1. Introduction

In Indonesia, the morbidity rate due to parasitic worms is quite high, this is due to Indonesia's geographical location in the tropics which has a hot but humid climate. In an environment that allows parasitic worms to reproduce well, especially by worms that are transmitted through soil (soil transmitted helminths). Transmission of parasitic worms can occur through food, drink, or directly through hands contaminated with infected worms. Cestoda are parasitic worms that are dorsoventrally flat, segmented, have a scolex, neck, proglottid, and do not have a body cavity.

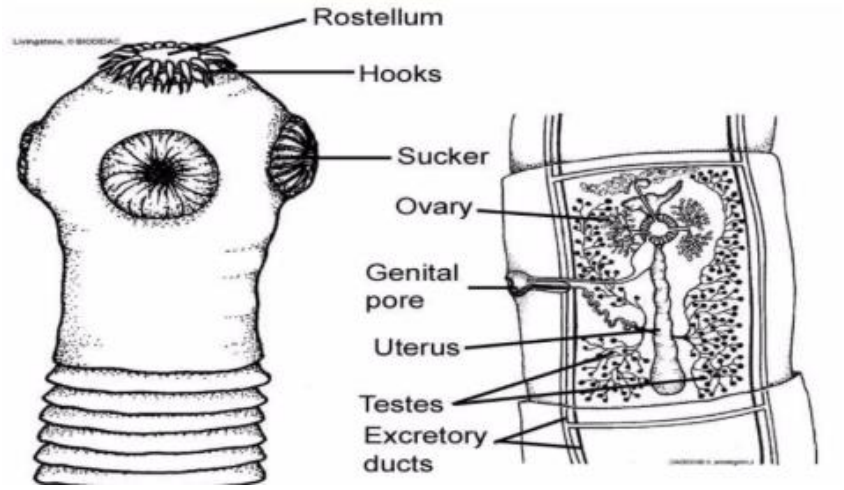
Cestoda are hemaphroditic or have multiple genitals in one body. Cestoda flatworms do not have a coelom, digestive system, blood vessels, and respiration. The neodermis (tegument), muscular and excretory systems have synchronized organization. The muscular and excretory systems (protonephridial systems) of cestodes are important for morphological comparisons of tapeworm taxa, as well as for the function of the systems in the parasitic lifestyle. A total of 9 species of helminths and one species of protozoan infection. Among the helminths *Ascaris*, *Taenia saginata,* hookworm, *Hymenolepis nana, Enterobius vermicularis* and *Hymenolepis diminuta , Trichuris trichura , Toxocara* spp and *Schistosoma japonicum* (Rahman *et al.,* 2020)

Based on where they live, cestodes are grouped into two groups, namely, intestinal cestodes and tissue cestodes. Species of intestinal cestodes include *Taenia saginata, Taenia solium.* The types of cestodes in ruminants are the species *Taenia saginata, Moniezias expansa,* and *Echiococcosis granulosus*. Of the three worms, only the *Moniezia expansa* species lives in the cow's body until adulthood. Tapeworm attacks are often found in cattle, especially the Taenia genus, namely *Taenia saginata.*

2. Taxonomy

- Kingdom : Animalia
- Phylum : Plathyhelminthes
- Class : Cestoda
- Order : Cyclophyllidea
- Family : Taeniidae
- Genus : *Taenia*
- Species : *Taenia saginata*
  Taenai Solium

3. Morphology



The adult tapeworm's flexible head, or scolex, has four muscular suckers for attaching to the upper jejunum (middle part of the small intestine) of its host, but no hooks on the anterior extension of the scolex, called the rotellum. The absence of hooks on the rostellum causes this species to be given another name, namely "armless tapeworm". *Taenia saginata* can be distinguished from its sister species, *Taenia solium*, by the absence of rostellar hooks on the scolex. The neck, which is about half the width of the scolex, separates the head from the rest of the body, is where new proglottids form, which together form a flat, segmented body called the strobilus. Thousands of strobilus proglottids make *T. saginata* one of the largest human parasites; Generally this species is less than five meters long, but bodies up

to 25 meters have been observed. The scolex and proglottids of the adult parasite can grow up to 60 cm in length, and because of the prolonged immune reaction, they penetrate the mucosal membrane and develops many nodules in the duodenum (Abid *et al*., 2023)

