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Identification of Digestive Tract Worms in Javan Gibbons (*Hylobates moloch*) at Maharani Zoo

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ABSTRACT

Worm infections in Javan gibbons often do not cause clinical symptoms, but have an impact on the health and performance of Javan gibbons, so a fecal examination is needed to determine the presence of worm infections in Javan gibbons. The aim of this research is to identify digestive tract worms that infect Javan gibbons at Maharani Zoo. The research was conducted on 3 Javan gibbons consisting of 2 males and 1 female with an age range of 6-14 years and a body weight of 4-6 kg. Macroscopic identification of worms in Javan gibbons showed an abnormality in one of the Javan gibbon's feces. The feces abnormality is in the form of a very soft consistency, with a brownish yellow color, and the feces has a foul odor. Microscopic identification of worms in Javan gibbons showed positive results for the presence of eggs and larvae Strongyloides sp. in one of the Javan gibbons. The Strongyloides sp. worm larvae identified were rhabitiform. The cause of worm infections in Javan gibbons was due to the vegetable feed given, namely water spinach and mustard greens, being contaminated with Strongyloides worm eggs. Prevention needs to be done to prevent contamination of worm eggs, including washing the vegetables.

Keywords: *Egg worm, Flotasi, javan gibbon, Rhabitiform, Strongyloides sp.*

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INTRODUCTION

Maharani Zoo is one of the ex-situ conservation areas in East Java. Maharani Zoo has various types of primates that are collected and kept, one of which is the Javan gibbon (*Hylobates moloch*). The Javan gibbon is the only type of lesser ape found on the Island of Java. The Javan gibbon is one of nine species belonging to the *Hylobatidae* nation found in Southeast Asia (Febrissa & Rinaldi, 2020). The Javan gibbon's distribution covers forest areas in West Java and parts of Central Java. The Javan gibbon occupies lowland to hilly tropical rainforests up to a height of 1500 meters above sea level. The distribution of Javan gibbons in West Java is in the Mount Gede Pangrango National Park, Mount Halimun National Park, Ujung Kulon National Park, Mount Simpang

and Leuweng Sancang Nature Reserves, while in the Central Java area around Mount Slamet and the Dieng Mountains (Ario et al., 2011).

The population of Javan gibbons is decreasing in Indonesia, one of the reasons being disease problems. The disease that primates are susceptible to is helminthiasis. Helminthiasis is a worm infection in animals that can be caused by one or more types of worms (Vu et al., 2021). The types of worms that can infect primates are *Trematode* worms, *Cestodes* and *Nematodes* (Mattioli et al., 2016; Siagian et al., 2021). Worms that often infect primates are generally from the *Nematode* phylum, namely *Strongyloides* sp (Ningtias et al., 2023), *Trichuris trichuria* (Siagian et al., 2021), *Trichostrongylus sp* (Kharismawan et al., 2022). These nematode worms are often found in Javanese gibbons kept in ex-situ rehabilitation or conservation centers. Worm infections in Javan gibbons often do not cause clinical symptoms, but have an impact on the health and performance of Javan gibbons. The long-term impact can cause death and of course can be transmitted to other animals and humans (Tolistiawaty et al., 2016), so feces examination is needed to determine the presence of worm infections in Javan gibbons (Siagian & Tiuria, 2018).

Rahmah et al., (2013), explains that the way to diagnose digestive tract worms is by examining feces to determine the presence of worm eggs. Worm eggs are released by female worms after mating. Worm infections can be transmitted through environmental and internal factors. Environmental factors such as feed consumed by animals that has been contaminated with worm eggs. Fecal examination is an initial detection to find out if an animal is infected with worms. Information regarding worm infections in Javan gibbons in ex-situ conservation is very important to know as a guide in animal health management to support the preservation of Javan gibbons (Sinaga et al., 2016). This research aims to identify digestive tract worms that infect Javan gibbons at Maharani Zoo.

