

# A SURVEY OF BACTERIAL AND PARASITIC INFECTIONS OF RATS CAUGHT IN THE VETERINARY RESEARCH INSTITUTE (VRI), IPOH

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**ABSTRACT.** A postmortem survey on ten rats (*Rattus* spp.) caught in the Veterinary Research Institute (VRI) was done to evaluate the parasite, viral and bacterial status. The rats were trapped in the laboratory animal facilities in VRI. The results indicated that seven rats harboured mites (*Demodex* sp.) from skin samples. Parasite eggs such as strongyle and *Strongyloides* sp. were also recovered from the intestines of four rats. Bacterial species isolated from the organs include *Mycoplasma arthritidis*, *Corynebacterium* sp., *Staphylococcus epidermidis*, *Escherichia coli* and *Enterococcus* sp. Serological test detected the presence of antibody against *Leptospira canicola*, *Leptospira celledoni* and *Leptospira pyrogenes*. Many of these organisms are zoonotic especially Leptospirosis which can cause severe disease in humans. No pathogenic viruses were recovered from the rats. Control and eradication of pests like rats is essential to safeguard the health of humans.

## INTRODUCTION

Rats can spread over 35 diseases to humans directly, through handling of rodents, through contact with rodent faeces, urine, or saliva, or through rodent bites or indirectly, through ticks, mites or fleas that have fed on an infected rodent (<http://www.cdc.gov/rodents/index.html>). Likewise, rodents can also spread diseases to animals in farms, homes and the outdoors. Wild rats can carry many different “zoonotic” pathogens, e.g. *Leptospira* sp. and *Toxoplasma gondii* and may transfer these across the species barrier to humans (The Merck Veterinary Manual, 2005). However, information on the current status on rodent-borne diseases in Malaysia is lacking.

## Hantavirus Pulmonary Syndrome (HPS)

Hantavirus pulmonary syndrome (HPS) is a deadly disease transmitted by infected rodents through urine, droppings, or saliva. Humans can contract the disease when they breathe in aerosolized virus. HPS was first recognized in 1993 and has

since been identified throughout the United States. Although rare, HPS is potentially deadly. Rodent control in and around the home remains the primary strategy for preventing hantavirus infection.

### **Murine Typhus**

Murine typhus (caused by infection with *R. typhi*) occurs worldwide and is transmitted to humans by rat fleas. Flea-infested rats can be found throughout the year in humid tropical environments, but in temperate regions are most common during the warm summer months. Travelers who visited rat-infested buildings and homes, especially in harbours or riverine environments, can be at risk of exposure to the agent of murine typhus.

### **Rat-bite fever (RBF)**

Rat-bite fever (RBF) is a systemic bacterial illness caused by *Streptobacillus moniliformis* that can be acquired through the bite or scratch of a rodent or the ingestion of food or water contaminated with rat faeces.

### ***Salmonella enterica* serovar Typhimurium**

As its name suggests, it causes a typhoid-like disease in mice. In humans *S. typhimurium* does not cause as severe a disease as *S. Typhi*, and is not normally fatal. The disease is characterized by diarrhoea, abdominal cramps, vomiting

and nausea, and generally lasts up to 7 days. Unfortunately, in immunocompromised people, that is the elderly, young, or people with depressed immune systems, *Salmonella* infections are often fatal if they are not treated with antibiotics.

### **Leptospirosis**

Leptospirosis is a bacterial disease that affects humans and animals. It is caused by bacteria of the genus *Leptospira*. In humans it causes a wide range of symptoms, and some infected persons may have no symptoms at all. Symptoms of leptospirosis include high fever, severe headache, chills, muscle aches, and vomiting, and may include jaundice (yellow skin and eyes), red eyes, abdominal pain, diarrhoea, or a rash. If the disease is not treated, the patient could develop kidney damage, meningitis (inflammation of the membrane around the brain and spinal cord), liver failure, and respiratory distress. In rare cases death occurs.

### **Eosinophilic Meningitis**

Eosinophilic meningitis is an infection of the brain occurring in association with an increase in the number of eosinophils, white blood cells that are associated with infection with worms that penetrate into the body. The organism most commonly causing eosinophilic meningitis is a rat lung worm called *Angiostrongylus cantonensis* (<http://www.cdc.gov>)

Webster and MacDonald (1995) studied the parasite and disease load of wild rats on farms in England and reported the following findings (<http://www.ratbehavior.org/WildRatDisease.htm>).

