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Research Article

Fry Production and Induced Breeding Practice in Fish Hatcheries at Mymensingh District in Bangladesh

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Abstract

The aim of this paper is to provide a comprehensive overview of fry production and induced breeding practices in fish hatcheries located in Mymensingh district of Bangladesh. A pre-planned questionnaire survey was used to gather primary data regarding fry production, breeding methodologies, and operational aspects of hatcheries. The study shows that 40% of the hatchery owners belong to middle age group followed by old (33.33%) and young (26.67%) age group. The lack of formal training for more than half of the respondents could impact the efficiency and sustainability of hatchery operations. Hatcheries in the study area vary in size and physical facilities. Induced breeding practices involving administration of exogenous hormones to stimulate ovulation and spawning, were found to be widely adopted in the surveyed hatcheries. Fry production and price in depended on fish species and production period. In the fish seed marketing channel, the intermediaries were the main stakeholder. Hatchery owner reported the occurrence of diseases including argulosis, fin rot, epizootic ulcerative syndrome (EUS), skin lesion, swollen abdomen, and fungal infection in different seasons. Various types of chemicals and drugs were found to use in the surveyed fish hatchery as antibacterial agent, disinfectant, pesticide, fertilizer, and growth promoter. Despite the progress made in fry production and induced breeding practices, the drainage problem, insufficient credit facility, theft, market competition, and price fluctuations were identified as critical problems in hatchery management. In conclusion, the results indicate that the Mymensingh district is a vital aquaculture hub. Addressing the identified challenges and implementing the recommended strategies such as expanding access to training for hatchery operators and establishment of better financial support systems is crucial for enhancing the operational capacity of hatcheries.

Introduction

Aquaculture has emerged as one of the fastest-growing sectors globally, contributing significantly to food security, nutrition, and economic development (Pradeepkiran, 2019). The increasing world population and the depletion of natural fish stocks due to overfishing, pollution, and habitat degradation made aquaculture an essential alternative to meet the growing demand for fish and fishery products (Kumar, 2014). Fish is a major source of animal protein and essential nutrients particularly in developing countries such as Bangladesh. Bangladesh is one of the top fish-producing nations in the world. In 2022-23, the total fisheries production was 4.91 million metric tons (MT) out of which aquaculture contributes 58.03% of the total production (DoF, 2023). The fisheries sector accounts for 3.57% of the national GDP and employs millions of people directly and indirectly (DoF, 2022). Hence, aquaculture is one of the key contributors to the country's economy and fish production.

Fry production is the backbone of aquaculture, as the quality and availability of fry directly determine the success of fish farming operations (Das et al., 2018). Hatcheries play a crucial role in supplying fry and fingerlings to fish farms which are then grown to marketable size (Debnath et al., 2020). At present there are 103 government and 953 privet hatcheries are in operation in Bangladesh which together produced 668.94 MT of fish fry and fingerlings in in 2020-21 (Islam et al., 2023). The demand for fry has risen dramatically with the expansion of aquaculture (Islam et al., 2017a). Induced breeding is one of the most significant advancements in modern aquaculture which involves the administration of exogenous hormones to sexually mature fish, stimulating ovulation and spawning under

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controlled conditions (Debnath et al., 2020). Induced breeding enables hatcheries to bypass natural breeding seasons, allowing for year-round fry production and reducing the dependency on wild-caught broodstock (Firkus et al., 2024). The success of aquaculture in Bangladesh hinges on efficient fry production and the implementation of advanced breeding practices. Without a steady and reliable supply of quality fry, the overall productivity of fish farms could be severely compromised (Uddin et al., 2024). Therefore, the development and optimization of fry production technologies and induced breeding practices have become top priorities for hatcheries in Bangladesh.