METHOD

Sample and Research Design

The research was carried out at Maharani Zoo which is located in the Lamongan area, East Java. This research used a sample of 3 Javanese gibbons owned by Maharani Zoo including 2 males and 1 female. The age range for Javan gibbons is 6-14 years and the body weight range is 4-6 kg. The procedure for examining worms in Javan gibbons includes collection of fecal samples, macroscopic and microscopic examination of feces and identification of the results.

Tools and materials

Tools used for sample collection and stool examination include spoons, plastic zip locks, permanent markers, slide glass, cover glass, dropper pipettes, cotton buds, beaker glasses, stir sticks, toothpicks, digital scales, latex gloves, masks, tea strainers, rack and test tubes, microscope, ice box and digital camera. The materials used in fecal examination are saturated sugar salt solution, distilled water, and Javan gibbon feces samples (Siagian & Tiuria, 2018).

Feces Sample Collection

Collection of Javan gibbon feces samples at Maharani Zoo was carried out in the morning when sanitation was carried out in the Javan gibbon enclosure and waiting for the Javan gibbon to defecate. The goal is to get a fresh stool sample. Javan gibbon feces collected from right under the cage using a spoon or shovel and placed it in a plastic ziplock. Plastic ziplock ziplocks containing feces are labeled using a marker to identify the animal. This identity consists of the name of the animal, the date and time the feces were collected. Fresh feces are immediately transported in an ice box and stored at a cold temperature in a refrigerator (refrigerator). Natalia (2019) stated that stool samples that are not immediately examined must be put in the refrigerator at a temperature of 4-6 0 C until examined. Stool samples should not be stored in the freezer because endoparasite eggs will usually be damaged if they are frozen. Feces can be stored at room temperature for < 1 hour. The preservative that is often used is a 5-10% formalin solution with a ratio of 1 part feces to 3 parts formalin. Jumriah (2013), fecal samples are stored for a maximum of 3 days if using formalin preservative, and 1 day if using refrigeration after collection.

Macroscopic Examination of Feces

The procedure for macroscopic examination of feces is by observing the feces with observation parameters including examining color, odor, consistency and mucus, and seeing with the naked eye the presence of adult worms that come out with the feces (Abdul et al., 2020; Setya, 2013).

Microscopic Examination of Feces Using Native Methods

The native examination procedure is that a Javan gibbon feces sample is taken using a toothpick then smeared on a glass object and given 3 drops of distilled water and homogenized. The sample was covered using a cover glass and observed using a microscope with a magnification of 100 and 400 times. This procedure is in accordance with (Zajac et al., 2012; Sofia, 2017).

Microscopic Examination of Feces Using The Flotation Method

The stool examination procedure uses the flotation method, namely a stool sample of 4 grams is weighed. Feces and a saturated sugar salt solution of 56 grams were put into a beaker and then homogenized. The solution was then filtered using a tea strainer 3 times. The final filter is inserted into the test tube until it forms a convex meniscus, then covered with a cover glass and left for ± 15 minutes. The goal is that the saturated salt and sugar solution can float the worm eggs and the worm eggs will stick to the cover glass. The cover glass was then placed on the object glass and observed with a microscope at 100 and 400 times magnification (Siagian & Tiuria, 2018).

Data analysis

Research data obtained from observations and examinations are analyzed descriptively.

RESULT AND DISCUSSION

Signalement

Signalement is the identity or self-identity of an animal which is a distinguishing characteristic that differentiates it from similar animals (Pramono, 2019). The main components of the signalements are the name of the animal, type of animal, nation or race, gender, age, skin and hair color, body weight and special characteristics (Oriza, 2017). Javanese gibbon signalements at Maharani Zoo, East Java are presented in Table 1.

