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Phytoplankton overgrowth checked by tilapia inclusion in freshwater prawn (*Macrobrachium rosenbergii*) culture pond

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Abstract

The effect of tilapia inclusion on the plankton abundance, water quality parameters and growth performance of freshwater prawn (*Macrobrachium rosenbergii*) was evaluated in 120 days of grow-out in nine earthen ponds. Simultaneously, the performance of two tilapia strain (Chitralada and GIFT) was compared in prawn-tilapia polyculture system. There were three treatments: only freshwater prawn (T_1), prawn + Chitralada (T_2), and prawn + GIFT (T_3) with three replications of each. A total 47 genera of plankton was identified. The total phytoplankton abundance was significantly higher in T_1 (3.4×10^4 cells l^{-1}) than T_2 (2.7×10^4 cells l^{-1}) and T_3 (2.6×10^4 cells l^{-1}). Higher abundance of Chlorophyceae and Euglenophyceae in T_1 was attributed with lower water transparency and higher Chlorophyll-α content. Tilapia inclusion had no negative effect on prawn performance rather tilapia controlled phytoplankton overgrowth, supported better prawn survival and increased combined production. Chitralada gained higher individual weight than GIFT, but their net production did not vary significantly.

Keywords: Phytoplankton, zooplankton, Chitralada, gift, freshwater prawn

1. Introduction

The freshwater prawn farming in Bangladesh is mainly based on the culture of a single species, *Macrobrachium rosenbergii*, which plays an important role in the economy due to vast export potentiality [1, 2]. Freshwater prawn and marine shrimp export contribute about 54.32% of the export earnings from fisheries sector, which is the second largest export industry in Bangladesh contributed 2.46% of to the total export earnings in 2011-2012 fiscal year [2, 3]. Despite the enormous potential of the freshwater prawn fisheries in Bangladesh, it faces numerous tribulations especially with poor production technology that hinders sustainability [1]. Traditionally, prawn culture was attributed with extensive culture in rice field that shifted towards polyculture in pond, which is the subjected to continuous adaptation by the farmers [1, 2]. Polyculture is the art of growing two or more compatible aquatic species of different feeding habits, who occupy different habitats for spatial distribution in a single waterbody [4]. Thus, polyculture, facilitates proper utilization of natural food available in water column without a substantial increase of additional feed [4]. Moreover, feed provided targeting a particular species cannot utilize all the feed particles that lead nutrient enrichment and can support excessive phytoplankton growth [5, 6]. Therefore, species of different food habit can utilize the natural foods like microscopic plankton, benthos and other organisms that develop in different strata of the water body [5]. As a result, polyculture setting can improve water quality through utilizing biotic communities and thereby supporting for increased production in the culture pond [7].

M. rosenbergii is a benthopelagic omnivore considerd as an excellent candidate species for polyculture [8]. Similarly, Nile tilapia (*O. niloticus*) is omnivorous but feed predominantly on phytoplankton and can utilize blue-green algae [9]. Tilapia is considered as the most popular species cultured around the globe and suitable for fish farming for their general hardiness, rapid growth rate, and good taste [10, 11]. With a purpose of increasing production, the GIFT (Genetically Improved Farmed Tilapia) strain was developed through selection program from a base population of Nile tilapia, *Oreochromis niloticus* [12] and was imported in Bangladesh in the year 2005 [13]. The Thai-Chitralada strain had been introduced to the Royal Chitralada Palace in Thailand in 1965 that actually originated from Egypt via Japan [14] and this strain performed parallel to other improved strain in grow-out [15, 16]. Both the strain was adopted in some hatcheries of Bangladesh to produce seeds artificially performance was not analyzed in Bangladesh context.

One of the most important aspects of polyculture is to increase the productivity of a water body through an efficient utilization of naturally produced food particles [17]. Therefore, prawn polyculture with tilapia has potentially higher production and income than prawn monoculture [7] and tilapia may prevent the rapidly grown algal bloom and support for improved ecological balance of culture environment [6]. Tilapia introduction in prawn culture system had both positive [18, 19] and negative [20, 21] impact on prawn survival and growth, but it is ambiguous considering the performance of prawn and the culture environment. So, we evaluated effect of tilapia inclusion on the water quality, plankton communities and production performance of freshwater prawn. The growth performance of two tilapia strains was also compared to find better one.

