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Morphology of Taenia asiatica Simalungun, Indonesia

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Abstract : ABSTRACT Introduction: To identified taenia species based on morphologically, one of them is macroscopic and microscopic gravid proglottid examination. By counting the number of uterine branches in the gravid proglottids, the species of taenia could be identified. Based on literature, the number of uterine branches of Taenia asiatica gravid proglottid ranges from 11 to 31 branches and the scolex have rostelum and apical pit. Aim: To explore the morphology of Taenia asiatica, we observed 21 gravid proglottids of Taenia asiatica simalungun by a Disecting Microscope and Scolex by SEM. Methods: We collected 171 faeces samples from 171 taeniasis carrier ini Silau Kahaean Sub-district, Simalungun District, Sumatera Utara Province - Indonesia after had been given Praziquantel 600 mg tablet single dose. After 1-2 hours of taking Praziquantel, they were given 2 tablets of Bisacodil (Dulcolax®) as a laxantia. They have offered faeces into a plastic bag when defecating. From 171 faecal samples, all of them were found fragments of proglottids, strand proglottids, eggs and 3 Scolexs. Results: We observed 21 gravid proglottids of Taenia asiatica simalungun by a Disecting Microscope and Scolex by SEM. It was found that the number of uterine branches was 16 and scolex have no rostelum and apical pit. Conclusion: Determination of morphology of Taenia asiatica that has been written in the literature needs to be reviewed, because the possibility of depend on taeniasis endemic area
Keywords : Keywords: Taenia asiatica, morphology, uterine branches, scolex

Morphology of *Taenia asiatica* Simalungun, Indonesia

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Abstract

Background

One of the methods to identify *Taenia* species that infect humans morphologically is microscopic examination of the gravid proglottid and the scolex. By counting the number of uterine branches in a gravid proglottid, the species of *Taenia* can be identified. According to literatures, the number of uterine branches of proglottid varies between 11 – 31 and the scolex has a rostelum and apical pit without hooklet.

Method

We investigated 19 gravid proglottids of *T. asiatica* from Simalungun District, North Sumatra Province using dissecting microscope examination and one scolex using light microscope and scanning electron microscope (SEM).

Results

The findings showed that the number of uterine branches of the gravid proglottid was 16, and neither rostelum nor apical pit in the scolex was found. However, a curved shape at the apex of the scolex was identified and named as snout.

Conclusion

The number of uterine branches of *T. asiatica* that was found in Simalungun District, North Sumatra Province was 16 and the morphology of the scolex was slightly different from that was reported previously. We suggest that the morphology of *Taenia asiatica* should be further reviewed, probably of the differences in morphology of *Taenia asiatica* according to its endemic area.

Keywords: *Taenia asiatica*, morphology, uterine branches, scolex, Simalungun Indonesia

Introduction

Tapeworms of the *Taenia* genus have a characteristic shape of long tape-like segmented shape. Each segment contains several uterine branches, which is called proglottid. Human is a definitive host of three *Taenia* species : *T. saginata*, *T. solium*, and *T. asiatica*. Oxes and cows are the intermediate host and vector for *T. saginata*, while pigs are the intermediate host for *T. solium* and *T. asiatica*. Someone can get infected by *Taenia* if they consume a raw or undercooked meat or internal organs of a cow or pig infected with *Taenia* because it contains the larvae (cysticercus).[1]

The life cycle of *T. asiatica* in human as a definitive host began by ingesting a raw or undercooked meat and organs of a *Taenia* infected pig which contains larvae (cysticercus). The larvae will enter the small intestines, adhere to the intestinal wall and then develop into a mature tapeworm after a few months. A mature *T. asiatica* is hermaphrodite and will increase its number of proglottids which contain the gravid uterine. The distal part of gravid proglottid will then detach, contract and move to the anus and get spontaneously discharged from the anus through defecation. The proglottid will release thousands of eggs which contaminate the soil and grass. Pigs can get infected from eating grass contaminated with *Taenia* eggs. In the pig's body, the eggs will develop into cysticercus which usually reside in the liver, spleen, lungs, heart, and mediastinum. The eggs of *Taenia spp*., can survive for several months to years in the soil under low to moderate temperature and high humidity.

