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RESEARCH ARTICLE

VARIATION OF TOTAL ERYTHROCYTE COUNT (TEC) IN CERTAIN FISHES OF SIDZII HILL STREAM, MANIPUR

***,[1]Jiten Singh Soram, [2]Sunita Gurumayum, [3]Abujam, S. K. S., [4]Sanjay Dakua and [3]Biswas, S. P.**

[1]Department of Zoology, Asufii Christian Institute, Mao, Senapati District, Manipur-795150
[2]Department of Botany, Asufii Christian Institute, Mao, Senapati District, Manipur-795150
[3]Department of Life Sciences, Dibrugarh University, Assam-786004
[4]Department of Ecology and Environmental Science, Assam University, India

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ABSTRACT

The present study has been taken up in the Sidzii streams of Mao, Manipur, a tributary of Doyang River, the largest and longest river of Nagaland during December 2011 to November 2012. The highest Total Erythrocyte Count (TEC) value was observed in male *Puntius sophore* during October with a corresponding value of $2.23x10^6/mm^3$ of blood while the lowest value was recorded in female *Parluciosoma daniconius* during February with the value of $1.12x10^6/mm^3$ of blood. Among the female fishes, highest TEC value was recorded in *Puntius ticto* with the value of $2.18x10^6/mm^3$ of blood during October while the lowest value was found in *Parluciosoma daniconius* during May. Again, in male fishes, the maximum TEC value was observed in *Puntius sophore* with the value of $2.23x10^6/mm^3$ of blood during October and minimum TEC was recorded in *Parluciosoma daniconius* with the value of $1.17x10^6/mm^3$ of blood during February. In all the four seasons, male fishes have comparatively more TEC values than their female counterparts. However, in July, the TEC value were found to be higher in females of *Puntius sophore* and *Puntius ticto* with the corresponding values recorded as $1.54x10^6/mm^3$ and $1.59x10^6/mm^3$ of blood respectively. It was also observed that the higher TEC values for all three species were recorded during post-monsoon as compared to the other seasons.

INTRODUCTION

Blood is the most abundant and readily available body fluid. The various composition of this very body fluid reflects the physiological condition of the possessing animal and varies depending on the immediate ambient environmental conditions the fish is exposed to. Thus, the blood parameters are considered as one of the most important pathophysiological indicators of the whole body but also can act as indicator of the surrounding environment. Thus, there is a growing concern and interest in haematological studies. However, the available information recorded indicates that such parameters of fishes vary with regard of age and development (Syrove, 1970), starvation (Kawatsu, 1974 and Mahajan and Dheer, 1983), temperature and season (Joshi *et al*., 1980), sex (Rukusa and Zukowaki, 1980; Sharma, 1984; Pickering, 1986; Shabana *et al*., 1990 and Al-Hassan *et al*., 1993), salinity and activity of the fish and disease etc. (Dheer *et al*., 1986). Since then, there has been an extensive amount of work done on haematology of fishes. Besides these, fish haematological studies have also given a useful insight into fishery management, fish physiopathology and physic-bio-chemistry during the past two decades (Hickey, 1982 and Joshi, 1992). Therefore the study of such parameters is important in diagnosing the structural and functional status of fish exposed to toxicants and various other kinds of pollutants (Adhikari *et al*., 2004). To name some amongst the blood parameters Hematocrit (Hct), Haemoglobin (Hb), Red Blood Cells (RBCs) are most widely studied and analysed parameters to access the functional status of oxygen carrying capacity of the bloodstream and have been used as indicator of the various types of pollution in the aquatic environment (Shah and Altindağ, 2004). As far as North-eastern India is concerned, particularly Manipur, there are very limited work done on the hill streams with respect to the haematological studies of fish fauna. Therefore, it is useful to build up a bank of information by generating basic data of haematological variations in different fish species in relation to ecological, environmental and physiological conditions so that later comparison can be easily made from these informations for later scientific usage. Hence, the present investigation on haematological study of three most abundantly available fish species was carried out from of Sidzii hill stream of Manipur.

