FISH PARASITES ON CULTURED FISH

*by Evelyn O. Castillo**

With the present world population boom, increased output of protein supply is specially important. One of the cheapest sources of protein is fish. But how to obtain the maximum yield of fish has become one of the major problems faced by both aquaculturists and fishery biologists.

Many factors influence the abundance and quality of fish supply, one of them being fish disease. Epidemics have been preceded usually by severe parasitic infection. To formulate preventive measures or treatment of fish disease, an investigator must first know what kind of epizzotic organism causes the fish depletion and then relate this to aspects such as the condition, age, size and population density of the host, and the water source and its physical and chemical properties.

With the advent of fish cultivation in cages, fish parasites affecting cultured fish in inland waters have been extensively studied. Information on fish parasites infecting fish cultured in lake waters, however, has been limited to scanty fragments resulting from investigative surveys and monitoring activities done by fisheries research institutions. The present study has been conducted in Lido Lake, Indonesia but its findings may apply to any similar body of water in tropical Asia.

Sachlan (1978) has listed eight fish parasites, mostly ectoparasites, prevalent among carp fry, java carp and gouramy cultured in ponds. It includes *Ichthyophthirius multifilis*, an ectoparasitic ciliate that had caused epidemic outbreaks in West Java in 1932. Furthermore, he mentioned that there are four groups of parasites infecting fishes in open waters where infection of *Acanthocephala* in *Ophiocephalus striatus* was recorded.

The seven month investigation (August 1981 – February 1982) conducted by BPPD on the ectoparasites infecting fishes in Lido Lake revealed seven species of parasites. Among these parasites, *Dactylogyrus* sp., a monogenean trematode infecting the gills, and *Myxobolus*, sp., a myxosporean, disclosed a high percentage of

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* BIOTROP-TAB Scholar from: Mindanao State University, College of Fisheries, Marawi City, Philippines.

prevalence. *Epistylis* sp., a facultative parasitic ciliate appeared only on the last month of observation. Among sporozoans represented by myxosporidian species, *Myxobolus* sp., *Myxosoma* sp., and *Thelohanellus* sp. are the most common parasites of carp, whereas *Henneguya* sp. infects gouramy. These myxoporeans if given the right conditions could multiply rapidly and create serious problems among fish farmers (Rukyani, 1978).

The study reported here therefore, attempts to determine if there is any difference in the occurrence of parasites between the fishes that came from the two different sources, i.e., pond-water and well-water, cultured in the lake. It also tries to know the appearance of the parasitic fauna in cultured fish.

Preparation

A brood stock of *Cyprinus carpio* (Majalaya strain) was induced to spawn in one of the sterile tanks at Inland Fisheries Research Institute (BPPD) — Sempur. After it has spawned, one-half of the total number of eggs produced was brought to the ponds of BPPD — Cibalagung for the unsterile treatment, while the other half was left on the sterile tanks at BPPD-Sempur. The resulting fry were then exposed to their respective treatments (i.e., sterile and unsterile) for 10 days before the fish were stocked in the fish cages set up in Lido Lake.

Eight fish cages measuring 1.5 m x 1 m x 1 m were placed in the lake. Each treatment was replicated four times. The cages were connected with a nylon rope and were each one meter apart. The ropes were knotted at the end of the cages and then tied to an extension rope connected to an anchor. This method gave stability to the cages even if there were strong winds. Floats made of styrofoam were also installed in the four surface corners of each cage to ensure stable flotation.

A day before stocking, 30 fish samples were taken from the two fish sources and examined for any presence of parasite. On stocking day (Jan. 14), the fish were transported in oxygenated cellophane bags and stored in ice boxes to keep the temperature low. There were ± 1000 fishes stocked in each cage.

Duration and Sampling

The study started from the time the brood stock had spawned and lasted up to the last sampling date (Jan. 3–March 16). For a period of 10 weeks, a total of five samplings were made with a two-week interval for each sampling. Ten fishes were sampled randomly, except for the first sampling where 15 fishes were obtained by the use of scoop nets, then put into marked cellophane bags and packed in ice boxes. They were then brought to the laboratory on the same day of sampling and stocked into the sterile aquarium that corresponded to the cages. The fish were fed five times a day using a commercial feed.

Examination

A total of 440 fishes were examined for parasitic occurrence. Total length of each fish was measured. The fish were sacrificed by pithing and examination was done within 72 hours upon arrival. The fins were cut and examined separately for any presence of parasite and the slime was scraped from its body. Gills were also cut and examined under a microscope (Fernando et.al., 1972).

Identification of the parasite was made by using the taxonomic key on fish parasites by Hoffman (1967) and also with the aid of some research personnel of the Fish Parasitology section in BPPD-Bogor. Photographs were also taken for further verification.

Physical and Chemical Parameters

For the purpose of the study, there were five physico-chemical parameters analyzed. Water temperature and pH were measured inside and outside the cage, using the Hach apparatus and a pH meter, respectively. Water samples were also taken at the same time for DO, ammonia and free carbon dioxide determination. They were analyzed on the same day of the sampling (except for NH_3, using Supomo's "Handbook on Bio-Assay Techniques" (unpublished, 1982).

Data Analysis

The prevalence of infestation was calculated as the number of infected fish divided by the number of fish samples that were examined, expressed in percentage (%). Intensity of parasite infection was expressed as the ratio between the total number of parasites per infected fish.

The Parasites

According to Dogiel (1970), the parasite fauna of cultured carp shows a considerable degree of uniformity, which consists mainly of species with a direct life cycle.

In this study, there were only seven parasites found to have infected the cultured fish in the two treatments. The species identified mainly belonged to either Protozoa or Monogenea. For the purpose of this study, the ectoparasites were identified as *Trichodina* sp., *Ichthyopthirius* sp., *Dactylogyrus* sp., *Gyrodactulus* sp., *Myxobolus* sp., *pistylis* sp., and *Oodinium* sp.