The Mymensingh district is recognized as one of the leading aquaculture hub in Bangladesh and home to a large concentration of fish hatcheries contributing significantly to the total fish production (Mely et al., 2024). Fish hatcheries in this district play a pivotal role in fry production, providing fingerlings and juvenile fish to meet the growing needs of commercial fish farms across the country (Tabassum et al., 2023). The district is home to hundreds of fish hatcheries that engage in fry production and induced breeding practices for a variety of fish species (Siddique et al., 2022a). It has been reported that 10% of the government hatcheries and 36% of the privet hatcheries of the country are located in Mymensingh district (Islam et al. 2023). The widespread adoption of these practices in the district has contributed to the expansion of aquaculture at both local and national levels. Despite the contribution and progress on fry production and induced breeding practices in the Mymensingh district, the study on fish seed production and induced breeding in this district is still scanty.

Therefore, this paper aims to provide an overview of fry production and induced breeding practices in the fish hatcheries of the Mymensingh district, analyzing the current status, challenges, and potential areas for improvement. The research also aims to identify gaps in existing practices and offer recommendations for improving hatchery performance and fry production outcomes.

Materials and methods

Study area

The current study was carried out in 12 hatcheries located in Trishal, Muktagacha, Mymensingh Sadar, and Bhaluka upazila (an administrative region functioning as a sub-unit of a district) of Mymensingh district (Table 1 and Fig. 1). This district is bordered on the north by Meghalaya, a state of India and the Garo Hills, on the south by Gazipur District, on the east by the districts of Netrokona and Kishoreganj, and on the west by the districts of Sherpur, Jamalpur and Tangail. It is located in between 24°15' and 25°12' north latitudes and in between 90°04' and 90°49' east longitudes.

Table 1. Name and location of hatcheries

Name of Hatchery	Location
Nirapod motshyo hatchery	Dhola, Trishal, Mymensingh
Adarsho motshyo hatchery	Dhola, Trishal, Mymensingh
Jonota motshyo hatchery and nursery	Dhola, Trishal, Mymensingh
Vai vai motshyo hatchery	Dhola, Trishal, Mymensingh
Hasib fish hatchery	Bashati, Muktagacha, Mymensingh
Ahmed shah hatchery	Bashati, Muktagacha, Mymensingh
Vai vai motshyo hatchery	Bashati, Muktagacha, Mymensingh
Moyna motshyo hatchery	Bashati, Muktagacha, Mymensingh
Maa motshyo hatchery and fisheries	Roghurampur, Mymensingh Sadar, Mymensingh
Meghna catfish hatchery	Roghurampur, Mymensingh Sadar, Mymensingh
Brahamaputra fish hatchery	Char Puliamari, Mymensingh Sadar, Mymensingh
Char vai hatchery	Char Puliamari, Mymensingh Sadar, Mymensingh
Khaza fish hatchery	Mamarishpur, Bhaluka, Mymensingh
Provita fish hatchery	Dhitpur, Bhaluka, Mymensingh

