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Gastrointestinal Parasites in Birds at Taman Rusa, Aceh Besar

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ABSTRACT

Captive animals are not immune to infectious diseases, including parasitic infections that can be fatal. Prolonged periods of captivity can increase the likelihood of transmission between animals and humans. This study was conducted to identify and document the parasites that infect birds housed at Taman Rusa in the Aceh Besar District. The collected fecal samples were placed in labeled sample bottles containing formalin and stored in ice boxes. Fecal samples were collected, preserved in 10% formalin, and examined using flotation, sedimentation, formol-ether, and modified Ziehl-Neelsen techniques. The data obtained from the examination of the fecal samples were tabulated and descriptively analyzed. The results of fecal sample examinations carried out on 60 birds (representing 28 species) indicated that 39 birds (19 species) were infected with parasites. The nematode class included *Heterakis* sp. (3.33%), *Capillaria* sp. (13.3%), *Trichuris* sp. (6.67%), and *Strongyloides* sp. (8.3%). The cestode class included *Hymenolepis* sp. (10%), while the trematode class included *Neodiplostomum* sp. (1.67%). Additionally, the class Conoidasida protozoa included *Eimeria* sp. (33.3%) and *Isospora* sp. (1.67%). The highest prevalence of helminth infection was observed in *Capillaria* sp. infection (13.3%), while *Eimeria* sp. exhibited the highest prevalence of protozoan infection (35%). The findings deliver valuable guidance for veterinary health management, disease surveillance, and biosecurity strategies in avian conservation facilities. The identification of parasites with established pathogenic and zoonotic potential, including *Strongyloides* sp. and *Capillaria* sp., highlights the significance of these results for both avian health and potential public health risks.

Introduction

The preservation of biodiversity and its educational value has resulted in the captivity of many wild bird species. The transition from a natural habitat to captivity alters birds' lifestyles, making them more susceptible to disease transmission, including gastrointestinal parasitic infections (Laatamna *et al.*, 2019). This increased vulnerability to parasitic infections is primarily due to stress, which weakens the birds' immune systems. Parasitic infections in captive wildlife can be fatal. Moreover, prolonged captivity can heighten interactions among parasites, animals, and humans, facilitating transmission (Sangpeng *et al.*, 2023). Dashe and Berhanu (2020) noted that captive husbandry management factors, such as environmental conditions, feeding practices, temperature, and humidity, make animals in captivity vulnerable to parasitic infections. This assertion is supported by a report from Muqorobin *et al.* (2017), which states that low temperatures during the rainy season can cause the soil to become moist, creating an ideal environment for worm eggs to develop and survive for extended periods.

Previous research has identified parasites in the Javan Hawk-Eagle and Changeable Hawk-Eagle housed in the ex-situ habitats of Pusat Penyelamatan Satwa Cikananga and Pusat Penyelamatan Satwa Gadog. The identified parasites include *Strigea* sp. and *Neodiplostomum* sp. from the trematode class, as well as *Heterakis* sp., *Ascaridia* sp., and *Capillaria* sp. from the nematode class (Kurniawan *et al.*, 2010).

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Additionally, Indrayati (2017) reported the presence of *Heterakis* sp., *Ascaridia* sp., *Capillaria* sp., *Strigea* sp., and *Neodiplostomum* sp. in eagles. Furthermore, *Strongyles* sp. worm eggs from the nematode class were discovered in Scarlet Macaws (*Ara macao*) housed in a zoo in Italy (Papini *et al*., 2012). Bayzid *et al.* (2022) also identified protozoa *Eimeria* spp. and *Isospora* sp. in older birds, as well as *Caryospora* spp. in Budgerigars kept in Chattogram, Bangladesh. Additionally, Widyaningsih *et al.* (2018) found the protozoa *Trichomonas gallinae* and *Eimeria* sp. in pigeons.

There was limited data on parasitic infections in captive birds in Aceh, and parasitic infections in wild or captive birds at Taman Rusa, Aceh Besar had never been reported. This study was conducted to identify and document the parasites that infect birds housed at Taman Rusa in the Aceh Besar District. The findings could have served as preliminary information on parasite infestations and provided a reference for managing parasite infections in both wild and captive birds, aiding in the control of parasites to protect the health of captive birds.

