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FUNGUS OR SAPROLEGNIA INFESTATION OF INCUBATING FISH EGGS

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INTRODUCTION

Non-living organic matter in water is rapidly attacked and utilized by a variety of microorganisms. Fungus or "water mold" is one of these organisms, and it can be found in virtually any natural water. Fish eggs are rich in concentrated foods, and if the eggs' natural defenses are breached they are soon invaded. Fungus, its direct and indirect effects, is probably the greatest single killer of incubating fish eggs under hatchery practice.

IDENTIFICATION

The presence of fungus in eggs is indicated by a cottony growth radiating from the egg. The growth consists of nonseptate (having no partitions) filaments (the mycelium) which branch but do not decrease in thickness. Under low magnification some filaments will be seen to terminate in club-like enlargements. These enlarged tips contain one of two types of spores which are the principal means by which the organisms reproduce. Fungus infestation is not apt to be confused with any other condition.

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CAUSE OF THE DISEASE

Water molds belong to the family of plants known as Saprolegniaceae. At least four genera in this family (Saprolegnia, Aphanomyces, Dictyuchus, and Achlya) contain species which are parasitic on fish and, therefore, are of interest to the fish-culturist. S. parasitica which has a saprophytic and/or parasitic nature is the species most commonly cited in fish and fish egg infestations, but Hoffman has isolated Achlya from dead trout eggs, and European publications also speak of Achlya in conjunction with fungusing in eggs. For practical purposes fungus infestation of eggs can be presumptively ascribed to S. parasitica. Species recognition or for that matter even separation of the genera Saprolegnia from Achlya remains a task for those well versed in the study of the aquatic fungi.

SOURCE AND RESERVOIR OF INFECTION

Vegetative spores (chlamydospores) and asexual reproductive spores (zoospores) are almost universally present in natural waters.

MODE OF TRANSMISSION

During incubation, some eggs die and are soon invaded by fungus. In time, surrounding

eggs are covered by the mycelium, and death is the result. Unless control measures are exercised the ever-expanding growth will claim virtually every egg. Kanouse found circumstantial evidence that under some conditions (probably crowding) fungus filaments could actively penetrate living eggs. Under experimental conditions living eggs (which were in no way crowded) were not invaded. Davis states that there is no evidence that Saprolegnia can develop on normal eggs unless foreign organic matter is present.

INCUBATION PERIOD

Depending upon the temperature, twenty-four to forty-eight hours are required to complete a minimum life cycle of reproductive spore to mycelium to reproductive spore.

PERIOD OF COMMUNICABILITY

Dead eggs of any stage of incubation are almost certain to be invaded by fungus.

SUSCEPTIBILITY AND RESISTANCE

Susceptibility of dead eggs is in general universal. Under favorable conditions healthy eggs resist fungus invasion, and at times dead eggs do not succumb to penetration for many days after turning white. Infertile eggs at times can be incubated a month or longer in the presence of Saprolegnia without being invaded.

RANGE

Saprolegniacea are almost universally present in natural fresh waters.

OCCURRENCE

There are no known seasonal restrictions to infestation of fish eggs by Saprolegniaceae.

METHODS OF CONTROL

Good sanitation and cleanliness are absolutely essential to effective control of disease and/or parasites among the more or less crowded and unnatural conditions necessary for efficiency in artificial culture or husbandry. This applies with great emphasis to incubation and hatching of fish eggs. Although, as mentioned in section 3 above, the exact classification of fungus in infected eggs is a task for the trained student, it is not necessary for effective control of the condition.

There are two methods of control of fungus: one is mechanical; the other is chemical. Mechanical control is effected by removing dead and infected eggs two or three times per week. This is a time-consuming procedure, and some healthy eggs are usually injured in the process. Chemical control is effected with malachite green, a fungicidal analine dye. The chemical method is simpler, cheaper and certainly the more efficient method. Early reports of daily flush treatments claimed effective control by adding stock solutions of the dye at heads and at mid points of the troughs. Based upon average trough capacity final dilution of the stock solution resulted in from about one-fourth to one-third of a part per million. Burrows recommends an hour-long treatment with 5 parts per million dye (1:200, 000) given twice weekly. He stated that the constant-flow siphon was valuable in maintaining the desired concentration during the hour period. Johnson et al. effectively used the same concentration and duration in a large scale, mechanized operation. Some hatcheries have found the twice-weekly treatment inadequate and though experimental results are not available, empirical evidence indicates that daily flush-type treatment at about 5 p.p.m. can usually be given without harm to the eggs. Small-scale trials should be conducted to determine how often treatment is necessary and whether or not recommended concentrations prove toxic to the eggs. Preparation of stock solutions is recommended to minimize staining the person and clothing by the light dye powder. Burrows points out that beyond one part of dye in 150 parts of water the dye will recrystallize and accuracy will be lost.

