Detection of *Falculifer* sp. mites in eagles in rehabilitation cage of Bali Wildlife Rescue Center

I W Batan¹, M K Ananda²,³, M S B Sembiring²,³, D H A Sianipar²,³, S Sunusi²,³, D A R T Noviarini⁴ and U K Hadi⁵

¹Laboratory of Veterinary Clinical Diagnosis,  
²Undergraduate Student,  
³Rothschildi Wildlife Student Community Faculty of Veterinary Medicine, Udayana University Jl Sudirman, Sanglah, Denpasar, Bali, Indonesia 80234.  
⁴Bali Wildlife Rescue Centre, Banjar Dukuh, Jl. Teratai No.49, Dauh Peken, Tabanan, Bali, Indonesia 82113  
⁵Divison of Parasitology and Medical Entomology, Department of Animal Infectious Diseases and Veterinary Public Health, Faculty of Veterinary Medicine, Bogor Agricultural University, Jl. Agatis Kampus IPB Darmaga, Bogor, West Java, Indonesia 16680

Email: wayanbatan@unud.ac.id

**Abstract.** Eagle is one of the many raptors were rescued by the Bali Wildlife Rescue Centre. This institution is a non-profit conservation institution in Indonesia. The salvated eagles were obtained from confiscated proceeds from the Bali Natural Resources Conservation Centre (BKSDA). Health checks such as ectoparasite examination on eagles are important to maintain the quality of life. This study was aimed to identify the presence of *ectoparasites* in several eagle species in Bali Wildlife Rescue Centre /PPS Bali. The study was conducted from June to September 2019. Feather samples were taken from 15 caged eagles, including six Brahminy Kite (*Haliastur indus*), one Changeable Hawk-eagle (*Spizaetus cirrhatus*), three White-bellied Sea Eagle (*Haliaeetus leucogaster*), one Grey-headed Fish Eagle (*Ichthyophaga ichthyaetus*), and four Crested Serpent Eagle (*Spilornis cheela*). The eagle feather samples were examined at the Denpasar Veterinary Investigation Center/BBVet for the presence of *ectoparasites*. This research was an observative study and the data obtained were analysed descriptively. The result showed that eight samples (two Crested Serpent Eagle, two White-bellied Sea Eagle, two Changeable Hawk-eagle, one Brahminy Kite, and one Grey-headed Fish Eagle) were found to be positively infected with mite external parasites from all examined eagles. These mites were identified belong to *Arachnid* class, the *Astigmata* order, the *Falculiferidae family*, and the genus *Falculifer* sp.

1. Introduction

Regulation of the Minister of Environment and Forestry of the Republic of Indonesia Number P.20/MENLHK/SETJEN/KUM.1/6/2018 concerning the determination of protected species of plants and wild animals, including eagles. However, this does not guarantee an eagle to be able to live comfortably without hunting. The rise of bird hunting and trade occurs because there is a shifting in...
understanding birds as economic dimension, that birds are interpreted as trading subject for economic benefits [1].

It is often found in communities that they were rearing eagles then the eagles were confiscated or self-consciously to Bali Natural Resources Conservation Office. The animals confiscated by the Bali Natural Resources Conservation Office were then was sent to the Bali Wildlife Rescue Centre for further maintenance process. The Bali Wildlife Rescue Centre is a non-profit institution in Indonesia. The confiscated eagles are needed a parasitic examination as one protocol to support their health. The presence of external parasites may affect the eagles’ health. Ectoparasites are parasitic organisms that live on the surface of the host body, suck blood or feed on the hair, hair follicles, and skin and suck the host’s bodily fluids [2].

Ectoparasites are a classic, detrimental problem, but they do not receive much attention. The losses incurred are very large, ranging from weight loss, decreased production, hair loss, trauma, irritation, anaemia, and even death in birds [3]. Parasitic disorders in birds need to be considered because parasites can cause diseases or injuries that can endanger human health [4], such as Sarcoptes scabiei mites. Parasite monitoring needs to be conducted to prevent the spread of parasites to animals in Bali Wildlife rescue centre, especially against Knemidocoptes sp. mites.

