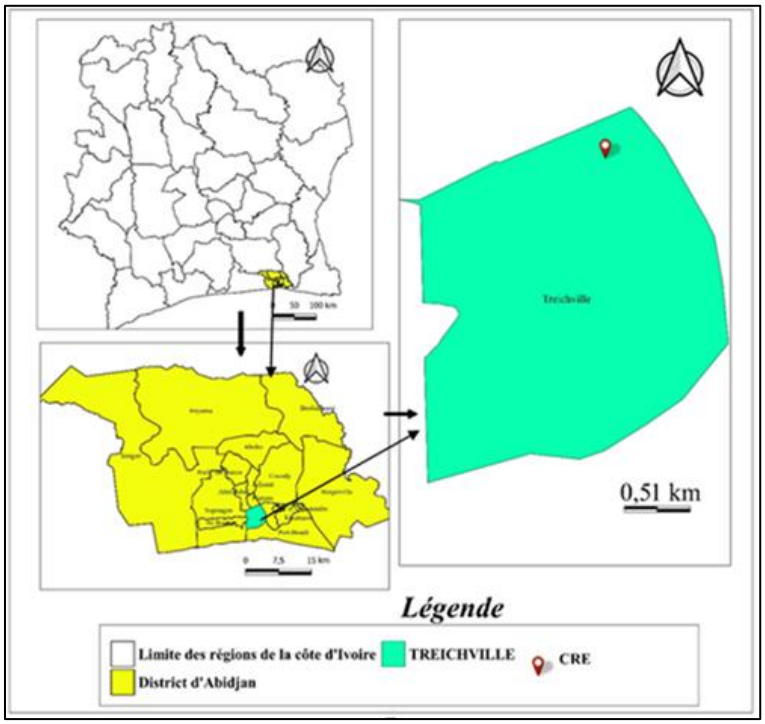

Figure 1: Location of the study area: Côte d'Ivoire, Autonomous District of Abidjan, and the municipality of Treichville, showing the site of the CRE experimental farm (adapted from [9]).

2.2 Faecal Sample Collection

Birds were separated by sex and held individually in labelled cardboard boxes for 10–30 minutes to allow spontaneous defecation. Each freshly voided sample was linked to its donor bird by means of a numbered string attached to the leg, placed into an individually labelled sterile tube, and kept at 4 °C in an insulated cool box during transport to the Laboratory of Animal Biology and Cytology at Nangui Abrogoua University, where all samples were processed within 24 hours of collection.

2.3 Coproscopic Examination

Three complementary methods, following the protocol of [10], were applied to a 3 g faecal aliquot from each bird. **Sedimentation.** Faeces were homogenised in 15 ml of distilled water, sieved, and the filtrate centrifuged twice (3,000 rpm, 5 min) [11]. The resulting pellet was stained with methylene blue and examined at ×100 magnification. **Flotation.** Faeces were diluted in 45 ml of distilled water, mixed, and left to settle for 20–30 minutes [12], after which the surface

deposit was examined in a Petri dish under a binocular microscope for low-density eggs. **McMaster egg counting.** A 3 g aliquot was diluted in 45 ml of distilled water, filtered and centrifuged (3,000 rpm, 5 min) [13]; the pellet was resuspended in saturated NaCl solution (density 1.30), loaded into McMaster counting chambers, and read at ×100 magnification after a 5-minute settling period [14]. Egg output was expressed in eggs per gram (EPG) of faeces, calculated as EPG = (N1 + N2) × 50, where N1 and N2 are the counts obtained from each chamber.

2.4 Parasite Identification

Nematode eggs were assigned to genus or morphotype level using standard morphological references [15, 16, 13, 14, 17]. Identification was based on observable egg morphology, including overall shape, shell appearance, internal contents, and developmental stage. The *Trichuris*-type egg showed the characteristic bipolar plugs, whereas the *Ascaridia*-type egg was recognised by its oval morphology and visible shell. The eggs morphologically compatible with *Trichostrongylus* were elongated, relatively clear and thin-shelled, with a poorly contrasted internal content. Because the latter morphology may overlap with other strongylid/trichostrongyle-type eggs, this finding is reported as an egg morphologically compatible with *Trichostrongylus* rather than as a definitive species identification. The available photographs were not calibrated with a micrometric scale; consequently, numerical egg dimensions were not derived from the photographs and the images are used here to document morphology only.

