Incidence of Black Spot Infection and Growth Patterns in Schizothorax Richardsonii (Gray) and Schizothorax Plagiostomus (Heckel) from Garhwal (West Himalaya)

Padma Vashist
Deptt. of zoology, P.G Govt. College, New Tehri

Reference to this paper should be made as follows:

Padma Vashist ,
"*Incidence of Black Spot Infection and Growth Patterns in Schizothorax Richardsonii (Gray) and Schizothorax Plagiostomus (Heckel) from Garhwal (West Himalaya)*",
Voyager: Vol. VIII, No. 1, June 2017, pp.70- 78
http://anubooks.com/?page_id=2430

Abstract

Diseases affect the economic value of fish. In view of its importance to fishery management investigations were carried out to determine the incidence of black spot infection and length-weight relationship of Schizothorax richardsonii (Gray) and Schizothorax plagiostomus (Heckel) in diseased fish. Samples of snow trout were collected randomly from the Alaknanda at Srinagar and incidence of disease categorized into low, medium and high infection with respect to their sex, size and season. The length-weight relationship was estimated by least square methods. The incidence of infection varied moderately with respect to sex, increased with size and was generally high during summer in both species of Schizothorax. The length-weight relationship indicated by 'n' follows the general parabola and increase in total length wsas highly significant for the increase in total weight of the fish. Linearity was highest in female S. richardsonii and male S.plagiostomus. Low value of 'n' in male as compared to female of S. plagiostomus and male as well as female of S. plagiostomus may denote marked effect of infection in male of S. richardsonii

Key Words: *Infection, incidence, length-weight relationship.*

Introduction

Diseases are known to influence fisheries of economically important fish. The black spot disease is common in the snowtrouts of this region (Lal 1980 a, Misra and Lal 1980, Singh et al 1981). It is caused by the Metacercariae Larva *Diplostomum minimum*. The spot develops around each larva as variations in the length-weight relationships provide a measure of condition of the fish and the suitability of its environment, the determination of this relation in diseased fish would help to assess the influence on weight attainment pattern with respect to increase in length, so essential for fishery. The important contributions on the length-weight relationship were those of Hile (1936) and David (1953). These studies were extended to other species by Lal (1980 b) and Basheer et al. (1993). In view of these facts a study was inducted to compare the length-weight relationship of economically important snow trouts*Schizothorax richardsonii* (Gray) and *S. plagiostomus* (Heckel) infected by black spot disease and the influence of the incidence of black spot disease on the length-weight relationship, if any.

Materials and Methods:

Fish samples were obtained from the Alaknanda at Srinagar Garhwal. Fishes were obtained from fisherman. They make use of 'funda' or 'kanta' to fish in this river. Black spot disease on the skin and fins were identified according to the symptoms suggested by Jhingran (1975). The fish sampled were sorted out into low, medium and high infection. Fishes with fewer black spots in their skin were categorized as 'low infection', fishes having comparatively more black spots as ' medium infection' while fishes having body full of black spots as 'heavily infection'. After sorting the samples according to these categorized fishes were grouped with respect to their sex, size and season. The total number of fishes in each category was expressed as percentage. In order to determine the length-weight relationship the total length (cm) and weight (gm) were measured in fresh condition and the data was transformed into logarithmic value. The length-weight relationship was estimated by the method of least squares using the parabolic equation as suggested by LeCres (1951), $W = al^n$ where W is a body weight in grams, L is total length in cm, a is constant and n the exponent. This relationship was fitted to straight line through the logarithmic transformation Log W = Log a + b Log L, where constant' a' is the intercept and 'b' the regression coefficient. The equations were obtained by performing regression analysis in a computer.The analysis was performed using MS-EXCEL (version-7.0). The significance level of the linearity of regression was tested using single ANOVA. Since racial analysis lack of heterogeneity (separate communication) in the three diseased categories (low, medium and high infection) the data on length and

weight of *S. richardsonii* and *S. plagiostomus* was pooled for all further analysis.

