E-ISSN: 2347-5129
P-ISSN: 2394-0506
(ICV-Poland) Impact Value: 5.62
(GIF) Impact Factor: 0.549
IJFAS 2017; 5(5): 01-06

www.fisheriesjournal.com
Received: 01-07-2017
Accepted: 02-08-2017

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Domestication of *Macrobrachium rosenbergii* in Terai region of West Bengal

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Abstract
Present investigation explored the possibility of *Macrobrachium rosenbergii* farming in Terai zone to open up a new venture in aquaculture production for the socio-economic upliftment of the farming community. From the agro-climatic standpoint though Terai zone bears unfavourable soil and water characteristics for fish farming with high seepage, acidic pH and prolonged winter, but a favourable texture of sandy to sandy loam soil in seasonal ponds may explore the potential for the domestication of *Macrobrachium rosenbergii* and its expansion in Terai region. Experiments conducted on standardization of package of practice for farming post larva (PL) and juvenile in different culture system revealed that 15 PL (0.04g wt) rearing for 45 days in indoor condition is essential to make them grow into juveniles (>1.0g wt) those are suitable for further release into the stocking ponds, otherwise direct release of 15 PL into the nursery or rearing pond lead upto 90% mortality. All the culture system require seed to be stocked with profuse supply of feeding, artificial aeration and hiding shelter for optimum growth and production. Mixed farming of prawn juvenile with Indian major and medium carps surprisingly elicited better growth of juveniles in the rearing pond. Experiment on feed treatment indicated maximum growth and specific growth rate (SGR) in lab made pellet feed T5 prepared with Spirulina, a commonly used neutraceuticals to keep animal health better. T5 elicited 16% and 67% higher increase in growth and SGR respectively over T1 (commercially available S1 level feed). It is therefore concluded that freshwater prawn farming has a tremendous scope in terai zone; only the recommended package of practice along with profuse feeding to PL and juveniles needs to be followed to reach an average individual weight gain of prawn by at least 50-60 g in four month period (seasonal pond) that can fetch a good market value of >Rs.800/- per kg.

Keywords: *Macrobrachium rosenbergii*, terai zone, domestication, post larva, juvenile, mixed farming, mono culture

Introduction
Giant freshwater prawn *Macrobrachium rosenbergii* is a commercially viable aquaculture species for tropical and subtropical climates. It is hardy by virtue of its omnivorous habit and ability to adapt to various types of fresh and brackish water conditions [1]. It fetches good market demand and export potential and the species enjoys immense scope for its expanded farming, either through monoculture or mixed culture with compatible freshwater fish, in the vast impounded freshwater bodies available in various states of India [2]. The aquaculture has shown a phenomenal increase in aquaculture production of *Macrobrachium rosenbergii* from <500 MT to >30,000 MT during the last decade and West Bengal state is one of the leading states contributing to the production yielding more than 3000 MT of giant freshwater prawn [1]. This has shown huge potential for further expansion of prawn culture in the vast aquaculture water resources available in West Bengal.

Terai region as well as the whole North Bengal in spite of being an integral part of West Bengal has no record of either seed production or culture of giant freshwater prawn *Macrobrachium rosenbergii* in any of the eight districts so far as literature is concerned. Terai zone is unique in its topography and soil-water characteristics with acidic pH, sandy loam soil and high seepage [4], thereby apparently not favourable for giant freshwater prawn farming [3]. Seed production is also quite difficult in Terai due to non-availability of saline water in the nearby areas, but still there lies a possibility to explore for culture of the same species with some manipulation of soil and water along with some other essential management practices considering its high preference and market potential in Terai.

The present study has therefore been carried out to standardize the package of practice for *Macrobrachium rosenbergii* farming in terai zone so as to generate and expand a new profitable aquaculture enterprise for socio-economic upliftment of the target population of the study area.

Materials and Methods

Total investigation was carried out following the two inter-related objectives.