Materials and Methods

Materials

The materials used in the study included of 60 bird feces samples, 10% formalin, distilled water, saturated sugar, 0.1% methylene blue, ether, 1% carbol fuchsin, 3% acid alcohol, and immersion oil. The tools used were ice box, microscope slide, cover slip, mortar, tea strainer, sample bottle, centrifuge, centrifuge tube, microscope, conical flask, beaker, test tube.

Sample Collection

Samples were collected after the birds defecated in the morning and afternoon. The collected feces were homogenized with 10% formalin in labeled sample bottles. The sample bottles containing the feces were stored in an ice box and transported to the laboratory for examination using four methods: flotation, sedimentation, formol-ether, and modified Ziehl-Neelsen method.

Flotation Method

In the flotation method, feces were placed into a mortar and homogenized with a saturated sugar solution. Once homogenized, the solution was transferred into a centrifuge tube until the surface became convex and was allowed to settle for 15 minutes. A microscope slide was placed on the convex surface and then quickly inverted. It was subsequently covered with a cover slip and examined under a microscope.

Sedimentation Method

In the sedimentation method, feces were homogenized with water in a mortar, after which the solution was filtered and transferred into a 100 ml conical flask. After being allowed to settle for 5 minutes, the supernatant was discarded. Water was added again to the precipitate, and after another 5 minutes, the supernatant was discarded once more. The remaining precipitate was placed on a microscope slide, covered with a cover slip, and examined.

Formol Ether Method

In the formol ether method, feces were mixed and homogenized with distilled water, then transferred into a beaker containing 10% formalin and homogenized again. The resulting solution was placed into a centrifuge tube, and 3 ml of ether was added. The mixture was centrifuged at 1500 rpm for 3-5 minutes. The supernatant and debris were discarded, and the precipitate was dissolved in 10% formalin to achieve the desired concentration. The mixture was then placed on microscope slide and covered with cover slip for examination.

Modified Ziehl-Neelsen Method

In the modified Ziehl-Neelsen method, feces were homogenized with distilled water and then placed into a microscope slide. The fecal samples were fixed with methanol for 3 minutes. 1% carbol fuchsin was applied to the samples and was allowed to settle for 15 to 20 minutes, after which it was rinsed and air-dried. 3% acid alcohol was then applied to the fecal sample, allowed to settle for 15 to 20 seconds, rinsed, and air-dried. Subsequently, 0.1% methylene blue was added to the sample, allowed to settle for 5 minutes, then rinsed and air-dried. The fecal samples were examined using a microscope (Khan *et al*., 2019).

Data Analysis

Data obtained from the examination of fecal samples were tabulated and analyzed descriptively. The identification of *Neodiplostomum* sp., *Strongyloides* sp., *Heterakis* sp., *Hymenolepis* sp., *Capillaria* sp., and *Trichuris* sp. eggs was based on their morphological features, including shape, size, color, shell thickness, and internal structures, and was carried out by comparing the observed specimens with standard descriptions in authoritative parasitology references (Soulsby, 1986; Anderson, 2000; Zajac and Conboy, 2012; Bowman, 2021). The identification of *Eimeria* sp. and *Isospora* sp. oocysts was based on their morphology (shape, size, number of sporocysts, and number of sporozoites per sporocysts) observed under the microscope, and compared with standard descriptions from recognized

parasitology references (Long and Joyner, 1984; Levine, 1985; Soulsby, 1986).

Results

The results of fecal sample examinations conducted on 60 birds representing 28 species at Taman Rusa in the Aceh Besar District revealed that 39 birds from 19 species were infected with gastrointestinal parasites, as presented in Table 1.