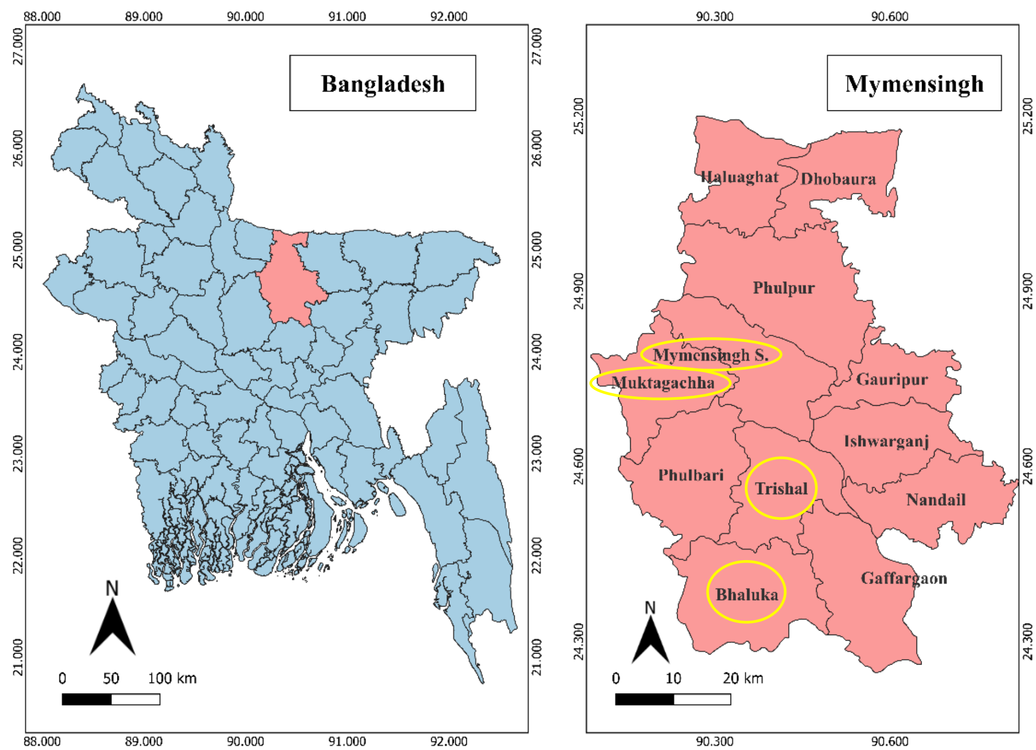

Fig. 1. Map of the study area.

Data collection

Primary data were gathered through surveys, monitoring, interview, and consultation with hatchery operators. A pre-planned questionnaire survey was used to gather primary data on fry production, induced breeding, and hatchery operation. Additionally, secondary information about fisheries resources and fish production was gathered from the Department of Fisheries (DoF).

Data analysis

The data obtained from the present study were analysed, and figures and associated tables were prepared by MS-Excel. QGIS (version 3.22) was used to generate the research area map. Likert scale with values of 4, 3, 2, and 1 was settled to rate the constraints faced by the farmers in the study area. The variable mean score of 2.5 or above were considered critical while variable with less than 2.5 were not critical. The final results were presented in textual, tabular, and graphic representation.

Result and Discussion

Demographic characteristics of hatchery owners

The demographic characteristics of hatchery owners in the study area, as outlined in the Table 1. This study shows that 40% of the hatchery owners belongs to middle age group followed by old (33.33%) and young (26.67%) age group. The involvement of active age group is essential for innovation and the long-term sustainability of the aquaculture sector, as they are likely more open to adopting new technologies and practices. Similar to our study, Siddique et al. (2022b) also reported that majority (60%) of the hatchery owners in Mymensingh district fall under middle age (31-50 years) category. However, the experience and knowledge of the older age group are also valuable.

The educational background of the hatchery owners is varied with 33.33% having completed secondary education, 40% holding higher secondary education, and 26.67% having a graduate-level education or higher. Rahman et al. (2016) reported that 32.5% fish farmer had secondary level education and 15% have graduate degree or above in Dhumki upazila of Patuakhali district which is more or less similar to this study. The absence of individuals without formal education suggests that literacy and basic education are prerequisites for successful hatchery operations. This is possibly due to the technical and managerial skills required in aquaculture (Mithun et al., 2020).

The data on occupation reveals that 73.33% of the hatchery owner consider fish seed production as their primary occupation, while 26.67% engage in fish farming as a secondary occupation. This suggests that most hatchery owners are deeply invested in aquaculture as their main source of income. For those who consider fish farming a secondary occupation, are involved in services, agriculture, business as primary occupation. Similarly, Rahman et al. (2017) reported that that 65% of fish farmer were engaged in fish farming as their main occupation while 15% was in business, 14% agriculture and 6% in service. According to Mely et al. (2024), fish farming is the primary occupation of fish farmers in Mymensingh because it is an important fish farming cluster in the country.

In the study area, majority of hatchery owners (60%) rely on their own funds to support their operations, while 20% use bank loans, and another 20% receive support from friends and relatives. The relatively low percentage of those using bank loans may indicate limited access to formal financial institutions. Das et al. (2018) also listed lack of loan facilities as a major problem therefore only 12.73% farmer's in Gazipur district of Bangladesh was reported to take loan from bank.

