HELMINTH PARASITES OF CATS FROM THE VIENNETIAN PROVINCE, LAOS, AS INDICATORS OF THE OCCURRENCE OF CAUSATIVE AGENTS OF HUMAN PARASITOSIS

SCHOLZ T.*, UHLÍŘOVÁ M.* & DITRICH O.*

Summary:
A total of 55 domestic cats (Felis catus f. domestica) and one wild (Bengal) cat (Prionailurus bengalensis) from the Vientiane Province, central Laos, were examined for helminth parasites with emphasis given to potential human parasites. The following species were found (parasites infective to man marked with an asterisk): Opisthorchis viverrini*, Haplorchis pumilio*, H. taichui*, H. yokogawai*, Stellantchasmus falcatus* (Digenea); Spiorocephalus sp.*, Dipylidium caninum*, Taenia taeniaeformis (Cestoda); Capillariidae gen. sp., Toxocara canis*, T. cat*, Ankylostoma ceylanicum*, A. tubaeforme, Gnathostoma spinigerum*, Physaloptera preputialis (Nematoda); and Oncicola sp. (Acanthocephala). This study demonstrated that examination of cats may provide useful data on the occurrence of helminths which are potential causative agents of human diseases.

KEY WORDS: helminths, cats, Laos, human parasites, prevalence, epidemiology.

INTRODUCTION

In some regions of Southeast Asia, such as Korea, northeastern Thailand and Laos, infections with helminth parasites, transmitted to humans by eating raw or undercooked fish (fish-borne helminthoses), are among the most frequent (Velasquez, 1982; Chai & Lee, 1990; Giboda et al., 1991a; Muller, 2002). Most of these are caused by trematodes (digeneans), the larval stages (metacercariae) of which are encysted in the flesh of freshwater fish. The diagnosis of human helminthoses is based mainly upon finding parasite eggs in human stools. However, some helminths can remain either coprologically undetected or medically unimportant species can be misidentified as pathogenic para-

sites due to the morphological similarity of their eggs (Ditrich et al., 1992).

Many helminths infecting man also occur in other mammals, including domestic cats, which live close to humans and consume similar food. Cats may thus serve as source of infection for some human parasites and indicate their occurrence in a specific locality (Chandler, 1925; Muller, 2002). Adult worms recovered from these hosts can give an indication of the infection in humans because the larvae and eggs of many parasites of man are indistinguishable (Muller, 2002).

Data on the occurrence of the helminth parasites of cats in Southeast Asia are rather scarce (e.g., Hinz, 1980; Shaikh et al., 1982; Khan, 1987; Rajavelu & Raja, 1988) and almost no information exists from countries of the past Indochina, including Laos (Segal et al., 1980; Muller, 1988). Ditrich et al. (1990) and Giboda et al. (1991a, b) listed five species of trematodes and other endo-helminths, most not identified to the species or even the genus level, from cats in central Laos. Scholz & Ditrich (1990) and Scholz et al. (1991a, 1992) described the morphology of the surface of the nematode Gnathostoma spinigerum, the liver fluke Opisthorchis viverrin-
rini and heterophyid trematodes of the genera *Haplorchis* and *Stellantchasmus*. However, detailed data on the species composition of the helminths occurring in cats in this country and rates of infection with these parasites have not been provided. In this study, a survey of endoparasitic helminths found in cats from three regions of central Laos is presented and the suitability of these hosts as possible indicators of the occurrence of potential human parasites is discussed.