1. Standardization of specific package of practice for Giant freshwater prawn in terai region

An extensive study on growth of 15 PL (1 cm long) and juvenile (1 inch long), two different seed forms of Giant freshwater prawn, were made separately in both indoor and outdoor condition. For indoor rearing cement vats were used and outdoor rearing were conducted in cement tanks and earthen ponds of different size. Five different trials for both PL and Juvenile were set in different type of water bodies and maintained for 75 days. Both the seeds were collected from freshwater prawn hatchery, Govt. of WB located at Digha, East Midnapur. They were fed with market available S_1 level prawn larval feed manufactured by Biogrost Pvt ltd, Andhra Pradesh, India throughout the culture period @ 10 % of body weight of prawn seed.

An illustration of five trials have been given in Table 1 and Fig1a and 1b.

Fig 1a: Hiding shelter, aeration and hollow pipe in cement vat

Fig 1b: Paddle wheel aeration in prawn rearing pond

Table 1: Treatments with different manipulations in the water bodies holding prawn seed

	T_1	T_2	T_3	T_4	T_5
Culture system	Cement vat/ Cement tank	Small rearing pond	Large rearing pond	Large nursery pond	Small nursery pond
Size	5ftx3ftx2ft/ 37.5 m^3	1500 m^3	2000 m^3	500 m^3	400 m^3
Aeration	Air pump	X	X	Paddle wheel aerator	Paddle wheel aerator
Hiding shelter	Water hyacinth & hollow pipes	X	X	Water hyacinth& hollow pipes	X
Mixed/mono culture	Mono	Mono	Mixed	Mono	Mono
Prawn Seed	PL/Juvenile	PL/ Juvenile	PL/ Juvenile	PL/Juvenile	PL/Juvenile

Important physico-chemical characteristics of water like temperature, pH, total hardness, dissolved oxygen, total alkalinity, total ammonia and nitrite in all the culture system were recorded fortnightly during the experiment period from July 2016 to September 2016 following the standard methods and they were maintained at the level recommended for *Macrobrachium rosenbergii* farming. (Table 2) [5].

Table 2: Optimum range of water quality required for *Macrobrachium rosenbergii* culture

Parameters	Optimum range of water quality	Water quality in treatments
Salinity	Freshwater / low salinity (<7 ppt)	Freshwater
Temperature (°C)	28-31	28-31
pH	7.0-8.5	7.5-8.5
Total Hardness (ppm)	40-100	55-75
Dissolve Oxygen (ppm)	>4	12-14
Total alkalinity(ppm)	50-100	60-120
Ammonia (ppm)	0.1	0.1
Nitrite (ppm)	<0.1	<0.1

Specific growth parameters like body weight, length, specific growth rate (SGR), mortality, survival of both PL and juveniles were recorded at 15 days interval throughout the culture period. Almost total produce was harvested after three months before drying of ponds leaving only some stock in T3 bearing mixed juvenile culture with Indian carps to check their monthly growth performance.

2. Standardization of supplementary feed for optimum growth of juveniles

The second part of experiment got a focus on growth of juveniles of *Macrobrachium rosenbergii* in lab condition with different supplementary feed prepared by different locally available ingredients along with feed supplements as tabulated in Table 3. Five different feed items were supplied

to five aquaria each containing 10 number of juveniles. Each aquaria were supplied with aquatic weeds, small pipes as hiding place and profuse aeration. Feed supplied thrice daily @ 10 % of body weight in the morning, evening and night for 60 days. Specific growth rate (SGR) were calculated to assess the assimilation of food.

Table 3: Different treatments of supplementary feed and their ingredients

Sl. No.	Feed Treatment	Ingredients
T1	Commercial S1 food	High quality fish meal, Squid meal, Fish oil, Wheat flour, Soyabean meal, Vitamin premix, Mineral premix
T2	Lab made food (LF)	Dry fish, Broken Rice, Soyabean, Maize, Calcium tablet
T3	LF+ Noni + Spirulina	LF, Noni, Spirulina
T4	LF + Noni	LF, Noni
T5	LF + Spirulina	LF, Spirulina

Noni and Spirulina are the two known food supplements (neutraceuticals) procured from Assure Pharmaceuticals, Chennai.

