*The Scientific Temper*
VOL-X, NO.1&2; JANUARY-JULY, 2019
ISSN 0976 8653, E ISSN 2231 6396
**A Web of Science Journal**
e-mail:letmepublish@rediffmail.com
**Doc ID :** https://connectjournals.com/03960.2019.10.27

# STATISTICAL ANALYSIS OF MONOGENEAN POPULATIONS INFESTING FRESH WATER FISH *CHANNA PUNCTATUS*

**RUCHI SHARMA AND YOUGESH KUMAR**
Department of Zoology
D.A.V. College, Muzaffarnagar- 251 001, INDIA
e-mail: dryougeshkumar@gmail.com

**ABSTRACT**

During routine course of morphological and taxonomical investigations on monogenetic trematodes of economically important fish hosts, periodical observations were made to evaluate population dynamics and statistical analysis of monogenetic trematodes during September 2006 to August 2010. The data on monogenetic trematodes, infecting the fishes of the genus *Channa* collected at random intervals throughout the course of investigation is presented and evaluated in this paper. Whole data collected throughout the year is presented in tabular form. The data obtained is analyzed for parameters such as prevalence, mean abundance, mean intensity, simpson's index, chi square test and "G" log- likelihood test.

**Key words:** Monogeneans, Freshwater Fish, *Channa*, Population dynamics, Seasonal occurrence.

## INTRODUCTION

Monogeneans (flukes) are a group of hermaphroditic parasites best known as flatworms. Term "monogenea" means born once, and refers to the simple mode of life cycle. They are obligate parasites of aquatic and semi-aquatic organisms because they are unable to withstand desiccation (Bychowsky, 1957). In general, fish are seldom affected by monogeneans (Schmahl and Mehlhorn, 1985) but fish forms the main host for the majority of the known monogeneans (Euzet and Combes, 1998; Lim, 1998). In heavy infections they can kill captive fishes and occasionally wild ones (Schell, 1970).They are mainly ectoparasites of the skin or gills of fish or aquatic vertebrates. They are attached to the host surface by a characteristic opisthaptor, which is species-specific and has hooks and hooklets (order Monopisthocotylea) or clamps (order

Polyopisthocotylea). This study aimed at determining the population dynamics and seasonal influence on occurrence of monogeneans on freshwater fish *Channapunctatus*.

**MATERIALS AND METHODS**

Fish *Channapunctatus* for the present studies wereroutinely obtained from the local fish markets and different water sources of Muzaffarnagar and were screened for the presence of parasites inthe laboratory. For the collection ofmonogeneans,Mizelle (1936, 38) freezing technique was employed. Low temperature, not only relaxes the worms, but also helps in automatic removal of mucous in which these worms were entangled. Gills were removed from fish body and placed in separate tubes, half filled with water and kept in refrigerator for 8-48 hours and shaken vigorously. Similarly skin was scraped with the help of a sharp scalpel in a petridish having small amount of water and kept in refrigerator for 8-48 hours. Live parasites were detected more easily due to their movements. The parasites were washed thoroughly several times with chilled distilled water with pressure, to remove mucous or debris adhering with them. The worms were fixed in hot 4% neutral formaldehyde for 8-12 hr.

A thorough record of basic data comprising the number of host specimens examined, number of host specimens infected and the number of parasites collected were maintained throughout the years. The available data was analyzed for parameters such as prevalence, mean abundance, mean intensity, simpson's index, chi square test and "G" log- likelihood test with the help of formulae as suggested by Bush et al. 1997 such as**:-**

**Prevalence Percentage –** It is used for expressing the percentage of total number of host infected in relation to its total number of host examined; observations were recorded annually and calculated by the following formula-

$$\textbf{Prevalence} = \frac{\text{Total number of host infected}}{\text{Total number of host examined}} \textbf{ X } 100$$

**Mean density or Abundance -** It takes into account the total number of parasites in relation to total number of host examined; observations were recorded month-wise and season-wise by the following formula

$$\text{Relative density or Abundance} = \frac{\text{Mean no. of parasites}}{\text{Total number of host examined}}$$

**Mean intensity -**It takes into account the total number of parasites in relation to total number of host infected; observations were recorded month-wise and season-wise by the following formula

$$\text{Mean intensity} = \frac{\text{Mean no. of parasites}}{\text{Total number of host infected}}$$

**Simpson's index-:** $SI = \sum_{i=1}^{S} (Pi)^2$

where, S = The number of species

Pi = Proportion of the i the species

In = Natural logarithm.