Table 1. Fecal examination results of various bird species in Taman Rusa, Aceh Besar

No	Types of Animal	Number of Birds (Tail)	Number of Positives	Type of Parasite	Percentage (%)
1	Asian Emerald Dove (*Chalcophaps indica*)	4	0	-	0%
2	Asian Fairy-bluebird (*Irena puella*)	3	0	-	0%
3	Black Eagle (*Ictinaetus malaiensis*)	1	0	-	0%
4	Black-naped Oriole (*Oriolus chinensis*)	2	0	-	0%
5	Black-winged Myna (*Acridotheres melanopterus*)	1	1	*Strongyloides* sp.	100%
6	Bornean Crested Fireback (*Lophura ignita*)	1	1	*Eimeria* sp.	100%
7	Brahminy Kite (*Haliastur indus*)	6	0	-	0%
8	Budgerigar (*Melopsittacus undulatus*)	1	1	*Capillaria* sp.	100%
9	Changeable Hawk-Eagle (*Nisaetus cirrhatus*)	2	0	-	0%
10	Crested Partridge (*Rollulus rouloul*)	1	1	*Trichuris* sp.	100%
11	Great Hornbill (*Buceros bicornis*)	2	1	*Capillaria* sp.	50%
			2	*Heterakis* sp.	28.5%
12	Indian Peafowl (*Pavo cristatus*)	7	7	*Eimeria* sp.	100%
			1	*Isospora* sp.	14.2%
13	Indian Pied Starling (*Gracupica contra*)	1	1	*Strongyloides* sp.	100%
14	Javan Myna (*Acridotheres javanicus*)	1	1	*Trichuris* sp.	100%
15	Lesser Whistling-Duck (*Dendrocygna javanica*)	1	0	-	0%
16	Moluccan Eclectus (*Eclectus roratus*)	1	1	*Strongyloides* sp.	100%
17	Moluccan King-Parrot (*Alisterus amboinensis*)	1	1	*Strongyloides* sp.	100%
18	Nias Hill Myna (*Gracula robusta*)	1	1	*Trichuris* sp.	100%
19	Polish Crested Chicken (*Gallus gallus domestica*)	2	2	*Capillaria* sp.	100%
			2	*Eimeria* sp.	100%
20	Rhinoceros Hornbill (*Buceros rhinoceros*)	1	1	*Capillaria* sp.	100%
21	Rosy-faced Lovebird (*Agapornis roseicollis*)	3	3	*Capillaria* sp.	100%
22	Silver Sebright Chicken (*Gallus gallus f. domestica*)	7	6	*Hymenolepis* sp.	85.7%
			6	*Eimeria* sp.	85.7%
23	Sumatran Laughingthrush (*Garrulax bicolor*)	1	1	*Strongyloides* sp.	100%
24	White-bellied Sea Eagle (*Haliaeetus leucogaster*)	1	1	*Neodiplostomum* sp.	100%
				Eimeria sp.	100%
25	White-breasted Waterhen (*Amaurornis phoenicurus*)	2	1	*Trichuris* sp.	50%
26	Wreathed Hornbill (*Rhyticeros undulatus*)	1	0	-	0%
27	Yellow-crested Cockatoo (*Cacatua sulphurea*)	1	0	-	0%
28	Zebra Dove (*Geopelia striata*)	4	3	*Eimeria* sp.	75%

The percentage of parasites infecting birds at Taman Rusa in the Aceh Besar District included nematodes such as *Heterakis* sp. (3.33%), *Capillaria* sp. (13.3%), *Trichuris* sp. (6.67%), and *Strongyloides* sp. (8.3%). Additionally, cestodes were represented by *Hymenolepis* sp. (10%), while trematodes included *Neodiplostomum* sp. (1.67%). Furthermore, the class conoidasida of protozoa was represented by *Eimeria* sp. (33.3%) and *Isospora* sp. (1.67%). The types of gastrointestinal parasites observed in the fecal samples are shown in Figure 1.