The current price of the technical grade of malachite green is about $5.00 per pound. The price is usually lower in wholesale purchases.

ANNOTATED BIBLIOGRAPHY

* Burrows, Roger E.
1949. Prophylactic treatment for control of fungus (Saprolegnia parasitica) on salmon eggs. Prog. Fish-Cult., Vol. 11, No. 2, pp. 97-103, illus.

Eggs were treated with malachite green, formalin, Roccal and Hyamine. Malachite green was very effective and had the greatest margin of safety in use. The constant-flow siphon is illustrated and described. Treatment technique is described in detail.

* Davis, H. S.
1953. Culture and Diseases of Game Fishes. University of California Press, Berkeley and Los Angeles, 332 pp., illus.

pp. 275-281. There is an excellent section on fungus disease of fish. Egg infestation is also discussed in detail. Prophylactic treatments for control of fungus in eggs is given, and the information is up-to-date. (The author inadvertently omitted the description of the constant-flow siphon, but the interested reader will find it given by Burrows, 1949, listed in this bibliography).

* Anon.
1955. Malachite green used to prevent fungus on lake trout eggs. Prog. Fish-Cult., Vol. 16, No. 1, pp. 38, illus.

Malachite green was found to very effectively inhibit fungus infestation of incubating lake trout eggs. Methods of preparation and application of a stock solution are given. The concentration used was about 10 parts per million.

* Foster, Fred J. and L. Woodbury
1936. The use of malachite green as a fish fungicide and antiseptic. The Prog. Fish. Cult., U.S. Dept. Comm., Bur. Fish. Memo I-131, No. 18, pp. 7-9.

This is the first account of use of malachite green in the treatment of fungus infestation of fish. The authors were highly successful in eliminating infestations in fish. Egg treatment was also successfully tried. Concentration and other details are given. Recommended concentration is about one-third of a part per million.

* Hoffman, Glenn L.
1949. Isolation of Saprolegnia and Achlya with Penicillin-Streptomycin, and attempts to infect fish. Prog. Fish-Cult., Vol. 11, No. 3, pp. 171-174.

Isolation and culture of Saprolegnia and Achlya is described. Sexual fruiting bodies developed on the medium. The author exposed injured and uninjured fish to pure cultures of two species of Saprolegnia and to one species of Achlya. S. parasitica was found to be infective for injured fish. The author isolated Achlya from dead trout eggs.

Johnson, Harlan E., C.D. Adams, and R.J. McElrath
1955. A new method of treating salmon eggs and fry with malachite green. Prog. Fish-Cult., Vol. 17, No. 2, pp. 76-78, illus.

The article describes and illustrates construction details of a pump driven system of injecting metered volumes of malachite green stock solution into a hatching house water system. The device maintained a 1:200,000 solution for hour-long periods: fungus was effectively inhibited by semi-weekly treatments, and labor was reduced to one-fifth of pre mechanized requirements.

Kanouse, Bessie B.
1932. A physiological and morphological study of Saprolegnia parasitica. Mycologia, Vol. 24, No. 5, pp. 431-452, illus.

The study of Saprolegnia is briefly reviewed. The organism was cultured on a variety of media, and sexual organs were developed. This is the first

demonstration of sexual organs in this organism. Complete morphology is described and illustrated. Observations were made and experiments conducted on parasitism by this fungus. Recommendations for control of Saprolegnia in the hatchery are given: mechanical removal and disposal of infected material constitute effective control measures.

* O'Donnell, D. J.
1947. The disinfection and maintenance of trout hatcheries for the control of disease, with special reference to furunculosis. Trans. Am. Fish. Soc., Vol. 74, pp. 26-34.
pp. 34. This page is devoted to "Treating eggs for fungus". Directions are given for using both copper sulphate and malachite green. Malachite green concentration is very light - amounting to about one-quarter of a part per million.

* Papers indicated by an asterisk are of special importance to fish culturists.

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