UNIVERSITI PUTRA MALAYSIA

MANAGEMENT OF MALAYAN SUN BEAR (Helarctos malayanus) IN BORNEAN SUN BEAR CONSERVATION CENTRE, SEPILOK SANDAKAN SABAH WITH EMPHASIS ON DEWORMING PROGRAM

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MANAGEMENT OF MALAYAN SUN BEAR (*Helarctos malayanus*) IN BORNEAN SUN BEAR CONSERVATION CENTRE, SEPILOK SANDAKAN SABAH WITH EMPHASIS ON DEWORMING PROGRAM

Fatin Nabilah Bte Aziz

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It is hereby certified that we have read this project paper entitled "Management of Malayan Sun Bear (*Helarctos malayanus*) Bornean Sun Bear Conservation Centre in Sepilok Sandakan Sabah with emphasis on the Deworming Program" by Fatin Nabilah bte Aziz and in our opinion it is satisfactory in terms of scope, quality and presentation as partial fulfillment of the requirement for the course VPD 4999 – Project.

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ABSTRAK

Abstrak daripada kertas projek yang dikemukankan kepada Fakulti Perubatan Veterinar untuk memenuhi sebahagian daripada keperluan kursus VPD 4901-Projek.

PENGURUSAN BERUANG MATAHARI (*Helarctos malayanus*) DI PUSAT KONSERVASI BERUANG MATAHARI BORNEO DI SEPILOK SANDAKAN SABAH DENGAN MEMBERI PENEKANAN KEPADA PROGRAM KAWALAN CACING

Oleh

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2015

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Endoparasit memainkan peranan penting dalam status kesihatan haiwan liar. Kajian ini bertujuan untuk menentukan keberkesanan program kawalan cacing yang berkaitan dengan amalan pengurusan yang dilakukan pada beruang matahari. Satu kajian telah dijalankan ke atas 18 daripada beruang matahari dalam pengurusan semi-kurungan dan di dalam kurungan di Pusat Pemuliharaan Beruang Borneo di Sepilok, Sandakan Sabah. Beruang tersebut telah

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diberi anthelmintic Drontal® plus (Prazikuantel / pyrantelpamoate / febantel) tiga bulan sebelum kajian. Sampel tahi segar dikumpulkan dari lantai setiap sangkar beruang. Teknik standard parasitologi yang calitan tahi langsung, pengapungan mudah, kaedah pemendapan mudah dan satu lagi teknik yang efektif ialah eter pemendapan formal digunakan untuk mengesan kehadiran helmin ova dalam najis. Kajian ini memberikan bukti bahawa sekali setiap tiga bulan Drontal® plus ditambah dalam program rawatan cacing pakai di pusat ini telah berjaya mengawal infeksi cacing. Faktor pengurusan yang merangkumi pembersihan rutin, disinfektan yang digunakan, kepadatan stok dan kebersihan makanan dipercayai berkesan untuk mencegah endoparasitism dalam beruang ini. Kajian ini adalah dipercayai menjadi dokumentasi yang pertama dalam keberkesanan program rawatan cacing dalam pusat pemuliharaan beruang matahari.

Kata kunci: Beruang Matahari (*Helarctos Malayanus*), Program Rawatan Cacing, Pengurusan, Teknik Parasitologi Standard , Pemendapan Eter Formal

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ABSTRACT

An abstract of the project paper presented to the Faculty of Veterinary Medicine in partial fulfilment of the Course VPD 4999 – Project.

MANAGEMENT OF THE MALAYAN SUN BEAR *(Helarctos malayauns)* IN BORNEAN SUN BEAR CONSERVATION CENTRE, SEPILOK ,SANDAKAN SABAH WITH EMPHASIS ON DEWORMING PROGRAM

By:

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Endoparasites play an important role in the health status of captive wild animals. This study aims to determine the effectiveness of deworming program related to the management practices done on Malayan sun bear. A cross sectional study was done on 18 of the Malayan sun bear in semi-captive and captive management in the Bornean Sun Bear Conservation Centre in Sepilok, Sandakan Sabah. The sun bears were given anthelmintic Drontal® plus (praziquantel/pyrantel pamoate/febantel) three months before study. Fresh fecal samples were

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collected from the floor of each bear cages. Standard parasitological techniques which are direct fecal smear, simple floatation, simple sedimentation method and another effective method which is formal ether sedimentation were used to detect the presence of ova in the faces. Results showed no helminth ova were present. The management factors which encompasses routine cleaning, disinfectant used, stocking density and food hygiene appeared effective to prevent endoparasitism in these bears. This study provides evidence that once every three month of Drontal® plus in deworming program adopted in this centre has successfully control helminth infestation. This study is belief to be the first documentation of the effectiveness of the deworming program in a Malayan sun bear conservation center.