Results:

The incidence of infection varied moderately with respect to sex, increased with size and was generally high duringsummer in both species of *Schizothorax* (Table 1, figs1 a-b, 2a-b).the correlation coefficient showed the total length was highly correlated to the total weight of the fish in male (0.96196) and female (0.95879) of *S. richardsonii* as compared with male (0.579895) and female (0.888095) of *S. plagiostomus* respectively (Table 2).

The regression equation for different length – weight relation ship was as follows.*S. richardsonii*: Male Y = 0.408815+1.336236 X; Female Y= -0.56974+2.006157X *S. plagiostomus*: Male Y = 1.94338+2.897575 X; Female Y= -2.09361+2.994069X

The value of 'n' or 'b' is less in male as compared to female of *S. richardsonii* and male as well as female of *S. plagiostomus*. The test of linearity of analysis of variance showed that total length was highly significant for the increase in total weight of the fish. Linearity was highest in females of S. plagiostomus (Table 2).

Discussion:

Variations in the incidence of different species of fish have been studied by several authors (Collard 1970, Dhasmana and Lal 1993). The variations may be due to sex, size or season (environmental variables). All fishes were found to be diseased thus showing 100% incidence of infection in both species. In male *S. richardsonii* the fishes with low and medium infection accounted for 56% of total sample. The percentage of low and medium infection in female was higher than the males. Together they accounted for 68% of total female fishes.

In *S. richardsonii* a relative greater share of heavy infected males (43.2%) were observed compared with 31.6% of females. Misra and Lal (1980) have described that the infections of the metacercariae of *D. minimum* were more frequent in females of *S. richardsonii*. Their males had 21.7% trematode and 21.7%protozoan infection, while in female 27.5% trematode and 12.3% protozoan infection. Thus the females were more susceptible to black spot diseases and males to costiasis. In *S. plagiostomus* males had 26% low, 42.1% medium and 31.6% high infection. All females (100%) were highly infected. Lal (1980 b) reported that in *S. plagiostomus*female were more susceptible to the metacercariae of trematode than the males where as males and females were equally parasitized by *costia necatrix* and white spot diseases. However the incidence of protozoan infection in male of *S. plagiostomus* was more (19.4%) than in females 14.9%. Some of them are of the view that female fishes are more susceptible to their parasites than the males. While other consider just reverse of it.

In case of *S. richardsonii* fishes from 10 cm size onward were found to be infected. 33.3% fish had low, medium and high infection in the 10-20 cm and 20-30 of size-group. Even in 30-40 cm size the difference was of small magnitude. The incidence of infection was more prevalent in higher size. *S. plagiostomus* showed slight variation in the amount of infection. The percentage of heavily infected fishes was more in 30-40 cm size groups. Reported trematode and protozoan infection (5.9%) in 11-21 cm size-group, 25.7% trematode and 17.1% protozoan infection in 21-31 cm of size-group, 30.0% trematode and 23.3% protozoan infection in 31-41 cm of size-group in 37.5% trematode and 12.55 % of protozoan infection in 41-51 cm of size-group in case of *S. richardsonii*. Hence, the trematode infection tended to increase with an increase in the size of fish. In the case of black spot and the costiasis diseases Lal (1980 a) have pointed out that the rate of the infection of the black spot increased with the increase in the length of *S. plagiostomus* whereas costiasis increased up to a certain length and then decreased to even nil in the higher groups.

During the course of their investigations Colley and Olson (1963) and Collard (1970) have described that the longer or more aged have greater incidences of the infection. Exceptions to this rule have been reported in the case of the infections of the blue gill and the large mouth bass. A rule has been accepted by several authors that the rate of infection increases with length of the fish but some exceptions are also prevalent that the lower size groups are more heavily infected than the higher size-groups or do not show any definite age relationships. Observations with regard to the black spot disease were found in close agreement in both species of snow trout with that of Colley and Olson (1963) and Avault and Allison (1965). They have described the greater length greater parasite burden phenomenon. A decrease in the attack of parasite after a certain age of the fish has also been recorded by Summerfelt and Warner (1970). The decrease in the attacks has been correlated either with the age resistance or with the die offs of the fishes after a certain periods of attacks.

