SEROLOGIC DETECTION OF *TOXOPLASMA GONDII* INFECTION IN *RATTUS* SPP COLLECTED FROM THREE DIFFERENT SITES IN DASMARIÑAS, CAVITE, PHILIPPINES

Cristina C Salibay\(^1\) and Florencia G Claveria\(^2\)

\(^1\)Biological Sciences Department, College of Science, De La Salle University-Dasmariñas, Dasmariñas, Cavite; \(^2\)Biology Department, College of Science, De La Salle University-Manila, Taft Avenue, Manila, Philippines

**Abstract.** Acute and chronic cases of toxoplasmosis in *Rattus norvegicus* and *Rattus rattus mindanensis* caught in agricultural, commercial and residential sites in Dasmariñas, Cavite, Philippines were determined serologically. Fifty-eight percent of *R. norvegicus* and 42.0% of *R. r. mindanensis* were positive for anti-*T. gondii* antibodies (Abs). Infection was higher in male rats, and those caught in the commercial site had 100.0% seropositivity. Thirty percent of the *R. norvegicus* and 51.0% *R. rattus mindanensis* had acute infection, with 1:64-1:128 Abs titer. Seventy percent of the *R. norvegicus* and 49.0% of *R. rattus mindanensis* were chronically-infected with Abs titer 1:256-1:2048 and 1:256-1024, respectively. The association between the presence of infection with the rat gender and species and their collection sites was insignificant (p>0.05). In a related study, however, mice experimentally-inoculated brain tissue homogenate obtained from chronically-infected *Rattus* spp, manifested differences in the onset as well as, severity of infection which was histopathologically evaluated, suggestive of a possible difference in *T. gondii* parasite strain(s) infecting different rat populations.

**INTRODUCTION**

*Rattus* species are the most diverse among the rodents, of which 20 species are considered important pests (Fall, 1980). In the Philippines, the two most important pestiferous rats that survive and proliferate around human habitation include *Rattus norvegicus* and *Rattus rattus mindanensis* (Fernando et al, 1985). Besides the agricultural and domestic damages caused by rats, they are also carriers of human disease, including toxoplasmosis (Morse, 1956; Tenter et al, 2000). *Toxoplasma gondii*, a zoonotic, heteroxenous obligate intracellular parasite has developed several potential routes of transmission within and between different host species (Levine, 1973; Ferguson et al, 1999). Common species of domestic and urban rats are chronic carriers of *Toxoplasma* and serve as a potential reservoir of infection to cats as well as other livestock animals (Wallace, 1973; Webster and MacDonald, 1995; Battersby, 1998). In the absence of cats, *T. gondii* can be maintained by vertical transmission in rats (Dubey, 1997a; Webster et al, 1994). Nevertheless, Wastling et al (2000) underscored the possibility of the natural life cycle of *T. gondii* via a cat-to-rodent-to-cat transmission which may indiscriminately involve infection of other warm blooded animals.

**MATERIALS AND METHODS**

In the Philippines, documented studies on toxoplasmosis are largely serologic in nature, in swine (Mendoza, 1974; Manuel and Tubongbanua, 1977; Marbella, 1980; Manuel, 1982), cats (Minervini, 1985; Dans, 2002), and in a few selected communities in Metro Manila, Mindoro and Leyte (Kawashima et al, 2000). Taking into account the wide distribution and abundance of rodents in environments close to human habitation (Fernando et al, 1985; Gratz, 1988), and their role as carriers/reservoir hosts of *T. gondii* (Galuzo, 1970; Fall, 1980), the present study sought to establish serologically the presence of *T. gondii* infection in *R. norvegicus* and *R. rattus mindanensis* caught in agricultural (AGR), commercial (COM), and residential (RES) sites in Dasmariñas, Cavite, Philippines.
Five ml of blood sample was extracted from each rat through venipuncture of the jugular vein. Blood was allowed to clot at RT for 30 minutes and centrifuged at 1,500 rpm for one minute. Sera were transferred into properly labeled tubes, stored in a refrigerator (4˚-8˚C), and were serologically processed within 24 hours post-collection.

Rat sera were assayed for the presence of anti-*T. gondii* Abs using the TOXOCELL AD Direct Agglutination Test Kit. The test kit contained a suspension of highly purified and concentrated *Toxoplasma* (Ags) used to determine the presence of IgM Abs (1:64-1:128) indicative of acute infection, and IgG Abs (≥1:256) indicative of chronic infection.

Serologic data generated per rat species and collection site were statistically analyzed using chi-square analysis and one-way analysis of variance (ANOVA) (p<0.05).