**Chi- square test ($X^2$ test)-**

$$\therefore X^2 \text{ test} = \Sigma \frac{(O-E)^2}{E}$$

Where Σ = Summation

O = Observed value

E = Expected value

**"G" log- likelihood test (using the 2x2 contingency tables):**

^

$$G = 4.60517 [ \Sigma f_i \log f_{i\_} \Sigma f_i \log f_i]$$

**RESULTS AND DISCUSSION**

The data obtained from the study of populations of monogeneans infesting *Channa punctatus*during different annual cycles from September 2006 to August 2010 was analysed statistically as per Bush et.al. 1997and is thereby presented in Table 1-4.

**Simpson 's index (C):** In *Channa punctatus*, the monogeneans were dominant during August and March (0.25), April (0.4444), May and June (1) and July (0.29) in 2006-07; In 2007-08 the monogeneans were dominant during April (0.5069) and May (1). In 2008-09 the monogeneans were dominant during August and May (0.25), February (0.3125), April (1.0020) and July (1); In 2009-10 the monogeneans were dominant during February

(0.25) and March (0.29).

**Chi-square test:** In *Channa punctatus* **(**2006-07), at 1 degrees of freedom the obtainable value of 'x²' at 1% level of significance is 6.635 as found on reference to 'x²' table and the 'x²' values calculated in this experiment are 3, 15, 72, 758.5, 168, 360, 557.33, 240, 80, 35, 258.33, 3, 2.5, 24 and 3 respectively. In 2007-08, at 1 degrees of freedom the obtainable value of 'x²' at 1% level of significance is 6.635 as found on reference to 'x²' table and the 'x²' values calculated in this experiment are 22.5, 15, 63, 80, 255, 15, 542.5, 240, 70, 2.5, 15 and 8 respectively. In 2008-09, at 1 degrees of freedom the obtainable value of 'x²' at 1% level of significance is 6.635 as found on reference to 'x²' table and the 'x²' values calculated in this experiment are 3, 58.5, 8, 240, 1023, 864, 288, 209.25, 3, 30, 8, 8, 483, 3, 15 and 8 respectively. In 2009-10, at 1 degrees of freedom the obtainable value of 'x²' at 1% level of significance is 6.635 as found on reference to 'x²' table and the 'x²' values calculated in this experiment are 3, 3, and 24 respectively.

**"G" log— likelihood test:** In *Channa punctatus* **(**2006-07) at 3 degrees of freedom the obtainable value of 'G' at 1% level of significance is 11.345 as found on reference to table and the 'G' value calculated in this experiment are higher than the tabulated value in most of the cases, except August (11.0901). In 2007-08 the 'G' value calculated are also higher than the tabulated value in most of the cases, except May (8.3169) and July (11.0892). In 2008-09 the 'G' value calculated are also higher than the tabulated value in most of the cases, except August (11.0892). In 2009-10 the 'G' value calculated are also higher than the tabulated value in more cases, except February and July (11.0892), April (6.933), May (5.5464), June (8.3197).

The studies on the seasonal variation of fish parasites with respect to the fluctuation of the entire parasite fauna of any host species are still meager.The study on seasonal dynamics of parasitism levels serves as a tool to understand broad aspects that determine the population biology of the host-parasite system (Chubb, 1982). According to Allumma and Idowu, 2011 parasite infection in *Clarias*was found to be higher in May compared to the other months of the study period, the prevalence, intensity and abundance of helminthes parasites in dry season are higher than in wet season of the year. Bashirullah and Hafizuddin, 2007 stated that the tendency of monthly infection of trematode shows the prevalence to peak twice a year, remaining high from January to April, dropping during May to July, and increasing again during the months of August to November.