When proglottids mature, they contain both male and female reproductive organs. When the proglottids are in the gravid state, they contain a number of uterine branches that produce eggs and can serve as an identifying characteristic of *T. saginata, T. saginata* proglottids have 12 or more uterine branches whereas T. solium, have 10 or less. Another feature of this species is that the genital pore is on the side of the proglottid and not in the center of T. solium. The body surface of the proglottid is surrounded by tegument which helps in the absorption of nutrients through the use of small folds called microvilli. The eggs usually measure 30 to 40 micrometers and are surrounded by a brown striated shell. The egg contains an embryo, a cephalopod, which produces a metacestode larva. Six-linked larvae, called hexacanths, hatch from the eggs and develop into cysticerci. Cysticerci are white, oval in shape, filled with fluid, generally between 7 and 10 millimeters long, 4 to 6 millimeters wide and have an invaginated scolex

The adult tapeworms reside within the lower two-thirds of the small intestine of the definitive host, attached by the four suckers present on the scolex. In addition to liberated eggs, mature gravid proglottids may also be passed in the feces individually or in strobilar fragments of around 8–16 segments. Based on the activity of the oncosphere, eggs are likely infective to the intermediate host immediately after passage. In dry conditions, oncospheric embryos gradually reduce the activity and die after approximately 1 week. Hot temperatures may also inactivate the eggs. When stored in cool, moist environments, oncospheres remained active after 2–3 months. When stored in water, most died after 5–6 weeks (Sapp *et al.,* 2020).

4. Life Cycle

Eggs - cestodes reproduce sexually, then produce and store eggs in their proglottids. The mature proglottid segments then "fall off" along with the eggs they contain. These eggs are excreted in the feces of the primary host and eaten by intermediate hosts (cows, pigs, etc.).

Oncosphere (oncosphere) – In the body of the intermediate host, the eggs hatch into oncospheres, namely hexacanth larvae (hexacanth) which are still covered by the embryonic layer.

Hexacant larvae – Oncospheres become hexacant larvae which are able to penetrate the walls of the digestive tract and be carried to the muscles.

Cysticercus cyst (cysticercus) – hexacant larvae that have been in the muscle then wrap themselves into a cysticercus. This cysticercus can survive several years in animals (intermediate hosts), then will be carried to the primary host (definitive host) if it is eaten together with animal flesh.

The young tapeworm - cysticercus which is in the intestine of the primary host will attach and begin to grow into an adult.

Adult tapeworms - adult worms attach to the intestine with the scolex and begin sexual reproduction, the tapeworm proglottids begin to fill with eggs numbering tens to hundreds of thousands per proglottid segment. Amazingly, tapeworms can have 1,000 - 2,000 segments.

Proglottid shedding - when it is mature and contains eggs, the proglottid segments full of eggs begin to fall off and are carried in the feces.

5. Pathogenesis

The pathogenesis of Cestoda in cattle involves the larval and adult worm stages. Swallowed eggs hatch into larvae (oncosphere) which migrate to body tissues, such as muscles, liver or lungs, causing tissue damage, inflammation and cyst formation (cysticercosis or hydatid cysts). If adult worms live in the intestines, digestive disorders, nutrient absorption and enteritis occur. As a result, cows experience weight loss, malnutrition and organ dysfunction, especially in severe infections. Cows usually become infected when consuming feed or water contaminated with worm eggs or larvae (oncosphere). After swallowing, the oncosphere penetrates the intestinal wall and moves to certain organs or tissues, such as the liver, muscles or lungs. *Taenia* eggs develop into larvae (cysticercus) in cow muscle tissue. This infection is known as cysticercosis. At this stage, the larvae cause tissue necrosis due to larval invasion, local inflammation triggered by the immune response, formation of cysts in muscles or organs, which can reduce the quality of beef. Echinococcus eggs produce larvae that form hydatid cysts in organs such as the liver or lungs. This cyst can grow large and press on the surrounding tissue and cause blood circulation or bile duct disorders.

