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Concerning pathogenicity of Dactylogyrus solidus Achmerov

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CONCERNING PATHOGENICITY OF DACTYLOGYRUS SOLIDUS ACHMEROV

by

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Preface to Translation[1]

Translation of this paper was undertaken as part of a long-term research project on the systematics, host-specificity and zoogeography of monogenetic trematodes.[2] Translation and editing were accomplished in the following manner:

1. Oustinoff[3] read translation on tape.
2. Mrs. Morales transcribed translation from tape to first typescript.
3. Hargis edited typescript.
4. Typescript retyped by Mrs. Morales.
5. Hargis again edited typescript for final corrections.

A conscious effort has been made to keep this translation as near the original as possible. It is probably inevitable, however, that some of the nuances of meaning in the original have been distorted or lost. For this we apologize to the author and the reader.

Certain passages were difficult to translate. Where a different English phrase seems to fit the author's meaning better or serves to clarify the text, it has been inserted in brackets. Certain obvious errors or misspellings in the original text were changed, less obvious ones are noted with (sic).

For convenience in referring to the Russian text the original pagination is given in the margin of the translation opposite the place where the new page begins. Occasionally figures or tables are somewhat displaced from their original page location; however, since they, themselves, are numbered sequentially no confusion should result.

This translation is intended as a service to researchers. Though effort has been made to make it comprehensible, accurate and useful, it is likely that improvements can be made. Should literary improvements or verification appear desirable it is suggested that the researcher make his own translation. Pagination is arranged to facilitate such activity. We will appreciate constructive suggestions for improvements in this and future translations.

Thanks are due to Mrs. Patricia C. Morales of the Virginia Institute of Marine Science who transcribed, typed and assembled the manuscript, and to Miss Evelyn Wells who assisted with final editing.

William J. Hargis, Jr.

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PARASITOLOGY

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CONCERNING PATHOGENICITY OF DACTYLOGYRUS SOLIDUS ACHMEROV

(Presented by Academician E. N. Pavlovski, 27 March 1951)

To the present, three species of gill monogenetic trematodes of genus Dactylogyrus have been known /to occur in the ponds operated by the/ in fish industries of the USSR: D. vastator, D. anchoratus and D. minutus. Of these, D. vastator has acquired considerable reputation for causing mass death of small carp. D. anchoratus which is widely distributed and D. minutus found in the Ukraine and earlier in Poland cause fewer deaths. p825

In 1948 A. Kh. Achmerov (1) described another species of the genus Dactylogyrus which he discovered on the gills of Amurean Sazan /carp/, specifically D. solidus. According to the data of Achmerov, D. solidus was imported in 1937 into the fish ponds of the European part of the USSR along with Amurean carp. D. solidus differs from D. vastator in being much larger. The length of the latter usually slightly exceeds 1 mm while D. solidus reaches 2 mm in length. In addition to this, the shapes of the attaching apparatus and copulatory apparatus in D. solidus differs considerably from those of D. vastator so that these two species can be distinguished without much difficulty.

In 1949 the Laboratory of Fish Diseases of the All-Union Scientific Research Institute of the Fish Industry of Lakes and Rivers undertook a program to clarify the biological and economic significance of D. solidus in the fish pond industries of the north-western regions of USSR*.

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*The first part of the work was conducted in the fish ponds of Novogorodsk by the author of this article. N. V. Nikolsky and M. N. Virhova, A. Kh. Achmerov, G. K. Petrushevskii and S. S. Shulman also participated in the examination of the fish hosts. The assistance and advice of B. E. Bychowsky (Zoological Institute of Academy of Sciences, USSR) was very helpful.

The study of the biology and the development of D. solidus was conducted in aquaria as well as by examinations of large numbers of fishes directly from the ponds. The study of the tempo of the deposition of the parasite

showed that, although D. solidus deposits eggs under usual summer temperatures as readily as D. vastator, these eggs fall apart and are incapable of further development. Only after lowering the temperature to 13-15°C did it become possible to obtain viable eggs. Thus, it was established that the optimum temperature for the multiplication of eggs of D. solidus in summer months is considerably lower than that for D. vastator, which multiplies considerably under the temperature of 24-25°C (3). In the fall months the multiplication of D. solidus proceeds under much lower temperatures and apparently does not cease even at temperatures around +1°C.

