Parasitic load and self-medication of Bornean Orangutan
(*Pongo pygmaeus ssp. wurmbii*) in Sebangau National Park
Central Kalimantan Indonesia

A Panda¹,²*, T S Djohan³, W T Artama⁴,⁵ and D Priyowidodo⁶

¹ Post Graduate Program, Faculty of Biology, Universitas Gadjah Mada, Jalan Teknika Selatan, Senolowo, Sinduadi, Mlati Sleman, Yogyakarta, Indonesia 55281
² Dept. of Biological Science, Faculty of Mathematics and Natural Science, University of Palangka Raya, Central Kalimantan Indonesia 73111 A
³ Ecology and Conservation Laboratory, Faculty of Biology, Gadjah Mada University, Yogyakarta, Indonesia
⁴ Biochemistry Laboratory, Faculty of Veterinary Medicine, Gadjah Mada University, Yogyakarta Indonesia
⁵ One Health Collaborating Centre, Gadjah Mada University, Yogyakarta Indonesia
⁶ Dept. of Parasitology, Faculty of Veterinary Medicine, Gadjah Mada University, Yogyakarta, Indonesia

* Corresponding author: adventus.panda@mail.ugm.ac.id; apanda@mipa.upr.ac.id

**Abstract.** Around 27.5% of human parasites have been found in primates. It is proposed that this parasitic load prevalence is not reflected in the specificity of the host or hosts capable of battling parasite infection. Since the dynamic of the field contributes to a broader understanding of host-parasite relationships, it is critical to proving what hosts capable of, in the first place. Therefore, the purpose of the study was to present adequate evidence of the Orangutan's capacity to medicate itself. In September – October 2017, a swift assessment was carried out in the Punggualas area, Sebangau National Park (SNP). As per behavior procedure, a total of 72 hours follows on habitual Orangutan, on which focal behaviors, including their social behavior, have been reported every 2 minutes. All data is evaluated descriptively. Three focal orangutans, consisting of two dominant males, namely Eboy and Sander, and one independent female with an infant. The results showed that two male individuals revealed no signs of self-medication activity in their natural diets, only feeding activity. In the meanwhile, the female shows the actions. While we did not specifically find out the symptom they may have, the research outcome gained ample evidence that self-medication is performed by the Orangutan.

**Keywords:** Zoopharmacognocy, Orangutan, Sebangau National Park, Parasitic load, Non-Human Primates

1. Introduction
The research of non-human primate parasites (NHPs) has evolved enormously in the last few decades. Their occurrence has been profound, as has the latest morphological or even molecular classification. Nonetheless, some 27.5% of human parasites have also been identified in primates. [1]. It is proposed that this parasitic load prevalence is not mirrored in the specificity of the host or hosts capable of
combating parasite infection. Often referred to as zoo-pharmacognosy, the animal can medicate itself. The underlying concept of this language is that animals use plants’ secondary and/or non-nutritional elements to treat themselves [2]. This ability has been well documented since 1987 in the Chimpanzees [3] and the other apes [4–7]. Several studies in the bird taxa have related to these abilities [3] in the Sahara Desert region, Africa, and the Sebangau Region of Central Kalimantan [8]. The use of soft tissue plant *Vernonia amygdalina* Del. (Compositae) by Chimpanzees (*Pan troglodytes*) and Mahale communities, Africa, to address complaints of nematode worms [9]. Meanwhile, the same pattern was reported for *Commelina* sp. (Commelinaceae) by Orangutan (*Pongo pygmaeus wurmbii*) and communities in the northern part of Sebangau, Central Kalimantan [8]. The use of this plant is suspected of being anti-inflammatory because this plant is treated by rubbing on the joints or bone swelling, both by Orangutan and the local population. Such evidence has raised concerns about the parasitic strain on Orangutans. Are they about permanence? The Orangutan will defend against such an infection, either inadvertently spread, or otherwise.