The survey indicates that 53.33% of hatchery owners have not received any formal training, while 26.67% have undergone training provided by government organizations (Department of Youth Development and Bangladesh Fisheries Research Institute), and 20% have received training from non-government organizations (NGOs). Bhuyan et al. (2011) also reported that in Rajshahi district of Bangladesh, 38.16% hatchery operators had no institutional training and 19.56% has short term training and rest of then gathered information through personal communication. The lack of formal training for more than half of the respondents (53.33%) highlights a significant gap in technical capacity that could impact the efficiency and sustainability of hatchery operations. Expanding access to training opportunities is essential to improving the knowledge and skill in fish breeding and brood management (Ali et al., 2023).

The table shows that 60% of hatchery owners possess their own land, while 40% operate on both owned and leased land, with no respondents indicating that they exclusively lease land. A combination of owned and leased land (40%) implies that some hatchery owners are expanding their operations beyond their own property, possibly to increase production capacity. Previous studies also reported that leasing land is a common practice in aquaculture operation of Bangladesh (Pravakar et al., 2013; Rahman et al., 2017; Mely et al., 2024).

Table 2. Demographic characteristics of hatchery owners

Category	Percentage (%)
Age group (age in year)	
Young (20-30)	26.67
Middle (31-40)	40.00
Old (41-60)	33.33
Education level	
No formal education	0.00
Secondary	33.33
Higher secondary	40.00
Graduate or above	26.67
Occupation	
Primary occupation	73.33
Secondary occupation	26.67
Source of Financial support for fish farming	
Own	60.00
Bank loan	20.00
Others	20.00
Source of training	
No formal training	53.33
Training from government organizations	26.67
Training from non-government organizations	20.00
Land ownership	
Own	60.00
Leased	0.00
Both	40.00

Physical status of hatchery

The physical status of fish hatcheries in the study area are presented in Table 2. The hatcheries in the study area vary in size, with 53.34% of the hatcheries classified as large (≥ 100 decimals), 26.66% as medium-sized (50-100 decimals), and 20.00% as small (≤ 50 decimals). The number of cisterns (used for holding brood stock or growing fry) ranges from 12 to 48, circular tanks (used for brood stock conditioning or spawning) range from 1 to 5, hatching tanks (used for incubating fertilized eggs) range from 10 to 32, and Overhead tanks (used for water supply and circulation) range from 1 to 3 per hatchery. The findings of this study is more or less similar with previous studies (Bhuyan et al., 2011; Debnath et al., 2020; Ali et al., 2023).

The hatcheries in the study area also utilize pond systems, which are vital for different stages of fish rearing, especially for nursery and broodstock management. Nursery ponds range from 4 to 10 per hatchery and brood ponds range from 2 to 8 per hatchery. Hatcheries with more brood ponds can maintain more diverse stocks of broodfish, potentially improving genetic diversity and breeding success. Debnath et al. (2020) reported that inadequate brood stocking facilities increase the chances of inbreeding.

The number of workers employed in the hatcheries varies, with permanent workers ranging from 2 to 12 and seasonal workers ranging from 3 to 8 per day. Permanent workers are required to maintain daily operations and seasonal workers are hired particularly during peak periods such as the breeding and fry production seasons (Bhuyan et al., 2011). The reliance on seasonal workers suggests that labor demand fluctuates throughout the year, and hatcheries may adjust their staffing based on production cycles.

Table 3. Physical status of hatchery in the study area

Properties	Number/range/count
Hatchery area	
Small (≤ 50 decimal)	20.00%
Medium (50-100 decimal)	26.66%
Large (≥ 100 decimal)	53.34%
Tanks	
Cistern	12-48
Circular tank	1-5
Hatching tank	10-32
Overhead tank	1-3
Pond	
Nursery pond	4-10
Brood pond	2-8
Worker	
Permanent	2-12
Seasonal	3-8/day