6. Clinical symptoms

Clinical symptoms in cattle infected with Cestoda depend on the type of parasite, severity of infection, and location of infestation. If you are infected with Cysticercosis (*Taenia* spp. Larvae), the symptoms can be a decrease in appetite and body weight, a decrease in the quality and quantity of meat (meat full of cysts). If the infection is severe, the infected muscle may feel hard or show localized

swelling. If the cyst is in the liver, it will be characterized by jaundice (yellowing of the mucous membrane due to bile duct obstruction) as well as digestive disorders due to pressure from the cyst on the surrounding organs. If the cyst is in the lungs it will be characterized by shortness of breath or chronic cough. Intolerance to physical activity. and if the cyst ruptures there will be a severe allergic reaction or anaphylactic shock.

7. Diagnosis (clinical symptoms/laboratory tests)

Microscopic examination of feces for ova and proglottids The stool should be examined for the presence of proglottids and ovum; cell Eggs may also be present in anal intake. *T.saginata* ovum cannot differentiated from *T. solium* (pork tapeworm) and *T. asiatica,* as well clinical picture and management of intestinal infections caused by three tapeworms.

1. Coproscopic examination

Qualitative examination can be carried out in various ways, for example direct examination (direct slide), which is an examination that is routinely carried out. The original method (direct slide) is the gold standard for qualitative stool examination because it is sensitive, cheap, easy and fast, but less sensitive for mild infections. Direct collection of feces is done by placing a small amount of feces on a glass object, homogenizing it with water, covering it and then observing it under a microscope.

The flotation test procedure is carried out by pouring 1 gram of homogenized feces with 10 ml of saturated salt solution into a test tube until it is full and a miniscus is formed. A cover glass was placed at the end of the test tube and left for 10 minutes, then the cover glass was taken and placed on the object glass. The McMaster E.P.G (Egg Per Gram) test is a quantitative test to calculate the number of oocysts per gram of feces. This test aims to measure the severity of infection based on the number of oocysts obtained. E.P.G. The McMaster test method and floating test are flotation tests where the principle is that worm eggs will float in a solvent that has a specific gravity greater than one.

8. Prognosis

The prognosis for Cestoda infections in ruminants varies depending on the type of parasite, severity of infection, and health condition of the host. Mild infections usually have a good prognosis if treated quickly with antiparasitics such as praziquantel or albendazole. However, in severe infections, especially those involving larvae such as hydatid cysts (*Echinococcus* spp.) or *Cysticercus* (*Taenia* spp.), the prognosis can be poor, especially if large cysts cause permanent damage to vital organs such as the liver, lungs, or muscles. . In addition, chronic infections can cause significant reductions in productivity, such as body weight, growth, or milk production. A worse prognosis may also occur if the infection is accompanied by complications, such as rupture of a hydatid cyst, which can trigger a fatal anaphylactic reaction. Early detection and effective control are essential to increase the chances of recovery

9. Treatment (therapy) (chemical drugs/herbal remedies)

Some efforts that can be made to prevent infection in livestock are by giving worms periodically every 3-6 months for general prevention even though the animal does not show symptoms. Good application of sanitation and hygiene of the cage: cleaning with disinfectant once every 2 weeks, maintaining the cleanliness of livestock by preventing excrement. Increase the endurance of farm animals by giving multivitamins regularly with the supervision of veterinarians or animal mantri. Provide knowledge about diatribes, symptoms, prevention, and treatment in breeders (Syadida *et al.,* 2021). Therapy for *Taenia saginata* worm infections involves the use of drugs antiparasitic drugs designed to kill adult worms and larvae.

1. Chemical Medicine

A. Praziquantel

Praziquantel is an antiparasitic drug that is very effective for treating adult tapeworm infections (*Taenia* spp., *Moniezia* spp., and *Echinococcus* spp.) in ruminants. This drug works by increasing the permeability of the worm's cell membrane to calcium ions, which causes muscle paralysis, disintegration of the

worm's body, and ultimately death. Praziquantel is usually given orally or by injection with doses that are adjusted based on the animal's body weight. This drug is safe to use in ruminants with minimal side effects if used as recommended.

B. Albendazole

Albendazole is a broad-spectrum anthelmintic drug that is effective against cestode larvae, such as Cysticercus bovis in cattle or hydatid cysts caused by *Echinococcus* spp. This drug works by inhibiting tubulin polymerization, which disrupts the function of the worm's microtubules, inhibits glucose uptake, and ultimately causes parasite death. Apart from being effective against larvae, albendazole is also often used to control adult worms in the digestive tract. Albendazole is usually given orally, but its use must be closely monitored to avoid teratogenic effects in pregnant animals.

