

## First record of the hog louse *Haematopinus suis* (Insecta: Phthiraptera) in Singapore, and its implications for the emergence and spread of zoonosis and wildlife disease

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**Abstract.** The hog louse (*Haematopinus suis*) is a parasite of veterinary and medical importance owing to its capacity to vector pathogens, including the zoonotic bacterium, *Mycoplasma suis*. The first record of this parasite from Singapore is presented with a discussion of the implications its occurrence has for wildlife disease and zoonosis in the country.

**Key words.** wild pigs, parasite, *Haematopinus suis*, African swine fever, *Mycoplasma suis*, Singapore

### INTRODUCTION

Wild pigs (*Sus scrofa* Linnaeus, 1758) are some of the largest terrestrial mammal species native to Singapore (Chua & Lim, 2011). Within the lowland rainforests of Southeast Asia, they are known to play a key role in structuring plant communities (Ickes et al., 2001). However, wild pigs were believed to be extinct on Singapore Island until recently when they apparently recolonised with individuals swimming across the Johor Straits from Pulau Ubin and Pulau Tekong and neighbouring Malaysia (Haridas et al., 2011). Following this recolonisation, their population has dramatically increased (Haridas et al., 2011). Despite their increasing presence, the diversity of their parasite communities within Singapore remains unexplored.

The hog louse, *Haematopinus suis* (Linnaeus, 1758), is a common ectoparasite of both wild and domestic pigs throughout much of their range (Durden & Musser, 1994). *Haematopinus suis* is of veterinary and medical importance owing to its ability to vector pathogens (Doster, 1995). However, it has never been reported to occur in Singapore. Therefore, its role in sylvatic disease cycles in wild pigs in Singapore has never been considered or studied.

While few parasitological studies have been historically undertaken within Singapore, the need to understand parasites of veterinary and medical importance has driven increased study of the field in recent years (Kwak, 2018; Kwak et al., 2018; Mendenhall et al., 2018; Neves et al., 2018). An opportunistic survey of ectoparasites from a road-killed wild boar revealed the presence of the hog louse in Singapore, a finding with significant implications for wildlife health.

### MATERIAL AND METHODS

Specimens of hog louse were collected from a road-killed wild pig from Singapore Island on 10 October 2013 and preserved in 70% ethanol. The specimens were deposited in the parasitology section of the Zoological Reference Collection (ZRC) of the Lee Kong Chian Natural History Museum at the National University of Singapore.

They were identified based on figures, descriptions and differential diagnoses provided by Ferris (1933) and Weisser (1974).

The dorsal and ventral sides of the specimens (Fig. 1) were imaged using the Dun Inc. Passport II Photomicrography imaging system (with a 1.4× Tamron SP AF Tele-converter attached to a 65 mm MP-E Canon Lens). The images were subsequently stacked using Zerene Stacker and processed in Adobe Photoshop CC.

### RESULTS AND DISCUSSION

The hog louse species was identified as *Haematopinus suis*. It appears to be the first record of this species in Singapore. Several key characters distinguish *Haematopinus suis* from closely related lice, namely the morphologically similar *Haematopinus aperis* and *Haematopinus ludwigi* which are also found on wild pigs in the Southeast Asian region. The chief feature differentiating *Haematopinus suis* and *Haematopinus ludwigi* from *Haematopinus aperis* is the presence of



Fig. 1. Dorsal and ventral views of a hog louse (*Haematopinus suis*) collected from a wild pig (*Sus scrofa vittatus*) in Singapore.

large, flared pleurites present in the former two but absent in the latter. *Haematopinus suis* and *Haematopinus ludwigi* can be distinguished by the length of the anterior portion of the head, which is short in *Haematopinus ludwigi* but long in *Haematopinus suis* (Ferris, 1933; Weisser, 1974).

Within Singapore, the management of wild pigs is a significant issue. Wild pigs are important biotic drivers of lowland rainforest ecology. However, the population of wild pigs in the country is no longer limited by mammalian predation, as the tiger (*Panthera tigris*), clouded leopard (*Neofelis nebulosa*), and leopard (*Panthera pardus*) are now locally extinct (Corlett, 1992). Therefore, while local policy makers and ecologists may wish to ensure a viable population of wild pigs to maintain ecological processes, they must also balance the risk of wildlife disease outbreaks and zoonotic spill over events posed by large, rapidly expanding populations.

*Haematopinus suis* has been linked to several diseases of veterinary importance in pigs. One of the most common louse-borne diseases of pigs is caused by the swine pox virus, which is mechanically transmitted by *Haematopinus suis* and can lead to secondary bacterial infections (Doster, 1995). African swine fever virus is also of importance owing to its recent re-emergence as a global threat to pig production and to immunologically naïve wild pig populations (Sánchez-Cordón et al., 2018). Unsurprisingly, this pathogen is also believed to be mechanically transmitted by *Haematopinus suis* (Sanchez & Badiola, 1966). *Mycoplasma suis* (described as *Eperythrozoon suis* Splitte, 1950), the etiological agent of porcine infectious anemia is also transmitted by *Haematopinus suis* (Prullage et al., 1993). Though this bacterium is particularly important due to its zoonotic potential, with human infections occurring commonly in Asia (Hu et al., 2009). While *Haematopinus suis* likely serves to maintain sylvatic cycles of *Mycoplasma suis*, Wu et al. (2006) noted that ticks may also play a role in its transmission. Therefore, while *Haematopinus suis* are not known to infest humans, and so are unlikely to facilitate spill over events in which humans become infected by *Mycoplasma suis*, ticks have the potential to spread this zoonosis due to the catholic feeding habits of some species (Durden & Musser, 1994).

Further research is needed to address several key questions concerning the wildlife disease and public health implications of *Haematopinus suis* in Singapore. Namely the prevalence and infestation intensity of this louse on wild pigs, as well as whether the aforementioned louse-borne pathogens, particularly *Mycoplasma suis*, occur in Singapore and therefore pose a risk to animal and human health.

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