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A Study on Black Spot Disease in *Catla catla* and *Labeo rohita* Fry in Fish Seed Rearing Center, Chhattisgarh, India

B. R. Honnananda[1]*, Pabitra Barik[2], Mangesh M. Bhosale[2]

[1]Department of Aquaculture, College of Fisheries, Karnataka Veterinary, Animal and Fisheries Sciences University, Mangalore - 575 002, Karnataka, India
[2]LSPN College of Fisheries, Dau Shri Vasudev Chandrakar Kamdhenu Vishwavidyalaya, Kawardha - 491 995, Chhattisgarh, India
*Corresponding Author: drhonnananda@gmail.com

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Abstract— *Black spot disease, also known as posthodiplostomiasis, is caused by digenetic trematodes belonging to the family Diplostomatidae, with* Posthodiplostomum cuticola *being a common etiological agent. The present study was conducted at the Government Fish Seed Rearing Center, Khairbanakala, Kawardha, Chhattisgarh, where an outbreak was observed in nursery ponds rearing fry of* Catla catla *and* Labeo rohita. *Infected fry were examined for black spot incidence, metacercarial cysts, and associated pathological conditions. A total of 200 fry were analyzed from over 1000 examined individuals. The mean fry length was 20.47 mm, with an average of 4.49 ± 1.53 black spots per fry. The cysts measured 0.79–1.01 mm in diameter, with metacercaria ranging between 0.70–0.98 mm. Histological observations confirmed encysted metacercaria surrounded by melanized host tissue. The infected ponds had abundant aquatic vegetation (*Hydrilla sp.*,* Vallisneria sp.*), alkaline water, and were inhabited by snails (*Planorbis sp.*,* Lymnaea sp.*) and piscivorous birds, facilitating completion of the parasite's life cycle. The study highlights the significance of pond ecology, snail abundance, and bird populations in disease transmission. Control measures such as snail population management and exclusion of piscivorous birds are recommended to reduce the incidence of black spot disease in nursery ponds.*

Keywords— ***Black spot disease, Posthodiplostomum cuticula, Catla catla, Labeo rohita, Chhattisgarh.***

I. INTRODUCTION

Indian aquaculture relies heavily on Indian major carps (IMCs), with *Catla catla*, *Labeo rohita*, and *Cirrhinus mrigala* forming the backbone of freshwater production. Among parasitic infections, black spot disease is easily recognized by visible pigmented cysts on fish, which although rarely fatal, significantly reduce commercial value and seed survival. Black spot disease, also known as posthodiplostomiasis, is caused by digenetic trematodes of the family Diplostomatidae, with *Posthodiplostomum cuticola* being one of the most frequently reported species in freshwater fish (Davis, 1967; Mierzejewska et al., 2004). The cercariae penetrate the skin and fins of fish, encyst as metacercariae, and induce melanization around the cysts, leading to characteristic black spots visible to the naked eye (Teixeira-de Mello & Eguren, 2008). This condition is particularly prevalent in earthen ponds and can be detrimental to fry survival during early rearing phases (Lucký, 1970).

The parasite life cycle involves piscivorous birds as definitive hosts, aquatic snails (*Planorbis planorbis*, *P. carinatus*) as first intermediate hosts, and fish as second intermediate hosts. Eggs excreted in bird feces hatch into miracidia, which infect snails and develop into cercariae. These cercariae penetrate fish tissues and encyst until consumed by birds, thus completing the cycle (Figure 1) (Olsen, 1974; de Kinkelin et al., 1985).

