Hymenolepis microstoma (Dujardin 1845) Handbook

PD Olson, updated 29.01.2009

Classification

Bilateria:Lophotrochozoa:Platyhelminthes:Cestoda:Eucestoda:Cyclophyllidea:Hymenolepididae:Hymenolepidinae

Synonyms (via Schmidt, 1986)

Rodentolepis microstoma (Dujardin 1845) Spasskii 1954
Taenia murisdecumani Diesing 1863
Taenia brachydera Diesing 1854
Taenia microstoma Dujardin 1845

Morphology and ontogeny

Egg

75-90 microns
3-5 polar filaments

Ontogeny in the intermediate host

Suitable hosts:
Tribolium confusum (confused flour beetle)
Tribolium castaneum
Oryzaephilus surinamensis

Location of cysticercoids: haemocoel

Time post-exposure		Developmental observations
29-30 C Voge, 1964	**24-26 C** Goodchild & Stullken, 1970	
~2 hrs		Anterior part of intestine and crop containing whole eggs, empty eggshells and oncospheres, some surrounded by oncosphere membranes. Empty oncosphere coats intact save single opening of emergence. Free oncospheres 30 by 45 um. No motility seen.
~6 hrs		Oncospheres found in small diverticula and ventricular portion of gut and in main tube of midgut
~24 hrs		Oncospheres found in the haemocoel, 45-50 um, cytoplasm uniformly granular

~48 hrs		STAGE 1 (Voge, 1964): Oncosphere a 90 um ball of cells
~72 hrs		STAGE 2 (Voge, 1964): Oncophere is 130 um with eccentric rounded cavity present in half bearing oncopheral hooks (the 'primitive lacuna'). The sphere becomes ovoid with a dense mass of cells in half opposite hooks.
~88 hrs		Cysticeroid is pear-shaped, 170 x 300 um, wider portion bearing hooks
~95 hrs		Cavity elongates, fine fibrous strands are seen within, in some cases two cavities separated by thick fibrous stands
~100 hrs		STAGE 3 (Voge, 1964): Two body divisions become more marked, outlines of suckers and rostellum may be visible, but no trace of hooks of sucker musculature. Length 336, tail width 293, scolex width 190.
3.5-4 days	4.5-5 days	STAGE 4 (Voge, 1964): Scolex part of the body withdraws into the cavity and larva is now pear-shaped
4.5-5 days		'Tail' lengthens, tissues around scolex more compact, rostellar hooks present but not fully differentiated (?)
6 days		Rostellar hooks and scolex musculature fully developed, 200 x 400 um; tail continues to grow and becomes heart-shaped
7-8 days		STAGE 5 (Voge, 1964): cysticercoid fully formed and infective
Post-patency		'Tail' continues to grow and may be as much as 3 mm after several weeks

Ontogeny in the definitive host

Suitable hosts:
Mus musculus

N.B. Laboratory attempts to infect rats have failed, whereas golden hamsters produced infections at much lower intensities than in mice, and with significant pathological consequences (Dvorak et al., 1961).

Location of mature adults: bile duct and biliary passages

Time post-infection	Developmental observations
Dvorak et al., 1961	
0-24 hrs	HCl and pepsin in the stomach required for dissolution of the cysticercoid membranes; bile salts in the upper duodenum activates the larval worms to excyst. Excysted worms are ~ 0.15 mm and move freely about the upper 25% of the small intestine; no increase in size noted.

~48 hrs	Are concentrated around the duodenum; increase in size to 0.3 mm
~72 hrs	Increase in length to ~ 0.67 mm
~4 days	Most worms have entered the bile duct; worms in bile duct ~ 1.6 to 2 mm in length, 3 to 5 times longer than any remaining intestinal forms
~5 days	Worms in bile duct ~ 2.7 mm
~ 6 days	Worms in bile duct ~ 3.9 mm; intestinal worms absent (presumably failing to establish if they fail to reach the bile duct). Worms attach to bile duct or bilary passages, with the ends of the strobila in the lumen of the duodenum.
~14 days	Worms fully mature & gravid
~5-6 months	Worms senesce and infections are lost

References

Dvorak JA, AW Jones and HH Kuhlman. 1961. Studies on the biology of *Hymenolepis microstoma* (DuJardin, 1845). *Journal of Parasitology* 47: 833-838.