Induced breeding practice

Brood fishes for induced breeding are collected are collected form government brood bank, nearby hatcheries, or mature fishes from own hatcheries are also used as food fish. The age of the brood fish ranged from 3-5 years and same brood fish is used for 2-3 years. Mainly pituitary gland (PG) and ovaprime were found to use as inducing agent in the surveyed fish hatcheries. Hormone type, dose, ovulation time, and hatching time varies with the species of fish (Table 3). After hormone injection brood fishes are kept in the circular tank and within 6-8 hours of final dose they become ready spawn. After fertilization the fertilized eggs are then transferred to the hatching tank and they hatch out within 24-72 hours depending on the species. Commercial feeds are used for feeding brood fish and fish fry. Argent hormone (17a-methyltestosterone) is used as the sex reversal hormone for producing monosex tilapia at a rate of 1mg/2kg feed for 35 days. The total activities were performed with the involvement of skilled technicians in the hatchery. The induced breeding practice in the study area is more or less similar with the practice in other areas of Bangladesh described in previous studies (Bhuyan et al., 2011; Aktar et al., 2014; Hossain et al., 2016; Khatun et al., 2017; Debnath et al., 2020; Biswas et al., 2021)

Table 4. Hormonal dosed, ovulation time, and hatching time of different species of fish

Species	Sex	1st dose of Hormone mg/kg	Interval (hour)	Final dose of hormone (mg/kg)	Ovulation (hour)	Hatching time (hour)
Rui (*Labeo rohita*)	Female	1.5-2mg/kg (PG)	6	6mg/kg (PG)	6	24-72
	Male			2 mg/kg (PG)		
Catla (*Catla catla*)	Female	1-2 mg/kg (PG)	6	5-6 mg/kg (PG)	6	24-72
	Male			1-2 mg/kg (PG)		
Mrigal (*Cirrhinus cirrhosis*)	Female	1-1.5mg/kg (PG)	6	5-6mg/kg (PG)	6	24-72
	Male			1-1.5 mg/kg (PG)		
Bata (*Labeo bata*)	Female	1.5mg/kg (PG)	6	4mg/kg (PG)	6	24
	Male			2mg/kg (PG)		
Kalibaus (*Labeo calbasu*)	Female	1-1.5mg/kg (PG)	6-8	4-5mg/kg (PG)	6	72
	Male			1.5-2mg/kg (PG)		
Silver carp (*Hypophthalmichthys molitrix*)	Female	1.5-2 mg/kg (PG)	6	6 mg/kg (PG)	6	24-30
	Male			2 mg/kg (PG)		
Grass carp (*Ctenopharyngodon idella*)	Female	1.5-2mg/kg (PG)	6-8	4-6mg/kg (PG)	6	72
	Male			2mg/kg (PG)		
Bighead carp (*Hypophthalmichthys nobilis*)	Female	2 mg/kg (PG)	6	6mg/kg (PG)	6	72
	Male			2mg/kg (PG)		
Thai puti (*Barbonymus gonionotus*)	Female	4-5mg/kg (PG)	6	5-6mg/kg (PG)	6	72
	Male			2 mg/kg (PG)		
Pangus (*Pangasianodon hypophthalmus*)	Female	2mg/kg (Ovaprime)		4mg/kg (Ovaprime)	8	16
	Male	0.05mg/kg (PG)				
Koi (*Anabas testudineus*)	Female	3-4mg/kg (PG)			6	10
	Male	2 mg/kg (PG)				
Tengra (*Mystus tengara*)	Female	0.8ml/kg (Ovaprime)			6	10
	Male	0.002-0.003ml/kg (PG)				
Pabda (*Ompok pabda*)	Female	0.5 mg/kg (Ovaprime)			6-8	24
	Male	0.25-0.33 mg/kg (PG)				
Gulsha (*Mystus cavasius*)	Female	0.5 mg/kg (Ovaprime)			6-8	24
	Male	0.25-0.33 mg/ kg (PG)				
Shing (*Heteropneustes fossilis*)	Female	0.5-2 mg/kg (Ovaprime)			6-8	24
	Male	0.25-0.33 mg/kg (PG)				