Spall and Summerfelt (1969) and Collard (1970) reported that winter season has been found favorable for the attack of *Callionymus lyra, Eimeria sardenae* and *E. clupearum* etc. whereas summer season for the attack of *Haemogregring bigemina, Aeromonas liquefaciens* and *Posthodiplostomum minimum* for the attack of*Collionymuslyra, Eimnasardinae* and *E. clupearum* etc, the probable cause of the high attack in summer may be low oxygen stress. Misra and Lal (1980) and Lal (1980 a) also found high infection *of D. minimumand C. necatrix* in *S. richardsonii* during summer.

Diseases are known to affect growth of the fish. The length-weight relationship is an ideal indicator of growth. In parabolic ($W= al^{n)}$ or linear model (Log W = Log a + b Log L) the 'n' is the indicator of growth. Allen (1938) suggested that the value of 'n' remains constant at 3.0 for an ideal fish and it follows the cube law. Further it was pointed out by Beverton and Holt (1957) that the departure from n=3.0 is rather rare. But Hile (1936) and Martin (1949) illustrated that the value of exponent 'n' generally lies between 2.5 and 4.0 and in majority of the cases the value n=3 differed with sex and locality. The length-weight relationship was considered to follow the cube in the shape and size of fishes as they grow and thus the parabolic relationship was considered to be superior by LeCren (1951).

Results of present study indicate that the value of 'n' varied from 1.336236 (male) to 2.00617 (female) in case of *S. richardsonii*.In sympatric *S. plagiostomus* the value varied from 2.897575 (male) to 2.994069 (female). The value was hence near to the ideal value of n=3.0 only in female of *S. plagiostomus*. In all others it was <3.0 while in *S. richardsonii* it was much less than 2.5. The present observations on *S. plagiostomus* resemble to that of Lal (1980 b) in which the value of exponent 'n' was reported to be 2.964. However, it differed from the observations made on S. richardsonii with those of Misra (1982) who reported the value of 'n' as 3.1599. As far as the other hill stream fishes of Garhwal region are concerned the value of 'n' or 'b' has been reported to vary 3.0161 for Tor tor (Lal 1980 b) and 2.8807 *for T. putitora* (Lal and Nautiyal 1980).

According to Nautiyal (1985) the exponent 'n' usually varied between 2.3 and 3.1 in Garhwal Himalayan Mahseer. In the pooled data the value of 2.9 (Nautiyal 1994) indicated that the length-weight relationship of *T.putitora* closely follows the cube law and thus may be considered as an ideal fish. According to this author the analysis of variance revealed that per millimeter increase in the total was significant for per gram gain in weight of *T. putitora*. Basheer et al (1993) observed that the value of regression coefficient (b=2.9419) reflects the fact that it follows the cube law. The departure from the cube law may be due to several factors including certain environmental factors. According to Dhasmana and Lal (1993) the value of 'n' differs with sex, season and year and locality, the range being 2.5 to 3.9 in hill-stream fish *Gara Gotyla gotyla.* The length-weight relationship was found parabolic and has no significant difference between the sexes. These observations were in close conformity with Lal (1980 b) and Krishnamoorti (1971). In the present studies 'n' was found to vary with sex in *S. richardsonii* male having very low value (1.3) and female a moderate value (2.0).

The cube law does not necessarily hold good always as the specific gravity or

outline of the fish are subject to changes (Rounseefell and Everhart 1985). There are reports of significant deviation from the cube law in case of different fishes (Sultan 1981, Sultan and Khan 1981 a, b, Hoda 1987, Sivakami 1987). The length-weight relationship of S. richardsonii and S. plagiostomus was also examined in relation to diseases. The length-weight relationship showed marked difference only in *S. richardsonii* of male. The low value of 'n' (1.336236) denoted that S. richardsonii of male may loose weight due to black spot disease as compared with S. plagiostomus where it did not. In male of *S. richardsonii* the incidence of infection wasfound high in comparison to its female and both sexes of*S. plagiostomus*. Misra (1982) when compared the 'n' value for undiseased fish 3.1869 (male) 3.0666 (female) and diseased fish 2.2115 (male) and 2.6847 (female) in *S. richardsonii*he found that the value or 'n' decreased in diseased fish as compared to undiseased fishes.

