Pertanika J. Trop. Agric. Sci. 35 (4): 805 - 814 (2012)

PERTANIKA JOURNALS

TROPICAL AGRICULTURAL SCIENCE

Journal homepage: http://www.pertanika.upm.edu.my/

Relationship between Size of Fish and Parasitic Intensity in Four Freshwater Fish Species from Tasik Merah, Perak, Peninsular Malaysia

Rahman, W. A.* and Hamidah Saidin

School of Biological Sciences, Universiti Sains Malaysia, 11800 Minden, Penang, Malaysia

ABSTRACT

A total of 79 fish from Tasik Merah, Perak, Peninsular Malaysia were examined for the presence of fauna. The fish species examined included *Puntius schwanenfeldii*, *Puntius gonionotus*, *Hampala macrolepidota* and *Notopterus notopterus*. Meanwhile, a total of ten species of the parasites were found to be belonging to two major groups of nematode and trematode. The nematodes were *Capillaria* sp., *Spinictus inermis*, *Echinocephalus* sp., *Microtetrameres* sp., and *Cucullanus* sp. The trematodes were *Paradiplozoon malayense*, *Paradiplozoon barbi*, and *Dactylogyrus* sp.

Keywords: Freshwater fish, Tasik Merah, parasite, fish size

INTRODUCTION

The total fish production for Malaysia in 1999 was 1,251,765 metric tons, of which 3,366 metric tons were from freshwater fish (Department of Fisheries, Malaysia Annual Fisheries Statistics, 1995), implying the economic importance of freshwater fish as an important protein source for Malaysians and the world population.

Some observations on the parasites of Malaysian freshwater fish have been reported in the literature, but these are mainly limited to the genus such as *Clarias* sp.*, the* catfish (Fernando & Furtado, 1963; Furtado & Tan, 1973; Leong & Mokhtar, 1981; Lim, 1991; Rahman & Ali, 1991; Rahman *et al.*, 1992; Shaharom *et al.*, 1992; Rahman & Bakri, 2008), or *Channa striatus*, the snakehead (Fernando & Furtado, 1963; Leong & Mokhtar, 1981; Rahman & Ali, 1991; Rahman & Bakri 2008) and *Anabas testudineus*, the climbing perch and *Trichogaster pectoralis*, the snakeskin Gouramy (Fernando & Furtado, 1963; Leong & Mokhtar, 1981; Rahman & Ali, 1991; Rahman & Bakri, 2008). Generally, their findings revealed that

ARTICLE INFO

Article history:
Received: 17 January 2011
Accepted: 19 October 2011

E-mail address:
arawahab@usm.my (Rahman, W. A.)
* Corresponding author

ISSN: 1511-3701

Clarias sp. are often infected by various species of nematodes and trematodes, while acanthocephalans are also found in *Channa* sp., and *Trichosgaster* sp. usually show low infection rates.

The present paper describes the parasitic fauna of four infrequently reported freshwater fishes from Tasik Merak, Perak, Peninsular Malaysia: *Puntius schwanenfeldii*, *Puntius gonionotus*, *Hampala macrolepidoata* and *Notopterus notopterus*. In this study, the relationship between fish size and parasite intensity was investigated.

MATERIALS AND METHODS

This study was carried out at Tasik Merah, Perak (longitude 100° 32'E, latitude 5° 10'N), Peninsular Malaysia. Only four major species, namely, *Puntius schwanenfeldii (lampam sungai, tinfoil barb) Puntius gonionotus (lampam jawa, java barb), Hampala macrolepidot (sebarau, jungle perch)* and *Notopterus notopterus (belida, grey leatherback)* were included in this research. Twenty fish from each of the species *Puntius schwanenfeldii (lampam sungai or tinfoil barb), Puntius gonionotus, Hampala macrolepidota* and *Notopterus notopterus* were randomly chosen and brought back to the laboratory in an ice box.