Infection /of young fish/ by D. solidus may take place even in the spawning ponds. The larvae of this parasite were first discovered on small 9-day-old fry. Later the infection of the young gradually increases. In p826
contrast to D. vastator (2,5) /infection by/ D. solidus does not diminish toward the fall but continues to increase and these parasites are retained during the entire winter. Subsequently, the infection continues to increase during the entire second year of the life of the fish. D. solidus is discovered also in rather large quantities on the gills of the spawners and/or recruits /or their replacements/.

Thus, older fishes are the distributors of D. solidus both in the spawning ponds as well as in the mixed adolescent fattening and hibernating ponds. It was noticed that fishes of less than one year and one-year-old fishes are strongly infected by D. solidus, whereas D. vastator usually occurs on fishes which have not yet developed fully (3). This could be explained by the fact that free-swimming larvae of D. solidus, which /is the stage that/ infects fishes, apparently stay in benthic, slightly warm layers of water, whereas the larvae of D. vastator, as was shown experimentally, maintain themselves near the surface. This /hypothesis/ explains better than any other the weak infection by D. vastator of more mature fishes which lead a benthic way of life. The data on biology and development of D. solidus lead us to conclude that, in contrast to D. vastator, D. solidus is a cold-loving form and by this very fact represents a potential danger for the northern elements of carp industry of USSR in which the economic significance of D. vastator is considerably lessened by the fact that it is a warm-loving form.

Studies of the pathogenic effects on small fry were conducted by histological study of the gills as well as by experimental infection of the small fish held in aquaria. It was established that while attaching itself to the gill filaments of the second order D. solidus causes thickening in the epithelial layer which results in impairment of the respiratory function of the gill. Experimental infections caused deaths of small fish. Also, small fry varying from 3-4 cm in length perished when the intensity of infection was 30-40 parasites per fish.

Apparently death also occurs when infection by D. vastator intensifies. Even in cases where the small fish does not die, a heavy infection by D. solidus causes a retardation of growth. Thus, in aquarium conditions small fry strongly infected by Dactylogyrus for the 20 days increased in size 16.7%, whereas those weakly infected by the same parasite attained 32% of the normal growth. Consequently, even though Dactylogyrus do not cause the death of the fish they can retard the growth of small fish.

During summer operations we also observed deaths of small fish in one of the ponds caused by a mass infection by D. solidus. This epizootic began during the last days of July and was accompanied by a typical situation for dactylogyrids: the small fish were congregating near the surface of the water at the lower part of the pond and were breathing heavily. When the small fish were autopsied a large number of parasites (up to 400 per fish) were found on their gills. Thus, under the conditions of a cool summer of northern zone of carp production, D. solidus can cause mass deaths of the small fish and thus inflict considerable losses to the fish industry.

The examination of the fish industries /facilities/ in a number of regions and republics showed that D. solidus is widely distributed in the fish ponds of the USSR. Its carriers are both the spawners as well as the stocking material (yearlings, under yearlings or fishes less than one year old) of any variety of Sazan and carp and their hybrids. Carassius are not subject to infection by these parasites.

These data permitted us to undertake a number of prophylactic and clinical measures to cope with this new dactylogyrid. Study of the action of salt baths showed that D. solidus is extremely salt resistant. If parasitized fish are immersed in a 5% solution of common salt for 5 minutes almost 100% of the D. vastator are killed, but D. solidus shows little effect. Even after such a bath, from 20 to 70% of the parasites /D. solidus/ remain alive and capable of reproduction. Even a 7% solution of NaCl used for 7 to 8 minute periods does not cause complete destruction of D. solidus; individual specimens of this parasite remain. This pecularity /of salt tolerance of D. solidus/ apparently explains the rapid distribution of D. solidus in the fish pond industry of the European part of the USSR.

Among the prophylactic measures which will decrease infection by D. solidus in individual fish ponds the following are recommended: 1) removal of the spawners from spawning ponds immediately after spawning; 2) stocking of older fish into the adolescent /rearing/ or hibernating ponds where fishes less than one year old are kept should not be allowed; 3) treatment with lye of the rearing ponds in which mass deaths of fishes less than one year old were caused by D. solidus; 4) utilization of adolescent ponds in which mass deaths of the small frys from dactylogyriasis has occurred only as fattening ponds /i.e. instead of rearing ponds/, or using them for culture of other fish (Tinca tinca, Carassius, Salmonidae, etc.).

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