Species and prevalence of endoparasites on the feces of sambar deer (Cervus unicolor) and spotted deer (Axis-axis) in conservation Universitas Sumatera Utara

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Abstract. The purpose of this research is to determine the species, prevalence and intensity of endoparasites level in the feces of sambar deer (Cervus unicolor) and spotted deer (Axis-axis). The sample used in this research are fifteen feces of sambar deer and seven of spotted deer, sampling conducted in the morning. Sample analysis is done in the Laboratory of Parasitology Balai Penyidikan dan Pengujian Veteriner Regional I Medan with sedimentation method using glass beads. Measurements of enviromental physical factor include: temperature, soil moisture, soil pH and air moisture. The result showed that one species of endoparasite is found in the feces of sambar deer i.e. Paramphistomum sp with prevalence level at 100%, category always and value intensity is 39.6, category of medium parasite. Endoparasites on the feces of spotted deer is two species they are Paramphistomum sp. with 71.42%, category usually and the intensity is 37.4, the category of medium parasite and Trichuris sp. with prevalence at 14.28%, the category often and intensive value is 2, the category of light parasites.

1. Introduction

Deer can adapt to the diverse conditions of agroecosystem [1]. The excessive and uncontrolled use of deer can lead to its decline populations in nature. Indonesia is known for four species of deer that are categorized as endangered species that need to be protected and conserved, i.e. Javan deer or Timor deer (Cervus timorensis), Sambar deer (Cervus unicolor), Bawean deer (Axis kulhi), and Spotted deer (Axis-axis) [2]. Sambar deer is already protected by the government but its population continues to decrease due to illegal hunting and degradation of its original habitat. Another type of deer that is also widespread in Indonesia is the spotted deer (Axis-axis). The population of spotted deer is still quite a lot, but does not close the possibility of extinction in the future. Therefore the breeding of deer needs to be done in anticipation of deer extinction.

The effort that can be done to anticipate the deer extinction is by placing deer in captive breeding. Captive breeding is the beginning of a thorough utilization effort. Captive breeding also aims to avoid extinction and at the same time make use of deer optimally and sustainably beyond their natural habitat (ex-situ conservation), but as a newcomer and also a wildlife the deer that live in this captive
breeding is not necessarily free from disease attacks, whether caused by viruses, protozoa, bacteria and parasitic worms, which will be very harmful.

The type of infecting gastrointestinal parasite can be observed through the feces, as a picture of parasites that live in the gastrointestinal tract [3]. Types of parasites found in deer's digestive tract are Capillaria bovis, Capillaria longipes, Spiculopteragia sp., Trichostrongylus axei, Fasciola sp. Haemoncus contortus, Oesophagostomum venulosum, Ostertagia leptospicuralis, Moniezia sp. [4,5,6,7]. Infection of Paramphistomum sp. can cause duodenitis and abomasitis. In the case of mass infection, worm growth becomes slow so that clinical symptoms will appear longer. In the ruminal phase, the worm will cause epithelial changes of the rumen that disturb the resorbsi capacity.

2. Materials and Methods

Fecal sampling was conducted at conservation of deer Universitas Sumatera Utara while testing of faeces samples was done at Laboratorium Parasitologi Balai Penyidikan dan Pengujian Veteriner Regional I Medan. Fecal samples were taken from two different species of deer. Sambar deer as many as 15 tails, spotted deer as many as 7 tails (50% of the total population). The number of samples taken ± 4g each deer, then inserted into the coolbox. Measurements of environmental factors carried out include; temperature, soil moisture, soil pH and air humidity. Stool examination was done by using sedimentation method using glass beads [8]. The identification of the endoparasit worm eggs based on the morphology, structure and size of the observations was then adjusted to the identification book of Helminth Arthropod and Protozoa of Domesticated Animal [9]. Analysis of prevalence or incidence frequency analysis was performed [10].

