Seasonal Variations of hard parts of *Hamatopeduncularia thalassini* Bychowsky and Nagibina, 1969 (Monogenea: Dactylogyridae, Ancyrocephalinae) on the gills of *Mystus seenghala* in river Ganges near Chandpur (U. P.) India

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Abstract

There are several abiotic factors including temperature, oxygen, pH etc. that affect the phenotypic plasticity of parasites. During present study, the authors concentrated on seasonal variation in measurements of attachment apparatus of Hamatopedunculariathalassini Bychowsky and Nagibina, 1969. Worms were collected from Mystusseenghalaat different water temperatures. Samples were taken at monthly intervals of about 30 (± 5) days during the period from December 2009 to March 2012. Main results indicate that the difference between winter and spring conditions cause significant changes in morphometrical variables of measurements of anchors and connective bars.All 14 characters (including length and width of transverse processes of dorsal transverse bar) measured on each of the 07 samples were normally distributed. Out of 16 characters, 10 have shown positive correlation with each other. During present investigation, it was found that dorsal anchor (including anchor shaft and point) is inversely related to water temperature. Length of outer root is temperature independent. Length and median width of dorsal transverse bar is inversely related to water temperature. Ventral anchor (including anchor shaft and point) is inversely related to water temperature. Length of outer and inner root is temperature independent. Length andwidth of ventral transverse bar is also inversely related to water temperature.

Keywords: *Monogenea, Hamatopeduncularia thalassini, attachment apparatus, seasonality, morphometric variations.*

Introduction

There are several morphological and anatomical characteristics of monogenea that are used for species determination. Main morphological parameters are morphometric characteristics of attachment apparatus and copulatory organ. Species definition using only the shape and measurement of attachment apparatus and copulatory organ is difficult in similar species, because some measurements often overlap, while shape is variable. Because the mistaken description, of an already existing species as newly discovered occurs, it is important to know which factors affect morphometrical variation to avoid incorrect determination of species (Gussev 1985).

The aim of this study was to investigate the differences of measurements of attachment apparatus between *H. thalassini*individuals in different temperatures. It is expected to detect metrical variation in morphology of *H. thalassini* considering seasonal changes in water temperature. *Hamatopeduncularia thalassini* Bychowsky and Nagibina (1969) has been extracted from the gills of *Mystus seenghala*collected from river Ganges near Chandpur (U.P.), India. Highest prevalence of infection was recorded in period from January to March.

Materials and Methods

Fishes for present investigation were collected from river Ganges at Chandpur from December 2009to March 2012. Total 12 specimens were examined. All specimens were used to study seasonal variations. Mizelle's (1936 and 1938) freezing technique was employed for collecting parasites. Parasites thus collected, were processed for morphometric studies as described by Mo (1991).

Parameters measured for morphometric analysis and study of seasonal variation as suggested by Mo (1991) include 13 morphometric parameters of the attachment apparatus: total length of anchor - la; length of anchor shaft - las; length of anchor point - lap; length of anchor root - lar; length of transverse bar - lb; total basal width of transverse bar - tbwb; basal width of transverse bar - bwb; total median width of transverse bar - tmwb; median width of transverse bar - mwb; maximal distance between processes of transverse bar - mdpb; total length of marginal hooks - lmh; length of marginal hook handle - lh; length of marginal hook sickle - lsi.

A total 60 specimens of *H. thalassini* were measured and photographed with help of calibration tool of Motic DMB1 Microscope. It was not always possible to measure all 13 characters, because some specimens were destroyed during the preparation or because with time had deteriorated. Sometimes attachment apparatus had inconvenient position or was unsuccessfully compressed between the coverslip and the slide therefore, have not been recorded. Unequal number of measurements and low number of specimens in autumn period was taken into account during statistical analysis. All data was processed using SPSS version 11 for calculating the mean and standard error. This data was also processed for probability coefficient and regression analysis. All results obtained were graphically presented. All the measurements are in microns (µ) in table 1. All temperature readings are in degree Celsius (ºC).

Results

Worms are elongated and elliptical in shape, measuring 890.22 - 1141.08 µ in length. Opisthaptor is fairly set off from body proper by a narrow peduncle. It measures 224.95 - 250.66 µ in length and 151.67 - 181.48 µ in width. Haptoral armature comprises of 'Varicorhinus' type dorsal anchor, 'AnchoratoidWegeneri' type dorsal transverse bar, with a postero-median 'Anchor' shaped appendix attached to it. Ventral anchors are 'Pterocleidus' type, with distinct clamping formation. Ventral transverse bar is a more or less straight bar with swollen lateral ends. 'Dactylogyrus' type marginal hookletswere also observed. Mean minimum and maximum lengths of haptoral hard parts are given in table 1.

