Veterinary Letters
ISSN 2581-2416
DOI: https://dx.doi.org/10.29244/avl.9.2.41-42
https://journal.ipb.ac.id/index.php/arshivetlett

Helminthic and protozoan coinfections in mona monkeys (*Cercopithecus mona*) at Batu Secret Zoo, Batu, East Java, Indonesia

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ABSTRACT: This case report originated from fecal examination of six mona monkeys, which lived together in a cage. The helminth eggs from the feces were evaluated microscopically using the native method. Six eggs of *Trichuris* sp. were found, and the monkeys were subsequently treated with Curcuma Plus® orally for 3 days, combined by 3 days of fenbendazole orally. On the 6th day, no *Trichuris* sp. eggs were found; however, *Entamoeba* sp. cysts were discovered. No *Entamoeba* sp. cysts were identified on day 13. Helminthic infections will frequently dominate during protozoal and helminthic co-infection stages. A protozoal infection can be recognized after the helminth infection, which was treated with anthelmintics.

Keywords:
Cercopithecus mona, *Trichuris sp., Entamoeba sp.*

■ INTRODUCTION

The mona monkey (*Cercopithecus mona*) is an indigenous human primate from the West African tropical forest. Their warm and humid tropical natural habitat provides an optimum environment for the development of infective eggs and larval stages of nematode helminths, such as *Trichuris* sp. (Hailu & Ayele 2021). *Trichuris* sp. is a type of soil-transmitted helminth that remains in the colon, consumes blood, and interferes with water absorption, causing diarrhea. Over time, this infection can lead to tissue damage and anemia (Riswanda & Kurniawan 2016). Li *et al*. (2015) reported that *Trichuris* sp. was primates most prevalent gastrointestinal parasite.

In addition to helminths, protozoa are also one of the most common parasitic agents that infect non-human primates. One of the pathogenic protozoan species frequently reported to infect nonhuman primates is *Entamoeba histolytica*. Pathogenic Entamoeba infections can cause many clinical symptoms such as diarrhea, anemia, and tissue damage, resulting in abortion and congenital defects (Murphy 2015).

The urgency of conducting endoparasite examinations on mona monkeys at Batu Secret Zoo arises from the potential health risks posed by these parasites, not only to the monkeys themselves, but also to other animals and humans in close contact. Mona monkeys in captivity are often exposed to environments that may facilitate the transmission of parasitic infections, particularly in zoos, where stress, confined living conditions, and close interactions with visitors can exacerbate susceptibility to infections. The objective of this case report is to describe helminthic and protozoan coinfections identified in mona monkeys at the Batu Secret Zoo, providing insights into their health status and improving captive management practices.

■ CASE

Anamnesis and Signalment: Fecal samples from six mona monkeys (four adults and two young monkeys) living in the same cage were collected and sent to the zoo clinic for routine check-ups. The fecal samples showed a semi-solid consistency. However, none of the monkeys showed any symptoms, had a good appetite, or had a good body-condition score. **Fecal Examination**: Helminth eggs were examined using the native method. A small fecal sample was collected using a stirring rod, mixed with NaCl 0.9%, and then homogenized, and dripped onto object glass. Fecal samples were observed under a light microscope (100x and 400x magnification). From fecal examination, eggs of *Trichuris* sp. were identified on the first day of routine checkups and on the fifth day after treatment. On the sixth day, *Entamoeba* sp. were identified in the fecal sample. **Diagnosis**: Helminthiasis and Amebiasis. **Treatment**: Curcuma Plus® per oral (0.5 mL for adult monkeys, 0.25 mL for young monkeys) and Fenbendazole (50 mg/kg weight) per oral for 3 days, both medications were mixed into feed.

