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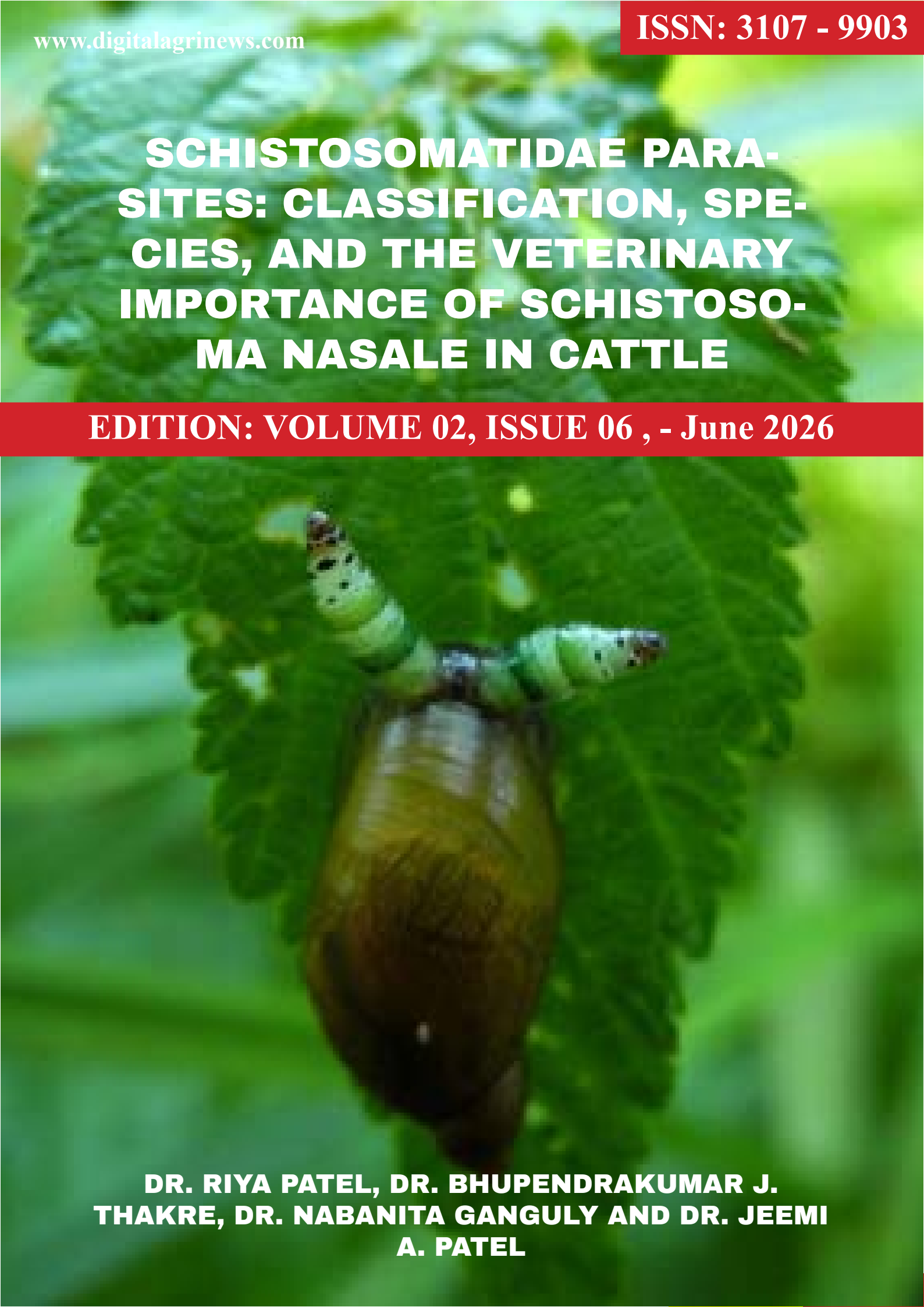

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Schistosomatidae Parasites: Classification, Species, and the Veterinary Importance of Schistosoma nasale in Cattle

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Abstract

Schistosoma nasale is a two-host trematode that resides in the blood vessels of the nasal mucosa in cattle and buffalo. Transmitted via freshwater snails, this parasite causes nasal schistosomiasis, a condition reported across most provinces of India and in neighboring countries. Often referred to as "snoring disease" or nasal granuloma in cattle, the infection produces nodular, cauliflower-like lesions inside the nasal passages. Affected animals commonly develop mucopurulent nasal discharge, difficulty breathing, and a characteristic snoring noise during respiration. This review concentrates on the occurrence of S. nasale, its developmental cycle, and available therapeutic approaches.

