
A Study on Prevalence of Intestinal Nematodes in Dogs in Phutho Province

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The investigation of the prevalence of gastrointestinal parasitic nematodes of dogs in Phu Tho, Vietnam from 2014-2015 using various methods: Skrjabin's method (1928), Fulleborn's method with the classification system of Schulz and Gvozdev (1970). The results showed that: three species of nematoda were found in the digestive system of dogs: *Spirocerca lupi* (Rudolphi, 1809), *Toxocara canis* (Werner, 1782), *Ancylostoma caninum* (Ercolani, 1859); the prevalence of infection of each species was 6.03%, 29.65% and 44.22%, respectively. There was 19.10% of dogs infected with three species. The infection of nematoda in dogs was high: An autopsy was performed on 342 dogs in Phu Tho province (Yen Lap district, Thanh Thuy district, Viet Tri city) for finding nematoda, the infection rate was 58.19%; the intensity of infection fluctuated from 1 – 54 roundworms/dog. An examination of fecal samples from 542 dogs indicated that, the prevalence of nematoda infection in Yen Lap district, Thanh Thuy district, and Viet Tri city was 63.68%, 44.44% and 47.09% respectively; the average infection rate was 52.03%. The infection rate of nematoda was different between dog species. It was highest in local dogs (66.87%), followed by hybrid dogs (45.93%) and lowest in exotic dogs (22.95%). This infection rate decreased with age. It was highest in dogs at the age of under 2 months old (72.09%); over 2 – 6 and over 6 – 12 months old (61.45% and 43.75 % respectively) and lowest at over 12 months old (22.54%). The infection rate of nematoda was different between modalities: highest in wandering dog 66.82% and lowest in dogs held in captivity (25%). The infection rate of nematoda was different between seasons of a year: it was higher in rainy season (60.29%) and lower in the dry season (43.70%).

Keywords: Dog, Fecal samples, Infection rate, Intensity of infection, Intestinal roundworms, Phu Tho, Viet Nam.

Introduction

Intestinal helminths are pathogens for dogs and a source of potential infection for humans. Prevalence of helminths in dogs was shown in many a study of 324 fecal samples collected from purebred dog races and mongrels in

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Spain revealed 22.2% of helminthes (Giraldo *et al.*, 2005). In Vietnam, 16 species of intestinal nematodes were found in dogs by Pham Sy Lang (1993) and its larvae caused diseases in human beings. According to a study by Iddawela D.R *et al.* (2003), the larvae of *Toxocara canis* (*T.canis*) that parasitizes in human beings caused abdominal pain (45.0%), cough (30.0%), body pain (23.0%), and hives (20.0%).

For the purpose of treating dogs infected with roundworms, our study investigated the prevalence of gastrointestinal parasitic nematodes in dogs in Phu Tho, Vietnam from 2014-2015.

Objectives: Assessing the infection of nematodes in dogs from some locations of Phu Tho Province.

Materials and methods

Materials

Dogs at different ages, their fresh fecal samples, alcohol 70⁰, microscope, animal operative instruments, petri dish, plain glass slice, chemical substances.

Methods

- Taking roundworm samples with the method of Skrjabin (1928); the samples were stored at normal conditions.

- Identifying nematodes using the system of Schulz and Gvozdev (1970), Phan The Viet *et al.* (1999), Nguyen Thi Ky (2003).

- Collecting fecal samples following the rules of the multi-stage sampling, storing the samples at normal conditions, testing fecal samples using the Fulleborn's method.

- Determinating the levels of nematode infection in dogs by counting eggs using the Mc.Master counting tool.

Number of eggs within 1 gram feces as follows:

< 1000 eggs: slight infection (+).

Between 1000 to 2000 eggs: medium infection (++).

> 2000 eggs: high infection (+++).

- Analysing data based on the method of biological statistics (Nguyen Van Thien, 2008) and Minitab 16.0.

