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Ectoparasites of *Rattus* sp from Petaling Jaya, Selangor, Malaysia

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ABSTRACT

Seven species of ectoparasites (Three Mites, two Sucking Lice, one Chewing Lice and one Dipteran) were recocvered from the Brown Rat Rattus norvegicus *(n = 10) and the Roof Rat* Rattus rattus *(n = 15 at the wet market of Jalan Othman, Section 3, Petaling Jaya, Selangor, Malaysia. The species collected in Brown Rat included* Echinolaelaps echidninus, Myobia *sp. and* Hoplopleura acanthopus *while those recovered from parasitized House Rat were* Echinolaelaps echidninus, Dermanyssus gallinae, Myobia *sp.*, Hoplopleura acanthopus, Goniocotes gallinae *and one unidentified Anopluran and Dipteran species. Result of the investigation indicated that there was variation in the infestation and distribution of ectoparasite in both species.* Echinolaelaps echidninus *was the dominant ectoparasite species found on all rats captured (100% infested). The presence of* Dermanyssus gallinae *and* Goniocotes gallinae *was peculiar as these were normally found on avian species. As trapping was conducted near a markaet area, infestation by such ectoparasites could have originated from chickens as the original hosts. The potential of each ectoparasite in the transmission of zoonoses diseases was discussed.*

INTRODUCTION

Most small mammal ectoparasite surveys within the state of Selangor, Malaysia, particularly in Bukit Lanjan and Air Hitam Forest Reserve were done in the late 80's (Shabrina *et al.*, 1989). Domestic rats, particularly those living in close association with man, play a major role in human health, welfare and economy. Their arthropod ectoparasites are important vectors of pathogenic organisms. Inherently, they are causative agents of many allergic disorders (Bakr *et al.*, 1996). No doubt, the increase in domestic rats population is followed by an increase in many zoonotic diseases, such as, scrub typhus (Lim *et al.*, 1980; Tanskul and Linthicum, 1999) and dermatitis (Rosen *et al.*, 2002). Due to the role of domestic rat ectoparasites such as chiggers, ticks and fleas as vectors of zoonotic pathogens, it is important to document host-parasite associations and infestation parameters for parasitic arthropods infesting domestic rats. The objective of the study was to examine the ectoparasite load and diversity of two common rat species, the roof rat *Rattus rattus* and the brown rat *Rattus norvegicus* in urban areas in Malaysia.

MATERIALS AND METHODS

Study Site

The study was conducted at the wet market in Jalan Othman, Petaling Jaya, Selangor (latitude 3° 05 North and longitude 101° 38 East), Malaysia i.e. 10 km from Kuala Lumpur. It is a residential and commercial area. The map of the study site is shown in *Fig. 1.*

Rat Trapping

Rats were captured in standard commercial live traps baited with fresh prawns. Traps were placed on the floor at places where rats were noticeably active. Two to three traps were placed at each trap point. The trap layout is shown in *Fig. 2.* The traps were set at 2200 hours and inspected at 2400 hours. Trapping sessions were carried out for three consecutive nights i.e. from 21 March to 23 March 2002.

Fig. 1: Location of rat trapping site (X)

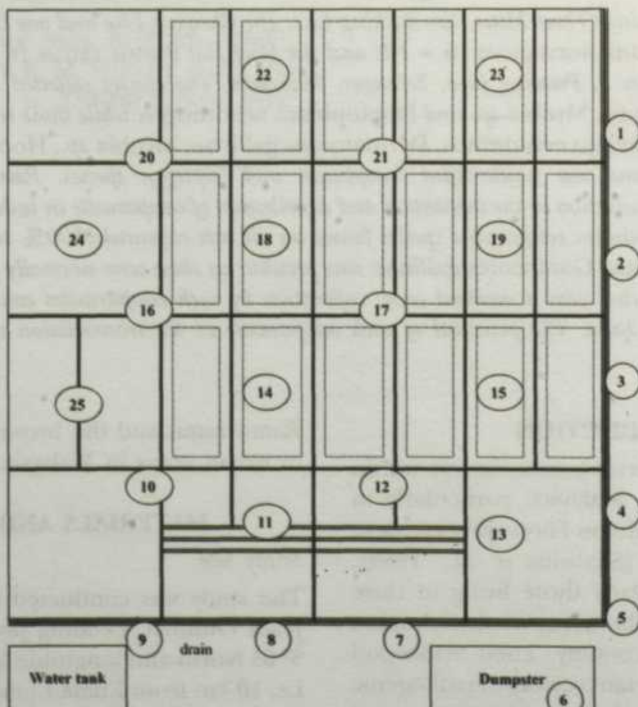

Fig. 2: Trap layout at the wet market of Jalan Othman, Petaling Jaya district of Selangor. Each number represents a trap point

Ectoparasite Removal and Collection

The captured rats were retained in the trap and brought to the laboratory, and killed by transfering into a cotton bag containing a piece of cotton soaked in chloroform. Once killed, the rats were removed from the cotton bag and brushed from tail to head, using a camel brush to remove any ectoparasites, which were collected on a white pan. The cotton bag was also examined for the presence of ectoparasites that might have fallen from the animal when the latter were killed with chloroform. The ectoparasites were stored in vials containing 70% ethanol for preservation and subsequent microscopic examination (Durden *et al.*, 2000). The contents of each vial were then observed under the light microscope and individual ectoparasites were carefully picked using a small forceps, to avoid damaging the ectoparasites. The ectoparasites removed were transferred to fresh vials containing 70% alcohol for preservation and later identification (Durden, 1995; Durden *et al.*, 2000).

