J.Bio.Innov2(1(a)),pp:1-7,2013

ISSN 2277-8330 *(Electronic)*

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SURVIVALITY OF *ANABAS TESTUDINEUS* LARVAE IN DIFFERENT FEED, STOCKING DENSITY AND WATER DEPTH

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ABSTRACT

In the present study, five different food items viz., newly hatched *Artemia* nauplii, Zooplankton (ciliates, mastigophores, rotifers *etc),* egg custard, freeze dried *Daphnia* and freeze dried *Tubifex* worms were given to the larvae of *Anabas testudineus* three times per day. Feeding preference were observed minutely to find out a suitable food item for the larvae of *A. testudineus.* The finding of the study revealed that, the survivality of larvae was better when fed with *Artemia* nauplii and Zooplanktons. In the case of food item *Artemia* nauplii, the survival rate was 73.33% and the survival rate was 70% in zooplankton feeding. It was found significanct at ($P \leq 0.01$). The larvae were stocked in different stocking densities (2, 4, 8 and 16 larvae per liter of water). More than 60% survivality was found at a stocking density of 2 and 4 larvae /l, whereas poor survivality (ranging from 32 to 38%) was observed in the stocking density of 8 and 16 larvae/l of water. The results of statistical analysis revealed that, there were significant differences in between the average survivaiity in the four stocking densities ($P \leq 0.01$). Four water depths (10cm, 15cm, 20cm and 25cm) with a definite bottom surface were prepared to find out the larval survivality. The results of the study revealed that, with increased of water depth the rate of survivality of larvae decreases. From the statistical calculation it was found that, there were significant differences ($P \leq 0.01$ among the average survivality of the larvae reared in different water depths. But there were no significant differences ($P > 0.01$) between the average survivality of larvae reared in 10cm and 15cm of water depths

KEYWORDS: *Anabas testudineus,* food, depths, salinity and survivaiity

No: of Tables : 6 **No: of References: 11**

INTRODUCTION

Despite the moderate growth, *Anabas testudineus* (Bloch) is considered as an esteemed fish for the flavor, restorative value medicinal property of its flesh and prolonged freshness out of water. It therefore, merits efforts of extend and intensify production through culture practices. Larval rearing of culturable fishes has been standardized with the application natural and artificial fishes. Banerjee and Prasad (1974) reported that micro crustaceans and rotifers were the preferred item of food for the larvae of *A. testudineus* right from the start of the feeding behavior, which manifested within 24 hours of hatching. (Mukherjee and Das, 2001). However, very few attempts have been made for air breathing fishes (Haque *et al.*, 1973). Larval rearing of *A. testudineus* is a challenging task for that scientist because it needs the standardization of food, stocking density and depth in the jar.

According to CIFRI Annual Report (1983), the newly hatched young ones could be reared to be without much mortality till yolk absorption i.e. the 4 to 5th day in case of *Heteropneustes fossilis* and to rd day in case of *A. testudineus.* After yolk absorptions the larvae are more prone to mortality due to several factors including scarcity of right type of food. The young larvae at this stage feed actively on minute zooplankton such as ciliates and rotifer.

Under the natural conditions the growth of the fish was in part dependent on the population density (LeCren, 1965; Backiel and LCren, 1967). However, there might be no relation between food abundance and growth when a space limiting effect operated on the population (Johnson, 1965). Okamoto (1969) reported that stocking density played a major role in survival of cultured larvae. The subdued growth of fishes in compact population within a limited space was explained by Chen and Prowse (1946).

This investigation was carried out to study survivality of *Anabas testudineus* larvae in different feed, stocking density and water depth to know the feeding behaviour, stocking density and water volume of larvae to reduce the mortality of *A. testudineus.*

MATERIAL AND METHODS

For survival study of larvae of *Anabas testudineus* was studied in the laboratory of Department of fisheries Resources Management, Faculty of Fisheries Sciences West Bengal University of Animal and Fishery Sciences. Samples were collected randomly from the larval rearing tanks by a beaker of known volume containing water and larvae. The average number of the larvae survived per unit volume of water was calculated from time to time to find out the percentage of survival.