PROTOZOA

Trichodina sp.

Trichodina sp. was found infecting the skin and gills of fishes that came from

the pond-water during the pre-stocking examination. But fishes from the well-water gave negative results. However, in the first sampling period, this parasite was already found infecting the fishes that came from the two fish sources, until the last day of observation.

In the pond-water, out of 220 fishes 129 were infected (59.0%) and there was heavy intensity of infestation throughout. In the well-water, from 106 to 220 fishes (48.4%) were infested and there was only moderate intensity of infestation (Table 1).

Host and distribution: *Trichodina* sp. is mainly an ectoparasitic ciliate infecting gills and skin of fish. It possesses a simple life cycle. This parasite can be found in both freshwater and marine fishes (Polyanskii, 1970).

According to Amlacher (1970), *Trichodina* species rarely give rise to pathological manifestations of disease, but high infestation could weaken the fish, making it susceptible to other harmful parasitic attacks.

Ichthyopthirius sp.

This was also found infesting the fishes from the pond-water but not in the well-water fishes in the pre-stocking examination. In the subsequent weeks of observation, however, infestation of this parasite was observed in the fishes from the two sources.

Ichthyopthirius sp. was found in the gills, fins and skin scrapings of 135 out of 220 (61.6%) fishes from pond- water, and from 88 to 220 (40.4%) of fishes from well-water. Total intensity was 9.3 and 7.5 in both pond-water and well-water fishes, respectively (Table 1).

Host and distribution: *Ichthyopthirius* sp. is a cosmopolitan ciliate and has caused a serious epidemic among cultured fish in Indonesia (Sachlan, 1952). The disease caused by this parasite is commonly called whitespot disease (Amlacher, 1970) and can also be found infesting aquarium fishes. The infective stage of this parasite is limited to within 33 to 48 hours. Within this time, the parasite must find a new host or it will die (Buschkiel and Shaperclaus in Ammlacher, 1970).

Colonies of this parasite were attached to the fins of 23 out of 220 fishes (10.6%) from the pond-water and 17.6 of 220 (8.0%) of the well-water fishes. Intensity in pond-water fishes was higher (6.1) compared with the well-water fishes (5.2). (Refer to Table I.)

Host and distribution: *Epistylis* sp. is a non-suctorian ciliate and can also affect the respiratory process of the fish and hasten secondary infection (Hoffman, 1967). Among the species assigned to the genus Epistylis only two have been reported as ectocommensals on fishes (Arthur, 1975, unpublished thesis). Dechtiar in Arthur (1975) reported that *Epistylis* sp. was found in one of the Canadian freshwater fishes *Etheostoma exile* Girard from northern Ontario.

Oodinium sp.

Gymnodinian swarmers and the parasitic stage of this parasite was found in the skin and fins of the fish of 35 out of 220 (16.0%) pond-water fishes and 18 out of 220 (8.0%) from the well-water fishes. Intensity in the two treatments were relatively the same (see Table I).

Host and distribution: *Oodinium* species is a dinoflagellate. Its flagella do not show , however, on forms attached to fish. Hoffman (1959), reported that *oodinium limneticum* can be found in the skin of freshwater aquarium fish and causes disease in aquarium fish hatcheries.

Myxobolus sp.

Spores of *Myxobolus* sp. were observed in the gills of from 66 to 220 (29.8%) pond-water fishes and 51 out of 220 (23%) well-water fishes. Total intensity of infestation of both treatments were moderate.

Host and distribution: *Myxobolus* sp. are actually obligate internal parasites and can cause considerable damage to cultivated fish, particularly Cyprinids (Sachlan, 1952). Its infective outcome can cause large swellings on the gills of the fish. These nodular swellings can disturb the respiratory function of the gills. Rukyani (1978) reported *Myxobolus koi* and *Thelohanellus pyriformis* from cultured common carp in Indonesia. Between the two, *M. koi* common affects the young common carp.

MONOGENEA

Dactylogyrus sp.

This parasite was found in the gills of 125 out of 220 (56.6%) fish samples from pond-water and 90 out of 220 (41%) well-water fishes. Total mean intensity were 8.7 and 5.4 in the pond-water and the well-water fishes, respectively (see Table I).

Host and distribution: *Dactylogyrus* sp. is a monogenetic trematode that mainly infects the gills of the fish. They are commonly called gill flukes and obstruct respiratory function (Amlacher 1970). In the BPPD report (Aug. 1981 — Feb. 1982), this parasite gave a very high percentage of incidence among common carp cultured in Lake Lido.

Gyrodactylus sp.

These skin flukes were found infecting the skin and fins of *Cyprinus carpio*. Out of 220 fishes from the pond-water 93 (42.0%) were found to be infected. Of the well-water fishes, 59 out of 220 (26.6%) were infected. There was not much difference in the total mean intensity in both treatments (Table I).

Host and distribution: Buschkiel (1951) reported the occurrence of this parasite in the kumpay, a variety of common carp at Cisaat, West Java. This parasite was also found among *Trichogaster pectoralis* in an aquarium at sepat-siam. In the BPPD investigation, this parasite was also observed among cultured carp in Lido Lake. *Gyrodactylus elegans* is the only species found in Europe (See Sachlan 1952).

Table I. Prevalence and intensity of individual parasite between the two fish sources.