Status of seed production

The production time, hatching rate, survival, production, and price of fry of different fish species in the study area are reported in table 5. Each species of fish has its own breeding time. Hatching operation runs from February to August of each year and October to January is considered as off-season in the study area. Ali et al. (2023) also reported March to June as the primary period for fish seed production and the lean season for hatchery activities is during January-February and July-August. Hatching rate, survival rate, and annual production varies with fish species (Table 5). The production rate of fish seeds depends on weather, water quality, brood fish selection, proper dose of hormonal injection, and expert hatchery operations (Bhuyan et al., 2011). The price of fish seed was also found to vary depending on the fish species. In the study area catfish fry were found to be the most expensive among all other fish fries. Islam et al. (2017b) also reported that the catfish fry are more expensive than the carp fry because of the complexity in their seed production and rearing system. Sharif and Asif (2015) reported that the price of different carp and catfish species ranged from 1500 to 2300 tk/kg in the Jessore district of Bangladesh.

Table 5. Fry production time, hatching rate, survival, annual production, and price of fish fry of different fish species in the study area

Species	Production time	Hatching rate (%)	Survival rate (%)	Annual production (kg)	Price (Tk/kg)
Rui	April- August	70-80	70-80	1000-1200	1000-2000
Catla	April- August	70-85	75-80	700-800	2000-5000
Mrigal	April- August	70-80	80-85	1000-1200	1200-3000
Bata	April- August	70-85	70-80	50-300	3000-4000
Kalibaus	April- August	70-75	70-80	1000-1200	1000-5000
Silver carp	April- August	70-85	70-80	700-800	1000-1500
Grass carp	April- August	70-85	75-80	1000-1200	1600-2300
Bighead carp	April- August	70-75	70-75	700-800	1000-1500
Thai puti	February-September	70-80	70-75	80-100	1500-2000
Koi	January-April	70-75	70-75	1500-1600	1000-1500
Tilapia	January-August	90-95	85-95	1000-1200	2000-4000
Pangus	April-September	80-90	85-90	1200-1500	2500-2800
Tengra	March-September	80-90	90-95	70-100	2500-3000
Pabda	February-July	70-80	50-95	100-500	3000-6000
Gulsha	April-August	60-90	90-95	70-100	6000-8000
Shing	March-August	70-80	70-90	200-550	3000-6000
Magur	February-September	40-60	80-90	50-100	8000-9000

Marketing channel of fish seed

Fish seed marketing typically involves a number of important parties and procedures (Fig. 2). Direct seed collection from the hatchery is done by the majority of fish producers. For farmers who live close to the hatchery, this is the simplest route. On the other hand, local wholesalers are frequently used in this region to provide fish farmers with hatchery seed. These intermediaries, also known as commission agents, are crucial in the process of gathering fish seeds from hatcheries and nursing pond owners and delivering them to fish farmers. Their networks of distribution are well-established. In some areas, especially larger markets and towns, wholesalers and retailers also assist with fish seed supply. Additionally, groups and cooperatives support the fish seed marketing industry. These cooperatives gather seed, distribute it to the farmers, and have direct communication with the local distributors or hatchery owners. Similar to the findings of this study, Islam et al. (2023) also reported that the intermediaries are the main stakeholder in the fish seed marketing channel in Bangladesh. Fish seeds are transported in polythene bags with oxygen supply for long distance and in aluminium pots or plastic drums for short distance using local transports (Sharif and Asif, 2015). The average mortality recorded in different stages of fish seed transportation was 5.67 to 17.67% and 4.67% to 15.67% in Sylhet and Mymensingh district, respectively (Hemal et al., 2017).