- Helminths (worms):
  - the oxyuroid pinworm *Syphacia muris* in 67% of the rats
  - the strongoloyd parasite *Nippostrongylus brasiliensis* found in 23%
  - the liver worm *Capillaria* in 23%
  - the cestode *Hymenolepsis diminuta* in 22%
  - *Toxocara cati* causing Toxocariasis in 15%
  - the oxyuroid pinworm *Heterakis* spp. in 14%
  - the cestode *Hymenolepsis nana* in 11%
  - the intestinal tapeworm *Taenia taeniaeformis* in 11%
- Bacteria
  - *Leptospira* spp. bacteria causing Weil's disease in 14%
  - *Listeria* spp. bacteria causing listeriosis in 11%
  - *Yersinia enterocolitica* bacteria causing yersiniosis in 11%
  - *Pasturella* spp. bacteria causing Pasturellosis in 6%
  - *Pseudomonas* spp. bacteria causing Meilioidosis in 4%
- Protozoa
  - *Cryptosporidium parvum* causing cryptosporidiosis in 63% of the rats
  - *Toxoplasma gondii* causing toxoplasmosis in 35%

- *Trypanosoma lewisii* in 29%
- *Eimeria separata* in 8%
- Rickettsia
  - *Coxiella burnetti* evidence of infection by Q fever in 34%
- Viruses
  - *Hantavirus* causing Hantaan-fever or hemorrhagic fever in 5%
- Ectoparasites (note: these ectoparasites are vectors for diseases which are transmissible to humans, such as typhus)
  - Fleas found on 100% of the rats
  - Mites found on 67%
  - Lice found on 38%

Thus, this study aims to determine the pathogens carried by rats in the VRI compound, that may be transmitted to humans and animals. This study is especially important as several zoonotic diseases are studied on the premises and laboratories, increasing the risk of contamination to wild rats in the compound.

## MATERIALS AND METHODS

Ten rats were caught in the VRI compound using the conventional mouse trap and post mortem was conducted for disease investigation. Samples of blood, faeces, skin scrapings, sera and organs were collected from each rat and sent for identification of pathogens that may be present such as parasitic, viral and bacterial. For parasitology, samples tested were faeces, blood and skin scraping. Faecal samples was subjected to floatation technique

while thin blood smear examination was conducted on blood samples (Christopher *et al.*, 1992). For ectoparasite detection and identification, skin scrapping was processed according to Manual of Veterinary Investigation Laboratory Techniques: Parasitology, 1978. Sera samples were used for antibody detection of leptospirosis using Microscopic Agglutination Test (MAT) and organ samples were sent for viral and bacterial isolation. MAT was conducted according to OIE 2004 and fifteen *Leptospira* antigens were used in this method such as *L. australis*, *L. ballum*, *L. bataviae*, *L. canicola*, *L. celledoni*, *L. cynopteri*, *L. djasiman*, *L. grippotyposa*, *L. hardjo*, *L. hebdomadis*, *L. tarassovi*, *L. icterohaemorrhagiae*, *L. pomona*, *L. pyrogenes* and *L. patoc*.

As for bacteriology, conventional technique of bacterial culture was conducted on the organ samples using blood agar and McConkey agar, incubated for 24 hours at 37°C and checked on the next day for further species isolation and Biochemical tests (Harknes & Wagner, 1995). Viral isolation was conducted also on the organ samples collected from the rats (OIE, 2004).

## RESULTS

The results show that seven rats harboured mites (*Demodex* sp.) from skin samples while parasite worm eggs such as *Strongyle* and *Strongyloides* sp. were also recovered from the intestines of four rats. Bacterial species isolated from the organs include

*Mycoplasma arthritidis*, *Corynebacterium* sp., *Staphylococcus epidermis*, *Escherichia coli* and *Enterococcus* sp. MAT results showed presence of antibodies against *Leptospira canicola*, *Leptospira celledoni* and *Leptospira pyrogenes* from the sera samples. However, no blood parasites were detected from thin blood smear examination and no virus was isolated from all the organ samples.

