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Research Paper

Growth Performance of Swordtail Fish (*Xiphophorus hellerii*) Under Controlled Laboratory Conditions

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Abstract: The present study evaluated the growth performance, survival rate, and condition factor of swordtail fish (Xiphophorus hellerii) under controlled laboratory conditions over a 90-day period. Twelve fry were reared in a 20 L tank (operated at 8–10 L) with maintained water quality parameters: temperature (22–28°C), pH (7.0–8.3), dissolved oxygen (5.9–6.5 mg/L), ammonia (0.0–0.1 mg/L), and hardness (300–450 mg/L) (Boyd, 1990). Fish were fed twice daily with Artemia, Azolla powder, and infusorians (Chong et al., 2000; Rajan & Brindha, 2022). Growth increased from 0.6 cm and 0.001 g to 2.4 cm and 0.15 g by Day 90. The survival rate was 83.33%, which is within acceptable limits for ornamental fish culture (Rahman et al., 2015; Demir & Kırankaya, 2025). Fulton's condition factor (K) improved from 0.463 to 1.085, indicating healthy growth (Le Cren, 1951). The study demonstrates that controlled laboratory conditions support optimal growth and survival of swordtail fish and provides baseline data for ornamental aquaculture (FAO, 2020; Rana et al., 2023).

Keywords: Swordtail fish, *Xiphophorus hellerii*, growth performance, ornamental aquaculture, condition factor, laboratory culture

Introduction:

The swordtail fish (*Xiphophorus hellerii*) is a widely cultured ornamental freshwater species belonging to the family Poeciliidae (Kallman, 1989). Due to its attractive coloration, adaptability, and ease of breeding, it holds high commercial value in the global ornamental fish industry (FAO, 2020; Rana et al., 2023). Growth performance is a key indicator of fish health and productivity and is influenced by environmental parameters, feeding practices, and stocking density (Ali et al., 2003; Rajan & Brindha, 2022).

Controlled laboratory experiments provide a uniform environment to evaluate growth parameters without external environmental

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fluctuations (Boyd, 1990). Recent studies have also emphasized the role of nutrition, probiotics, and environmental factors in improving growth and survival in ornamental fishes (Rajan & Brindha, 2022; Naser et al., 2024). However, limited studies have been conducted on the growth performance of swordtail fish under controlled laboratory conditions in India (Arun et al., 2013). Therefore, the present study was undertaken to evaluate growth, survival, and condition factor under standardized laboratory conditions.

Materials and Methods:

Experimental Setup

The experiment was conducted in a fisheries laboratory using a plastic tank of 20 L capacity, maintained at 8–10 L water level. A total of 12 swordtail fry were stocked following standard ornamental fish culture practices (Rahman et al., 2015).

Feeding Regime

Fish were fed twice daily with Artemia, Azolla powder, and infusorians. These feeds are widely used for larval and juvenile stages due to their high nutritional value (Chong et al., 2000; Rajan & Brindha, 2022). Feeding was adjusted weekly, and no feeding was provided on Sundays to maintain water quality (Boyd, 1990).

Water Quality Parameters

Water quality was maintained within optimal ranges: temperature (22–28°C), pH (7.0–8.3), dissolved oxygen (5.9–6.5 mg/L), ammonia (0.0–0.1 mg/L), and hardness (300–450 mg/L), as recommended for freshwater ornamental fish culture (Boyd, 1990).

Growth Measurement

Fish length and weight were recorded at regular intervals over a 90-day period to evaluate growth performance (Ali et al., 2003).

Condition Factor

Fulton's condition factor (K) was calculated following Le Cren (1951):

$K=W/L3\times100$

Where:

- K = Condition factor
- W = Weight of the fish (in grams)
- L = Total length of the fish (in centimetres)

Observation:

Growth and Development of Swordtail Fish

Table: 01. Showing Growth and Development of Swordtail Fish over time

Age (Weeks/Days)	Length (Approx.)	Development	Feeding/Behavior
1st Week	6–8 mm	Transparent body, weak fins	Infusoria, Artemia
2–3 Weeks	10–12 mm	Light coloration begins	Active swimming
4–5 Weeks	1.2–1.5 cm	Color intensifies	Normal feeding
6–8 Weeks	1.5–1.6 cm	Full coloration	Social behavior
8–9 Weeks	1.7–1.9 cm	Fin development	Increased activity
10–12 Weeks	2.0–3.0 cm	Juvenile stage	Active feeding

These developmental stages are consistent with earlier reports on livebearer fish growth and morphology (Basolo, 1990; Naser et al., 2024).