Keywords: *Schistosoma nasale*, cattle, fercocercous cercaria

Introduction

The family Schistosomatidae comprises a group of dioecious (separate male and female) blood flukes belonging to the phylum Platyhelminthes, class Trematoda, subclass Digenea. The Schistosomatidae are elongated, separate-sex (unisexual) and sexually dimorphic trematodes that inhabit the blood vessels of their hosts. The female is longer and thinner,

while the male carries the female in the gynaecophoric canal. Suckers are weak or absent, and the pharynx is absent. The intestinal branches usually unite posteriorly into a single tube. Testes are lobed, and the ovary lies anterior to the intestinal junction with vitelline glands located behind it. Eggs are thin-shelled, non-operculated, and may have lateral or terminal spines; they are passed through faeces or urine. The furcocercous cercariae develop from sporocysts without a redial stage and infect the host by directly penetrating the skin without encystment (Soulsby, 1992).

Schistosoma nasalis closely resembles S. spindale. The adult worms are approximately 5–11 mm long, and their eggs are boomerang-shaped, measuring about 350–380 × 50–80 µm. The parasite inhabits the nasal veins of buffalo, cattle, goats, sheep, and horses, mainly in the Indian subcontinent. Infection causes rhinitis with mucopurulent nasal discharge, leading to symptoms such as coryza, sneezing, difficulty in breathing, and snoring, commonly known as snoring disease. The prevalence may reach 40–50% in buffalo and cattle.Adult worms cause enlargement and blockage of nasal veins. The nasal lining develops granulomas and small egg-containing abscesses, and prolonged infection results in fibrosis and excessive growth of the nasal epithelium. Compared to cattle, buffalo generally experience milder disease, showing only small eruptions and congestion of the nasal mucosa. This indicates that buffalo may be a more suitable definitive host for S. nasalis than cattle (Basu *et al.*,2018).

Species	Definitive host	I.H.	Location of adult parasite In definitive host
Schistosoma bovis	Cattle, sheep, Goat	*Bulinus* spp.	Mesenteric and portal vein
Schistosoma mattheei	Cattle, sheep, Goat	*Bulinus* spp.	Mesenteric vein
Schistosoma spindale	Cattle, buffalo, sheep, goat	*Indorplanorbis exustus*	Mesenteric veins of intestine
Schistosoma nasale	Cattle, buffalo	*Indorplanorbis exustus*	Mesenteric and nasal mucosa
Schistosoma japonicum	Man, cattle, buffalo, pigs, dogs, other mammals	*Oncomelanin* species	Mesenteric and portal vein

Species	Definitive host	I.H.	Location of adult parasite In definitive host
Schistosoma mekongi	Man & dog	*Neotricula aperta*	Mesenteric vein
Schistosoma malayensis	Rodents (ocassionally man)	*Robertsiella* spp.	Mesenteric vein
Schistosoma mansoni	Man, primate, rodents	*Biomphalaria* spp.	Inferior mesenteric veins of large intestine
Schistosoma intercalatum	Man	*Bulinus* spp.	Mesenteric veins of rectum and colon
Schistosoma haematobium	Man	*Bulinus spp.*	Vesicle and pelvic veins of urinary bladder
Schistosoma rodhaini	Rodents		Mesenteric vein
Schistosoma margrebowiew	Antelopes and wild ruminants	*Bulinus spp.*	Mesenteric vein
Schistosoma hippopotami	Hippopotamus		Mesenteric and portal vein

Genus	Species	I.H.	D.H.	Location of parasite
Ornithobilharzia	*O. turkastanicum*	*Lymnaea spp.*	Cattle, sheep, goat, wild ruminants	Mesenteric vein & portal vein
	O. bomfordi	*Not clearly established*	Cattle, sheep, goat, wild ruminants	Mesenteric vein
	O. seychellensis		Cattle, sheep, goat, wild ruminants	Mesenteric vein
	O. curvicauda		Cattle, sheep, goat, wild ruminants	Mesenteric vein