Ecto-parasites are the most dangerous group that causes severe mortalities (Shalaby and Ibrahim, 1988). Monogenetic trematodes usually don't cause any problems in the natural environment unless the host is continually reinvested so that massive numbers of worms build up on the fish (Woo, 1995). After studying the trematodes Gyrodactylus *colemanensis, G. salmonis*by Cone and Cusack (1988), it was observed that the intensity of infection during winter to a spring peak followed by a decrease during the summer months.Change in water temperature is commonly regarded as one of the most important factors determining the presence and abundance of monogenea. Koskivaara et al., 1991 stated that seasons influence the abundanceof monogenea, crustacea and cestoda and temperature is commonly regarded as one of the most important factors determining the existence and abundance of monogenean parasites. Chubb, 1977 observed a different seasonal pattern of the abundance changes in oviparous gill parasites of Dactylogyrus and Eudiplozoon (with maximum abundance observed in summer) compared to viviparous Gyrodactylus species (with maximum abundance in winter). Pojmanska, 1995 found optimum period for the growth of one *Dactylogyrus* sp. was in winter and the maximum infection level of other sp.was in autumn or spring when the water temperature was cool. Bauer, 1962 stated that the seasonal abundance of dactylogyrids are sometimes more influenced by other biotic and abiotic factors such as light, pH, oxygen and salinity than by temperature. Shulman, 1989; Ozer and Erdem, 1999;Ozer, 2002 have studied the seasonal changes of monogenean infection in fish. Zitnan, 1978; Pojmanska and Chabras, 1993 reported that the

seasonal variations of Dactylogyrids are influenced by temperature, oxygen concentrations of water, size of fish host and fish maturity. Dogiel, et. al. 1970, Hanzelova and Zitnan, 1985 stated that the seasonal environmental changes of water (e.g. temperature, pH, conductivity) affect the occurrence of parasites of aquatic hosts, some of them tend to produce more at a higher water temperature, others prefer a cool water temperature. From a graphical perspective, their use in simple and visual inspection of the plots remains the best method to evaluate existing patterns (McGill et al. 2007).

In the present study Fishes were susceptible to heavy infestation with parasites mainly in winter season when fishes were weakened by hibernation. In *Channapunctatus* the highest infection rate of monogeneans was recorded during winter while the lowest infection rate was recorded during summer. Theprevalence, mean abundance and mean intensity of helminth parasites was high from November to June, dropping during July to September and increasing again from October in 2006-07; In 2007-08 theprevalence, mean abundance and mean intensity of helminth parasites was high from November to May and dropping during June (no result) to July and increasing again during the months of August to October; In 2008-09 theprevalence, mean abundance and mean intensity was high from November to February and dropping during March to April and increasing again during the months of May to October ; In 2009-10 theprevalence, mean abundance and mean intensity was found only during February and March and no result was found during April to August and data not present during the months of September to November**.**The higher infection in this period could be attributed to the suitability of the environmental condition to the parasites or low resistance of the