Table 1: Mean minimum and maximum length of haptoral hard parts of *H. thalassini* (December 2009 – March 2012)

	Dorsal Anchor (µ)				DTB (µ)		DTB (Transverse process) (µ)		Ventral Anchor (µ)				VTB (µ)		Marginal Hooklet(µ)	
	LA	LAS	LAR-Out	LAR-Inr	LB	MWB	L	W	LA	LAS	LAR-out	LAR-Inr	LB	MWB	LMH	LH
Dec.	45.90, 62.02; (56.23)	16.89, 35.08; (29.19)	22.48, 36.78; (29.01)	23.16, 39.36; (30.64)	59.50, 97.55; (75.72)	2.46, 4.08; (3.67)	7.21, 11.51; (8.62)	2.28, 4.70; (3.06)	40.40, 55.53; (47.54)	23.25, 30.81; (27.40)	20.78, 31.04; (25.12)	21.75, 31.67; (25.71)	46.55, 75.20; (60.39)	2.66, 6.14; (4.11)	11.72, 18.79; (14.57)	8.03, 15.71; (12.31)
Jan.	47.54, 66.68; (58.63)	24.11, 39.99; (31.87)	26.45, 36.07; (32.97)	26.76, 40.02; (36.3)	59.65, 86.55; (79.59)	3.28, 4.70; (4.16)	9.36, 12.40; (9.94)	2.97, 4.93; (3.23)	44.20, 62.16; (51.51)	23.52, 35.68; (27.79)	24.42, 31.62; (25.31)	27.01, 33.46; (28.06)	60.68, 80.15; (72.76)	3.92, 6.48; (5.00)	13.82, 20.19; (15.77)	10.33, 17.08; (12.44)
Feb.	59.17, 66.88; (63.49)	32.71, 39.06; (36.73)	31.46, 44.31; (33.15)	36.93, 40.85; (36.61)	70.86, 100.36; (90.81)	4.41, 5.51; (4.96)	9.52, 11.40; (10.65)	3.02, 4.16; (3.80)	48.10, 55.04; (52.90)	30.78, 35.06; (32.06)	26.46, 33.65; (29.10)	29.36, 33.41; (30.54)	63.87, 94.10; (75.03)	4.49, 6.58; (5.55)	14.26, 16.52; (16.54)	11.90, 13.77; (14.41)
Mar.	56.34, 65.24; (60.25)	29.29, 37.29; (31.65)	28.81, 36.52; (39.53)	27.10, 39.53; (38.93)	65.68, 106.81; (75.67)	3.59, 4.91; (4.35)	9.46, 10.55; (10.32)	2.82, 3.91; (3.80)	47.20, 53.88; (51.80)	26.23, 31.18; (28.96)	23.57, 29.25; (30.7)	24.96, 33.97; (31.68)	62.86, 82.43; (71.96)	4.21, 6.84; (5.48)	13.56, 18.40; (15.83)	10.15, 17.31; (12.82)

Discussion

During present investigation worms were obtained from piscine host *viz*. *Mystus seenghala*(Sykes). Worms at disposal of author exhibit variations in measurements of various hard parts of haptor. These variations in measurements are due to increase or decrease in water temperature during summer and winter respectively. Present study describes morphometric seasonal variations in size and shape of the opisthaptoral hard parts of *H. thalassini*from *Mystus seenghala*. All 16 characters (including length and width of transverse processes of dorsal transverse bar) measured on each of the 07 samples were normally distributed. Out of 16 characters 10 show positive correlation with each other. Characters that did not show a significant regression were anchor point, basal and median width of dorsal and ventral transverse bar. Mean Table 01 shows a difference between mean lengths of dorsal anchor, dorsal transverse bar, ventral anchor, ventral transverse bar and marginal hooklet of all four months of *H. thalassini*

Pearson Correlation

Pearson correlation was used to determine if the hard armature of *H. thalassini* is significantly correlated or not. Based on spss outputs of haptor authors have drawn data Table 02 which shows correlation between variables. Results of this data obtained were significantly correlated to each other. In case of dorsal anchor, character length of anchor with length of shaft is positively correlated in December and January, r = 0.845 and r = 0.958 significant at 0.05 and 0.01 level respectively. Character length of anchor with length of point does not show correlation. Length of outer root with inner root is significantly correlated in December, February and March, r = 0.985, r = 0.788 and r = 0.937. Correlation is significant at 0.01, 0.05 and 0.01 levels respectively. Dorsal transverse bar of *H. thalassini*shows a highly positive correlation in all months.