Goodchild CG and RE Stullken. 1970. *Hymenolepis microstoma*: cysticercoid morphogenesis. *Transactions of the American Microscopical Society* 89: 224-229.

Schmidt GD. 1986. Handbook of tapeworm identification. CRC Press Inc., Boca Raton. 675 p.

Voge, M. 1964. Development of *Hymenolepis microstoma* (Cestoda: Cyclophyllidea) in the intermediate host *Tribolium confusum*. *Journal of Parasitology* 50: 77-80.

Passage of *H. microstoma*

Maintenance of stock beetles:

- ~ 2 L glass jars with ventilated lids are used to maintain stocks of flour beetles (*Tribolium confusum*).
- Our insectory is maintained at 25-26 C and 27 relative humidity; higher temperatures (e.g. 30 C) will promote faster growth of both the beetles and larval worms.
- Beetles are fed ad labitum on a 50:50 mixture of commercial Strong White and Strong Brown Bread Flour, with some dry yeast added.
- N.B. beetles do not need water beyond what they absorb from the atmosphere and will drown in an overly moist environment.
- Around 3 cm of flour mixture is added to the jars and filter paper is used to create structure for the beetles to crawl on, allowing them escape from the flour and detritus that accumulates over time.
- The beetle enclosures will need to be cleaned every 4 to 6 months, depending on population sizes.
- Add fresh flour mixture to a clean jar and transfer the filter paper ‘structure’, along with any beetles on it, from the jar to be cleaned.

- Pour the contents of the dirty jar into a sieve with ~1 mm hole size. Agitate to allow the flour and debris to sieve through (N.B. as the flour/debris mixture will contain live eggs and other intermediate stages, it should be disposed of properly to avoid an unwanted beetle infestation). What remains in the sieve will be both living and dead adult beetles, as well as some intermediate ontogenetic stages.
- Fold a large (10-12" diameter) piece of filter paper into a cone and pour the contents of the sieve into it. The live beetles will immediately crawl upwards, away from the dead carcasses and other detritus and can be swept into the clean jar using a small paintbrush or similar implement with which they can be collected and transferred gently. Check for and transfer any remaining live beetles from the sieve.

Infection of beetles:

- Transfer ~50 adult beetles to a 4" glass, covered Petri dish.
- Starve the beetles for 4-7 days to ensure high infection rates and intensities.
- Dissect mice to recover gravid adult worms from the bile duct/small intestine.
- Remove the gravid portion of the strobilas and transfer to a dry depression well or similar.
- Macerate the strobila with razors and blot excess liquid away from the tissues
- Smear ~ 1 g of macerated tissue on a small filter paper, avoiding excess water (N.B. a completely soaked filter paper will result in high humidity in the Petri dish and drown the beetles)
- Leave the beetles exposed to the eggs overnight, then remove the filter paper from the Petri dish and replace with a small amount of flour.
- After 7-10 days, depending on temperature, beetles will harbour fully patent cysticercoids.

Infection of mice:

- Dissect infected beetles: using fine forceps and a stereo microscope, transfer a beetle to a small watchglass or similar with water in it (tap water probably OK, conditioned water better, insect physiological saline presumably best—but unnecessary in my experience).
- Using forceps, pull the head and thorax of the beetle away from the abdomen. Cysticercoids will typically spill out of the haemocoel, particularly in heavy infections, and are in any case easy to disassociate from the contents of the abdomen. Transfer the cysticercoids in water to a separate watchglass.
- Successful beetle infections should results in near 100% prevalence, with intensities highly variable, perhaps averaging ~10 cysticercoids/beetle, but lighter and heavier infections are common. In at least one case I've observed > 60 cysticercoids/beetle.
- Accumulate cysticercoids in this way until enough are harvested to allow infections of ~ 20 cysticercoids/mouse.
- Infect mice via oral gavage.
- Infections are largely self-limiting with typical intensities of 6-12 adult worms/mouse. Some crowding effect is observed.