2. Materials and methods

2.1 Experimental design and site:

The study having 3 treatments with 3 replications of each was conducted in 9 earthen ponds (80 m^2 each) at the Fisheries Field Laboratory complex of the Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh for a period of 120 days from mid-April to mid-August 2009. Only prawn, prawn with GIFT and prawn with Chitralada were stocked as treatment T_1, T_2 and T_3, respectively. Stocking density of prawn was 30,000 h^{-1} in three treatments and for tilapia was 10,000 h^{-1} in T_2 and T_3.

2.2 Pond preparation, stocking and management

Undesirable fishes were eradicated by pond drying, aquatic weeds were removed manually. Lime ($CaCO_3$) was applied at a rate of 250 kg ha^{-1} and fertilized 3 days after liming with urea and triple super phosphate (TSP) each at a rate of 25 kg ha^{-1} after three days of liming. The juvenile of *M. rosenbergii* (0.715 g) were collected from Bangladesh Fisheries Research Institute, Mymensingh. Fry of Chitralada (0.90 g) were collected from a local hatchery at Kashinathpur, Pabna district and GIFT fry (0.89 g) were collected from local hatchery Agro-3 at Mymensingh district. In order to ensure the same age of tilapia, fry of the same hatching date was collected. Floating feed for tilapia was provided 5 minutes before giving the sinking feed for prawn. Both were fed with pelleted feed containing 28% crude protein and the feeds were provided two times half in the morning and rest half in the evening. The ration was adjusted from 10-5% after every month sampling.

2.3 Water quality monitoring and plankton study

The water transparency was measured by a Secchi disc (20 cm diameter). Water temperature and dissolved oxygen was recorded by digital dissolved oxygen (DO) meter (YSI MODEL 58), pH by a digital pH meter (HACH) at the pond site. A volume of 250 ml water from each pond was collected, and 100 ml of water was filtered through a glass microfibre filter paper (Whatman GF/C) by electric air pump for nitrate, phosphate determination. Total alkalinity (mg l^{-1}) was determined following titrimetric method [22]. After acetone extraction of the filter paper, Chlorophyll-α was determined by using extract through a spectrophotometer (Milton Roy Spectronic, Model 1001 plus, Rochester, NY, USA) following standard method [23]. A direct reading spectrophotometer (model DR 2010, HACH, Loveland, CO, USA) was used to analyze nutrients.

A plankton net of 45 µm meshed size was used to filter ten litres of water collected from different locations of each treatment pond for plankton samples and plankton abundance was estimated by the procedure followed by Rahman *et al.* [24]. Filtered sample was made to a standard volume of 50 ml with distilled water then preserved in buffered formalin (10%), followed by counting using a Sedge wick Rafter (S-R cell) under a binocular microscope (Olympus, M-4000D). The quantitative abundance of plankton was estimated using the following equation [23]: $N = (A \times 1000 \times C) \div (V \times F \times L)$; where, N= number of plankton cells, A=total number of plankton counted, C= volume of final concentrate of the sample in ml, V= Area of field (mm^2), F= Number of fields counted, L= Volume of original water in liter.

2.4 Sampling and harvesting

The weight and length of tilapia and freshwater prawn were sampled monthly using seine and digital electronic balance (OHAUS, MODEL No. CT-1200-S). At 120th day of stocking, water all prawns and tilapias were harvested, and weighed. The weight gain was calculated from the difference between average initial weight and average final weight. The net production of prawn and tilapia was calculated by deducting stocked biomass from harvested biomass. Specific growth rate (SGR) and survival were estimated following equation:

SGR = [Ln (final weight) - Ln (stocked weight)] × 100/culture period (days)

Survival (%) = (Number of individual harvested÷Number of individual stocked) × 100

2.5 Statistical analysis

For the statistical analysis, the means was compared through ANOVA followed by Duncan's test using the SPSS (Statistical Package for Social Science, version-16.0). Independent samples 2-tailed *t*-test was used to analyze growth performance of tilapia. The level of significance was assigned at 0.05% ($P<0.05$).