Results and Discussion

1. Water quality: The key water quality parameters as per recommendation for M*acrobrachium rosenbergii* were maintained in all trials and water used was also free from any toxic chemicals and pollutants [5]. Though Terai agro-climate naturally do not reflect an ideal water alkalinity (Table.2) but perennial and sustained application of lime (quick lime/ calcium oxide) in water, imparted moderate change in water pH from acidity to medium alkalinity which allowed and favoured fish farming [6]. Fortunately natural sandy loam soil of terai offers suitability of prawn farming in the target area [5].

2. Standardization of specific package of practice for Giant freshwater prawn

2.1. Growth performance of 15 PL of *M. rosenbergii*: 15 PL released in different treatment system with variable interventions demonstrated a huge variation in their growth as well as survival indices pattern (Table 4). Maximum weight gain by PL in 75 days was recorded in T1. Survival and SGR was also higher in case of T1. T1 was followed by T4, T5, T3and T2 for only growth and SGR of scampi but survival was very poor (<25%) in all the cases. Therefore T1 can be considered as the one and only option for rearing PL in indoor condition. Within 45 days PL attain the juvenile stage weighing >1.0 g and ready to be released into stocking pond [3]

Table 4: Growth performance of PL of *M. rosenbergii* in cement vat and ponds in Terai region

Treatment	T_1			T_2			T_3			T_4			T_5		
Days	45	60	75	45	60	75	45	60	75	45	60	75	45	60	75
Average initial weight (gm)	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Average final Sweight (gm)	1.07	1.39	5.47	0.90	1.33	4.03	1.01	1.20	4.26	0.89	1.01	4.96	0.85	0.99	4.75
SGR (%)	2.29	2.25	7.24	1.91	2.15	5.32	2.16	1.93	5.63	1.95	1.61	6.56	1.8	1.58	6.28
No. of release (No.)	100	-	-	2000	-	-	2000	-	-	1000	-	-	1000	-	-
No of harvest (No.)	80	77	75	500	350	200	450	370	180	200	115	75	230	125	85
Mortality (%)	20	23	25	75	82.5	90	77.5	81.5	91	80	88.5	92.5	77	87.5	91.5
Survival (%)	80	77	75	25	17.5	10	22.5	18.5	9	20	11.5	7.5	23	12.5	8.5

Alam *et al*. (1997) reported that nursery rearing of *M. rosenbergii* post-larvae in hapa-nets at densities as high as 300/m^2 may offer benefits of rearing of sufficient numbers of post-larvae to allow them to grow to a desirable stocking size and to survival, and to faster turnover for both the hatchery and nursery operators [7] This report substantiated our observation on Pl rearing in protected area like cement vat. In fact size of seed and size of water body used for culture are the two major determining factors for PL rearing when growth and survival are considered. PL being very small in size needs safety and proper care. In the smaller water area with proper care, they can feel comfortable and secured. They can acclimatize well in small cement vat (T1) and being free from any predation they can take sufficient feed and grow well with high survival rate. Observations revealed that even smaller earthen nursery ponds like T4 and T5, though demonstrated a higher SGR value, but could not be considered as a suitable water body for PL rearing because of very poor survival rate (Fig 2a-2d). So predation free indoor rearing of PL in T1 evolved as the best option to produce juvenile for further stocking into ponds for commercial production.