**MATERIAL AND METHODS**

A total of 55 domestic cats (*Felis catus f. domestica* Linnaeus, 1758) and one Bengal cat (*Prionailurus bengalensis* Kerr, 1792) were examined from the following areas of the Vientiane Province, central Laos, between May and September 1989:

i) Vientiane (markets, temples and streets of the Lao capital; 18° 45' N; 102° 38' E) – 27 domestic cats examined;

ii) Ban Thinkeo, Keo-Oudom District (18° 33’ N; 102° 32’ E) – six domestic cats;

iii) villages around Nam Ngum water reservoir (18° 25'-18° 45' N; 102° 30'-102° 45' E; see Ditrich et al., 1990 for a survey of localities and cats examined) – 22 domestic cats. The Bengal cat, which was shot in the mountains around the reservoir, was purchased in the market of the village of Hanunghok. The cats were anaesthetized and then killed by overdoses of ether and examined in the laboratory using standard procedures. Trematodes, cestodes and acanthocephalans were fixed with 4% formaldehyde solution under coverslip or slide pressure, stained with Mayer’s carmine, dehydrated in graded ethyl alcohol, and mounted in Canada balsam. Nematodes were fixed with hot 4% formaldehyde solution. Small nematodes (*Ancylostoma*) were cleared in graded glycerine solution (1:20-1:2) while large nematodes (ascarids, spirurids) were measured under a dissecting microscope and selected specimens were dissected to observe the structure of the oesophagus.

For scanning electron microscopy (SEM), standard procedure were used. Samples were examined using a Jeol JSEM 6300 microscope and all specimens studied have been deposited in the helminthological collection of the Institute of Parasitology, AS CR, České Budějovice (see Table I for collection numbers).

**RESULTS**

A total of 16 species of the following helminth parasites were found in domestic cats from the Vientiane Province, central Laos (Table I): five species of trematodes (Digenea), namely *Opisthorchis viverrini* (Poirier, 1886) (Opisthorchiidae), *Haplorchis pumilio* (Looss, 1896), *H. taichui* (Nishigori, 1924), *H. yokogawai* (Katsuta, 1932), *Stellantchasmus falcatus* (Onji & Nishio, 1916) (all Heterophyidae), three tapeworms (Cestoda), i.e. *Spirometra* sp. (Dipylidiidae), *Dipylidium caninum* (Linnaeus, 1758) (Dipylidiidae), *Taenia taeniaeformis* (Batsch, 1796) (Taeniidae) (Figs 1-2); seven nematodes (Nematoda), i.e. Capillariidae gen. sp.; *Toxo-

<table>
<thead>
<tr>
<th>Species</th>
<th>Collection number</th>
<th>Vientiane (n = 27)</th>
<th>Ban Thinkeo (n = 6)</th>
<th>Nam Ngum water reservoir (n = 22)</th>
<th>Total (n = 55)</th>
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<tr>
<td></td>
<td></td>
<td>Prevalence (%)</td>
<td>Mean intensity (min.-max.)</td>
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<tr>
<td><em>Opisthorchis viverrini</em></td>
<td>D-254</td>
<td>15-450</td>
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<td><em>Dipylidium caninum</em></td>
<td>C-237</td>
<td>11-30</td>
<td>13-1-54</td>
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<tr>
<td><em>Spirometra</em> sp.</td>
<td>C-242</td>
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<td><em>Taenia taeniaeformis</em></td>
<td>C-239</td>
<td>1-1-4</td>
<td>17-1</td>
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<tr>
<td><em>Ancylostoma ceylanicum</em></td>
<td>N-802</td>
<td>32-1-222</td>
<td>19-6-30</td>
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<tr>
<td><em>Ancylostoma tubaeforme</em></td>
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<td>1-1-2</td>
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<tr>
<td><em>Guadstrongylus spinigerum</em></td>
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<td><em>Toxocara canis</em></td>
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<td>6-1-18</td>
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Table I. – Helminths found in domestic cats in Vientiane Province, central Laos.
The species spectrum of the helminth parasites found in the Bengal cat harboured the following helminths: the most abundant parasites, with the intensity of infection reaching up to several hundreds of specimens, were the intestinal flukes of the genus *Oncicola* (Acanthocephala), namely *Oncicola* sp. (Fig. 13), and *Physaloptera praeputialis* (von Linstow, 1889) (Figs 3-7) (Physalopteridae); and one thorny-headed worm of the acanthocephalan genus *Taenia* (Fig. 11; Table II), *A. tubaeforme* (Figs 9-10) (Toxocaridae). *Ancylostoma ceylanicum* (Looss, 1911) (Fig. 12) (Ancylostomatidae), *Gnathostoma spinigerum* (Owen, 1836) (Gnathostomatidae), *Physaloptera praeputialis* (von Linstow, 1889) (Figs 3-7) (Physalopteridae); and one thorny-headed worm (Acanthocephala), namely *Oncicola* sp. (Figs 13-14) (Oligacanthorhynchidae).