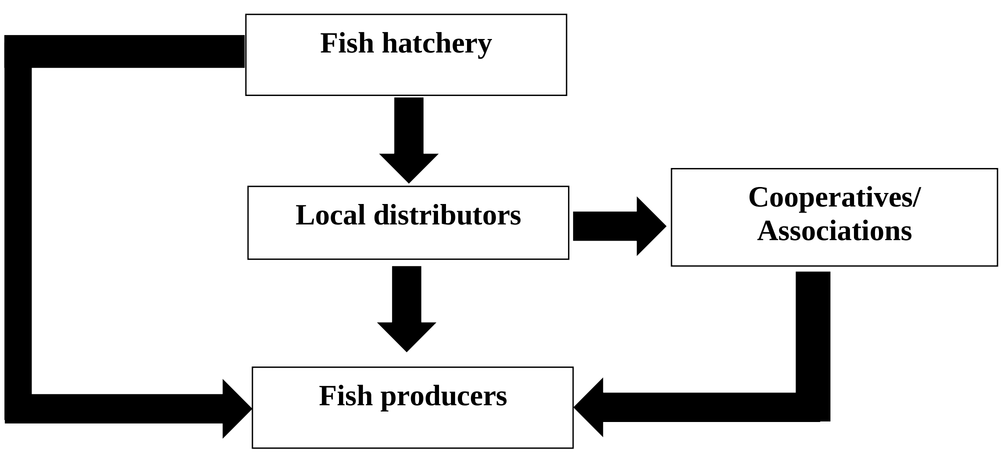

Fig. 2. Fish seed marketing channel

Disease occurrence in hatcheries

Disease outbreaks and disease-induced mortality are major constraints to the economic success and expansion of the fish seed industry. In the study area, hatchery owner reported the majority of diseases including argulosis, fin rot, epizootic ulcerative syndrome (EUS), Skin lesion, swollen abdomen, fungal infection in different seasons in the hatchery (Fig. 3). Fish fry and fingerlings become more susceptible to the pathogen due to their immature immune system (Faruk and Anka, 2017). Poor quality of water, high stocking density, and sudden fluctuation in temperature were identified as the leading causes of diseases (Shikuku et al., 2021). Common fish diseases in hatcheries and early rearing stages are caused by parasites, bacteria, viruses, and fungi (Alam and Rashid, 2014). Proper health management strategies, maintenance of good water quality, proper nutrition, and the establishment of biosecurity measures are very important to prevent or restrict the introduction and spread of disease within or between fish production facilities (Faruk and Anka, 2017).

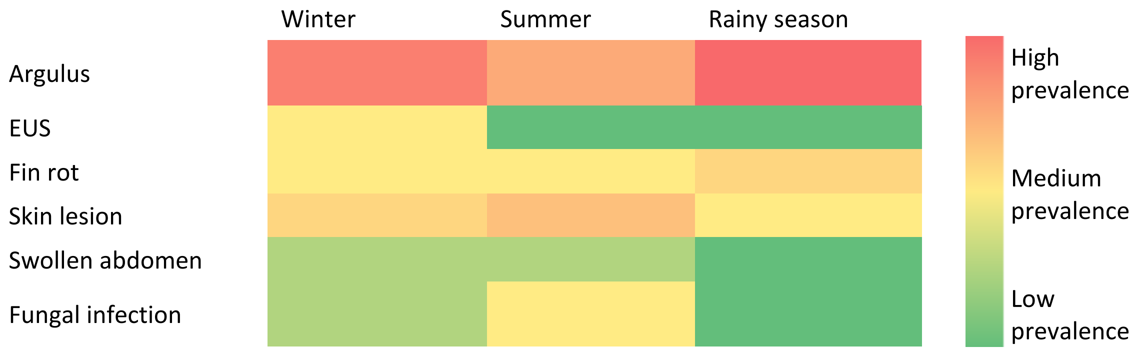

Fig 3. Heat map of prevalence of diseases in different season of the year

Chemicals and drugs

Various types of chemicals and drugs were found to use in the hatcheries of the study area as antibacterial agent, disinfectant, pesticide, fertilizer, and growth promoter (Table 6). Antibacterial agents are used for prevention and control of bacterial infection, disinfectants are used for health and water quality management, cleaning fish tank and hatchery equipment's, pesticides are used for killing predatory fishes, fertilizers are used for producing natural food in the fish pond, and multivitamins are used as growth promoters. Alam and Rashid (2014) reported that a number of companies are selling aqua medicines and chemicals in different trade names. Yasmin et al. (2022) reported that the hatchery operators do not follow the recommended dose of chemicals and drugs which may cause serious biodiversity loss of aquatic organisms. Moreover, it makes infections more difficult to treat by developing drug resistance pathogens which has serious human health concerns (Islam et al., 2023). Therefore, it also recommended regulating the use of chemical inputs in aquaculture which are hazardous to human health and the environment.