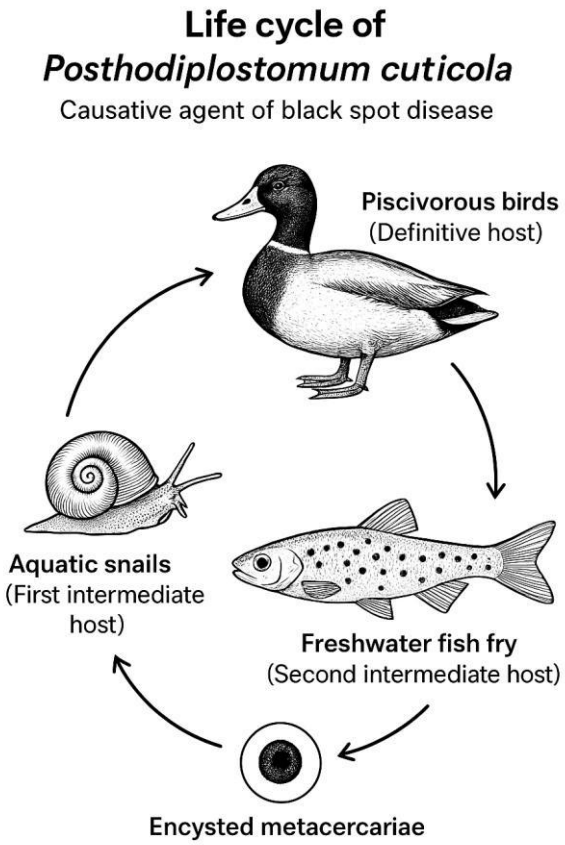

Fig. 1. Schematic representation of the life cycle of Posthodiplostomum cuticola, the causative agent of black spot disease in Catla catla and Labeo rohita fry. The cycle involves piscivorous birds (definitive host), aquatic snails (first intermediate host), and freshwater fish fry (second intermediate host). Encysted metacercariae appear as black spots on fish skin and fins, completing the cycle when infected fry are consumed by birds.

Outbreaks of black spot disease have been reported worldwide in cyprinids and other freshwater fishes (Hoffman, 1967; Rolbiecki, 2004; Zrncic et al., 2009). Common in carp seed-rearing centers of West Bengal, Bihar, Odisha, Chhattisgarh, and Assam. Prevalence peaks during warmer seasons (March–June). High snail density in ponds directly correlates with infection levels.Fry and fingerlings show highest infection rates. Infected fish exhibit stunted growth, poor appetite, organ pathology, and increased mortality (Williams & Jones, 1994). The present study documents the incidence of *P. cuticola* infection in *Catla catla* and *Labeo rohita* fry at the Fish Seed Production and Training Center, Khairbanakala, Kawardha, Chhattisgarh.

II. MATERIALS AND METHODS

2.1. Sample Collection

Infected fry of *Catla catla* and *Labeo rohita* were collected from two adjacent nursery ponds at the Government Fish Seed Rearing Center, Khairbanakala, 10 km from Kawardha, Chhattisgarh. Approximately 1000 fry were examined, of which 200 infected fry were retained for further study. Fish were transported live in pond water to the Live Fish Laboratory, College of Fisheries, Kawardha, and maintained in aerated aquaria. Water samples, aquatic plants, and snails from the ponds were also collected.

2.2. Sample Analysis

Fry length and number of black spots were recorded. Cysts were excised and opened to release metacercaria, which were fixed in 4% hot formalin and examined microscopically (Bauer et al., 1973; Moravec et al., 1991). Water samples were analyzed for physicochemical parameters as per APHA (1992). Snail specimens were identified following Huet (1974).

III. RESULTS AND DISCUSSION

The infected nursery pond (62 × 31 × 1.4 m) had dense aquatic vegetation (*Hydrilla sp.*, *Vallisneria sp.*), with water visibility of 30.5–35.5 cm. Organic and inorganic fertilizers (cow dung, urea, and SSP) had been applied to maintain productivity. Water quality parameters were alkaline and within acceptable limits for carp culture (Table1) (Boyd & Tucker, 1998). Snails (*Planorbis sp.*, *Lymnaea sp.*) were abundant in the pond, supporting parasite transmission, as reported by Zafar Iqbal et al. (2014).

Table 1. Physicochemical Parameters of Pond Water

Parameter	Observed Range	Optimum range (Carp culture)
Water Temperature (°C)	26–28	25–32
Dissolved Oxygen (mg/L)	5.8–6.5	5–8
pH	7.8–8.2	7.0–8.5
Total Hardness (mg/L)	140 - 155	50 - 300
Total Alkalinity (mg/L)	120 - 135	75 - 200

Table 2. Infection Intensity in Fry

Parameter	Observation
Number of fry examined	1000
Number of infected fry	200
Mean length of fry (mm)	20.47 (15–27)
Total black spots recorded	899
Mean black spots per fry	4.49 ± 1.53
Cyst diameter (mm)	0.79–1.01
Metacercaria length (mm)	0.70–0.98

Table 3. Clinical effects of black spot disease in Indian major carps

Stage affected	Clinical features	Impact
Fry	Reduced survival, abnormal swimming	Seed mortality
Fingerlings	Pigmented cysts on fins/skin	Poor growth
Adults	Visible black spots, poor marketability	Economic loss

Table 4. Reported prevalence of black spot disease in Indian Major Carps (IMCs)