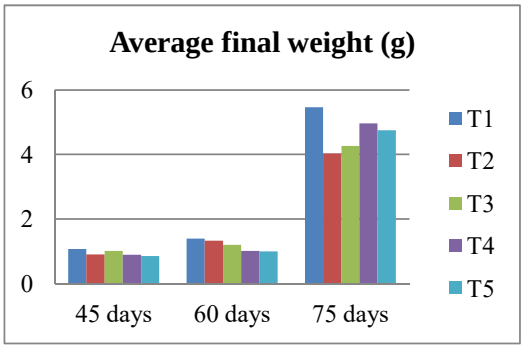
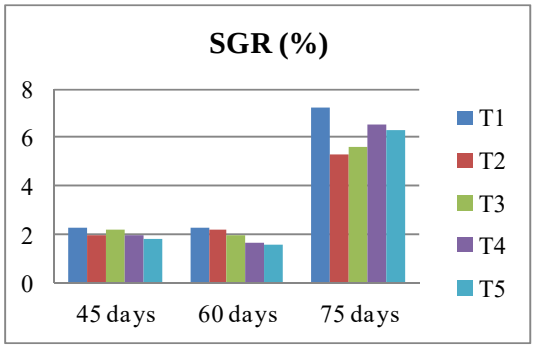


Fig 2a



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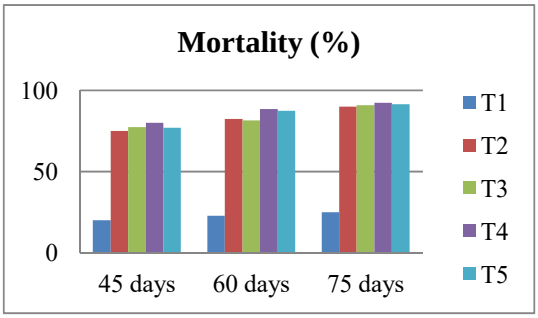

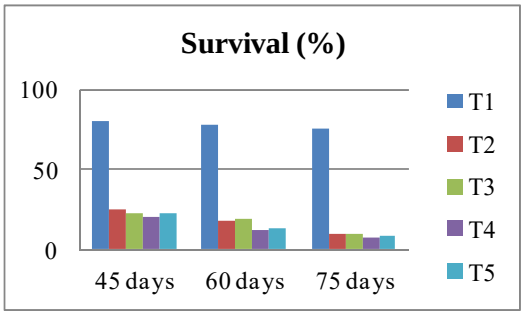

Fig 2c **Fig 2d**

Fig 2a-d: Growth performance of PL of *M. rosenbergii* in cement vat and ponds in Terai region

2.2.. Growth performance of juvenile of *M. rosenbergii* : Juvenile rearing indicated the best growth response in T3 followed by T4, T2 and T5 (Table 5).Though mortality was little higher in T2 and T3 being larger water body, still sufficient growth of juveniles can compensate little higher mortality and produce a satisfactory yield. In addition, T4 and T5 being nursery pond with smaller size were found much better for survival and growth of juvenile to produce adult leading to a tangible commercial production with preferred size of prawn. But T1 in terai zone was found unsuitable for Juvenile rearing in small cement tanks for long time as evidenced from very poor growth in our case which opposed the opinion of New et. al. (1980) who concluded that the production of *Macrobrachium* from concrete ponds can be surprisingly good, and that the realisable production rate from earthern ponds has by no means been reached yet [8]. However, tremendous survival rate in T1 may be exploited through keeping the juveniles in larger cement tank for one month with a consequent transfer of them into the stocking ponds for better growth. It has been recorded during rearing in terai zone that a PL can grow upto 20 g in 4 month (Fig 3) when released directly into the ponds whereas a juvenile grows upto 50g (Fig4) in the same time.

It can overall be interpreted that the larger water bodies may lead to a higher weight gain of juvenile, provided two important aspects like feed and predation are being properly taken care of. In addition, mixed farming can also be suggested because the reason for maximum growth in T3 might be explained as a blessing of mixed farming of prawn with Indian carps where the composite environment along with feed enriched bottom layer of pond can be utilized completely by juveniles.(Fig.5a-5d) [13]

Fig 3

Fig 4

Table 5: Growth performance of juvenile of *M. rosenbergii* in cement tank and ponds in Terai