Nilkolsky (1963) described that parasitic and other disease of the fishes effect the productivity of the stock far more in an indirect way through changes in the growth rate and reproductive capacity of the individuals. The form of influence probably has far greater significance than the direct mortality of fishes due to diseases. One or a combination of harmful effects such as reduced growth emaciation or smaller average length in heavily parasitized fish when compared with uninfected fish from the same lake was reported by a few workers. Statistically significant weight loss in 4-inch small mouth bass experimentally infected with strigiid cercarie of *Uvulifer amploplitis* was observed by Hunter and Hunter (1938). Fish with heavy metacercariae infections were 10% shorter than those with lighter infections reported by Hugghins (1959). Fish with heavy infections of metacercariae had noticeable less visceral fat and were often thin (Bengham 1938).

The present authors concluded that the males of *S. richardsonii* were more prone to black spot disease as compared to females of *S. richardsonii* and both sexes of *S. plagiostomus*. In both sexes of the above species the incidence of infection increased with the increase in the size of the fish. Thus fishes between 30-50 cm lengths were heavily infected. Summer was the period of high infection. The value 'n' follows the general parabolas which do not differ significantly. Value of 'n' or 'b' in *S. richardsonii* of male was fund to very low as compared to female and both sexes of *S. plagiostomus*.

Acknowledgements:

I thank Professor and Head Dr. Asha Saklani, Department of Zoology, University of Garhwal, Srinagar for instrumentation and laboratory facilities.

References

Allen, K.R. (1938). Some observations on the biology of the trout Salmo trutta in Windermere. *J. Anim. Ecol*., **7**:**333-49.**

Avault, J.W. and Allison, R.1965. Experimental biology control of a trematode parasite of blue gill, *Exp. Parasitol*., **17**:**296-301.**

Basheer, V.S. khan, A.A. and Siddiqui, I. A. (1993). On the length-weight relationship of Channa *punctatus* (Bloch) from the river Yamuna. P. **241-246**. In: H. R. Singh (ed). Advances in *Limnology*, Narendra Publishing House, Delhi.

Bengham, R. V. (1938). Parasites of *Centrarchidae* from southern florid. *Trans. Amer*. Fish. *Soc*., **68**:**263-268.**

Beverton, R. J. H. and Holt, S. J. (1957). On the dynamics of exploited fish population. Fish. Invest. London. *Ser*.,**2(19)**: *533.*

Collard, S. B. (1970). Some aspects of host parasite relationship in mesopelagic fishes. *Symp. Amer*. Fish. *Soc*.**, 41-56.**

Colley, F. C. and olson, A. C. (1963). Posthodiplostomum minimum(Trematode: Diplostomatidae) in fishes of lower Otay Reservoir, San Diego country. *California J. Parasitol*., **49**:**149**

David, A. (1953). Notes on the early stages of Mahanadi Mahseer (Tor mosal var. mahanadicus) *J. Asiat. Soc. Sci*., **19(2)**: **197-209.**

Dhasmana, N. and Lal, M. S. (1993). Length-weight relationships of a hill stream fish Garra gotyla (Gray) p 291-298. In: H. R. Singh(ed.). *advances in limnology*. Narendra Publishing House, Delhi.

Hile, R. (1936). Age and growth of *Cisco leucichthys artedt* (Lesueur) in the Lakes of North-Eastern *Highlands. Wisconsin. Bull. U. S. Bur. Fish.,***48**:**211-317.**

Hoda, S. M. S. (1987). Relative growths of body parts and length-weight relationship *in Boleophthalmus dussumieri* and *B. dentatus* of Karachi Coast. *Indian J. Fish*., **34(1)**: **120-127.**

Dhasmana, N. and Lal, M. S. (1993). Length-weight relationships of a hill stream fish *Garra gotyla* (Gray), pp 291-298. In: H. R. Singh (ed.). *Advances in Limnology*. Narendra Publishing House, Delhi.