Survival studies under different condition

Survivality of larvae in different feeds: For this experiment five different food items of animal origin were selected. Five days old induced bred larvae of *A. tesdineus* was used as test animal for the above experiment. Larvae were stocked at a stocking density of 5 larvae/litre of water. The experiment was conducted in glass jars (20x20x30 cm^3) containing filtered pond water. The water depth in the jars was always maintained with 23 cm height. The larvae were fed three

ISSN 2277-8330 *(Electronic)*

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times a day with excess quantity of feed (viz., newly hatched *Artemia* nauplii, Zooplankton (ciliates, mastigophores, rotifers *etc),* egg custard, freeze dried *Daphnia* and freeze dried *Tubifex* worms) such that there was sufficient availability of food for the larvae. Sufficient aeration was provided to meet the oxygen demand of the larvae. The number of dead larvae in both the replicates was counted and removed immediately. The average number of larvae survived in the replicates was counted on 5th, 10th, 15th and 20th day for each food item.

Survivality of larvae in different stocking densities: For this experiment four different stocking densities viz. 2, 4, 8 and 16 nos. of larvae/l of water were stocked. Five days old larvae of *A. testudineus* obtained from induced breeding were selected for the experiment. The experiment was conducted in replicates in glass glass jars (20x20x30 cm^3). Water depth was always maintained at 13cm height throughout the experiment. Water was exchanged daily by 20% of pond water. Before use, the water was filtered through plankton net having 50 meshes per linear cm. The larvae were fed three times a day with equal intervals. Excess quantity of live food was provided such that the abundance of food was maintained sufficiently for the larvae. Optimum quantity of aeration was provided throughout the experiment to met the high oxygen demand of the larvae. The number of dead larvae in the experimental tanks were counted and removed immediately to avoid purification. The percentage of survivality on 5^{th}, 10^{th}, 15^{th}, 20^{th} and 25^{th} day was calculated.

Survivality of larvae in different water depths: For this experiment four different water depth viz. 10cm, 15cm, 20cm and 25cm were taken. Test animals were 5 days old larvae of *A. testudineus,* which were obtained from induced breeding. The experiment was conducted in glass aquarium (20x20x30 cm^3) in duplicates. The volume of water required for the respective depths (10, 15, 20 and 25cm.) are 4, 6, 8 and 10 litre respectively to maintain a fixed ground surface. Larvae were stocked at a stocking density of 4larvae/l. Water was exchanged daily with freshly collected with pond water before feeding. The larvae were fed with zooplanktons four times a day. Sufficient care was taken to maintain the availability of food and optimum level of oxygen. On 5^{th}, 10^{th}, 15^{th}, 20^{th} and 25^{th}, the survival rate of the larvae was calculated for each water depths.

RESULT AND DISCUSSIONS

Efficiency of different feeds in survival of spawn: The five different food items of animal origin viz., newly hatched *Artemia* nauplii, Zooplankton (ciliates, mastigophores, rotifers *etc),* egg custard, freeze dried *Daphnia* and freeze dried *Tubifex* worms were given to the larvae three times per day (Table 1). Out of the five food items, *Artemia* nauplii gave the best result with 73.33% survival after 20 days of experiment. Zooplankton gave the second best result with 70% survivality after 20 days of rearing. Freeze dried *Daphnia* gave the lowest survival rate of 40% in 20 days of experimental period. The one-way analysis of variance also showed that there were significant differences ($P \leq 0.01$) between different food items on larval survivality up to 20 days of rearing. But no significant difference was observed between *Artemia* nauplii and Zooplankton on larval survivality up to 20 days (Table 1& 2).

In the present study, five different food items were studied to find out a suitable food item for the larvae of *Anabas testudineus.* The finding of the study revealed that, the survivality of larvae was better when fed with *Artemia* nauplii and Zooplanktons. In the case of food item *Artemia* nauplii, the survival rate was 73.33% and the survival rate was 70% in zooplankton (Table 1). Here it was concluded that, *Artemia* nauplii is preferred much by the larvae than Zooplankton. On the other hand, egg custard, freeze dried *Daphnia* and freeze dried *Thbifex* worms were less preferred as it showed the survivality between 40% and 48.33%. This survival rate was found less because; the larvae were not able to engulf the supplied food items due to its larger size as compared to the mouth opening of the larvae. The present finding was similar with the findings of Pal *et at.*, (1977). From the statistical analysis, it was found that, there were significant differences ($P \leq 0.01$) in survival rate of larvae in different food items. But there were no significant differences in survivality of larvae between the *Artemia* nauplii and Zooplankton (Table 1). This is also supported by the findings of Pandey *et al.*, (2001). For this reason, Zooplankton is more preferable than *Artemia* nauplii, which is not at all economical for the farmers due to its higher cost.

