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Evaluation of *Anabas testudineus* Farming in Natural Ponds and Impact on Subsequent Crop

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***Abstract*:** The climbing perch (*Anabas testudineus*) is a species of amphibious freshwater fish in the family Anabantidae and is widely found across the globe. This fish can survive without water for a short period by resting under the mud during dry seasons. They do aerial respiration using paired suprabranchial labyrinthiform organs. This fish was used as a biocontrol agent against mosquitoes in confined water bodies, including rice fields, as they can feed on insects at the water surface. The performance of monoculture Anabas in natural ponds and impacts on the consecutive carp culture in the same pond are evaluated in the present study. The average production of Anabas recorded was 1.39 Kg per m^2 area of the pond with survival of 57.33%. The significant reduction survival percentage of carps was observed in the second crop. The reduction in carp stock was observed due to the predation by retained Anabas of the previous culture. They resist the toxicity of sea seed cake once hidden in the pond bottom. They might have survived inside the deep layer of clay with the help of respiratory support of the labyrinth and were established later. The study confirms the opportunistic carnivore feeding behavior without other feeds. The study concludes that Anabas is a good candidate fish for places where water availability is an issue. Proper fencing around the ponds needed to check its movement out and through the land. When a different candidate species is planned for the subsequent crop, complete harvest, even from the deeper portions of the pond bottom, must be ensured to prevent surviving Anabas from feeding on the fingerlings of the next crop.

Keywords:

Anabas testudineus (Bloch 1792), belonging to the Perciformes order and Anabantidae family, is widely found across the globe particularly in tropical and subtropical Asian continents (Khatun et al 2019). The peculiar walking/climbing ability makes it a different fish and is commonly called a Climbing perch. This fish is called 'Koi' in Bangladesh and India (Chakraborty et al 2012). It inhabits confined water bodies such as canals, lakes, ponds, swamps, and estuaries (Hossain et al 2015). Anabas possesses the ability to live in low saline water bodies also. The body of Anabas is slender with large scales and spines on the gill cover. This fish has the adaptive ability to survive in adverse climatic conditions such as low dissolved oxygen, high turbid water, extreme pH, high temperature, etc. They can also live without water for a short period by resting under the mud during dry seasons (Tay et 2006, Paliwal et al 2014) and have aerial respiration using paired suprabranchial labyrinthiform organs. It is a carnivorous air-breathing species using a labyrinth organ to take oxygen directly from the atmosphere. Anabas is an omnivore that primarily feeds on fish larvae and shrimps rather than algae (Mustakim et al 2020). This fish was used as a biocontrol agent against mosquitoes in confined water bodies, including rice fields (Bhattacharjee et al 2009) and can feed on insects at the water surface. The seed production of Anabas is standardized, and hatchery-produced seeds are being used for its farming. Anabas breeds at sizes 70-100 mm with the onset of monsoon. Paddy fields and seasonal ponds having low water columns are their breeding grounds. Anabas is farmed commercially in rice fields, ponds, and artificial tanks. Slow-growing local strain and fast-growing Koi strain are the two strains of Anabas popular in India. Local strain reaches only 80-100 g in 8 months, whereas Koi strain reaches 300-400 g in 8 months. Those farmers who take up polyculture are facing issues due to the predation of Anabas on tiny fish larvae and fries. This issue is more predominant in natural ponds than artificial ponds. Complete eradication of Anabas is difficult due to its hibernation ability. Anabas predation is a growing issue for those freshwater fish farmers who are farming in ponds where complete drying is impossible. This study's main objective is to evaluate monoculture Anabas's performance in natural ponds and its impacts on the consecutive Carp culture in the same pond.

MATERIAL AND METHODS

Monoculture of Anabas: Three freshwater ponds, each having dimensions 8m×5m and 0.9m depth, are located at Chenkara, Kothamangalam, Ernakulam district, Kerala, India (10.1170° N, 76.6597° E) for the experiment. The ponds

were located at mutual distances of 100-150 m. The ponds were dewatered, excess humus removed, and weed fish eradicated by applying Teaseed cake (Kulakkattolickal 1989) at the rate of 5g per m^2 and pond bottom sun-dried for two days. Subsequently, powdered dolomite was used at 100 g per m^2 as a liming material to correct acidity and enhance phosphorus and carbon contents towards higher phytoplankton production. The ponds were aged for a further three days, and the fresh water was pumped into the pond through a 200-micron mesh screen to prevent the entry of weed fishes. Ponds were fertilized using cow dung groundnut cake and urea at 125, at 7.5 and 1.25 g/m^2 and aged for five days. Koi strain *Anabas testudineus* fingerlings (4.50±0.67 cm & 1.75±1.75 g) 400 numbers sourced from a hatchery were stocked in the ponds.