| Months 2006-2007 | No. of fish Total | exami-ned M/F | Standard length (cm) | No. of fish in-fected | Mono-genean | P(%) | MA | MI | Simpson's index (c) | Chi- square test ($x^2$) | "G"log-likeli hood test |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Aug** | 7 | M- 4 | 7.4-8.2 | 1 | 2 | 25 | 0.2857 | 2 | 0.25 | 3 | |
| | | F- 3 | 8.1-8.3 | 0 | 0 | 0 | | | 0 | 0 | 11.0901 |
| **Sep** | 8 | M- 3 | 7.9-8.9 | 0 | 0 | 0 | 0.5 | 4 | 0 | 0 | |
| | | F- 5 | 8.7-8.9 | 1 | 3 | 20 | | | 0.0625 | 15 | 12.4768 |
| **Oct** | 9 | M- 7 | 9.9-10.3. | 3 | 15 | 42.8571 | 1.6666 | 5 | 0.04 | 72 | |
| | | F- 2 | 10.1-10.4 | 0 | 0 | 0 | | | 0 | 0 | 16.633 |
| **Nov** | 11 | M- 6 | 9.8-10.5 | 2 | 39 | 33.3333 | 2.3636 | 8.6667 | 0.00262 | 758.5 | |
| | | F- 5 | 12.4-12.6 | 1 | 13 | 20 | | | 0.00591 | 168 | 27.3487 |
| **Dec** | 14 | M- 6 | 13.2-13.8 | 1 | 19 | 16.6666 | 2.1428 | 7.5 | 0.00277 | 360 | |
| | | F- 8 | 13.7-14.9 | 3 | 41 | 37.5 | | | 0.00535 | 557.3333 | 36.4117 |
| **Jan** | 10 | M- 7 | 12.8-13.3 | 2 | 22 | 28.5714 | 0.31 | 5.1667 | 0.00826 | 240 | |
| | | F- 3 | 11.9-13.2 | 1 | 9 | 33.3333 | | | 0.01234 | 80 | 18.02 |
| **Feb** | 10 | M- 4 | 9.6-11.3 | 1 | 6 | 25 | 1.7 | 4.25 | 0.02777 | 35 | 19.4107 |
| | | F- 6 | 13.2-14.6 | 3 | 28 | 50 | | | 0.01147 | 258.3333 | |
| **Mar** | 10 | M- 3 | 12.6-12.9 | 0 | 0 | 0 | 0.2 | 2 | 0 | 0 | 15.2477 |
| | | F- 7 | 12.8-13.8 | 1 | 2 | 14.2857 | | | 0.25 | 3 | |
| **Apr** | 14 | M- 9 | 13.1-14.6 | 2 | 3 | 22.2222 | 0.2142 | 1.5 | 0.44444 | 2.5 | 22.1808 |
| | | F- 5 | 14.3-15.1 | 0 | 0 | 0 | | | 0 | 0 | |
| **May** | 7 | M- 3 | 11.9-12.4 | 0 | 0 | 0 | 0.2857 | 1 | 0 | 0 | 12.4772 |
| | | F- 4 | 12.3-12.7 | 2 | 2 | 50 | | | 1 | 0 | |
| **Jun** | 9 | M- 6 | 13.2-13.8 | 3 | 3 | 50 | 0.3333 | 1 | 1 | 0 | 16.6338 |
| | | F- 3 | 13.4-14.5 | 0 | 0 | 0 | | | 0 | 0 | |
| **Jul** | 9 | M- 4 | 9.8-11.4 | 1 | 5 | 25 | 0.3888 | 3.5 | 0.04 | 24 | 15.2477 |
| | | F- 5 | 13.2-13.7 | 1 | 2 | 20 | | | 0.25 | 3 | |

**Table - 1 Data showing the population dynamics & statistical results of helminth parasites of Channapunctatusfrom August 2006 to July 2007**

fish to parasitic infestation as a result of poor feeding habit and lower food abundance which is likely to weaken their immunity at that period.

**ACKNOWLEDGEMENTS**

Authorities of D.A.V. College Muzaffarnagar are acknowledged for providing infrastructural and laboratory facilities. This research was supported through a financial assistance in the form of a Major Research Project No. F- 34/470 (2008) SR Dated 29 December 2008 from University Grants Commission, New Delhi.

**REFERENCES**

Allumma, M. I. and Idowu, R. T.(2011).Prevalence of Gills Helminth of ClariasGariepinus in Baga Side of Lake Chad. *J. Appl.Sci. Environ. Manage.* 15 (1) 47 – 50.

Bush, A.O. Lafferty, K. D. and Lotz, J. M..andShostak, A.W. (1997). Parasitology meets ecology on its own terms: Margolis *et al*. revisited. *Journal of Parasitology*, 83, 575–583.

Bashirullah, A. K. andHafizuddin, A. K. M. (2007). Seasonal distribution and population structure of P. fusiformis (Digenea: Bucephalidae) in E. vacha in Kapti lake, Bangladesh. *Saber, Universidad de*

*Oriente, Venezuela.* 19(2): 137-144.

Bauer, O. N. (1962). *Parasites of freshwater fish and the biological basins for their control.* Israel Program Scientific Translations, Jerusalem, p. 236.

Bychowsky, B. E. (1957).Monogenetic Trematodes. Their Systematics and Phylogeny. Translated from Russian by Hargis, W. J., Jr. 1961. *American institute of Biological Sciences*, Washington, D.C. 627 PP.

Chubb, J. C. (1977). Seasonal occurrence of helminthes in fresh water fishes. Part 1 *Monogenea.*

*Advances in Parasitology.* Academic Press. London and New York. **15**: 133-199.

Chubb, J.C (1982). Seasonal occurrence of helminthes in freshwater fishes. Part IV. Adult CestodaNematoda and Acanthocephala. *Advances in Parasitology.*20*,* 1-292.