Results

Prevalence and infection levels of gastrointestinal parasitic nematodes in dogs through an autopsy

Table 1. Prevalence and infection levels of gastrointestinal parasitic nematodes in dogs (autopsy)

Location (town)	No. of examined dogs (dogs)	No. of namatodes infected dogs (con)	Infection rate (%)	Levels of infections (No. of parasite/dog) min ÷ max
Yen Lap	116	83	71.55 ^a	1 - 54
Thanh Thuy	114	61	53.51 ^{ab}	1 - 41
Viet Tri city	112	55	49.11 ^b	1 - 47
Overall	342	199	58.19	1 - 54

Notes: numbers with different letters in the rows are different and have statistical meanings (P < 0.05)

As shown in Table 1, there were 199 dogs infected with parasitic nematodes in total 342 examined dogs (58.91%), the levels of infection were between 1 to 54 nematodes/dog. The number of dogs with nematode infection (1-54 nematodes/dog) was highest in Yen Lap town (71.55%), lowest at Viet Tri city (49.11% and 1-47 nematodes/dog). This difference of the prevalence had a statistical meaning with P<0.05.

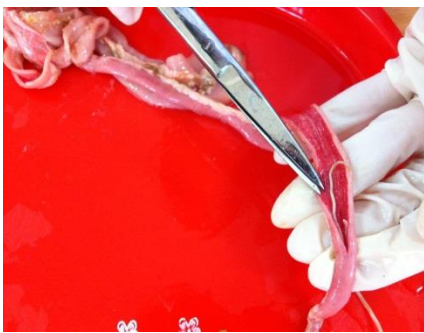


Figure 1. Collecting samples



Figure 2. Nematodes collected in Vietnam

Species identification of gastrointestinal parasitic nematodes in dogs from Phu Tho, Vietnam

Table 2. Species identification of gastrointestinal parasitic nematodes in dogs from Phu Tho, Vietnam

Species	Colonized position	Location (Town)			Coefficient
		Viet Tri city	Yen Lap	Thanh Thuy	
<i>Spirocerca lupi</i> (Rudolphi, 1809)	Oesophagus	+	-	+	66.67
<i>Toxocara canis</i> (Werner, 1782)	Small intestine, stomach	+	+	+	100
<i>Ancylostoma caninum</i> (Ercolani, 1859)	Small intestine	+	+	+	100
Number of species	-	3	2	3	-

Notes: (+) means positive detection, (-) means negative detection.

The results of Table 2 showed that there were 3 species of gastrointestinal nematodes in dogs from Phu Tho, Vietnam. They are *Spirocerca lupi* (Rudolphi, 1809); *Toxocara canis* (Werner, 1782); *Ancylostoma caninum* (Ercolani, 1859), respectively.

Species detection of gastrointestinal nematodes in dogs in Phu Tho, Vietnam showed that 2 out of 3 species were found at the small intestine and stomach of dogs in the studied areas (100%), only 1 species found at the oesophagus of dogs (75%) in Phu Tho, Vietnam.



Figure 3. Mouth, anus and reproductive pore of *Spirocerca lupi* under a light microscope.



Figure 4. Mouth and tail of *Toxocara canis* under a light microscope



Figure 5. Head, reproductive pore and tail of *Ancylostoma caninum* under a light microscope.

Prevalence and the infection levels of gastrointestinal parasitic nematodes based on species

Table 3. Prevalence and the infection levels of gastrointestinal parasitic nematodes based on species

No. of examined dogs (dog)	No. of infected dogs (dog)	Infection rate (%)	Species	No. of infected dogs (dog)	Infection rate (%)	Levels of infection (no. of parasite/dog) min ÷ max
342	199	58.19	<i>Spirocerca lupi</i>	12	6.03 ^d	4 - 52
			<i>Toxocara canis</i>	59	29.65 ^b	1 - 13
			<i>Ancylostoma caninum</i>	88	44.22 ^a	1 - 22
			<i>Cross-infection</i>	38	19.10 ^c	2 - 26

Notes: numbers with different letters in the rows are different and have statistical means ($P < 0.05$).

Notes: numbers with different letters in the rows are different and have a statistical meaning ($P < 0.05$)

The results of Table 3 showed that *Ancylostoma caninum* made up the highest rate (44.22%) in total three species found in Phu Tho, Vietnam while *T.canis* 29.65% and *Spirocerca lupi* 6.03%. The cross-infection of three species in total 38 dogs was 19.10%. This difference of the prevalence has a statistical meaning with $P < 0.05$.

Regarding the levels of roundworm infection discovered in dogs, there was a great significance in total roundworm infections, the highest species number was observed by *Spirocerca lupi* (4 - 52 parasite/dog), the lowest ones was *T.canis* (1 - 13 parasite/dog).

