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Cestodes of the Brown-banded Bamboo Shark *Chiloscyllium punctatum* (Elasmobranchii: Hemiscylliidae) from the Gulf of Thailand

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Abstract

Specimens of cestode parasites were collected from 120 brown-banded bamboo sharks, *Chiloscyllium punctatum*, collected from Chon Buri province, in the Gulf of Thailand. All fish specimens were found to be infected with cestodes. Eight species in 4 genera of cestodes were recorded, *Caulopatera pagei*, *Orectolobicestus tyleri*, *Spiniloculus mavensis*, *Yorkeria hilli*, *Y. kelleyae*, *Y. saliputium*, *Y. yubodohensis* and *Y. chonburiensis*. In this study, 3,834 specimens of cestodes were found in *C. punctatum* of which 1,539 specimens (40.14 %) were *Yorkeria* spp. *O. tyleri* (51.41 %) with *Y. chonburiensis* the lowest (0.05 %). The prevalence of the cestode infection was highest in August (61.9 parasites per fish) followed by October (57.9 parasites per fish) and July (57.6 parasites per fish), whereas infection was lowest in February (21.6 parasites per fish). *O. tyleri*, *S. mavensis*, *Y. hilli*, *Y. kelleyae* and *Y. yubodohensis* were found in all seasons. Five species; *C. pagei*, *O. tyleri*, *S. mavensis*, *Y. saliputium* and *Y. yubodohensis* were the first records in Thailand.

Keywords: Cestode, brown-banded bamboo shark, *Chiloscyllium punctatum*, the Gulf of Thailand

Introduction

The brown-banded bamboo shark *Chiloscyllium punctatum* Müller & Henle, 1838 (Hemiscylliidae) is a small benthic shark inhabiting coral reefs, sheltered tidal pools and off-shore bays throughout the Indo-west Pacific region from Australia to Japan and India [1,2]. *C. punctatum* is probably a fecund (oviparous) tropical species [3]. However, the species is likely to be threatened by overfishing and habitat loss due to destructive fishing methods [3]. It has been included on the IUCN Red List of Threatened Species as 'Near Threatened' globally, but with a regional assessment of 'Least Concern' in Australia [4,5]. *C. punctatum* is a favorite aquarium species because of its small size, and tolerability to a wide range of environmental fluctuations [5].

Cestode parasites can be deleterious to the health of their hosts and have been incriminated as agents of diseases in farmed fishes [6]. Many species of cestodes have been reported to parasitize *C. punctatum*, *viz.*, *Caulopatera pagei*, *Orectolobicestus tyleri*, *Spiniloculus mavensis*, *Yorkeria chonburiensis*, *Y. hilli*, *Y. kelleyae*, *Y. parva*, *Y. pusillulus*, *Y. saliputium* and *Y. yubodohensis* have been reported to parasitize *C. punctatum* [7-12]. However, cestode prevalence was found to vary among locations and seasons [13]. The main purpose of this study was to observe year-round parasitic diversity and distribution in *C. punctatum* from the Gulf of Thailand. This study will be essential for monitoring and prevention of cestode parasitic disease in the *C. punctatum* population.

Materials and methods

C. punctatum were collected from the Gulf of Thailand, Chon Buri province. Ten sharks were collected each month for a period of 12 months for assessment of cestode parasites. Spiral intestine of the

fish specimens were removed from the body cavity and opened with a longitudinal incision. The gut contents were examined under the microscope. The cestode specimens were fixed in 70 % ethanol for 24 h before staining with Mayer's hydrochloric carmine, and then dehydrated and mounted in Canada balsam. Parasite specimens were photographed and measured (Olympus DP70 digital camera mounted on an Olympus BX51 microscope). Measurements of the cestodes in micrometers, with their ranges and averages are given. Identification and classification of the parasite species follows [7,8,10,12,14-19].

Results and discussion

Eight cestode species from 4 genera were found in the spiral intestine of *C. punctatum*, including, *Caulopatera pagei*, *Orectolobicestus tyleri*, *Spiniloculus mavensis*, *Yorkeria hilli*, *Y. kelleyae*, *Y. saliputium*, *Y. yubodohensis* and *Y. chonburiensis* (**Figure 1**). All 4 genera belonged to the order Tetraphyllidea and were characterized by their unique scolex morphology. *Yorkeria* has bothridia with 2 C-shaped hooks of different sizes, medial and lateral hooks. Medial hooks were large while lateral hooks were smaller on bothridia with 1 small accessory sucker. *Spiniloculus* was similar to *Yorkeria*, because they had scolex with 4 simple bothridia, but each bothridium has 2 C-shaped hooks of equal size and 1 large accessory sucker. *Caulopatera* was different from other tetraphyllidean genera in having stalked, circular, non-loculate bothridia that lack an apical sucker [11]. However, *Orectolobicestus* was transformed from *Phyllobothrium* to the new genus [8], the scolex of this tetraphyllidean consisted of 4 bothridia; each bothridium with a single apical sucker and marginal loculi. This genus differed from other tetraphyllidean genera (except *Anthocephalum*, *Cardiobothrium*, *Anindobothrium*) in its possession of loculi on the margins of its bothridia [8].

