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NOTES ON THE EFFECTS OF SOLUTIONS OF NEW JERSEY ENDOWMENT FOUNDATION MOSQUITO LARVICIDE ON BROOK TROUT AND RECOMMENDATIONS AS TO PROPER CONCENTRATIONS FOR BLACK-FLY CONTROL

by

Paul Eschmeyer

The effects of Dendrol, a commercial insecticide, on trout and black-fly larvae were discussed in a recent Institute report.[1] Since it was concluded that this insecticide was not suitable for the control of black-fly larvae from streams inhabited by trout, efforts have been made to find some other suitable means of alleviating the black-fly nuisance in certain areas of the state. As a step toward finding such a means, a number of experiments were conducted at the Watersmeet Hatchery in late October, 1942, to test the effects of New Jersey Endowment Foundation Mosquito Larvicide on brook trout. The active ingredient in this larvicide is pyrethrum. Tests of this larvicide were suggested by Dr. Robert D. Glasgow of the New York State Museum as a result of an inquiry addressed to Dr. John R. Greeley, Senior Ichthyologist of the New York State Conservation Department.

The experiments with the larvicide were carried out in a manner similar to those in which dendrol was used, as described in the above mentioned report. A wooden trough (13½ inches wide by 12½ feet long) was used, through which fresh water passed at the rate of 5 gallons per minute. Into this trough the trout were placed for treatment. At the upper end of the trough was placed an 18-gallon oil drum in which water and larvicide, in

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[1] Leonard, Justin W., and Eschmeyer, Paul, "The Effect of Dendrol Solutions on Brook Trout and the Larval Stages of Blackflies," Institute for Fisheries Research Report No. 778, 1942 (manuscript).

the desired proportions, were mixed. To expose a given group of fish to treatment, the fresh water was turned off, and two hoses siphoned treated water into the trough at the rate of 5 gallons per minute. For the duration of a given experiment, the treated water was caught in a 5-gallon bucket at the lower end of the trough, and replaced in the oil drum at the head end of the trough, for immediate re-use.

The results of the tests made are shown in Table I.

Table I. Summary of Effects of N. J. Endowment Foundation Mosquito Larvicide on Trout

Concentration	Duration of Exposure	Number of Fish Used	Number of Fish Dying as Result of Treatment	Approximate Average Time Required for Recovery of Those not Killed*
1:100	5 minutes	5	0	5 minutes
1:100	10 "	5	0	10 "
1:100	15 "	3	0	15 "
1:100	30 "	5	0	5 "
1:100	30 "	15	0	63 "
1:50	15 "	4	0	34 "
1:50	20 "	4	0	30 "
1:50	25 "	6	0	85 "
1:50	30 "	5	4	180 "

*Permanent assumption of an upright position was presumed to indicate recovery.

All trout exposed to the larvicide showed much irritation, almost immediately after exposure. For about the first ten minutes of treatment, the fish struggled actively, darting about in the trough, frequently breaking the surface. They were unable to hold their equilibrium, and many of the fish were swept down the trough and lodged against the screen at the lower end. In the case of longer exposures, the fish lay on their sides, breathing spasmodically and swimming only rarely, and then only in short spurts.

It is not known why the 5 trout treated with a solution of a concentration of 1:100, for 30 minutes, were so little affected, as compared to the 15 trout similarly treated. By and large, it appears that trout can survive concentrations of 1:100 for 30 minutes and 1:50 for 25 minutes, without appreciable mortality. However, as has been mentioned, the fish become relatively helpless after being exposed for only about 10 minutes, to either concentration. Under stream conditions, many of the fish might be destroyed by current action, or perhaps predators, while in this helpless condition, even though no mortality occurred as a direct result of contact with the larvicide.

Fish used in the above experiments ranged from 2½ to 7 3/4 inches. They were wild fish, taken from Sargent's Creek, a small tributary entering the Middle Branch of the Ontonagon River one mile east of Watersmeet. Ten rainbow trout and 1 brown trout were used, while the remainder were brook trout. All trout which are indicated as having survived their respective treatments were still alive one week after the experiment had been terminated. No mortality occurred among 15 fish used for controls.