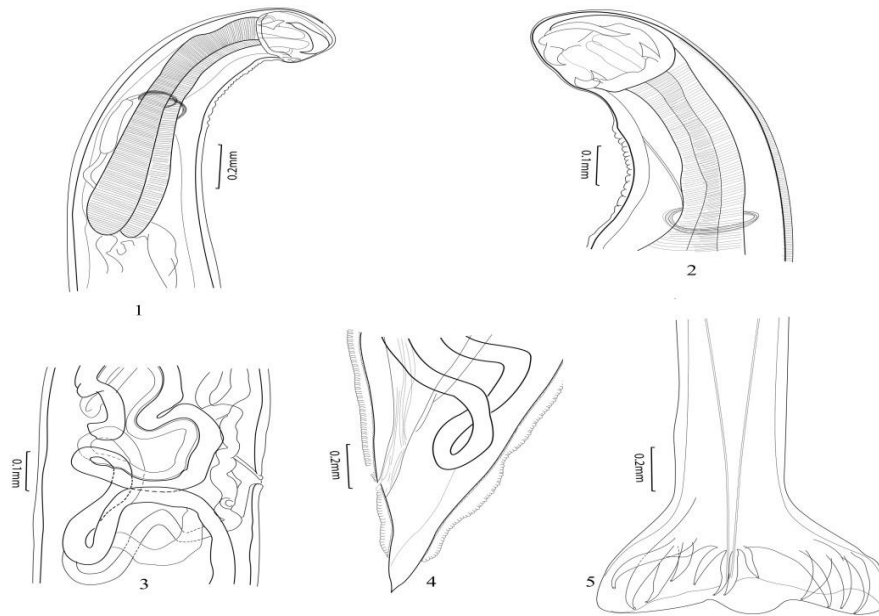


Figure 6. A photograph of *Ancylostoma caninum* (Ercolani, 1859) 1899
1-2. the above of body; 3. the reproductive pore. 4. the tail of female ones.
5. the bursa tail of male ones

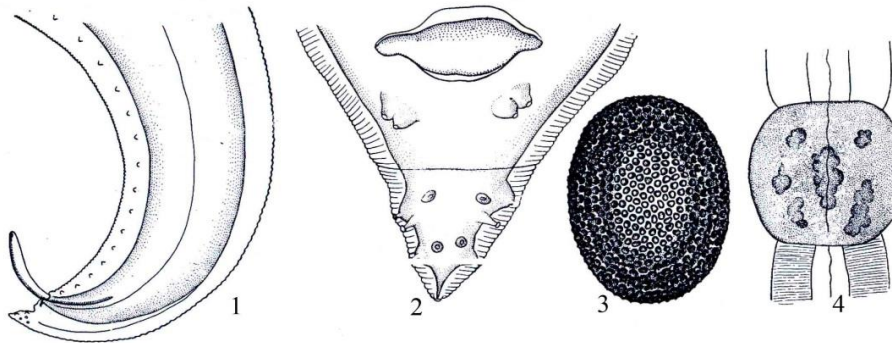


Figure 7. A photograph of *T. canis* (Werner, 1782) Stiles, 1905
1. the tail of male ones. 2. the top of tail of female ones. 3. eggs. 4. oesophagus

Prevalence and the infection levels of gastrointestinal parasitic nematodes by locations

Table 4. Prevalence and the infection levels of gastrointestinal parasitic nematodes by locations (based on fecal examination)

Location (Town)	Fecal samples (ones)	No of positive (ones)	Infected Rate (%)	The levels of infection					
				Light (+)		Medium (++)		High (+++)	
				n	%	n	%	n	%
Yen Lap	190	121	63.68 ^a	73	60.33	32	26.45	16	13.22
Thanh Thuy	180	80	44.44 ^b	49	61.25	23	28.75	8	10.00
Viet Tri city	172	81	47.09 ^{ab}	52	64.20	21	25.93	8	9.88
Overall	542	282	52.03	174	61.70	76	26.95	32	11.35

Notes: numbers with different letters in the rows are different and have statistical meaning ($P < 0.05$).

The results of the table 4 shown that there was 282 positive samples in total of 542 examined samples (52.03%). This rate was different in various studied locations in which the infection rate of the Yen Lap town was with highest (63.68%), the infection rate of the Viet Tri city was lowest (47.09%).

The levels of infection was mostly small in the first level (61.70%), medium high (26.95%) and highest level (47.09%), respectively.