Key Words: Malayan sun bear (*Helarctos malayanus)*, Deworming program, Management, Standard Parasitological Techniques, Formal Ether Sedimentation

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1.0 INTRODUCTION

The sun bear *(Helarctos malayanus*) is the least studied bear species, and very little information exists on the threats to its survival (Meijaard, 1999).

The Malayan Sun Bear (*Helarctos malayanus*) is the smallest of the eight living bear species and differs from other ursids, particularly asiatic black bears *(Ursus thibetanus)* and sloth bears *(Melurus ursinus)* in that it is smaller in size, short sleek coat, modified rhinarium, more protrusible lips and tongue, and presence of whorls of hair on forehead and behind ears (Christopher *et al*., 2002). Sun bears in Borneo (*Helarctos malayanus euryspilus*) are different from those on the Asian mainland and Sumatra.

The Bornean Sun Bear Conservation Centre (BSBCC) Sepilok Sabah was establish with a mission to rescue the illegally captured sun bears, promoting sun bear conservation in Borneo through animal welfare, conservation, rehabilitation, research and education to stop the cruelty practices.

Parasites cause many problems for wildlife, although it often appears that wildlife have adapted to the presence of the parasites, they have not adapted to the adverse effect of parasitism which can lead to the effects of malnutrition and death in a immunsuppressed bears (Bliss, n.d.). There are some cases where the deworming program in captive wildlife is a failure, as reported by Nalubamba (2011), the anthelminthic treatment failure in captive wild impala antelope was due to anthelminthic resistance, improper administration of the drug and other management factor such as high stocking density.

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The first objective of this study is to determine the efficacy of deworming program in Bornean Sun Bear Conservation Centre in Sepilok Sandakan Sabah. One of the problems occurring in the sun bear is parasitic infestation of gastrointestinal tract that can lead to death if the problem is not treated. The second objective is to relate the management practices that contribute to the effectiveness of the deworming program. Effective deworming program will help to reduce cost of anthelminthic drug, reduce anthelminthic frequency and prevent drug resistance. Gastrointestinal parasite infestation in the semi-captive sun bear is important to study because the environment and management of the cage and forest enclosure systems are predisposing factors that can lead to parasitic infestation. Therefore, the efficacy of deworming program needs to be done effectively. The spread of parasitic disease in the sun bear appears to have negative effects including development of secondary health problems and infectious disease can also impair the health of the sun bear in semi-captivity

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2.0 LITERATURE REVIEW

2.1 Population and Distribution

Historically, sun bears are found in the forest of Bangladesh, Myanmar, Thailand, Loas, Kampuchea, Vietnam, Southern China, Peninsular Malaysia, Island of Sumatra and Borneo (Stirling, 1993). Native distribution of Malayan sun bear are at the Bangladesh, Brunei Darussalam, Cambodia, China, India, Indonesia, Lao people's Democratic Republic, Malaysia, Myanmar, Thailand and Vietnam (IUCN Red List of Threatened species, 2014). Sun bears are found at low densities throughout dipterocarp and the lower montane forest of Sabah in Malaysia from 0 to 1350meter in elevation (Davies and Payne, 1982). Malayan Sun bear population is declining due to its decline habitat as a result of deforestation as sun bear is mainly depend on primary forest.

2.2 Ecology and Behavior

The Malayan sun bear diet as documented by Wong (2002) were bee nests, termites, earthworms, small rodents, small birds, lizards, animal carcasses, fruits and the heart of coconut palms.