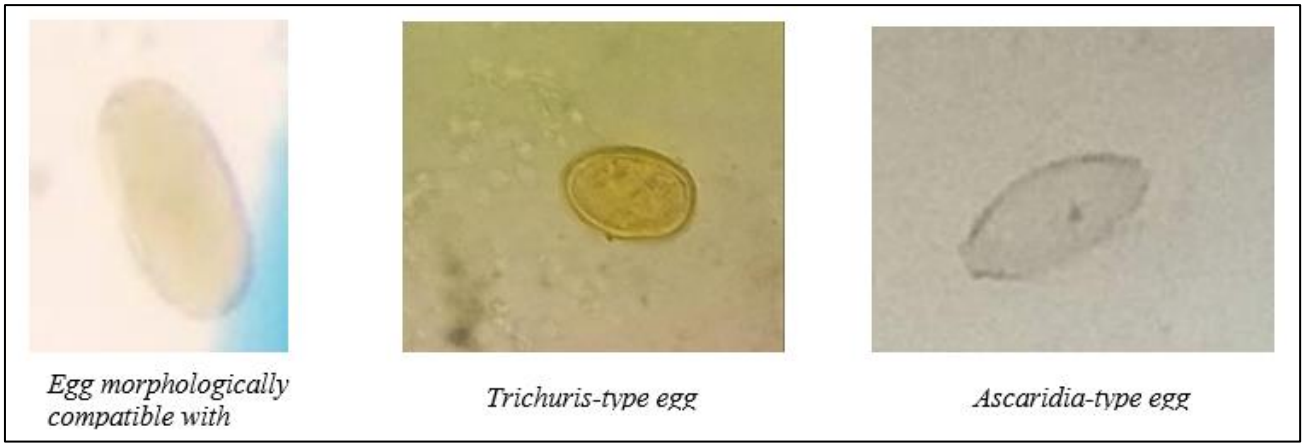

Figure 2: Representative nematode eggs observed in duck faecal samples.

2.5 Derived Parameters

For each sex, genus-specific prevalence was defined as the percentage of examined birds positive for a given genus or compatible egg morphotype. Overall prevalence was defined as the percentage of birds positive for at least one detected nematode type. Mean EPG was calculated among positive individuals for each detected type. Relative frequency described, within the positive subgroup, the proportion of positive birds harbouring a given nematode type.

2.6 Statistical Analysis

Data were compiled in Microsoft Excel and analysed with R (version 4.3.1). Differences between sexes in prevalence and overall prevalence were tested with Fisher's exact test; odds ratios with 95% confidence intervals were also calculated for these comparisons. Because the Shapiro–Wilk test indicated a non-normal distribution of EPG values ($p < 0.05$), the exact Mann–Whitney U test was used to compare egg burdens between sexes among positive individuals. Null values (uninfected individuals) were excluded from intensity comparisons, since they reflect the absence of excretion rather than a measurable infection intensity. Exact p-values are reported throughout, and significance was set at $\alpha = 0.05$.

3 RESULTS

Table 1 presents, for the 11 ducks found positive for at least one nematode genus, the individual presence (1) or absence (0) of *Ascaridia* sp., *Trichuris* sp. and *Trichostrongylus*-compatible eggs, by sex. *Trichuris* sp. was detected in all 11 nematode-positive ducks (7/7 males and 4/4 females). *Ascaridia* sp. was present in 6 of the 7 infected males and in 3 of the 4 infected females. *Trichostrongylus*-compatible eggs were present in all 7 infected males and were absent from all infected females.

Table 1: Presence (1) or absence (0) of nematode eggs in each infected duck, by sex.

Sex	Duck no.	*Ascaridia* sp.	*Trichuris* sp.	*Trichostrongylus*-compatible eggs
Males	1	1	1	1
	2	1	1	1
	3	1	1	1
	4	1	1	1
	5	1	1	1
	6	1	1	1
	7	0	1	1
Females	1	1	1	0
	2	1	1	0
	3	1	1	0
	4	0	1	0