Total fish length was measured in cm. The fish were divided into three sub-groups labelled as small, medium and large size-groups because the larger the size, the older the fish were and the longer the exposure of the fish to their environment. For *P. schwanenfieldi*, the fish that measured ≤ 15.5 cm were classified as small, 18.5 – 20.5 cm as medium and ≥ 21.0 cm as large. For *P. gonionotus*, the fish that measured ≤17.5 cm were classified as small, 18.0 – 19.0 cm as medium, and ≥ 19.5 cm as large. As for *H. macrolepidata*, the fish that measured ≤ 21.5 cm were classified as small, 22.0 – 28.0 cm as medium, and ≥ 29.0 cm as large. For N. notopterus, however, the fish that measured < 18.5 cm were classified as small, 19.0 – 20.0 cm as medium, and ≥ 21.0 cm as large.

The external features were visually examined for ectoparasites. The gills of the fish were removed and examined for helminthes under a dissecting microscope. The fish were slit open and the contents were collected on Petri dishes, and examined under a dissecting microscope. All the parasites found were individually picked and kept in small bottles. Trematodes and acanthocephalans were preserved in formaline-alcohol-acetic acid, while nematodes were preserved in 5% glycerine with 70% alcohol. Trematodes were stained with semichon's acetic carmine stain and mounted permanently in Canada balsam. Nematodes and acanthocaphlans were cleared in lactophenol and examined in temporary mounts.

The obtained data were then analyzed by using student t-tests or Wilcoxon-Man-Whitney tests, depending on the number of replicates. H_o was when the mean intensity of parasite in every size-group of fish was similar. H_a was when the mean intensity of parasite in every size-group of fish was different. Nonetheless, the data could not be analyzed by using ANOVA since there were different numbers of replicates in every

subgroup and most of them were less than 6. As a result, comparisons of the mean parasite intensity between the small- and medium-sized groups, small- and large-sized groups, as well as the medium- and large–sized groups for every fish species were carried out.

RESULTS

Eight species of ecto- and endoparasites were found to infect the four fish species (Table 1). The two most abundant parasites were the nematodes *Cucullanus* sp and *Spinitectus inermis*. *Cucullanus* sp was recovered only from *Puntius schwanenfeldii* while *Spinitectus inermis* was found in all the four species of fish. The number of parasites obtained showed no dependence on fish size. The other two nematodes infecting the fishes were *Paradiplozoon* sp. and *Capillaria* sp. The four species of trematodes infecting the fish were *Paradiplozoon barbi*, *P. malayense*. *P. barbi*, *Echinocephalus* sp. and *Dactylogyrus* sp. *Paradiplozoon barbi* infecting *Hampala macrolepidota* were present in a large number in one fish host while only one a single *P. malayense* was found in *P. Schwanenfeldii*. Meanwhile, *Hampala macrolepidota* seemed to be a favourite host for many parasites as compared to the three other species of fish.

For *P. schwanenfeldii* and *P. Gonionotus,* similar results were observed (Tables 2 & 3; Fig.1). The larger the size group, the percentage of the infected fish and the number of parasite would also increase. For *P. schwanenfeldii*, 100% of the fish examined from the medium- and large-sized groups were infected with parasites as compared to 71.4% in the small size-group. Meanwhile for *P. gonionotus*, 14.3% of the fish in the small-sized group were infected and for the medium-sized group, 33.3% were infected. The large-sized group showed a 42.9% infection rate.

In *H. macrolepidota,* the reverse was observed (see Table 4 and Fig.1). The

TABLE 1
The total number of parasites infecting the four fish species in Tasik Merah, Perak

	P. schwanenfeldii	*P. gonionotus*	*H. macrolepidota*	*N. notopterus*	No. of host
Cucullanus sp	79	-	-	-	1
Spinitectus inermis	23	20	1	10	4
Microtetrameres sp	-	-	6	-	1
Capillaria sp	-	-	3	-	1
Paradiplozoon barbi	-	-	10	-	1
P. malayense	1	-	-	-	1
Echinocephalus	-	-	-	1	1
Dactylogyrus sp	-	-	2	-	1
Total no. of parasites	103	20	22	11	
Parasite species	3	1	5	2	