Sun bear is a tropical forest dwelling bear species. This species play an important role as seed disperser (Mcconkey and Giletti, 1999). Ridley (1930) reported that this species can disperse the durian's seed but not a potential seed disperser for any other plants. Sun bear do not hibernate because they are found in the tropical region where the forest in this region did not experience seasonality thus, foods were abundance and available year-round which indirectly influences the sun bear to be forest dependent species.

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Food availability influences the movement of the sun bear. Fredriksson *et al.*, (2006) noted that during mast fruiting period, the diet of the sun bear consisted mostly of fruit while during intermast period, the diet was predominantly shifting to insectivorous which differ from the research done by Wong et al. (2004, 2005) which he noted that, figs were found to be an important food source during intermast intervals.

Onuma et al. (2011) reported that there was no seasonal reproductive pattern for the female sun bear in captivity since there is little data on sun bear's behavior and ecology in the wild. He also noted that, the breeding season of the sun bear is associated with the rainy season in its area of distribution. Schwarzenberger et al. (2004) reported that, the cubs of the sun bear were born a couple of months before mast fruiting period to allow the cubs to feed on the fruits.

2.3 Status of Malayan sun bear in Malaysia

The Malayan sun bear was categorised as "Data Deficient" in 1996 by the International Union for Conservation of Nature (IUCN) Red List (Onuma et al. 2001), but in 2008, this species is categorised as Vulnerable (Vu) (IUCN, 2014). Malayan sun bear also has been listed on Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Appendix 1 since 1979.

2.4 Parasites in Malayan sun bear

There has been no study on the gastrointestinal and protozoan parasite study done in Malayan sun bear in Malaysia. However, as reported by Schaul (2006) *Baylisascaris (Toxascaris) transfuga* the bear roundworm has been reported in all species of bears including

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the Malayan sun bear. Besides, *Ancylostoma malayanum* was found in the captive sun bear from India (Baylis and Daubney, 1922; Schaul, 2006). Baylisascariosis was reported to be somatic larval migrans that may not induce clinical sign unless a high dose of nematode ova enough to induce hemorrhagic pneumonitis from extensive pulmonary migrations (Schaul, 2006). Other reports of adult cyclophyllidean tapeworms include Pentorchis arkteios in a sun bear in Burma (Meggitt 1927),

The routes by which parasites can be brought exposed to the captive wildlife are various way that is by the animal food (contaminated fruits and vegetables, infected meat or fish,etc), by intermediatary and paratenic host (snails, ants, cockroaches, other insects, worms, rodents,etc), by newly acquired parasitezed animals and by infected zoo staff and visitors. (Panayotova-Pencheva, 2013)

2.5 Deworming program in general health care of captive or semi-captive wildlife

As recommended by American Association of Zoo Veterinarians (AAZV) Veterinary Standard Committee (1998) the fecal samples should be collected annually on individual animals or composite samples are examined on a group of animals. Frequent fecal exam may be necessary in a susceptible species like bears for detection and as routine treatment with anthelminthic agents. To facilitate the detection and treatment of parasite infections before clinical signs appear, more frequent exams may be required on those groups recognized to be most susceptible. Fecal examination should be repeated following treatment to evaluate efficacy.

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The most common drug used is Ivermectin, to treat ecto-and endoparasites in a number of zoo animals. Carnivores are typically administered subcutaneous injection upon sedation for routine examination or when sedated for movement or procedures requiring anesthesia (Schaul, 2006).

The used of combination of praziquantel, pyrantel pamoate, and febantel provides an effective, convenient against a broad range of parasites (FDA, 2009). Febendazole (Panacur) is commonly used in captive bears to eliminate nematodes, cestodes, trematodes and protozoa (Schaul, 2006).

2.6 Management in captive wildlife

Preventive measure is the most important aspect of medical care in captive wildlife. AAZV Committee (1998) stated that preventive medicine program is important because it is often difficult to recognize and treat illness in non-domestic animals. To reduce or eliminate microbes, the area should then be disinfected after organic material is removed. Disinfectant used including quaternary ammonium compounds, phenolics, chlorhexadine solutions, and iodophores are all effective bacteriocidal agents, and are virucidal for many common agents. Feed and water containers and utensils should be cleaned and disinfected daily if possible. The importance of cleaning the food wastes and excrement daily is to prevent attraction of insects or rodents.