Report approved by: A. S. Hazzard

Recommendations as to Concentrations of Larvicide to be Used in Controlling Black-Flies

Experiments conducted by Dr. J. W. Leonard at the Hunt Creek Fisheries Experiment Station during the fall of 1942 showed that concentrations of the larvicide which Eschmeyer found to be non-toxic to trout were about 50 per cent lethal to black-fly larvae. He observed that many larvae which did not die were rendered helpless and he concluded that in a rapid stream they might be swept from their anchorage, lodge in quiet water and would die there because of the high current demands of these insects.

Considering the relative toxicity of this larvicide and Dendrol (Report No. 778 describes the effects of Dendrol) to black-flies and to trout, it is apparent that the New Jersey Endowment Larvicide is more effective and less harmful to trout and should be used in preference to Dendrol for any future attempts to control black-flies in Keweenaw County or elsewhere in Michigan.

Procedure for its use should be as follows:

1) Measure the flow of the stream to be treated by the use of a weir or, if judged to be less than fifty gallons per minute, by building a temporary dam and catching the overflow in a pail of known capacity.

2) Using a pail or barrel of known volume, pour enough larvicide into the center of the stream over a ten minute period to maintain a concentration of one part of larvicide to fifty parts of stream water. A watch should be used and the pouring should be so regulated that the proper strength is maintained throughout the ten minute period. A float siphon in a barrel with a hose and with a petcock adjusted to the proper flow will give better results than by pouring especially on streams larger than 100 gallons per minute.

For example—the stream to be treated is found to be flowing 50 gallons per minute. Ten gallons of larvicide will be needed for one treatment and should be poured or siphoned in at the rate of one gallon each minute.

Treatment is advised in late April (early May this year) for northern areas such as Keweenaw County in order to kill the black-flies which have wintered over as larvae. A second treatment early in July might be necessary to control the larvae resulting from early spring egg deposition. No further treatment during the season should be necessary.

A recent communication from Dr. Greeley (Mar. 29, 1943) informs us that no pyrethrum larvicide is obtainable now since the government requires all of the available stock. This condition will probably continue for the duration of the war. However, as soon as the larvicide can be secured it should be used in the control of black-flies in preference to Dendrol.

NOTE: Since the above communication was received a letter from the Seacoast Laboratories Inc., 156-158 Perry Street, New York City, New York has been forwarded to the Ann Arbor office from the Hunt Creek Station. This letter is quoted below in full.

"March 29, 1943

"Institute of Fisheries Research
Hunt Creek Experiment Station
Box 5
Lewiston, Mich.

"Gentlemen:

"In view of the present acute shortage of Pyrethrum we are making an attempt to ascertain, before the Mosquito season starts, the quantity of New Jersey Mosquito Larvicide (Endowment Foundation that we may be called upon to supply for mosquito control work. We would therefore, like to ask your cooperation in placing your order now for the approximate amount of larvicide that you will need this year, and when you would like to have it delivered. This would allow us sometime in our effort to secure pyrethrum extract, if at all possible.

"While we cannot, at present, guarantee to fill your entire order, we will endeavor to supply you with at least part of it at the beginning of the mosquito season and with the rest of it during the summer months.

"As far as we know now, the price of the larvicide in 55-gallon drums will be 34½¢ per gallon, F.o.b., New York City, plus $6.00 for the drum which is returnable for full credit.

"Your early reply will be appreciated.

Very truly yours,

BEV:lc SEACOAST LABORATORIES, Inc."

If any treatment for Keweenaw County streams is planned for this season, an order for the required amount should be placed with this firm immediately specifying delivery of half the order by May 15, the second half by July first.

[The above recommendations were derived from monthly activity reports submitted by Dr. Leonard and from conversation with him. No formal report was prepared of his experiments on the effects of the larvicide on black-flies due to sudden induction into the army. A. S. Hazzard, April 8, 1943.]

Typed by: G. Wood