**Table 1.** Compilation report on Self-Medication (after Huffman 2003 and Morrogh-Bernard 2008*)

| Animal Taxa | Plants species/Family | Description on utilities |
|-------------|-----------------------|-------------------------|
| Malay elephant | *Entada schefferi* (leguminosae) | For stamina before a long walk, possible pain killer |
| African elephant | *Boganiceae sp.* | Induce labor; used by Kenyan ethnic group to induce labor and abortion. Similar story related to Huffman about observations made in Tanzania |
| Indian Bison | *Holarrhena antidysenterica* (Apocynaceae) | The bark is regularly consumed. Species name suggest anti-dysenteric action |
| Wild Indian Boar | *Boarhavia diffusa* (Nyctaginaceae) | Roots are selectively eaten by boar and are traditional Indian antihelmintic |
| Pigs | *Punicum granatum* (Punicaceae) | Roots sought after by pigs in Mexico |
| Indian Tigers, Wild dogs, bears, civets, and Jackals | *Careya arborea* (Barringtonaceae), *Delbergia latifolia* (Leguminosae), etc. | The alkaloid in roots toxic to tapeworms |
| South American Wolf | *Solanum lycocarpom* (Solanaceae) | Fruits of various species eaten by large carnivores. Possibly helps in the elimination of parasites ingested along with contents of intestines of herbivore prey |
| Asiatic two-horned rhinoceros | *Ceriops candoleana* (Rhizophoraceae) | Rotting fruit said to be eaten to cure stomach or intestinal upset |
| Black howler monkey | | Tannin-rich bark is eaten in large amounts enough to turn urine bright orange. Possible use in control of bladder and urinary tract parasites |
| Orangutan* | *Commelina* sp. (Commelinaceae) | fur-rubbing using *Commelina* leaves; anti-inflammatory |

Therefore, the study aimed to present adequate evidence of the Orangutan's capacity to medicate itself. Also, it seeks a hypothetical standpoint in Sebangau National Park about parasitic load over wild orangutan.
2. Methods

2.1. Time and location
The study was conducted in the Punggualas area, the western part of Sebangau National Park Central Kalimantan (Figure 1). It is the area on which several biodiversity research, including the orangutan behavior, has been running since 2010. The rapid assessment was launched in around September to October 2017, whereas we spot numbers of Orangutan activity during September- November periods, in the past several years.

![Figure 1. The map of Sebangau National Park, Central Kalimantan, Indonesia (Source: WWF-Indonesia, Central Kalimantan)](image)

2.2. Orangutan (P. p. Wurmbii)
Orangutan was followed according to the standardized protocol on orangutan study. Behavioral observations using a grid system; wherein the Punggualas area, there are four (4) main transects, each having a length dimension of 1000 m; in each major transect, sub-transect is divided in every 100 m, so that the intersection of each path, yields a grid of 100 x 100 m (10,000 m² = 1 Ha).
Thus, the study area is $4 \times 100 \times 10,000 \text{ m}^2 = 4,000,000 \text{ m}^2 \approx 400 \text{ Ha}$. The team regularly travels through the main transect, looking for signs of orangutan presence (nests, long call). At the time of the encounter, the team did not record the behavior but did habituation. Habituation aims to familiarize Orangutans with the presence of observers, so gradually feel uninterrupted. The team keeps (follow) until the individual makes the night nest. At the time the Orangutan leave the nest the next day, the team should be located not far from the Orangutan nest, so that when daily activity begins, so is the behavioral record. Behavior is recorded at two minutes intervals (2 x 60 sec), according to the standard of observation of Orangutan study. If Orangutans are still in the grid, this activity will be repeated the next day, otherwise, (they’re off the grid), the record is completed.

2.3. Faecal collection
We collected a small portion of Orangutan faecal samples, stored them in a vial, contains 10% formalin. Since there was not possible to conduct on-site parasites recovery techniques at the moment, we will cross-reference to the study of [10–12]. As soon as arrived at the field camp, the sample was processed for transport to the Zoology Laboratory, University of Palangka Raya (UPR). The sample was processed using fecal floatation and sedimentation techniques [13].

3. Results and Discussions
Two males (Eboy, Sander) and a female-infant (unknown 01) cover a total of 72 hours of orangutan (Figure 3). As they feed their natural feeding sources, the first-mentioned individuals have shown no sign of zoo-pharmacognosy behavior. The female individual, meanwhile, suggests such behavior. The selective feeding of the young leaves of *Mezzetia* sp., *Dyera lowii*, and *Ilex cymosa* bark is distinguished by this.

**Figure 2.** Map of transect network of Orangutan behavior observation at Punggualas Research Station (Source: WWF-Indonesia, Central Kalimantan)
We proposed that this activity was a preventative measure against conditions of exhaustion. The ingestion of a mixture of three species of plants is thought to be consistent with endurance. This conclusion emerged after a female orangutan that followed for three consecutive days no longer appeared at the time of the next meeting. Although it is not clear whether the aforementioned plant was used to combat the Wild Orangutan's intestinal parasites, it is obvious that something that has happened is treated by Orangutan itself for certain behavior. Analysis of each portion of a secondary metabolite can be performed well, such as the research [14]. Selective feeding on particular species, however, is suspected of providing advantages not only for orangutans but also for humans concerning self-medicated behavior. To look at orangutan feeding habits relevant to care actions, it is really helpful to list orangutan diets at site-specific and collect a list of all feeding materials. In the nearby villages, the two varieties of plants used by the traditional physician are Uncaria gambir and Pterandra galeata [15]. One of the two types of natural feed for orangutans is P. galeata, based on the list of orangutans feeding types. There is an imperative for the habitual orangutan to further explore self-medication behavior in their natural environment.