2. Herbal Medicine

A. Pumpkin Seeds (Cucurbita pepo)

Pumpkin seeds contain active compounds such as cucurbitin, which has antiparasitic properties and can paralyze tapeworms in the digestive tract of ruminants. Pumpkin seeds can be given in powder form mixed with feed or ground into a paste. The mechanism of action involves disrupting the neuromuscular function of the worms, making them easily excreted in the feces. Pumpkin seeds are safe to use and provide additional benefits in the form of nutrients such as essential fatty acids and vitamins.

B. Garlic (*Allium sativum*)

Garlic contains allicin, a bioactive compound with antiparasitic effects that helps reduce the burden of tapeworm infections. Garlic can be given directly in fresh form, mixed into feed, or made into an extract. Allicin works by damaging the parasite cell membrane structure, disrupting metabolism, and causing worm death. In addition, garlic also has immunostimulant properties that support ruminants' natural immune response to infections.

C. Papaya (*Carica papaya*)

The seeds contain proteolytic enzymes such as papain which are effective against cestodes. This enzyme damages the protective coating of the worms' bodies, making them more susceptible to digestive tract conditions and ultimately death. Dried papaya seeds can be ground and mixed into ruminant feed. Apart from being safe, using papaya seeds also improves the digestive health of animals because of their enzymatic properties.

10. Prevention/Control

Some efforts that can be made to prevent infection in livestock are by giving worms periodically every 3-6 months for general prevention even though the animal does not show symptoms. Good application of sanitation and hygiene of the cage: cleaning with disinfectant once every 2 weeks, maintaining the cleanliness of livestock by preventing excrement. Increase the endurance of farm animals by giving multivitamins regularly with the supervision of veterinarians or animal mantri. Provide knowledge about diatribes, symptoms, prevention, and treatment in breeders (Syadida *et al*., 2021).

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12. Attachments

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Genetic confirmation for morphological identification of *Stilesia globipunctata* in camel in Iraq

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Abstract

Camels (*Camelus dromedaries*), similar to other ruminants, are infected by the Anoplocephalidae family belonging to the class cestode causing mild to severe illness. This study utilized a conventional PCR assay to confirm *that Stilesia spp*. is morphologically identified. Slaughtered camel intestines from the Al-Najif abattoir in the central part of Iraq were morphologically examined for *Stilesia* spp. Applied a PCR and genetic analysis for twenty adult worms. The presence of *Stilesia* spp. adult worms were initially identified through morphological characterization. The scolex and strobili were found in the intestine lumen and its nodules. All the worms' specimens were identified as a *Stilesia* genus, and PCR amplified their partial DNA fragment on the location of the ITS2, 5.8S rDNA gene. Camels infected with *Stilesia* spp. found in eviscerated camel carcasses in south Iraq, and twenty isolates of *Stilesia globipunctata* molecular data have been recorded an accession numbers OM221663- OM221682 in the NCBI.

Introduction

Arabian camel (*Camelus dromedaries*) is well-adapted to extreme heat and dry conditions (1). In addition to the use for transportation recently, it has emerged for festivals and events, tourism, and racing in Arab gulf countries (2). Parasites, including Cestoda, affected camels as other ruminants causing mild to severe illnesses and significant economic loss (3-7) *Stilesia* spp. (Rivolta, 1874) is a neglected ruminant parasitic (cestode) infection that invades the small intestine of camels (definitive host) in tropical and subtropical areas (8,9). *Stilesia globipunctata* belong to the (cysticercoid), which develops inside the mite, completing the life cycle (13-15). In general, the intermediate hosts for *S.globipunctata* are *Scheloribates undica* and *Erythraeus* spp. *Stilesia hepatica* is a species affecting sheep and goats and is more prevalent than S. *globipunctata* (16-18). Morphological traits can be used for parasite diagnosis and quantification (19).

In this study, the investigation includes camels slaughtered in the center of Iraq, and due to the limited morphological information and lack of molecular data, molecular techniques were used to identify this parasite by targeting the ITS gene. The study utilizes conventional PCR

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In this study, the investigation includes camels slaughtered in the center of Iraq, and due to the limited morphological information and lack of molecular data, molecular techniques were used to identify this parasite by targeting the ITS gene. The study utilizes conventional PCR assays to identify worm samples of the genus at the species level.