Problems in fish hatcheries

Present study sorted various types of problem related to hatchery management from the Mymensingh district and the major constraints faced by hatchery owners are presented in Table 7. In the study area, drainage problem, insufficient credit facility, theft, market competition, and price fluctuations were identified as critical problems. In another study, Uddin et al. (2024) reported that lack of capital and high cost of fish feeds were found important for the hatchery owners in Mymensingh district. Hemal et al. (2017) and Debnath et al. (2020) also reported insufficient credit facility as critical problem in hatcheries in Sylhet and Patuakhali district of Bangladesh. The problems associated with fish farming are more or less similar in all over Bangladesh (Pravakar et al., 2013; Asif and Habib, 2018; Das et al., 2018; Mely et al., 2024).

Table 6. Chemicals and drugs used in the fish hatcheries in the study area

Chemicals and drugs	Dose	Use
Antibacterial agent		
Amoxicillin	5g/kg feed	Antibacterial agents are used for prevention and control of bacterial infection
Erythromycin	5g/kg feed	
Bacto Nil	1-2ml/ton water	
Renamycin (vet)	1-15g/100kg feed	
Biomycin	5g/kg feed	
Disinfectant		
Bleaching powder	10-100 ppm	Disinfectants are used for health and water quality management, cleaning fish tank and hatchery equipment's
Potassium permanganate	2-5 ppm	
Methelene Blue	50g/decimal	
Copper sulphate	50g/decimal	
Lime	250g/decimal	
Salt	250g/decimal	
Pescicide		
Rotenone	20-30g/decimal	Piscicide are used for killing predatory fishes
Sumithion	2-3/decimal	
Fertilizer		
Cow dung	6-8kg/decimal	Fertilizers are used for producing natural food in the fish pond
Urea	100-150g/decimal	
TSP	50-75g/decimal	
Multivitamin		
Liquavit aqua	0.5-1ml/ton water	Multivitamins are used as growth promoters
Panvit aqua	0.5-1ml/ton water	
Energy plus	1-2g/l	
Revit C	1g/5kg feed	
Megavit aqua	1g/kg feed	

Table 7. Major constraints faced by hatchery owners in the study area

Constraints	Very critical	Critical	Moderately critical	Not critical	Score	Average	Remarks
Lack of skilled person	0	4	7	4	30	2.00	Not critical
Insufficient water in dry season	1	3	4	7	31	2.07	Not critical
Drainage problem	4	7	3	1	44	2.93	Critical
In sufficient credit facility	3	9	2	1	44	2.93	Critical
Theft	1	7	6	1	38	2.53	Critical
Ownership issues	1	3	5	6	29	1.93	Not critical
Flood	0	2	4	9	23	1.53	Not critical
Accessories	0	2	5	8	24	1.60	Not critical
Competition	7	3	4	1	46	3.07	Critical
Price fluctuation	4	7	4	0	45	3.00	Critical
High transportation cost	2	4	6	3	27	1.80	Not critical
Electricity supply	0	2	5	8	24	1.60	Not critical
Middleman	2	2	6	5	31	2.07	Not critical
Insufficient government support	2	2	6	5	31	2.07	Not critical

Conclusion

The findings indicate that Mymensingh district is an important area for fish seed production. However, a substantial portion of hatchery owners lack formal training which could impact the efficiency and sustainability of hatchery operations. Moreover, the study underscores the necessity for stricter regulations on chemical inputs to mitigate these risks. Additionally, addressing the identified challenges including drainage problem, insufficient credit facility, theft, market competition, and price fluctuations is crucial for enhancing the operational capacity of hatcheries. Implementing the recommended strategies such as establishment of better financial support systems, expanding access to training for hatchery operators, and addressing identified as critical problems in hatchery management will not only improve the sustainability and productivity of fish hatcheries but also contribute significantly to the overall growth of the aquaculture sector in Bangladesh.

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Conflict of interest

The authors declared that they have no conflict of interest

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