THE INFESTATION RATES OF ECTOPARASITES ON RATS IN KINGFISHER PARK

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ABSTRACT

A parasitological study was done on commensal rodents in Kingfisher Park, Sabah. The study was primarily conducted to determine the infestation rates of ectoparasites on the rat specimens. The data collected was also used to determine differences among location, gender and infestation rates. A total of 34 individual rats were captured. The 34 individuals were successfully divided into three rat species which were *Rattus norvegicus*, *Rattus exulans* and *Rattus argentiventer*. From those 34 rats a total of 634 positive counts of ectoparasites were recorded. The 634 individual ectoparasites were then identified and divided into 11 major broad groups; *Polyplax sp1*, *Polyplax sp2*, *Polyplax sp3*, *Polyplax spinulosa*, *Dermatophagoides sp1*, *Dermatophagoides sp2*, *Ornithonyssus bacoti*, lice morphospecies sp1, lice morphospecies sp2, mite chigger morphospecies sp1 and mite chigger morphospecies sp2. *Dermatophagoides* sp2 was the species with the highest individual count; where 167 individuals were detected, and lice morphospecies sp2 with 7 individuals were the least found. The total infestation rate obtained from the 34 rats in Kingfisher Park was 91.18%. Mann-Whitney U test on the genders resulted with U=111.00, Z= -1.189, and p= 0.234. The observed p-value was larger than the expected p-value. The means of infestation rates based on genders did not have any significant difference. The Kruskal-Wallis test was used for the sampling location and resulted $\chi^2 = 28.493$, df = 2, p = .000 which means that there was significant differences with the infestation rates between locations, the p-value is smaller than .05. The differences was detected between sampling location in the open area with a mean rank of 9.00 and the commercial area with a mean rank of 30.00.

ABSTRAK

Satu kajian parasitologi dijalankan ke atas tikus komensal di Kingfisher Park, Sabah. Tujuan utama kajian ini dijalankan adalah untuk menentukan kadar infestasi ektoparasit ke atas specimen tikus. Data-data yang diperolehi dapat digunakan untuk menentukan perbezaan antara lokasi, jantina tikus dan kadar infestasi ektoparasit. Sebanyak 34 tikus ditangkap. 34 tikus tersebut telah dibahagikan kepada tiga spesies; *Rattus norvegicus, Rattus exulans* dan *Rattus argentiventer*. Daripada 34 tikus tersebut, sebanyak 634 ektoparasit dapat dikutip. Kesemua 634 individu ektoparasit tersebut diidentifikasikan dan dikalsifikasikan ke dalam 11 kumpulan; *Polyplax sp1, Polyplax sp2, Polyplax sp3, Polyplax spinulosa, Dermatophagoides sp1, Dermatophagoides sp2, Ornithonyssus bacoti,* morfospesies kutu sp1, morfospesies kutu sp2, mite chigger morphospecies sp1 dan mite chigger morphospecies sp2. *Dermatophagoides* sp2 merupakan species ektoparasit yang terbanyak dijumpai dengan 167 individu dan morfospesies kutu sp2 didapati merupakan spesies paling sedikit dijumpai, 7 individu sahaja. Jumlah kadar infestasi yang didapati daripada 34 individu tikus di Kingfisher Park adalah 91.18%. Ujian Mann-Whitney U menunjukkan U=111.00, Z= -1.189, dan p= 0.234. Nilai nilai-p cerapan didapati lebih besar daripada nilai-p kiraan. Ini menunjukkan bahawa min kadar infestasi pada jantina tidak mempunyai perbezaan yang signifikan. Ujian Kruskal-Wallis digunakan untuk menguji perbezaan min kadar infestasi pada lokasi persampelan. Hasil mencatatkan χ^2 = 28.493, df = 2, p = .000 dan ini menunjukkan bahawa terdapat perbezaan signifikan kerana nilai-p lebih kecil daripada .05.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PHOTOS

CHAPTER 1

INTRODUCTION

1.0 INTRODUCTION

Parasitism is a symbiosis relation (Tortora *et al.*, 2002) which is a special form of predation, where the parasite usually lives in or on its host. Wikipedia (2004a), also describes a parasite as an organism which consumes resources from the host organism. It is assumed that it is not an advantage for the parasite to kill its host, since by doing so it would only destroy its source of nourishment and in some cases, protection (Avila, 1995). The prevalence of ectoparasites in the general population is relatively and usually low, but the number can increase in vulnerable groups (Heukelbach and Feldmeier, 2004).

The term parasites is very wide, therefore, it is define to two major groups; endoparasites and ectoparasites. Both the groups are defined by their choice of infestation

on its host; endoparasites are parasitic organisms that live within the host's tissues or organs and ectoparasites refers to parasitic organisms that live on the surface of the host's skin (Campbell, 1996).