Corresponding author: justienaone@gmail.com, santosh.abujam@gmail.com

MATERIALS AND METHODS

The sampling collection was done from 'Sidzii stream' during December 2011 to November 2012. It is perennial stream and also the biggest hill streams in the Mao area, a sub-division of Senapati District, Manipur. The stream originates from the Barail Range called Pforphe (25°29'30.66"N 94°08'04.72"E, 1460 msl), It has a length of about 37 km up to the point where it joins Szüü River which originates from the Japfü Hills at Chakhabina below Kijiimetouma of Japfü peak and become Doyang, the largest and longest river of Nagaland. The fish species like *Puntius sophore*, *Puntius ticto* and *Parluciosoma daniconius* were selected for the present investigation and caught with the help of local fishermen using fine net. The fishes of interest were selected from among the caught fishes and the sex of the fishes was recorded. Every effort was taken to avoid the fish mortality for which the desired fishes were put inside a hand net remaining dipped in the stream water. Blood samples were drawn by cardiac puncture after carefully opening the thoracic cavity by a longitudinal incision medially between the pectoral fins. A syringe

fitted with 24 gauge needle was inserted into the heart after fluids were wiped out. The blood so thus collected was then gently released into vials containing double oxalate (potassium and ammonium oxalates) as anticoagulant. The RBC count determined by Double Neubaeur Haemocytometer using Hayem's fluid as diluting fluid. The total number of RBC is expressed in terms of $X10^6/mm^3$ of blood. The data which were recorded during the study period has been divided into four seasons i.e. winter (December-February); pre-monsoon (March-May); monsoon (June-August) and post monsoon (September-November).

RESULTS

The seasonal variations of TEC (Total Erythrocyte Count) for all species were recorded and given in Table 1. In overall, it was observed that the highest TEC value was observed in male *Puntius sophore* during October with a corresponding value of $2.23x10^6/mm^3$ of blood while the lowest value was recorded in the female *Parluciosoma daniconius* during February with a corresponding value of $1.12x10^6/mm^3$ of blood. In case of the female fishes, highest TEC value was recorded in *Puntius ticto* with a corresponding value of $2.18x10^6/mm^3$ of blood during October while the lowest value was found in *Parluciosoma daniconius* during May. In case of male species, the highest TEC value was observed in *Puntius sophore* with the TEC value $2.23x10^6/mm^3$ of blood during October and lowest TEC was found in *Parluciosoma daniconius* with the TEC value $1.17x10^6/mm^3$ of blood during February. It is also been observed that in all the four seasons, male fishes have comparatively more TEC values than their female counterparts. However, in July, the TEC value were found to be higher in females of *Puntius sophore* and *Puntius ticto* with the corresponding values of $1.54x10^6/mm^3$ and $1.59x10^6/mm^3$ of blood respectively. In the same month, the male counterparts were also recorded with TEC values of $1.51x10^6/mm^3$ for *Puntius sophore* and $1.52x10^6/mm^3$ for *Puntius ticto*. It was also observed that the Total Erythrocyte Count values for both the sexes of all three fishes were maximum in post monsoon and followed by winter, pre-monsoon, monsoon season respectively.

Table 1. Seasonal variation in TEC ($x10^6/mm^3$ of blood) in three Sidzii stream fishes

Seasons	Months	*Puntius sophore*		*Puntius ticto*		*Parluciosoma daniconius*	
		Male	Female	Male	Female	Male	female
Winter	Dec '11	1.62±0.21	1.51±0.62	1.60±0.22	1.54±0.23	1.35±0.52	1.31±0.19
	Jan '12	1.60±0.51	1.37±0.32	1.61±0.10	1.43±0.41	1.29±0.12	1.27±0.13
	Feb '12	1.76±0.12	1.52±0.54	1.74±0.12	1.56±0.31	1.17±0.13	1.12±0.21
	Average	1.66±0.28	1.50±0.50	1.65±0.15	1.51±0.32	1.27±0.26	1.23±0.18
Pre Monsoon	March '12	1.75±0.11	1.53±0.43	1.74±0.24	1.55±0.09	1.64±0.18	1.39±0.42
	April '12	1.37±0.12	1.33±0.23	1.44±0.41	1.40±0.16	1.34±0.15	1.26±0.12
	May '12	1.65±0.38	1.57±0.21	1.69±0.51	1.64±0.25	1.63±0.21	1.14±0.43
	Average	1.59±0.20	1.48±0.29	1.62±0.39	1.53±0.17	1.53±0.18	1.26±0.32
Monsoon	June '12	1.34±0.21	1.23±0.11	1.44±0.23	1.41±0.22	1.21±0.23	1.23±0.40
	July '12	1.51±0.14	1.54±0.14	1.52±0.17	1.59±0.41	2.12±0.23	1.78±0.32
	Aug '12	1.85±0.51	1.74±0.10	1.81±0.21	1.32±0.06	2.02±0.15	1.43±0.13
	Average	1.57±0.29	1.50±0.11	1.59±020	1.44±0.23	1.78±0.20	1.48±0.28
Post Monsoon	Sep '12	1.96±0.22	1.91±0.43	1.92±0.31	1.90±0.34	2.23±0.35	2.08±0.42
	Oct '12	2.23±0.19	2.12±0.17	2.21±0.21	2.18±0.23	1.76±0.61	1.43±0.08
	Nov '12	2.03±0.24	1.86±0.32	2.12±0.08	2.03±0.46	1.98±0.37	1.76±0.16
	Average	2.07±0.22	1.96±0.31	2.08±0.20	2.04±0.34	1.99±0.44	1.76±0.22