Taeniasis asiatica infection cases in Indonesia have been reported in the population of Samosir Island in Toba Lake, Samosir District, North Sumatra Province.[2] The most recent study reported a newly found endemic area of *T. asiatica* which had not been identified before in the Simalungun District, North Sumatra Province.[3]

To identify the species of *Taenia*, we can perform examinations using dissecting microscope, light microscope, scanning electron microscope (SEM) and molecular or genetic test. Molecular methods are used to identify several parasites including *Taenia*. This method has been developed to detect and differentiate the species of *Taenia* accurately using its DNA with a good quantity and quality.[4] Dissecting microscope is used for counting the number of uterine branches in a gravid proglottid, and delivers a better result. There is a difference in the total

number of uterine branches of the gravid proglottid of the three species, namely *T. saginata* 14-32, *T. solium* 7-16, and *T. asiatica* 11-31.[5] However, SEM is preferred to identifying the morphology of scolex, to see the presence of rostelum, hooklet, oral sucker, and apical pit.

Materials and Methods

The location of the study was in Nagori Dolok Village, Silau Kahaen Sub-District, Simalungun District, North Sumatra Province. The study began in September 13th 2017. We had a meeting with the Village Head and local public figures to obtain approval for recruiting villagers who were suspected to have taeniasis or a carrier of taeniasis as respondents. We prepared questionnaire forms, informed consent forms, tablets of 600 mg Praziquantel (Biltricide, Bayer, Leverkusen, Germany), Bisacodyl laxantia tablets (Boehringer Ingelheim, Ingelheim am Rhein, Germany), object glass, dye, syringes, plastic containers for the faeces, and materials for Kato Katz for detecting *Taenia* eggs. Microscopic examination was performed in the Dr. Umar Zein Tropical Disease and Infectious Clinic, Medan.

At the agreed time, our team visited the Nagori Dolok Village and the villagers suspected to have taeniasis were gathered at the health service unit of Nagori Dolok Public Health Center (Puskesmas). All of the respondents who turned up received explanations regarding the signs and symptoms of taeniasis and the measures that will be taken by the team for them to obtain fecal samples and proglottids which will be discharged after administration of medication. Ethical clearence was issued by the Ethics Committee of the Faculty of Medicine, Methodist University of Indonesia, Medan, Indonesia.

Results

On October 20th 2017, from 30 respondents who turned up and went through history taking and physical examination, 29 respondents were suspected to have taeniasis. After receiving explanation regarding the study and signing the informed consent, they received treatments with a single dose of 600 mg Praziquantel tablets. After 1-2 hours of ingesting Praziquantel, they were given 2 tablets of Bisacodyl (Dulcolax®) as a laxantia. They were asked to collect their faeces during defecation into a plastic container. From 29 fecal samples, proglottid segments, proglottid strands and eggs were found in all samples. The longest proglottid strand found was as long as 2.86 meters (Figure 1, A).

On November 2nd 2017, our team had the second visit. Ninety-six respondents suspected to have taeniasis were found and treated the same way as it was on our first visit. From 96 respondents, we obtained 96 fecal samples containing proglottid segments, proglottid strands and *Taenia* eggs. The longest proglottid strand found was 10.5 meters (Figure 1, C).

Our third visit was on November 4th 2017. We obtained 46 fecal samples from 46 respondents. The longest proglottid strand we found was 8 meters (Figure 1, B). From three visits, we collected 171 respondents and fecal samples. There were only 3 scolex found. Those scolices were examined using light microscope and SEM. Examination using SEM was performed at the Bioscience Laboratory, Brawijaya University, Malang, Indonesia.

The longest intact proglottid strand from was 10.5 meters (Figure 1, C). Demographic data of the 171 respondents are presented in Table 1. The body parts of *Taenia* that were found from the 171 fecal samples are presented in Table 2.

Macroscopic and Microscopic Examination of Taenia Proglottids

Prior to examination under a microscope, the proglottids were injected with a dye through the genital pore of the proglottids, then it was pressed between two object glasses (Figure 2). Specifically, to count the numbers of uterine branches of gravid proglottid, it was examined under a dissecting microscope with 5x magnification. All had 16 uterine branches in 19 proglottids examined (Figure 3). Examination of scolex was performed using light microscope and SEM, and there was no rostelum and apical pit found (Figure 4).

Discussion

Transmission of taeniasis infection in Simalungun District was related to the practice of eating Simalungun traditional cuisine called Hinasumba. Hinasumba is a raw pork dish which is processed by soaking it in lime juice and seasoned with spices and Sikkam sawdust. It was predicted that many taeniasis patients in Simalungun have complaints about their diseases. They usually seek medical treatment from local health care providers. Despite the doctors knowing the diagnosis of taeniasis, the Praziquantel drugs were not available in all health care facilities in Indonesia. The villagers also raise pigs that roam freely in their yards and farmland.