3.1 Prevalence of Gastrointestinal Nematodes According to Sex

Among the 80 ducks examined, 11 were positive for at least one gastrointestinal nematode genus or compatible egg morphotype, corresponding to an overall prevalence of 13.75% (11/80). Prevalence was 17.5% (7/40) in males and 10.0% (4/40) in females; this difference was not statistically significant (Fisher's exact test, p = 0.5179). *Ascaridia* sp. was detected in 6/40 males (15.0%) and 3/40 females (7.5%), giving an overall prevalence of 11.25% (9/80; Fisher's exact test, p = 0.4814; odds ratio 2.18, 95% CI: 0.50–9.39). *Trichuris* sp. was detected in 7/40 males (17.5%) and 4/40 females (10.0%), giving an overall prevalence of 13.75% (11/80; Fisher's exact test, p = 0.5179; odds ratio 1.91, 95% CI: 0.51–7.12). *Trichostrongylus*-compatible eggs were detected exclusively in males, with a prevalence of 17.5% (7/40) in males and 0% (0/40) in females, and an overall prevalence of 8.75% (7/80; Fisher's exact test, p = 0.0117). The odds ratio is formally infinite because no female was positive; therefore, a finite odds-ratio estimate should not be interpreted without a continuity correction. The exact test nevertheless indicates a statistically significant sex-associated distribution in this dataset.

Considering only the 11 nematode-positive ducks, *Trichuris* sp. was the most frequently detected nematode, occurring in 100% (11/11) of positive ducks, followed by *Ascaridia* sp. in 81.82% (9/11) and *Trichostrongylus*-compatible eggs in 63.64% (7/11). These percentages describe frequency within the positive subgroup and should not be confused with prevalence in the full sample of 80 ducks.

3.2 Egg Excretion and Nematode Intensity

Table 2 presents the individual egg counts recorded for each infected duck. For *Ascaridia* sp., the six positive males had egg counts ranging from 301 to 386 EPG, with a mean of 359.17 EPG; the three positive females had counts ranging from 525 to 731 EPG, with a mean of 625.00 EPG. Considering all nine *Ascaridia*-positive ducks, the overall mean egg count was 447.78 EPG. For *Trichuris* sp., all seven males and four females were positive. Male egg counts ranged from 231 to 547 EPG, with a mean of 357.14 EPG, whereas female counts ranged from 567 to 768 EPG, with a mean of 627.00 EPG. The overall mean among the 11 positive ducks was 455.27 EPG. *Trichostrongylus*-compatible eggs were detected only in males. The seven positive males had egg counts ranging from 304 to 399 EPG, with a mean of 355.71 EPG. No female was positive for this egg morphotype; therefore, no between-sex intensity comparison was performed. The individual total egg counts, obtained by summing the EPG values of the three detected genera for each positive duck, ranged from 847 to 1,247 EPG in males and from 768 to 1,304 EPG in females. The mean total egg count was 1,020.71 EPG in males and 1,095.75 EPG in females, while the overall mean for the 11 nematode-positive ducks was 1,048.00 EPG.

Table 2: Number of determined EPGs

Sex	No.	*Ascaridia*	EPG Asca.	*Trichuris*	EPG Trichu.	*Trichostr.*	EPG Trichostr.	Total EPG
Males	1	1	374	1	272	1	308	954
	2	1	365	1	376	1	374	1115
	3	1	386	1	334	1	336	1056
	4	1	301	1	547	1	399	1247
	5	1	358	1	289	1	373	1020
	6	1	371	1	231	1	304	906
	7	0	0	1	451	1	396	847
Total males	7	6/7	2155	7/7	2500	7/7	2490	7145
Females	1	1	731	1	573	0	0	1304
	2	1	525	1	600	0	0	1125
	3	1	619	1	567	0	0	1186
	4	0	0	1	768	0	0	768
Total females	4	3/4	1875	4/4	2508	0/4	0	4383

3.3 Comparison of Nematode Burden Between Males and Females

Table 3 classifies each infected duck according to the number of nematode genera detected simultaneously (mono-, co-, or triple-genus infection). Among the seven infected males, six (85.7%) harboured all three genera simultaneously (triple infection), while one duck was co-infected with *Trichuris* sp. and *Trichostrongylus*-compatible eggs only. Among the four infected females, three (75.0%) were co-infected with *Ascaridia* sp. and *Trichuris* sp., and one duck showed a mono-infection with *Trichuris* sp. only. Overall, triple infections accounted for 54.5% (6/11) of nematode-positive ducks, co-infections for 36.4% (4/11), and mono-infections for 9.1% (1/11), confirming that most nematode-positive ducks, particularly males, carried more than one nematode genus simultaneously.