3. Results

3.1 Water quality parameters

The mean values of water quality parameters in three treatments are presented in Table 1. The water quality parameters namely water temperature, dissolved oxygen (DO), pH, alkalinity, phosphate phosphorus (PO_4-P) did not differ significantly ($P>0.05$) among the treatments (Table 1). Conversely, the water transparency was significantly lower in T_1 with significantly higher Chlorophyll-α and nitrate nitrogen (NO_3-N) concentration. The mean values of water transparency in treatments T_1, T_2 and T_3 were 29.87±1.81, 35.67±0.81 and 35.93±0.97 cm, respectively (Table 1). The water transparency decreased with progression of time in T_1, but was relatively similar in other treatments (Figure 1). The level of Chlorophyll-α varied considerably throughout the experimental period and showed reversal to water transparency, ranged from 0.011 to 0.107, 0.022 to 0.078 and 0.010 to 0.073 µg l^{-1} in T_1, T_2 and T_3, respectively. The concentration of Chlorophyll-α increased progressively towards final sampling (Fig. 2) and was significantly higher in treatment T_1, than in T_2 and T_3 (Table 1). The mean values of NO_3-N in ponds under treatments 1, 2 and 3 were 0.027±0.004, 0.018±0.002 and 0.020±0.002 mg l^{-1} respectively and was significantly higher in T_1.

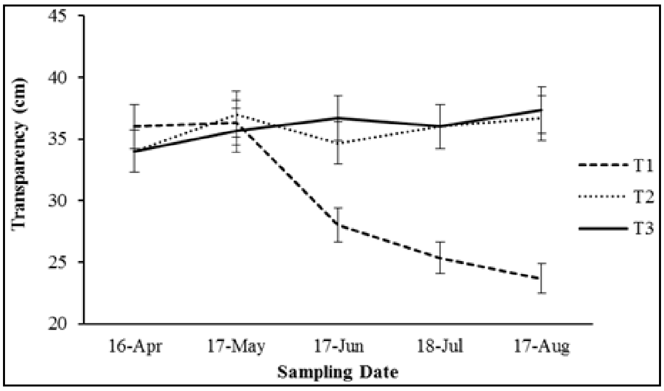

Fig 1: Monthly variation in transparency among different treatments

The mean values of water temperature were 30.66±0.158, 30.68±0.175 and 30.69± 0.186 °C in treatment T_1, T_2 and T_3, respectively (Table 1). The dissolved oxygen (DO) concentrations, pH values, alkalinity and PO_4-P concentration were found to fluctuate from 4.45 to 5.65 mg l^{-1}, 6.7 to 7.9, and 64.93 to 32 mg $l^{-1}$and 0.22 to 2.045 mg l^{-1}, respectively in all the treatments.

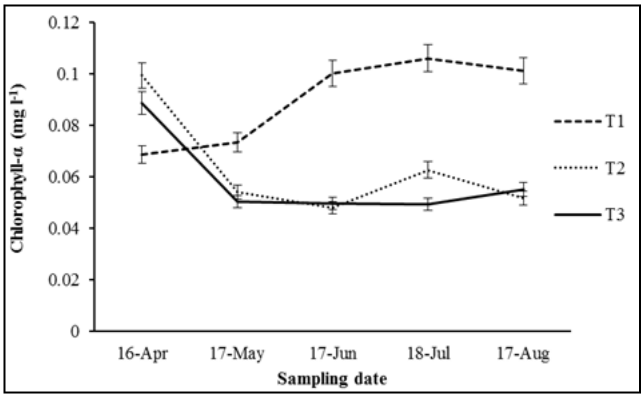

Fig 2: Monthly variation of Chlorophyll-α concentration among different treatments

Table 1: Water quality parameters (Mean ± SE) in three treatments. Superscripts mean significantly different (*P*<0.05).