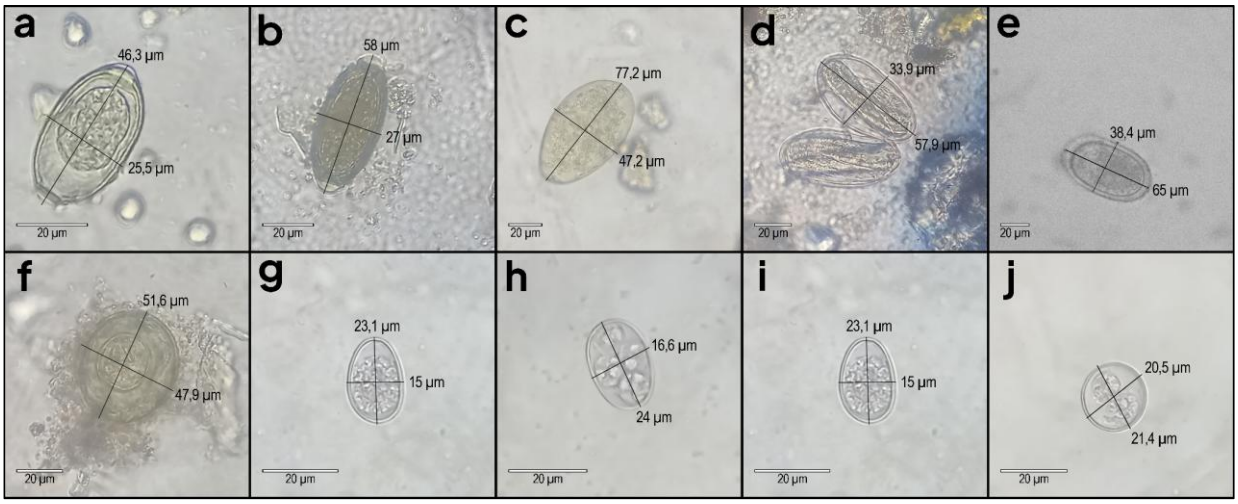

Figure 1. Gastrointestinal parasite in fecal sample of birds: (a) *Capillaria* sp.; (b) *Trichuris* sp.; (c) *Neodiplostomum* sp.; (d) *Strongyloides* sp.; (e) *Heterakis* sp.; (f) *Hymenolepis* sp.; (g-i) *Eimeria* sp.; (j) *Isospora* sp.

Discussion

The examination of bird feces samples revealed the presence of various digestive tract parasites, including nematodes, cestodes, trematodes, and protozoa from the class conoidasida. The identified nematode eggs included *Heterakis* sp., *Capillaria* sp., *Trichuris* sp., and *Strongyloides* sp. The cestode eggs identified were from *Hymenolepis* sp., while the trematode eggs belonged to *Neodiplostomum* sp. Additionally, the protozoa detected were *Eimeria* sp. and *Isospora* sp.

Capillaria sp., a nematode class of worm eggs, is commonly identified in the fecal examinations of various bird species. In this study, *Capillaria* sp. eggs were detected in the feces of Budgerigars, Rosy-faced Lovebirds, Rhinoceros Hornbills, Great Hornbills, and Polish Crested Chickens. These eggs exhibit a lemon-like shape, are yellowish in color, possess thin egg walls, and have plugs at both poles, with an average size ranging from 23.6 to 27 µm in width and 38.9 to 46.6 µm in length. This size aligns with previous research; Kurnia *et al.* (2021) reported *Capillaria* sp. eggs with an average size of 23.3 to 68.2 µm in width and 12.1 to 35.8 µm in length, while Amaliah *et al.* (2018) found *Capillaria* sp. eggs measuring 20.5 µm by 43.3 µm. Additionally, *Trichuris* sp. eggs were identified in the fecal examinations of Javan Mynas, Crested Partridges, and White-breasted Waterhens. *Trichuris* sp. eggs are similar in shape to those of *Capillaria* sp., but are longer, brownish, and feature a transparent covering that protrudes at both ends, with an average size of 49.5 to 58 µm in length and 25 to 27 µm in width.

After *Capillaria* sp., the most commonly found nematode egg was *Strongyloides* sp., which was identified in the feces of the Moluccan Eclectus, Moluccan King-Parrot, Sumatran Laughingthrush, Indian Pied Starling, and Black-winged Myna. These eggs have a thin-walled, ovoid shape and contain larvae, with an average size of 32-46 × 45-75 µm. Research conducted by Alifia *et al.* (2023) reported that *Strongyloides* eggs are oval with thin walls, measuring 27.25 × 65.11 µm. Similarly, Mega *et al.* (2024) also observed *Strongyloides* sp. eggs with a thin-walled, oval shape, measuring 37.48 × 55.51 µm. In contrast, *Heterakis* sp. eggs were exclusively found in the feces of Indian Peafowl, characterized by a thick-walled, elliptical shape, with an average size of 65-65.8 × 38.4-40.7 µm.