In 2019, confiscated animals being treated at the Bali Wildlife Rescue Center (PPS in Tabanan City) included estuarine crocodiles, sun bears, crooked beaks, pig tail monkeys, Bali starlings, and some species of eagles. The confiscated eagle species at the Bali Wildlife Rescue Center were the Crested Serpent Eagle, Changeable Hawk-eagle, Brahminy Kite, Grey-headed Fish Eagle, and White-bellied Sea Eagle. The presence of feather loss disorders in those confiscated eagles might indicate the possible infections by external parasites, especially infections by mites. In addition to feather loss, mites infection can also cause scaly leg or scaly face mite condition [3]. During 2012-2013 in California - USA, three wild Golden Eagle (Aquila chrysaetos) were found with severe skin disease and two died. The cause was a rare mite, that most closely related to Knemidocoptes derooi mites [4]. Accordingly, special attention needs to be given to the presence of mite infections to prevent transmission between birds. This study, therefore, was aimed to explore mange ectoparasites from confiscated eagles in Bali Wildlife Rescue Centre. This study was the first to detect the presence of ectoparasites in Bali Wildlife Rescue Centre.

2. Methods

Feather samples obtained from eagles were based on parasitic predilection sites in birds. The most commonly found was from tail feathers [5]. Samples were taken from all eagles (15 eagles) from five species of eagles in Bali Wildlife Rescue Centre, namely Crested Serpent Eagle (4 individuals), Changeable Hawk-eagle (1 individual), Brahminy Kite (6 individuals), Grey-headed Fish Eagle (1 individual), and White-bellied Sea Eagle (3 individuals). Samples were collected from tail feathers. One damaged tail feather was pulled out from each bird. The eagles were restrained by their keepers in their wings and leg to minimize the stress. Feather samples were kept separately in a plastic clip and then were stored in a box. This research was conducted from June to September 2019. Parasites identification was carried out at Denpasar Animal Disease Investigation Centre by using light microscope with differential interference contrast (DIC), mites were identified to species taxa [3, 6]. Further identification was conducted at the Medical Entomology Laboratory, Faculty of Vet Medicine, Bogor Agriculture University, in which the mites were documented by using light microscop camera with 100 micrometer bar. The data were analysed descriptively.

3. Results and Discussion

The observation showed that eight samples (two Crested Serpent Eagle Spilornis cheela, two White -bellied Sea Eagle Haliaeetus leucogaster, two Changeable Hawk-eagle Spizaetus cirrhatus, one Brahminy Kite Haliastur indus, and one Grey-headed Fish Eagle Ichthyophaga ichthyaetus) were found to be positively infected by one type of mite from 15 individuals examined. Based on the results
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of the identification, the mite was from the *Arachnid* class, the *Astigmata* order, the *Falculiferidae family*, and the genus *Falculifer* sp. (Table 1).