Table 1. Javanese gibbon signalement at Maharani Zoo

Name	Sex	Age (Year)	Hair Color	Body Weight (kg)
Poki	Male	14	Grey	6
Moki	Female	13	Grey	6
Momo	Male	6	Grey	4

Macroscopic Examination Identification Results

Based on Table 2, the results of the macroscopic examination of the three Javan gibbon feces samples show that the Momo Javan gibbon's feces have a very soft consistency, with a brownish yellow color, the feces have a foul odor, no worm fragmentation, mucus and blood were found. Momo's feces are macroscopically different from the feces of the other two Javan gibbons. Macroscopically, Momo's feces showed abnormal characteristics in the parameters of the shape and consistency of the feces, so based on macroscopic observations it was suspected that he was infected with worms.

Table 2. Results of macroscopic examination of Javan gibbon feces at Maharani Zoo

Parameters of examination	Macroscopic Examination Results		
	Poki	Moki	Momo
Consistency	Soft	Soft	Very soft
Color	Yellow	Yellow	Brownish yellow
Smell	Typical Javanese gibbon feces	Typical Javanese gibbon feces	Rotten
Worm fragmentation	There isn't any	There isn't any	There isn't any
Mucus	There isn't any	There isn't any	There isn't any
Blood	There isn't any	There isn't any	There isn't any

The characteristics of normal Javan gibbon feces are yellow to blackish brown, shaped like human feces but smaller in size, there is no blood and mucus, the consistency is soft and not watery (Yazthi, 2010). Javan gibbon's hard feces usually have been dry for a long time, while fresh feces are relatively softer. Clinical symptoms of endoparasites are characterized by diarrhea, liquid feces mixed with mucus and red blood (Dewi & Nugraha, 2007).

Microscopic Examination Identification Results

The results of microscopic examination of three Javan gibbons at Maharani Zoo using the native method and the floating method showed positive results for one Javan gibbon named Momo. The presentation of worms in Javan gibbons at Maharani Zoo was 33.33%. The type of worm eggs found in the flotation examination were nematode eggs, namely *Strongyloides* worm eggs (Figure 1), apart from that, *Strongyloides* worm larvae were also found (Figure 2). The results of microscopic examination of Javan gibbon feces at Maharani Zoo are shown in Table 3. The characteristics of *Strongyloides* worm eggs found in Javan gibbon feces at Maharani Zoo are that they are oval in shape, with a thin albumin layer on the walls and there are larvae inside. The characteristics of *Strongyloides* eggs found are in accordance with research conducted by (Padmadinata et al., 2016). According to Fadli et al., (2014), explained that worm eggs from the *Strongyloides* sp type *Nematode* have an oval morphology, have a thin membrane, and embryos measuring 40-50 x 20-30 µm.

Table 3. Results of microscopic examination of Javan gibbons

Name	**Microscopic Examination Method**		
	Native	**Flotation**	**Result**
Poki	Negative	Negative	-
Moki	Negative	Negative	-
Momo	Positive	Positive	*Strongyloides* egg worm *Strongyloides* worm larvae

