

Current Status of *Gnathostoma* Infection in Thailand

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Abstract

At least five species of *Gnathostoma*: *G. spinigerum*, *G. hispidum*, *G. doloresi*, *G. vietnamicum* and *G. malaysiae* have been documented in Thailand, but only *G. spinigerum* is known to cause human infection. From 1961 to 1963, about 900 patients were clinically diagnosed each year as having gnathostomosis, and about 10 deaths were reported between 1967-1981. Each year, from 1985 to 1988, between 300-600 suspected gnathostomosis patients came to the gnathostomosis clinic at the Hospital for Tropical Diseases, Faculty of Tropical Medicine, Mahidol University. From 1989 until now, about 100-400 new cases of suspected gnathostomosis have been seen each year at this hospital. In Nakhon Nayok and Prachin Buri Provinces, central Thailand, the prevalences of *Gnathostoma* infection in eels were 38.1% and 24.0%, respectively. Most of the positive eels harbored only 1-9 larvae. In Nakhon Nayok, about 12,000 fresh-water fish were examined: 8 out of 72 species were found to be infected with gnathostome larvae. The infection rates in *Monopterus albus*, *Anabas testudineus*, *Channa striata*, *Clarias macrocephalus* and *Channa micropeltes* were 30.1%, 7.7%, 7.4%, 6.7% and 5.1%, respectively. The overall positive rate for *G. spinigerum* eggs in dog fecal samples, which were collected from 21 localities in Nakhon Nayok, was 1.2%. In Bangkok, no infections with *G. spinigerum* were found in the stomachs and intestines of 200 stray dogs; negative results for the worm eggs were also obtained with fecal samples of 370 cats and 518 dogs. A cyclops survey in each of two areas (Ban Phrao, Nakhon Nayok and Tha Ngam, Prachin Buri) found no evidence of natural cyclops infection.

Keywords: *Gnathostoma*, gnathostomosis, current status, Thailand

Human gnathostomosis is a disease primarily caused by larval and immature stages of *G. spinigerum* [1-2]; however, four other species—*G. hispidum* [3-4], *G. doloresi* [5-6], *G. nipponicum* [7-8] and *G. binucleatum* [9-10] are also found to be etiologic agents of the disease. In Thailand, at least five species of *Gnathostoma*: *G. spinigerum* [11-12], *G. hispidum* [13-14], *G. doloresi* [13], *G. vietnamicum* [15] and *G. malaysiae* [16] have been documented in the literature (Table 1), but only *G. spinigerum* is known to be responsible for infection in man [1,17-18].

Human gnathostomosis

From 1961 to 1963, about 900 patients were clinically diagnosed with gnathostomosis each year, and about 10 deaths were reported between 1967-1981 [1,17]. Each year, from 1985 to 1988, between 300-600 suspected gnathostomosis patients came to the gnathostomosis clinic at the Hospital for Tropical Diseases, Faculty of Tropical Medicine, Mahidol University, Bangkok, and annually from 1989 till the present time, about 100-400 new suspected cases (about 1,000-2,000 total cases) visited the Hospital for Tropical

Diseases [19] (Fig 1). It may be thought likely that gnathostomosis cases have decreased gradually over the years. However, this is not true, since the patients' sera sent to the Department of Helminthology, Faculty of Tropical Medicine for serodiagnosis of the disease has never decreased. Each year, between 1997 and 2001, we received about 400-1,000 serum samples, of which quite a number were sent from other private clinics and hospitals [Dekumyoy, personal communication].

Canine and feline gnathostomosis

In Bangkok, the prevalence and positive rates of the infection have varied from 1.1%-10.0% in dogs and 4.0%-8.3% in cats [1,20-24].

However, in 1998, the stomachs and intestines of 200 stray dogs, which were obtained from the Rabies Control Subdivision, were found to have no infection with *G. spinigerum* [25]. Currently, in 2001-2002, 370 cat fecal samples and 518 dog fecal samples, collected from 16 temples, also revealed negative results for the worm's eggs [Rojekittikhun *et al*, unpublished data] (Tables 2 and 3).

In northeastern Thailand, the infection rates in dogs are 1.3%-6.9% [26]. In contrast, the prevalences reported in 1983, in north and northeastern Thailand, were as high as 30.0% in dogs and 26.0% in cats. However, in the same study, gnathostome eggs could not be detected in fecal samples of pigs, cattle and water buffalo [27].

Table 1 *Gnathostoma* species in Thailand.

