Prevalence of intestinal helminth parasites in wild and soft-release Bornean Orangutan (*Pongo pygmaeus*) in Lamandau Wildlife reserve, Central Kalimantan

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Abstract. Faeces samples were collected from 35 orangutans in Lamandau Wildlife Reserve. The orangutan consists of wild and soft release orangutan in four camp (Gemini, JL, Rasak, Buluh). Samples were collected in November until December 2017. Faeces were examined to measure the prevalence of gastrointestinal parasite in wild and soft-release orangutan. The examination performed by flotation and sedimentation (formalin-ethyl acetate concentration). The results showed the percentage of orangutan infected with gastrointestinal parasite was 91.4%. High prevalences were found for *Strongyloides* sp. (68.6%), Hookworm (71.4%), *Enterobius* sp. (20%) and *Trichuris* sp. (17.1%). Most orangutan infected with mixed infection parasite (62.8%) dominated by a combination between *Strongyloides* sp. and hookworm and only 28.6% infected with single infection.

1. Introduction

Orangutans (*Pongo* spp.) are the great ape species that endemic in Indonesia and Malaysia. In Indonesia, their distribution is restricted in Sumatra (*Pongo abeli* and *Pongo tapanuliensis*) and Kalimantan (*Pongo pygmaeus*). Orangutan is now classified as critically endangered species by the International Union for Conservation of Nature [1]. Orangutan also categorized by CITES as appendix one, a list including all plant species and wild animal threatened by international trade commercially. The population estimate of Bornean orangutan (*Pongo pygmaeus*) was only 55,000 orangutan in Kalimantan [2]. The main threats for these rapidly declining population are hunting, trade, and habitat loss.

Many conservation is performed to preserve the orangutan population. Wildlife reserve is one of the in-situ conservation method that protect and reintroduce orangutan to their native habitat. This program has been started in Kalimantan since early 1960 to release orangutan back to the wild. Nevertheless, most of conservation just focus on the forest restoration and forget about the orangutan health and diseases like parasite.

Parasite infections can have a serious impact on the health of orangutan. Some problems such as weight loss, pneumonia, loss appetite and anemia can be occurred by parasite infection. Furthermore, animal immunity to another diseases could be decreased and disturbed productivity [3,4]. There are...
many factors have been found which affect parasite infection such as environment variable, species characteristic, population factor, and host animal behavior [5].

Parasite can be transmitted between wild animal and reintroduction population, between both of these and other wildlife species, and between great apes and human [6]. Therefore, animal which infected with parasite should be treated to prevent transmission of parasite between animal and human and vice versa. Close relationship between human and orangutan genetically may spread transmission of parasite. Some of helminth parasites (e.g. Hookworm, *Strongyloides* and *Trichuris*) can be transmitted between orangutan and human (zoonotic diseases). Very little information about parasite in a primate, especially in orangutan. The information about parasite in conservation is needed due to proper administered anthelmintic. The aim of this study was to identify and measure the prevalence of helminth parasites in Lamandau Wildlife Reserve. Understanding about parasite infection is very important to ensure the success of reintroduction and conservation efforts.

2. Materials and methods

2.1. Subject

We collected samples from free-ranging (wild) and soft-release (wild caught and rescue orangutans that are released into the wild after reintroduction program) Bornean orangutan. Samples were collected in Lamandau Wildlife Reserve in Kotawaringin Barat, at Central Kalimantan. We collected samples in four different camps (Gemini, JL, Buluh and Rasak) between November-Desember 2017. Orangutans in Lamandau Wildlife Reserve are *Pongo pygmaeus wurmbii* subspecies.

![Figure 1. Helminth eggs from faeces (a) *Strongyloides* sp. (b) Hookworm (c) *Enterobius* sp. (d) *Trichuris* sp.](image)

2.2. Sample collection and analysis

Faecal samples were collected from both wild and soft-release orangutans. Of each freshly passed fecal mixed with formalin directly after collection. We are assisted by experienced staff In other to avoid repeated sampling from orangutans. To identify the worm eggs, stool examined using several methodes such as flotation and sedimentation (formalin-ethyl acetat concentration) methodes in the laboratory of Helminth, Bogor Agricultural University. The data from feaces analyzed descriptively.