Materials and methods

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Original Article

Prevalence of cestodes infection among school children of urban parts of Lower Dir district, Pakistan

Prevalência de infecção de cestóides entre crianças em idade escolar de partes urbanas do distrito de Lower Dir, Paquistão

H. Ur Rahman[a], W. Khan[b], S. A. Mehmood[a], S. Ahmed[a], S. Yasmin[a], W. Ahmad[a], Z. Ul Haq[a], M. I. A. Shah[c], R. Khan[b], U. Ahmad[b], A. A. Khan[b], P. De los Ríos Escalante[d,e]

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Abstract

Tapeworms of zoonotic importance have been described as a leading public health problem. Current research was aim to assess the prevalence of tapeworms among 5-12years school children residing in district Lower Dir, Pakistan from January 2019-December 2019. The wet mount preparation in saline/iodine/methods were used for stool examination. Data was analyzed using appropriate descriptive, static methods. Of the 400 children studied 71.7% were infected with one or more species of intestinal parasites. Single infection of cestode species was found in 69 individuals with 17.2% prevalence and multiple parasitic infections were identified in 19.7% (n=79/400) individuals. The multiple infection were comprised as 10% (n=40) double, 6.75% (n=27) triple and 3% (n=12) quadruple. A total of 9 species of helminths and one species of protozoan infection. Among the helminths *Ascaris lumbricoides* was the most prevalent 33.1% (n=95), *Taenia saginata* 22.6% (n=65), hookworm 19.8% (n=57), *Hymenolepis nana* 18.8% (n=54), *Enterobius vermicularis* and *Hymenolepis diminuta* 1.39% (n=4each), *Trichuris trichura* 1.04% (n=3), *Toxocara* spp 0.69% (n=2) and *Schistosoma japonicum* 0.34% (n=1) were reported. One protozoan species was *Cryptosporidium* spp 0.69% (n=2) in current study. In case of *A.lumbricoides*, hookworm, *E.vermicularis*, *T.trichura*, *T.saginata*, *H.nana* and *H.diminuta* the male children of below 8 years of age were highly infected. Other infections are reported in the same prevalence with slight difference if any. We conclude that there is a need for mass scale campaigns to create awareness regarding health and hygiene in children and the need for development of effective poverty control programs because deworming alone is not adequate to control parasitic infections.

Keywords: intestinal parasitosis, tapeworm infection, zoonosis, school children, poor sanitation.

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Keywords: intestinal parasitosis, tapeworm infection, zoonosis, school children, poor sanitation.

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Review

Review on Molecular Diagnosis of Cestode and Metacestode in Cattle

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ABSTRACT

Cestode infestations in animals are the most important parasite of livestock and humans because most of these parasites are zoonotic causing cysticercosis and hydatidosis in man and it causes economic and production losses in livestock. Diagnosis of Taenia *Spp* by microscopic observation lack sensitivity and specificity and detection by enzyme-linked immunosorbent assay (ELISA) technique form cross-reaction. The molecular diagnostic can be best to detect in adult and larval stage in definitive and intermediate host based on the amplification of deoxyribonucleic acid (DNA) of target gene with the primer using a different technique of polymerase chain reaction (PCR) such as multiplex PCR. Conventional PCR, real-time PCR, nested PCR, and PCR-restriction fragment length polymorphism (RFLP) are highly sensitive for the diagnosis of cestode and metacestode. Those diagnoses are used for differentiation of *Taenia* species and differentiation of *Taenia* and *Echinococcus* species. As compared to other diagnostic techniques most molecular methods have higher sensitivity and specificity but due to the relatively higher cost, few are commercially available. Most of the molecular diagnostic tests developed to date are generally applicable for laboratory research purposes. The developments in the genomic and proteomic analysis should be used for further understanding of parasite-animal host interaction to find additional targets for diagnosis.

Keywords

Cestode; Molecular test; Metacestode; Veterinary importance.