Table 3: Type of infection (mono-, co-, or triple-genus)

Sex	Duck no.	*Ascaridia* sp.	*Trichuris* sp.	*Trichostrongylus*-compatible eggs	Infection type
Males	1	1	1	1	Triple
	2	1	1	1	Triple
	3	1	1	1	Triple
	4	1	1	1	Triple
	5	1	1	1	Triple
	6	1	1	1	Triple
	7	0	1	1	Co
Females	1	1	1	0	Co
	2	1	1	0	Co
	3	1	1	0	Co
	4	0	1	0	Mono
Total	11	9	11	7	

Comparisons restricted to positive ducks showed that total egg excretion did not differ significantly between sexes (median 1,020 vs 1,155.5 EPG; exact Mann–Whitney U test, U = 9.0, p = 0.4121). Overall prevalence, assessed in the full

sample, also did not differ significantly between sexes (17.5% vs 10.0%; Fisher's exact test, p = 0.5179). By contrast, genus-specific intensity among positive ducks differed significantly between sexes for two of the three genera. For *Ascaridia* sp., females showed significantly higher excretion than males (median 619 vs 368 EPG; U = 0, p = 0.0238). For *Trichuris* sp., females again showed significantly higher excretion than males (median 586.5 vs 334 EPG; U = 0, p = 0.00606). For *Trichostrongylus*-compatible eggs, no female was positive, which precludes a meaningful sex comparison of intensity for this genus. Overall, males had a higher prevalence of *Trichostrongylus*-compatible eggs, whereas positive females had significantly higher egg-excretion intensity for *Ascaridia* sp. and *Trichuris* sp. than positive males. Thus, prevalence and intensity followed different patterns in this dataset.

Table 4: Summary of statistical comparisons between sexes for prevalence and egg-excretion intensity.

Parameter	Males	Females	Test	Exact p
Infected ducks	7/40 (17.5%)	4/40 (10.0%)	Fisher exact	0.518
Ascaridia sp.	6/40 (15.0%)	3/40 (7.5%)	Fisher exact	0.481
Trichuris sp.	7/40 (17.5%)	4/40 (10.0%)	Fisher exact	0.518
Trichostrongylus-compatible eggs	7/40 (17.5%)	0/40 (0%)	Fisher exact	0.0117
Intensity *Ascaridia* (positive)	median 368	median 619	Mann–Whitney exact	0.0238
Intensity *Trichuris* (positive)	median 334	median 586.5	Mann–Whitney exact	0.00606
EPG total (positive)	median 1,020	median 1,155.5	Mann–Whitney exact	0.4121

4 DISCUSSION

The present study detected three nematode egg types in the examined ducks: *Ascaridia* sp., *Trichuris* sp., and eggs morphologically compatible with *Trichostrongylus*. Eleven of the 80 ducks examined were positive for at least one type, corresponding to an overall prevalence of 13.75%. Prevalence was 17.5% in males and 10.0% in females, but the difference was not statistically significant (Fisher's exact test, p = 0.5179). The relatively low prevalence observed in this flock may be compatible with the management and environmental conditions at the study farm. However, because this study did not compare farms with different management systems or quantify hygiene, stocking density, or environmental contamination, the observed prevalence cannot be attributed causally to the husbandry system [1, 5], although management-related risk factors for parasitic infection have been documented for other livestock species raised in this same district of Abidjan [18]. The three nematode genera did not show the same distribution according to sex. *Trichuris* sp. was detected in all nematode-positive ducks, representing 100% of the positive individuals, whereas *Ascaridia* sp. occurred in 81.82% and *Trichostrongylus*-compatible eggs in 63.64% of nematode-positive ducks. The high occurrence of *Trichuris* sp. among positive ducks suggests that this genus constituted the most consistently detected parasite in the present dataset. However, this proportion should be interpreted as the frequency among nematode-positive ducks and should not be confused with prevalence in the whole study population. When calculated against all 80 examined ducks, the prevalence of *Trichuris* sp. was 13.75%. The prevalence of *Ascaridia* sp. was 11.25% overall, with 15.0% in males and 7.5% in females. The difference was not statistically significant (Fisher's exact test, p = 0.481). The corresponding odds ratio was 2.18, but its confidence interval was wide (95% CI: 0.50–9.39), reflecting the small number of positive individuals. Therefore, the apparent higher occurrence in males should not be interpreted as evidence of a sex-associated difference in *Ascaridia* infection. A similar pattern was observed for *Trichuris* sp. Its prevalence was 13.75% overall, 17.5% in males and 10.0% in females. The difference was not statistically significant (Fisher's exact test, p = 0.518). The estimated odds ratio was 1.91 (95% CI: 0.51–7.12), again indicating considerable uncertainty around the magnitude of the observed difference. A cautious interpretation therefore seems warranted: although the observed proportions were higher in males, the available sample did not provide sufficient evidence of a significant sex effect. In contrast, *Trichostrongylus*-compatible eggs showed a marked sex-related distribution. They were detected in 7/40 males and in none of the 40 females, corresponding to prevalences of 17.5% and 0%, respectively, and Fisher's exact test indicated a statistically significant association (p = 0.0117). Because the female cell contained no positives and the sample was small, the magnitude of the association should be interpreted cautiously. The finding is an epidemiological observation and does not establish a biological mechanism. The intensity of egg excretion also differed among nematode genera. Among *Ascaridia*-positive ducks, males had a mean egg count of 359.17 EPG, whereas females had a mean of 625.00 EPG. The corresponding medians were 368 and 619 EPG, respectively. When only positive ducks were considered, the exact Mann–Whitney test showed a statistically significant difference between sexes (U = 0.0, p = 0.0238). Thus, although males showed a higher prevalence of *Ascaridia* sp., females that were positive tended to exhibit higher egg excretion. This distinction is important because prevalence and intensity describe different epidemiological characteristics and do not necessarily vary in the same direction. The same pattern was observed for *Trichuris* sp. All seven males and four females were positive. The mean egg counts were 357.14 EPG in males and 627.00 EPG in females,

