

PATHOGENIC MICROORGANISMS IN WILD RATS AND SHREWS

**Nur Ain Shafiqah Mohd Said, ¹Mohd Azmi Mohd Lila, ^{1,3}Shaik Mohamed
Amin Babjee, ^{1,3}Abdul Rahim Mutalib, ²Abdul Rani Bahaman
& ¹Zeenathul Nazariah Allaudin**

¹*Department of Veterinary Pathology and Microbiology*

²*Department of Veterinary Laboratory Diagnosis*

³*Wildlife Research Centre*

Faculty of Veterinary Medicine

Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia

ABSTRACT

Rats are the most widespread pest species and well-known to transmit zoonotic disease agents and cause destruction to the environment. In this study, twenty rodents were trapped by using wire traps baited with various baits in Serdang, Sepang, Seremban and Rembau, Malaysia. The locations represented the urban and suburban habitats and distribution of rodents. Three rat species and one shrew species were trapped from these habitats. There was no significant ($p>0.05$) difference in bait preference by the rats from either habitat. No *Salmonella* was detected in the rodents. Seventy-five percent of the rodents were found to be infested with at least one of nine different types of ectoparasites identified. All rodents (100%) were infested with at least one type of endoparasites. There was significant ($p<0.05$) difference in parasitic distribution between habitats, with urban rats more infested with ectoparasites. Among the parasites of potential medical importance identified were *Polyplax spinulosa*, *Hoplopleura pacifica* and *Ornithonyssus bacoti*. In conclusion, the species parasites of rats were partly determined by the nature of their habitats. Also, the rodents live in close proximity to human especially in urban areas and they carry organisms that may be detrimental to the health of humans and other animals. Thus, appropriate measures are needed to control the rodent population to prevent the spread of diseases to humans and other animals.

Keywords: rat infestation, bait preference, *Salmonella*, ectoparasites, endoparasites, public health

INTRODUCTION

Rats are the most common urban pest species that has been a major problem all around the world. The rodent pests have caused extensive structural damages, foodstuff spoilage and are carriers of various disease agents, such as *Leptospira* sp.,

Seoul hantavirus, murine typhus, *Yersinia pestis* and *Coxiella burnetii* (the cause Q fever in humans). Rats also harbour various types of ecto- and endo-parasites such as *Taenia taeniformis*, *Hymenolepsis diminuta*, *Capillaria hepatica*, *Toxocara cati*, which causes toxocariasis in humans, *Nippostrongylus brasiliensis*, *Heterakis* spp and *Toxoplasma gondii*. Some of these ecto- and endo-parasites are important vectors of pathogenic microorganisms and parasitic zoonoses such as babesiosis and plague (Paramasvaran *et al.*, 2009). Since the rodents live in the close proximity to humans, they are in constant contact with humans and increasing the risk of zoonotic disease transmission.

This study was conducted to investigate the habitat and the potential role of rats in transmitting disease agents.

MATERIALS AND METHODS

Trapping and Identification of Rodents

Trapping of rodents was conducted in Serdang and Sepang and Rembau and Seremban, Malaysia. All rodents were trapped alive using ten wire traps of various sizes. Oil palm fruit, banana, baked coconut, dried fish, bread and leftover food were used to determine bait preferences of the rodents. Trapped rodents were euthanised by placing the rodents in a container with cotton wool soaked with chloroform. Identification of rodent species was by morphological measurements and physical appearances of the rodents using the keys and illustrations described by Brooks and Rowe (1987) and Herbreteau *et al.*, (2011).

Collection and Processing of Samples

Upon euthanasia, the fur of the rodents was combed vigorously with a flea comb to dislodge ectoparasites onto a tray layered with a piece of white paper. Fine forceps was used to extract ticks that did not dislodge by combing. Skin scrapping and hair pluck were taken around skin lesions. All recovered ectoparasites were preserved in a collection bottle containing 75% alcohol, and mounted with Hoyer's medium before they were examined under the microscope for identification. The rodents were dissected and the gastrointestinal tracts were examined for adult worms. Colon content was taken for faecal floatation technique to look for the presence of ova and *Coccidia*. All adult worms were put in the 75% alcohol for preservation. Cestodes were stained with aceto-alum-carmin to view of the scolex and mature proglottid for more accurate identification.

To isolate *Salmonella*, swab samples of colon content were incubated in Rappaport-Vassiliadis broth as selective-enrichment broth for *Salmonella* and incubated at temperature of 37°C for 48 hours. Then loopfuls of the cultured broth were spread onto XLD and BGA agar and incubated at 37°C for 24 hours. If the typical *Salmonella* colonies appeared on BGA (as pink/red colonies) and on XLD (as blackish colonies), subculture was done on blood agar to purify before identification using biochemical tests, which included SIM, TSI, citrate, urea, ONPG

and LDC. If the results of the biochemical tests showed typical characteristics of *Salmonella*, serotyping with Polyvalent O was conducted.