Species	Host	References
<i>G. spinigerum</i> Owen, 1836	Tiger, dog, cat	Prommas & Daengsvang, 1933; Daengsvang, 1980, 1983
<i>G. hispidum</i> Fedtschenko, 1872	Pig	Dissamarn <i>et al</i> , 1966; Daengsvang, 1972
<i>G. doloresi</i> Tubangui, 1925	Pig	Dissamarn <i>et al</i> , 1966
<i>G. vietnamicum</i> Le-Van-Hoa, 1965	Otter	Daengsvang, 1973
<i>G. malaysiae</i> Miyazaki & Dunn, 1965	Rat (<i>Rattus surifer</i>)	Kamiya <i>et al</i> , 1987

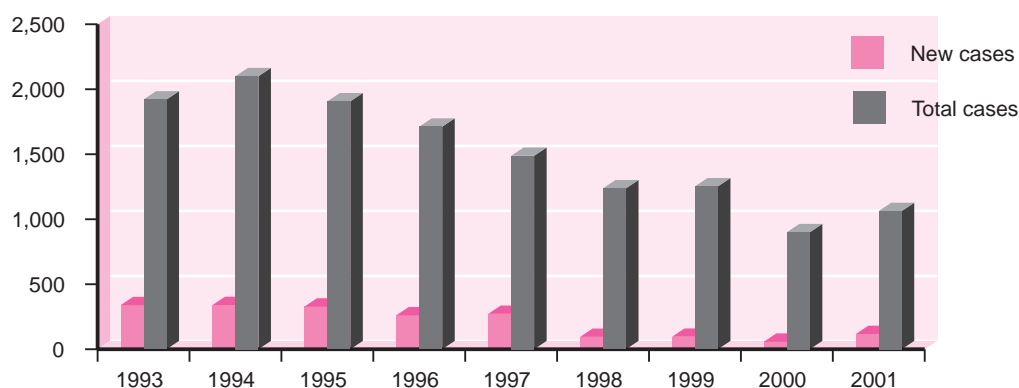


Fig 1 The number of gnathostomosis cases at the Hospital for Tropical Diseases, Faculty of Tropical Medicine, Mahidol University, 1993-2001.

In Nakhon Nayok Province, central Thailand, a total of 1,193 samples of stray and domesticated dogs were collected from 21 localities of four districts—Muang, Ongkharak, Ban Na and Pak Phli, and examined especially for the presence of *G. spinigerum* eggs. Seven of 490 samples (1.4%) from five areas of Muang District were positive for the worm's eggs. Two of 223 samples (0.9%) from two areas of Ongkharak District, and five of 264 samples (1.9%) from all four areas of Ban Na District were

also positive, whereas those from all four areas of Pak Phli District were negative. The overall positive rate for gnathostome eggs was 1.2%, with the highest rate (4.2%) being in Don Yo of Muang District [28]. In cats, the prevalence rates in 1989 and 1996 were only 1.9% and 2.9%, respectively [29] (Tables 2 and 3).

In Tha Ngam, Prachin Buri Province (adjacent to Nakhon Nayok), no gnathostome eggs were found in all three batches of 109, 115 and 100 fecal samples of dogs [19].

Table 2 Prevalences of *G. spinigerum* in dogs in Thailand.

Year	Specimen	Location	No. examined	% positive	Authors
1933	stomach	Bangkok	5	100	Prommas & Daengsvang
1962	feces + stomach	Bangkok & Thonburi	1,000	1.6	Sirisumpan
1962	stomach	Bangkok	100	10.0	Ito <i>et al</i>
1964	stomach	Bangkok	1,048	5.2	Daengsvang <i>et al</i>
1965-70	stomach; feces	Bangkok & others	17,855; 277	1.1	Daengsvang
1969	feces	Bangkok	2,599	6	Manning <i>et al</i>
1980	feces	Bangkok	107	2.8	Hinz
1983	feces	North & Northeast	941	30.0	Impand <i>et al</i>
1987-9	stomach	Northeastern	2,940	4.1	Maleewong <i>et al</i>
1998	stomach	Bangkok	200	0	Rojekittikhun <i>et al</i>
2000	fecal sample	Nakhon Nayok	1,193	1.2	Rojekittikhun <i>et al</i>
2000-1	fecal sample	Prachin Buri	324	0	Rojekittikhun <i>et al</i>
2001-2	fecal sample	Bangkok	518	0	Rojekittikhun <i>et al</i>

Table 3 Prevalences of *G. spinigerum* in cats in Thailand.