TABLE 2
Various parameters of the various parasite populations in different size groups of *Puntius schwanenfeldii*

	Puntius schwanenfeldii					
	≤15.5 (small)		18.5-20.5 (medium)		≥21.0 (large)	
	No. infected fish (%)	Mean intensity (range)	No. infected fish (%)	Mean intensity (range)	No. infected fish (%)	Mean intensity (range)
Nematode						
Cucullanus sp	2 (28.6)	3.0 (2-4)	5 (83.3)	4.6 (1-10)	7 (100)	7.1 (1-15)
Spinitectus inermis	2 (28.7)	6.5 (5-8)	2 (33.3)	3.5 (3-4)	2 (28.6)	1.5 (1-2)
Trematode						
Paradiplozoon malayense	-	-	-	-	1 (14.3)	1.0 (1)
No. of fish examined	7		6		7	
% of fish infected	71.4		100		100	
No. of parasite species	3		3		3	
Total no. of parasite	20		32		54	
Statistical analysis (1) t-test between ≤15.5 (small) and 18.5-20.5 (medium) showed that the mean intensity of the parasite between them is the same (p≤0.05).						
Statistical analysis (2) t-test between the small and large fish showed that the mean intensity of the parasite between them is the same (p≤0.05).						
Statistical analysis (3) t-test between the medium and large fish showed that the mean intensity of the parasites between them is the same (p≤0.05).						

percentage of the infected fish and the number of parasites decreased with group size. The percentage of the infected fish was the highest in the small-sized group, whereby 62.5% of the in the small-sized group were infected with a total number of 17 parasites, as compared to only 20% of the big sized fish with a total number of 3 parasites.

Notopterus notopterus showed the same result as those of *P. Schwanenfeldii* and *P. gonionotus* (Table 5). However, the total number of the parasites found was only 2 in the large-sized but only 1 in the medium-sized groups. In the small-sized group, on the contrary, no parasite was found.

Based on the obtained data and their analysis, no relationship was found between the mean intensity of the parasites and fish sizes for all the four species of fish. However, if we consider the percentage of infected fish and the total number of parasite obtained from every group, the data were significant.

DISCUSSION

The present study was carried out to show the parasitic infection with the size of

TABLE 3
Various parameters of the parasite populations in different size groups of *Puntius gonionotus*

	Puntius gonionotus					
	≤17.5 (small)		18.0-19.0 (medium)		≥19.5 (large)	
	No. infected fish (%)	Mean intensity (range)	No. infected fish (%)	Mean intensity (range)	No. infected fish (%)	Mean intensity (range)
Nematode						
Spinitectus inermis	1 (14.3)	4.0 (4)	2 (33.3)	4.0 (1-7)	2 (28.6)	4.0 (4)
No. of fish examined	7		6		7	
% of fish infected	14.3		33.3		42.9	
No. of parasite species	1		1		2	
Total no. of parasite	4		8		9	
Statistical analysis (1) t-test between ≤17.5 cm (small) and 18.0-19.0 cm (medium) showed that the mean intensity of the parasite is the same ($p \leq 0.05$).						
Statistical analysis (2) t-test between the small and large fish showed that the mean intensity of parasite is the same ($p \leq 0.05$).						
Statistical analysis (3) t-test between the medium and large fish showed that the mean intensity of the parasites is the same ($p \leq 0.05$).						

the fish rather than species specificity. However, it is interesting to note that most of the parasites found in this study showed specificity toward certain fish hosts. Paul and John (2002) pointed out that it is not uncommon to find a fish harbouring several parasite infections rather than only one single parasite species. In the present study, only a single parasite showed a wide range of host infections, i.e. *S. inermis* was found to infect all the four fish species.