Parameters	Treatments			*F-Value*	Significance
	T_1	T_2	T_3		
Temperature (^{0}C)	30.66±0.158	30.68±0.175	30.69±0.186	0.006	NS
Transparency (cm)	29.87±1.81^b	35.67±0.81^a	35.93±0.97^a	7.202	*
Dissolved Oxygen (mg l^{-1})	4.76± 0.08	4.83 ±0.09	4.82±0.08	0.202	NS
pH	7.620±0.139	7.420 ± 0.11	7.553± 0.126	0.653	NS
Alkalinity (mg l^{-1})	50.00±3.53	57.60±3.42	56.53 ±3.78	1.118	NS
NO_3 (mg l^{-1})	0.0273 ±0.0035 ^{a}	0.018±0.002 ^{ab}	0.020 ±0.002 ^{b}	2.964	*
PO_4 (mg l^{-1})	0.9707±0.284	1.179±0.401	1.191±0.398	0.115	NS
Chlorophyll-*α* (µg l^{-1})	0.0898±0.008^a	0.063±0.007^b	0.058±0.007^b	5.492	*

3.2 Abundance of plankton and benthos

Mean abundance of plankton in different treatments are shown in Table 2. Plankton populations in the experimental ponds were found to be of 47 genera belonging to 6 planktonic groups (Table 2 & 4). All phytoplankton mainly composed of 4 major groups: Bacillariophyceae, Chlorophyceae, Cyanophyceae, and Euglenophyceae and the zooplankton composed of 2 groups: Rotifera and Crustacea. Considering genera, Phytoplankton composed of 36 genera belonging to Bacillariophyceae (10), Chlorophyceae (15), Cyanophyceae (7) and Euglenophyceae (4) and zooplankton composed of 11 genera belonging to Rotifera (6) and Crustacea (5). The total phytoplankton abundance was significantly higher in T_1 and the measure was 34633±2409 cells l^{-1} in T_1, 27833±1767 cells l^{-1} in T_2 and 26367±2137 cells l^{-1} in T_3. Chlorophyceae was dominant among the phytoplankton group and Euglenophyceae was the least dominant group (Table 3), and both the group was significantly higher abundant in T_1 (Table 2). The abundance of Chlorophyceae decreased throughout the culture period in T_2 and T_3, but increased in T_1 (Fig. 3). The mean abundance of Bacillariophyceae and Cyanophyceae did not differ significantly among the treatments (Table 2). Total zooplankton varied 4633±418, 4167±438 and 4067±642 individual l^{-1} in the treatments T_1, T_2 and T_3, respectively and the abundance of Rotifera and Crustacea did not vary significantly among treatments.

Table 2: Plankton abundance (cells l^{-1}) in three treatments (N=15). Superscripts mean significantly different (*P<0.05*).

Plankton group	Treatments			*F*-value	Significance
	T_1	T_2	T_3		
Bacillariophyceae	7.4×10^3	7.8×10^3	7.5×10^3	0.029	0.971
Chlorophyceae	$1.3\times10^{4\ a}$	$9.5\times10^{3\ b}$	$8.6\times10^{3\ b}$	4.526	0.017
Cyanophyceae	9.8×10^3	8.1×10^3	7.8×10^3	1.290	0.286
Euglenophyceae	$3.7\times10^{3\ a}$	$2.3\times10^{3\ b}$	$2.3\times10^{3\ b}$	7.066	0.002
Total phytoplankton	$3.4\times10^{4\ a}$	$2.7\times10^{4\ b}$	$2.6\times10^{4\ b}$	4.325	0.020
Rotifera	2.1×10^3	1.4×10^3	2.0×10^3	1.357	0.268
Crustacea	2.5×10^3	2.7×10^3	2.0×10^3	0.985	0.382
Total zooplankton	4.6×10^3	4.1×10^3	4.0×10^3	0.352	0.705
Total Plankton	$3.9\times10^{4\ a}$	$3.2\times10^{4\ b}$	$3.0\times10^{4\ b}$	4.112	0.023

The monthly variation in plankton abundance reflects plankton was more abundant in the month of July that presumably for higher day length (Table 3). The cell concentration of Chlorophyceae in T1 increased from April to June then slightly decreased until August; but the concentration was always higher than the treatment T_2 and T_3 (Fig. 3).