In this study, 3,834 cestodes were found in *C. punctatum* of which 1,539 specimens (40.14 % of the total parasite number) belonged to the genus *Yorkeria*. *O. tyleri* was the most prevalent (1,971 specimens, 51.41 %) followed by *Y. hilli* and *Y. yubodohensis* with 972 specimens (25.35 %) and 448 specimens (11.68 %), respectively. *Y. chonburiensis* was the least common species found (2 specimens, 0.05 %) (**Table 1**).

The prevalence of the infection (**Table 2**) was highest in August (average 61.9 parasites per fish), October (57.9) and July (57.6) and was lowest in February (21.6). *O. tyleri*, *S. mavensis*, *Y. hilli*, *Y. kelleyae* and *Y. yubodohensis* were found all year round. Nevertheless, *Y. saliputium*, *C. pagei* and *Y. chonburiensis* found only 6, 3 and 2 specimens, respectively during 1 or 2 months. **Table 2** also suggested that cestode intensity seemed to decline during the winter season (December - January) and start to increase their population after winter period.

Cestodes were reported to affect the growth of their host; infected fish had a slower growth rate [20]. The diameter of the lumen of their host is reduced by more than 50 % and this probably affects the movement of food through the intestine [21]. Numerous cestodes cause disease in fish in aquaculture and fisheries [22]. Cestodes cause epizootic outbreaks with heavy mortalities in the juvenile stage of fish held in rearing ponds and hatchery conditions [23]. The pathology caused by cestodes in the gut may cause tissue alternation or destruction, mechanical blockage and reduced nutrient absorption associated with acute inflammation in the region of contact [22].