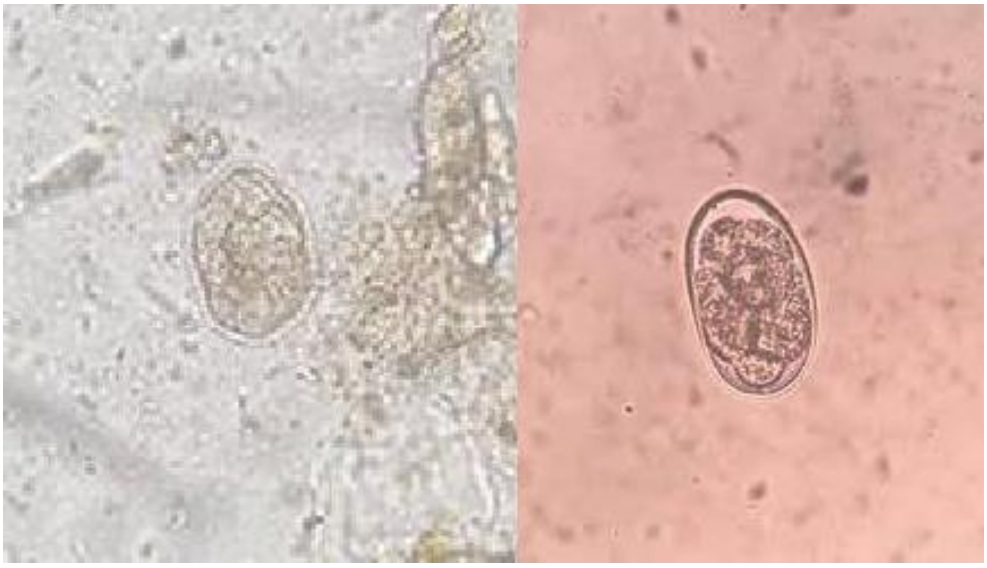

Figure 1. *Strongyloides* worm egg. (A) Examination results; (B). According to (Madani et al., 2021)

The results of identification of *Strongyloides* worm larvae in Javan gibbons at Maharani Zoo showed that the type of nematode worm had a *rhabditiform* esophagus shape, and was long in shape (Figure 2). The characteristics of the *Nematode* worm

larvae show the larval morphology of the *rhabditiform* larvae type *Strongyloides* worm. These findings are in accordance with the opinions of (McDonald & Moore, 2017; Soedarto, 2011). According to the statement by (Ideham &Suhintam, 2014), *Strongyloides sp* larvae are classified into two types, namely rhabditiform larvae and *filariform* larvae. *Rhabditiform* larvae are ± 25 microns long and ± 16 microns wide, have a short oral cavity accompanied by a pair of esophageal enlargements that fill the anterior quarter of the body. *Filariform* larvae have a slim and long morphological shape, have no sheath, have a forked tail and have an esophagus that is half the length of their body.

Figure 2. *Strongyloides* worm larvae, (A) Examination results (B) according to (Torres, 2018)

Javan gibbons infected with *Strongyloides* worm eggs at Maharani Zoo are thought to have been caused by the food the Javan gibbons ate. The Javanese gibbon's food is mustard greens and kale. The vegetables that will be given to the Javan gibbons at Maharani Zoo are obtained from the market. These two types of vegetables are the most likely source of contamination in *Strongyloides sp* worm infections, because the process of collecting these vegetables is not clean and vegetables are usually washed with ditch water or river water located around the garden. The vegetables are then marketed after being harvested and washed. Vegetables from the market are supplied to Maharani Zoo in the afternoon and will be stored in the feed warehouse without being washed first. The feed will be distributed to the animals in the morning. This cause is in accordance with the opinion of Ario (2017), who stated that the cause of worm infections in Javan gibbons is generally due to the food consumed by these animals. The food consumed by Javan gibbons is contaminated with worm eggs.

Dewi (2017) revealed the same thing based on the results of her research on vegetables contaminated with worm eggs. The results of his research showed that there was digestive tract worm egg contamination of vegetables sold in the market. The vegetables examined were spinach, kale, lettuce, mustard greens, and so on. The

results of Dewi's research are known to show that the prevalence of worm egg infections in these vegetables is 80%. The prevalence of worm egg infection is very high and it is dangerous if vegetables are consumed immature. Javanese gibbons are given vegetables raw, even though they have been washed, some worm eggs are still left in the raw vegetables.

The type of adult worm that is thought to have *Strongyloides* worm larvae and eggs in the Javan gibbon at Maharani Zoo is the *Strongyloides sp*. worm. The *Strongyloides sp* worm is a digestive tract *Nematode* worm that often attacks primates (Murdayasa et al., 2019). Adult *Strongyloides sp* worms with female sex are characterized by measuring 1 mm in length and 0.05 – 0.07 mm in width, an esophagus located in the anterior 1/3 of the worm's body, and a pair of uterus containing a series of segmented eggs. Male *Strongyloides sp* worms are characterized by measuring 0.7 mm in length and 40 - 50 µm in width, having 2 spicules, and the posterior end curves ventrally (Admojo, 2012). *Strongyloides sp* worms have a free life cycle. These worms can cause autoinfection. Most clinical manifestations show asymptomatic symptoms, but can turn into a fatal fulminant disease. This condition depends on the host's immune system (Maryanti & Kurniawan, 2010).