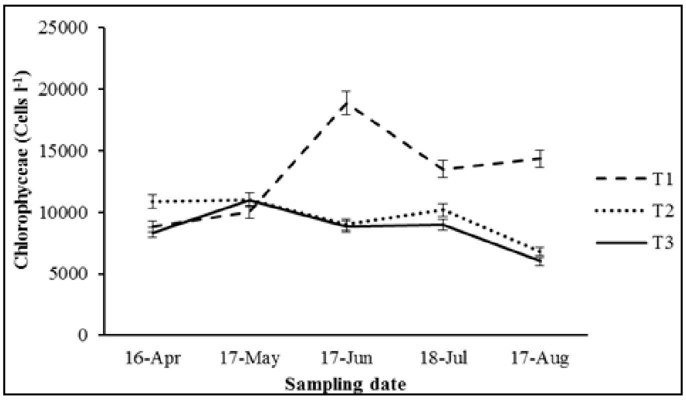

Fig 3: Monthly variation in Chlorophyceae abundance among different treatments

Table 3: Monthly average plankton count (cells l^{-1}) in three treatments.

Treatment	Sampling date	Phytoplankton					Zooplankton			Total plankton
		Bacillariophyceae	Chlorophyceae	Euglenophyceae	Cyanophyceae	Total Phyto	Rotifera	Crustacea	Total zoo	
T_1	16 April	7833	8833	4000	9833	33167	2500	1167	3667	36833
	17 May	4500	10000	3000	6333	35667	2000	1833	3833	39500
	17 June	5167	18833	3000	3500	21667	2333	2000	4333	26000
	18 July	15667	13500	3167	14500	46667	1667	3667	5333	52000
	17 Aug	4167	14333	5500	5167	23667	2167	3833	6000	29667
	Sum	37333	65500	18667	39333	160833	10667	12500	23167	184000
	Average	7467	13100	3733	7867	32167	2133	2500	4633	36800
T_2	16 April	9833	10833	2500	4333	27500	1167	1167	2333	29833
	17 May	6333	11000	2000	9500	28833	1667	2333	4000	32833
	17 June	3500	9000	2333	4500	19333	1333	3500	4833	24167
	18 July	14500	10167	1667	15667	42000	833	3500	4333	46333
	17 Aug	5167	6833	3000	2667	17667	2000	3333	5333	23000
	Sum	39333	47833	11500	36667	135333	7000	13833	20833	156167
	Average	7867	9567	2300	7333	27067	1400	2767	4167	31233
T_3	16 April	4333	8333	3167	6000	21833	1000	1667	2667	24500
	17 May	9500	11000	2167	4333	27000	1333	1167	2500	29500
	17 June	4500	8833	1833	10667	25833	833	1500	2333	28167
	18 July	15667	9000	1500	10667	36833	4833	2833	7667	44500
	17 Aug	3667	6000	3000	3667	16333	2000	3167	5167	21500
	Sum	37667	43167	11667	35333	127833	10000	10333	20333	148167
	Average	7533	8633	2333	7067	25567	2000	2067	4067	29633

Table 4: Groups of plankton with genera recorded in prawn-tilapia culture pond.

Phytoplankton			Zooplankton
Bacillariophyceae	**Chlorophyceae**	**Cyanophyceae**	**Rotifera**
Fragillaria	*Actinastrum*	*Anabaena*	*Brachionus*
Cyclotella	*Ankistrodesmus*	*Gleocapsa*	*Filinia*
Diatoma	*Botryococcus*	*Spirulina*	*Keratella*
Melosira	*Chlorella*	*Merismopedia*	*Lecane*
Navicula	*Coelastrum*	*Gomphosphaeria*	*Asplanchna*
Nitzchia	*Closterium*	*Microcystis*	*Polyarthra*
Surirella	*Oocystis*	*Oscillatoria*	**Crustacea**
Synedra	*Pediastrum*	**Euglenophyceae**	*Cyclops*
Tabellaria	*Scenedesmus*	*Euglena*	*Diaptomus*
Rhizosolea	*Tetraedron*	*Phacus*	*Diphanosoma*
	Ulothrix	*Trachelomonas*	*Moina*
	Volvox	*Gymnodinium*	Nauplius
	Zygnema		
	Palmella		
	Microspora		

The major benthic groups were Chironomidae, Oligochaeta, and Mollusk and their abundance did not differ significantly (Table 5). Few other benthos were observed and they were included in miscellaneous group

Table 5: Mean abundance of benthos (nos. m^{-2}) with their different groups among different treatments.

