PARASITE BIODIVERSITY IN *RATTUS* SPP CAUGHT IN WET MARKETS

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Abstract. *Rattus* spp trapped in wet markets in Quiapo, Manila and Balayan, Batangas had ectoparasites, *Echinolaelaps echidnius* (mite), and *Polyplax spinulosa* (louse). The endoparasites identified were *Hymenolepis diminuta*; the acanthocephalan *Moniliformis moniliformis*; *Taenia taeniaeformis* strobilocercus larvae and *Capillaria hepatica* in liver; *Trichosomoides crassicauda* of the urinary bladder; *Sarcocystis* sp of muscle tissue; and two different species of strongyloid-looking intestinal nematodes. Rats had 100% infection with *C. hepatica* and *T. taeniaeformis*, exhibiting high parasitemia. The co-existence of rats with diverse parasitic species is reflective of the host's capability to support parasites' behavioral, physiological, and developmental needs. Despite heavy infection with intestinal parasites, and marked hepatic tissue damage owing to severe capillariasis and strobilocercus larval infection, all rats appeared healthy and agile, suggestive of a well-established rat host-parasite relationship. In view of the diversity and zoonotic nature of rat parasites, and the impoverished conditions prevailing in communities where *Rattus* spp survive and proliferate, they can readily facilitate parasite transmission to humans and other susceptible animal hosts.

INTRODUCTION

In tropical and subtropical countries, at least 20 species of rodents have been recognized as pests to agricultural crops, including *Rattus norvegicus* (Norwegian rat/ brown rat/ sewer rat) and *Rattus rattus* (house rat/ roof rat/ black rat/ ship rat), two of the most successful and widespread species in the world (Roberts, 1977; Fall, 1980 cited by Fernando *et al*, 1985). Rats are omnivorous, feeding on stored food, grain, fruits and vegetables. In the Philippines, *R. norvegicus* and *R. rattus* (and their subspecies) are often identified as important pest species (Sanchez, 1975). Rodents are hosts to a number of ectoparasites such as lice, mites and ticks that can transmit viral, bacterial and protozoan parasites to man and animals (Linardi *et al*, 1985; Durden and Page, 1991; Soliman *et al*, 2001). In addition, they can harbor many different protozoan and helminthic endoparasites (Nickel and Buchwald, 1979; Davoust *et al*, 1997; Mafiana *et al*, 1997; Namue and Wongsawad, 1997; Mahida, 2003). Other than the tremendous economic losses to agriculture owing to their pestiferous nature, rats survive and proliferate in close association with humans in households, agricultural and commercial places (Benigno and Marges, 1978), thus making them interesting subjects for research. Although there are several reports on rat parasites in other parts of the world, documented studies in the Philippines are wanting. In this paper, we present our findings on the biodiversity of parasites in *Rattus* spp caught in wet markets.

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MATERIALS AND METHODS

Nine female and three male adult rats (*Rattus* sp) weighing 231 to 400 g were captured in wet markets in Quiapo, Manila and in Balayan, Batangas, using traps with food bait. Rats housed in wire cages were brought to the laboratory for examination. Some rats had black fur, while others were brown in coloration, suggestive of the two most common and widely distributed rat species, *R. rattus* and *R. norvegicus*.

Skin examination for parasites

Rats were anesthetized by plugging cotton balls dipped in chloroform in the snout. The fur was gently scraped off using a fine brush; hair particles and ectoparasites that dropped off were transferred to a Petri dish, and examined using magnifying lenses and dissecting microscope. The ectoparasites collected in small vials were fixed in 70% alcohol.

Examination for endoparasites

Rat skin was removed and the body cavity was slit open from the throat to the anus, revealing the esophagus, stomach, intestine, liver and urinary bladder. Tissue samples of the tongue and diaphragm were pressed between two glass slides, and examined for *Trichinella* sp and *Sarcocystis* infection, with the

aid of both dissecting and light microscope. The esophagus, stomach, intestine, liver and urinary bladder were placed in individual Petri dishes containing 0.95% mammalian saline solution (MSS). Except for the liver, which was examined for the presence of cysts/nodular structures, tubular organs were flushed with MSS and/or split open to facilitate detection of parasites in the flushings as well as in the organ itself. Small and large parasites isolated from tubular organs were fixed in 70% methanol and 10% formalin, respectively. Tissue samples of intestine, liver and urinary bladder of infected rats, as well as tongue and diaphragm that had cysts or cyst-like bodies, were fixed in 10% formalin and processed using the standard histologic H & E staining technique (Carleton, 1957).

