Endoparasite infestation of Indian Muntjac (*Muntiacus muntjak*) in Citra Pesona Ladangku Animal Park, North Sumatra

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**Abstract.** An investigation on the infestation by endoparasites in the fecal samples of Indian Muntjac (*Muntiacus muntjak*) captured at Citra Pesona Ladangku Animal Park, North Sumatera, Indonesia had been conducted from October to November 2020. The study aimed to determine the endoparasite species, prevalence, and intensity of the infestation. Fecal samples were prepared for microscopical examination using glass bead sedimentation method. Based on the observation on 9 deers, three species of endoparasites were found namely *Ascaris* sp, *Haemonchus* sp and *Paramphistomum* sp. Observations in the first week revealed the prevalence of each species from often (*Ascaris* sp, *Haemonchus* sp) to common (*Paramphistomum* sp) with light (*Haemonchus* sp, *Paramphistomum* sp) to moderate (*Ascaris* sp). Observations in the second week only revealed the presence of *Paramphistomum* with often prevalency and light intensity of infection.

1. **Introduction**

Indian Muntjac (*Muntiacus muntjak*) is a deer species native to Southeast Asia in the Cervidae family. Deer are protected animals with the conservation status of least concern or low risk of extinction [1]. Conservation of deer to prevent population decline or extinction in the wild may be attempted through captive-breeding efforts. The deer species has been well maintained in captivity at Taman Satwa Citra Pesona Ladangku with an area of 15 Ha. One of the common challenges in maintaining the health of captive wildlife is the infection caused by parasites.

Parasites may infect either the outer part or the inner part of an animal so called as ectoparasites and endoparasites, respectively. Endoparasite infection is often neglected due to its cryptic nature yet exposing serious health issues to the captive animals. Parasitic diseases may emerge due to several factors consisting of environmental conditions, maintenance methods, and feed or drinking sources[2]. Endoparasites that infect animals can be transmitted through drinking water and food contaminated with helminth eggs [3]. The helminth eggs will develop into infective larvae depending on the suitable environmental conditions [4]. Local infestation will tend to continue if the food and water sources contaminated by the parasites remain for a long time and are accidentally ingested from one animal to another.
Several studies have reported on the endoparasite infestation of deer at Dhaka Zoo, Chittagong Zoo and Dulahazara Safari Park, Bangladesh which reported 7 species of endoparasites, namely *Paramphistomum* sp, *Haemonchus* sp, *Strongyloides* sp, *Trichuris* sp, *Trichostrongylus* sp., *Oesophagostomum* sp and *Capillaria* sp. [5]. The present study then reported our first investigation on endoparasite that infected *M. muntjak* in Citra Pesona Ladangku Animal Park, North Sumatera.

2. Methodology

Fecal samples were collected at Citra Pesona Ladangku Animal Park, while endoparasite examination was carried out at the Laboratory of Parasitology, *Balai Penyidikan dan Pengujian Veteriner (BPPV) Regional 1*, Medan, North Sumatera. Fecal samples were collected from 9 deers once a week for 2 weeks. Fresh feces (2–3 g) were collected in the morning. Each sample was labelled in codes and the period of collection. Measurement of environmental conditions such as temperature, humidity, soil moisture and soil pH were performed *in situ*. Fecal samples were prepared using the sedimentation technique or glass beads [6]. Data were analyzed descriptively, with the species identification of each parasite through microscopical examination based on the morphology in the atlas [7]. Other parameters measured in this study were:

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Prevalence(\%) = \frac{Total\, number\, of\, infected\, deers}{Total\, number\, of\, deers\, examined} \times 100
\]

\[
Intensity = \frac{Total\, number\, of\, parasites}{Total\, number\, of\, infected\, specimens\, examined}
\]

3. Results and discussion

3.1. Endoparasites species found in Indian Muntjac (*Muntiacus muntjak*)

The results revealed the presence of three endoparasite species in the fecal samples of deer (*Muntiacus muntjak*) at Citra Pesona Ladangku Animal Park as presented in Table 1.

| Table 1. Endoparasite species found in this study |
|-----------------------------------------------|
| Class          | Family               | Species      |
| Nematoda   | Ascarididae          | *Ascaris* sp |
| Nematoda   | Trichostrongylidae  | *Haemonchus* sp |
| Trematoda | Paramphistomitidae | *Paramphistomum* sp |

Based on Table 1, it can be seen that the gut of deer (*Muntiacus muntjak*) was infected by three species of endoparasites namely *Ascaris* (Nematoda), *Haemonchus* (Nematoda), and *Paramphistomum* (Trematoda). The presence of these endoparasites was considered as common infective agents with a rapid growth and fast life cycle. The endoparasites from nematode class do not require an intermediate host which explained its faster life cycle than other types of endoparasites [8].