Benthic group	Treatment			*F*-value	Significance
	T_1	T_2	T_3		
Chironomidae	366 ± 66	401 ± 66	284 ± 66	0.839	0.439
Oligochaeta	509 ± 108	381 ± 117	359 ± 57	0.687	0.508
Mollusk	108 ± 26	235 ± 72	279 ± 86	1.782	0.181
Miscellaneous	33 ± 3	35 ± 4	27 ± 2	1.758	0.185
Total Benthos	1016 ± 123	1051 ± 143	948 ± 101	0.180	0.836

3.3 Performance of prawn and tilapia

The growth rate and yield of prawn and fish in different treatments are shown in Table 6. The survival, individual weight gain and net production of prawn did not vary significantly among the treatments thus indicate tilapia inclusion have no negative impact on prawn production. Survival of prawn was recorded 60%, 65% and 67.64% and the mean individual weight of prawn was 14.36±0.009, 13.23± 0.004 and 13.26±0.003 gm in treatments T_1, T_2 and T_3, respectively (Table 6). The net production of prawn was achieved 251.06±23.74 kg ha^{-1}120 days^{-1} in T_1, 250.04 ± 8.83 kg ha^{-1}120 days^{-1} in T_2, and 263.13± 28.64 kg ha^{-1}120 days^{-1} in T_3.

GIFT had the significantly higher survival (92.50%) than that of Chitralada (65.83%) but Average individual final weight of Chitralada (254.22 g) was significantly higher than that of GIFT (201.52 g). The specific growth rate (SGR) of GIFT tilapia was significantly lower (P<0.05) (4.52% of bw day^{-1}) than that of Chitralada (4.70% of bw day^{-1}). The higher net production of tilapia was found in GIFT (1864.17 kg ha^{-1}120 day^{-1}) than Chitralada (1678.25 kg ha^{-1}120 day^{-1}); but the yields were not significantly different between the treatments. The net combine production of prawn and tilapia among the treatments were 251.06 kg ha^{-1} in T_1, 1919.33 kg ha^{-1} T_2, and 2118.38 kg ha^{-1} in T_3 (Table 6). So, prawn monoculture yielded significantly lower production than polyculture with tilapia.

Table 6: Production performance (Mean±SE) comparison among three treatments. Means with the different superscripts in same row are significantly different (P<0.05).

Species	Parameters	Treatment		
		Prawn (T_1)	**Prawn + *Chitralada* (T_2)**	**Prawn + GIFT (T_3)**
Prawn	Mean initial stocking weight (g)	0.727	0.725	0.715
	Survival (%)	60	65	67.64
	Mean final body weight (g)	14.36±0.03	13.23±0.68	13.26±0.56
	SGR (% body weight day^{-1})	2.48	2.41	2.38
	Net production (kg ha^{-1})	251.06±23.74	250.04±8.83	263.13±28.64
Tilapia	Mean initial stocking weight (g)		0.90	0.89
	Survival (%)		65.83^b	92.50^a
	Mean final body weight (g)		254.22^a ±17.28	201.52^b±4.74
	SGR (% body weight day^{-1})		4.7031^a	4.5161^b
	Net production (kg ha^{-1})		1669.29±147.48	1855.24±67.97
Combine	Net production (kg ha^{-1})	251.06± 23.74	1919.33±153.48	2118.38±54.12

4. Discussion

The water quality parameters were found within the suitable range of prawn monoculture and polyculture. Fair and Foftner [25] reported the suitable range of water temperature for *M. rosenbergii* is (21.9 ºC to 33.5 ºC) and New [26] stated the range is between 26 and 32 ºC. So, the pond water temperature in this experiment was favorable for prawn and tilapia culture. Kunda *et al.* [27] reported dissolved oxygen level should range from 5.98 to 6.53 mg l^{-1} in freshwater prawn polyculture and in this experiment it ranged from 4.68 to 4.90 mg l^{-1}. The circum-neutral pH or slightly alkaline pH was observed throughout the study period, and was within the suitable range (6.8 to 8.4) for fish culture [28]. According to Boyd [23] total alkalinity should be more than 20 ppm in fertilized ponds and total alkalinity was recorded 32 to 64.93 mg l^{-1} in the study ponds seems productive. Nitrate can accumulate in production systems without affecting fish growth [29] and tilapias can tolerant nitrate concentration of up to 0.45 mg l^{-1} [30]. Significantly higher nitrate level in T_1 was attributed with high densities of Euglenophyceae and Chlorophyceae [5].