Parasites isolated from the skin and organs (and those observed in tissue sections) were identified using several references (Chandler, 1961; Faust *et al*, 1970; Schmidt and Roberts, 1989; Roberts and Janovy, 1996; Bush *et al*, 2001), and documented using photomicroscopy.

RESULTS

Despite the relatively few rats examined, we were able to isolate several different parasites. Eight (67.0%) and five (42.0%) of the rats had infestation with the mite *Echinolaelaps echidnius* and louse *Polyplax spinulosa*, respectively, manifesting heavy and mixed infestation in some rats.

The esophagus and stomach of all 12 rats were negative for parasites. The intestine of eight rats had *Hymenolepis diminuta*, and five rats had light to heavy infection with the acanthocephalan parasite *Moniliformis moniliformis*. Intestinal parasitic roundworms exhibiting strongyloid-like morphologic features were isolated, the species of which could not be verified owing to the worm's coiled body form, presumably due to the use of insufficiently heated fixative. The liver of all 12 rats examined had heavy infection with the *Taenia taeniaeformis* strobilocercus larva ("cysticercus fasciolaris"), and *Capillaria hepatica* manifesting heavy parasite egg burden. Liver tissue sections manifested necrosis and granulomae around egg masses. Rodents are known to serve as secondary hosts of *T. taeniaeformis* (with felines as primary hosts), while *C. hepatica* infects primarily rodents through predation or until the liver decomposes. However, it has been found in a wide variety of mammals, including humans (Schmidt and Roberts, 1989). Five female rats had light infection with the threadworm nematode, *Trichosomoides crassicauda*, with some partially embedded in the epithelium of the urinary bladder. Tissue sections of the tongue and diaphragm had thick walled sarcocysts containing numerous zoites.

DISCUSSION

We identified the two most commonly reported epidermal parasites, *E. echidnius* and *P. spinulosa* (Linardi *et al*, 1985; Soliman *et al*, 2001). The high infection rate and heavy infection of rat liver with *C. hepatica* and *T. taeniaeformis*, and with the intestinal *H. diminuta* and *M. moniliformis*, are consistent with earlier studies in other countries (Min, 1979; Antonakopoulos *et al*, 1991; Webster and MacDonald, 1995; Mahida, 2003). Particularly interesting was the 100% rat infection with *C. hepatica* and *T. taeniaeformis*, which reinforces the idea of the potential use of *C. hepatica* in the control of rat population (Gardiner *et al*, 1981). Infection of rodents with *T. crassicauda* and/or several species of *Sarcocystis* is consistent with earlier reports by Dubey *et al* (1989) and Jakel *et al* (1997).

Other than those species that we isolated and identified, earlier surveys documented rat susceptibility to several other protozoan and helminthic parasites, including *Xenopsylla cheopis,* a commonly known flea that infests oriental rats (Seo *et al*, 1964; Nickel and Buchwald, 1979; Schmidt and Roberts, 1989; Webster and MacDonald, 1995; Davoust *et al*, 1997; Namue and Wongsawad, 1997). The small number of rats we examined may account for our failure to document other parasitic species of rats.

The diversity in rat parasites points to their adaptability as well as the enormous capability of the host to support parasites' behavioral, physiological/nutritive and developmental needs. Despite heavy intestinal infection with *H. diminuta* and *M. moniliformis*, and marked damage to hepatic tissue due to severe capillariasis and strobilocercus larval infection, the rats appeared healthy and agile/active, reflective of a well-established and presumably successful rat host-parasite interrelationship. In view of the diversity and zoonotic nature of rat parasites, and the impoverished conditions prevailing in communities where *Rattus* spp survive and proliferate, rats can readily facilitate parasite transmission to humans and other susceptible animal hosts.

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