Character length of dorsal transverse bar with maximal distance between processes of bar shows positive correlation with each other from December - March, r = 0.977 significant at 0.01 level, r = 0.827 significant at 0.05 level, r = 0.949 significant at 0.01 level and r = 0.959 significant at 0.01 level respectively. Length of bar with median width of transverse bar is not correlated with each other, r = 0.577. It means one variable is increasing with relation to temperature but other one does not show any change. Length of transverse processes with width of processes show strong correlation to each other in December and March, r = 0.774 and r = 0.939 respectively. Correlation is significant at 0.05 and 0.01 level.

Ventral anchor show significant correlation in January in case of length of anchor with length of shaft, r = 0.805 significant at 0.05 level. Character length of ventral anchor with length of point show positive correlation in January, r = 0.805

which is significant at 0.05 level. In case of Length of outer root with inner root there is strong positive correlation from January - March, r = 0.806 significant at 0.05 level, r = 0.769 significant at 0.05 level and r = 0.875 which is significant at 0.01 level.

Ventral transverse bar show positive correlation in its variable length of bar with maximal distance between processes in December - March, r = 0.987, r = 0.913, r = 0.980 and r = 0.996. Correlation is significant at 0.01 levels respectively. Basal width of transverse bar with median width is negatively correlated to each other, r = -0.736 which means increase or decrease in value of corresponding basal width of bar will either decrease or increase the value of median width. Length of bar with median width of transverse bar is negatively correlated to each other, r = -0.816. Correlation is significant at 0.05 levels. Length of marginal hooklet with hook handle is positively correlated with each other in December, February and March, r = 0.874 significant at 0.05 levels, r = 0.953 and r = 0.984 both are significant at 0.01 level respectively. In case of hook handle with length of sickle there is also positive correlation in January, r = 0.804. Correlation is significant at 0.05 levels.

Table 2: Significant Pearson correlations of *H. thalassini*

Hard parts having bivariate correlation	*H. thalassini*
La - las of Dorsal anchor	0.960
Lb - mwb of Dorsal Transverse Bar	0.848
L - W (Transverse Process) of Dorsal Transverse Bar	0.878
La - las of Ventral Anchor	0.722
Lb - mwb of Ventral Transverse Bar	0.939
Lmh - lh of Marginal Hooklet	0.801

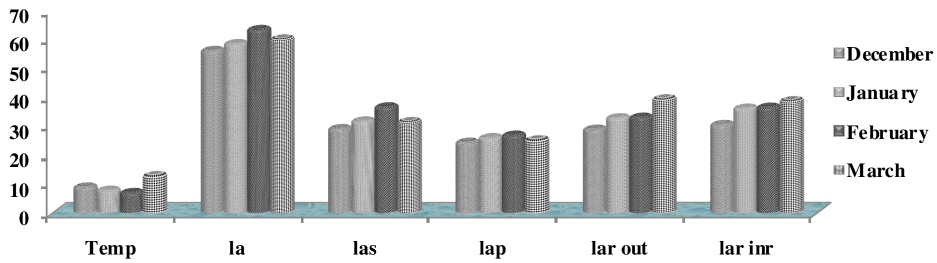
Histogram Representation

Histogram of different haptoral hard parts were obtained and represented in the form of Table 03 - 07; Graph 01 - 05 of four months. Most of the histogram shows a wide range of variations in size of haptoral hard parts of *H. thalassini* with temperature (ºC). Length of dorsal and ventral anchor shaft and point is inversely related to water temperature. While, length of outer and inner root is independent of temperature. As temperature decreases from December to February, length of anchor increases. When temperature decreases from December to February outer and inner root show a slight increase in length. While, as temperature increases in March, length of outer root still increases. Inner root is also water independent.

Length and median width of dorsal and ventral transverse bar is dependent on water temperature because as temperature decreases from December and February length of transverse bar increases considerably. And in March as temperature increases its length and width decreases.