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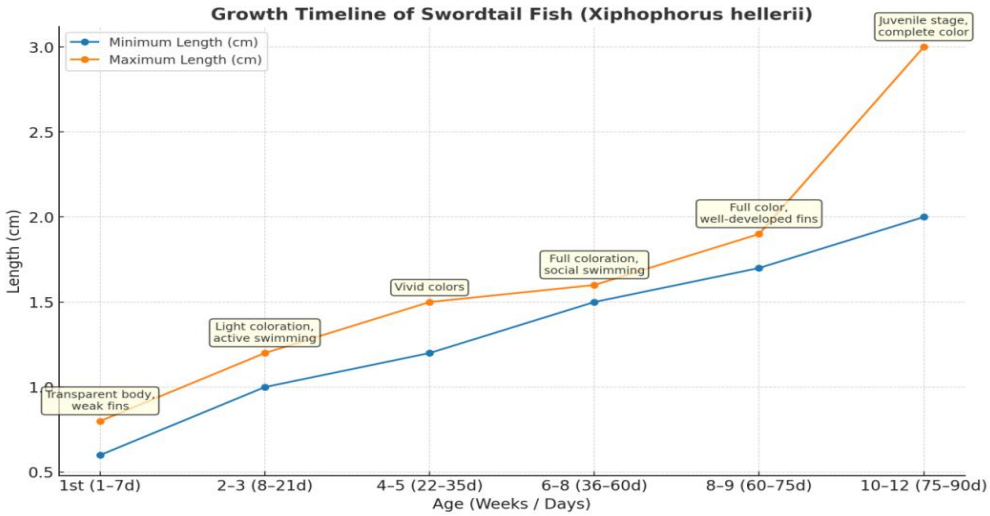

Figure: 1.The line graph is showing the growth of Sword tail fish over time in terms of both length and age.

Day	Length (cm)	Weight (g)	Condition Factor (K)
1	0.6	0.001	0.463
7	0.8	0.002	0.391
14	1.1	0.05	3.766
28	1.3	0.03	1.366
70	1.8	0.06	1.028
90	2.4	0.15	1.085

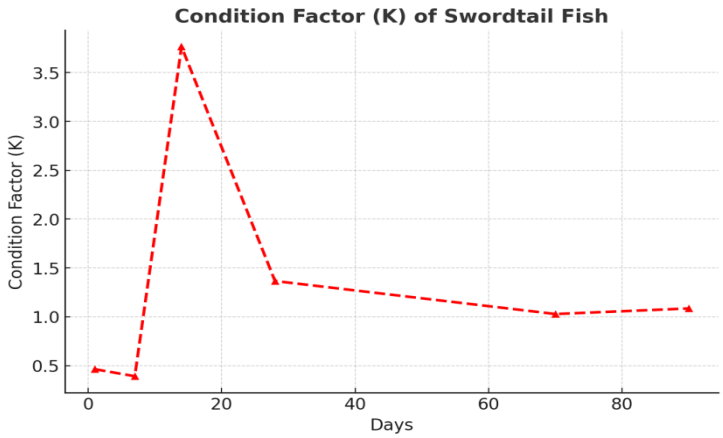

Figure: 2. The line graph is showing the growth of Sword tail fish over time in terms of both Condition Factor and days

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Results:

Growth Performance

The fish exhibited steady growth from 0.6 cm and 0.001 g to 2.4 cm and 0.15 g over 90 days. Maximum growth was observed between Day 14 and Day 28, possibly due to improved feeding efficiency and environmental adaptation (Ali et al., 2003; Rajan & Brindha, 2022; Rana et al., 2023).

Survival Rate

Out of 12 fish, 10 survived, resulting in a survival rate of 83.33%, which aligns with previous findings for ornamental fish under controlled conditions (Rahman et al., 2015; Demir & Kırankaya, 2025).

Condition Factor

The condition factor improved from 0.463 to 1.085. Values around 1.0 indicate healthy physiological condition and proper growth (Le Cren, 1951).

Discussion:

The observed growth pattern is consistent with previous studies indicating that proper feeding and water quality significantly enhance growth performance (Chong et al., 2000; Boyd, 1990). Recent research highlights that probiotic and nutritionally enriched diets improve growth efficiency in swordtail fish (Rajan & Brindha, 2022).

Plant-based carotenoids have also been shown to enhance both coloration and growth in ornamental fish species (Rana et al., 2023). Environmental factors such as turbidity and habitat conditions can influence morphology and growth patterns (Naser et al., 2024).

The survival rate observed in this study is within acceptable limits, confirming the suitability of controlled laboratory conditions for ornamental fish culture (Rahman et al., 2015). Additionally, swordtail fish exhibit strong adaptability and reproductive potential, making them ideal for aquaculture systems (Demir & Kırankaya, 2025).

Conclusion:

The study confirms that swordtail fish (Xiphophorus hellerii) can be successfully reared under controlled laboratory conditions with good growth performance and survival rate. Proper feeding strategies and maintenance of water quality are crucial for achieving optimal results. The findings provide valuable baseline data for ornamental aquaculture, particularly for small-scale breeding and laboratory-based studies.

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Day 1

0.6 cm

Day 7

0.8 cm

Day 14

1.1 cm

Day 28

1.3 cm

Day 70

1.8 cm

Day 90

2.4 cm

Image 1. Showing different life stages and growth of experimental fish