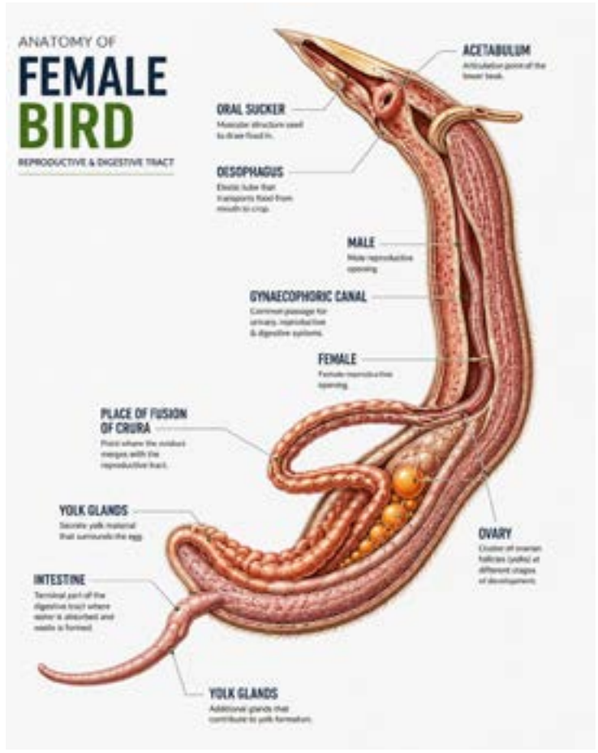
Genus	Species	I.H.	D.H.	Location of parasite
Bilharziella	*B. polonica*	*Planorbis spp.*	Ducks & other water birds	Mesenteric vein
Heterobilharzia	*H. americana*	*Lymnaea cubenensis*	Dog, racoons and other mammals	Mesenteric vein & portal vein
	H. azeteca	*Lymnaea humilis*	Dog, racoons and other mammals	Mesenteric vein & portal vein
	H. faustiana	*Lymnaea spp.*	Dog, racoons and other mammals	Mesenteric vein & portal vein
	H. canadensis	*Lymnaea columella*	Racoons	Mesenteric vein & portal vein
Austrobilharzia	*A.terrigalensis*	Marine snail	Shore birds and sea birds	Mesenteric vein
	A.variglandis	Marine snail	Shore birds and sea birds	Mesenteric vein
Bivitellobilharzia	*B. nairi*	*Indoplanorbis exustus*	Elephant	Hepatic portal system and mesenteric vein
	B. szidati	*Indoplanorbis exustus*	Elephant	Hepatic portal system and mesenteric vein
	B. adventitiosa	*Indoplanorbis exustus*	Elephant	Hepatic portal system and mesenteric vein
Gigantobilharzia	*G. huronensis*	Freshwater snail	Aquatic birds	Blood vessels (mainly meseteric vein)
	G. acotylea	Freshwater snail	Aquatic birds	Blood vessels (mainly meseteric vein)
Trichobilharzia	*T. regenti*	*Lymnaea* spp.	Ducks and other water birds	Mesenteric vein
	T. ocellata	*Lymnaea* spp.	Ducks and other water birds	Nasal vein and blood vessels
	T. physellae	*Physella* spp.	Gallinaceous birds, rats, mice	Blood vessels

Detailed Description of Schistosoma nasale

Introduction

Schistosoma nasale is a dioecious blood fluke belonging to the family Schistosomatidae. It is an important parasite of cattle and buffaloes, causing nasal schistosomiasis, a chronic granulomatous disease of the nasal

cavity. The parasite was first described by Rao (1933) from cattle in India. The disease is mainly distributed in tropical and subtropical regions, especially in the Indian subcontinent, where it causes significant economic losses due to reduced productivity, impaired growth, decreased milk yield, and treatment costs. Unlike other species of Schistosoma that inhabit the mesenteric or vesical veins, adult S. nasale worms reside in the venous plexus of the nasal mucosa, making it unique among veterinary schistosomes.



Geographic Distribution

Schistosoma nasale is mainly found in tropical and subtropical countries.

Definitive hosts: Cattle (Bos taurus and Bos indicus) and Water buffalo (Bubalus bubalis). Buffaloes are generally considered more resistant than cattle, although both species can be infected.

Intermediate host: The freshwater planorbid snail: *Indoplanorbis exustus*. (The snail is essential for completion of the parasite's life cycle).