This difference of the prevalence has statistical means with $P < 0.05$. The reasons of the highest infection rate of nematodes parasite in dogs in Yen Lap was due to bad veterinary hygiene conditions in practice, dogs was kept freely and uncaring dogs treatment.



Figure 8. Fecal samples of infected dogs with roundworms

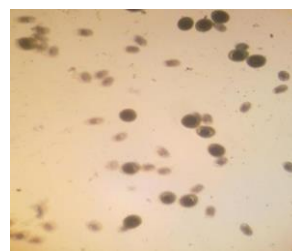


Figure 9. Eggs of roundworms observed by microscope (x100)

Prevalence of gastrointestinal parasitic nematodes based on breed of dogs (via fecal examination)**Table 5.** Prevalence of gastrointestinal parasitic nematodes based on breed of dogs (based on fecal examination)

Breed of dogs	No. of tested fecal samples (ones)	No. of positive samples (ones)	Prevalence (%)	Levels of infection					
				+		++		+++	
				n	(%)	n	(%)	n	(%)
Local dogs	163	109	66.87 ^a	58	53.21	35	32.11	16	14.68
Hybrid dogs	135	62	45.93 ^{ab}	42	67.74	14	22.58	6	9.68
Exotic dogs	61	14	22.95 ^b	12	85.71	2	14.29	0	0
Overall	359	185	51.53	112	60.54	51	27.57	22	11.89

Notes: numbers with different letters in the rows are different and have a statistical meaning ($P < 0.05$)

The results of Table 5 showed that there was 185 positive samples in total of 359 examined samples (51.53%) which samples collected from various breed of dogs. This rate was different in various breeds in which the highest infection rate are domestic dogs (66.87%), hybrid dogs (45.93%), lowest rate in external-dogs (22.95%), respectively. This difference of the prevalence has statistical means with $P < 0.05$.

The levels of infection were in between three levels which are small (60.54%), medium and high levels (11.89%).

Prevalence of gastrointestinal parasitic nematodes by age of dogs (based on fecal examination)

The results of Table 6 showed that there were 164 positive samples in total of 320 tested samples (51.25%). This rate was different at different ages; In particular, the highest infection rate was in dogs at 2 months old and under (72.09%), hybrid dogs (61.45%), lowest rate was seen in exotic dogs (22.95%), respectively. This difference had a statistical meaning with $P < 0.05$. Dogs within 2 months of age were more sensitive to bacterial pathogen with a lower antibody content against environment than those over 12 months of age.

Table 6. Prevalence of gastrointestinal parasitic nematodes by age of dogs (based on fecal examination)

Age of dog (month old)	No. of tested fecal samples (ones)	No. of positive samples (ones)	Prevalence (%)	Levels of infection					
				+		++		+++	
				n	(%)	n	(%)	n	(%)
≤ 2	86	62	72.09 ^a	34	54.84	20	32.26	8	12.90
> 2 – 6	83	51	61.45 ^{ab}	30	58.82	16	31.37	5	9.80
> 6 – 12	80	35	43.75 ^{bc}	24	68.57	8	22.86	3	8.57
> 12	71	16	22.54 ^c	12	75.00	3	18.75	1	6.25
Overall	320	164	51.25	100	60.98	47	28.66	17	10.37

Notes: numbers with different letters in the rows are different and have a statistical meaning ($P < 0.05$)

Prevalence of gastrointestinal parasitic nematodes by living conditions (based on fecal examination)

Table 7. Prevalence of gastrointestinal parasitic nematodes by living conditions (based on fecal examination)

Living condition	No. of tested fecal samples (ones)	No. of positive samples (ones)	Prevalence (%)	Levels of infection					
				+		++		+++	
				n	(%)	n	(%)	n	(%)
Freely	217	145	66.82 ^a	73	50.34	51	35.17	21	14.48
Limitedly	76	19	25.00 ^c	16	84.21	3	15.79	0	0
Semi-limitedly	249	118	47.39 ^b	79	66.95	30	25.42	9	7.63
Overall	542	282	52.03	168	59.57	84	29.79	30	10.64

The results of Table 7 showed that there were 282 positive samples in total 542 tested samples (52.03%), the rate of infection was between 25% and 66.82%.

There were 66.82% dogs infected with roundworms in the free living condition, 47.39% infected dogs in the semi-limited condition and 25% infected dogs in limited conditions. This difference of the prevalence had a statistical meaning with $P < 0.05$.