All findings were analysed using chi-square test.

RESULTS AND DISCUSSION

Species Distribution

Seventeen rats and 3 shrews were caught during the study. *Rattus tiomanicus* was the most dominant population of rat species caught. This could be due to the fact that most of the suburban sampling locations were located near oil palm plantations and *R. tiomanicus* are usually found in secondary forests and oil-palm plantations.

Bait Preference

Chi-square test showed that there was no significant difference between types of bait preferred by the trapped animals. However, oil-palm fruit was observed to be much more preferred by rodents in sub-urban areas where most of the *R. tiomanicus* were caught. According to Brooks and Rowe (1987), rodents tend to select a nutritional balanced diet if given the choice, and oil-palm fruits are known to have high nutrient value. The urban rats appeared not to be uninterested in oil-palm fruit, most possibly because the fruit is not a familiar food material for urban rodents. The fruit was probably considered by the rodents as something new and need to be avoided. This phenomenon may be associated with the 'neophobia', which is fear of eating new and unfamiliar foods (Inglis *et al.*, 1996). Neophobia may also explain why in this study it was difficult to capture the rats, especially in urban habitats, which are commonly inhabited by *Rattus norvegicus*. In this study, the rats seemed to be avoiding the traps.

Isolation of Salmonella

No *Salmonella* was isolated from the colon content in this study. *Salmonella* is excreted intermittently in the faeces of the rats, and only a small percentage (20%) of infected rats became carriers and shed the bacteria in their faeces (Bartram *et al.*, 1940). Dunlap *et al.* (1991) showed that *Salmonella* tends to reside in the spleen and liver, by localising in the cells of those organs as a means to escape the host immune system or from antibiotic treatment.

Ectoparasite

Almost all rats were found to harbour at least one species of ectoparasites. Chi-square test showed that there is significant ($p < 0.05$) difference between number of ectoparasite-infested rats and habitats with the urban being more infested with ectoparasites than suburban rats.

Rats from both habitats harboured almost the same species of ectoparasites. Among ectoparasites species that were collected were mites: *Ornithonyssus bacoti*, *Laelaps echidninus*, *Notoedres muris*, and Trombiculid mites; lice: *Polyplax spinulosa*, *Polyplax serrata*, and *Hoplopleura pacifica*; ticks: *Ixodes*; and fleas:

Xenopsylla cheopis. The finding of the study is similar that of an earlier study (Paramasvaran *et al.*, 2009).

Endoparasites

All rats and shrews were found to be infested with more than one endoparasites. There was no significant ($p>0.05$) difference between number of infested rats and habitats. Also there was no significant ($p>0.05$) difference between type of endoparasites between habitats.

Using the faecal floatation technique, it was found that very few rats and shrews had *Coccidia* (Urban: 25%, Sub-urban: 33.3%). The rodents were also found to harbour *Capillaria*, *Ascarididae*, Strongyles, and *Hymenolepididae*. Examination of the intestinal contents recovered mostly tapeworms and they were of the genus *Hymenolepididae*. One acantocephalan was also found in one of the rats from urban habitats. Very few adult worms were collected from direct examination of intestinal contents. This suggests that these rats were mildly infested, thus the number of the adult worms were too low to be detected by examination of the intestines.

REFERENCES

- Bartram MT, Welch H, and Ostrolenk M (1940). Incidence of members of the Salmonella group in rats. *The journal of Infectious Diseases*, 67(3): 222-226.
- Brooks JE and Rowe FP (1987). Commensal Rodent Control. World Health Organization.
- Dunlap NE, Benjamin WH, McCall RD, Tilden AB, and Briles DE (1991). A 'safe-site' for *Salmonella typhimurium* is within splenic cells during the early phase of infection in mice. *Microbial Pathogenesis*, 10: 297-310.
- Herbreteau V, Jittapalopong S, Rerkamnuaychoke W, Chaval Y, Cosson J-F and Morand S (2011). Protocols for field and laboratory studies. Kasetart University Press. Pp20-23.
- Inglis IR, Shepherd DS, Smith P, Haynes PJ, Bull DS, Cowan DP and Whitehead D (1996). Foraging behaviour of wild rats (*Rattus norvegicus*) towards new foods and bait containers. *Applied Animal Behaviour Science*, 47: 175-190.
- Paramasvaran S, Sani R, Hassan L, Krishnasamy M, Jeffery J, Oothuman P, Salleh I, Lim K, Sumarni and Santhana M (2009). Ectoparasite fauna of rodents and shrews from four habitats in Kuala Lumpur and the states of Selangor and Negeri Sembilan, Malaysia and its public health significance. *Tropical Biomedicine*, 26(3): 303-311.