Parasites	Well-Water		Pond-Water	
	Prevalence	Intensity	Prevalence	Intensity
PROTOZOA				
Trichodina sp.	48.4	mod.	59.0	heavy
Ichthyopthirius sp.	40.4	7.5	61.6	9.3
Epistylis sp.	8.0	5.2	10.6	6.1
Oodinium sp.	8.0	4.3	16.0	5.2
Myxobolus sp.	23.0	mod.	29.8	mod.
MONOGENEA				
Dactylogyrus sp.	41.0	5.4	56.6	8.7
Gyrodactylus sp.	26.6	2.1	42.0	3.3

The Occurrence of individual parasite

During the pre-stocking examination, fishes that were exposed to the pond-water environment were already infected with *Trichodina*, *Ichthyopthirus* and *Dactylogyrus*. Examination of fishes from the well-water produced negative results. But on the first two weeks of exposure in the lake infestation of these parasites, except for *Dactylogyrus*, were already found in both treatments. On the 4th week of sampling, *Gyrodactylus* appeared in the pond-water fishes together with *Dactylogyrus* in the well-water fishes. On the 6th week of sampling, *Myxobolus* sp. were found infesting the gills of fishes from both the pond-water and well-water sources. On the fourth period of sampling, *Epistylis* sp. and *Oodinium* sp. made their appearance in the fishes examined (Table II).

The early appearance of *Trichodina* sp., *Ichthyopthirius* sp. and *Dactylogyrus* sp., may be due to the fact that these parasites have already been infecting the fishes in the pond-water, before these fishes were transferred to the lake. The parasites could have propagated in the new environment, therefore infesting other fishes in the cages. This observation also supports the findings of Layman in Dogiel (1970) that these three parasites begin to attack the fish within 6-12 days of exposure. Sinaga (1982) also found out that *Dactylogyrus* sp. and *Trichodina* could infect the fish within seven days. The high fish population in the cages during the first weeks may have also hastened the infestation. *Gyrodactylus* sp. was found to infect the

fish on the fourth week of observation, contrary to Sinage's (1982) findings that this parasite infected the fish in the pond within seven days of exposure, together with *Trichodina* sp., and *Ichthyopthirius* sp. It can also be viewed that *Dactylogyrus* sp. and *Myxobolus* sp. gave a very high percentage of prevalence, which confirms the BPPD findings in 1982 (Table III).

On the other hand, it has been revealed that *Ichthyopthirius* sp. has the highest mean intensity in both treatments in contrast to the low intensity of *Gyrodactylus* sp. (Table IV). This observation bears out Teels' (1955) findings that there exists an

Table II. Chronological appearance of parasites in relation to period of sampling.

Pond-Water Pre-Stocking Sampling	Well-Water Pre-Stocking Sampling
Trichodina sp. Ichthyopthirius sp. Dactylogyrus sp	None
FIRST PERIOD (First 2-weeks) Trichodina sp. Ichthyopthirius sp. Dactylogyrus sp.	Trichodina sp. Ichthyopthirius sp.
SECOND PERIOD (4th-week) Gyrodactylus sp.	Dactylogyrus sp. Gyrodactylus sp.
THIRD PERIOD (6th-week) Myxobolus sp.	Myxobolus sp.
FOURTH PERIOD (8th-week) Epistylis sp. Oodinium sp.	Epistylis sp. Oodinium sp.

Table III. Prevalence of individual parasite in relation to period of sampling.

Parasite species	Sampling Period				
	I	II	III	IV	V
A. pond-water,					
Trichodina	42	60	68	70	55
Ichthyopthirius	53	55	50	80	70
Dactylogyrus	7	36	70	75	95
Gyrodactylus	0	20	45	75	70
Myxobolus	0	0	13	43	93
Epistylis	0	0	0	23	36
Oodinium	0	0	0	30	50
B. Well-Water					
Trichodina	33	45	53	63	48
Ichthyopthirius	17	40	30	75	46
Dactylogyrus	0	10	55	65	75
Gyraodactylus	0	10	30	48	45
Myxobolus	0	0	10	30	75
Epistylis	0	0	0	20	20
Oodinium	0	0	0	10	30

Table IV. Intensity (mean) of individual parasite in relation to period of sampling.

Parasite species	Sampling Period				
	I	II	III	IV	V
A. Pond-Water					
Trichodina	mod.	heavy	heavy	heavy	mod.
Ichthyopthirius	2.8	6.1	2.2	19.8	15.4
Dactylogyrus	2.0	2.5	8.8	12.4	17.9
Gyrodactylus	0	6.0	3.9	5.1	1.5
Myxobolus	0	0	low	mod.	heavy
Epistylis	0	0	0	14.3	16.2
Oodinium	0	0	0	18.8	15.4
B. Well-Water					
Trichodina	low	mod.	heavy	mod.	low
Ichthyopthirius	1.4	2.6	1.8	19.7	12.1
Dactylogyrus	0	1.8	6.2	8.4	10.8
Gyrodactylus	0	1.5	3.7	3.8	1.5
Myxobolus	0	0	low	mod.	heavy
Epistylis	0	0	0	12	14
Oodinium	0	0	0	9.8	11.7