DISCUSSION

The seasonal changes in the immediate surrounding environment of an animal have definite influence on every aspect of the animal and the impact is more conspicuous on cold blooded animals. The body metabolism in such animals also changes abruptly either during winter hibernations or during breeding seasons. Hill stream fishes demand more oxygen resulting into higher RBC content to enable carrying out higher metabolic activities to survive and stay against the turbulent force of hill stream water during monsoon and post monsoon seasons (Fig.1). However, Sharma (1984) has recorded remarkably higher values of RBC in both the sexes of hill stream fish *Tor putitora* as compared to our study on the three hill stream fishes *Puntius sophore, Puntius ticto* and *Parluciosoma daniconius*. Such an observation may be due to relatively smaller size of fish species in the present study. The relatively less values of TEC recorded in female fishes are also supported by the fact that, during the spawning season, fishes undergo naturally caused starvation (Sharma,1984) due to the paucity of space in its abdominal cavity. Besides this the major portion of lipid reserves responsible for synthesis of RBC cell membrane are mobilized and used for the purpose of gametogenesis, especially vitellogenesis in females (Fletcher, 1985). There is also a sudden decrease in the availability of food during the winter season due to the reduction in water volume and climatic conditions. Thus in such conditions, there is every chance for fishes to go starved which might have reflected with lower values of TEC. Similar decrease in TEC values on starvation of rainbow trout and *Channa punctatus* for 110 and 56 days respectively were also observed (Kawatsu, 1974; Mahajan and Dheer, 1983). The haematological parameters in a fish are also thus reflected by the physic-chemical conditions of its habitat (Bala *et al*., 1994). Dissolve oxygen also plays a very important role in either increase or decrease in total erythrocyte counts. Singh *et al*. (2012) has also reported that DO value of the Sidzii stream was found to be higher in winter season. Thus, this higher dissolve oxygen level might have given an impact on the total erythrocyte count to be low during the winter season as it has been already found out that erythrocyte count increases when the fishes were held in water of low dissolve oxygen. Higher water temperature, reaching its maximum value in late summer can hold less oxygen in solution.

Thus, higher TEC values recorded during post-monsoon seasons in both the sexes of all species and indicate a high metabolic rate associated with consumption of more food, active life style and lower dissolves oxygen. The lower values are associated with sexual maturity with consequent production of gametic cells and low consumption of food during breeding season, less active life style and high dissolve oxygen during winter season. On the other hand, relatively lower TEC values was observed in females as compared to the male counterparts, it may be due to weaker constitution, less active life and spending more energy and materials for the development of gonads to undergo vitellogenesis.

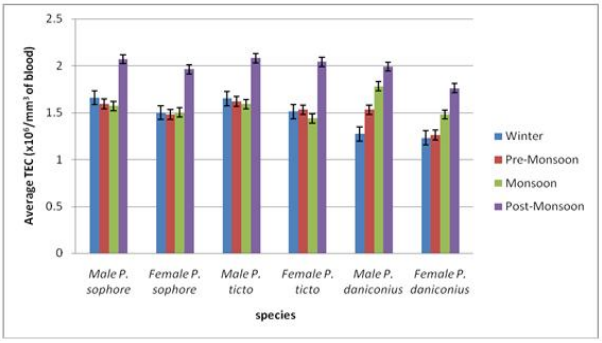

Fig. 1. Seasonal variation in TEC ($x10^6/mm^3$ of blood) in three stream fishes

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