with median values of 334 and 586.5 EPG, respectively. The exact Mann–Whitney test indicated a significant difference in egg excretion intensity between sexes (U = 0.0, p = 0.00606). Positive females thus appear to excrete more *Trichuris* eggs than positive males, despite the absence of a statistically significant sex difference in prevalence. For *Trichostrongylus*-compatible eggs, the seven positive males showed a mean egg count of 355.71 EPG, with a median of 373 EPG and a range of 304–399 EPG. No female was positive for this genus. Because there were no positive females, a conventional comparison of intensity between sexes is not meaningful. The appropriate interpretation is therefore limited to describing the observed excretion among positive males and the absence of detectable excretion among females. When the egg counts of the three genera were summed for each positive duck, total egg excretion ranged from 847 to 1,247 EPG in males and from 768 to 1,304 EPG in females. The mean total excretion was 1,020.71 EPG in males and 1,095.75 EPG in females. Although females had a slightly higher mean and median total EPG than males, this difference was not statistically significant (Mann–Whitney exact test, U = 9.0, p = 0.4121). Therefore, the higher genus-specific egg counts observed in females for *Ascaridia* and *Trichuris* did not translate into a statistically significant difference in overall egg excretion. These sex-related patterns in prevalence and excretion intensity are consistent with a broader literature documenting sex differences in susceptibility to gastrointestinal nematodes across vertebrate hosts, including poultry. Early experimental infections of chickens with *Ascaridia galli* showed that male chicks harboured more worms than females, although the difference became statistically significant only after several weeks of age [19]. Comparable sex-associated differences in nematode burden have also been reported in free-range domestic ducks in Kenya, where males carried higher mean worm counts than females [8]. Such patterns have been attributed to the immunosuppressive action of testosterone on cell-mediated and humoral immunity, a mechanism proposed to underlie sex differences in parasite burden across a wide range of taxa [20, 21]. In poultry more specifically, adult female chickens have been shown to mount stronger, albeit shorter-lived, protective immune responses against *A. galli* than males [22]. However, sex biases in parasite prevalence are not universal and can vary with ecological context, seasonality, and parasite taxon, as shown by a recent meta-analysis of sex-specific parasite prevalence across wild bird species [23]. These considerations suggest that the sex-associated patterns observed in the present study, particularly the higher intensity of egg excretion in positive females despite their lower prevalence, may reflect a combination of physiological and ecological factors that were not directly measured here. An important feature of the present results is the occurrence of multiple nematode genera within individual ducks. The individual records show that most infected males harboured all three genera, whereas the positive females carried *Ascaridia* and *Trichuris* but not *Trichostrongylus*. This pattern indicates that the detected infections were not restricted to single-genus infections. The co-occurrence of several nematode genera may have epidemiological importance because it suggests simultaneous exposure to different sources of contamination [4]. The present dataset also draws attention to the value of distinguishing between infection frequency and nematode intensity. The overall prevalence of 13.75% describes the proportion of ducks harbouring at least one detected genus, whereas the EPG values describe the level of egg excretion among positive individuals. Consequently, a sex may exhibit a lower prevalence but a higher intensity among its positive individuals, as observed in the present study for females. Reporting these two indicators separately provides a more accurate description of the epidemiological pattern than using a single global mean, an approach that supports reporting prevalence and egg-excretion intensity as complementary epidemiological measures [5]. The absence of statistically significant differences in overall prevalence and total egg excretion should be interpreted in light of the limited sample size. Only 11 positive ducks were available for intensity analyses, including seven males and four females. This small subgroup limits statistical power and results in substantial uncertainty around measures of association. Overall, a relatively small proportion of ducks were positive for at least one of the investigated gastrointestinal nematode types, a lower level of infection than reported in several other poultry surveys in sub-Saharan Africa [4], broadly consistent with the comparatively low pooled prevalence reported for free-ranging poultry in West Africa relative to other African subregions [24] and with global estimates of gastrointestinal helminth infection in chickens [25]. *Trichuris* sp. was detected in all positive ducks, whereas *Trichostrongylus*-compatible eggs showed the clearest sex-associated distribution. Positive females had higher genus-specific egg-excretion intensities for *Ascaridia* sp. and *Trichuris* sp., despite their lower observed overall prevalence; total EPG did not differ significantly between sexes. Even low levels of detectable egg excretion may be epidemiologically relevant because positive birds can contribute eggs to the environment [2]. Routine coprological monitoring, with prevalence and egg-excretion intensity reported separately, may therefore help characterise parasite occurrence in semi-intensive duck flocks.