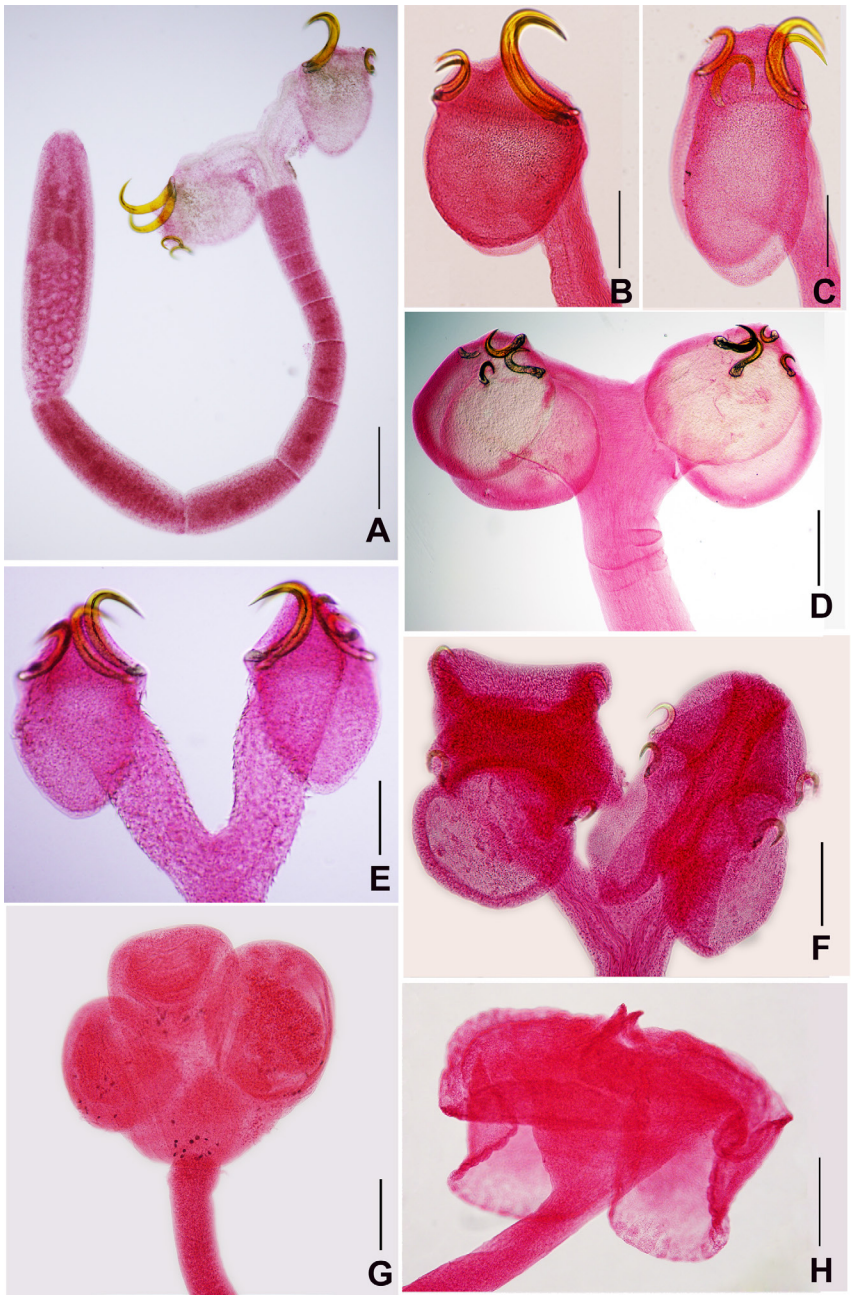

Figure 1 Cestode parasites of *Chiloscyllium punctatum*.
A. *Yorkeria hilli* B. scolex of *Yorkeria yubodohensis*
C. scolex of *Yorkeria kelleyae* D. scolex of *Yorkeria chonburiensis*
E. scolex of *Yorkeria saliputium* F. scolex of *Spiniloculus mavensis*
G. scolex of *Caulopatera pagei* H. scolex of *Orectolobicestus tyleri*
(scale bar A = 250 µm; B,C,E = 100 µm; D = 500 µm; F-H = 300 µm)

Table 1 Occurrence of cestode parasites from *Chiloscyllium punctatum*.

Parasite species	Number of infected fish	Number of parasites / fish	Total number of parasites	Prevalence	Mean intensity
Caulopatera pagei	3	1	3	2.50	1.00
Orectolobicestus tyleri	108	4-37	1,971	90.00	18.25
Spiniloculus mavensis	22	1-26	321	18.33	14.59
Yorkeria chonburiensis	2	1	2	1.67	1.00
Yorkeria hilli	95	2-20	972	79.17	10.23
Yorkeria kelleyae	28	2-19	111	23.33	3.96
Yorkeria saliputium	4	1-3	6	3.33	1.50
Yorkeria yubodohensis	70	1-14	448	58.33	6.40

Table 2 Average number of each parasite species per fish in each month.

Parasite species	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Caulopatera pagei	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Orectolobicestus tyleri	12.9	17.1	13.5	17.1	27.3	27.6	13.2	22.8	17.1	9.0	7.8	11.7
Spiniloculus mavensis	0.0	0.0	3.9	1.5	1.2	3.3	2.4	3.9	7.5	3.0	4.5	0.9
Yorkeria chonburiensis	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Yorkeria hilli	9.6	6.0	3.0	13.5	13.8	11.4	12.0	12.9	3.9	3.3	5.4	2.4
Yorkeria kelleyae	0.9	0.6	0.6	0.9	0.3	1.5	0.9	0.6	1.5	0.6	1.2	1.5
Yorkeria saliputium	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Yorkeria yubodohensis	1.5	1.8	3.3	3.0	6.0	5.7	3.3	6.0	4.5	6.9	1.2	1.5

Many species of *Yorkeria* spp. were found in *Chiloscyllium* species, including *Y. chiloscyllii* from *C. griseum* and *Y. xiamenensis* found in *C. plagiosum* [18]. *Y. parva*, *Y. pusillulus*, *Y. saliputium*, *Y. yubodohensis*, *Y. kelleyae* and *Y. hilli* have been reported from *C. punctatum* [7,8]. Some of the cestode fauna in this study were similar to the parasites found on *C. punctatum* near Borneo and Malaysian Borneo such as *O. tyleri* [8] and *S. mavensis* [10]. *S. mavensis* was originally described by Southwell [24] in *Mustelus* sp. and also found in *Chiloscyllium indicum* from Sri Lanka [25], *Chiloscyllium griseum* from India [26], *Chiloscyllium indicum* [27] and *Chiloscyllium punctatum* from Australia [10,15]. *O. tyleri* was found in *C. punctatum* from the South China Sea of Mukah, Sarawak, Malaysia [8]. Five species of cestodes; *C. pagei*, *O. tyleri*, *S. mavensis*, *Y. saliputium* and *Y. yubodohensis* found in this study are thought to be the first records of these species in Thailand.

Conclusions

C. punctatum from the Gulf of Thailand were infected with 8 species of Tetraphyllidean cestodes, including *C. pagei*, *O. tyleri*, *S. mavensis*, *Y. hilli*, *Y. kelleyae*, *Y. saliputium*, *Y. yubodohensis* and *Y. chonburiensis*. Most of these cestodes species were found throughout the year with the highest numbers in August and the lowest in February. This study is the first record of *C. pagei*, *O. tyleri*, *S. mavensis*, *Y. saliputium* and *Y. yubodohensis* in Thailand.

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