According to Page & Judd (2018); Gandahusada (2009), *Strongyloides sp* worms have a life cycle, namely direct cycle, indirect cycle and auto infection. The direct cycle in *Strongyloides sp* worms occurs 2-3 days in the soil. Rhabditiform larvae in this direct cycle will turn into filariform larvae. If filariform larvae penetrate the primate's skin, the larvae grow and enter the venous blood circulation and then through the right heart to the lungs. These worms begin to mature and penetrate the alveoli, then into the trachea and larynx. These adult worms cause a cough reflex when they are in the larynx. As a result, the *Strongyloides sp* worm is swallowed by the host and enters the duodenum and becomes an adult. The indirect cycle of rhabditiform larvae turns into adult worms, both male and female. Female worms will produce eggs which hatch into rhabditiform larvae. Within a few days, rhabditiform larvae will produce infective filariform larvae and enter the host's body. Auto-infection of rhabditiform larvae becomes filariform larvae in the intestine or in the area around the anus (perianal). These filariform larvae will penetrate the perianal mucosa or skin and then develop inside the host's body.

According to Siagian et al., (2021), Javan gibbons in primate captivity can be infected with *Trichurid* worm eggs. The types of worms that commonly attack primates are *Ascaris lumbricoides, Trichuris trichiura, Strongyloides sp, Enterobius sp,* and hookworms. Mogi & Simarmata (2021), several factors influence the spread of worm infections in general, namely the host, agent and environment. Infection occurs when there are infective larvae as a source of infection and the availability of a sensitive host in a place and environmental conditions that cause contact between the two. Worms are an infectious disease caused by worms that can infect humans and animals. This disease is called a zoonotic disease. Poor sanitation and hygiene are factors in the transmission of worm infections (Aziz, 2012). Muangkram et al., (2006) explained the clinical symptoms of *Strongyloides sp* worm infection, namely depression, anorexia, weight loss and mild to severe diarrhea such as dysentery.

Helminthiasis Control Measures

Helminthiasis control measures include preventive and curative measures. Preventive action is in the form of efforts to prevent disease, while curative action is in the form of efforts to treat disease. The preventive measures taken by Maharani Zoo in an effort to prevent disease in Javan gibbons include carrying out a routine deworming program every 6 months and sanitizing the cage. The worm medicine that is usually given is oxfendazole 225 mg caplets. Curative action is given to Javan gibbons infected with worms, namely by giving the worm medicine oxfendazole 225 mg caplets. According to Baaka et al., (2017), oxfendazole can kill *Nematode* worms. According to Anna (2013), stated that the type of worming medication must be adjusted to the type of worm that infects it, however, giving the same worming medication can cause a decrease in the effectiveness of the worming content. Long-term use of drugs will result in a phenomenon called drug tolerance, so there is a need to increase the dose of the drug to get the desired drug effect.

CONCLUSION

The results of macroscopic identification of worms in Javan gibbons at Maharani Zoo showed abnormalities in one of the Javan gibbon's feces. The stool abnormality is in the form of a very soft consistency, with a brownish yellow color, the stool has a foul odor, there is no worm fragmentation, mucus and blood. The results of microscopic identification of worms in Javan gibbons at Maharani Zoo showed positive results, finding worm eggs and *Strongyloides* worm larvae in one of the feces using both the native and floating methods. Adult worms that have worm eggs and *Strongyloides* worm larvae, namely the *Nematode* worm *Strongyloides sp*. The cause of the *Strongyloides sp* worm infection in Javan gibbons at Maharani Zoo is thought to be because the Javan gibbon's feed in the form of mustard greens and water spinach is contaminated with *Strongyloides* worm eggs.

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