Abbreviations

Bp: Base pair; DNA: Deoxyribonucleic acid; ELISA: Enzyme-linked immunosorbent assay; gDNA: Genomic DNA; AMP: Loop-mediated isothermal amplification; NAD: Nicotinamide adenine dinucleotide; NADH: reduced form of NAD; PCR-REA: Polymerase chain reaction restriction enzyme analysis; PCR: Polymerase chain reaction; RFLP: Restriction fragment length polymorphism; rRNA: Ribosomal ribonucleic acid; REA: Restriction enzyme analysis; SSCP: Single-strand conformation polymorphism.

Review

Review on Molecular Diagnosis of Cestode and Metacestode in Cattle

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ABSTRACT

Cestode infestations in animals are the most important parasite of livestock and humans because most of these parasites are zoonotic causing cysticercosis and hydatidosis in man and it causes economic and production losses in livestock. Diagnosis of Taenia *Spp* by microscopic observation lack sensitivity and specificity and detection by enzyme-linked immunosorbent assay (ELISA) technique form cross-reaction. The molecular diagnostic can be best to detect in adult and larval stage in definitive and intermediate host based on the amplification of deoxyribonucleic acid (DNA) of target gene with the primer using a different technique of polymerase chain reaction (PCR) such as multiplex PCR. Conventional PCR, real-time PCR, nested PCR, and PCR-restriction fragment length polymorphism (RFLP) are highly sensitive for the diagnosis of cestode and metacestode. Those diagnoses are used for differentiation of *Taenia* species and differentiation of *Taenia* and *Echinococcus* species. As compared to other diagnostic techniques most molecular methods have higher sensitivity and specificity but due to the relatively higher cost, few are commercially available. Most of the molecular diagnostic tests developed to date are generally applicable for laboratory research purposes. The developments in the genomic and proteomic analysis should be used for further understanding of parasite-animal host interaction to find additional targets for diagnosis.

Keywords

Cestode; Molecular test; Metacestode; Veterinary importance.

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Parasitology

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The forgotten exotic tapeworms: a review o uncommon zoonotic Cyclophyllidea

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Review

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Abstract

As training in helminthology has declined in the medical microbiology curriculum, many species of zoonotic cestodes have fallen into obscurity. Even among specialist practition knowledge of human intestinal cestode infections is often limited to three genera, *Tae Hymenolepis* and *Dibothriocephalus*. However, five genera of uncommonly encountered notic Cyclophyllidea (*Bertiella*, *Dipylidium*, *Raillietina*, *Inermicapsifer* and *Mesocestoides*) also cause patent intestinal infections in humans worldwide. Due to the limited availabilit summarized and taxonomically accurate data, such cases may present a diagnostic dilemm clinicians and laboratories alike. In this review, historical literature on these cestodes is syn sized and knowledge gaps are highlighted. Clinically relevant taxonomy, nomenclature, cycles, morphology of human-infecting species are discussed and clarified, along with clinical presentation, diagnostic features and molecular advances, where available. Du the limited awareness of these agents and identifying features, it is difficult to assess true incidence of these 'forgotten' cestodiases as clinical misidentifications are likely occur. Also, the taxonomic status of many of the human-infecting species of these tapewo is unclear, hampering accurate species identification. Further studies combining molec data and morphological observations are necessary to resolve these long-standing taxono issues and to elucidate other unknown aspects of transmission and ecology.

Introduction

The order Cyclophyllidea includes the 'classic' tapeworms and represents the largest ce order, with over 3000 named species (Mariaux *et al.*, 2017). Perhaps the most familiar bers are the intestinal tapeworms commonly infecting humans; *Taenia solium*, *T. sag T. asiatica* and *Hymenolepis nana*. Agents of human cestode infections other than thes seldom discussed, if even covered at all within medical educational curricula and textb However, several other cestode genera exist that can colonize the intestinal tract h hosts and produce patent infections – but these also suffer from a great sparsity of cl and diagnostic information, research and modern interest. In many clinical settings, even eric identification of tapeworm infections is either never performed or automatically asc to well-known agents (e.g. *Taenia* spp.) without a detailed examination of parasite prog scolex or egg morphology. This further obscures the true diversity and occurrence of zoonotic cestodiases.

