

**Challenge PA2210-2**

September 2022

Stool: *Taenia species*, *Blastocystis species*, *Endolimax nana*, *Entamoeba coli*

**CMPT QA/QC/ Statistics**

This sample was verified by two reference laboratories. Laboratories were expected to report the presence of *Taenia* species.

All challenge components are confirmed before shipping by the reference laboratories. No further statistical analysis is performed on the results beyond that described under “Suitability for grading.”

**SURVEY RESULTS**

**Reference laboratories:** both laboratories reported the presence of *Taenia* species, *Blastocystis* species, *Endolimax nana*, and *Entamoeba coli*; one of the laboratories also reported *Entamoeba hartmanni*

**Participants:** All participants correctly reported *Taenia* species and *Blastocystis* species and received an Acceptable grade. Participants also reported *E. nana*, *E. coli*, *E. hartmanni*, and *Enteromonas hominis* (Table 1).

**Suitability for Grading**

A challenge component is considered suitable for grading if agreement is reached by both (100%) reference laboratories and at least 70 percent of the participants.

Parasite identification was correctly performed by both reference laboratories and greater than 70 percent of all laboratories and was thus, determined to be suitable for grading.

**IDENTIFICATION**

Identification of *Taenia* to the species level is not possible from the eggs because their eggs are morphologically identical. Identification is usually based on the recovery and examination of gravid proglottids. If the scolex is recovered after therapy, the presence of the four suckers and the armed rostellum with hooks will differentiate *T. solium* from *T. saginata*.<sup>1</sup>

Terminal segments and free eggs are shed periodically. *T. saginata* sheds perhaps 10 to 15 segments a day, but *T. solium* sheds fewer and more irregularly.<sup>2</sup> Proglottids of *T. saginata* leave the host spontaneously, *Taenia asiatica* proglottids are passed singly and often spontaneously and proglottids of *T. solium* do not usually leave the host spontaneously, but passively in chains with the feces.<sup>1</sup>

**EGGS**

Ova of the family Taeniidae, including *T. solium* and *T. saginata*, are indistinguishable from each other and should be reported as *Taenia* species in clinical samples.

The eggs measure 30-35µm in diameter and are radially-striated. If visible, the internal oncosphere contains six refractile hooks (Figure 1).<sup>1</sup>

**Grading**

Reporting *Taenia* species and *Blastocystis* species was graded Acceptable



**Figure 1:** egg of *Taenia* species. Image courtesy of CDC Public Health Image Library

**Table 1.** Results reported

Reported	Labs	Grade
<b>Taenia species, Blastocystis species</b>	14	Acceptable
+ <i>Endolimax nana</i>	8	
+ <i>Entamoeba coli</i>	7	
+ <i>Entamoeba hartmanni</i>	3	
+ <i>Enteromonas hominis</i>	1	
<b>Total</b>	<b>14</b>	

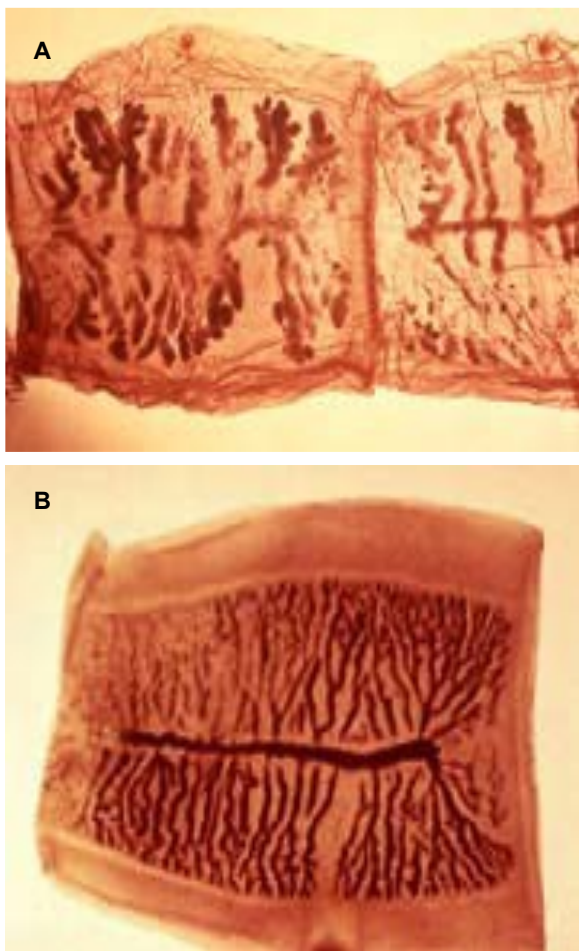
**PROGLOTTIDS**

The uterine structure in the gravid proglottids is often used as the main criterion for identification. The use of India Ink or the clearing of gravid proglottids with Euparal are two methods that can be used to determine the species. Either of these 2 methods allows visualization of the number of primary lateral branches on either side of the central uterine stem. Their number of uterine branches allows differentiation between the two species: *T. saginata* has 15 to 20 branches on each side while *T. solium* has only 7 to 13 (<17) (Figures 2 and 3).

On occasion, there may be an overlap in the number of lateral uterine branches (especially in immature proglottids). In such situations, differentiation between the species is not possible. The proglottids should be reported as "Proglottids of *Taenia* species; unable to speciate definitively due to the overlap in the number of uterine branches between *T. saginata* and *T. solium*."