Ectoparasite Identification

Individual ectoparasites were mounted on slides in Hoyer's medium (50 ml distilled water, 30 g Arabic gum, 200 g chloral hydrate and 20 ml glycerine). Care was taken to avoid damaging the internal organs of the ectoparasites. Each mounted ectoparasite was cleaned by heating or immersing in lactophenol for at least 24 hours to remove the sclerotin that darkens the exoskeleton and prevent penetration of light, thus aiding in the identification. Mounted specimes were dried in the oven with temperatures between 40 °C to 50 °C for three days (Varma, 1993). Identification of ectoparasites was based on standard taxonomic keys and identification references (Kocan and Niec, 1975; Evans, 1992; Wall and Shearer, 2001). All ectoparasite specimens were sent to Acarology Division, Institute for Medical Research, Kuala Lumpur for further identification and confirmation of the ectoparasite species. (Dr. Ho Tzi Min, Inst. of Medical Research, Malaysia, Personal Communication.)

Rat Identification

Each of the rats captured was identified, labeled as male or female and measured. Identification of *Rattus rattus* and *Rattus norvegicus* was based on external features and measurements. The head and body length of *R. rattus* measures between 180 and 220 mm, tail length is between 185 and 240 mm, hind foot is less than 40 mm, and weighs between 80 to 300g (Tweedy, 1978; Medway, 1978). The head and body of *R. norvegicus* measures between 160 and 260 mm, tail length is between 170 to 230 mm, hind foot is more than 40 mm, and weighs between 200 and 485 g (Walker *et al.*, 1964; Tweedie, 1978; Medway, 1978). Rat species identification was used to compare the two species in terms of infestation levels, prevalence and relative densities of the ectoparasites collected.

Data Analysis

The following parameters as suggested by Durden (1995) were calculated for data analysis.

1. The percentage of rat infested with ectoparasites;

$$\text{Infestation (\%)} = \frac{\text{No of rats infested}}{\text{No. rats collected}} \times 100$$

2. The mean intensity of infestation;

$$\text{Mean Intensity} = \frac{\text{No. of ectoparasites collected}}{\text{No. of rats infested}}$$

3. The relative density i.e. mean no. of ectoparasites per rat host;

$$\text{Relative density} = \text{Infestation (\%)} \times \text{mean intensity}$$

RESULTS AND DISCUSSION

Twenty five domestic rats belonging to 2 species, Brown rat (*Rattus norvegicus)* and Roof rat (*Rattus rattus)* were trapped alive with a trap success rate of 31.2%. Table 1 lists the % infestation (percentage of hosts infested), mean intensity (mean per infested hosts) and relative density (mean per hosts) for each ectoparasite identified, actual number of ectoparasites and % composition (percentage of each ectoparasite from the total number of ectoparasites from each rat species). Seven species of ectoparasites (3 mites, 2 sucking lice, 1 chewing lice and 1 dipteran) were recovered from *R. norvegicus* and *R. rattus* and a total of 521 individual ectoparasites were collected from both rats. Seven species of ectoparasites (288 specimens) were collected from *R. rattus* compared to three species (233 specimens) collected from *R. norvegicus.* Telford *et al.* (1980) documented similar findings in terms of ectoparasite diversity between the two rat hosts.

Echinolaelaps echidninus was common to both *R. norvegicus* and *R. rattus* bearing the highest infestation rate i.e. 100% and 93.3%, respectively. *E. echidninus* is a well documented ectoparasite of rats (Botelho and Linardi, 1996; El Deeb *et al.*, 1999). Table 1 also shows that % composition of *E. echidninus* was higher in *R. norvegicus* (92 %) than *R. rattus* (51 %). Telford *et al.* (1980) found that *E. echidninus* accounted for 75 % of the ectoparasites recovered from *R. rattus.* According to Schmidt and Roberts (2000) and Marquardt *et al.* (2000), *E. echidninus* has the potential to spread the protozoan *Hepatozoon*

TABLE 1
Ectoparasites recovered from 25 domestic rats at the wet market of Jalan Othman, Section 3, Petaling Jaya, Selangor, 2002