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\text{Prevalence} = \frac{\text{the number of samples infected with the parasite infection}}{\text{number of samples examined}} \times 100\%
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\text{Intensity of attack} = \frac{\text{number of parasites found}}{\text{number of parasite infected samples}}
\]

Criteria for prevalence and intensity of attacks are based on [11].

3. Results and Discussion

3.1 Type and Number of Endoparasites in Sambar Deer (Cervus unicolor) Feces

In sambar deer feces (Cervus unicolor) found one type of endoparasit namely Paramphistomum sp. It is identified by the characteristics of oval egg, thin wall, somewhat transparent and yellow color, eggs within blastomeres [12]. The morphology of egg is looked transparent, embirional cells and operculum is clear, transparent colored walls, there is often a small bulge at the posterior end, the egg sizes are around 113-175µm [13]. Paramphistomum sp. egg and the number of endoparasites can be seen in Figure 1 and Table 1 respectively.
Figure 1: *Paramphistomum* sp. egg. (A) *Paramphistomum* sp. egg from sambar deer (*Cervus unicolor*) feces in the conservation of deer Universitas Sumatera Utara (10x10). (B) *Paramphistomum* sp. egg (10x40) [13]

*Paramphistomum* sp. in its life sustainability requires snail as intermediate hosts derived from Planorbidae and Lymnaeidae. Host definitive infections occur when animals eat grass or drink water containing metacercariae. Metacercaria enter the digestive tract, in the small intestine will develop into a young worm and can cause damage to the intestinal mucosa, due to previous bites. Young worms penetrate the mucosa to the inside and can cause strangulation, necrosis, erosion and hemorrhagic to the mucosa. As a result can arise acute inflammation of the intestines and abomasum. Young worms then growth swiftly, then go towards the mucosal surface and migrate to the rumen approximately within a month of infestation. In the rumen, the worms develop into adults and bite the rumen mucosa and can survive long. Adult worms then lay eggs about 75 eggs/day.

Eggs come out through the feces and fall in a wet and humid place allows the miracidium in the egg to grow quickly and out of the eggs then swim to find a suitable snail as the host between. Inside the snail body, miracidium develop into an oocyst, and then becomes redia, and becomes cercane for about 4-10 weeks. Serkaria comes out of the snail’s body and develops into metacercaria by releasing its tail. This metacercaria will be attached to the leaves and grass, waiting to be consumed ruminant livestock [14].

The presence of *Paramphistomum* sp. causing the infected deer losing weight. This is because *Paramphistomum* sp. causing damage to rumen work. *Paramphistomum* sp. is one of the worms in the Trematode class that lives in the attacked animal’s rumen and reticulum. This causes the rumen work to be disturbed so that the feed cannot be digested perfectly. *Paramphistomum* sp. young worm predilate in the small intestine and will migrate into the rumen and reticulum as adults.

Table 1 it can also be seen that the highest average number of *Paramphistomum* sp. endoparasit infections is found in female deer, this is because the female's immune system is less stable when it has experienced the period of pregnancy and childbirth. Stated that higher paramphistomiasis infections in females are allegedly caused due the female livestock is generally maintained longer as a mother for breeding so exposure by *Paramphistomum* sp. will be bigger, moreover the instability of female livestock immunity during pregnancy, childbirth and lactation is suspected to affect the worm infection [15].
Table 1. Number of endoparasites in sambar deer (*Cervus unicolor*) feces in conservation of deer Universitas Sumatera Utara

| No | Sex | Species          | n  |
|----|-----|------------------|----|
| 1  | Male| *Paramphistomum* sp. | 51 |
| 2  | Female| *Paramphistomum* sp. | 56 |
| 3  | Female| *Paramphistomum* sp. | 39 |
| 4  | Male| *Paramphistomum* sp. | 9  |
| 5  | Female| *Paramphistomum* sp. | 40 |
| 6  | Female| *Paramphistomum* sp. | 33 |
| 7  | Male| *Paramphistomum* sp. | 12 |
| 8  | Male| *Paramphistomum* sp. | 16 |
| 9  | Female| *Paramphistomum* sp. | 51 |
| 10 | Male| *Paramphistomum* sp. | 65 |
| 11 | Male| *Paramphistomum* sp. | 15 |
| 12 | Male| *Paramphistomum* sp. | 32 |
| 13 | Female| *Paramphistomum* sp. | 46 |
| 14 | Female| *Paramphistomum* sp. | 108 |
| 15 | Male| *Paramphistomum* sp. | 21 |