Formulated floating pellet feed (0.80 mm size) fed three times a day at the rate of 10 percent of body weight and gradually reduced to 2 percent of body weight within six months. The pellet size gradually increased to 1.2 mm, 1.8 mm, and 2.5 mm, respectively, after 1, 2, and 4 months of a stocking to match mouth size. Water quality parameters were recorded regularly. After completion of the seventh month, the harvest was done by entirely dewatering, and fish weight, length, and survival percentage were recorded. One-way Analysis of variance was done using Microsoft excel 2019 toolkit to test the equality of values.

Polyculture of carps: All the ponds were further prepared by following the same standard protocol and refilled using screened water from the same source. Forty numbers of grass carps, Rohu, and Amur carp frys of 3 cm size were stocked in all the ponds. Feeding provided with 0.6mm size formulated feed containing 33 percent protein and 4 percent fat thrice a day for 45 days. Sampling was done at weekly intervals to check survival percentage.

RESULTS AND DISCUSSION

Monoculture of Anabas: The average production of Anabas recorded in the experiment was 1.39 Kg per m^2 area of the pond. This value is on par with the report of Kohinoor et al (2007). The survival percentage was only 57.33, whereas the culture ponds observed no daily mortality. The reduction in survival may be due to the movement of Anabas to other ponds rather than mortality issues. The fishes might have moved using the pelvic fins and spiny opercula, as reported by Liem (1987). The hinged sub-operculars of Anabas allow them for near-upright posture and provide fulcra for vaulting for movement on land. Anabas's eye in a deep bony orbit facilitates rapid water drainage from a corneal surface when the fish leaves the water, aiding vision in the air (Davenport 1990). Sokheng et al (1999) reported that they perform walking movements mainly during low light time due to its negative phototaxis, which may be why such activities are less noticed. The weight gain of 160.56 g and length of 214.4 mm were recorded after seven months of farming (Table 1). Periodical testing was done to monitor changes in water quality and the data is presented in Table 2.

Polyculture of carps: The survival percentage of carps after four weeks was as low as 22 percent (Table 3). Due to the sudden reduction in survival, the existing fish stock was harvested in the fourth week. While catching, Anabas also received a 30 number of considerable size (180 mm).

The reduction in carp stock was observed to be due to the predation by retained Anabas of the previous culture. Even though not stocked any Anabas in the carp culture ponds, Anabas may have been maintained from the earlier stocks by resisting the toxicity of tea seed cake by resting in the pond bottom. They might have survived inside the deep layer of clay with the help of respiratory support of the labyrinth and were established later. Anabas is an omnivore and prefer to feed on carp fingerlings in large quantities due to the

Table 1. Growth *Anabas testudineus* (Mean±SD)

Period (Days)	Length (mm)	Weight (g)
30	45±6.7	1.75±1.75
60	62±11.0	5.88±2.99
90	97.5±9.6	21.30±8.81
120	128.0±14.7	59.80±13.17
150	141.8±11.6	81.12±17.16
180	162.3±22.3	135.12±29.54
210	214.4±46.7	160.56±50.32

Table 2. Water quality parameters in the ponds

Parameters	Range	
	Minimum	Maximum
pH	6.3	8.4
Alkalinity (mg/l)	700	160
Hydroxide (mg/l)	0	0
Total hardness (mg/l)	30	110
Ammonia (mg/l)	0	0.56
Nitrite (mg/l)	BDL*	0.11
Sulfide (mg/l)	BDL	BDL

Table 3. Carp survival during different week

Time	Survival percentage
1st Week	89±3.6
2nd Week	74±1.0
3rd Week	48±5.5
4th Week	22±2.5

abundance of fingerlings in a confined water body. Mustakim et al (2020) reported that Anabas like to eat fish or non-vegetarian rather than vegetarian food, and their intestinal are adjusted for it. Its teeth system is also said to resemble that of predatory fishes. Food and feeding studies confirmed the opportunistic carnivore feeding behavior without other feeds.

CONCLUSION

Anabas is a good candidate fish for places where water availability is an issue. However, using HDPE nets ensure proper fencing to check its movement out of the ponds, even though the land. When a different candidate species is planned for the subsequent crop, complete harvest, even from the deeper portions of the pond bottom, must be ensured to prevent surviving Anabas from feeding on the fingerlings of the next crop.

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