Table I presents the prevalence and intensity of infection with individual parasite species in cats from three different regions in central Laos. All but two cats harboured at least one helminth species, with one host having been infected with as many as six helminth species; 7 % of the cats harboured five species, 16 % four species, 20 % three species, 22 % two species, and 29 % one helminth species.

From the same hosts in other countries in Southeast Asia but differences exist in infection rates of the individual parasite species (Shaikh et al., 1982; Fujinami et al., 1983; Fukase et al., 1984; Asato et al., 1986; Khan, 1987; Rajavelu & Raia, 1988; Saito et al., 1998).

Most of the helminths found in cats in Laos are potential human parasites, or have been reported from accidental infections in man. The highest number of the species are the causative agents of fish-borne helminthoses, namely the flukes *Opisthorchis viverrini*, *Haplorchis* species, *Stellantchasmus falcatus*, and the spiruroid nematode *Gnathostoma spinigerum*.

In Southeast Asia, the liver fluke *O. viverrini* causes opisthorchiosis which affects millions of persons (Hari­nasuta & Vajrasthira, 1960; Wykoff et al., 1965; Rim et al., 1994; Muller, 2002).

All trematodes of the family Heterophyidae found in this study belong to the so-called "small intestinal flukes", which cause heterophyidosis, with most cases occurring in Southeast Asia (Velasquez, 1982; Radomyos et al., 1983, 1990; Sohn et al., 1989; Chai & Lee, 1990; Muller, 2002). Adult trematodes infecting fish-eating birds and mammals differ from each other by the morphology and armament of the ventro­genital complex (Pearson, 1964).

Proso­branchiate snails serve as the first and freshwater fish, in particular cyprinids, and as the second intermediate hosts of both *O. viverrini* and the heterophyids (Pearson, 1964; Wykoff et al., 1965; Scholz et al., 1991b; Abd El-Kader Saad & Abed, 1995).

Definitive hosts of the spiruroid nematode *G. spinigerum* are felids and canids, but man can also become infected after consuming second intermediate or paratenic hosts, in particular freshwater fish (Miyazaki, 1960; Daengsvang, 1982; Anderson, 2000). Frogs and reptiles are potential sources of human infections with species of the pseudophyllidean cestode genus *Spirometroda*. Plerocercoids of this cestode can migrate within the human body, causing sparganosis, the highest prevalence of which is in East and Southeast Asia (Ausayakhun et al., 1993; Chang et al., 1999; Veena Tandon & Imkongwapang, 1999; Muller, 2002).

Cats in Laos were also infected with *Ancylostoma* spp. as well as *Toxocara cati* and *T. canis* that cause the syndrome *larva migrans* (Davies et al., 1993; Muller, 2002).

Migration of infective larvae of species of *Toxocara* within internal organs or in the eyes (ocular larva migrans) in an inappropriate host may result in serious health complications (Glickman, 1993; Magnaval et al., 2001; Taylor, 2001). The hookworm *A. ceylanicum* has been reported from man in India, Thailand, the Philippines, Taiwan, and Japan (Velasquez & Cabrera, 1968; Yoshida et al., 2001; Imkongwapang et al., 1999; Tandon & Muller, 2000; Abd El-Kader Saad & Abed, 1995).