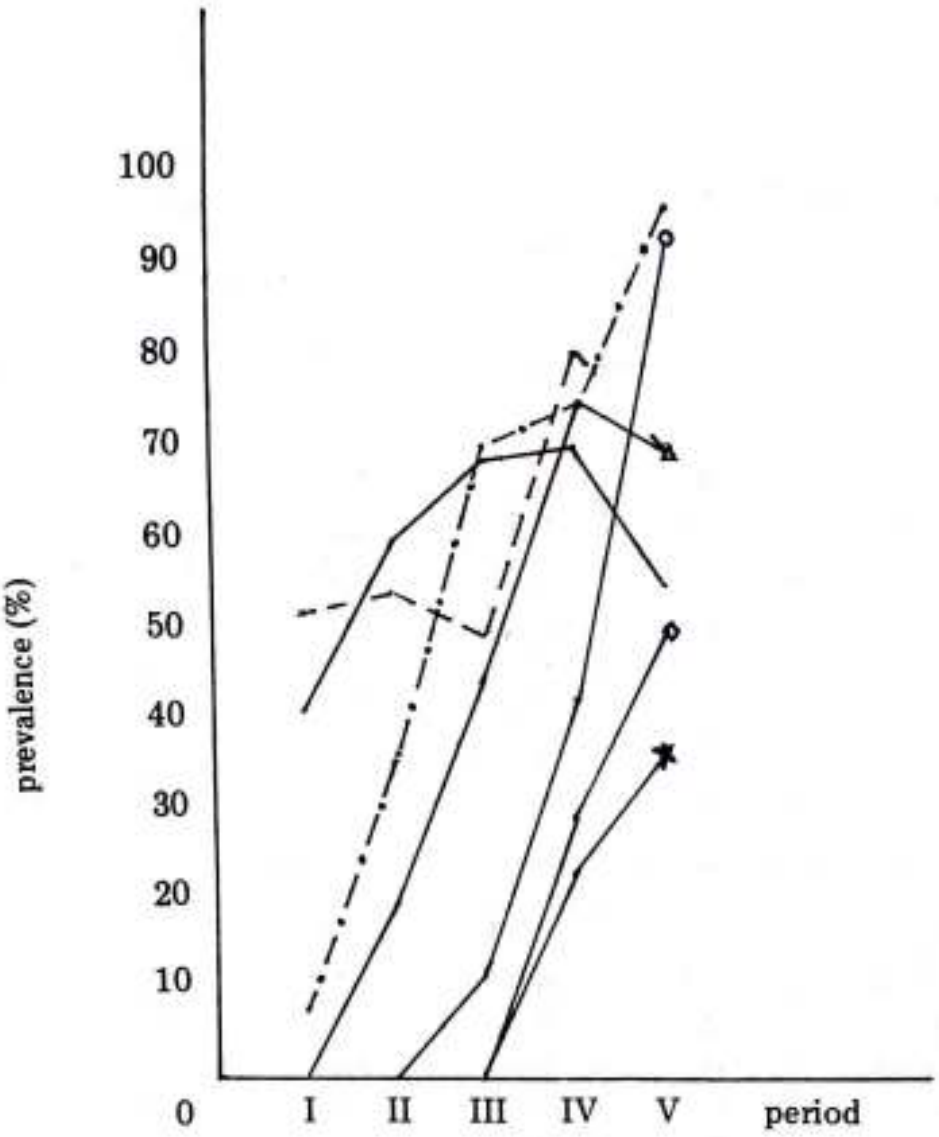

FIG. 1

Prevalence of individual pond-water parasite in relation to period of sampling.

Legend:

——— Trichodina
– – – – Ichthyopthirius
·–·–·– Dactylogyrus
o——o Myxobolus
□——□ Epistylis
—— Oodinium
△——△ Gyrodactylus

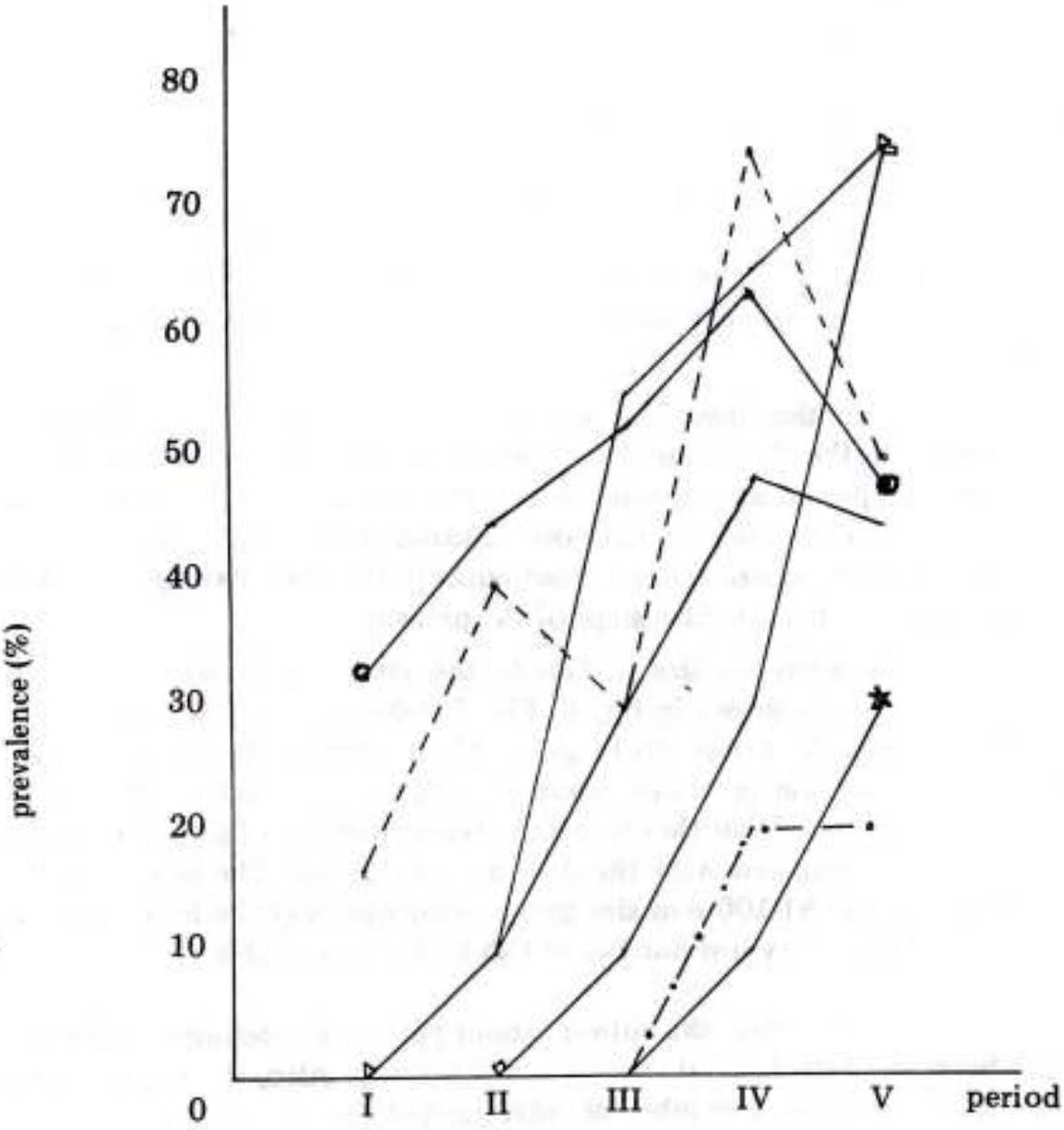

FIG. 2
Prevalence of individual well-water parasite in relation to period of sampling