Treatment	T1- cement tank			T2- pond (BDO)			T3-pond (F/L)			T4-pond (PT)			T5-pond (N)		
Days	45	60	75	45	60	75	45	60	75	45	60	75	45	60	75
Average initial weight (gm)	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Average final weight (gm)	1.34	1.86	3.42	2.97	7.32	14.36	3.10	7.65	17.06	2.58	7.39	15.05	2.93	6.49	14.28
SGR (%)	2.68	2.88	4.39	6.31	11.98	18.97	6.6	12.53	22.57	5.44	12.1	19.89	6.22	10.6	18.87
No. of released (No.)	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
No of harvest (No.)	90	85	80	70	68	65	80	76	72	80	77	77	88	85	83
Mortality (%)	10	15	20	30	32	35	20	24	28	20	23	23	12	15	17
Survival (%)	90	85	80	70	68	65	80	76	72	80	77	77	88	85	83

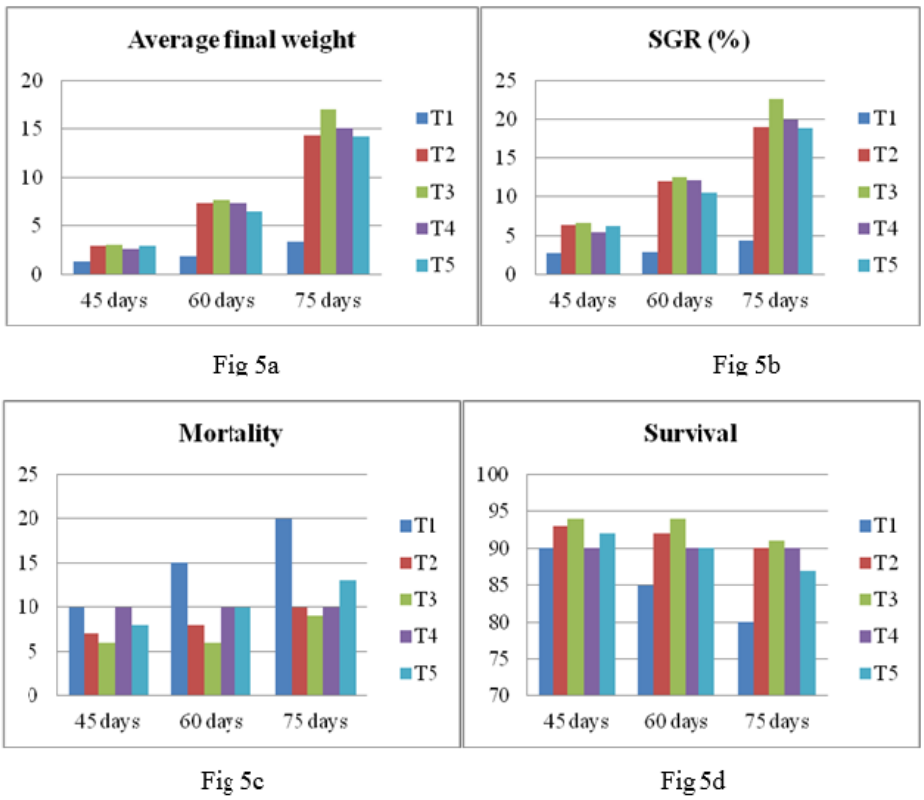

Fig 5a-5d: Growth trend of juvenile of *M. rosenbergii* in cement vat and ponds in Terai region