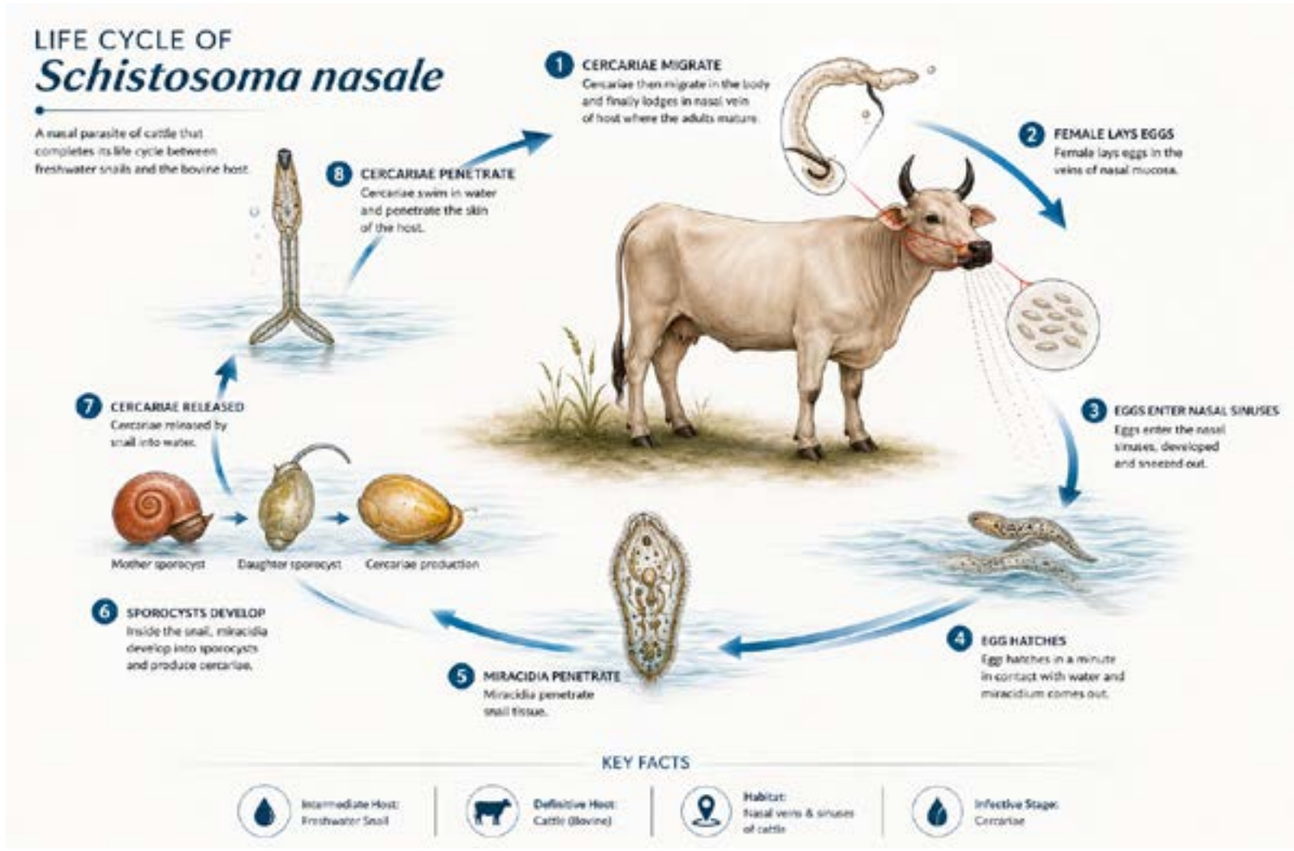
Lifecycle

1. **Egg stage:** Adult worms reside in the **nasal veins of cattle and buffaloes**. The eggs penetrate the nasal mucosa and are discharged into the environment through nasal secretions.

2. **Miracidium:** When eggs reach water, they hatch and release a ciliated miracidium, which actively penetrates a suitable freshwater snail (intermediate host), mainly ***Indoplanorbis exustus***.

3. **Development in snail:** Inside the snail, the miracidium transforms into **mother and daughter sporocysts**. There is **no redial stage**. Sporocysts produce numerous fork-tailed cercariae.

4. **Cercarial stage:** The **furcocercous cercariae** leave the snail and swim freely in water.



5. **Infection of the definitive host:** The cercariae penetrate the skin of cattle or buffaloes during contact with contaminated water. They lose their tails and become schistosomula.

6. **Migration and maturation:** The schistosomula enter the blood circulation, migrate to the nasal veins, and develop into mature male and female worms. The adult's pair, and the female remains within the male's gynecophoric-canal, completing the life cycle.

Epidemiology

1. The occurrence of schistosomosiss is strongly linked with permanent water bodies such as ponds, lakes, and marshy grazing lands where aquatic snails, the intermediate hosts, survive. Water becomes contaminated when infected animals and birds pass schistosome eggs in waterlogged areas. Animals, especially cattle and buffaloes, are commonly infected due to frequent contact with contaminated water, mainly through skin penetration

by *furcocercous* cercariae. Infection may also occur by drinking water containing these cercariae. (Pal, *et al.*,2014).