According to Dogiel *et al.* (1970), the diversity of the parasites in a fish host is dependent on the life-span of the host. The longer the life-span, the movement of the host during their life will also increase. This will contribute to the accumulation of the parasites in the host. The age of the fish can be represented by the length, and the longer the length of the fish, the age must be older and vice versa. Thus, a fish of longer length can be assumed to have accumulated more parasites as compared to shorter ones.

The relationship between parasites and the length of host may vary depend on the species of both the hosts and the parasites (Hila Bu & Leong, 1997; 1999). They found that the distribution of twin worm *Paradiplozoon* sp was independent on the size of the infected fish hosts while the number of *Dactylogyrus* sp decreased with the increase of host's size in *Hampala macrolepidota*. The decreasing number of gill parasites in the largest-sized group of fish could be due to the morphological changes of the gill filaments which might

TABLE 4
Various parameter measurements of the parasite population in the different size groups of *Hampala macrolepidota*

	Hampala macrolepidota					
	≤21.5		22.0-28.0		≥29.0	
	No. infected fish (%)	Mean intensity (range)	No. infected fish (%)	Mean intensity (range)	No. infected fish (%)	Mean intensity (range)
Nematode						
Unidentified sp 2	1 (12.5)	2.0 (2)	-	-	-	-
Microtetrameres sp	2 (25.0)	1.0 (1)	1 (16.7)	1.0 (1)	1 (20.0)	3.0 (3)
Capillaria sp	-	-	1 (16.7)	1.0 (1)	-	-
Spinitectus inermis	1 (12.5)	1.0 (1)	-	-	-	-
Trematode						
Paradiplozoon barbi	1 (12.5)	10.0 (10)	-	-	-	-
Dactylogyrus sp	1 (12.5)	2.0 (2)	-	-	-	-
No. of fish examined	8		6		5	
% of fish infected	62.5		16.7		20.0	
No. of parasite species	5		2		1	
Total no. of parasite	17		4		3	
Statistical analysis (1)- t-test between ≤21.5 cm (small) and 22.0-28.0 (medium) fish showed that the mean intensity of the parasite is the same ($p \leq 0.05$).						
Statistical analysis (2) Wilcoxon-Man-Whitney test between the small and large fish showed that the mean intensity of the parasite is the same.						
Statistical analysis (3) Wilcox-Man-Whitney test between the medium and large fish showed that the mean intensity of parasites is the same.						

have affected the attachment of parasites, the acquired immunity of the hosts and other behavioural changes of the host.

According to Poulin and Rohde (1997), however, the host body size is correlated to the number of ectoparasites infecting them. This may be due to the changes in the host's diet with age. The larger the size of a fish, the size of the space and target site for the colonization and infection of parasite will also increase. Meanwhile, the intensity of parasite infection increases with the size of the host due to the longer exposure and larger surface area of the attachment of ectoparasite (Hanek & Fernando, 1978; Liang & Leong, 1991). Furtado and Tan (1973) also have almost the same opinion regarding this matter. They found that larger hosts have greater incidence of being infected by parasite but this is due to the differences in the level of immunity rather than size. However, according to Paul and John (2002), beside the size of host fish, other factors that may influence parasite distribution and variability within infected fish are geographic range and local habitat

TABLE 5
Various parameters of the various parasite populations in the different size groups of *Notopterus notopterus*

	Notopterus notopterus					
	≤18.5 (small)		19.0-20.0 (medium)		≥21.0 (large)	
	No. infected fish (%)	Mean intensity (range)	No. infected fish (%)	Mean intensity (range)	No. infected fish (%)	Mean intensity (range)
Nematode						
Spinitectus inermis	-	-	1 (10.0)	8.0 (8)	1 (20.0)	2.0 (2)
Echinocephalus sp	-	-	-	-	1 (20.0)	1.0 (1)
No. of fish examined	5		10		5	
% of fish infected	-		10.0		40.0	
No. of parasite species	-		1		2	
Statistical analysis (1) Wilcoxon-Man-Whitney test between ≤18.5 cm (small) and 19.0 – 20.0 (medium) showed that the mean intensity of the parasite is the same.						
Statistical analysis (2) Wilcoxon-Man-Whitney test between the small and large fish showed that the mean intensity of parasite is the same.						
Statistical analysis (3) Wilcoxon-Man-Whitney test between the medium and large fish showed that the mean intensity of the parasite is the same.						