Region	Host fish	Prevalence (%)	Reference
West Bengal	*Catla catla* fry	45–60	Bandyopadhyay & Mitra, 2005
Chhattisgarh	*Labeo rohita* fry	40–55	Kumar et al., 2021
Assam	Mixed IMCs	35–50	Choudhury & Tandon, 2015

Table 5. Management strategies for black spot disease

Method	Approach	Advantages	Limitations
Snail control	Molluscicides, habitat management	Reduces transmission	Environmental impact
Bird control	Netting, scare devices	Prevents definitive host entry	Costly for large ponds
Biological control	Snail predators (ducks, fish)	Eco-friendly	Partial effectiveness
Pond management	Liming, drying, sanitation	Prevents snail breeding	Requires labor
Health management	Probiotics, Immunostimulants	Improves host resistance	Does not kill parasites

Of the 1000 fry examined, 200 were infected. Fry length ranged from 15–27 mm (mean: 20.47 mm). A total of 899 black spots were observed, with an average of 4.49 ± 1.53 per fry. Cysts measured 0.79–1.01 mm, while metacercaria ranged 0.70–0.98 mm. (Table 2). Further analysis revealed metacercaria encysted in tissues with melanization, confirming *P. cuticola* infection (Figure 2 & 3).

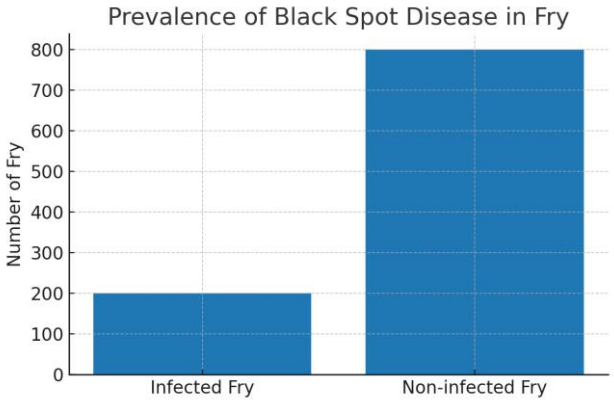

Fig. 2. Prevalence of Black Spot Disease in fry. The number of fry infected with black spot and uninfected fry in the study sample is represented through bar diagram.

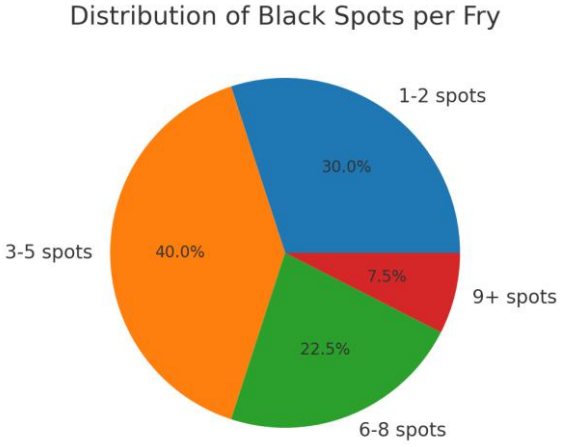

Fig. 3. Distribution of black spot per fry. The number of black spots per fry is calculated from the infected samples.

No skeletal deformities were noted, indicating recent infection. However, heavy infections in sensitive sites (gills, eyes) may impair respiration or vision, reducing survival (Table 3) (Hoole et al., 2001). Infected fry also

exhibited reduced mobility, increasing predation risk by piscivorous birds, thereby enhancing parasite transmission (Bauer et al., 1973; Ondrackova et al., 2006).

These findings are consistent with earlier reports of *P. cuticola* infection in cyprinids, including *C. catla* and *L. rohita* (Table 4) (Ganapati & Rao, 1962; Zrncic et al., 2009). Environmental factors such as organic enrichment, aquatic vegetation, and snail populations were likely key contributors to the outbreak (Garg et al., 2009).

IV. CONCLUSION AND RECOMMENDATIONS

The outbreak of black spot disease in *C. catla* and *L. rohita* fry was strongly associated with high snail populations, abundant aquatic vegetation, and piscivorous bird activity in and around nursery ponds. Preventive measures should focus on reducing snail density and deterring piscivorous birds (Table 5). Although snail eradication is difficult due to their burrowing ability (Brown, 1991), regular pond management and bird control can minimize infection. Long-term control requires ecological management to reduce disease recurrence.

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