Legend:
——Trichodina
- - - Ichthyopthirius
—·—· Dactylogyrus
●——●Myxobolus
▫——▫Epistylis
★——★Oodinium
▲——▲Gyrodactylus

antagonistic relationship between parasites of different species, where the increase in number of one parasite species causes the decrease in the number of the other parasites to the extent of its complete disappearance. Moreover, being viviparous, the *Gyrodactylus* sp. in the infective larval stage has a slow rate of infection. The appearance of *Myxobolus* sp. in the fishes from both sources on the sixth week of observation could demonstrate the transovarian phenomenon cited by Van Duijn (1973), where the resting spores of this parasite infecting the ovary of the blood stock are transmitted to the eggs in the ovary. When the eggs are spawned the spores are already present, lying in wait for the right conditions for it to develop within the internal organs of the fry. The *Epistylis* sp. and *Oodinium* sp. that appeared on the eighth week of sampling could have attacked the fish in the cages during their free-living state.

It was also found out that there was already total infestation among the fishes from the pond water on the third period of sampling and total infestation occurred on the fourth sampling period among fishes that came from the well water (Table V Fig. 3). This may be due to the fact that the cultured fishes were subjected to a homogeneous environment, where water is continuously flowing, thereby providing the ease of transmission of the infective stage of the parasites.

The correlation between the size of fish to the average number of parasite species inhabiting its body is shown in Fig. 6. Fig. 7 indicates the total number of fish in every size groups. According to Dogiel (1970), ectoparasite infestation increases as the size of the fish increases, because of the greater surface availability for attachment. It can be noted that there is a high average number of parasites in this 81-90 mm size group, compared with the 0-10 mm size group. The lower average number of parasites in the 91-100 mm size group compared with the 81-90 mm size group can be related to the very low number of fish in that size (Table VI).

In this experiment, however, the author cannot yet make a definite conclusion on this aspect because of the limited duration of the study. Also, the development of parasite fauna depends on a number of intermingled factors such as stocking density, physico-chemical factors and the age and condition of the host species (Sumawidjaja 1980).

After the termination of the study, a total of 929 out of ± 4000 (23.23%) fishes were recovered from the pond-water cages. From the well-water cage, 1166 out of ± 4000 (29.2%) fishes were recovered.

Individual analysis of parasites on both pond-water and well-water fishes revealed that the pond-water treatment is a limited factor and only significant in the appearance of *Trichodina* sp. and *Ichthyopthirius* sp. The period of exposure to the environment exerts an influence on the occurrence of *Oodinium* sp., *Myxobolus* sp., *Espistylis* sp., *Dactylogyrus* sp., and *Gyrodactylus* sp.