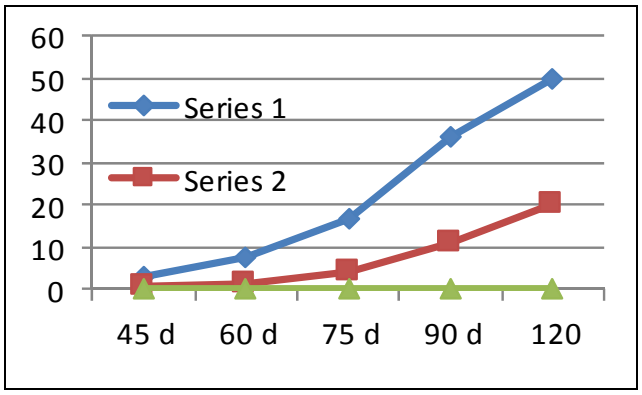

Fig 6: Growth profile of PL and Juvenile in outdoor rearing

From the observations it can be interpreted that the survival that mortality of PL is much more than juveniles in pond condition (Fig 6) and in such a situation Juveniles are more suitable than 15PL for stocking and farming in seasonal ponds of Terai for better growth and commercial production. In case of irregular or short supply of juveniles, indoor rearing of 15PL is necessary to convert them into juveniles which are the good option to minimize the risk of PL mortality as well as to avoid carrying hazards of juveniles from outside as seed. Regarding feed, satisfactory SGR with application of S1 commercial feed on both PL and Juvenile suggest the use of such feed during rearing. However, to reduce the cost of culture, the way for availability of some alternative feed must be explored.

3. Standardization of supplementary feed for optimum growth of juveniles: It is clearly represented from Table 6 and Fig7 that all the prepared feed except FT4 elicited more or less same efficiency as that of commercial S1 feed (FT1) demonstrating satisfactory growth in two months and it is expected that application of those feed on pond will generate a better result than lab condition. It needs further study. The most interesting result was achieved in case of FT5 feed bearing spirulina, a popular food supplement (neutraceuticals) used worldwide for a better health of animal life, where maximum growth of juvenile resulted in.

Table 6: Effect of different feed on growth of juvenile of *M. rosenbergii*

Feed Trial	20 days			40 days			60 days		
	Average initial weight	Average Final weight (gm)	SGR	Average initial weight	Average Final weight (gm)	SGR	Average initial weight	Average Final weight (gm)	SGR
FT 1	0.13	0.57	2.20	0.13	1.34	3.03	0.13	1.86	2.88
FT 2	0.13	0.56	2.15	0.13	1.39	3.15	0.13	1.90	2.95
FT 3	0.13	0.45	1.60	0.13	1.33	3.00	0.13	1.83	2.83
FT 4	0.13	0.33	1.00	0.13	0.70	1.43	0.13	1.01	1.47
FT 5	0.13	0.46	1.65	0.13	1.10	2.43	0.13	2.14	3.35

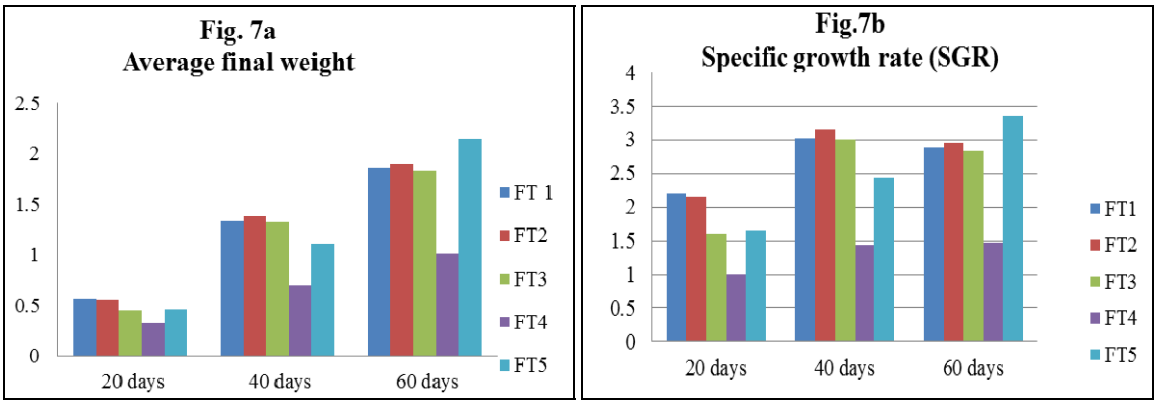

Fig 7a &7b: Growth trend of juvenile of *M. rosenbergii* by using five different feed

The experimental outcome had strongly been substantiated by several earlier findings. As the quality and quantity of feed is the major input in giant freshwater prawn industry, this area must be addressed properly. P.L. nutrition is a critical step in culturing commercially important crustaceans [9]. Any feed with 'insufficient' dietary components and nutrition definitely expressed 'cannibalism' during prawn farming [10]. Alam and Alam confirmed the production of good quality gravid females in ponds by maintaining proper stocking density, water quality and providing balanced feed [11]. Rebecca and Bhavan concluded that selected herbs when supplemented at suitable proportion in feed, have promoted the growth and survival of *M. rosenbergii* post larvae [12]. Considering importance of feed in growth of scampi, the identified feed need to go for further trial and formulations.