Description: n = number of parasites that infect the deer

3.2 Type and Number of Endoparasites in Spotted deer (*Axis-axis*) Feces

The type of endoparasites in spotted deer (*Axis-axis*) feces in conservation of deer Universitas Sumatera Utara i.e. *Paramphistomum* sp. (**Figure 1**) and *Trichuris* sp. (**Figure 2**). *Trichuris* sp. which is identified by the characteristics of egg size 50-54x22-23µ, brown and shaped like a lemon with both ends having a transparent plug. Eggs are 50x25 µ in shape like a jar and have an operculum that is a kind of cover on both poles and protruding on both poles. Walls consist of two layers, inside layer is clear and the outside layer is brown. The amount of endoparasites in faecal samples from 7 Spotted deer (*Axis-axis*) can be seen in Table 2.

Table 2 it can be seen that the type of endoparasites found in the Spotted deer (*Axis-axis*) feces is *Paramphistomum* sp. and *Trichuris* sp. Both types of these endoparasites are derived from different classes, *Paramphistomum* sp. of the Trematoda class while *Trichuris* sp. of the nematode class. Worm eggs from the class of Trematodes and Nematodes are parasites of worm eggs whose genus is commonly found in mammals in the tropics. The spread of worm eggs from trematodes and nematodes covers the tropical and sub-tropical regions of domestic and wild mammals [9].
Figure 2 *Trichuris* sp. Egg. (A) *Trichuris* sp. egg which is found on spotted deer (*Axis-axix*) feces in the Conservation of deer Universitas Sumatera Utara (10x10), (B) *Trichuris* sp. egg (10x40) [13]

On the digestive tract of spotted deer (*Axis-axis*) in the gate one garden of University of Hasanuddin Makassar found Nematode endoparasit, Strongyloidea Order with type *Oesophagostomum* sp. and *Haemonchus* sp. This happens because of differences in sampling, sampling during the dry season is different from taking in the rainy season. The rainy season is suspected to be the cause of infestation of the gastrointestinal worms due to the increasingly humid environment conditions that support the development of the gastrointestinal worms. In the rainy season the air humidity is high, and the low temperature is a condition favored by parasitic worms to thrive.

| No | Sex    | Species            | n  |
|----|--------|--------------------|----|
| 1  | Female | Paramphistomum sp. | 26 |
| 2  | Male   | *Paramphistomum* sp.| 55 |
| 3  | Female | *Paramphistomum* sp.| 42 |
| 4  | Male   | *Paramphistomum* sp.| 21 |
| 5  | Female | *Paramphistomum* sp.| 43 |
| 6  | Female | *Paramphistomum* sp.| 2  |
| 7  | Male   | *Trichuris* sp.    |    |

n = number of parasites that infect the deer

Based on Table 2 it can be seen that from the seven samples of the examined stool there is one sample of feces that is not infected by endoparasit, this is because the negative affected endoparasites sample is still classified as fawn (± 6 months). The influence of age is closely related to the period of infestation, especially in the field. The older the livestock, the higher the prevalence of intensity. In young livestock, the prevalence is lower. This is due to the intensity of the young livestock grass feeding is still low compared to adult livestock, this is because young livestocks are still drinking their mother’s milk, so the possibility to be infected with metacercaria larvae is smaller.
3.3 Prevalence and Intensity

The prevalence and intensity of endoparasites found in the Sambar deer (Cervus unicolor) feces and the spotted deer (Axis-axis) in conservation of deer Universitas Sumatera Utara can be seen in Table 3.