Cone, D.K. and Cusack, R. (1988). A study of *Gyrodactyluscolemanensis*Mizelle and Krilsky, 1967 and *Gyrodactylussalmonmis* Yin and Sproston, 1948 (Monogenea**)** parasitizing captive salmonids in Wovw Scotia (Canada) *Can. J. Zool,* 66 (2): 409-415.

Dogiel, V. A. Petruschievski, G. K. and Polyanski, Yu. I. (1970). *Parasitology of fishes*. Edinburg,

Oliver and Bovs Ltd. histopathology.*Ind. Jour. Exp. Biol.* 12 (6), 584-586.

Euzet, L. and Combes, C. (1998). The selection of habitats among the Monogenea.*InternationalJournal for Parasitology 28*, 1645-1652.

Hanzelova, V. and Zitnan, R. (1985).Epizootiologic importance of the concurrent monogenean invasion in carp. *J. Helminthologia*, 22: 277-283.

Koskivaara, M..Tellervo, E.V. and Prost, M. (1991).Seasonal occurrence of gyrodactylidmonogeneans on the roach (*Rutilusrutilus*) and variations between four lakes of differing water quality in Finland. *Aqua Fenn*, 21: 47-55..

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 fresh water fishes. *Illinois Biol. Mongr.*, **17:** 1-81.

Mcgill B.J., Etienne R.S., Gray J.S. Alonso D. Anderson M.J. Benecha H.K., Dornelas M., EnquistB.j., Green J.L., He F, Hurlbert A.H.,Magurran A.E., Marquet P.A. Maurer B.A.,Ostling A, Soykan C.U., Ugland K.I., White E.P. (2007).Species abundance distributions moving beyond single prediction theories to integration within an ecological framework. *Ecol. Lett***10:** 995-1015.

Ozer, A. and Erdem, O. (1999). The relationships between occurrence of ectoparasites, temperature and culture conditions: a comparison of farmed and wild common carp *(Cyprinuscarpio*L., 1758) in the

Sinop region of northern Turkey.*J. of Natural History*, 33: 483-491.

Ozer, A. (2002). Co-existence of *Dactylogyrusanchoratus* Dujardin, 1845 and D. *extensus*Mueller &

Van Cleave 1932 (Monogenea), parasites of common carp *(Cyprinuscarpio*). *Helminthologia*, 39 (1): 45-50.

Pojmanska, T. (1995). Seasonal dynamics of occurrence and reproduction of some parasites in four cyprinid fish cultured in ponds. Monogenea. *ActaParasitol. Polonica*, 40: 79-84.

Pojmanska, T. and Chabras, M. (1993). Parasites of common carp and three introduced cyprinid fish in pond culture. *Actaparasitologica*, 38: 101-108.

Roux, D.J. (1994).Role of biological Monitoring in Water Quality Assessment and a case study on the Crocodile River, *Eastern Tranvaal*. MSc- Thesis, RAU, 130 PP.

Schell, S. C. (1970). "*How to know the Trematodes*." Wm .C.Brown, Dubuque, Iowa.

Schmahl, G. and Mehlhorn, H. (1985). Treatment of fish parasites: 1. Praziquantel effective against monogenea (*Dactylogyrusvastator*, *Dactylogyrusextensus*, *Diplozoonparadoxum*). *Z. Parasitenkd*. 71: 727-737.

Shalby, S.I. and Ibrahim, M.M. (1988).Therelationship between the monogenetic tremato descichlidogy rustubicirrusmagnus first record in Egypt and morphological lesions of gills among tilapia nilotica.Egyption J. of comparative pat and Clin. Path., **1***(9):* 116-126.

Shulman, B.S.(1989). Effect of ecological factors on the abundance dynamics of *Gyrodactylus* (Monogenea, gyrodactylidae) under polar conditions. In: O.N.

Bauer (Ed.), Parasites of freshwater fishes of North-West Europa. *Petrozvodsk*: 136-145.

Woo, P.T.K. (1995). "Fish diseases and disorder." Vol. 1. Protozoon and metazoan infections phylum Arthropoda.

Zitnan, R. (1978). Epizootiological importance of G. *shulmani*Ling. Mo-en.1962 Monogenea) in carp breeding. IV. *Int. Cong. of Parasitology (Warszawa), Short Comm Section.* C, 200-201.

http://www.scientifictemper.com/