5 CONCLUSION

This survey of 80 ducks kept under semi-intensive management at the CRE experimental farm detected gastrointestinal nematode eggs in 13.75% of examined birds. *Trichostrongylus*-compatible eggs were detected only in males, whereas positive females showed significantly higher egg-excretion intensities for *Ascaridia* sp. and *Trichuris* sp. than positive males. Total egg excretion did not differ significantly between sexes. These findings indicate that prevalence and egg-excretion intensity provide complementary information and should be reported separately. Larger, multi-flock studies are needed to determine whether the observed sex-associated patterns are reproducible. The controlled husbandry conditions at the farm therefore appear broadly effective at limiting parasite pressure, and the findings point to sex and the distinction between prevalence and intensity as variables worth tracking in future parasitological monitoring of duck flocks in Côte d'Ivoire, ideally with larger sample sizes to confirm the associations observed here.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

Acknowledgments

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Disclosure of conflict of interest

Konan Alexis OUSSOU declares that he has no conflict of interest. Kouamé Jean Paul ANGUI declares that he has no conflict of interest. Zahouli Faustin ZOUH BI declares that he has no conflict of interest.

Statement of ethical approval

Faecal samples were collected non-invasively, without handling stress or injury to the animals, and no bird was subjected to experimental infection or any invasive procedure during the study.

Data availability statement

The datasets generated and analysed during this study are available from the corresponding author on reasonable request.

Author contributions

Konan Alexis OUSSOU, Kouamé Jean Paul ANGUI, and Zahouli Faustin ZOUH BI conceived and conducted the study, performed the parasitological analyses, and wrote the manuscript. They all participated in data collection and laboratory work. All authors read and approved the final version.

REFERENCES

[1] Chavarro-Tulcán J, Arias-Sosa LA, Rojas AL. Evaluation of metabolic syndromes and parasitic infection in Muscovy ducks under different management conditions. Trop Anim Health Prod. 2021;53(5):493.

[2] Permin A, Hansen JW. Epidemiology, Diagnosis and Control of Poultry Parasites. FAO Animal Health Manual No. 4. Rome: Food and Agriculture Organization; 1998. 160 p.

[3] Golezardy H, Hodžić A, Mitrović S. Role of parasitic infections in livestock production losses. Acta Vet. 2021;71(4):433-44.

[4] Komba EVG, Mbanzulu KM, Kimera ZI. Prevalence and impact of gastrointestinal nematodes in village poultry in sub-Saharan Africa. Vet World. 2022;15(3):548-55.