3. Results and discussion

A total of 35 faecal samples from free ranging/wild (25 samples) and soft release (10 samples) orangutans were examined. Overall, 32 orangutans (91,4%) infected with parasites. Eggs of four genera of helminth were identified (Tabel 1). Eggs from *Strongyloides* sp. measured 50-63 x 26-35 μm, oval, smooth thin shell, contain larva. Hookworm eggs measured 60-75 x 30-40 μm, oval, morula (8-16 cells), smooth thin shell, but were not identified to genus level. Eggs of *Enterobius* sp. measured 50-60 x 20-32 μm, oval, thin shell, asymetrical shape. *Trichuris* sp. eggs measured 50-56 x 21-25 μm, bipolar plugs, thick shell and brown colour.
Table 1. Prevalence of helminth parasites in wild and soft release orangutans.

| No. | Parasites    | Positive | Total (%) |
|-----|--------------|----------|-----------|
| 1.  | Strongyloides sp. | 22 | 3 | 68.6 |
| 2.  | Hookworm     | 19 | 5 | 71.4 |
| 3.  | Enterobius sp. | 5  | 2 | 20   |
| 4.  | Trichuris sp. | 2  | 4 | 17.1 |

Overall prevalence of intestinal in samples from orangutans in wild was higher than in soft-release orangutans, except for *Trichuris* sp. Parasite Infection dominated by *Strongyloides* sp and hookworm. Both of them commonly transmitted by soil (soil transmitted helminth) and penetrate into the skin. Wild orangutan have more occasion for direct contact with soil and feces from other orangutans than soft-release orangutan. Orangutan lives on the tree naturally. But some of wild orangutan spend more time on the ground. Living on the ground may increase exposure to feces and increase infection risk of parasite [7]. Huffman *et al.* (2013) also suggest that primates which contact more with soil have higher possibility to infected with parasite [8]. Some of study also shown a high prevalence of *Strongyloides* sp. infection in orangutan [9-11].

*Trichuris* sp. infection was higher in soft-release than in wild orangutan. Infection could be occurred when soft-release orangutan are released in reintroduction program. Some of orangutan seen playing on the ground and occasionally eat the soil. Moreover, soft-release orangutan have more contact with human as well. It is observed in the orangutan population in Sumatra, with a high incidence of parasitic diseases in orangutans, given frequent contact between wild orangutans with visitors [12]. Interaction degree with human is an important factor in parasite transmission in primates [13].

Some factors have important role in parasite infection, such as behavior, physical condition, nutrition, age, body weight, sex, immunity and social status of orangutan. Another important factor are the weather, the density of orangutans, the degree of contact with humans, human activity in hunting, and cutting down forests and all the factors that important role in terms of climate change [14]. Under conditions of stress and malnutrition, immune conditions of orangutans can be decreased, thereby allowing the parasite infection into the body of the orangutan.

Amount of 35 orangutan feces that were taken from four different camp. Positive samples which were collected from gemini, jl, buluh and rasak were (12/12), (5/6), (7/7) and (8/10) samples respectively. Gemini camp is the highest camp in Lamandau wildlife reserve infected with parasites. Besides having large orangutan population, forest in gemini is also habitat for several animal, such as apes, wild boar, deer and bekantan (proboscis monkey). Several studies describe the association between animal density and parasite prevalence based on the hypothesis that there is likely to be increased transmission through increased contact (whether direct or indirect) between members of a more dense population [14,15]. This condition also allows the occurrence of parasite transmission between other primates or animal species in the forest.
Most of parasite infection were dominated by mixed infection (42.8%) than single infection (28.6%). Mixed infection also dominated by Strongyloides sp. and hookworm. Enterobius sp. and Trichuris sp. usually appear in mixed infection with more than two parasites as well. A parasite-induced immunosuppression caused by infection with one intestinal helminth species may explain the spread of a secondary infection [16]. In the other research, there was a positive association between the infection with Strongyloides spp. and Trichuridae in Proboscis monkeys in Borneo [17]. It is mean that co-infection in helminth parasite has high possibility to occur.

Orangutans share 96.4% of their genetic information with humans [18], which is an important consideration due to the potential for zoonosis in surrounding human populations. Some parasite species found in orangutans are typically zoonotic and anthroponotic [19]. Parasites transmission from human to orangutan also needs an attention as well. Important sources of these infections are staff, ranger, volunteers, researchers, tourists, guides, or local people. A better understanding of the relationship between orangutans and parasitic in nature, can make the key to the success of reintroduction strategy and repopulation of orangutans and protect all primates in natural biodiversity.

4. Conclusion
In this study, we found a high prevalence of overall parasite infection (91.4%) in Lamandau Wildlife Reserve where the infection in wild orangutan is higher than in soft-release orangutan. Parasite infection were dominated by Strongyloides sp. and hookworm. Mixed infection is more often be found than in single infection in overall parasite infection. We also propose that further factor, such as behavior affected the parasite transmission in orangutan.

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