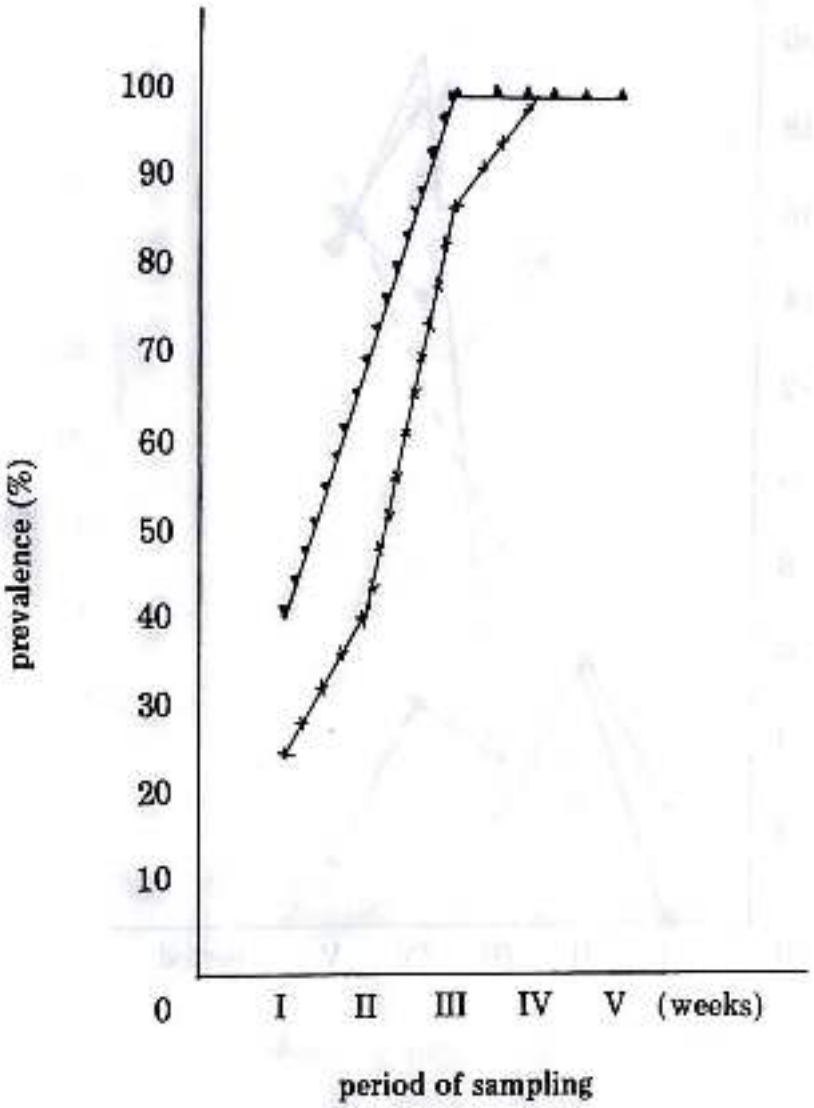

FIG. 3 Total prevalence of parasites

Legend:
▲—▲—▲ pond-water
×—×—× well-water

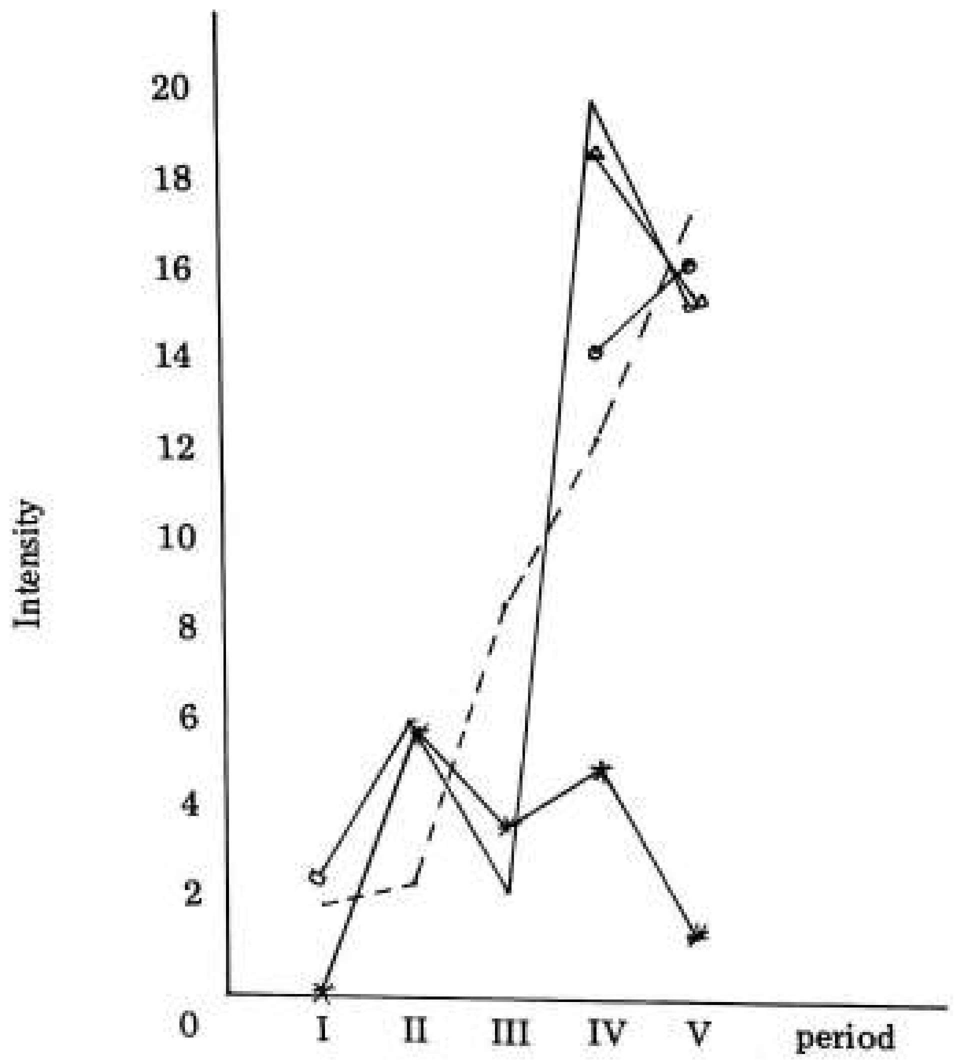

FIG. 4

Intensity of individual pond-water parasite in relation to period of sampling

Legend:

- Dactylogyrus
- Gyrodactylus
- Ichthyopthirius
- Oodinium
- Epistylis

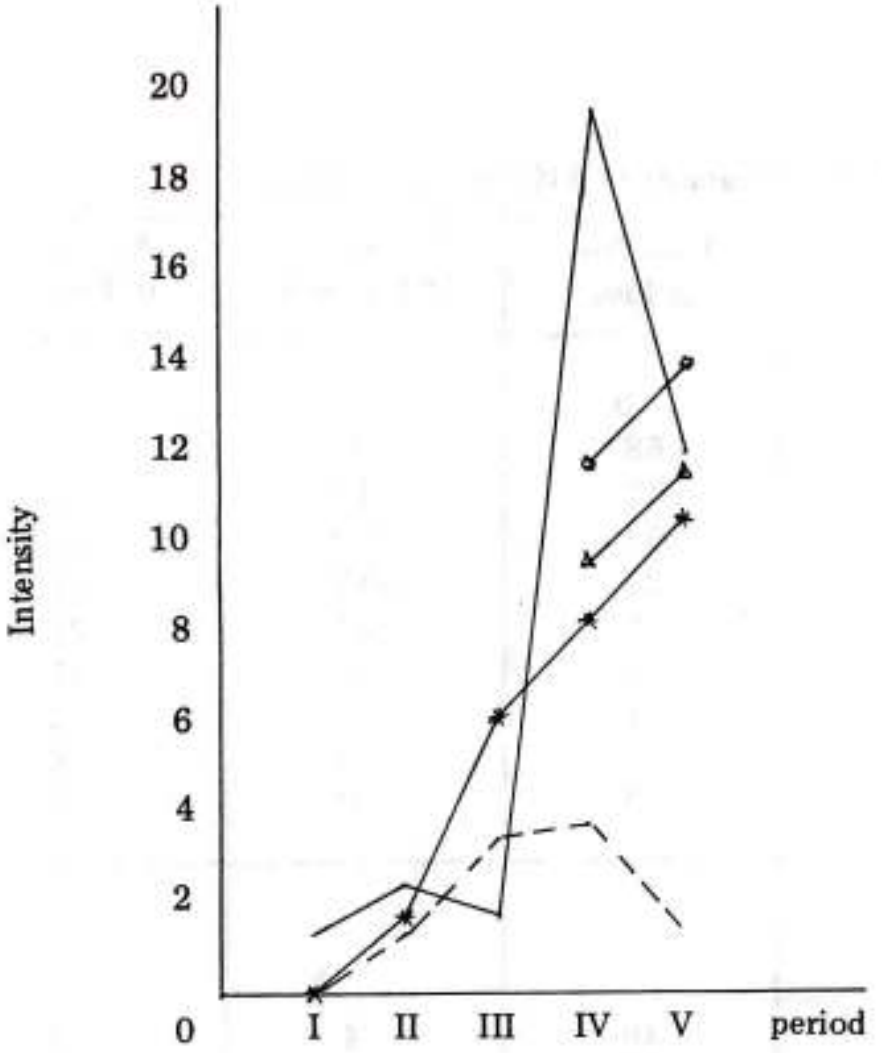

FIG. 5 Intensity of individual well-water parasite in relation to the period of sampling.

Legend:
– – –Dactylogyrus
*—*Gyrodactylus
▫—▫Ichthyopthirius
△—△Oodinium
○—○Epistylis

Table VI. Average number of parasite in different size groups.

A. Pond-Water Fish size (mm)	Total No. of Fish	Total No. of Parasites	Average No. of Parasites
0 – 10	0	0	0
11 – 20	68	141	2
21 – 30	47	451	10
31 – 40	69	1370	20
41 – 50	27	685	25
51 – 60	6	124	21
61 – 70	1	11	11
71 – 80	1	2	2
81 – 90	1	6	6
91 – 100	0	0	0
B. Well-Water Fish size (mm)			
0 – 10	16	4	3
11 – 20	55	20	4
21 – 30	37	339	9
31 – 40	49	861	18
41 – 50	26	536	20
51 – 60	12	225	19
61 – 70	16	265	17
71 – 80	5	81	16
81 – 90	3	71	24
91 – 100	1	18	18

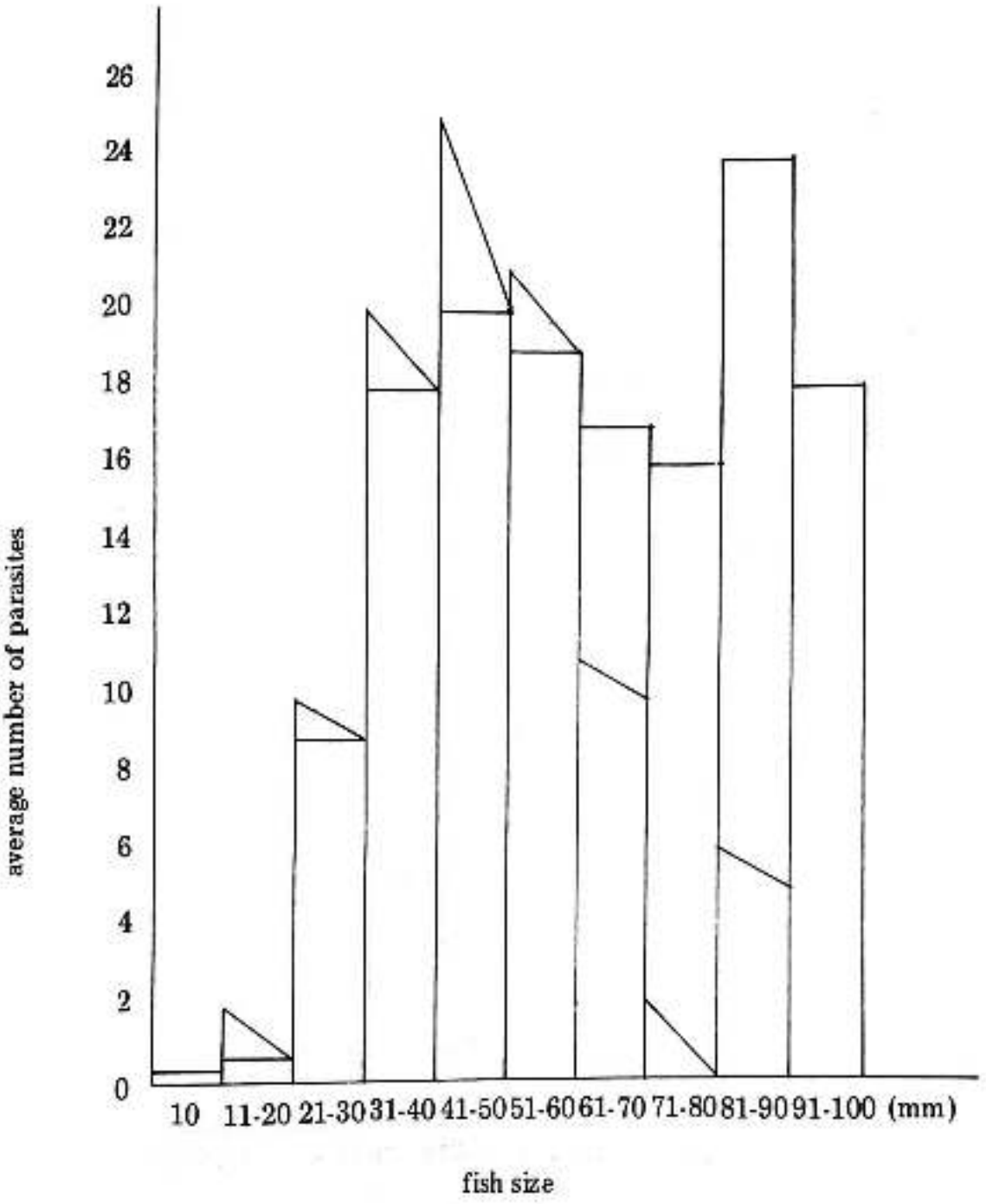

FIG. 6 Relationship between fish size and the average number of parasites

Legend:

pond-water

well-water

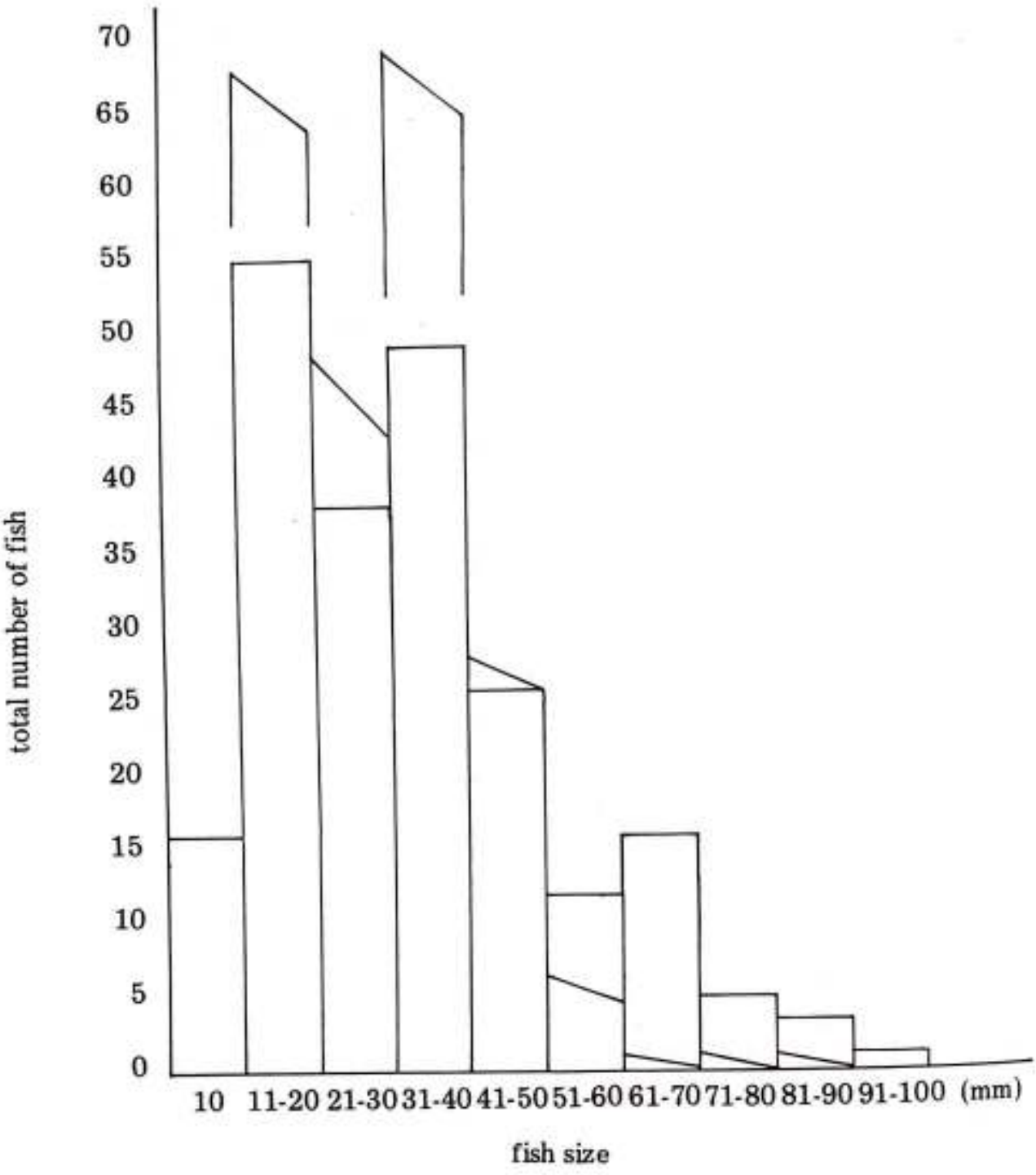

FIG. 7 Relationship between fish size and the total number of fish

Legend:

pond-water

well-water

Among the physical parameters recorded, temperature ranges from 25.5 – 28.2°C. The pH concentration ranges from 5.9–7.0. Dissolved oxygen (DO) ranges from 7.6 – 8.5 ppm; ammonia (NH_3) readings lie between .04122 – .04135 ppm; free carbon dioxide (CO_2) ranges from 2.0 – 12.0 ppm (Table VII).

Table VII. Values of physical and chemical parameters per sampling period.

Parameter	Depth	Sampling Period				
		I	II	III	IV	V
		1-19-83	2-9-83	2-23-83	3-2-83	3-16-83
Temperature °C	S	26.5	27.9	26.3	28.2	27.2
	3m	25.6	27.3	25.5	27.2	26.1
pH	S	6.1	6.2	6.4	6.7	7.0
	3m	5.9	6.0	6.3	6.5	6.8
Dissolved Oxygen (ppm)	S	8.2	8.0	8.5	8.1	8.3
	3m	7.9	7.6	8.1	7.7	7.8
Ammonia (ppm)	S	.04122	.04122	.04125	.04125	.04125
	3 m	.04125	.04135	.04135	.04135	.04125
Free-CO_2 (ppm)	S	11.0	8.3	7.0	5.3	2.0
	3m	12.0	10.2	8.6	6.1	3.3

Summary and Conclusions

It was found out that pond-water treatment exerts only a limited influence on the occurrence of parasite infection. But as the time of exposure grows longer, total infestation among the fishes from both water sources follows. It was also found out that parasites with a short life cycle, e.g. *Trichodina* sp. and *Ichthyopthirius* sp., appear earlier than those parasites which have a longer life cycle like *Myxobolus* sp. Fishes that came from the pond-water were found to have a higher prevalence and intensity of parasite infestation compared with well-water fishes.

Further studies of these parasites in connection with fish production is recommended, since the data obtained in this study were not adequate to draw definite conclusions on this aspect.

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