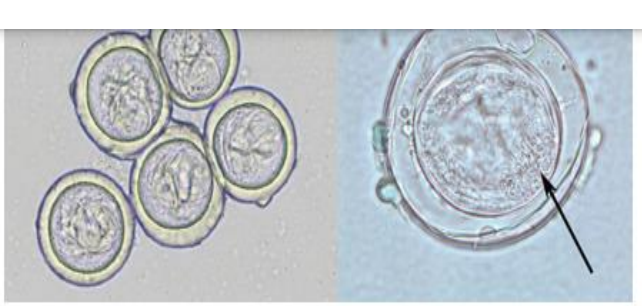

Fig. 2. Specimens of *Bertiella studeri*. (A) Carmine-stained scolex; (B) single elongate, gravid proglottid (scale bar = 1 cm), (C) multiple eggs showing pyriform appa- rati; (D) singular egg, showing oncosphere with hooklets (arrow). Photos courtesy of DPDx, Centers for Disease Control and Prevention.

flotation, the eggs may appear flattened on one side or irregular in form, with folds, wrinkles or even vacuolated regions observed in the shell (Stunkard, 1940).

Life cycle and hosts

Currently, there are 29 known species of *Bertiella* infecting Marsupialia, Rodentia and Dermoptera in Asia, Papua New Guinea and Australia (Beveridge, 1985; Denegri and Perez-Serrano, 1997) and primates from Asia, Africa, South America and some Caribbean and Indian Ocean islands (Denegri and Perez-Serrano, 1997). The adult tapeworms reside within the lower two-thirds of the small intestine of the definitive host, attached by the four suckers present on the scolex (Belding, 1965). In addition to liberated eggs, mature gravid proglottids may also be passed in the feces individually or in strobilar fragments of around 8–16 segments. Based on the activity of the oncosphere, eggs are likely infective to the intermediate host immediately after passage. In dry conditions, oncospheric embryos gradually reduce the activity and die after approximately 1 week. Hot temperatures may also inactivate the eggs. When stored in cool, moist environments, oncospheres remained active after 2–3 months. When stored in water, most died after 5–6 weeks (Stunkard, 1940).

Oribatid mites are the intermediate hosts of *Bertiella* species and many other Anoplocephalidae (Fig. 1) (Denegri, 1993). These mites consume *Bertiella* eggs in the environment and oncospheres will hatch within the mite. Cysticercoids begin to form within 9 days; they are pyriform in shape and measure 130–160 × 100–120 μm with a visible invaginated scolex (Stunkard, 1940). In one experiment, infected mites dissected 76 days after exposure contained identifiable cysticercoids, though it could not be determined if these were still viable (Stunkard, 1940). These intermediate host mites live naturally in cool and moist soil and frequently fruit (Stunkard, 1940; Denegri and Perez-Serrano, 1997). Consumption of vegetation, fruit or soil containing mites by primate definitive hosts completes the life cycle (Fig. 1).

Zoonotic species

Only *Bertiella studeri* and *B. mucronata* are currently recognized as infecting humans (Denegri and Perez-Serrano, 1997), though *B. studeri* may in fact represent a species complex that may include some zoonotic members. Following the resurrection of *B. satyri* and its separation from *B. studeri* (Foitová *et al.*, 2011), early reports of *B. satyri* infection of humans may warrant re-investigation (Chandler, 1925). Regardless of the species, primates are the reservoir hosts of all *Bertiella* species currently recognized as infecting humans.

Bertiella studeri: Blanchard's original description of *Bertiella* contained two separate species of the new genus of cestode, including *Bertia* [sic] *satyri* in a Bornean orangutan (*Simia satyrus*; now *Pongo pygmaeus*) and *Bertia* [sic] *studeri* from an African chimpanzee (*Troglodytes niger*; now *Pan troglodytes*). In 1927, Baer synonymized *B. studeri* and *B. satyri*, with *B. studeri* as the senior synonym (Baer, 1927). However, recent work based on a molecular and morphologic investigation by Foitova *et al.* has resurrected the species *B. satyri* (Foitová *et al.*, 2011). This report also suggested that many Old World *Bertiella* human infections from outside of Africa reported as *B. studeri* may represent *B. satyri* or another species of *Bertiella* (Foitová *et al.*, 2011). Furthermore, investigation of multiple *B. studeri*-type

Some efforts that can be made to prevent infection in livestock are by giving worms periodically every 3-6 months for general prevention even though the animal does not show symptoms. Good application of sanitation and hygiene of the cage: cleaning with disinfectant once every 2 weeks, maintaining the cleanliness of livestock by preventing excrement. Increase the endurance of farm animals by giving multivitamins regularly with the supervision of veterinarians or animal mantri. Provide knowledge about diatribes, symptoms, prevention, and treatment in breeders (Nuraini, et al., 2020).

