ECTOPARASITES OF THE COMMON PALM CIVET (*PARADOXURUS HERMAPHRODITUS*) AT SAKAERAT ENVIRONMENTAL RESEARCH STATION, THAILAND†

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Abstract

Vertebrate parasites can influence the survival and reproduction of their hosts and thus affect the population biology of host species. Thus, understanding the affect of parasites on biodiversity and ecosystems is an important question in conservation biology. We studied the diversity and abundance of ectoparasites and blood parasites in seven common palm civets (*Paradoxurus hermaphroditus*) at Sakaerat Environmental Research Station in Northeast Thailand from February to November 2008. Three tick genera were found on civets, included *Hemaphysalis* sp., *Ixodes* sp., and *Amblyomma* sp.. No blood parasites were found. Ectoparasite load appeared to vary between juvenile and adult civets. The most common tick was *Hemaphysalis* sp. which was found on 57.1% of all civets (100% on juveniles, 25% on adults), *Ixodes* sp. was found on 28.6% of civets (66.7% on juveniles, not found on adults), and *Amblyomma* sp. was found on 14.3% of civets (33.3% on juveniles, not found on adults). *Ixodes* sp. was found in the highest numbers per civet followed by *Hemaphysalis* sp. and *Amblyomma* sp., respectively. The ticks *Hemaphysalis* sp. and *Amblyomma* sp. were not found on adult civets. This study provides important data about parasites of wild carnivores in Thailand.

Keywords: common palm civet, ectoparasites, Sakaerat Environmental Research Station (SERS), Thailand

Introduction

Parasitism has important functions in ecosystems. It is defined as an interaction between two organisms, in which one organism benefits (parasite) and the other is harmed (host). In general, parasites are much smaller than their hosts. Parasites can have many effects on their hosts such as reduction in fitness, disease, and sometimes mass mortality of the host population (Klimpel *et al.*, 2007).

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Furthermore, parasites can function like keystone species in some habitats (Curtis and Hurd, 1983), and can have significant effects on community and population structure (Minchella and Scott, 1991; McCallum and Dobson, 1995). Given the ubiquity of parasites in life, understanding how they affect biodiversity and ecosystem dynamics is now a central question in conservation biology (Scott and Dobson, 1989; Rozsa, 1992; Thomas *et al.*, 1995).

Carnivores are important indicators of an ecosystem's integrity in that they influence the structure and reflect the vigor of the trophic levels upon which they depend (Eisenberg, 1989). They usually have a large home range and are frequently in close contact with several other vertebrate species (the prey). These factors could lead carnivores to have higher parasite species richness than non-carnivores (Labruna *et al.*, 2005).

The common palm civet (*Paradoxurus hermaphroditus*) belongs to the small carnivore family (Viverridae). They are nocturnal and solitary animals, exhibiting a variety of lifestyles and adaptations. For example, they are excellent climbers, suited to foraging in trees, but, are equally adept to living and foraging on the ground (Vaughan *et al.*, 2000). Although this species is a forest dweller, it has come to favor living near areas of human habitation. It is one of the most numerous of South East Asia's carnivores and also found in South Asia (Lekagul and McNeely, 1977).

A number of studies have been conducted on common palm civet ecology (Colón, 2002; Jeaning *et al.*, 2006) but, there is a lack of data available on parasites associated with this important carnivore. The objectives of this study were to quantify abundance and diversity of the ectoparasites and blood parasites in common palm civets at Sakaerat Environmental Research Station in Northeast Thailand.

Materials and Methods

Our study was conducted at Sakaerat Environmental Research Station (SERS) in Nakhon Ratchasima, Northeast Thailand (14° 30′ N, 101° 55′ E). SERS covers 81 km^2 and the landscape was dominated by dry evergreen and dry dipterocarp forests. The climate at the SERS is tropical rain forest with three distinct seasons, summer (March-May), rainy season (June-October), and winter (November-February).

Common palm civets were trapped between February and November 2008 using 10 steel mesh cages (100 × 40 × 50 cm) baited with ripe banana, chicken or fish (Colón, 2002; Perkin, 2004; Jeaning *et al.*, 2006). Traps were set at dusk at 100 m intervals along main roads and fire protection roads where signs of civets were found. We checked traps in the morning. Captured civets were returned to the field laboratory at SERS, anesthetized with an intramuscular injection of Zoletil® (Virbac Laboratories, Carros, France) at 5 mg/kg and physical examinations were performed after sedation. Age was classified as juvenile (not full grown, undeveloped reproductive organs, and milk teeth present) or adult (full grown and mature reproductive organs). Reproductive status was determined by checking the condition of the nipples in females and testes in males (Jeaning *et al.*, 2006). Ectoparasites were collected by combing the civet's fur or examining the skin and removing parasites with tweezers. Each parasite was preserved in 70% ethanol, examined by microscope to determine genus, sex, and stage of development. Tick species were identified utilizing methods referenced in Wall and Shearer (1997).

Thin blood smear were prepared from blood samples which were collected from marginal ear veins. Thin blood smears were air dried, fixed with methanol and stained with Giemsa's stain at pH 7.2. The slides were examined for 15 min under oil immersion at 1000× magnification.