Year	Specimen	Location	No. examined	% positive	Authors
1933	feces	Bangkok	24	37.5	Prommas & Daengsvang
1964	feces	Bangkok	36	8.3	Daengsvang <i>et al</i>
1965-70	feces	Bangkok & others	402	4.0	Daengsvang
1983	feces	North & Northeast	296	26.0	Impand <i>et al</i>
1989	feces	Nakhon Nayok	104	1.9	Rojekittikhun <i>et al</i>
1996	feces	Nakhon Nayok	102	2.9	Rojekittikhun <i>et al</i>
2001-2	feces	Bangkok	370	0	Rojekittikhun <i>et al</i>

Infection in swamp eels

From 1964 to 1991, the prevalences of larval *Gnathostoma* infection in swamp eels (*Monopterus albus*, previously *Fluta alba*) were 22.5%-54.7% in Bangkok, 80.0% (24/30)-100% (4/4) in Nakhon Nayok, 100% (13/13) in Prachin Buri, and 30.8% in Chiang Mai [23,30-31]. The prevalence rates in 1998 in 11 provinces in central Thailand were 10.0%-68.7%. These included 68.7% in Nakhon Nayok, 50.0% in Prachin Buri; 33.3%, 26.7%, 18.9%, 13.3% and 10.0% in Ayutthaya, Ang Thong, Ratchaburi, Saraburi and Lop Buri, respectively [32] (Table 4).

The average prevalence of the infection in Nakhon Nayok was found recently to be 38.1% (117/307) and only 24.0% (74/308) in Prachin Buri. In Nakhon Nayok, of eight subdistricts and unspecified areas, the highest prevalence rate (50.0%) was found in Phrommani, but the heaviest intensity of infection (65 larvae/eel) was in unknown areas. There was only one batch of eels from Tha Chang that gave a negative result (0/6). In Prachin Buri, all five subdistricts and unspecified areas were positive for the infection. The highest prevalence, 43.6%, was observed in

Nong Nam Khao, while the heaviest intensity of infection (59 larvae/eel) was in Khok Makok [19].

Infection in fresh-water fish

In Bangkok, in 1989, 2,081 fresh-water fish bought from 30 local markets were examined: 9 out of 59 species (including swamp eels) were found to be infected with gnathostome larvae. The prevalences in *Channa striata*, *Chitala ornata*, *Mastacembelus armatus*, *Boesemania microlepis*, *Clarias macrocephalus*, *Trichogaster pectoralis*, *Anabas testudineus* and *Macrognathus siamensis* were 22.6%, 7.1%, 5.6%, 5.3%, 3.2%, 2.4%, 2.1% and 1.9%, respectively [30].

In Nakhon Nayok, in 2000-2001, about 12,000 fish were examined during a one-year period: 8 out of 72 species (including swamp eels) were infected with larval *Gnathostoma*. The overall infection rates in *Anabas testudineus*, *Channa striata*, *Clarias macrocephalus*, *Channa micropeltes*, *Channa lucius*, *Clarias batrachus* and *Ompok krattensis* were 7.7%, 7.4%, 6.7%, 5.1%, 4.0%, 1.4% and 0.6%, respectively [Rojekittikhun *et al*, in preparation].

Table 4 Prevalences of *G. spinigerum* larvae in swamp eels in Thailand.

Year	Location	No. examined	% positive	Authors
1938	Bangkok	?	80.0	Daengsvang & Tansurat
1964	Bangkok	234	54.7	Daengsvang <i>et al</i>
1987-9	Nakhon Nayok & Prachin Buri	4-33	80.0-100	Setasuban <i>et al</i>
1988-9	Bangkok	15-102	22.5-26.7	Setasuban <i>et al</i>
1989	Chiangmai	26	30.8	Setasuban <i>et al</i>
1989	Bangkok	15	40.0	Rojekittikhun <i>et al</i>
1992-8	Central Thailand	30-437	10.0-68.7	Nuamtanong <i>et al</i>
2000	Nakhon Nayok	307	38.1	Rojekittikhun <i>et al</i>
2000	Prachin Buri	308	24.0	Rojekittikhun <i>et al</i>
2000-1	Nakhon Nayok	1,844	10.7-44.1	Rojekittikhun <i>et al</i>

Cyclops

Searches for naturally infected first intermediate hosts of *G. spinigerum* in Bangkok, Nakhon Nayok and Prachin Buri have been extensively conducted during the past 10 years; however, natural infection in any of the tiny crustacea examined was unable to be demonstrated [33; Maipanich, personal communication].

In a cyclops survey in 2000, approximately 4,000-5,000 crustacea each in Ban Phrao, Nakhon Nayok and Tha Ngam, Prachin Buri were examined. In both places, they comprised mainly species of water-fleas and copepods, however, as it normally appears to be, no *Gnathostoma*-infected cyclops was discovered [19].

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