The intestinal parasites of Bornean Orangutan (Pongo pygmaeus ssp. wurmbii Tiedeman 1808) in Sebangau National Park, Central Kalimantan, Indonesia

Adventus Panda, Tjut Sugandawaty Djohan, Wayan Tunas Artama & Dwi Priyowidodo
adventus.panda@mail.ugm.ac.id

GREASE 11th Scientific meeting and steering committee
D. I. Yogyakarta, Aug 21-22, 2023
Background

- Study of Parasites in NHPs; in the orangutans (w/sc/c) – conducted since 1930 (Nurcahyo et al., 2017) – field biologist point of view
- Sebangau lowland tropical peatland, (S01°54'-3°08' and E113°20' - 114°03'; 0-50 asl); continuously facing threats; logged-over forest
- Terrestrial locomotion (Rao & van Schaik 1997; Ashbury et al., 2015; Loken et al., 2013); changes habitat structure (Ancrenaz et al., 2014) – ideal for IP transmissions; underlying threats!
- Ranging – Energy budget vs Parasites – fitness
- Hypothesized – orangutan home range variation affect the parasites richness, their prevalence (and their faecal microbiota?)
A: Borneo island; B: Sebangau NP; C: Punggualas & D: CIMTROP

Methods for field sampling (1)

START

Tracking the orangutan (smells, long calls, food found, etc.)

Individual(s) identity

Yes

Habituation

No

Individual(s) have known

Follow as per protocol

Individual(s) behavior data (sex, home range, etc.)

Delegation

Labels (time, coordinates, photograph, sample code)

Yes

another protocol for fecal analysis

No

Stop (off the grid)

Night nest

END

Yes
MiniFlotac allowed 3-5 gr fecal samples; PEs in fecal are not well distributed (Cringoli et al. 2017)

DNA extraction: gDNA extraction for NGS (GMA-3001-NGS)
GridIon (Oxford Nanopore Technology) → QC, BaseCalling, Bioinformatic analysis
Comparisons among location (PA vs CIM), Sex (Male vs Female) and Ranging size (HR<68 Ha vs HR>68,1 Ha); calculated and ordered for 2x2 contingency table ($\chi^2$ and Fischer exact-test); Sig. p-value <0.05

<table>
<thead>
<tr>
<th>Parasites recovered</th>
<th>PA</th>
<th>CIM</th>
<th>$\chi^2$</th>
<th>P-Value</th>
<th>Fisher-Exact</th>
<th>M</th>
<th>F</th>
<th>$\chi^2$</th>
<th>P-Value</th>
<th>Fisher-Exact</th>
<th>HR&lt;68 Ha</th>
<th>HR&gt;68,1 Ha</th>
<th>$\chi^2$</th>
<th>P-Value</th>
<th>Fisher-Exact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protozoa</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Endolimax nana</em> (Cysts)</td>
<td>10</td>
<td>10</td>
<td>0.583</td>
<td>0.445</td>
<td>0.593694a</td>
<td>0</td>
<td>20</td>
<td>0.181</td>
<td>0.671</td>
<td>0.82063a</td>
<td>10</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Endolimax nana</em> (Trophozoite)</td>
<td>30</td>
<td>20</td>
<td>0.583</td>
<td>0.445</td>
<td>0.593694a</td>
<td>330</td>
<td>400</td>
<td>0.583</td>
<td>0.445</td>
<td>0.593694a</td>
<td>400</td>
<td>390</td>
<td>0.493827a</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Entamoeba coli</em> (Cysts)</td>
<td>380</td>
<td>410</td>
<td>0.583</td>
<td>0.445</td>
<td>0.593694a</td>
<td>0</td>
<td>1000</td>
<td>0.000000000a</td>
<td>20</td>
<td>10</td>
<td>22,222</td>
<td>0.00000000007a</td>
<td>40</td>
<td>0</td>
<td>0.0666667a</td>
</tr>
<tr>
<td><em>Dientamoeba fragilis</em> (Trophozoite)</td>
<td>10</td>
<td>10</td>
<td>0.000000000a</td>
<td>100</td>
<td>123</td>
<td>32</td>
<td>0</td>
<td>0.00000000000a</td>
<td>100</td>
<td>20</td>
<td>13,33</td>
<td>0.0004359b</td>
<td>0</td>
<td>20</td>
<td>1,000000a</td>
</tr>
<tr>
<td><em>Entamoeba hartmanni</em> (Trophozoite)</td>
<td>20</td>
<td>20</td>
<td>0.00000000000a</td>
<td>100</td>
<td>123</td>
<td>32</td>
<td>0</td>
<td>0.00000000000a</td>
<td>100</td>
<td>20</td>
<td>13,33</td>
<td>0.0004359b</td>
<td>0</td>
<td>20</td>
<td>1,000000a</td>
</tr>
<tr>
<td><em>Giardia</em> spp (Trophozoite)</td>
<td>20</td>
<td>0</td>
<td>13,33</td>
<td>0.00000000000a</td>
<td>100</td>
<td>123</td>
<td>32</td>
<td>0</td>
<td>0.00000000000a</td>
<td>100</td>
<td>20</td>
<td>13,33</td>
<td>0.0004359b</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>Nematoda</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Enterobius vermicularis</em> (Eggs)</td>
<td>10</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Ascaris lumbricoides</em> (infertilized)</td>
<td>450</td>
<td>0</td>
<td>313,04</td>
<td>0.0000000000a</td>
<td>240</td>
<td>210</td>
<td>32</td>
<td>0</td>
<td>0.00000000000a</td>
<td>240</td>
<td>210</td>
<td>0.451</td>
<td>0.502</td>
<td>0.601064a</td>
<td></td>
</tr>
<tr>
<td><em>Ascaris lumbricoides</em> (fertilized)</td>
<td>230</td>
<td>0</td>
<td>166,11</td>
<td>0.0000000000a</td>
<td>140</td>
<td>90</td>
<td>39,565</td>
<td>0.00000000000a</td>
<td>140</td>
<td>90</td>
<td>0.112</td>
<td>0.738</td>
<td>0.100000a</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Trichuris trichiura</em> (Egg)</td>
<td>30</td>
<td>10</td>
<td>12,153</td>
<td>0.0000000000a</td>
<td>30</td>
<td>10</td>
<td>39,375</td>
<td>0.00000000000a</td>
<td>30</td>
<td>10</td>
<td>0.079</td>
<td>0.778</td>
<td>0.00000000000a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hookworm egg</td>
<td>40</td>
<td>30</td>
<td>4,762</td>
<td>0.029</td>
<td>0.0485816c</td>
<td>30</td>
<td>40</td>
<td>28,571</td>
<td>0.00000000000a</td>
<td>30</td>
<td>40</td>
<td>0.079</td>
<td>0.778</td>
<td>0.00000000000a</td>
<td></td>
</tr>
</tbody>
</table>

Possible route transmission:
Punggualas (comm activity); fecal-oral
CIMTROP (orangutan translocation) – L3 Larvae

Source: Panda, A. Tjut S. Djohan, Wayan T. Artama, Dwi Priyowidodo, (In-Prep)
comparisons vs captive – Taiwan zoo (Ying et al., 2022)

Our finding: diet play significant role -- 42 (63.6%) of 67 tree species; natural patch tree (Fruits, young leaves, inner bark); self-medication

Siamang (Symphalangus syndactylus), Owa (Hylobates lar) dan Orangutan (Pongo pygmaeus)
Thank you
are tarima kasih
Arigatoo gozaimasu
Matur sembah Suwun