Blood parasites were identified using techniques outlined in Urquhart *et al.* (1996) and Bowman and Lynn (1999). After processing, civets were marked by ear notching (Bradshaw, 2003) and released at the captured location.

Prevalence of ectoparasites and blood parasites were calculated by the number of hosts infected with one or more individuals of a particular parasite divided by the number of hosts examined for that parasite and expressed as a percentage. Mean intensity of ectoparasite were calculated by the total number of parasites found in a sample divided by the number of hosts infected with that parasite (Bush *et al.*, 1997).

The data were not statistically compared between age classifying of hosts, because of relatively low sample sizes (Crooks *et al.*, 2004).

Results and Discussion

A total of 14 civets were captured during 556 trap nights; seven recaptured animals were immediately released. Thus, only seven individual civets (three juveniles, four adults) were sampled for parasites. Trapping success was 1.8% in juveniles (ten captured in 556 trap nights, seven recaptured) and 0.8% in adults (four captured in 556 trap nights, none recaptured). Total trapping success was 2.5%. Our low capture success hindered our ability to study parasites in common palm civets. Civets are notoriously difficult to capture because of their suspicion when encountering traps. For example, Jennings *et al.* (2006) showed a success rate of only 3.1% in trapping Malay civets in Indonesia. Similarly, a trapping success rate of 2.5% was achieved in this study, thus confirming the trap shyness of this carnivore group.

Fleas, lice, and mites were not found on common palm civets in this study. Ticks were the only ectoparasites found and were identified and classified into 3 genera: *Hemaphysalis* sp. (n = 12), *Ixodes* sp. (n = 9), and *Amblyomma* sp. (n = 1). The tick *Hemaphysalis* sp. was the most common ectoparasite on common palm civets at SERS being found on 57.1% of all civets (100% on juveniles, 25% on adults). *Ixodes* sp. was found on 28.6% of all civets (66.7% on juveniles, none on adults), and *Amblyomma* sp. was found on 14.3% of all civets (33.3% on juveniles, none on adults) (Table 1).

The tick *Ixodes* sp. was the most intense parasite on civets, followed by *Hemaphysalis* sp. and *Amblyomma* sp., respectively. Ectoparasite load varied between adults and juveniles - the ticks *Hemaphysalis* sp. and *Amblyomma* sp. were not found on adult civets (Table 1). No blood parasites were found on civets in this study.

Our study was the first to quantify ectoparatites and blood parasites in common palm civets in Thailand. Our findings indicate that the ticks *Ixodes* sp., *Hemaphysalis* sp., and *Amblyomma* sp. are the only ectoparasties of common palm civets at SERS. Few studies are available to compare with our results but Grassman *et al.* (2004) recorded the ectoparasites *Amblyomma testudinarium*, *Ixodes granulatus*, *Hemaphysalis asiatica, H. hystricis, H. sermermis*, and *Rhipicephalus haemaphysaloides* from clouded leopard, Asiatic golden cat, marble cat, leopard cat, dhole, yellow-throated marten, binturong, and large Indian civet in Thailand. Tanskull and Inlao (1989) recorded *H. bispinosa* and *H. koningsbergeri* from binturong, *H. asiatica* and *I. ovatus* from large Indian civet, and *H. asiatica*, *I. ovatus* and *I.granulatus* from leopard cats in Thailand. The data suggests that the genera *Ixodes*, *Hemaphysalis*, and *Amblyomma* may be the common tick group infecting wild carnivores in Thailand.

The prevalence and mean intensity of

Table 1. Ectoparasites collected from common palm civets at Sakaerat Environmental Research Station, Thailand, 2008

	Juveniles (n=3)		Adult (n=4)		Total	
Ectoparasites	Prevalence (%)	Mean intensity	Prevalence (%)	Mean intensity	Prevalence (%)	Mean intensity
Haemaphysalis sp.	100.0	3.7	25.0	1.0	57.1	3.0
Ixodes sp.	66.7	4.5	0	0	28.6	4.5
Amblyomma sp.	33.3	1.0	0	0	14.3	1.0

ectoparasites appear to be lower in adult than juvenile civets but our low sample size precludes statistical comparisons between age classes of hosts and our results should be considered tentative because of relatively low sample sizes. However, larger host sample size may have revealed additional statistical differences between infestation parameters for some of the parasites (Durden *et al.*, 2006).

Surprisingly few civets on our study were infected with ectoparasites. These results are similar to those of other studies of carnivores such as skunk (Crook *et al.*, 2004), puma and jaguar (Durden *et al.*, 2006); therefore suggesting that lifestyle patterns of civets such as a solitary existence, living, and foraging in trees may beadapted to avoid parasites.

Blood parasites were not found on civets in this study. Our results differ from those of Dunn *et al.* (1968) who found that 19 out of 119 common palm civets in Malaysia were infected by microfilaria and nine out of 119 were infected by red cell protozoa. A large sample size of hosts may be important to examine blood parasites in wild carnivores.

Conclusions

The few common palm civets infected with parasites at SERS would indicate that the civets had good health status. No negative effects of parasites on civet health, such as diseases or mortality, were observed. Moreover, common palm civets did not appear to represent a parasite reservoir in this ecosystem. Additional research on the interaction between civet parasites with other carnivores is needed. Data from this study provides important data about parasites of wild carnivores in Thailand.

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