Hile, R. (1936). Age and growth of Ciscoleucichthys artedt (Lesueur) in the lakes of North-Eastern High lands. *Wisconsin. Bull. U. S. Bur. Fish*., **48**:**211-317.**

Hoda, S. M. S. (1987). Relative growths of body parts and length-weight relationship in *Boleophthalmus dussumieri* and B. dentatus of Karachi Coast. *Indian. J. Fish*., **34(1)**:**120-127**

Hugghins, E. J. (1959). Parasites of fishes in south Dakota. S. Dak. Exper. Sta. Bull., **484: 73.**

Hunter, G . W . and Hunter, W. S. (1938). Studies on the host reactions to larval parasites 1. The effect on weight. *J. Parasitol.*, **24**: **477-481**

Jhingran, V. G. 1975. Fish and fisheries if India. Hindustan Publishing Corporation(India). New Delhi.

1-954.

Krishnamoorthi, B. (1971). Biology of thread fin bream Nemipterus japonicas (Bloch). *Indian. J. Fish*., **18(1-2):1-21.**

Lal, M. S. 1980 a. Ecobiological studies of some hillstream fishes of Garhwal Himalayas 4. Length-weight relationship of Schizothorax plagiostomus (Heckel). ***Indian. J. Zoot.,* 21(1-3):79-81.**

Lal, M. S. (1980) b. Ecobiological studies of some hillstream fishes of Garhwal Himalaya 6. Occurrence of certain protozoan and trematode diseases in Schizothorax plagiostomus. *Indian. J. Zoot.*, **21(1-3): 125-33.**

Lal, M. S. (1980) c. Ecobiological studies of some hillstream fishes of Garhwal Himalayas, Length weight relationship of Tor tor. *Indian J. Zoot.*, **21(1-3): 91-95.**

Lal, M. S. and Nautiyal, P. (1980). Ecological studies of some hillstream fishes of Garhwal Himalayas 2. Length-weight relationship of Tor putitora (Ham.). *Indian J. Zoot.* **21(1-3): 107-110.**

LeCren, E. D. (1951). The length-weight relationship and seasonal cycle in gonad weight and condition in the perch (Perca fluviatilis). *J. Anim. Ecol.,* **20(2): 201-19.**

Martin, W. R. (1949). The mechanism of the environmental control of body form in fishes. Univ. Toronto. *Stud. Biol.,* **58(70):2-91.**

Misra, M. (1982). Studies on fishery biology of Schizothorax richardsonii (Gray), on economically important food fish of Garhwal Himalaya. D.Phil. Thesis Garhwal University, Srinagar (Garhwal) **1-215**.

Misra, M. and Lal, M. S. (1980). Eco-biological studies of some hill stream fishes of Garhwal Himalayas, 7. Occurrence of certain protozoan and trematode diseases in Schizothorax richardsonii. *Indian. J. Zoot.,***21(1-3):111-115.**

Nautiyal, P. (1985). Length-weight relationship and relative condition factor of the Garhwal Himalayan Mahseer with reference of its Fishery. *Indian J. Anim. Sci*., **55(1):65-70.**

Table 1. Incidence (as %) of infection in different sexes, size and seasons groups of Schizothorax richardsonii.
% of infection

	Schizothorax richardsonii			Schizothorax plagiostomus		
	Low	Medium	High	Low	Medium	High
Sex						
Male	27.27	29.54	43.19	26.31	42.10	31.59
Female	34.21	34.21	31.58			100
Size group (cm)						
10-20	33.33	33.33	33.34			
20-30	33.33	33.33	33.34	41.18	29.41	29.41
30-40	36.36	33.33	30.30	31.25	31.25	37.15
40-50	9.09	27.27	63.64			
Season						
Summer	34.48	24.14	41.38	12.50	37.50	50.00
Monsoon	31.82	31.80	36.36	29.42	35.29	35.29
Winter	27.59	41.38	31.03	50.00	25.00	

Table 2. Regression data for linearity (analysis of variance).

	df	SS	MS	F	Significance F
S. richardsonii (Male)					
S.S. due to regression	1	0.482948	0.482948	13.170306	0.001219
Residual S.S.	26	0.953207	0.036662		
Total	27	1.436156			
Equation y= 0.408815+1.336236x					
S. richardsonii (Female)					
S.S. due to regression	1	1.400664	1.400664	153.0482	2E-15
Residual S.S.	41	0.375223	0.009152		
Total	42	1.775888			
Equation y= 0.56974+2.006157x					