Since we were unable to recover parasites from our small portions of Orangutan fecal samples, we switched to creating checklists for Wild Orangutan intestinal parasites (Table 2), minus the number of captive orangutan observations. Therefore, as a reference for future work, we will establish the basis of the gastrointestinal parasite. In the wild Bornean Orangutan, Table 2 revealed the compilation work. Here, we can see that the parasite load was determined by the process of recovery that researchers deployed. While it originally represented the intent of the study, the wealth of parasites appears to vary among researchers.

**Figure 3.** Total hours (cumulative) on following the habituated Orangutans in the Punggulas area

| Habituated Orangutan | Total Hours |
|----------------------|------------|
| Eboy                | 10.5       |
| Sander              | 13.1       |
| unknown_01          | 41.1       |

| Total Hours | 10.5 | 13.1 | 41.1 | 54.7 |
Table 2. Gastrointestinal parasites in Wild (W) and Semi-Wild (SW) Bornean Orangutan; highlighted (bold printed) are species commonly recovered within sites.

| Descriptor         | [11]                                    | [10]                                    | [12]                                    |
|--------------------|-----------------------------------------|-----------------------------------------|-----------------------------------------|
| Location Site(s)   | Kalimantan, Danum Valley, Sabah, Malaysia | Kalimantan, Wanariset (East Kalimantan) | Kalimantan, Natural Laboratory, CIMTROP UPR, Sebangau, Sebangau Central Kalimantan |
| Species            | Pongo pygmaeus ssp. morio                | Pongo pygmaeus ssp. morio               | Pongo pygmaeus ssp. wurmbii             |
| Classification     | W                                       | SW, W                                   | W                                       |
| No. of Samples     | 73                                      | 167                                     | 9                                       |
| Fixative Solution  | 10% Formalin                            | 10% Formalin                            |                                         |
| Methods            | Morphology fecal examination            | Fecal floatation                        | Fecal floatation                        |
|                    |                                         | Fecal sedimentation                     | Fecal sedimentation                     |
|                    |                                         | SAFC                                    | MacMAsst & Baermann                     |
| Unicellular eukaryotic | Balantidium coli                     | Balantidium sp                          | Troglodytella abrassarti                |
|                    | Entamoeba spp.                          | Blastocystis sp.                        | Entamoeba histolytica/dispar            |
|                    | Entamoeba histolytica/dispar            | Endolimax nana                          | Entamoeba coli                          |
|                    | Chilomastix mesnili                     | Entamoeba histolytica/dispar            | Entamoeba coli                          |
|                    |                                          | Entamoeba hartmani                      |                                         |
|                    |                                          | Iodamoeba buetschlii                    | Unidentified protozoa                   |
|                    |                                          | Entamoeba spp.                          |                                          |
|                    |                                          | Chilomastix mesnili                     |                                          |
|                    |                                          | Giardia sp.                             |                                          |
| Nematoda           | Strongyloides sp.                       | Strongyloides sp.                       | Strongyloides sp.                       |
|                    | Strongyloides fuelleborn                | Trichurus sp.                           | Trichurus trichiura                     |
|                    | Trichurus sp./spp.                      | Ascaris sp.                             | Ascaris lumbricoides                    |
|                    | Strongyloides fuelleborn                |                                        | Trichostrongyulus sp.                   |
|                    | Pongobius foitovae                      |                                        | Hookworm                                |
|                    | Pongobius hugoti                        |                                        | Enterobius vermicularis                 |
|                    |                                          |                                        |                                          |
| Cestoda             |                                        | Hymenolepsis sp.                       |                                          |
| Trematoda           |                                        | Dicrocoelium sp.                       |                                          |

It was obvious that the fecal was apparently sampled once, or else the so-called collection of snapshot data. However, we can specifically claim that common parasites that were protozoans, i.e. genus
Giardia, Balantidium, Entamoeba, and Trichodomyelia, were recovered between sites. Strongylloides, Trichurus, and Ascaris are the common nematodes of the genus.

There is much to investigate for the study, later on, especially the linkage between terrestrial locomotion, dilution effects on the prevalence of parasites on wild Bornean Orangutan, specifically P. p. wurmbii. We propose that terrestrial locomotion will allow for open transmission over soil nematodes, while the impact of dilution will minimize the likelihood of direct transmission as well as prevent parasites from recognizing their particular target. Furthermore, as [16] to obtain the most accurate estimate of infection prevalence, researchers have recommended using individual-based study designs with repeated sampling of individuals, which will be an important point for further study design.

4. Conclusion
We can draw a conclusion based on the findings that the Orangutan can medicate themselves by utilized non-natural diet on specific plants. The number of parasites on the Wild Orangutans should be resampled to cover the host specificity of the parasites.

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