In the cestode class, the eggs of *Hymenolepis* sp. were found in Silver Sebright chickens. These eggs are characterized by a thick, cool, round shape and a yellowish color, with two clear membranes. They measure 47.9 × 51.6 µm and contain a hexacanth embryo. According to Soulsby (1986), the eggs of *Hymenolepis* sp. are round and also contain hexacanth embryos, with sizes ranging from 30-55 × 44-62 µm. In contrast, in the trematode class, eggs of *Neodiplostomum* sp. were discovered in White-bellied Sea Eagles. These eggs have a thin-walled, oval shape and measure 47.2 × 77.2 µm. *Neodiplostomum* sp. belongs to the trematode class, which commonly affects birds (Achatz *et al.*, 2022).

Two types of digestive tract protozoa were identified in fecal samples: *Eimeria* sp., which was found in the Nias Hill Myna, Zebra Dove, Bornean Crested Fireback, Silver Sebright Chicken, Polish Crested Chicken, Indian Peafowl, and White-bellied Sea Eagle. The *Eimeria* sp. observed were elliptical in shape, had smooth walls, contained four sporozoites, and measured an average of 12.8-18.5 × 14-24.2 µm. In contrast, *Isospora* sp. was exclusively found in the Indian Peafowl, characterized by a round shape, smooth walls, and containing two sporozoites, with a size of 20.5 × 21.4 µm. Although the oocysts of *Eimeria* sp. and *Isospora* sp. exhibit similar

morphology, they differ in size and the number of sporocysts. *Eimeria* sp. oocysts are oval, measuring 15 × 30 µm, and contain four sporocysts, each with two sporozoites. In comparison, the shape of *Isospora* sp. oocysts are round to elliptical, measuring 10-30 × 10-40 µm, and contain two sporocysts, each housing four sporozoites (Azmy *et al*., 2015). Referring to Table 1. *Eimeria* sp. infection was present in nearly all individuals of the bird species infected by *Eimeria* sp. This suggests that *Eimeria* sp. can be easily transmitted between individuals under conditions of poor management, high population density, poor litter quality, and elevated humidity.

This research offers several noteworthy contributions to the field. It is, to the best of our knowledge, the first documented investigation of gastrointestinal parasite infections across multiple bird species inhabiting Taman Rusa, Aceh Besar, Indonesia. In contrast to previous studies, which largely concentrated on either wild or captive birds from other localities, this survey systematically assessed 28 avian species within a single semi-captive conservation environment. The study further combines a comprehensive approach to parasite identification encompassing nematodes, cestodes, trematodes, and protozoa by applying four complementary diagnostic methods (flotation, sedimentation, formol-ether, and modified Ziehl–Neelsen staining), thereby enhancing detection accuracy. Moreover, by providing species-specific prevalence data, the findings deliver valuable guidance for veterinary health management, disease surveillance, and biosecurity strategies in avian conservation facilities. The identification of parasites with established pathogenic and zoonotic potential, including *Strongyloides* sp. and *Capillaria* sp. highlights the significance of these results for both avian health and potential public health risks.

Conclusions

Fecal examination of 60 birds representing 28 species at Taman Rusa in the Aceh Besar District revealed that 39 birds from 19 species were infected with gastrointestinal parasites (65%). The identified helminth parasites included *Heterakis* sp., *Capillaria* sp., *Trichuris* sp., *Strongyloides* sp., *Hymenolepis* sp., and *Neodiplostomum* sp. Meanwhile, the protozoan parasites detected were *Eimeria* sp. and *Isospora* sp. The highest prevalence of helminth infection was observed in *Capillaria* sp. infection (13.3%), while *Eimeria* sp. exhibited the highest prevalence of protozoan infection (33.3%).

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