Prevalence of gastrointestinal parasitic nematodes by seasons (based on fecal examination)

Table 8. Prevalence of gastrointestinal parasitic nematodes by seasons (based on fecal examination)

Season	No. of tested fecal samples (ones)	No. of positive samples (ones)	Prevalence (%)	Levels of infection					
				+		++		+++	
				n	(%)	n	(%)	n	(%)
Winter - Spring	270	118	43.70 ^b	88	74.58	23	19.49	7	5.93
Summer - Fall	272	164	60.29 ^a	82	50.00	56	34.15	26	15.85
Overall	542	282	52.03	170	60.28	79	28.01	33	11.70

Notes: numbers with different letters in the rows are different and have a statistical meaning ($P < 0.05$)

The results of Table 8 showed that 60.29% of the dogs had roundworms in the gastrointestines in summer - fall period, 43.70% in the winter-spring time, respectively. This difference of the prevalence had a statistical meaning with $P < 0.05$.

Discussions

All the results showed that the prevalence of nematode infection in dogs in three locations of Phu Tho province, Vietnam was higher than previous studies and different between those locations due to a high number of dogs in the studied areas. The high rate of nematode infection in dogs can cause limitations in the dog's growth, been affected by other infectious diseases.

As the investigation of Agnieszka Tkowska *et al.* (2010), there were 5 species of gastrointestinal nematodes in dogs in western Pomerania, in which

T.canis is the most common species and *T. vulpis* is the uncommon species. Comparison of this study's results to the publication of Hailu *et al.* (2011), there is a similarity between those, however the infection rate with *T.canis* in dogs in Ethiopia was 25.5%. The infection rate with *Ancylostoma caninum* in Phu Tho is lower than that species in Mexico (62.5%) which is published by Aguilar *et al.* (2005). Our results are in agreement with the results of the infection rate of gastrointestinal roundworms in Nigeria reported by Kutdang *et al.* (2010) which was 5.80% (*Spirocerca lupi*), 38.20% (*T.canis*) and 51% (*Ancylostoma caninum*), respectively.

These study results of the nematode infection rate were higher than the results of Orhun and Avaz's study (2006) in Turkish (30.4%), but lower than Hailu *et al.*'s study (2011) which is 64.4% in Jimma, Ethiopia.

Through this practical investigation of dog care in the studied areas in Phu Tho, Vietnam demonstrated the difference in prevalence and infection levels of roundworms between dog breeds due to characteristics of the breed. Because of veterinary care conditions of external-dogs was better than domestic dogs' care conditions so that the infection rate of roundworms of domestic dogs was lower than external-dogs' rate.

The study results were higher than the results published by Dalimi *et al.* (2006) who reported that the prevalence of *T.cainis* infection in wild dogs was 6.02%, 4.54% in Fox and 10% in Jackals.

There is an agreement between these results and the results of Fok *et al.* (1988) which reported that the infection rate of *T. canis* was highest in dogs within 3 months of age (35.3%), lowest in dogs over 12 months of age (4.0%).

For dogs living in free conditions or semi-limited conditions, they used to excrete feces out to the environment which makes grounds contaminated with eggs of parasites including eggs of nematodes. In addition, the eggs of nematode parasites are stable with temperature, light etc... these eggs might exist several years inside of grounds. Notably, it would be easy to get infected with eggs of nematodes in public areas such as parks or playgrounds (1-30%) which are pathogenic sources for both dogs and humans (Kutdang *et al.*, 2010). That is the reason that the rate of infection of roundworms for dogs in freely living conditions is higher.

Overall, recommendations for dog-owners is to limit travelling dogs arbitrarily in order to reduce eggs and larvae contamination of *T.canis* in the environment which results in decreasing pathogenic infection and larvae.

As the study of Skrjabin K.I and Petrov A.M (1963), dogs were infected with roundworms most of the time but puppies could be infected *T.canis* in months with hot and humid weather as well as from summer to autumn. Another report by Pham Sy Lang (1989), Vietnam's weather is suitable for

eggs of hookworms develop into larvae with ability causing disease that happens from April to October. The weather in winter could be limited development of larvae because of cold weather which kills larvae. Subsequently, the rate of infection of roundworms for dogs in winter is lower than spring and summer.

The results of autopsy examination and testing for 120 dogs in Mexico by Aguilar *et al.* (2005) shown that there were dogs infected with parasites, in which common infected with *T.canis* in puppies and dried seasons.

Overall, the results of this study are in agreement with previous studies.

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