Chlorophyll-α value is an indicator of pond productivity that showed an inverse relationship with water transparency [31] In the treatment T_1, Chlorophyll-α concentration increased with progression of time and conversely water transparency decreased (Fig. 1 and Fig. 2). Chlorophyll-α was significantly more abundant in the T_1 that presumably due to the higher abundance of phytoplankton, and the higher abundance of phytoplankton produced dense algal surface film might be attributed with higher abundance of Chlorophyceae and Euglenophyceae (Table 2). Therefore, significantly higher abundance of phytoplankton cells in T_1 than T_2 and T_3 reflects the algal blooms formed in the water surface in prawn monoculture ponds where tilapia was absent. Thus, prawn as a single species could not utilize all the feeds and thereby unutilized nutrient from feed supported phytoplankton growth. Therefore, phytoplankton cells were significantly more abundant in prawn monoculture pond than in polyculture (Table 2). It reflects tilapia filter fed the algae from the water column by means of active feeding [32] thereby decreased Chlorophyll-α concentration. Nile tilapia can ingests phytoplankton and can assimilate 70-80% of blue green algae [33]. The significantly higher water transparency in the tilapia included treatments suggests tilapia inclusion controlled phytoplankton overgrowth [6].

The abundance of phytoplankton and zooplankton was relatively similar with the findings of Kamal *et al.* [34], who identified 40 genera of phytoplankton and 11 genera of zooplankton, and also estimated phytoplankton range from 5.6×10^4 to 8.3×10^5 cells l^{-1}. Nirod *et al.* [35] recorded zooplankton concentration from 4.58×10^3 to 6.45×10^3 cells l^{-1} which is nearly similar with the findings of the present study.

The survival of prawn and two tilapia strains in our experiment was found similar with the findings of Cebreros *et al.* [36] who observed for tilapia the survival ranged from 94% to 75%, and for prawn 43% to 86% (Table 4). Detrimental effect of GIFT on prawn's survival was reported by Uddin *et al.* [20], but we found relatively higher survival of prawn in polyculture with GIFT and Chitralada than in monoculture (Table 4). Moreover, polyculture of freshwater prawn with Nile tilapia was found successful in terms of yield and income [7, 20, 37] and cannibalism was only among prawns, which was not influenced by the inclusion of tilapia [38]. Similarly, the weight gain of prawn did not differ significantly among treatments [7]. Therefore, polyculture did not impact negatively on prawn survival, growth performance [19]. Moreover, significantly higher net combined production in prawn-tilapia polyculture than prawn monoculture proved that tilapia inclusion increased the total yield of fish and prawns without decreasing prawn production [7, 21]. It might be due to in a polyculture setting, tilapia and prawn can utilize different niches in the culture setting. Tilapia can filter feed on phytoplankton and zooplankton in the upper water column but prawn spend most of the time in the pond bottom grazing on the bottom substrate. The production performance of GIFT and Chitralada did not differ significantly [14], but the individual weight gain and SGR was significantly higher in case of Chitralada [15, 16]. As, Chitralada was transported from a longer distance to the experimental pond, so we assume transport stress might have lowered their survival and net production. Therefore, tilapia inclusion had not negative effect on prawn culture and Chitralada may be more beneficial for the farmers in terms of final individual weight gain, but it requires intensive field trial comparison.

5. Conclusion

The addition of tilapia in freshwater prawn culture pond facilitated the culture practices through reducing exaggerating phytoplankton thus enhanced the utilization of natural foods like plankton, microbial organisms, and thereby improved water quality, increased the prawn survival and overall production.

6. References

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