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3.0 MATERIALS AND METHODS

3.1 Study area and animals

For this study, the site location was done in Bornean Sun Bear Conservations Centre (BSBCC) in Sepilok, Sandakan Sabah (5°51'47.9"N 117°56'57.8"E). There are two bear houses in BSBCC, with capacity of 43 bears accommodated in two new bear houses and eight large fenced forested enclosures. Currently, January 2015 the bear centre housed 36 bears. Some of the sun bears are semi-captive and they roam around in the forest enclosure for about 1.4 hectare that has been provided surrounds the bear house. Some of the sun bears are kept in the enrichment cages. In this study, bears that are kept in individual cages were taken as a sample study. The management of the bears in the cage will be discuss further in the results.

The routine deworming program that was done in this centre was to give anthelminthic drug Drontal ®plus (praziquantel/pyrantel pamoate/febantel) 1tab/10kg once, every three months and was given orally by mixing the anthelminthic drug in a cool porridge. By observation, all the porridge was finished. Ivermectin (Macrocyclic Lactones) 0.03ml/kg, was also given injection subcutaneously, annually.

3.2 Sample Collection

The sun bears (n=18) that was included in this study are listed in Table 1. Anthelminthic drug (Drontal ®plus (praziquantel/pyrantel pamoate/febantel) 1tab/10 kg) was given three month before fecal sample was collected. The fecal samples were collected on the floor in the bear cages during morning before the workers and volunteers cleaned up the cages. 18 fecal samples were collected from the individual bear cage and the feces were kept in sealed

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plastic bag with the labeled bear's name. The fecal samples were kept in the ice box and preserved with 10% formalin to prevent development from the ova and will be processed using direct fecal smear, simple floatation, and sedimentation method. Formal ether sedimentation method was also used to enhance the sensitivity of diagnosis of protozoa and worm infection.

Table 1: Information on individual sun bear in study sample

Identification of bears	**Age (years old)**	**Sex**	**Manage**
Bermuda	15	Male	Captivity
Linggam	11	Male	Captivity
Om	10	Male	Captivity
Amako	22	Male	Captivity
Kudat	7	Male	Semi-captive
Ronnie	9	Male	Captivity
Phin	7	Male	Captivity
Julaini	7	Male	Semi-captive
Fulung	5	Male	Semi-captive
Panda	7	Female	Captivity
Manis	14	Female	Semi-captive
Susie	9	Female	Semi-captive
Mamatai	14	Female	Captivity
Wan wan	9	Female	Captivity
Diana	9	Female	Captivity
Chin	8	Female	Captivity
Natalie	5	Female	Captivity
Ah lun	7	Female	Semi-captive
Damai	3	Female	Semi-captive

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3.3 Coprodiagnostic Techniques

a) Direct fecal smear

A small amount of feces was emulsified in two drops of normal saline on a clean glass slide with an applicator. A coverslip was placed carefully over the suspension with ensuring that it is thin, uniform and clear. Examination for parasite began starting from under x10 objective. A higher magnification was used for confirmation.

b) Simple floatation method

One gram of feces was emulsified in 1 ml of tap water together with 20ml saturated sodium chloride solution. The resulting solution was strained with a tea sieve into a beaker and one minute was needed to allow the filtrate to stand. After that, the content was poured into the vial with a meniscus appears at the mouth of the vial. Cover slip was placed on top of the meniscus and stand for about 20 minutes. 2 drops of water was place on the glass slide and was covered with cover slip from the vial with meniscus. Examination for parasite began starting from under x10 objective. A higher magnification was used for confirmation.

c) Simple Sedimentation method

Four grams of feces were emulsified in 100ml of tap water. The solution was poured into a conical jar and filtered using tea sieve. After the filtrate was sediment for about 3minutes, the supernatant was decanted to about 10ml sediment. This procedure was repeated until the water in the jar is clear. 3 drops of the sediment was diluted in a petri dish. Examination of parasite was begun using stereomicroscope.