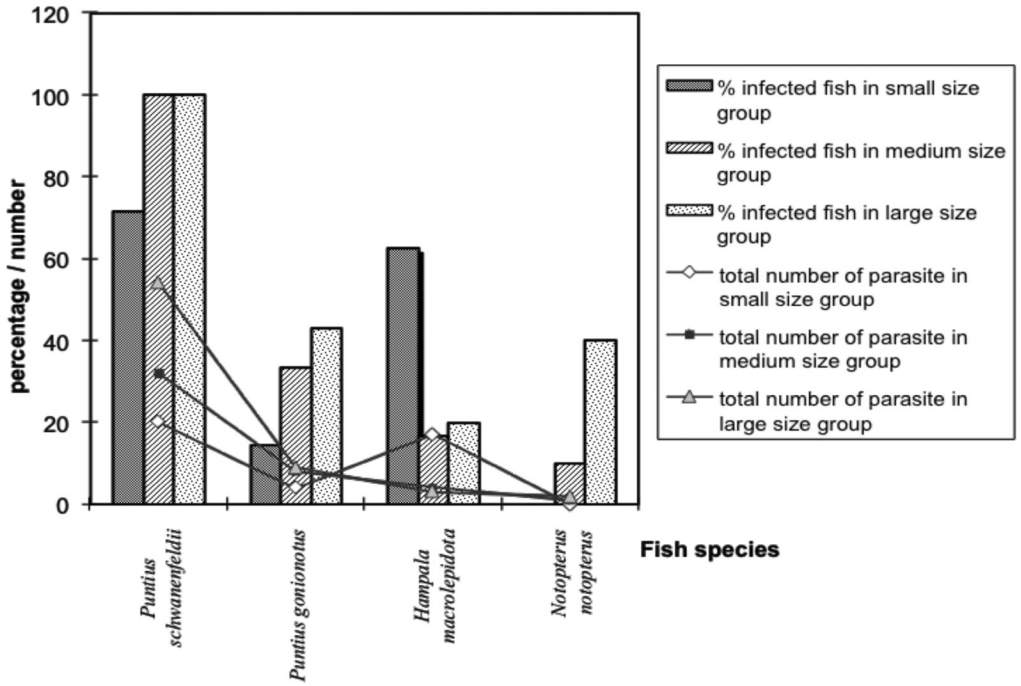

Fig.1: The percentage of the infected fish and the total number of the parasites in the small-, medium- and large-sized groups

used by the fish. The researchers further reiterated that local habitat diversity and species richness will increase the probability of the correct host and habitat requirements for parasites with direct lifecycle or free-living stage will be met.

CONCLUSION

In conclusion, larger fish tend to harbour more parasites as compared to smaller ones. However, this also depends on the species of fish. In this study, only *H. macrolepidota* was found to have shown the reverse. More parasites were found in the smaller size groups as compared to the bigger ones. However, this could be due to the differences in the immune response rather than the size alone.

REFERENCES

Betterton, C. (1979). Some observation on natural infections of *Transversotrema patialense* (Soparkar, 1924) in fish and snail hosts from Penang, Malaysia. *Malay. Nat. J*., *32*, 271-279.

Chiang G. L., & Leong T. S. (1979). Parasites of fishes from Sungai Pinang and Sungai Teluk Bahang Pulau Pinang, Malaysia. *Malay. Nat. J*., *32*, 247-251.

Department of Fisheries Malaysia. (1996). Annual Fisheries Statistics 1995, Ministry of Agriculture, Vol. 1, p. 211.

Dogiel, V. A., Petrushevski, G. K., & Polyanski, I. (1970). *Parasitology of fishes (translated from Russian, 1967 by Kabata Z)*. England: T. F. H. Ltd.