We also found that there is still a habit of defecating on the soil of some of the residents, causing the chain of transmission of taeniasis to be even harder to break. From history taking, we found that in patients with taeniasis in Simalungun, the spontaneous discharge of proglottids from the anus was very active, several times a day. The spontaneous discharge of proglottids will be even more active up to 10 times a day if the patient consumes pork.

According to the previous studies reported in the literature regarding the morphology of *T. asiatica*, the number of uterine branches of proglottids varied between 11-31[4] and other reported it was between 16-21.[5] Our finding in this study showed that the number of uterine proglottids of *T. asiatica* from Simalungun was constant, which was 16 branches. The counting was performed using dissecting microscope examination with 5x magnification.

In 1993, Eom and Rim from Korea reported the morphology of Asian *T. saginata*, which was then called as *T. asiatica*. They reported that the number of uterine branches of gravid proglottids was between 16-21, and scolex has a rostellum.[5] Parija and Pnombath in 2013 reported that the number of uterine branches with different variation, which was between 11-31 and scolex has a rostellum and apical pit.[4] Our finding, upon light microscope examination with 100x and 400x magnification, there was no rostellum or apical pit found. Further examination using SEM with 80x and 120x magnification also found no rostellum or apical pit. However, we found that there was a curved shape at the apex of scolex which was different from the shape of apical pit, and we named it as snout[6] (Figure 4). We illustrated the differences in morphology of the three *Taenia* species in human on Figure 5.

Conclusion

According to this finding, it is strongly suspected that there are morphological differences between *T. asiatica* in Simalungan, Indonesia and *T. asiatica* in other countries in Asia that have been reported. For further conclusion, further studies are needed by examining larger number of samples and confirmation using accurate molecular and genetic tests.

Authors' contributions

All authors helped to draft the manuscript. All authors read and approved the final manuscript

Competing interests

The authors declare that they have no competing interests.

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Figure 1. Proglottid strands as long as 2.86 meters (A), 8 meters (B) and 10.5 meters (C)

Table 1. Characteristics of 171 respondents with Taeniasis

Age (Year)	Gender					
	Male	%	Female	%	Total	%
12 - 30	18	10.5	3	1.8	21	12.3
31 - 40	26	15.2	2	1.2	28	16.4
41 - 50	58	33.9	12	7.0	70	40.9
51 - 60	29	16.9	4	2.4	33	19.3
> 60	18	10.5	1	0.6	19	11.1
Total	**149**	**87.0**	**22**	**13.0**	**171**	**100**

Table 2. Body parts of *Taenia* found in the 171 fecal samples

Examination Result of Faeces	Amount of cases
Proglottids and eggs	140
Proglottids only	8
Eggs only	21
Scolex	3
Total	**171**