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d) Formal ether sedimentation method

One gram of feces was emulsified in 15 ml of 4% of formal saline. The solution was filtrate through the filter in the centrifuged tube. The solution later, was added with 1ml of diethyl ether. The centrifuge tube was centrifuge at 1500 r.p.m for 5 minutes. The supernatant was pipetted off until about 0.5ml from bottom of the tube. A drop of sediment was placed on the glass slide and examination for parasites was done using compound microscope.

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4.0 RESULTS

Table 2 shows the result of fecal diagnosis using various techniques to determine the parasite status. All 18 bears in the study samples had been dewormed with Drontal® plus (praziquantel/pyrantel pamoate/febantel) 1tab/10kg three months ago. All the sun bears ate all the porridge that mixed with the anthelminthic drug and this indicated that the dose recommended which is 1 tab/10kg is fully consume by the bears.

All bears, whenever observation could be made, apparently looked healthy and active without any visible clinical sign of infection. The feces appear to be tubular shape, with variable of color according to the type of fruits given and tend to have fruity smell.

Table 2: Results for the coprodiagnostic analysis done in 18 fecal sample of sun bear

Identity of the sun bear	Fecal direct smear	Simple floatation	Sedimentation method	Formal ether sedimentation
Bermuda	0	0	0	0
Linggam	0	0	0	0
Om	0	0	0	0
Amaco	0	0	0	0
Kudat	0	0	0	0
Ronnie	0	0	0	0
Phin	0	0	0	0
Julaini	0	0	0	0
Fulung	0	0	0	0
Panda	0	0	0	0
Manis	0	0	0	0
Susie	0	0	0	0
Mamatai	0	0	0	0
Wan wan	0	0	0	0
Diana	0	0	0	0
Chin	0	0	0	0
Natalie	0	0	0	0
Ah lun	0	0	0	0
Damai	0	0	0	0

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Fecal analysis was done after fecal sample was collected. However, the result shows no ova were presence based on the four method of coprodiagnostic analysis. Palumbo *et. al* (1976) reported that formal ether sedimentation is the most effective method as compared to direct methods such as smear, sugar floatation, zinc sulphate detergent floatation and sedimentation technique. However, in this case there was no ova was found, even though the advantage for this sensitive method is the smear are quite clear for microscopy , the sediment can be kept for a couple of days if delay is unavoidable and the microscopy detection can be repeated if the results are negative. The disadvantage of this method is that only a small amount of feces was used to diagnose and misdiagnosis can also lead to the negativity of result. Repeatability using small amount of feces in the same sample is needed to improve detection of ova.

There was no significant difference between sun bear that was kept in semi-captive and captive management. The results showed negative for both management of parasite prevalence.

The factor of management that could contribute to the effectiveness of the deworming program are regular cleaning cage routine, disinfectant used, food hygiene, and stocking density.

Sun bear that are kept under captivity are enriched with dried leaves, old trunk of logs and hammocks for them to play with.Semi-captive bear were allowed to go to the forest enclosure 1.4 hectare surrounding the bear house. The environment of the forest enclosure were exactly similar with the forest, with the tree for them to climb and the old trunk logs that may have some insect for them to eat.

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The sun bear diet in this centre are banana, snake fruit, papaya, sweet potato, egg, corn, coconut, and water spinach. All the fruits and vegetables were washed before given to the bears. This practice will prevent consumption of contaminated of food with helminth of ova or larvae. The porridge that contains rice was also wash and cooked before given to the sun bears.

The anthelminthic drug was administered orally. The drug was mix inside the cold porridge. All the required dose was calculated with their body weight and with observation, all the porridge that contain anthelminthic was consumed by all the bears.

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5.0 DISCUSSION

This study has demonstrated that the effectiveness of the deworming program in the captive and semi-captive sun bear can be associated with the management factor as there are no ova of helminth presence in the feces sample. The findings of this study will need to take into account other factors that include a) sampling and coprodiagnostic technique, b) effectiveness of anthelmintic drug used in this deworming program c) management practices that include routine cage cleaning, disinfectant used, stocking density and food hygiene.