RESULTS

A total of 157 rat sera were assayed for anti-*T. gondii* Abs. Eighty-seven (55.0%) were seropositive (sero+), broken down as follows: 50 (60.0%) of the 83 *R. norvegicus*, and 37 (50.0%) of the 74 *R. rattus mindanensis* (Table 1). While serologic data suggest greater susceptibility of *R. norvegicus* to *T. gondii* relative to *R. rattus mindanensis*, statistical analysis showed insignificant association between parasite infectivity, rat species, and collection sites.

More male rats tested sero+, except for *R. rattus mindanensis* caught in the COM site (Fig 1). Statistical analysis of gender-related data on toxoplasmosis in *R. norvegicus* and *R. rattus mindanensis* revealed insignificant association (p>0.05).

Comparison of acute and chronic cases across two rat species and three collection sites is summarized in Fig 2. Thirty-five (70.0%) of the sero+ *R. norvegicus*, and 18 (49.0%) of sero+ *R. rattus mindanensis* were chronic cases and registered anti-*T. gondii* Abs titer of 1:256-1:2048, and 1:256 1:1024, respectively (Table 2). All sero+ COM-site *R. norvegicus* were chronically-infected.

DISCUSSION

The relatively high (>55.0%) number of sero+ rats is consistent with earlier documented studies in domestic and wild rats (Webster and MacDonald, 1995; Battersby, 1998). Although more male rats tested sero+ but there was insignificant association (p>0.05) of gender-related toxoplasmosis and this finding corroborates earlier findings in cats (Minervini, 1985) and humans (Lee et al, 2000), suggestive of the parasite’s indiscriminate infectivity to both genders (Minervini, 1985; Dans, 2000).

Present findings are consistent with earlier reports that have identified domestic rats as chronic carriers of the tissue form of *Toxoplasma* (Wallace, 1973; Sasaki et al, 1976; Dubey et al, 1997b) and as a potent reservoir of infection to cats (Wallace, 1973).

The wide range of anti-*T. gondii* IgG titers assayed in the present study is suggestive of a difference in the status/persistence of *T. gondii* infection in rats surveyed vis-à-vis the frequency of their re-exposure to infection. Galuzo (1970) pointed out that the potential of animals to become reservoir hosts of *T. gondii* increases with re-exposure, where the host immune state is heightened with an increase in anti-*T. gondii* IgG titer. However, considering the continued proliferation of parasites even in the presence of high Abs titer, humoral-related immunity may still be insufficient to provide host protection (Stites et al, 1984).

Table 1

<table>
<thead>
<tr>
<th>Collection site</th>
<th>No. sero+ R. norvegicus/total no. assayed</th>
<th>No. sero+ R. rattus mindanensis/total no. assayed (%)</th>
<th>Total no. sera (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGR</td>
<td>20/34</td>
<td>13/28</td>
<td>33/62 (53.0)</td>
</tr>
<tr>
<td>COM</td>
<td>16/24</td>
<td>8/16</td>
<td>24/40 (60.0)</td>
</tr>
<tr>
<td>RES</td>
<td>14/25</td>
<td>16/30</td>
<td>30/55 (54.0)</td>
</tr>
<tr>
<td>Total sero+/total no. of sera species (%)</td>
<td>50/83 (60.0)</td>
<td>37/74 (50.0)</td>
<td>87/157 (55.0)</td>
</tr>
</tbody>
</table>
Fig 1- Gender-related *T. gondii* seropositivity differences in *R. norvegicus* (R.n.) and *R. rattus mindanensis* (R.r.m.) caught in agricultural (AGR), commercial (COM), and residential (RES) sites.

Fig 2- Comparison of acute and chronic cases of *T. gondii* infection in *R. norvegicus* and *R. rattus mindanensis* caught in AGR, COM, and RES sites; antibody titer (acute: 1:64-1:128; chronic: 1:256-1:2048).

Table 2

<table>
<thead>
<tr>
<th>Species</th>
<th>Collection site</th>
<th>Titer (IgG Abs)</th>
<th>Total chronic cases(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1:256</td>
<td>1:512</td>
</tr>
<tr>
<td><em>R. norvegicus</em></td>
<td>AGR</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>COM</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>RES</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td><em>R. rattus mindanensis</em></td>
<td>AGR</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>COM</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>RES</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Total no. of rats per IgG titer (%)</td>
<td></td>
<td>20</td>
<td>19</td>
</tr>
</tbody>
</table>

In conclusion, we have established serologically the presence of *T. gondii* infection in *R. norvegicus* and *R. rattus mindanensis* caught in the AGR, COM, and RES sites in Dasmarinas, Cavite, Philippines. To our knowledge, the present findings may represent the first documented study of *T. gondii* infection in rats in the country.

REFERENCES


Dubey JP. Toxoplasmosis in rats (*Rattus norvegicus*):
congenital transmission to first and second generation offsprings and isolation of Toxoplasma gondii from seronegative rats. *Parasitology* 1997a;115:9-14.