3.2. Number and infection level of endoparasites

The number and comparison of endoparasitic infection level in deer (*Muntiacus muntjak*) at Satwa Citra Pesona Ladangku Animal Park can be seen in Table 2. Based on the result, it can be seen that from 9 fecal samples examined, there were 5 samples of feces infected with endoparasites with a moderate level of infection. This may due to different immune systems from each individual [9].
Table 2. Number of eggs and infection level of endoparasites in deer (*Muntiacus muntjac*)

| Sample | Species               | 1<sup>st</sup> Week | 2<sup>nd</sup> Week |
|--------|-----------------------|----------------------|---------------------|
|        |                       | Number of eggs | Category | Number of eggs | Category |
| 1      | -                     | -              | -         | -              | -         |
| 2      | *Paramphistomum* sp   | 2               | Light     | 3               | Light     |
| 3      | -                     | -              | -         | -              | -         |
| 4      | *Ascaris* sp          | 8               | Light     | -               | -         |
| 5      | *Haemonchus* sp       | 1               | Light     | -               | -         |
| 6      | *Paramphistomum* sp   | 8               | Light     | -               | -         |
| 7      | -                     | -              | -         | -              | -         |
| 8      | *Paramphistomum* sp   | 7               | Light     | 1               | Light     |
| 9      | -                     | -              | -         | -              | -         |

Note: (-) Absence of parasites.

Observations in the first and second weeks revealed inconsistent findings of endoparasite eggs. The highest number of helminth eggs was recovered from specimen-4 and specimen-6 loaded with 8 eggs/gr for *Ascaris* and *Paramphistomum* sp. In addition, *Paramphistomum* sp was detected intensely as recovered from specimen-2, specimen-6, and specimen-8. Meanwhile, in the second week of observation, there were only infestations by *Paramphistomum* sp in specimen-2 and specimen 8 with 3 eggs and 1 egg, respectively. The difference in the number of eggs for each week may due to the specificity of life cycle of each gastrointestinal parasite. Other factors such as host immunity, the intensity of defecation, fecundity and ages may also contribute to the presence of endoparasites [10,11]. Based on the number of parasitic eggs found in *M. muntjak*, it was classified as a mild or moderate level of infection, which was between 1–499 eggs/g [12].

3.3. Prevalence of endoparasite

The prevalence of endoparasites in deer (*Muntiacus muntjac*) at Satwa Citra Pesona Ladangku Animal Park is presented in Table 3.

Table 3. Prevalence of endoparasites in deer (*Muntiacus muntjac*)

| No. | Species         | 1<sup>st</sup> Week | 2<sup>nd</sup> Week |
|-----|-----------------|----------------------|---------------------|
|     |                 | Prevalence (%) | Category | Prevalence (%) | Category |
| 1   | *Ascaris* sp    | 11                   | Often     | -              | -         |
| 2   | *Haemonchus* sp | 11                   | Often     | -              | -         |
| 3   | *Paramphistomum* sp | 33           | Common    | 22             | Often     |