Wherever possible, the fecal sample should be collected as fresh or directly from the animal. Fresh fecal sample may give the presence of the protozoa parasites. In this study, the fecal sample was taken on the cage floor early in the morning before cleaning routine was done. Feces sample that is not fresh will also contained urine that will destroy tropozoites. A variable type of feces form will determine the time that is suitable to do examination prior to get a good morphology of helminth ova. In this study most of the fecal sample was in a formed stool (tubular or normal form) and this will give a longer duration of examination time, which after 24 hours would still reveal an intact protozoan cysts. However, preservation with formalin 10% is needed in this study, to maintain the protozoan morphology and prevent development of helminth ova. The feces sample after process needs to be examined under microscope which requires knowledge to distinguish between hair fiber, plant cells and other debris. Morphology of helminth ova quite distinctive from plant cell which have thick or thin capsule and embryonated structure inside the ova.

The most common method to determine the effectiveness of deworming program in domestic animals is to do fecal egg count reduction test (FECR) and to monitor egg count over

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time using fecal egg count (FEC) method. However, in this study the result on helminth is not positive with the other standard parasitological and sensitive method. Thus, using FECR and FEC may also show a negative result in this case because the precision and accuracy of the FECR improved as egg excretion increased. Besides, to determine the prevalence of gastroendoparasite of sun bear in this study, it may require a large sample size, multiple samples and longer time to collect the fecal sample from time to time as it may improve the possibility to discover the ova of helminth in the stool sample. In this study, with a limited time provided for this research, samples were taken only twice to be analyses before deworming program was done. However, both results were negative for a presence of helminth ova.

There is no publish report of Drontal® plus being used in captive wildlife. However, confirmation of safety for the use of this anthelmintic tablets (praziquantel/pyrantel pamoate/febantel) in dogs has been done in clinical field trials (FDA, 2009). All three of the drug components in this combination are approved individually. Pyrantel pamoate is approved for *Toxocara canis, Toxascaris leonina, Uncinaria stenocephala,* and *Ancylostoma caninum*. Praziquantel is approved for *Taenia pisiformis, Echinococcus. granulosus*, and *Dipylidium caninum*. Febantel is approved for *Toxocara canis, Toxascaris leonina, Uncinaria stenocephala, Ancylostoma caninum,* and *Trichuris vulpis*. A two-way combination consists of praziquantel + febantel (Vercom ® paste) and is approved for *Taenia pisiformis, Dipylidium caninum, Toxocara canis, Toxascaris leonina, Uncinaria stenocephala, Ancylostoma caninum*, and *Trichuris vulpis*. Safety and efficacy information is available on all three components of this combination. Synergistic of the drugs used may prevent development of the

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gastroendoparasite in the Malayan sun bear mostly *Baylisascaris (Toxocaris) transfuga* and *Ancylostoma caninum.*

Anthelmintic drug that was used which is Drontal® plus (praziquantel/pyrantel pamoate/febantel) 1tab/10kg is effective based on the coprodiagnostic analysis and healthy status of the sun bear in the period of time of study. No eggs were detected in the treated group of sun bear and faecal samples from this group remained negative throughout the rest of the study resulting in a treatment efficacy.

Ivermectin (macrocyclic lactones) 0.03ml/kg annually definitely helps to reduce the possibility for parasitic infection because it has a potent, broad antiparasitic spectrum at low dose levels (Merck Veterinary Manual, 2014).

An efficient deworming program will save money for the anthelminthic cost and reduce the possibility of having anthelminthic resistance in following years.

It is recommended that fecal examination be conducted twice a year and any required treatment is provided in response to the results of the examination (The polar bear protection Act, 2002). In this study, since some of the sun bear are semi-captive and roam around the forest enclosure with increase time contact with soil is high, the possibility of having an internal parasite is increase; therefore a regular deworming program is needed for the semi-captive bears as a preventive measure.