Received: 19-02-2025 | **Revised:** 16-03-2025 | **Accepted:** 21-03-2025

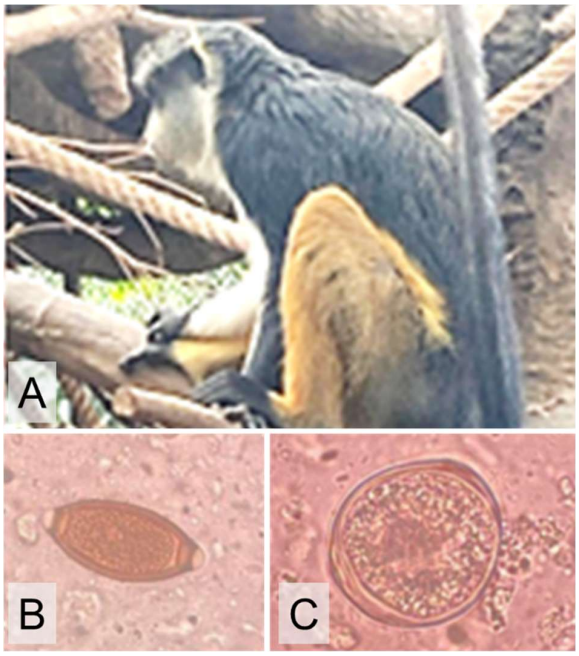

Figure 1 Image of endoparasites found in the fecal sample of (A) Mona monkey in the Batu Secret Zoo, (B) Trichuris sp. (400x magnification) and (C) Entamoeba sp. (1000x magnification).

■ RESULTS AND DISCUSSION

Seven *Trichuris* sp. eggs were detected under a light microscope on the first day of fecal examination. Mona monkeys received Curcuma Plus for 3 days, followed by the anthelmintic fenbendazole for 3 days. Curcuma Plus is a multivitamin containing curcuminoid, vitamin B1, vitamin B2, vitamin B6, vitamin B12, beta carotene 10%, dexpanthenol, and lysine HCl. Curcumanoids improve the immune system and prevent possible side effects of anthelmintics. Curcumin regulates pathways such as NLRP3 inflammation and NF-kB, which are essential for activating macrophages and producing cytokines such as IL-1β and TNF-α (Boroumand *et al*. 2018). Fenbendazole is a broad-spectrum anthelmintic with low toxicity and is well-tolerated by most species, even at six-fold doses (Sultana *et al*. 2022). Fenbendazole inhibits tubulin polymerization, a structural protein involved in cell proliferation, intercellular organelle transport, and cell secretion in parasites (Dogra *et al*. 2018).

Fecal samples were examined on day five after treatment, showing four eggs. On day six, no *Trichuris* sp. eggs were found, but three *Entamoeba* sp. cysts were found and disappeared by day 13. *Trichuris* sp. is a common parasitic helminth in non-humans; the most common species in non-human primates is *Trichuris trichiura*, which can infect humans. Mild infections are usually asymptomatic, but severe infections can cause enteritis, anorexia, gray mucoid diarrhea, and even death (Cale & Joslin 2014). Semi-solid feces indicated gastrointestinal issues caused by the parasites. *Entamoeba* sp. can be classified as pathogenic or non-pathogenic. *Entamoeba histolytica* is pathogenic, whereas *Entamoeba coli* is nonpathogenic. *E. histolytica* infections can cause severe gastrointestinal symptoms and liver abscesses (Li *et al*. 2015). The entamoeba species in mona monkey feces is unknown and requires identification to determine its pathogenicity and treatment.

Helminthic infections dominate protozoal infections during helminthic-protozoal co-infections (Mbuthia *et al*. 2021). Here, protozoan infection was observed after the helminthic infection was ameliorated by anthelmintic therapy. The absence of entamoeba cysts on days one and five, but their detection on day six, could be due to native fecal examinations missing mild infections. The cysts became detectable as the helminthic infection cleared, reducing the parasitic load and rendering the protozoan infection more visible. The disappearance of entamoeba cysts by day 13 without specific antiprotozoan treatment may be attributed to the host immune response. The immune-boosting effects of Curcuma Plus, with a reduced helminthic burden, enabled monkeys to clear protozoal infections.

■ CONCLUSION

Mona monkey (*Cercopithecus mona*) at Batu Secret Zoo was diagnosed with helminthiasis and amebiasis. Fenbendazole therapy was effective in eliminating the helminthiasis. Further identification of the *Entamoeba* sp. is required.

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