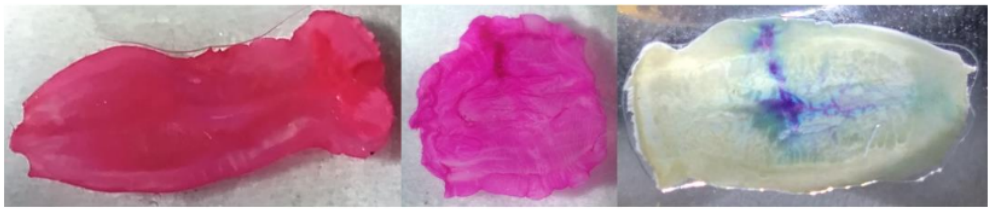

Figure 2. Three Proglottids That were Injected with Dye

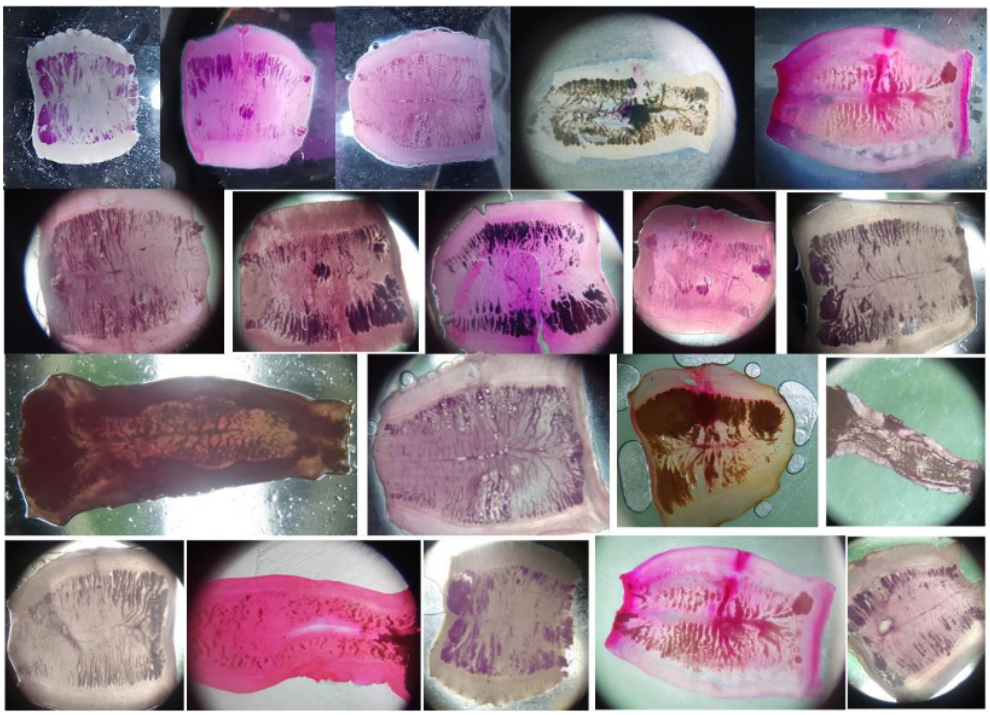

Figure 3. Nineteen Gravid Proglotttids Using Dissecting Microscope Examination with 16 Uterine Branches

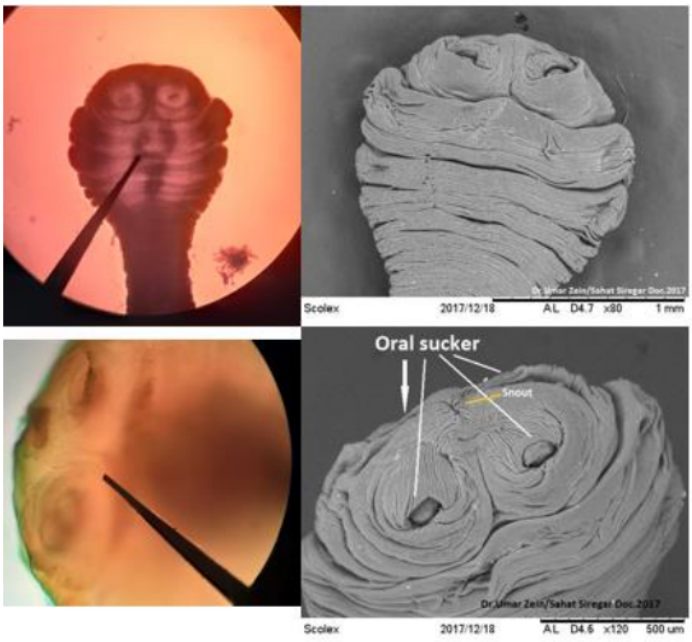

Figure 4. A scolex of *T. asiatica*. Left: By Light Microscopy Using 100x Magnification (top) and 400x (bottom). Right: By SEM Using 80x Magnification (top) and 120x (bottom). No Rostelum, Hooklet, and Apical pit. A curved shaped at the apex is Snout

Morphological features	*Taenia saginata*	*Taenia solium*	*Taenia asiatica*	*Taenia asiatica simalungun*
Scolex				
Rostelum	Absent	Present	Present	**Absent**
Hooklet	Absent	Present	Absent	**Absent**
Apical pit	Absent	Absent	Present	**Snout**
Gravid proglottid				
Uterine branches	14 – 32	7 - 16	11 - 31	16
Pattern of uterine branching	Dichotomous	Dendritic	Dichotomous	Dichotomous
Expulsion from host	Actively, usually single	Passively during defecation, usually in groups	Actively, usually in single	Very actively, 5 – 15 proglottids/day and during defecation. Stimulated by eating meat

Figure 5. Morphological Differences of the three *Taenia* species (*T. saginata, T. solium, and T. asiatica/asiatica simalungun*).[4,5,6]

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