Conclusion

The study undertaken provided a positive direction for domestication of *M. rosenbergii* in Terai zone. Both monoculture and mixed culture with carps were found prospective. Specific management practices like increased aeration, profuse feeding and provision of hiding shelter in the water body are to be followed strictly with the release of Juveniles as prawn seed in the seasonal ponds to make them grow up to a marketable size within five months effective culture period. In addition, supplementation of probiotics like Spirulina in animal protein rich feed is also advisable to improve weight gain as well as enhanced specific growth rate of juveniles of *M. rosenbergii*. The overall effort on the semi-intensive culture of scampi in Terai zone can therefore trigger a Potential Avenue for rural livelihood improvement in aquaculture sector.

Acknowledgement

Authors are grateful to the Department of Agriculture, Govt of West Bengal for Innovative Fish Farming Project and Department of Biotechnology, Ministry of Science and Technology, New Delhi for financial support for the research activities undertaken.

References

1. Fisheries. http://agritech.tnau.ac.in/fishery-freshwater prawn, 2014
2. New MB. Farming freshwater prawns A manual for the culture of the giant river prawn (*Macrobrachium rosenbergii*)**.** Food and Agriculture Organization of the United Nations. Rome, 2002, 1-144.
3. Kanaujia DR, Pillai BR. Seed production and grow out culture of freshwater prawns. Central Institute of Freshwater Aquaculture. Bhubaneswar, 2005, 14-19.
4. Ray SK, Mukhopadhyay D. A study on physicochemical properties of soils under different tea growing regions of West Bengal (India). International Journal of Agricultural Sciences. 2012; 4(8):325-329.
5. Kanaujia DR, Pillai BR. Seed production and grow out culture of freshwater prawns. Central Institute of Freshwater Aquaculture. Bhubaneswar, 2005, 1-5.
6. Sarkar D, Ray N. Assessment of fishery status in Coochbehar district of West Bengal. Environment and Ecology. 2004; 22:382-385.
7. Alam MJ, Hoq ME, Jahan DA, Mazid MA. Nursery rearing of *Macrobrachium rosenbergii* (de Man 1779) using hapa-nets : effects of stocking density. Bangladesh Journal Fisheries Research. 1997; 1(1):09-16.
8. New MB, Boonyaratpalin M, Vorasayan P, Intarapichate S. An assessment of the performance of *Macrobrachium rosenbergii* fed simple non-vitamin-supplemented pelleted diets. FAO Corporate Document Repository. Thailand, 1980, 1-4.
9. Velu CS, Munuswamy N. Composition and Nutritional Efficacy of Adult Fairy Shrimp *Streptocephalus dichotomus* as Live Feed. Food Chemistry. 2007; 100:435-1442.
10. Habashy MM. Growth and Body Composition of Juvenile Freshwater Prawn, *M. rosenbergii*, Fed Different Dietary Protein/Starch Ratios. Global Veterinaria. 2009; 3:45-50.
11. Alam MS, Alam MN. Development of the giant freshwater prawn *Macrobrachium rosenbergii* (De Man 1779) broodstock in culture ponds of South- Western Bangladesh: a case study. Journal of Entomology and Zoology Studies. 2014; 2(5):108-113.
12. Rebecca A, Bhavan PS. Growth promotion and survival enhancement of The freshwater prawn M*acrobrachium rosenbergii* Post larvae fed with *Allium sativum, Zingiber officinale* and C*urcuma longa*. International Journal of Pure and Applied Zoology. 2014; 2(2):138-149.