Pathogenesis

Schistosoma nasale infection is commonly referred to as nasal schistosomosis, nasal granuloma, or snoring disease. The eggs deposited in the veins of the nasal mucosa and submucosa stimulate a granulomatous inflammatory response. In the initial stages, infiltration of inflammatory cells such as eosinophils and lymphocytes occurs. With the progression of infection, fibrous connective tissue develops along with proliferation of nasal epithelial cells, resulting in a cauliflower-like granulomatous growth in the nasal cavity. The lesions are generally more severe in cattle, whereas buffaloes usually exhibit only mild inflammatory reactions due to lower host susceptibility.

Clinical signs

Sneezing – Occurs due to irritation of the nasal mucosa caused by deposited eggs and granulomatous lesions. Snoring or noisy breathing – Caused by narrowing of the nasal passages due to cauliflower-like granulomatous growths. Dyspnoea (difficulty in breathing) – Results from obstruction of the nasal cavity by large granulomas. Mucopurulent nasal discharge Develops due to inflammation of the nasal mucosa and secondary bacterial infection. Coryza (nasal inflammation) – Caused by immune-mediated inflammatory reaction around the eggs. Weakness and debility – Seen in chronic infections because of prolonged inflammation and reduced feed intake. Anaemia – Develops due to chronic inflammatory changes and continuous blood loss. Signs are more severe in cattle than in buffaloes – Because cattle show a stronger granulomatous reaction, whereas buffaloes usually exhibit mild lesions.

Fig: Granulomatous growth in nasal cavity

Diagnosis

Diagnosis of nasal schistosomiasis can be achieved by microscopic detection of eggs in nasal secretions. A conventional method involves mixing 1 ml of nasal mucus with 9 ml of 10% potassium hydroxide (KOH) and allowing the mixture to digest for 10–20 minutes. Subsequently, the lower portion of the digested sample is collected and examined under a light microscope for the presence and enumeration of schistosome eggs.

A modified technique includes treating approximately 1g of nasal mucus with 10% KOH, followed by centrifugation of the sample. The sediment obtained after centrifugation is then microscopically examined for the detection and counting of ova. Collection of nasal scrapings directly from the affected lesions using a spoon has been reported to be more sensitive than examination of nasal discharge, as it yields a significantly higher number of eggs.

Immunological methods are also valuable in the diagnosis of nasal schistosomiasis, particularly in asymptomatic animals. A heterologous intradermal test employing Schistosoma japonicum antigen is performed by injecting the antigen beneath the base of the

Fig: Egg of S. nasalis

tail, where positive animals develop a characteristic wheal and erythematous reaction.

Serological techniques such as indirect haemagglutination using crude S. nasale antigens have demonstrated detectable antibody titres in clinically affected cattle. Additionally, serodiagnostic methods including DOT-enzyme-linked immunosorbent assay (DOT-ELISA) using whole worm antigens of S. nasale have shown high sensitivity and are considered rapid and reliable diagnostic tools.

Counter current immunoelectrophoresis with whole worm antigens has also exhibited high sensitivity and may identify animals

with previous exposure to the parasite even when eggs or adult worms are not detected during postmortem examination. Advanced diagnostic approaches, particularly polymerase chain reaction (PCR) and ELISA, offer greater sensitivity and specificity and are useful for the early detection of S. nasale infections.

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Differential Diagnosis: The clinical manifestations of nasal schistosomiasis closely resemble those of rhinosporidiosis in cattle. Therefore, differentiation between the two diseases is necessary, as concurrent infection with both conditions may occasionally occur. (Basu *et al.*,2018)

Treatment: Praziquantel is the drug of choice for schistosomiasis due to its high efficacy (>90%). It is administered orally as a single dose of 60 mg/kg or 20 mg/kg three times at 4-hour intervals. Mild side effects such as nausea, vomiting, and dizziness may occur. The treatment of nasal schistosomiasis in cattle and buffalo caused by Schistosoma nasale includes antimonial compounds. Tartar emetic is effective at a maximum dose of 2 mg/kg, while sodium antimony tartrate is administered at 1.5 mg/kg twice daily for 2 days. Trichlorophon has also been found effective at a dose of 30–40 mg/kg with repeated administration.

Control

Control of S. nasale mainly involves reducing exposure of animals to cercariae and controlling the snail intermediate host. Snail populations can be controlled using molluscicides such as Frescon and Bayluscide. Preventing animals from drinking or wallowing in snail-infested water, providing clean piped water through troughs, regular cleaning of troughs, and improving water flow in irrigation channels help reduce transmission. Proper disposal and fermentation of contaminated night soil for 25–45 days destroys schistosome eggs. (Soulsby, 1982)

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