There had been some series of research on infestation rates of ectoparasites on domestic rats in the Peninsula of Malaysia and in Sabah, but there are no records revealing research work done in Kingfisher Park. In Ulu Gombak Forest, Shariff (1990) reported that 30% of the samples collected was positive with ectoparasites infestations. In Ho and Krishnasamy (1990) research in Taman Negara, Malaysia, ectoparasites can be found on the specimens collected. Mites, regardless the species, have the highest infestation rates and are most common on rats (Shariff, 1990; Shariff *et al.*, 1989; Shariff *et al.*, 1992; Ho and Krishnasamy, 1990). And studies also revealed that fleas are the least found species of ectoparasites.

According to Williamson (1996), every other developing area around the world, regardless the surrounding environment, will have pest problems coming from rats. Commensal rodents, particularly domestic and field rats, will inflict pest problems to its surrounding ecosystem (Lim *et al.*, 1989). And in this case Kingfisher Park is included to the list. The rats in the surrounding area are exposed to various filthy and unhealthy conditions surrounding them and their habitat. Infestations of ectoparasites on the rats are inevitable due to poor grooming and unclean habitat environment. Most mammals,

regardless whether they are of terrestrial or of partially terrestrial background, have a coat of hair or fur. And within the coat are a variety of arthropods, mostly ectoparasites, in which will prey on their hosts briefly or permanently live on the host's body.

The infestations that happens on a rat does not only affects the rats but to other organisms in the surrounding area, especially the residents of Kingfisher Park. According to Friedhoff (1990), there are interactions between protozoan parasites with ectoparasitic vectors. The probability of an ectoparasite causing a disease is quite high because they are may vector microorganisms and may indirectly infecting its prey when feeding. Ectoparasites has been known for transmitting dangerous diseases such as leptospirosis, schistosomiasis and scrubtyphus (Audy, 1961; Lim *et al.*, 1989). As what also happened during the 14th century, the primary vectors that started transmitting the great plague in Europe were rats (Cartwright, 1991). Rats have high adaptability towards man-made habitats (Harwood, 1981) which makes them rather dangerous and harmful.

1.1 JUSTIFICATION OF STUDY

The main rational for this study is to determine the variety of ectoparasites that are infesting on commensal rats in Kingfisher Park. Furthermore, there has not been any study recorded in Kingfisher Park. The information collected during the study here will aid in determination of the actual potential of an outbreak cause particularly by ectoparasitic organisms. According to Ho and Krishnasamy (1989), the host of the major parasites of medical importance were found in areas of human settlement. Kingfisher Park is a new developing area, where human activity rates are increasing annually. With a history of coastal and wet land environmental background, the surrounding area is very suitable habitat for rat infestations. If there is a high possibility of rat infestation, then there will certainly be a high possibility of ectoparasitic infestations on the rats. Thus by having a list of known ectoparasite and vector, we can determine the potentiality of a singular rat species to vector a dangerous disease or plague.

The infestations that happens on a rat does not only affects the rats but also to other organisms in the surrounding area, especially in this case the residents of Kingfisher Park. According to a study by Friedhoff (1990), there are interactions between protozoan parasites with ectoparasitic vectors. Ectoparasites vector these diseases by carrying protozoan microorganisms and indirectly infecting its prey when feeding. The parasites can be transferred into the tissues of the host as the ectoparasite feeds.

Ectoparasites have been known for transmitting dangerous diseases such as leptospirosis, schistosomiasis and scrubtyphus (Audy, 1961; Lim *et al.*, 1989). And as what also happened during the 14th century, the primary vectors in transmitting the great plague which kill in Europe were rats (Cartwright, 1991). Wikipedia (2004b), also claimed that the Great Plague or the bubonic plague in Britain killed one fifth of the population in London during its outbreak in 1665. Generally it was taken into account that the rats were vector to fleas carrying a parasitic infection by a bacterium, *Yersinia pestis*.

Previous studies done by Shariff, (1990), Shariff *et al.*, (1989), Shariff *et al.*, (1992), and Ho and Krishnasamy, (1990), had showed that mites infestations on rats are the most common ectoparasites found. And studies also revealed that fleas are the least found species of ectoparasites. According to Roberts and Janovy (2000), a common rat mite, *Echinolaelaps echidinus*, is responsible for transmitting a protozoa *Hepatozoon muris* from rats to rats. Although there are no records stating about transmitting to humans, the mite has been suspected to be responsible for dermatitis.

Rats have high adaptability towards man-made habitats (Harwood, 1981) and this factor makes them an even more dangerous and potential vector that can eventually harm man-kind. The study on infestation rates of ectoparasites on rats will eventually

make realize about the harmfulness of the infestations mainly towards the surrounding residents (Arbain, 1990).