[5] Permin A, Bisgaard M, Frandsen F, Pearman M, Kold J, Nansen P. Prevalence of gastrointestinal helminths in different poultry production systems. Br Poult Sci. 1999;40(4):439-43.

[6] Arias-Sosa LA, Rojas AL. A review on the productive potential of the Muscovy duck. World's Poult Sci J. 2021;77(3):565-88.

[7] Amanidja BD, Komara M, Soro D, Loba ALEG, Otchoumou A. Diagnostic analysis of the breeding of local breed ducks (*Cairina moschata* Linnaeus, 1758) in the Southern Forest of Côte d'Ivoire. Eur Sci J. 2018;14(36):488.

[8] Waruiru RM, Mavuti SK, Mbuthia PG, Njagi LW. Prevalence and intensity of gastrointestinal helminth infestations of free range domestic ducks in Kenya. Livest Res Rural Dev. 2018;30, Article #66.

[9] Igbou GN. Social representations and uses of public gardens in the commune of Treichville. Eur Sci J. 2021;17(27):149.

[10] Zouh Bi ZF, Karamoko Y, Yapi YG, Fofana P, Koné MW. Diversity and prevalence of gastrointestinal parasites of the grasscutter (*Thryonomys swinderianus*) in southern Côte d'Ivoire. Int J Biol Chem Sci. 2013;7(3):1166-74.

[11] Foreyt WJ. Veterinary Parasitology: Reference Manual. 5th ed. Ames: Iowa State University Press; 2001. 235 p.

[12] Gordon HM, Whitlock HV. A new technique for counting nematode eggs in sheep faeces. J Counc Sci Ind Res. 1939;12:50-2.

[13] Kaufmann J. Parasitic Infections of Domestic Animals: A Diagnostic Manual. Basel: Birkhäuser Verlag; 1996. 423 p.

[14] Thienpont D, Rochette F, Vanparijs OFJ. Diagnosing Helminthiasis by Coprological Examination. 1st ed. Beerse: Janssen Research Foundation; 1979. 187 p.

[15] Euzéby J. Experimental diagnosis of animal helminthosis, Volume I. Paris: Éditions Vigot; 1981. 349 p.

[16] Euzéby J. Experimental diagnosis of animal helminthosis, Volume II. Paris: Ministry of Agriculture; 1982. 361 p.

[17] Thienpont D, Rochette F, Vanparijs OFJ. Diagnosing Helminthiasis by Coprological Examination. 2nd ed. Beerse: Janssen Research Foundation; 1995. 205 p.

[18] Kante N, Kaba L, N'Gotta KI, Camara AOD, Salako AS, Berete K, Tuo K, N'Docho AF, Gondo É, Teohou MMC, N'Gotta AA, Traore AK, Barro N. Prevalence of gastrointestinal parasites in horses in the district of Abidjan, Ivory Coast. Sci Rep. 2026.

[19] Todd AC, Hollingsworth KP. Host sex as a factor in development of *Ascaridia galli*. Exp Parasitol. 1952;1(3):303-4.

[20] Zuk M, McKean KA. Sex differences in parasite infections: patterns and processes. Int J Parasitol. 1996;26(10):1009-23.

[21] Folstad I, Karter AJ. Parasites, bright males, and the immunocompetence handicap. Am Nat. 1992;139(3):603-22.

[22] Shohana NN, Rony SA, Ali MH, Hossain MS, Labony SS, Dey AR, Farjana T, Alam MZ, Alim MA, Anisuzzaman. *Ascaridia galli* infection in chicken: Pathobiology and immunological orchestra. Immun Inflamm Dis. 2023;11(9):e1001.

[23] Valdebenito JO, Jones W, Székely T. Evolutionary drivers of sex-specific parasite prevalence in wild birds. Proc R Soc B. 2024;291(2028):20241013.

[24] Walter I, Malatji MP, Nyagura I, Tembe D, Mukaratirwa S. Epidemiology of gastrointestinal nematodes of free-ranging chickens (*Gallus gallus domesticus*) in Africa: A systematic review and meta-analysis. J Helminthol. 2026;100:e36.

[25] Shifaw A, Feyera T, Walkden-Brown SW, Sharpe B, Elliott T, Ruhnke I. Global and regional prevalence of helminth infection in chickens over time: a systematic review and meta-analysis. Poult Sci. 2021;100(5):101082.