**DISCUSSION**

In cats from the Vientiane Province, Central Laos, as many as 16 species of helminth parasites were found. Parasitic nematodes were the dominant helminth group as to the species richness and prevalence, but small intestinal flukes of the genus *Haplorchis* were the most abundant parasites, with the intensity of infection reaching up to several hundreds of specimens (Table I).

The species spectrum of the helminth parasites found in Laos does not differ significantly from that reported from the same hosts in other countries in Southeast Asia but differences exist in infection rates of the individual parasite species (Shaikh et al., 1982; Fujinami et al., 1983; Fukase et al., 1984; Asato et al., 1986; Khan, 1987; Rajavelu & Raia, 1988; Saito et al., 1998).

Most of the helminths found in cats in Laos are potential human parasites, or have been reported from accidental infections in man. The highest number of the species are the causative agents of fish-borne helminthoses, namely the flukes *Opisthorchis viverrini*, *Haplorchis* species, *Stellantchasmus falcatus*, and the spiruroid nematode *Gnathostoma spinigerum*.
Fig. 8. *Toxocara canis*. Anterior end with cervical alae; ventral view. Figs 9-10. *Toxocara cati*. 9. Anterior end with cervical alae; ventral view. 10. Circumoral lips; apical view. Fig. 11. *Ancylostoma ceylanicum*. Mouth cavity with two pairs of cuticular teeth; subapical view. Fig. 12. *Ancylostoma tubaeforme*. Mouth cavity with three pairs of cuticular teeth; subapical view. Figs 13-14. *Oncicola* sp. Proboscis; subapical views (SEM photomicrographs).
1968, 1973; Areekul et al., 1970; Chowdhury & Schad, 1972). The high prevalence of *A. ceylanicum* in cats from Laos may indicate its common occurrence in this country, in both the feline and the human population. Giboda et al. (1991c) reported the prevalence of infection of Laotians with hookworms up to 48% (n = 112) in the Keo-Oudom District near the Nam Ngum water reservoir; due to the morphological similarity of hookworm eggs, the possibility that some samples actually contained eggs of *A. ceylanicum* cannot be excluded.

The dog tapeworm *Dipylidium caninum* can accidentally infect man, especially in countries where it is known to occur in cats, with most cases reported from children (Hasslinger, 1987; Chappel et al., 1990; Muller, 2002). The cestode *Taenia taeniaeformis* occurs frequently in the small intestine of cats and, much more rarely, of dogs and other carnivores. Its findings in humans are exceptional and without medical importance (Kassai, 1999; Holberg, 2002). Spirurid nematodes found in the stomachs of domestic and Bengal cats from Laos, reported as *Spiraloptera praeputialis*, a common parasite in the stomach of felids and reported from cats in the USA and Asia (Segal et al., 1968; Rajavelu & Raja, 1988; Roberts & Janovy, 1996).

Human infections with species of *Physaloptera* have not been reported, except for accidental cases caused by *P. caucasia* (Linstow, 1902), a parasite of monkeys in tropical regions and other countries (Tongson et al., 1980; Mark, 1982; Rajavelu & Silpa, 1991). The only acanthocephalan found in cats from Laos belongs to the genus *Onicola* Travassos, 1916 (see Schmidt, 1972). Medical importance of species of this group of acanthocephalans is negligible (Roberts & Janovy, 1996; Muller, 2002).

The importance of cats as a source of human parasites was first mentioned by Chandler (1925). Other authors (Hasslinger et al., 1974; Hinz, 1980; Hasslinger, 1987) pointed out that man and cats share some species of parasites, in particular helminths. The present study has demonstrated that the examination of cats may provide valuable information about the occurrence, species composition and biology of potential human parasites, as it was in studies on human parasitoses in Laos in 1989 (Ditrich et al., 1990; Giboda et al., 1991a-c).

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