Table 1: Survivality of *A. testudineus* larvae in different food items

Food items	**Replicates**	Volume of water (l)	Stocking Density (Larvae/l)	**Quantity of Feed supplied per day per 10 spawn**	**Survival rate (%)**				**Avg. Survival rate**
					On 5^{th} day	**On 10^{th} day**	**On 15^{th} day**	**On 20^{th} day**	78.3325^{a}
Artemia nauplii	2	6	5	20-50 nos	83.33	80	76.67	73.33	75.8325^{a}
zooplanktons	2	6	5	50-100 nos	81.67	78.33	73.33	70	60.4175^{b}
Egg custard	2	6	5	1mg	71.67	65	56.67	48.33	49.5825^{bc}
Freeze dried daphnia	2	6	5	1mg	63.33	51.67	43.33	40	55.8325^{b}
Freeze dried Tubifex worms	2	6	5	1mg	65.67	60	53.33	43.33	

Values with same super scripts (a, b and c) do not vary significantly (P> 0.01)

ISSN 2277-8330 *(Electronic)*

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Table 2: ANOVA for the main effects of different food items on the survival rate of *A. testudineus* larvae at different times of experimental periods.

Source of variation	Degree of freedom	Sum of squares	Mean sum of squares	F- ratio
Between food items	4	2530.476	632.6191	61.210*
Error	12	124.0222	10.3352	
Total	19	3595.674		

*Significant at 0.01% level (P≤0.01) CD:5.81954 SE:3.214838

Table 3: Survivality of *A. testudineus* larvae in with different stocking densities

Stocking Density (fish/l)	Replicates	Volume Of Water (l)	Space available To catch Spawn (l)	Survival in nos.					Survival rate (%)					
				On 5th day	On 10th day	On 15th day	On 20th day	On 25th day	On 5th day	On 10th Day	On 15th day	On 20th day	On 25th day	Avg. Of Survival rate
2	2	23.4	1	39	37	34.5	32	30	84.78	80.43	75	69.57	65.22	75[a]
4	2	23.4	0.5	75	70	66.5	61	56	81.53	67.09	72.28	66.30	60.86	71.412[a]
8	2	23.4	0.25	135	122	108	93	72.5	74.18	67.03	59.35	51.10	38.77	58.086[bc]
16	2	23.4	0.125	262	140	199	164.5	120	70.05	64.17	53.21	43.98	32.08	52.698[b]

Values with same super scripts(a, b and c) do not vary significantly(P>0.01)

ISSN 2277-8330 *(Electronic)*

www.jbino.com

Table 4: ANOVA for the main effects of stocking density on the survival rate of *A. testudineus* larvae at different times of experimental periods.

Source of variation	Degree of freedom	Sum of squares	Mean sum of squares	F- ratio
Between eater depth	3	992.4677	330.8226	21.7686*
Error	12	182.3665	15.19721	
Total	19	3320.232		

*significant at 0.01% level (P≤0.01) CD:6.311846 SE:3.89836

Table 5: Survivality of *A. testudineus* larvae in different water depths.

Water Depth (cm)	Replicates	Vol. of Water (l)	Stocking Density (larvae/l)	Survival in nos					Survival rate(%)					Avg. Survival rate
				On 5th Day	On 10th day	On 15th day	On 20th day	On 25th day	On 5th day	On 10th Day	On 15th day	On 20th day	On 25th day	
10	2	4	4	14	13	12.5	11.5	11	87.5	81.25	78.13	71.88	68.75	77.502[a]
15	2	6	4	21	19	18	16.5	15	87.5	79.17	75	68.75	62.50	74.584[a]
20	2	8	4	26.5	24	22	19	13.5	82.81	75	68.75	59.38	42.19	65.626[b]
25	2	10	4	31	28	24.5	20	15.5	77.5	70	61.25	50	38.75	59.50[bc]

Values with same super scripts (a, b, and c) do not vary significantly (P>0.01)

Table 6: ANOVA for the main effects of water depths on the survival rate of *A. testudineus* larvae at different times of experimental periods.