Host Species	Ectoparasites*	I (%)	MI	RD	n	C(%)**
Brown rat,	Mites					
Rattus norvegicus	*Echinolaelaps echidninus*	100	21.4	21.4	214	92
n = 10 (2 males, 8 females)	*Myobia* sp.	30	3.7	1.1	11	5
	Sucking Lice (Order: Anoplura)					
	Hoplopleura acanthopus	50	1.6	0.8	8	3
Roof rat,	Mites					
Rattus rattus	*Echinolaelaps echidninus*	93	10.4	9.7	146	51
n = 15 (8 males, 7 females)	*Dermanyssus gallinae*	40	14.7	5.9	2	0.6
	Myobia sp.	13	1.0	0.1	30	10
	Sucking Lice (Order: Anoplura)					
	Hoplopleura acanthopus	60	3.3	2.0	88	31
	Antarctopthirus sp.	33	3.4	1.1	17	6
	Chewing Lice (Order: Mallophaga)					
	Goniocotes gallinae	13	2.0	0.3	4	1
	Flies					
	Diptera (unidentified)	7	1.0	0.1	1	0.3

* For each ectoparasite species, infestation parameters listed are % infested, I; mean intensity (mean per infested host), MI; relative density (mean per host), RD; actual no. of ectoparasites, n; and % composition, C.
** T-test indicates that the ectoparasite composition was not significantly different between the two rat species, t = 0.002, ns.

muris in rat populations, but thus far, there is no evidence that it infects humans (Schmidt dan Roberts, 2000).

Myobia sp. and *Hoplopleura acanthopus* were also recovered from both rat hosts. The presence of prostigmatid mites, *Myobia* sp. is a matter of interest. According to Hirst (1922), a number of mites from the subfamily Cheyletinae were not dependent on their host and are predators of other mites such as Tyroglyphid mites or other small arthropods, but are sometimes, also parasitic.

Ninety six specimens or 18.4 % of all ectoparasites recorded were the sucking lice, *Hoplopleura acanthopus* (Order: Anoplura) (Table 1). *H. acanthopus* was found on both host species but with higher infestation and percentage composition on *R. rattus* compared to *R. norvegicus*. Hopkins (1949) stated that the genus *Rattus* is often infested with *Hoplopleura* sp. and *Polyplax* sp. King *et al.* (1980) reported that 25 % of *Rattus norvegicus* and 20% of *R. rattus* examined were infested with *Polyplax* sp. and *Hoplopluera* sp. These lice may play a supplementary role in the infection of murine thyphus in rat populations (King *et al.*, 1980).

The occurrence of *Dermanyssus gallinae* and *Goniocotes gallinae* were peculiar, which are normally found on avian species. Close proximity between rat populations and chickens is a plausible explanation. This phenomenon was also reported by Bakr *et. al.* (1995) wherein *D. gallinae* found on rodents were in close association with domestic animals. *D. gallinae* has been known to infest domestic chickens and turkey and wild birds such as pigeons, sparrows and starlings. (Varma, 1993). *D. gallinae* has been suggested as a vector for the St Louis encephalitis arbovirus (Varma, 1993). This was substantiated by Mehlhorn (2001), who associated *D. gallinae* with the spread of St. Louis encephalitis virus and anemia on chickens. Regan *et al.* (1987) claimed that *D. gallinae* is a potential vector for the eastern and western equine encephalomyelitis virus. According to Kirkwood (1967), *D. gallinae* can cause anemia, leading to lower egg production in domestic chickens and birds and may cause death of the host species. *D. gallinae* also poses a potential health hazard to workers in poultry pens and chicken farms (Hoffman, 1987). According to Bowman *et al.* (2002), *D. gallinae* is the only chicken mite that can cause dermatitis to humans, particularly when there is an absence of avian hosts, nearby poultry pens and chicken processing units.

Goniocotes gallinae commonly known as chicken lice was only found on *R. rattus*. *R. rattus* is not a usual host for *G. gallinae* which may become infected with the latter when the normal host dies. Since the study site is a wet market where chickens were slaughtered, it is most likely the ectoparasite looks for an alternative host i.e. *Rattus rattus* that are in close proximity to the chicken host.

The presence of *G. gallinae* and *D. gallinae* on rat host in this study is a new documentation on host-parasite interaction. A similar host-parasite interaction involving domestic cats and *D. gallinae* has been reported by Muller *et al.* (1983) and Grant (1985; 1989). Most of the cases of *D. gallinae* infestation of domestic cats can be related to the close association between the former and chicken farms (Bowman *et al.*, 2002). This supports the present study which indicates a close association between domestic chicken *Gallus gallus* and the roof rat, *Rattus rattus,* in terms of host parasite interaction.

Xenopsylla cheopis, a vector of the dreadful bubonic plague was absent from the sampled rat hosts. Any epidermic zoonoses, if present, may be restricted within the rat population as indicated by the high infestation of *E. echidninus* in the study area.

In terms of ectoparasitic composition, the two rat species were not different (T-test; t = 0.002, ns), although *R. rattus* carries double the number of ectoparasite species, i.e. six compared to three in *R. norvegicus*. In terms of ectoparasite composition, *R. norvegicus* recorded 92% *Echinolaelaps echidninus* compared to 51% in *R. rattus*. The latter also recorded 30% *Hoplopleura acanthopus*. This may reflect the different ecology and foraging habits of the two commensal rats.

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