Table 3: Mean variations in size of dorsal anchor of *H. thalassini*with temperature (December 2009 – March 2012)

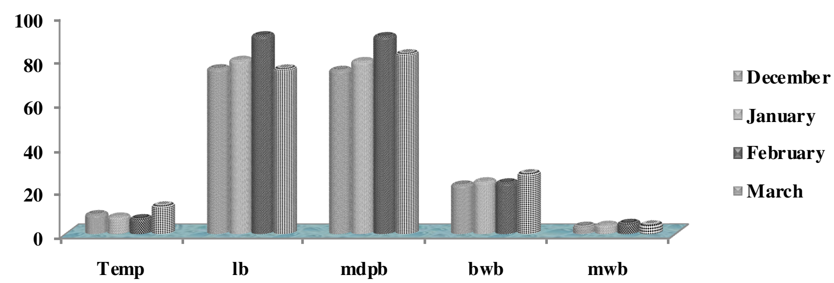
	Temp	la	las	lap	Lar - out	Lar - inr
December	9	56.23	29.19	24.48	29.01	30.64
January	7.9	58.63	31.37	26.11	32.97	36.3
February	7.1	63.49	36.73	26.94	33.15	36.61
March	13.0	60.25	31.65	25.39	39.53	38.93



Graph 01: Mean variations in size of dorsal anchor of *H. thalassini*with temperature (December 2009 – March 2012)

Table 4: Mean variations in size of dorsal transverse bar of *H. thalassini* with temperature(December 2009 – March 2012)

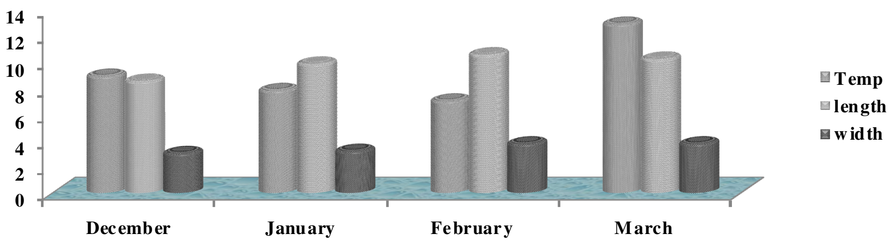
	Temp	lb	mdpb	bwb	mwb
December	9.0	75.72	74.99	22.53	3.67
January	7.9	79.59	79.02	24.02	4.16
February	7.1	90.81	90.41	23.48	4.96
March	13.0	75.67	82.63	27.73	4.35



Graph 02: Mean variations in size of dorsal transverse bar of *H. thalassini*with temperature (December 2009 – March 2012)

Table 5: Mean variations in size of transverse processes (dtb) of *H. thalassini* with temperature (December 2009 – March 2012)

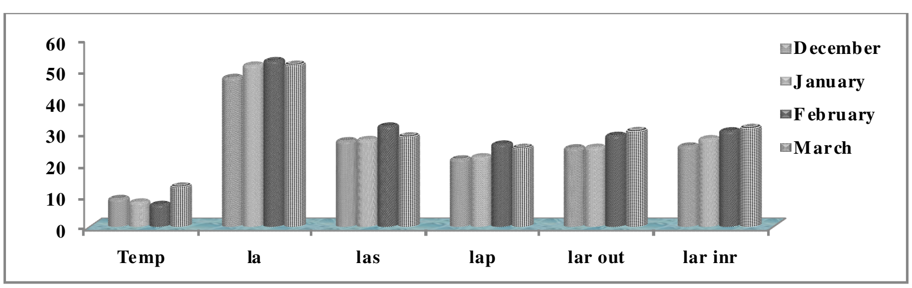
	Temp	L	W
December	9.0	8.62	3.06
January	7.9	9.94	3.23
February	7.1	10.65	3.80
March	13.0	10.32	3.80



Graph 03: Mean variations in size of transverse processes (dtb) of *H. thalassini* with temperature (December 2009 – March 2012)

Table 6: Mean variations in size of ventral anchor of *H. thalassini* with temperature (December 2009 – March 2012)

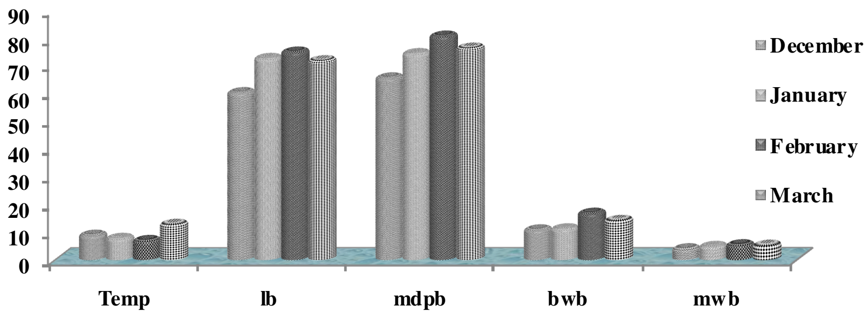
	Temp	la	las	lap	lar - out	lar - inr
December	9.0	47.54	27.4	21.6	25.12	25.71
January	7.9	51.51	27.79	22.3	25.31	28.06
February	7.1	52.9	32.06	26.33	29.1	30.54
March	13.0	51.8	28.96	25.33	30.7	31.68