Based on Table 3, in the first week of observation, it was revealed that the prevalence by *Paramphistomum* sp was the highest (33%) classified as common (Table 3), followed in the next week by the same species, *Paramphistomum* sp (22%) classified as often. *Paramphistomum* sp is an endoparasite from trematode species which required snails as intermediate hosts. Infective larvae develop into metacercariae will be consumed by animals, which was the causal factor of the high prevalence of *Paramphistomum* sp [13]. The existence of snails is very dependent on the moist habitat that supports their growth and development. Snails as intermediate hosts play a crucial role in the transmission chain of parasite because from inside the snail's body there are cercariae that can infect animals. This was in accordance with the conditions of the drinking water tank and the place where the forage was given. The drinking water tank available in the cage may contain a variety of aquatic plants which serve as suitable habitats for snails thus increasing the number of individuals of the snail [7].
The prevalence of *Ascaris* sp (11%) and *Haemonchus* sp (11%) was classified as often, while no presence of *Ascaris* sp and *Haemonchus* sp in the second week of observation. The possible factors that caused the helminth eggs not found in the second week of sampling were due to the age of the parasites, host immunity, sex and the level of infection. In addition, periodical cage sanitation and maintenance managememt may also contribute to the fluctuative results in the prevalence [7, 14].

3.4. **Intensity of endoparasites**

The intensity of endoparasites in deer (*Muntiacus muntjak*) at Satwa Citra Pesona Ladangku Animal Park is presented in Table 4.

| No. | Species               | 1st Week | 2nd Week |
|-----|-----------------------|----------|----------|
|     |                       | Intensity| Category | Intensity| Category |
| 1   | *Ascaris* sp.         | 8        | Moderate | -        | -        |
| 2   | *Haemonchus* sp.      | 1        | Light   | -        | -        |
| 3   | *Paramphistomum* sp.  | 5.6      | Light   | 2        | Light   |

Based on Table 4, it can be seen that in the first week of observation, the highest intensity was from *Ascaris* sp classified in the moderate category, while the intensity of *Haemonchus* sp was classified in the light category. The results may be explained due the nature of the nematodes without any intermediate host or having a direct life cycle.

In the first week of observation, *Paramphistomum* sp had an intensity of 5.6 and 2.0 in the second week both classified in the light category. The results may dueits dependence for an intermediate host and the appropriate humidity of the environment. Helminth eggs originating from animal feces will develop into infective larvae in a suitable environment. Therefore, the more ideal of an environment, the greater the chance of gastrointestinal parasites being infested in the same or new hosts [15].

In the second week of sampling, it can be seen that the intensity of *Ascaris* sp and *Haemonchus* sp does not infect animals. Eggs that were not found could be influenced by the age of the worms and the fecundity of the worms [16]. Other factor that influenced the occurrence of parasitic infestation was the level of infection which was related to temperature and humidity [17].

The temperature required for nematodes such as *Ascaris* sp and *Haemonchus* sp ranging from 18 to 38oC and high humidity is very helpful for the development of parasite eggs to infective larvae [18], while *Paramphistomum* sp can develop at a temperature of approximately 27oC, this condition supports the development of the miracidium phase to metacercariae [19]. Based on the results of physicochemical characteristics in Citra Pesona Ladangku Animal Park, the area facilitated optimal conditions for the development of gastrointestinal parasites. The average temperature ranges from 25.5oC, with an air humidity of 91%, soil moisture of 44% and soil pH of 5.5.

The intensity of endoparasitic infestation in *M. Muntjak* was classified from mild (light) to moderate level. This was because of good and proper management at Citra Pesona Ladangku Animal Park. Sanitized cages may reduce the onset of endoparasite population in the environment. The low intensity of parasite attack will not produce any health problems and affects animal productivity, followed by an immediate preventive method to a routinely monitoring of endoparasites in the laboratory.

Control of helminths in animal aimed to reduce the level of infection. Helminth control by administering anthelmintics to reduce the level of infection in deers is one of effective strategies to mitigate the outgoing disease. Control can be done in two approaches, namely using chemical and non-chemical techniques through improvement on animal nutrition and protecting the forages against the presence of infective stage worms, especially for juveniles [20].
4. Conclusion
The results obtained three species of endoparasites infecting the Indian Muntjac (*Muntiacus muntjak*) in Citra Pesona Ladangku Animal Park, namely *Ascaris* sp, *Haemonchus* sp, and *Paramphistomum* sp. The observations in the first and second week revealed inconsistent finding of species presence. The most frequent parasite was *Paramphistomum* as being examined from many specimens and in the second week of observation. The prevalence of endoparasites in this study was categorized from *often* to *common* while the intensity ranged between *light-to-moderate* level of infection.

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