Oliver and Boyd Ltd. (1982). In Z. Darmawan, Z., *Metazoan parasites of Thrissocles hamilthoni (Grey), T. mystax (Schneider) and Sillago sihama (Forskal) from Teluk Aling*. (B.Sc. Thesis dissertation), School of Biological Science, University Sains Malaysia.

Fernando, C. H., & Furtado, J. I. (1962). Some studies on helminth parasites of freshwater fishes, *UNESCO First Regional Symposium on Scientific Knowledge of Tropical Parasites*, University of Singapore, pp. 293-302.

Fernando, C. H., & Furtado, J. I. (1963). Helminth parasites of some Malayan freshwater fishes. *Bull. Nat. Mus. Singapore*, *32*, 45-71.

Food Agriculture Organization of United Nation (FAO) Yearbook (2000). Vol. 90/1, p. 617.

Furtado, J. I., & Tan, K. L. (1973). Incident of some helminth parasites in the Malaysian catfish *Clarias batrachus* (Linnaeus). *Verh. Internat. Verein. Limnology*, *18*, 1674-1685.

Hanek, G., & Furtado, J. I. (1973). Gyrodactylus fermandoi sp. N. (Monogenea: Gyrodactylinae) from Clarias batrachus L. in Malaysia. *Zoo. Anz. 191*, 196-198.

Hanek, G., & Fernando, C. H. (1978). Spatial distribution of gill parasites of *Lepomis gibbosus* (L.) and *Ambloplites rupestris* (Raf.). *Can. J. Zool*., *56*, 1235-1240.

Hila Bu, S. S., & Leong, T. S. (1997). Fish parasite communities in tropical reservoirs along Perak River, Malaysia. *Hydrobiologia*, *356*, 175-181.

Hila Bu, S. S., & Leong, T. S. (1999). Spatial distribution of Gill Monogeneans in a Tropical Cyprinid from Cenderuh Reservoir, Perak, Malaysia. *Malay. Nat. J*., *53*, 239-247.

Leong, T. S., & Mokhtar A. S. (1981). Parasites of freshwater fish from Alor Setar and Sungai Petani fish markets, Kedah. *Malay. Nat. J*., *34*, 135-141.

Liang, K. S., & Leong, T. S. (1991). The distribution of gill monogeneans in cultures golden snapper, *Lutjanus johni* Bloch. *Trop. Biomed*., *8*, 123-130.

Lim, L. H. S. (1991). Three new species of *Bychowskyella* Achmerow, 1952 (Monogenea) from Peninsular Malaysia. *Syst. Para*., *19*, 33-41.

Paul, J. B. H., & John, D. R. (2002). *Handbook of fish biology and fisheries*. Blackwell Publishing.

Poulin, R., & Rohde, K. (1997). Comparing the richness of metazoan ectoparasite communities of marine fishes: Controlling for host phylogeny. Oecologia, *110*, 278-283. In J. B. H. Paul & D. R. John (Eds.), *2002 Handbook of fish biology and fisheries* (pp. 359 – 384). Blackwell Publishing.

Rahman, W. A., & Ali, A. (1991). Helminthic fauna of some freshwater fish caught from two habitats in Pulau Langkawi, Kedah. *Trop. Biomed*., *8*, 23-26.

Rahman, W. A., Ali, A., & Ros, A. C. (1992). On some Helminthic parasites of the Malayan catfish, *Clarias batrachus* in pond cultures from north Malaysia. *Trop. Biomed., 9*, 1-2.

Rahman, W. A., & Bakri, M. (2008). On the endoparasitic fauna of some paddy field fishes from Kedah, Peninsular Malaysia. *Journal of Bioscience*, *19*, 107-112.

Shaharom, F., Kartini, M., & Sheikh Omar, A. R. (1992). *Boviena serialis* infestation in the catfish *Clarias macrocephalus*. *J. Vet. Malaysia*, *4*(2), 151.