Graph 04: Mean variations in size of ventral anchor of *H. thalassini* with (December 2009 – March 2012)

Table 7: Mean variations in size of ventral transverse bars of *H. thalassini*with temperature (December 2009 – March 2012)

	Temp	lb	mdpb	bwb	mwb
December	9.0	60.39	65.72	10.93	4.11
January	7.9	72.76	74.5	11.33	5.00
February	7.1	75.03	80.78	16.92	5.55
March	13.0	71.96	76.52	14.42	5.48



Graph 05: Mean variations in size of ventral transverse bars of *H. thalassini*with temperature (December 2009 – March 2012)

Regression Analysis

Spss outputs obtained from regression analysis of *H. thalassini* to find out their linear mathematical relationships with hard parts of haptor are as follows:

Dorsal anchor

Length of anchor = 29.665 + 0.927 x Length of shaft

Dorsal transverse bar

Length of bar = 31.766 + 11.361 x Median width of bar

Dorsal transverse bar (Transverse processes)

Length of transverse process = 2.824 + 2.033 x width of transverse process

Ventral anchor

Length of anchor = 27.671 + 0.801 x Length of shaft

Ventral transverse bar

Length of bar = 23.292 + 9.284 x Median width of bar

Marginal hooklet

Length of marginal hook = 6.886 + 0.677 x Length of hook handle

Discussion

Regression analysis of *H. thalassini*helps to find out a linear mathematical relationship between haptoral hard parts length of dorsal and ventral anchor, length of dorsal and ventral transverse bar is an independent variable. Length of transverse process of dorsal transverse bar is also an independent variable. Length of marginal hooklet has been chosen as an independent variable. Length of anchor shaft of dorsal and ventral anchor, median width of dorsal transverse bar and ventral transverse bar is dependent variable. Width of transverse process of dorsal transverse bar is also a dependent variable. Length of marginal hook handle is dependent variable.

Authors agree with Mo (1991) who suggested that when temperature increased during spring, size of hard parts decreased rapidly. Drop in water temperature during autumn, did not cause a corresponding rapid increase in size. The size however, gradually increased during cold period of year. Kulemina (1977) made similar observations on species of *Gyrodactylus* from the skin of crucian carp *Carassiuscarassius* (L.) and gold fish *Carassiusauratus* (L.). She stated that phenomenon could depend upon the curtailment of embryogenesis in uterus at higher water temperature and subsequent production of new born individuals with functional, although not yet fully developed hard parts. Furthermore, a rapid increase in water temperature could increase the mortality among old specimens, resulting in a rapid replacement of old specimens by young ones. Inversely, a decrease in water temperature would prolong embryogenesis in uterus, resulting in new born individuals with more completely developed hard parts. Furthermore, a lower temperature would prolong the life span, resulting in a slow replacement of old specimens by young specimens.

References:

Bychowsky, B. E. and Nagibina, L. F. (1969). Ancyrocephalinae (Dactylogyridae, Monogenoidea) from fishes of the family Ariidae. *Parazitologiya*. **3: 337 – 368** (In Russian).

Gussev, A. V. (1985). Monogenea. In: O. N. Bauer (Ed.), Key to Parasites of Freshwater Fish of the USSR. Vol. II *Nauka,* Leningrad, pp.**10 – 424** (In Russian).

Kulemina, I. V. **(1977)**. Size and variability of the adhesive elements in some species of *Gyrodactylus. Investigation of Monogeneans in the USSR.* Editor in chief**:** O. A, Skarlato, pp. **34 - 37**.

Mo. T. A. **(1991)**. Seasonal variations of opisthaptoral hard parts of *Gyrodactylussalaris*Malmberg, 1957 (Monogenea**:**Gyrodactylidae) on parr of Atlantic salmon *Salmo salar* L. in the river Batnfjordselva, Norway. *Systematic Parasitology*, **19: 231 - 240**.

Mizelle, J.D. **(1936)**. New species of trematodes from gills of Illinois fishes. *Amer. Midl. Nat.,* **17: 785 - 806.**

Mizelle, J. D. **(1938)**. Comparative studies on trematodes (Gyrodactyloidea) from gills of North American freshwater fishes. *Illinois Biol. Mongr.*, **17: 1 - 81.**