Source of variation	Degree of freedom	Sum of squares	Mean sum of squares	F-ratio
Between water depths	3	1657.238	552.4128	40.31*
Error	12	164.4354	13.70295	
Total	19	3767.84		

*Significant at 0.01% level (P≤0.01) CD: 5.9935 SE: 3.7017

Effects of stocking density on survival of larvae: For this experiment a stocking density of 2, 4, 8 and 16 larvae/l of water was stocked providing a living space of 0.51, 0.25, 0.13 and 0.063 litter of water to each larvae respectively (Table 3). The stocking density of 2 and 4 larvae/l of water gave a survivality of 65.22% and 60.86% respectively upto 25 days of rearing. But when the stocking density was 8 and 16 larvae/l of water, the survivality had gone down to 38.77% and 32.08% respectively after 25 days. The average ultimate space available to each larva was estimated to be 0.43 litre. One-way analysis of variance showed that stocking densities have significant effects (P≤0.01) on the survival rate of larvae after 25 days of rearing. It was also found that at a stocking density of 2 and 4 larvae/I of water do not have any significant affect on larval survivality upto 25 days (Table 3, 4).

In the present study, the larvae were stocked in different stocking densities (2, 4, 8 and 16 larvae/l). More than 60% survivality was found at a stocking density of 2 and 4 larvae/l. Whereas poor survivality ranging from 32 to 38% was observed in the stocking density of 8 and 16 larvae/l of water (Table 3). The results of statistical analysis revealed that, there were significant differences in between the average survivaiity in the four stocking densities ($P \leq 0.01$). It was also found that, there were no significant differences among average survivality of 2 and 4 larvae/i of water, as well as, the stocking densities of 8 and 16 larvae/l of water (Table 3). Therefore, it was concluded that, the larvae could be reared in a stocking density of 4 larvae/l of water. In this regard no information was available for *Anabas testudineus* larvae, except for *Clarias macrocephalus* larvae (Mollah, 1985).

Effects of water depths on survival of larvae: For this experiment four water depths viz., 10cm, 15cm, 20cm and 25cm were selected. The volume of water required for the respective depths were 4, 6, 8 and 10 litres. It was found that at a water depth of 10 cm, survivality was 68.75% within 25 days of rearing. But at 15 cm water depth survivality was achieved to 62.50% (Table 5). As water depth increased from 15cm to 20cm and then to 25cm the survivality had gone down. At water depth of 25cm survivality of 38.75% was recorded after 25days of rearing. One-way analysis of variance showed a significant difference between different water depths on larval survivality up to 25 days of rearing ($P \leq 0.0l$). But there was no significant difference between the water depth of 10cm and 15cm (Table 5 & 6).

In the present study, four water depths (10cm, 15cm, 20cm and 25cm) with a definite bottom surface were prepared to find out the larval survivality. The results of the study revealed that, with increased of water depth the rate of survivality of larvae decreases. From the statistical calculation it was found that, there were significant differences ($P \leq 0.01$) among the average survivality of the larvae reared in different water depths. But there were no significant differences ($P > 0.01$) between the average survivality of larvae reared in 10cm and 15cm of water depths. But still less survivality was found in the water depth of 20cm and 25cm (Table 5). From this study it was concluded that, it is better to rear the larvae in the water depth of 15 cm or less. This finding was coinciding with the results of Pal *et al.*, (1977), where he mentioned that the water depth of larval rearing tank of *A. testudineus* should be less than 15cm. Further, this was also supported by Mollah *et al.*, (1985). But the present finding was not in agreement with the finding of Mookherjee and Mazumdar (1946), where they mentioned the water depth of the larval rearing tank should be more than 10 inches (around 25cm).

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