Table 3. Prevalence and intensity of endoparasites in sambar deer (Cervus unicolor) and Spotted deer (Axis-axis) in conservation of deer Universitas Sumatera Utara  

| Type of Endoparasit | Prevalence (%) | Cervus unicolor | Axis-axis | Intensity | Cervus unicolor | Axis-axis |
|--------------------|----------------|-----------------|-----------|-----------|----------------|-----------|
| Paramphistomum sp. | 100            | 71.42           | 39.6      | 37.4      | -              | 2         |
| Trichuris sp.      | -              | 14.28           | -         | -         | -              | -         |

Table 3 shows that the prevalence of endoparasitic paramphistomum sp. in sambar deer is 100% while in spotted deer is 71.42%, the prevalence of endoparasit Trichuris sp. on Sambar deer is 0% whereas in spotted deer is 14.28%. This indicates that the prevalence of Paramphistomum sp. higher than the prevalence of Trichuris sp. This is because the growth and development of helminth endoparasit can be influenced by environmental factors where the host is located. According to the results of physical-chemical factor examination, the temperature at which the stool sampling location is 28°C, air humidity by 50% and soil moisture by 80%. This is in accordance with [14] statement, which stated that the life cycle of the worm parasite depends on suitable environments, especially high humidity and sufficient temperature (± 27°C), the condition is necessary for the development of mirasidium phase to metacercaria phase of Paramphistomum sp. While the optimum temperature for Trichuris sp. to growth is 30°C, so maybe just a little of Trichuris sp. egg which can survive because the environment is not suitable for the development and growth for Trichuris sp.

Environmental conditions outside the host body greatly affect the emergence of worms infestation include temperature compatibility, humidity and availability of oxygen. Suitable environments allow the worm eggs that come out with the feces to hatch and develop into infective larvae that will infest the new host. This means that the more ideal the environmental conditions, the chances of the emergence of worm infestation cases will be greater. The life of the parasite is strongly influenced by external factors that directly or indirectly contribute to the survival of the parasitic life cycle. A harmonious environment for parasite growth and breeding accompanied by susceptible hosts has a direct correlation with the process of parasitism.

Table 3 it can be seen that the prevalence of Paramphistomum sp. on the sambar deer is higher than the spotted deer, this may occur because the weight of sambar deer is bigger than the spotted deer so the consumption of feed is also more this causes the chance of Paramphistomum sp. infection. The weight of sambar deer is bigger so that the feed consumption is bigger compared to the spotted deer. Intensity of endoparasit Paramphistomum sp. attack on the Sambar deer is 39.6 whereas in spotted deer is 37.4 and the intensity of endoparasit Trichuris sp. attack on the Spotted deer is 2. This shows that the intensity of the endoparasitic attack of Paramphistomum sp. against sambar deer and spotted deer is still in the category of moderate intensity and intensity of Trichuris sp. endoparasit attack against the spotted deer included in the category of minor attacks. The intensity value of the endoparasit attack of Paramphistomum sp. on the sambar deer and the spotted deer show an intensity value that is not much different. This is because both types of deer are placed in the same cage, the same feeding and drinking.

In Table 3 it can also be seen that Sambar deer is not infected by endoparasit Trichuris sp. This is because genetic variation and host resilience have an effect on parasitic infections. Genetic variation in one animal type affects its resistance to parasitic infection. The host immune level also affects the prevalence of infection. General parasitic worm infection runs chronic which caused by weak natural...
defenses and the ability of parasitic worms to circumvent defensive-specific host defenses, the weaker the host defensive body's resistance, the more it is likely to be infected [9].

4. Conclusion

The type of endoparasit in the sambar deer's feces is *Paramphistomum* sp. with a prevalence of 100% always category and intensity value of 39.6 with medium parasite category. In spotted deer there are 2 types namely *Paramphistomum* sp. with prevalence of 71.42% Usually category and intensity value is 37.4 with medium parasite category and *Trichuris* sp. with prevalence of 14.28% often category and intensity value of 2 with light parasite category.

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