## DISCUSSION AND CONCLUSION

During this study, it was found that more than half of the rats were positive for the diseases mentioned. Leptospirosis, which is zoonotic, can infect several primary hosts including dogs, rodents (rats, mice, voles), pigs, cattle and horses. In these animal species the infection may be subclinical, however when it is transmitted to other incidental hosts (species such as humans and cats) the infection can be more severe. Transmission to humans usually occurs via inhalation, ingestion or skin contact and inoculation – especially contact with urine (<http://www.cdc.gov/rodents/index.html>). A few cases of Leptospirosis have been reported in humans lately in Malaysia and have even caused death.

In this study, seven out of the ten rats were positive for *Demodex* sp. mites. *Demodex* is a genus of tiny parasitic mites that live in or near hair follicles of mammals (Soulsby, 1982) which can cause demodecosis of skin which may have a rosacea-like appearance. Paramasvaran (2009) reported *Nippostrongylus*

**Table 1.** Results obtained for parasitology, virology and bacteriology from 10 rats caught in VRI

No. Samples	Parasitology			Virology	Bacteriology	Serology test
	Skin	Organ	Intestine	Organ	Organ	Serum
Rat 1	Positive mites	Negative	Strongyloides	Negative	Negative	Negative
Rat 2	Positive mites	Negative	Negative	Negative	Negative	Negative
Rat 3	Positive mites	Negative	Negative	Negative	<i>Mycoplasma arthritidis</i>	Negative
Rat 4	Positive mites	Negative	Negative	Negative	<i>Mycoplasma arthritidis</i>	Negative
Rat 5	Positive mites	Negative	Negative	Negative	<i>Corynebacterium sp.</i> and <i>Staphylococcus epidermidis</i>	<i>Leptospira canicola</i>
Rat 6	Positive mites	Negative	Strongyloides	Negative	Negative	Negative
Rat 7	Positive mite	Negative	Negative	Negative	<i>Escherichia coli</i> , <i>Staphylococcus epidermidis</i> and <i>Enterococcus sp.</i>	Negative
Rat 8	Negative	Negative	Strongyloides	Negative	<i>Mycoplasma arthritidis</i>	<i>Leptospira celledoni</i> , <i>Leptospira pyrogenes</i>
			Strongyle			
Rat 9	Negative	Negative	Strongyloides	Negative	Negative	Negative
			Strongyle			
Rat 10	Negative	Negative	Strongyle	Negative	Negative	Negative

*braziliensis*, a strongyle commonly found in rats. In this study, 2 rats was positive for *S. epidermidis*, 2 positive for *M. arthritidis* while one each for *Corynebacterium sp.*, *E. coli* and *Enterococcus sp.*, *S. epidermidis*, is a gram-positive bacteria commonly found on the skin of most animal species, including mice and rats.

In rats, ulcerative dermatitis may be observed on the head and neck, often secondary to skin trauma from fighting or scratches. (The Merck Veterinary Manual,

*Demodex sp.* from skin scraping

2005). *Corynebacterium* species occur commonly in nature in the soil, water, plants, and food products (Collins *et al.*, 2004; Yassin *et al.*, 2003). *Escherichia coli* (*E. coli*) is a bacterium that is commonly found in the gut of humans and warm-blooded animals. Most strains of *E. coli* are harmless. Some strains however, such as enterohaemorrhagic *E. coli* (EHEC), can cause severe foodborne disease (<http://www.who.int/mediacentre/factsheets/fs125/en/>).

Percy and Barthold (2001) found that wild rats carry mycoplasma, though the percentage of the population that is infected may vary from place to place. Wild rats also do not carry the plague. When rats catch the plague, they die from it. Other wild rodents who are resistant to the plague carry it in their bloodstream, and the plague is transmitted from animal to animal by fleas. Plague epidemics were caused by the plague jumping (fleas) from these wild rodents to rats, and from rats (before or as they died) to humans. Today, the plague is treatable with antibiotics and cases are rare. Wild rats almost never carry rabies, and there has never been a case of human rabies caused by rat bite in the United States, though such cases have been found very rarely in other countries.

From this study, it can be concluded that wild rats can be responsible for the spread of many diseases, either directly, through contamination of human food with their urine or faeces, or indirectly, by way of rodent fleas and mites as vectors. Therefore, precautions need to be taken

in order to prevent the spread of diseases especially for workers involved in animal care.

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