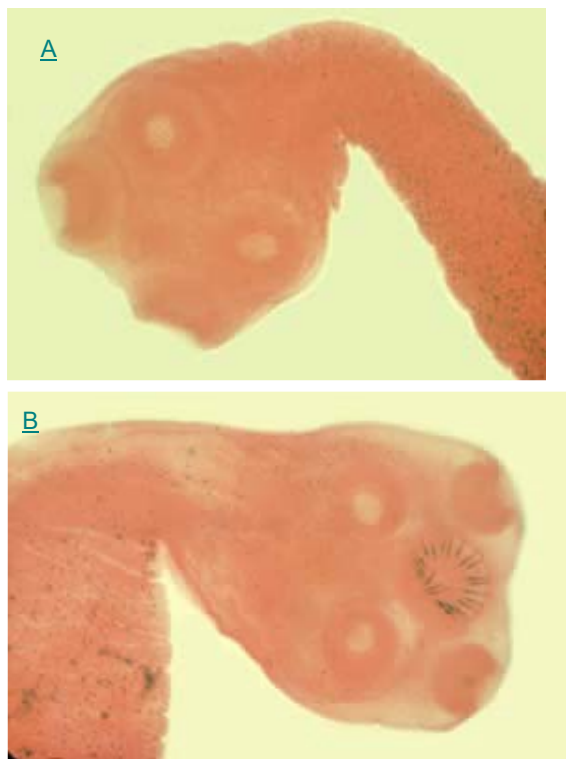
**Figure 3:** gravid proglottids of *Taenia* species. Clearing method with Euparal. Image courtesy of Provincial Laboratory for Public Health, Edmonton, AB



**Figure 2:** gravid proglottids of *Taenia* species. A: *T. solium* proglottid with 7 to 13 uterine branches; B: *T. saginata* proglottid with 15 to 20 uterine branches. Image courtesy of CDC Public Health Image Library

**SCOLICES**

Although rarely seen, another means of differentiating between the species of *Taenia*, would be by the morphological examination of the scolices. The scolex of *T. saginata* has 4 large suckers but no rostellum or rostellar hooks. The scolex of *T. solium* has in addition to the 4 prominent cup-shaped suckers, a rostellum bearing 2 rows of large and small hooks (usually there are approximately 13 hooks of each size) (Figure 4).



**Figure 4.** *T. saginata* (A) and *T. solium* (B) scolices. Image courtesy of CDC Public Health Image Library

## CLINICAL RELEVANCE

There are approximately 45 species and nominal subspecies of *Taenia*, but humans are the only definitive hosts for *T. saginata* (beef tapeworm), *T. solium* (pork tapeworm) and *T. asiatica* (Asian tapeworm). Recent molecular and phylogenetic studies indicate that *T. asiatica* is a distinct species closely related to *T. saginata*.<sup>1</sup>

The presence of the adult *T. solium* worm usually causes no problems other than slight irritation at the site of attachment or vague abdominal symptoms.

Cysticercosis infection with *T. solium* larvae is relatively common in certain parts of the world. It is acquired through the ingestion of eggs that hatch in the duodenum or jejunum after exposure to gastric juice in the stomach. The released oncospheres penetrate the intestinal wall, are carried via the mesenteric venules throughout the body, and are filtered out in the subcutaneous and intramuscular tissues, the eyes, the brain, and other body sites. This form of the infection is far more serious than the presence of the adult worm in the intestine.

The symptoms depend on the particular body site involved. The presence of cysticerci in the brain represents the most frequent parasitic infection of the human nervous system and is the most common cause of adult-onset epilepsy throughout the world.<sup>1,3</sup>

### *Taenia saginata/asiatica*

Although the biology and distribution of taeniasis in humans has been extensively documented over the past 150 years, recently, a third, apparently host-specific, species of *Taenia* was discovered and described. *T. asiatica* has a relatively limited geographic distribution in South-east Asia, although its similarity in the strobilate stage to *T. saginata* suggest the potential for a wider range for the host-parasite assemblage.<sup>4</sup>

In contrast to *T. solium* and *T. saginata*, specific socio-cultural factors and customs are the primary determinant of transmission for *T. asiatica*. Transmission to humans occurs through the consumption of undercooked viscera or organs of swine and wild boar, particularly the liver.<sup>5,6</sup>

### LIFE CYCLE

As *T. asiatica* is more commonly found in Asia, discussion on life cycle will focus on the more commonly found *T. saginata* and *T. solium*. Humans are the only definitive

hosts for *T. saginata* and *T. solium*. Eggs or gravid proglottids are passed with feces. Humans become infected by ingesting raw or undercooked infected meat. In the human intestine, the cysticercus develops over two months into an adult tapeworm, which can survive for years.

The adult tapeworms attach to the small intestine by their scolex and reside in the small intestine. The length of adult worms is usually 5m or less for *T. saginata* (however it may reach up to 25m) and 2 to 7m for *T. solium*. The adults produce proglottids which mature, become gravid, detach from the tapeworm, and

migrate to the anus or are passed in the stool (approximately 6 per day). The eggs can survive for days to months in the environment.

Cattle (*T. saginata*) and pigs (*T. solium*) become infected by ingesting vegetation contaminated with eggs or gravid proglottids. In the animal's intestine, the oncospheres hatch, invade the intestinal wall, and migrate to the striated muscles, where they develop into cysticerci. A cysticercus can survive for several years in the animal.<sup>7</sup>

## REFERENCES

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