CONCLUSION

Based on research that has been conducted on cow feces in Tegalbanteng Village of Lumajang Regency conducted by saturated NaCl method, it can be concluded that from 30 samples examined obtained results: The Gut Nematodes group was found in 14 samples by 46.7% especially ascaris lumbricoides species and 16 negative samples by 53.3%. The Cestoda group was not found in the 30 samples, so the percentage of diatribes was 0% positive and 0% negative.

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MINIREVIEW

Cystic Echinococcosis

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Echinococcosis is one of the 17 neglected tropical diseases (NTDs) recognized by the World Health Organization. The two major species of medical importance are *Echinococcus granulosus* and *Echinococcus multilocularis*. *E. granulosus* affects over 1 million people and is responsible for over $3 billion in expenses every year. In this minireview, we discuss aspects of the epidemiology, clinical manifestations, and diagnosis of cystic echinococcosis or cystic hydatid disease caused by *E. granulosus*.

Echinococcosis is a zoonotic infection caused by the larval stage of cestode species belonging to the genus *Echinococcus*. Although *E. granulosus* was initially regarded as the only causative agent of cystic echinococcosis (CE), it was clear that there were different taxa with differences in adult morphology, host specificity, and pathogenicity (1). Different strains of *E. granulosus* were identified to precisely portray their specificity for intermediate hosts (e.g., sheep, buffalo, horses, cattle, pigs, camels, and cervids). The lion strain, which was defined based on the definite host, was the exception. Recent advances in phylogenetic systematics have resulted in the recognition of nine species of *Echinococcus*: *E. granulosus sensu stricto* (G1 to G3), *E. equinus* (G4), *E. ortleppi* (G5), *E. canadensis* (G6 to G10), *E. multilocularis*, *E. vogeli*, *E. oligarthrus*, *E. felidis*, and *E. shiquicus* (1–3). The taxonomy of cystic echinococcosis continues to be under discussion and is far from being completed. For example, the taxonomic status of genotypes G6, G7, G8, and G10 of *E. granulosus* has not been solved (4).

Different species of *Echinococcus* cause different diseases in humans. Cystic echinococcosis (CE) is caused by *E. granulosus sensu stricto*, *E. equinus*, *E. ortleppi*, and *E. canadensis*. Alveolar echinococcosis is caused by *E. multilocularis* and polycystic echinococcosis by *E. vogeli* and *E. oligarthrus*. The most recently described species, *E. shiquicus*, is found in the Qinghai-Tibet plateau. It inhabits the small intestine of the Tibetan fox (*Vulpes ferrilata*), and the larval stage is found in the plateau black-lipped pika (*Ochotona curzoniae*). To date, no human cases of infection by *E. shiquicus* the affected organ after a period of time that can vary. Protoscolices bud from the germinal layer (see below) and develop within the cyst and, when ingested by a definitive host, evaginate and attach to the intestinal mucosa, developing into sexually mature adults in a period averaging 4 to 7 weeks. A single cyst can have thousands of protoscolices, and each protoscolex is capable of developing into an adult worm if ingested by the definitive host or, if the cystic fluid is spilled in a cavity such as the peritoneum, into a new cyst (secondary echinococcosis) (6). All mammals in which metacestodes develop act as intermediate hosts, but not all intermediate hosts perpetuate the life cycle. For example, humans are considered accidental or aberrant hosts as they are highly unlikely to be involved in disease transmission. Human-to-human transmission does not occur (6).

Cysts in each anatomic site, with the exception of bone, are composed of the periparasitic host tissue (pericyst), which encompasses the endocyst of larval origin. The endocyst has an outer, acellular laminated layer and an inner, or germinal, layer that gives rise to brood capsules and protoscolices. The cyst is filled with clear fluid and, when fertile, with numerous brood capsules and protoscolices. In some stages of cyst development, daughter vesicles of various sizes are present (6, 7). In cysts that are degenerating, one might see abundant free-floating hooklets. These structures represent the "hydatid sand" that sometimes can be seen during imaging procedures when the patient is asked to shift positions (see Fig. 1A).