1.2 STUDY OBJECTIVES

The objectives of this paper are firstly, to prepare a list of ectoparasites of the domestic rats in Kingfisher Park based on a series of sampling around the area. The list will be based on the morphological identification made on the ectoparasites collected. Next, the relations for the infestation rates with the sampling location plots are determined.

1.3 STUDY SCOPE

The study scope is to determine the relation between the rates of ectoparasites infestation on rat specimens in Kingfisher Park with the sampling location plot within the area of habitat.

CHAPTER 2

LITERATURE REVIEW

2.0 PARASITISM

The origin concept of parasitism defined the relationship as the use of one organism, the host, as both habitat and a source of nourishment by another organism, the parasite (Zelmer, 1998). Parasitism is a symbiosis relation (Tortora *et al.,* 2002) which is a special form of predation, where the parasite usually lives in or on its prey, which is also refer as a host. As with more conventional predator-prey relationships, it is not at an advantage for the parasite to destroy or kill its host, because by doing so it would only destroy its source of nourishment and in some cases, protection (Avila, 1995). The prevalence of ectoparasites in the general population is relatively and usually low, but the number can increase in vulnerable groups (Heukelbach and Feldmeier, 2004).

Parasites are divided into two separate classes which generally indicate the availability of the parasites on or in the host. According to Campbell (1996), the term ectoparasites refer to the parasitic organisms that can be found on the external surface of a host. And on the other hand, the term endoparasites refer to parasitic organisms that live within the host tissues. There are no groups of animal that has more important value in the study of parasitism than the arthropods. Perhaps this fact is not at all surprising because the phylum Arthropoda consists of 80% of the known animal species. Not only are most of the arthropods parasitic species, but many of them are infested with parasitic microorganisms and furthermore acts as a vector. Most of the transmissions are to other animals, mainly consists of the vertebrate. Addition to that, there are some parasitic organisms that actually act as an intermediate hosts for many helminth parasites at their larvae stages (Street, 1975).

2.1 MORPHOLOGIES, CHARACTERISTICS AND HABITATS OF ECTOPARASITES.

Below is a list of morphologies, characteristics and habitats of the four major ectoparasites that is expected to be found and detected on the rat specimens in Kingfisher Park;

2.1.1 FLEAS

Fleas are from the *Insecta* class and had been included in the order *Siphonaptera*. Fleas are small, compressed, well-adapted, intermittent blood-sucking ectoparasites (Mani, 1982). Fleas are believe to have evolved from the flies, which lost the ability of flight. According to Street (1975), fleas are not host specific parasites, which means that a single flea may have a variety of host as long as the host has what it needs; blood nourishment. There are not more than 1,000 species of fleas but the functions the fleas play in vectoring disease and plagues makes their presences significant.

The flea's physical presences can be detected easily on the surface as it is relatively big enough to be seen without any optical aids. Basically, adult fleas are about 1/16 to 1/8 of an inch long, dark reddish brown and have a relatively hard body (Lyon, 2004). It is flatten bilaterally and thus give it an advantage moving between hair, fur or feathers (Saleha, 1994). It is a flightless insect that has adapted very well with the ability to jump. It uses its hind legs to jump and can achieve remarkable records; for example according to Street (1975), the human flea, *Pulex irritans*, is able to reach a length of 13 inches horizontally and 8 inches vertically.

Morphologically according to Mani (1982), the flea's integument is heavily sclerotized, and has smooth, shiny brown color. A propleurosternum covers the head from below resulting immobility of its head. The flea has antennal fossae. The flea's thorax consists of 3 segments and its abdomen consists of 10 segments; greatly swollen in female (Mani, 1982). The fleas have mouthparts designed for piercing and sucking. Its bite are rarely felt but the salivary secretions may cause skin irritations among its host (Lyon, 2004). Addition to that, there is a row of spines or combs on the head near the mouthparts known as the genal comb (Saleha, 1994). The genal comb is absent in species of fleas found on rats (Lyon, 2004). It also has spines on its body which actually projects to the posterior of its body (Mani, 1982)

Unlike other insects, fleas undergo a complete metamorphosis during their life cycles. For a flea to complete its life cycle from an egg to an adult will varies from few weeks to a couple of months; which directly depends on the surrounding conditions which includes; temperature and humidity, and also species (Street, 1975). When hatched, the tiny larvae are cylindrical and looks very similar to a maggot. Legs and eyes are not present on the larvae, but the larvae are sensitive and able to detect and avoid light, wherever possible. Larvae do not have the capability to suck blood yet. It will then feed on any organic matter available to them, in which most of it consist of hair, dead skin and faeces of adult fleas (Lyon, 2004). According to Street (1975), the faeces of an adult flea usually contain an abundance supply of their hosts' undigested blood.

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