Routine cage cleaning that involves removing the fecal materials, food residues, organic material using water jet, sweeper and floor wiper may help to prevent accumulation of pathogens. Cleaning of a building or area should include dry cleaning to physically remove

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waste matter, followed by wet cleaning, involving soaking, washing, rinsing and drying. Leaving surfaces wet may allow bacteria to multiple to levels higher than they were before the cleaning started (Kiupel *et.al*., 2010)

Disinfectant used at the entry of bear house act as a biosecurity may also help to reduce any pathogen that may coming from outside of the bear house. Low stocking density help to reduce infestation of parasite. In this study, the bear in this sample was taken from individual cage. Low density will minimize the risk of parasitism. A dynamic link occurs between animal population density and parasite density. The more concentrated wildlife in a given area, the greater the chance for increased parasite contamination of the environment (Bliss, n.d)

Source of parasitic infestation could be from the food or fruits that are contaminated with the infective stage of helminths. Therefore, cleaning the fruits is important to remove the possibility to get contamination with ova helminths.

Management practice that emphasis in deworming program is important to reduce stress that is cause by parasitic infestation that could lead to decrease in reproduction, decreased longevity and increase susceptibility to other disease. The benefit that is gain for this study is that, an effective deworming program will save the drug cost, avoid anthelminthic resistant and will reduce deworming frequency. Therefore, this document represents the deworming program that was being done once in every three month with Drontal® plus (praziquantel/pyrantel pamoate/febantel) 1tab/10kg is effective in this management. However, handlers especially bear keeper were adviced to practice a good hygiene practice wherever doing work in bear house.

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6.0 CONCLUSION

This study found no ova in the sun bear feces three months after deworming. There is no significant difference for the parasitic infestation of the sun bear that is kept semi-captive or in captive. The anthelmintic used for the deworming program which is Drontal® plus (praziquantel/pyrantel pamoate/febantel) 1tab/10kg once every three months gave negative result for all the coprodiagnostic technique use in this study. Management practices adopted at the centre reduced parasite transmission. The deworming interval can be extended to reduce cost, avoid anthelminthic resistance and reduces deworming frequency.

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APPENDICES

Figure 1: Normal form of sun bear feces. Variable of feces colour according to the fruits taken as diet. Red color consider as watermelon or papaya, yellow color is banana, green color is vegetables, cream brownish color is porridge.

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Figure 2: One of the fecal debris that could be mistaken as ova of helminth

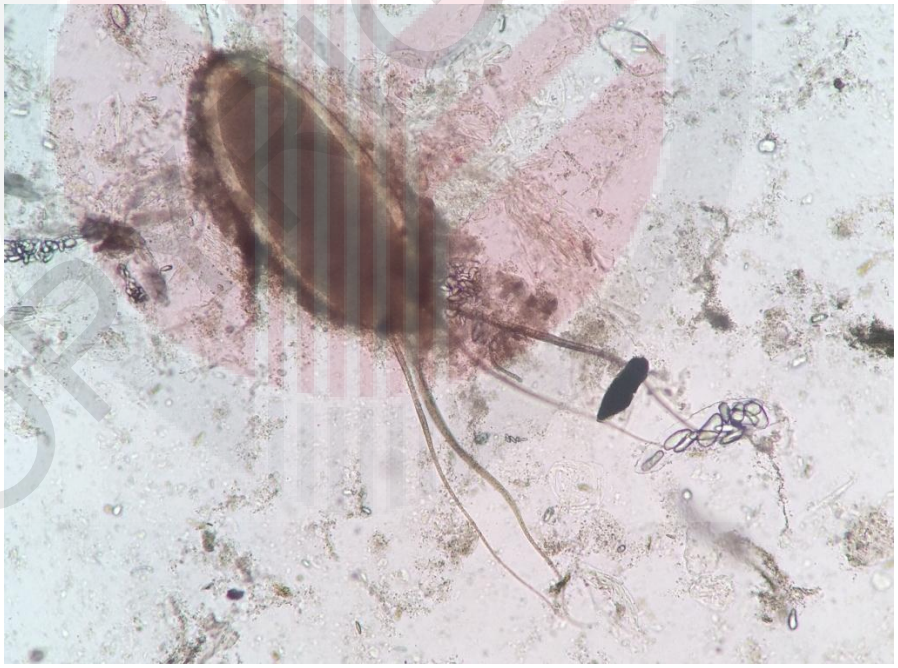

Figure 3: Ectoparasite ova with flagellated structure that could be mistaken as ova of helminth

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Figure 4: Hair fiber that could be mistaken as a larvae during microscope examination

Figure5: Fecal debris that could be mistaken as ova of helminth

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