| Table 1. Eagles that infected by *Falculifer* sp. mite in Bali Wildlife Rescue Centre |
|-----------------------------------------------|-----------------|
| **Sample Code**                              | **Falculifer sp. mite** |
| White-bellied sea eagle                      | Positive (+)     |
| *(Haliaeetus leucogaster)* 1                 |                  |
| White-bellied sea eagle                      | Positive (+)     |
| *(Haliaeetus leucogaster)* 2                 |                  |
| White-bellied sea eagle                      | Positive (+)     |
| *(Haliaeetus leucogaster)* 3                 |                  |
| Gray-headed fish eagle                       | Positive (+)     |
| *(Icthyophaga ichthyaeus)*                   |                  |
| Crested serpent eagle *(Spilornis cheela)* 1 | Positive (+)     |
| Crested serpent eagle *(Spilornis cheela)* 2 | Positive (+)     |
| Crested serpent eagle *(Spilornis cheela)* 3 | Positive (+)     |
| Crested serpent eagle *(Spilornis cheela)* 4 | Positive (+)     |
| Brahminy kite *(Haliastur indus)* 1          | Positive (+)     |
| Brahminy kite *(Haliastur indus)* 2          | Positive (+)     |
| Brahminy kite *(Haliastur indus)* 3          | Positive (+)     |
| Brahminy kite *(Haliastur indus)* 4          | Positive (+)     |
| Changeable hawk-eagle                        | Positive (+)     |
| *(Spizaetus cirrhatus)* 1                    |                  |
| Changeable hawk-eagle                        | Positive (+)     |
| *(Spizaetus cirrhatus)* 2                    |                  |
| Changeable hawk-eagle                        | Positive (+)     |
| *(Spizaetus cirrhatus)* 3                    |                  |

Case studies in Brazil have noted that non-passerine birds from captive were infected with astigmata feather mites. Feathered mites (*astigmata: Falculifer* sp.) belong to the most diverse group of ectosimbions that live on bird feathers [6]. The genus *Falculifer* sp. is a parasite or feather mite in poultry [7]. *Falculifer* species has been reported to infect pigeon, non-passerine birds, and are commonly found in Ancient World and New World columbiform birds [6, 8, 9, 10].

In this study it was found that *Falculifer* sp. could also infect eagles including Crested Serpent Eagle, White-bellied Sea Eagle, Changeable Hawk-eagle, Brahminy Kite, and Grey-headed Fish Eagle. *Falculifer* sp. mite infection in eagle has not been widely published (Figure 1). This preliminary finding showed the need for further research to improve the knowledge about *Falculifer* sp. in eagles. Similar studies stated that the ectoparasite infestations in the fur and skin proved that their presence caused uncomfortable condition and could lead to a significant unhealthy life [11].

The effects of environmental and climate change on bird–mite relationships might be a factor in the emergence of mange. This is because mites are transmitted by contact, stress induced by crowding, toxicosis; and concurrent pathogens might account for the severe disease among birds in close proximity [12]. The density of eagles might reflect habitat changes bringing individuals into closer contact or increasing stress. The methods for controlling these highly contagious cutaneous parasitic diseases, which cause considerable losses to animal condition, were described as: acaricides may be used as dips, showers or sprays, as a topical application to the back (‘pour-on’), or administered by the parenteral route [13].
Figura 1. Falculifer sp. was found in the tail feathers of eagles kept in Bali Wildlife Rescue Centre.

Fluralaner, ivermectin, amitraz and phoxim were used as therapeutic acaricides in the treatment of sarcoptic mange in captive wildlife. The most commonly used therapeutic agent was ivermectin. Ivermectin was delivered by manual subcutaneous injection or remote rife darting and at a dose ranging between 200–400 µg/kg [14]. A new generation of anti-acaricidal drug that has been proven effective in overcoming poultry red mite (Dermanysus gallinae) such as fluralaner (Enzolt®, MSD Animal Health, Australia) should be tried on eagles infected by mites [15]. The fluralaner dose is 0.5 mg/kg body weight, given twice with an interval of administration for seven days. Fluralaner is generally given by mixing it into drinking water and for eagles it may be mixed in the feed (0.05 mL Exzolt® for 1 kg body weight).

Although rarely fatal, epizootics of mite infections among wild birds have been described, most affected raptors have been in captivity or rehabilitation centers [16]. Consistent multidisciplinary data collection is needed for identification of the mite’s host species range, ecology, and pathogenicity and for enhanced understanding of this possibly emerging fatal disease [4].

4. Conclusion
Based on the results of this study, it was concluded that the mites Falculifer sp. were identified in most of the eagles in rehabilitation centers in this study. Further action is needed to be conducted to prevent the mites from spreading to the other healthy eagles.

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